Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament

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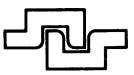


Series 1: Disarmament Technologies – Vol. 3

Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament

edited by

Melvin L. Best, Jr.
MBEnterprises, Great Falls, VA, U.S.A.

John Hughes-Wilson
EURONET, Brussels, Belgium

and

Andrei A. Piontkowsky
World Laboratory, Strategic Studies Centre, Moscow, Russia

Springer-Science+Business Media, B.V.

Proceedings of the NATO Advanced Workshop on
Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament
Washington, D.C., U.S.A.
April 6–10, 1995

A C.I.P. Catalogue record for this book is available from the Library of Congress.

ISBN 978-90-481-4642-0 ISBN 978-94-015-8396-1 (eBook)
DOI 10.1007/978-94-015-8396-1

Printed on acid-free paper

Originally published by Kluwer Academic Publishers in 1995
Softcover reprint of the hardcover 1st edition 1995

CONTENTS

Preface

This Report contains a Consensus Report and the papers submitted to the April 6 - 10, 1995 NATO Advanced Research Workshop on *Strategic Stability In The Post-Cold War World And The Future Of Nuclear Disarmament*, held in Washington D.C., United States Of America at The Airlie Conference Center. The workshop was sponsored by the NATO Division of Scientific and Environmental Affairs as part of its ongoing outreach programme to widen and deepen scientific contacts between NATO member countries and the Cooperation Partner countries of the former Warsaw Treaty Organization.

The participants recognize that the collapse of the former Soviet Union has left a conceptual vacuum in the definition of a new world order. Never before have the components of world order all changed so rapidly, so deeply, or so globally. As Henry Kissinger points out, the emergence of the new world order will have answered three fundamental questions: " What are the basic units of the international order? What are their means of interacting? and What are the goals on behalf of which they interact? "

The main question is whether the establishment and maintenance of an international system will turn out to be a conscious design, or the outgrowth of a test of strength. The concept of a planning framework that could shape or govern these interactions is emerging and may now be at hand. Capturing this emerging framework is the thrust of this NATO-sponsored Advanced Research Workshop.

OBJECTIVES OF THE ADVANCED RESEARCH WORKSHOP (ARW) :

The objective of this workshop is to reach a consensus on defining a model (calculus) for Strategic Stability in a changing multipolar world in the presence of weapons of mass destruction -- the model (calculus) being the core of a conscious design to shape or govern the interactions of nation-states in a new world order.

The basis for constructing this model will be regional models that reflect the role weapons of mass destruction play in each nation's early twenty-first century security strategy. These models, among other things, will address the effect that future modernization, reductions in weapons (to levels below START II), and proliferation will have on the many dimensions of Strategic Stability.

The participants have begun to rigorously document this multipolar model, develop each dimension of Strategic Stability, and identify issues for further investigation.

FRAMEWORK FOR THE ARW:

A fully described model is a necessary condition for a conscious design to shape actions toward Strategic Stability. The following taxonomy of the dimensions of Strategic Stability was accepted by the participants as the first step toward such a model.

- Stability in Geo-politics and Balance Of Power
- Arms Race Stability
- Deterrence Stability; Crisis Stability; First Strike Stability
- Stability in the presence of clandestine Proliferation

The focus of their investigations are to extend each dimension of stability into a dynamic

multipolar world. These investigations will focus on the role and effect of proliferation of nuclear weapons. Regional models reflecting each nation's security strategy will be developed and will form the basis for constructing a global model. Rigorous operational definitions and metrics will be necessary to complete the fully described model.

This unprecedented gathering of top academic, scientific and military experts from the USA, Russia, United Kingdom, France, China, India, and Israel would not have been possible were it not for the tireless and selfless devotion of the participants and the sponsorship of the NATO Scientific Affairs Division. As in any gathering of bright and outspoken individuals it is not possible to reach consensus on all points by all participants. However, after four grueling days the participants reached general agreement that is captured in the "Consensus Report". Then each participant made a individual contribution that further fleshes out the dimensions of Strategic Stability.

This amazing gathering is now the foundational work that can provide joint concepts for all leaders of the nuclear powers to shape their decisions for the next decades. And for the first time they can base their decisions on agreed scientific facts, not just political judgements. The turbulence of the emerging new world will no doubt bring unprecedented challenges and I am sure that the delegates are unanimous in their view that new solutions to tomorrow's problems can only be achieved through unprecedented cooperation and dialogue.

Mel Best
Workshop Director

List of Participants
NATO-ARW
"Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament"

- ***DIRECTOR -- Melvin Best*** -- MBEnterprises -- USA
- ***Co-Director -- Col.(ret)John Hughes-Wilson*** -- EURONET -- UK
- ***Co-Director -- Dr. Andrei Piontkowsky*** -- World Laboratory, Moscow -- Russia

NATO Participants

USA

- ***Maj. Gen. Robert Linhard*** -- US Air Force
- ***Dr. Ronald Lehman*** -- Lawerence Livermore National Laboratories
- ***Dr. Fritz Ermarth*** -- Former Chairman National Intelligence Council
- ***Lt. Gen. Glenn Kent (ret)*** -- RAND Corporation
- ***Dr. Robert Chandler*** -- Strategic Planning International
- ***Dr. Emerson Niou*** -- Duke University - Political Science Department
- ***Dr. Jerry Bracken*** -- Yale (Adjunct Professor)
- ***Dr. Fred Nyland*** -- Nyland Enterprises

United Kingdom

- ***Col.(ret) Roy Giles*** -- Defence Research Agency
- ***Sir Rodric Braithwaite*** -- Morgan Grenfell & Company
- ***Gen.(ret) Sir Anthony Farrar-Hockley*** -- National Westminster Bank

France

- ***Dr. Michel Rudnianski*** -- University of Reims, and Paris V
- ***Dr. Christian Schmidt*** -- University of Paris

NON-NATO Participants

Israel

- ***Dr. Ilan Amit*** -- Former Director Center for Military Analysis

India

- ***Gen.(ret) Krishnaswami Sundarji*** -- Former Army Chief Of Staff

China

- ***Professor Zhongyue Song*** -- Society for Strategy and Management Research
- ***Lt. Col. Liping Xia*** -- National Defense University, PLA

Russia

- ***Academician Eugene Velikhov*** -- Vice President,Russian Academy of Sciences
- ***Dr. Dmitry Chereshkin*** -- VP-Russian Academy of Natural Sciences
- ***Dr. Vasiliy Krivokhizha*** -- Dep Dir-Russia's Institute Strategic Studies
- ***Dr. Arkady Skorokhodov*** -- Institute for Systems Analysis
- ***Dr. Anton Surikov*** -- Institute of USA and Canada Studies Studies

THE CONSENSUS REPORT

THE PARTICIPANTS OF THE NATO ARW
"Strategic Stability In The Post Cold War World
And The Future Of Nuclear Disarmament"
Airlie Conference Center: April 6-10, 1995
Airlie, Virginia

1. PART 1 : Overview & Executive Summary

1.1 BACKGROUND

NATO's Advanced Research Workshop (ARW) on "Strategic Stability in the Post-Cold War World and Future of Nuclear Disarmament" assembled at a critical moment for the international system. It is increasingly clear that the end of the Cold War and dismantling of the bi-polar model of the world necessitates a fundamental re-examination of the traditional concepts of stability. Attempts to deal with new problems of the multi-polar world on the basis of the traditional concepts has proven to be inadequate, counter-productive and sometimes regionally disastrous.

1.2 EMERGING AREAS OF DISAGREEMENT

- A comparatively new phenomenon in recent months is a growing divergence between Western and Russian perceptions of World development. During frank and substantive discussions the ARW discovered that this discrepancy has a theoretical nature too.
- The apparent points of disagreement (former Yugoslavia, NATO enlargement, some aspects of Middle East policies, etc) are not reasons for, but a manifestation of growing mistrust, threatening a potential "Cold Peace" period. This mistrust is exacerbated by a conceptual gap between NATO and Russian perceptions of the world.
- After the end of the Cold War a considerable part of Russian public opinion, oriented on Russian reintegration into Europe, was looking for a fundamental change in the old stability and security paradigms. In the nuclear field that means a transition from the MAD concept of stability, codifying hostilities in relations, toward more sophisticated ways of ensuring nuclear stability, based more on such tools as protection and counter-proliferation.
- On the European scene that could mean a transition from traditional bloc confrontation models to new mechanisms of European stability with the eventual merging of NATO and Organization for Security and Cooperation in Europe (CSCE) mechanisms.
- The perception that corresponding Russian political initiatives were received rather coolly, created a feeling in Russia that many in the West are not interested in a change in the stability paradigms, but in preserving an old one; one that in their perception was useful because it brought a victory in the Cold War and therefore will be equally useful in the future.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 1–30.

1.3 AIMS & OBJECTIVES

Such conceptual mismatching of the old Cold War antagonists' intentions and perceptions risks further cooling of relations between Russia and the West. This makes the political and analytical task of exploring possible new concepts of strategic and European stability even more important and urgent. Based on this mandate the workshop concentrated mainly (but not exclusively) on the nuclear aspect of strategic stability.

1.4 CONSENSUS ON STABILITY MECHANISMS

- As a consequence of the post-Cold War realities, deterrence alone is not sufficient to deal with all of the contemporary challenges. Complementary measures are now required.
  Deterrence can be reinforced and supplemented by:
  - protection
  - disarmament
  - counter-proliferation
  - conflict prevention
  - changing patterns of thinking (spiritual and philosophical), etc.

  However, some threats may be difficult to deter, and some actors may not be deterrable.
- Nuclear forces will remain a part of the post-Cold War period, but they may not be the most appropriate or primary deterrent for some threats of this new era. In particular, post-Cold War deterrence should recognize that the scenario of a large-scale conventional war in central Europe involving the nuclear powers on opposite sides, which drove and seems to be still driving much of the nuclear planning, is now unlikely.
- Missile defenses were limited during the Cold War to codify a historically limited mutual deterrence situation, but defenses may prove of value to the community of nations in the Post- Cold War world because:
  - Russia, the US, and others wish to cooperate to defend their populations rather than hold them hostage.
  - Some nations feel threatened by the possible proliferation of ballistic missiles.
  - Some nations feel more comfortable remaining non-nuclear weapons states if missile defenses could be provided.
  - Guarantor nations may feel more willing to make security commitments on the basis of providing missile defenses than to extend more explicit nuclear guarantees.
- In addition to theater missile defenses and limited defenses such as the Moscow ABM system, consideration should be given to global or regional missile protection systems as a stabilizing measure.

1.5 AREAS FOR GREATER SECURITY COOPERATION

- To leave the Cold War behind, some unfinished business must be completed, including:
  - Ratification, Enter Into Force, and Implementation of the START II Treaty
  - Ratification, Enter Into Force, and Implementation of the CWC
  - Implementation of greater cooperation and transparency
  - Measures such as Nunn-Lugar, military-to-military discussions, lab-to-lab cooperation, etc.
  - More non-governmental fora to foster debate among newly freed republics as they reevaluate their security requirements
  - (CTB)
- An effort should be made to cooperate in improving fissile material control and accountability with an eye toward encouraging all nations, including non-parties to the NPT, to:

- cease the production of fissile materials that are not under international safeguards
- begin a step by step process of placing more of their nuclear material under international safeguards as the security situation warrants

- Greater attention must be given to the deterrence of non-nuclear WMD and to new forms of protection where nations' deterrence is ineffective or impossible. Reductions in nuclear forces require the creation of conditions which make them mutually acceptable.
- Success in non-proliferation requires addressing the fundamental regional security and political motivations which cause nations to consider acquiring nuclear weapons.
- In considering proposals for deep reductions in nuclear arms, partial consideration must be given to:
  - implications for stability
  - interaction with Nuclear Weapon States (NWS) and threshold states
  - non-proliferation
  - unintended consequences

2. PART 2 : Context & Background

2.1. THE NEW SECURITY ENVIRONMENT.

In the past the world faced a readily identified and mutually accepted threat that was well understood, and considered relatively stable. The new international security environment has neither.

2.2. BACKGROUND.

Although both the superpower alliances were established to contain mutual fears of expansionism or hegemony in Europe, from their earliest days the bi-polar relationship was confronted with crises outside the original area of the Treaties (Korea, Suez, the various Arab-Israeli wars, Afghanistan).

2.3. A CHANGED INTERNATIONAL SYSTEM

With the end of the Cold War, the existing security system confronts major changes in the international system. As the 1994 German White Paper on Defense put it, "Today Europe stands at the beginning of a new epoch. " One feature of the international system that shows no sign of abating, however, is the phenomenon of international crises.

2.4. A LESS STABLE WORLD

The major change in the situation has been the re-alignment of the economic and political structure of the former Soviet Union. The alteration of one of the sides of the old superpower equation has already brought about a destabilizing effect to the international scene. The deterrent strategy of the Cold War often kept localized crises in check. These constraints have now, in many cases, been removed.

2.5. CHANGING SECURITY MODELS

The effect of these events on the existing security model has been for the so-called New World Order to relax constraints and containment policies on regional conflicts. These are no longer viewed as leading inevitably to a superpower clash and the danger of a nuclear exchange. However the conjunction of the removal of constraints, the wider availability of nuclear and other weapons of mass destruction (WMD), and the growing risk of regional conflict have led to a less stable model of international security, and a potentially more dangerous situation in both the immediate and foreseeable future.

2.6. VALIDATION OF SECURITY MODEL

During consideration of the modeling processes and conclusions, the workshop found it valuable to revert periodically to actualities. This was found to be invaluable as a means of maintaining perspectives, and as an indication of options for future modeling. Any security model should be subject to validation checks against real data. It is only within the context of reality that security models have any real utility.

3. PART 3 : Theoretical Overview

3.1. THE 3 APPROACHES

The theoretical work at the ARW has developed along three different routes - geopolitical, confrontational and cooperative. The geopolitical research (by E.M. S. Niou and P. C. Ordeshook) strives to identify the possible stable "world orders", such as balance-of-power, in which the rules of conduct are not backed by sanctions, or collective security, in which they are. Both are stable (although collective security less strongly so), but so are many other combinations of coalitions that impose collective security within, but practice balance-of-power on the outside. Collective security guarantees the survivability of its members (if it survives), while balance-of-power does not. The former is, consequently, more desirable as world order but, being less stable, needs institutions, agreements and the like to prop it up. While there is a considerable body of work on the geopolítical and Confrontational Theories, there is much less valid work on Cooperation Theory. This is an imbalance which should be addressed.

3.2. METHODOLOGIES

The confrontative part of the research began with a reexamination of the concepts and premises involved in a bipolar nuclear conflict - deterrence, first-strike and arms-race stability, with a view of their extension to a multi-polar world. Most conflicts in such a world will still be bipolar: between two states, two coalitions, or between a coalition and a state. If that is indeed the rule, then the stability of a group of nations can be measured by *its most potentially unstable pair of states or coalitions* (J. Bracken). However, this may lead to difficulties if one major power is involved with some lesser ones. Moreover, there could arise situations that are perhaps not readily analyzed as bipolar, e.g - Iraq retaliating against Saudi Arabia in response to an American attack. A framework for dealing with such cases of multi-party deterrence may be found in the graph approach to n-person games of deterrence (M. Rudnianski & A. D'Assignies). In this context it is also possible to generalize Richardson's conditions for bipolar arms-race stability to the multi-polar case (F. Nyland). Nevertheless, the stability analysis of a multi-polar nuclear world has yet to be put on a firm theoretical ground.

3.3 DYNAMICS BETWEEN APPROACHES

Several problems have dominated the research on the cooperative aspects of a multi-polar nuclear world: arms reduction, ABM defense and the maintenance of proliferation stability. A theoretical argument in favor of the zero-option (E. Velikhov) was based on the assumption that the risk of defection from such a regime was less than its expected gains, in view of the distribution of economic and political power. Another argument (A. Piontkowsky) suggested that a minimal option could be made stable by ABM protection, and that a stable path to such an option from the existing START I levels could be found. Another potential role for an ABM defense could be to "cap" rogue countries, in order to prevent them from initiating NBC missile attacks (G. Kent), with appropriate arrangements to avoid destabilizing the

global nuclear equilibrium. With respect to the latter, a theoretical argument in favor of minimal ABM defenses against lesser nuclear powers has been demonstrated (J. Bracken). The issue has, however, been contested and needs further clarification. Finally, the geopolitical climate, in which proliferation stability will have to function has been described: for the international arena (F. Ermarth) and for the Asia-Pacific region (X. Liping). A simulation model suggests that reassurance can play only a limited role in maintaining proliferation stability (I. Amit).

GEOPOLITICAL STABILITY

3.4 THE CHANGING GEOPOLITICAL IMPERATIVES

Stability is a multi-level problem and is not restricted to the field of nuclear strategy. The dismantling of the Soviet Union and the corresponding breakdown of the bi-polar world model created not only a vacuum of force in some regions but, more importantly, a conceptual vacuum. Hesitant and unconvincing steps of new American and new Russian administrations, and failures of policy while the world community suffered in its attempts to deal with the Yugoslavia, Rwanda, Chechnya tragedies are explained not merely by inexperience or mistakes of World leaders. The principal reason is a lack of an adequate conceptual security framework. In the absence of this framework main protagonists are tentatively looking for their new roles in a different geopolitical environment. The end of the communism did not usher the end of history, as Dr. Fukuima predicted in his famous paper, but rather the opposite - the re-awakening of many unpleasant historic antagonisms. The attempts to deal with these problems on the basis of traditional concepts elaborated in the relatively static bi-polar world has proved to be inadequate and counterproductive.
During the Cold War, thinking about stability was focused on the US-Soviet nuclear deterrence relationship. For decades strategic stability between the USSR and the US has been based on a MAD-concept, i.e. on the ability of either side to inflict unacceptable damage on the adversary - it is now time for a new approach.

3.5 NEW CONCEPTS OF STABILITY

The end of the Cold War necessitates a fundamental re-examination of the concept of stability. The new international environment differs markedly from the bipolar confrontation of the last four decades. While the previous emphasis on the "stability of deterrence" might not be abandoned entirely, the future will certainly require a much broader perspective. There are likely to be many international tensions with military, economic, and social dimensions. For example, the fracturing of the bipolar environment has regionalized many issues. The spread of weapons of mass destruction, the means for their delivery, and associated technologies is likely to continue or accelerate. Nationalism, ethnicity, and fundamentalism are demonstrating increasingly violent manifestations. The demise of the Soviet Union and the Warsaw Pact have left a power vacuum in East and Central Europe. Previous clients of both superpowers have been unable to cope with the social and economic demands of modernization.

3.6 GEOPOLITICAL STABILITY

There exists an evident need for a broader concept of stability - what we define as "geopolitical stability". Geopolitical stability is a state of relations among nations that is conducive to peaceful change and progress and contains no incentives for initiating hostilities. A party has established a unilateral stable defense against the other parties within a system if the party is confident that: the other parties have no intention of launching an attack, or the other parties cannot accept the risk of attacking, or any attack can be repelled. If all parties within a region or system have established a *unilateral stable defense*, the region is a *multipolar stable defense system.* To achieve geopolitical stability in the face of diverse and frequently unpredictable issues and threats, the world community must elaborate and have

the ability to execute a broad range of approaches and means.

3.7 APPROACHES TO STABILITY

A variety of approaches (deterrence, protection, disarmament and non-proliferation, de-escalation of multi-level conflicts, prevention, compulsion and cajoling) and their combinations can be used to ensure stability depending upon the specific nature of the problems that might face the world community. Combinations of different approaches may be appropriate as a realistic political compromise. Thus, we regard the concept of Mutually Assured Protection (MAP) as an adequate stability approach to the realities of modern nuclear geopolitical stability needs.

3.8 NEW CONCEPTS OF SECURITY

Nevertheless some people are still convinced in the wisdom of maintaining the MAD-doctrine. This point of view is expressed by part of the military and academic communities during the current strategic debates in both Russia and the US. However the threat of nuclear arms and missiles technologies proliferation has drastically increased. An extreme political regime or criminal terrorist groups acquiring these technologies becomes a menacing reality and demands a corresponding reaction.

Under these circumstances it is possible to use a combination of the deterrence and the protection approaches in ensuring the nuclear level of the geopolitical stability.

While it is quite feasible to design a Global Defense System (GDS) that could provide global protection from potential limited terrorist strikes while at the same time not breaking the MAD-conditions between Russia and the US, the real focus of stability planning and modeling should be on moving beyond doctrines of mutual suicide.

3.9 SECURITY AND STABILITY

The guideline for choosing an appropriate combination of ways in every concrete case must be the security of individuals. An individual is secure when there is no threat to his life, health, basic needs or human dignity. A society, a country is secure when their members, their citizens are secure. In this definition, security and stability have new political, military, economic, psychological, ecological, and other dimensions. Satisfaction of all of these dimensions is required for geopolitical stability. The task of analysts concerned with ensuring geopolitical stability is to explore:

MULTIPLE WAYS *to ensure*

MULTI-LEVEL STABILITY *in the*

MULTI-POLAR WORLD

PROLIFERATION

3.10 PROLIFERATION REGIONS

At present, the regions of the most serious proliferation of weapons of mass destruction are the Middle East, South Asia and Northeast Asia. The proliferation of nuclear weapons may alter or even upset the current regional balance of power and disrupt the stability of the region. It may also lead to new military conflicts. During a regional conflict, one nuclear threshold state may use nuclear weapons against its adversary.

3.11 PRESSURES FOR PROLIFERATION

There are four factors which are driving the nuclear proliferation in the Asia-Pacific region: political, military, economic and technological factors. Among them, political and military factors are the two main causes of nuclear spread, while economic and technological factors are playing relatively less important roles in this dimension. It was noted that dumping of large quantities of sophisticated conventional weapons by the United States, other Western countries and Russia into the Asia-Pacific region also stimulates the spread of nuclear weapons. For example, many imported advanced fighter planes can be used as or transformed into nuclear carrying vehicles-- thus, giving some states a nuclear carrying capability. Other states which import less advanced weapons try to acquire nuclear bombs to compensate for their conventional inferiority and counter a potential adversary's sophisticated conventional weapons.

3.12 PRIORITIES

Under the circumstances, the international community should devote its best efforts to eliminating the nuclear proliferation in the Asia-Pacific region. Prior to achieving that final goal, states in the region should seek to maintain the strategic stability of the region in the presence of nuclear proliferation. In order to achieve that objective, the Asia-Pacific region should set up a model including multilateral security mechanisms and bilateral security and confidence-building measures.

NON-QUANTIFIABLE ELEMENTS OF STABILITY

3.13 ALTERNATIVE STRATEGIC PERSPECTIVES

The discussions concerning the quantitative elements of strategic stability and the appropriate models for its evaluation were supplemented by a range of differing strategic perspectives based on the regional and national frameworks of the ARW participants. These non-quantifiable or qualitative elements offer important insights into how differing understandings of strategic stability can influence the development and use of representative quantitative models. The quantitative and qualitative aspects of strategic stability must be taken together; each is dependent on the other. In order to ensure strategic stability in the future, both the objective factors (as expressed through quantitative models) and the influence of the strategic images (through which those numerical relationships are interpreted) must be incorporated. Two general regional strategic perspectives were offered during the Workshop, both of which require future work.

3.14 ASYMMETRIC REQUIREMENTS

The first was a Northern-Southern hemisphere perspective of the criteria used by the established nuclear powers (all of them in the Northern Hemisphere) in judging the validity of nuclear weapons programs in the South. Why is India's nuclear program, for example, judged by some to be destabilizing in South Asia, while U.S. or France's nuclear weapons are seen as contributors to strategic stability? What criteria are used to make the case for these differences? Who decides they are the right criteria? Why do countries in the North assume the sovereignty needs of countries in the Southern Hemisphere are not as crucial to the peoples in those states as they are to those in the North? No efforts have been made so far to answer these questions nor to devise suitable models that might illustrate the differences. Rather, these non-quantatifiable elements were expressed as challenges to the underlying assumptions that support many Northern analyses of strategic stability.

3.15 DIFFERING PERCEPTIONS BETWEEN RUSSIA AND NATO

A second broad range of regional perspectives expressed was between the East and the West. Specifically, the differences in perceptions by the Russian participants and the representatives from the NATO countries were often seen by the other as being strongly influenced by the Cold War experiences. The discussions of the quantitative models were punctuated by these differing world views at several points in the workshop. If anything, the work on the quantitative aspects of the models examined at the workshop illustrated common areas of agreement when analyses are constrained to examining the objective conditions of stability. It was generally agreed that fora such as this NATO Advanced Research Workshop are essential to building new relationships upon which a better understanding of others' world views can be obtained. Developing agreed models of strategic stability, in parallel, might encourage even greater understanding between different peoples.

3.16 THE INDIA-CHINA VIEW

Alternative views of India and China concerning the strategic stability between the two countries were particularly instructive. The Chinese strategic image of stability is based on the perception that since China has no intention of using nuclear weapons first, as it has declared to the world, the fear in India of China's nuclear arsenal is unfounded. The image of strategic stability in South Asia, on the other hand, is profoundly influenced by the perceptions of China's nuclear arsenal and its threat to Indian security. Since the world view from India expresses a concern about the lack of equilibrium due to China's nuclear program, India's nuclear program is designed to provide a capability to balance and react to any Chinese use of its nuclear weapons. Once a country obtains nuclear weapons, it was argued, it inevitably sets in motion a number of destabilizing reactions by countries adversely affected.

3.17 NEW ASIAN DOMINOES?

In one view, China was the first nuclear domino in Asia, causing a security dilemma in India. Thus, India as the second domino had no choice but to protect its sovereignty by fielding a nuclear capability. Regrettably, Pakistan became the third domino as it faced a new security dilemma raised by the Indian nuclear programs. Therefore, it is unrealistic of the Chinese to claim a right to safeguard its national security through nuclear arms while denying other countries similar rights. A contrary point of view was expressed in which the United States was in fact the first domino in Asia, and China's response to restore strategic stability through its nuclear program should be understood in that light, and China's declaration of no first use should reassure India. These differing strategic perceptions of the stability in East Asia were acknowledged by the participants as requiring further resolution by cooperative initiatives.

3.18 THE MIDDLE EAST

A second range of perspective on strategic stability and the role of nuclear weapons centered on the Middle East. It was asserted that Israel holds 200 nuclear weapons. Therefore, the potential nuclear programs of Iran, Iraq, and other countries in the region should not be judged as destabilizing. The participants acknowledged that different strategic images persist in the region and that models of strategic stability may not be able to satisfactorily account for these alternative views. The discussion underscored the need to account fully for both the qualitative and the quantitative considerations affecting strategic stability in the different regions.

3.19 NEW EUROPEAN CHALLENGES

A third area of supplementary discourse focused on the strategic stability of Europe and the alternative strategic perspectives of the Russian participants and those from the NATO countries. While there was

general agreement that European strategic stability can not be assured in the absence of coordinated efforts by governments, there was a divergence of views of how best to preserve stability in the post-Cold War era. Specifically, the representatives from Russia were unanimous, despite the differences of their individual views that they expressed on other salient issues, in their concern about the negative impact of the prospective enlargement of NATO on strategic stability in the region.

3.20 NEW RUSSIAN PERCEPTIONS

The NATO participants noted Russian concerns over the possible consequences of NATO enlargement, and accepted them as genuine reelections of the current Russian security debate. Hence, strategic stability in Europe and the models developed to capture these relationships quantitatively must attempt to account for this diversity of view.

3.21 MODELING ALL SIDES' SECURITY PERSPECTIVES

European strategic stability might be best assured, according to one view, by a political framework of genuine cooperative security on military matters. By building on successful and ongoing arms control and other cooperative relationships between Russia and the NATO countries, governments might better assure their security and stability. A cooperative security arrangement that involves states from North America, NATO Europe, former non-Soviet members of the Warsaw Pact, the Baltic republics and other new states formerly a part of the Soviet Union, neutral countries, and Russia might provide a useful framework for strategic stability in the future. For the time being, models of strategic stability in Europe should account for the differing perspectives or strategic images held by decision-makers in the affected countries.

CRISIS STABILITY

3.22 CALCULATIONS OF THREAT

In spite of the end of the Cold War, there are currently no major changes in the strategy of planning for the use of Russian strategic Nuclear Forces. As in Soviet times, Russian military analysts continue to see two geopolitical potential adversaries - the West (USA + UK + France + Israel + Pakistan, etc.) and China. The Chinese SNF are not considered by Russian analysts as a serious threat. However, the Western SNF are still considered to be the principal Russian strategic challenge. Therefore Russia continues to develop its plans for using and improving its SNF to retain the capability of delivering an unacceptable damage to the West in the case of any western SNF's first nuclear strike.

3.23 RUSSIAN STRATEGY AND CONCERNS

Russia is ready to actively explore together with US and other partners new concepts of strategic stability beyond MAD - stability concept. But before they can do it, it is necessary to finish up with today's and even yesterday political agenda. The START-2 Treaty faces the ratification process in both parliaments. This treaty, as does its predecessors, continues the rationale that codifies the hostility-type relationship between Russia and the US. In principle, it could have been signed in 1972. It reflects the philosophy of the MAD-doctrine and must be judged by the criteria of this doctrine. Russian calculations (Sulikov, Piontkowsy) show that in general their START II - constrained SNF can continue to guarantee an unacceptable second strike capability. However, Russian participants at the ARW felt that START II ratification may face serious difficulties in the current Russian parliament. There are two reasons for this situation. The first is technical - the Russian Parliament worries about a US re-loading potential. They have assessed it to be 2500 nuclear warheads verses Russian reloading potential to be about 500-600 warheads. Secondly, parliament worries about US efforts to create and deploy a theater BMD (THAAD)

system. It's expected technical characteristics (as proposed by the US in Geneva), are assessed to have some modest capability to intercept Russian ICBMs, SLBMs and their warheads. Such a deployment, they suggest, would inevitably create political linkages to any proposal for NATO enlargement -- in Russian's perception of strategic stability.

3.22 IMPOSING AN ORDER ??????? AND SYSTEMS

This analysis proposes a game-theoretic analysis that attempts to model the essential features of anarchic international systems -- systems without exogenous mechanisms of enforcement and which allow not only for cooperation *but also for non-cooperation* in the form of threats to eliminate countries altogether. Briefly, the model assumes that, conditional on maintaining their sovereignty, countries pursue a single transferable resource in constant supply-- it can be either "power" or economic wealth. A constant supply is assumed because cooperation cannot be secured simply by making the gains from it too great, and because sustaining cooperation in the context of constant sum competition reveals more clearly the role that institutions can play in ameliorating conflict. Next, so as to avoid confusion between the notion of equilibrium and that of stability, a system is *stable* if (and only if) all countries can ensure their sovereignty in the sense that if all countries choose their equilibrium strategies, no single country will have its resources reduced to zero.

3.23 BALANCE OF POWER & COLLECTIVE SECURITY

To model a balance of power, strategies are considered to be *stationary* -- that is, each country makes the same choices whenever it encounters the same threat. Thus, it thereby ignores who made a threat or who agreed to participate in a threat. In a balance of power system, all states are potentially fit alliance partners -- none is seen as significantly more 'evil' than any other. On the other hand, modeling a collective security environment requires simple *punishment strategies.* Where punishment is directed against those who try to upset the status quo either by making a threat or by agreeing to participate in it. The strategies forming a collective security equilibrium, then, are not stationary because they posit the formation of specific alliances, depending on who defects from a specified pattern of action.

3.24 EQUILIBRIUM & DESTABILIZING INFLUENCES

Equilibria, in a balance of power system, is supported by stationary strategies where only countries controlling some relatively critical level of resource can guarantee their existence within such a model. This implies that countries must be vigilant about the relative gains and losses of that resource (power or economic) cooperation generates. This makes such cooperation difficult, if not impossible. Collective security equilibrium is supported by punishment strategies in which no country offers an initial threat. This implies that the realization of this equilibrium renders the issue of sovereignty and relative position less salient. If the benefits that accrue through free trade and the like require a non-conflictual world, and if these benefits disappear when agreements to achieve them are disrupted by competition over relative position, then special attention should be paid to the circumstances under which such an equilibrium can be achieved and a balance of power equilibrium avoided.
Collective security requires that states punish defectors; but proposing a punishment (as opposed to some other threat) may be rational only if it is certain beforehand that the ostensible partners in the punishment will maintain their commitment to it. Since a collective security model equilibrium is considered theoretically perfect, doing so is rational in this case. But the practical possibility cannot be ignored, that states might be concerned that a defection of one type increases the perceived likelihood of other defections, so that defection becomes a self-fulfilling prophecy. The model assumes that all countries have perfect foresight. However, in reality there is always something left to chance, so (barring a perfectly functioning coordination mechanism), the viability of pursuing a punishment strategy may be reduced.

Collective security as an equilibrium means only that no state has any incentive to defect *unilaterally* from the agreement. This does not mean that states cannot gain if two or more of them defect simultaneously -- if there are coordinated defections. Indeed, if states can coordinate to achieve one type of equilibrium, then, barring other considerations, it is logical to assume that subsets of them can coordinate to achieve other ends -- if n countries can coordinate, then it is reasonable to assume that $m < n$ can also coordinate.

3.25 LESSONS

The principal lessons of the theoretical models of balance of power and collective security analysis are:

- A balance of power and a collective security equilibrium can exist simultaneously in an anarchic system that does not allow for universal gains from cooperation.
- In a balance of power, nations must be concerned with relative resources, because a loss of sovereignty cannot be precluded if they become too weak; under collective security, nations can focus on absolute gains since no one makes threats against the sovereignty of any state, large or small.
- A balance of power equilibrium is attractive because it is both strong and theoretically perfect. If a country believes that all, or nearly all, other states abide by it and if it believes that all or nearly all other states will coalesce freely and cannot be relied on to participate in punishments -it will then have a positive incentive to abide by it as well. It will also accept primary threats when they are offered and make them itself when it is possible to do so without destabilizing the essential security equation.
- If defection from a collective security equilibrium implies not only a punishment administered by other states but also the inability to pursue gains from cooperation, then collective security equilibria become attractive. Thus, to the extent that international organizations facilitate trade and cooperation, *collective security becomes a more secure alternative to balance of power.*
- The analysis, moreover, reveals a critically important function served by international organizations. Because two substantively plausible equilibria can be identified, nations must explicitly coordinate to achieve a genuine equilibrium. Hence, within a single scenario, the problems associated with coordinating particular equilibria can be examined.

A collective security equilibrium calls for states to "do nothing" until there is a defection from the system that warrants punishment. Regardless of the verbal agreements they reach, each state, as the game unfolds, may question whether others are abiding by their collective security strategies or whether they are merely postponing making a threat until circumstances are favorable.

CONFRONTATIONAL THEORY

3.26 GENERAL

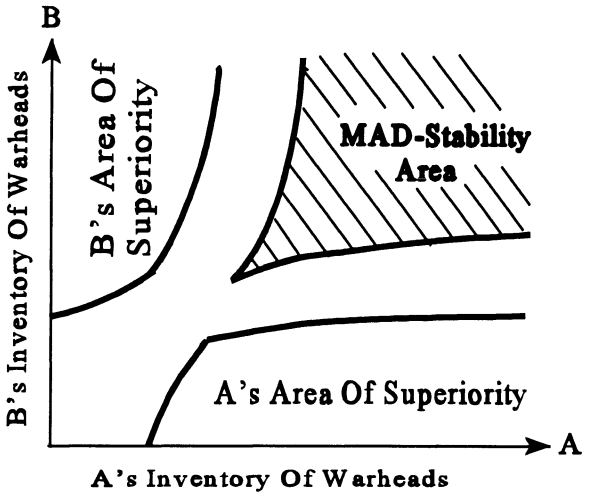
The aim of strategic stability is essentially to avoid *instability*. An instability is a situation in which one side may have an incentive to initiate hostilities, to strike first. (An incentive means calculation or hope to get some military or political advantage as a result of conflict). Stability is an absence of such a situation. The different ways to ensure stability are:

A. Deterrence	Threat of punishment for an attack
B. Protection	Frustrating of an attack.
C. Disarmament + Non-proliferation	No tools for attack
D. Conflict prevention	No reason for an attack
E. Spiritual Education	No psychological patterns for warfare
F. Irrational threats	No known sanctions

During the Cold War period a strong emphasis was made on one aspect of stability assurance, deterrence.

3.27 DETERRENT MODELS

A number of conceptual and analytical tools have been elaborated. The central concept has been Mutual Assured Destruction (MAD) formalized by the 1972 Moscow ABM Treaty. Its parameters for bipolar USSR - USA confrontation were analyzed and depicted using several analytical models focused on the MAD - stability concept

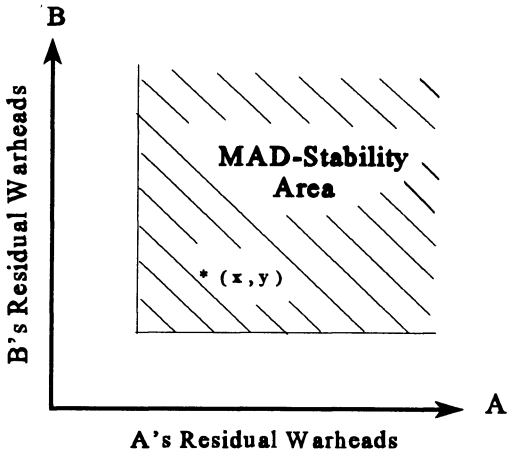


The two types of the deterrent model domains are: (1) Inventory and (2) Residual Warheads remaining after an opponent has delivered an optimized first strike.

Figure 1. MAD - Stability Inventory Domain

3.28 EXPLANATION OF THE DETERRENT MODEL

A point (x,y) is the result of solving two optimization problems (B attacks A, and A attacks B). This point contains, in compressed form, all of the data about both sides strategic forces systems (structure, accuracy, posture, etc.) that were used in calculating the surviving warheads as a result of the force exchanges..



First Strike Stability deals with the incentives or pressures to strike first. The concept of deterrence stability provides more information than just dividing the plane into areas of stability and instability. It measures in some sense the degree of instability. A First Strike Stability Index (FSSI) is defined as:

Figure 2 MAD-Stability Residual Warheads Domain

FSSI = min $\{Cost1_A/Cost2_A, Cost1_B/Cost2_B\}$

B's cost of striking first is: $Cost1_B = \min [D_B - L*D_A + L]$, $0<=D<=1$ where all of B's weapons are allocated in his first strike (A's best scenario),and B's cost of waiting is: $Cost2_B = \max [D_B - L*D_A + L]$ where all of A's weapons are allocated in its first strike on B (worst scenario for A). The FSSI concept includes the concept of MAD-stability. That is, FSSI≡1 is considered stable which is the case for all points inside MAD-stability area (upper right hand corner of figure 3)-- because $D_A = D_B = 1$ under any scenario inside this area. Hence,

$$Cost1_B = Cost2_B = Cost1_A = Cost2_A = 1 - L*1 + L = 1$$

FSSI≡1 is also at the point (0,0) -- because at this point $D_A = D_B = 0$,

$$Cost1_B = Cost2_B = Cost1_A = Cost2_A = 0 - L*0 + L = L .$$

At all other points FSSI < 1, indicating some degree of instability.

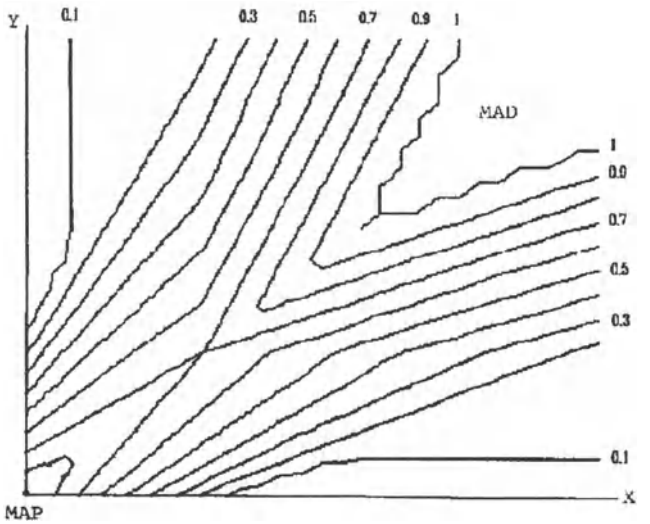


Figure 3. The First Strike Stability Index (FSSI) for Deterrence Stability.

3.29 ARMS RACE STABILITY

There is a well-known analytical approach, based on Richardson's equations. The multi-polar model of this type was extended in the Nyland papers. These models deal with the numbers of WMD, actually deployed by arms race participants and their associated reaction coefficients. However, what really matters are not *numbers* themselves, but those functional consequences which the implications of the capability that the numerical balance provides to both sides. For example, whether under such weapons relationship (which includes not only numbers, but structures of corresponding strategic forces systems,

their qualitative characteristics, etc.) do both sides have second-strike capabilities, or does one of them have a disarming first-strike capability, or does one side have a superiority in counter-force strikes ?
This is a valuable tool for translating the interactions among arms race equations into the consequences resulting from strategic forces exchange models.

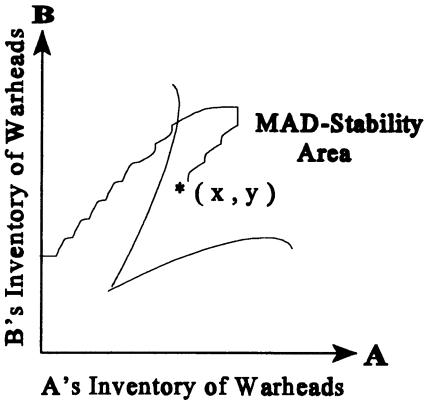


Figure 4. Evaluation of the Consequences of an Arms Race

3.30 IMPORTANCE OF MAD DETERRENT DOCTRINE

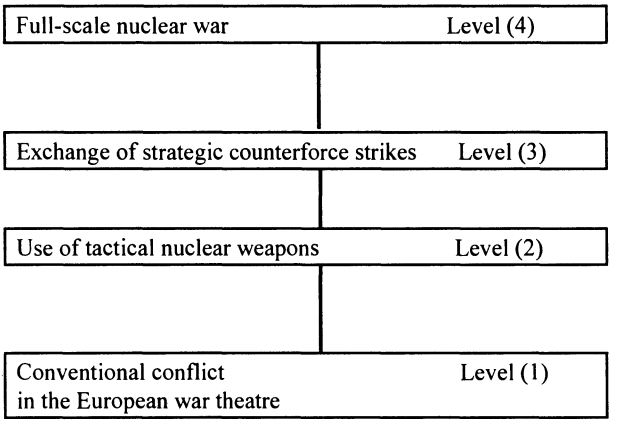
During the Cold War arms race participants were concerned primarily with keeping the two sides' strategic forces systems inside the MAD-stability area, or at best to attempt to move it into its own superiority area. The locus of points depicting the consequences of a shift in warhead inventories can be plotted on the graph (see figure 4). Thus, all the major strategic events (arms race, disarmament, exchange of strikes) may be depicted, evaluated and interpreted within the same graphical representation.

3.31 DETERRENCE AS A CRISIS STABILIZING TOOL

Crisis instability is usually referred to as "a situation that exists when a leader feels pressure because of the posture of forces to strike first to avoid worse consequences". As far as the posture of forces is concerned this subject is covered by the FSSI technique. Crisis stability as a concept is essentially first-strike stability + psychology factors. Psychological factors can be implicitly included in the FSSI concept (the Lambda coefficient). Another important element of crisis psychology is the fact of the crises itself. The incentive to strike first using nuclear weaponry does not appear out of the blue but arises in the context of the unfolding scenario (escalation, initial political imperatives, military or economic conflict).

3.32 MULTI-LEVEL CATEGORIES OF DETERRENCE THEORY

The classical cold war confrontation between NATO and Warsaw Treaty countries has always been interpreted in the context of the escalation ladder.



The 1972 ABM-Treaty effectively sealed the conditions of MAD between the then USSR and US. It also codified security stability at level 4 of the escalation ladder shown above. But it did not exclude a situation of instability that could arise at some other level, (i.e. that one side could hope to get some military or political advantage as a result of conflict at that particular level).

3.33 THE IMPACT OF UNCERTAINTY

Thus, during decades of the Cold War Western military strategic thought proceeded from the premise of the Warsaw Treaty functional superiority at level 1. Awareness of one's inferiority at a definite step of the conflict naturally provokes a striving to transfer it to another "more advantageous" level. This led to the appearance of such concepts as "flexible response ", "nuclear threshold" and "limited nuclear war in Europe". This deliberate uncertainty about NATO's nuclear intentions served as a psychological deterrent against any adversary's potential plans to realize any advantage at level 1. The radical changes in Europe, Russia and NATO have now effectively switched the role of nuclear weapons in Russia's relationship between conventional and nuclear forces. Because of Russia's considerably less capable conventional forces (1995) it is now Russia who tends to rely on the nuclear factor as a stabilizing element of its defense strategy.

3.34 COUNTER FORCE DETERRENCE

An instability situation may also arise at other levels of the escalation ladder. In the 1970's a "counter-force strategy" was developed (see Fred Ikle papers of that time). As then US Defense Secretary J.Schlesinger noted: "the US is not seeking either to achieve a disarming first strike capability. This does not mean, however, that we don't intend to have certain precision-guided systems which will be useful for limited counter force strikes". What J. Schlesinger meant was a possible conflict at level 3 (see fig.5). If one side gained an advantage (by having more and better precision-guided systems) at the counterforce exchange level, the realization of these exchanges would remove the two powers strategic forces system from the MAD-stability area; thus, undermining MAD-stability at level 4. In Fig. 5 at point 1, side B possesses such an advantage: at point 1' side A does correspondingly.

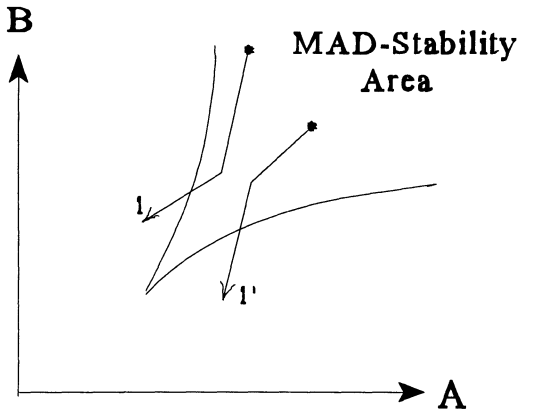


Figure 5. Effect of Counterforce Strikes on Deterrence

3.35 STABILITY AT ALL LEVELS

This analysis of movements inside and out of the MAD-stability area shows that not all the points inside this area are strategically equivalent. This consideration was obviously taken into account by the arms race participants. It therefore follows that the problem of stability bears a multi-level character and cannot be restricted only to the fulfillment of level 4 stability conditions. Situations of strategic instability must be avoided at *all levels* of the potential escalation ladder.

3.36 MAD: PROTECTION BY PARADOX

Until now we concentrated mainly on only one way of ensuring stability -- deterrence. It is particularly relevant, because this tool was essential for the stability structures of the cold war world, especially in the nuclear field. Having signed the ABM-treaty in 1972 both sides deliberately opened their defenseless territories for all the might of the opponent's nuclear potential. They turned to this choice as a last resort, realizing that, however paradoxical, this defenselessness provided their only possible defense in the geopolitical reality of the time. The assumption was that a rational adversary would never strike first, because he understood that an opponent had a survivable second-strike capability: consequently any first strike would automatically mean mutual suicide. Such was the reality of Mutually Assured Destruction. The very acronym for the worst phase of the Cold War possessed a grim logic. Such an extreme strategy was justified by the circumstances of that time and was perhaps the only possible military-political logic of the Cold War world.

3.37 MUTUALLY ASSURED PROTECTION (MAP)

But it would be methodologically wrong to regard the historically limited (i.e., valid only under very specific political and military circumstances) concept of MAD-stability as a universal one. In a radically different political environment (disappearance of a deep geopolitical conflict between two nuclear superpowers, a degree of mutual confidence and cooperation, deep cuts in offensive arms) it is now possible to rely on another paradigm of strategic stability, which we would define as MAP (Mutual Assured Protection)-Stability concept.

3.38 OBJECTIVE OF MAP

The objective of this strategy is to guarantee completely the territories of states from any nuclear strikes, including possible unauthorized launches and terrorist attacks from third sides, which are not deterred by existing strategic constraints. Until now most of the nuclear strategists and political decision-makers still continue to follow the intellectual habit of the MAD-stability concept, which was designed for a different historical epoch and responded to a different spectrum of potential threats.

3.39 MAD INERTIA

The inertia of thought among many experts in nuclear strategy is not just a curious and harmless methodological legacy of the Cold War. The old logic of the MAD-stability concept inevitably leads to two serious practical consequences which have an adverse effect on current global strategic stability.

3.40 MAD & DISARMAMENT

MAD concepts impose practical limitations on the superpowers' nuclear disarmament processes within the framework of START-2 agreement. For example, it requires the modernization and upkeep of huge Russian and USA nuclear arsenals. These enormous quantities are now futile for any clear-cut strategic objective under the realities of the new security environment. The mere maintenance of the nuclear complexes of such dimension increases (especially in Russia) the danger of ecological and radiation disaster as well as the danger of leakage and proliferation of the main components of nuclear weaponry.

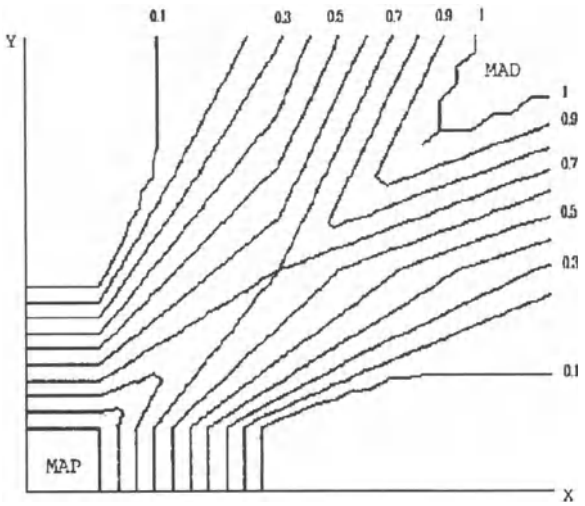


Figure 6. Isolines of limited ABM system and p>1

3.41 INHIBITIONS ON BMD

MAD-stability concepts forbid (by its own internal logic) deployment of any Anti-Ballistic Missile systems. Just this argument - ABM system deployment would undermine stability conditions - was the key determinant during the debates on global defense both in Russia and in the United States. Although seemingly convincing this argument is misleading. To scrutinize this point, consider FSSI technique.

As we saw in Figure.3, FSSI=1 inside MAD-stability area -- because in this area $D_A = D_B = 1$ and likewise $Cost_{1A} = Cost_{2A} = Cost_{1B} = Cost_{2B} = 1$. Also, FSSI = 1 at the point (0,0) -- because $D_A = D_B = 0$ by definition. Thus $Cost_{1A} = Cost_{2A} = Cost_{1B} = Cost_{2B} = L$.

In the world without GDS this (0,0) point is the only point of MAP - stability area. Let's consider now the evolution of both MAD-stability and MAP-stability with the deployment of GDS. We will characterize the efficiency of this system by the parameter K (number of warheads intercepted by such a system). Due to the deployment of the limited global GDS system the area of MAP-stability increases, starting from the origin and moving up to the right in the form of a square area

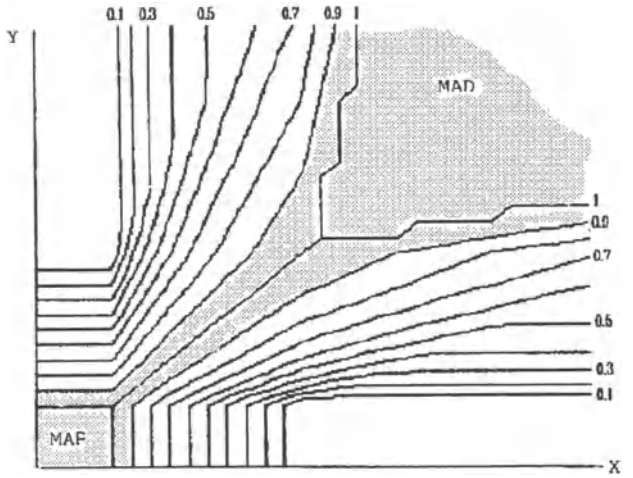
with length K. At the same time the MAD-stability area decreases, moving up to the right as it was correctly noted in the papers in which the SDI project was described as a destabilizing idea (see Figure.6). However what was not noted is that the MAP-stability area is rising and increasing. In fact, the (x,y) plane has a general area of stability, combining these two mutually complementary aspects of stability. In a general case, this area is unconnected and its MAD and MAP subsets are divided by the instability area where FSSI is less then unity.

3.42 MAD TO MAP ?

The problem of deep cuts in offensive strategic forces (beyond START-2) is basically the problem of a transition from MAD-stability to MAP-stability. The mere raising of this problem is of course, only possible, under certain political conditions (namely, degree of mutual confidence, absence of global confrontation, sound partnership relations). But we also need to analyze the technical aspects of the problem -- discovering the most stable path of transition from the MAD-area to the MAP-area (i.e. a path where FSSI is equal to unity or very close to unity).

3.43 NEW MODELS OF STRATEGIC STABILITY

In this context, let's consider a case where the offensive forces of each side are invulnerable - p<L (see figure.7). Comparing the case presented in Figure 6, FSSI increases considerably in the area between MAD and MAP and, actually there is a connected path of a general stability area, inside which we can



realize a stable transition from the cold war stability paradigm to a new stability paradigm for cooperation and security. (In the shaded area FSSI>=0.9).

3.44 A GENERAL STRATEGIC STABILITY THEORY

This analysis demonstrates that the concept of Mutual Assured Destruction and the MAP-stability concept are in reality only two approaches to a wider general theory of Strategic Stability and security. The same mathematical tool - the First Strike Stability Index - has allowed us to unify these two apparently opposite notions into a single concept of general stability. Those states of the strategic forces system are regarded as stable whose FSSI value is equal or very close to 1. In military political terms it means that in this state neither side has any *rational incentive toward initiating a conflict*. This unified stability area covers both the points corresponding to MAD-stability and ones corresponding to MAP-stability areas. Moreover, this stability domain demonstrates the possibility of a stable transition path (i.e. by preserving FSSI ≡ 1 condition along all the transition path) from MAD-stability subdomain to MAP -stability subdomain. This provides, for the first time, a unified stability theory.

3.45 PRACTICAL IMPACT OF THE GENERAL THEORY

The latest conclusion solves an important and long-debated problem, namely, the possibility of a smooth (i.e. preserving generalized stability conditions at all intermediate stages of transition process) change of strategic stability paradigm. As discussed in previous sections 3.4 - 3.9, stability is a multilevel problem for which nuclear stability is an important facet. A variety of approaches (deterrence, protection, disarmament, and proliferation issues) can now be addressed within this general military stability framework which covers both MAD-stability and MAP-stability domains. This is an unusual case where mathematical methods can have an immediate and substantial impact on policy formulation so far unobtainable by other means.

3.46 MULTIPOLARITY OF THE POST-COLD WAR WORLD.

The collapse of the bi-polar world structure eliminated some traditional threats to global security and a new spectrum of potential threats are emerging as a result of the collapse. Deterrence and protection concepts in the bi-polar context must now be extended to the multi-polar world. In general, in a multi-polar environment composed of n parties, there are N potential confrontation coalitions partitioned into bilateral relationships. The number N is given by the recursive formula: $N_n = 3N_{n-1} + C^1_{n-1} + C^2_{n-1} + C^{n-1}_{n-1}$ the formula gives the following results:

$N(2) = 1$
$N(3) = 3 + C_2^1 + C_2^2 = 6$
$N(4) = 18 + C_3^1 + C_3^2 + C_3^3 = 25$
$N(5) = 75 + C_4^1 + C_4^2 + C_4^3 + C_4^4 = 90$, etc.

3.47 DETERRENCE THEORY IN A MULTIPOLAR WORLD

Deterrence is the practice of credibly threatening an unacceptable penalty (by Cost / Damage/ Counteraction) against any potential adversary, so that the opponent will exercise restraint in his behavior. From this simple bilateral theory of deterrent thinking, models of multipolar deterrence can be extrapolated .

3.48 MODELING DETERRENCE IN A MULTIPOLAR WORLD

At its' core, deterrence is an oriented bilateral relationship. That is, party A is said to deter party B from implementing B's strategy S_B , if A threatens B by retaliating with a strategy S_A , such that, the following three conditions apply:

(1) S_A can be "not incredibly" implemented by A;
(2) The consequence of A selecting S_A , and B selecting S_B , is unacceptable to B;
(3) B has an alternative strategy S_B^1 that he believes can be successfully implemented and will yield him an acceptable outcome.

The above bilateral definition is the nucleus of all deterrent relationships, and can be represented by an arc of origin S_A , and extremity S_B . The representation of a multipolar system will be a graph of arcs that represent the bilateral deterrent relations between parties and coalitions of parties (a coalition being treated as another party in the graph). For a three party system with a strategy triple of (S_A , S_B , S_C) - whether A and B coalize or not - we shall say that strategic combination (S_A , S_C) is deterrent vis-a'-vis S_B , if the three above conditions are satisfied, with strategy S_A being replaced by strategic combination (S_A , S_C). Thus, strategic combination (S_A , S_C) will be treated a simple strategy from the point of view of implementation, with nevertheless two cases - which look similar at first sight - to be distinguished:

1) in non-cooperative situations - that is situations where no coalition occurs between the parties - non-cooperative strategic combination (S_A , S_C) can be "not incredibly" implemented with acceptable outcomes to A and C, if and only if the same ?? For strategies S_A and S_B considered separately.

2) in cooperative situations, where coalitions occur - the coalition A and C comprised of A and C is considered as a simple party, with the confidence that unacceptableness of a situation to one of the coalition's members suffices to make this situation unacceptable to the coalition.

3.49 MODELING ASSUMPTIONS AND CATEGORIES

In general, in a multipolar environment composed of n parties, there are $2^{n(n-1)}$ possible deterrent structures built on bilateral deterrent relationships. In practice, there are usually some dominant rules of thumb that will prune the number of categories that are under consideration at any given time. However, generic rules of thumb are difficult to establish. But in any given situation they tend to be readily apparent. The assumptions underpinning deterrence involve expectations between adversaries about how their opponent(s) will think, behave, formulate policy decisions and the willingness or credibility of an opponent to exercise penalties (sanctions). These basic assumptions are as follows:

(1) rational leadership is exercised on both sides. Each party is considered to be rational if it makes its' best effort to avoid an unacceptable outcome. For each party, what is unacceptable will be evaluated in each particular situation.

For instance, consider a situation where party A wishes to deter party B from selecting an option S_B . B is considered rational if, confronted by the theat S_A , B discards all actions that will lead to an unacceptable outcome for him -- provided that B has an alternative strategy S_B^1 which for B will lead to an acceptable outcome.

The acceptability of the outcome strategy S_B^1 by B will be heavily influenced by whether A has another strategy S_A^1 , that in combination with S_B^1 , may theoretically lead to a worse outcome for B than accepting the outcome of S_A . Hence, deterrence has a recursive process to it where the possibilities of credible strategies of the various parties must also be analyzed.

A practical example of the recursive process is where, at the tactical level, A wants to deter B from using a specific category of weapons. But achievement of the tactical level of deterrence may have strong consequences at the strategic level. A is said to have a global capability to deter B.

S_A , if implemented by A, may lead to an unacceptable outcome for A, but still be perceived as a threat by B provided the sanction is credible.

(2) The threat or sanction must be credible, and the means of imposing the penalty under the control of the leadership. For each party, credibility depends on the consequences of sanctions being

implemented, and the existence of alternative strategies for each party. For instance, if implementing a sanction leads to an unacceptable result for A, the sanction can still be a credible threat if the consequence to A of not implementing the sanction is also perceived by its' opponent(s) as unacceptable.

Credibility is also derived by having the sanctions under the control of the leadership: a capability without the means of implementation is not credible. In the case of military affairs, the strategic means are not only weapon systems, but also the operational plans and command and control necessary to execute them, as credibility also depends on the means to effectively communicate the sanction.

(3) The parties must have effective means of interaction and communication among them sufficient for mutual understanding about sanctions, thresholds, and expectations. Communication is fundamental to imparting knowledge to the other parties. If a sanction cannot be effectively communicated, no threat will be perceived by the other parties. Effective communication is more than transmitting a message; it also includes the guarantee that the message was properly received and interpreted as a threat. Communications are subject to noise, mistrust, delays, and misinterpretations. At a very basic level A must not only know he has transmitted a sanction, but he must also know that the sanction was received as a threat. To the extent that the sequence (A knows that B knows that A knows) is infinite among all parties, common knowledge is reached.

(4) Behavior is governed by cost benefit calculations, and that a proposed penalty (sanction/cost/counteraction) can be credibly threatened which dominates the expected benefits. The nature of the penalty can be offensive or defensive. A defensive counteraction S_A to B's strategy S_B can prevent B from reaching his goal(interdiction). An offensive counteraction S_A is not directed at preventing B from reaching his goal, but punishing him for doing so (sanction). Both offensive and defensive actions can be combined to comprise a strategy.

For instance, if S_B is a strategy of invasion of A's territory, and S_A is A's military strategy to counter (defend against) B's offensive action as well as mount a counterattack against B , the consequence of implementing the strategic pair (S_A , S_B) can lead to B unable to achieve invasion of A's territory, and the price of its' attempt clearly raised to an unacceptably high level. In this situation both modes of deterrence are present.

FIRST STRIKE INCENTIVES/CONTROLS

3.50 INHIBITIONS ON FIRST STRIKE

The condition that exists when, owing solely to the posture of forces, leaders are not perceived in a crisis to feel pressure to strike first against one or more opponents to avoid the worse consequence of incurring a first strike. The enhancement of first strike stability can eliminate force posture as a catalyst to crisis instability. A national leader has the ambiguous choice between striking first against one or more opponents and waiting. If he waits, he does not know whether he will be avoiding war or incurring a first strike.

3.51 BI- POLAR MODEL

In a bi-polar world, first strike stability is a function of two ratios -- one for each opponent. The ratio for each opponent is the cost of striking first to the cost of waiting and striking second. The index of first strike stability is given by

$$\frac{C(Astrikes1st)}{C(Astrikes2nd)} * \frac{C(Bstrikes1st)}{C(Bstrikes2nd)}$$

where the cost is defined at the difference the damage suffered (a fraction of valued assets damaged) and the discounted damage not inflicted on the opponent.

$$C=D_{SELF}-\lambda\cdot(1-D_{OPPONENT})$$

3.52 MULTI-POLAR MODEL

In a multipolar world, calculating the index of first strike stability is more complicated. One means of calculating a multipolar First Strike Stability Index consists of finding a cost ratio for all opponents (I=1,2,3,....n) as indicated below:

$$CR_i=\frac{C_i(strikes\ first)}{C_i(strikes\ other\ than\ first)}$$

The multipolar First Strike Stability Index is given by : $S=\min[CR_1,CR_2,CR_3,.....CR_n]$

or by the smallest cost ratio amongst all (n) of the opponents.

- If there are coalitions amongst the nations involved, each coalition is treated as one opponent.
- If there are three coalitions of approximate capability the previously defined S is thought to be correct.
- If there are three coalitions of which one is dominant, the two small coalitions will be destroyed if they preempt or if they initiate, so the first strike stability S will be that of the dominant coalition.
- If there are three coalitions of which two are competing for dominance and one is small, the first-strike stability S will be that of the less stable of the two dominant coalitions.

The above two paragraphs demand that the definition of dominance be found. Additionally, at this juncture, the finer-structure issues such as multiple strikes by single coalitions on single coalitions are not understood.

QUANTITATIVE GEOPOLITICS - BALANCE OF POWER VERSUS COLLECTIVE SECURITY : GAME-THEORETIC ANALYSIS

3.53 QUANTITATIVE APPROACHES TO MODELING DETERRENCE, CRISIS STABILITY, AND FIRST STRIKE STABILITY

Since deterrence is concerned only with positions of the parties with respect to their own thresholds, all parties outcomes will be gathered into two groups:

- acceptable outcomes represented by a "1"
- unacceptable outcomes represented by a "0"

Consequently, two-player games will be modeled through binary bi matrices. The analysis of deterrence on the binary game will be performed by studying the playability properties of the players strategies, through a recursive process. There are two ways for strategy of player A to be playable :

(1) because it is a "good" strategy -- player can guarantee himself an acceptable S_A outcome , provided player B is rational. We shall say S_A , positively playable; and

(2) because player A has no reason to discard it just because it is not a "good" strategy. We shall say S_A is playable by default.

This method can be extended to analyze n-player games.

ARMS RACE DYNAMICS

3.54 THE TWO CATEGORIES: WARHEADS & DELIVERY SYSTEMS

During the NATO Advanced Research Workshop, two different problems emerged. One problem was the arms race instability determined from the *number of nuclear weapons* in each of two or three opponent's armament inventories. The other aspect of arms racing addressed *delivery systems* instabilities caused by the production rate of different kinds of weapons such as combat aircraft.

3.55 MODELING ARMS RACES

The first formulation of an arms race is based on Richardson's equations, but extended to three or even four contenders. Arms race evaluation based on this method would employ monitoring of weapon inventories of all contenders. Both approaches to arms races have their place in understanding the implications for the growth of nuclear weapon inventories amongst multipolar interactions in the future which cannot be completely disconnected from other weapon systems.

3.56 RICHARDSON'S MODELS SIMULATION

The criterion for stability is derived from solutions of Richardson's equations for three contenders:

$$dx/dt = ky + yz - ax + G$$
$$dy/dt = mx + nz - by + H$$
$$dz/dt = px + qy - cz + I$$

Instability is defined as a condition where weapon inventories increase without limit. To prevent instability in a three-way arms race, the following criterion must be observed:

$$\frac{yqm+npk}{abc}+\frac{nq}{bc}+\frac{yp}{ac}+\frac{mk}{ab}<1$$

where :
a,b,c = cost constraint fractions
x,y = X reactions to Y and Z
p,q = Z
G,H,I = hostility indices of X,Y,Z

The solution to the equations results in a time history of the number of warheads in each contender's inventory. Examples included involvement by U.S., Russia, and China. A third area example was treated with a "catch-up" model based on activities of China, India, and Pakistan.

In the future, historic data will be applied to derive coefficients to Richardson's equations to generate short term predictions of future arms racing behavior.

The second approach to understanding arms races involves combat arms production with special emphasis on combat aircraft.

3.57 ARMS RACE MODELING DYNAMICS

The ratio of domestic production /export production has dramatically shifted in recent years among the major producers, (U.S., Russia, and European countries) where the production for export is now larger than for domestic purposes. This is one of the main results of the drastic reduction of military forces

everywhere, and an undesirable consequence of the end of the Cold War.
This free market in arms has four main dynamics:

1) the market is entirely driven by the major exporters
2) Arms export is one of the main issues for solving industrial problems raised by the reductions and restorations in military systems and in the National defense in industry.
3) Military allies are the main competitors in this export dynamics; they most often belong to Atlantic Alliance (of U.S. versus European countries)
4) Russia and China, for different reasons, are playing a very specific role in this dynamic: Russia because of its conversion problem and China for both domestic and international reasons and because of its geographic position in the Eastern area.

Assuming that the players in Arms market are fewer and fewer the economic dynamic of arms race is to be modeled in the terms of Cournot-Nash oligopoly models (indexes can be used for relating competitive market structure to equilibria).

3.58 FROM ARMS DYNAMICS TO INTERNATIONAL INSTABILITY (OR STABILITY)

Two types of political or strategic tensions seem to be induced from the dynamics of the arms trade:
(1) between allies as US and some European countries in NATO
(2) the new list and new major importers (China, Taiwan, South Korea, Pakistan, India, Iran).
For modeling the international instability consequences of the arms trade - and in order to formalize the relationship between the amount of arms and the stability through nuclear deterrence for US and Soviet Union (cf Intriligator 1975 ...) - this general framework must be used in order to take into account the content and the novelty of multipolar world. Two clear suggestions can be made:
(1) Revisiting the "surprise attack" - Schelling's concept in the case where the surprise attack is not "deliberate" but "unintended" if not accidental - the assumption on potential adversaries' knowledge is to be forecast for elaborating the Schelling suggestion (see Schmidt 1994).
(2) Using the redefinition of deterrence (Rudnianski) to reformulate the kind of Intriligator's figure.

3.59 CONCLUSIONS OF ARMS RACE MODELS

The different types of traditional arms race models are almost irrelevant, Richardson's interaction equation as well as the bureaucratic models (see $x = a_1(x-x_{to})+-az$); it is therefore necessary to support new classes of interconnected models (economic arms race and strategic stability) to explore these potentially destabilizing security areas.

COOPERATION THEORY

3.60 STABILITY MECHANISMS

From the quantitative proceedings of the workshop it was possible to identify certain qualitative areas and problems that call for the development of stability mechanisms to assist in the settlement of disputes and the achievement of mutually acceptable solutions by Russia and NATO. Such stability initiatives need to be coordinated and their impact tailored as part of a wider policy incorporating other factors.

3.61 ECONOMIC & POLITICAL FACTORS

It is important to identify a feature of great current concern to Russia. Resulting from the provisions of arms control agreements, Russian military industry is facing a conversion requirement of stupendous proportions. The quantity of conventional armaments that are surplus to the actual needs of the Armed Forces numbers tens of thousands. The instability caused by this surplus is many-sided. Militarily, such armaments, if disposed of by cheap sales, or even donations, to other states. This could drastically upset

the balance of power in the relevant region. Economically, the effect is double-edged: on the one hand, a simple sale would of course result in a hard currency profit for Russia. However, the satisfying of external demand by off-loading second-hand equipment in large quantities cancels any opportunity of genuine sales of newly produced equipment. Thus, the Russian military sales budget would benefit, but the Russian defense industry would be much the poorer. The other feature of this problem is connected with the obtaining of political influence through the provision of armaments. Because of the destabilizing effects, a mechanism to coordinate, and give equilibrium, to arms exports should be established between NATO and Russia as a matter of strategic stability policy.

3.62 THE HUMAN IMPACT

The need has arisen in Russia to retrain many thousands of serving officers and NCOs, and fit them for civilian life. To a far lesser degree, these same problems are facing many NATO nations. The experiences of different NATO countries, allied to constructive initiatives and practical ideas for possible use in Russia, would be a valuable stability tool. It could even be possible to exchange employment opportunities between NATO countries and Russia, perhaps by involving other organizations.

3.63 IMPORTANCE OF EXCHANGE

The public awareness of different levels of the population in both Russia and NATO of major strategic issues and actions has shown a need for a wider exchange of public information. An international mechanism is required, incorporating experts from military, academic and political/scientific research establishments, and supported by both NATO and Russia. Such a forum should be provided with the best sources of mass media information and links with official, governmental, organizations and given clear terms of reference to act as a link for strategic exchanges and academic work on strategic stability subjects.

3.64 IMPACT OF CONVENTIONAL WEAPONRY ON INSTABILITY

Finally, the significance of new types of conventional weapons has led several speakers in the workshops to comment that the improvement of this class of armament requires a new assessment, and a system to counter their transfer. Mostly, it has been the spread of precision guidance, but also new advances in the technology of warheads are significant. The Workshop considered that a joint mechanism for controlling the export or other transfer of high-performance conventional weaponry would assist in the maintenance of stability in this sphere.

3.65 STABILITY ENHANCING MEASURES

The priorities are:

1. An appropriate mechanism, jointly supported by NATO and Russia, to identify and develop common strategic and security programs.
2. The coordination between NATO and Russia of an armaments export policy.
3. The exchange of information, ideas, and practical help in the retraining and re-settlement of military personnel.
4. A control mechanism to cover the transfer of conventional weapons of high accuracy or special lethality.

If the above mechanisms can be introduced and supported by NATO and Russia, a decisive and beneficial effect will be created for stability into the 21st century.

4.0 PART 4 : Perspectives, Recommended Actions and Future Work

4.1 PERSPECTIVES

4.3.1 *China:* The delegates have thoroughly and frankly expressed their viewpoints, such as, the Russian viewpoint of their enemies after the end of the Cold War and the proliferation issue presented by India. All of this frank talk helped us a lot in understanding each other's viewpoints and laid a foundation for future work in dispelling these misgivings.

All the models presented at this workshop are based on a scientific analysis. They help us (Chinese strategic analysts) in our research work. We will report this work to our Societies, Universities and concerned institutions.

4.3.2 *Israel:* There is a linguistic difficulty. We have an academic group, with an understanding of modeling theory - we also have an important group of non-academic practitioners who have to deal with the realities of the world. Both have their separate functions, and both must exist separately - but there has to be a bridge between the two.

On stability:

- Israel does not reveal its nuclear arsenal for sound reasons of stability. The population is certainly held at hostage so they must be protected by uncertainty.
  - ** Clarity (eg 220 warheads at 2500 kms) would destabilize the region.
  - ** The only stable option for deterrence in the region is non-disclosure and non-transparency.
  - ** What would happen if other regional nations acquire nuclear warheads, not aimed at Israel but at their Arab neighbors?
    - New stabilization measures would be needed - and quickly
    - Bilateral/Tri-lateral agreements would be needed, subject to certain principles:
      - ** WMD must be under strict control of the POLITICAL and not MILITARY leadership (cf. Saddam Hussein's delegation of CW/BW authority to the commanders during the Gulf War).
      - ** The nuclear forces in the region must be kept small - no tactical nuclear weapons, only strategic capability.
      - ** These forces, as forces of last resort, should NOT be kept at high readiness or alert states.
- By using these principles, regional stability MIGHT be assured. But we don't have the instruments to assert these measures at present.

4.3.3 *Russia:*

- Security paradigm: It is not a perception - misperception problem. There are two contradictory approaches
  (1) For West - changes inside the old paradigms as a result of the defeat in a Cold War/Victory -- no sense of change
  (2) For Russia - changing of the paradigm and creation of a new global and European security system which is typical for romantic vision of Western realities and intentions in attitude to Russia
- As a result, backlash in Russian public opinion is inevitable. This is not to say that this process has acquired an irreversible character. But, in this case, we face a problem of synchronicity of intentions and perceptions.

** In this context, the necessity for dialogue acquires a very special attention, and our three day experiment proves it; as well as, the possibility to narrow the gap between participants, and

narrow the gap between theory and official practice.

** Our decisions allowed us to cover a wide scope of problems, and it has a sense of how to identify a clue, the priority problem of international agenda and contribute to global stability through the elaboration of some problems in primarily an applied way:
- Nuclear stability : current understanding & implementation
- WMD proliferation
- European security -- what is in direct interest of NATO
- Parity, non-linear distortions to stability in multipolar world
- Correlation between nuclear and global stability, non-linear distortion in multipolar world

- To make a long story short we should have in mind the need to overcome conceptual gaps between corresponding visions of global relations using the exchange of information during workshops like this -- thanks to our host.

4.3.4 *France:*

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- Threat assessment: The great uncertainties due to the collapse of the Soviet Union imply new assessments of the threat.
  - From the East
  - From the South

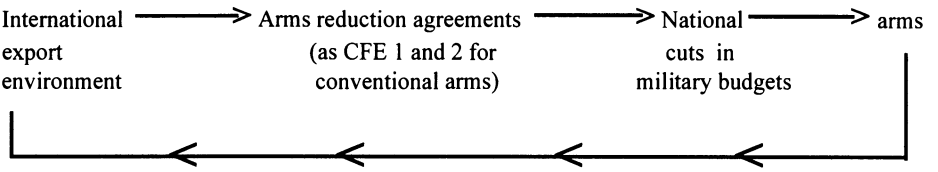
  with respect to both:
  - conventional arms, and
  - weapons of mass destruction /proliferation
- Deterrence and Proliferation: If there is little doubt that deterrence will play a smaller role in the near future with respect to relations between NATO countries and Russia, that does not mean that nuclear deterrence should be eliminated. On the contrary, because of uncertainties, it will be a factor of security for a long time. At the same time, proliferation is becoming a greater danger every day. To cope with this apparent contradiction, fresh thoughts have to be brought to bear on deterrence in a multipolar world that simultaneously ensures security and prevents proliferation.
- The industrial and economic dimension of international security need to be studied at three levels:
  (1) The relationship between arm's reduction and international stability in arms exports.
  (2) The various aspects of the conversion problem in the former Soviet Union but also in NATO's countries (supporting United Kingdom proposal)
  (3) The study of the kinds of cooperation in defense industries relative to the economic side as well as the security side of the proposals. 1,2 & 3 must be elaborated both at a descriptive level and at an analytical level using different modeling techniques

4.3.5 *United Kingdom*:

Insights And Implications For Global And Regional Stability:

- *The Impact of Advanced Conventional Weapons.* The participants recognize that advanced conventional weapons have taken the place of some nuclear weapons. In this way, conventional armament has crossed over into an instability area where the current provisions of arms control agreements and the MTCR do not apply. This is an important area for attention now; it is better to analyze before it becomes critical.

- *New Patterns For Arms Races In Production And Exports*: As the French have pointed, one must make the distinction between two facets of the problem: (1) arm's sale as a dynamics per se; and (2) the strategic impact of the arms race on international stability (or instability). The two questions are disconnected and require two separate models to be linked. Their schema summarizes the general picture for the near future.



The emphasis must be put on the feedback loop of the figure.

- *The Impact Of Dumping Conventional* Weapons: The danger of instability in South Asia resulting from the dumping of conventional weaponry by other states was highlighted by the Chinese. The "general schema" (above) shows the cycle of how the improving international environment leads to arms reduction agreements, these lead to cuts in national armament/military budgets, which lead to a compulsion to export arms; this in turn leads back to arms impacts on the international environment. Thus, arms control implicitly brings with its train a series of problem areas that require study. The instability impact affects not only NATO, Russia and Europe -- it is global.

- *The Impact Of Surplus Military And Military/Industrial Personnel:* The defense conversion problem in Russia, both in personnel and equipment, highlighted an area for cooperation with NATO. The increasing pool of dissatisfied military personnel is creating a "time bomb" for the future. This problem strikes many countries in different proportions, but none are immune.

4.3.6 *India:*

- Stability is indivisible. South Asian stability cannot be looked at in isolation. China, though it might be a global player impacts upon India. India in turn impacts on Pakistan's perceptions. The world milieu is therefore relevant for regional analyses.

- The threat to world stability is more likely to come in the future decades through threats from non-state actors, such as religious fundamentalism, the 'empire of cocaine', terrorism and subversion from cults, sub-national and ethnic groups, transnational mega-firms etc. Bringing these into the international structure and taming them to the extent possible is vital. Otherwise it will be virtually impossible to deter them with threats, or to take punitive action if deterrence fails, as targeting these wraiths will be virtually impossible.

- While dealing with nation states on nuclear proliferation, the approach thus far has concentrated too much on the supply side of the equation and not nearly enough on the demand side. Genuine security concerns of nation states ought to be taken care of by a suitable international regime, if these states are to be persuaded not to go it alone in their quest for security. The big powers setting a good example in drastically cutting back their nuclear stockpiles, with a 'do as I do' approach rather than one of 'do as I say' would go a long way.

- I would suggest that at the Moscow conference, more time be made available for interaction between qualitative strategic analysts and quantitative ones.

- Finally I would like to say that, thus far, India's approach to non-proliferation has been somewhat simplistic. There has been advocacy of total and universal nuclear disarmament; not enough thought has been given to arms control, with virtually no debate on the subject. This must change. However, I believe that as long as India perceives a threat to its security including a nuclear one, and there is no credible international or big power guarantee regarding the safeguarding of the security interests of non nuclear powers, no amount of pressure will make India give up its nuclear option.

4.3.6 *USA: Insights and Implications*

- Contemplated this workshop and the participants from so many countries -- impressed by those with:
  ** Longstanding friendships
  ** Former enemies and new friendships
- Sociology of the workshop proved to be very interesting -- have not been disappointed
- Assembled in order to try to develop practical models/approaches to strategic stability
  Believe we have made substantial progress in that regard
- Nonetheless, suggest that strategic images each of us carry around inside our heads also had a major influence on our discourse.
  ** At the root, pictures in our heads of strategic relationships is our reality - we act on those images
  ** These images are supported by key assumptions shaped by past experience
  ** Our natural behavior prompts us to screen out discordant information so that we can keep our image intact -- we comprehend selectively
  ** I have no doubt of the complexities of theproblem
  ** I have no doubt of the advantage of conventional weapons as tool for stability
  ** No one needs to admit it openly but I think we have seen some fascinating examples of cognitive dissonance at work in others as well as; perhaps, inside ourselves
- Some of this says that we are not very bright because we carry around cold war frameworks in our heads It doesn't argue that we are bad people. It simply says, I think, that we are human --that each of us is locked up inside of a French, Chinese, American, Russian, or whatever nationality body
- This says to us that international exchanges such as this one are essential to future strategic stability
  ** This NATO advanced Research Workshop introduced a human element to this arcane world of quantitative models of strategic stability and perhaps started to reshape those images.
  ** After all, strategic stability is all about people living together on this earth and working to assure peaceful conditions in spite of important differences and contrary world views
  ** I think we collectively have demonstrated the human face of strategic stability
  ** I look forward to continuing our discourse by fax, mail, and the telephones, and, of course, Internet in the months to come.
- Our future work should continue to emphasize the calculus associated with strategic stability
  ** But our efforts must be tempered by a due regard given to the psychological
  ** The strategic images that guides all in our respective interpretations of strategic stability and what it means for our respective countries
- As these past days have shown, our discourse helps to address strategic stability and clarify the strategic perspectives we may not share.

4.2 RECOMMENDED ACTIONS

- The participants found this NATO Advanced Research Workshop extremely instructive as a foundational work toward reaching a consensus on an analytical framework to address the future role of nuclear weapons (and other Weapons of Mass Destruction) and possible disarmament measures. The participants unanimously recommended the continuation of this effort, under NATO sponsorship, in order to further the work begun. The Russian delegation volunteered to host the next meeting in Moscow (May - June 1996) should NATO support the second workshop. The Director of the workshop and its Co-Directors, without hesitation, recommend a second workshop. The Chinese volunteered to hold a third workshop in Beijing.

- Conventional weapons. NATO and Russia should set up a joint working group to examine the impact on stability of conventional weapons with high accuracy or other special capabilities. The working group should examine the possibility of amending MTCR to regulate such technology, or make alternative provision for the necessary supervisory control.

- Defense conversion and re-employment. NATO and Russia should set up an association of academics, political scientists, military experts and industrialists to create ideas, exchange information and assist in planning for defense conversion and re-employment of military personnel. This association should also incorporate mass media personnel, and should operate as a motivated "think tank", available to assist NATO and Russia on specific problems connected with arms control, defense conversion and stability problems. The attendance list of this ARW would be an excellent start point for such an association. Which should be created with the minimum of bureaucracy. This association would bridge the "information gap" which has troubled many delegates.

4.3 FUTURE WORK

This landmark workshop has produced the foundational work necessary to undertake the quantitative and qualitative evaluation of multiple ways to ensure multiple levels of stability in a multipolar world. The overarching consensus of the ARW is that a broader spectrum of threats in the post cold war world must be met by a broader set of approaches and means. This workshop encompassed four separable activities.

- Analysts examining the dynamics of various categories of stabilities(or instabilities)The analyses included a clear statement as to:
  (1) the category of stability being addressed;
  (2) the measure, if any; and
  (3) which factors promote (erode) stability in that category
- Strategic planners projecting the world environment and identifying possible threats to various categories of stability (or instability)
- Creative conceivers formulating and defining new concepts to avoid possible instabilities and to promote stability as opportunities are presented These concepts were focused accordingly to the potential problems that the planners identified.
- Strategic planners (and analysts) evaluating the merits and demerits of proposed concepts. The evaluations being performed in the presence of potential instabilities identified by the planners and the dynamics as developed by the analysts.

This (first) workshop made considerable progress toward identifying potential instabilities and understanding the dynamics attendant to particular categories of stability. The immediate task is to inventory an agreed set of threats to global and regional stability in our dynamic and changing world and match them with appropriate concepts to redress the threat(s).

The thrust of the second ARW will be to focus on papers centered on new concepts to alleviate possible instabilities. And have the following tasks:

- Formulate concepts that will promote stability in a multipolar world that is not dominated by Mutual Assured Destruction. Special attention should be given to concepts based on protection.
- Continue the development of the theoretical underpinnings begun in the first ARW. Special emphasis should be given to Cooperation Theory and the robustness derived by the interaction between Confrontational and Cooperational Theory and their measures.
- Evaluate new proposed concepts to promote stability in the presence of nuclear (and other WMD) weapons. The described concepts must also be defined to include appropriate measures of merit.
- Important concepts should then be brought to the attention of governments and exposed to public opinion through the dissemination of a consensus report reflecting the deliberations of the workshop

All participants of this workshop agree that NATO is crucial and the proper organizational structure to sponsor future ARWs involving scientific and military institutes from the participating countries. These ARWs build on the Partnership For Peace/NATO-Russian CIS-Eastern Europe

The Russian delegation expressed readiness to take the responsibility to organize and coordinate the next ARW on Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament in Moscow (May-June 1996).

About The Authors

Ilan Amit is an independent consultant and a past fellow of CEMA (Center for Military Analysis), Israel, and a former Director of the Center. He held previous positions as visiting fellow of the institute of Advanced Studies at the Hebrew University and as an Editor of 'Think', an IBM sponsored interdisciplinary journal. His fields of research include economics of defense and strategic analyses. Dr. Amit received his B.S. in 1962 and his doctorate in 1967, both in Mathematics, from Technicon, The Israel Institute of Technology.

Melvin Best is the President of MBEnterprises. He has operational experience as a missile crew commander, as well as, nuclear weapons application planning at Headquarters Strategic Air Command (SAC). He is a recognized expert in defense systems engineering analysis, nuclear policy analysis and planning. Counseled the very highest levels of the US Government on the military effectiveness and arms control implications of strategic programs. Served on three Air Force Scientific Advisory Boards (1978 - 1979), was technical advisor to the 1980 Defense Science Board, and briefed the President's Blue Ribbon Commission on Strategic Modernization. Produced analyses that were acclaimed as the foundation for major milestone decisions on both the Peacekeeper (MX) and the President's Global Strategic Defense System (SDI). A finalist in the 1993 Koopman Prize.

Jerome Bracken is Adjunct Professor of Operations Research at Yale University and an independent consultant on military operations research problems. He received his doctorate from Harvard University in 1963. He was a research staff member of the Research Analysis Corporat-ion (1964-67) and a research staff member of the Institute for Defense Analysis (1967-87), including one year as the Distinguished Visiting Analyst of the US Army Concepts Analysis Agency. He has addressed strategic nuclear warfare issues as well as conventional ground, air, and naval warfare problems. He has authored or coauthored three books, over forty refereed journal articles, and over 50 technical reports.

Rodric Braithwaite is advisor on the Former Soviet Union to Morgan Grenfell & Company, Ltd. He was a member of the British foreign service from 1955 to 1992. His service includes Jakarta, Warsaw, Moscow (1963-66), Rome, Brussels(EC), and Washington. He was responsible to the Foreign Office at various times for politico-military, European security, European Community, and economic problems. He was head of the Policy Planning Staff in 1979-1980, Deputy Sherpa at the G-7 summits in 1985 - 1988. In 1988 - 1992 he was Britian's Ambassador to Moscow . Then served as foreign policy adviser to the Prime Minister 1992-1993.

Robert Chandler is President of Strategic Planning International, Inc. (SPI). He is a widely recognized expert in a variety of defense-related areas including military strategy, force structure analyses for nuclear and conventional forces, and program validation for military systems and emerging technologies. He created the conceptual design for SPI's Counter proliferation Employment Planning and Analysis Tool which represents a targeting framework for preventing the acquisition and use of nuclear, biological, and chemical weapons. From 1983-86 he was a Special Assistant to the Chief of Staff, SHAPE (U.S. Matters) where he supported the SACEUR/USCINCEUR, General Bernard Rogers, in preparation for the U.S. Defense Department's Defense Resources Board, as well as nuclear policy and arms control matters. He holds a Ph. D. In Political Science from the George Washington University.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 31–35.

Dmitry Chereshkin is the expert on the Security Council of the Russian Federation and Vice President of the Russian Academy of Natural Sciences. The main sphere of his investigations is the systems analysis concerning the informatics and applying new information technologies in different spheres of human activity. He was the head of a scientific group which prepared the Concept of Information Security of Russia. He defended his doctors degree in the area of Systems Analysis in the Academy of Science of the Soviet Union. He is the author of more than 150 books and papers. Member of the International Working Group on Information Security in telecommunications.

Fritz Ermarth is the former Chairman of the US National Intelligence Council (1988 - 1993) which prepares National Intelligence Estimates. He is currently on assignment in the Office of the Chief of Naval Operations, Department of the Navy. He has over thirty years experience in national security affairs in government, academia, and private institutions specializing in Soviet, strategic, and regional conflict issues. Early in his career he was a Soviet Affairs analyst at Radio Free Europe and at the RAND Corporation (1965-1973). In 1973 he was the Special Assistant to the Director of Central Intelligence and went on to be the Director of the Strategic Evaluation Center,CIA (73-76); then Director, Office of Program Evaluation, Intelligence Community Staff (76-77). He returned to RAND as the Director of Strategic Programs (1977-1978). In 1978 -80 he was a member of the National Security Council Staff and a Senior Technical Analyst at the Northrop Corporation (1980-83). He returned to the CIA in 1983 as the National Intelligence Officer for USSR and East Europe, Special Assistant to the President and Senior Director of Soviet and European Affairs, National Security Council Staff (1986-88). He is the recipient of the Distinguished Intelligence Medal and the National Intelligence Distinguished Service Medal.

Anthony Farrar-Hockley served in the British Army for 42 years. In the Second World War he served in a parachute battalion. Post war, he service included Palestine, Malaya, Korea, Cypress, Jordan and Aden. Later he commanded a parachute battalion and brigade, an armored division the Army in Northern Iceland and in south-east England, and Allied(NATO) Forces in Northern Europe. He held a fellowship at Oxford University 1968-1970. Since retirement in 1993 with the rank of General, he has become a defense consultant and lecturer, and is also an official historian for the United Kingdom. Among fourteen books - military histories, biographies, and defense studies - he has completed two volumes of the British Part in the Korean War of which the second has just been published.

Roy Giles is Director of the Progremme for Partnership in Technology at the Defence Research Agency, Farnborough, England. He served in the British Army for 36 years; in this time he enjoyed a "twin track" career, half with the infantry units in Germany, Cyprus, Marentins, Belize, Aden and Northern Ireland. The other half was spent using the Russian language which included nearly eight years with the British Military Mission to Soviet Forces in Potsdam. From 1986 he was the UK's Senior Inspector in conventional arms control, setting up and leading the inspectorates under the Stockholm and Vienna Accords, and the CFE Treaty.

Glenn Kent retired from the Air Force, in 1994, as a Lt. General. Currently with the RAND Corporation, his efforts center on developing analytical models to provide insight for top-level deciders ,as well as, formulating and defining new concepts as possible solutions to challenges by strategic planners. In 1964, he developed the analytic framework for deciding how (and whether) to implement the objective of "Limiting Damage to the United States -- If Deterrence Fails". Later he developed the analytical framework for measuring "First Strike Stability" in the context of the interaction of strategic nuclear forces of the USSR and the United States.

Vasiliy Krivokhizha since 1992, is the Deputy Director of the Russian Institute for Strategic Studies "think tank" established by presidential decree for information and analytical support to the highest levels in the country both executive and legislative. From 1971 - 1980 and 1987 - 1991, he was a post graduate student and research fellow in the Institute of USA and Canada Studies. His Ph.D. in History focused on the theory of international conflicts. In 1980 - 87 he was in the Foreign Ministry analyzing problems of arms control and disarmament, and Soviet - USA relations. He has authored two books and a number of articles on the problems of defense policy, strategic stability, non-proliferation and military-political aspects of Russian Security Concepts. Full member of the International Academy of Informatization.

Ron Lehman is the Assistant to the Director, Lawrence Livermore National Laboratory. He was Director of the US Arms Control and Disarmament Agency under President Bush. President Reagan appointed him Assistant Secretary of Defense for International Security Policy, US Chief START Negotiator, and Deputy to the President for National Security Affairs. Ron served in Vietnam with the US Army. President Clinton recently appointed him to the President's Advisory Board on Arms Proliferation Policy.

Robert Linhard, a Major General, is the Director of Plans, Headquarters US Air Force. He is responsible for Air Force strategy and doctrine development and assessment. He worked on President Reagan's National Security Council staff as a Special Assistant to the President for nuclear issues and arms control. General Linhard was a member of the historic Reykjavik Summit as well as those in Moscow, Geneva, and Washington. Additionally, his experience includes US and allied nuclear strategy, policy and programs, strategic defense issues, the Strategic Defense initiative, and US nuclear and conventional arms control policy. His operational and field experience includes Commander of the 57th Air Division, Headquarters Strategic Air Command's Deputy Chief of Staff for Plans and Resources.

Emerson Niou is Associate Professor of Political Science at Duke University; specializing in Formal Theory, International Relations, Political Economy and Chinese Politics. He received his Ph.D. from the University of Texas at Austin in 1987. He is he coauthor of *The Balance of Power*, Cambridge University Press, 1989. His most recent research focuses on the formation and disolution of alliences in anarchic international systems.

Fredrick Nyland is the president of Nyland Enterprises, a firm devoted to operational research for the arms control and defense communities. He is currently a consultant to the Arms Control and Disarmament Agency for issues relating to reduction of nuclear weapons, arms races, and nuclear and ballistic missile proliferation. Prior to this retirement in 1991, he was with the Martin Marietta and RAND Corporations. At RAND, he was the Director of National Security Research. He has written many reports on space operations, anti-satellite systems, bomber penetration, maritime missions for land-based air, air and ballistic missile defense, hypersonic flight, and strategic targeting and contributed to a number of books.

Peter C. Ordeshook is Professor of Political Science at the California Institute of Technology. He is the author of *Game Theory and Political Theory* and *A Primer in Political Theory*, coauthor of *Positive Political Theory* and *The Balance of Power*. His primary research interest at present is the study and design of electoral, constitutional, and international institutions, with special emphasis on those things that facilitate cooperation and coordination in complex environments. He received his Ph.D. from the University of Rochester in 1969.

Andrei Piontkowsky is Director of the Strategic Studies Center of the Moscow branch of the World Laboratory. Born in Moscow in 1940, he received his academic training at the University of Moscow where he was awarded a Ph. D. in applied mathematics in 1965. From 1965 - 1989 he was a senior researcher at the Academy of Science of the USSR and , in 1990, a visiting professor at the University of Cambridge. Professor Piontkowsky has published more than 100 papers on optimal control, decision theory, global modeling, and strategic stability. Member of the American Mathematical Society.

Michel Rudnianski is currently Associate Professor of Automation and Game Theory at the University of Reims, and Paris V, former member of the scientific board of the Fondation pour les Etudes de Defense Nationale, which is part of the French Ministry Of Defense. He is President of ARESAD (Association pour la Reflexion sur les Etudes Scientifiques Appliquees a la Defense), and consultant at the Secretairat General de la Defense Nationale (Prime Minister's office). He holds a DEA in history (1972) and a Doctorate in Physics (1973). His current research subjects are the applications of Game Theory to Strategic and Economic problems, and the development of the Theory of Games of Deterrence. In the area of modeling defense problems, he has edited "Defense Decision Making" (1991) and "la Decision dans les Crise Internationale" (1992).

Christian Schmidt is professor of economics and management in the University of Paris Danphine. He is the director of the LESOD (LaBoratoire d'economie et de Sociologie des organisations de defense) and president of the IDEA (International Defense Economics Association). He belongs to the editorial board of many journals in the field of defense economics and conflict analysis as well as Defense and Peace Economics and the journal of Conflict Resolution. He has published and edited many books and articles in this area -- the Economics of Military expenditures (1987), Defense Peace and Economic Analysis (1987), Penser la guerre, penser l'economie (1991), Game Theory and International Relations (1994).

Anton Surikov graduated from the Moscow Aviation Institute in 1984. Till 1990 he worked in different organization of the Soviet Military Industrial Complex. In 1987 he defended a Ph. D dissertation on a classified topic in the 50th Scientific Research Institute of the Soviet Ministry of Defense. Since 1990 he has worked in the Moscow Institute for USA and Canada Studies as a Deputy Director of the Military Strategical and Technological Center. He is an expert of the Parliament in the military and security fields.

Zhongyue Song is a Professor of Political Science at the China Society for Strategiy and Management Research. He is a 1959 graduate of the Nanjing Military Academy. He worked in the Academy for two years and became a Battalion Commander in 1962. After which he returned to the Academy in 1964. In 1977 he worked for the Foreign Ministry and two years later he went to the Academy of Military Science conducting research in East Asian Affairs. His works include " The Peace and Cooperation in East Asia" and "the Military Strategy of the US and Soviet Union and Their Contest" in the later part of the 1980's.

Arkady Skorokhodov has been a senior researcher at the Institute for Systems Analysis, Moscow since 1982. He received his doctorate in Applied Mathematics from the Institute of Applied Mathematics, Moscow in 1982. Prior to his post graduate work, he was a researcher at the Lebedev Physical Institute. His undergraduate studies were at the Moscow Physical -Technical Institute. His specality is mathematical modeling of strategic stability and the disarmament process. He has co-authored twenty articles on strategic stability, global defense and global security.

Krishnaswami Sundarji joined the British Indian Army in 1945. He saw service in the northwest frontier of undivided India. Retired from the Indian Army as Chief Of Staff in 1988. Graduated from the Indian Defense Services Staff College and National Defense College; The US Army Command and General Staff College; Madras and Allahabad Universities with a Master of Arts in International Affairs, an M.Sc. and Ph.D. in Defense Studies. Since retirement he has been Traveling, Lecturing and learning! Authored one book and many research papers and articles in professional journals in India and abroad, free lance columnist and commentator on International Political and National Strategic Affairs.

Eugeni Velikhov born in 1935, is Vice President of the Russian Academy of Sciences, Director of the Kurchatov Nuclear Physics Institute. He is the President of the International Thermonuclear Fusion Project, one of the leading world researchers on plasma physics and nuclear energy. Awarded the 1995 International Scillard Prize. President of the International Fund for Intellectual Resources which is dedicated to studying theoretical approaches and develop practical recommendations to prevent and resolve conflicts and establish geopolitical stability in the rapidly changing multipolar world. He is the President of "Rosshelf" company.

John Hughes-Wilson retired as a Colonel from the British Army in 1993 and is now an independent consultant specializing in NATO Affairs. He was the United Kingdom member of the CFE Verification Support Staff in NATO's Political Affairs Directorate. Earlier he served as the head of the Policy Section to the Supreme Allied Command Europe at SHAPE.

Xia Liping , a Lieutenant Colonel, is an associate professor at the Institute for Strategic Studies, National Defense University, PLA China. In 1989, he received his masters degree in law with a major in International Relations, from the PLA Foreign Language University. He is currently on assignment as a senior visiting fellow at the Atlantic Council of the USA. His speciality is East Asian security and arms control with a focus on non-proliferation of nuclear weapons.

CONTRIBUTING PAPERS

DETERRENCE, DISARMAMENT, AND POST-COLD WAR STABILITY: ENHANCING SECURITY FOR BOTH "HAVES" AND "HAVE NOTS"

AMBASSADOR RONALD F. LEHMAN II
Lawrence Livermore National Laboratory
April 1995

DETERRENCE, DISARMAMENT, AND POST-COLD WAR STABILITY: ENHANCING SECURITY FOR BOTH "HAVES" AND "HAVE NOTS" [1]

AMBASSADOR RONALD F. LEHMAN II
Lawrencce Livermore National Laboratory
P.O. Box 808
Livermore, California 94550

1. Introduction

The concept of stability, like the idea of deterrence, predates both the Cold War and the nuclear age. Nevertheless, both received their most extensive examination during that period. Thus, much of the literature on stability and deterrence is focused on a bipolar world, superpower perceptions, the declaratory policies of Washington and Moscow, and weapons of mass destruction in the hands of two sides.

Of course, this literature recognized that much of the competition between the United States and the Soviet Union took place in the midst of regional disputes or involved internal conflicts within the boundaries of individual nations. The literature often referenced conventional forces, particularly in the NATO-Warsaw Pact sense. Cold War analysis also acknowledged that stability and deterrence calculations could not be completely separated from broader political and economic circumstances.

This recognition of a wider context was more than a gratuitous caveat. Each year of the Cold War reconfirmed that nuclear weapons could not deter all conflict. Extensive analysis was made of conventional war scenarios and conditions that might lead to limited wars, civil wars, and revolution. The primary organizing theme of that era, however, remained the bipolar competition.

The centerpiece of the analysis involved the strategic nuclear balance between the United States and the Soviet Union. The nuclear age, more than with dynamite, machine guns, submarines, and even poison gas, had put a premium on avoiding war. Deterrence, even when based upon doctrines and forces focused on so-called "war fighting," was predominantly about prevention. The recognition that a universal nuclear deterrent such as that symbolized by the U.S. Army's "Pentomic" divisions of the 1950s was inappropriate to limited wars renewed interest in both conventional forces and special operations. It did not, however, greatly alter the view that successful strategic nuclear deterrence was based on holding a nation's civilization hostage. Indeed, a mutual hostage relationship came into existence and efforts were made to codify that joint vulnerability. Disarmament, meant to eliminate the nuclear "Sword of Damocles," took second place to measures such as the ABM Treaty and the SALT I agreement on strategic nuclear arms which sought to fix in place a simplified balance of terror. According to this view, a strategy combining precision offense with the force economies of defense, so characteristic of modern ground warfare, was destabilizing in the nuclear context. Forces capable of counter-military strikes or defending against attack were seen as inconsistent with "crisis stability" because they might

[1] Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 39–50.

provoke either a "use it or lose it" psychology or the belief that one could fight and win a nuclear war. More effective offensive and defensive weapons raised concerns about "arms race stability," a desire to avoid the measure/countermeasure syndrome. Modernization of nuclear forces even raised concerns about political instability within democracies as the nuclear debate polarized societies and between the superpowers as the Cold War rhetoric became more shrill during modernization cycles.

Later in the Cold War, understanding of the relationship between deterrence, defense, disarmament and stability became more complex. Circumstances were discussed in which force modernization, missile defenses and certain arms reductions were seen as both stabilizing and enhancing deterrence. Still, at the heart of deterrence theory, simple or sophisticated, was the adversarial relationship between the United States and the Soviet Union embodied in a bipolar balance of terror. The nuclear forces of the three other nuclear weapons states, each first appearing on the stage with some fanfare, slipped out of the spotlight to become minor sideshows even though their force levels consumed significant resources and reached levels well beyond those which existed when the two superpowers were so anointed.

Now that the Cold War is over, there is extensive uncertainty as to how to think about stability and deterrence. This uncertainty has an idealistic component-the Cold War is over so why not begin the end of the nuclear age? Why not bring to the realm of nuclear weapons the global bans contained in the Biological Weapons Convention (BWC) and the Chemical Weapons Convention (CWC). This renewed interest in denuclearization is not driven by the romance of a "new world order" of harmony, freedom, and prosperity. The vision of such a new world order based upon universal adherence to international norms appeared briefly at the end of the Gulf War as the Cold War dissipated, but a sound foundation was destroyed in Yugoslavia. Developments in places like Somalia, Chechnya, and the like have continued the process of weakening global multilateralism. The alternative, however, has not been a return to the Cold War. Rather, we have seen an effort to reduce the erosion of international norms even as more and more countries assert greater independence in their policies and as regional and ethnic turmoil flare in nearly every part of the globe. Particularly with respect to weapons of mass destruction, the declaratory policy of nations continues to oppose their spread, even as the objective conditions for success remain uncertain. Thus, we see a number of conflicting trends that will influence considerations of stability and deterrence in the post-Cold War era. The bipolar architecture is gone, but a strong mono-polar architecture built around international law and norms has not emerged. Nor is the United States so clearly the all-dominating remaining superpower that some pundits had proclaimed. At the same time, the greater independence being displayed, in particular by the former allies of the superpowers, has not yet led to a truly multi-polar world in which the security equation is reflected in classical regional balances of power.

We have been unable to define exactly what the post-Cold War era will be like because great uncertainty exists as to how nations will organize to deal with real security concerns. We are in a period of transition, but a transition to what? And what does the existence of weapons of mass destruction mean for the concepts of stability and deterrence in the years ahead? One can imagine a number of different scenarios. One can also see that the future of nuclear weapons cannot be divorced from that of other "weapons of mass destruction."

2. Weapons of Mass Destruction

The term "weapon of mass destruction" has a long lineage. Early use of the phrase was charged with a connotation of illegitimacy, and the phrase was often used in anti-nuclear political campaigns. Over time, however, it has become a part of the jargon of the deterrence theorists as "WMD," typically comprising nuclear, chemical, biological, and radiological weapons and anticipating any other weapons which could threaten large populations shortly after use. Sometimes means of delivery such as ballistic missiles are covered by the term, but more often than not they are simply mentioned in the same context.

The weapons tagged WMD all carry a special onus, but important differences exist among them. All can be packaged in small containers, all can cause widespread death, but only nuclear weapons cause

instantaneous physical destruction. A biological weapons attack would be difficult to detect in the real world and can cause death on a massive scale, but advanced or early warning can permit defensive measures and, in some cases, medical treatment. Chemical weapons, as we now know them, are less lethal than nuclear or biological weapons. Like biological weapons, chemical weapons have significant drawbacks as tactical military weapons including uncertain target coverage and effectiveness, the existence of countermeasures, and the dangers they pose to friendly forces. CW and BW can impose a significant burden on forces under attack by requiring them to operate in protective gear and in a more complex, deceptive mode, but they may also impose that problem on attacking forces. They can be militarily effective in special scenarios, contaminating and disrupting logistics for example, but their timeliness and effectiveness may actually be less than now provided by advanced conventional munitions. Against unprotected populations, however, they are true weapons of mass destruction with a particularly powerful psychological component as well.

3. Alternative Visions of the Future

During this period of transition after the Cold War, the most immediate period will reflect the status quo. How long that period will last remains to be seen. What do I mean by the status quo? Today, both the United States and Russia remain superpowers in the sense that they both retain large numbers of strategic nuclear forces. The global political and economic impact of Russia is less than it will someday be because the recovery from the collapse of the Soviet Union has not yet taken place. This is not to say that Russia is not a global player. Russian policy on issues such as Yugoslavia, the Middle East, and nonproliferation, for example, can be critical. At great distances from its border, however, Russia's economic and military reach is narrow in scope.

In some similar ways the United States has also lost influence. Although the economic troubles of the American economy seem trivial when compared with those of most other nations, they have been sufficient to turn the American political focus inward and to cause the United States to spend its money accordingly. This coincided with the need to express pent- up desires for more independent policy approaches by many nations which during the Cold War placed unity first and saw American leadership as the keystone of their national security strategies.

Increasing tensions between Moscow and Washington are not a sign that the Cold War is returning, any more than promises not to target one's missiles at the other meant that it is over. Even during the most ideological phases of the Cold War conflict, Moscow and Washington found geopolitical differences, and also some area of common ground. In a post-Cold War era, we are seeing elevated in the bilateral relationship long existing issues which were simply obscured by the Cold War competition. Thus, it is not surprising that there will be tension between Russia and other countries over the status of ethnic groups in Russia and over Russia's role in neighboring countries, many of which were created out of the breakup of the Union of Soviet Socialist Republics. Nevertheless, despite some of its own actions complicating both nonproliferation and regional stability, Russia has been prepared to cooperate in a number of areas to strengthen international norms against proliferation and to participate in some of the more remarkable peace processes which have emerged in recent years.

Both of the nuclear superpowers have been prepared to show some restraint in the use of their own military force and in the sizing of their deterrents. Furthermore, they have worked together with other nations to maintain at least the legal architecture for the spread of nonproliferation commitments. Neither has completely left behind its Cold War concerns about the other, but, despite recent setbacks, the level of cooperation is remarkable given the rapid and uncertain change which has taken place.

The other nuclear weapon states have also committed themselves to restraint even as they are more reluctant to reduce nuclear forces in being. In some ways, the post-Cold War era has been easier for these states. Because their nuclear forces were never so definitively justified on the basis of a bipolar world, their doctrines of stability and deterrence have been less effected by its demise. The Sino-Soviet

split made clear at an early date that the world was less strictly bipolar than some analysts maintained, but then this should have been obvious in the case of France and the United Kingdom as well.

Throughout the Cold War each of the five nuclear weapon states discovered that it had important policy objectives not necessarily shared by the others and largely divorced from the question of weapons of mass destruction. The geopolitics of the Cold War often served to dampen the expression of these differences, but the periodic emergence of these issues even during the Cold War was a measure of how persistent and important they were. With the end of the Cold War, they will become even more emphatic. Under the status quo scenario, however, one would anticipate that they would be managed with restraint-exceptions serving mainly to demonstrate the rule.

Under the status quo scenario, non-nuclear weapon states would tend to follow their current policies. Declaratory policy would press for broader disarmament even as economic policies would promote the spread of the technologies which make possible the creation of weapons of mass destruction. Some of these states will retain a strong nuclear allergy while others will privately work to keep options open. The nuclear question will inevitably find itself caught up in the North-South debate over development just as occurred in the nuclear arena with "Atoms for Peace" and Article IV of the Nonproliferation Treaty and in the chemical arena with a negotiation of the Chemical Weapons Convention. In time the same psychology will intensify in the area of biological sciences related to biological weapons.

In summary, inertia may well result in a continuation of the status quo for many years to come. Within an architecture of international norms antithetical to weapons of mass destruction, those that have nuclear weapons will keep them while showing restraint and those that do not have them will show restraint while keeping their options open and exploiting the difference between haves and have nots for political leverage.

In the long run, political and economic forces may force the end of the status quo. But which way will it go? Will the world move towards nuclear disarmament on a scale equal to or beyond that which it has sought for chemical and biological weapons? Or will it move in the opposite direction with the spread of nuclear weapons and other weapons of mass destruction around the globe? It's not too soon to think about either option.

Disarmament as an alternative future has gained credibility with the end of the Cold War. In a sense, the arguments both for it and against it have been weakened by the same events. Not one of the five nuclear weapon states seeks to give its nuclear forces the centrality that they had in previous periods. All are committed under Article VI of the Nuclear Nonproliferation Treaty to steps which would provide for the cessation of the nuclear arms race and its elimination in the context of general and complete disarmament (GCD). Although the timing and phasing of the Article VI commitment has never been precisely defined, all five nuclear weapon states have acknowledged their obligation and argue that arms control measures already negotiated, negotiations underway, and declaratory policies of restraint are demonstrations of good faith implementation. Zero may not be near at hand, but it remains the stated goal.

One can imagine a world in which all existing nuclear weapons have been dismantled. One can imagine that such a world would be very different politically than the world that exists today, but the mechanisms for nuclear disarmament would be derivative of inspection regimes negotiated in the START Treaties, the Chemical Weapons Convention, and other negotiations such as those underway for a cut-off on the production of fissile material. Undoubtedly for such an outcome to actually occur, regional stability problems that we face today would have to be resolved. Also, it is doubtful that nuclear disarmament could take place in a world in which certain authoritarian and aggressive regimes which exist today were to remain. Nevertheless, one cannot rule out the possibility that the conditions for nuclear disarmament could be achieved. Unfortunately, one cannot rule out the opposite possibility either.

The spread of the knowledge, technology, and materials necessary to produce nuclear weapons and other weapons of mass destruction, already extensive, is accelerating through a process of education, trade and development which will continue. Perhaps the greatest challenge of the immediate post-Cold War era is to be found in the reality that the ability to produce weapons of mass destruction is spreading

to troubled regions faster than the many peace processes can successfully address the causes of conflict. We speak today of five nuclear weapon states, but we acknowledge the advanced capability of at least three threshold states—India, Pakistan, and Israel. To this list we can add the uncertain status of North Korea and Iraq, and the uncertain intentions of other nations such as Iran. All of these countries exist in regions of frequent violence and conflict. The deployment of nuclear weapons in these regions carries with it not only instability for the region, but global implications as well.

It has become popular to think of nonproliferation as the spread of an international norm like an oil slick over more and more of the world's troubled waters. Successes in South Africa, Belarus, Ukraine, and Kazakhstan are often cited as measures of movement ever closer to universality. Indeed, roll back remains an important concept in nonproliferation. It gives hope in the face of failure. It offers the possibility of undoing what has been done. Nevertheless, the spread of technology and the persistence of political and economic disputes should remind us that the veneer of the international norm against proliferation remains very thin, and the prospects of a chain reaction toward proliferation resulting in regional nuclear balances remain significant. If North Korea were to go nuclear, what does it mean for South Korea, Japan, and perhaps Taiwan? What would the emergence of new nuclear weapon states mean for India and Pakistan and in the Middle East? And what then of other advanced nations such as Germany, Brazil, and Argentina, especially if the politics of weapons of mass destruction reopens the issue of membership on the United Nations Security Council, etc.?

Universal disarmament and widespread proliferation are not the only alternative worlds to the status quo. Another alternative is what many experts have come to call the world of virtual proliferation. This is a world in which a large number of nations have the ability to produce weapons of mass destruction, but the conditions are such that they choose not to. In this world concern would remain about compliance by nations, but it is almost by definition a world with particular concern about rogue regimes or the acquisition of nuclear weapons and other weapons of mass destruction by subnational entities and terrorists. In such a world the benign conditions necessary for nations to forego nuclear weapons status imply widespread feelings of secure boundaries and economic prosperity. Free trade would be extensive and global travel largely unencumbered. In that world stability among nations and deterrence as we have known it would not be central issues. Of greater concern would be the threat to international order and prosperity posed by subnational actors not amenable to the types of military deterrents theorists usually consider. Such subnational actors would, in a world in which they had access to weapons of mass destruction and were using them, stress the very conditions of international markets and civil rights which would have permitted nations themselves to move away from weapons of mass destruction in the first place. Thus, the issue of denuclearization cannot be separated from the issues of domestic law, order, and justice.

4. Considering a More Near-term, Step-by-Step Perspective

All of these worlds are possible, and in the more immediate years ahead, combinations of the elements of each are even more likely. Certainly one can expect to see the interaction of the status quo with steps toward disarmament, proliferation setbacks, regional balances of power, and the challenge of virtual proliferation, all at the same time. Let me offer a more prescriptive view of an alternative world, one in which the transition from the Cold War to a truly post-Cold War era is achieved while enhancing stability.

Rather than jump ahead perhaps fifty or more years, to see which of the alternative worlds described above has emerged or is emerging, let us look ahead only about fifteen years. I will focus primarily on the nuclear question, but I will weave in and out themes related to chemical and biological weapons. Again, it is important to keep in mind the similarities and differences of the various weapons of mass destruction.

Much can change even over fifteen years, but much can also remain the same. By 2010, through elections, the U.S. would have eight new congresses and from two to four follow-on administrations. At

the same time, some ethnic violence dating back two millennia is likely to continue. Even Qaddafi and Saddam Hussein could still be in power. My heuristic assumption here is that the START II reductions would have been completed and that the force structure described in the recent Nuclear Posture Review (NPR) was sustained during that period of reductions. Maintaining deterrence in a broad form will remain essential as a matter of policy, but the centrality of nuclear deterrence will depend on the nature of the world which has come into being.

Looking backward at force structure and policy, one can gain a perspective on the future. The experience of deterrence at low levels is not new, after all, much lower levels were in existence during the nuclear build up of the late 1950's through the 1960's. Levels of 3000 to 3500 deployed nuclear weapons have existed before, but during modernization leading to large, flexible stockpiles. Fifteen years from now, there will be similarities and differences when compared to the last time these lower levels were deployed. Unconstrained by arms control, eighteen Ohio Class D-5 submarines could have carried 5184 warheads alone over the next fifteen years (and twenty submarines were once planned), but SLBM deployed warheads are START II limited to 1750. The actual number of SLBM warheads deployed is likely to be lower. The NPR forces structure under START II calls for 450 to 500 ICBM warheads. This level of strategic ballistic missile warheads is not new. In 1971, the U.S. had about 2000 deployed on ICBMs and SLBMs, but a much larger nuclear armed bomber force brought the total to around 5000 deployed warheads. By 1971, however, the actual total number of nuclear weapons in the U.S. stockpile had already begun to drop, a process which is being repeated today at a rate of about 2000 weapons per year.

Fifteen years from now, we will be facing significant modernization questions. The U.S. strategic modernization program tends to come in roughly twenty-year cycles with the 1960's and the 1980's providing the major funding. The 2010's may reveal new modernization issues. The B-2, of which there may only be 20, will be 18 years old, and the D-5 Trident II will be 21 years old. The modified Minuteman IIIs, however, will be approaching 40 years old, and any B-52s will be approaching 50 years old. The B-1, which first flew in the 1970's, will be in a non-nuclear role. Political and technological cange is accelerating, but the U.S. has no follow-on nuclear weapons designs or delivery systems planned, and much of the nuclear weapons and delivery system infrastructure is in limbo, being retained as a hedge while uncertainties about the future remain. The likely status of that infrastructure and the overall defense industrial base fifteen years from now is an unknown.

5. Lessons from the Evolution of U.S. Doctrine

A look at the evolution of thinking about U.S. nuclear doctrine in past periods might also help inform our speculation about the future. Most such discussion focuses on the few words which have provided short hand about declaratory policy. A brief chronology will remind the reader of much of the history.

- 1954 = "massive retaliation"
- 1963 = "flexible response"
- 1965 = "assured destruction/damage limiting"
- 1967 = "mutual assured destruction"
- 1969 = "sufficiency"
- 1974 = "essential equivalence"
- 1976 = "rough equivalence"
- 1979 = PD-59/"countervailing strategy"
- 1981 = NSDD-13/"peace through strength"
- 1983 = "strategic defense initiative"
- 1989 = "weapons of last resort"

A few comments on this chronology are in order. First, these declaratory policies, at heart, highlight two realities; namely (1) the destructiveness of nuclear war and (2) the changing balance between the United States and the Soviet Union. Underneath these public phrases is an implementing policy which reflects far more continuity.

Nuclear weapons doctrine has actually evolved very slowly and cautiously, and this process may give us insight for the future. Perhaps the most significant departure from mainstream deterrence theory during the Cold War was Secretary of Defense Robert McNamara's requirement to retaliate against an attack in such a way that one guaranteed the destruction of a certain percentage of the population of an aggressor. This departure was short lived, in part because of questions about its morality or legality and in part because doubts about its credibility were believed to undermine deterrence. U.S. doctrine understood that escalation, however much it was primarily counter military could, at some point, involve major countervalue consequences. The entire concept of the escalatory ladder and escalatory control, in fact, was designed to strengthen deterrence by combing the notion that the U.S. had militarily significant options which, even if they failed in their immediate military purpose, might ultimately still lead to unacceptable destruction.

Basic U.S. deterrence theory, in reality, was "flexible response" before the United States gave it that name and "flexible response" long after it dropped the name. U.S. policy has long been to hold at risk that which an aggressor values most in a way which creates great uncertainty that his attack can succeed and great certainty that it would not be worth the price even to try. If defense requires a nuclear response, the U.S. could escalate at a time and in an intensity of its choosing in a manner designed to terminate conflict on terms acceptable to the U.S. and its allies. Except for a brief period in the Sixties, the U.S. has not targeted population per se. The U.S. seeks to limit collateral damage, but it recognizes the countervalue implications of a nuclear exchange. The U.S. will not be the first to send its military forces into war against another nation, but it does not rule out the first use of nuclear weapons in response to major attack by a nuclear weapon state or its allies. U.S. policy was that nuclear retaliation is a "last resort" before NATO highlighted that phrase, but that U.S. and NATO doctrine never meant that alliance nuclear forces would wait until the U.S. or those who rely on its nuclear umbrella were defeated before nuclear use would be authorized.

In summary, U.S. nuclear doctrine, whether associated with large numbers of nuclear weapons or small numbers, has recognized the destructiveness of nuclear weapons as an ultimate sanction, but it has not been based upon the belief that a bald threat of vast countervalue targeting was consistent with a credible deterrent. It has always sought flexible options. This history would suggest that at very reduced levels, nuclear weapons states may keep in mind, and perhaps make more explicit in their public statements, the countervalue consequences of the use of even a few nuclear weapons. At the same time, they will always wish to maintain more limited options and concepts of escalation control and war termination even as their declaratory policies attempt to reflect political change.

6. Declaratory Policies of the Future

New declaratory names for the deterrence policies of nuclear weapons states will undoubtedly accompany further reductions. In 1994, the Clinton Administration conducted its Nuclear Posture Review and examined post-Cold War deterrence. Its policy continued the evolutionary trend with little change in force structure or declaratory policy-the most notable public statement being its "lead, but hedge" commitment to reductions. Over the next fifteen years or so, one can expect similar declarations. Perhaps our policy will be called a "sustained deterrent" reflecting maintenance of the Triad. Perhaps it will be called a "flexible deterrent" to reflect capabilities and options. At some point, it might be called a "responsible hedge deterrent" to reflect the need to maintain a floor on capabilities until great uncertainties are resolved. Some may wish to call it a "minimal deterrent" to reflect deep reductions while differentiating it from a "minimum deterrent" which carries with it the baggage of countervalue targeting only.

At a later time, one could imagine an increasingly "virtual deterrent" in which numbers and readiness levels are low and the consultative process on use is more extensive than one has today, even by NATO standards. This "virtual deterrent" would still be in national, rather than international hands, and would be more substantial than the "virtual capability" that threshold states and advanced industrial states have today. Rather, it would reflect an evolution of policy under which nuclear weapons would be increasingly "held in trust for mankind." Over time, international supervision of material and facilities would be strengthened both in nuclear weapons states and non-nuclear weapons states until, perhaps, a world has been created in which all existing weapons are dismantled. Nuclear disarmament might then be achieved.

Without a major change in the world as we know it, the final dismantlement of all existing nuclear weapons will not be possible. Even then, however, the knowledge of how to make an atomic bomb will not have been eliminated, and the basic human flaws which continue to build a legacy of violence and war around the globe will remain leaving us with the prospect that conflict will return. In that environment, fear will remain that some nation or entity might again build nuclear weapons. Ironically, one of the major issues of a denuclearized age would be the determination of the circumstances under which legitimate authorities might reconstitute a nuclear force. Even in an age of disarmament, a capability to reconstitute a nuclear deterrent will remain an important hedge and safeguard. The nuclear age does not end with the dismantlement of the weapons. Again and again we are reminded that throughout the process of reducing nuclear dangers that there are other dangers as well and that fundamental conditions need to changed if we are to make the greatest progress. We are faced with important questions for which answers must be found.

7. Questions which Remain to be Answered

A review of some of the questions which must be addressed as we pursue greater post-Cold War stability in an age in which the technologies of mass destruction are widespread would be useful. Few of the most important questions are technical; all are difficult. Sometimes they seem more like contradictions or dilemmas because they reflect the inconsistent pace and direction of history. In many cases they reflect conflicting desires of different societies. Both questions and possible answers will shape the evolution of nuclear doctrine and force structure.

The most important questions are forced upon us by political change and uncertainty. Democracy, market economies, and regional peace processes are not yet a global norm, but they are widespread and increasingly the standard by which governments are judged. Nevertheless, Iraq, North Korea, Libya, and the like have displayed remarkable staying power, and the ethnic violence in the former Yugoslavia is proving not to be the last reminder of old animosities. Civil disorder or ethnic violence is a problem in a number of threshold states or potential proliferant nations. In addition, such violence is a consideration in the future of existing nuclear weapons states. The war in Chechnya does not mean that we face a nuclear "Yugoslavia" in Russia, but it highlights the reality that nuclear weapons are known to be based in some of the nations such as Russia, China, and Ukraine facing turmoil and could become a factor in countries such as India, Pakistan, Israel, North Korea, Iran, Algeria, perhaps even someday South Africa.

Some of the questions are large in scope. Is geopolitical progress already underway reversible? Is real peace possible? Other questions are more narrow or technical. What are the motives and incentives in the post-Cold War era to have nuclear weapons? Who has them, and who wants them? And what do they want? Because technologies useful to a nuclear weapons program continue to advance, are increasingly dual use, often reduce the resources necessary to acquire and maintain nuclear weapons, other WMD, and their means of delivery, and are increasingly spreading as part of the emerging global economy, are we really facing extensive "virtual proliferation?" In other words, will certain nations of concern become so advanced industrially that only a final decision would stand between nuclear weapons and nonproliferation? To what degree, then will the ability to understand and influence intentions rather

than capabilities determine our nonproliferation focus? And to what degree will our military and intelligence concerns be focused less on existing deterrence than on measures to deal with covert capabilities and breakout? What contingencies should be funded related to prevention versus response-the nonproliferation/counterproliferation balance? To what degree do the issues of trust, verification, and/or safeguards apply to a nuclear balance, and to what degree are they a part of nonproliferation?

Certainly, proliferation will weigh more heavily in nuclear policy decisions in the years ahead, but here uncertainty also creates dilemmas. For example, Article VI of the NPT obligates ultimate disarmament for existing nuclear powers, but low levels may create incentives for some nations to acquire or keep nuclear weapons as it becomes easier for more nations to approach levels to which the superpowers may reduce. Indeed, many states which support Article VI's goal of the elimination of nuclear weapons also have relied upon security guarantees from nuclear weapons states, particularly the United States, to justify their own decisions not to seek nuclear weapons. Indeed, the nuclear umbrella, positive security assurances, Cold War bipolar stability, and alliance security commitments have played an important role in promoting nonproliferation. Will a desire for a lower nuclear and military profile combined with increased isolationism reduce the ability and willingness of the United States to make credible commitments which may be important to nonproliferation, particularly in troubled regions? Many of the questions we face about the relationship of nuclear deterrence to nonproliferation involve the fundamental security calculations of non- nuclear weapons states and the role they see for the United States and other nuclear weapons states in those considerations.

The other side of the calculation is, of course, those of the nuclear weapons states. They have pressed for near universal commitment to an emerging international norm of nonproliferation even at the price of greater pressure on themselves for denuclearization. At the same time, they see that widespread virtual proliferation is inevitable. They reconcile these trends in opposite directions largely by stressing the importance of creating the political and security conditions necessary to eliminate incentives for any decision to acquire nuclear weapons. Whatever the merit of this logic, or the likelihood of its fulfillment, it still leaves open important issues concerning nuclear deterrence which would need to be addressed during the transition period, i.e. the world as it really is today. These deterrence dilemmas are considerable. In theory, the nuclear weapons states need flexibility to meet diverse scenarios which are multiplied by the great political and technological change under way. Yet, the arsenals for deterring nuclear powers may be different from those required to dissuade proliferation or deter a new proliferant. Indeed, the world is likely to be faced with more scenarios in which there is a far less compelling nuclear role and for which forces in being are inappropriate.

The ability to maintain an appropriate post-Cold War deterrent will be complicated by the broader policy environment. We have already discussed the inherent tension between nonproliferation and nuclear disarmament inherent in Article VI, and we will return to that topic below in the context of phased reductions. We have also discussed the importance of security commitments to nonproliferation. Maintaining a balance in these considerations will be further complicated by other considerations including shrinking budgets for defense and diplomacy, increased uncertainty as to the proper role of international organizations such as the UN and the IAEA, a resurgence of the North-South ideological split now reflected in the debate over NPT extension, and the broader reordering (or disordering) of the international system. Thus, a reassuring, but effective deterrence policy must balance its declarations in support of political change and disarmament with the need for credible nuclear guarantees and the capacity to meet overseas obligations. We have found it easiest to say that the Soviet threat is gone and we face a "new world disorder." In the nuclear arena and with respect to the deterrence of WMD, we also find it easier to justify retaining deterrence by reference to a hedge against the return of the old Soviet threat rather than by focusing on what might be new or different about the world that seems to be emerging. In the short run, with the Cold War so recent, this may well be a sound outcome. If we do leave the Cold War far behind us, however, the questions will become more intense and more difficult.

8. Existing Nuclear Weapons States and the Geopolitics of Numbers

For deterrence policy, the post-Cold War era requires us to reconcile the following perspective: Belief in the plausible use of nuclear weapons by the U.S. in the years ahead has declined even as the plausibility of their use by others seems to be increasing. Thus, while maintaining deterrence against large arsenals to hedge against adverse political developments, our deterrence theory must cope with small nuclear threats and fears of other weapons of mass destruction while meeting the needs both of those who want nuclear security guarantees and of those who want guarantees that nuclear weapons are on the path to elimination. And throughout this, we must keep in mind international norms and goals of nonproliferation.

The arsenals of the existing five nuclear weapons states will influence these developments. Despite much common interest and similarity of policy, at least on the surface, not all of the nuclear weapons states have made the same calculations about the post-Cold War era. Nor have they completely set aside concerns about each other. Take for example, some of the American considerations. The Soviet Union and the Warsaw Pact are gone, but former communists rule in a number of the central and eastern European states. To what degree must the U.S. hedge against hostility of large nuclear states such as Russia, or China, or a resurgent coalition made up of some states formerly part of the USSR? Suppose events do not go well in Russia or Ukraine. Could we become adversaries again? Given the political uncertainty, how much uncertainty in the size of the Russian nuclear stockpile can the U.S. accept? What steps can be taken that would bound these uncertainties?

Suppose China continues its economic growth and continues on a path to become the dominant power in Asia. What does it mean for the U.S. and its allies and other trading partners in that region? What level of nuclear stockpile does China believe it needs, how is it related to the arsenals of others, and what would be tolerable for other nations? What if the in- being Chinese capacity to produce nuclear weapons were to become significantly greater than that of the other nuclear weapons states? Furthermore, China is not the only nuclear weapons state whose nuclear stockpiles will come under increased scrutiny in the post-Cold War era. The size of the superpower nuclear arsenals are declining significantly, but the large numbers remaining will continue to come under the public spotlight.

Increasingly, however, it will be noted that the arsenals of the other three declared nuclear weapons states are growing. This will raise many questions which those countries will have to address, but it will also raise questions for the U.S. which have not been significant for many years. For example, what do other's stockpile levels mean for U.S. foreign policy? In the years ahead, the geostrategic implications of numbers will have to be examined. In the past, the U.S. sought to maintain overall equality with the Soviet Union to inspire confidence in its deterrent and the nuclear umbrella. The START II Treaty, however, was negotiated with a dual ceiling in part to de-emphasize a preoccupation with exact equality between Russia and the United States. A new cooperative relationship was envisioned. The prospect that four former Soviet states might retain nuclear weapons, however, would have changed the traditional measures of balance. Could the United States, with its global obligations, tolerate the possibility of some coalition of states of the former Soviet Union with a combined arsenal larger than the U.S.? If so, under what circumstances? If not, why not? Despite the new U.S./Russian relationship, parliamentarians in Moscow have sought to reinstate the centrality of Russian equality with the U.S. in numbers, and the U.S. itself has debated the rate of its unilateral draw downs in the context of existing Russian numbers. In the future, does this mean that Russia and the U.S. will return to an insistence on fairly strict numerical equality? If so, we will need to consider what that tells us about the geopolitical nature of nuclear weapons. And if U.S. and Russian reductions continue, we need to consider the interactions with the other nuclear weapons states and with the Ukraine which has now joined the NPT and is currently removing from its soil what had been the world's third largest nuclear arsenal.

The questions go on. If Russia and the U.S. were to reduce to 2000 or 1000 weapons, would perhaps China be inspired to increase its forces to comparable levels? What about the British and French? Conversely, in the face of deep cuts by the two superpowers, would Britain, France, and the PRC initiate further cuts of their own, or would they press for the superpowers to reduce first to the levels of the three

smaller nuclear forces? The answers to these questions will tell us much about multi-polar nuclear deterrence, but it will also challenge the reliability of the nuclear umbrella of the United States and the credibility of Positive Security Assurances (PSAs) which it might give. In some ways, the answer to the balance of numbers question will influence how the five nuclear weapons states are viewed separately by other nations and how they are viewed as the Permanent Five (P-5) of the United Nations Security Council.

The reduced force levels of the five nuclear weapons states will certainly have important implications for non-nuclear weapons states protected by the nuclear umbrella, extended deterrence, or PSAs. If those commitments are seen as weakened in the context of world conditions at the time, will some of these states seek their own weapons of mass destruction? Will some of them seek new guarantees from other states or new alignments and alliances? What will be the implications for the UN and its Security Council? The analytical excursions are obvious and numerous. We will need to look also at the impact of reduced force levels on threshold states and other potential proliferants. Will reduced levels create incentives for threshold states to deploy and build to equality? Indeed, would virtual proliferants be inspired to make decisions to go nuclear in order to obtain a perceived instant superpower status? The very asking of these questions highlights how important the global context will be for considering the future of nuclear deterrence at reduced levels.

One assumes that the decision to go to zero will be a far more difficult decision than any decision simply to reduce. If the circumstances are created in which all existing nuclear weapons are dismantled, however, the nuclear deterrence question does not go away. The prospect that a nation might reconstitute a nuclear force will influence behavior, and it will also present the question of who, at zero, reconstitutes nuclear deterrence if someone proliferates nuclear weapons or other weapons of mass destruction.

9. Conclusions and Recommendations

This paper has inspired more questions than can be answered with the knowledge we have today. In the end, the best answers to the questions we have raised, and to reconciling inherent dilemmas, are those associated with improving the security of nations and bringing about the political and economic changes that are necessary to reduce international violence and war within nations. The problem of the irrational actor, the non-deterrable entity, or terrorist armed with WMD will not make solution to these problems any easier. Nevertheless, a few conclusions and recommendations may be helpful. Circumstances have changed, but much of the logic around nuclear deterrence will change less.

A cautious, evolutionary approach is in order. The United States and the other nuclear weapons states must recognize that nuclear deterrence calculations will often be less salient to post-Cold War security considerations, but they will not go away. Indeed, in an age of turmoil and the spread of the technology of all forms of weapons of mass destruction, nuclear forces will continue to have meaning in our analysis of more complex determinants of stability. The following recommendations, not necessarily in order of priority, would seem appropriate:

1. Responsible deterrence will remain vital to reducing the danger presented by weapons of mass destruction, and that deterrence will require both nuclear and conventional strength.

2. Nuclear deterrence must be implemented in a manner supportive of an overall strategy designed to reduce incentives for proliferation by advancing regional security and promoting political and economic reform.

3. Reductions should take place only in the context of the conditions being created which would justify them.

4. Arms control and disarmament progress will be necessary for non-nuclear weapons states as well as nuclear weapons states if deep reductions are to be possible.

5. In the case of nuclear nonproliferation, a renewed emphasis on the control of special nuclear materials will be required, but a freeze on the production of fissile material outside international control, followed by step-by-step reductions in un-safeguarded material taken in the context of improvements in security calculations, could provide a foundation for greater confidence in a world of reduced nuclear weapons.

6. Responsible international organization will be necessary, building upon the success of bodies such as NATO.

7. The United States must remain engaged in world affairs and provide leadership on those issues where history and geography have given it a unique ability to contribute.

8. The U.S. should lower the profile of nuclear weapons, but must maintain a strong nuclear deterrent, as an ultimate sanction, against overwhelming threats such as those posed by weapons of mass destruction.

9. The U.S. should also maintain sufficient flexibility in its nuclear and non-nuclear forces and policy to reflect the different, complex world which is emerging.

10. Progress in nuclear arms control and disarmament can help as a guide, a gauge, and as leverage in creating the conditions for moving in the direction of further reductions, but care must be taken not to confuse cause and effect.

11. Increased military cooperation among states can make a significant contribution to stability, but only if some of the ideological baggage of the Cold War can be left behind, for example, in cooperating in missile defense to dissuade and protect against proliferation rather than opposing missile defenses in order to hold populations hostage to retaliation by nations which have declared their friendship.

12. Recognition that nuclear weapons will increasingly have to be held in trust for all mankind and be subject to greater consultation should be included in the evolution of the deterrence policies of the U.S. and other nuclear weapons states, especially as they examine the future of positive security assurances (PSAs).

13. Transparency and the strengthening of compliance with all global norms by both nuclear weapons and non-nuclear weapons states will be essential for progress toward further reductions.

14. Diplomacy should be aimed at the real conditions for security and arms reductions and not the appearance of progress so often reflected in declaratory pledges, the debates over the removal of pretexts for proliferation, and in the introduction into the debate over proliferation of archaic issues left over from the Cold War or the North-South debate.

We are in transition from the Cold War era to a new century which we have not yet defined because its shape is not yet clear. This paper has raised more questions than it has answered, and it has not even raised all of the questions. Hopefully, an early effort to understand forces and trends will permit us to bend them toward a more peaceful, safer world. The process of achieving that understanding may also be a process for building that better world.

Section 2.1

Qualitative - Global

ON DETERRENCE, BALANCE OF POWER, AND GEOPOLITICS

ROBERT W. CHANDLER
Strategic Planning International, Inc.
2100 Washington Boulevard
Suite 2002
Arlington, Virginia 22204

ABSTRACT. A concept paper for the NATO advanced research workshop on "Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament."

1. Introduction

The language of politics is essential to definition of a workable U.S. strategy for dealing with the emerging new nuclear actors. Theoretical concepts provide the organizing principles guiding our understanding of international relations and how nation-states respond to changes to the existing order. These concepts are also the raw material for building models that will yield a calculus for strategic stability. The ultimate tests for a model of strategic stability are (1) whether it embraces common meaning for both the model-builder and the political decision-maker, and (2) whether it offers assistance to decision-makers in the real world of international politics. Hence, before the modeler can turn on his computer to obtain a useful calculus of strategic stability, he must first reach agreement with the political decision-maker on which concepts are relevant to the analysis and on their definition.

Many of the conceptual elements of U.S. strategy applied during the Cold War are now outmoded or are in need of redefinition. Three of these concepts bear an especially close reexamination to determine their relevance in the still emerging new world order. They are deterrence, balance of power, and geopolitics. To be useful for the political decision-maker, a model of strategic stability will have to account for these three theoretical concepts and their interrelationships in the new U.S. military strategy designed to function in a world of established nuclear powers and emerging nuclear actors.

Over twenty countries are currently developing or otherwise trying to obtain nuclear weapons, and biological and chemical weapons, and the missiles to deliver them.[1] Deployment of nuclear weapons in even small numbers will profoundly change the stakes of regional conflicts. The stakes can include the lives of thousands of people that may become targets or, in the extreme, entire countries could be placed at risk. These kinds of stakes will have a profound influence on the international community's propensity to act in the face of nuclear threats to military forces in the region and in some cases against the homelands of the nations underwriting UN-sanctioned responses against aggressors. Given the

[1]Nuclear powers: United States, Russia, Britain, France, and China; denuclearizing powers: Belarus, Kazakhstan, and Ukraine; threshold nuclear states (nuclear-capable and possibly nuclear-armed): Israel, India, Pakistan, and North Korea; and nuclear-capable states: Iraq, Iran, Taiwan, South Korea, South Africa, Brazil, Argentina, and Nth countries.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 53–67.

growing availability of nuclear expertise, fissile material, and bomb-making capacities, it is only a matter of time before new nuclear actors emerge on to the world scene.[2]

Three questions arise in the areas of deterrence, the balance of power, and geopolitics concerning the influence of nuclear proliferation on future U.S. military strategy. First, many open questions involve the new nuclear powers. As Stephen P. Rosen of the Olin Institute for Strategic Studies at Harvard University explains, the intrusion of non-rational and emotive factors into crisis management decisions often prevent the conditions necessary for deterrence from being manifest in real crises. Rational actors rarely respond to each other's strategic communications dispassionately and unambiguously in pursuit of outcomes that best protect or promote their respective interests. Moreover, the knowledge required about an adversary in order to deter should be comprehensive and detailed--nations rarely understand each other this completely.[3]

Secondly, until the Cold War and the advent of nuclear weapons and long-range delivery systems, the central organizing principle of international relations was the classical balance of power. The "power" being balanced was primarily military power to seize and hold territory. The objective for countries participating in the balancing process was the prevention of any other country or coalition of states from achieving the power necessary to seize the territory of others and eventually use the resources on that territory to achieve hegemony over the balancing countries. To put it in a more direct way, the objectives were to *deter* those who would disturb the status quo from aggression and, if deterrence failed, to *defend* against the aggressor to restore the balance. In the first case, to deter aggression countries joined alliances against the potential adversary and amassed the armaments necessary to defeat attacks against them. If deterrence failed, states engaged in war to restore equilibrium.

Through the 1950s when strategists and commentators of the world scene wrote eloquently of the new "balance of terror" wrought by the advent of nuclear weapons, it became increasingly clear that a new theoretical concept had been superimposed on the longstanding central organizing principle of the balance of power. By the end of the decade and the early 1960s, it became generally recognized that nuclear weapons and intercontinental ballistic missiles had changed the rules of the game. Nuclear weapons did not represent power to contest the control of territory or to seize the territory of others. Rather, they represented power to inflict severe punishment and *deter* by the threat of such punishment. Thus, nuclear weapons and long-range delivery systems, especially missiles, changed the very nature and meaning of the balance of power.[4]

And, thirdly, understanding the geopolitical changes that are being created by the drive toward global proliferation of nuclear weapons is a daunting intellectual challenge. Since the flow of information cannot be controlled in the modern world, the dispersal of technologies and knowledge of nuclear, biological, and chemical weapons, or the so-called "weapons of mass destruction" (WMD), promise to be more widespread as time passes. Nuclear weapons and other WMD in the hands of some regimes in the Third World will change the meaning of geography. Geopolitical relationships established during the Cold War will be up for redefinition. The problem of deterring emerging nuclear actors (threshold

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[2]"North Korea's Bombs," Wall Street Journal (January 31, 1995), p. A20; Chris Hedges, "Iran May Be Able to Build an Atomic Bomb," New York Times (January 5, 1995), p. A10; Clyde Haberman, "Israel Eyes Iran in the Fog of Nuclear Politics," New York Times (January 15, 1995); Brooks Tigner, "Proliferation Threat Unites NATO," Defense News (January 23-29, 1995); and "Nuclear Non-Proliferation: Between the Bomb and a Hard Place," Economist (March 25, 1995), pp. 23-25.

[3]Dr. Stephen P. Rosen, "Decision-Making: How Can We Account for Rationality by Leaders of the New Nuclear States," remarks at the a conference sponsored by the U.S. Strategic Command and the Defense Nuclear Agency on July 7-8, 1993. See Counter-proliferation: Deterring Emerging Nuclear Actors (Arlington, Va.: Strategic Planning International, Inc., August 1993).

[4]Glenn H. Snyder, "Balance of Power in the Missile Age," Journal of International Affairs, 14-1 (1960), pp. 21-34.

and other nuclear-capable states) while reassuring their neighbors in the region of a timely international response to aggression looms as a significant challenge to maintaining strategic stability. Many of the framework. Obtaining a geopolitical perspective that embraces the new dynamics of "fissionable instability" is a prerequisite to creating a U.S. strategy for dealing with the new nuclear actors.[5]

How should the United States, whether in concert with the international community or alone, deter and defend against the emerging nuclear actors (e.g., a country holding from five to ten nuclear weapons)? Since a few nuclear weapons in the hands of an aggressor in a particular region may be inadequate to underwrite a classical deterrence concept vis-a-vis the United States and other established nuclear powers, a new organizing principle is necessary. Emerging nuclear actors are most likely to use "a few nuclear weapons" or other WMD as political and military tools to underwrite efforts to use conventional military forces to seize and hold the territory of others. That is to say, key elements of the classical balance of power seem to have been given renewed life in the wake of the Cold War's end.

In theory, a multilateral response such as a United Nations-approved intervention force might be preferable over a U.S.-only response in answering nuclear threats and limited use of nuclear weapons. In practice, on the other hand, there is no other country waiting in the wings with the military capabilities necessary to respond effectively to regional nuclear threats and uses by the emerging nuclear actors. "The United States needs to maintain a unilateral military option," Richard N. Haass argues. "It cannot plan its forces on the assumption that others, including the United Nations, will be willing or able to bear the burdens of major military undertakings."[6] Moreover, the U.S. should not surrender its right to respond unilaterally when its security interests are threatened, especially when they involve nuclear threats and uses of nuclear weapons and other WMD.

Organizing principles used in the development yesterday's strategy may still be applicable to the U.S. response to the still emerging post-Cold War circumstances. Just a few months after the Japanese attack on Pearl Harbor in 1941, Nicholas J. Spykman, a professor at Yale University, began to look ahead to the post-war security environment. While wisely eschewing detailed predictions of the post-1945 world, Spykman applied key geopolitical and balance of power concepts in making the case for an active U.S. role in foreign affairs following the coming defeat of Germany and Japan.[7] Spykman's worldview was clearly integrated into the subsequent U.S. containment strategy. With the end of the Cold War, much of Professor Spykman's world, from an American perspective, still appears relevant to the emerging international order. At the risk of oversimplifying Spykman's geopolitical verities, the following summary contains key elements that may influence the development of U.S. military strategy in the years ahead.

- A country's geographic location and relation to competing centers of military power define its problem of security;

- While widely separated regions can function as relatively autonomous power zones, no area of the world can be completely independent of the others;

- Because of the distribution of the land masses and military potential, a balance of power in the transatlantic and transpacific zones "is an absolute prerequisite" for the United States;

- The post-war power pattern of international society will be similar to the pre-war pattern . . . " the

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[5]"Between the Bomb and a Hard Place," Economist, p. 25.

[6]Richard N. Haass, "Military Force: A User's Guide," Foreign Policy, No. 96 (Fall 1994), p. 35.

[7]Nicholas J. Spykman, America's Strategy in World Politics (1942) and The Geography of Peace (1944 after his death) (Reprints by Archon Books, 1969, 1970).

distribution of the land masses, the location of strategic raw materials, and the relative distance between countries will not change;"

- U.S. interests will demand the preservation of a balance of power in Europe and Asia;

- It will be cheaper in the long run to remain a working member of the European power zone after the war; and

- To maintain a balance of power in the Far East, the United States will have to adopt a protective policy toward Japan.

Conventional military operations, integrated with nuclear weapons and other WMD, are emerging in various regions as representing power to intimidate neighbors politically and to contest the control of territory militarily. The weapons of mass destruction also promise to inflict a severe punishment on regional states choosing to resist as well as inflict heavy casualties on international-sponsored military forces deployed to the theater of operations. This evolving strategic condition is not quite a "classical" balance of power situation, but neither is it quite "classical" deterrence. New theoretical concepts are necessary to provide the logical underpinnings of a workable U.S. strategy and a usable model of strategic stability for dealing with the emerging regional geopolitical power shifts.

2. Deterrence

Deterrence evolved as the central organizing principle of relations between the superpowers in the 1960s; nuclear deterrence retained its preeminence through the 1970s and 1980s. Now often referred to as *classical deterrence*, this theoretical concept for more than three decades supplanted classical balance of power considerations and also replaced the "balance of terror" which became popular jargon in the 1950s. During the long reign of the deterrence concept as a central theoretical concept to frame the competition between the United States and the Soviet Union, the strategic nuclear balance between the superpowers became melded with regional balance of power considerations, especially in Northeast Asia and Europe where the U.S. extended its strategic umbrella over its allies threatened by Moscow's nuclear and conventional military superiority. In a word, the U.S. used its nuclear power and long military reach to counterpoise the Soviet capacity to seize and hold territory of its neighbors; every potential conflict was transformed into a potential U.S.-Soviet nuclear war.

The Cold War's central organizing principles shifted dramatically with the crumbling of the Berlin Wall, dissolution of the Soviet Union, and all of the associated political, economic, and military changes that subsequently have taken place. *Classical deterrence* seems to retain much of its internal logic of mutual assured destruction vis-a-vis the United States and Russia and the other former-Soviet states holding nuclear weapons. Yet, new international relations are emerging from the proliferation of nuclear weapons.

Today, and increasingly so in the emerging world order, deterrence must include more than a threat of "massive retaliation." Deterring the new emerging actors threatening use of a few nuclear weapons and transnational terrorist organizations loom as significant challenges to future strategic stability. As John R. Powers and Joseph E. Muckerman recently argued in Orbis, "there is no choice but to assume that a political decision to acquire nuclear weapons is also a political decision to use them."[8]

From the U.S. perspective, a key concern is how to convince the emerging nuclear actors of the credibility of American guarantees to respond to nuclear threats and actual use in regions far removed from the United States. As Stephen Rosen points out, the Cold War problem of developing a destabilizing combination of nuclear offensive and strategic defensive capabilities will be reduced in the

[8]John R. Powers and Joseph E. Muckerman, "Rethink the Nuclear Threat," Orbis (Winter 1994), p. 103.

still emerging world order of multiple new nuclear actors. Hence, deterrence through " . . . a war winning strategy of responding to the threat or actual use of nuclear weapons with a disarming offensive strike supported by air and ballistic missile defensive forces deserves consideration."[9]

What targets should be held at risk to deter the leadership of the emerging nuclear actors? Fundamentally, a deterrence policy must threaten what the nuclear regimes value most: the mechanisms used to maintain internal control and assure the leadership's survival. Lieutenant David J. Gellene, U.S. Navy, provides a particularly useful analytical structure for identifying a suitable target structure to hold at risk for deterrence purposes in his master's degree thesis for the Naval Postgraduate School.[10]

Since many emerging nuclear powers may be authoritarian regimes in the Third World, one can safely assume that the leadership will face restive minority populations, a narrow domestic support base, and perhaps internal challenges to its authority. Internal security is a prerequisite for regime survival. Thus, a key to deterring their external threat or use nuclear weapons will be holding at risk the leadership's mechanisms for maintaining internal control.

A second internal control mechanism is exercised through distribution of economic resources. In many Third World countries it is easier to maintain control through the distribution of goods than it is to do so through suppression of dissent. The leadership offers economic rewards for the loyalty of the most powerful elites. On the other hand, economic resources are withheld from those posing potential opposition and power of the gun is used to ensure they stay in line.[11]

Lieutenant Gellene nominates two broad target categories to serve as the basis of deterring the emerging nuclear actors.

- Targeting Suppression. Threatening to neutralize a regime's elite security forces could remove internal restraints on opposition forces. The leadership must perceive that if they use military forces against their neighbors, regardless of whether nuclear weapons are threatened or actually used, that they will face coordinated and sustained attacks against their internal control forces and the facilities necessary for their command and control.

- Targeting Economic Distribution. While economic sanctions can be expected to exact some pain from the regime in power, experience shows us that they are rarely one hundred percent effective and the longer they are imposed the greater are the opportunities to work around the procedural barriers put into place. Hence, another deterrence element can be obtained by posturing forces for counter-control military strikes against capabilities the regime needs for export extraction and transmission to the outside. Targeting a regime's oil fields, for example, might present useful deterrence opportunities.[12]

In addition to Gellene's target categories, one might consider adding strikes against the emerging nuclear actor's military capabilities, with a particular focus on nuclear, biological, and chemical weapons and the ballistic and cruise missiles available to deliver them accurately across great distances. At the same time, disaffected groups might be encouraged to engage in non-cooperation with the regime's

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[9]Stephen Peter Rosen, "Future Roles and Missions for U.S. Nuclear Forces, 1993-2013," a Concept Paper for the Institute for Strategic Studies (April 1993), p. 7.

[10]David J. Gellene, Deterring Nuclear-Armed Third World Dictators: A Targeting Strategy for the Emerging Threat (Monterey, Ca.: Naval Postgraduate School, June 1992) (available through the Defense Technical Information Center).

[11]Ibid., pp. 47-65.

[12]Ibid., pp.65-76.

actions and perhaps even conduct sabotage against its military operations. Avoiding targets that impact disaffected populations could be supplemented with psychological operations, personal action teams inserted to encourage defection from the regime, and arms and assistance from special operations forces.

This targeting scheme suggests a different kind of deterrence in the new world order. During the Cold War a lot of effort went into devising models purporting to show the critical relationship between nuclear weapons and foreign policy. Static comparisons and dynamic exchange models claimed to show the status of strategic stability at any given time. Yet, the models of stability of the U.S.-Soviet and NATO-Warsaw Pact balances never captured the underlying psychological dynamics at work nor did they account for the political use of non-use of nuclear weapons.

The emerging new world order will demand more from the analytical community. Plainly, the analyses of deterrence need to focus on Clauswitz' teaching that the purpose of war is not destruction of the enemy but of the enemy's will to resist. To that end, all strategy is psychological.

3. Balance of Power

The phrase "balance of power" is much abused in the United States and has several meanings. In an extensive survey of the political literature in the early 1950s, Ernst B. Haas found eight or more distinct verbal definitions and four separate applications of the balance of power concept.[13] At the risk of some semantic or theoretical confusion, "balance of power" is used here in a minimal sense as a factual characterization of the relative distribution of military power necessary to seize or hold territory.

Balance of power is an unfortunate term, especially for Americans who, owing to their heritage of liberalism, tend to equate it with power politics and evil. Liberals, as Michael Howard points out, have been railing against this "foul idol" for years.[14] "The notion of balance of power has always been unfashionable in America," Henry Kissinger explains. "But it is the precondition of security, and even of progress. If mere avoidance of conflict becomes our overriding objective, and if our own military power is disparaged, the international system will be at the mercy of the most ruthless."[15]

The idea of security through countervailing power is so fundamental to the human existence that it is not surprising to find evidence of the workings of the balance of power throughout history. "What made war inevitable," Thucydides observed in citing the underlying cause for the Peloponnesian War, "was the growth of Athenian power and the fear which this caused in Sparta."[16] The Persians, fearing for their own safety should Athens or Sparta predominate over the other, joined forces with whichever side was weaker. David Hume, commenting on these events and similar ones marking the Roman world and the Middle Ages, observed that ". . . the maxim of preserving the balance of power is founded so much on common sense and obvious reasoning, that it is impossible it could altogether have escaped

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[13]Verbal meanings: balance meaning distribution of power, equilibrium, hegemony, stability and peace, instability and war, and power politics generally, as well as balance implying a Universal Law of History and balance as a system and guide to policymaking. Intentions of the user: purely descriptive, propagandistic, an analytical concept, and a guide to foreign policy-making. See Ernst B. Haas, "The Balance of Power: Prescription, Concept, or Propaganda?" in Power, Action, and Interaction, ed. by George H. Quester (Boston: Little, Brown, 1971), pp. 250-83 (reprint from World Politics, 5-4, July 1953).

[14]Michael Howard, War and the Liberal Conscience (New Brunswick, N.J.: Rutgers University Press, 1978), pp. 43-44.

[15]Henry A. Kissinger, "Statement With Respect to the Treaty on Strategic Arms Limitation Before the Committee on Foreign Relations of the United States Senate," July 31, 1979 (unpublished.).

[16]Thucydides, History of the Peloponnesian War, trans. by Rex Warner (Baltimore: Penguin, 1976), p. 49.

antiquity, where we find . . . so many marks of deep penetration and discernment."[17]

The balance of power has a built in self-regulating mechanism. When a state increases its military capabilities that would allow territorial or economic aggrandizement, regardless of its intentions, a threat is posed to others which must take countervailing actions through alliances with others or fielding of additional military forces. This "laissez-faire theory of international order" is evident in the contemporary world order.[18] Yet, this homeostatic property is not unique to the nuclear era nor is it a modern development. Ancillon, a Prussian State Secretary for Foreign Affairs, made a clear case in the early 1830s:

> Each state can have no other maxims in its external relations than these: whoever can do us damage through an excessive balance of power in his favor, or through his geographical position, is our natural enemy, but whoever in view of his position and forces is able to harm our enemy, is out natural friend. These simple maxims which the need for self-preservation has given to man, are and have been at all times the anchors on which all politics rests.[19]

Haunting the contemporary balance of power is the specter of nuclear proliferation and the possible use of these weapons in regional conflicts or by terrorists against targets in the United States. The uncertainties associated with the spread of these weapons places a premium on intelligence gathering. "A balance-of-power system," historian Edward Vose Gulick admonishes, "depends for operability on the watchfulness of foreign offices over the various important member states."[20] The affected states need information on the weapons programs of potential adversaries to allow time for joining alliances or deploying countervailing weaponry. The problem is magnified in the post-Cold War world where missile flight times between regional adversaries are short and the destructive potential of nuclear attacks is enormous.

Another contemporary balance of power instability results from the inability to calculate with confidence the consequences of proliferation for regional politics as well as the global implications that might result. The inevitable uncertainty of the balance of power is magnified when future projections are made. These prognostications of the state of the world five, ten, or fifteen years downstream introduce yet another complication. The fact that future nuclear proliferation portends to alter the conditions for stability dramatically in key regions of the world demands that nuclear weapons be dealt with in practical ways: As Kenneth Waltz says, "balance-of-power politics is risky; trying to ignore it is riskier still."[21]

The trouble is that the balance of power metaphor implies a form of mechanistic assessment of relative military power while ignoring important social, political, cultural, and psychological factors. Numerical comparisons, especially dynamic analyses, can help us understand force effectiveness in the context of time and space, and they can yield useful insights to the calculus of strategic stability. Nonetheless, these analyses fail to account for the all important human quality of fighting power. Columnist Joseph Kraft poignantly illustrates the weaknesses inherent to the "numbers-only" approach.

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[17]David Hume, "Of the Balance of Power" in The Balance of Power and Nuclear Deterrence, ed. by Frederick H. Gareau (Boston: Houghton Mifflin, 1962), p. 57.

[18]Robert E. Osgood and Robert W. Tucker, Force, Order and Justice (Baltimore: Johns Hopkins University Press, 1967), pp. 97-99.

[19]As quoted by Haas, "The Balance of Power," p. 277.

[20]Edward Vose Gulick, Europe's Classical Balance of Power (New York: W. W. Norton, 1967), p. 16.

[21]Kenneth N. Waltz, Man, the State, and War (New York: Columbia University Press, 1954), p. 221.

> People speak of military balances as if they were nice, neat, tidy items. The kind of things that are subject to exact measurement and marginal adjustment on a day-by-day basis. A little like bank balances. But . . . military balances express rough equations that regularly ignore vital factors and constantly yield poor prognostications . . . . So trying to measure the balance nicely is a mug's game . . . . What we owe to ourselves . . . is the caution bred by the one sure thing about war--uncertainty.[22]

The post-Cold War order reflects a peculiar unraveling of the logic of classical deterrence and a partial return to classical balance of power considerations, at least with regard to the emerging nuclear actors. In the absence of the superpowers exercising some degree of political control over the actions of client-states and third countries in various regions of the world, many governments are now left to their own devices to assure their security objectives vis-a-vis their neighbors. Regional balances of power are based primarily on conventional military forces--the armed capacity necessary for seizing and holding or defending territory. Without the nuclear guarantees of the superpowers, regional balances of power are emerging at different rates of change in Europe, the Middle East, South Asia, and Southeast Asia. Northeast Asia, too, is evolving to new conditions of regional equilibrium but several wild cards question which direction trends may take the region (e.g., what will Japan's reaction be to the evolution of a peacefully unified, nuclear-armed Korea?).

The three main instruments being used for the formation and maintenance of the regional balances are political accommodation with former adversaries, formation of incipient regional alliances, and armament programs. The advent of new nuclear actors, even those with a few weapons, can have a significant impact on regional stability which can reverberate to effect strategic stability. The main impact may not result from the physical effects of nuclear weapons use per se. Rather, the threat of nuclear use as a means of coercing neighboring states may be most important. The emerging nuclear states can also gain military advantages from a few nuclear weapons because of their impact on the conventional force deployments, operational and tactical doctrines, and logistics of neighboring states.

Not only do threats intimidate and sap an adversary's will to resist, but the target countries would do well to devalue their conventional military forces as potential targets of nuclear weapons. This translates to a need to disperse forces to the extent possible and mass for defensive purposes at the right time. Innovative logistical resupply of dispersed conventional forces poses significant challenges to defending against nuclear strikes. The problem of electro-magnetic pulse (EMP) effects on conventional forces is another open question. Finally, external forces arriving in the theater can usually be expected to present lucrative nuclear targets while clustered for a time at a few ports, airfields, and assembly areas made available by the host country.

Stephen Rosen provides an example of how the course of the Gulf War may have been altered if Iraq had held a few nuclear weapons. Since nuclear weapons development programs have never elicited a U.S. military response, including the Iraqi program, countries logically conclude that it is risk-free to pursue nuclear weapons. Professor Rosen's hypothetical case of a nuclear-armed Iraq in the Gulf War suggests that Iraqi nuclear weapons could have deterred or interfered with U.S. military deployments to the theater in two ways: (1) Iraqi nuclear weapons could have coerced Saudi Arabia and other countries to deny the United States access to ports, airfields, and other important facilities in the theater, and (2) U.S. military leaders could have had serious doubts as to the wisdom of concentrating some 500,000 American servicemen within range of Iraqi nuclear weapons.[23]

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[22]Joseph Kraft, "The Great Un-Balancer," Washington Post (May 30, 1982), p. C7.

[23]Stephen Peter Rosen, "Lessons from the 1991 US-Iraq War: Hypothetical Nuclear Weapons Use," a paper for the Los Alamos National Laboratory (draft copy dated August 31, 1991), pp. 1-8.

4. Geopolitics

"Geopolitics is a creature of militarism and a tool of war."[24] Denunciations such as this one by Derwent Whittlesey during the Second World War gave geopolitics the status of a barnyard expletive in the United States. This is an understanding sentiment given the time. Molded in the hands of Karl Haushofer, "geopolitik" combined political, geographical, historical, economic, and racial factors in justifying the Nazi attempt to extend control over vast areas and natural resources. Haushofer believed that a state must continue to expand its borders or decay; he thought that Germany, like Japan, had too many people to feed for lack of space. From this line of reasoning, he argued that Nazi Germany had the right to extend its borders to obtain the "living space" needed to satisfy its people's needs.[25]

When trimmed of the ideological baggage left by Haushofer, geopolitics stands as a neutral theoretical concept that can be helpful in explaining the political and geographical relationships of the nuclear powers and emerging nuclear actors in the post-Cold War order. A geopolitical appraisal may be useful to gaining insight to the dynamics of strategic stability in the emerging international order.

To have meaning, the balance of power must be appraised from a geographical reference point. Diplomats and generals are strongly influenced by their worldview of where their country lies in the general order of the regional and global power arrangements. Typically, their country is seen as being located at the center of the regional balance of power and the broader international system. "Natives of London, New York, and Tokyo, carry around in their minds maps of the world that center, respectively, on London, New York, and Tokyo."[26]

The Greek and Persian-centered worlds around 500 B.C. were tiny in comparison with the global scope of perspectives today. Early perceptions of the earth were marked by visions of wonder and myth. Homer wrote about the earth as a flat disk surrounded by a constantly flowing ocean from which the sun rose and set. In Phaedo, Plato wrote of Socrates' sensing of a much larger world: "I believe that the earth is very large and that we who dwell between the Pillars of Hercules (Gibraltar) and the river Phadis (in the caucasus) live in a small part of it about the sea, like ants or frogs about a pond, and that many other people live in many other regions."[27] The mental maps held by the Roman emperors included the entire Mediterranean Basin by 200 A.D. Discovery of the New World and the subsequent circumnavigation of the globe increased proportionately the spatial relationships and strategic considerations to be grasped by policymakers. The political and military meanings of geography changed over the centuries as the means of moving military equipment and troops across vast distances were improved dramatically.

"Geography is the bones of strategy" Theodore Ropp points out.[28] Twentieth century advances in the speed of movement on and above the earth's surface changed the time-space relationship in military strategy. Now ships routinely cross the Atlantic in four to five days, the Pacific in twelve to fourteen days. Aircraft cross the Atlantic in seven hours, some in only three. Intercontinental ballistic missile flight times are counted in minutes.

To understand strategic stability in the post-Cold War world, the policymaker and the strategist should have a seasoned appreciation for the contemporary geopolitical realities of time and space and their relationship with the balance of power. In the final analysis, geography serves as a common denominator

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[24]Derwent Whittlesey, "Haushofer: The Geopoliticians" in Makers of Modern Strategy, ed. by Edward Mead Earle (1943. Reprint. Princeton University Press, 1971), p. 388.

[25]Andreas Dorpalen, The World of General Haushofer (New York: Farrar & Rinehart, 1942), p. 42.

[26]Colin S. Gray, The Geopolitics of the Nuclear Era (New York: Crane, Russak, 1977), p. 20.

[27]John Noble Wilford, The Mapmakers (New York: Knopf, 1981), pp. 17-18.

[28]Theodore Ropp, War in the Modern World, rev. ed. (New York: Collier Books, 1962), pp. 161, 170-71.

to determine the time, distance, and movement dimensions of military planning.

The geographic location of nuclear powers and the emerging actors will be very important to strategic stability in the future. Professor Nicholas Spykman explains the locational imperative in the following way:

> It is the geographic location of a country and its relation to centers of military power that define its problem of security .... In terms of that location, it must conduct its military strategy in war time, and in terms of that location, it should conduct its political strategy in peace time.[29]

Underlying the geographical dimension of strategy are spatial concepts based on the idea of distance from what is considered the nerve center of the state. "Physical distance is the simplest, but . . . also the most misleading yardstick for measurement."[30] This is especially the case at a time of proliferation of nuclear, biological, and chemical weapons and the ballistic and cruise missiles to deliver them speedily and accurately. As radical shifts in the nature of the threats in specific regions evolve, U.S. security interests must be reappraised continuously in terms of location, time, and distance.

A major challenge facing U.S. counterproliferation programs is how best to reassure friends and allies located near emerging nuclear actors that Washington will respond to blackmail and intimidation with countervailing forces in time to be relevant to the threat. Given the speed and expected accuracies of ballistic and cruise missiles, the emerging nuclear actors will have the an upper hand in the absence of an effective U.S. response.

A part of the answer is deployment of theater missile and air defense systems to protect countries within range of the new nuclear actors. NATO's Medium Extended Air Defense System extending along the southern region will protect the alliance from low flying threats from North Africa, including cruise missiles. Area defense against ballistic missiles fired from the Levant also will be deployed early in the 21st century.[31] Three geographical dimensions of theater air and missile defense include (1) protection of U.S., host nation, and third country forces deployed in the region (at their forward bases, posts, and other fighting locations, (2) protection of military and civil facilities in rearward areas that are essential to successful defense by the deployed forces (e.g., ports, airfields, and assembly areas), and (3) protection of the host nation capital and urban areas.

Another aspect of reassuring regional allies and friends is through the presence of military forces. Forward presence was a key component of the U.S. containment strategy. The objective was to deter and if necessary defend against aggression thereby reassuring allies of the American political will. The strategy was underwritten by alliances (e.g., NATO, U.S.-Japan), forward-based forces on land and at sea, and rapid U.S.-based reinforcement and resupply capabilities. In the emerging world order the smaller number of U.S. forces and shrinking defense budget will dictate the development of new organizing principles for maintaining presence and reassuring friends and allies.

Global presence is a new concept that promises to satisfy the geopolitical imperatives of time and space while accounting for the realities of fewer military forces. First, all U.S. military forces can exert presence no matter where they are located so long as four conditions are satisfied: U.S. interests must be involved, the U.S. must have the political will to defend those interests, Washington must have the means to monitor and assess the actions of regional powers, and the U.S. must possess sufficient forces available to protect its interests, if they are challenged. So long as these four factors are present, military forces--even those based in the United States-- are likely to influence new nuclear actors.

Secondly, U.S. military forces possess unique attributes that affect the scope and quality of the

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[29]Spykman, America's Strategy in World Politics, p. 447.

[30]Joseph Frankel, National Interest (London: Macmillan, 1970), p. 80.

[31]Martin Sieff, "West Reacts to 'Southern Threat,'" Washington Times (March 10, 1995), pp. A1, A14.

presence they exert, and when appropriately applied they complement each other even at long range. The different attributes inherent in U.S. military forces enhance a theater commander's ability to design joint force packages that will exert presence in consonance with the principles of war: some forces will arrive quickly at the locations where they are needed (responsiveness); other forces possess the ability to maintain or adjust operational tempos over an extended period of time (persistence); forces can often be configured for a particular set of conditions (flexibility and versatility); many forces have an inherent capacity to limit risks of their destruction when deploying (survivability); and operational support mechanisms allow the efficient allocation of resources in the deployment and employment of forces.

And, lastly, technological innovations enhance the U.S. ability to exert presence by enabling forces to influence the new nuclear actors with less risk. Improvements in situational awareness, strategic agility, and lethality allow the U.S. to consider a wide range of military responses to regional events. Advances in information-based technologies allow military forces to monitor and assess most regional events rapidly and efficiently. Improvements in the ability to move a variety U.S. forces rapidly to distant locations allows effective responses to regional aggression. Likewise, new weapons system technologies make it possible to maintain a credible deterrent with a smaller force structure and at less cost.[32]

5. The New Language of Politics and Strategy

The theoretical concepts of deterrence, balance of power, and geopolitics were deeply affected by the end of the Cold War and they continue to evolve to keep pace with the reality of newly emerging nuclear actors on to the world scene. As organizing principles for helping us better understand the dynamics of strategic stability and the strategy needs facing the United States, these three concepts have taken on new meanings.

5.1. DETERRENCE

Classical deterrence, as developed during the Cold War on the basis of mutual assured destruction, appears to remain valid between the United States, Russia, and other established nuclear powers. *Regional deterrence* of emerging nuclear actors, on the other hand, needs to be based on a war-winning strategy and military posture encompassing U.S.-regional, offensive-defensive, nuclear-conventional, and theater based-externally based forces that can support discriminate strikes.

5.2. BALANCE OF POWER

With the end of the Cold War, deterrence by threat of punishment through widespread nuclear strikes lost much of its internal logic, especially with regard to regions lacking the presence of established nuclear powers. In these areas, there seems to have occurred a partial return to *classical balance of power* considerations of conventional forces being used to seize and hold territory. As emerging nuclear actors field weapons of mass destruction, one should anticipate, at least initially, a modified balance of power in the affected region that reflects the importance of conventional forces supplemented by a few nuclear weapons.

5.3. GEOPOLITICS

Reassuring allies and friends of the U.S. capability and political will to respond to aggression when the

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[32]U.S. Air Force, Global Presence, a white paper on reconsidering presence in light of new security, technology, and budget considerations (Washington, D.C.: U.S. Air Force, February 1995).

U.S. has little of no presence in the region looms as a major challenge. A would-be attacker will not be dissuaded if a U.S. response is not believable. Hence, Washington must be careful not to mislead an adversary into believing that a U.S. response would not be forthcoming in event of aggression. Deterring a conventional or nuclear attack is always preferable to defending against them. Underwriting deterrence in ways that will make an effective U.S. response believable to would-be aggressors requires an ability to use conventional weapons and, if necessary, nuclear weapons with discrimination. Discriminate strikes that neutralize the target with minimum collateral damage can give the adversary an incentive to restrain any impulse to lash out against civilian or other soft targets that may result in numerous casualties. Theater defenses against air and ballistic missile attacks can help to reassure allies and friends. The new American concept of *global presence* also helps to satisfy the imperatives of time and space within the context of an affordable military posture.

6. Discriminate Deterrence Revisted

In a rather peculiar turn of events, many of the main tenets of a 1987-88 report by the U.S. Commission on Integrated Long-Term Strategy are becoming increasingly relevant as nuclear proliferation progresses through the waning years of the twentieth century. The Commission's January 1988 report, Discriminate Deterrence, is hopelessly outdated since it addresses U.S. strategy vis-a-vis the USSR through 2007. Many of the Commission's main points about the interaction between technology and strategy, however, remain valid in the context of the newly emerging nuclear actors.[33]

An integrated war-winning strategy designed to deter emerging nuclear actors, preserve regional stability, and reassure allies and friends of U.S. intentions, for example, should satisfy the following principles and key elements in the current defense effort:

- Integrate new technology, force structure, mobility and bases, conventional and nuclear arms, offensive and defensive forces;

- Tailor U.S. plans and forces for a wide range of conflicts, from the lowest intensity and most likely to the most apocalyptic and least likely;

- Avoid emphasis on extreme threats that stress credibility and offer plausible contingencies that call for discriminating military responses and account for the risk that in situations involving an adversary's nuclear threat some allies and friends may opt out;

- Develop militarily effective responses that limit destruction so that such options do not invite destruction of what the U.S. is defending;

- Exploit technologies of precision, control, and intelligence so that U.S. conventional forces can be made more selective and more effective in destroying military targets;

- Ensure an appropriate mix of offensive and defensive systems to help deter nuclear attacks and deter or respond to conventional aggression;

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[33]U.S., Commission on Integrated Long-Term Strategy, Discriminate Deterrence, co-chairs: Fred C. Ikle and Albert Wohlstetter (Washington, D.C.: Government Printing Office, January 1988). Members: Anne L. Armstrong, Zbigniew Brzezinski, William P. Clark, W. Graham Claytor, Jr., Andrew J. Goodpaster, James L. Holloway, III, Samuel P. Huntington, Henry A. Kissinger, Joshua Lederberg, Bernard A. Schriever, and John W. Vessey.

- Control space in wartime and prevent the enemy from using space freely to support targeting of U.S. and regional forces;

- Deploy capabilities needed for discriminate nuclear strikes to deter a limited nuclear attack on allied or U.S. forces and if necessary to stop a massive invasion;

- Deploy versatile, mobile forces that are minimally dependent on overseas bases in delivering precisely controlled strikes against distant military targets; and

- Budget for military forces on the basis of strategy and strategic priorities and remain aware of the risks associated with any shortfall.

A central aspect of American military strategy in the emerging world order is restoring the political effectiveness of nuclear weapons. The ongoing internal American debate over the appropriate role of nuclear weapons in U.S. foreign policy reflects significant subjective restraints at work that inhibit their use both politically and militarily. Consequently, the policy of where, when, and under what circumstances nuclear weapons would be used to support U.S. foreign policy objectives vis-a-vis the emerging nuclear actors is ambiguous. This ambiguity, or confusion of policy, could hearten the proliferators and give them further incentives to pursue nuclear weapons programs. In addition, the absence of workable nuclear policies could deflate the will of friends and allies to resist the coercive effects of these nuclear programs.

The United States needs to restore the psychological effects of nuclear weapons as a part of carefully constructed regional war-winning strategies vis-a-vis the emerging nuclear actors. Since the U.S. foreign policy objectives are to deter proliferation, maintain regional stability, and reassure friends and allies, there can be no logical split between conventional and nuclear threats and responses. To obtain the needed psychological effects to deter adversaries, reassure friends, and break an enemy's will to resist, U.S. forces have to possess the right kinds and mixes of firepower, including offensive and defensive forces, conventional and nuclear weapons.

In seeking a coherent strategy that will respond to the new conditions spawned by the end of the Cold War and the emerging proliferation of nuclear weapons and other weapons of mass destruction, the United States must emphasize technologies for multiple platform sensors, information processing, precision guidance, selective destruction, and battle management and communications. Since even a limited conventional war would be conducted in the shadow of potential nuclear strikes, the defenders (the U.S. and its friends and allies) would have to conduct operations in a manner that would avoid presenting a nuclear-armed adversary with opportunities for decisive use of small numbers of nuclear weapons.

A strong nuclear component in the U.S. strategy is essential. Without usable nuclear weapons integrated into the U.S. force posture, emerging nuclear actors could be offered greater incentives to deploy and threaten or use nuclear weapons politically (if not actual use). These weapons could be seen as a way to deny U.S. conventional superiority or to dissuade an American response to regional aggression.[34]

Active and passive defenses could also help to diminish incentives for selective nuclear attacks against the defender's military targets by protecting, especially those defending forces that could play a key part in stopping the aggressor's follow-on conventional attacks. These defensive capabilities could

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[34]George H. Quester and Victor A. Utgoff, "No-First-Use and Nonproliferation: Redefining Extended Deterrence," Washington Quarterly (Spring 1994), p. 107.

become essential aspects of an integrated war-winning strategy that links theater-based conventional forces and externally-based conventional and nuclear forces. A defender's will to resist conventional attacks from a regional adversary could be crippled by an emerging nuclear actor delivering a small number of nuclear weapons against key facilities. Such selective nuclear attacks could leave the defender's urban centers untouched, giving them strong incentives to cease resistance against conventional assaults and deny access to their ports and airfields by U.S. and other external forces.

The U.S. nuclear systems supporting strategic stability in the various regions should be configured so that if they are needed, they will be available and effective in carrying out a war-winning strategy that will blunt an invasion by conventional forces, disarm the enemy's nuclear capacity to the extent possible, threaten the regime's existence, and shift the burden of further nuclear use to the adversary. This strategy should also account for the geopolitical asymmetry between the emerging nuclear actor and the United States.[35]

Six military tasks vis-a-vis WMD and their missile delivery systems are inherent to a regional war-winning strategy and help to clarify the weapons systems required: (1) punish illegal proliferation and delay acquisition of capabilities, (2) destroy existing capabilities before they can be used, (3) deter the use of those that cannot be destroyed, (4) if deterrence fails, attack and destroy existing capabilities, (5) defend against nuclear weapons and other WMD launched against friendly forces, and protect friendly forces and populations from the effects of radiological, biological, and chemical materials; and (6) destroy remaining WMD and military capabilities after the conflict.

Taking into account the credibility of response, the strategy needs to distinguish which of these tasks must be satisfied by weapons based in the theater from those that can be delivered by externally-based forces. To reassure allies and friends in the regions, the strategy should emphasize the widest possible breadth of regional participation; no gaps or breaks should be allowed between the regional forces and U.S. forces.

To deter the emerging nuclear actors from using nuclear weapons, the U.S. and its regional partners must convince the adversary that the combined nuclear and conventional forces in theater and external forces will defeat the aggression and hold at risk the foundation of the enemy regime's power. A strong rapid-response conventional capability, complemented by a capacity to execute selective nuclear options, can face emerging nuclear actors with risks too great to chance attacks against their neighbors.

To make threats of effective counter-strikes credible, U.S. forces need a capacity to act effectively against targets of military and political significance early in a conflict while limiting collateral damage. When precision-strike conventional weapons promise to be effective, they may be the weapon of choice against many of the enemy's key military targets. In other cases, such as hardened underground structures, tunnels, and other facilities that may be impervious to even precision-strike conventional weapons, the U.S. may require confined-effects nuclear weapons. These U.S.-based weapons must be able to be delivered with sufficient discrimination so as to avoid collateral damage. Hence, precision-strike and constrained nuclear effects weapons could be essential components of a U.S. regional war-winning strategy. Such a strategy means that U.S. and regional forces would have to create the doctrine necessary to fight combined non-nuclear and selective nuclear war while avoiding presenting a nuclear-armed adversary lucrative targets.[36]

The new meanings of deterrence, balance of power, and geopolitics provide a framework for strategic stability in the new world order and sets the stage for a U.S. strategy designed to (1) *deter* emerging nuclear actors by the threat of a rapid-response war-winning strategy, (2) preserve regional stability by maintenance of a *balance of power* through political engagement, alliances, and countervailing forces, and (3) reassure regional friends and allies through *geopolitical* guarantees of military responses,

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[35]U.S., Commission on Integrated Long-Term Strategy, The Future of Containment, report by the Offense-Defense Working Group (Washington, D.C.: Department of Defense, October 1988), pp. 20, 83-95.

[36]Ibid., pp. 88-90.

protection of regional states by means of theater missile and air defenses, and development of the new theoretical concept of global presence.

Strategic stability must account for regional conventional military balances that may be influenced by the deployment of nuclear weapons and other WMD by the new nuclear actors as well as the relationship between established nuclear powers. The problem in the new world order is accounting for the effects of nuclear proliferation on conventional military operations, screening of these regional impacts for indicators of their influence on regional stability, and incorporating the influence of an American war-winning strategy vis-a-vis the emerging nuclear actors into the calculus of the broader, global strategic stability paradigm.

PROLIFERATION STABILITY AND INSTABILITY: CONDITIONING FACTORS

FRITZ W. ERMARTH[1]
Former Chairman National Intelligence Council
Central Intelligence Agency
Langley, Virginia

1.0 Introduction

Proliferation stability can be thought of in two dimensions. In the first, dimension we are concerned with the propensity of states, or other entities, to acquire nuclear weapons or other weapons of mass destruction; we are concerned with factors that allow or encourage such proliferation versus factors that inhibit or discourage it. In the second dimension, we are concerned with the propensity of states who actually have weapons of mass destruction to use those weapons in conflict, that is, with factors that either encourage or discourage actual use. Stability can be said to be or associate with a low propensity to proliferate and to use; instability with a high propensity.

Most analysis of both kinds of proliferation stability tends to focus on the immediate situation of the potential proliferator or user, on his strategic aims or security situation (demand side), and on his access to or facility for acquiring the requisite technology, capability, etc. (supply side). This is entirely appropriate. But it is also appropriate to give consideration to larger factors in the international environment that either encourage or discourage proliferation and use of weapons of mass destruction. Rather than a strategic, this might be termed an ecological perspective. In one respect, this perspective is often taken, i.e., proliferation analysis is often concerned with the physical availability of weapons material and technology in the international environment. The assumption or belief is that large amounts of either will be conducive to proliferation and, eventually, to use of weapons of mass destruction.

This paper will look at other factors in the international environment, factors of a more political or social nature. In general, they are the factors that condition international stability itself. The assertion here is that proliferation stability or instability is likely to relate more or less directly to general international stability or instability. In other words, international conditions we associate with generalized stability are likely to correlate with proliferation stability, i.e., a low propensity to acquire or use WMD. Moreover, it may make sense to distinguish among kinds of stability. General stability based upon consent, i.e., the voluntary agreement of participants in the system, would seem on the whole to be both more stable and more inhibitive of proliferation than stability based on coercion. The notion of consensual stabilty is perhaps but an anodyne way to express the idea of universal peace that has been the focus of political thought for centuries. As the Cold War drew to a close, this vision found expression in a variety of slogans and formulations, from Gorbachev's "new thinking" to Bush's "new

[1]Note: The views in this paper are solely and personally those of the author and do not represent the official positions or policies of any US government agency.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 69–75.

world order" to Fukuyama's "end of history". Nonconsensual or coercive stability has been much more the reality in human affairs. Dictatorship imposes such stability within states. And it is worth noting that most of the dangerous proliferators of our day are highly authoritarian states (e.g., North Korea, Iraq, Iran). At the same time, two undeclared nuclear powers are relatively stable democracies: Israel and India. The Cold War environment might be termed a semi-coercive stability in that it imposed relatively predictable and confining conditions on the participants against their will (e.g., the lesser Warsaw Pact states) or preferences (NATO states). In one sense, that stability seems to have inhibited proliferation. By the end of the Cold War there were fewer nuclear weapons states in the world than many predicted ealier that there would be. At the same time, the Cold War brought five declared nuclear powers, tens of thousands of nuclear weapons and delivery systems, and vasts amounts of material, technology, and talent for making weapons of mass destruction into being. We may look back and find that the most dangerous aspect of the Cold War, after the potential for a global nuclear holocaust that did not occur, was the latent popensity for proliferation that it built up. In some sense, we are now asking what international factors of stability will encourage or discourage that propensity in the post-Cold War world.

I want to offer and talk briefly about eight large factors or variables which seem likely to determine the stability or instability of the general international environment in the post-Cold War period. They are:

- The condition of the great powers, which will influence their ability to act in world affairs as well as the direction of their actions.
- The relationship of the great powers, which will influence whether they act in concert or conflict with one another.
- Globalization, i.e., phenomena which tend to undermine or marginalize the power of nation-state actors.
- The transformation of war, a variety of phenomena that are changing the very character of military affairs.
- Transparency, or the intelligence environment, which will influence the ability of actors to hide or find activity relating to proliferation.
- Economic development prospects, which will shape relationships among the haves and have-nots of the world.
- Specific regional developments and variations.
- The "shock variable."

In offering this list, I propose neither a universal theory of post-Cold War international affairs nor that this is the only way to organize one's thinking about it. Nor do I propose that these variables all relate directly and obviously to proliferation stability, although some of them clearly do. Rather, I am suggesting that here are a number of very important variables that will determine international stability, which in turn will influence proliferation stability in important ways. Giving them some consideration will enrich our discussion of the dynamics of proliferation.

I would further suggest that, at present, a rather high degree of volatility and uncertainty characterizes each of these variables. Each one features important kinds, rates, and degrees of change on which we have a poor intellectual grip. This is one reason why, after initial satisfaction at the end of the Cold War, political elites around the world view international affairs with some disquiet and even alarm.

2.0 The Condition of the Great Powers

Despite a tendency for the sovereignty of great powers to erode (discussed below), international affairs, especially security affairs, are still shaped by the actions of a relatively small number of states to which the somewhat archaic-sounding term great power still applies. The list surely includes: Russia, China, Japan, Europe (considered either as an entity or as a family of powers), and the USA. Perhaps India

should already be added. And the list seems likely to grow somewhat in coming decades, perhaps adding Indonesia, or Brazil, or a unified Korea. The capacity of these powers to act in international affairs, and the direction and strength of their action will be determined by their
internal conditions as states and societies. In all cases, I see important and uncertain transformations taking place.

Russia is clearly undergoing a profound and sweeping revolution which is redefining statehood, government, economics, and society itself. How this revolution turns out -- whether it produces a more or less stable, democratic, western-oriented country as most reformers hope, or a more autocratic and xenophobic state as in the past -- is one of the most important uncertainties we confront. Moreover, this uncertainty is likely to endure for some time because it may take a generation or more for this revolutionary process to find a stable outcome. In the long term, this outcome will importantly determine the shape of the international environment. In the meantime, Russia's instability is itself perhaps the most significant single source of proliferation instability in the world because it encourages, allows, or risks the transfer of a host of dangerous military technologies and materials through official, unofficial, and illegal channels.

China is likewise in the throes of transformation. The picture of rapid economic growth disciplined and exploited by a stable authoritarian political order offers one scenario, auguring increased Chinese military power and international influence, perhaps even the possibility of a new superpower challenge to the rest of the world. But this is not the only scenario. Even as a generational shift is occurring in China's leadership, economic development is challenging the viability of its political system. Whether this challenge will be managed in an evolutionary manner or cause a temporary breakdown of China's integrity, and what it will ultimately produce, are quite uncertain. Meanwhile, as in the Russian case, aspects of China's internal situation -- e.g., the propensity of her military to export weapons technology out of purely business motives -- are causes of proliferation instability on the supply side. Fears of China's long-term aims and power are likely to be important sources of proliferation instability on the demand side.

Japan is an economic superpower, but little more. Its future role in international affairs is likely to be influenced by significant internal transformations. The social and political arrangements that supported Japan's single-minded mercantilism and avoidance of other forms of internationl engagement in the past may not do so to the same extent in the future. The Japanese people seem to want government more responsive to their needs and an economy that permits them greater enjoyment of Japan's wealth. At the same time international change is pressing Japan to assume greater responsibility for regional security which will require shifts in Japanese domestic attitudes. It is possible that Japan will be a somewhat different actor in the future.

What Europe will be as an international actor in the future is uncertain. The drive to unity is likely to be slowed by national reservations in the West and diluted by the inevitable inclusion of Central European states in some form. Security affairs are likely, in the final analysis, to rest in the hands of the governments of the major countries, most importantly Germany, France, and Britain. All of these countries face the strains of "post-industrial" adjustment that challenge the responsiveness of their political systems and the capacity of their economies to deliver general welfare. At issue is the confidence of these societies to shoulder security responsibilities in the face of regional instability and in quest of consensual stability. That confidence cannot simply be assumed, as we see in the Balkans. The most powerful single European state, Germany, is searching for a post-Cold War international role, decidedly in a European context. German power will make it impossible for Germany to take one some leadership role. But internal political and economic conditions raise doubts about how strong or decisive it is likely to be.

This is also the essential question about the United States. The US remains a superpower in that its interests are global and its "reach" in both political and military terms is still global. But it is also beset by chronic internal difficulties -- economic, political, and social -- which are testing its will and capacity to be the kind of global leader it has been in the past. And this seems likely to continue for some time. Although isolationism is hardly possible as a practical policy, given the manifold interdependencies vital

to domestic well-being as well as security, it is clear that isolationism as a sentiment is very much alive in the US, fueling a penchant for unilateralism and great selectivity in international commitments. The willingness and the ability of the US to provide security guarantees to potential proliferators will be a significant influence on proliferation stability of both types. And clearly this rests ultimately on domestic confidence.

Even this superficial sketch should establish that who and what the great powers are can change, and must be treated as something of an uncertainty.

3.0 Relations Among the Great Powers

The stability of the international order will be greatly influenced by the kind of relationships that develop among the great powers. Three general models have been suggested by various analyses. The good news is that the most attractive of the three has some chance of emerging. This is a concert of nations in which there is essentially no focused military hostility among them, and they all, or subgroups of them, have a tendency to cooperate on vital security issues. Such a system would not exclude, in fact would have to find ways to tolerate, friction over many issues. The powers would still be expected to maintain armed forces against the prospect of system breakdown, or against actors that are judged to be outside the system. Almost by definition, a concert of nations would act most strongly to prevent or contain the dangers of proliferation. The ambiguity of the current relationship among the powers is well illustrated by the fact that they are largely in agreement about indefinite extension of NPT, but are clearly at odds over specific threats (e.g., Russian and Chinese policy vis-a-vis Iran).

There are other, less attractive, systems toward which great power relationships could well veer. Russia or China could emerge as superpower challengers, leading to a repolarization of international affairs; their internal development is likely to be the determinant here. Or a fluid, fragile balance-of-power system could emerge, akin to Europe in the 18th and 19th Centuries. A repolarized international system might either encourage or discourage proliferation, depending on how rigorously it disciplined the supply and demand sides of the proliferation dynamic. A fluid system is likely to encourage proliferation because of a relatively high degree of independence of the members, and pervasive desire by greater and lesser actors to hedge against threats they must face alone. What kind of system will emerge will depend on a number of variables: the strength and consistency of the US leadership role, whether or not Russia and China are integrated into the essentially "Western" system, and future integration of Europe.

4.0 Globalization

The forces that shape the lives of people in all advanced societies, and increasingly in developing ones, are ever more global in their character; that is, they operate across or without reference to national boundaries and in most if not all parts of the world. There can be no question that they have the net effect of bringing people and nations closer together, despite physical distance, and contribute to net increases in human productivity and economic well-being. These effects are generally thought to be positive in terms of peace and human welfare. But there are some important ambiguities and contradictions in globalization.

Some effects are obviously good, e.g., international trade and information exchange, although they can bring negative side effects such as job displacement. Some are obviously bad, e.g., the globalization of organized crime, narcotraffic, and terrorism. Some are inherently ambiguous in their effects. For example, international money flows increase the efficiency of capital but can destabilize currencies and economies. International arms traffic can bring both security and insecurity. The global spread of Western, especially American, popular culture increases cultural familiarity, but often also breeds cultural contempt and resentment.

Most importantly, globalization erodes or compromises the power of national governments to shape national life. Yet national governments are still, at least in more or less democratic states, the repositories of political legitimacy. People don't vote for the forces and persons who drive the engines of globalization, except through their behavior in the marketplace. This is as much to say that the political institutions of the globe are out of synch with the forces operating on the globe. Perhaps they will catch up. In the meantime, there is uncertainty and instability.

5.0 The Transformation of War

The proliferation and potential for use of weapons of mass destruction arise in, and are somewhat driven by, larger transformations in the overall phenomenon of warfare and military affairs. Three aspects deserve mention.

First, in addition to WMD, high and low technology conventional weapons are steadily proliferating around the globe, despite some reduction in global arms budgets and arms traffic since the end of the Cold War. The appetites of many countries for weaponry have not been diminished by the end of the Cold War; for some it has increased. The eagerness of suppliers in advanced countries, both in the West and in the former and still communist worlds, to find customers has in some ways increased. We may be seeing a phenomenon often seen after great conflicts in the past: the weapons, technology, and talent previously engaged need to find new outlets.

Second, as widely noted, a revolution is occurring in military affairs. The technologies that supply speed, range, accuracy, stealth, and, above all, battle information are radically increasing the proficiency of forces which master them, and even creating new modes of combat (e.g., information warfare). The interesting question here is: How does the RMA influence international stabilty? One logic would assert, if the masters of the RMA are the technologically advanced countries, and they are on the whole democractic and prone to consensual relations, then stability will be served. But that's a tenuous string of "ifs". There could be forces working in the other direction. Some of the wonders of the RMA make powerful weapons cheaply available to poorer, weaker, perhaps less responsible countries, e.g., anti-air and anti-ship missiles; this could work against the power of advanced countries and against stability. The advanced countries may be less willing to spend on mastering the RMA than some less advanced ones are to sacrifice to take advantage of some aspects of it. The potential of the RMA to degrade the military value of mass forces on which some states rely could increase their incentives to acquire weapons of mass destruction as an "ace in the hole" against suffering a fate similar to that suffered by Iraq in 1991.

Third, there is a tendency around the globe for real on-going warfare to become more disorganized, a phenomenon Martin van Creveld has labled itself the tranformation of war. The military establishments of the US and other advanced countries contemplate preparing for ever more spectacularly proficient versions of the Gulf War. Such preparations may pay off in future victories or continuing deterrence. Meanwhile, what is constantly going on is evidenced in Somalia, Rwanda, Bosnia, Chechnya, Tadzhikistan, and many other places. The advanced democratic countries in Europe, America, and Japan, are profoundly reluctant to become engaged in these quagmire wars. Confronted with them on their immediate periphery, the Russians have shown themselves less reluctant, although not eager, and are militarily engaged in ambiguous operations at several points on Russia's periphery. By their nature or location, most of these conflicts do not present direct security challenges to the advanced powers. Yet they "barbarize" the international environment, and degrade international stability. The effective discriminant of military power equations in the future may be less capability than willingness to fight. If the advanced countries are generally unwilling to fight where the real, if not immediately threatening, security problems are, while less advanced but more ruthless countries, movements, or ethnic groups are willing to fight, instability conducive to proliferation is likely to result.

6.0 Transparency

No country I can think of set out to acquire weapons mass destruction in public. An environment has evolved, thanks to the NPT, the CWC, and the BWC, in which acquisition and, until the point of actual need to use, possession must proceed in secrecy. This makes the balance between capability to hide and capability to find relevant activities significant for proliferation stability. It is not clear whether the risk of "getting caught" has deterred any serious proliferator. But there are now a number of cases where the fact of getting caught has stopped nuclear programs. Of course, discovery had to be followed by political and other pressures. There are cases where intelligence from outside may have contributed to avoiding conflict with the potential for nuclear use, e.g., the US effort to damp down the Indo-Pakistani crisis of 1990. In any case, serious international efforts to stop or obstruct poliferation depend on intelligence.

On a global scale, the main "finder" has been the world-wide intelligence capability of the United States. A very important supporting role has been played by intelligence cooperation between the US and key allies in the effort to thwart proliferation through dangerous technology transfers. The future of these two sources of transparency is somewhat uncertain. Although the professed priority of proliferation as a concern of policy and intelligence in the US is likely to remain highy, downward budget pressures, institutional reforms, and other post-Cold War adjustments are likely to change, and possibly reduce, US intelligence capabilities. Such reductions and changed political relationships may interfere with intelligence cooperation so important to counter-proliferation efforts.

At the same time, more countries are entering the satellite reconnaissance arena, and the information age is rendering more domains of human activity at least potentially transparent. One should not argue that the finders are going to lose ground to the hiders, although they could if they are negligent. The point is that the larger intelligence environment should be explicitly considered in assaying prospects for proliferation stability.

7.0 Economic Development

It is probably true that technological and economic backwardness in the world has prevented more proliferation than it has caused. It is probably also true, however, that economic backwardness goes hand in hand with social and political conditions conducive to conflict and to proliferation instability. This deserves to be considered.

The central question is whether economic development will bring large enough areas of the Third World into the "comfort zone" of prosperity to the degree and in a manner that enhances stability. The paths to development are clearly there and have been successfully followed by the Asian tigers over the past few decades. They involve education, savings, and wise governance. Doubts about the rest of the Third World concern whether it can create the political conditions this formlula requires.

8.0 Regional Variations

A global/environmental approach to evaluating proliferation stability must, at some point, give way to considering the variations and specific conditions of strategic regions. It is readily apparent that the most dangerous regions are the Middle East, South Asia, and Northeast Asia. This is not only because of proliferation activities currently occurring there, but because the strategic conditions incentivizing them seem likely to persist, and even to intensify if the US tends to withdraw from distant security commitments. Latin America, Africa, and Europe, by contrast, appear to be low risk areas.

9.0 The Shock Variable

Much analysis of the proliferation problem tends to project familiar conditions. But we know from past experience that dramatic events can radically change the international environment. Such events cannot

readily be forecast. But some potential shocks are visible enough to speculate about. A very dramatic and quite plausble case would be another Korean war in which weapons of mass destruction were threatened or used by either side. Were such a war to occur, even without the use of nuclear weapons, there would be a widespread consciousness that North Korea's nuclear ambitions and US resistance to them were in large measure the cause of the war. It might go down in history as the first real proliferation war.

What might be its effects? One can imagine quite varied results, even assuming the probable immediate outcome, the destruction of North Korea. Much would depend on the cost in terms of casualties and treasure, the extent of destruction in South Korea, or possibly even Japan, the degree of cooperation exhibited among the US, South Korea, Japan, China, and Russia. One imaginable outcome would see the relevant powers galvanized into a "never again" mentality determined to prevent future proliferation, especially to irresponsible or rogue states. This might lead to new levels of international cooperation on security matters. On the other hand, especially if the US suffered high costs and was seriously disappointed in the performance of its allies, the result might be a withdrawal of the US from security commitments and a concommitant increase in the propensity of those who previously relied on such commitments to proliferate, most importantly Japan.

Scenarios of this sort can be developed in elaborate detail, usually without adding greatly to enlightment. It remains important, however, to consider the shock factor in developing forecasts of the international environment, especially as it bears on proliferation.

10. Concluding Thought

Much of the conference has been devoted to the quest for quantitative theory to explain and forecast proliferation and other kinds of military behavior. Nothing is as practical as a good theory, according to Lenin, who should well have learned nothing is as dangerous as a bad one. In physics, so also in human affairs, some times are not as good as others for good theory. Sometimes we don't know enough for good theory. We need to do empirical work. Many of the areas above lend themselves to that. We need to get a better grip on what is really driving human affairs now.

VERIFYING THE FUTURE - TOWARDS AN INTERNATIONAL CONVENTIONAL ARMS CONTROL AND CONVERSION REGIME FOR THE 21ST CENTURY

ROY GILES[1]
Defence Research Agency
Farnborough
England

ABSTRACT. Strategic stability enhancements in the nuclear sphere have combined with the problematic side-effects of some conventional arms control accords, to produce destabilising elements. The author identifies these elements: the increased significance of precision weaponry; a superfluity of conventional military equipment of all sorts; and excessive manpower in military service and military industry. The author proposes a regime to address these connected problems.

1. Setting the Scene

1.1 THE NUCLEAR PRIORITY

Can we now rejoice? Decades of existence under the protection of a deterrent doctrine, thermonuclear and bipolar - so appropriately blessed with the acronym "MAD" (Mutually Assured Destruction) - are now behind us. In the aftermath of the breakup of the Warsaw Pact, and the disappearance of the Soviet Union as a monolithic globally-threatening superpower[2], political and economic factors have combined to encourage most states to reduce their nuclear arsenals. This priority process in general is of course to be encouraged; it will hopefully continue despite the threat of the so-called "rogue" regimes[3] to acquire their own nuclear weapons for unclear motives, concealing both the manufacture and storage of weaponry, flouting international agreements and defying sanctions in their pursuit of particular ends. With bipolarity a bygone, the present Advanced Research Workshop (ARW) in examining multipolarity may succeed in producing a model for strategic stability that will take these latter aspects into consideration; it is certainly appropriate for the majority of our analysis and discussion to be directed toward such an end. However, the author believes that our attending to the nuclear priority should be cautioned by a certain awareness: military so-called "conventional" technological advance in the past

[1] This paper represents the opinions solely of the author, not those of the United Kingdom Government or Ministry of Defence

[2] Mortimer, Edward: "European Security after the Cold War" Adelphi Paper 271. IISS Brassey's, London 1992: p 8

[3] Earle, Ambassador Ralph: "Defence and Disarmament Priorities: A View from the United States", The Council for Arms Control, London 1993: p 15

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 77–83.

decade has been as rapid and arguably as decisive, as the political changes that decided NATO on the theme of our workshop. Before we rejoice, let us therefore pause awhile.....

1.2 APPRECIATING THE ADVANCING CONVENTIONAL THREAT

The deployment and effective use by the Coalition Partners of high-precision conventional weapons during the Gulf War convinced many observers that this class of armament has advanced so fast and so decisively, that a new appreciation of the global threat spectrum is required[4]. Conflict scenarios previously requiring the deployment and use of nuclear, or other, weapons of mass destruction are now apparently amenable to solution by so-called conventional means. Visually most impressive during operations against Iraq, with combat photography displayed on the world's television screens, was the neutralisation of massive concrete bunkers and hangars by comparatively small laser-guided bombs or rockets. The Iraqi structures were designed and built (at enormous trouble and expense, reputedly far surpassing the most exacting Western standards) to withstand conventional high explosive attack; moreover, the provision of a sophisticated, hardened air filtration system protected against known chemical or biological agents. The thickness of concrete and the depth of underground burial demanded at the very least a nuclear weapon to achieve crippling damage. With war-fighting assets thus defended, a state might justifiably feel confident in facing up to any threat short of the nuclear. Thus in the absence of any illogical aggressive predilections, it could be assessed theoretically that nuclear stability was enhanced: such strong defensive fortifications ruled out a conventional attack, and the known self-preserving and self-deterring reluctance of nuclear-weapon-equipped states to engage in "first use" completed the equation.

2. Ingenuity Wins the Day

2.1 TECHNOLOGY IN ACTION

With the availability of very high quality pre-strike reconnaissance facilities to determine the challenge presented by apparently impregnably-hardened (but fixed) defensive structures, technological ingenuity on the Coalition side - predominantly by the United States - resulted in a war-winning weapon combination. Remote or pre-determined precision guidance enabled cruise missiles to inflict crippling damage on air defence systems, radar sites, headquarters and the vital national infrastructure. To deal with massive concrete or buried bunkers, actively-guided bombs and rockets were the proven means of destruction. These weapons were usually steered onto their targets by homing onto a laser beam projected from either the launch aircraft or an accompanying "buddy". One very British combination, delightfully *ad hoc*, teamed the 1950's technology veteran "Buccaneer" as the laser projector paired to the 1980's "Tornado" bomber. The "Tornado" did not at the time possess its own laser designator, but the "Buccaneer" fortunately did. (It has been speculated that Service pride insisted that the bombs on these operations were carried by the "Tornado"; actually the grand old "Buccaneer", thanks to its original role as a long range nuclear bomber for the Fleet Air Arm, was equipped with an excellent bomb bay of its own....) This vignette should not divert attention from the overwhelmingly American character of the conventional precision attack. US technology included a specially produced heavyweight penetrative bomb, which when delivered accurately was capable of demolishing even the strongest concrete installations; the effect achieved was reminiscent of damage inflicted by the "Tallboy" family of World War II super-heavy bombs. Destruction by the most effective teaming of tactics and weaponry on the Coalition side must have been overwhelming to those on the receiving end in Iraq. The devastating and unannounced blasts of supersonic V-2 weapons brought a particular horror to the inhabitants of London

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[4] Willett, Susan: "Controlling The Arms Trade; Supply and Demand Dynamics". Faraday Discussion Paper No. 18, The Council for Arms Control, London, 1991: p 21

in the closing months of World War II in Europe. Comparable must have been the effect of the guided penetrative bomb, delivered in similarly unannounced style from high in the sky, by the US Air Force's undetectable F-117 "Stealth" aircraft. An awesome ingenuity won the day.

2.2 WEIGHING THE PRECISION FACTOR

In the case of the Gulf War, precision weaponry was in the hands of one side only - subjectively, the "good guys". Consider the situation if the same level of technology, matched by equal professional military skill, had been available to the Iraqi side. Today for Western nations, in debating the *pros* and *cons* of military intervention, the "body bag" factor exerts a high, perhaps overriding, influence at the political level. The suspected possession by Iraq of an offensive chemical and biological capability required the Coalition on the one, military, hand to embark on a comprehensive, expensive, defensive programme covering large-scale precautionary medical injections of personnel, and the purchase of special detection equipment and vehicles, and the mobilisation of decontamination units - including the admirable contribution of such a unit by the Czechoslovakian Armed Forces, which undertook to treat affected casualties irrespective of their nationality, both service and civilian alike[5]. On the other, political, hand, it was necessary in the months before the committal of Coalition forces to publicly counter some alarmist statements - usually by prominent figures opposed to the very concept of hostilities, but sometimes by military commentators - in which the possibility of catastrophic casualty levels was widely aired. It is not fanciful to assess that if the situation regarding precision weaponry had not been so one-sided, this factor might have posed not only a testing strategic military risk calculation. With the contemporary *sine qua non* of prior public approval for large-scale military operations, the precision weaponry factor would have certainly also posed a very taxing public relations problem. In consequence, this author believes that the uncontrolled large-scale introduction of high-precision conventional arsenals will be severely destabilising to any security regime based on nuclear balance, nuclear deterrence, or a mutual nuclear "no first use" agreement. Hence, my enthusiasm for raising these issues for wider examination in this current, expert and versatile forum.

3. Embarrassment of Riches - Another Destabiliser

As if the foregoing were not enough, a further major destabilising factor is already internationally apparent. Thanks to the coincidence of political change with economic imperatives and arms control agreements, enormous surpluses of military equipment, and military manpower, have been thrown up on both sides of the old Oder-Neisse line.

3.1 EXCESSIVE EQUIPMENT HOLDINGS

First was an undeclared excess of significant fighting vehicles: holdings that their owner, the Soviet Union, did not want included in the CFE treaty's provisions. During the period from January 1989 to the date of signature of the CFE Treaty on 19th November 1990 the absolutely stupendous total[6] of sixteen thousand four hundred battle tanks, fifteen thousand nine hundred armoured combat vehicles, and twenty-five thousand pieces of artillery - all "Treaty Limited Equipment" (TLE) - were moved from locations in eastern Europe and western Russia, covertly, mostly by rail, to deployment areas and storage sites east of the Ural mountains. To appreciate the real proportions of this undertaking, add together the contemporary TLE holdings of the entire armies of France, Germany and the United

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[5] Personal briefing to the author by the Czechoslovakian unit commander, Prague May 1992

[6] Convention, Treaty on Conventional Armed Forces in Europe (CFE), U.S. Government Printing Office, Washington 1991: p 219

Kingdom[7]. Now treble that sum. The total arrived at will still be about a thousand short. Imagine, indeed marvel, at the movement planning and logistic requirements worked out by the Soviet General Staff; marvel also at the motivation for inflicting such a paralysing burden on any country in peacetime, let alone a country already on its economic knees.....No-one should be surprised that this extraordinary decision, so very Russian in character, brought with it both an immediate and a long-term destabilising consequence. The aftermath of such a large-scale priority usage of the national railway network by military trains was failure of the planned civilian locomotive deployment programme[8] well into 1991. This inevitably resulted in a shortage of conventional goods trains to move the subsequent Russian harvest. National television interviewed distressed collective farmers standing in front of wagons filled with rotting vegetables. The population's enforced deprivation of staple items, particularly in big towns far from agricultural areas, in turn brought the fear of food riots in Moscow and St Petersburg, which then led to the European Community's delivery of meat and butter to those two cities. This large-scale and logistically-taxing benevolence in its turn created a nationalist backlash against Yeltsin, for accepting such shameful charity....That was just the short-term consequence. Long-term, Russia is burdened with thousands of military vehicles for which she has no use, and for which she is now seeking buyers[9]. Selling equipment for hard currency to a foreign purchaser is officially "konversiya" (conversion) and is undertaken with enthusiasm. The problem of military surplus is by no means Russia's alone; Germany inherited thousands of TLE from the armed forces of the German Democratic Republic, and under the terms of the CFE Treaty has the largest reduction (destruction) obligation after Russia. Less well-equipped NATO states are receiving more up-to-date equipment from their allies, and destroying older items[10]. This "cascading" process has more than tactical significance. Disposal by Germany of significant quantities of unwanted Soviet-produced equipment to countries such as Greece and Turkey has not been without political ramifications. The UN Conference on Disarmament has been invited to study "excessive and destabilising accumulations of arms".[11]

3.2 THE HUMAN FACTOR

Compulsory "konversiya" does not only affect equipment. Reductions and redeployment of armed forces units and formations, and cancellation of orders for military equipment, have resulted in severe displacement of personnel. Most publicised are the hundreds of thousands of underemployed, sporadically-paid and generally distressed Russian officers, living in poor housing conditions following withdrawal of their units from eastern Europe. Attention is focused on them, partly due to the uniquely generous provision by Germany of aid in funding their domestic rehousing schemes, partly due to the publication in western countries of their embittered personal opinions[12] on a wide range of social and constitutional issues, and partly due to the headline-grabbing accusations of associated large-scale corruption in the Russian Army which led to the dismissal of the Commander, Western Group of Forces.

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[7] Heisbourg, Francois (dir), "The Military Balance 1990-1991", IISS Brassey's, London Autumn 1990

[8] Personal briefing to author, Moscow 1992

[9] Earle, Ambassador Ralph: ibid, p 4

[10] Latter, Richard: "Russia, its Neighbours and the Future of European Security" Wilton Park Paper 94, HMSO December 1994: p 20

[11] Beach, General Sir Hugh: "The New Arms Control Challenges", Faraday Discussion Paper No.19, The Council for Arms Control, London 1992: p 19

[12] "Military Elites in Russia", published by SINUS Moscow on behalf of Friedrich-Ebert-Stiftung, Moscow/Munich August 1994

However, the problem of demobilisation is being faced by almost all nations; for some, with forces based on conscription, difficulties can be eased by organising a gradual reduction in personnel drafted for service, or by shrinking the period of embodied service. For countries such as the United Kingdom, with an all-professional force, a purpose-built scheme is devised, for retraining and re-orientating skilled military experts for the civilian world. Military industry is forced also to contract; a prime example can be found in the state of California, where a concentration of the American "military-industrial complex" (MIC) has suffered very significant cutbacks. Job losses have averaged 300 thousand per annum[13] in the last 3 years; set against a population of 32 million, this very severe "downsizing" has required decisive and coordinated action at state and federal level to alleviate distress. Personal experience indicates that the Russian MIC is equally deprived of orders for production and funds for research, but has not to date been able to grip the problem in Californian style. Individual Russian MIC institutes and factories have insufficient funds to pay off staff in a compulsory redundancy scheme, so a random "brain drain" is in operation: talented individuals with initiative resign, seeking alternative employment. Many employees remain on the established strength of an organisation, but attend for work only symbolically, drawing a salary that has failed to keep pace with rampant inflation; often, there is a second job, in the service sector perhaps, and sometimes even a third paid activity in the evenings. The scale of the problem facing Russia was an important feature of a previous ARW[14]. Internationally, dual-use technology is frequently proposed as a partial solution to the situation facing military industries; however, drastic retargetting of production onto an entirely civilian consumer-oriented output, geared to a viable market, is probably the only route to survival and successful long-term employment.

4. A Useful Model - the Missile Technology Control Regime[15]

Compared with the higher public profile of treaties such as START and CFE, the Missile Technology Control Regime (MTCR) seldom features in today's media discussions. However, it possesses several features that serve as a useful model on which to base an international conventional arms control and conversion regime. First, it is non-regional. Member States and Adherents (who adhere to MTCR guidelines but do not attend meetings) are worldwide. Second, it is non-partisan: a state subscribes in its own right, not as a member of a particular bloc. Third: the purpose of MTCR is to limit the risks of proliferation of weapons of mass destruction by controlling transfers that could make a contribution to delivery systems (other than manned aircraft), but, in application, the limitations and associated sanctions have been both intelligent and very varied. Fourth: it is a voluntary association of states, that functions by consensus. Within the overall guidelines that cover delivery range (beyond 300 kilometres) and payload weight (500 kilograms), MTCR controls the transfer of such varied technology as materials, rocket engines, and missile components. The author believes that the destabilising spread of precision weapons could be controlled under an amended MTCR. Basically, MTCR could be expanded to include limitations covering missile accuracy, linked to a different, shorter delivery range specification.

5. A Spur to Strategic Stability

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[13] Personal briefing to the author by representative of the California State Governor, January 1995

[14] Weichhardt, Reiner (ed): "External Economic Relations of the Central and East European Countries", NATO Colloquium Brussels, April 1992 pp 151-167: the chapter by Cooper, Professor Julian: "Defence Industry Conversion in the East: The relevance of Western Experience"

[15] Suzanna van Moyland of the Verification Technology Information Centre (VERTIC), Carrara House, 20 Embankment Place London, kindly provided the author with information for this section

In the author's opinion, the situation that has arisen is crying out for an inspirational, international, and "all sources" framework for ideas. The requirement is for a mechanism, flexible and non-bureaucratic, that takes note and advantage of the implementation of existing conventional arms control and confidence-building agreements, adapts the success stories of current regional arms control arrangements to the developing geo-political situation, grasps the newly-pressing problems such as the management of precision weapons, the civilian conversion of military equipment, the re-orientation of military industry and manpower, and then spreads knowledge and experience for the common benefit. Already, NATO has usefully shown a lead by expending effort on a previous ARW that examined the international economic aspects of the changes taking place in former Comecon countries[16]. Untapped as yet on an international basis is the enthusiasm and practical imagination of many arms control executives, serving and retired, whose experience and motivation could be usefully harnessed.

5.1 HARNESSING ARMS CONTROL EXPERTISE IN A NON-PARTISAN NGO

General encouragement for the creation of an international Non-Governmental Organisation (NGO) with an arms control and conversion programme is derived from the author's own experience[17] setting up the United Kingdom's Verification Units for implementing the Stockholm Document from 1986, and the CFE treaty from 1990. In each case, those charged by signature states with implementing the accords across Europe's frontiers developed a practical, non-partisan problem-solving outlook. Facing common difficulties and novelty, commanders of Verification Units in effect created an unofficial international "club". Ideas discussed, and projects launched, were often more advanced than those foreseen at headquarters level. Practical considerations at the ground, operating, level generated a fusion of purpose, difficult to stimulate in the more bureaucratic atmosphere commonly prevalent in national ministries....the concept of a non-partisan international NGO is worth at least considering. Such an association would support and stimulate the broadening arms control regime. It would in parallel generate schemes for defence equipment conversion, dual-use technology, and re-employment of personnel, military and military-industrial alike. It would be an association of committed supporters of existing arms control accords, and in particular of a revised MTCR. A possible title could be "International Arms Control and Conversion Institute" (IACCI).

6. Conclusion

The recent, demonstrated capability of high-precision weapons to destroy, or at least neutralise, objectives originally targettable by nuclear or other weapons of mass destruction indicates that conventional offensive technology has crossed over into an unregulated arena. The resultant influence is destabilising. The Missile Technology Control Regime (MTCR) should be suitably modified and enlarged to incorporate this new class of weaponry, by imposing limitations on transfer of the relevant technology to non-conforming states. In a wider context, the process of arms control needs and deserves international non-governmental ideas and support. To spur the conventional arms control regime into the 21st century, an International Arms Control and Conversion Institute (IACCI) should be created, whose aims would be the furthering of existing international accords, support for enlargement of the MTCR, the spreading of enterprise and initiative in the conversion of military production through the re-

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[16] Weichhardt, Reiner ibid: pp 49-58, the chapter by Kaser, Professor Michael: "International Economic Relations during Post-Communist Restructuring (1990-1992)"

[17] Poole, JB and Guthrie, R (eds): "Verification 1993 - Peacekeeping, Arms Control and the Environment," Verification Technology Information Centre (VERTIC)/Brassey's, London 1993 pp 137-144: the chapter by Giles RL: "JACIG sans frontieres"

orientation of military industry to commercial civilian use, and the retraining of redundant military personnel. On foundations laid in the 20th century, this twin-track international initiative will build a new regime for the 21st century.

CRISIS STABILITY IN A MULTI-POLAR WORLD

ROBERT E. LINHARD
Major General, USAF
Headquarters U.S. Air Force, Director of Plans

1. Introduction

I would like to begin by offering a definition of crisis stability. Actually it is a definition of crisis instability.

"Crisis instability is the condition that exists when either leader feels pressure because of emotion, uncertainty, miscalculation, misperception, or the posture of forces to strike first to avoid the worse consequence of incurring a first strike."[1]

Many of you will recognize that as a quotation from the works of General Glenn Kent. I hope you will not accuse me of favoritism, but I believe the definition captures many of the concepts that must go into the discussions at this workshop. In particular, it captures the central role played by perceptions, calculations, emotional stress, and so on. That definition also points out some of the shortcomings in how we have been thinking about crisis stability.

I would like to offer two observations that will come out of this talk.

First, many characteristics of crisis stability that were relevant during the Cold War period of international relations were relevant before the Cold War and are still relevant today. This is because most crises did then and do now occur among smaller countries -- that is, outside of the immediate purview of the major powers.

Let's take a look at the record of crises during the 1945 to 1985 period -- more-or-less during the Cold War period. (See chart below.) First, we see that there were a large number of crises -- 254 according to one study carried out at the University of Maryland and McGill University.[2] We also see that there were relatively few cases that the United States or the Soviet Union perceived as crises for themselves. The chart also shows some examples from each of the cells.

Second, we must move beyond numerical rationalizations of force levels if we are going to understand the dynamics of crises. The greatest danger of crisis is not posed by numerical first strike advantage; rather, it is posed by change sufficient to cause stress, uncertainty, miscalculation, or misperception.

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[1]Glenn A. Kent and David E. Thaler, "First Strike Stability; A Methodology for Evaluating Strategic Forces," RAND Report R-3765-AF (August 1989), p. xvii.

[2]The International Crisis Behavior Project (ICB Project). C.f., Michael Brecher and Jonathan Wilkenfeld, eds., *Crisis, Conflict and Instability*, Oxford: Pergamon Press, 1989.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 85–93.

It's interesting to note how many crises occurred around the world during the Cold War period. We did not pay attention to all of them because of our Cold War focus. Few of those crises were about first strike or nuclear weapons. Many were triggered by non-violent events. Of the 254 crises examined, 46% were triggered by non-violent events. In managing the crisis Ð that is, actions taken following the crisis trigger, whatever its form – 47% saw no violence

We speak about objective change brought about by the end of the Cold War. Much of the change since the end of the Cold War is simply in how we think about the security environment. Emotional stress, uncertainty, miscalculation, and misperception will become key drivers, moreso than nuclear
force postures.

Superpower Involvement in International Crises, 1945-1985*

	U.S.	Other	
S.U.	11[1]	11[2]	22
Other	35[3]	197[4]	232
	46	208	254

[1] Examples: Invasion of Afghanistan, October-Yom Kippur War, Six Day War, Cuban Missiles

[2] Examples: Ussuri River, Prague Spring, Hungarian Uprising, East Berline Uprising

[3] Examples: Invasion of Grenada, U.S. Hostages in Iran, Tet Offensive, Pueblo Incident, Dominican Republic

[4] Examples: Iraqi Nuclear Reactor, Falklands/Malvinas, Burkina Faso/Mali Border, Basra/Kharg Island

*Source: Crisis, Conflict and Instability, M. Brecher and J. Wilkenfeld, eds., Oxford: Pergamon Press, 1989

Having thrown these opening remarks onto the table, I will address The Meaning of Crisis Stability and Application to a Multi-polar World.

2. The Meaning of Crisis Stability

If you go to the library and look for definitions of crisis stability, most will emphasize the importance of the military forces. Indeed, most will emphasize *nuclear* forces. Definitions of crisis stability have a nuclear weapons focus. Definitions of crisis stability also focus on first strikes. That is a hold over from the Cold War and is not so relevant today.

One contributor to the emphasis during the Cold War on nuclear weapons and first strikes is that we could not afford the perceived costs of a central conflict. We were so focused on maintaining stability because the stakes involved with taking the wrong step were potentially so high. We evaluated events around the globe in terms of the U.S.-Soviet relationship, spheres of

influence, and the likelihood that our actions could result in East-West confrontation and escalate to nuclear war. The threat of escalation from local or regional conflict focused our attention on how to not use nuclear weapons.

During that time period, discussions about stability echoed the theme of concern regarding first strike. Thus, we see in the introductory definition the notion that it is necessary for one side to strike first to avoid the worse consequence of incurring a first strike from the other side.[3] We understood stability in terms of equivalence of force sizes. We saw the overwhelming Soviet conventional forces facing Western Europe and matched them with a deterrent nuclear threat. Based upon Soviet strategic capabilities, we developed our inter-continental nuclear forces to be survivable and invulnerable, and structured them to assure a retaliatory strike in the event of a Soviet first strike against the United States. In other words, we viewed the Soviet force size and composition and trends in their forces and made decisions about our forces.

Today, there is a need for better ways to think about crisis stability. I will begin with a discussion of crisis, follow that with a discussion of stability, and bring them together in a definition of crisis stability.

2.1 DISCUSSION OF CRISIS

A useful definition of crisis has three general applications: shocks to the international system, factors internal to a given country, and confrontation between and among countries.

From the perspective of the international system, a crisis is a strong shock to the structure that holds the system together. Thus, the assassination of Austrian Archduke Francis Ferdinand in Sarajevo precipitated the collapse of the balance of power system that characterized international relations prior to World War I. Likewise, the collapse of the Soviet Union and break up of Warsaw Treaty Organization led to a crisis in that the leadership of many countries felt the possibility of military hostilities in which they might easily become involved because of reactions by any number of parties based upon emotion, uncertainty, miscalculation, misperception, or the posture of forces.

From the perspective of a single country, a crisis is an event or set of circumstances that poses a severe problem for policy makers. Outbreaks of civil wars and revolutions are obvious examples, and point out that crisis triggers can be internal as well as external. Crises for individual countries are often of great concern to the international community because of potential for spill over and the tendency to polarize viewpoints. An obvious example today is former Yugoslavia. A special concern at this level of analysis is non- and sub-state actors.

From the perspective of confrontational countries, a crisis is a major challenge by one state to the international position of the other. This is the form of crisis and crisis stability that we most often consider -- even though the greatest recent potential for crisis has come about through the shock to the international system by the demise of the East-West confrontation and because of the potential for adverse internal reactions in Russia.

In each of these, the circumstances that trigger a crisis are (1) threat to basic values, (2) awareness of a finite time in which to respond, and (3) a high probability of involvement in military hostilities.

I will return to this, but let's first turn to a definition of stability.

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[3]As an aside, one can imagine situations in a non-nuclear world where one side would want the other side to strike first so that there is an excuse to strike back.

2.2 DISCUSSION OF STABILITY

Defining stability is a little bit more difficult. It's something that we all know when we see it. Still, whether or not a given action or set of conditions is seen as stabilizing or destabilizing can depend on the viewer's perspective. History is filled with situations that were seen by one country as contributing to stability and by another as detracting from stability. This, of course, begs the question of what is stability.

From a geo-political perspective, stability suggests peaceful change and progress.[4] Change, when it takes place, is orderly and does not cause leaders to feel pressure because of emotion, uncertainty, miscalculation, misperception, or the posture of forces.

Stability can mean the absence of conflict. However, conflict in the short term can sometimes produce peace in the longer term. Many view stability as a steady state of a system. However, some change, even if it is accompanied or accomplished by the use of force can be perceived as supporting or restoring stability. For example, the United States was willing to use force to return the elected President of Haiti to power in order to restore Haitian democracy.

Essential to this discussion are the actions and conditions that may be destabilizing. Most obvious among these are the military manifestations of underlying security concerns. Examples include arms build ups, the spread of weapons of mass destruction, significant power realignments, intimidation through the threat of attack, and outright attack, including small-scale actions such as border skirmishes.

But there are numerous non-military actions and conditions as well that can lead to crisis and conflict. As an example, economic strength is based, at least in part, on access to foreign markets, energy, mineral resources, the oceans, and space. Disruptions in such access can be destabilizing. Japan's attack on the United States in World War II was motivated, among other things, by its need for assured access to raw materials. Economic interests played a key role in the pre-WWI balance of power system. In the U.S. view, open international economic systems with minimal distortions to trade, non-volatile currencies, and rules for resolving disputes are conducive to prosperity both at home and abroad, and therefore, are key sources of crisis stability.

2.3 CRISIS STABILITY

An operational definition of crisis stability is: Orderly change that does not cause a leader to feel pressure to act because of (1) threat to basic values, (2) awareness of a finite time in which to respond, and (3) a high probability of involvement in military hostilities.

Now, let me explain a couple of these terms. First, "orderly change" tends to mean change within some range of normal fluctuation. Change outside of some normal fluctuation can lead a leader to feel pressure to act. It is interesting to note that this idea implies the concept that war is an outbreak on a continuum of peace; that means that peace is the normal state of existence for peoples and nations and that war is a deviation from the expected course. On the other hand, some societies view conflict as the normal state of affairs and view peace as an outbreak on a continuum of conflict. Apparently that is the case for some Chinese decision makers.[5] We probably don't have enough time today to explore that notion.

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[4]The January 1993 *National Security Strategy of the United States* states that we seek "global and regional stability which encourages peaceful change and progress."

[5]C.f., Davis B. Bobrow, "Understanding How Others Treat Crises,"*International Studies Quarterly*, vol. 27 (1977), pp. 199-223; and Davis B. Bobrow, Steve Chan, and John A. Kringen, *Understanding Foreign Policy Decisions: The Chinese Case*, NY: Free Press, 1979.

A country's basic values include its territory, its influence in international affairs, continuity in its political system, damage to its real property, and so on. It's interesting to note that some countries, including the United States, consider attacks on its citizens -- no matter where they are -- to be attacks on that country. The gravity of a threat, then, can range from threat to the survival of a country as such, including its people or its territory, to overthrow of a regime, loss of key markets or blocked access to resources.

"Finite time to respond" means that there is a perceived beginning to a crisis. Stability and instability result in large part from the level of pressure or stress felt by a leader to respond within some time period. The time period can be immediate, as we most often think is the case, or it can be within some extended time period. Some people would argue that the extended time period puts more pressure on the decision maker.

High probability of military involvement, I believe, is at the core of any definition of crisis stability. This does not necessarily mean that forces attack. It does not necessarily mean that forces are mobilized or that they are put on heightened alert. What it does mean is that the leader for whom the circumstances and events represent a crisis feels the pressure of a high probability of military involvement.

We turn now to the application of crisis stability to the multi-polar world. This section primarily addresses the components of an approach.

3. Application of Crisis Stability to the Multi-polar World

As another aside, but one that is particularly relevant to this workshop, we should note that, although the period 1945 to 1985 more-or-less marks the Cold War era, it is generally recognized that the bi-polar era of international relations spans roughly from 1945 or '46 to somewhere in the late 1950s or early 1960s. Following the bi-polar period of international relations is a period generally described as "polycentrism." The other poles of power during the polycentrist period are variously described as China and the key industrialized nations, and characteristics marking the move away from a bipolar system include declining bloc cohesion, shifts to a more viable East-West interaction system after the Cuban Missile Crisis, and the realization of the "unusability" of nuclear weapons. Therefore, one important consideration for this workshop is to clarify the meaning of "multi-polar."[6]

3.1 UNDERPINNING ASSUMPTIONS OF CRISIS STABILITY

One of my assignments for this workshop was to state some underpinning assumptions of crisis stability. The following list highlights several assumptions that I believe are important for

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[6]C.f., Raymond Aron, *Peace and War*, NY: Doubleday, 1966; James N. Rosenau, "Pre-Theories and Theories of Foreign Policy," in R. Barry Farrell (ed.), *Approaches to Comparative and International Politics*, Ill: Northwestern University U. Press, 1966, pp. 27-92; Gordon A. Craig and Alexander L. George, *Force and Statecraft: Diplomatic Problems of Our Time*, NY: Oxford U. Press, 1983; Kalevi J. Holsti, *International Politics*, 4th Ed., NJ: Prentice-Hall, 1983; William R. Keylor, *The Twentieth-Century World: An International History*, NY: Oxford U. Press, 1984; David W. Ziegler, *War, Peace and International Politics*, 3rd Ed., Mass: Little, Brown, 1984; Frederic S. Pearson and J. Martin Rochester, *International Relations: The Global Condition in the Late Twentieth Century*, Mass: Addison-Wesley, 1984; Charles W. Kegley, Jr. and Eugene Wittkopf, *World Politics: Trend and Transformation*, NY: St. Martin's Press, 1985; Bruce M. Russett and Harvey Starr, *World Politics: The Menu for Choice*, 2nd Ed., NY: W.H. Freeman, 1985.

considerations at this workshop.

(1) Emotional stress, uncertainty, miscalculation, and misperception are leading drivers of crisis behavior. Similarly, situations outside of a country's purview can be cause for concern, but they are not cause for crisis.

(2) Events and conditions that put pressure on a decision maker to act can be economic and diplomatic actions; they do not have to be military. In keeping with the definition cited above, they evoke the perception of a high probability of military involvement.

(3) The fragility of many countries – new and old – following the end of the Cold War will place pressures on the major power, leadership countries to treat many conditions and events as "crises." The leadership countries will have to walk the line between intervention and isolation.

(4) The basis for ownership of a "pole" in a multi-polar world is as likely to be economic or political as military. Similarly, new types of warfare may be emerging; the emergence of "information based" societies provides enormous potential to conduct operations with and against the information that empowers and sustains those societies, for example.

3.2 WAS THE COLD WAR AN ANOMALY REGARDING CRISIS STABILITY?

Some Dimensions of Crises

Context / Dimension	Within East-West Conflict	Outside East-West Conflict*
Actors	U.S. (NATO) - S.U. (Warsaw Pact)	- Regimes/Personalities - Sub-national Groups - Alliances/Coalitions
Objectives	Protect Primary Interests While Avoiding Global Nuclear War	Defend/Promote Interests While Lessening the Possibility of Large-Scale War or Campaigns
Threat	- Direct, Survival-Threatening - Escalation of Local Conflict	- Can be Indirect - Often Principle-Threatening
Focus	Nuclear Weapons	- Regional Conflict - Terrorism/Fanaticism - NBC an Increasing Concern
History of Interactions	- Multi-Issue Experience/ Treaties - Actions Constrained by Fear of Escalation	- Weak/Few Precedents - International Law Basis - Constraints Can Be Due to Non-Military Concerns

*** Pertains to during the Cold War as well as since the end of the Cold War**

A question that seems to arise is whether or not the Cold War was an anomaly in terms of crisis stability. I suggest that the Cold War *was not* an anomaly in terms of international crises. We see in the chart that, during the 1945 to 1985 period, there were 254 crises. Of these, 57 involved the United States, the Soviet Union, or both. That means that there were 197 crises that involved neither superpower as a crisis actor during that forty-year period. Those crisies are the ones that we will increasingly find the need to address. And, they show that business went on for many countries in spite of us

On the other hand, the Cold War *was* an anomaly regarding crisis stability. In the next chart we see in the right-hand column that characteristics along several crisis dimensions will be the same in the future as during the Cold War. We also see that characteristics within the East-West context were quite different, particularly as regards the centrality of the threat. In the Cold War context, the centrality of the threat and its focus on nuclear weapons narrowly circumscribed crisis behavior. Now that the Cold War is over, it is possible that we can afford to get involved-- and will therefore tend to do so.

A key dimension of crises in the future will likely be the actors involved. What might happen, for example, if terrorists get a weapon of mass destruction? It seems unlikely that such a situation will easily lend itself to traditional military or police solutions. In such cases, people and their diverse personalities – in contrast to nations -- are the central element. Differences in personalities (e.g., between Presidents) did make a big difference during the Cold War, but the personalities of the nuclear powers were constrained by political institutions.

In the future, crises resembling those outside of the East-West conflict are the ones we will increasingly find the need to address. The number of actors in a crisis will likely be growing. There will be a greater variety of motivations, and some we cannot affect. Crisis stability will come from reducing vulnerabilities to threats and attacks, through defenses and the way we configure our forces; from cutting into the agendas of crisis actors by working on the conditions that underlie their actions; and by not expecting all crises to be military situations.

3.3 TRIGGERS OF CRISES

Actions and conditions that will trigger crises include:

- Violent acts such as border clashes, invasion of air space, sinking of vessels
- Violent acts against an ally, friendly state, or client state
- Non-violent military acts, such as show of force, war games or maneuvers, change in force postures
- Internal challenges to the existing regime or ruling elite
- External change, for example, in the global political-military structure
- Economic acts, including embargoes, nationalization of economic property
- Political acts such as alliance with adversaries, violation of treaties, severance of diplomatic relations
- Political acts that outwardly affect other nations' sovereignty, such as changes in foreign policy goals and expectations regarding behavior (e.g., emphasis on human rights without regard to sovereignty)

3.4 CRISIS MANAGEMENT TECHNIQUES

Crisis management techniques refer to the tools used after a crisis has been triggered. A crisis might have a violent trigger, yet the subsequent actions that lead to a resolution might be non-violent. Or, a crisis might have a non-violent trigger -- such as an embargo -- and be played out as a war. Crisis management techniques include:

- Negotiation or mediation, whether formal or informal, bilateral or multilateral, through diplomatic exchange
- Application of non-military pressure, for example withholding of economic aid
- Application of military pressure, for example, heightened alert levels, pre-positioning materiel, exploitation of information vulnerabilities
- Use of force. This can include "volleys across the bow," "gunboat diplomacy," actions against information resources, up to and including war

3.5 ANALYITICAL FRAMEWORK

Rather than provide an entire analytic framework for the study of crisis stability, I would like to suggest some steps for analysis.

First, I suggest we examine the historical record of crises. One of the reference sources for this talk examined 698 actor-crises over the 1929 to 1985 time period.[7] A review of that historical record should prove helpful .

Second, and along those lines, rather than reviewing the record for differences between then and now, review it for similarities. The former French colonies of Africa are today exhibiting reminiscent behavior. The series of crises for Morocco and Algeria during the early 1960s and again in the 1979 to 1981 time frame would be interesting reading for sources of international crises, triggering events, and crisis management techniques.

Third, there are many novel techniques available today that are helpful for thinking about international relations and understanding some of the many complexities of the real world. Several recent articles have applied chaos and catastrophe theory and self-organizing behavior methods to the study of international relations, for example. Some of those articles examine why traditional approaches failed to predict events during the Cold War or even something as major as the end of the Cold War itself. They address so-called "non-linear" change and are being applied to thinking through implications of the "chaotic" nature of the post-Cold War security environment. In other words, a suggested step for analysis is that thinking about the unexpected should become commonplace.

Those methods can help us to understand, and perhaps even foresee, events and circumstances such as those that came as surprises in the past. Two of the lessons learned along the way are:

- Linear extrapolations of current trends are usually misleading in the long term,
- We can never predict with any certainty -- no matter the detail of our models.

4. Concluding Remarks

I would like to close by offering a couple of thoughts:

(1) By not paying close attention to events outside of the East-West confrontation, including crises, we may have planted the seeds for later problems, including those we are witnessing now. In playing out alternative futures, we should keep this in mind.

(2) Eliminating the sources of crisis is possible to some degree and it can work. The availability of international capital after World War II relieved pressure on defeated and victor nations alike to

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[7]ICB Project, *op. cit.*

rebuild their economies and physical devastation. Expansion of NATO could be the next example of the international community's capacity to learn and adapt. It is important to keep in mind that a military planner is in the *security* business, not the weapons business.

(3) A key focus of crisis stability analysis, therefore, must be the conditions that underlie a deeper social solution to conflict. Those conditions go well beyond weapons. We must "shape the battlefield" by first understanding the geo-strategic trends that will shape our future environments. Those trends are (a) *globalization*, or the growing interdependence that results from increasing political and economic integration and which helps to bind nations together in ways that reduce the risk of war; (b) demographic *disintegration* due to global migrations which result in refugee problems that tear at the seams of society and serve as the source of issues and conflicts in the world; and (c) *proliferation*, which is perhaps the most immediate and militarily significant geo-strategic trend.[8]

Some actions can be taken today to shape the future. It would seem that most progress is made on arms reductions and control when relevant issues are least salient. The best contribution to crisis stability, therefore, arises from foundation efforts that provide a "virtual presence" -- that is, efforts that shape the battlefield in our favor by increasing the comfort level of potential actors in our favor. Shared information, cooperative technical efforts, and similar activities and relationships that reduce the vulnerabilities of local actors by bringing their interests into symmetry with ours also serve to reduce our vulnerabilities. Those activities can also serve to heighten our vulnerablities, so we must implement measures to protect the information we possess.

In conclusion, we must utilize the power of information. And, we must work to elevate issues and concerns of individuals and groups to the level of the nation state where the bases for our power operate best. The geo-strategic trends of globalization, disintegration, and proliferation beg us to "get the future right."

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[8]C.f., Major General Robert E. Linhard, USAF, "Getting the Future Right," *Strategic Review*, Winter 1995, pp. 56-58.

Section 2.2

Qualitative - European

RUSSIA AND THE WEST: A PARTNERSHIP?

RODRIC BRAITHWAITE
79 Hampstead Way
London NW11 7L
United Kingdom

1. Introduction.

Much lip service has been paid since 1991 to the idea of "partnership" between the West and the new Russia. So far the idea has been given little substantial content. The West has concentrated on the familiar if exceedingly tricky business of trying to manage its own internal affairs. The Russians have been fobbed off with fine words, half measures, and "partnerships" which sometimes appear to them to put Russia on the same basis as the smallest of its East European neighbours.

The paradigm of "partnership" was the unprecedented cooperation between the Soviet Union and the Western permanent members of the Security Council in the period from 1988 to 1992. This continues, but it has become more complicated as the interests of the P4 have diverged from time to time. This is not because the Russians have become noticeably less cooperative. Russian policy on Bosnia or on Iraq sanctions is sometimes singled out as evidence to the contrary. But the truth is that for much of 1994 France, Britain and Russia agreed about Bosnia while the United States took a different line. And France as well as Russia wishes to relax sanctions against Iraq, although Britain and the United States do not. Such differences are normal even between close partners.

So far both the Russian government and the governments of the West remain committed to the pursuit of "partnership". But fatigue is growing on both sides. Increasingly vocal, though not yet very influential, voices in the West argue that Russia is incorrigibly authoritarian and imperialistic, that the reforms there are bound to fail, and that the only prudent course is to cordon the place off and ignore it. In Russia the nationalists argue that Western policy is unremittingly hostile, that foreign economic advice and foreign business investment are merely devices to prevent the resurgence of a great Russian state as a rival on the international stage, and that the only way into the future is a return to the Russian past.

There is thus what the Marxists would have called an "objective alliance" between the extremists in both Russia and the West. The destructive and irresponsible voices on both sides of the divide have been reinforced by the incompetence and brutality with which the Russian government has handled the crisis in Chechnya. If Western governments do not devote much creative effort, hard work, sustained attention, and resources to developing a real partnership with the Russians, the voices of doom will create the conditions for a self-fulfilling prophecy.

2. Policy Aims

Many of the issues converge over the proposed enlargement of both NATO and the European Union to the East. This is intended to stabilise the territories between Russia and Germany which have been a temptation and a threat to their neighbours for centuries. The two institutions hope to repeat the success

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 97–106.

they achieved in the 1950s and the 1960s, when they succeeded, perhaps for ever, in removing the sources of tension between France and Germany which had led to three major European wars in seventy years.

The objective is simple and worthy. The execution is extremely complicated. It calls for an expenditure of resources and political will which the electorates of the present members of both NATO and the European Union may be unwilling to deploy. Wrongly handled, taken too fast, or pushed to extremes, enlargement could weaken both organisations, and leave the continent less stable than before.

The risk of instability and insecurity will be heightened if enlargement is undertaken with no regard for the likely effect on Russia. The stabilisation of Eastern Europe is as much in Russia's interest as of the rest of us. The Russians may recognise this. They can probably be brought to accept that the double enlargement is one means - perhaps the best - by which this common interest can be achieved. But they will do so only if they feel involved in the process, and can be convinced that it is not primarily directed against them.

Against this background, I assume that the West's major policy aims in relation to Russia and Europe are the following:

(1) To support the development of liberal economic and political institutions in Russia as the best guarantee that Russia will be a cooperative partner in future.

(2) To bring the Russians into a genuinely close and cooperative relationship with Western organisations, including those of which they are unlikely to become full members.

(3) To stabilise the new democracies in East Europe, and bring them into a closer relationship with Western organisations.

(4) To provide them (and us) with a convincing - in effect a US - insurance against the possibility of a renewed Russian threat.

(5) To persuade the Russians that the developments at (3) and (4) do not menace them

3. The Future of the Russian State

The key question is of course whether the new Russia is and will remain capable of playing a constructive part in any partnership with the West.

Russia is a country with no natural frontiers. It is historically vulnerable to invasion from East and West. To counter this threat the Russians created a militarised, ruthless and authoritarian state which sought its security through the domination and then incorporation of its neighbours in a process of secular expansion. By the end of the nineteenth century the Tsar had the largest land empire in history.

From the end of the eighteenth century onwards, enlightened groups of Russians made one attempt after another to reform their country's political system. Every attempt failed.

Many hoped at the time that the revolution of February 1917 would finally bring the country genuine reform. The attempt was hijacked by the Bolsheviks. They adapted and exploited the institutions of the Tsarist state with a ruthlessness unmatched since Peter the Great and Ivan the Terrible. Stalin took advantage of the victory of 1945 to extend a new empire - the Soviet empire - further than any of his predecessors, first into Central Europe, and then into Africa and Latin America.

The subsequent failure of the Soviet system - and of the Russian political and state tradition on which it was based - was absolute. The economy was unable to sustain either the burden of empire or the ruthless militarisation of the economy by which the Soviet Union had achieved strategic parity with the United States. Even the people stirred. The regime's attempt to keep its citizens in ignorance not only of the outside world, but even of events within their own country, was fatally undermined by the spread

of urbanisation and education, and by the technological imperatives of the information age.

Russia is now going through a triple revolution. It is trying to construct a democratic political system in the absence of most of the relevant institutions and traditions. It is trying to build a market system from the misdeveloped ruins of the Marxist economy. And it is trying to cope with a post-imperial situation of unparalleled complexity.

The management of this triple revolution cannot but be accompanied by dramatic setbacks from time to time. The resulting uncertainties have given rise to a welter of scenarios for the future of Russia.

The prediction that Russia is bound to revert to the authoritarian and expansionist patterns of the past ignores the extent and quality of the historical change which has taken place in Russia in the last decade.

Equally extreme is the view that briefly prevailed after 1991. This was that Russia had already become something pretty close to a liberal democracy. and that before long it would become a liberal market economy as well, that it would unquestioningly adopt as its own the Western definition of its interests, and would therefore in all matters side with the West in international affairs. Not surprisingly, these naive thoughts were rapidly disappointed.

A third view, also extreme, is that the collapse of the Soviet Union is likely to be followed by the disintegration of Russia itself. But the Russians have always been willing to shed blood in great quantities to avert domestic chaos and to keep their country together. It was beyond reasonable doubt - even before Chechnya - that they would do so again if they felt it necessary.

Thus none of these three views adequately reflects the complexity of real life and none can serve as a reliable basis for policy. But even within these extremes, a number of scenarios is possible.

In the short term the trend is unclear. Russians now enjoy political freedoms - of the press, of assembly, of travel - which were not permitted even under the Tsars. The present team of Yeltsin, Chernomyrdin, Chubais, and Kozyrev are committed to democratic and market reform at home, and to cooperative partnership with the West abroad. Despite much wavering under the pressure of events, they have so far stuck to their guns. Under their aegis an economic revolution is taking place in the country. A substantial part of the economy is now in private hands. More and more Russians are taking to the market, acquiring entrepreneurial skills, and getting rich. The down side is that hyperinflation still looms, organised crime menaces everyday life and perhaps even the state, the gap between rich and poor is widening, unemployment is increasing, and the social welfare network is inadequate to sustain those who now find themselves below the poverty line. Nevertheless, even conservative Russian economists, and many Western economists and businessmen with practical experience of the working of the Russian economy, now believe that the move to the market cannot be reversed.

But many Russians fear that the tensions of change could lead to serious political and social disorder. Even among the moderate opposition there are those who are not opposed to democracy, but who believe that Russia is not yet ready for it. They favour a regime of "mild authoritarianism" that can hold the ring and keep order while the market economy develops and becomes sufficiently deeply rooted to sustain in due course the luxury of democracy. This argument will gain more adherents if the political and social situation deteriorates further, and if the crime wave continues to grow.

Some Russians on the right and the left would go further. They believe that democracy is not appropriate for Russia. They dream of restoring an authoritarian and militarised regime based on a centralised economy. But these people have shown no sign that they understand the requirements of a modern state and a modern economy. They might engage in foreign adventures for which Russia does not at present have the resources, and for which the Russian people probably no longer have the will. Their attempts would not succeed for very long. And when they failed the move towards reform would have to be resumed.

If all that is so, then there is a reasonable prospect that Russia will evolve towards a recognisable democratic political system, with an adequate market economy. It will be generations, not years, before Russia has a full range of effective democratic institutions, or can deliver to its people anything like the standard of living that the West already enjoys. But the underlying trend is in the right direction.

That proposition is a matter of intuition and judgement. It cannot be demonstrated by the methods of Euclidean geometry. But it is reliable enough as the basis for constructing a Western policy based on the

concept of a genuine partnership with Russia.

4. Russia's Post-Imperial Problem

This is despite the fact that it will be a long time before Russia has sorted out all the problems of its imperial inheritance.

Economic weakness ensured that the Russians would eventually lay down the burden of empire. But there was a very strong political element as well. The Soviet failure in Afghanistan had a domestic political impact similar to the Western failures in Vietnam, Indochina, and Algeria. Millions of Russians were determined never again to be involved in an imperial adventure beyond their borders.

Stalin's empire is now a matter of history. It was victory in war that brought the Russians into Central Europe, and a combination of Marxist Messianism and later the inflated price of oil that brought them into Africa and Latin America. Now that the preconditions have disappeared it is inconceivable that the Russians will recover their global ambitions. Nor are they likely soon to reconstitute a threat to Central and Eastern Europe despite their occasional claims that it remains within their sphere of influence.

But the problem of the Tsar's empire - the territorial entity which existed before the first world war, and which included the whole of the former Soviet Union - continues to baffle Russian policymakers. This problem exists whether or not one imputes imperial ambitions to the present generation of Russian rulers or their successors.

The essence of the problem is that the Russian empire, unlike the British or the French, evolved as a land empire with no natural boundaries. Russians were unsure where the borders of Russia ended and foreign parts began. More than twenty million of their countrymen now live outside the borders of the Federation. Russia now has fourteen new neighbours. Most of these new states, even those with genuine historical roots, have no experience of statehood or of managing their own affairs. Many of them are riven by ethnic conflicts, by no means all of which are the result of "divide and rule" tactics by their former Russian masters.

No Russian government, of whatever stripe, can avoid the issues of policy which arise in consequence: the protection of Russians abroad, the maintenance of stability on the borders, and the restoration of economic and other links with the new states which were fractured in the breakup of the Union.

4.1. RUSSIAN MINORITES

The Russian minorities who live in the new states feel increasingly vulnerable to pressure by local governments and indigenous populations. Three million have already been displaced by war or ethnic discrimination and have sought refuge in Russia. In Latvia and Estonia more than a third of the population is Russian; and in Eastern Ukraine and Northern Kazakhstan the bulk of the local population is Russian and close to large population centres in Russia proper. The potentiality for Russian irredentist ambitions and intrigue is obvious. But despite a good deal of rhetoric, the Russians and their neighbours have so far preferred to deal with contentious issues such as language laws, dual citizenship, and pension rights through negotiation rather than conflict.

4.2. PEACEKEEPING

Russia - like other large countries - claims a vital national interest in the stability of its borders and of the countries beyond. In the past Russia sought to manage that interest by dominating or absorbing its neighbours rather than by cooperating with them. Since the collapse of the Soviet Union, it has preferred instead to use either negotiation, or less direct methods. Some of these operations - for example in Moldova or Abkhazia - involved comparatively small packets of troops in cooperation with one or other of the local political interests. They have substantially limited both the violence and the independence

of the local political authorities. Others have been more substantial: in Tajikistan 25,000 Russian troops sustain a reactionary neo-Communist regime against an insurgency supported from Afghanistan and Iran. The Russians have asked for assistance in these peacekeeping operations from the world community and from the Organisation for Security and Cooperation in Europe. Whether or not these appeals are sincere, they have so far met with little but fine words.

4.3. "REINTEGRATION"

The present Russian government fully accepts the sovereignty of the members of the Commonwealth of Independent States. So do many Russians. The conservatives and nationalists who openly believe that the former Soviet Union should be reconstituted as a unified imperial state are in a minority.

But very few Russians believe that all the countries of the former Soviet Union are capable of sustaining a genuine independence. They think that the political, economic, and personal ties which link the new states with Russia are too strong, and that many of them are fated willy nilly to be "reintegrated" into the Russian orbit. Many would prefer to avoid the burdens which they fear "reintegration" will bring. Others argue that the process is natural in the modern world, and simply mirrors what is happening in Western Europe.

The resulting arguments about policy began as the Soviet Union was breaking up. In December 1991 Yeltsin and his colleagues from Ukraine and Belarus foresaw the creation of a "Commonwealth of Independent States" with common defence and economic policies and institutions. But the Ukrainians made it clear from the start that they would not let their independence be compromised by new mechanisms. Gaidar argued strongly that Russia too needed to establish its economic independence. He therefore broke Russia's monetary and budgetary links with the other republics. Trade within the CIS has declined considerably in consequence.

All the CIS members have now adhered to the framework agreement on economic union signed in December 1993. But the institution remains dead in the water. More detailed proposals for economic integration, such as the plan for a currency union between Russia and Belarus, have been opposed by nationalists on both sides and by economists in Russia. Despite the succession of CIS summit meetings, the development of defence and political institutions has been even less impressive. Some kind of "reintegration" between many of the former Soviet republics may be inevitable for economic if not for political reasons. But it is likely to be a slow process.

5. Enlarging NATO and the European Union

The double enlargement, to which both NATO and the European Union are now committed, will certainly go ahead. But it raises serious problems.

5.1. DENATURING THE INSTITUTIONS

It goes without saying that there is a limit to the extent to which either NATO or the European Union can enlarge without altering their fundamental nature. Both institutions will need to ensure that new members import no extraneous problems into their affairs, whether these are border disputes, ethnic conflicts, or insufficiently democratic political systems. They will also need to ensure that new members can meet the legal, economic and (in the case of NATO) military requirements for effective membership. Neither institution can afford to carry passengers.

During the Cold War NATO was the answer to the geopolitical problem that one superpower was situated in Europe and the other was three thousand miles away across the ocean. The presence of American forces was also a reassurance to the Europeans, the Russians, and indeed the Germans themselves, that Germany would not again succumb to the temptations of the past. Geography has not changed: neither have these basic principles.

NATO's unprecedented effectiveness as an integrated military organisation depended on its members' willingness to make the necessary sacrifices of sovereignty, manpower and resources. It is this which rendered NATO's security guarantees to its members so wholly convincing. With the end of the Cold War, the readiness of NATO members to continue such sacrifices even for the existing organisation is in doubt. It is still less clear that they will be willing to assume the increased burden involved in giving comparable guarantees to more than a very few new members. But the countries of Eastern Europe have bitter historical memories of "guarantees" which could not be made good in practice. Ill-considered, over-hasty, or over-ambitious expansion of NATO could fail to meet the aspirations of the new members, denature the existing military organisation, and reduce rather than increase the security of Europe.

Unlike NATO, the European Union was not primarily designed to counter an external threat, but to settle once and for all the European civil war, to promote the economic prosperity of its members, and also (increasingly as the Community expanded to the South and the East) to underpin democratic institutions.

But the enlargement of the Union involves delicate negotiation about the detailed economic interests of the aspirant members. It has substantial financial implications for the Union's present members. It raises fundamental problems for the Union's existing agricultural and regional policies. The institutional issues - monetary and economic cooperation, the decisionmaking process in Brussels - which appear so irritatingly obscure to outsiders, are of fundamental importance to the future of the organisation itself. These problems have to be tackled, and will complicate the enlargement process.

5.2. THE PROBLEM OF TIMING AND THE "DROIT DE REGARD"

Even the best qualified candidates from Eastern Europe are unlikely to enter the European Union until early in the next century. Some protagonists of NATO enlargement therefore argue that it must be implemented in the next two or three years. Otherwise the "window of opportunity" - in which the West still has the will to enlarge and the Russians do not yet have the strength to block it - will disappear. There is a sub-text: that NATO enlargement will become an issue during the US Presidential campaign of 1996, and that NATO needs to have made a concrete offer to potential new members before then.

The argument of substance is exaggerated. Neither the countries of Eastern Europe nor anyone else believes that they will face an external military threat for many years if not decades. NATO had the will to take hard decisions when the Soviet Union was at the height of its powers. A new Russian threat would certainly be less formidable. There is no obvious reason why NATO should not once again be able to muster the will, if its essential institutions had meanwhile been preserved intact. In practice the enlargement of NATO and the enlargement of the European Union could proceed in step.

There is a related argument: that genuine consultation and cooperation with the Russians on security matters risks giving them a "droit de regard" or a veto over our actions. The argument is widely used in relation not only to NATO enlargement, but also to other proposals for strengthening Russia's links with Western institutions. It too is exaggerated. Of course we must retain our freedom of decision. That is not such a difficult act of will. But unwillingness to engage with the Russians can also damage our interests. At the height of the Cold War we refused for many years to accept their idea for a European Security Conference which, in the event, played a significant part in the collapse of the Soviet empire in Europe. Today we can have more self-confidence.

5.3. DRAWING THE LINE

Since neither NATO or the Union can expand indefinitely, different solutions will be devised for different countries. Even in Central and Eastern Europe, some countries will move fairly quickly towards NATO and the Union. But for a variety of political and economic reasons, others will move more slowly. The Alliance is unlikely to give full military guarantees to the Baltic States, for obvious military reasons. But all three are likely to move into a closer relationship with the European Union. The other members of the former Soviet Union are unlikely to become full members of either organisation for the foreseeable

future.

Whatever decisions are taken about enlargement, and over whatever timescale, the problem of the countries destined to remain outside is serious. One overriding principle will need to be established beyond doubt in the minds of all concerned, and above all of the Russians. This is that the idea of traditional "spheres of interest" in Europe is no longer acceptable. Whatever the institutional arrangements, the countries of Central and Eastern Europe, and of the former Soviet Union, are entitled to choose their own domestic arrangements and their own international relationships as they see fit. Some may eventually join NATO, the Union, or both. Others may choose to remain free of foreign entanglements. Still others may seek a closer relationship with Russia. The West has no grounds for objecting to "reintegration" if - but only if - it is clear beyond a doubt that Russia is not attempting thereby to reconstitute a system of imperial domination. A neo-imperial Russia could expect to see a rapid deterioration of its relationships with the West, and a greatly increased determination to incorporate as many of the countries of Central and Eastern Europe as possible into the Western security system.

5.4. THE REACTION OF THE RUSSIANS

The enlargement of NATO and the European Union will impinge directly on Russian interests. There are those who argue that the Russian reaction to enlargement is irrelevant, because the Russians will behave badly (or well) whatever we do. Of course in the end it is the Russians themselves who will choose whether they want reform to succeed, and what kind of relations they want with the rest of the world. But it is absurd to think that the outside world has no influence. Foreign policy is conducted by all states in the belief that it can influence foreigners. The West's policies in the Cold War did affect Soviet domestic as well as foreign policy for the better. Our policies at Versailles did have an adverse effect on Germany's economy, and subsequently on its domestic politics. To claim the opposite is an intellectual cop-out, though it simplifies the debate.

Russia will never become a full member of the European Union. But the relationship is already developing fast. In 1995 the European Union will account for about half of Russia's external trade. Because of their makeup, Russia's exports to the European Union are less exposed to anti-dumping and other restrictions than those of the East European countries. If the Visegrad countries join the Union, this figure could rise to over two thirds. Meanwhile the Partnership and Cooperation Agreement signed in 1994 at the Corfu Summit (and currently suspended because of Chechnya) provides for regular ministerial meetings, and two summit meetings a year between the Russian President, the President of the European Council, and the President of the Commission. There is to be a review in 1998 to consider the creation of a free trade agreement between Russia and the Union. The shift in trade patterns and the new institutional links have considerable political as well as economic implications. Together they are perhaps the single most powerful instrument for anchoring Russia in the democratic European mainstream.

The Russians believe (as we do) that NATO is a serious military institution. Very few of them accept that it was never a direct threat to Russia, despite Western protestations that its purposes were always purely defensive. Not many of them understand why NATO remains in being now the Cold War is over. The argument that NATO enlargement is in the Russian interest because it will stabilise Central and Eastern Europe is one that only the most sophisticated are likely to grasp. Russian reformers argue that NATO enlargement will be a political gift to the Russian neo-imperialists: the last thing the reformers need in the run-up to this year's parliamentary elections and the Presidential election in June 1996.

These arguments are not decisive. They certainly do not constitute a reason to rule out NATO enlargement in principle. But they should not be simply dismissed. The Alliance needs to devote as much effort to finding ways of making enlargement palatable to the Russians as it is devoting to the issue of enlargement itself.

6. Conclusions for Policy

In formulating policy, the West needs to avoid rhetoric which raises expectations which it has neither the will nor the resources to back with action. In his recent book on Russian foreign policy,[1] Kozyrev asks how long the Russians will have to wait before their critics in the United Nations "which are situated thousands of kilometres away from Abkhazia, Nagorny Karabakh, Tadjikistan, will be ready to assume the burden of peacemaking there?" It is a fair question.

And although it is right to react critically to Russian departures from accepted norms, such as the wholly disproportionate brutality displayed in suppressing the Chechnya rebellion, it is a mistake to take punitive action which penalises just those people and institutions in Russia with which the democratic future lies. The European Union has not avoided that mistake.

6.1. ENLARGEMENT OF NATO AND THE EUROPEAN UNION

The decisionmaking process in NATO should be slowed down. No conclusions should be reached, still less announced, until after the Russian presidential election in June 1996.

Enlargement should be confined in the first instance to Poland. From the geo-strategic point of view, Poland is the key - the age-old route for armies marching Eastwards as well as Westwards. Polish membership of NATO would underline, as nothing else, that Central and Eastern Europe is no longer to be the plaything of its neighbours. Poland could be made a full member of NATO without overstraining the Alliance's resources or its reserves of will.

Beyond that NATO enlargement should proceed at much the same rate as the enlargement of the European Union, and should be subject to the same criteria: new members should be democratic, market-orientated, import no new political or territorial disputes, and be capable of shouldering the obligations of membership.

The Union itself should enlarge as rapidly as possible. But - like NATO - it should ensure that enlargement does not weaken its ability to pursue common policies in the interests of its old as well as its new members. The process will be complex, expensive, and protracted. It is unlikely that even the best qualified candidates from the Visegrad Four will enter in much less than ten years. This will not undermine the strategic process: a firm prospect of membership will of itself strengthen the domestic political and economic arrangements and the external security of potential Eastern European members. A gap one way or the other of a few years between the timetables for NATO and Union enlargement is not critical.

6.2. RUSSIA AND THE TWO INSTITUTIONS

Russia is unlikely to become a member of either institution in the foreseeable future. But the double enlargement should be paralleled by the development of closer practical and institutional links with Russia.

The Union's existing Agreement on Partnership and Cooperation between Russia and the Union should be reactivated as soon as possible. Its provisions should be strengthened. European barriers to Russian imports should be reexamined and reduced. The Union's technical aid programme, TACIS, whose ponderous procedures are the despair of its intended beneficiaries, should be greatly streamlined. If this is not possible, the Union's members should find ways of renationalising their effort - a move that would be popular not only in Russia, but in the other countries of the former Soviet Union as well.

The "bilateral" relationship between Russia and NATO should also be greatly strengthened and institutionalised. This means pressing ahead with the Partnership for Peace programme. But it means going further than that, and giving real substance to current proposals for a "Treaty" between Russia and

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[1] [Transformation], page 132. Moscow 1995

NATO which would be commensurate with Russia's great power status. There should be more concrete and more regular politico-military discussions between the Russians and Alliance institutions, especially the North Atlantic Council, but also with NATO's specialised bodies, such as the Defence Planning Committee and the Nuclear Planning Group. Despite Chechnya practical exchanges with the Russian military, especially on peacekeeping, should not be allowed to lag behind the countries of Eastern Europe and the FSU. Though the Russians should be encouraged to take the logical first step - activation of their Partnership programme - as soon as possible, this should not be the precondition for serious discussion of a more formal bilateral arrangement.

6.3. UKRAINE AND THE OTHER SUCCESSOR STATES

To match the developing relationship with Russia, the West will need to strengthen its ties with those countries of the former Warsaw Pact and Soviet Union which will not become members of either of the two organisations.

Of these the test case is Ukraine. Ukraine is slowly establishing its independent statehood. After a shaky start the prospects for economic reform have improved. Many Ukrainians believe that their future lies in a cooperative - but independent - political and economic relationship with Russia. It is for the Ukrainians (and no one else) to decide how far they wish that process of cooperation to go. The Russians know that. But they may occasionally need reminding that an attempt to interfere in Ukraine (as in the Baltic States) would have the most serious effect on relations with the West. Western efforts to reinforce Ukrainian independence should be intensified, both bilaterally and by strengthening Ukraine's relations with European institutions. Ukraine's participation in the Partnership for Peace should be further deepened. The objections to Ukraine joining the Council of Europe should be overcome. So should objections within the European Union to participation in current plans for financial support for the Ukrainian economy.

Unless the West is prepared to give a positive answer to Kozyrev's question, it will not be easy to devise an effective policy for the rest of the FSU. The Russians may feel that they are justified in "helping" the unstable new states on their borders to preserve stability, or that they have no choice but to succour Russians abroad in time of need. It would be unacceptable, not only to our domestic opinion, to indicate that the Russians had a free hand there. We may have to recognise that the Russians have real problems. But we should underline that failure to observe normal standards of international behaviour will have political consequences. And we should develop our relations with the individual countries, especially those that are making a real attempt to observe the same principles as we demand of the Russians.

6.4. OTHER EUROPEAN ARRANGEMENTS

The only pan-European institution of which Russia is a full member is the Organisation for Security and Cooperation in Europe (OSCE). The OSCE has already helped to ameliorate the post-imperial mess in the former Soviet Union. It has acted on Chechnya (the Russians' willingness to cooperate with the OSCE over Chechnya is unprecedented, though they have not been given much credit for it), in the Caucasus and Moldova, and in Latvia where it is monitoring the agreement on social rights for Russian military pensioners and the dismantling of the Skrunda radar station. These achievements may be modest but they are not negligible. The OSCE's existing work on peacekeeping machinery should be developed, and the necessary funds increased. Its large and disparate membership makes it a cumbersome body. Russia has proposed a directorate to strengthen its decision-making machinery. The idea was poorly presented, and was rejected by the West because of the "droit de regard" it would allegedly have given Russia over European affairs. It should be looked at again, modified to make it acceptable, and implemented.

We should also be more flexible about the Treaty on Conventional Forces in Europe. The Russian argument that we should modify a Treaty designed to regulate the forces of two military blocs which no

longer exist is perfectly reasonable. By evading an answer, we are edging them towards non-compliance. We need to enter into serious discussions with them about how to manage their problem of compliance by the November deadline without undermining the Treaty or damaging the prospects for the review conference in 1996.

Russia showed unprecedented willingness to let the experts of the Council of Europe examine its legal and penal institutions. But Russian accession was under question even before the Chechnya war. It has now been suspended. It should nevertheless be kept under review. Membership of the Council, even before Russia is fully able to meet its requirements, will help to reinforce democratic institutions in Russia and Russia's place in Europe.

7. Towards a Genuine Partnership

The Russians feel that they have been lectured to and condescended to, but that when it came to point they have often been ignored and forgotten. Some of this is characteristic Russian paranoia, magnified by the humiliations which the country has suffered in recent years. Some of it is unsupported by fact. But some of it is justified.

If "partnership" is to be given substance, the West will have to accept two things. First, the Russians are determined that their country should be treated as a great and equal power. Second, Russia's interests will not always coincide with those of the West, any more than Western countries will always agree amongst themselves. A "partnership" that continues to insist that Russia must always follow where the West leads is bound to fail.

In return the Russians will have to accept that there are certain kinds of Russian behaviour - both domestic and international - which the West will find unacceptable, and against which the West will have to insure itself. Western security institutions will remain intact for the foreseeable future. The West will not condone departures from the Helsinki principles within the Russian Federation. In supporting these principles, it will also give comfort and support to those within Russia who are carrying the democratic process forward.

The West must of course recognise that Russia is fully entitled to strengthen economic and other links with its neighbours. But the Russians must in turn concede that these neighbours do not constitute a sphere of influence in which they are entitled to exercise diplomatic, economic, or military pressure to enforce their will.

On the basis of some such bargain, it should be possible to construct a real partnership between Russia and the West. That will depend not only on Russia, but on the West as well.

POSSIBILITIES FOR COOPERATION OF RUSSIA AND THE USA IN DESIGNING, CORRECTION AND REALIZATION OF NATIONAL SECURITY DOCTRINES

D. S. CHERESHKIN
Russian Academy of Sciences, Institute for Systems Analysis
9, Prospect 60-Let Octiabria
Moscow 117312 Russia

ABSTRACT. Conditions that promote and prevent possible cooperation between Russia and the USA in developing, correlation and realization of national security doctrines, aimed at coordination of actions by Russia and the USA to provide strategic stability in the world, are considered here. The common and opposite interests of Russia and the USA in the field of strategic security are analyzed, and five main factors are singled out among them. Directions for alteration of nuclear doctrines of Russia and the USA, required for their settlement, are outlined. The problems and possibilities of co-ordination of Russia's and the USA interests in other areas of defence cooperation, like that of ordinary armaments, increasing openness in mutually provided information, joint participation in international peace-keeping operations are dealt with in short. In conclusion, the necessity of common efforts to work out a mutually acceptable concept for a new strategic doctrine is shown, attracting wide public circles of both countries to this problem.

1. Prerequisites And Conditions For Strategic Cooperation Between Russia And The USA

The political and economic situation, existing in the present world is a consequence of the cardinal political, defence, social and economic changes, that have occurred at the territory of the former Soviet Union, altered to a great extent the main principles and rules of official defence policies in Russia and the USA. Evidently, this transition from the "cold war" policies and nuclear opposition to policies of strategic stability will also require a transition to new defence doctrines in both countries.

The main requirement here will be to provide for all changes to be aimed not only at overcoming the "cold war" heritage, but also at bringing closer the views of the two defence establishments concerning the purposes and means for their achievement. We can suppose, that such an approach will become one of the most effective ways of establishing a strategic cooperation of the two countries, called to secure lasting peace in all the world. One of the most important conditions for such cooperation is the search and realization of existence of a wide circle of tasks for safeguarding security, which requires close cooperation.

Though it may be quite natural, it is paradoxical, that even in the time of "cold war" the USSR and the USA managed to find common strategic interests. For example, the Soviet Union and the USA were interested not to allow a nuclear war in any form. At the same time the both countries have undertaken joint efforts to restrict nuclear weapons proliferation.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 107–113.

At present, besides mentioned interests, Russia and the USA have to join their efforts in solving the problems of growing international terrorism, separatism, facing the growth in number and rage of international and regional conflicts, that are manifested in our world.

Despite most part of interethnic and interreligious conflicts and border conflicts do not require armed measures of pressure, in some cases (as proved by experience of Iraq, former Yugoslavia, Algeria, etc.) diplomatic efforts, economic sanctions, humanitarian or economic assistance may prove inadequate to prevent a full-scale military conflict. This is particularly true for those conflicts, that result from social tensions. The employment of international peace-keeping forces in such cases requires tight co-operation between foreign and defence departments of Russia and the USA.

Such co-operation can have different forms - from creating a system of early warning and jointly performed evaluation of degree of conflicts' danger, up to joint planning of actions in a special situation and joint preparation for conducting an international action to support peace.

Today any interaction of Russia with the USA occurs in absolutely new political and economic conditions, most uncommon for both countries. The division of USSR into a number of formally independent states, disintegration of the Warsaw treaty, transfer of Russia from centralized economy to a market one, reduction of economic and a part of defence potential, all this has determined the change in Russia's role in the world. If the USA and Russia have previously led a policy of active confrontation practically in each point of the globe, then today Russia is not capable of continuing this opposition and the USA may feel itself as a predominant force in the world. However, we should not forget in this instance, that with all of its difficulties, Russia continues to remain a great military power and will strive for an absolutely equal position with the USA in the world, with this urge determined not just by the great past, but with anticipation of not less glorious future. At the same time Russia is interested in establishing such relations with the USA in the area of guarantees for security, which could prevent one-sided orientation of American strategy in this sphere.

Great importance in providing a more close relationship of Russia and the USA in the sphere of world security belongs to public opinion and mass media means (MMM), which form it. In general, the problem of information relationship within the sphere of strategic partnership has not been observed up to now, though its importance is understood by everyone. First, these are problems of interchange in information, important for both countries, second, these are problems of describing and analyzing the interests and actions of the sides in conflict situations, by mass media means, third, these are the problems of ensuring information security.

In general, information security should be the main theme of relations between Russia and America. It is necessary to ensure understanding of common interests in the sphere of security.

With such close cooperation of Russia and the USA, their relations with third countries are an important problem, particularly, if these relations will bring a reduction in the level of security for these countries. The analysis shows, that the closer is the partnership between Russia and the USA in the sphere of security, the weaker is the possible threat to traditional US partners and more reliable their mutual security.

2. The Unity And Difference Of Interests Of Various Countries In The Field Of Security

Converging of Russian and American policies in the field of security has to develop naturally within the framework of the common course of foreign policy in both countries, guided for cooperation and not confrontation.

The fate of foreign relations of the two countries will evidently be determined by the development of political situation in Russia and its apprehension in America. Any manifestation of nationalism or political "movement" towards authoritarian power, increasing of the role of leaders of Shirinovski type or other variations, all this is perceived by the Western public as an indication of policy returning to the tracks of armed opposition, new military confrontation. On the other hand any western attempts to isolate Russia (creating a "sanitary cordon" of former Warsaw treaty countries or former republics of the Soviet

Union will also generate a growth of nationalist spirits in Russia, received as a treachery against Russia on the part of the USA and West as a whole, and also act as a cause of new conflicts.

We also cannot disregard the "cold war" heritage in the sphere of defence and in public mentality. In reality the heaviest heritage is the manner of thinking of the higher political and military leaders in both countries. It would be strange, if after fifty years of existence in the form of "the main real political and military enemy" practically in each point of the globe, now if the form would change "to the immediate opposite". Besides, there exist and continue to act quite a number of factors and problems, which are capable, in case of a lack in conscious pursuit of cooperation, to lead to a resurrection of situation of military confrontation between the both countries.

In the first place, this structure of nuclear forces is confrontational in its ideology, characteristics and performances. Despite already achieved agreements on reduction of armaments, altering their combat readiness characteristics, their "menacing" structure changes in a practically insignificant portion. Any attempts of some modernization in strategic rocket weapons or conducting nuclear weapons tests - all this could be received with prejudice and serve as a pretext for actions in response and transition to a new level of confrontation.

Secondly, creation of new types of weapons, even conventional ones, but with higher characteristics, also could be viewed by defence authorities of both countries as a potential threat.

Thirdly, the problem of describing their attitudes to "possibility of a first strike", or "local employment of nuclear weapons" in the defence doctrines of both countries, which in conditions of a deep reorganization of defence system by Russia (changing borders, creating and deploying defence systems at new positions etc.) appears as a clearly destabilizing factor.

Fourthly, in conditions of a difficult economic situation, Russia has no practical way for realization of its commitments with the disarmament agreements (for example, in chemical weapons etc.), which could also serve as a cause for possible confrontation.

Fifth, there are problems, related with the sale of weapons or transfer of technologies, related to nuclear energy or missiles systems in particular. Tight international competition in the field of exports of weapons and technologies often compels governments of exporting countries to apply special political efforts to support manufacture of their own products or counteract the competitors' sales. Such US actions could be viewed as a hostile act in Russia and present a reason for opposing actions.

The problems of possible tensions in relations between Russia and neighboring countries have a special position in relations of Russia and the USA. Russia is clearly intending to achieve acceptance of its interests by its neighbors unconditionally and on a mutual basis (defending interests of the russian-speaking population, living in various republics of the former Union; providing border security; retaining the leading role by Russia over the most of post-Soviet territory). The arising tensions could produce anxiety and incorrect comprehension by the US political circles and public on the essence of situation arisen and possible recriminations of a too active US position on this problem.

However, besides the above mentioned problems of possible contradictions, there exists an area where Russia and the USA are potentially the most important allies. It is the area of securing regional stability and opposing regional hegemonizm. Practically, in many regional situations the interests of Russia and the USA intertwine closely, which requires their coordinated policies in the regions, which are recognized to be of vital importance for one or both states.

Concerning the problems of cooperation between the states in providing regional security, one has to take into consideration, that the main threat to Russia's security comes from within, but not from the outside and is not a military one in nature. The main interests of Russia are connected now (and will be in the next 10 to 12 years) with problems of regional security in republics of the former USSR, states that border them or Russia directly. Destruction of the former system for securing borders and influencing the bordering states, which existed in the USSR previously, an increase in the level of instability in Middle Asia, Transcaucasia, at western borders, at North Caucasus, presence of armed conflicts at the former territory of Russia - all of these determine their vital importance and Russia's interest in coordinating its political and defence position with the USA concerning these regions. It is necessary to consider also, that such a position is not a short term one, the process of forming a new national

statehood in new republics can easily assume a violent and armed character. The presence of open armed conflicts in which the present day Russia was involved (Karabakh, Dniester region, Abkhazia, Tajikistan, Chechnia), is capable not only of disturbing the territorial sovereignty of Russia, but even break the Federation into parts. As a result of such conflict, there will be millions of refugees and Russia will be drawn into an endless line of small wars along the perimeter of its territory.

For this reason, any actions by the USA and the West, aimed at NATO expansion to the east and exclude Russia in the process, are capable of major influence on the outlook for converging of defence policies of both countries. On the other hand, both countries are interested in establishing stability in those regions, where they conducted the policy of open confrontation during the "cold war" period. Their interest for providing stability for these regions may produce a basis for partnership between the countries in conditions of political and economic difficulties in Russia in particular, which is understood today both in Russia and in the USA. Evidently, possibilities for cooperation between these countries in establishing and supporting regional stability are not limitless, but understanding of mutual interests will be a factor for coordination of their strategies.

Both reliable informative awareness of higher political defence leadership, and of public of the countries concerning the ongoing activities are or major importance for adequate understanding of Russia's and the USA actions in the present day world and of possibilities for their strategic cooperation. The problem of presenting really complete and reliable information on actions of the other side at the level of higher political leadership in both countries is solved today by means of creating direct communication lines between the first executives. But this does not eliminate the problems of presenting a biased information, creating (in the interests of various political or economic circles) distorted public opinions concerning this or that action in the country or abroad. Thus, Russia's political initiatives regarding Yugoslavia received an evaluation in American mass media, which was quite inadequate to reality. On the other side, the Russian mass media evaluates the US actions in supporting the Baltic states, which often conduct their anti-Russian policies, in a clearly biased way too. It seems that only a more close cooperation of mass media representatives and organization of cooperation in the field of information between representatives of political and defence authorities at different levels will allow to solve all these problems.

An important factor for possible cooperation and, correspondingly, settling and coordinating the defence doctrines of both countries is constituted by their desire to provide for their security and their vital interests. It is related to a great extent with the necessity of creating new international associative political structures, allowing to consider and find solutions for various inter-state problems within their framework. Undoubtedly, it is desirable, that these structures have a possibility of using power in those rare instances, when only this may provide for finding a solution to the conflict situation. Evidently, the problem of forming such an association (or such a union) is not an easy task, but nowadays there are much more reasons for finding solutions, that are suitable for both sides, than of those preventing it.

3. Possibilities For Adjusting The Nuclear Doctrines Of Russia And The USA

The directions for bringing closer the policies of Russia and the USA in the sphere of security should be governed by the key problems. All these problems are connected with nuclear armaments, nuclear strategy and doctrine, nuclear weapons delivery means.

The first problem is in the fact of both countries possessing giant arsenals of nuclear weapons, that, even after the performed reductions, are sufficient for mutual destruction. These arsenals determine the existing paradoxical situation, as on one hand there are fears, that a possible political conflict could lead to a new nuclear opposition, forcing us to retain powerful nuclear forces; on the other hand, maintaining combat readiness by those forces fur such an occasion is determined precisely by the mighty nuclear arsenals. It is possible, that finding a solution to this paradox is one of the most important problems, determining possibilities for a real cooperation of Russian and the USA experts in co-ordination of nuclear doctrines.

The second problem is the necessity of altering the concept and nuclear restraining strategy, embedded in SALT-1 and SALT-2 treaties, since these (the concept and strategy) are not aimed at a genuine cooperation in the sphere of security. It is necessary to find at the same time solutions to problems, that are connected with development and modernizing the means of delivery, that is rockets, warheads, strategic bombers, nuclear submarines etc., and maintaining combat efficiency of weapons.

The third problem is to bring alterations to nuclear strategies of these countries, which stipulate not only the declarative refusal of the "first employment of nuclear weapons", but also common working out and conducting corresponding measures for control of tactical nuclear forces, actions for preparing weapons systems etc.

The fourth problem is the necessity to increase the level of mutual informing both sides about actions, conducted for replacement of boosters, targeting of rockets, their transfer, etc. At the same time agreements are required on the subject of conducting mutual and combined control inspections.

The fifth problem is in the necessity to transfer the dialogue between Russia and America on the problem of nuclear weapons to a new, more constructive and trustworthy level of working out settled criteria for evaluation of strategic stability, combined work on analyzing the arising situations, elaborating a common system for early warning on missile launching by third parties, working out common actions for concrete cases, related to employment of weapons of mass destruction by third countries.

Most probably, only after finding solutions to all these problems on a basis, mutually advantageous for both countries, such an alteration of nuclear strategies will be possible, which will provide for common actions of Russia and the USA to provide strategic stability of the world.

While considering all possible actions to work out common decisions, alter and bring together positions and strategic doctrines of Russia and the USA, it is necessary to take into account the interests and possible reactions to these decisions by other nuclear powers. If the USA can discuss these actions in rather a simple manner, (at least within NATO), and draft decisions with Great Britain and France, but bringing into account the position of China represents a complex diplomatic task. Evidently, joint foreign policy efforts by Russia and the USA are required for their solution. Some difficulties may arise with Ukraine, as the nationalist-minded part of Ukrainian Rada (parliament) is trying to play a "nuclear" game in relations between Russia and the USA. It is possible, that political actions of Russia and the USA, coordinating and preventing conflicts, could also provide for a solution to this problem too. It seems, that decisions, required for this, could be determined within the framework of a new concept of global security, which takes new realities, that settled in the world, into consideration.

4. Other Defence Problems And Possibilities For Finding Their Settled Or Mutually Acceptable Solutions

4.1. ORDINARY WEAPONS

The problem of reducing ordinary weapons, their transfer and regrouping, produced great difficulties for Russia. In conditions of a complex economic situation, experienced by Russia, conducting a simultaneous reduction, transfer and rearming (in accordance with the new defence doctrine of the country) the army in the proposed period (of 5 to 7 years) presents an exhausting task. As this takes place, the tasks of utilizing the present defence equipment, burial of nuclear engines and materials, used by ships and submarines, spring up in this case. It is possible, that Russia won't be capable of solving these problems with no assistance coming from the world community, creating an explosive situation of social unrest in the country (unemployment among a high number of officers and sergeants, taught to use weapons and having no means for normal living, unemployment at the plants of military-industrial complex, etc.), which is filled with great troubles for the rest of the world countries too.

Measured and jointly settled actions by Russia and the USA are required here for reviewing the problems of removing Russian troops from Baltic states, using their infrastructure for conducting aerial and radiotechnical reconnaissance of the territory of Russia.

The problem of ordinary weapons exports is sufficiently important for both countries, because not just defence, but also commercial interests are employed here. The possibility of finding decisions in the near future, that satisfy both sides, is fairly low. However, dealing with this problem from the point of view of strategic stability requires an agreement on some principal arrangements. For example, a common decision on the types of weapons that generally con not be exported and prohibiting the export of concrete categories of armaments to some countries. It is possible, that the intended agreements on common designing and production of new types of weapons and their realization will allow to bring together the positions of both countries in this sphere.

4.2. INCREASING THE DEGREE OF MUTUAL OPENNESS

The problem of degree of security with exchange of information on all specific problems is of great importance for real cooperation between Russia and the USA in particular in the sphere of providing for strategic stability and adjustment of strategic defence doctrines. It is connected to a high degree with the problems of internal openness and accountability of defence departments to governments and parliaments of these countries. The major role belongs here to the public circles of these countries, which has to perform active control in working out and executing defence budget, actions of defence forces in conditions of local conflicts, international peace-keeping operations, etc. Development of mutual control systems, conducting joint exercises and manoeuvres, joint tests of new weapons and other similar actions could solve the problems of reducing the level of allowed secrecy and openness of strategic information.

4.3. PERFORMING MUTUAL ACTIONS

Multi-sided operations to preserve peace as one of the most promising directions of defence cooperation between Russia and the USA. This is an ideal means for uniting all components of cooperation in the sphere of defence, from strategic planning to financial provisions of operations.

In the course of peace-keeping operations and manoeuvres, Russian and American units, participating in them mutually, are getting more closely acquainted with particulars of defence and technical provisions, the use of equipment, execution of regulations and overcoming the language barriers.

5. Practical Ways of Finding Cooperation

A change in world defence and political situation requires a substantial change in military doctrines of Russia and the USA too. In this instance it is absolutely clear, that selection of the key problems and approaches to altering these doctrines can not be similar for experts of Russia and the USA. The key problems for Russian military experts are those of transfer of large troops contingents, the necessity of changes in the structure of armed forces in conditions of a complex political and difficult economic situation in Russia. The problems of coordination in considerable reductions of military budget and retaining the ability to use military power in possible regional conflicts is most important for strategic planning.

Besides, if the task of coordinating strategic doctrines of Russia and the USA is in fact a real one, important for development of the contemporary world, then both Russians and Americans should search for and find those particular initial principles, which will be capable of serving as a basis for mutually beneficial decisions.

It seems that the principle of "avoiding provocations from the other side" by any actions should be set as a basis for new doctrines, oriented at mutual (and world) security and stability. Such actions, as, for example, increase in concentration of troops in the points of contradicting interests of the countries,

a desire to expand the existing military unions by admitting the near neighbors into them, developing and testing new weapons systems, etc.

In order to prevent actions by third parties to unleash some kind of conflict with a possible employment of nuclear weapons, it would be reasonable to develop together the concepts for use of armed forces of the both countries to resist the aggressor. Evidently, availability of information on development or existence of such mutual plans could be a substantially serious restraining factor for the possible aggressor.

It is necessary to conduct constant work to reveal such common points, find approaches, suitable for both sides and mutually satisfactory variants for their solutions, and it will be reasonable to invite not only defence experts, but also systems experts from these countries. In our opinion, one of compulsory conditions to bring success to this work, is to attract wide attention of the public in both countries to it.

DETERRENCE AND STABILITY

V. I. KRIVOKHIZHA
Russia's Institute for Strategic Studies
Flotskaya street, 15
125413 Moscow
Russia

1. Introduction

Upon the elaboration of the new methods of scientific analysis usable for such an important practical task as the assessment of the effectiveness of different approaches to preservation of strategic stability, a special type of studies is being developed. It is represented by the attempts to develop formalized mathematical models, which are applicable for the quantitative analysis of the status of international security.

The structural-systemic method can serve as the underlying principle of such models. In this regard, we should approach the strategic stability as the systemic equilibrium and balanced structure of the formalized interrelationship between the elements of the system that comply with the gomeostatic organizational principles and criteria of the secure existence and development of separate elements and the whole system.

In addition it seems that the very process of formalization and description of the phenomenon with the minimal loss of information represents the critical aspect in the development of the simulation models. It is clear that the problem of creation of mathematical models that are adequate to the situation, especially with regard to such complicated and contradictory systems as the human society, that represents the correlated and aggregated sum of social structures, is of a methodological nature. In this regard we should admit that the methodology of the analysis of the social interrelationship has not given the final answer to two questions that are important for such simulation:

First, whether the branches of science a specific logical and theoretical base of their own or whether they should develop themselves according to the traditional model of the natural sciences and whether the humanitarian knowledge represents the discursive phenomenon or intuitional one. In other words whether it can be described in mathematical terms.

Second, what term describes reality in a most precise way: "chaos" or "order". In simplier terms the question is, whether the international system in its development can be regarded as "linear" or its is predominantly dominated by the "non-linear" interrelations.

Nevertheless, the attempts to develop even the most simplistic models of the international stability (if we leave aside the very issue of the principle possibility of development of such models) from the very beginning should be based upon the adequate description of the elements of the international system and the nature of the interrelationship between them. Unfortunately, currently upon the development of the models of the international relations we did not manage to avoid deep and consistent simplification of such models and as the result the prognostic potential of the models decreased to zero. In addition, that happens because the elements of the system of stability, that are introduced as the basic ones, as well as

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 115–129.

their interrelationship are of extremely dynamic ("tangible") by their nature in historical perspective.

It also seems relevant to conduct multi-factor analysis of current understanding of the essence of the phenomenon that in the final sense determine the meaning and parameters of the models of strategic stability under the conditions of the dynamic multipolar world. It becomes even more important because the disintegration of the so-called "bi-polar" static system of stability did not create the situation when the international system can not be described in terms of pure aggregation of bilateral relations. The world system acquired new features and aspects that we have only begun to understand.

2. "Absolute" status of the system of international relations

Since 1950s when first models for the elaboration of the effective system of international relations were formulated, there was an enduring gap between logic cornerstones of the theories of international relations based on the simulation methods and real political processes.

An analysis of the failure of the simulation attempts makes it possible to claim that it happened because an impossibility to allocate the basic fundamental principle of the preservation of stability that is not influenced by instant drastic and chaotic change in the system of international relations. In other words, in the process of simulation we were not able to overcome the habit of extrapolation of the realities of today's world into the situation of tomorrow.

For example, the simulation of the situations in the security sphere is based upon the thesis that the preservation of peace lies only in the sphere of international relations. In fact all the major conflicts that were instigated after the end of the Cold War, including 34 armed ones, that occurred in 1993-94 were of an internal political nature, while only one - a border clash between Peru and Ecuador was an international one. Thus if we continue to be guided by existing "standard" criteria, the most destructive wars such as the wars in Afghanistan, Angola, Azerbaijan, Bosnia-Hertzogovina, Georgia, Somalia, Sri-Lanka, Tajikistan and many other countries can be considered only as part of internal jurisdiction of the sovereign countries while remaining beyond sphere of competence of any international organization and in general could not be predicted and simulated using models of development of international relations.

Models based upon allegedly firm basic proposition according to which "no guarantees of enduring peace exist before complete and general disarmament is reached and confirmed legally" also do not comply with political realities. The idea that such guaranties are related to the elaboration of an agreed system of measures for prevention of wars and the main aim is to prevent the concentration in somebody's hands the means for the successful waging of war and nullification of other's arsenals used for deterrence of aggression.

Probably, upon the elaboration of the methods of simulation of international, and in particular, strategic stability, it is necessary to base one's assumptions on some sort of "cautious" approach that the establishing of the new system of security would most probably occurred through trials and failures, rather than on the basis of theoretical models.

In fact the formation of the system of international security, organized not only upon relevant theories but rather upon concrete pragmatic decisions and precedents has already begun. The process of step-by-step adaptation of different international institutions to the new demands (and not vice-versa) is also underway. Under such conditions the main purpose of simulation of stability phenomena should be formulated as the clarification of the acceptably limits and general direction of the evolution of the system that is being created. And in this regard all the assessments should be driven by the proposition that no separate state (or group of states) could impose any limits upon the international community that can strip other states of their capabilities to form independent politics in the security sphere.

From all stated above one can make an important conclusion that the mutual inter-state guarantees should be viewed as the basis of the new global (and even regional) security system and these guarantees can be secured only through the necessary development of cooperation between the sovereign states in the spheres that were traditionally considered to be the nucleus of the state sovereignty, - i.e. problems of the national security. In this case the essence of the new security system would lie in a recognotion

of the fact that within its framework there should be established a number of legal and institutionalized limitations upon the principles of sovereignty and non-interference. In fact these circumstances demand a clarification of what the countries in the new situation can not do.

3. The Stability of System of International Relations

3.1. FACTORS OF INFRINGEMENT OF STABILITY

The implementation and maintenance of security is the fundamental requirement of humans on the personal level, as well as on the level of social systems. The infringement of security of large social systems such as system of international relations in most cases corresponds to dis-balancing of their stability.

The infringement of stability is the category of activity, i.e. it represents a result of functioning of social systems. Once can merely approximately explain the irrelevance between requirements (that in fact is the category of ideal results) of the activity and its real results using the systemic theories as the result of errors defects and failures in feed-back mechanisms.

It is accepted to allocate six types of errors of the feed-back mechanism which are observed in social systems on structural level (individual level here is not considered):

- the mismatch of operations of elements during achievement of system purpose (conflict over aims or ways of their achievement);
- the blocking of feed-back mechanism (absence of signals on deviation from aim direction);
- the distortion of reaction (corrective intervention and "penalties" are applied not to the elements which generate the errors);
- the delay of the reaction (the infringement of the system's ability to conduct correction in a necessary time limits);
- the formulation and the issuing of incorrect decision as reply to correct and timely information;
- the absence of system resources for restoration.

Within certain limits all social phenomena and mechanisms, that induce conflicts and the instability can be described by the complex of the factors named above. The elimination of the these factors within social life in turn can be a base for "adjustment" of stability. Among the other things, nationalism and any sort of "aggressive" ideology, that ignores the necessity to observe the ecological balance, the infringement of universal and international standards can be interpreted as irrational rejection of correct reaction; the errors in evaluation of the dynamically evolutionary political situation and the loss of control over crisis escalation as the result of absence of the feed-back signals etc. Thus the international and national systems of security should be "saturated " by the institutes and by the mechanisms, that are relevant to the tasks of creation of effective and reliable feed-back mechanism.

3.2. OPTIMAL OPERATIONS LEVEL

There are six possible levels of operation used in preservation of stability of system of international relations:individual, local, national, regional, international, and global. Each level corresponds to a specific part of major problems, that impact the safety and the strategy their settlement.

In the process of determining the ways to overcome of infringements and threats of safety and methods of preservation of stability it is necessary to define the most effective operational level. It seems relevant here to be guided by the principles of subsidiarity, according to which any problem should be settled on the lowest possible level with the combined efforts of all parties concerned.

The participation of all the interested sides is required for finding a really adequate solution (not necessarily consensus). There are several arguments in favor of the use of the lowest possible level for such a purpose:

- on the basic level there is a strongest possibility to use the undistorted and the most complete information about problem;

- the implementation of the measures for the restoration of stability will occur within shortest time possible;
- at the higher hierarchy level (the upper levels of subordination) there is a probability that the aim of search of optimal decision of a particular problem will be sacrificed to the other priorities and purposes;
- the primary stability subjects i.e. the ones that are directly envolved into the developments around the problem of preservation of safety, are basically more inclined to view the consequences of accepted steps with higher responsibility;
- the probability of differences and errors in selections of means of maintenance of stability on the lowest possible hierarchical level seems to be smaller.

At the same time the motivated group of stability subjects acting at the low level does not posses necessary resources, objective opportunities and even the political will that are required for implementation of the proposed steps (as example of such situation one can point out to the condition of ecological problems in countries the Third World). Therefore the optimal level should combine the "potential ability" and "potential decisiveness" together with the adequate spectrum of information to conduct the constructive strategy.

3.3. BASIC APPROACHES TO MAINTAIN AND TO STRENGTHEN STABILITY

It seems necessary to correspond basic approaches towards development of the strategy of preservation and strengthening of stability with the main defects of the feed-back in the social systems in the adaptation mechanisms that were described above. These approaches can be based upon a limited number of fundamental principles.

The first principle is the settlement or softenning of conflicts on the basis of actions of the participating parties, that can be described using the models of the so-called "positive-sum games". The concentration of the attention of the parties upon the common interests is their specific feature. As the result the participants can receive benefits by making concession in secondary issues. The formal methodological apparatus of such theories has already been properly developed and gives the opportunity to assess how it is necessary to initiate and stimulate the cooperation, while rewarding the cooperation of the partner and punishing its refusal to cooperate by the adequate actions. The weakest aspect of such concepts is the unsettled problems of practical overcoming of the barrier of dogmatism in real practice.

The second principle is the creation of the signal system for the feed-back mechanism that should bear two important functions: discrimination and indication of the problems in maintenance of stability and the transfer of elements of system of international relations in conditions of readiness to react on these problems. This can be fulfilled using quite simple means: through research in the security, the widest possible dissemination of their results and other objective information, expansion of international information exchange, regular international contacts of all levels, and creation of independent satellite systems for the verification of information, and securing sufficient transparency of political regimes.

Third direction is the correction of the distortions in the feed-back mechanisms. Such actions should lead to the creation of "guaranteed responsibility" situation when those who make decisions basing upon egoistic incentives and factors will inevitably be influenced by their negative consequences.

The fourth basic principle of revision of the security strategy is to overcome the "delayed reaction" of correction mechanisms. The most complicated task in this regard is the construction of such system of stability in which the priority of the short-term interests should be decreased, because it is their logic that represents one of the reasons for the escalation of conflicts of the arms race. In a wider sense we need to speak about elaboration of a responsibility etiquette for the sake of the future generations.

The fifth direction is to surmount of the existing "irrational traditions and ideas" i.e. factors of disbalancing of the system of safety and undermining stability, that result from unpredictable and incalculable national, cultural and historical prejudices, cult of force and greatness, unwillingness to surrender even the smallest part of national sovereignty in the interpretation. Within this category also lies the phenomena of aggravation of conflicts in the international relations that was noticed by politologists and described in the theory of psychological attribution. The essence of this phenomenon is that people tend to approach themselves and others with different criteria, attributing decent motives

of behavior to themselves, and negative to opponents.

Finally the sixth principle is to expand the spectrum and the scale of means that enable us to remove the pressing importance of the modern problems of security. There are two main types of such means - ideas and tools. The analysis of nature and development of international crises revealed that in periods of crises there is a deficiency not of the adequate tools of their settlement but rather of relevant ideas. In this regard one might recommend to conduct discussions of the experts from largest possible number of countries with the aid of satellite communication systems.

During designing of safe social systems it is relevant to use not only the principles of functioning of cybernetic machines but also the spectrum of survivals mechanisms that were elaborated by nature during its evolution such as adaptability, diversity, economical efficiency, symbiotic factors and some other.

It is known, for example that the ability for adaptation is the basic precondition for survival in varying situation and actually is the main feature of successful strategy of preservation of stability. For international community it means the preference of the evolutionary ways of development of the system of international relations in comparison with revolutionary ones, because the cumulative effect of the evolutionary changes in such system, despite their graduality can be quite huge and more steady as a final result. In the sphere of security it implies that the most important thing is to provide the mechanisms that secure the adaptation to the new and for the time being unforeseen factors, while desisting from rigidly formulated models of response and giving priority to the limited but effective innovations and international projects.

The diversity (that is second fundamental feature of nature) is necessary because of the larger number of possible approaches is the best guarantee for reaching the objective. As well as the use of wide integrated systems of various means of maintaining stability has more chances for success than separate even most effective measures. It is worth noticing that some studies led to the conclusion that the highest level of stability and the security of may be reached in sort of an ideal world system which represented a set of small-sized blocs, that differed from each other and had characterized by an internal diversity, while being linked with each other by a mighty network supra-territorial organizations.

The diversity is supplemented by the redundancy. Its purpose consists in creation of reserve of resources in case of crisis situations. The quality of redundancy permits system of security to be not dependent upon serviceability of each of its separate part compensating the occurring failures and errors. It should be stated though that the principles of designing of reliable systems from reliable components can be applied to the functional links inside the system of international relations. Earlier projects of settlement of the global problems failed also because they have been based upon only one idea whether it has been the aid to the development, or the reliance on the market system or planned economy. Now it is necessary to acknowledge that settlement any of these problems requires complete arsenal of approaches.

The numerous versions of symbiotic coexistence (that is essentially mutually supporting coexistence) are desirable analogies for creation of the stable relations between various social institutes as well as inter-state relations that guarantee stability. Some lessons with regard to creation of the stability models can be extracted from the fact that the given joint possession of knowledge already covers all humankind by the network of symbiotic relations which in some sense are richer and have wider scale than those existing in nature.

Social systems should as well have such features as justice, collective decision-making, anticipation of developments, planning, creative imagination that do not exist in the nature.

4. Strategic Stability

The genesis of the idea about strategic stability on global level in second half òò century as well as the conclusion about principle possibility of preserving of such stability is connected primarily with the recognition of bipolar structure of the post-war world. The existence of strategic stability was considered as the result of long-term tendency of reduction of probability of war between the great powers. It was

tacitly acknowledged that the armed conflicts and other forms of use of force on periphery of spheres of influence of the superpowers do not destabilize the global stability and only reduce it "in acceptable limits".

The existence of this specific trend is explained by an interrelated actions of two main groups of factors: gradual devaluation of the importance of the direct application of force in relations between the "poles" of the world system and by the actual implementation of prevention of global conflicts which follow from presence such extraordinary in the historical and retrospect sense phenomenon as extremely quick "self-creation " of the effective mechanisms of mutual deterrence.

4.1. THE GLOBAL STABILITY AS THE FUNCTION OF DETERRENCE

It is obvious that all these initial prerequisites can not be automatically used for the creation of the model of dynamic multipolar world. The probability of "natural" emergence of the new mechanisms of mutual deterrence is limited. Their creation in fact is an independent and effort-demanding problem. The following issues still remain quite vague:

- is there currently an alternative to nuclear deterrence that can serve as new objective basis for a kind of deterring containment;
- whether it is possible in a multipolar world to create a "parallel" structure and disengaged mechanisms of deterrence (or containment) based separately on nuclear and non-nuclear factors, that operate in the intersecting fields;
- are there any effective modes for "containment" of the aspirations for possession and implementation of the decisive unilateral advantages as the factors of power, that radically upset the stability.

Today there are no relatively serious preconditions for instigation of a new world war. In this regard there are all the attributes of existence of strategic stability on global level. The paradox, however, is that the desire for such a stability has lost its pressing necessity with the transformation of the world system in quantitatively new one.

Unfortunately the development of theory of dynamic strategic stability applied to conditions of unstable world (unstable in a sence that its structure i.e. the number and the composition of poles and other elements, their characteristics and the nature of relationship of elements is in a process of constant evolution) is regarded as an impracticable task. Therefore our judgements are applicable only for a quasi-dynamic model of world which describes the sequential circuit of realizations of static conditions in the international relations. In the "breakpoints" and leaps the phenomenon of stability its quantitative characteristic is removed and it does not make sense to discuss it.

In newly emerged, "frozen" conditions the deterrence still remains the most reliable model of securing of strategic stability (and in a multipolar world it is always a paring comparison). It though bears a new specifics and represents not the integrated system of particular measures, intended for conduct of war, but rather a sort of warning to the potential adversaries. It is difficult here to avoid analogies with mechanisms of prevention of infliction of damage upon separate biological beings during occurrence of internal conflicts within species since the nature in this instance provided complex "informational" modes of their settlement instead of opened and destructive forms of struggle.

Puting aside numerous theories of deterrence used for the purposes of simulation of stability it is reasonable to limit ourselves by the analysis two types of deterrence which are implemented in practice: equilibrium of power and capabilities (balance of power) and deterrence (ability for retaliation).

The first type of interactin is closely related to an idea of "testing" of potentials of state or use of superiority or equality (parity) of various components of the state power for avoidance (or to the contrary - for instigation) of war.

The historical experience demonstrates that even in a "bipolar" situations one should not rely on efficiency of concept mutual deterrence with the use of conventional armed forces. Thus from any rational military point of view, using as objective criteria of the quantity of personnel, the quality and dislocation of the armed forces Germany should not begin the war neither 1870, nor 1914 and 1939.

For clarification of the factor of deterrence and thus to make the calculation of probable outcome of war it is important to compare the levels of economic potentials of sides (sometimes this factor is even

exaggerated). At the same time as the history proves the differences in military and economic potentials of sides usually did not serve the purpose of deterrence of the aggressors and that was once again confirmed by the Iraq's initiation of the war against its larger neighbor Iran. Moreover it was the "desperate situation as the result of economic weakness" that pushed Iraq into the occupation of Kuwait, as well as the similar circumstances pressed Germany and Japan to initiate WWII. The governments of Germany and Japan of that time, that are guilty of instigation of war neglected the factors of approximate parity of military forces and national potentials and regarded the military art and the primary one.

Recently the point of view became popular that other phenomena, such as historical, psychological and cultural, technological, military-technical, resource and economic self-support factors, geographical location, structure of political system, internal political deterrence factors and some others can perform the role of deterrence (and containment) factors that provide for the strategic stability. This point of view also includes a hypothesis that deterrence is provided not by the very existence but rather by a complex of dynamic interaction of elements of power. Nevertheless we have to acknowledge that despite an evident utility of such research for clarification of a "humanitarian" dimension of deterrence their implementation in the elaboration of a formalized simulation models is extremely problematic.

Special attention should be payed to such category of military security as parity and the balance of forces. It has already became clear, for example that the earlier global "competition" between the USSR and the USA from its very beginning contained a serious internal contradiction. And the attempts to overcome it were related with serious (though hypothetical) danger for the existence of these states. The specific feature of this confrontation was that it actually from the very first days has been developing under the conditions balance of military power.

Upon the analysis of the role of parity position in approaches to simulation of strategic stability one should also consider the question whether the parity meant something more than just transfer strategic competition into evidently stalemated condition. It is clear that politicians from both sides had to make difficult but inevitable choice: whether to acknowledge that the "absolute" stability in the military-strategic sphere was unequivocally positive for national security or to try make a "breakthrough" and to channelize the efforts towards searching of the ways out of strategic dividends. In later case there was an opportunity to use "linear" approach i.e. to attempt once again to acquire a decisive unilateral military superiority through creation of "absolute weapon" or other bulky but traditional actions of military-technical or military-economic nature. The other way was to try to approach the problem in a "nonlinear" way i.e. to find through marginal superiority oof traditional means actually non-traditional variants of reaching the objective, connected with ideas of transformation of bipolar world into unipolar one.

Currently more and more information appears that American elite shortly after the end of the WWII began to develop politics which purpose was to secure the US national security through some sort of "peresetroyka" (alteration) of the second world pole of military force and nullification of its confrontational potential. That led to the particular instructions and recommendation that stated that "The US politics and operations should provoke fundamental changes in nature of the Soviet system. It will be more effective if these changes to the highest degree possible will come as result of actions operation of the internal forces of Soviet society..."

5. Non-Nuclear Deterrence

5.1. DETERRENCE USING CONVENTIONAL WEAPONS

Numerous theories, that explain the reasons of emergence of strategic stability using conventional deterrence are based upon one main idea. It says that it is necessary to create such situation when the attacking party will confront high level of risk to receive retaliatory strike or other action by military (non-nuclear) means as the result of which the adversary will sustain unacceptable damage. In this regard specific accent is made upon actual compellance of potential aggressor to peaceful conflict resolution at the earliest possible stages.

The modern point of view on this the problem claims, however that conventional armed forces or

separate integration weapons' systems (including and "smart" and "super-clever" weapons) can not reliably perform the deterrence function. The central moment here is a simple consideration that during conflict with use of conventional armaments neither country at present can secure infliction of the necessary given damage upon enemy that is comparable with the damage of the massive use of nuclear weapons. In this regard the criteria of unacceptable damage remain rather vague and it is difficult to define the critical level of potential deterrence.

It is worth noticing that all those discussions are relevant to those countries, that posses the comparable potential. For cases of when we study the countries with non-comparable potentials some other mechanisms of deterrence based upon military means are known such as: insurgency war (which in the post-WWII period proved its efficiency), threat of state terrorism etc.

The advantages and disadvantage of numerous concepts of deterrence with the use of conventional armaments are quite adequately described in scientific literature. For example the main aspect of the doctrine of "defensive deterrence" is the proposition that the task of "retaliation" (which is achieved through deployment and implementation of the armed forces of a purely defensive nature), essentially consists of hurling the enemy back to the initial positions if it has already occupied the part of territory of the state, prevention of armed aggression and outside intervention or the elimination of the benefits of the aggressor through inflicting and unacceptable damage upon him.

A difficult problem is a clarification of the terminology i.e. what is offensive weapons and defensive ones, and what is general defensive organizational nature of forces, though specialists think that it is possible to reach and agreement in this regard. For example, "defense army" should not be equiped with such components as the long-range aviation, strategic transport aviation, unequivocally offensive weapons of the Army, there should be no unbalance between the number of tanks and anti-tank weapons. etc. Within the framework of doctrine of "defensive deterrence" rather disputable concept of "first non-nuclear strike" was developed, that was intended to disrupt the strategic offensive of the enemy by destruction or significant weakening strike groups and destruction of logistic infrastructure, necessary for the offensive.

But the main disadvantage of these and other concepts of "defensive deterrence" is thought too be the opportunity for enemy is calculate quite precisely a "necessary price of victory in strategic offensive operation" i.e. to define of the necessary quantity of forces and means for overcoming deterrence.

We can regard the doctrine of a "non-nuclear deterrence" as some sort of modification of the doctrine of "defensive deterrence". It relies upon an important principle of currently existing impossibility for each party to define precisely the level unacceptable damage in conventional war. Thus it is taken for granted that currently the situation exists when the combination of uncertainty takes place not only in determination of acceptable political and other losses (and all the losses inflicted through the use of conventional weapon are not of "total" nature) but but also there is an uncertainty in determination of losses inflicted by applications of the latest types of the non-nuclear weapons that posses the destructive capability comparable with the nuclear weapons.

Such a concept has however many political disadvantages, because it contains the provocative element and stimulates the first "disarming" (or to be more precise - "decisive") strike. On the other hand with the exception of some moral and psychological factors it is actually identical with the concept nuclear deterrence.

It is worth considering an approach that provides for securing of the strategic deterrence at the expense of implementation of the concept of guaranteed victory in defensive war. The basic idea used here is that as the result of technical progress first of all as result of development of electronic and informatization means and creation of "clever" precise-guided munitions and personal air-defense and anti-tank systems there has been a significant shift in favor of the effectiveness of the defensive means and that now the objective of controlling territory became much easier than to capture it. This gives a chance to repel the offensive and to quickly stabilize the situation after transferring combat operations into trench warfare and thus to upset the enemy's plans. The concepts of the "non-provocative" and "super-defense" defense also have certain value for simulation of stability within such doctrine. Usually these terms reflect the models of operations conducted according to the principles of "territorial defense" and "defense in depth

of the operative space", which means creation of zones of "trashing" of advancing adversary through creation of the active defense in a specially allocated and prepared areas and providing such zones with a great number of small units of special operation forces, armed with hi-tech weapons (Hi-Tech SOF) and so on. The critics labeled such concept as "a war till the last German".

5.2. SCIENTIFIC AND TECHNICAL FACTORS OF DETERRENCE

An important feature of the concept of non-nuclear deterrence is that the concept of continuous sophistication of conventional weapons (in this case weapons alternative to nuclear) on the basis of technical progress is in a way incorporated in a way into it. Simultaneously it is assumed that the possibility of scientific and technical breakthrough which can create either conventional weapons with strategic characteristics comparable with those of nuclear weapons, or the means that can devaluate the strategic importance of nuclear weapons can be implemented at any moment.

The development of the process of the "deterrence through the scientific and technical process" is of clearly institutional nature since the new types of weapons and new "dangerous" knowledge is elaborated in the scientific laboratories and other institutions.

The scientific and technical progress in fact became a synonym to deterrence. It is symptomatic that discussions on the problems of deterrence currently conducted not by the armed forces command but by the military specialists in the spheres of nuclear warheads, ABM systems. For example according to the conclusions of the US intelligence Soviet leadership regarded the Western technological superiority in some spheres as an important deterring factor. It means that they included this factor into the complex of negative conditions that should be taken into consideration during the elaboration of the response measures aimed towards the preservation of strategic stability. An enduring process of the sophistication of the weapons really can be regarded as an important cornerstone of stability and its halt can substantially influence the perception of criteria of stability and change the very essence of concept of deterrence.

The scientific and technical progress no doubt is an important condition for preservation of strategic stability, but at the same it is not self-sufficient one. The contradictory nature of this factor also manifests itself that it in a way envisages a drastic instant violation of stability.

Under the conditions of dynamic multi-polar world the importance of the factor outlined above should be given extra attention. It seems that its positive potential is decreasing because of reduction of its importance in the creation of balance of power between the new pole of power. At the same time the danger of acquisition of the decisive unilateral advantages by certain country will have deeper negative consequences for the preservation of stability.

Nevertheless the institutional character of scientific and technical progress gives the opportunity to increase the international stability through agreed measures aimed towards the creation of the transparent regime that will make the surprise introduction and use of "psycotronic generators" and "zombi cannons" impossible.

At the same time even the history of creation of nuclear weapons proves the aspiration of scientific community to prevent the utilization of science for disbalancing of stability.

5.3. NON-VIOLENT DETERRENCE

Lately the attempts has intensified to find the models for the non-nuclear deterrence based upon non-violent actions including the total nature of the civil resistance. Such concepts are usually called "total civil self-defense" or "controlled hostility of society". Their essence lies in the fact that one of the parties of the conflict from the beginning is ready to surrender to the control of the other part of its territory, even more the military occupation is regarded as some sort of inevitable event and the countermeasures are elaborated in this framework beforeheand. On parallel terms inside the country conditions are created that give the opportunity to upset the plans of the enemy through the organization of resistance with the participation of a widest possible parts of civilian society. It is assumed that all that should lead to some sort of retribution i.e. to the disruption of the final plans of the attacking party in different non-military

spheres - economic, ideologic, political etc.

Such concepts are based upon the successful conduct of the national liberation and civil wars against the external enemy that uses power for suppression or against internal repressive political regime. Using this experience one can outline such real patterns of resistance in which there is a possibility to implement the most effective forms of resistance to the aims and actions of the aggressor on behalf of different groups of population. The fact that an aggression or other forms of disruption of strategic stability is not a spontaneous act of political gambling but represents a calculated decision that includes the evaluation of different parameters of risks and benefits. It is assumed that there are always an acceptable limits between the aims of actions and its costs. In principle the situation when there is a possibility to contain the potential aggressor by certain actions and organizational measures within the society, that demonstrate to him that his goals can be achieved only with high costs, unacceptable to him are quite often. This important conclusion gives us the opportunity to speak theoretically about objective existence of prerequisites for a sort of "non-violent" deterrence in which one of the parties use no force.

It is clear that such concept allows to inflict the damage upon the attacking side at the occupied territories (through the stimulation of tensions between army command and occupation regime), in the international arena (diplomatic and economic sanctions against the occupant country), in the domestic sphere (erosion of the society support of the military action, strengthening of the opposition, discrediting of the ruling regime). An important condition for successful deterrence in this regard is that the multi-aspect preparation of the society as a whole and selected groups of population for which the probable occupation carries a direct danger for the conduct of active non-violent actions aimed towards the paralysis of life under the conditions of occupation (beginning with the "Italian" strikes up to specific non-violent forms of insurgency war and psychological terror) should be done beforehand.

In a multi-polar world, especially considering it dynamics this concept looks quite attractive though its implementation is related to several substantial difficulties:

There are there aspects of such doctrines that represent their weakness:

- the necessity of the preemptive transformation of the institutions of society from the traditional models into the ones that secure the most effective deterrence through the "hostility of the society" for which some period of mutual hostility is needed, which can in tern serve as justifying and stimulating factor of transformation;
- the unattractiveness of the idea of surrendering the territory without struggle, which does not comply with the historically created image of "positive actions" in such situations;
- the existence of difficulties in communication sphere that are related to the issue of "signal recognition" i.e. to the adequate perception of the party which is being deterred of the signal of infliction of unacceptable damage through the "non-violent deterrence".

From our point of view that ideas of "social non-violent deterrence" introduce the probability of changes of the national elites as the deterrent factors.

One can imagine that in a multi-polar dynamic world with the absence of clear cut antagonistic contradictions of ideologic or other irrational form, as well as the absence of prerequisites for the use of force in total forms, the problems of security and stability will be linked not to a totalitarian mobilization of society but rather to the mobilization of the elite. In this regard it is relevant to analyze the mechanisms of deterrence that are based upon the danger of change of a ruling political elite and removal of "potential aggressors" from power as the "retaliatory strike" and elements of deterrence.

5.4. THE SUBJECTIVE ASPECT OF DETERRENCE

One of the reasons for the long post-war period of relative stability was the fact that the strategic adversaries became predictable for each other. A dynamic multi-polar world, "world without visible enemies" will be an absolutely new world space of competition that we all yet have to adjust ourselves. In such conditions the behavior of the political leaders rather than the systems acquire special importance. In order to overcome the unprecedented situation now it is not enough to be guided by the formal theories that become irrelevant since the number of variable quantities reduces to zero the possibilities for the generalization. Under such conditions such subjective features of political leaders

as calmness, courage, common sense, perspicacity which can help them to manage the unpredictable development of the situation will become the important factors of deterrence.

Though the considerations of such subjective characteristics as objective realities are predominantly rejected of the authors of the formalized model of the international relation we should not regard their use in the models of strategic stability as completely impossible. The experience of sociology, psychology, and politology in principle gives the opportunity to define some sort of dynamic coefficient of security of a taken foreign leader, to elaborate the assessment of his tolerance and to include it into structure of simulation model.

5.5. THE FACTOR OF CREATION OF POLITICAL AND MILITARY COALITIONS

The post WWII history does not confirms the hypothesis on the special role of coalitions in the conduct of deterrence politics. The influence of the coalitions upon the deterrence was of indirect nature and was dependent on the nature of obligations of allies.

The post-WWII history of the coalition politics can be theoretically divided into two substantially different periods: "trench Cold War" and "mobile Cold War". The first period was characterized by the efforts of both the USA and the USSR to limit their influence be respective regions, which they considered to be parts of the spheres of their vital interests. During the 1960s there were unions based upon the principles of the "mobile Cold War". They were used for involving new allies into superpowers' spheres of influence and to use them against adversary. Such unions and coalitions were ineffective and created a heavy burden of obligations that involved the superpowers into Third World conflicts even in cases when their real interests were not involved. Nevertheless the peace between the superpowers was preserved despite the existence of these two different systems of coalitions. That leads to the conclusion that in general the coalitions made a limited contribution to the preservation of the post-WWII peace.

Thus, if firm permanent or temporary coalitions existed together with the stable relations between the great powers, we can not regard the preservation of peace as the product of influence of some coalition structures as some politicians claim.

From this point of view the importance of the allied relations in a multi-polar world for the purpose of deterrence should not be exaggerated.

5.6. REGIONAL STABILITY FOR THE "POST-SOVIET" SPACE

Stability of the "post-Soviet" space has been seriously upset. It is reflected in the very fact that the objective of provision of condition for the transition of Russia to the stable path of development has been officially declared the priority of the activities of the security structures of the Russian Federation. In scientific circles a specific point of view is circulating according to which the CIS within the process of simulation of stability can not be viewed as a systemic factor. That can be fully applied to Russia. Under such conditions for the assessments of stability in the region we can not use the standard criteria and recommendations for the stabilization. The model of the situation can be regarded as the "race with time", when the existing defensive potential of the USSR that is inertialy covering the "post-Soviet space" is disintegrating quicker than the new stabilization mechanisms are created. This fact does not give Russia the opportunity to use something except the threat of use of nuclear potential against the "outside" threats i.e. to those countries that can start the attempts to put the claims on the space that is existing in some sort of a "security vacuum".

In this regard a new notion of "partially vulnerable" condition emerged. It means that the complex of threats to the security and potential for the upsetting of stability on the one hand does not comply with the internal stabilization resources of Russia, but on the other, all these threats remain considerably lover that the level where the mechanisms of nuclear deterrence can be implemented. In addition this level is constantly increasing.

It is necessary to point out that though the very process of understanding of the new challenges to stability of Russia (and other post-Soviet states) has not been completed yet, the process of the dismantlement of the excessive military potential with the international society lags behind not only the

process of decreasing of intensity of military threats to Russia, but rather the process of correlation of national security concept with possible challenges to its security. The impression emerges that with regard to Russia the objective of withdrawal of her resources for non-nuclear and other types of deterrence has the priority but not the task of stabilization of the "post-Soviet space". This fact contains the possibility for further destabilization of situation.

6. NUCLEAR DETERRENCE

6.1. TRANSFORMATION OF THE CONCEPT OF NUCLEAR DETERRENCE UNDER CURRENT CONDITIONS

The key problem of the elaboration of the adequate approaches to the simulation of strategic stability is the clarification of the role of nuclear deterrence in the multi-polar world. The main difficulty here is that currently there are two opposite points of view on the problem of the real possibilities of nuclear deterrence.

According to one concept after the disintegration of the USSR the nuclear weapons ceased to be the main guarantee for the security and interests of the USA and their allies. This was justified by the fact that currently there is no security threat comparable with the nuclear war. The events of the last years demonstrated that in the emerged geopolitical situation it can not play the role of a deterring factor against the threats to security and stability in a multi-polar world. The nuclear might of the great powers appeared to be useless in the prevention of the regional conflicts.

There are even serious doubts regarding the very idea of the universal nature of the nuclear deterrence. The concept that nuclear deterrence was usable only in the conditions of the Soviet-American nuclear confrontation and that within other geographic frameworks this concept conceptually changes became widely accepted. It is possible for example to put forward a question whether the mutual nuclear deterrence is possible in current realities of Middle East, Indostan continent, or Central American countries. Or even whether the nuclear deterrence is at all usable in cases of regional instability or the nuclear deterrence remains exclusively the feature of the system of international relation that has passed away after the cold war.

Today more and more experts tend to think that nuclear weapons can not be used in principle especially now when we see that the precision-guided munitions have an opportunity to fulfill certain vital tasks that earlier have been the allocated to nuclear weapons. Upon studying this aspect of the principles of nuclear potential utilization for the strategic deterrence we can agree with the number of serious scholars that the nuclear weapons are the dead-end way in the development of the weaponry, that with regard to the general complex of the means used for the conduct of war exists in the regime of self-containment and which role in the foreseeable future will be substantially limited through the "strategic bargaining" and political deals. But the critical question in this respect is what is the kind and generation of the nuclear weapons which is usually talked about.

On the other hand while paying a tribute to the new realities, the political leaders binded by the feeling of political responsibility are not likely to revise the concept of stability based upon nuclear deterrence. It is symptomatic that such "conservative" form of deterrence as nuclear deterrence spreads its influence upon the new political situations.

The Western powers and the USA envisage the possession of the nuclear weapons as the guarantee of security in case of drastic development of the situation related to the emergence of the new nuclear powers first of all in the world of Islam.

The European approach to this problem, for example is based upon the belief that NATO in its security policy should rely upon the nuclear deterrence and its member-states should not enter the "twilight zone" with the danger to slip into the "swamp of uncertainty", when the strategy of nuclear deterrence will be substitute by defense based upon conventional weapons, because only "strategic nuclear deterrence is acceptable for Europe".

The term "residual deterrence" which is widely used now in the US interpretation does not in fact mean

a step-by-step dismantlement of nuclear strategy. In fact just one element which is nuclear deterrence of superior conventional weapons was removed from this strategy. That is obvious, since the United States and their allies seem to posses undisputable superiority in conventional weapons. Now the only important task for the United States is to preserve the achieved the superiority in the conventional forces and the necessity in the nuclear balance is naturally removed. In other aspects the nuclear deterrence does not loose its universal character, since the for the US it is necessary to conduct such a nuclear strategy which can demonstrate that not a single state can reach its military and political goals in case it begins the conflict with the US and its allies. In addition the nuclear deterrence serves as a central element of the United States strategy in the national sphere.

Summarizing all what was said above we can make a conclusion that the basic stereotype of currently existing attitude towards the problem of nuclear deterrence is the following statement: as a result of evolution of political and military-strategic situation in the world the possibility of creation of nearly completely nuclear-free world is steadily increases. At the same time the complete abandoning of the nuclear weapons that serves as the most reliable guarantee against aggression is impossible and undesirable and can not serve the purpose of creation of the new structure of the international relations free of violence and brutality.

6.2. PSYCHOLOGICAL ASPECTS OF NUCLEAR DETERRENCE

The problem of nuclear deterrence is closely related to a number of psychological factors and primarily to possibility of a conduct of a massive retaliatory strike. Nuclear retaliation is regarded as maybe a justifiable act, but in essence not less catastrophic and immoral that the first nuclear strike. Even if we consider that the retaliatory strike will not lead too a nuclear war and destruction of the civilization it is very difficult to imagine that the rationally thinking leaders of "democratic countries" are ready to use such destructive means against the civilian population of the "evil empires". In this regard a problem emerged that in strategy of deterrence is called "a problem of credibility" of retaliation. Some scholars explain the emergence of this problem by the removal from the political arena of the politicians who were characterized as "nuclear hawks", the reorientation of the first strike nuclear planning to the objective of destruction of nuclear potential of the adversary only, increase of the accuracy of the warheads etc. These signals can not be ignored.

The fact that it is necessary to prove to the opponent that nuclear weapons will be used in order to avoid their use is a principle psychological paradox of nuclear deterrence doctrine. The state of the system of international relations is also quite important for the nuclear deterrence. For its effective implementation it is necessary to have a certain climate of hostility and to exploit the notions of war, good and evil and labeling the opponent using the "evil empire" terms. At the same time the credibility of nuclear deterrence doctrine under the conditions of the absence of artificially stimulated confrontation is drastically reduced.

In this regard it is worth pointing out to some studies conducted by Russian scholars that demonstrated that the population in general sustains an intuitive fear not with regard to a nuclear war and its consequences, but rather of the actions of politicians who can provoke such a war.

Thus the impossibility of credible prognosis of its stability under the erosive influence of other psychological factors remains and important disadvantage of nuclear deterrence.

The problem of the so-called "nuclear guarantees" also introduces a substantial uncertainty into psychological credibility of the nuclear deterrence concept. Some time ago the question whether the United States would conduct a massive attack against the Soviet Union for the sake of salvation of Europe, with guaranteed retaliatory strike at the national territory of the US especially when the hostilities in Europe would not pose direct threat to the US was a classical one. It is known the general de Gaulle has given the negative answer to this question and decided to create national nuclear deterrence means. Relatively recently this point of view was supported by Henry Kissinger who claimed that American nuclear guarantees is a sort of mystification and also said that "it is an absurd to build the strategy of the West upon the idea that there is a smallest piece of truth in the idea of mutual suicide".

6.3. UNACCEPTABLE AND PLANNED DAMAGE

The interaction and interrelationship of the categories of planned and unacceptable damage represents the fundamental factor of the implementation of the nuclear deterrence and strategic stability.

The issue of the scale of the unacceptable damage was not given a relative answer and that was honestly recognized by the military specialists after the the failure of numerous attempts to determine its objective level. At the same time the understanding emerged that the category of "unacceptable damage" in a psychological sense is a historical one: eventually new moral principles and stereotypes are being formed and old became stricter, thus the attitude of political leaders of the largest nuclear states to the possibility of a nuclear war also changes. From this point of view the precise level of the unacceptable damage can not be defined absolutely. While for one country it can be the possibility of delivery to its territory of 1 or 2 nuclear warheads, the political elite of the other might not be deterred by the "McNamarra criteria" which is the destruction of 70% of the manufacturing industry.

In principle during the discussion of the issues of strategic stability a task of agreed definition of the minimal level of unacceptable damage for each country can be a subject of special discussion since it contains the solution of the problem of definition of the limits for the reduction of strategic nuclear forces in general. For example, today we can clearly state that even the solitary strikes against such vital targets as big cities, industrial centers, nuclear power stations and other facilities and river dams etc. can completely disorganize the economy and would result in long-term consequences disrupting the normal existence and development of independent states.

For the clarification of the issue whether the strategic weapons have the deterrence capability and what is the number of nuclear warheads that the SNF should posses, the notion of necessary (planned) damage is used rather than the term "unacceptable damage" and it seems that such situation will be preserved in future. An ultimate feature of a notion of the "planned damage" as a category of strategic stability is that it represents some sort of final result of unilateral independent calculations. As the result the composition of nuclear forces is determined and the "factor of uncertainty" for other aspects of nuclear planning is removed basing upon the calculated choice and introduction of quantitative and qualitative characteristics of damage that one country plans to inflict upon the enemy.

It will not be overestimation to say that the arms control in the sphere of strategic armaments is based not upon the lowering of the threshold of the planned damage but rather upon the mutual definition of conditions for its securing utilizing the lowest possible number of warheads of the lowest possible yield. It is symptomatic that no attempts of simultaneous lowering of the nationally established levels of planned damage during the arms reduction talks were noticed. It means that the strategic stability and nuclear security in a way remain isolated and independent from each other and create the problem of implementability of strategic nuclear forces reductions.

It is clear though that the level of necessary damage for the deterrence of a given state varies widely and that is determined by the different structure of economies, by the differences of mobilization potentials of industries, and the degree of steadiness of the industry to the external influence. The ideal criteria of the planned damage (that deters the aggression) can be quite different and the issue of choosing of the most relevant one still remains unsettled.

6.4. THE CONDITIONS FOR ENHANCING OF STRATEGIC STABILITY WITHIN THE NUCLEAR DETERRENCE STRATEGY

The analysis of the problems of strategic stability in the international relations with the use of the formalized quantitative methods of evaluation is mostly related to the search for the military equilibrium of the combat capabilities of the confronting states (or coalitions) in which both sides posses the capability of inflicting the planned damage in the retaliatory strike.

These evaluation methods are based upon the so called operative models of exchange with nuclear strikes between the belligerent states and simulation of the conduct of hostilities. As a rule the results of calculations represent the diagrams at which the spheres and lines of combat capabilities (zone of strategic stability, sphere of survival etc.) are represented in different coordinate scale.

The development of strategic nuclear forces and defense systems of confronting states (or coalitions) that facilitate the widening of a zone of military equilibrium (zone of strategic stability) at the expense of reducing the zone of uncertainty and instability (the zone in which none of the sides can inflict the planned damage to the other in a retaliatory strike, but can do so in a preemptive one) is regarded as a stabilizing one. The development of the means that reduce the zone of military equilibrium and the zone of uncertainty and instability increases is a destabilizing one. Therefore, the search for means and mutually agreed decisions in the sphere of development of the strategic nuclear forces and defense systems of the states, that improve the strategic stability will lead to the reduction (until total elimination) of the sphere of uncertainty. In this regard certain limit for the depth of reduction of nuclear potential and increase of the capabilities of the strategic defensive systems exists, trespassing of which can lead either to the situation of uncertainty, or to strategic superiority of one side which in turn will upset the stability.

It should be especially noted that in case of a stabilizing development of the SNF the number of nuclear weapons that each nuclear party needs to posses for deterrence of any aggressor from waging nuclear as well as conventional war is smaller that their number in case of a destabilizing development. That means that fulfillment of the objective of nuclear deterrence under the conditions of stabilizing SNF development in principle can be achieved with the lover level of nuclear confrontation and vice versa. That is why the qualitative improvement of the Strategic Nuclear Forces and defensive means of nuclear powers of the world should be conducted only in such directions that are recognized bilaterally or multilaterally as the stabilizing ones. It is vitally important that the destabilizing directions of the SNF sophistication are legally internationally banned and put under control of the international community.

The results of numerous calculations and assessments using different models of preservation of the strategic stability based upon the nuclear deterrence give us the opportunity to list several basic factors of development of forces and technical means of SNF, that stabilize the situation under currently existing conditions in the system of international relations. These factors are:

- development of multicomponent strategic offensive forces (triad with both stationary and mobile basing);
- the improvement of the system of control over the armed forces;
- increase of the survivability of the strategic nuclear forces;
- qualitative improvement of the combat systems of the air-based missile weapons' systems;
- transition to the single warheads in the absence of the ABM and preservation MIRVed warheads within the SNF in case of deployment (or threat of deployment) of the ABM systems with the opposite side;
- deployment of a low-altitude point ABM defense system of strategic missiles bases;

The development of the potential in this direction gives the opportunity to preserve the strategic stability with the lower number of nuclear weapons with the Strategic nuclear forces and to increase the depth of reduction of strategic nuclear weapons (below the level outlined by the START-2).

Section 2.3

Qualitative - Asian

GEO-POLITICAL STABILITY AND THE BALANCE OF POWER IN EAST ASIA

GENERAL SIR ANTHONY FARRAR-HOCKLEY
National Westminster Bank
PO Box 43
30 Wellington Street
Aldershot
Hampshire, GU11 1YJ
United Kingdom

1.0 Introduction

The year 1995 marks not only the fiftieth anniversary of victory in Europe and the Far East in the second world war but also fifty years without a third world war, an event often forecast as imminent during the long confrontation between the forces of Communism and democracy. Will there be celebrations in 2039 to mark the break up of the Soviet Union and the base for world revolution?

Considerations of this sort inevitably focus on events in Europe during the past fifty years and the interconnection with North America in as much as the United States is an Atlantic power. Clearly, the European continent has been the principal arena of confrontation, not least nuclear confrontation, the theatre in which Stalin manifestly attempted expansionism and his successors continued a strategic poker game until the Soviet Union brought herself to the edge of bankruptcy.

During the forty years in which the nations of the Warsaw Pact maintained a capability for offensive action at a few hours notice and the Atlantic Alliance a similar preparedness for defence, a mass of studies has been accumulated on the aspects and prospects of this situation, political, economic, social, and of course military. None conceived the order of its settlement. Among the military forces, the potential problems of applying land, sea, and air forces, exerted a peculiar fascination,due in considerable measure to the changing options offered by advancing technology in weapons and equipment, conventional and nuclear. In terms of professional expertise, this was the theatre which offered most to the ambitious officer, not least because service in a combat formation was rated as an opportunity to acquire operational experience. This was strange because, throughout the years of the cold war, NATO fortunately held the Warsaw Pact Forces in check without a shot being fired. The theatres in which hot wars continued against Communist power lay in the Far East.

2.0 Asian Geo-Politics Post World War II

In Asia, from the conclusion of the second world war, national Communist parties were associated with - and were often leaders in - the movements for independence or change of status in the divers territories, colonial and otherwise; so much so that there were apprehensions in Australasia, Europe and, most strongly, in the United States, that Asia was in danger of falling to cooperative Communist forces, directed centrally by the Soviet Union. Some official papers predicted that local Communist Parties

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 133–139.

would, on instructions, create widespread disorders threatening the ability of governments to maintain their authority. All such perceptions were flawed.

2.1 SOUTH EAST ASIA

The Communist Party in India in 1945, though intermittently financed by the Soviet Union, was unable to compete with the Congress Party; disorders in the sub-continent in 1947 were due to the separation of Muslims and Hindus following the establishment of Pakistan. Shortly, India passed to independence with the advantage of a stable and experienced structure of civil government. From the Dutch East Indies, Indonesia emerged under the leaders of an Islamic national front formed against the Japanese occupation, maintained subsequently against the Netherlands. The movement owed nothing to Marxism. In Malaya, Communism was confined principally to indigenous Chinese, backbone of the underground resistance to the Japanese occupying power. A strong remnant of this group returned to the jungle in 1948 with the aim of raising the populace against colonial rule. They failed. The Malay, Indian, and Tamil peoples dissociated themselves from the movement and were persuaded to support the British counter-insurgency measures when it was made clear that Malaya would be granted independence as soon as these were successful.

Any prospects of Communist power in the Philippines were lost with the accession to independence from the United States in 1946. Indeed, the only territories in South East Asia in which Communists retained cohesion and a substantial degree of popular support, albeit as an underground movement, were the three components of French Indo China: Viet Nam, Laos, and Cambodia. In each, as the French and, later, the United States discovered, there was not only a universal wish for independence but a lack of any credible political alternative to the Communists.

2.2 NORTH EASTASIA

In North East Asia, Communism was ascendant in China. The Party, riven by internal disputes during the first phase of its conflict with Chiang Kaishek's Nationalist movement, was united under Mao Zedong by 1945 and was led by him through a series of campaigns to outright victory in 1949. This success did not entirely please Stalin, notwithstanding the hand of comradeship persistently offered to him by Mao. For one thing, he was never able fully to accept the credentials of a revolution dependent on massed agricultural as distinct from industrial workers. For another, he saw that the People's Republic of China, for all its poverty and lack of an industrial base, was too powerful to be treated as anything but a full partner in the advance of international Communism.

On this account, among others, the Soviet Union retained close control of North Korea, neighbour to North East China and Siberia, which offered Stalin a sally port to Japan. Presently, after consultation with Mao, the North Korean Army was unleashed to subjugate the Republic of South Korea. This event, in the summer of 1950, took the greater part of Asia by surprise, as indeed the remainder of the world. It was at once rated by the United States and British governments as an act of aggression inspired, they guessed, or, at the very least, sanctioned, by Stalin to test their mettle.

Burdened by a high defence budget, drawn into European security commitments by the Atlantic Treaty, President Truman and his Secretary of State were engaged in shortening their Pacific outposts, a process begun when American mediation between Chiang and Mao came to nothing in 1946. As a Pacific power, the United States intended to defend Japan, the Ryukus, and the Philippines against predators, and to encourage British Commonwealth and French counter-insurgency in Malaya and Indo China respectively.

The invasion of South Korea indicated that territories left to fend for themselves would be picked off by Soviet surrogates. Assisted by Britain, the American government rallied the United Nations to commit armed forces to assist South Korea, and interposed the Seventh Fleet between the Chinese mainland and Taiwan, the island sanctuary and only province remaining to Chiang Kaishek's authority. When the

North Koreans were defeated by the United Nations Command and thrown back towards the Chinese frontier on the Yalu river, Mao committed a quarter of a million troops to check the advance, a contingent which swelled eventually to two million as his intervention forces attempted to occupy South Korea. As the United States provided the greater part of the United Nations contingent, the Chinese considered it undesirable that their soldiers should be engaged openly in hostilities with those of the Americans, a proceeding which might lead inescapably to general war between the two states. To avoid this, troops of the People's Liberation Army posted to Korea were officially described as 'volunteers', somewhat after the style of the International Brigades fighting in the Spanish civil war in the 1930s. Stalin was careful to ensure that his limited subscription of armed forces was never manifest.

The Korean war ended in 1953 in a stalemate which preserved the Republic in the south. An armistice was concluded, though it was not ratified by a peace treaty. From that date, for the next twenty five years, the United States, Britain, Australia, and New Zealand, were involved actively in South and North East Asia opposing Communist expansion, the single source of regional instability,with one exception, during this period.

2.3 SINO-SOVIET RELATIONS

For some years, the notion persisted in the United States that China and the Soviet Union were acting still in partnership directly or indirectly throughout the region. This was far from the truth. The two powers were quarrelling almost continuously on matters of political policy, competing for influence, occasionally openly at enmities as in the clashes between their forces during the long running territorial dispute on the Sino-Siberian frontier. The Soviet Union took the lead in encouraging and supplying Ho Chi Minh's war against the French colonial garrison and, subsequently, operations against South Viet Nam and the American intervention force. China sought to extend her influence among the neighbouring nations of the Third World, a policy which ended disastrously following such events as the clash of arms with India in 1962 - again, in a frontier dispute - and a precipitate flexing of political muscle by the Communist Chinese minority in Indonesia in 1965. Thereafter, until the Nixon-Kissinger overtures in 1971 offered new options in foreign policy, China was almost friendless in the world and preoccupied by the destructive exercises of the Cultural Revolution.

In 1971, China discovered that the United States had come to recognise her anti-Soviet credentials, her desirability as a trading partner, and her potential for political stability in Asia. China's place in the United Nations, witheld from her since 1949, was opened and occupied. But she was not as powerful as the Americans believed - was unable, indeed, to influence the Viet Minh leadership to offer the United States a means of making a dignified exit from Viet Nam. Equally, with Mao still a power in Beijing, the group in the Chinese government most anxious to attract western investment and technology was obliged to limit the nature and range of its enterprise. Still, their associates wedded to untra-Left ideas were marginalised. The European democracies, Australia, Canada, New Zealand - even Japan - were encouraged to resume or open embassies in Beijing from 1972, though the United States, inhibited by her relationship with Taiwan, was unable to negotiate full diplomatic relations until 1979. By that date, Mao was dead and the Gang of Four, which had aimed to succeed him, had been routed.

The progressive recognition of China's respectability as an international power by western Europe, Australasia, Canada and, finally, the United States, owed much to acceptance that her government was inclined neither to expansionism nor irredentism. Nonetheless, over thirty years in office, the governments in Beijing had consistently claimed and, where opportunity offered, fought to secure, territories subject to Chinese authority at the height of her imperial power. Taiwan was, from 1949, foremost in her sights. Few would dispute that the island is, historically, a province of China. Similarly, Mao and his successors have followed the imperial tradition of asserting a degree of authority over those minor neighbours who appear to be getting above themselves. Viet Nam was considered to be in this category in 1979. Hence the limited punitive expedition into her north eastern province in that year, a strategy which, though successful locally, exposed the limitations of the Chinese armed forces.

Viet Nam bore the rebuke; the Soviet Union remained her close ally. Of more importance, however,

the Chinese hierarchy felt obliged to support the bloodthirsty Pol Pot and the Khmer Rouge against Viet Nam. China had settled in this year, when ambassadors were exchanged between Beijing and Washington, into a clear identification of her enemies. The newspapers and periodicals which had once attacked, issue by issue, the wickedness of the United States and such 'running dogs' as the British, such 'obsequious tools of aggression' as the Japanese, focussed now upon the iniquities of the Soviet Union, her satellites and protegées. Chinese military planning was overwhelmingly concerned with strategy to defeat the anticipated Soviet aggression against China. Her limited nuclear capability, developed for hostilities with the United States, was redirected towards the Soviet Union.

3.0 Balance Of Power

The ascendancy of Communist China had seemed to threaten those in the South East from the time of the Korean war. The protection offered by the United States forces based in Japan and the Philippines, and of the British and Commonwealth forces in Singapore and Malaya, and the commitment to collective defence of the region embodied in the South East Asia Treaty Organisation, were comforting, even to those who criticised the measures publicly as an extension of colonialism. But a series of events brought these arrangements substantially to an end.

3.1 INDONESIA

The first of these was the drift by the Indonesian President, Soekarno, into a flirtation with the Soviet Union, and a quarrel with his neighbour, Malaya, concerning the sovereignty of certain territories and sea areas. Relationships worsened when the British government, withdrawing from its Borneo possessions and protectorates, Sarawak, North Borneo, and Brunei, proposed to pass the first two to Malaya. Soekarno considered that all three should be incorporated into the main island, which was a province of Indonesia. A muddled attempt by an agent of Soekarno's to seize Brunei by coup d'etat in December 1962 was followed by cross border raids of the Indonesian Army into all three states. It was thought that these would persuade the British to withdraw prematurely to avoid the expense of a military campaign. This was a considerable misjudgement. A strong British Commonwealth contingent joined local forces to out manoeuvre the Indonesians, who were driven back from the border zone by 1965. Discredited, Soekarno survived an internal coup to bring him down but was then forced out of office by his own military commanders. General Suharto became president and eradicated all opposition, of which the great majority belonged to the Communist Party, some of whom favoured the Soviet Union, while the majority, Chinese in origin, maintained links with Beijing. Few survived the massacres following widespread arrests by the armed forces and police. Friendly relations were restored between Indonesia and Malaysia (the title assumed by Malaya after her incorporation of Sarawak and British North Borneo).

3.2 ASSOCIATION OF SOUTH EAST ASIAN NATIONS (ASEAN)

As a direct consequence of these events, the Association of South East Asian Nations (ASEAN) was formed in 1967. Indonesia, Malaya, Singapore, Thailand, and the Philippines were founder members. Brunei was to join them in 1984. They were not seeking primarily to establish a military alliance, still less an integration of their national forces though, as time passed, local cooperation grew in matters of defence, including mutual assurances that none would tolerate subversive movements within their communities which threatened their own stability or that of other members of the Association.

ASEAN solidarity was tested in the aftermath of the United States withdrawal from Indo China; for example, the Communist governments of Laos and Viet Nam resisted the Association's attempts to designate the region a 'Zone of Peace'. In the autumn of 1978 Viet Nam attempted to negotiate bilateral treaties with its members. These were refused. The five were already becoming concerned about the ambitions of Viet Nam to ascendancy in Indo China, though all were given assurances that this

apprehension was false and that the sovereignty of Cambodia in particular would be respected. They were thus disturbed when Viet Nam invaded that state in December 1978. Thailand was particularly apprehensive that the struggle might spill over into her territory. It is a mark of their anxiety that when the foreign ministers of the Association met in Bangkok in January, 1979, all agreed that Viet Nam should not be named as the aggressor: their communique simply proposed 'the immediate and total withdrawal of the foreign forces from Kampuchean (Cambodian) territory.'

However, there was a silver lining of sorts to the clouds of uncertainty and anxiety which enveloped the five governments in this connection. It became apparent that China objected to the attack on Cambodia and, more, offered this promise during a tour by the deputy chief of staff of the People's Liberation Army in December, 1979. 'If Thailand and other ASEAN countries are invaded by outside forces, the Chinese government and people will resolutely side with them.'

Formerly, such a declaration might have been unwelcome - construed, even, as a veiled threat. Times had changed.

3.3 UNITED NATIONS CONVENTION OF THE LAW OF THE SEA (UNCLOS)

A third development which heightened the responsibilities of the ASEAN members was the 1982 United Nations Convention of the Law of the Sea (UNCLOS), which extended all territorial waters to a limit of 200 miles, establishing the areas within these limits as Exclusive Economic Zones. Rights to offshore resources passed to the respective nations of Asia as elsewhere throughout the world, opening the requirement to police them. Subsequent evaluation of submarine resources occasioned disputes between nations in narrows offshore and semi-enclosures. China reminded her neighbours once more of her claims to the Paracel islands off Hainan and, more remotely, to the Spratly Islands relatively close to Viet Nam, Malaysia, and the Philippines, claims disputed by these three, notably on account of the oil and gas deposits believed to be in the areas. All at once, the importance of retaining sea and maritime air forces became no less important than disposing land forces to all but nations such as Thailand with limited sea frontages. Immediately, the world recession made it difficult to finance the range of equipment required.

3.4 COLLAPSE OF THE USSR

Finally, in Asia as in Europe, the demise of the Soviet Union in 1989, profoundly affected the climate of security. Notably, in South East Asia, Viet Nam lost the support of her once great ally. She adapted rapidly to what is known in Communist parlance as a 'capitalist roader', implying the tolerance of private enterprise operating within the centralised economy of a single-Party autocracy. The capitalist roaders flourished no less in China, exploiting a trend begun with the rise to power of Deng Xiaoping. Already, China was trading profitably with economically dynamic neighbours such as Japan and the Republic of Korea, formerly deemed to be political outcasts.

4.0 Threshold Of The Twenty-First Century : Current Geo-Politics

In this last decade of the twentieth century, therefore, in which Asia has advanced from a collection of states, dominated by imperial powers, backward in technology, limited in the means to develop their economies, the last major factor of constraint, the process of Communist expansionism, appears to have fallen away. The national security problems which remain are relatively minimal. The longstanding disputes between India and Pakistan, notably concerning Kashmir, are regional. Expense is likely to dissuade either state from engaging the other in a conventional war. The use of nuclear weapons to resolve issues would at once engage the intervention of the United Nations. Myanmar (Burma) is preoccupied with her own internal problems but even when these are resolved she has no cause to threaten or feel threatened by her regional neighbours. The ASEAN organisation has drawn political and trading partners into periodic conferences: Australia, Canada, the European Union, Japan, the Republic

of Korea, the United States. China has attended as a 'guest'. Laos, Viet Nam, and Papua-New Guinea have sent observers.

Of course, all problems of the region have not fallen away. Indonesia wishes to see the end of the Five Power Defence Agreement which has provided Malaysia and Singapore a security relationship with Australia, New Zealand and Britain. She has sooner or later to make concessions regarding the future government of West Irian. The Khmer Rouge have yet to be brought to book. Piracy has to be brought to an end in the South China Seas and adjacent waters. But none of these matters threaten the states of South East Asia.

4.1 FUTURE THREATS

Yet, two matters may trouble East Asia as a whole. The first relates to China. She maintains her right to secure by whatever means are necessary the territorial inheritance of her imperial past. The occupation of Tibet in 1950-51 and the denial of the Tibetan people's wish for independence, at least autonomy, illustrates this determination. The Chinese government has already shown no inclination to compromise in the matter of the Paracel and Spratly islands. It is unlikely that China will attack other nations to warn them off, though it is probable that she will hasten the procurement of modern sea and air forces as a means of protecting her interests. It is to be hoped that a past tendency to be aggressive in the course of protection has been overtaken by a greater sense of responsibility befitting a major power with a permanent seat in the Security Council.

4.1.1 *China Disintegration ?* Suppose, however, that China should disintegrate. The speed of economic growth in her regions, the loss of control by the central government over this process including the rapid rise in inflation, and the regionalisation of the People's Liberation Army encouraged by the employment of soldiers in industry, might bring about such a result. Such an outcome would disrupt stability in East Asia and make a settlement of the Paracel and Spratly disputes more difficult.

4.1.2 *North Korea.* A greater and more imminent danger lies in the future conduct of the Democratic People's Republic of Korea. The government in P'yongyang has shown itself to be wholly unreliable in every international bargain it has made since the death of Stalin. It has pursued every course within its power, short of hostilities, to undermine the Republic of Korea, abandoning in the process many of the provisions of the armistice agreement relating to inspection of the mobilisation and deployment of its armed forces. It continues to renege on its agreements with the International Atomic Energy Authority, and clearly intends to manufacture nuclear weapons. It has openly threatened the Republic of Korea with nuclear war. The Republic has abandoned nuclear weapons, and continues to offer to discuss the peaceful resolution of differences with her immediate neighbour and to trade on most favorable terms. During his lifetime, Kim Il-sung, the 'Great Leader' of North Korea, never abandoned his aim of capturing South Korea by force of arms and it is far from certain that this danger has perished with him. Irrational as this policy clearly is, and doomed to failure, the renewal of war between the two states is still a possibility. Those who control North Korea now have shown little sign of rationality in their dealings in and outside their borders.

5.0 What To Do

The solution to this abiding problem lies in the application of political measures by all those who are directly connected with it, and perhaps by buying off North Korea, an option which her goivernment has suggested directly and indirectly for several years. China recognises that a Korean war on her north east frontier would be contrary to her interests. It seems likely that she has already warned P'yongyang of her opposition. The same is true of Russia and Japan, though their influence is more limited. The United States retains 37,000 troops and airmen in the Republic of Korea as a deterrent force. More would arrive by way of reinforcement if North Korea opened hostilities. It is immediately more important that the

United States resists all attempts by the P'yongyang government to deal with it on a bilateral basis in security and connected matters. It is the latter's intention to shut out the Republic from any settlement relating to the Korean peninsula.

Lord Attlee, when prime minister of the United Kingdom in 1950, warned the British public as the war began that 'the fire in Korea may burn our house down'. These words may no longer be applicable to the United Kingdom but they are true still for the nations of East Asia, as they progress in a period of prosperity and peace. From the foregoing, it will be seen that the dangers of nuclear proliferation are low in East Asia, and are currently confined to North Korea. Fortunately, the latter is by no means able to dictate the price of a settlement, actually or metaphorically. Time is running against her; North Korea is approaching bankruptcy. There is, therefore, going to be a resolution of the long term division of the Korean peninsula, conceivably by the end of the century. If this comes about due to war or to a loss of control by the North Korean authorities, there will be a period of destabilisation. Still, it is manageable, and steps have been taken to be ready for one or another form of outcome. Thereafter, North East Asia and the nations who trade from outside thge region will find themselves engaged with a nation of 70 million highly educated and skilled people in a dynamic work force.

Destabilisation due to conventional aggression is unlikely to occur in any of the minor outstanding regional territorial disputes, including the government of West Irian, but may arise if China maintains arbitrary possession of the Paracel and Spratly islands. A peaceful settlement of the latter will be assisted by the moderating efforts of Australia and New Zealand.

In sum, the region is free of the political apprehensions and anxieties which occupy Europe and North America in their own hemisphere. The factors which contribute to this situation may well arise from an absence of nuclear profusion, a low incidence of territorial disputes, and a continuously rising standard of living.

The effect of these may be pondered to advantage.

STRATEGIC STABILITY IN THE EARLY 2000S: AN INDIAN VIEW OF A SOUTH ASIAN MODEL

GENERAL KRISHNASWAMI SUNDARJI
Former Chief of the Indian Army,
"Woodside" Wellington,
T. Nadu 643 231, India

1. Introduction

The collapse of the Soviet Union has left the 'West' suddenly bereft of a focal threat; the cement that held them so firmly together has gone. The countries of Eastern Europe, freed from the Soviet empire face economic problems, and the pangs of political democratization. The republics of the erstwhile USSR, suddenly freed from Russian hegemony, face not only similar problems as Eastern Europe and in greater measure because of their past closer integration in the Soviet Union, but also a strategic threat from the predominantly powerful Russian Federation. Russia has not only severe economic problems, but equally severe problems of socio-political restructuring. The third world countries have lost the sense of cohesion that non-alignment gave them, with the disappearance of one of the two poles. Many of their economic assumptions, though these varied from communist models to fabian socialism have all been sorely shaken by the collapse of the Soviet system and the apparent victory of capitalism. The 'North-South' schism seems to be gaining primacy as the 'East-West' divide disappears.

The world is in a state of strategic flux. Nationalism has received a boost. Some states are threatened by what were sub-nationalisms turning into ethnic resurgence pushing for new national identities. This already chaotic world scene is further confused by the emergence of supra-national forces such as religious fundamentalism and the drug empires that do not recognize the boundaries of nation states. Can the new world order be molded by conscious design, or do we let these forces interact more or less freely, and let the upshot shape it? Can we afford such relatively free interaction of forces when the number of players have increased and many of them possess or will possess weapons of mass destruction (WMD) legally or otherwise? Prudence demands that a conscious design be attempted, that should be optimized to encompass and modulate the various divergent interests in the world, and so restructure international bodies like the UN that supra national interests that are not nation states and thus are currently out of the UN, are brought into the system and 'tamed' to the extent possible. This design may not succeed in acting as a blue print but can at least moderate the mercantile rapacity of the rich nations and restrain the poor nations from the irresponsible use of terrorism and environmental pollution in their legitimate quest for a fairer world economic and socio-political order.

First, we have to define and analyze the meaning of 'stability' and then guesstimate as best as we can, the kind of world we are going to be in by the year 2015. Only thereafter can we launch on our quest for a stability model, at whatever level.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 141–167.

2. Stability -- General

The dictionary defines 'stability' thus: 'The condition or quality of being stable, as resistance to sudden change, dislodgment, or overthrow'. A quick analysis of stability is essential, even at the risk of its becoming simplistic. The best form of stability is a natural one, where there is equilibrium between needs and availabilities. The basic perceived needs could be geo-political, geo-economic, socio-economic, socio-political, cultural, intellectual and spiritual to mention only some, but all leading to the ability of peoples and nations to live with dignity and in honor. Where there is disequilibrium, external influence, generally in the form of *Power* needs to be applied to restore equilibrium. The best stability, is theoretically one where no power has to be applied to maintain equilibrium and when discontent is at zero on the scale. This is impractical, and one could settle for stability with the least application of power. At the other end of the spectrum is a situation where even the application of the maximum available power not prevent an explosive overthrow of the existing system, as graphically shown in Figure 1. It is natural that those who are benefited by the present dispensation will be tempted to keep increasing the power input in an attempt at maintaining the status quo. However wisdom would demand that reform is undertaken and a better deal is offered to the under-privileged before an explosion overwhelms the system; when should this be? I would suggest it ought to be when the 'discontent quotient' has risen to between 50 and 75 on a scale of 0 to 100. This will give enough time to get the reforms into place before criticality is reached. Reforms should aim at taking the discontent level down to 25 or less, so that the system stays in place long enough for continuity before the discontent quotient rises to intolerable levels again.

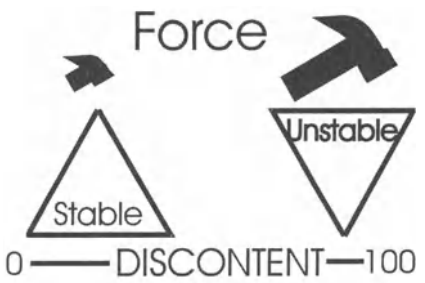

Figure 1

At the heart of all stability are 'Human Rights' at the individual level leading to internal stability, followed by stability at the national through global level, as depicted in Figure 2.

Figure 2

3. Stability in Geopolitics and Balance of Power

Stability in geo-politics requires that all nations are generally in a state of satisfaction regarding the needs discussed earlier, and content with evolutionary change in an atmosphere of relaxed status quo. Obviously, this is not so in the world of today, with vastly varying degrees of development and affluence; promiscuous use of the earth's non-renewable resources by the affluent and developed minority; near-perpetuation of the inequitable international economic order, by the current rule book that is heavily weighted in favor of the affluent minority and only permits of glacial improvement in the status of the less affluent. In imbalance, the status quo can be maintained only by the application of power, and *balance of power* becomes necessary. Further it is in the presence of this great imbalance of today that much power has to be applied to maintain stability. I reckon that today, the discontent quotient is between 50 and 75 and rising.

Balance of power stability can be maintained only by so ameliorating the socio-economic causes of imbalance, that the under privileged are prepared to work for their self-improvement within the existing system. When that stage has been passed whatever the causes, balance of power stability is in dire danger;

because *power can only be applied to nation-states*. When operational control passes to transnational Mafiosi and terrorist outfits that possess weapons of mass destruction, the powerful nations of the world will have no recognizable target to hit or threaten with the application of power. The parallel between the futility of attempting to fight guerrilla opponents with high-tech conventional forces as in Vietnam, and targeting terrorist groups with say nuclear or high-tech conventional forces is too striking to ignore.

As long as undue reliance is placed on balance of power to underpin an unfair status quo, balance of power stability will be constantly under threat by the attempts of some states to increase their own power, overtly if possible or clandestinely if they must, to redress the balance.

4. Arms Race Stability

An arms race denotes the competitive qualitative and quantitative increases that two adversaries or adversary alliances make in their respective forces in order not to be caught at a disadvantage in the confrontation with each other. Basic to the process is the fact that all other things being equal, *more is better*. This is only true in *war-fighting* and not in *war-deterring*. "Those who foresee arms racing...fail to make the distinction between 'war fighting' and 'war deterring'...forces designed for war-fighting have to be compared with each other. Forces designed for war-deterring need not be compared. The question is not whether one country has less than another, but whether it can do 'unacceptable damage' to another, with unacceptable damage sensibly defined. More is not better if less is enough."[1] The same confusion exists in assuming that deterrence also permits of options -- keeping capabilities covert, ambiguous or overt. For deterrence to be effective, whether nuclear or conventional, capabilities and the determination to use the capabilities under given circumstances must be clear and credible to the adversary. It is only in the case of war-fighting, that the options of keeping capabilities covert or ambiguous might pay dividends.

It has now been explicitly accepted by both Russia and the USA, that nuclear war is neither fightable nor winnable. So discussing nuclear arms racing by them is meaningless. In the case of smaller nuclear powers as well, though nuclear weapon use will be of a much smaller order and the survival of civilization will not be at stake, the scale of damage in nuclear war-fighting will be so horrendous that pro-active use of nuclear war-fighting for achieving foreign policy or security objectives will not be a sane option. This will be discussed in greater detail in the South Asian scenario. Arms racing has no logical place in a deterrence regime as already brought out. Because it did take place during the cold war, does not make it necessary are even likely for the future. There are some unthinking commentators who hold the erroneous view even today, that only open ended stock piles of nuclear weapons can assure effective deterrence. This is wrong; the quantum of force required for even massive deterrence is finite, and has been computed by analysts.[2]

In the case of conventional forces, arms racing is certainly likely unless specific mutually agreed measures are adopted by potential adversaries on a bilateral or regional or global basis.

5. Deterrence Stability

Any attempt to automatically transfer certain doctrines of the bipolar era into a multipolar future has to be analyzed carefully. To assume that nuclear war has become fightable or winnable in a multipolar

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[1]Kenneth N. Waltz, "What Will Nuclear Weapons Do to the World?" in John Kerry King, ed., **International Political Effects of the Spread of Nuclear Weapons** Washington D.C. : US. Government Printing Office, 1979 p. 188.

[2]Geoffrey Kemp, *Nuclear Forces for Medium Powers*, **Adelphi Papers No. 106** (London: International Institute for Strategic Studies)

situation or that a preemptive first strike has now become feasible without axiomatic consequences leading to dangerous ecological degradation would be wrong. Would a larger number of possible nuclear adversaries, severally or in varying combinations and alliances cause instability? Would it induce increases in nuclear stockpiles? If increases occur would they be modest or open-ended? in short would it lead to a spiraling nuclear arms race? These are pertinent questions and have to be addressed.

Richard Rosecrance considers the military requirement in a multi-polar state thus: "Multipolar stability cannot technically be obtained unless each state or bloc is able to deter others from attacking. At the extreme, this means that each should be able to retaliate against any or even all the remaining powers in the system; more realistically, it requires that a state have the capacity to destroy or severely hurt any possible combination of its likely enemies."[3] Some analysts believe that every potential aggressor state will have to take into consideration that post-aggression, its own nuclear capability and power would at least temporarily be degraded and the effect that this would have on its own vulnerability vis-a-vis other powers of the region which had stayed out of the conflict, but are its potential adversaries. It is therefore argued, that the level of damage that would be required to be inflicted against an adversary to obtain a given level of deterrence would be lower in a multipolar situation than had a bipolar situation existed.[4] Before further analysis, let us examine the likelihood of alliances forming, and taking conjoint or orchestrated nuclear action against a nuclear adversary.

We have been used to the idea of alliances fighting either powerful single countries or adversary alliances in the pre-nuclear era. In the post nuclear era also alliances did face off, but did not fight. These post nuclear alliances were also qualitatively different from the pre nuclear ones. During the cold war these alliances had two preeminent superpowers leading them. On the side of the Warsaw Pact, only the USSR had nuclear weapons and controlled their use. In the case of NATO too, this was essentially so with the control resting with the United States, although the token British deterrent (and later the French force-de-frappe) did make a theoretical difference, but none in practical terms to the supreme control of the USA. These were therefore not truly alliances of equal states defined thus: States all and each of which could undertake activity that might trigger adversary reaction that could cause exceedingly severe damage through nuclear weapon use to some or all the states of their own alliance. These so called alliances were essentially two powerful states with adherents who were less than equal. This bitter pill was somewhat sugar coated in NATO without essentially changing the roles of supreme leader and camp follower; it was stark and without any attempt at camouflage in the Warsaw Pact. The question to be answered is: 'In a multipolar milieu, can meaningful alliances of nuclear weapon powers form, against other nuclear weapon powers, given that any automatic inter-linking of the nuclear action-reaction sequence might very probably cause unacceptable damage to one's own country and people?' Under these circumstances, any light hearted repetition of old formulas such as 'an attack on country 'A', my ally, will automatically be considered an attack on my country' seem highly unlikely.

Even in pre nuclear days when the scale of damage in conventional total war was rising, one saw the extreme reluctance of say, Neville Chamberlain's Britain to live up to professed obligations to some of the European powers at the cost of crossing swords with Hitler's Germany. As damage potential of even conventional war rises still more with today's conventional technologies, we see that the willingness to accept hurt for the sake of altruism is palpably decreasing; one can see national reluctance even on the part of the so called great powers to accept damage and hurt except possibly when their innermost core interests are threatened. Further, even the perceived extent of the innermost core interests is shrinking. For the present therefore it would be fair to conclude that tightly knit coalitions are most unlikely to form in a multipolar world of somewhat autonomous nuclear powers to confront other nuclear powers. There may be coalitions which form against states that have no nuclear weapons. These can be lectured, hectored, coerced, and if necessary militarily attacked without any danger of severe damage to the

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[3] Richard Rosecrance, *"Strategic Deterrence Reconsidered"*, **Adelphi Papers No. 116**, International Institute of Strategic Studies (IISS), London.

[4] Op. Cit. 2, Geoffrey Kemp, **Adelphi Papers No. 106.**

homeland of the 'avengers'. It is quite possible that loose groupings might form which avow common aims and generally make noises about consulting about the situation when any member is attacked, hoping vaguely to deter the aggressor (if it is a nuclear power) without committing themselves to any automatic nuclear action reaction sequence in advance. If this be so, there would be no need for any nuclear weapon power to assume that it needs a substantial addition to its nuclear stock pile to deter a multiple threat from more than one adversary. The multiple threat is most unlikely to take the form of a coordinated and premeditated nuclear first strike; so the size of the first strike against which survivability of the second strike has to be measured need not be unduly inflated to the combined might of all potential adversaries. One has to constantly remind oneself that in war-fighting more is generally always better, but in deterrence more is not better if less is adequate. Should deterrence unfortunately fail and a nuclear exchange takes place between two nuclear powers, the theoretical possibility of a third nuclear power doing a 'hyena act' by threatening to use or using nuclear weapons on one of the stricken countries with whom it had a score to settle cannot be gainsaid. However, such a brazen act in today's world, to say nothing of tomorrow's appears to be a far-fetched nightmare, belonging more to a think tank simulation than to the real world. Even if this kind of contingency has to be catered for, a steep increase in the level of nuclear stock piles is unnecessary; a small marginal increase to take care of a hyena contingency might be more likely.

6. Stability in Situation of Clandestine Proliferation

There is a general fear in the West, that clandestine proliferation could occur, specifically designed to destabilize strategic stability. Thus, it is believed that security strategies will have to be worked out to deal with such situations. The international policy for preventing proliferation, by which one really refers to US and thus Western policy, has so far been dominated by attempts to tackle the supply side, without conspicuous success. There may be advocates for stronger punitive measures. Punitive measures could fall into four categories: political, economic, technological and military. Punitive actions have a high probability of success only in the case of nations that are below a critical size or level of various ingredients of national power. To name only a few, these ingredients are geographical spread, growing seasons, population, natural resources, economic, technological and industrial levels, military power, and political organization. If nations are above the critical level in these ingredients, punitive action may for a while appear to give results; but in the medium to long haul will be decisively counter productive.[5] Notwithstanding the disappearance of the Soviet Union and the USA being left as the lone super power, the state of the world is vastly different from the period when Great Britain produced such effective results from gun-boat diplomacy. Any US attempts at emulation in today's world will be messy, even when dealing with small powers

The demand side of the equation, the assuaging of the genuine security or socio-economic concerns of potential proliferants by credible international guarantees and reform must get at least equal emphasis, if not priority over the supply side. This must be accompanied by Confidence Building Measures (CBM) initiated by the 'nuclear haves' led by the US, such as:

- A genuine and credible effort on the part of the U.S.A to reduce its own nuclear arsenals to drastically lower levels than presently contemplated, and persuading the four other legalized nuclear weapon powers to also do so. The current American position that it is physically impossible to dismantle more than 2000 warheads a year and hence announcing further cuts are not possible is disingenuous. If this be so, additional warheads could be taken out of the inventory and stockpiled separately under

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[5] For an elaboration of this theme, see Sundarji, *" Changing Military Equations In Asia : The Relevance Of Nuclear Weapons"*, in University of Pennsylvania's forthcoming book , **Bridging the Non-Proliferation Divide : The United States and India**, based on the proceedings of an Indo-US seminar held at the Center for the Advanced Study of India, University of Pennsylvania, October 3-6, 1993, under publication by the University Press of America 1995.

international safeguards till these can be dismantled. A statement of intent that Universal Nuclear Disarmament would be the eventual goal, would have a good psychological effect.

- A non discriminatory universal CTBT, with no loop-holes for the privileged.
- Universal cut off of weapon grade fissile material production, with non discriminatory inspections.
- A No First Use declaration by all nuclear weapon powers. There are understandable reservations on this in the USA. These could be overcome by ensuring that the declaration does not preclude nuclear retaliation against any country making proven first use of CW. In all other cases, the right to first use could be subject to prior UN approval.
- A demonstrated willingness on the part of the North to negotiate a more equitable world economic order.
- Equitable sharing of costs of imposing measures to prevent further deterioration of the ecology, between the developed and developing worlds; bearing in mind that the present crisis has been created by the rapacity (might be unwitting) of the developed, and the enforced measures will increase the cost and retard the pace of development of the backward.

These aspects have to be borne in mind when designing arms control regimes as part of the overall design for ensuring strategic stability in the planned world order. Punitive security strategies to check clandestine proliferation might not work in all cases.

7. World Order in the 2000s

There are a number of theories that are being projected about the type of world order that is likely to prevail in the 2000s. These range from models that are quite revolutionary, to those that are futuristic but not conventionally evolutionary.

7.1. The Demographic Explosion Model

The population of the world in 2100 is estimated to be 10 billion. Of these, the developed world would have a little over one billion, and the developing world almost 9 billion.[6]The population of the prolific black, brown and yellow races is going to explode. AIDS, before effective measures are found for combating it, may control this explosion somewhat. The World Health Organization has recently raised its estimates from the former 25-30 million HIV positive cases globally by the year 2000, to 40 million. Fully 90 per cent of these cases would be in the developing countries, mainly in the poorest ones.[7] Paul Kennedy, refers to a 1992 report, by Harvard epidemiologists in which the estimate has been raised to 100 million, with more in Asia than Africa.[8] Nonetheless, it is estimated that "Africa's overall population would still be growing rapidly ... in the midst of an appalling scene in which millions of people were dying of disease."[9] It is expected that there would be a population explosion, and migration of populations from Asia, to low-density areas in Africa, the Americas and Australasia. This surge can neither be halted by tight immigration laws, nor even by the use of WMD.

The Industrial Revolution in Britain, came almost concurrently with Malthus' pessimistic *Essay on Population*. A medium to long term escape for the fast growing population of his time became available, by increased industrial production and higher per capita incomes, which over time altered life styles and slowed population growth. Will industrialization do the same for the poor agrarian societies that are facing today excessively rapid population growth? Some analysts think not; they believe that the new

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[6] The *Economist*, January 20, 1990, p. 19.

[7] L. K. Altman, "W.H.O Says 40 Million Will Be Infected By AIDS Virus by 2000", *New York Times*, 18 June 1991.

[8] Paul Kennedy, *Preparing For The Twenty-First Century*, New Delhi: INDUS Imprint of Harper Collins 1993, p.28.

[9] Ibid.

technologies that are burgeoning today are of a kind that can be exploited only by the affluent countries of the North and will not be of substantial benefit to the very poor countries; "Marvelous though the technologies behind the new agricultural and industrial revolutions may be, they neither offer solutions to the global demographic crisis nor bridge the gap between North and South."[10]

If countries like China and India do succeed in industrializing and bring down the rate of growth of population, then it is claimed that the damage to the ecology would be disastrous. According to one calculation, the average American baby represents twice the environmental damage of a Swedish child, three times that of an Italian, thirteen times that of a Brazilian, thirty five times that of an Indian, and 280 times that of a Chadian or Haitian because its level of consumption throughout its life will be so much greater.[11] Even with their low level of industrialization and per capita consumption, China and India are said to be even now, the world's fourth and fifth largest contributors to the annual increase in the greenhouse effect.[12] The effects on the ecology of various factors and their consequences are looked at in the next model.

7.2 The Ecology Based Model

Let us assume that the effects of global warming, due to carbon-dioxide emissions caused by the promiscuous burning of fossil fuels; the 'ozone hole' etc., are as per median forecasts. Even so, there will be a small but disastrous rise in world temperatures. This would lead to the desertification of the present grain belt in the Northern Hemisphere and to the opening up of growing seasons in the more frigid North, such as in Siberia and in Northern Canada. Nevertheless, the latter will not compensate for the former loss. The same phenomena would lead to the melting of the polar ice-caps, resulting in the submerging of many coastal areas and the increase in the supply of liquid water in the oceans. However, this would not compensate at all for the loss of potable water or of water suitable for irrigation. The desalination of sea water, or the towing of icebergs to areas of potential use are all fuel intensive operations. And that is where the entire problem began -- the over-use of fossil fuels. There is scope for other types of power -- nuclear for one, which does not entail carbon-dioxide emission but as of today's technology, it needs a lot of water! Therefore, water may emerge as the key. And unlike energy, there is no alternative to water.

Suppose that water is the key, and it is such a rare and irreplaceable commodity that it has to be handled like crude oil! Futures, cartelization etc., -- the new compulsions would force new rules and create new bed-fellows. Will there be a reordering of the world power structure taking cognizance once again of geographical size and the size of the population of countries, along with their natural endowment of resources? Naturally, in such a dispensation, the power quotient would get multiplied by their economic and technological progress; but there would be no hopes of big power status for geographically small countries with small populations.

7.3. The Powershift Model

As defined by Alvin Toffler, "A power shift is a transfer of power. A 'powershift' is a deep-level change in the very nature of power."[13] He considers that there are three sources that form the power triad: Violence, Wealth and Knowledge. He concludes that, "Knowledge itself is not only the source of highest quality power, but also the most important ingredient of force and wealth... This is the key to the powershift that lies ahead..."[14]

Toffler believes that in any political system, there has to be some congruence between the way people make wealth and the way that they govern themselves. If a knowledge-based economic system is rapidly

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[10] Ibid. p. 94.

[11] P. R. Ehrlich and A. E. Ehrlich, *The Population Explosion*, New York: 1990 p. 134.

[12] *World Resources 1990-91*, p. 345.

[13] Alvin Toffler, *Powershift* Bantam Books 1991.

[14] Ibid. p.17

taking over from the erstwhile 'smoke-stack' industry based system, it is inevitable that concomitant changes would occur in the political systems too. What are the changes likely to be? He first looks at the industrial world. "...there is mounting evidence that giant firms, backbone of the smokestack economy, are too slow and maladaptive for today's high-speed business world." In addition the other advantages of big size are also dwindling. "... savings that sheer size once made possible are fading as new technologies make customization cheap, inventories small, and capital requirements low... 'diseconomies of scale' are catching up with many of the bloated giants...huge firms will become more dependent... on a vast substructure of tiny but high-powered and flexible suppliers." What is this doing to the forms of organization in the business world? He believes it "... flattens the hierarchy rather than extending it upward. It will be based on networks of alliances, consortia, specialized regulatory agencies... 'low-rise' architecture."[15]

Looking at the concomitant changes in the political sphere, the same pressure towards decentralization is visible; however, the habitual urge towards high-rise architecture in institutions is more evident. He says, "A clear example of vertical organization is the European Community, which seeks in effect to build a supra-government that would... reduce the present countries of Europe to the status of provinces.... A more revolutionary approach would be to lace existing organizations in each of these regions together, without imposing a new layer of control." As far as 'national governments' are concerned, "After half a century in which governments continually took on more tasks...leaders as different as Republican Ronald Reagan and Socialist Francois Mitterand began to systematically strip away government operations or functions...."[16]

A very interesting result of the changing system of making wealth, is the rise of mega-firms. He says, "The liberalization of finance has encouraged the growth of some six hundred mega-firms, which used to be called 'multinationals'... the term is obsolete.... Mega-firms are essentially non national."[17] He explains that till recently multinationals used to 'belong' to a nation. For example IBM was unquestionably American. Under the new system it is very difficult to say this. IBM Japan is in many ways a Japanese firm he says. Similarly, General Motors is the largest stockholder in Isuzu. Management consultant Kenichi Ohmae writes: "It is difficult to designate the nationality of... global corporations. They fly the flag of their customers, not their country."[18]
This will have profound implications for third world attitudes. Toffler writes, that changes like these will force us to rethink such emotionally charged concepts as economic nationalism, neocolonialism, and imperialism.

With the diminution of power of the nation-state, he believes that it is inevitable that there would be entities other than countries who would demand a say in the affairs of the world. He has identified three: "First, with the resurrection of religion globally, there would be leaders like Khomeini who claim to speak for religious blocks that run across national frontiers..."[19] The second force he believes would be international crime, typified by the drug cartels that he calls the Empire of Cocaine. He quotes James Mills who writes: "... the Under-ground Empire today has more power, wealth, and status than many nations. It flies no flag on the terrace of the United Nations, but it has larger armies, more capable intelligence agencies, more influential diplomatic services than many countries do."[20] The third would be the mega-firms, which being non national cannot look to any country to come to their aid when their

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[15] Ibid. p. 457

[16] Ibid. p.252

[17] Ibid. p. 454

[18] "Borderless Economy Calls for New Politics," by Kenichi Ohmae, *Los Angeles Times,* March 26, 1990.

[19] Op cit. 13, Toffler, p. 452

[20] Ibid. p. 453

operations are being jeopardized by any other country. The CIA's de-stabilization of Allende in Chile at the behest of American companies in the 70s is unlikely to be repeated when firms are not tied to nations. But firms will not meekly walk away from their investments; he believes it quite possible that the corporate 'condottieri' might decide to put in their own brigades. Nations are proving inept at handling religious frenzy and organized international crime. They are just as likely to find themselves helpless against unilateral actions by mega-firms too. Therefore he writes: "Clearly we are headed for chaos if new international laws aren't written and new agencies created to enforce them -- or if key Global Gladiators, like the transnational corporations, religions and similar forces are denied representation in them."[21] The United Nations too he says, can no longer continue to be just a trade association of nation states. We cannot continue to extrapolate for the future in a linear fashion from the present world order.

7.4. Model Based on Clash of Civilizations

The model based on the clash of civilizations, is a theory that Professor Samuel P. Huntington postulates.[22] He asks, "What will be the fundamental source of conflict in this new world?", and goes on to answer, "My hypothesis is that it will not be primarily ideological nor primarily economic. The great divisions ... will be cultural .... The clash of civilizations will dominate global politics. The fault lines between civilizations will be the battle lines of the future."[23] He looks at the broad groups of civilizations, as Western Christianity, Orthodox Christianity, Islam, Confucian and Hindu. Of these, he anticipates a tactical accommodation between the Confucian and the Islamic civilizations. The Hindu is not so drawn to the Confucian-Islamic, and may be drawn towards the Western Christian; but none of these groups can expect to be accepted by the Western Christian, except perhaps the Eastern Orthodox Christian.

7.5. Applicability for Short Term Assessments

For any short term forecast, say for fifteen or twenty years, it would be safer for us proceed on an extrapolation of the present dispensation, bearing in mind at the same time, the changes that are likely in the longer haul. The conclusion drawn by Michael Lind appears to be the best one to follow for the short haul. He writes, " ... the world is not entering an era of harmonious global interdependence and genuinely liberal democracy. While the stakes will be lower, global competition will increase: geo-economic competition between the leading economic powers will interact in complex ways with geo-political competition involving them with less prosperous but militarily significant great powers.... In the most advanced industrial nations, the new catalytic state, by its very nature, will encourage the evolution of technocratic elitism, while in the newly marketizing great powers, such as Russia, China and India, authoritarian legacies along with geopolitical and developmental imperatives will probably produce variants of plebiscitary or dominant party democracy with praetorian underpinnings."[24] The key question to answer is, 'What are the ground rules going to be?'

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[21] Ibid. P. 456

[22] Harvard University, John M. Olin Institute for Strategic Studies: Project on **The Changing Security Environment and American National Interests: Working Paper No 4 January 1993** *The Clash of Civilizations?* By Samuel P. Huntington

[23] Ibid. Pp. 1-2

[24] Op cit. 22, **Working Paper No 1 January 1993** *New Modes and Orders: State and Statecraft in a Changing World*, by Michael Lind pp. 45-46

7.6. World Order 1995-2015

During the period 1995-2015 as the world moves towards greater multipolarity, the USA will continue to be preeminent. So we have to deduce what the USA's aims would be during these decades and what kinds of policies it is likely to adopt in pursuing those aims. We will also have to guesstimate what the aims and interests of the major South Asian countries, Pakistan and India are during the period.

Strategic perceptions cannot be examined strictly by regions. The intersection of circles of interest of states, whether they are those of states with only local concerns, regional or global concerns is axiomatic. For example, in South Asia, the circles of concern of India and Pakistan will intersect. Even if India is considered to be only a regional player, its circle of concern will include China. China's circle in turn, would be large enough to cover the USA and Russia at least. If this inter-connection, is all the way from the local, through the regional to the global spheres, then unless strategic stability models take cognizance of such inter-relation, they would fail in their purpose. So, we will have to analyze in similar fashion the likely aims and policies of China also. Before we can begin that kind of exercise, we need to try and find the best answers that we can to a few important questions.

7.7. Assumptions -- Geopolitical

7.7.1 *Questions.* By 2015, would the world order be such that:

- The world would be moving towards world government and the United Nations would have been considerably strengthened towards that end?
- Nationalism would have withered adequately for nation-states to regionally federate?
- Nationalism would have at least weakened insofar as nations would be willing to give up some of their sovereignty, to be part of regional groupings?
- Nationalism would still be so strong that nations would be loath to give up any sovereignty?
- Economic colonialism and technological colonialism would have been ended voluntarily by the nations of the North? Or would the North have to be coerced by the South to achieve a 'New International Economic Order'?
- To what extent would unconventional force, such as proxy war by sponsored insurgency, subversion and terrorism including narco-terrorism be usable by nation states against adversary states as instruments of policy in the period 1995-2015?

7.7.2 *Guesstimates.* Just because the cold war is over, it does not mean that geopolitics will not count or that realpolitik has been legislated out of existence. It is true that after the Soviet Union has ceased to exist, the USA continues to be the only global power, albeit with somewhat inadequate economic means. However there would be some clash of economic and technological interests between the USA and its Western allies and Japan. China and other emerging powers or groupings would also figure in the overall equation. There could be clashes in the approach to ecological issues.

The UN may be strengthened, but not enough to so credibly, fairly and effectively police the world that nation states would disarm totally. To this extent, nationalism would still be alive. Nationalism is also likely to get a boost from the war in Bosnia.

Too many federal coalitions are unlikely. Western Europe, where the conditions were most propitious for such a step, is nevertheless displaying all the psychological and sentimental barriers that are natural and have to be overcome. Loose confederations are more likely, with individual states being under the pressure of similarity of self interests. Some indications of this trend are visible in Southeast Asia and the Asia Pacific Region.

It is most unlikely that the North will willingly or voluntarily end economic and technological colonialism. Klaus Knorr in discussing why the South had made such little progress in its demands for a New International Economic Order {NIEO) writes, "Why had the South failed to achieve more decisive advances in line with its collective demands on the North?....The general answer to the preliminary question is obvious and banal. The weak always tend to find it hard to wrest significant changes in the

status-quo from the strong."[25] All the same, 'haves' must realize that the 'have nots' cannot be quarantined in perpetuity in a ghetto and kept sanitized. Foul emanations from the neglected ghetto, from uncontrollable efflux of populations to an uncontrolled fouling of the environment endangering the ecology of the whole planet will invade their affluent and aseptic segment of the planet. Northern stubbornness, could force the South to export terrorism, including nuclear, biological and chemical terrorism.

The disappearance of the Soviet Union as a counter weight to the USA, has imparted a boost to American bullying capacity and the USA may possibly gang up with the OECD powers in maintaining first world advantages in the world economic dispensation. This would force other nations to form cooperative groups for political, economic and security reasons, as they cannot hope to cope with this juggernaut by playing a lone hand.

The unholy alliance between narcotics and terrorism has unfortunately given both a fresh lease of life. To narcotics by its masquerading as the fund-raising element of 'National Liberation' movements, or movements for 'self-determination'. To terrorism, because its original and possibly genuine causes are no longer germane; and hence democratic attempts to remove socio-political and economic grievances are unlikely to succeed. Hence, we must expect that this kind of activity would continue into the next decade. Foreign country inspired insurgencies are also likely to continue, being low cost options which most non-status-quo countries would be loathe to give up.

However, when looking at the next twenty or twenty five years, the picture might be somewhat more optimistic. I would first state emphatically that these kinds of activity other than terrorism by imported teams in alien countries can neither succeed nor will be attempted unless there is fertile ground for it in the target country. In the case of alien terrorist teams, there has to be sufficient cause and adequate despair to motivate the 'aggrieved' to act against great odds in a hostile country, especially one without local sympathizers. In all cases therefore, the first order of business ought to be to eliminate the causes. Having said which, however, there has to be deterrence at the global level. This will call for severe punitive action by the world community against delinquent states. Past inaction by the USA and the USSR, was because terrorist states were tolerated as allies. With the end of the Cold War, this tendency will fade. There is good hope that as the decades roll by, the use of insurgency and terrorism as instruments of policy will decrease.

7.8. ASSUMPTIONS -- ARMS AND ARMAMENTS

We must get at least tentative answers to questions such as, by 2015, is it practical to expect that:

- The world would have achieved universal nuclear disarmament?
- Universal disarmament of conventional weapons (other than those of national police forces) would be achieved?
- Chemical and biological weapons would be banned?
- The deployment of weapons in Space would be successfully proscribed?

7.8.1 *Analysis of Likely US Policies.* The answers to all these questions are going to depend very largely on the attitude of the USA and the leadership it provides to the world during the coming decades. Let us assume that the almost defunct Commonwealth of Independent States by some magic becomes more functional, retains all the nuclear weapons of the erstwhile Soviet Union, and improbably turns anti American. Even this cannot pose a threat to Western Europe like what the Soviet Union could. With any other outcome, including a Russia back under the control of non-penitent communists, the threat to the USA will still be much smaller than what it was in the bad old days. Economic and technological rivalry and competition between the USA and Germany or Japan or Europe leading to a military confrontation is unlikely. Even if one occurs, it cannot be sudden and will give the USA more than adequate reaction

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[25] Op cit. 1, Klauss Knorr, *"North-South Relations in a World of Many Nuclear Powers"* in, **International Political Effects of the Spread of Nuclear Weapons,** p. 30.

time. The same argument applies to any possible regional power strengthening itself to an extent that might challenge US interests militarily. Thus, there is no case for the USA retaining a massive nuclear stockpile. The future of the world could depend upon how the USA handles this opportunity for statesmanship. For analysis, we will use three assumed US choices; the first, providing the best option for disarmament and arms control in the world; the second the next best option and the third the worst.

- The first scenario: Under the leadership of the USA:
  - The USA and Russia, cut back their nuclear arsenal to 10% or less of their original levels.
  - The Ukraine, Kazakhstan and Belarus are made to give up their nuclear weapons.
  - Nuclear arsenals of China, Britain and France are capped at the present levels.
  - All the five so called legitimate nuclear powers give up privileged treatment in production of fissile material, or avoiding intrusive international inspection of all facilities. They accept a non discriminatory comprehensive test ban treaty, and agree to 'no first use'. They accept that their nuclear forces could be manned by their respective nationals, but be placed under UN control to the extent that the five countries pledge not to use them or threaten to use them against any country without the approval of the UN.
  - It is ensured that the UN Security Council is neither hijacked by a big power or the coterie of a big power to sub-serve its parochial interests rather than the interests of international justice. This might be achieved by stipulating that military force can be used against a state under UN auspices, only if 4 out of the 5 veto powers actually vote to do so. There could also be legislation to prevent any single country commanding any UN force set up to enforce such intervention, so that there is no danger of its running away with the bit in its teeth. Likewise, the Council should be prevented from being held to ransom by the unreasonable veto of any single country possessing the veto. While taking away the veto from the present five may not be practicable at present, enlarging the number of veto powers may not be the answer, as it would give a fresh lease of life to the concept of a caste system in international affairs. What could be a better solution would be for the veto to be effective only if three out of the five veto powers use it. This kind of arrangement would also be to the advantage of all the veto powers including the USA. It is downright dangerous to give such a capability to a maverick power to paralyze the UN -- one never knows what the future holds; it might be any veto power that turns maverick, China, Russia, France the UK or the USA.

This kind of situation would be close to the ideal and constitute a giant step forward towards confidence building in the world. It would accelerate the abolition of chemical and biological weapons; help proscribe the deployment of weapons in Space; and greatly help in the field of conventional arms control. It would not however place the big powers totally at the mercy of small and perhaps irresponsible powers; nor would it subject totally the powerful minority to the 'tyranny of the majority' of weak nations. A completely non discriminatory regime may be ideal, but is utopian, and would be unachievable for quite a few decades.

- The second scenario: is generally the same as the first, except that China, Britain and France have capped their arsenals at a slightly higher level than the present. In addition, the nuclear powers do not place their nuclear forces under UN command but retain them under their own national command, while at the same time pledging 'no first use'. This has a better chance of acceptance domestically in the weapon countries than the first, and perhaps would meet most of the objections of countries like India.
- The third scenario: is that the USA only offers apparently big cuts in the nuclear arsenal, such as the reduction to 33.3% agreed to between the USA and Russia, retains very large stockpiles on the excuse that warheads cannot be destroyed any faster than at present; retains a first strike option; and adopts a CTBT that provides for continued laboratory testing.

If the USA chooses the first scenario, it will eliminate the danger to civilization as we know it from mass use of nuclear weapons. The prospects for complete disarmament beyond 2015 would be very bright, as much more trust and confidence are likely to have been generated by that time. In the meantime, it will erode considerably the legitimacy of nuclear weapons as the prestigious coinage of power. This in turn would almost eliminate the incentive for non nuclear weapon powers to attempt clandestine weapon development, especially if coupled with effective and credible international arrangements that are put into place to ensure the national security of all UN members, big and small. This is a much surer method of ensuring abstinence by the non-nuclear powers. In a fair regime, there would be almost total

universal support for tough measures against any nation stepping out of line. This would be a powerful disincentive for those inclined to cheat. The world's discontent quotient in my estimation, would have dropped to 25.

If events follow the second scenario, the discontent quotient would be about 50. However, for democratic, moderate, status quo powers like India, even in this situation the incentive to go nuclear would be almost totally absent. In the case of fundamentalist and dictatorial regimes, however, clandestine attempts to produce nuclear weapons will still continue.

In the case of the third scenario, the regime would continue to be thoroughly discriminatory and cynical. Even for the sake of nebulous future threats if the USA feels compelled now, to hold on to a large nuclear arsenal, the message to regional powers with more live and immediate threats, some of them nuclear would be loud and clear. There is no alternative to nuclear weapons and ballistic missiles if you are to live in security and with honor. Those who cannot for whatever reasons go the nuclear and ballistic missile route will have every incentive to clandestinely go the chemical and biological route; it will be open season for international terrorism with nuclear overtones. The discontent quotient would be hovering between 75 and 100. Humankind would have thrown away one more and possibly the last chance to tame the nuclear menace before probable planetary disaster.[26]

8. Assumed International Environment for Strategic Stability Modeling

8.1. ANALYSIS

Michael Lind believes that the world's leading industrial democracies are restructuring themselves as catalytic states, while developing countries and ex-socialist states are abandoning command economics. He writes, "World politics in the Twenty-First century will be complicated not only by the rivalries between catalytic states, but by shifting combinations between catalytic states and those developmental states which remain or become great powers. In this world environment, the United States can attempt to pursue either a 'neo-internationalist' strategy, forestalling geo-economic and geo-political rivalries among North America, Europe and Japan, or a 'neo-nationalist' strategy, which would be more or less openly mercantilist and unilateral." He goes on to state that because the U.S. lacks the economic resources and political will for the former course, it is almost certain to follow the latter strategy.[27]

When the Soviet Union was alive but not so well, and the Gorbachevian thrust towards denuclearization was already visible, he proposed the abolition of all nuclear weapons. The New York Times reaction was, "Are these serious ideas? No, as they concern abolition. In a world of nations that have renounced nuclear weapons, the man with one bomb would be King.... If he were Qaddafi, Libya would be a superpower."[28] The University of New Mexico's Institute for Public Policy, carried out a study in April 1994. This shows, that after the end of the cold war among the general public, 54 percent believes there is now an 'increased likelihood' of nuclear war, compared to only 28 percent who thinks this danger has decreased. The perceived risk of nuclear proliferation, as seen by 63 percent, has also grown.[29] I will

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[26] *Leashing the Nuclear Menace: India's position and First World Responsibilities* by General K. Sundarji, **Foreign Service Journal** Published by the Foreign Service Association Washington DC., June 1992 pp. 35-37.

[27] Op cit. 24, Lind, p.2

[28] *New York Times*, 19 January 1986

[29] Quoted by David Cortright, in *Disarmament: The Public Mood*, **Inforum** Fall 1994, No. 15, Fourth Freedom, Inc., Goshen Indiana.

therefore, make the following assumptions regarding the aims and policies of the USA for the period 1995-2015:

· Avoid universal nuclear disarmament for as long as possible.
· Keep the US nuclear stockpile level comfortably high, not only to reassuringly ensure US security, but for obtaining a domestic consensus.
· Prevent any country other than Russia obtaining large scale missile capability of reaching Continental United States (CONUS) with land-based ballistic missiles.
· Keep the numbers and sophistication of Chinese ICBM as low as possible.
· Keep the numbers and sophistication of Chinese, French and British SSBN as low as possible. Prevent new entrants to the SSBN club.
· Accept no international commitment that would hinder the maintenance and enhancement of US technological preeminence.
· Prevent proliferation of WMD, local arms races and regional wars.
· Retain US freedom to use conventional forces to influence regional situations for safeguarding US interests, without any threat to the forward deployed US forces from WMD of regional powers. This is to be achieved by three means: first, by preventing the emergence of new regional nuclear powers; second, by nuclear deterrence, reinforced by protecting forward deployed forces from regional nuclear attack by the deployment of Global Protection Against Limited Strikes (GPALS); third, deter chemical attacks from regional powers by retaining the right to retaliate with nuclear weapons; this last requirement would demand that the USA should not subscribe to a 'No First Strike' doctrine.

8.2. ASSUMPTIONS

Any realistic attempt to produce a design to mold the world order during the next two decades, will have to be on the premise that:

· The UN is unlikely to be strengthened to the extent that it can so credibly, fairly and effectively police the world that nation states can disarm to any appreciable extent.
· Chemical and Biological Weapons may be banned by all legal nation states, but may be available to so called 'freedom fighters', subversives and terrorists.
· Space would perhaps be successfully kept free of deployed weapons.
· Nuclear proliferation would be inevitable in the case of states having the basic capabilities to produce or smuggle the wherewithal and have perceived threats to their security. This proliferation could be possibly overt, but more probably covert and may proceed to the level of becoming threshold states.
· Nationalism would still be a force to reckon with in most parts of the world, but some regional groupings would form, to safeguard their common economic and possibly security interests.
· Ethnic sub-nationalisms would strive for the formation of new states. Some of these forces, including terrorists may get access to nuclear weapons or lethal fissile materials.
· Forces, such as religious fundamentalism, empires of narcotics and transnational mega firms that are presently outside the world regulatory bodies like the UN etc., will need to be brought into the system and regulated or otherwise dealt with.
· A New International Economic Order (NIEO) is unlikely to come about without a good deal of resistance and a determined rearguard action from the first world.

9. China's Posture And Its Impact On South Asia

China's formal position continues to be that there should be no discrimination between big and small powers, or the strong and the weak in the world and that China will never aspire to be a super power. However, it is quite clear that they do not support the abolition of permanent members in the UN Security Council or the veto. China believes that unless one is strong, it is difficult to uphold principles and the big powers will not respect one.

Similarly, the need for strength for any worthwhile progress towards an equitable world economic and technological order is emphasized. China generally appreciates that the United Nations Organization has become more important latterly and, but is very touchy about erosion of national sovereignty. Similarly, there is appreciation of the need for opening out to the world in economic, trade and technological terms. But, there is deep suspicion of the theories of the 'global village' that are seen as theories propagated by the North to maintain its inequitable advantages over the South. China's prescription is for nations of the South to settle their differences and unite to wrest an equitable order from the North.

In the period up to 2015 AD, China is not sure what exact form multipolarity would take in the world, or which the poles would be. However, China pledges never to seek super power status, but will work towards an honored place in the international community as an equal partner. China once believed that it could not afford to have a large arsenal like the USA, and that it was this attempt on the part of the Soviet Union that beggared it and caused its collapse, and hence all that was required was minimum or proportionate deterrence vis-a-vis the USSR and the USA. The dramatically improving economy of China, and the voluntary acceptance of drastic reductions in nuclear arsenals by the USA and Russia have led China to set its sights anew. Becoming near-coequal in nuclear arsenals generally, if not yet in total military terms, has become achievable. In a multipolar situation, they believe, the USA is less constrained and more bullying can be anticipated.[30]

China's view of South Asia and India, has undergone various changes dictated by its perception of the geopolitical and geo-economic situation in the world, India's guesstimated aims and interests and its own aims and interests. For evaluating the present Chinese attitude towards India and South Asia, we must crank all these variables into the equation. In analyzing current Chinese attitudes therefore, the following backdrop will play a deciding role:

· China no longer sees Russia as its greatest threat. India that was earlier seen, rightly or wrongly as ganging up with the Soviet Union against China, is no longer seen in that light. This, coupled with the fact that India has explicitly accepted Chinese sovereignty over Tibet, is likely to place India in the category of potential friend and supporter than in that of potential adversaries. There are some who think that there has not been a genuine reorientation of Chinese policy with regard to India; that the Chinese speak with different voices depending upon where their visitors are from; India, Pakistan or the USA. I suppose we will have to watch for a period of time before we can discern where the truth is.

· The importance of the USA in modernizing the Chinese economy is not under-rated but, it is not acceptable to the Chinese at the cost of what is seen as unwarranted US interference in the internal affairs of China. The Chinese are confident that because of their importance as a current and potential market for American goods and services, they can expect solid support from US big business and kid glove treatment from the US administration. This is being borne out by recent events. China believes that the US attitudes to 'North-South' questions have hardened and that the South will have to unite and wrest concessions from an unwilling North. In all this, the support of India is seen as invaluable.

· In Southeast and East Asia and in the Asia-Pacific region, the Chinese are quite concerned about the possible Japanese aims and the possible congruence of interests between the Japanese and the USA. Their

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[30] The assessment of China is partly based on the author's visit to China at the invitation of the Beijing Institute of International Strategic Studies in 1991. He had extensive discussions with academics, non officials and officials. He also revisited China in February 1994 and read a paper regarding the impact of international nuclear arms control measures on the Sino-Indian-Pakistan nuclear equation at a workshop held at Fudan University in Shanghai. It was a four cornered workshop, with teams from the USA, China, India and Pakistan. During the discussions, some of the US members were provoking Chinese fears regarding the development of the Indian *Agni* missile. The Chinese reaction, much to US embarrassment was: 'We have no intention of targeting or firing nuclear weapons at India; India will not fire nuclear tipped Agnis at us unless we hit them first; so we are not worried! Why are you, whose country is outside the range of the Agni so bothered? We are the ones who could have been worried but are not!

ability to safeguard Chinese interests, irrespective of the permutations and combinations would be much greater if India's support can be assured.

It is against this background that China's attitude to India and South Asia has to be analyzed. South Asia is seen as India's legitimate sphere of interest and the Chinese accept the primacy of these interests. They are very happy that there is peace in the region.

In the changed geopolitical situation in the world the compulsion for getting India to go along with them as an active and willing partner, in dealing with the North in general and the USA in particular could be a factor.

I am assuming the following would be the Chinese aims for the period 1995-2015:

· As a large, populous country with an ancient civilization, China wants to be in the major league of world powers, by right and not accepted grudgingly as an 'also ran'. China wants to be near-coequal in nuclear arsenals generally, if not yet in total military terms with the other two.

· Keep the number of nuclear weapon powers in the world restricted to the present five, but not make common cause with the USA in this regard, if that country thwarts Chinese ambitions of becoming gradually coequal. The enlargement of the nuclear club might serve Chinese tactical aims of obtaining better leverage vis-a-vis the USA. The Indian and Japanese nuclear stance will have much weight in this regard. The Japanese would be conditioned by the North Korean or a united Korean nuclear weapon capability. This could color Chinese attitudes to North Korean nuclear ambitions.

10. Pakistan[31]

From the Pakistani media, we can see that there is a fairly influential school of thought in that country, that believes that it is no longer a question of keeping South Asia nuclear weapon free, but nuclear weapon safe. The official position in this regard however, still emphasizes a nuclear weapon free zone. With a defacto nuclear stand-off vis-a-vis India, Pakistan believes that it can push its sponsorship of subversion and terrorism in Kashmir and in other parts of India, with reduced dangers of an Indian conventional armed reaction against Pakistan.

In Pakistan and India, there are broadly three schools of thought concerning mutual relations. The first believes the worst; that the other country's ruling elite and people are devious and untrustworthy besides being unreconciled to the very existence of the other. Hence, attempting to find peaceful and lasting solutions will be impossible; the only possible course will be to remain in a wary adversarial stand-off or to balkanize or undo the other country. Many of the people in this group are misguided by propaganda or prejudice, with some cynically committed to this line because of the vested interest of staying in power. It is this kind of thinking that produced the three rounds of war between the two countries. Such wars in the past, in pursuit of policy might have been affordable in the calculation of some. However, today with the near certainty that both countries have nuclear weapons, such wars have the potential of devastating India, and totally destroying Pakistan as a viable state.

The second group consists of those who sincerely believe that the bulk of the population of both the countries consists of good people; that if only we can side-line the wicked ruling elite, and enable large scale contacts between the two peoples, our countries can make up tomorrow morning! This group is larger in India than in Pakistan. It contains idealists who tend to rely more on emotions than reason and a few who exploit this line cynically for their own purposes. In Pakistan, this approach excites enormous fear in the belief that it would lead to the loss of the very reason of Pakistan's separate existence.

The third nascent group consists of realists, who are knowledgeable about war and peace; who have studied nuclear doctrine as enunciated by the big powers, and have arrived at a doctrine that will be workable in the third world context. This group does not share the despair or cynicism of the first group and believes that a fair, honorable and peaceful solution of all problems between the two countries is

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[31] Partly based on the author's visit to Pakistan in 1992, and the discussions that he had, with the media, academics, officials and non officials then, as well as in his meetings with Pakistani colleagues at seminars around the world.

possible. It believes that: war that might lead to nuclear weapon use, is no longer an option that can be lightly chosen by decision makers; results of nuclear weapon use might be terminal in the case of Pakistan, but India too would be grievously damaged; minimum nuclear deterrence in the interim will add to stability and peace; but the only salvation is for both countries to follow policies of cooperation and not confrontation; however, history suggests that the honesty of purpose of both sides will have to be carefully monitored. I agree with this school of thought.

I am assuming that the following would be Pakistan's aims for the period 1995-2015:

· Maintain a 'non weaponized' and 'non deployed' minimum nuclear deterrent to counter India's superior conventional power potential.

· Resist all attempts to force it to sign the NPT, or accept 'capping' and 'roll back' of its nuclear weapon capability. It may claim that it would do so if India also goes along. This would be a bargaining ploy, in the full confidence that India would never agree unless it is a non discriminatory universal regime. {Suppose that India agrees to a bilateral Indo-Pak dismantling of nuclear weapon capability, and Pakistan also does so; Pakistan would lose the level playing field that it has obtained and will be hard put to keep up a balance with India's conventional forces; such an agreement may put India at China's mercy and hence India's refusal to accept bilateralism in nuclear restraint is taken for granted by Pakistan.)

· Maintain an adversarial posture against India, and work for an early pro-Pakistan solution of the Kashmir problem by stepped up sponsored insurgency and international pressure. Only if after prolonged and frantic efforts they fail in this aim, and it also results in poor economic performance and domestic political turbulence, would a cooperative arrangement with India be considered.

11. India's National Aims

India's national aims and vital interests have never been articulated in specific detail by the Government of India. So, before I attempt an analysis of the period 1995-2015, I have to assume certain national aims for that period. What does India want to be, a global player, a regional player or an inward looking isolationist country? Assuming that it wants to be a global player -- though there is no evidence to suggest this -- will the economic wherewithal permit this during the period under discussion?

The GDP projections for China, India and four selected West European countries for the period 1980-2020 were extrapolated by the Economist/IMF, and quoted by Paul Kennedy.[32] The Indian GDP calculated as per the Exchange Rate Method of computation in this projection was a little above 1.5 trillion US (1980) dollars by 2020. Currently, the Purchasing Power Parity (PPP) Method is being claimed to be the more accurate method of comparison of world economies. By this method, by 1992 the Indian economy is already said to be about dollars one trillion (in 1989 US $), in sixth place after the USA, China, Japan, Germany and France. Even so, and notwithstanding India's economic liberalization, and the consequent high expectations of its future economic performance, I believe that it will neither have the wherewithal nor does it have the intention to become a world power in the period 1995-2015. There are no indications that it wants to be an inward looking isolationist power either.

12. India's Internal Threats

Many skeptics might wonder whether India can cope with its internal threats and survive as a nation. First, it is seen as being unable to control the growth of population, that according to popular belief, is exploding and would lead to severe social and economic tensions. Second, given that it is a plural society, and wants to remain a secular state, can it resist the centrifugal force exerted by ethnic, religious, language and other diversities and stay united, in this age of religious fundamentalism and ethnic resurgence?

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[32] Paul Kennedy ***"The Rise and Fall of Great Powers: Economic Change and Military Conflict From 1500 to 2000"***, London: Harper Collins 1989, p.587

12.1. POPULATION

First I will comment on the population problem. Figure 3.[33] Shows the crude Indian birth rate and death rate from 1901 to 1991, based on the ten-yearly Indian census. Dr. Vasant Gowariker a noted Indian space scientist who also successfully pioneered a now proven computer model for monsoon predictions has been working on modeling India's population data. He has incorporated the best among demographers etc., in helping his study, based on the Indian census and a host of other Indian indicators of trends. These, he believes are quite different from those that demographers generally use, which are based on the Western experience during and after the Industrial Revolution

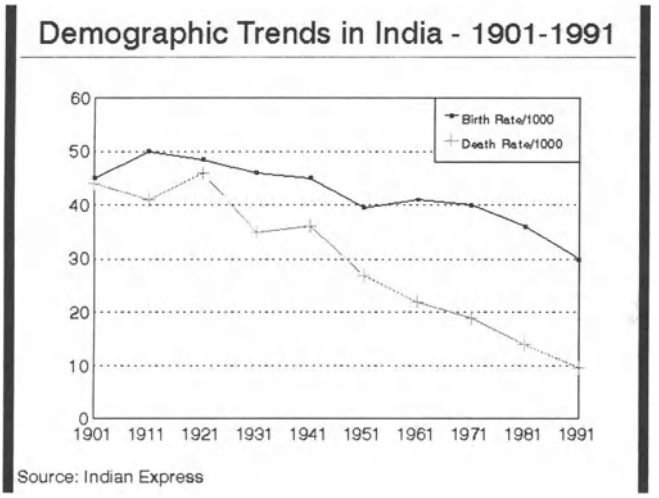

Figure 3

His findings[34] are summarized below:

· Demographic transition in India has already set in, and is moving swiftly to its final stage.

· By 2000 AD, the crude death rate will reach a figure of 8, which is a level comparable to that of many countries with a stable population.

· The birth rate while still high, has already started showing a classical pattern of sharp decline in both urban and rural areas. By 2001 the rate will decline to 21 per thousand.

· The second phase of transition is very much in evidence. He predicts that India will reach the threshold of the Net Reproduction Rate of 1, within a decade from now.

(He estimates the maximum margin of error in his computations at no more than 10%.)

12.2. CENTRIFUGAL FORCES

India is a secular multi-ethnic, multi-lingual, multi-religious plural society. The geographical boundaries of each of these 'multis' are different and do not coincide. Hence the result is more like a resilient, bonded plywood rather than a brittle jigsaw puzzle, where the saw has cut through all the plies at the same places. India also has a strong sense of culture in the civilizational sense, if not nationhood in the modern sense, which goes back into the mists of time. The state per se has waxed, waned and fragmented and reunited at various times in history. Indian society has been caste based for thousands of years, and this is not

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[33] *Indian Express* July 25, 1993.

[34] Ibid.

confined to Hindu society. It is also prevalent in almost all other communities which consist of Hindu converts, in some form or the other; and almost all communities in India are fundamentally Hindu converts, though many of them will deny this for psychological or political reasons. Nonetheless, these caste groups in the various religions are active and retain their identity, Christianity came to India perhaps in 32 or 33 A.D., and that was long before it went to any part of Europe; nonetheless, these Christian communities still very largely only marry within their original castes. The Moslems are no exception. That these ready-made 'interest groups' in the form of caste groups would be exploited in democratic elections based on universal adult franchise was a foregone conclusion. This was especially so, in a society in which over 80% of the population at independence used to be in the unorganized agricultural sector, and in which there were no trade or craft guilds. Caste-based politics are metamorphosing however slowly, to economics-based politics. All these factors have to be constantly borne in mind by those who observe the heat, dust and superficial chaos of Indian democracy in action. It kindles hope and expectation in the unfriendly observer, of an early coming apart at the seams. To the well-meaning one also, if he is uninitiated, balkanization will appear imminent. But foreign policy planners of other countries may as well realize that India is unlikely to disappear as an entity.

13. India's External Threat Perceptions

13.1. Economic Threats

What are India's aims likely to be regarding the so called North-South problem and the new international economic order? Does this problem really exist or is it merely a hangover from colonialism and the ideological battles of the cold war, which has no relevance in today's global village with integrated world trade? If India decides that there is a problem and the developing countries do need to get a better deal from the developed ones, how altruistic is it prepared to be in such a struggle, even if it hurts its national self-interest in the process? Will it modulate its championing of the third world cause up to a point where it does not hurt it too much? If its domestic economic reforms work out as expected and it closes up to the 'haves' in the first decade of the Twenty-First century what would its choices be? These are questions that have to be analyzed and answers found from time to time. I rather suspect that regional interests will reign paramount during this period.

13.2. Geo-Political and National Security Threats --Global

The external security environment may be seen in two different international security scenarios. The first would be a generally benign one, and could come about if the USA chose either the first or second options discussed earlier. In this case, India might consider remaining in a state of *Existential Nuclear Deterrence*, by staying unweaponized and undeployed, but capable of rapid enough transition to a second strike capability if subjected to a nuclear first strike.

If the USA chooses the third option of retaining a fairly large nuclear stockpile, or retaining the right to make a first strike; or accepts only a loop-holed CTBT; then, India facing serious nuclear threats from many quarters, cannot but opt for a minimum or proportionate nuclear deterrent if it is to live with security and honor.

I am proceeding on the worst case scenario; that the USA adopts the third option, and adopts an overbearing approach to India, using a mix of inducement and threat, with threat dominating the blend! First, it might attempt to force India to sign the Nuclear Non Proliferation Treaty in its present form or with cosmetic modifications. Second, it might try to make India give up the quest for developing frontier technology that the USA construes as having military applications. That this would in effect eliminate a possible future competitor to the developed world would be gleefully accepted as a spin off benefit, but would be officially decried as untrue; the suggestion being made that it is the figment of third world

paranoia. The third, might be to open up the Indian market to unrestricted foreign trade. The fourth, would be not permitting a change in the world's present economic rule book that is in favor of the first world. Fifth, would be a threat of a nuclear first strike if there is any possibility of Indian interference, even non-nuclear, with US deployments or military activities in the region. Not all of these need occur; only some might. Many of such irritants could coexist with attempts at genuinely building a better relationship between the two countries.

13.3. THE INNER RING -- CHINA AND PAKISTAN

There is no major clash of vital national interests between India and China. There is no cause big enough for the threat or the actual use of nuclear weapons by China especially if India has a minimum nuclear deterrent in place, even if it is a non-weaponized and undeployed one. The border dispute does not fall into this category and can be resolved in time, by give and take. In the event of the USA adopting a tough line with India, the latter would very likely cooperate with China in resisting US pressures without painting itself firmly in the Chinese corner. There is scope for agreement on mutual limitation of nuclear stockpiles deployed or otherwise, and conventional force reductions in terms of forces deployable against each other, by China and India.

In the short haul, there would be a fairly considerable threat from Pakistan. This is due to the exaggerated expectations entertained in that country, of the moral impact of its acquisition of nuclear weapons; and the resultant exuberance in fostering and supporting terrorism and insurgency in almost every state of the Indian Union. The assumed de facto mutual deterrence between India and Pakistan during this period, has among other things, given Pakistan the advantage of freedom to actively sponsor a higher level of insurgency in Kashmir than before. Post 1965, the Indian strategy for dealing with this kind of situation was clearly spelt out. It was: 'Interference in Jammu and Kashmir beyond a point will be considered an act of war and we reserve the right to counter attack you with conventional forces in heartland Pakistan, and you shall suffer terribly. So please do not go all out to stir up trouble in Kashmir'.

Pakistan understood this well and after 1965, desisted from interfering on a large scale in Kashmir till 1988. This twenty three year abstinence in Kashmir was not only caused by the defeat of Pakistan in the 1971 war with India, but also by the certainty of India raising the stakes and going in for a conventional counter offensive against Pakistan. This remained credible even after Pakistan's armed forces were refurbished and modernized by the USA commencing from 1979-80 after the Soviet invasion of Afghanistan. It is no coincidence that the Pakistani master plan for massive insurgency in Kashmir was put into effect from 1988, when the de facto nuclear stand-off also started taking shape. Mutual nuclear deterrence was seen by Pakistani planners as giving them the benefit of a more level playing field vis-a-vis India. Indian conventional superiority would be tempered by the possibility of conventional war degenerating into a nuclear exchange between the two countries, in which both countries would suffer grievous damage. 'Therefore', thought the Pakistani planners, 'the Indians would put up with a good deal more of our covert or even overt interference in Kashmir than in the past; who knows, they may even lack the gumption to go to conventional war however much we might provoke them!'.[35]

There was some validity in this Pakistani thinking. However there was danger in the possible ascendancy in decision making, of the extreme group among Pakistani planners that held the belief that the Indians would never have the guts to risk a Pakistani nuclear riposte. This might lead to a recklessness in Pakistani provocation that might inevitably lead to a nuclear exchange between the two countries. However, as they think the nuclear equation through, and as the unusability of nukes in a proactive situation becomes evident, there is bound to be a toning down of this exuberance. That a mutual minimum nuclear deterrent situation does not mean that India loses all options of conventional reaction in response to rising levels of Pakistan inspired insurgency and terrorism in Kashmir and the Punjab or elsewhere in India, will also sink in with time. This would further cool ambitions. Admittedly, the impact of any

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[35] See, General K. Sundarji, *"Is Pakistan's Nuclear Deterrence Losing Credibility?'*, **Indian Express**, 15 September 1994

benign changes in Indian policy will be slow in making an impression on Pakistan, given the high level of mutual distrust. However hard headed self interest on the part of each, will have a positive impact on mutual relations in the long run.

13.4. The Outer Ring

13.4.1 *The Geo-Political Threat.*The nuclear weapon capable countries in the outer ring are Khazakstan, Israel and South Africa. Of these, South Africa claims to have dismantled its nuclear weapons, and Khazakstan has declared its intention to adhere to the NPT as a non weapon power. India would hope that both these do happen. I do not think that geopolitically India sees any threat in the Israeli possession of nuclear weapons, even though its missiles may have, or have in the future, the range to reach Indian targets.

The other potential candidates for proliferation in West Asia are Iraq and Iran. Saudi Arabia has nuclear capable missiles (sold by China) that can reach India, but as yet no nuclear weapon capabilities. In East Asia, the North Korean drive towards nuclear weapons, unless halted or capped, might lead to the following alternatives in the Korean peninsula: A nuclear weapon armed North and a South with a nuclear weapon capability or at least an autonomous full nuclear fuel cycle; or a united Korea with nuclear weapons. This in part, and an unbridled vertical proliferation on the part of China, might more certainly propel Japan towards reexamining its nuclear weapon policy. On top of this any weakening or perceived weakening of the USA's extended nuclear deterrence in defense of Japan will almost certainly push Japan towards producing its own nuclear weapons and ballistic missiles. It is true that Japan has been the only unfortunate target of nuclear weapons thus far, but the faith in Japan's perpetual sainthood is not too strong in Asia; the memories of World War II are still very vivid. In South East Asia, a possible proliferant is Indonesia; it might be driven by vertical proliferation by China, or horizontal proliferation in the Korean peninsula and Japan. If all this were to occur in a worst case scenario, I am sure India would be generally uneasy, but is still unlikely to feel any big threat geopolitically.

13.4.2 *The Psychological Threat.* Though clinically looked at, geopolitics may allay a sense of threat, psychological reasons may supervene and color threat perceptions. Indian allergy to fundamentalist Islam, reinforced by the Chinese sale of missiles to Saudi Arabia, Iran, Pakistan, etc., would play a part. It would almost appear that Professor Samuel P. Huntington's prophecy regarding the accommodation between the Confucian and the Islamic worlds is indeed being fulfilled.[36] The threat would appear to be most from rabid fundamental regimes with Iran leading the pack, and at the other extreme a non-fundamental Indonesia posing no threat for the present. However, the recent upsurge in fundamentalism in Indonesia is worrisome.

14. India's National Security Related Aims

I will make the following assumptions regarding India's aims that would have a direct bearing on threat perceptions:

- India does not intend to liberate the areas of its territory that it considers wrongly occupied by China; it will decide to settle the question by a process of 'give and take'.
- India does not intend to liberate so called 'Azad Kashmir', currently occupied by Pakistan.
- India does not rule out solutions of the Kashmir problem that accept its independence as part of a South Asian Confederation.
- India believes that a loose South Asian Confederation of at least Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka is a viable entity by 2015.

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[36] Op cit. 22, Huntington, *"The Clash of Civilizations?"*

· India believes that there is no way by which a populous and poor third world country as China, India or Pakistan can cope with the first world perpetuating the status-quo, except by cooperating with each other. It does not mean that cooperation involves ganging up against the first world on principle.

15. Indian Grand Strategy

If the lines on which US policy unfolds is as per the worst case scenario discussed earlier, what should the Indian approach be? I would reckon that it would still not be one of confrontation with the USA. It is likely to be a cooperative one, not by 'Poodle-ization', but on the basis of India being a potential nuisance that better be co-opted.[37]

Towards this, I believe India would strengthen regional cooperation, with the South Asian Association for Regional Co-operation (SAARC) in general, and with Pakistan in particular. Step up cooperation with China. Go in for a policy of non-weaponized and undeployed (as defined in the West) nuclear minimum deterrence. What are the likely contours of this nuclear minimum deterrence policy? This will have relevance to the security solutions of many small and medium powers in the rest of the world. John Mearsheimer argues that in the case of the Ukraine, conventional defense would not be viable against Russia, because it would remain "vulnerable to Russian nuclear blackmail." He goes on to say, "nuclear weapons are the only reliable deterrent to Russian aggression." He is in favor of all major powers including Germany acquiring nuclear weapons as the "best formula for maintaining stability in post-Cold War Europe."[38] In South Asia, a mutual minimum nuclear deterrent will act as a stabilizing factor. Pakistan will see it as counteracting India's superior conventional power potential and providing a more level playing field. The chances of conventional war between the two will be less than before. As Kenneth N. Waltz puts it, "Conventional wars fought by countries that do not have nuclear weapons are likelier than conventional or nuclear wars fought by countries that have nuclear weapons"[39]

16. Assumed Indian Nuclear Doctrine[40]

The doctrine is based on the following premises:

· That nuclear weapons can only be deterred by nuclear weapons.

· That it is enough if India goes in for minimum deterrence.

· That there is no need to match any adversary in the number of weapons, nor yields nor types of weapons; nor of achieving superiority; as long as there is an assured capability of a second strike that can inflict unacceptable damage defined sensibly. Hence, nuclear arms racing is truly counter productive.

· That at the tactical level also, the philosophy is nuclear deterrence. The idea is not to treat tactical nuclear weapons to be as automatically usable as the big powers used to think in the Fifties. The intention is to deter the adversary from making first use of tactical nuclear weapons, and thus gaining a battle-field advantage. In case this fails, the second strike will not be on tactical point targets but on area targets that

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[37] Stephen Philip Cohen, *India's Role in the New Global Order: An American Perspective*, presented to the **Third Indo-US. Strategic Symposium April 1992**, Airlie Virginia.

[38] John J. Mearsheimer, *"The Case for a Ukrainian Nuclear Deterrent"*, **Foreign Affairs** (Summer 1993): p.50 *et seq.*

[39] Op cit. 1, **International Political Effects of the Spread of Nuclear Weapons,** Kenneth N. Waltz, *"What Will Nuclear Weapons Do to the World?"* p. 194.

[40] See General K. Sundarji, *Nuclear Deterrence: Doctrine for India*, published in two parts; Part 1 in **Trishul,** Vol. V, Issue No 2 December 1992, Defense Services Staff College, Wellington India; and Part 2 in the July 93 issue of the same journal.

abound in the combat zone. Most of these are optimally attacked by weapons of yields of 10 to 20 Kt fired as low air bursts (producing hardly any fall out). Hence there is no need for unique tactical nuclear weapons to be produced. There is also no need for producing expensive, miniaturized sub kiloton warheads to be fired for example from artillery. Such a requirement would only exist if they are to be used in war-fighting for giving close support to troops, whilst ensuring requisite safety.

· Finally I have also assumed that with no aims of changing the status quo, and with only deterrence that we are aiming for, the Indian policy will be one of declared 'No First Use' of nuclear weapons.

16.1. Implications of Nuclear Minimum Deterrence

I shall offer some general comments at this stage, and will also try to highlight some of the glaring differences between minimum deterrence in a Small Nuclear Power (SNP) and Medium Nuclear Power (MNP) context and the super power brand of deterrence in the paragraphs below. The adoption of a simple deterrence philosophy, with a minimum deterrent aimed at destroying a handful of cities in the second strike mode, is all that is required. McGeorge Bundy writes, "There is an enormous gulf between what political leaders think about nuclear weapons and what is assumed in complex calculation of relative 'advantage' in simulated strategic warfare. Think-tank analysts can set levels of 'acceptable' damage up in the tens of millions of lives. They can assume that the loss of dozens of great cities is somehow a real choice for a sane man. They are in an unreal world. In the real world of real political thinkers... a decision that would bring even one hydrogen bomb on one city of one's own country would be recognized in advance as a catastrophic blunder; ten bombs on ten cities would be a disaster beyond history; and a hundred bombs on a hundred cities are unthinkable."[41] Adoption of a policy of minimum deterrence that calls for a second strike only on a handful of cities, leads to the following[42]:

· First Strike is eschewed. There is no question of nuclear war-fighting as a preferred option, as the damage on both sides would be horrendous. There will be little satisfaction in the fact that 'he' suffered more damage than 'we', if both are measured in millions of lives and in a number of big cities. There can be no true 'winners' in nuclear war fighting. For deterrence, one only needs the ability to hit the aggressor who made the first strike, in a guaranteed second strike and cause unacceptable damage; that too with 'unacceptable damage' defined sensibly. A 'No First Strike' doctrine does not take away from any SNP or MNP its inherent right to defend itself with all means at its disposal when its very survival is at stake. All that the doctrine denies is nuclear war-fighting or early first use in the event of conventional hostilities. Pakistan has been making much of the fact that India is a larger country; that India's armed forces are much larger than Pakistan's and so on. Therefore the Pakistanis see their nuclear capability as compensating for this conventional weakness. So, why should they make a no first use declaration and make it clear right from the start that they will not offset Indian conventional advantage by first and early use of tactical weapons? India does not have such a large edge in conventional force deployable against Pakistan. Admittedly Pakistan has been using the argument of disparities of sizes of the respective *countries*, extrapolated misleadingly to their *armed forces*, largely for propaganda purposes; the Pakistani planner realizes this. He also will realize that any early use of nukes by Pakistan will certainly entail Indian retaliation in kind which might include value targets. Any nuclear exchange between the two countries may cause serious damage to India, but would perhaps wipe out Pakistan as a nation. The value of the Pakistani nuclear weapon is in the last resort defense of the country when its survival is in jeopardy, neutralizing Indian conventional superiority. Its first or early use will be only asking for Indian nuclear retaliation ensuring Pakistan's destruction.

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[41] McGeorge Bundy, *To Cap the Volcano*, **Foreign Affairs**, October 1969.

[42] Based on *India's Nuclear Weapon Policy*, a Paper read by General K. Sundarji at a conference on **Nuclear Technology and Politics**, organized by the Peace Research Institute of Oslo and the Norwegian Government, June 16-18, 1993 at Rjukan, Norway (Yet to be published).

· Finite requirement means no arms racing. The requirement of force for nuclear deterrence is finite. For assured deterrence, according to McNamara, it would require the ability to destroy one fifth to one fourth the population, and one half of Soviet industry, by the USA in the second strike mode.[43] The requirement even for such massive assured destruction is finite and not open-ended. Analysts like Geoffrey Kemp have indeed computed it[44] In the case of minimum deterrence also it is finite and can be computed. In war-fighting it is otherwise. Whether the war-fighting is conventional or nuclear, whilst calculating relative strengths, more is always better. But for deterrence, more is not better if less is adequate. This is generally lost sight of. A major reason for the aberration in the super powers acquiring such obscenely large stock piles of unusable nukes, was the assumption by both sides in the early days that in the event of war, the use of nuclear weapons would be axiomatic. Even when such automatic use of nuclear weapons in all types of wars was no longer contemplated from the Sixties on, nuclear war was still considered fightable and winnable. Therefore, the assumption by some commentators that SNP would ape the big powers and mindlessly indulge in a nuclear arms race is not necessarily true. What it would take for the prevention of a nuclear arms race, is for a firm political hand to be kept on the professional military and the think tanks. This may not have happened in the past because of the esoteric nature of nuclear strategic theory. Today, much of this thinking is in the public domain, and most political leaderships, even in India and Pakistan are better informed. Hence fears of a military penchant for arms racing are exaggerated.

· Strategic targets will be value (city) targets. This is because the strike is only in a retaliatory mode and is not a first strike aimed at degrading the other side's strategic nuclear attack capability. This is not an imposed restriction, but one derived from common sense; even a massive counter-force first strike cannot assure the attacker that the few weapons required for a minimum deterrent counter value strike will not survive. This may not give the defensive planner enough of reassurance of success; but by the same token, it will not give the planner of the first strike any great reassurance of knocking out all the nuclear retaliatory means of the defender. He will expect to receive damage in the second strike and thus be deterred. Fears of 'disarming first strikes' leading to the temptation to 'go first' in a 'use or lose' atmosphere are think tank exaggerations. Likewise, the consequent instability in SNP and MNP equations is not as axiomatic as it is made out to be. A value target oriented strategy also means that the very high accuracy demanded by surgical strikes against hardened counter force targets, will not be required. Very large yields to compensate to some extent for the lack of accuracy are also not required. As to which zone in a city gets hit is not of much consequence. The yield need not be very high. The weapons that struck Nagasaki and Hiroshima were between 15 and 20 KT and we know the results.

· A hair-trigger response is not required for launching the second strike. Commenting on my papers on minimum deterrence published in the Trishul[45]. Professor Stephen P. Cohen of the University of Illinois at Champagne Urbana has this comment to make: "The one major gap in the paper, I think, is a discussion of crisis stability. What kinds of systems--weapon and command--would enhance it? Given the short distances between India and both China and Pakistan, this would seem to deserve more space. Indeed, the problem of warning time, of the difficulty of reading the Chinese, and the too great ease of reading the Pakistanis (and thus misreading them and vice versa) would seem to set South Asia apart from other regions, and certainly the US-Soviet strategic contest."[46] The one basic assumption

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[43] Robert S. McNamara, *The Essence of Security*, New York: Harper and Row, 1968, p.76.

[44] Op cit. 2, Geoffrey Kemp, *Nuclear Forces for Medium Powers,* **Adelphi Papers No. 106**

[45] Op cit. 40, Sundarji

[46] Professor Stephen P. Cohen, in a letter he wrote to me commenting professionally on my papers in **Trishul**.

underlying the entire question of crisis stability in this quotation is the axiomatic requirement of a hair trigger reaction to a threat of attack or actual attack. This is not a requirement of minimum deterrence as per my enunciation, and that too coupled with a 'no first use' declaration. The response can be a good few hours or even perhaps a day after the receipt of the first strike. A very highly sophisticated, highly responsive command, control and communication (C^3) system that functions in real time is not necessary. There is no requirement for major retargeting between the pick up of the launch of an enemy attack and before his missiles impact, as the USA once thought it needed. Even a so called successful decapitating attack by the adversary cannot give him any assurance of the non-launch of the surviving second strike by the recipient of the first strike. Standing Operating Procedures may well lay down the launch of the second strike against predetermined targets, say after X hours of the receipt of the first strike, if no orders countermanding it are received by that time.

· A very high state of availability and reliability is not required. Only area targets are being targeted in the second strike. To stretch a point, say, of every three 20 kiloton war heads catered for each city target, in some cases, only two are available and of these only one successfully detonates on the target, it might still be acceptable (Hiroshima and Nagasaki got only one each). So, a very rigorous regimen of physical testing of weapons may not be required to generate adequate assurance in the minds of the user. Computer testing of the total design coupled with segmented testing of components in a form that does not involve a nuclear explosion might be acceptable. The usual gut feeling of Western analysts is exemplified by a question put to me by Professor Stephen Cohen: "Without testing would any commander be willing to accept delivery of a warhead/missile combination, given the high costs of technical failure?"[47] The answer is yes, when what one is talking about are retaliatory second strikes against cities in the strategic sphere and against area targets in the tactical category. A partial failure will not negate the purpose of a second strike. In a first strike, on strategic counter-force targets or on close support tactical targets, survival might depend on the near total success of the strike. In these circumstances the question posed is relevant and hence its relevance is taken for granted in Western thinking. However it is not so critical, when the doctrine is minimum deterrence as defined by me.

16.2. Effects of Proliferated Nuclear Threats on Minimum Deterrence

If proliferation occurs whether it is little or much, how would it affect the stability of SNP and MNP doctrines of minimum deterrence? Would it induce increases in nuclear stockpiles? If increases occur would they be modest or open-ended? These are pertinent questions and have already been addressed earlier in the paper. The conclusions arrived at are equally applicable to MNP and SNP doctrines of minimum deterrence. The doctrine will continue to be effective and will not lead to massive increases in stock piles or a spiraling arms race.

17. Western Doubts on Minimum Deterrence

Western analysts have quite naturally been steeped in super power nuclear doctrine, and most of them, use scaled down versions of super power doctrine for the developing world. Applying this, they assert that the spread of nuclear weapons to conflict prone areas like South Asia, will increase the likelihood of nuclear weapon use in war[48]. There have been a few who have articulated a

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[47] Ibid.

[48] This position almost amounting to theology, is an enduring and predominant one in Western literature; to give a decade-wise sampling: Kathleen C. Bailey, *Doomsday Weapons in the Hands of Many: The Arms Control Challenge of the '90s* (Urbana: University of Illinois Press, 1991); Lewis A. Dunn, *Controlling the Bomb* (New Haven: Yale University Press, 1982); Ted Greenwood, Harold Feiveson, and

contrary view, that the spread of nuclear weapons may indeed increase stability, rather than threaten international peace. Kenneth N. Waltz is the best known exponent of this theory of stable nuclear deterrence[49]. Recently John J. Mearsheimer has joined the ranks.[50] However they are not altogether alone in this, and there are others who have supported various parts of their theories, if not in totality[51].

Many weaknesses are attributed to SNP and MNP. The human ones are, political leaderships ranging from low grade to crazy; lack of knowledge leading to over-insurance and over-reaction; and teeming populations simmering with discontent; tempting their rulers into populist but irresponsible acts. Structural weaknesses: poor political organization; lack of checks and balances; a small nuclear force that may not be able to ride out a nuclear first strike against it, hence encouraging a reckless 'use before you lose' attitude; likelihood of loss of nuclear weapons, by theft or hijack, to terrorists; and weak safeguards against accidental explosions. Technological weaknesses are, low levels of reliability; rudimentary state of Command, Control, Communications and Intelligence (C^3I); and weak controls leading to the 'mad colonel' carrying out an unauthorized attack. Finally it is pointed out that there were so many false alarms in spite of the sophisticated surveillance systems in the West, that SNP/MNP systems put together with scotch tape and chewing gum invite disaster.

This listing appears formidable, but has never been argued against the background of a broad minimum deterrence doctrine. Discussions degenerate into theological harangues from the West, indignantly dubbed by the third world analyst as racist! Many young scholars, without cold war intellectual baggage, such as Devin T. Hagerty argue that both the 'proliferation is dangerous' school and the 'more may be better' school, rest their arguments on 'logics' that "...are ultimately inadequate, because neither yields compelling explanations of the consequences of nuclear proliferation."[52] He argues that, "The two countries continue to feel their usual assortment of imperatives toward conflict, like the insurgency in Kashmir, but nuclear weapon capabilities introduce a new set of incentives to cooperate. Among these are the desire to avoid mutual devastation....The fear of escalation is thus factored into political calculations: faced with this risk, states are more cautious and more prudent than they otherwise would be."[53] Having occupied a ring side seat for many years at the center of Indian decision making, I intuitively feel that Hagerty is right in his reading of the South Asian situation.

Theodore B. Taylor, *Nuclear Proliferation: Motivations, Capabilities and Strategies for Control* (New York: McGraw-Hill, 1977); Leonard Beaton and John Maddox, *The Spread of Nuclear Weapons* (New York: Praeger, 1962).

[49] Kenneth N. Waltz, *The Spread of Nuclear Weapons: More May Be Better*, Adelphi Paper No. 171 (London: International Institute of

[50] Op cit. 38 Mearsheimer.

[51] Bruce Bueno de Mequita and William H. Riker, *An Assessment of the Merits of Selective Nuclear Proliferation* in **Journal of Conflict Resolution 26**, No. 2 (June 1982) pp. 283-306; Steven J. Rosen, *A Stable System of Mutual Nuclear Deterrence in the Middle East* in **American Political Science Review** 71, No. 4 (December 1977) pp. 1367-83; John J. Weltman, *Managing Nuclear Multipolarity* in **International Security** 6, No. 3 (Winter 1981/82) pp. 182-94; John J. Weltman, *Nuclear Devolution and World Order* in **World Politics** 32, No. 2 (January 1980) pp. 169-93.

[52] Devin T. Hagerty, *The Power of Suggestion: Opaque Proliferation, Existential Deterrence, and the South Asian Nuclear Arms Competition*, in **Security Studies**, Volume 2, Numbers 3/4, Spring/Summer 1993, Frank Cass, London.

[53] Ibid. pp. 258-9.

18. India's Conventional Strategy and Force Requirements

With a non-weaponized and non-deployed (by Western definition) minimum nuclear deterrent in place, India would still need to have sufficient conventional forces to deter China and Pakistan. In addition such forces, all of which are not necessarily incremental, would also be required to make it very expensive in casualties for any country including the USA or any coalition led by the USA, to secure ports, airfields, beachheads or air heads on Indian territory. This requirement as far as the army and the tactical air force are concerned will be below India's conventional force levels needed for deterring China and Pakistan, and will not be a great burden. The force structure and force levels of the navy ought to be separately worked out, as these forces would have to raise the casualty threshold of any hostile attempt at massing large conventional forces in our region before a Desert-Storm-like operation targeting India.

I am not foolishly suggesting a navy that can take on the US Navy, but one that can cause it sufficient damage to make such a venture not worthwhile except in extreme cases. I think that the force structure of such a navy cannot be a scaled down version of a big power navy. David could not expect to beat Goliath, employing Goliath's tactics. The best tactics he could employ against Goliath demanded the devising of a suitable tool. I would therefore conjecture that an Indian Navy that is designed to have the best potential to raise the threshold of costs to the US or any other big power navy from hostile intervention in the region must be structured in a tailor-made fashion. The result may not be a balanced force, that a naval purist might desire, but would be an effective one. However this does not mean that a balanced navy would not be required for defense against the navy of a hostile regional power. Having said which, I must also add that the two requirements will have common components, and need not add up to unbearable costs.

As and when a South Asian Confederation is set up (2015?), the requirement of India and Pakistan to deter each other would hopefully be no longer needed. Only the force levels meant for the unwelcome intrusion of outside forces into the region would be required. These forces could be found cooperatively, by the regional powers, with Pakistan and India contributing the major share. Undoubtedly, the defense burden on the region as a whole would thus have decreased.

In the event of the United States' policy towards India being more benign, an India with a force structure as envisaged would not be to the USA's disadvantage. Such an India cooperating with the USA would take much load off America in maintaining its regional interests in South Asia in particular and the balance of power in Asia in general, with lesser need for the committal of US forces to the region.

19. India's Broad Policies -- 1995-2015

Given these assumptions, I expect Indian policies to be:

· Work towards a loose South Asian Federation based on SAARC by 2015 and carry Pakistan along as a major and honored partner in the enterprise.

· Based on the recently signed agreement with China on demarcating the Line of Actual Control on the Sino-Indian border, prevent border incidents with China; and work towards the long term settlement of the border dispute on a basis of give and take.

· Cooperate with the United States in maintaining regional stability and the Asian balance of power, if it is possible to do so with honor and without the 'poodle-ization' of India, or by succumbing to US pressure tactics. If the USA pressurizes India unreasonably and unduly, make common cause with China in resisting such pressures.

NON-NUCLEAR PROLIFERATION AND STRATEGIC STABILITY IN THE ASIA-PACIFIC REGION

XIA LIPING
Associate Professor
National Defense University, China
and
Senior Fellow
The Atlantic Council of the United States

ABSTRACT. At present, there exists the clandestine proliferation of nuclear weapons in the Asia-Pacific region. The nuclear proliferation may alter or even upset the current regional balance of power and disrupt the stability of the region. It may also lead to new military conflicts. During a regional conflict, one nuclear threshold state may use nuclear weapons against its adversary. Under the circumstances, international community should devote its best efforts to eliminating the nuclear proliferation in the region. Before that final goal is reached, states in the region should seek to maintain the strategic stability of the region in the presence of nuclear proliferation. In order to achieve that objective, the Asia-Pacific region should set up a model including multilateral security mechanisms and bilateral confidence and security-building measures.

1. The Present Situation of Nuclear Proliferation in the Asia-Pacific Region

With the end of the Cold War and the collapse of the bipolar structure, the world has entered a transitional period toward a new international strategic structure. At present, the Asia-Pacific region is enjoying political stability and rapid economic growth, but there exist some unstable factors, which may make a negative impact on future peace and security of the region if they are not dealt with properly. One of the unstable factors is the presence of clandestine proliferation of nuclear weapons in the region. How to maintain stability
under the circumstances has become one of the most important security issues in Asia and the Pacific.

Up till now, the nuclear threshold states(areas) in the Asia-Pacific region can be sorted into two categories.

The first category includes the states(areas) which have some conditions to develop nuclear weapons but the conditions are not sufficient; and which have a strong desire to develop nuclear bombs but they are restricted by some factors. India, Pakistan, Taiwan, North Korea and South Korea belong to this category.

Since India exploded a nuclear device for self-claimed peaceful purpose in 1974, there has been a nuclear arms race in South Asia. Two de facto nuclear weapon states have emerged as a result, namely, India and Pakistan. Whether they will turn this more or less covered nuclear status into an open one is perhaps the most outstanding issue in the efforts for preventing nuclear proliferation in this region today.

Having greatly benefitted from the imported nuclear material, technology and facilities said to be for

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 169–176.

the civilian use, India seemed to have succeeded in accumulating enough weapon grade plutonium for manufacturing nuclear bombs. According to another report, India is now capable of producing 75 kg weapon grade plutonium annually, with which 15 nuclear warheads may be manufactured. The country also has various aircraft to carry the bombs. All of them could be used to attack Pakistan. Recently, India has intensified its efforts for developing short-range and intermediate-range ballistic missiles. In 1988, it successfully tested "Prithvi" missiles with the range of 250 km. In 1989, India again succeeded in another test of firing an intermediate-range "Agni" missile with the range of 2,500 km, which was obviously intended for against China.

Pakistan was reported to start accumulated nuclear material in 1985. It is now said to be able to produce enriched uranium annually enough for manufacturing 2-3 bombs. It is widely believed that to reduce the pressure from the united States, Pakistan has so far refrained from producing a complete nuclear device. Once necessity acquires, however, it could have the bomb simply by assembling the various parts it has already stored within a short period of time. The carrying vehicles Pakistan has are chiefly combat airplanes.

The purpose of Pakistan maintaining the nuclear option seems mainly to cope with the threat it has perceived from India. Pakistan has repeatedly declared that if India relinquishes the nuclear choice, it will do the same. A number of proposals were put forward for this purpose, like simultaneous joining the Non-Proliferation Treaty(NPT) by two states; establishing a mechanism of joint supervising each other's nuclear facilities; or setting up the nuclear-free zone in South Asia. India has turned down all these proposals.

Thus the pace of the nuclear arms race in South Asia will largely depends on the attitude of India in the future. India claimed that it had retained the nuclear option chiefly to "deal with China", but in fact it has a desire to have the benefits of becoming a nuclear power. Many Indian high-Ranking officials have kept asking for the reformulation of India's defense strategy with nuclear force as its core, which may make India become an open nuclear weapon state. But on the other hand, one should not ignore the powerful elements, which would restrain India from crossing the nuclear threshold openly. The role of nuclear weapons in the political and military fields has now been markedly reduced. The nuclear superpowers will cut their arsenals in large numbers. The pressure of international community against nuclear proliferation is increasing. Under the circumstances, India has to realize that going into the nuclear club might have to pay a heavy price. It could well push itself into isolation in the world community, and reduce its important position in the third world. Moreover, the act could also militarily invite an accelerated nuclear arming of Pakistan, which would then only serve to erode the already superior position of India. There are perhaps also technological obstacles. The nuclear capability of India could not have been achieved without the assistance from Western countries(in many cases even illegally). And it seems also true in the future. Thus, when the developed countries are tightening their control over nuclear technology, one should not ignore the technological difficulties that India might have to become a nuclear weapon state especially with war-fighting capability. Perhaps owing to these factors, India also showed certain amount of restraint while carrying out its nuclear program. Hopefully, India seems now still not yet to make final decision. The possibility of India staying at the position as it does now should not be ruled out.

In a small degree, there is also a risk of nuclear proliferation in the Korean Peninsula.

South Korea began its research program of nuclear weapons in the early 1970s. Although it suspended the program later under the pressure of the U.S., South Korea could make rapid progress in its nuclear program due to its high level of technology once it makes its decision of developing nuclear bombs again in the future.

The North Korea began its program of nuclear energy in the early 1960s. According to the report by North Korea to International Atomic Energy Agency(IAEA) in May 1992, there are 14 nuclear facilities in North Korea, including 5 nuclear reactors(3 completed, 2 under construction). North Korea joined the NPT treaty in 1985, and agreed to compliance with NPT safeguards in January 1992. From May 1992 to February 1993, the inspectors from IAEA made 6 inspections to nuclear facilities in North Korea. The results of former 5 inspections showed that the nuclear technology of North Korea is still

in a low phase and is far away from making of a bomb. But the U.S. suspected the credibility of the inspections' results. According to the results of the 6th inspection, IAEA also thought that the possibility of concealing the nuclear reprocess by North Korea could not be ruled out, and asked for special inspection to two nuclear facilities in Yongbyon. North Korea refused the demands from IAEA on the grounds that the two facilities are military bases and irrelevant to nuclear. Soon afterwards, IAEA passed a resolution to press North Korea to accept special inspection by IAEA within a month. At the same time, the U.S. held a large-scale
military exercise "Team-Spirit 93" with South Korea, and North Korea declared that it would withdraw from NPT Treaty, which lead to a sharp confrontation between North Korea and the U.S..

Under the common efforts of international community, after a series of hard negotiations, the United States and North Korea signed an agreement in October of 1994, which will eliminate North Korea's capability to make nuclear arms and move the nation toward normal political and economic relations with the United States. That is an important step to finally resolve North Korea's nuclear problem. But it will be still a long way to achieve that goal and there will be many difficulties in implementing the agreement.

Taiwan province of China began its research program of nuclear weapons in 1966. In 1983 Taiwan Authorities admitted that it had the technological capability of manufacturing nuclear bombs. It was reported in 1988 that Taiwan was constructing a nuclear facilities which could produce weapon level enriched plutonium. Taiwan is developing a kind of intermediate-range ballistic missile with the range of 1,000 km, which may carry nuclear warheads if Taiwan manufactures nuclear weapons in the future.

The second category includes states which have sufficient conditions to develop nuclear weapons, but due to some serious political and military restrictions on them, they have not the strategic intention to develop nuclear warheads. Japan belongs to this category. But there is the danger that Japan may abandon its Three Principles of Non-Nuclear. If it does so in the future, the international system of nuclear non-proliferation will be in peril. It is reported that Japan will store up to 5 to 10 tons of plutonium within the next 5 years. Although these plutonium are not weapon-level, it is not difficult for Japan to transform them into weapon-level ones. It was said by Japanese media that once necessity acquires, Japan could have its nuclear bombs within a year. Japan has had strong powered rockets which can launch satellites into the orbit around the earth, and can also be transformed into ballistic missiles.

Moreover, there is a temporary nuclear state -- Kazakhstan in the Asia-Pacific region. With the collapse of the Soviet Union, there are 104 SS-18 intercontinental ballistic missiles and at least 1,000 Strategic nuclear warheads on the territory of Kazakhstan. Although it promised in February of 1993 to dismantle those strategic nuclear weapons and transfer them to Russia for destruction within 7 years, it has attached some security and economic conditions on dismantling the nuclear weapons.

Up to now, the prevention of nuclear weapons proliferation in the Asia-Pacific region depends in technology mainly on the current international system of non-nuclear-proliferation, which has played an important role in slowing down the speed of nuclear spread and restricting potential nuclear states from entering into the nuclear threshold. However, due to some defects of the system and other factors, the system can not fundamentally prevent the trend of nuclear proliferation in the region.

At present, in the Asia-Pacific region, the political situation is relatively stable; most of hot spots have made some progress in moving toward political settlement; the pressure of international community against proliferation and use of nuclear weapons is growing; more and more non-nuclear weapon states seem determined to give up the nuclear option. Those factors are beneficial to strengthening the international non-proliferation regime and are increasing the pressure upon nuclear threshold states. Under the circumstances, it seems that in 1990s the trend of nuclear proliferation will be so restrained that most of nuclear threshold states in the region will still stay at the position as they do now. In 1985, the nuclear-free zone in South Pacific was established. Almost all the Asia-Pacific states have supported this initiative, and there are signs that many states are exploring the possibility of establishment of nuclear-free zones in various forms in Southeast Asia and South Asia.

However, there are also potential dangers of nuclear proliferation in Asia and the Pacific:

-- Some nuclear threshold state may become an open nuclear weapon state.

-- The wide use of nuclear energy and spread of nuclear technology may lead to the emergence of some new nuclear threshold states(areas).

3. Factors Driving the proliferation of Nuclear Weapons

There are four factors which are driving the nuclear proliferation in this region: political, military, economic and technological factors. Among them, political and military factors are the two main causes of nuclear spread, while economic and technological factors are playing relatively less important roles in this dimension.

3.1. POLITICAL FACTOR.

During the more than 40 years of the Cold War, the Asia-Pacific region had been an important rivalry ground for the U.S. and former Soviet Union, where both them had deployed huge quantity of nuclear and other sophisticated weapons, and each provided its allies with advanced military hardware including ballistic missiles and fighter planes. The rivalry led to conflicts in a number of subregions, and intensified contradictions among the states of the region. All those have long fuelled the spread of nuclear weapons and their carrying vehicles in the region. Now although the Cold War between the two superpowers is over, many of the problems that the Cold War left over have not been resolved and some new problems are emerging in the Asia-Pacific region. The reunification of the states which were divided due to the Cold War have not been achieved; the political settlements of the hot spots are encountering many difficulties; the military confrontation between North and South Korea is still there; the dispute between India and Pakistan has not been resolved, which have resulted in three wars between them since the late 1940s; the structure of relations of powers in the region has been in readjustment; due to various historical reasons, there exist disputes over territories or resources and ethnic and religious contradictions among many Asian countries, which may lead to new conflicts if they are not dealt with properly. Moreover, lack of a mechanism of confidence and security-building in the region has made many states not trust each other. All these will play an important role in facilitating nuclear spread in the region.

3.2. MILITARY FACTOR.

Though the U.S. and Russia began to reduce their nuclear weapons, their nuclear arsenals will be still too large even if they complete their nuclear reduction on time according to two START treaties. Moreover, both the U.S. and Russia are improving the quality of their nuclear weapons and developing small and mini nuclear warheads. That the two nuclear superpowers keep large nuclear arsenals and continue to upgrade nuclear weapons is one of the important factors which are stimulating nuclear proliferation in Asia and the Pacific. On the other hand, some states want to beef up their political positions and military deterrent capabilities through grasping nuclear weapons or capability of manufacturing nuclear bombs. Moreover, dumping of large quantities of sophisticated conventional weapons by the United States, other Western countries and Russia to the Asia-Pacific region also stimulates the spread of nuclear weapons. Many imported advanced fighter planes can be used as or transformed into nuclear carrying vehicles, which made some states possess nuclear carrying capabilities. At the same time, some other states which import less advanced weapons try to grasp nuclear bombs to compensate their conventional inferiority and deal with adversary's sophisticated conventional weapons.

3.3. ECONOMIC FACTOR.

The rapid growth of economy in the Asia-Pacific region also provides adequate economic and technological basis for the development of nuclear capability and greater arms transfer. At the same

time, with the end of the Cold War, market rule has replaced political elements as the decisive factor in arms transfer. Developed states try to dump more and more advanced weapons into Asian states so as to gain higher profit.

3.4. TECHNOLOGICAL FACTOR.

In many Asia-Pacific states, special emphasis is placed on the development of civil high technologies like those in nuclear energy, carrying rockets, etc. As most of these technologies may be for dual purpose, they can serve strong technological basis for these states to develop nuclear and other advanced weaponry. On the other hand, for a long time, some Western companies have been transferring various technologies, materials and parts related with nuclear weapons and carrying vehicles to some Asian states through various channels(in many cases even illegally). Since the collapse of the former Soviet Union, Russia and other former Soviet republics are facing political turbulence, economic difficulties and growing ethnic conflicts, which have increased the danger of proliferation of tactical nuclear weapons, nuclear materials and technologies from these countries to other Asian countries.

4. Impact of Nuclear Proliferation

4.1. REGIONAL ARMS RACE .

The nuclear proliferation creates in the region a "action and counter-action" effect, which may stimulate some states to compete with each other in developing nuclear weapons. The regional nuclear arms race may alter or even upset the current regional balance of power and disrupt the stability and peace of the region.

4.2. MILITARY CONFLICTS.

The nuclear proliferation may lead to new military conflicts. Some states may launch a preemptive attack because they are afraid that nuclear bombs and ballistic missiles developed by their adversary will harm their security. The spread of nuclear and other advanced weapons may also make the capabilities of some states exceed the need of their self-defense so much that they will be more willing to resort to force when they deal with disputes over territories and borders with other states. During a regional military conflict,
one nuclear threshold state may use nuclear weapons against its enemy state.

4.3. IMPACT ON ECONOMIC AND SOCIAL DEVELOPMENT.

The spread of nuclear and other advanced weapons will make Asian states allocate more financial and other resources for arms race, which will give negative impact on their economic and social development.

5. The Main Features of the Asia-Pacific Security Situation after the End of the Cold War

5.1. STRUCTURE OF RELATIONS OF POWERS IN THE ASIA-PACIFIC REGION.

With the disintegration of the former Soviet Union and the end of U.S.-Soviet military confrontation, the structure of relations of powers in the Asia-Pacific region has been in readjustment. Since the end of the Second World War, it is the first time that no significant problems make the major powers -- The U.S., Japan, Russia and China -- of the region split into opposition camps. The economic interdependence

among them continues to develop, it will be beneficial to peace and stability in the Asia-Pacific region. But there still exist some factors of potential uncertainty and instability in the relations among the major powers. Under certain conditions, the contradiction between any two major powers may be intensified to such an extent as to lead to some conflicts.

5.2. FUTURE TRENDS OF JAPAN AND RUSSIA.

There exist some uncertain factors in the future trends of Japan and Russia. Now Japan is taking advantage of opportunities that The United States demands it to play more important political role in the Asia-Pacific region and in the world. Japan has been speeding up its pace towards a political power and accumulating its military potential which will be commensurate with its future status of a great political power. It is still a question that what kind of political power Japan will become, a political power which will contribute to world peace and stability or one which will seek for a dominant position in the Asia-Pacific region. At the same time, some Asian countries are also worried about whether Japan will become a military power. Furthermore, although coordination is still the main feature of U.S.-Japan relationship, economic contradictions between them are sticking out. In case Japan is fully fledged politically and militarily and takes back the North Islands in the future,the political contradictions between them may rise gradually.

Since the breakup of the Soviet Union, Russia has succeeded its position in the Asia-Pacific region. At present, Russia is facing internal political instability, economic difficulties and intense ethnic contradictions. If the situation continues to deteriorate, it may lead to further internal conflicts. On the other hand, there is the possibility that Russian national extremists will seize power in the future and then take advantage of Russian chauvinism to divert Russian people's attention from internal problems to outward expansion. The trend of Russia's internal situation will not only determine its Asia-Pacific policy, but also affect the security of the region to some extent.

5.3. " HOT SPOTS."

The hot spots with the background of the two superpowers' contending for dominant position have been relaxed to some extent, such as in Cambodia and Afghanistan, where conflicts between foreign invaders and native guerrillas have changed into ones among native factions. On the other hand, there exist ethnic, territorial and religious contradictions and disputes -- some of which are very complicated -- among many Asian countries due to a variety of historical reasons. If the contradictions are not dealt with properly, they may be intensified to such an extent so as to lead to new conflicts. Moreover, although the Cold War between the U.S. and Soviet Union has ended, the divisions in some Asian countries caused by the Cold War have not been settled. And Taiwan independence movement has become one of the major unstable factors in the Asia-Pacific region.

5.4. ESTABLISHMENT OF MULTILATERAL SECURITY MECHANISMS IN THE ASIA-PACIFIC REGION.

There are some important progress in establishment of multilateral security mechanisms in the Asia-Pacific region, such as ASIAN Security Forum and APEC informal summit meetings. But it is still in an initial stage. At the same time, some bilateral security and confidence-building measures have been made by some states, such as between China and Russia, between China and India.

5.5. ASIAN FOCUS ON ECONOMIC DEVELOPMENT.

Most of Asian countries are focusing their efforts on economic development, and have created their own ways of development which are suited to local conditions. Now the Asia-Pacific region is one of the most dynamic regions in economy in the world. At the same time, Asia-Pacific countries are increasing

their economic cooperation in the region. In order to have a peaceful international environment which is beneficial to economic development, most of Asia-Pacific countries hope to maintain the peace of the region and seek to resolve regional conflicts and disputes through negotiations. But on the other hand, economic competitions among Asia-Pacific countries and between them and other countries are getting more intense.

6. How to Maintain Stability in the Presence of Clandestine Proliferation

Under the circumstances, international community should devote its best efforts to eliminating the nuclear proliferation in the Asia-Pacific region. Before that final goal is reached, states in the region should seek to maintain the strategic stability of the region in the presence of clandestine spread of nuclear weapons. That includes two aspects: to prevent any nuclear threshold state from shifting balance of power by possessing nuclear weapons in peacetime; and to prevent any nuclear states and nuclear threshold states from launching a preemptive nuclear attack in a crisis.

In order to achieve that objective, the Asia-Pacific region should set up a model including multilateral security mechanisms and bilateral confidence and security-building measures. Now the development of economic interdependence is reducing the danger of military confrontation among Asia-Pacific states and is increasing the possibility of coordination and cooperation on security issues among them. Under the circumstances, especially major powers in the region should strengthen their coordination and cooperation to deal with some problems which may cause some instabilities in the region. At the same time, efforts seem indispensable at least in six aspects:

1. Two nuclear superpowers should further reduce their nuclear weapons and stop upgrading their nuclear arsenals so as to prevent nuclear weapon technology from vertical proliferation. Five nuclear powers should make legal commitments of unconditional no-first-use of nuclear weapons against each other. They should also agree not to use nuclear weapons against non-nuclear states and nuclear-free zones. If all these can be done, they will play a positive role in curbing nuclear proliferation in Asia and the Pacific. In September 1994, Chinese president and his Russian counterpart signed an agreement on no-first-use of nuclear weapons and stopping targeting their nuclear weapons at one another. If China and the United States can reach a similar agreement, that will increase the strategic stability and be beneficial to holding back nuclear spread in the Asia-Pacific region.

2. International community should make efforts to stop clandestine nuclear arms races. The current international system of non-nuclear proliferation should be strengthened and NPT treaty should be extended permanently. We should continue to curb the spread of technologies of nuclear weapons and ballistic missiles, especially those technologies which can make ballistic missiles carry nuclear warheads. International community should focus its efforts on preventing nuclear threshold states from becoming open nuclear states. For this purpose, we should impel non-member states to join the NPT treaty and improve the reliability of verification by IAEA. International community should also encourage the efforts to establish nuclear-free zones and zones of peace, which are one of the most important ways to prevent nuclear proliferation in many regions. China holds that negotiations should be undertaken with a view to concluding a Comprehensive Test Ban Treaty(CTBT) not late than 1996 and another negotiations should be undertaken to conclude a convention banning the production of weapon-grade fissile materials. The number of China's nuclear tests has been much fewer than that of either nuclear superpowers. The main purpose of the recent few nuclear tests carried by China is to improve the safety of its nuclear warheads. China doesn't want to increase the amount of its nuclear weapons or upgrade the quality of its nuclear arsenal, because many Chinese strategists think that with the end of the Cold War, the role of actual war-fighting of nuclear weapons has been declining. China has always stood for the complete prohibition and thorough destruction of all weapons of mass destruction. It holds that a convention on complete prohibition of nuclear weapons

should be concluded in the same way as the conventions banning all biological and chemical weapons.

3. The Asia-Pacific states should continue their efforts to establish cooperative security arrangements in the region, which should fit in with the reality of the region and benefit the common security of all Asia-Pacific states. The cooperative security arrangements should include both multilateral and bilateral security mechanisms. Because the security situation is very complicated in Northeast Asia and it is difficult for ASIAN Security Forum and APEC to deal with the security issues of the subregion, it is necessary to establish a multilateral mechanism in Northeast Asia for security dialogue and coordination. One of the most important issues the cooperative security arrangements should focus on is to establish various confidence and security-building measures among Asia-Pacific states, including establishing of hot lines between states, on nuclear-free zones, on prior circulation of large-scale military manoeuvre and military activities near border areas and so on.

4. The Asia-Pacific states should promote economic cooperation and mutual trust so as to foster a harmonious and stable atmosphere in the region. They also should spur the political settlements of territorial and border disputes through negotiations, so as to reduce the possibility of military conflicts. On the Nansha Islands(the Spratley Islands) issue, China has had sovereignty over the islands since ancient times. For a long time, there were no disputes about that. Just in the late 1970s, some countries around the South China Sea made claims over them or part of them. However, China has restrained itself and is willing to develop the region in a co-operative way, putting aside disputes. Recently, in order to protect Chinese fishermen's life and production who have been fishing in the South China Sea, Chinese fishing authorities built shelters on the Meiji reef. It is not a military activity and will pose no threat to other countries. At present, there is no tension and crisis in the region. China hopes to resolve the problem about Nansha Islands issue through negotiations. Before the disputes are finally solved, the parties concerned should establish some confidence-building measures in the area through talks, such as signing of treaties on avoidance of accidents at sea among warships of different countries.

5. Developed states should drastically reduce the export to the region of conventional weapons, especially advanced fighter planes which can carry nuclear bombs and may disrupt the regional balance of power.

6. When a crisis happens between two states, the U.N. and other states in the region should try their best to mediate a settlement, so as to reduce the tension and avert escalation of the crisis to an armed conflict. After the establishment of some bilateral and multilateral security mechanisms, involving parties should make full use of the mechanisms. For example, if two states have had hot lines between, during a crisis between them they should make contact with each other through the hot lines, so as to avert misunderstanding and miscalculation of each other's intentions, because the misunderstanding and miscalculation may lead to a first strike.

Section 2.4

Quantitative : Geopolitical Stability & Balance Of Power

BALANCE OF POWER VERSUS COLLECTIVE SECURITY: A GAME-THEORETIC ANALYSIS

EMERSON M. S. NIOU
Duke University

and

PETER C. ORDESHOOK
California Institute of Technology

ABSTRACT. Although the debate between realism and neoliberalism offers deep insights and raises fundamental questions into the nature of international systems, it also offers the confusion that accompanies imprecisely formulated concepts and an imperfect application of subsidiary ideas. Using a noncooperative extensive-form game to model anarchic international systems, this essay seeks to resolve that debate by restating it in a more explicit and deductive context. Arguing that collective security corresponds to the system envisioned by neoliberals, we begin by differentiating between balance of power and collective security in terms of the strategies that characterize the foreign policies of countries. Next, we establish that both balance of power and collective security can correspond to equilibria in our game. Arguments about goals and institutions are then recast in terms of the different properties of these equilibria. In particular, a balance of power equilibrium does not guarantee every country's security, so in it countries must be vigilant about their relative share of resources. A collective security equilibrium, on the other hand, ensures everyone's sovereignty, and thereby allows absolute resource maximization. Unlike a balance of power equilibrium, however, a collective security equilibrium is not strong and it is not necessarily perfect, so the institutional structures facilitating the realization of mutual gains from the variety of cooperative "subgames" characterizing the world economy play a critical role in establishing the stability of that equilibrium.

1. Introduction

On August 10, 1990, the Los Angeles Times offered the following news report: "Lack of Fear Over WWIII Leads to Rare Global Cooperation ... The extraordinary worldwide response to the call for sanctions ... against Iraq represents the fulfillment of an elusive dream of leaders past, Woodrow Wilson's recipe for achieving global security through collective action of all nations." For forty five years international politics has been overshadowed by a balance of terror in which organizations such as the United Nations were no more successful at ensuring peace than was the abortive League of Nations. However, the world took a more hopeful view following the Iraq war, the overthrow of communist regimes in Eastern Europe and the USSR, and the increasing acceptance of democratic principles worldwide. Nevertheless, before we can proclaim any new world order, we must contend with the fact that Western Europe seems determined to maintain its time-honored tradition of exhibiting an inability to police its own neighborhood (c.f., Yugoslavia), with the fact that ethnic tensions in the

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 179–190.

successor states of the USSR threaten further political instability, and with the possibility that the emerging economic competition between Japan and China will take a military route. Thus, we cannot easily dismiss the argument that states will continue to be concerned with relative military status, with the argument that they will continue to seek economic advantage over even ostensible allies, and with the realpolitik view that a balance of power continues to provide a surer basis for theorizing about international political processes that does the concept of collective security.

The debate over these views -- the debate between realists who foresee stability arising only from a balance of power and neoliberal institutionalists who foresee the possibility of greater cooperation in the form of collective security arrangements -- focuses on two issues: (1) delineating the goals of countries that best account for their actions, especially patterns of cooperation and conflict; and (2) evaluating the possibility that institutions of various descriptions can ameliorate conflict in an otherwise anarchic environment. Realists argue that although states may be concerned in the long run with absolute welfare, the impossibility of eliminating the threat of conflict forces them when evaluating strategies and outcomes, to be predominantly concerned with relative position as measured by military capability, economic productivity, and the like. This concern with relative position, in turn, attenuates the opportunities for cooperation and the role of institutions as facilitators of cooperation and forces states to abide by strategies consistent with balance-of-power politics. In contrast, neoliberals, drawing on the lessons of scenarios such as the repeated Prisoners' Dilemma and the myriad instances of actual cooperation in international politics, see less reason for supposing that states are concerned *necessarily* with relative gain, see greater opportunities for mutually beneficial cooperation, and see an expanded role for institutions as facilitators of that cooperation. Equivalently, they are more willing than realists to extend the notion of collective security beyond domain of economic cooperation so that it includes strategic military issues as well.

This essay seeks to contribute to the resolution of this debate by offering a more precise formulation of the distinction between balance of power and collective security. Reviewing some results proved elsewhere about a game-theoretic model of anarchic systems, we consider whether balance of power and collective security can each be supported by equilibrium strategies. Arguments about the functions served by international organizations such as the United Nations and GATT, the viability of international military cooperation, and the viability of the Commonwealth of Independent States are then recast in terms of the different properties of these equilibria. Section 2 summarizes our theoretical perspective, which consists of developing a model of international threat and counter-threat processes. Section 3 offers some formal notation and the game we use to model anarchic systems. Briefly, in that model "power" is the sole determinant of winning and losing coalitions, threats and counter-threats are the mechanisms whereby countries secure resources and ensure their sovereignty, alliances are formed or maintained because it is in the interest of individual countries to do so, and no exogenous constraints ameliorate conflict. Section 4 provides our main result about balance of power equilibria, which establishes the existence of such equilibria but which also establishes that the two largest countries vie for control of the system and that the sovereignty of the smallest countries is not guaranteed. Section 5 provides our main result about collective security equilibria, which is that such equilibria exist and that they ensure the sovereignty of all countries in the system. Finally, Section 6 argues that much of the discussion between realists and neoliberals about balance of power versus collective security is, in fact, an argument over the ease with which states can coordinate to one equilibrium rather than the other and the signals they can offer to indicate their commitment to a particular equilibrium.

2. Theoretical Perspective

The essential character of international systems that renders them anarchic is that if states cooperate, they must do so out of simple self-interest: Cooperation must characterize the equilibrium strategies of the non-cooperative game that models the system. In turn, balance of power politics as well as collective security arrangements, if they exist at all, must correspond to alternative equilibria in this model. Thus,

assuming that we possess such a model, the questions we must confront include: Can balance of power and a stable collective security system be supported by non-cooperative equilibria? Does the existence of such equilibria require any special configuration of power relations among countries? If both equilibria exist, how can states coordinate to ensure that a particular equilibrium prevails? Is a balance-of-power equilibrium more stable than a collective security equilibrium? Is there a special role for institutions in achieving and maintaining equilibria and do either of these equilibria allow states to cooperate so as to realize mutual economic gains?

Rather than rely on metaphorical appeals to scenarios such as the repeated Prisoners' Dilemma, Chicken, or the Battle of the Sexes, we offer in this essay a game-theoretic analysis that attempts to model the essential features of anarchic international systems -- of systems without exogenous mechanisms of enforcement and which allows not only for cooperation but also for non-cooperation in the form of threats to eliminate players (countries) altogether. Briefly, our model assumes that, conditional on maintaining their sovereignty, countries pursue a single transferable resource in constant supply, which we can think of as either "power" or economic wealth. We assume constant supply because we do not want to secure cooperation simply by making the gains from it too great, and because sustaining cooperation in the context of constant sum competition reveals more clearly the role that institutions can play in ameliorating conflict. Next, so as to avoid confusion between the notion of equilibrium and that of stability, we say that a system is *stable* if and only if all countries can ensure their sovereignty in the sense that if all countries choose their equilibrium strategies, no country will have its resources reduced to zero.[1]

Our model of anarchy, now, supposes that each country's resources determines who can threaten whom, where threats and counter-threats are the mechanisms whereby countries secure resources from each other. Informally, the game we use to model anarchic systems proceeds as follows: A country, say i, randomly chosen by nature, either offers an initial threat or it "passes," where the threat is a new resource distribution and a proposed threatening coalition C. If i passes, nature selects another country. If i threatens, its partners in C must decide whether or not to participate in the threat. Only if all such partners choose to participate does i's threat call for a response by the threatened countries. Responses are of two types. First, each threatened country, taken in sequence, can offer a counter-threat, which is a new threat, and which, if unanimously accepted by the newly proposed coalition, cancels the original threat and becomes the new current threat. The second type of response is a proposal by one or more threatened countries to surrender resources to one or more members of the originally threatening coalition. If a transfer is accepted by the countries involved, it determines a new status quo, and the game proceeds as before.

With respect now to the types of equilibria that we consider for this portrayal of an anarchic international system, we know that nearly any "reasonable" outcome can be sustained as an equilibrium, given an appropriate specification of strategies.[2] But the complexity of many of these strategies strains credulity. Fortunately, the notions of balance of power and collective security point us in the direction of the most intuitively plausible possibilities. To model balance of power, we suppose that strategies are *stationary* -- that each country makes the same choices whenever it encounters the same threat, and that it thereby ignores who made a threat or who agreed to participate in a threat. In a balance of power system, then, "all states are potentially fit alliance partners; none is seen as much more evil than any othe

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[1] Niou, Emerson M. S., Peter C. Ordeshook, and Gregory Rose. 1989. *Balance of Power*, New York, Cambridge University Press.

[2] Fudenberg, Drew and Eric Maskin. 1986. "The Folk Theorem in Repeated Games with Discounting or with Incomplete Information," *Econometrica*, 54,3:533-54.

other".[3] To model collective security, on the other hand, we look at simple *punishment strategies*, where punishment is directed against those who try to upset the status quo either by making a threat or by agreeing to participate in it.[4] The strategies forming a collective security equilibrium, then, are not stationary because they posit the formation of specific alliances, depending on who defects from a specified pattern of action.

Notice now that if we find equilibria supported by stationary strategies, and if only countries controlling some critical relative level of resources can guarantee their existence in it, then countries must be vigilant about the relative gains and losses that economic cooperation generates, which makes such cooperation difficult if not impossible. If, however, there is a collective security equilibrium supported by punishment strategies in which no country offers an initial threat, then realization of this equilibrium renders the issue of sovereignty and relative position less salient. And if the benefits that accrue through free trade and the like require a non-conflictual world, and if these benefits disappear when agreements to achieve them are disrupted by competition over relative position, then we should pay special attention to the circumstances under which such an equilibrium can be achieved and a balance of power equilibrium avoided.

3. The Model

With respect to notation, we let $(S,\mathbf{r}^o)$ denote a *system*, where $S = \{1,2,...,n\}$ is the set of countries and $\mathbf{r}^o = (r^o_1, r^o_2,...,r^o_n)$ is the distribution of resources across S. Without loss of generality, we let $r^o_1 > r^o_2 > ... > r^o_n > 0$. If $r(C)$ is the sum of resources controlled by the members of the coalition $C \subseteq S$, and if $R = r(S)$, then C is winning if $r(C) > R/2$, it is losing if $r(C) < R/2$, and it is minimal winning if, for all i in C, $C-\{i\}$ is not winning. Countries in S who are in at least one minimal winning coalition are *essential*; otherwise they are *inessential*. If $r^o_i > R/2$, i is *predominant* -- it is winning against all other countries and it can incorporate their resources at will -- so every country has an incentive to avoid the possibility that some other country becomes predominant. If $r^o_i = R/2$, i is *near-predominant*. With respect to the status quo distribution $\mathbf{r}^o$, max[C] is the country in C with the greatest total of resources. Finally, the game Γ that we use to model conflict proceeds as follows:

(1) Nature randomly selects $i \in S$;

(2) i offers a threat $(\mathbf{r},C)$, $i \in C$, or i passes. If i passes, we return to (1). Country j is assumed to be a member of C if $r_j \geq r^o_j$.

(3) The members of $C-\{i\}$ simultaneously choose between approving or rejecting $(\mathbf{r},C)$. If no $j \in C-\{i\}$ rejects, then $(\mathbf{r},C)$ becomes the *current threat*; otherwise, return to (1).

(4) With $(\mathbf{r},C)$ the current threat, nature randomly orders the members of $S-C$.

(5) With $m \in S-C$ offering the first *counter*, a counter takes one of two forms: a new threat, $(\mathbf{r}',C')$, $m \in C'$; or a resource transfer from $S-C$ to one or more members of C. We denote those party to the transfer by C'.

(6) The members of $C'-\{m\}$ simultaneously choose between approving or rejecting $(\mathbf{r}',C')$. If a counter which is itself a threat is approved unanimously, it becomes the new current threat, and we return to (4). If one or more members of $C'-\{m\}$ reject the counter, we select the next threatened country in the order chosen by nature and we return to (5). For counters that are

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[3] Jervis, Robert. 1986. "From Balance to Concert: A Study of International Security Cooperation,"in Kenneth A. Oye, ed., *Cooperation Under Anarchy*, Princeton: Princeton University Press, p.60.

[4] Friedman, James. 1986. *Game Theory with Applications to Economics*. New York, Oxford University Press.

resource-transfers, unanimous acceptance renders the transfer the new status quo and we return to (1).

(7) If the counter of the last threatened country is rejected, the resource distribution of the current threat becomes the status quo and we return to (1).

Notice that Γ is a recursive game, because it allows threats and counters, as well as resource reallocations, to continue in sequence forever. This game's correct treatment, then, is to pretend that it is finite by supposing that we know the consequences of all branches in its extensive form. After postulating these consequences, an equilibrium is characterized by strategies in which no one has an incentive to defect unilaterally to any choice not dictated by that player's strategy, and the postulated consequences are consistent with those strategies -- the subgame perfect choices they imply must yield those consequences.[5]

We are, of course, less interested in the mechanics of how this game ought to be analyzed than we are in the types of equilibria that can prevail in it. In fact, we are primarily interested in ascertaining whether two broad types of strategies can define alternative equilibria -- strategies that correspond to balance of power (competitive) politics and strategies that correspond to a collective security (universally cooperative) arrangement. Specifically, suppose for the moment that $n = 3$ and suppose further that a threat or counter-threat can only take one of three forms -- (150,150,0), (150,0,150), and (0,150,150). That is, suppose threats and counters (excluding alternative resource transfers) all have two countries eliminating the third, where those two countries agree to share the system's resources equally. Then a "balance of power equilibrium" has countries adopting the following types of strategies:

BP: If, for instance, country 1 is given the first move, then it threatens (150,0,150); 2 threatens (0,150,150); 3 passes or threatens (150,0,150) or (0,150,150). If the initial threat is (150,150,0), then "reject;" otherwise "accept." If threatened, states 1 or 2 transfer to the largest threatening country. If state 3 is threatened, then 3 offers (150,0,150) or (0,150,150) as a counter-threat.

That is, in a balance of power equilibrium, countries threaten each other and others agree to participate in threats owing to the expectation that if they fail to agree, others will subsequently threaten them. On the other hand, in a collective security arrangement, strategies will look as follows:

CS: No state makes an initial threat, but if one is offered, the proposed partner "rejects." If the initial threat is rejected, then the "defecting" state is punished by being threatened in the next stage (and this threat is accepted). If two players defect by making and accepting an initial threat or by failing to punish, then play the game as described in BP.

The question, then, is whether each of these descriptions of strategies (suitably extended to n-country scenarios) can correspond to equilibria in our model of anarchic systems. And in the event that they are equilibria, we should ask whether one or the other is especially stable, whether existence depends on the actual initial distribution of resources, and whether the number of countries in the system, n, plays any special role.

4. Balance of Power

Because our discussion of collective security builds on an analysis of balance of power, we focus initially on stationary strategies of type BP. Appreciating the fact, though, that readers may not want to wade

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[5] Selten, Reinhardt. 1965. "Spieltheoretische Behandlung eines Oligopolmodells mit Nachfragetragheit," *Zeitschrift fur die gesamte Staatswissenschaft*, 121:301-24.

through the notation required to summarize our conclusions rigorously, we note here that what follows is intended to establish some assumptions and a classification of threats that allows us to support the following conclusion:

> *If all countries are essential -- if all are members of at least one minimal winning coalition -- then there is a balance of power equilibrium in which no country is eliminated but in which one of the "larger" countries secures half the resources in the system at the expense of some losing coalition. But if there are inessential countries, then those countries cannot assure their continued existence.*

To provide a more precise statement of this result, let Γ_r denote the game that follows the threat of $(\mathbf{r},C)$ and its acceptance, let $v_i(\Gamma_r)$ denote the value that i in S associates with playing that sub-game Γ_r. Thus, $\mathbf{v}(\Gamma_r) = (v_1(\Gamma_r),...,v_n(\Gamma_r))$ is the *continuation value* of Γ_r and specifies what the countries believe follows from the approval of $(\mathbf{r},C)$. So $v_i(\Gamma_r)$, when compared against whatever follows if $(\mathbf{r},C)$ is rejected, determines *i*'s preference for acceptance or rejection of $(\mathbf{r},C)$ or for making this threat in the first place. Once values for all threats are specified we can assume that the acceptance of a threat or counter is a terminal node with its continuation value as the "final outcome." We then analyze Γ like a finite extensive-form game of complete information and we deduce sub-game perfect equilibrium strategies by working backwards from the terminal nodes in the same way we treat finite agendas in majority voting games -- we deduce what each country ought to do any time it must choose a threat, a counter, or accepting or rejecting a threat or counter. An equilibrium, then, is a set of continuation values -- one for each threat -- and a set of strategies for each country such that these values and strategies are consistent. Thus, in equilibrium, the choices that the continuation values imply -- the strategies that are a subgame perfect equilibrium given the continuation values -- must, in turn, imply those continuation values.

To posit continuation values we isolate one class of threats, where the members of one class are associated with one type of continuation value and all remaining threats are associated with a second type. We first identify Type 1 threats, which satisfy four conditions:

> **Type 1 Threat**: $(\mathbf{r},C)$ is a Type 1 threat -- $(\mathbf{r},C) \in T^1$ -- if
> i $r^o_{\max[C]} + r^o(S\text{-}C) \geq R/2$,
> ii $r_j = 0$ for all $j \in S\text{-}C$,
> iii $r_{\max[C]} = R/2$,
> iv There exists a $C' \in W$ such that $C' \cap C = \{k\} = \{\max[C']\} \neq \{\max[C]\}$.

Next, we refine T^1 further to define the set of *primary threats*, $T^p \subseteq T^1$. Letting L be those countries in S who can be the largest member of a minimal winning coalition, T^p satisfies two conditions: First for no two $(\mathbf{r},C)$ and $(\mathbf{r}',C')$ in T^p is it the case that C and C' have a unique common member corresponding to the largest member of C and C' such that the remaining members of C and C' are in $S\text{-}L$. This requirement, after continuation values are assigned, ensures that no primary threat is an effective counter against another such threat. Second, the set of primary threats is maximal in that no winning coalition can offer a Type 1 threat that can be added to this set so as not to violate condition 1. Formally, letting $\mathbf{T}_o$ be the power set of T^1, then,

> **Primary Threats**: $T^p \in \mathbf{T}^o$ satisfies
> i for no $(\mathbf{r},C) \in T^p$ is there an $(\mathbf{r}',C') \in T^1$ such that $C \cap C' = \{\max[C]\} = \{\max[C']\} = \{k\}$ with both $C\text{-}\{k\}$ and $C'\text{-}\{k\}$ subsets of $S\text{-}L$;
> ii There does not exist a $(\mathbf{r},C) \in T^1$ that can be included in T^p without violating condition i.

This definition renders T^p unique. We now define two types of continuation values:

C1: $(\mathbf{r},C)$ in T satisfies C1 if

$$v_j(\Gamma_r) \begin{cases} = r^o_j \text{ if } j \in C \text{ and } j \neq \max[C] \\ = R/2 \text{ if } j = \max[C] \\ \leq r^o_j \text{ if } j \in S\text{-}C \end{cases}$$

C2: $(\mathbf{r},C)$ in T satisfies C2 if

$$v_j(\Gamma_r) \begin{cases} \leq r^o_j \text{ if } j \in C \cap S\text{-}L \\ < R/2 \text{ if } j \in C \cap L \\ \leq r^o_j \text{ if } j \in C \cap L \text{ and if } r^o_j < r^o_{\max[S\text{-}C]}. \end{cases}$$

Before we can assign these continuation values, however, we must impose three assumptions.

A1: If $r^o_i = R/2$, then $r_i > R/2$ if any threat is made and implemented.

So systems with a near-predominant country are "frozen" -- no threat is made since everyone knows that the implementation of such a threat will allow the near-predominant country to become predominant, in which case it can eventually secure all of the system's resources.

A2: If i can become near-predominant either from a transfer or from implementing a threat, i prefers the transfer.

Hence, if max[C] is the largest member of C with respect to the status quo, then the system is frozen if S-C offers to render max[C] near-predominant. Clearly, if S-C prefers freezing the system, it should transfer to max[C], since this choice minimizes the resources that S-C must surrender. And max[C] accepts the offer: Because attempts to secure more than $R/2$ will be blocked, securing $R/2$ by transfer is max[C]'s most preferred feasible outcome.

A3: Letting u_i denote country i's payoff, $u_i(\mathbf{r}) = r_i$ at terminal nodes. For non-terminal nodes, if $\mathbf{R}(\mathbf{r})$ is the set of terminal and non-terminal resource distributions that might be reached from $\mathbf{r}$, then $u_i(\mathbf{r}) = \min[R_i(\mathbf{r})]$.

A3 "prunes" non-terminal transfers from the extensive form. If choosing between r_i with certainty (as when another country transfers to a third party that ends the game) and playing a game with r'_i resources, $r'_i > r_i$, then i prefers the certainty of r_i since i may be threatened subsequently with the necessity for transferring resources itself to a level below r_i. But if i is threatened and if in countering this threat i must choose between retaining r_i after it transfers to end the game and retaining r'_i, $r'_i > r_i$, by transferring a smaller amount so as to attract someone away from the threatening coalition, then i prefers the terminating transfer.

Finally, we use the following assumptions to refine our description of stationary strategies:

A4: If $(\mathbf{r},C)$ is the current threat, then $i \in S$-C chooses a counter, $(\mathbf{r}',C')$, such that $C' \cap C = \{j\}$, and $C'\text{-}\{j\} \subseteq S$-$C$.

To illustrate, let $(\mathbf{r},C)$ be the current threat and let $i \in S$-C offer a counter-threat. Any counter, of course, must either entail a transfer, since C is necessarily winning, or it must coopt one or more members of C into a new coalition, C'. A5 supposes that if $i \in S$-C can form a counter that coopts only one member of C so that all of i's other coalition partners in the counter are in S-C, then i chooses that counter. More valuable alternatives are not ignored, but, whenever it is indifferent, i takes advantage of the fact that S-C is a coalition that, because of C's threat, is "already nearly formed."

Three lemmas follow now from this construction.[6]

> **Lemma 1**: For each $i \in L$, there is at least one $(\mathbf{r},C) \in T^p$ such that $i = \max[C]$ (in particular, $\{i\} \cup L_o$, $i \in L$, has a threat in T^p); and for each $j \in L_o$, there is at least one $(\mathbf{r},C) \in T^p$ such that $j \in C$.
>
> **Lemma 2**: If all threats not in T^p satisfy C1, and if all threats in T^p - $\{(\mathbf{r},C)\}$ satisfy C2, then for any stationary equilibrium, $(\mathbf{r},C) \in T^p$ satisfies C2.
>
> **Lemma 3**: If T in T^p satisfy C2, if $(\mathbf{r},C) \notin \mathcal{T}$, and if all other threats satisfy C1, then for any stationary equilibrium, $(\mathbf{r},C)$ satisfies C1.

We turn now to our central result -- the characterization of a stationary equilibrium. What remains at issue is a specification of a country's choice whenever it is selected to make the initial threat, and the responses of its partners in a proposed initial threat. Postponing the question of the fate of inessential countries, assume that all S are essential. Limiting the discussion to symmetric strategies -- strategies in which all countries in L, and all those in L_o abide by the same strategy, consider this statement as a characterization of equilibrium:

> If $i \in S$ is chosen to make the initial threat, i randomly chooses $(\mathbf{r},C) \in T^p$, $i \in C$ and all $j \in C$ -$\{i\}$ accept; and if $i \in L$, then i chooses $(\mathbf{r},C)$ such that $i = \max[C]$.

So if $i \in L$ is chosen by nature to make the initial threat, then i proposes a primary threat in which it is the largest member of the threatening coalition; if $i \in L_o$ is chosen, then i proposes a randomly selected primary threat in which it is a member of the threatening coalition, and all members of the proposed threatening coalition accept. Using this characterization of strategies, we learn that for the game Γ as specified:[7]

> **Result 1:** *If all $i \in S$ are essential, there is a stationary equilibrium such that $(S,\mathbf{r}^i)$ is stable such that some country in L is rendered near-predominant.*

Furthermore, if we allow sequential threats (i.e., i proposes that C threatens $j \in S$-C, then $k \in S$-C, etc.), then inessential countries as well as smaller essential ones will be unable to assure their sovereignty in any n-country system. Thus, there is a balance of power equilibrium that ensures the sovereignty of "larger" states, but not of smaller ones, and with sets the two largest countries in the system in competition against each other for near-predominance.

It is important to note that this equilibrium is also *strong* in this sense: The "largest" countries (those in L), if given the opportunity to make a threat, prefer to do so because they gain and thereby avoid the possibility of loss, whereas smaller countries, although unable to gain by participating in a threat, avoid the possibility of losses by doing so. So if i believes that all others in S will choose their equilibrium strategies, then i has a positive incentive to make or to agree to primary threats that include it in the threatening coalition, since not doing so diminishes i's utility. So a balance of power equilibrium is attractive.

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[6] Niou, E.M.S., and P.C. Ordeshook. 1990. "Stability in Anarchic International Systems," *American Political Science Review*, December.

[7] Niou, E.M.S., and P.C. Ordeshook. 1990. "Stability in Anarchic International Systems," *American Political Science Review*, December.

5. Collective Security

Turning now to collective security and punishment strategies designed to preserve the status quo, we simplify matters by modifying the assumption that nature chooses randomly from S after a threat is rejected. Without altering our conclusions about the nature of balance of power equilibria, we let D denote the countries that are the potential targets of punishment as determined by the strategy specified below, and we assume that nature chooses from the set S-D. That is, nature chooses from those players who will administer a punishment (if a point in the game is ever reached in which $D = S$, then suppose that nature thereafter chooses from S with uniform probability).

Next, we formulate a punishment strategy that matches the simplicity of stationary strategies, because we do not want to confront the objection that balance of power equilibria are easier to compute: (a) No country proposes an initial threat; (b) No country accepts an initial threat if one is offered; (c) Threats are directed against one or more defectors (members of D); (d) Countries accept threats that are punishments; and (e) Whenever any threat is accepted, all countries use stationary strategies thereafter. Players defecting from (a)-(d) are added to D and are thereafter subject to punishment.

To proceed we must now modify our notation for continuation values. Assume that subgames begin after countries pass, or after all relevant countries choose between accepting and rejecting the last offered threat, we let $\mathbf{v}^D(\Gamma_r) = (v^D{}_1(\Gamma_r),...,v^D{}_n(\Gamma_r))$ denote the continuation value of the subgame beginning after the threat $(\mathbf{r},C)$ is made and accepted, where D is the current set of defectors. If there is no current threat (e.g., a country passes), then $\mathbf{v}^D(\Gamma_o)$ denotes the corresponding continuation value. The general form we assume for $v^D_j(\Gamma_r)$ and $v^D_j(\Gamma_o)$ is as follows:

$$v^D_j(\Gamma_r) = v_j(\Gamma_r) \qquad (1)$$

$$\begin{aligned} v^D_j(\Gamma_o) &= r^o_j \text{ if } j \notin D \text{ and } j \neq \max[S\text{-}D] \\ &= a, \text{ where } r^o_j < a \leq R/2, \text{ if } j \notin D \text{ and } j = \max[S\text{-}D] \\ &< r^o_j \text{ otherwise.} \end{aligned} \qquad (2)$$

Expression (1) states that, in accordance with (e), if there is a standing threat, then all countries play stationary strategies thereafter and continuation values are as specified previously. But if there is no current threat, the specification of $v^D_j(\Gamma_o)$ in expression (2) states that if j is not in D -- if the presumed equilibrium does not target j for punishment -- and if j is not the largest member of S-D, then j merely retains its current resource allocation. If j is not a target for punishment but if it is the largest member of S-D, j receives a transfer that either renders j near-predominant or which eliminates S-C. Finally, if $j \in D$, then j's expected payoff is less than its current resource holdings.

These definitions yield the following result about collective security:[8]

> **Result 2:** *If $|S| > 3$, and if there are four or more essential countries, the strategy described in (a)-(e) yields a strong subgame perfect equilibrium in which no country makes an initial threat and no country is eliminated.*

We limit the domain of this result to systems with four or more essential countries, because although a collective security equilibrium exists otherwise, it is neither strong nor subgame perfect. The weakness of such equilibria if $|S| = 3$ arises because only 2-country coalitions have primary threats. For example, if $\mathbf{r}^o = (120,100,80)$ and if country 3 defects by proposing the primary threat (150,0,150), then 1 has a positive incentive to accept this threat -- in accordance with (e) and with the postulated continuation values for primary threats when stationary strategies are used, the eventual outcome is (150,70,80).

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[8] Niou, E.M.S., and P.C. Ordeshook. 1991. "Realism versus Neoliberalism: A Formulation," *American Journal of Political Science*, May.

Country 3, of course, is indifferent between threatening (150,0,150) or passing, which renders the equilibrium weak rather than strong, and 1's willingness to accept the threat rather than punish 3 precludes subgame perfection. In larger systems, on the other hand, more than one country must accept a proposed primary threat, and this fact renders a collective security equilibrium both strong and subgame perfect.

6. Implications

The principal lessons of our analysis are these:

1. A balance of power and a collective security equilibrium can exist simultaneously in an anarchic system that does not allow for universal gains from cooperation.
2. In a balance of power, nations must be concerned with relative resources, because a loss of sovereignty cannot be precluded if they become too weak; under collective security, nations can focus on absolute gains since no one makes threats against the sovereignty of any state, large or small.
3. A balance of power equilibrium is attractive because it is both strong and perfect. If a country believes that all or nearly all other states abide by it -- if it believes that all or nearly all other states will coalesce freely and cannot be relied on to participate in punishments --it will have a positive incentive to abide by it as well and to accept primary threats when they are offered and to make them when it is possible to do so.
4. In a balance of power one of the two largest states becomes near-predominant.
5. Collective security equilibria are strong only if the number of countries exceeds three.
6. If defection from a collective security equilibrium implies not only a punishment administered by other states but also the inability to pursue gains from cooperation, then collective security equilibria become attractive. Thus, to the extent that international organizations facilitate trade and cooperation, collective security becomes a more secure alternative to balance of power.

Our analysis, moreover, reveals a critically important function served by international organizations. Because we have identified two substantively plausible equilibria, countries must explicitly coordinate to achieve an equilibrium. To illustrate this problem in its simplest form, suppose there are only three countries, that $\mathbf{r}^o = (120,100,80)$, and that each country must choose between a balance of power foreign policy (BP) and a collective security foreign policy (CS). This simple characterization of foreign policy decision-making yields a normal form like the one in Table 1. That is, if either of the two larger countries defects from a collective security equilibrium, it is punished and must transfer resources to its largest opponent; but if only one such country abides by such a strategy, it alone is the target of threats. Thus, (BP,BP,BP) and (CS,CS,CS) are both equilibria, and international organizations must not only facilitate the realization of mutual welfare gains, they must also ensure that the countries can coordinate to (CS,CS,CS).

	BP		CS	
	BP	CS	BP	CS
BP	110, 110, 80	150, 70, 80	110, 110, 80	70, 150, 80
CS	70, 150, 80	110, 110, 50	150, 70, 80	120, 100, 80

Table 1

This coordination task is especially important in a collective security equilibria, because even if no

threats are observed initially, no country can be certain that others have not defected from or will otherwise fail to abide by appropriate punishment strategies. As presently formulated, our model offers no opportunity for signaling a commitment to such strategies, so if a sufficient number of states believe that others would participate in threats, the collective security arrangement is destroyed. With respect to the game in Table 1, notice that if country 3 abides by BP, then BP is a dominant choice for countries 1 and 2; but if 3 abides by CS, then CS is dominant for 1 and 2. Thus, the equilibrium that prevails depends critically on what 1 and 2 believe about 3. Correspondingly, the policies associated with collective security that maximize welfare without regard to relative gains are likely to be viewed as risky, with pessimists warning of dangers and questioning whether international organizations can perform their cooperative and coordinative functions.

The relevance of this example, then, is four-fold. First, both cooperative and non-cooperative equilibria -- world orders -- can exist within a scenario other than a repeated Prisoners' Dilemma in which all countries have an incentive to avoid some mutually destructive outcome. Second, since we have already incorporated the influence of power into the analysis by way of defining legitimate threats and counter-threats, we cannot now use power to predict which of these two equilibria prevail. Equilibrium selection -- coordination to a particular equilibrium -- must occur on some other basis. Third, neither of the equilibria we identify here is Pareto-dominated by the other. Thus, there is no reason to suppose *a priori* that states will gravitate to one rather than the other -- whether they thus gravitate will depend on things other than the relative efficiency of one equilibrium as compared to another. Finally, this analysis illustrates that learning how states coordinate to particular equilibria is an essential part of any explanation for final outcomes. If there are multiple equilibria in so simple a model as the one we offer, then we can be certain that this multiplicity characterizes an even more complex reality.

6. Conclusions

Having thus identified some of the equilibria that can exist within a single scenario, let us now consider the problems associated with coordinating to particular equilibria. Referring again to the game in Table 1, consider the prospect of the three countries in this example coordinating merely with some pre-play discussion. It is here, however, that we can discern the sources of the realist's disagreement with neoliberalism, because there are good reasons for supposing that mere pre-play discussion is ineffectual with respect to ensuring the collective security equilibrium (CS,CS,CS). First, this equilibrium calls for states to "do nothing" until there is a defection that warrants punishment. Hence, regardless of the verbal agreements they reach, each state, as the game unfolds, may question whether others are abiding by their collective security strategies or whether they are merely postponing making a threat until circumstances (not modeled here but presumably including exogenously induced changes in the distribution of resources) are favorable to that purpose.

Second, collective security requires that states punish defectors; but proposing a punishment (as opposed to some other threat) may be rational only if it is certain beforehand that the ostensible partners in the punishment will maintain their commitment to it. Because a collective security equilibrium is subgame perfect in our model, doing so is rational here. But we should not ignore the possibility, as a practical matter, that states might be concerned that a defection of one type increases the perceived likelihood of yet other defections, so that defection becomes a self-fulfilling prophesy. Our example, after all, assumes that all countries have perfect foresight, whereas if there is always something left to chance, then, barring a perfectly functioning coordination mechanism, the viability of pursuing a punishment strategy may be reduced.

Third, that collective security is an equilibrium means only that no state has an incentive to defect *unilaterally* from the agreement. This does not mean that states cannot gain if two or more of them defect simultaneously -- if there are coordinated defections. For example, if states 2 and 3 defect from (CS,CS,CS) to (CS,BP,BP), then 2 gains and 3 loses nothing. And, stepping outside the limits of our formal analysis for a moment, country 2 can presumably reward 3 somehow for its compliance. Indeed,

if we are willing to assume that states can coordinate to achieve one type of equilibrium, then, barring other considerations, we should be willing to assume that subsets of them can coordinate to achieve other ends -- if n countries can coordinate, then it is reasonable to assume that $m < n$ can also coordinate.

Although the realist's objection to the neoliberal argument takes the form of a discussion of these issues, we can see its theoretical content better by referring to the game in Table 2, which, like the Battle of the Sexes and like the game in Table 1, has two non-equivalent, non-interchangeable equilibrium strategy pairs, (a_1,b_1) and (a_3,b_3). At first glance we might suppose that, barring any prior asymmetrical beliefs about strategies, neither equilibrium is more likely to prevail than the other. But suppose we consider the outcome that prevails if the two players start at arbitrary strategy pairs and if they adjust their strategies sequentially. For example, if they begin at (a_1,b_2), they arrive at (3,4) if column chooser moves first, whereas they arrive at (4,3) if row chooser moves first, followed by column chooser (via the route a_1 to a_3, b_2 to b_3). Counting the number of ways each equilibrium can be reached from some other pair of strategies, there are four routes to (3,4) and ten to (4,3). Thus, we might suppose that in the absence of coordination, (4,3) is more likely to prevail than is (3,4).

	b_1	b_2	b_3
a_1	3, 4	0, 0	0, 0
a_2	0, 0	2, 2	1, 4
a_3	0, 0	4, 1	4, 3

Table 2

A similar calculation pertains to the situation portrayed in Table 1 if we suppose that country 3 gains some nominal amount from its coalition partner whenever it participates in an initial threat -- there are twice as many routes to (E1,E1,E1) as there are to (E2,E2,E2). The realist's objection to neoliberalism, then, can be restated thus: Although the equilibrium neoliberal institutionalists postulate require explicit coordination, the absence of effective coordination is more likely to yield realist's scenario than it is to any other outcome. Understanding this, states naturally prepare for a competitive and less than wholly cooperative or benign environment.

The game in Table 1 and its n-country counterparts, however, cannot resolve matters in favor of one side or the other until other matters are considered, including the costs of conflict, the positive externalities that accrue to all states from cooperative action, incomplete information, deception, and misperception. Neoliberalism continues to have available to it the response that not only is a cooperative equilibrium attractive because convergence to it can be made mutually beneficial, and not only do events reveal that the requisite coordination is feasible, but the mechanisms of coordination can also expand the opportunities for convergence to that equilibrium. On the other hand, barring a compelling argument to the contrary, realists are justified in arguing that prudent states will be concerned that the promise of a wholly cooperative equilibrium is only that -- a promise -- and that those who fail to make appropriate preparations for a more conflictual system will be disadvantaged. These preparations, in turn, establish a set of beliefs that move outcomes away from those that neoliberals envision as equilibria. That is, the supposition of a conflictual environment may be more readily sustained as a self-fulfilling prophesy than a wholly cooperative one.

RUSSIA'S NUCLEAR STRATEGY: 90-S AND AFTER

A.PIONTKOWSKY, A.SKOROKHODOV
Strategic Studies Centre
Institute for System Analysis
117312 Moscow, Russia

In this paper we will try to review some characteristic features of the dramatic changes to the world structure, which made a number of traditional military-strategic conceptions obsolete and counter-productive.

1. Military-Political Stability Structures In The Cold War Period

Let us recall as a starting point those postulates which the military-strategic equilibrium in Europe and in the world were based on during the decades of the cold war. First and foremost the confrontation itself was generated by an ideologically-charged geopolitical conflict of two nuclear superpowers, their allies and satellites. Conventional forces of the antagonists faced each other on the European theatre and from time to time they got involved in local conflicts in different parts of the world either directly or more frequently through proxies.

The basic strategic confrontation between NATO and Warsaw Treaty countries has always been interpreted (whether explicitly or not) in the context of an escalation ladder (Fig.1). Both sides were modernizing and deploying weapons designed for potential use at each of the stages of escalation.

The 1972 agreements sealed the concept of strategic parity between the USSR and the US which has been interpreted as the impossibility of winning a full-scale nuclear war. MAD conditions (second-strike capability for both sides) ensured stability at the level 4 of the escalation ladder.

But the problem of stability was not restricted only to the fulfillment of MAD conditions. In the author's view, the stability should be regarded as a multi-level conception. Such approach required the implementation of conditions which ensure stability at each level of the ladder of a potential conflict (Fig.1).

Let's suppose that these conditions are not observed for some of these levels, that is, one side can achieve a sensible advantage in military or political terms at some particular level of conflict. In this case, the other side would be tempted to consider an escalation, that is, transition to the next level so as to deprive the enemy of the real (or imaginary) advantage which it enjoys at the lower stage of the conflict.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 191–200.

On the other hand, the impossibility of winning at the highest level of escalation prompted a search for superiority at lower levels.

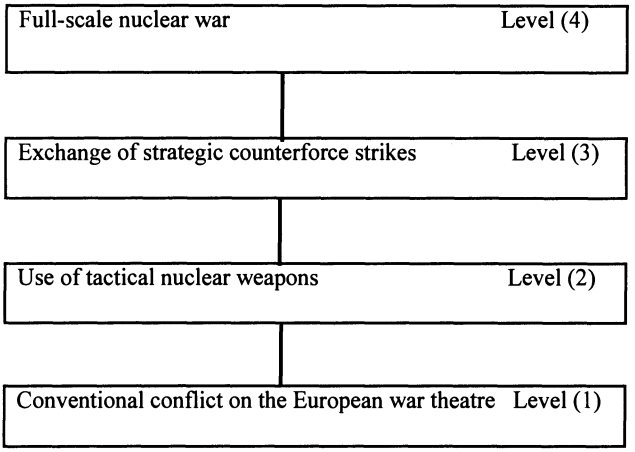

Fig.1. Escalation ladder.

As Richard Nixon stated in 1972 "The President cannot be faced with a situation where his only possible response will be a strike with all available nuclear forces at the enemy cities. The president must have a wide choice of alternative responses to various possible hostile actions. If the United States has the ability to use its strategic forces in a limited, controlled fashion, the possibility of a nuclear response will be more viable. The essence of the United States new strategic doctrine must boil down to the deterrence of a broader range of probable threats".

The objective of the United States leadership to achieve superiority in an exchange of counterforce strikes (level 3) was expressed with the utmost clarity on August 17, 1973 at a press conference by the US Defense Secretary James Schlesinger. Having noted that for any side it would be difficult to go for a massive strike at cities, he added that the United States had not given up the counterforce option. "The United States has repeatedly emphasized", he said, "that it is not seeking either to achieve a disarming first strike capability or to deny the Soviet Union a second strike capability. This does not mean, however, that we do not intend to have certain precision-guided systems which will be useful for limited counterforce strikes".

We have cited these statements to remind the reader that the United States military and political leadership did not consider all situations between the capability for a second retaliatory strike and for the disarming first strike as strategically equivalent.

When the mutually assured destruction conditions were fulfilled, superiority was interpreted by the American side as the ability to gain the advantage in counterforce exchanges. The counterforce exchanges could undermine the mutual assured destruction conditions and finally transfer the two power strategic force system from MAD-stability toward the United States strategic superiority (see,

for example, our detailed analysis in Gelovani[1] and Piontkowsky[2]).

Throughout the 70s, this was precisely the politico-military doctrine by which the United States leadership was guided. Both in the programs for the development of its strategic forces and in the deployment of its nuclear forces in Europe.

The idea of the interconnection of the escalation ladder's different levels applies to the two lower levels of the escalation ladder (1)-(2) as well. During decades of the confrontation between the Warsaw Treaty and NATO, Western military strategic thought proceeded from the premise of the Warsaw Treaty functional superiority (this was apparently justified for a long period) on the level 1 of a conflict involving conventional operations. This functional superiority was interpreted as a potential ability of the Warsaw Treaty forces for a territorial advance deep into Western Europe.

Awareness of one's inferiority at a definite step of the conflict naturally engenders a striving to transfer it to another, "more advantageous" level. While in the above-analyzed case involving strategic nuclear arms a conflict perception was lowered by one step, in the event of a conflict on the European theatre of military operations the Western strategists considered one step up the ladder - the use of tactical nuclear weapons. This led to the appearance of such concepts as "flexible response", "nuclear threshold" and "limited nuclear war in Europe". Naturally enough, these concepts were reflected not only in the papers and reports by Western strategists, but also in concrete plans of the military upgrading and developing of new types of weapons.

In this context of a multi-level stability a persistent reluctance of the West to declare a no-first use of nuclear weapons pledge was quite natural and strategically well-founded. It didn't reveal any immanent nuclear aggressiveness but just reflected strategic realities of a concrete military-political situation in Europe.

This deliberate uncertainty about NATO nuclear intentions reminded about the existence of level 2, serving as a psychological deterrence against opponent's potential plans to realize its advantage at the level 1.

In such manner this multilevel system of balances and deterrence had been functioning during cold war years generally preventing the confronting camps from direct military clash even in the moments of the most acute political crises.

2. Strategic Realities Of Post-Cold War World

Let us now analyze those changes and their consequences to the hierarchical structure of stability we witnessed for the last few years. First of all the main geopolitical or rather geoideological conflict which originally generated this system of superpower confrontation as well as all its techniques of balances and deterrence vanished; not became weaker or somewhat mitigated but just vanished.

This does not mean at all that the world entered an epoch of harmony and that the possibility of sharp contradictions between Russia and the United States national interests are excluded in principle. These contradictions will inevitably be taking place from time to time as it is the case for example between the United States and Japan. They could be of economical nature (struggle for markets), or even territorial ones (demarcation of sea shelf in the Bering Strait for instance); but one may be sure that the matter of a conflict will never be differences of a "social-economic systems" or ideological preferences of the leaders of Poland, Germany, Afghanistan or Ethiopia.

The second fundamental change bears an even more pragmatic character. Since the mid-40's, when

directly controlled by Moscow communist regimes were imposed on East European countries, powerful military forces in Europe faced off along their boarders. It is evident that after the disastrous Great Patriotic War the Soviet Union had to take care of the security of its Western borders. At that time there was another option to enhance the Soviet Union security. (Independent Finland retained its social-political structures while being bounded by military-political commitments with the Soviet Union). But the leadership of the Soviet Union for the third time (since Tilzit peace agreement and Molotov-Ribbentrop Pact) repeated the same military-strategic mistake of Russia's rulers; through the split of Europe they established a permanent strategic face off between confronting military forces. In this case it was limited to the decades of the "cold war" which proved to be no less disastrous for Russia than two Patriotic wars. The deterrent character of nuclear weapons prevented it from a real clash even at times of sharp political crises.

After the withdrawal of USSR troops from Eastern Europe the probability of conflict at the stage 1 diminished to practically zero. This immediately affected the other stages of the escalation ladder. It was not just a coincidence that by the Fall of 1991 the American administration agreed with the elimination of tactical nuclear weapons in Europe.

The consequences for nuclear strategy of two new fundamental factors (an elimination of both the basic geopolitical conflict between two superpowers and the frontal face off conventional military forces) are much deeper than a mere revision of the role of tactical nuclear weapons.

To see it more clearly, let us scrutinize such a key nuclear strategy term "deterrence". In the classic concept of MAD-stability, deterrence is understood as a factor preventing a potential enemy from considering a nuclear strike by threatening to inflict an unacceptable damage by a retaliatory strike.

At the same time a nuclear attack or even the threat of such an attack does not arise just from the mere fact that it is technically feasible (i.e. from the existence of nuclear arms and means of its delivery). For instance, nobody ever contemplated the possibility of a nuclear attack by the United States against Canada, or the United Kingdom against France. The contemplation of a nuclear strike comes to life only in the context of a basic conflict and its further potential to escalate. It is not the possession of nuclear arms in itself that is fraught with a risk of nuclear clash, but the basis of a political conflict between the powers possessing such arms.

And here another aspect of nuclear deterrence comes out. The analysis of the development of the conflicts between superpowers of last decades, including the most acute - the Caribbean one, shows that on the level of leadership both American and Soviet one there always was a tendency to block the escalation of the conflict to its lowest level, far away from the stage of potential nuclear arms involvement.

Thus the real political role of nuclear weapons throughout the decades of cold war was not as much in the deterrence from the direct nuclear attack as in mutual deterrence from a potential conflict escalation.

It is understandable that the West has always been extremely sensitive to any encroachment upon the nuclear component of its defense strategy in Europe. Indeed, in the past, any proposal of elimination of tactical nuclear weapons in Europe had justly been regarded as an attempt to leave the West vulnerable in the face of Soviet superiority. For many years this idea had really been one of the USSR priorities in the arms control agenda. Even in the 1990 United States "Soviet Military Power" document placed "Soviet Arms Control Objectives" under the heading of standard rubric "eliminate US theatre and tactical nuclear systems from Europe".

But since then, as a result of radical changes in Europe, Russia and NATO have really switched their roles in the relationship of their conventional and nuclear forces. Now it is Russia who tends

to rely on the nuclear factor as an important element of its defense strategy.

Western observers often asked the question: why was Russian public opinion relatively unperturbed by such cardinal changes affecting Russian national security as the unification of Germany and the dissolution of the Warsaw Pact? Indeed, despite sharp attacks on Soviet and then Russian foreign policy and accusations of defeatism by representatives of nationalist circles, such criticism has not gained any broad public support.

In our opinion, this is explained by the idea of the sufficiency of the nuclear deterrence for safeguarding our security in Europe. This idea has not yet been formulated in clear-cut strategic conceptions, but has apparently been clearly realized and felt by the public. It is probably not surprising that the official propaganda campaign for universal and total nuclear disarmament has quietly died down over the past few years. It is clear now that in the foreseeable future the nuclear component will remain an important element of Russian national security. Just as the double role that nuclear weapons played in NATO's strategy of ensuring strategic stability and parrying the threat of Soviet superiority at level 1, it is time now for the Russian nuclear potential to play a similar role.

But tactical nuclear weapon may constitute a destabilizing factor in view of a higher danger of their seizure by terrorists, malfunctions or accidents. In principle, this threat has always been around, though in conditions of local political and ethnic conflicts it naturally increases. That is why an elimination of tactical weapons in Europe would answer the interests of both sides and the interests of overall stability and security in Europe.

But what if Russia, having achieved at last its long standing objective of elimination of tactical nuclear forces in Europe, find herself vulnerable in the face of present NATO conventional forces superiority? Skeptics may consider unconvincing the argument that there is no political grounds for the possibility of NATO military conflict with Russia.

In fact, no long-term strategy can be based upon the current status of political situation how ever favorable it may seem to be. But there are strategic nuclear armed forces that have been serving and will continue to serve as the ultimate guarantor of Russia's security.

As for European security, we perceive that they will not play the role so much of an "umbrella" against a particular military threat, that doesn't exist now, but rather as of a psychological stabilizing factor in the period of transition from military confrontation to a system of all-European security.

In spite of recent frictions and problems in the Russia-NATO relationship, particularly connected with NATO enlargement prospects, we still believe that basically Europe is moving to the situation where military conflict between Russia and NATO countries will be as unthinkable as between Great Britain and France or Canada and USA.

Thus, the logic of geopolitical and psychological changes in the world leads to an objective change in political role of nuclear weapons in the strategy of Russia and other nuclear powers as well. Nuclear arms possession transforms itself from a tool of bi-polar confrontation toward an important psychological factor of "defence a tout les azimutes" strategy.

3. New Challenges Of Nuclear Threat

Naturally enough these changes were reflected in the "Military Doctrine of Russia". It interesting to note that in its first version published in May 1992 there was still a phrase: "Russia will not use first its nuclear or any other arms of mass destruction" (it was deleted from the text in the final

version).

The author's view of this statement was a typical mixture of propaganda and strategy, which was characteristic for the official documents during the Soviet period. First of all, such a declaration is meaningless because it cannot be verified in principle. Secondly, it contradicts the concept of "defence a tout les azimutes" whose elements are present in other chapters of "Military Doctrine of Russia" explicitly stated or not.

As we attempted to show, the possession of nuclear arms deters the potential enemy not only from nuclear attack but from risk of even conventional military conflict with a nuclear power.

One cannot find this broader aspect of nuclear deterrence in the quotation given above. Although this aspect of nuclear deterrence under the current circumstances is now more important for Russia then ever.

Always implied Russia's advantage on the conventional level 1 is lost. Now it is theoretically possible that a coalition of powers will arise superior to Russia in this respect. In this situation the political factor of Russia's nuclear potential will exert necessary psychological impact on potential challengers of such a coalition and even on the mere possibility of its appearance.

That is why a traditional no-first use declaration by Russia is no longer appropriate. One of nuclear strategy paradoxes lies in the fact that just refusal of no-first use statement ensures real no-use of nuclear weapons more effectively.

In the situation when "Russia does not consider any of the nations or a coalition of nations as her enemy" ("Military Doctrine of Russia") it is natural to her to accept a "defence a tout les azimutes" strategy, an important element of which is the political factor of strategic nuclear arms possession.

The natural question arises - how consistent with this new strategy are deep cuts of offensive strategic arsenals provided by START-2 agreement, and Russian-American declaration about "elaboration of global ABM defense system conception as common strategy on ballistic missiles and other WMD proliferation problem".

As far as arms reductions are concerned however apparently radical they do not change qualitatively the long-established strategic stalemate situation. Even reductions more deep than provided by START-2 would still keep the Russia-USA strategic forces system inside the stability area understood traditionally in the context of MAD doctrine (see, Piontkowsky [3,4]).

Generally speaking these piles of strategic arms accumulated by the Soviet Union and the United States became an anachronism having no clear military-strategic or political objectives. They were being stockpiled due to the mindless logic of an on going global confrontation - the more the better. As for high precision counterforce systems, they were to get an upper hand at level 2 (see Fig.1) of a potential conflict. But now as it was above discussed these considerations lost any sense; - level of 3.000 - 3.500 warheads to be reached by the year 2003 will be as surplus and absurd as an initial level of 10.000 - 12.000. Thus it is clear that "patriotic" criticism of START-2 agreement is nonprofessional and guided by considerations far away from national security concerns.

A much more fundamental problem than any radical reduction are raised by the concept of global ABM defense system referred to in the January 1992 Russian-American declaration. Since then discussions on this problem have been going on in Russia. As a matter of fact, these debates(discussions) became the first public national security discussion in the history of our country. Before returning to this issue, let us reflect on the potential spectrum of national security threats in one way or another related to the nuclear weapons factor in the foreseeable future:

- nuclear attack on Russia by one of the nuclear powers;
- formation of the coalition of nations having conventional arms superiority over Russia;

- accidental or premeditated use of nuclear arms against Russia by a group of individuals as a result of the loss of control over it.

The first threat does not exist at all. Nevertheless the MAD conditions between Russia-USA will be present at least to the year 2003, according to START-2.

The second threat is not perceived but not be theoretically excluded. As previously mentioned the very fact that Russia possesses nuclear arms (even in much lower quantities than stipulated in START-2) serves as a sufficient and convincing response to such a threat.

Finally, the threat from the third group is growing from an obscure peripheral anxiety into an important factor affecting the security of Russia, as well as global security. So some shift in the superpower nuclear concerns and arising of a new item on their agenda - global defense system - were not incidental.

As soon as GDS initiative was announced by President Yeltsin in his January 1992 speech at the Security Council meeting a wave of criticism was unleashed in the Russian strategic community. It was perceived that global defense system meant Russia would join the US SDI system and this realization would undermine strategic stability. In the author's view these arguments were based on some misunderstandings.

The Reagan SDI program was designed and announced in the period of superpower confrontation. Its objective was to provide a drastic change in the strategic situation, namely - in theory to deprive the adversary of the capability to inflict a nuclear strike. The program was subjected to intense criticism on the basis of its military-political consequences; as well as, the basis of its technical feasibility. As a result, its development was not realized and the focus of the R&D in this field was redirected toward a framework of Global Protection Against Limited Strikes (GPALS).

The GPALS project renounced the strategic objectives embodied in the 1983 SDI program. It is now geared to the protection of the United States territory from any potential unauthorized or accidental launches, from the strikes from the third nuclear nations or terrorist groups. The transition from the SDI concept to GPALS - is a visible and positive development in the evolution of American strategic philosophy, and it is to Russia's advantage to support this tendency and positively influence its development. Fundamental changes in the world's political situation have practically excluded the threat of global nuclear war; but at the same time other threats to national security of the United States and of Russia are surfacing as a result of the transformation.

The SDI project did threaten to undermine the strategic stability understood as mutual assured destruction capability. As for global defense system which conception is still on early stage of discussion the situation is different in several aspects.

First, it is quite possible to design a GDS system that would provide global protection from potential limited terrorist strikes while at the same time would not breaking the MAD-conditions between Russia-USA (leaving their territories vulnerable both to first and retaliatory nuclear strikes).

Second, and it is more important we must keep in mind the military-historical relativity of the MAD-stability concept. The nuclear balance of terror and corresponding stability concept were born in the context of deep and prolong geopolitical and ideological conflict between two superpowers, global confrontation of their conventional forces, and the real threat of their military collision. In the 90's context of deep cuts of offensive arms and the development of a partnership relationship between former adversaries, a stability concept in the sense of a territory's protection against nuclear strikes is not now excluded and is becoming real and meaningful.

If the stability of terror was based on the deliberate inability of each of its sides to avoid

unacceptable damage, then after radical cuts of offensive arms a new stability concept naturally arises, in fact a inverse one, which provides to each side a protection from unacceptable damage (see more details in our other paper "FSSI as universal measure of stability: From MAD-stability toward MAP-stability").

Another possible attribute of a GDS is that it allows (through the process of negotiations) to involve the US GPALS program development into the mainstream of an overall global security discussions. An alternative to this would be self-realization of American program according to its internal logic, with the perspective of a potential competition with hardly positive consequences for both sides, especially for Russia.

With the diminishing of the probability of a large-scale conventional war or moreover a nuclear one, the threats stemming from the third threat category are coming forward in the spectrum of threats to Russian national security. It means, that national security issues are being more than ever before interwoven with the problems of global security and therefore need to be resolved within a framework of partnership and cooperation.

Concerns of Russian opponents to the global defense system is quite natural within the general environment of the current political debates in Russia. They are expressed for example by Dr. A. Arbatov in his article in "Nezavisimaya Gazeta": "Joint SDI - will it contribute to anybody's security ?". Arbatov believes that in the case of the CDS project "The Russian-American relationship will be radically changed. It will hardly be possible to talk about equal partnership and about maintenance of stability of mutual deterrence, reciprocal reductions of potentials, etc. One is reminded that there are no such items on the USA-Great Britain, USA-Japan, or USA-Germany agendas. But these countries have at least impressive economic cards... It will be necessary to forget about any independent role of new Russia for a long time".

Basically Arbatov raises the following question - will Russia remain a world power if Russia and USA loses the potential ability to destroy each other through mutual suicide; or in the other words, what else can Russia be equal to USA besides this unique and terrifying ability, by what else may Russia be interesting and important as a subject of the world politics but her potential ability to destroy the whole world ?

This is a fundamental issue and is to be discussed not in somewhat subdued fashion but openly and frankly. Specifically, this issue is not to be substituted by another - the "inevitable one-sided disarmament of Russia" as attempted by the Arbatov article. Generally speaking this problem is wider than purely a national security matter and bears an axiological character.

As for the national security considerations we may note that the term "deterrence" itself supposes the existence of some particular threat to deter (in MAD-deterrence case - the threat of all-scale nuclear attack). If there is another way to remove this threat there is no need to use the possibility of such an exotic as mutual suicide. MAD-deterrence can not be useful for any other meaningful political objectives. Before our eyes the USSR broke up and ceased to exist in spite of possessing the largest in the world potential of nuclear deterrence.

But having abandoned together with the United States the concept of mutually assured destruction, isn't Russia losing something more? Isn't she being exempted from the only achievable sphere of equality? Isn't she losing for good the only the distinction of a world superpower? Our civil society if it does exist at all should answer these questions. Here we can provide only our personal opinion. We believe that politics based on the above assumption would be proving the existence of a sort of collective inferiority complex. This is true that a potential kamikadze will always be reckoned with. But is it the only role which great Russia aspires to play in the 21st century world's community?

Coming back to the issue of "equal partnership" it should be noted besides that to our regret we will be tied up for a long period of time if not forever with the United States by "equal partnership" in dismantling and ecological neutralization of this enormous and extremely dangerous machine of nuclear arsenal production, the machine we created by our joint efforts during the period of cold war.

4. Conclusion

The dramatic events of the last decade deeply transformed the geopolitical picture of the world. But were all these fundamental changes adequately reflected in strategic stability concepts prevailing among experts and politicians ? Most of them still have a habit of continuing to follow MAD-stability concept which was designed for another historical epoch and responded to another spectrum of potential threats.

The inertia of thought of many experts in nuclear strategy is not just curious and a harmless methodological weakness. The MAD-stability concept logic inevitably leads to two serious practical consequences negatively affecting global security.

Firstly, it imposes limitations on superpowers nuclear disarmament process (practically by framework of START-2 agreement) and by doing so it requires keeping up and modernizing of Russia and USA huge nuclear arms arsenals which are futile in such enormous quantities for any clear cut strategic objective.

The mere maintenance of the nuclear complexes of such dimension increases (especially in Russia) the danger of ecological and radiation disaster as well as the danger of leakage and proliferation of nuclear weaponry main components. We have been witnessing the manifestation of both of these dangers almost every day.

Secondly, the MAD-stability concept forbids (and by its own internal logic quite justly) deployment of a Anti-Ballistic Missile system. Just this argument - ABM system deployment would undermine stability conditions - is the key argument used during the debates on global defense both in Russia and in the United States. Although seemingly convincing this argumentation is misleading. As already mentioned above, the historically limited definition of stability - MAD-stability concept - is often mistakenly regarded as an universal one.

In 1972 R.Nixon and L.Brezhnev signed ABM-treaty forbidding deployment of any antiballistic missile systems. That treaty legally sealed the conditions already accepted by both sides the mutual assured destruction concept. Both sides deliberately opened their defenseless territories for all the might of the opponent's nuclear potential. They turned to this choice as a last resort realizing that, however paradoxical it might be, this defenselessness provided them only possible defense in that geopolitical reality. The assumption was that a rational adversary would never strike because he understood that an opponent had a second-strike capability and consequently the first strike would automatically mean the mutual suicide.

Such was a really mad (so "MAD" abbreviation was not purely incidental) logic, but justified by the extreme circumstances of that time and maybe the only possible military-political logic of cold war confrontation. It seems that modern MAD-stability concept supporters forgot the specific military and political sources of its peculiar logic and continue to follow it blindly in absolutely different historical context. MAD-stability nowadays means that Russia, USA and other countries must open their territories and not to take any measures to defend their population against a quite

real threat of a group of irrational and irresponsible nuclear terrorists.

Thus nuclear strategists concerned with already non-existent threats of the past put mankind defenseless before a real and ever growing threat of the present.

Nevertheless a considerable part of Russian public is still not convinced that our political relations with the United States have turned from confrontation toward partnership to a such extent that MAD-conception has lost its significance. This a natural conservative position, which is to be reflected in national security debates. Its proponents may be satisfied with the fact that with the realization of the START-2 agreement the MAD-conditions will be still preserved. Deeper cuts are impossible during this period merely by technical reasons. It is believed that 90's will provide a more clear answer on tendencies of world's political development and fundamental decisions in the field of Russian nuclear strategy will be taken in the atmosphere of frank public discussion.

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Section 2.5

Quantitative : Deterrence, Crisis Stability & First Strike Stability

MULTIPOLAR NUCLEAR STABILITY: INCENTIVES TO STRIKE AND INCENTIVES TO PREEMPT

JEROME BRACKEN
Yale University
New Haven, Connecticut 06520
USA

ABSTRACT. This paper considers three armed sides and one unarmed side. All four sides have value targets and all four sides may have defenses. The paper proposes a concise, parsimonious theory of multipolar nuclear stability, with two measures -- incentive to strike and incentive to preempt.

The objective of this paper is to present a framework with the minimal number of dimensions required to describe the problem, which turns out to involve sixteen resource and attrition parameters. Together with behavioral assumptions about the fighting of twelve possible wars -- six with three sides acting separately and six with three sides organized into two coalitions -- the sixteen dimensions are mapped onto measures of incentive to strike and incentive to preempt. The framework is abstract but the qualitative insights are logically persuasive.

An example is given addressing the stability of START II and beyond strategic force structures. The sides are (1) United States/Britain/France, (2) Russia, (3) China with a larger arsenal and (4) "Rest of the World". Two other scenarios have also been analyzed within the same framework:

a. Mideast Scenario. How do deployable tactical missile defenses affect stability among three sides: (1) United States/Western Europe/Mideast Allies, (2) Russia and (3) China/Mideast Allies?

b. Korea Scenario. What is the regional stability among (1) armed North Korea, (2) armed South Korea, (3) armed China and (4) unarmed Japan? How do defenses affect stability?

One robust conclusion obtained from analyzing multipolar nuclear scenarios with this structure, which is expected to hold for all similar three-sided and four-sided scenarios, is that defenses of two large sides which are large relative to a third small side but small relative to each other are stabilizing. Also, a defense of the fourth, unarmed side which is large relative to the third side but small relative to the first and second sides is stabilizing.

1. Overview

This paper presents a concise, parsimonious theory of multipolar nuclear stability. The framework is intended to enable understanding of force structure and other relationships which affect incentives to strike and incentives to preempt, unilaterally or in coalitions.

The paper addresses warfare involving three armed sides and one unarmed side. There are presently five major nuclear powers: United States, Russia, Britain, France and China. The aggregation into three armed sides and one unarmed side analyzed in the example presented here is (1) United States, Britain

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 203–220.

and France, (2) Russia, (3) China and (4) "Rest of the World".

Regional scenarios can also be analyzed in the same framework. For instance, the stability of a deployable defense is analyzed in Best and Bracken (1993c) for three sides: (1) United States/Western Europe/Mideast Allies, (2) Russia and (3) China/Mideast Allies. Regional stability in Asia is analyzed in Bracken (1993b) for four sides: (1) North Korea, (2) South Korea (3) China and (4) Japan with no offensive weapons but, possibly, with defenses.

2. Background

First-strike stability in a bipolar world is defined and analyzed in Kent and Thaler (1989) and, with particular attention to the impact of defense, in Kent and Thaler (1990). The concept of first-strike stability, addressing the incentive to preempt for both sides due to the "reciprocal fear of surprise attack", was first suggested by Schelling (1960).

Incentives to strike and first-strike stability in a multipolar world are defined and analyzed in Bracken and Shubik (1993). Five nuclear powers are organized into all possible coalitions of two sides.

First-strike stability and strategic defense is the focus of Best and Bracken (1993a), where five powers are organized into all possible coalitions of two sides. The cost function from Kent and Thaler (1989,1990) is adopted as the basic measure of utility, and a multipolar extension of their bipolar first-strike stability measure is presented. The insight is derived that though defenses are uniformly destabilizing in a bipolar world, defenses which are large relative to the smaller powers and small relative to the larger powers are stabilizing in the multipolar world.

First-strike stability with three players acting separately is introduced in Best and Bracken (1993b).

The present paper allows three players to act separately or to form two coalitions. There are twelve possible wars. A measure of utility is suggested. Behavior of the three sides is modeled. Both incentives to strike and first-strike stability are addressed. An example is given with several variations. Alternative utility functions are discussed. Of particular interest is the role of the unarmed, fourth side in influencing the incentives to strike and the first-strike stability of the three armed sides.

3. Resources and Measures

3.1. RESOURCES

There are three armed sides and one unarmed ("rest of the world") side. The data describing the four sides are:

V_1 , V_2, V_3 , V_4 = value targets of sides 1,2,3,4
O_1 , O_2 , O_3 = offensive weapons of sides 1,2,3
D_1 , D_2 , D_3 , D_4 = defensive weapons of sides 1,2,3,4

Some of the offensive weapons of sides 1, 2 and 3 may be vulnerable. During the war all weapons are expended. The value targets before and after the war are:

V_1^1 , V_2^1 , V_3^1 , V_4^1 = value targets before the war
V_1^2 , V_2^2 , V_3^2 , V_4^2 = value targets after the war

3.2. UTILITY

The utility of a side is dependent on the state of the world with respect to value targets. The utilities of Side *i* before and after the war are:

$$U_i^2 = \frac{V_i^2}{V_1^2 + V_2^2 + V_3^2 + V_4^2} \qquad U_i^1 = \frac{V_i^1}{V_1^1 + V_2^1 + V_3^1 + V_4^1}$$

That is, the utilities of Side *i* are the fractions of the world's value possessed by Side *i* before the war and after the war, respectively.

3.3. INCENTIVE TO STRIKE

Incentive to strike for Side *i* is the ratio of the utility of Side *i* after the war to the utility of Side *i* before the war. If incentive to strike is equal or greater than one, Side *i* has a larger fraction of the world's total resources after the war than before the war. Incentive to strike is as follows:

$$I_i = \frac{U_i^2}{U_i^1}$$

This measure can be less than one or greater than one. If it is less than one the side is worse off from striking, while if it is greater than one the side is better off from striking.

Later we will introduce a measure which is not simply a ratio of the fraction of the world's resources possessed by a side, since one or more sides may abhor a war, or may at least abhor the loss of their own value. However, the above function is the most simple measure of the warfare-related change in relative value of a side as the result of a war.

3. 4. FIRST-STRIKE STABILITY (INCENTIVE NOT TO PREEMPT)

First-strike stability differs from incentive to strike in that it compares the utility of a side if it strikes first to the utility of a side if it strikes other than first, and then examines all sides to determine which side fares relatively worst from not striking.

First-strike stability of Side *i* is as follows:

$$S_i = \frac{U_i^2 \textit{ of worst outcome for Side i for all first strikes by other sides}}{U_i^1 \textit{ of worst outcome for sidePHANTOM i for all first strikes by Side i}}$$

Side *i* assumes that if someone else strikes first Side *i* will get his worst outcome from striking other than first. Side *i* also assumes that if Side *i* strikes first he will get his worst outcome from striking first. Side *i* further assumes that possible first strikes by other will include two sides in coalition against Side *i*. However, first strikes by Side *i* will not include another side in coalition with Side *i*. In other words, others can act in a coalition against Side *i* but Side *i* cannot plan on acting in a coalition.

The first-strike stability of all of the sides taken together is:

$$S = \textit{minimum}\ (S_1, S_2, S_3)$$

This can be interpreted as follows. The first strike will be undertaken by the least-satisfied side, so all sides have the same incentive to strike first as has the least-satisfied side.

4. Possible Wars and Assumed Strategies

There are twelve possible wars among three sides. The sides may act separately in the following six orders: 1 2 3, 1 3 2, 2 1 3, 2 3 1, 3 1 2 and 3 2 1. The sides may form two coalitions and act in the following orders: 1 23, 2 13, 3 12, 12 3, 13 2 and 23 1.

For each sequence of actions the strikers know the sequence and the behavioral motivations of the other strikers.

4.1. THREE SIDES ACTING SEPARATELY

When three sides act separately they may attack in any of the six orders. Denote the first striker by a, the second striker by b and the third striker by c. Denote the fourth side by d.

The first striker a attacks b forces, c forces, b value, c value and d value, maximizing the utility of the first striker. The second striker b attacks c forces, a value, c value and d value, maximizing the utility of the second striker. The third striker c attacks a value, b value and d value, maximizing the utility of the third striker.

The optimal strategies of the three sides are found by working backward from the end of the war. Each first and second strike leads to an optimal third strike. Each first strike leads to an optimal second strike. Knowing the optimal third strike the optimal second strike for each first strike can be chosen. Knowing the optimal second strike the optimal first strike can be chosen. The optimal first, second and third strikes yield utilities for a,b,c and d.

4.2. THREE SIDES ACTING IN TWO COALITIONS

When three sides form two coalitions there are two types of wars -- one side attacks two sides and two sides attack one side. In all cases the fourth side is attacked. Denote the sides by a,b,c and d.

4.2.1 In the first three wars, where the first coalition of one side attacks the second coalition of two sides, the first coalition chooses its counterforce and countervalue allocation to maximize its utility, and the second coalition chooses its countervalue allocation to maximize its utility. The first coalition of side a attacks b forces, c forces, b value, c value and d value. Then the second coalition of sides b and c attacks a value and d value. The optimal choice of the first coalition anticipates the optimal choice of the second coalition.

4.2.2 In the second three wars, where the first coalition of two sides attacks the second coalition of one side, the first coalition chooses its counterforce and countervalue allocation to maximize the minimum utility of its two individual members. The second coalition of one side chooses its countervalue allocation to maximize its utility. The first coalition of sides a and b attacks c forces, c value and d value. Then the second coalition of side c attacks a value, b value and d value. The optimal choice of the first coalition anticipates the optimal choice of the second coalition.

5. Example

5.1. DATA

The resources in the example are as follows:

Value targets V_1 , V_2 , V_3 , V_4 = 3000, 2000, 1000, 2000
Offensive weapons O_1 , O_2, O_3 = 4000, 3000, 1000
Defensive weapons D_1, D_2 , D_3 , D_4 = 0, 0, 0, 0

Side 1 is the United States, Britain and France, Side 2 is Russia and Side 3 is China. Side 4 is the rest of the world.

Value target data are consistent with the upper range of Committee on International Security and Arms Control, National Academy of Sciences (1988) and with the medium range of Congressional Budget Office (1991). Offensive weapon data are consistent with START II levels of the United States and Russia, present weapon levels of Britain and France, and a substantially expanded arsenal of China.

The fractions of offensive weapons assumed to be vulnerable of Sides 1, 2 and 3 are .5, .67 and .67, respectively. In other words, one-half of the side 1 weapons are invulnerable and one-third of the side 2 and side 3 weapons are invulnerable.

The attrition to weapon targets and to value targets are calculated from the following equations:

$$\textit{Weapon Targets Killed} = \textit{Weapon Targets} \times [1 - \exp - (\frac{3.0\ \textit{Attacking Weapons}}{\textit{Weapon Targets}})]$$

$$\textit{Value Targets Killed} = \textit{Value Targets} \times [1 - \exp - (\frac{1.5\ \textit{Attacking Weapons}}{\textit{Value Targets}})]$$

These attrition equations yield the following attrition results:

Attackers/Targets	*Weapon Targets Killed*	*Value Targets Killed*
.25	.53	.31
.5	.78	.53
1.0	.95	.78
2.0.	.998	.95

There is a decreasing marginal utility of assigning weapons to targets. Weapon targets are relatively more lucrative because weapon targets are assumed to involve systems with multiple warheads (ICBMs) and systems with many weapons vulnerable per target (submarines in port and bombers on bases); weapon targets killed per weapon expended is high for small attacks.

5.2. ALLOCATION POSSIBILITIES

5.2.1 For the six cases of three sides acting separately, the first striker has 93 choices of allocation to five targets, the second striker has 45 choices of allocation to four targets and the third striker has 10 choices of allocation to three targets. The 93 choices of the first striker allow all combinations of 1.0 to one target, .5 each to two targets, .33 each to three targets, .25 each to four targets and .20 each to five targets. And, 0., .1 or .2 of the total weapons can be drawn off for assignment to the value targets of Side 4. The 45 choices of the second striker allow all combinations of 1.0 to one target, .5 each to two targets, .33 each to three targets, and .25 to four targets, and 0. .1 or .2 can be drawn off to assignment to the value targets of Side 4. The 10 choices of the third striker allow all combinations of 1.0 to one target, .5 each to two targets, .33 each to three targets and a mix of .5 to one target and .25 each to two targets. Thus there are 93 X 45 X 10 = 41,850 possible paths to be followed.

5.2.2 For the three cases of one side attacking two sides the first striker has 180 choices of attacking four types of targets and the second striker has 25 choices of attacking two types of targets, a total of 180 X 25 = 9500 possible paths.

5.2.3 For the three cases of two sides attacking one side the first striker has 10 choices of attacking three targets and the second striker has 10 choices of attacking three targets, a total of 100 possible paths.

5.3. COMPUTATIONAL IMPLEMENTATION

The computational implementation is a modification of the model documented in Bracken (1993a), which treats three armed sides and one unarmed side. That model, however, is based on the costs of Kent and Thaler (1989, 1990) and considers incentive to preempt only; incentives to strike to improve after-war position as compared to before-war position are not addressed therein. The present analysis modifies that model to define utilities and to consider both incentive to strike and first-strike stability.

5.4. RESULTS

Table 1 gives results of the calculations for the twelve possible wars. Presented are value targets before the war, value targets after the war, utilities before the war, utilities after the war, incentives to strike and first-strike stability.

5.4.1 Asterisks on incentives to strike denote the first striker in a sequence. In the first six wars, where the three sides act separately, the utilities of the first strikers are always improved -- all of the incentives to strike are equal to or greater than one. In the next three wars, where one side attacks two sides, incentive for Side 1 is greater than one and incentives for Sides 2 and 3 are less than one. In the last three wars, where coalitions must form, incentives are all greater than one; the incentives for Sides 2 and 3 to combine are least.

In the first six orders there are strong incentives to strike first. If the first-striking side knows how the war will progress and allocates accordingly, and so do the other sides, all three sides have a motivation to strike first. In the next three orders, Side 1 has a motivation to strike while Sides 2 and 3 do not. In the last three orders the coalitions all have a motivation to form and strike.

5.4.2 First-strike stability is evaluated three ways. Measure 1 may involve ratios of small numbers -- the utility for going other than first (in the numerator) may be very small and the utility for going first (in the denominator) may also be very small. A small resulting ratio will result in a low first-strike stability, though preemption may not be reasonable since the side with these properties may well not be motivated to strike first. The next two measures override this possibility by considering both after-war utility and before-war utility. Measure 2(.5) sets stability equal 1.0 when the incentive to strike is equal to or less than .5; that is, if the ratio of after-war utility to before-war utility is less than one-half, a side will not preempt even if it may be relatively better off striking than waiting should war occur. Similarly, Measure 3(.9) sets stability equal 1.0 when the incentive to strike is equal to or less than .9.

First-strike stability for the three sides for Measure 1 is .46,.46,.51. Sides 1 and 2 are equally-motivated and Side 3 is least-motivated to preempt. First-strike stability for Measure 2(.5) is .46,.46.1.00. Sides 1 and 2 are equally-motivated to preempt and Side 3 is stable -- the Side 3 lowest measure of incentive to strike of .24 places it below the cutoff for Measure 2(.5). First-strike stability for Measure 3(.9) is .46,1.00,1.00; Side 1 is most-motivated to preempt. This illustrates how first-strike stability of three sides individually and of three sides taken together changes as the measure changes.

5.4.3 Overall, for all three measures, first-strike stability is .46 although the incentives of the three sides differ within the measure.

Table 1. Results for Example

	Side 1	Side 2	Side 3	Side 4
Value Targets Before the War				
	3000.	2000.	1000.	2000.
Value Targets After the War				
Order				
1 2 3	1044.	134.	165.	319.
1 3 2	892.	173.	91.	141.
2 1 3	785.	721.	223.	284.
2 3 1	296.	446.	223.	222.
3 1 2	892.	181.	325.	81.
3 2 1	336.	446.	223.	235.
1 23	1104.	446.	50.	446.
2 13	2141.	648.	363.	506.
3 12	3000.	2000.	160.	128.
12 3	2760.	1765.	72.	145.
13 2	2164.	307.	613.	419.
23 1	1104.	799.	399.	358.
Utilities Before the War				
	.38	.25	.13	.25
Utilities After the War				
1 2 3	.63	.08	.10	.19
1 3 2	.69	.13	.07	.11
2 1 3	.39	.36	.11	.14
2 3 1	.25	.38	.19	.19
3 1 2	.60	.12	.22	.05
3 2 1	.27	.36	.18	.19
1 23	.54	.22	.02	.22
2 13	.59	.18	.10	.14
3 12	.57	.38	.03	.02
12 3	.58	.37	.02	.03
13 2	.62	.09	.17	.12
23 1	.41	.30	.15	.13
Incentives to Strike				
1 2 3	*1.67	.32	.80	.77
1 3 2	*1.83	.53	.56	.44
2 1 3	1.04	*1.43	.89	.56
2 3 1	.67	*1.50	1.50	.75
3 1 2	1.61	.49	*1.76	.22
3 2 1	.72	1.44	*1.44	.76
1 23	*1.44	.87	.19	.87
2 13	1.56	* .71	.79	.55
3 12	1.51	1.51	* .24	.10
12 3	*1.55	*1.49	.12	.12
13 2	*1.65	.35	*1.40	.48
23 1	1.11	*1.20	*1.20	.54
First-Strike Stability				
Measure 1	.46	.46	.51	.46
Measure 2(.5)	.46	.46	1.00	.46

6. Variations of Example

6.1. DEFENSES

Three defenses are investigated, as follows:

D_1, D_2, D_3, D_4	=	1000,	1000,	0,	0
D_1, D_2, D_3, D_4	=	1000,	1000,	0,	1000
D_1, D_2, D_3, D_4	=	2000,	2000,	0,	0

The first defense is 1000 perfect interceptors each for Side 1 and Side 2 and none for Side 3 and Side 4. This defense is large enough to protect Side 1 and Side 2 from strikes by Side 3 alone. Side 3 can still act in coalition with Side 1 or Side 2, and Side 3 can still attack Side 4.

The second defense is 1000 perfect defenders each for Sides 1, 2 and 4 and none for Side 3. Now, Side 4 is protected from attack by Side 3.

The third defense is 2000 perfect interceptors each for Side 1 and Side 2 and none for Side 3 and Side 4. Now, Side 1 and Side 2 can partially defend themselves against each other. This is the type of defense which induces first-strike instability. One side can attack with more weapons than can be confronted by the defense of the other, with the penetrating attackers allocated to counterforce and countervalue missions such that they kill vulnerable weapons and value targets; the relatively few surviving weapons of the second striker cannot effectively penetrate the defense of the first striker and thus few value targets of the first striker are destroyed. Whichever side strikes first does much better and thus both sides are highly motivated to preempt.

6.1.1 Table 2 gives results for defense 1000,1000,0,0. Comparing Table 2 with Table 1 (the undefended case), incentives to strike for Side 1 and Side 2 are higher in Table 2 while incentives to strike for Side 3 are far lower. Side 3 is removed from being a unilateral problem; for the orders 3 1 2 and 3 2 1 incentives to strike drop from 1.76 and 1.44 in Table 1 to .83 and .31 in Table 2.

For Measure 1 first-strike stability of Side 1 increases from .46 to .60, first-strike stability of Side 2 decreases from .46 to .31 and first-strike stability of Side 3 decreases from .51 to .07; thus overall first-strike stability decreases from .46 to .07. But Measure 1 involves for Side 3 a ratio of very small utilities since Side 3 is severely damaged both as a first striker or as other than a first striker. For measure 2(.5) overall first strike stability decreases from .46 to .31; Side 2 is the least stable. For Measure 3(.9), however, overall first-strike stability increases from .46 to .60, since only Side 1 has incentive to strike exceeding .9.

6.1.2 Table 3 gives results for defense 1000,1000,0,1000. Comparing Table 3 with Table 2, incentives to strike for Sides 1, 2 and 3 are usually lower. Of particular interest is that for Measure 2(.5) first-strike stability increases from .31 to .59 and for Measure 3(.9) first-strike stability increases from .60 to 1.00 (due to Side 1 having incentive to strike for sequence 1 23 of .85). The qualitative result is that, overall, first-strike stability is increased by defending Side 4, the unarmed side.

6.1.3 Table 4 gives results for defenses 2000,2000,0,0. Comparing Table 4 with Table 1 (the undefended case), incentives to strike for Side 1 and Side 2 are significantly higher. Incentive to strike for Side 3 is significantly lower. First-strike stability for Side 1 is higher and for Side 2 is lower. First-strike stability overall is lower for all measures.

Comparing Table 4 with Table 2 (defenses have been increased from 1000 to 2000) incentives to strike for Side 1 and Side 2 increase. For Side 2, incentive to strike for order 2 13 goes from .85 (worse off) to 1.30 (better off). This results in first-strike stability for Measure 3(.9) being significantly lower -- decreasing from .60 in Table 2 to .38 in Table 4. This is the qualitative effect discussed earlier. Going from 0 to 1000 Side 1 and Side 2 defenders increases first-strike stability, but going from 1000 to 2000 Side 1 and Side 2 defenders decreases first-strike stability, to below the undefended case of Table 1; this is particularly true if one believes that Measure 3 (.9) is the most plausible of the three measures.

Table 2. Results for Defense 1000,1000,0,0

	Side 1	Side 2	Side 3	Side 4
Value Targets Before the War				
	3000.	2000.	1000.	2000.
Value Targets After the War				
Order				
1 2 3	3000.	876.	190.	102.
1 3 2	2336.	211.	325.	287.
2 1 3	1820.	2000.	160.	122.
2 3 1	1820.	2000.	160.	135.
3 1 2	2336.	285.	325.	194.
3 2 1	1820.	2000.	160.	135.
1 23	3000.	1375.	223.	360.
2 13	1104.	649.	1000.	307.
3 12	3000.	2000.	72.	27.
12 3	3000.	2000.	5.	0.
13 2	1104.	649.	1000.	307.
23 1	3000.	676.	1000.	446.
Utilities Before the War				
	.38	.25	.13	.25
Utilities After the War				
1 2 3	.72	.21	.05	.02
1 3 2	.74	.07	.10	.09
2 1 3	.44	.49	.04	.03
2 3 1	.44	.49	.04	.03
3 1 2	.74	.09	.10	.06
3 2 1	.44	.49	.04	.03
1 23	.61	.28	.05	.07
2 13	.36	.21	.33	.10
3 12	.59	.39	.01	.01
12 3	.60	.40	.00	.00
13 2	.36	.21	.33	.10
23 1	.59	.13	.20	.09
Incentives to Strike				
1 2 3	*1.92	.84	.36	.10
1 3 2	*1.97	.27	.82	.36
2 1 3	1.18	*1.95	.31	.12
2 3 1	1.18	*1.94	.31	.13
3 1 2	1.98	.36	* .83	.25
3 2 1	1.18	1.94	* .31	.13
1 23	*1.61	1.11	.36	.29
2 13	.96	* .85	2.61	.40
3 12	1.57	1.57	* .11	.02
12 3	*1.60	*1.60	.01	.00
13 2	* .96	.85	*2.61	.40
23 1	1.56	* .53	*1.56	.35
First-Strike Stability				
Measure 1	.60	.31	.07	.07
Measure 2(.5)	.60	.31	1.00	.31

Table 3. Results for Defense 1000,1000,0,1000

	Side 1	Side 2	Side 3	Side 4
Value Targets Before the War				
	3000.	2000.	1000.	2000.
Value Targets After the War				
Order				
1 2 3	3000.	1194.	76.	1287.
1 3 2	3000.	1194.	76.	1287.
2 1 3	1104.	2000.	91.	700.
2 3 1	1104.	945.	1000.	945.
3 1 2	3000.	1194.	76.	1287.
3 2 1	1104.	945.	1000.	945.
1 23	1894.	1081.	1000.	2000.
2 13	1936.	1155.	1000.	1155.
3 12	3000.	2000.	72.	83.
12 3	3000.	2000.	5.	307.
13 2	1104.	649.	1000.	649.
23 1	669.	945.	1000.	945.
Utilities Before the War				
	.38	.25	.13	.25
Utilities After the War				
1 2 3	.54	.21	.01	.23
1 3 2	.54	.21	.01	.23
2 1 3	.28	.51	.02	.18
2 3 1	.28	.24	.25	.24
3 1 2	.54	.21	.01	.23
3 2 1	.28	.24	.25	.24
1 23	.32	.18	.17	.33
2 13	.37	.22	.19	.22
3 12	.58	.39	.01	.02
12 3	.56	.38	.00	.06
13 2	.32	.19	.29	.19
23 1	.19	.27	.28	.27
Incentives to Strike				
1 2 3	*1.44	.86	.11	.93
1 3 2	*1.44	.86	.11	.93
2 1 3	.76	*2.05	.19	.72
2 3 1	.74	* .95	2.00	.95
3 1 2	1.44	.86	* .11	.93
3 2 1	.74	.95	*2.00	.95
1 23	* .85	.72	1.34	1.34
2 13	.98	* .88	1.53	.88
3 12	1.55	1.55	* .11	.06
12 3	*1.51	*1.51	.01	.23
13 2	* .87	.76	*2.35	.76
23 1	.50	*1.06	*2.25	1.06
First-Strike Stability				
Measure 1	.59	.82	.07	.07
Measure 2(.5)	.59	.82	1.00	.59

Table 4. Results for Defense 2000,2000,0,0

	Side 1	Side 2	Side 3	Side 4
Value Targets Before the War				
	3000.	2000.	1000.	2000.
Value Targets After the War				
Order				
1 2 3	3000.	446.	105.	64.
1 3 2	3000.	446.	105.	87.
2 1 3	1820.	2000.	50.	15.
2 3 1	1820.	2000.	50.	39.
3 1 2	3000.	446.	105.	87.
3 2 1	1820.	2000.	50.	39.
1 23	3000.	1573.	138.	176.
2 13	3000.	2000.	1000.	151.
3 12	3000.	2000.	72.	27.
12 3	3000.	2000.	5.	0.
13 2	1820.	2000.	1000.	47.
23 1	3000.	446.	1000.	100.
Utilities Before the War				
	.38	.25	.13	.25
Utilities After the War				
1 2 3	.83	.12	.03	.02
1 3 2	.82	.12	.03	.02
2 1 3	.47	.51	.01	.00
2 3 1	.47	.51	.01	.01
3 1 2	.82	.12	.03	.02
3 2 1	.47	.51	.01	.01
1 23	.61	.32	.03	.04
2 13	.49	.33	.16	.02
3 12	.59	.39	.01	.01
12 3	.60	.40	.00	.00
13 2	.37	.41	.21	.01
23 1	.66	.10	.22	.02
Incentives to Strike				
1 2 3	*2.21	.49	.23	.07
1 3 2	*2.20	.49	.23	.10
2 1 3	1.25	*2.06	.10	.02
2 3 1	1.24	*2.05	.10	.04
3 1 2	2.20	.49	* .23	.10
3 2 1	1.24	2.05	* .10	.04
1 23	*1.64	1.29	.23	.14
2 13	1.30	*1.30	1.30	.10
3 12	1.57	1.57	* .11	.02
12 3	*1.60	*1.60	.01	.00
13 2	*1.00	1.64	*1.64	.04
23 1	1.76	* .39	*1.76	.09
First-Strike Stability				
Measure 1	.76	.38	.08	.08
Measure 2(.5)	.76	.38	1.00	.38

Of note in Table 4 is that for almost all orders Side 1 and Side 2 have greater survival of value targets than in Table 1 and Table 2. Defenses both decrease their losses from striking each other and encourage them to strike Side 3 and Side 4.

6.2. VULNERABLE WEAPONS

Total weapons of Sides 1, 2, 3 are 4000, 3000, 1000, respectively. The variation is to raise those weapons which are vulnerable from 2000, 2000, 667 to 3000, 2700, 900.

This would correspond to, for Side 1, 1000 of the 4000 weapons on submarines at sea and all land-based missiles and bombers vulnerable, for Side 2, 300 of the 3000 weapons at sea or on untargetable missiles and, for Side 3, 100 of the 1000 weapons at sea or on untargetable missiles.

The earlier case to which this comparison is made is that of Table 2, for defense 1000, 1000, 0, 0

Comparing Table 5, where there are more vulnerable weapons, with Table 2, now Side 2 can attack Sides 1 and 3, in the order 2 13, and be better off -- incentive to strike for order 2 13 increases from .85 to 1.26. This is because in Table 2 Side 2 is not motivated to attack Side 1 weapons, leaving them to destroy much of Side 2 in response, but in Table 5 Side 2 is motivated to attack Side 1 weapons, being able to defend against their response. Side 1 weapons instead attack the undefended Side 4.

First-strike stability decreases. For Measure 2(.5) it decreases from .31 to .21. For Measure 3 (.9) it decreases from .60 to .21.

7. Alternate Utility Function

The cost function of Kent and Thaler (1989,1990) is:

$$\textit{Cost} = \textit{(Damage to Self)} - \textit{Weight} \times \textit{(Damage to Others)} + \textit{Weight},$$

where Weight is usually set to .3. This results in valuing one's own casualties more than those of others. If Weight is equal to 1.0 all sides are treated the same.

The utility function presented in Section 3 above and used in the example does not allow a side to discount the effects on the other sides. All sides are treated the same.

The following utility function reflects all three of these criteria: (1) one's percent of all value surviving, (2) the undesirability of a war, and (3) a preference for one's own value:

$$U_i^1 = \frac{V_i^1}{V_1^1+V_2^1+V_3^1+V_4^1} \times \frac{V_i^1 + Weight(V_{Others}^1)}{V_i^1 + Weight(V_{Others}^1)}$$

$$U_i^2 = \frac{V_i^2}{V_1^2+V_2^2+V_3^2+V_4^2} \times \frac{V_i^2 + Weight(V_{Others}^2)}{V_i^1 + Weight(V_{Others}^1)}$$

That is, the utility after the war is the percent of value held by Side *i* times the percent of the original value left, with Side *i* setting a weight on how much he cares about the others with respect to original value left.

Tables 6 and 7 give results for Weight = 1 (Side *i* values everyone the same) and for Weight = .2 (Side *i* values others .2 times as much as himself). Comparing both Table 6 and Table 7 with Table 1, for the original utility function, there is now less incentive to strike. This is because all sides have an incentive

Table 5. Results for Defense 1000,1000,0,0 and Increased Vulnerability of Offensive Weapons

		Side1	Side2	Side3	Side 4
Value Targets Before the War		3000.	2000.	1000.	2000.
Value Targets After the War					
	Order				
	1 2 3	3000.	876.	268.	129.
	1 3 2	2336.	211.	325.	287.
	2 1 3	1961.	2000.	180.	35.
	2 3 1	1961.	2000.	180.	40.
	3 1 2	2336.	285.	325.	194.
	3 2 1	1961.	2000.	180.	32.
	1 23	3000.	1453.	259.	294.
	2 13	3000.	2000.	1000.	329.
	3 12	3000.	2000.	72.	27.
	12 3	3000.	2000.	5.	0.
	13 2	1104.	649.	1000.	307.
	23 1	2336.	1470.	347.	42.
Utilities Before the War		.38	.25	.13	.25
Utilities After the War					
	1 2 3	.70	.21	.06	.03
	1 3 2	.74	.07	.10	.09
	2 1 3	.47	.48	.04	.01
	2 3 1	.47	.48	.04	.01
	3 1 2	.74	.09	.10	.06
	3 2 1	.47	.48	.04	.01
	1 23	.60	.29	.05	.06
	2 13	.47	.32	.16	.05
	3 12	.59	.39	.01	.01
	12 3	.60	.40	.00	.00
	13 2	.36	.21	.33	.10
	23 1	.56	.35	.08	.01
Incentives to Strike					
	1 2 3	*1.87	.82	.50	.12
	1 3 2	*1.97	.27	.82	.36
	2 1 3	1.25	*1.92	.35	.03
	2 3 1	1.25	*1.91	.35	.04
	3 1 2	1.98	.36	* .83	.25
	3 2 1	1.25	1.92	* .35	.03
	1 23	*1.60	1.16	.41	.23
	2 13	1.26	*1.26	1.26	.21
	3 12	1.57	1.57	* .11	.02
	12 3	*1.60	*1.60	.01	.00
	13 2	* .96	.85	*2.61	.40
	23 1	1.49	*1.40	* .66	.04
First-Strike Stability	Measure 1	.78	.21	.07	.07
	Measure 2(.5)	.78	.21	1.00	.21
	Measure 3(.9)	.78	.21	1.00	.21

Table 6. Results for Alternate Utility Function with Weight = 1.0

	Side 1	Side 2	Side 3	Side 4
Value Targets Before the War				
		3000.	2000.	1000.
2000.				
Value Targets After the War				
Order				
1 2 3	3000.	2000.	50.	146.
1 3 2	3000.	446.	1000.	3.
2 1 3	3000.	2000.	67.	0.
2 3 1	1820.	2000.	105.	0.
3 1 2	3000.	446.	1000.	3.
3 2 1	958.	1601.	1000.	26.
1 23	2399.	945.	223.	732.
2 13	1527.	2000.	132.	15.
3 12	3000.	1601.	130.	85.
12 3	2540.	2000.	1000.	2000.
13 2	1777.	307.	1000.	2000.
23 1	1104.	2000.	1000.	19.
Utilities Before the War				
	.38	.25	.13	.25
Utilities After the War				
1 2 3	.38	.25	.01	.02
1 3 2	.38	.06	.13	.00
2 1 3	.38	.25	.01	.00
2 3 1	.23	.25	.01	.00
3 1 2	.38	.06	.13	.00
3 2 1	.12	.20	.13	.00
1 23	.30	.12	.03	.08
2 13	.19	.25	.02	.00
3 12	.38	.20	.02	.01
12 3	.32	.25	.13	.22
13 2	.22	.04	.13	.22
23 1	.14	.25	.13	.00
Incentives to Strike				
1 2 3	*1.00	1.00	.05	.06
1 3 2	*1.00	.22	1.00	.00
2 1 3	1.00	*1.00	.07	.00
2 3 1	.61	*1.00	.11	.00
3 1 2	1.00	.22	*1.00	.00
3 2 1	.32	.80	*1.00	.01
1 23	* .80	.47	.22	.33
2 13	.51	*1.00	.13	.01
3 12	1.00	.80	* .13	.04
12 3	* .85	*1.00	1.00	.89
13 2	* .59	.15	*1.00	.89
23 1	.37	*1.00	*1.00	.01
First-Strike Stability				
Measure 1	.40	.15	.38	.15

Table 7. Results for Alternate Utility Function with Weight = .2

	Side 1	Side 2	Side 3	Side 4	
Value Targets Before the War					
		3000.	2000.	1000.	2000.
Value Targets After the War					
Order					
1 2 3	2538.	743.	105.	36.	
1 3 2	2089.	446.	581.	132.	
2 1 3	1392.	1735.	408.	469.	
2 3 1	1352.	930.	465.	222.	
3 1 2	1294.	602.	642.	511.	
3 2 1	1237.	930.	465.	426.	
1 23	1919.	945.	223.	1023.	
2 13	3000.	770.	1000.	770.	
3 12	3000.	2000.	160.	128.	
12 3	2760.	1765.	72.	145.	
13 2	2309.	783.	675.	474.	
23 1	1820.	910.	455.	411.	
Utilities Before the War					
	.38	.25	.13	.25	
Utilities After the War					
1 2 3	.50	.09	.01	.00	
1 3 2	.37	.04	.08	.01	
2 1 3	.17	.30	.05	.04	
2 3 1	.19	.13	.06	.02	
3 1 2	.17	.07	.10	.05	
3 2 1	.16	.13	.06	.04	
1 23	.28	.11	.02	.12	
2 13	.47	.07	.14	.07	
3 12	.49	.31	.01	.01	
12 3	.46	.27	.01	.01	
13 2	.37	.09	.09	.04	
23 1	.28	.11	.06	.04	
Incentives to Strike					
1 2 3	*1.34	.35	.08	.01	
1 3 2	*1.00	.17	.66	.04	
2 1 3	.44	*1.19	.38	.16	
2 3 1	.51	* .52	.50	.08	
3 1 2	.47	.27	* .79	.21	
3 2 1	.43	.52	* .50	.18	
1 23	* .73	.45	.18	.48	
2 13	1.27	* .30	1.15	.28	
3 12	1.31	1.26	* .12	.03	
12 3	*1.22	*1.10	.05	.04	
13 2	* .98	.34	* .74	.16	
23 1	.73	* .46	* .46	.14	
First-Strike Stability					
Measure 1	.59	.58	.43	.43	
Measure 2(.5)	.59	1.00	1.00	.59	
Measure 3(.9)	1.00	1.00	1.00	1.00	

to preserve the world. With respect to the effect of Weight alone, the qualitative effect of going from Table 6 to Table 7 is to decrease most incentives to engage in warfare and to increase first-strike stability. These sensitivities are because when Weight = .2 all sides are more insensitive to the destruction of others and thus perform more countervalue attacks. Any initiator thus faces more damage to his own value.

8. Summary of Insights

This theory of multipolar nuclear stability attempts to encompass the minimum number of entities which affects the problem.

The resources are: (1) value of Sides 1,2,3,4, (2) offensive weapons of Sides 1,2,3 and (3) defenses of Sides 1,2,3,4. Some of the offensive weapon resources may be vulnerable. There are two attrition functions, counterforce and countervalue.

The behavioral motivations are captured in the utility function, incentive to strike and first-strike stability.

The three sides act in any of twelve ways -- six orders in which they may strike separately and six orders in which they may act in two coalitions.

There are thus sixteen dimensions for resources and attrition: the eleven resource levels, the three weapon vulnerability parameters and the two attrition functions. They are integrated by the utility measure and the incentive measures in examining all of the twelve wars. The motivations to strike and to preempt are the focus of the analysis.Several strong conclusions can be drawn:

1. Results are sensitive to all of the sixteen resource and attrition dimensions. Some of the sensitivities are presented in the paper.

2. Stability increases and decreases can be explained as the sixteen dimensions are changed.

3. An interesting finding with respect to defenses is that having enough defense to block the offensive weapons of the weakest side but not those of the other two sides increases stability. Adding defenses to the unarmed side also increases stability.

Specific results of the analysis of the example are obtained for four levels of defense. First-Strike Stability Measure 3(.9), where only those sides with incentive to strike larger than .9 will initiate, yields the following:

Defense of Sides 1,2,3,4				First-Strike Stability
0,	0,	0,	0	.46
1000,	1000,	0,	0	.60
1000,	1000,	0,	1000	1.00
1000,	1000,	0,	1000	1.00
2000,	2000,	0,	0	.38

These numerical results correspond to the conclusions discussed above. Stability increases with smaller defenses but decreases with larger defenses.

9. Caveats

The quantitative results given in the tables might be changed somewhat if a more detailed grid of permissible allocations were considered. It would be desirable to verify with more detailed calculations these approximate computational results. It is unlikely that the qualitative conclusions would be changed.

Withholding of weapons by Sides 1, 2 and 3 for future strikes has not been discussed in this paper. This can be analyzed by the methods of Bracken (1993c), which constructs a combined utility function for value and weapons and optimizes a multi-stage nuclear exchange.

10. Acknowledgments

I am indebted to the following colleagues for various contributions to my understanding of this general class of problems and the application of game-theoretic concepts thereto: Marvin Alme, Melvin Best, Glenn Kent, Thomas Quint and Martin Shubik. They are not responsible for any errors in the present paper.

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CONTROLLING INSTABILITIES CAUSED BY ROGUE GOVERNMENTS

GLENN A. KENT
8300 Wagon Wheel Road
Alexandria, VA 22309

1.0 Introduction

The emerging capabilities of rogue nations to employ weapons of mass destruction (nuclear, chemical, or biological) is now front and center and poses a serious threat of regional instabilities. The more likely means of employing these weapons include cruise missiles and ballistic missiles and there is now an expanding effort on countering such missiles. This paper focuses on countering ballistic missiles.

2.0 Two Objectives

We now face two problems: (1) to avoid regional instabilities we need to provide an effective defense against missiles deployed by rogue governments; and (2) at the same time, in order to preserve deterrence and first-strike stability (with respect to the interaction of strategic offensive forces of the United States and Russia), we need to limit the capability of each nation to defend their centers of value.

The challenge is clear. How should we go about providing an effective counter to theater missiles while, at the same time, preserving deterrence and first-strike stability?

3.0 The ABM Treaty

The basic intent of the ABM Treaty of 1972 is stated in the preamble:

> "Considering that effective measures to limit anti-ballistic missile systems would be a sustaining factor in curbing the race in strategic offensive arms ---."

Also, in Article I of the Treaty, the parties have agreed as follows:

> "1. Each party undertakes to limit anti-ballistic (ABM) systems and to adopt other measures in accordance with the provisions of this Treaty.
> 2. Each party undertakes not to deploy ABM systems for a defense of the territory of its country and not to provide a base for such a defense, and not to deploy ABM systems for defense of an individual region except as provided for in Article III of this treaty."

The intent of the ABM Treaty of 1972 is clear--to provide effective measures to limit the capabilities of

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 221–227.

ABM systems for defense of the territory of each country against attacks by strategic nuclear forces.

At this juncture, we make a careful distinction between two matters:

- Preserving the intent of the Treaty.

And, on the other hand.

- Maintaining the Treaty itself--or, more specifically, maintaining the approach, construction, and logic inherent in the current Treaty.

The above distinction is critical. The author will argue that an approach that centers on "Maintaining the present construction of the Treaty" does not necessarily ensure that we will achieve the first objective--"maintaining the intent of the Treaty." That while the construction in the current treaty (as reflected in the current wording of the Treaty) was undoubtedly appropriate for the situation in 1972, that may no longer be the case; there now exists a demand for effective theater missile defenses. Accordingly, we should now examine other approaches.

4.0 One Possible Approach

One approach "to provide effective measures" with regard to national missile defenses (and at the same time allow deployments of theater missile defenses) would be along the following lines: (1) distinguish between ABM interceptors and TMD interceptors; and then (2) prohibit each side from deploying ABM interceptors but allow TMD interceptors.

To distinguish between the two types of interceptors one would proscribe limits regarding TMD interceptors. First, a limit on testing--TMD interceptors are not to be tested against targets having a velocity of more than "X" Km/sec. Second, a limit on the performance of the interceptor itself--the velocity of the TMD interceptor will not exceed some limit--like 3 Km/sec. Then, by definition, an interceptor that adheres to these limits is a "TMD interceptor" and is not, again by definition, an "ABM interceptor."

Such an approach maintains the same basic construction reflected in the current Treaty. Whether this construction maintains the intent of the Treaty (providing effective measures to limit ABM capabilities) is another matter.

We now examine a situation that could possibly result from such an approach--an approach that centers on a definitional difference between ABM interceptors and TMD interceptors. The situation is described as follows:

- The Treaty (as revised) makes a definitional difference between ABM interceptors and TMD interceptors.
- Each party deploys TMD interceptors--the number of such interceptors not specified. (According to the definitions of the Treaty none of these interceptors are "rated" as ABM interceptors and thus any number can be deployed without violating the Treaty.)
- These interceptors are equipped with a nuclear warhead (Russian version) or a terminal hit-to-kill engagement system (U.S. style).
- However, there is a catch. Both the United States and Russia have deployed some of these interceptors, geographically, to defend their centers of value.
- There is considerable chagrin on both sides--about SIOP[1] degrade by the United States and about RSIOP[1] degrade on the part of the Russians.Each side laments and protests that deterrence stability has been seriously eroded. Analysts that keep track of the index for "first-strike

[1] SIOP--Single Integrated Operational Plan.

[1] RSIOP--Russian Single Integrated Operational Plan.

stability" report a precipitous and worrisome drop in that index.[3]

- Legal counsels examine these deployments as to violations. They report that such deployments are allowed. That is, according to the definitions in the Treaty, no ABM interceptors are being deployed. And, since TMD interceptors are not prohibited, deploying such interceptors is not in violation of the Treaty. What is not prohibited is allowed

The example above is to make and underline one central (and hopefully obvious) point. Making a definitional distinction between ABM interceptors and TMD interceptors does not, in itself, represent an adequate approach for providing deterrence/first-strike stability.

5.0 Another Possible Approach

Now examine another approach for amending the Treaty.

- No distinction is made between ABM interceptors and TMD interceptors. All interceptors are known simply as "ballistic missile interceptors." No constraints as to velocity and testing are imposed on these "ballistic missile interceptors." (We may have to distinguish between "ballistic missile interceptors" and "aircraft and cruise missile interceptors," but that is quite different than distinguishing between different types of "ballistic missile interceptors.")
- There is a clear distinction, however, between: (1) a case where interceptors are deployed, geographically, to protect the homeland--a National Missile Defense (NMD); and (2) a case where the interceptors are deployed, geographically, to counter ballistic missiles in the hands of a particular rogue nation--a Theater Missile Defense (TMD).
- The terms of the Treaty are explicit as to where each party is allowed to deploy their interceptors. These interceptors can only be deployed in agreed areas. For example, for the case of countering missiles possessed by Iran and Iraq, the interceptors can only be deployed in regions surrounding those countries: in the Southern Regions of Russia, other Southern tier countries of the FSU, on ships in the Caspian Sea, in northern Saudi Arabia, the upper reaches of the Persian Gulf, or the eastern reaches of the Mediterranean.
- The Treaty is also explicit as to the platforms on which these interceptors can be deployed. The allowed platforms being ground transporters, ships, and aerial vehicles--manned or unmanned. The Treaty explicitly disallows spacecraft as a platform.

6.0 Evaluating The Two Approaches (In Terms Of Deterrence/First-Strike Stability)

First, we will evaluate each approach in terms of whether the approach does in fact provide effective measures to limit the capabilities of ABM systems. The evaluation will be according to the perspective of the United States with respect to deterrence/first-strike stability. "SIOP degrade" will be used as the measure. The SIOP degrade being the reduction in value (points) destroyed by the U.S. attack stemming from the presence of Russian defenses. If, without defenses, "X" points are expected to be destroyed by U.S. attacking RVs in the SIOP, and if only .8X points are expected to be destroyed in the presence of Russian defenses, then the SIOP degrade is 20 percent.

It is difficult to gain a sense of this degrade for Situation A. First and foremost, the number of interceptors that might be deployed to defend centers of value is not controlled by the Treaty. Second, for a given deployment the degrade would be at one level if the United States knew the exact number of interceptors deployed and how many were deployed at each target; on the other hand, the degrade would

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[3] See report *First-Strike Stability and Strategic Defenses,* RAND/R-3918-AF, Kent and Thaler, 1990.

be greater in the situation where the specifics of the deployments were not known by U.S. planners.

But, most importantly, the degrade, whatever it is, is not controlled by the terms of the Treaty. There is no constraint in the Treaty on the number of interceptors deployed. The interceptors are, by definition, TMD interceptors and they can be deployed anywhere and in any number. Accordingly, one cannot make a limiting argument that the degrade will be no more than a certain amount. Deterrence/first-strike instability is not bounded.

It seems evident that even a modest deployment of interceptors by either side to defend their cities would be quite destabilizing. Such a deployment would cause each country to take remedial action--such as placing bombers on alert, deploying pen aids, and increasing the number of ballistic RVs deployed in the first place. Surely reductions in strategic offensive nuclear arms would be curtailed or reversed--after all there is no constraint as to the numbers of interceptors that might eventually be deployed.

Situation B is far less destabilizing. The deployments of the interceptors would be far to the south of the principal centers of value. Accordingly, each side could use mid-course decoys to good advantage. Take the case of Russia deploying interceptors in the southern most areas of their country to counter Iraq and Iran. If the Russian interceptors are committed early in order to defend targets to the north, they are committed against decoys as well as RVs and their effectiveness to defend is greatly diluted. On the other hand, if Russian interceptors are not committed early and await atmospheric sorting, then the interceptors cannot engage those RVs attacking targets to the north. In this case (where the interceptors are not committed early), the footprints of the interceptors are drastically reduced and, by virtue of where they are deployed, they (the interceptors) could defend very few important Russian targets. The same arguments would apply for the case of the U.S. deploying defenses to counter rogue governments.

Such is not the case in Situation A. Since the interceptors are deployed at the targets they are protecting, they can wait for "atmospheric sorting" of the mid-course decoys. And thus their limited number of interceptors are not diluted by mid-course decoys.

Now some calculations as to the SIOP degrade for Situation B. Take the following case. Suppose the Treaty allows "I" number of interceptors and that the product of the "number of interceptors" times the SSKP (single-shot-kill-probability) is about one-half the number of attacking warheads. Also, there are two decoys for every attacking warhead. We now assume, as a limiting argument, that the interceptors of the defense can engage any and all of the objects (RVs or decoys) and that the battle control system is perfect--a so-called adaptive preferential defense. In actual practice the defense cannot possibly operate in this mode--but this is a limiting calculation. The calculations show that for the above case the SIOP degrade would be less than 20 percent.[4]

We see then that there exists four measures [5] to limit the effectiveness of these interceptors in the context of a NMD:

- The number of interceptors allowed.
- The number of RVs in the attack.
- Where the interceptors are deployed.
- And lastly, how many mid-course decoys are used.

The above discussion has one central purpose:

- To demonstrate that the overall effectiveness of a defense system to protect the centers of value of a nation is determined more by where the interceptors are deployed than by how fast they go and against what type of targets they have tested.
- That limits on velocity and testing of interceptors does not represent an effective

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[4] How to make the calculations is not shown in this paper, but is available on request.

[5] One notes that controlling the velocity was not onr of the four measures. The reason being, as will be shown later, that using this measure precludes achieving the second objective -- providing a truly effective theater missile defense

measure for limiting overall ABM capability, especially if the limit on velocity is no lower than 3 Km/sec.

- That the most effective measure for limiting ABM capability is to place limits on where interceptors are deployed.[6]

In Approach A we may have "maintained the construction of the present Treaty," but we have not maintained the intent of the Treaty. That is, we have not provided effective measures to limit the effectiveness of anti-ballistic missile systems--at least not in the context of limiting the capability of each party to defend the territories of its country against attacks by strategic nuclear forces.

The reverse is true in Situation B. While we have changed the present construction of the Treaty, we have indeed maintained the intent of the Treaty, i.e., we have provided effective measures to limit the effectiveness of anti-ballistic missile systems against attacking strategic nuclear missiles. We have preserved deterrence/first-strike stability.

7.0 Evaluating The Two Approaches (In The Context Of Countering Rogue Nations)

Now evaluate these two approaches from the perspective of "countering rogue nations."

One of the likely threats is a missile equipped with small canisters loaded with chemical or biological agents. There is also the possibility of missiles equipped with nuclear warheads and mid-course decoys. Further, these canisters and decoys can be dispensed soon after burn-out. Providing enough interceptors to engage each canister and decoy that could possibly arrive at each and every target seems out of the question. This argues for a defense system that is able to engage the missile itself prior to the event of dispensing the sub-munitions or decoys: In effect putting a "cap" over the territory of the rogue nation--no ballistic missiles can exit the territory.

Now time is critical. And since time is compressed we need fast interceptors. The "footprint" of the interceptor is nominally a linear function of the rated velocity of the interceptor. The footprint of a missile rated at 6 Km/sec is about twice that of an interceptor rated at 3 Km/sec. If the engagement time (time begins when we have enough information to launch (commit) the interceptor and ends when the sub-munitions are dispensed) is 100 sec, the 3 Km/sec interceptor has a nominal footprint of 300 Km and the 6 Km/sec interceptor has a footprint of twice that--600 Km.

A simple survey on a globe reveals that a footprint of something like 750 Km is required to cover Iran and Iraq--given the assumption that interceptors are deployed in the upper reaches of the Persian Gulf, the lower reaches of the Caspian Sea, and the eastern reaches of the Mediterranean Sea. If we are to operate in the presence of 100 sec of engagement time and aspire to a footprint of 750 Km, then by calculation, we need an interceptor rated at 7.5 Km/sec (or more). On the other hand, if the interceptor is deployed on an aerial vehicle, a footprint of 300 Km could perhaps be effective--depending, of course, on where the aircraft can be deployed.

This paper does not intend a discussion about what velocities can be attained with projected interceptors. That is a matter for engineers. Rather, the purpose is to underline one critical point--that the demand for fast (or super fast) interceptors is just as strong (if not stronger) for the case of countering rogue nations as for the case of so-called "ABM systems."

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[6] Approach A could be adjusted--adjusted in the sense of defining how many 'TMD' interceptors are allowed and where they can be deployed. This adjustment is a step toward Approach B. Having taken this step, then ask the question 'Why make a distinction between 'ABM interceptors' and 'TMD interceptors' in the first place?

8.0 The Evaluation In Summary

We have described and evaluated two approaches.

- Both approaches have the purpose of providing "effective measures" to limit ABM capabilities while allowing for effective TMD capabilities.
- Approach A attempts to achieve both objectives by distinguishing between ABM interceptors and TMD interceptors. ABM capabilities are to be limited by constraints on the number of ABM interceptors deployed. But there are no constraints on deploying TMD interceptors--neither in number nor geography.
- Approach B attempts to achieve both objectives by allowing a stated number of "ballistic missile interceptors" to be deployed for the purpose of countering the missiles in a stated country. Also these interceptors are to be deployed in areas attendant to that purpose. In this approach an interceptor is an interceptor; there is no distinction between a TMD interceptor and an ABM interceptor. At the same time, ABM capabilities are limited by constraints on the total number of interceptors and, most importantly, where the interceptors are deployed.

The authors submit that Approach B is clearly superior to Approach A on both counts.

- Approach B is better than Approach A in terms of preserving and maintaining the intent and purpose of the ABM Treaty, i.e., to provide effective measures to limit the capability of each party to defend the territories of their respective countries against strategic nuclear forces. Better in terms of preserving deterrence/first-strike stability and, as well, political stability.
- At the same time, Approach B is better than Approach A in terms of preserving the option for providing effective defenses to counter missiles in the hands of rogue governments. Better in terms of avoiding regional instabilities.
- Accordingly, we strongly prefer Approach B.

9.0 A More Strategic Approach

We now propose a more strategic approach--an approach that centers on shared interests between the United States and Russia. These shared interests could be stated as follows:

- That in the presence of the threat of rogue governments possessing ballistic missiles equipped with weapons of mass destruction;
- The United States and Russia do hereby agree and state that countering this threat is a common goal and a shared responsibility;
- And, accordingly, the governments of each country will seek collectively and jointly to provide capabilities to counter these threats--especially with respect to active defenses.
- The operational concept is to collectively impose a "cap" over designated areas--a cap in the sense that no ballistic missiles can exit that area. Such a defense protects all would-be targets and is quite different from deploying terminal interceptors at each and every possible target and equipping these defenses with sufficient interceptors to engage all submunitions that might possibly arrive at that target.[7]

In accordance with such an agreed statement the governments would then embark on a joint venture to develop and deploy such defenses to counter weapons in selected countries--presumably North Korea, Iran, and Iraq would be high on the list.

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[7] A defense that provides intercepts prior to or shortly after burn-out invites the construction of 'countering the missiles of a stated rogue government' This is distinct from the construction of 'defending a particular region'--a construction by so-called terminal (and mid-course) defenses.

The revised Treaty (an instrument for codifying and implementing what has been agreed at the highest level) might then reflect the following:

- That there will be a joint surveillance and control system--components of the control system could be based in space.
- That, according to this joint venture, each side is to provide and deploy a stated number of interceptors in stated areas.
- That the interceptors may be deployed on platforms that are ground-based, sea-based, or air-based--but not space-based. And that those platforms designated as interceptor platforms can only be deployed in proscribed areas.
- That none of these interceptors will be equipped with nuclear warheads; the United States will provide the Russians with the technologies attendant to "hit to kill" terminal engagement systems.
- That there will be a joint venture to develop super fast interceptors--based on emerging technologies.
- That "inspection" is cooperative (as distinct from intrusive) and , through a cooperative security system, the location of all designated platforms (and interceptors) are declared and known at all times. Thus, the existence of any interceptor (or interceptor platform) that has not been previously declared is a violation.

10. A Word About Break-Out

Now to examine briefly the effects of a possible "break-out." A "break-out" from the proscribed deployment could be initiated by either the United States or the Russians. Either nation might deploy undeclared interceptors or re-deploy declared interceptors to defend priority targets. The most immediate military response by the other nation would be to activate bombers to a posture of quick alert, deploy decoys, and, at the very least, halt reductions in the number of warheads delivered by ICBMs and SLBMs. In the presence of such obvious responses, it would seem ludicrous for either side to seriously erode political stability by engaging in any attempt to gain a dubious advantage--especially where such attempts involved violating the Treaty.

However, the main point is not whether Russia or the United States would find it to their advantage to take actions in violation of the Treaty. Rather, the point is that the "allowed potential" inherent under Approach A is far more worrisome than the "violation potential" possible under Approach B.

11.0 In Summary

To avoid serious regional instabilities we are required to deploy theater missile defenses to counter possible attacks (or threats of attacks) by rogue governments. At the same time, deterrence/first-strike stability must be preserved. Approach B, as described above, represents an appropriate approach for achieving both of these objectives: Approach A does not.

Also Russia and the United States should consider adopting a more strategic and cooperative approach along the lines suggested.

This paper does not address the objective of each country protecting their centers of value from limited attacks. An approach toward this objective would be to allow each country to deploy a stated number of "ballistic missile interceptors" at stated geographic locations. Such an approach, in effect, represents an extension of Approach B as described in this paper. That is, adopting Approach B is quite compatible with carrying out, at a later date, the objective of protecting centers of value from limited attacks.

FROM MAD TO MAD.

MICHEL RUDNIANSKI
University of Reims, University of Paris V
ALETH D'ASSIGNIES
University of Paris V,
39 Bis Avenue Paul Doumer, Paris 75116 - France.

1. Introduction.

The Cold War has left the world with a doctrine of nuclear deterrence known as MAD, or Mutual Assured Deterrence, sometimes called Mutual Assured Destruction.

It is true that different deterrence doctrines have been conceived, according to various refinements brought up by strategists, or required by specific geopolitical situations of certain countries (like France). But roughly, whatever the refinements, the core of the genuine MAD remains : " since you and I have the power to destroy each other, it would be foolish for you to attack me, as it would be foolish for me to attack you".

Since the collapse of Soviet Union, many questions have arisen about the meaning of deterrence in a world where bipolarity no longer exists, and nuclear proliferation increases everyday. Is there a future for deterrence in a multipolar world ? How proliferation will affect a possible deterrence system? etc... There is little doubt that proliferation and multipolarity are closely related. Nevertheless, from a strictly analytical point of view, these two concepts should not be confused, for if proliferation is a necessary condition for multipolarity, the latter can be considered for its own, associated with a given state of proliferation. Proliferation represents somehow the deterrence systems dynamics, while a given multipolar deterrence structure defines the state of the system. One could argue that the systems dynamics could also consist in a nuclear exchange, and distinguish the *slow* dynamics of proliferation (arms building) from the *fast* dynamics of nuclear war (arms using). But this view should be discarded on the grounds that, if a nuclear exchange occurs, it means by definition, that deterrence has failed, and hence, that this fast dynamics cannot be considered *within* the deterrence system.

Since the study of such a system is quite a complex task, it seems logical to proceed step-by-step, and first give consideration to multipolarity, before looking at how proliferation affects the evolution of multipolarity with time.

But even if we restrict our attention to multipolarity, we are left with a huge task since, given a multipolar system comprised of N parties and an ordered pair of parties (i,j), depending whether i deters j or not, we can think of $2^{N(N-1)}$ different structures for such a system, not counting all the various possibilities for one party to deter another. The combinatorial explosion makes the exhaustive analysis of all these structures through some brute force algorithm quite a lengthy task, as soon as N is greater than few units. Therefore, alternative directions should be explored, like considering credible transitions from the present state of the system of nuclear deterrence, based on MAD.

More precisely, can one think about a MAD, where the acronym would now stand for Multipolar Assured Deterrence, and the new MAD would be derived from the old ?

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 229–258.

Although one among many others, such a deterrence system seems interesting for three reasons at least:

1) Since MAD has been a dominant strategic concept during the bipolar era, building a multipolar deterrence system based only on MAD, will probably facilitate the necessary adaptations of the existing arms using doctrines;

2) In this type of deterrence system, each party has only to worry about *its* relations *with* the other parties, and not about relations *between* these parties;

3) Extension of mutual deterrence seems to be quite acceptable, since it leaves no party in a situation of inferiority. So a party might be less tempted to change the system.

To these three reasons, we shall add a fourth one, the justification of which will fully appear in the technical discussion herebelow : sometimes, in the case of an uneven power ratio between two parties, deterrence from the weak to the strong derives from the strong's self-restraint, and not from mutual threats, which amounts to saying that in this case MAD resembles very much unilateral deterrence.

Thus, the exclusive use of Mutual Assured Deterrence as raw material to build a system of Multipolar Assured Deterrence, does not lead to a loss of generality as great as one could have expected. Having these considerations in mind, a tentative answer to the above questions will be given through a three-step approach, using game theory.

First, we shall revisit Mutual Assured Deterrence using matrix games of deterrence, and point out all possible power ratios consistent with MAD. We shall then extend the conclusions to N-player games with possible coalitions. Multipolar deterrence will be analysed as a combination of Mutual Assured Deterrence and more generally of bipolar deterrence relationships. At last, as an appplication, a scenario of nuclear deterrence in a multipolar world will be drawn, taking the yougoslavian crisis as a basis.

2. The Mutual Assured Deterrence Revisited.

2.1. MATRIX GAMES OF DETERRENCE : THE BASIC CONCEPTS.

In order to analyse bilateral relationships of deterrence, we shall resort to *qualitative* binary matrix games, where 1 means an acceptable outcome, and 0 an unacceptable one. Solving these games - that we shall call *game of deterrence* - means analysing the players strategies playability properties.

It should be stressed for readers familiar with game theory but not with games of deterrence, that these games are only concerned with the players strategies playability properties, and not with maximizing some utility function, like in the usual *quantitative* games. Therefore, one should not try to look for classical equilibria - like Nash equilibria -, even if it can be shown that, *depending on the nature of playability* (see below), some relations may exist between pairs of playable strategies and these equilibria.

Given the fact that the games under consideration are binary ones, we shall consider a player is rational as soon as he does everything to get an acceptable outcome, and we shall distinguish two types of playable strategies :

1) *positively playable* strategies, that is "good " strategies in the sense that their selection by a player garantees the latter an acceptable outcome, provided the other player is rational;

2) strategies *playable by default*, that is " bad " strategies, that nevertheless may be played in situations where the player under consideration has no positively playable strategy.

A particular type of positively playable strategy is a strategy that garantees the player who selects it an acceptable outcome, whatever the other player's choice. Such a strategy is said to be *safe*. Any non safe strategy is said to be *dangerous*. It should be stressed that one can encounter many games where dangerous strategies are playable, even positively playable.

Playability is a basic concept in order to define deterrence. More precisely, player A is said to deter

player B from implementing strategy S_B, if A has a strategy S_A such that the three following conditions apply :

1) S_A is playable (positively or by default);

2) the consequence of the players selecting strategic pair (S_A,S_B) is unacceptable to B.

3) B has an alternative strategy S'_B, positively playable.

It can then be shown (Rudnianski[6]) that a strategy S_B of player B is playable if and only if there is no strategy S_A of player A, that is deterrent vis-à-vis S_B. This means that playability and deterrence are dual concepts, and hence that discussing deterrence amounts to analysing the players strategies playability properties.

Games of deterrence where players cannot revisit their choices are called non-sequential games of deterrence.

2.2. NON-SEQUENTIAL GAMES OF DETERRENCE : THE GRAPH APPROACH.

Several versions of MAD are envisageable, depending on strategical assumptions, in particular those concerning the possibility of strategic defense, and / or second strike capability.

If we first consider the case where no such possibility exists, then the strategical relationship between the two superpowers at the time of Cold War, can be summarized by the following matrix game of deterrence :

		USSR	
		a	a
USA	A	(1,0)	(0,0)
	a	(1,1)	(0,1)

where :

- A and a stand for attack, in the sense of first strike;
- A and a stand for no-attack, in the sense of no first strike but retaliation.

One can see straightforward that both strategies of each player are equivalent in the sense that they give him the same outcome for each adverse strategy. Hence, all are playable. The matrix structure shows that playability here is a playability by default. The same conclusion can be obtained by associating with the matrix a graph G, we shall call the *graph of deterrence*, and define as follows :

Given a binary bimatrix game with two players E and R (E selecting the lines and R the columns), and their respective strategic sets S_E and S_R :

1) G is a bipartite graph on $S_E \cup S_R$;

2) given a strategic pair (e,r) belonging to S_E x S_R, there is an arc of origin e (resp. r) and extremity r (resp. e) if the outcome of R (resp. of E) associated with (e,r) is unacceptable.

Obviously, every graph can be decomposed into paths and/or circuits. We shall call *E-path* any path the root of which has no predecessor, and is a strategy of player E. A similar definition applies for an R-path. We shall call *primary circuit*, a circuit such that none of its vertices has a predecessor which is not on a circuit. More generally, a graph with no E-path and no R-path, will be called a *C-graph*.

The reason for introducing those apparently complex definitions is two-fold :

1) there is a one-to-one mapping between the game matrix and the graph of deterrence, meaning that any property found in the graph space, can be given a counterpart in the matrix space;

2) decomposition of the graph of deterrence into connected parts such that each one is either an E-path, an R-path or a C-graph, leads to a classification property, which can be stated as follows :

i) depending on the graph decomposition, the game belongs to only one of the seven following types : E, R, C, E/R, E/C, R/C, E/R/C, where for instance we shall say that the game is of type E/C, if the decomposition of the graph of deterrence into connected parts includes only E-paths

and C-graphs.

ii) the solution set of the game is entirely defined by its type (Rudnianski[6]).

In short, to solve the game, it suffices to determine its type. More precisely (ibid) :

1) if the graph is an E-path (resp. and R-path) then the only (positively) playable strategy of E (resp.R) is the root, whille all strategies of R (resp.E)are playable by default;

2) if the graph is a primary circuit, then all strategies of both players are playable by default.

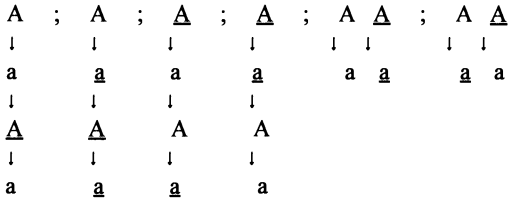
The above results apply whatever the number of strategies, provided this number is finite. In the above example, the graph of deterrence is a C-graph, that can be made equivalent to a primary circuit, hence all strategies of both players are playable by default, and there is no deterrence from any side.

2.3. APPLICATION : A SYSTEMATIC EXPLORATION OF MUTUAL DETERRENCE IN 2X2 GAMES.

More generally, let us consider a two-party deterrence structure such that the two above strategies are available to each party.Theoretically, 256 games of deterrence are possible. Using the graph approach, and some obvious assumptions, we can dramatically reduce the number of cases coresponding to different deterrence structures :

2.3.1. *E-Games and R-Games*.

There are 6 possible E- games :



The only possible E- games for which one could possibly expect mutual deterrence, are those for which no root of an E-path is strategy A. This leaves the two central games above, composed of a single E-path, the root of which is A. But then, all strategies of USSR are playable by default. Hence if strategy A of the USA is deterred, strategy a of USSR is not. On the whole, no mutual assured deterrence occurs for a E-game.

By symetry, the same would apply for for the 6 possible R-games.

2.3.2. *E/R-Games*.

There are two E/R-games, for which mutual deterrence occurs.

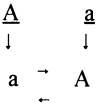
The graph of deterrence of the first one is :

It corresponds to the following matrix :

		USSR	
		a	a
USA	A	(0,1)	(1,1)
	a	(1,1)	(1,0)

The interpretation of such a case seems rather difficult, since it is hard to think of a situation where, by selecting the attack strategy, the USA would be better off if the USSR also attacks, than if she would not.

The graph of deterrence of the second game is :

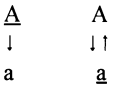


with the corresponding matrix :

		USSR	
		a	a
	A	(0,1)	(0,0)
USA			
	a	(1,1)	(1,0)

This case lacks realism for similar reasons : in case of a US attack, USSR is better off by not attacking than by attacking.

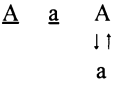
2.3.3. *E/C-Games and R/C- Games.* Let us consider the E/C-games. A necessary condition for mutual deterrence is that no strategy A be a root of an E-path. Moreover, since each player has only two strategies, the graph of deterrence is necessarily composed of a single E-path and a single primary circuit. Consequently, there is only one possibility :



The only positively playable strategies are A and a. But the game has a structure similar to the E-R-game above, and so we can apply the same conclusions : the case, although theoretically possible, seems hardly realistic.

The same applies for R/C-games.

2.3.4. *E/R/C-Games.* There is only one E/R/C-game for which mutual deterrence can occur :



Again this system seems hardly realistic since it assumes that a player, when anticipating an attack, is better off if he does not attack than if he does.

2.4. SEQUENTIAL GAMES OF DETERRENCE.

2.4.1. *General Features.* On the whole, no mutual assured deterrence can be directly modelled through a non-sequential game. To understand that rather unexpected conclusion, we need to analyse the rules of the game.

Players choose their strategies simultaneously, and once for all (no modification is possible once each player knows the other's choice). Moreover, there is no communication between the players, each one being only interested in its own outcome, an attitude which we shall call egoistic. If we relax the first rule, we give way to relax the second and the third, since each player can somehow "put" in its strategic choice a signal to the other, such if the latter made the wrong choice (according to the first player) he can revize it. By doing so, we enter the field of sequential games.Two questions need now to be addressed :

1) how to explicit the reasons for which one party would revize its choice ?

2) are there conditions for which the revision process can come to an end ?

Of course these two questions are tightly linked.

2.4.2. *Preference and Precedence Orders.* Since we consider binary outcomes, each possible state of the world can be represented by one of the following 4 outcome vectors : (0,0), (0,1), (1,1), (1,0). So each player will take into account the other party's interest as well (this attitude that we shall call altruism, should not be confused with benevolence, since by its definition, praying for the death of someone is also an altruist attitude !), and order the four outcome vectors according to his preferences. For each player there are 4! different preference orders. Since each pair of preference orders can be associated with a specific game, for each assumptions set, 576 different games are theoretically to be considered. This number can be dramatically reduced, since it has been shown (Rudnianski[6]) that in order to be fully rational, no player should prefer - even for some obscure tactical reasons - an outcome vector that gives him an unacceptable outcome to an outcome vector that gives him an acceptable one.
For each player, only four preference orders satisfy this condition. For instance for the US :
(1,0) > (1,1) > (0,0) > (0,1) (malevolence)
(1,0) > (1,1) > (0,1) > (0,0) (inverted benevolence)
(1,1) > (1,0) > (0,0) > (0,1) (inverted malevolence)
(1,1) > (1,0) > (0,1) > (0,0) (benevolence).
Similar inequalities apply for USSR.
An other element should be introduced in order to complete the description of all possible modifications of the players choices. Indeed, suppose that given an initial strategic pair, both players want to change it. Obviously the result will depend on who is going to move first. There are three possible cases : either, one player moves first, either the second one does, or both move simultaneously. Each of these three possibilities will define a *precedence order.* A specific precedence order may be associated with each strategic pair.

2.4.3. *Game of Initial Strategies, and Game of Final Strategies.* Let us go back to the first game introduced above, and assume that each player chooses malevolence. One can easily verify that whatever the initial strategic pair and precedence order, the sequential process will inevitably lead to the sequential solution (A,a). In other words, if each player is malevolent, the game ends tragically : there is no mutual assured deterrence here, but a mutual assured destruction.

Since we are considering a sequential process, each player's *final strategy* may be different from his *initial strategy.* Initial strategies are there, either because of initial misunderstanding between the players, or because one or both players want to gesticulate, that is to send signals to the other side.
Operationality of both types of strategies can be assessed through their playability properties.

First, the *game of initial strategies* is a non-sequential game of deterrence in which with each strategic pair we associate the outcome vector obtained at the end of the sequential process starting from this pair. For instance, in the game above, as all initial strategic pairs lead to the final pair (A,a), the outcome vector for all four initial strategic pairs is (0,0), which means in turns that all strategies are playable by default as initial strategies. Similarly, we shall build the game of *final strategies* as follows.

Given any strategic pair, for each strategy of the pair :

- if this strategy is different from the final strategy of the player under consideration, we shall associate with it a 0 (meaning that this strategy is not good as a final strategy);
- if this strategy is the final strategy of the player under consideration, then we shall associate with it the outcome which is associated with it in the original non-sequential game.

We can easily see that in the example above, the matrix of the game of final strategies is only composed of vectors (0,0) which means that all strategies are playable by default as final strategies.

Suppose now that both players are benevolent. This time, whatever the initial strategic pair, and precedence order, the sequential solution is (A,a), in other words, the status quo : both players show restraint in their behavior. The matrix of the game of initial strategies includes only vectors (1,1) and the matrix of the game of final strategies is :

		USSR	
		a	a
	A	(0,1)	(0,0)
USA			
	A	(1,1)	(1,0)

Each no-attack strategy is not only safe - hence positively playable - but also deterrent vis-à-vis the attack strategy of the other side.Consequently, in this case mutual assured deterrence occurs. If we consider inverted benevolence, both asymetrical attitudes - (A,a) and (A,a) - are stable while both symetrical attitudes lead to the asymetrical ones depending on the precedence order. It can then be easily verified that there is no mutual deterrence, either in the game of inital strategies or in the game of final strategies.

At last, for inverted malevolence, strategic pairs (A,a) and (A,a) are stable. The sequential process starting from each of the two other pairs depends on the precedence order. But this leads to no conflict between the two players. Starting from initial pair (A,a), both players should wish that priority is given to the US, since it will garantee both of them an acceptable outcome, while if priority was given to USSR, then both would get an unacceptable ooutcome. It is the opposite for pair (A,a). So, all initial pairs other than (A,a) lead to sequential solution (A,a), that is to the status quo.

The matrix of the game of initial strategies is composed of vectors (1,1) except for the outcome vector associated with pair (A,A) that equals (0,0). It means that no-attack strategies are safe as initial strategies. With respect to attack strategies, the situation is more complex, since the attack strategy of one player is playable if and only if the attack strategy of the other player is not and vice-versa. So there seems to be no definite conclusion here. But since both players have alternative strategies which are safe, the second and the third conditions for a strategy to be deterrent are satisfied. So we can consider that we have here a degraded form of deterrence. The matrix of the game of final strategies is the same as in the case of benevolence, with the same conclusions : mutual assured destruction occurs here.

The case study should of course be completed by considering non-symetrical preference orders. To save time, and because it does not bring any conclusion other than the ones we came to, we shall skip it, and just recall that mutual assured deterrence occurs in sequential game as defined hereabove, for certain pairs of preference orders.

2.4.4. *Further Examples.*Let us consider now a deterrence structure similar to the one above, with the only difference that each side is equipped with a strategic defense, assumed for the sake of simplicity being near-perfect (i.e. the number of casualties due to the inefficiency of the defense system is acceptable to the party attacked). The matrix game then becomes :

		USSR	
		a	a
	A	(1,1)	(1,1)
USA			
	A	(1,1)	(1,1)

There is no deterrence possible, whether with the non-sequential or the sequential game, since all outcomes are acceptable for each player. Consider next a deterrence structure where no party has a strategic defense, but a survivable second strike capability. The matrix game is :

		USSR	
		a	a
	A	(0,0)	(0,0)
USA			
	A	(1,1)	(0,0)

All strategies are playable by default.
Whatever the preference and precedence orders, with respect to the games of initial strategies and of final strategies, the sequential process leads to the same conclusions as in the first example, when both parties were adopting an attitude of inverted malevolence.

Consequently, mutual assured destruction occurs here (which is consistent with the fact that in the quantitative treatment of the game, strategies of non attack are weakly dominant). So a survivable second strike capability eliminates the need for altruism.

Again, in order to complete the analysis, asymetrical situations should be considered where one player has a defensive system, the other not. The matrix then is somehow a combination of the two matrices above. Suppose for instance that the USA are fully equipped with a SDI-like system, while USSR is not. Then clearly, the asymetry in the assumptions is found also in the conclusions : The US can deter the Soviets from attacking, while the reverse is impossi : deterrence exists but is unilateral.

2.5. INTRODUCING GRAPHS IN THE SEQUENTIAL APPROACH.

2.5.1. *Generic Conditions for Mutual Deterrence.* As seen above, there are 256 possible 2x2 non-sequential games of deterrence. To each one correspond 16 possible pairs of preference orders and 81 sets of precedence orders, which means 331,776 different sequential games to be theoretically examined in order to complete the analysis of MAD, and that just for 2x2 games ! Although the task is certainly tractable by computer, it may be dramatically simplified by resorting to the graphs of deterrence.
In order mutual deterrence to occur, the following conditions must apply :

1) no-attack strategies must be positively playable;
2) attack strategies must be not playable.

These two conditions are sufficient to ensure the fact that the no-attack strategy of one party is deterrent vis-à-vis the attack strategy of the other. Indeed, we know that a necessary and sufficient condition for a strategy to be playable in a two-player game of deterrence is that no strategy of the other player is deterrent vis-à-vis the former. Since the attack strategy of, say the US, is not playable by condition 2) hereabove, it means that there exist a strategy of USSR deterrent vis-à-vis the former. Since the first condition for a strategy to be deterrent is that it is playable, the only possibility is that the soviet deterrent strategy is the no-attack strategy. Hence the conclusion. So it is necessary to analyse which types of games - among the seven possible - satisfy the two conditions above.

We discard at once E-games, R-games and C-games, since :

- in the first one, all soviet strategies are playable by default;
- in the second one, all american strategies are playable by default;
- in the third one, all strategies of both players are playable by default.

The only types of games left are those already seen in the non-sequential case, which lead to four possibilities that need now to be reinterpretated in the sequential case, more precisely in the frame of games of final strategies.

2.5.2. *E/R/C-Game*. The game of final strategies matrix is :

		USSR	
		a	a
	A	(1,1)	(0,0)
USA			
	a	(1,1)	(1,1)

Consider for instance strategy A. It gives the US various outcomes depending on the strategic choice of USSR. But by definition of the game of final strategies, this means that A can be taken as a final strategy, for otherwise all outcomes of the USA associated with A would be 0. So no E/R/C game can be representative of a game of final strategies leading to mutual deterrence.

2.5.3. *E/C and R/C-Games*. For the E/C-game, the game of final strategies matrix is :

		USSR	
		a	a
	A	(0,0)	(1,1)
USA			
	a	(1,1)	(1,0)

The conclusion is the same as previously and applies by symetry for R/C games.

2.5.4. *E/R-Game*. For the first of the two possible E/R-games of final strategies, the matrix is :

		USSR	
		a	a
	A	(0,1)	(1,1)
USA			
	a	(1,1)	(1,0)

The conclusion is again the same than in 2.4.2.
So let us consider now the second possible game of final strategies :

		USSR	
		a	a
	A	(0,1)	(0,0)
USA			
	a	(1,1)	(1,0)

No-attack strategies are safe and deterrent vis-à-vis the attack strategies of the other side. So mutual deterrence occurs here. All that remains is to find the matrix of the non-sequential game to be associated with this game of final strategies. Since no-attack strategies are the final strategies, we know that the outcome vector associated with the pair of no-attack strategies is simply (1,1). When attack strategies - that should not be playable as final strategies - are introduced in the picture, things become a little more complex, because preference and possibly precedence orders are to be taken into account.

There are theoretically 4^3 possibilities for the set of the three outcome vectors where attack strategies appear. Some of them can be rejected out of hand. For instance, the set such that all three outcome

vectors are (1,1), for in this case all outcome vectors being equivalent, no strategy can be deterred, either in the non-sequential game or in the sequential one.

Consider now pair (A,a). In the game of final strategies it is associated with outcome vector (0,1), which implies that a is a final strategy. But this implies in turn that the sequential process cannot lead to a transition from (A,a) to (A,a). Suppose then (A,a) is associated with outcome vector (1,1), in which case it is also a sequential solution. But this impossible, because were it the case, then the outcome vector associated with that pair should be the same in the game of final strategies, and in the non-sequential game. Similar conclusions apply to pair (A,a). Hence, there can be at most two sequential solutions, that are located on the matrix second diagonal.

More generally, candidate matrices for non sequential games of mutual deterrence must satisfy the following set of rules :

R1 The two strategic pairs located on the first diagonal cannot be associated with outcome vector (1,1).

R2 Each player always prefers an acceptable outcome to an unacceptable one.

R3 Whatever his own strategy, no player prefers his opponent to attack.

R4 If his opponent's strategy is attack, no player prefers not to attack.

R5 The sequential process can only be one of the 4 below :

(A,a)		(A,a)	(A,a)	←	(A,a)	(A,a)	(A,a)
↓		↓	↓		↓	↓	
(A,a)	← (A,a)	(A,a)	←	(A,a)	(A,a)	← (A,a)	(A,a) ← (A,a)
1.		2.			3.	4.	

Since separate examination of each candidate is a rather lengthy task, we shall first consider rules 1 to 4. This will allow a sensible reduction of the number of candidates, which can then be analysed at the light of rule 5. Rule 1 implies that the only possible candidate matrices are those represented through the figure of next page, where :

- each column corresponds to one of the four strategic pairs;
- the search process is implemented by always following the path (A,a) → (A,a) → (A,a) → (A,a);
- the Ri (i = 2,3,4) along the horizontal lines indicate which rule applies for deleting a particular path.

One sees that only ten possible cases remain at this stage, labeled for simplicity by numbers 1 to 10 on the figure, and which must satisfy rule 5, in order to be definitely selected. All four possible sequential processes defined by rule 5 forbid transitions toward (A,a), which makes cases 2,5,8,9 impossible. So we shall now consider separately each of the four processes above, for the remaining 6 cases : 1,3,4,6,7,10

1- Process 1.

- Cases 1,4,7 and 10 are impossible since no transition occurs between (A,a) and (A,a);
- case 6 is impossible, since there is no transition from (A,a) to (A,a).

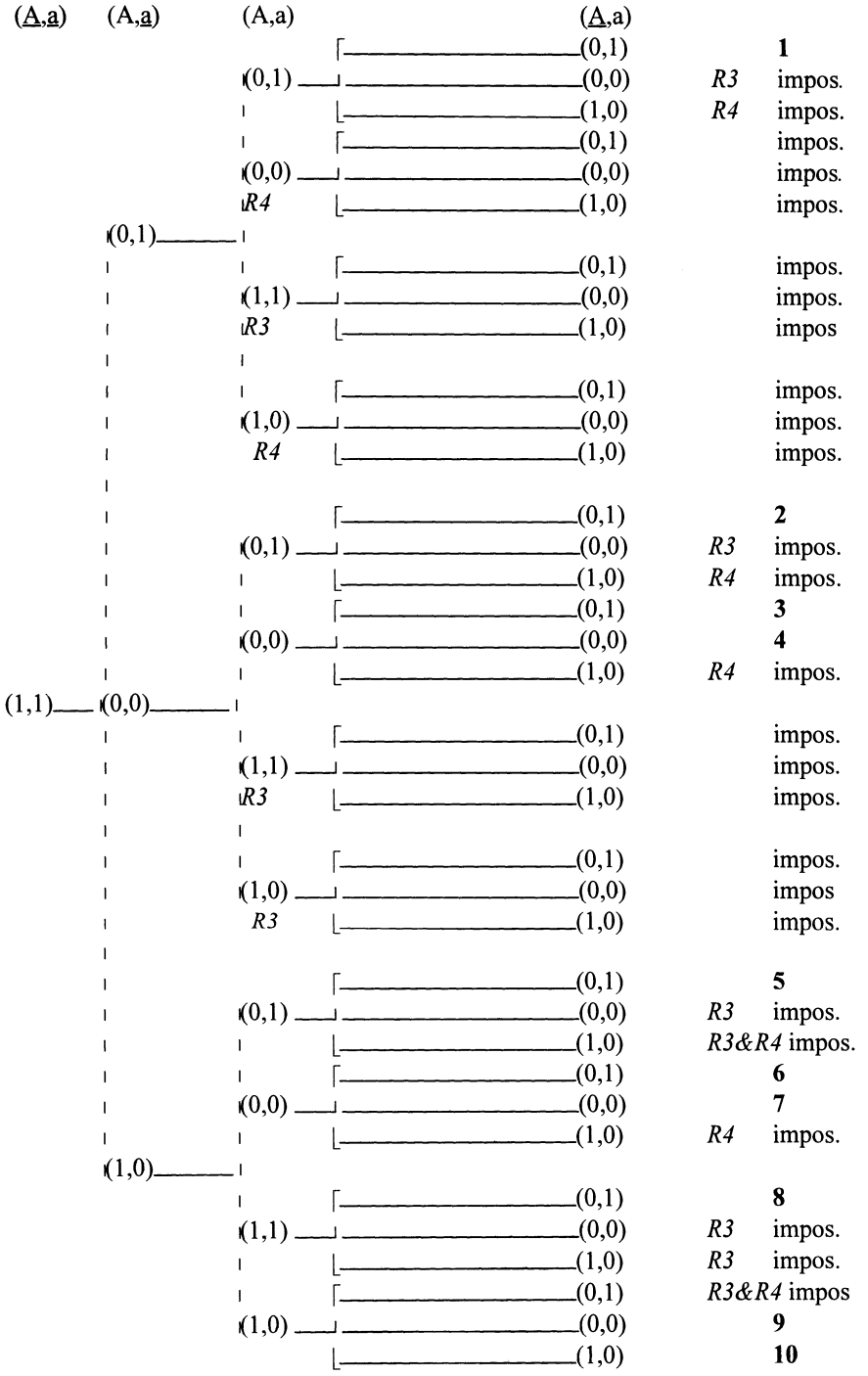
So the only possible case for mutual deterrence, consistent with process 1, is case 3.

2- Process 2.

Process 2 is derived from process 1 by adding a transition from (A,a) to (A,a). Case 3 becomes impossible, while case 6 becomes consistent with process 2

3- Process 3.

Process 3 can be derived from process 2 by deleting the transition from (A,a) to (A,a). Accordingly, the only case consistent with process 3 is case 7.


(A,a) (A,a) (A,a) (A,a)
(0,1)
1
(0,1) (0,0) R3 impos.
(1,0) R4 impos.
(0,1) impos.
(0,0) (0,0) impos.
R4 (1,0) impos.
(0,1)
(0,1) impos.
(1,1) (0,0) impos.
R3 (1,0) impos
(0,1) impos.
(1,0) (0,0) impos.
R4 (1,0) impos.
(0,1)
2
(0,1) (0,0) R3 impos.
(1,0) R4 impos.
(0,1)
3
(0,0) (0,0)
4
(1,0) R4 impos.
(1,1) (0,0)
(0,1) impos.
(1,1) (0,0) impos.
R3 (1,0) impos.
(0,1) impos.
(1,0) (0,0) impos
R3 (1,0) impos.
(0,1)
5
(0,1) (0,0) R3 impos.
(1,0) R3&R4 impos.
(0,1)
6
(0,0) (0,0)
7
(1,0) R4 impos.
(1,0)
(0,1)
8
(1,1) (0,0) R3 impos.
(1,0) R3 impos.
(0,1) R3&R4 impos
(1,0) (0,0)
9
(1,0)
10

4- Process 4.
Process 4 can be derived from process 3 by deleting the transition from (A,a) to (A,a). Accordingly cases 1,4,7 and 10 are possible.Hence, the only cases consistent with process 4 are 1, 4, and 10.

2.6. GENERAL INTERPRETATION.

2.6.1. *Sequential and Non-Sequential Deterrence.* The analysis conducted above shows that we need to distinguish two different forms of deterrence :

- non-sequential deterrence, that is deterrence obtained in non-sequential games;
- sequential deterrence, that is deterrence in the game of final strategies.

As we have seen above, sequential deterrence may occur in the absence of non-sequential deterrence. The reciprocal is also true : a strategy deterrent vis-à-vis another one in a non -sequential game may not keep this property in all sequential games then can be derived from the former. Nevertheless, it can be shown (Rudnianski[6]), that there is at least a pair of preference orders, such that the strategy remains deterrent in the sequential game.

Structures of mutual deterrence are closely related to graphs of deterrence (E/R-games) and sequential processes. All this makes Mutual Assured Deterrence a particular case of deterrence, which requires communication between the parties and altruism (in the sense defined above). Only 6 out of the 256 possible 2x2 binary matrix games allow mutual assured deterrence : each one corresponds to a different power ratio between the parties.

2.6.2. *Case 1.* It is associated with sequential process 4. The corresponding matrix is :

		USSR	
		a	a
	A	(0,1)	(0,1)
USA			
	A	(1,1)	(0,1)

USSR has an overwhelming advantage, with her both strategies being safe, while all american strategies are dangerous and hence playable by default. The source of this power ratio may lay in the setting up of a near-perfect soviet strategic defense, which leaves USSR with an acceptable outcome, whatever the US strategy.

Deterrence of Soviet strategy a in the game of final strategies implies at least partial benevolence from USSR. But such a preference order is most questionable, since it does not correspond to a necessity for USSR, unless this restraint derives from a general system of negative garantees, which for instance could be a helpful example devoted to preventing proliferation among third parties.

2.6.3. *Case 3.* It is associated with sequential process 1. The corresponding matrix is :

		USSR	
		a	a
	A	(0,0)	(0,0)
USA			
	A	(1,1)	(0,1)

USSR seems to have an advantage to preempt, since retaliation from the US, leaves the Soviets with an acceptable outcome. Assuming that the two parties potential is comprised of three components, including

an unvulnerable submarine component, this may happen in the case where USSR has a strategic defense system. But this system is less-than-perfect, because in the case of simultaneous preemption it leaves the Soviets with an unacceptable outcome. It is apparently a very destabilizing factor, because in order to optimize its strategic defense, USSR has interest to preempt. The Americans, knowing it, might as well be tempted to preempt, which reinforces the soviet temptation etc...

In terms of game analysis, both soviet strategies are equivalent, hence playable, which implies that no US strategy is positively playable. This implies in turn that all four strategies are playable by default, and consequently we come back to the conclusion that no non-sequential deterrence occurs.

Sequential deterrence occurs, whatever the american preference order, if the soviet preference order is at least partial benevolence (that is, either benevolence or inverted malevolence). In other terms, sequential deterrence occurs only, if the strongest party is not looking for putting down its adversary, and is capable of sending him a strong an credible signal in this sense.

2.6.4. *Case 4*. It is associated with sequential process 4.The corresponding matrix is :

		USSR	
		a	a
	A	(0,0)	(0,0)
USA			
	A	(1,1)	(0,0)

The power ratio here is even, with no party having a valuable strategic defense. This case has already been studied. There is no non-sequential deterrence, and the sequential deterrence is obtained whatever the players preference orders, which makes it particularly strong, since its occurrence requires no benevolence from any side .

2.6.5. *Case 6*. It is associated with sequential process 2. The corresponding matrix is :

		USSR	
		a	a
	A	(1,0)	(0,0)
USA			
	A	(1,1)	(0,1)

Though the power ratio is even, both parties can be credited with less-than-perfect strategic defense, giving each of them an interest to preempt. So again the power ratio is very destabilizing.
Both strategies of each party are equivalent, hence playable by default, and there is no non-sequential deterrence.

Sequential deterrence requires benevolence from the two parties. But benevolence derives here from necessity: it is the only way to deter attack strategies, whatever gesticulations from each side. A possible interpretation would be that of a system of mutual negative garantees, with as a secondary aim, proliferation prevention.

2.6.6. *Case 7.* It is associated with sequential process 3. The corresponding matrix is :

		USSR	
		a	a
	A	(1,0)	(0,0)
USA			
	A	(1,1)	(0,0)

This the symetric case of case 3, the advantage going to the USA.
Discussion is similar to the one of case 3, with sequential process 3, being the symetric of process 1.

2.6.7. *Case 10.* It is associated with sequential process 4. The corresponding matrix is

		USSR	
		a	a
	A	(1,0)	(1,0)
USA			
	A	(1,1)	(1,0)

This is the symetric case of case 1, the advantage going to the USA.
So discussion is similar the one of case 1, with the same sequential process.

2.6.8. *Toward a classification of situations of mutual deterrence.* On the whole, the six possible cases correspond to 4 categories of situations :

1) one side has a total advantage, obtained by implementation of a unilateral global near-perfect strategic defense (cases 1 and 10). The power ratio is so unbalanced that MAD derives only from self-restraint.

2) One side has an advantage to preempt, since it has only a less-than-perfect strategic defense (cases 3 and 7). This situation is very destabilizing. Mutual deterrence requires partial benevolence at least from the side which has the edge. But contrary to the former situation, the leading side has an interest in showing benevolence.

3) Each side has an advantage to preempt, since it is equipped only with less-than-perfect defense (case 6). This situation is again very destabilizing. The only way to secure mutual deterrence is that both sides adopt benevolent attitudes, which for instance, could consist of a system of negative garantees.

4) No side has an interest to preempt, which amounts to saying that no side has a valuable strategic defense (case 4). This is the most stable situation, since then mutual deterrence occurs whatever the parties preferences.

One could wander why the above analysis didn't point a situation where both sides are equipped with global near-perfect defenses, since it intuitively appears that in this situation the parties preferences don't matter, which makes it quite stable. The answer is almost obvious. Such a situation would be represented by a matrix the entries of which would be only outcome vectors (1,1). We have already rejected this possibility, since then, all strategies being safe, there is no deterrence.

3. N- party systems of deterrence.

3.1. BASIC ASSUMPTIONS.

Let us consider now an international environment comprised of N parties, each one having a nuclear potential, and let us try to see among all possible deterrence systems, if some can be decomposed into only MAD bilateral relationships. Interpretations of MAD were performed in the case of two superpowers. But the analysis remains general, and can be applied to the case where one of the parties at least is not a superpower. Then, only interpretations need to be revisited, especially with respect to strategic defenses : one party may find acceptable that the other preempts, without having a near-perfect global strategic defense, but only a less-than-perfect one, since the preempting party has only a very limited number of missiles.

Theoretically, since for each bilateral relationship, the above analysis has shown that 6 cases were to be considered, and since for N parties there are N(N-1) / 2 bilateral relationships we can think of $6^{N(N-1)/2}$ different systems of deterrence, comprised of only MAD relationships. But this number can be dramatically reduced by considering consistency constraints, with respect to power ratios in terms of offensive and defensive weapons. For instance, if assumptions on a bilateral relationship between party i and party j are such that i has no strategic defense, then i has no strategic defense when considered in its relationship with a third party k.

3.1.1. *Consistency Constraints, and Levels of Strategic Weapons.* More generally, we can use consistency constraints to set up the three following rules.

1) If a party has limited means of attacking another party, then the same applies with respect to any other party;
2) If in a bilateral relationship, one party has no strategic defense, then it has no strategic defense in any other bilateral relationship;
3) If in a bilateral relationship, one party has a less-than-perfect defense, it has a less-than-perfect defense in any other bilateral relationship.

Furthermore, for the sake of simplicity, we shall assume a three-level quantification of offensive and defensive weapons, respectively.

With respect to offensive weapons, we shall consider :

1) *superpowers* assumed to have a potential sufficient to simultaneously launch massive strikes or counter-strikes against all parties;
2) *medium powers* which can massively attack or retaliate one party, or have means of limited strikes or counter-strikes against several parties;
3) *weak powers* which have means of limited strikes or counter-strikes against one party.

Similarly, with respect to strategic defense, we shall consider :

1) *near-perfect* defense, assumed to fully protect a party's territory against simultaneous massive strikes from all other parties;
2) *less-than-perfect* strategic defense, assumed to protect a party's territory, either partially against a massive strike, or totally against a limited strike;
3) *no-defense*.

3.1.2. *Bilateral Relationships Typology.* As strategic defense is much more money and technology consuming than offensive weapons, we shall assume that only superpowers or coalitions of neighbouring countries equivalent to a superpower can set up a strategic defense, even at the lowest level, i.e., that of less-than-perfect defense. Combining these rules and assumptions for offensive and defensive weapons,

leads to the following array :

Defense / Offensive	Superpower	Medium Power	Weak Power
Near-Perfect	I	impossible	impossible
Less-Than Perfect	II	impossible	impossible
None	III	IV	V

On the whole, 5 cases are possible. This implies that any bilateral relationship is given by the following array, the entries characterizing the type of mutual deterrence :

	I	II	III	IV	V
I			10	10	10
II		6	7	7	10
III	1	3	4	4	7
IV	1	3	4	4	7
V	1	1	3	3	4

The entries defined by coordinates pairs (I,I) (I,II) and (II,I) are empty, since they imply that strategic pair (A,a) is associated with outcome vector (1,1), which is impossible, because in this case the situation would not be representative of mutual deterrence, as it has been previously seen. The above array shows that only superpowers can be of different types (three exactly).

3.1.3. *Curbing Down the Number of Cases.* Since by the above assumptions a party will get (offensive) nuclear power before acquiring a strategic defense, and since we are not considering here the dynamics of proliferation, we can consider that the level of power of each party is given. Let us furthermore assume that among the N parties there are N' superpowers. Then two cases are to be considered :

1) If a superpower is of type I, it stems from the above that all N'-1 other superpowers are of type III. This implies in turn that there are only N' possible deterrence systems consistent with conditions of mutual deterrence, and the given distribution of offensive power.

2) If no superpower is of type I, then each one is of type either II or III. For any given distribution of types among the N' superpowers, there is only one possible deterrence system consistent with conditions of mutual deterrence. So, to assess the total number of all deterrence systems corresponding to this situation, what is left is to compute the total number of type distributions among the superpowers. Since each superpower can be of only two types, there are $2^{N'}$ distributions of types among N' superpowers. On the whole, there are $2^{N'}+N'$ possible deterrence systems consistent with the conditions of mutual deterrence. This is quite a reduced number compared to the $6^{N(N-1)/2}$ prior possibilities.

If we consider for instance the real world, the number of superpowers is two at most (USA and Russia), and there are no more than three to six medium powers to be considered in the next future (China, France, Great-Britain, India, Israel, Pakistan). The rest of possible intruders in the nuclear club will be composed, at least for a while, of weak powers, mainly from the muslim world (Algeria, Egypt, Irak, Iran, Lybia, North Corea, Syria). Then the total number of possible members of the nuclear club amounts to 15. This means 6^{105} prior possibilities, while the decomposition above dramatically reduces that number to only 6. If we suppose that in a more distant future China becomes a superpower, it raises the total number of possibilities to 11.

3.2. SIMULTANEOUS ATTACKS.

In order to complete the analysis, we must explore the model's robustness in case of simultaneous attacks. This case has not been considered yet for obvious reasons : since we try to build multipolar deterrence systems with only bilateral relationships as raw material, taking simultaneous attacks into account seems out of scope, unless simultaneous attacks do not change the structure of the deterrence system, or if they can be taken into account through coalitions.

Considering the point of view of a single party i, two cases must be considered :

1) i may simultaneously attack, parties j, k...
2) i may be simultaneously attacked by parties j,k....

These two situations reveal important differences of kind.

3.2.1. *Party i Attacks Parties j and k.* Modelling the possibility of a simultaneous attack of parties j and k by party i will be achieved by decomposing the tripolar relationship (i,j,k) into two bilateral relationships (i,j) and (i,k). If the relationships between i and j, and i and k respectively, are both represented by mutual deterrence, it follows that i is deterred to attack j, and i is deterred to attack k, hence i is deterred to attack j *and* k.

3.2.2. *Party i is Attacked by Parties j and k.* No condition is put on the nuclear potential or defense level of any party, whether i, or j, k .. The question here lays at another level : what is the significance of a simultaneous attack of party i by parties j, k,..? More precisely, does the temporal coïncidence of attacks against party i mean something in terms of alliances or, better, coalitions between the attacking parties? We can give a positive answer for reasons similar to the ones hereabove.

Since we are trying to build a multipolar deterrence system with only mutual deterrence as bilateral relationships, it means that, when considered *separately*, j and k are deterred from attacking i. So the only case where they could possibly attack i, is when they form a coalition, because the addition of their forces is the only possibility for them to do so. Now, when considering entering this coalition, either j or k must also take into account the consequences of such a simultaneous attack on its bilateral relationship with some fourth party l : the nuclear exchange between i on the one hand, j and and k on the other, may weaken one of the attackers to such a point that he exerts no more deterrence on l. So one condition for the coalition to form is that deterrence is maintained with respect to other parties. But this implies in turn that each of the two would-be coalition members must worry about its partner's ability to maintain its deterrence vis-à-vis other parties. In short, simultaneous attack is a playable strategy for *both* coalition members, only if it does not deteriorate the deterrence capability of *each one* vis-à-vis third parties (this is obvious if the third party is i). But this amounts to considering the coalition as a single player which we shall denote j&k, with for each strategic N-tuple in the game without coalitions, the coalition's outcome simply being the product of each of the two members outcomes.
What is left now to discuss, is a combination of the previous cases.

3.2.3. *Parties i and j Simultaneously Attack Parties k and l.* If i attacks k but not l, and j attacks l but not k, the situation is the one of a simple superposition of two separate bilateral relationships. But since, by assumption, these relationships are those of mutual deterrence, it means that such a situation cannot occur.

Consequently, there is at least one pair of parties, say (i,j) which simultaneously attack a second pair of parties, say (k,l). But this means that i and j simultaneously attack k for instance.
It then stems from the discussion of the second case, that i and j form a coalition.

4. An Elementary Case Study : Is There a Possible Nuclear Excursion of the Yougoslavian Crisis?

4.1. THE GEOPOLITICAL ENVIRONMENT.

4.1.1. *Background.* The Yougoslavian conflict is, no doubt about it, quite a complex one, because in particular of the number of actors involved. If some of them are local, many third parties come into the picture when analysing the possibilities of a direct extension of the actual conflict in Bosnia. Take Macedonia for instance, a small country, located in the heart of the Balkans, and a historical intersection between Europe and the East, and surrounded by Albania, which is predominantly moslem, and three orthodox countries : the "new Yougoslavia", reduced to Serbia and Montenegro, Bulgaria and Greece. All, during the course of history, have coveted, in part or entirely the territory of Macedonia.

Today, the Macedonians of former Yougoslavia, who declared their independance in September 1991, claim ther own identity and seek international recognition. They feel rather isolated, and threatened at the north by an aggressive Serbia which considers the region as ancestral, "southern Serbia", at the south by Greece, which contests their name, and at the East, where Bulgaria considers Macedonians Bulgarians, and faces national minority problems of its own. Currently, Macedonia is the region outside Bosnia, that undergoes the most heated controversies and it becomes evident that an aggravation in the instability of Macedonia would cause great repercussions in the Balkans.

4.1.2. *Escalation and Nuclear Game : Some Basic Assumptions for a Scenario.* For instance, if the conflict between Serbs and Albanians for Kossovo intensifies, and the till now passive resistance of Kossovars becomes violent, the government of Belgrade could take the opportunity to intervene. This new front would be the source of another upsurge of refugees in Macedonia, which thus be lead into the conflict. This could trigger a more general extension of the conflict, with the possible intervention of third moslem parties like, say, Iran. Indeed, the Iranians could intervene in the yougoslavian conflict for different reasons :

- to help their moslem brothers "abandoned" by western countries;
- to boost their image in the moslem countries;
- to expand islamic influence, and help founding in the long run an islamic regime in the Balkans.

Furthermore, if we assume that such an excursion of the yougolsavian crisis will happen only a few years from now, we should consider the possibility of Iran being then equipped with some nuclear potential. Since four nuclear powers are already involved in this crisis (USA, Russia, Great-Britain, France), we cannot a priori exclude there is place for some multipolar nuclear game, or at least gesticulation. Many different scenarios of escalation could be built in this sense, starting from an intensification of fightings, due to the massive help sent by moslem countries. Although its probability is quite low, one then should not reject out of hand the possibility, for instance, of a nuclear strike over theater forces in the region, or of a more strategic nuclear threat, based on the future capacity of Iran to launch a limited number of missiles over targets located in Europe.

Of course, Iran here is taken just as an example of a possible intervention of a third-world moslem country. Other countries could be considered as well : Irak who already proved during the war with Iran, and during the gulf war, that he was not rebuked by the idea of launching missiles strikes over other countries territories, may be Algeria, if the fundamentalists come to power etc...So, if we are only interested in a possible nuclear game, we can consider as a first approximation that situations of France and Great-Britain are similar. Indeed, both :

- are members of the European Union;
- have sent peace keeping forces on the theater under the UN banner;
- are medium powers with respect to nuclear offensive capacities etc...

So, in order to simplify the description and solution of the game, we can only consider the presence of one of them. Since the most important national contribution to the local UN forces is french, and France has a nuclear policy more independant from the US, we shall keep the latter, and thus consider a situation where the following four nuclear powers are involved in the yougoslavian conflict :

- the two superpowers : USA and Russia;
- one medium power : France;
- one weak power : Iran.

Several games can be considered, depending on the existence of coalitions, and the possibility of strategic defense in western Europe. We shall explore four of them, and make the following assumptions :

- for a foreseeable future at least, a US attack against France, or a french attack against the USA can be excluded;
- Russia a has a less-than-perfect defense;
- Iran has no capacity to launch intercontinental ballistic missiles, that is to strike USA.

This last assumption implies that, if we exclude the case of near-perfect defense, the USA can be credited, either with no defense at all, or with a less-than-perfect one. Since, we have assumed that Russia has one, it seems reasonable to make a similar assumption for the US, but just for the sake of it, since here this assumption is meaningless, because of the lack of iranian capacity to strike the american territory.

4.2. GAME 1 : NO COALITION AND NO EUROPEAN STRATEGIC DEFENSE.

4.2.1. *The Strategic Sets.* It follows from the general discussion that we can exclude simultaneous strikes, if we want the general model to be consistent with the conditions of mutual deterrence. Hence, the players strategies are :

For the US :

- E_1 : attack Russia;
- E_2 : attack Iran;
- $\underline{E}$: do not attack (but retaliate).

For Russia :

- R_1 : attack the USA;
- R_2 : attack France;
- R_3 : attack Iran;
- $\underline{R}$: do not attack (but retaliate).

For France :

- F_1 : attack Russia;
- F_2 : attack Iran;
- $\underline{F}$: do not attack (but retaliate).

For Iran :

- I_1 : attack Russia;
- I_2 : attack France;
- $\underline{I}$: do not attack (but retaliate).

4.2.2. *Strategic Combinations.* Furthermore, since there is no strategic defense, but assured retaliation, we can consider that the situations corresponding to the following strategic combinations are unacceptable :

- for the US : all strategic combinations including E_1 or R_1;
- for Russia : all strategic combinations including E_1, F_1, R_1, or R_2;
- for France : all strategic combinations including F_1,F_2,R_2,or I_2;
- for Iran : all strategic combinations including E_2,R_3,F_2,I_1, or I_2.

On the opposite, for each player all strategic combinations which do not include the stated strategies in the line associated with the player under consideration, are acceptable to him. It should be remembered that the fact that a certain situation is unacceptable to a player does not mean that his corresponding strategy is not playable : he simply may have no other choice. The search for the game's solutions will be organized around the determination of the strategies playability properties. Since the game includes more than two players, the recursive process of deterrence must take into account the properties of strategic combinations, and not only of simple strategies. Therefore we shall introduce similar playability properties for strategic combinations as for "simple" strategies. In particular, we shall say a non-cooperative strategic combination (i.e. a strategic combination such that no strategy of the combination belongs to a member of a coalition) is positively playable if all strategies, components of this combination are positively playable strategies. The definitions of playability by default and non playability of non-cooperative strategic combinations are the same as for strategies.

4.2.3. *Resolution of the Game.* To analyse the strategies and strategic combinations playability properties, we need to analyse the correspondence file given in the appendix, which associates with each strategic four-tuple, the vector comprised of the outcomes of the four players. More precisely, we shall first look for ordering the playabilities of a given player's strategies according to the following rule :
given two strategies S and S' of the same player, we shall say that the positive playability of S is at least as great as the positive playability of S' if, each time that a strategic four-tuple including S' gives the player under consideration an acceptable outcome, it does the same when S' is replaced by S.
If Simultaneously, the playability of S is at least as great as the playability of S', and the playability of S' is at least as great as the playability of S, we shall say that both strategies have equal playabilities.
Analysis of the file shows that positive playabilities of $\underline{E}$ and E_2 are equal, and at least as great as the positive playability of E_1.

This gives us a way to dramatically simplify the brute force procedure, which consists in systematically exploring all possibilities. Indeed, considering the US strategies positive playabilities should normally lead to 8 possible cases. With the ordering of these playabilities, only three cases remain.
Furthermore, if E_2 is non positively playable, then no American strategy is, which means that all are playable by default. So let us assume, that E_2 is positively playable.
Then, from the correspondence file, we can deduce that strategic combinations :

$R_1F_1I_1$
$R_1F_1I_2$ are not positively playable.
$R_1F_1\underline{I}$

By the above definitions, a non-cooperative strategic combination is not positively playable, as soon as one of its components is not positively playable. So, either one of the iranian strategies is positively playable, or all iranian strategies are not positively playable, and hence playable by default. In either case strategic combination R_1F_1 is not positively playable.

In the same way, we can show that combinations R_1F_2 and $R_1\underline{F}$ are not positively playable. Thus, whether one french strategy is positively playable, or all french strategies are playable by default, R_1 is not positively playable. The same can be shown of R_2, R_3, and $\underline{R}$. So all Russian strategies are playable by default. It is then straighforward that the same goes with the Iranian strategies. But if this the case, the analysis of the correspondence file shows that E_2 cannot be positively playable.

On the whole, given the ordering of American strategies positive playabilities, it means that all US strategies are playable by default. But in the development hereabove, this modification of the playability property of E_2 does not changes the conclusions. Hence all the players strategies are playable by default, and consequently, there is no non-sequential deterrence.

4.3. GAME 2 : NO COALITION AND A EUROPEAN STRATEGIC DEFENSE.

We consider here, that facing the danger of proliferation from the south, and given their willingness to build a european defense, the partners of the European Union set up a strategic defense, which is less-than-perfect, and hence can only stop limited strikes. This implies that France can now benefit from the same level of defense as the two superpowers, and hence be protected against iranian strikes. In this case, strategic combinations including F_2 or I_2 give no more unacceptable outcomes to France, the other unacceptability conditions being left unchanged. It can be very easily shown by analysing the corrrespondence file of the appendix associated with this case, that nothing is changed concerning the playability properties of the strategies : no non-sequential deterrence occurs.

4.4. GAME 3 : TWO COALITIONS AND NO EUROPEAN STRATEGIC DEFENSE.

Let us assume now that for some reasons Russia enters a coalition with Iran. Although at first sight such a coalition looks strange with respect to the yougoslavian crisis, there may be - who knows in Yougoslavia ?- an evolution of local alliances with for instance the Bosnians and the Serbs, backed by Iran and Russia respectively, forming an alliance against the Croatians who are then supported the western countries; or for reasons of grand strategy, that have nothing to do with the situation in Yougoslavia, Russia may decide to look for an alliance in the middle-east etc...

Furthermore, let us assume that in front of this coalition, the US and France decide also to form a coalition. Again, the four-player game is transformed into a two-player one. But the difference with the previous case lays in that now, given the possible changes in thresholds, simultaneous attacks cannot be discarded anymore. This means in particular, that the two coalitions following strategies have to be taken into account :

- for the Russian / Iranian coalition : R_3I_2 and $R_3\underline{I}$
- for the French / American coalition : E_3F_1,E_3F_2, and $E_3\underline{E}$.

But this possibility of simultaneous attack changes nothing : all strategies are playable by default, and hence, there is no non-sequential deterrence.

4.5. GAME 4 : THE GRAND COALITION AND NO EUROPEAN STRATEGIC DEFENSE.

We assume here that, confronted to the danger of escalation in Yougoslavia due to the Iranian support to the moslems, The US, Russia and France decide to form a grand coalition. Let us remember that the term of coalition is given here a special meaning the players of a coalition somehow melt into a single player, whose outcome is the product of the coalition members outcomes. Hence the game is reduced to a two player-game, the coalition on one side, and Iran on the other.

All strategic combinations corresponding to an attack of one of the coalition members by another, or more precisely all strategic combinations including E_1,R_1,R_2, or F_1 can be discarded. Moereover, we shall assume that, by exchanging their informations, the coalition members are able to locate and destroy all iranian nuclear weapons. The realism of such an assumption may be a subject of discussion, especially after the Gulf War. But if the reader thinks the assumption is wrong, he can simply change the matrix entries accordingly, and analyse the corresponding game. The assumption is taken here because it allows the assessment of thresholds changes associated with certain strategic combinations, and hence

the model's robustness.

The conclusions here are the same as in the previous game : no strategy is positively playable, and no non-sequential deterrence occurs.

4.6. LOOKING FOR SEQUENTIAL DETERRENCE.

We know that the absence of non-sequential deterrence in the four previous games, does not mean that sequential deterrence is impossible. But, if we consider for instance one of the non-cooperative games (i.e. games without coalitions), it means that we have to set up preference and precedence orders, based on four-tuples. Since there are 16 possible binary four-tuples, there is a prior possibility of 16! preference orders per player, which means $(16!)^4$ preference orders four-tuples. Even, if reductions can be obtained by taking into account consistency conditions related to the players rationality, the number will still be huge, and once again resolution of the game might prove very lengthy.

But since we have seen that simultaneous attacks either can't happen or change nothing in the 4 games under consideration, we can obtain a dramatic simplification through decomposing each four-player game into a set of two-player ones. More precisely, as we have assumed that there was no nuclear game bteween the US, and France, it means that the four-player game can be decomposed into five two-player games, and we find each of these games corresponds to one case of mutual deterrence analysed earlier. Thus when considering the decomposition of the first non-cooperative four-player game :

- the american / russian game corresponds to case 4;
- the american / iranian game corresponds to case 1;
- the russian / french game corresponds to case 4;
- the russian / iranian game corresponds to case 1;
- the french / iranian game corresponds to case 4.

Decomposition of the second non-cooperative four-player game differs from the previous one by the fact that the French / Iranian game corresponds now to type 1. Coming to the first coalition, the sequential game can be dramatically reduced since many strategies of each party are equivalent. It shows in particular, that strategies of simultaneous attacks - although now consistent with the rules of mutual deterrence - are useless, and the game is equivalent to case 7.

The same conclusions can be drawn from the sequential analysis of the grand coalition game, with the reduced game being able to be decomposed into two two-player games equivalent to cases 1 and 3 respectively.

5. Conclusions.

This paper's aim was to analyse one category of multipolar deterrence system, derived from the classical MAD or Mututal Assured Deterrence. As already pointed out, the interest lays mainly in that if such a system proves viable, it is the most evident to consider, because it uses classical concepts, and seems quite acceptable for small countries - the most probable perturbators in the nuclear game. At the same time, the diversity of this category as appearing through the six possible modes, does not erase its possibility to consider systems with quite an uneven distribution of nuclear power or/and strategic defense. Of course, some of the assumptions, especially those related with the consistency constraints, were taken more for the sake of simplicity - a necessity to a tentative approach - than with the definite aim of a realistic representation.

The paper paves the way for future research, which should go much further into details, when classifying offensive powers and defense levels. Most probably, one should then resort to differential games in order to carrefuly analyse the various threshold effects, and be able to answer such questions

as what is the size of a limited attack or a massive attack, and what are the levels of defense required to face such attacks.

Other avenues for future research are widely opened. In the first place, multipolar deterrence systems not based on MAD should be explored with the help of games of deterrence used here. Secondly, we have drawn our attention exclusivley on multipolarity, deliberately ignoring proliferation. But of course multipolarity is the product of proliferation. In that sense, the type of proliferation will evidently affect the type of multipolar deterrence that can be thought of for the future. Conversely, one can think of building a global system of nuclear deterrence, where the type of multipolarity would be designed first. Then the question would be two-fold :

1) Given the actual state of the world, what kind of proliferation is consistent with the selected multipolar deterrence system ?

2) How to make sure that no other type of proliferation will be permitted ?

In any case, anti-ballistic defense will be a pending question in the beginning of the XXIth century if not earlier. The american experience in the field, whether under the form of SDI, GPLS, or BMDO, has shown that it is a money and technology consuming challenge. This will have consequences for small and medium developped countries, especially in Europe.

It is very doubtful that in a foreseeable future, western european countries, even the most powerful of them (France, Germany, Great-Britain) will be able to support a purely national and sustainable ABM-type program. Therefore, a high degree of cooperation will be necessary, first within the European Union, but also probably with the US. Such a cooperation, which has already been initialized at an elementary level, in the frame of the MEADS program, raises some problems, concerning both its aims and modalities. First, european nuclear powers like France, would certainly not like to see the development of a near-perfect defense, because it would endanger their national system of deterrence. But on the other hand, the growing danger of nuclear proliferation in the south, especially among ruthless dictatorships, which don't care about the price of human lives and even less about public opinion, requires considering the partial of total failure of deterrence vis-à-vis those dictatorships, and hence the setting up of a defense, whether at the theater level, or at the level of the national sanctuary. Secondly, because defense systems are money and technology consuming, there may be many expectations about possible financial and technological returns, which would make the negotiations between the participating countries not so easy. Nevertheless, if these questions can be solved, there seems to be no other major political obstacle. Indeed, first it goes along with the build up of a european defense as prescribed by the Maastricht treaty. Second, the obvious technical requirement of an automatization of the system's activation raises no problem of multiple decision, since the system is defensive by nature, and the consequences of its activation would only be the destruction of attacking missiles. Last, it allows to postpone the most delicate problem of sharing nuclear weapons.

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Appendix

GAME 1 : NO COALITION AND NO EUROPEAN STRATEGIC DEFENSE

1	E_1	R_1	F_1	I_1	0	0	1	1
2	E_1	R_1	F_1	I_2	0	0	0	1
3	E_1	R_1	F_1	$\underline{I}$	0	0	1	1
4	E_1	R_1	F_2	I_1	0	0	1	0
5	E_1	R_1	F_2	I_2	0	0	0	0
6	E_1	R_1	F_2	$\underline{I}$	0	0	0	0
7	E_1	R_1	$\underline{F}$	I_1	0	0	1	1
8	E_1	R_1	$\underline{F}$	I_2	0	0	0	0
9	E_1	R_1	$\underline{F}$	$\underline{I}$	0	0	1	1
10	E_1	R_2	F_1	I_1	1	0	0	1
11	E_1	R_2	F_1	I_2	1	0	0	1
12	E_1	R_2	F_1	$\underline{I}$	1	0	0	1
13	E_1	R_2	F_2	I_1	1	0	0	0
14	E_1	R_2	F_2	I_2	1	0	0	0
15	E_1	R_2	F_2	$\underline{I}$	1	0	0	0
16	E_1	R_2	$\underline{F}$	I_1	1	0	0	1
17	E_1	R_2	$\underline{F}$	I_2	1	0	0	0
18	E_1	R_2	$\underline{F}$	$\underline{I}$	1	0	0	1
19	E_1	R_3	F_1	I_1	1	0	1	0
20	E_1	R_3	F_1	I_2	1	0	0	0
21	E_1	R_3	F_1	$\underline{I}$	1	0	1	0
22	E_1	R_3	F_2	I_1	1	0	1	0
23	E_1	R_3	F_2	I_2	1	0	0	0
24	E_1	R_3	F_2	$\underline{I}$	1	0	0	0
25	E_1	R_3	$\underline{F}$	I_1	1	0	1	0
26	E_1	R_3	$\underline{F}$	I_2	1	0	0	0
27	E_1	R_3	$\underline{F}$	$\underline{I}$	1	0	1	0
28	E_1	$\underline{R}$	F_1	I_1	0	0	0	1
29	E_1	$\underline{R}$	F_1	I_2	0	0	0	1
30	E_1	$\underline{R}$	F_1	$\underline{I}$	0	0	0	0
31	E_1	$\underline{R}$	F_2	I_1	0	0	1	0
32	E_1	$\underline{R}$	F_2	I_2	0	0	0	0
33	E_1	$\underline{R}$	F_2	$\underline{I}$	0	0	0	0
34	E_1	$\underline{R}$	$\underline{F}$	I_1	0	0	1	0
35	E_1	$\underline{R}$	$\underline{F}$	I_2	0	0	0	1
36	E_1	$\underline{R}$	$\underline{F}$	$\underline{I}$	0	0	1	0
37	E_2	R_1	F_1	I_1	0	0	1	0
38	E_2	R_1	F_1	I_2	0	0	0	0
39	E_2	R_1	F_1	$\underline{I}$	0	0	1	0
40	E_2	R_1	F_2	I_1	0	1	1	0
41	E_2	R_1	F_2	I_2	0	1	0	0
42	E_2	R_1	F_2	$\underline{I}$	0	1	0	0
43	E_2	R_1	$\underline{F}$	I_1	0	1	1	0
44	E_2	R_1	$\underline{F}$	I_2	0	1	0	0
45	E_2	R_1	$\underline{F}$	$\underline{I}$	0	1	1	0

46	E_2	R_2	F_1	I_1	1	0	0	0
47	E_2	R_2	F_1	I_2	1	0	0	0
48	E_2	R_2	F_1	$\underline{I}$	1	0	0	0
49	E_2	R_2	F_2	I_1	1	1	0	0
50	E_2	R_2	F_2	I_2	1	1	0	0
51	E_2	R_2	F_2	$\underline{I}$	1	1	0	0
52	E_2	R_2	$\underline{F}$	I_1	1	0	0	0
53	E_2	R_2	$\underline{F}$	I_2	1	0	0	0
54	E_2	R_2	$\underline{F}$	$\underline{I}$	1	0	0	0
55	E_2	R_3	F_1	I_1	1	0	1	0
56	E_2	R_3	F_1	I_2	1	0	0	0
57	E_2	R_3	F_1	$\underline{I}$	1	0	1	0
58	E_2	R_3	F_2	I_1	1	1	1	0
59	E_2	R_3	F_2	I_2	1	1	0	0
60	E_2	R_3	F_2	$\underline{I}$	1	1	0	0
61	E_2	R_3	$\underline{F}$	I_1	1	1	1	0
62	E_2	R_3	$\underline{F}$	I_2	1	1	0	0
63	E_2	R_3	$\underline{F}$	$\underline{I}$	1	1	1	0
64	E_2	$\underline{R}$	F_1	I_1	1	0	0	0
65	E_2	$\underline{R}$	F_1	I_2	1	0	0	0
66	E_2	$\underline{R}$	F_1	$\underline{I}$	1	0	0	0
67	E_2	$\underline{R}$	F_2	I_1	1	1	1	0
68	E_2	$\underline{R}$	F_2	I_2	1	1	0	0
69	E_2	$\underline{R}$	F_2	$\underline{I}$	1	1	0	0
70	E_2	$\underline{R}$	$\underline{F}$	I_1	1	1	1	0
71	E_2	$\underline{R}$	$\underline{F}$	I_2	1	1	0	0
72	E_2	$\underline{R}$	$\underline{F}$	$\underline{I}$	1	1	1	0
73	$\underline{E}$	R_1	F_1	I_1	0	0	1	1
74	$\underline{E}$	R_1	F_1	I_2	0	0	0	1
75	$\underline{E}$	R_1	F_1	$\underline{I}$	0	0	1	1
76	$\underline{E}$	R_1	F_2	I_1	0	0	1	0
77	$\underline{E}$	R_1	F_2	I_2	0	0	0	0
78	$\underline{E}$	R_1	F_2	$\underline{I}$	0	0	0	0
79	$\underline{E}$	R_1	$\underline{F}$	I_1	0	0	1	1
80	$\underline{E}$	R_1	$\underline{F}$	I_2	0	0	0	0
81	$\underline{E}$	R_1	$\underline{F}$	$\underline{I}$	0	0	1	1
82	$\underline{E}$	R_2	F_1	I_1	1	0	0	1
83	$\underline{E}$	R_2	F_1	I_2	1	0	0	1
84	$\underline{E}$	R_2	F_1	$\underline{I}$	1	1	0	1
85	$\underline{E}$	R_2	F_2	I_1	1	1	0	0
86	$\underline{E}$	R_2	F_2	I_2	1	1	0	0
87	$\underline{E}$	R_2	F_2	$\underline{I}$	1	0	0	0
88	$\underline{E}$	R_2	$\underline{F}$	I_1	1	0	0	1
89	$\underline{E}$	R_2	$\underline{F}$	I_2	1	0	0	0
90	$\underline{E}$	R_2	$\underline{F}$	$\underline{I}$	1	0	0	1
91	$\underline{E}$	R_3	F_1	I_1	1	0	1	0
92	$\underline{E}$	R_3	F_1	I_2	1	0	0	0
93	$\underline{E}$	R_3	F_1	$\underline{I}$	1	0	1	0

94	E	R_3	F_2	I_1	1	1	1	0
95	E	R_3	F_2	I_2	1	1	0	0
96	E	R_3	F_2	I	1	1	0	0
97	E	R_3	F	I_1	1	1	1	0
98	E	R_3	F	I_2	1	1	0	0
99	E	R_3	F	I	1	1	1	0
100	E	R	F_1	I_1	1	0	0	0
101	E	R	F_1	I_2	1	0	0	1
102	E	R	F_1	I	1	0	0	1
103	E	R	F_2	I_1	1	1	1	0
104	E	R	F_2	I_2	1	1	0	0
105	E	R	F_2	I	1	1	0	0
106	E	R	F	I_1	1	1	1	0
107	E	R	F	I_2	1	1	0	0
108	E	R	F	I	1	1	1	1

GAME 2 : NO COALITION AND EUROPEAN STRATEGIC DEFENSE

1	E_1	R_1	F_1	I_1	0	0	1	1
2	E_1	R_1	F_1	I_2	0	0	1	1
3	E_1	R_1	F_1	I	0	0	1	1
4	E_1	R_1	F_2	I_1	0	0	1	0
5	E_1	R_1	F_2	I_2	0	0	1	0
6	E_1	R_1	F_2	I	0	0	1	0
7	E_1	R_1	F	I_1	0	0	1	1
8	E_1	R_1	F	I_2	1	0	1	0
9	E_1	R_1	F	I	1	0	1	1
10	E_1	R_2	F_1	I_1	1	0	0	1
11	E_1	R_2	F_1	I_2	1	0	0	1
12	E_1	R_2	F_1	I	1	0	0	1
13	E_1	R_2	F_2	I_1	1	0	0	0
14	E_1	R_2	F_2	I_2	1	0	0	0
15	E_1	R_2	F_2	I	1	0	0	0
16	E_1	R_2	F	I_1	1	0	0	1
17	E_1	R_2	F	I_2	1	0	0	0
18	E_1	R_2	F	I	1	0	0	1
19	E_1	R_3	F_1	I_1	1	0	1	0
20	E_1	R_3	F_1	I_2	1	0	1	0
21	E_1	R_3	F_1	I	1	0	1	0
22	E_1	R_3	F_2	I_1	1	0	1	0
23	E_1	R_3	F_2	I_2	1	0	1	0
24	E_1	R_3	F_2	I	1	0	1	0
25	E_1	R_3	F	I_1	1	0	1	0
26	E_1	R_3	F	I_2	1	0	1	0
27	E_1	R_3	F	I	1	0	1	0
28	E_1	R	F_1	I_1	0	0	0	0

29	E_1	R	F_1	I_2	0	0	0	1
30	E_1	R	F_1	I	0	0	0	1
31	E_1	R	F_2	I_1	0	0	1	0
32	E_1	R	F_2	I_2	0	0	1	0
33	E_1	R	F_2	I	0	0	1	0
34	E_1	R	F	I_1	0	0	1	0
35	E_1	R	F	I_2	0	0	1	0
36	E_1	R	F	I	0	0	1	1
37	E_2	R_1	F_1	I_1	0	0	1	0
38	E_2	R_1	F_1	I_2	0	0	1	0
39	E_2	R_1	F_1	I	0	0	1	0
40	E_2	R_1	F_2	I_1	0	1	1	0
41	E_2	R_1	F_2	I_2	0	1	1	0
42	E_2	R_1	F_2	I	0	1	1	0
43	E_2	R_1	F	I_1	0	1	1	0
44	E_2	R_1	F	I_2	0	1	1	0
45	E_2	R_1	F	I	0	1	1	0
46	E_2	R_2	F_1	I_1	1	0	0	0
47	E_2	R_2	F_1	I_2	1	0	0	0
48	E_2	R_2	F_1	I	1	0	0	0
49	E_2	R_2	F_2	I_1	1	1	0	0
50	E_2	R_2	F_2	I_2	1	1	0	0
51	E_2	R_2	F_2	I	1	1	0	0
52	E_2	R_2	F	I_1	1	0	0	0
53	E_2	R_2	F	I_2	1	0	0	0
54	E_2	R_2	F	I	1	0	0	0
55	E_2	R_3	F_1	I_1	1	0	1	0
56	E_2	R_3	F_1	I_2	1	0	1	0
57	E_2	R_3	F_1	I	1	0	1	0
58	E_2	R_3	F_2	I_1	1	1	1	0
59	E_2	R_3	F_2	I_2	1	1	1	0
60	E_2	R_3	F_2	I	1	1	1	0
61	E_2	R_3	F	I_1	1	1	1	0
62	E_2	R_3	F	I_2	1	1	1	0
63	E_2	R_3	F	I	1	1	1	0
64	E_2	R	F_1	I_1	1	0	0	0
65	E_2	R	F_1	I_2	1	0	0	0
66	E_2	R	F_1	I	1	0	0	0
67	E_2	R	F_2	I_1	1	1	1	0
68	E_2	R	F_2	I_2	1	1	1	0
69	E_2	R	F_2	I	1	1	1	0
70	E_2	R	F	I_1	1	1	1	0
71	E_2	R	F	I_2	1	1	1	0
72	E_2	R_1	F	I	1	1	1	0
73	E	R_1	F_1	I_1	0	0	1	1
74	E	R_1	F_1	I_2	0	0	1	1
75	E	R_1	F_1	I	0	0	1	1
76	E	R_1	F_2	I_1	0	0	1	0

77	E	R_1	F_2	I_2	0	0	1	0
78	E	R_1	F_2	I	0	0	1	0
79	E	R_1	F	I_1	0	0	1	1
80	E	R_1	F	I_2	0	0	1	0
81	E	R_1	F	I	0	0	1	1
82	E	R_2	F_1	I_1	1	0	0	1
83	E	R_2	F_1	I_2	1	0	0	1
84	E	R_2	F_1	I	1	0	0	1
85	E	R_2	F_2	I_1	1	0	0	0
86	E	R_2	F_2	I_2	1	1	0	0
87	E	R_2	F_2	I	1	1	0	0
88	E	R_2	F	I_1	1	1	0	1
89	E	R_2	F	I_2	1	0	0	0
90	E	R_2	F	I	1	0	0	1
91	E	R_3	F_1	I_1	1	0	1	0
92	E	R_3	F_1	I_2	1	0	1	0
93	E	R_3	F_1	I	1	0	1	0
94	E	R_3	F_2	I_1	1	1	1	0
95	E	R_3	F_2	I_2	1	1	1	0
96	E	R_3	F_2	I	1	1	1	0
97	E	R_3	F	I_1	1	1	1	0
98	E	R_3	F	I_2	1	1	1	0
99	E	R_3	F	I	1	1	1	0
100	E	R	F_1	I_1	1	0	0	0
101	E	R	F_1	I_2	1	0	0	1
102	E	R	F_1	I	1	0	0	1
103	E	R	F_2	I_1	1	1	1	0
104	E	R	F_2	I_2	1	1	1	0
105	E	R	F_2	I	1	1	1	0
106	E	R	F	I_1	1	1	1	0
107	E	R	F	I_1	1	1	1	0
108	E	R	F	I	1	1	1	1

GAME 3 : TWO COALITIONS : USA / FRANCE AGAINST RUSSIA / IRAN

	R_1I_2	$R_1\underline{I}$	R_2I_2	$R_2\underline{I}$	R_3I_2	$R_3\underline{I}$	$\underline{R}I_2$	$\underline{RI}$
E_1F_1	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
E_1F_2	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
$E_1\underline{F}$	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
E_2F_1	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
E_2F_2	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
$E_2\underline{F}$	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,0)
E_3F_1	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
E_3F_2	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
$E_3\underline{F}$	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
$\underline{E}F_1$	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
$\underline{E}F_2$	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
$\underline{EF}$	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(1,1)

GAME 4 : THE GREAT COALITION AGAINST IRAN

	I_1	I_2	$\underline{I}$
$E_2R_3F_2$	(1,0)	(0,0)	(1,0)
$E_2R_3\underline{F}$	(1,0)	(0,0)	(1,0)
$E_2\underline{R}F_2$	(1,0)	(0,0)	(1,0)
$E_2\underline{RF}$	(1,0)	(0,0)	(1,0)
$\underline{E}R_3F_2$	(1,0)	(0,0)	(1,0)
$\underline{E}R_3\underline{F}$	(1,0)	(0,0)	(1,0)
$\underline{ER}F_2$	(1,0)	(0,0)	(1,0)
$\underline{ERF}$	(1,0)	(0,0)	(1,1)

FSSI AS AN UNIVERSAL MEASURE OF STABILITY: FROM MAD-STABILITY TOWARD MAP-STABILITY

A.PIONTKOWSKY, A.SKOROKHODOV
Strategic Studies Centre
Institute for System Analysis
117312 Moscow, Russia

1. Historical Relativity Of MAD-Stability Conception

As it's well known since the early 1960s strategic stability between the USSR and the United States had been based on a balance of terror, or to be more precise on the ability of either side to inflict unacceptable damage on the adversary in a retaliatory strike even under the most unfavorable circumstances.

The ABM Treaty signed in 1972 was clearest possible manifestation of acceptance of this doctrine by both the US and the USSR governments. Strategically this treaty meant that the participants deliberately opened their territories for a retaliatory strike. The strategic stability was being explicitly interpreted as second strike capability of both states (MAD-stability).

The nuclear balance of terror and corresponding interpretation of stability arose in the atmosphere of an acute geopolitical and ideological conflict between the two powers, global confrontation between their conventional armed forces and a real threat of war between them. Consequently one should be aware of the historical limitation of traditional conception of MAD-stability and the need to look for new conceptual approaches in an absolutely new political environment.

It is significant that according to the MAD-stability conception there is no strategic stability between such pairs of states for example as the US and Canada, France and Germany, and France and Great Britain. But it doesn't occur to anyone to think in terms of strategic instability about the relations between these countries. The strategic stability based on the MAD-doctrine is not an universal conception. On the contrary, this conception was born and put into practice as the result of the very particular political circumstances of the Cold War period.

If the logic of strategic forces cuts is continued it is likely to place Russia and the US on the threshold of leaving the area of stability based on mutual assured destruction threat and moving onto the area, where stability will have to be ensured by other means of both a political and technological nature.

MAD-stability was based on the vulnerability of both sides to an unacceptable damage. Subsequent to radical nuclear arms reductions and in the atmosphere of political confidence, a new (actually opposite) conception of stability - Mutual Assured Protection stability - is becoming possible.

The strategic forces system is considered as MAP-stable if relationship of offensive and defensive arms is such that it makes both sides invulnerable to fall of the nuclear ballistic missiles upon their territories. For example if each of the sides has 150 warheads and global protection system intercepts 200 warheads then the system is MAP-stable.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 259–267.

2. On FSSI Definition And Calculation

To analyze more closely MAP-stability conception and its relationship with MAD-stability we'll use the notion of First-Strike Stability Index (see Best[1]).

The bipolar first-strike stability index is defined usually as follows:

$$S = (Cost_{B1}/Cost_{B2})*(Cost_{A1}/Cost_{A2}),$$

where
$Cost_{B1}$ is the cost to side B of striking first,
$Cost_{B2}$ is the cost to side B of waiting,
$Cost_{A1}$, $Cost_{A2}$ are the costs corresponding to side A.

Cost is defined as follows:

$$Cost = Damage_{Self} - L*Damage_{Enemy} + L.$$

We assume that damage is measured by ratio of the warheads which have reached the enemy value targets to the "unacceptable damage" - C equal to some fixed number of warheads. Damage is defined between 0 and 1, where 1 corresponds to the notion of "unacceptable damage". For our analysis we measure the damage suffered by a side by a number of warheads delivered on it by the adversary at a countervalue strike:

$$Damage = n / 100,$$

(C=100 warheads are chosen to be regarded as an unacceptable damage, more then 100 warheads are not delivered because an increase of the damage beyond an unacceptable level doesn't serve any rational objective).

The coefficient $L<1$ reflects a natural greater anxiety of either side to minimize its own damage rather than maximize enemy damage. (Following Best[1], later on we will assume $L=0.3$.) Thus cost is defined between 0 and 1+L.

For any pair (x,y) warheads numbers of sides A and B we can define the function

$$S_B(x,y) = Cost_{B1}/Cost_{B2},$$

assessing quantitatively an incentive for B to strike first.

Then, if "unacceptable damage" and other parameters for both sides are assumed the same, from symmetry considerations we have

$$S_A(x,y)=S_B(y,x),$$

and stability index will be equal to

$$S(x,y) = S_A(x,y)*S_B(x,y) = S_B(y,x)*S_B(x,y).$$

But unlike Best[1] we'll later use as first-strike index the following expression:

$$S(x,y) = \min\{S_A(x,y),S_B(x,y)\}=\min\{S_B(y,x),S_B(x,y)\}.$$

(This small modification seems to be logical. Each of two coefficients (S_A,S_B) evaluates an incentive for a side to strike first (less the coefficient, more the incentive). Therefore the minimum of the two

coefficients gives the objective estimate of the greatest threat for stability, i.e. the greatest incentive for one of the sides to strike first).

This index is an quantitative measure of stability of two powers strategic forces system. The stable phase states correspond to S=1, the maximum unstable state corresponds to S=0.

Let p is probability of destroying of one side's warhead by another side's warhead. To simplify the analysis we consider that the probability p is the same for both sides and all missiles have only single warhead. Then parameters p and L are sufficient to determine index $S_B(x,y)$ and therefore $S(x,y)=S_B(y,x)*S_B(x,y)$.

In fact to obtain $S_B(x,y)$ value it is necessary to calculate

"cost of striking" $\quad Cost_{B1}(x,y) = D_{B1} - L*D_{A2} + L \quad (1)$

where the side B minimizes (1) through optimal allocation of its warheads at the first strike on side A and

"cost of waiting" $\quad Cost_{B2}(x,y) = D_{B2} - L*D_{A1} + L \quad (2)$

where the side B estimates the cost of the worst possible scenario at which the side A maximizes (2) through optimal allocation of its warheads at the first strike on the side B. The warheads can be delivered:

either on opponent's values (increasing D_E from 0 to 1 according to formula $D_E = \min[n/100,1]$, where n is the number of warheads used in a countervalue strike,

or on opponent's warheads (decreasing their number and decreasing correspondingly an own damage D_S from the retaliatory strike).

So we have to determine $S_B(x,y)$ for all x,y x>=0,y>=0. Generally speaking formulas (1) and (2) have physical sense for integer x and y (warhead numbers) only, but we'll determine corresponding values for all (x,y) that will give us a visual continuous geometrical picture of stability index S(x,y) distribution on the whole (x,y) plane.

The results are presented at Fig.1. (The equations for $Cost_{B1}(x,y)$ and $Cost_{B2}(x,y)$ see Piontkowsky[2]). We see that S(x,y)=1 only at zero and those points when each side may inflict an unacceptable damage (D=1) to the adversary in a retaliatory strike. In this points

$$CostB1=CostB2=CostA1=CostA2=D_S-L*D_E+L=1-L+L=1$$

$$S_B = S_A = 1/1 = 1.$$

So we see that the FSSI adequately reflects the conception of the MAD-stability (FSSI=1 inside MAD area) but at the same time the nature of the FSSI is more rich. Besides defining the stability area in the strategic system state space it gives also numerical assessment of instability degree ($0 \le FSSI < 1$) in other areas.

Now let's consider the case when a limited global protection system is deployed (protecting each side under any circumstances from K striking warheads). The S(x,y) distribution in this case is presented at Fig.2 and Fig.3. We see that a new area where S(x,y)=1 arose around the zero point. In points of this MAP-stability area the absence of damage (D=0) is guaranteed for both sides under any scenario. Therefore in those points

$$Cost_{A1}=Cost_{A2}=Cost_{B1}=Cost_{B2} = 0 - 0 + L$$

$$S_B(x,y) = S_A(x,y) = L/L = 1, \quad S(x,y) = 1.$$

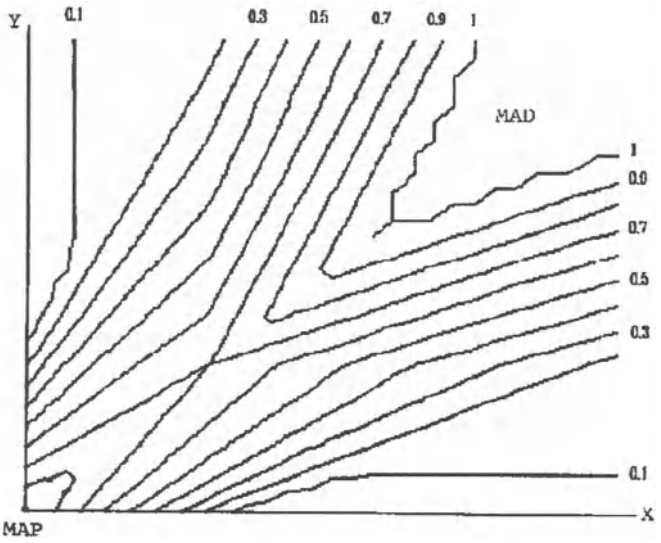

Fig.1. S(x,y) isolines without ABM system and p>L.

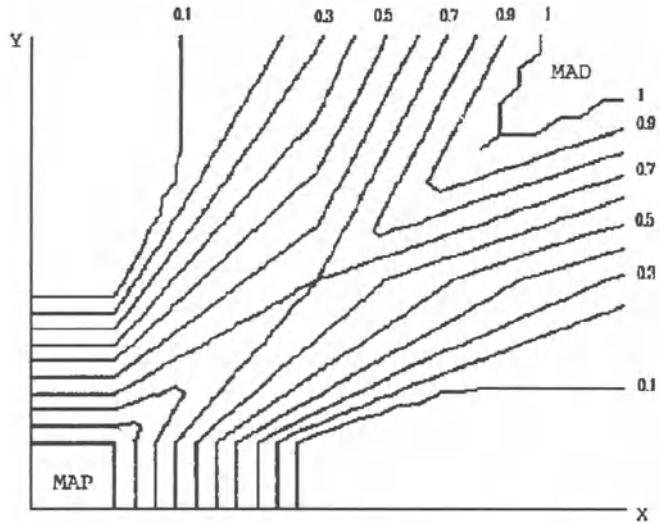

Fig.2. S(x,y) isolines with deployment of limited ABM system and p>L.

3. MAD And MAP Stability As Two Sides Of One Strategic Reality

We discussed in section 1 the conceptual difference even an antipodal character of the two paradigms of strategic stability. Each of them is rooted in its own geopolitical context and seems to have nothing in common with another.

But the FSSI concept turns to be extremely revealing, unifying two apparently contradictory concepts of stability through the same mathematical technique. Indeed in all points of MAD-stability and MAP-stability areas and only at those points FSSI=1.

Without ABM system the MAP-stability area degenerates into a single point, which is the initial point of the coordinates system. Index S is equal to 1 at this point as well as at the points of the classical area of MAD-stability (Fig.1).

Let's consider now the evolution of MAD-stability and MAP-stability areas due to deployment of an limited ABM system. We will characterize the efficiency of this system by a parameter K (number of warheads being intercept by such a system). Due to deployment of the limited global ABM system the area of MAP-stability increases, starting from the zero point and moving up-right in the form of square area with the length K. At the same time the MAD-stability area decreases, moving up-right as it was always justly noted in the papers in which SDI project was described as destabilizing idea (Fig.2).

However what wasn't noted is that the MAP-stability area is arising and increasing. In fact we obtain on the (x,y) plane a general area of stability, combining its two not contradictory but rather mutually complementary aspects. In general case this area is unconnected and its MAD and MAP subsets are divided by instability area where S is less than unity.

The problem of the offensive strategic forces deep cuts (beyond START-2) is basically the problem of the transition from MAD-stability sub-area into MAP-stability sub-area.

The mere raising of this problem is possible of course, as it was noted above, under certain political conditions, namely mutual confidence, absence of global confrontation, partnership relations. But we need also analyze technical aspects of the problem - discovering of most stable path of the transition from MAD-area to MAP-area (i.e. such path where for all its intermediate points index S is equal unity or very close to unity).

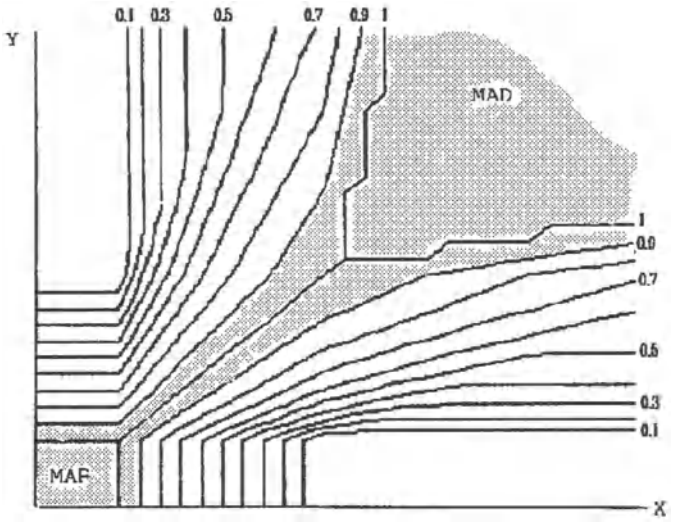

Fig.3. S(x,y) isolines with deployment of ABM system and p<L.

In this context let's consider the case when the offensive means of the sides are invulnerable enough - p<L (Fig.3). We can see that comparing with the case presented on Fig.2 stability index S(x,y) increases considerably in the area between MAD and MAP subsets and, actually we obtain the connected general stability area, inside which we can realize the stable transition from cold war stability paradigm to stability paradigm of cooperation and security. (In the shaded area S(x,y)>=0.9.)

4. Differing Metrics On Crisis Stability Analysis

This set of notions and conceptions was originally presented to an international strategic community at the World Laboratory Special Workshop "Global Stability Through Disarmament" more than a year ago. Many important points were clarified during discussions between American and Russian strategists, first of all some confusion connected with the FSSI basic definition. Paradoxically enough Russia and US experts seemed use the same formulas for the FSSI definition but got different results. It turned out that there were subtle differences in the understanding of optimization procedures implicitly included into FSSI definition.

Let's remind once more again the formulas for $Cost_{B1}(x,y)$ and $Cost_{B2}(x,y)$:

$$\text{"cost of striking"}Cost_{B1}(x,y) = D_{B1} - L*D_{A2} + L$$

$$\text{"cost of waiting"}Cost_{B2}(x,y) = D_{B2} - L*D_{A1} + L$$

To understand better a fine structure difference of the interpretations of the exact meaning of the terms "B minimizes (1) through optimal allocation..." and "B estimates the cost of the worst scenario at which the side A maximizes (2) through optimal allocation..." we'll not consider a general case but rather reproduce a piece of life dialogue between some A and R discussing a particular numerical example:

.

A. "Let's consider an example of the special case where each side has x=y single-weapon missiles, which have a kill probability p=0.6 against each other, x and y $\leq$100, and the parameter indicating the preference between damage to other and self of L=0.3.

In this case your equations properly indicate that the 1st striker allocates all of his missiles to missiles, and his first value strike is F=0. The 2nd striker is then left with x(1-p) missiles. He would get no value for striking empty launchers, so he allocates all of them to value, and his second value strike is S=x(1-p). Because the forces are symmetric, F and S are the same whether A or B strikes first. Knowing F and S, the cost of striking 1st and 2nd are

$$C1 = S/100 + L(1-F/100) = x(1-p)/100 + L(1-0) = x(1-p)/100 + L$$

$$C2 = F/100 + L(1-S/100) = 0 + L[1-x(1-p)/100]$$

Note that the difference between C2 and C1 is

$$C2 - C1 = -(1-p)x(1-p)/100,$$

which is always negative, so the cost of striking first is always greater than striking second, and configurations of imperfect singlet missiles is stable, as generally believed. The ratio of costs is

$$C1/C2 = [x(1-p)/100 + L]/L[1-x(1-p)/100],$$

which is always greater than unity for p<1. For p=1 it reduces to L/L=1. Thus, the stability index $(C1/C2)^2$ is always unity or greater, indicating stability for equal offensive forces.

Your remark suggests that the reason for our difference is that the 1st and 2nd striker perform two separate allocations. In this example, however, once the first striker has made his allocation, the second striker has no choice but to deposit his remaining weapons on value, for the reason indicated above. Thus, no second allocation is necessary or allowed. To invoke one is to use a different metric than that used in the US stability papers, and one which does not meet the logical criteria used above. I look forward to your comments".

R. "What we are discussing is very important and sensitive point lying on the intersection of the mathematics and the psychology. But after all the nuclear strategy is just this intersection.
Let me use the grammar of your comment to clarify my point.

You are saying "Once the first striker A has made his allocation, the second striker B has no choice but to deposit his remaining weapons on value. Thus no second allocation is necessary or allowed".

But the so-called second striker or to be more exact "player assessing himself in the waiting role" doesn't make his calculations after another player has made something. In calculating $Cost_{B2}$ player B makes his assessments in his perception without knowing anything about the other player's (A) psychology, rationality, mathematical skills and so on with only one duty to assess worst possible for himself scenario of opponent's behavior, or speaking mathematically that scenario which gives maximum to $Cost_{B2}$.
Let's try to put ourselves in the B's skin. In your example x=y=100, L=0.3, p=0.6. B must decide whether to initiate or to wait. To make his decision he must compare $Cost_{B1}$ and $Cost_{B2}$. There is no disagreement about $Cost_{B1}$. If B in his first strike allocates all of his missiles to opponent's missiles he minimizes his cost

$$Cost_{B1} = 100(1-0.6)/100 + L = 0.4+0.3=0.7.$$

So for B cost of initiating is 0.7. We agree on it.

Now B must assess risk of waiting in terms of worst possible (maximum) $Cost_{B2}$. Your figure for $Cost_{B2}$ is $L(1-x(1-p)/100]=0.3(1-0.4)=0.18$ and correspondingly $FSSI=(Cost_{B1}/Cost_{B2})^2 =3.89^2 =15.12$. I state that the risk of waiting is really much larger:

$$Cost_{B2} = \max [D_B - L*D_A + L]$$

on all possible kinds of A behavior in his first strike.

Calculating $Cost_{B2}=0.18$ you took into account one of the possible ways of A's behavior. But now I'm presenting a different possible option of A in his first strike. A hits B's values with all his missiles. In this case

$$Cost_{B2} = 1 - L*1 + L = 1.$$

B has no right to discount this possibility while assessing the risk of waiting. While calculating $Cost_{B2}$ B must imagine A as nasty as possible and as irrational as possible in his desire to damage B most by first.

B principally doesn't know A's formulas for assessing A's cost. He must expect worst under this relationship of forces. So,

$$Cost_{B2} = \max [D_B - L*D_A + L] = 1$$

on all possible kinds A's behavior,

$$S_B = Cost_{B1}/Cost_{B2} = 0.7/1 = 0.7.$$

S_A=0.7 from symmetry considerations (We may just repeat the same reasoning for A's perceptions).

$$FSSI = \min[S_A, S_R] = 0.7<1,$$

what corresponds with our general view that FSSI=1 only in MAD and MAP areas and less then unity at all other points".

Looking back to this discussion between A and R we may note now that any analyst has a certain freedom of choice in using or designing his analytical constructions. What is demanded is firstly that these constructions would be logically consistent and secondly that they reflect adequately a reality they are designed to study.

So the above discussion wasn't about whose interpretation is just and whose is wrong but about whose interpretation is more convenient for describing a strategic reality. In this respect our interpretation of FSSI meaning seems to be more natural and adequate. Indeed according to it FSSI has the maximum value (unity) in MAD and MAP areas. This strictly corresponds to the fact that in this areas neither side has any incentive for striking first by definition.

In the MAD case each side can inflict the maximum damage D=1 both in the first and the second strikes. So initiating of hostilities doesn't bring any advantages under any scenario.

In the MAP case neither side can inflict any damage at all by its strikes.

In all other cases there is no such certainty about results of waiting and in the moment of extreme military-political tension some incentive for first strike may arise, which is reflected mathematically by the fact that FSSI in this cases is less than unity. The exact value of FSSI numerically measures the degree of this incentive, i.e. degree of instability.

It's interesting that according to all interpretations FSSI is equal to unity in the MAD and MAP areas. But it's difficult to reconcile with a common sense that in the region between MAD and MAP areas FSSI can be more than unity, indicating a deeper stability.

Returning to the above example (x=100,y=100) we see that an alternative interpretation gives FSSI in this point the value 3.89. Our result of FSSI=0.7 for this example seems to be more realistic. It indicates on small but nevertheless distinctive source of instability. By waiting B (or A) risks to suffer unacceptable damage D=1. By striking first (on opponent's missiles) he can't protect himself from a very serious damage but nevertheless can deprive A of possibility to inflict unacceptable damage. It differs principally from the MAD-situation when no first strike allocation saves you from unacceptable retaliation. This mere difference creates a small source of instability (some incentive to strike first in the case of extreme political conflict) what is reflected by FSSI value decreasing from 1 to 0.7.

5. Conclusion

Above made analysis demonstrates that traditional Mutual Assured Destruction stability conception and formulated by us Mutual Assured Protection stability conception are actually only two aspects, two partial cases of one general Strategic Stability reality. The same mathematical tool - First Strike Stability Index - has allowed to unify these two apparently opposite conceptions into the single general stability conception. Those states of the strategic forces system are regarded as stable for which FSSI value is equal or very close to 1. In military-political terms it means that in this states neither side has any incentive toward initiating a conflict. This unified stability area covers points corresponding to MAD-stability and those corresponding to MAP-stability conceptions as well. Moreover the connectedness of this stability domain proves the possibility of stable transition (i.e. preserving FSSI_1 condition along all the transition path) from MAD-stability subdomain to MAP-stability subdomain.

This latest conclusion gives an answer to an important military-political problem, namely, about possibility of a smooth (i.e. preserving stability conditions at all intermediate stages of transition process) change of the strategic stability paradigm.

To our view this is a rather rare case of mathematical methods using in politology when their

application isn't only of illustrative and auxiliary character but leads to deep substantial results which couldn't be obtained by any other means.

We are thankful to our US colleagues M.Best, J.Bracken and G.Canavan for introducing to us the importance of the FSSI notion and very stimulating discussions.

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Section 2.6

Quantitative : Arms Race

ANALYZING THREE-WAY ARMS RACES

FREDERIC S. NYLAND
302 Colorado Boulevard
Post Office Box 1674
Idaho Springs, CO 80452
USA

ABSTRACT. This paper addresses the analysis of three-way arms races based on an expansion of Richardson's arms race equations. Two-way races are reviewed, and then three-way races examined. A model for examining a three-way catch-up process is presented. The emphasis is on third world nations which might possess or desire to possess weapons of mass destruction. Examples of arms race time histories are given to illustrate methods of analysis.

Preface

This report represents one attempt to shed light on the analysis of arms races involving two or more contenders. The methods of analysis proposed here may be useful in capturing fundamental and contentious policies amongst potential armament proliferators in the third world. In this report, arms race equations proposed by Richardson and some variants form the basis of analysis. The intent is to gain an understanding of arms races, but not to predict the outbreak of war. The underlying motivations for proliferation of weapons of mass destruction are central issues for consideration subsequent to the end of the cold war amongst the superpowers. The analyses presented here represent one attempt to quantify some salient elements of future competitive arms buildups leading to further proliferation of weapons of mass destruction.

This report should be of interest to personnel in the arms control, diplomatic, defense, and intelligence communities. Analysts ins these communities may wish to extend these proposed approaches to encompass difficulties encountered in specific regions of concern.

The U.S. Arms Control and Disarmament Agency (ACDA) supported this research project. In particular, the research was sponsored by the Office of Operations Analysis and Information Management, and their encouragement is appreciated. The methods of analysis, their results, and the specific applications in this report may not reflect any aims or policy goals of ACDA or of any other government organization. Any views presented here are solely those of the author.

1. Introduction

The purpose of this report is to address means of analyzing arms race stability and behavior in a multi-polar world, namely an arms competition amongst three contending nations or parties. Since the breakup of the Soviet Union, more attention has been mustered in addressing various types of stability in a multi-polar strategic environment. Two efforts have addressed first strike stability in a multi-polar world[1,2], but no known efforts have been undertaken to derive criteria for arms race stability and solving for time domain behavior involving three competitors, a start to understanding prehostility interactions in a multi-

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 271–295.

polar world. While the analyses presented here can be used to address arms race stability between major powers such as the U.S., the Russian Federation, and China, the intent of this report is to provide analysis methods that can be applied to other nations who may develop capabilities that could include weapons of mass destruction, i.e., nuclear, chemical, or biological warfare systems. With the breakup of the former Soviet Union, competition among the new republics may also be a subject of these analytical methods.

L. F. Richardson[3] proposed differential equations which he thought would capture the behavior of nations engaged in an arms race. He hoped that his investigation could lead to indicating means of avoiding war. Chapter 2 provides a summary of his equations for two opponents, and one approach for providing direct solutions in the time domain. The specific solutions provide insights as to the interactions amongst arms race participants. Solutions in the time domain were not treated by Richardson.

In Chapter 3, Richardson's equations are expanded to examine arms race stability and behavior among three contenders. Richardson suggested such possibilities, some with even more contenders, but did not provide direct solutions or stability criteria in terms of the parameters of his differential equations. In this chapter, a number of techniques derived from modern automatic control theory are employed to derive stability criteria and three party behavior in terms of arms growth or decrease. Whenever possible, results of arms races involving two and three competitors are compared, and expansions noted.

In Chapter 4, a new but similar set of equations are presented to capture a situation where one of three contenders sets out on his own, and the others, while interacting with each other, try to catch up.

Chapter 5 contains an examination of how Richardson's equations or their variants could be used to study how one nation may or may not wish to enter an arms competition. The basis for the analysis is rooted in the assumption that one nation may possess the means of producing weapons of mass destruction, and is considering whether or not to acquire nuclear or other capabilities.

Chapter 6 is a summary and review of some of the main points derived in the body of this report. References follow Chapter 6.

2. Two-Sided Arms Races

The purpose of this chapter is to present a summary of the two-sided arms race formulation based on the equations proposed by L. F. Richardson. The differential equations, their image function using the LaPlace transform, and a criterion for stability will be presented. Inverse LaPlace transformation of the image functions yield time domain results of the arms race.

2.1. EQUATIONS AND TRANSFORMATIONS

Richardson assumed that each side in an arms race would base its rate of weapon inventory growth on three factors: a reaction to the opponent's inventory size, a cost constraint factor, and a hostility index. Under these assumptions, the differential equations describing the two sides' behavior are given below.

1) $dX(t)/dt = k*Y(t) - a*X(t) + g$

2) $dY(t)/dt = m*X(t) - b*Y(t) + h$

The reaction coefficients are given by k and m. The cost constraint fractions are indicated by a and b. The hostility indices are g and h. Initial conditions will be XI and YI.

The cost constraint fractions (a and b in this analysis) were defined by Richardson as "positive constants representing the fatigue and expense of keeping up defenses...". This suggested definition can be made more specific by solving either equation 1 or 2 under the assumsptions that the reaction coefficients are zero, and the hostility indices are zero. The solution for contender X becomes X(t) =

XI*exp(-a*t), or in terms familiar to reliability engineers, X(t) = XI*exp(-0.6931*t/MTF) where MTF is the mean time to failure without repair. This relationship indicates the weapon system degradation with time resulting from less than perfect reliability. For example, if the mean time to failure is 10 years, then the cost contraint fraction would be 0.069311 or ln(2)/10, if the time units of the analysis were expressed in years.

The hostility index was originally derived "to represent grievances and ambitions..". Elaborating, the hostility index can also be treated as a source of funds to maintain the present force, and additionally to expand its size. If one contender decides not to react to the other contender's inventory (k=0 or m=0), then to maintain a force size at its initial value, the hostility index must be set equal to the product of the cost constraint fraction and the initial inventory size (e.g., a*XI), thus providing sufficient funds (in terms of weapons) to perform the needed repairs to keep the weapons available over time. In later discussions of solutions to arms race equations, we shall examine the different values of the hostility indices and their effect.

To provide direct solutions in the time domain, the LaPlace transform will be employed to reduce the differential equations to algebraic equations. The LaPlace transform of the time domain functions, F(t), where t>=0, is defined as the integral from zero to infinity of F(t)*exp(-s*t)*dt, and is represented by an s-domain function, f(s). The variable s is complex and may have real and imaginary parts. Many references are available concerning transformation and many include tables[4,5,6,7]. Richardson's equations for the two sides in the s-domain are

3) $(s+a)*x(s) = k*y(s) + G,\ G = (g+XI*s)/s$

4) $(s+b)*y(s) = m*x(s) + H,\ H = (h+YI*s)/s.$

The initial inventories of X and Y are XI and YI. The solutions for the behavior of the two contenders in the s-domain become

5) $$x(s) = \frac{XI\{s^2 + [b+(g+k*YI)/XI]s + (kh+bg)/XI\}}{s[(s+a)(s+b) - mk]}$$

6) $$y(s) = \frac{YI\{s^2 + [a+(h+m*XI)/YI]s + (ah+gm)/YI\}}{s\{(s+a)(s+b) - mk]}$$

When it is assumed that the hostility indices, g and h, are zero, then equations 5 and 6 become

5a) $$x(s) = \frac{XI(s + b+k*YI/XI)}{(s+a)(s+b) - mk}$$

6a) $$y(s) = \frac{YI(s + a+m*XI/YI)}{(s+a)(s+b) - mk}$$

The difference between these two sets of equations are substantial. When hostility indices are set to zero, then the time domain solutions converge to zero, i.e., complete and total disarmament on the part of both parties. When hostility indices are assumed to be non-zero, the final value of inventories in the time domain are non-zero. Under either set of assumptions, the criterion for stability will be the same, in spite of the differences in solutions.

2.2 STABILITY CRITERION DERIVATION

The denominator of both sets of equations 5 and 6 is known as the characteristic equation. If any real root, or the real part of any complex root is positive, then the system is unstable, or the time domain

solution will diverge without limit. If the system is to be stable then there should be no positive roots in the s-domain. This restriction leads to the criterion for stability in a two sided arms race.

7) mk <= ab

The product of the reaction coefficients must be less than or equal to the product of the cost constraint fractions. If these two quantities are equal, then the system is considered marginally stable. When hostility indices are zero, both sides will still retain weapons, but their inventories will not diverge with time. If hostility indices are non-zero and positive, then both sides' inventories will diverge linearly with time when mk=ab. When mk>ab, then the inventories of both sides will diverge exponentially with time. If either k<0 or m<0 (but not both), the system will never be unstable.

One or both parties in an arms competition could make errors in estimating the size of an opponent's inventory of weapons. What effect might such errors have on arms race stability? To examine this question, the basic equations (1 & 2) can be modified. In equation 1, let k be replaced by the prduct k*K, and in equation 2 let m be replaced by the prduct m*M. K*y(t) and M*x(t) are then the **perceived** inventory sizes. M and K are the coefficients of perception by contenders Y and X, respectively. When one of these coefficients is less than unity, then the inventory in question is being underestimated. When either K or M or both are equal to unity, then "perfect intelligence" is assumed. When either M or K or both are greater than unity, then "overestimation" is assumed. Taking such misperceptions into account, the stability criterion given in equation 7 must be modified.

7a) mk <= (ab)/(MK)

Under this criterion, underestimates by one or both sides would relax the stability constraints on the reaction coefficients, k and m. If both sides base the value of their reaction coefficients on overestimates of strength, then it is likely that there may be an accidental arms race with both sides perceiving their competitor to be in the lead. Thus, in an arms race, national leaders would prefer that their intelligence agencies should err on the side of underestimation. Some observers have commented that intelligence organizations usually err in the opposite direction when estimating their enemy's future strength.

Often, control system analysts employ the root locus technique developed by W. R. Evans[8]. This technique allows the analyst to plot the loci of the roots of the characteristic equation as a function of the "closed loop gain", mk in this case. When both m and k are positive, then the root loci are shown in Figure 1.

In this example, the roots of the characteristic equation move in the direction indicated by the arrows as m*k is increased. The roots of the characteristic equation when m*k=0 are indicated by A and B. Whe m*k>a*b then one root is positive, and one term in the characteristic equation will be (s-r), for example. In the time domain, taking the inverse LaPlace transform, one term of the time function will be of the form exp(+rt), which will cause the time function to increase without limit. Such a condition is clearly unstable, and is predictable from the solution of equations in the s-domain. Keeping the critical value of m*k less than the product of cost constraint fractions (a,b) will avoid instabilities in a two party arms race.

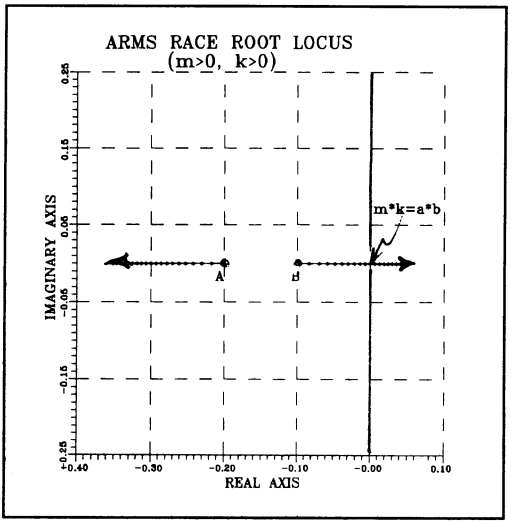

Figure 1

The other possible case occurs when one of the contenders has a negative reaction coefficient. If the Blue side (x) employs a negative reaction to the Red side's (y) inventory, and if Red were to increase its inventory of weapons, then Blue would decrease its inventory. Over time, Red would also decrease its inventory, according to the differential equations. In the s-domain, the real roots of the characteristic equation would be negative, and the real parts of any complex roots would also be negative. This condition would inidcate a system that was always stable, no matter how much the gain, m*k, increased. Figure 2 shows this possibility through a root locus diagram.

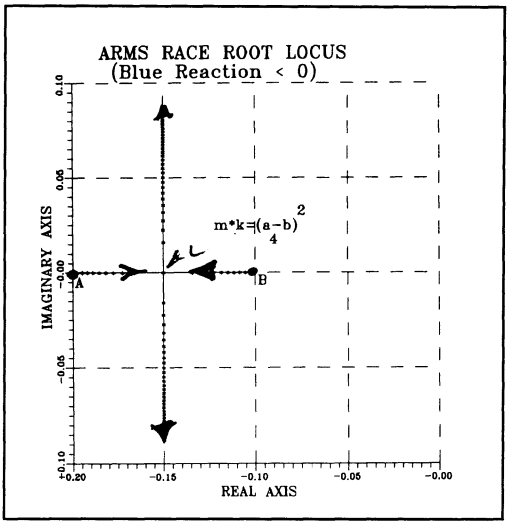

Figure 2

In this example, the roots of the characteristic equation would move in the direction indicated by the arrows as a function of increasing absolute value of m*k. The roots when m*k=0 are indicated by A and B, the cost constraint fractions. When 4*|m*k|>(a+b)^2, then roots are a conjugate complex pair. In the time domain, the behavior would be a damped sinsusoid. No matter how high the gain, the system would be stable, and the inventories of both sides would rapidly coverge to zero weapons of the type under consideration.

The roots in the s-plane are directly involved in determining the nature of the time domain response. In what follows, three examples are used to illustrate the time domain behavior of two opponents under the assumption that hostility indices are set to zero. Later, we will consider outcomes when hostility indices are greater than zero.

The first example of a two-way race is based on the assumption that both sides' reaction coefficients are such that the race is stable, i.e., m*k<a*b where m>0 and k>0. Figure 3 shows each side's inventory as a function of time. When the arms race is stable, as is the case here, both side's inventories coverge to zero, eventually. Initially, Red is at a disadvantage and begins to react to Blue's superiority in the number of weapons. As Blue begins to reduce arms, Red reacts and follows suit. When m*k<a*b and hostility indices are zero, then Richardson's formulation always results in complete and total disarmament. Only when the product of the reaction coefficients is exactly equal to the product of the cost constraint fractions do both sides retain weapons, but are not in an unstable arms race so long as both sides' hostility indices remain at zero. The effect of non-zero hostility indices will be examined later in this analysis.

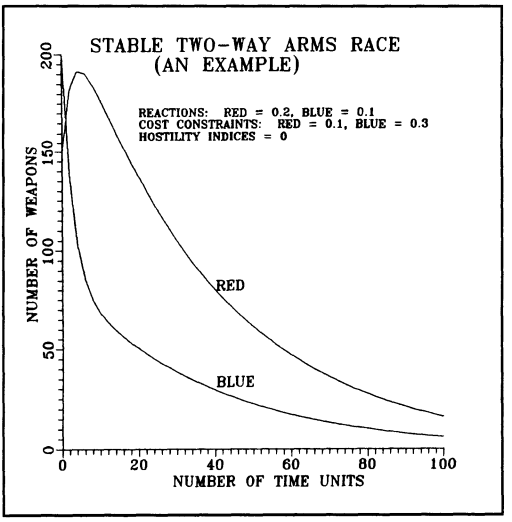

Figure 3

The second example is the same as the first, except that the reaction coefficients have been increased to illustrate an unstable arms race (m*k>a*b). The results are shown in figure 4. In this example, the inventories of both sides increase without limit. Blue's initial superiorty in number of weapons starts Red reacting immediately. Initially, Blue decreases his inventory, but as Red increases, this trend is reversed. Both sides then proceed to increase their inventories exponentially. Richardson postulated that such a race would eventually lead to a war. How long such an arms race would procede without an outbreak of hostilities cannot be determined under Richardson's formulation, nor do we intend to make prediction as to when combat might commence. How such a race might be reversed is the nex subject for discussion.

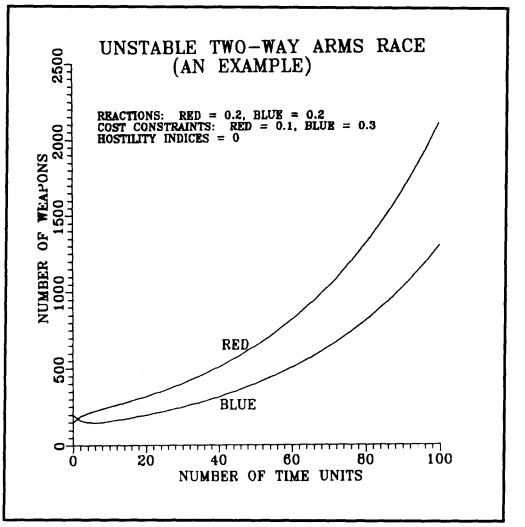

Figure 4

The third example is based on the assumption that one side is striving to reduce the armaments on both sides and reacts in a negative fashion in order to bring about this result. The reaction coefficients in this example would lead to an uncontrolled arms race if both were positive. For purposes of illustration, however, we assume that Blue's reaction coefficient is negative. As was noted in the root locus analysis, Richardson's formulation would result in a stable situation under these conditions. Figure 5 shows the results when one reaction coefficient is negative. The inventories of both sides are
reduced rapidly, and again, the end result is total and complete disarmament.

The assumption that hostility indices are equal to zero may not apply in all cases. The hostility index provides a mathematical surrogate for the provision of funds to maintain or increase the size of a force over time. When it is assumed that hostility indices are non-zero, then the end result is a non-zero inventory for either contender, or both of them.

With non-zero values of hostility indices, the roots of the characteristic equation do not differ from those developed previously. While the criterion for stability is no different, the time solutions are quite different in that their final value is non-zero. When hostility indices are assumed to be equal to zero, then there is total and complete disarmament. When hostility indices are assumed to be non-zero, then the ultimate limits in the time domain when time is allowed to approach infinity are lim X(t) = (bg+hk)/(ab-km) and lim Y(t) = (ah+gm)/(ab-mk). From these results, the inventories of both contenders in an arms race can become quite large as the critical stability condition (mk=ab) is approached.

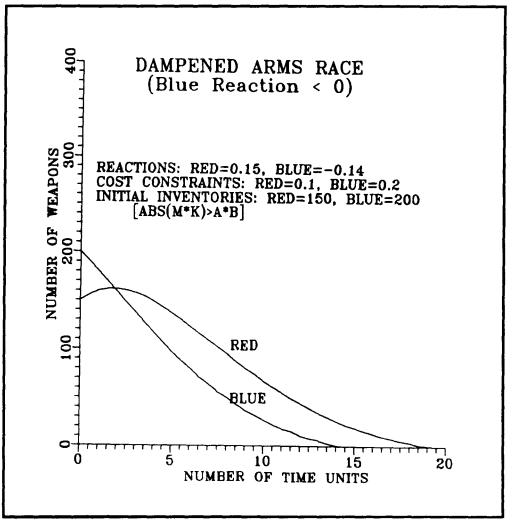

Figure 5

To examine the effects of non-zero hostility indices, we have made similar assumptions as in a previous example. In this example we assume that hostility indices are set such that if there were no reaction to the other side's inventory size, each set of weapons would remain constant at their initial value. Thus g = a*XI and h = b*YI. Other assumptions are noted in figure 6. The effect of non-zero reaction coefficients and non-zero hostility indices is clearly demonstrated. Both sides substantially increase their inventory of weapons beyond their initial value. If the reaction coefficients were set to zero, then each side would maintain its inventory at its initial value.

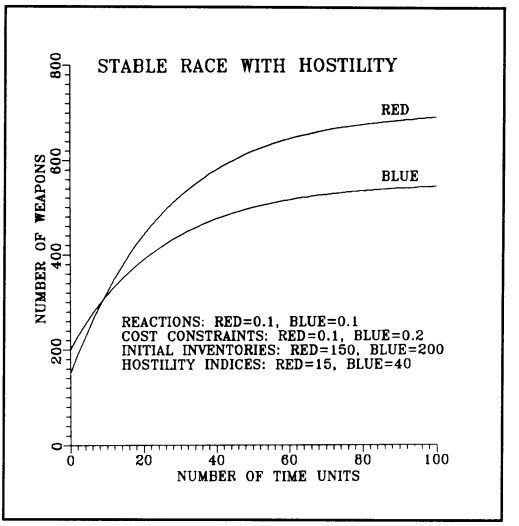

Figure 6

This summary of the two-way arms race has illustrated how two opponents may engage in a stable or unstable competition. The techniques of analysis utilized were the LaPlace transform to reduce differential equations in the time domain to algebraic equations in the s-domain. Further, the roots of these equations can be determined analytically or graphically, and stability criteria can be deduced from the s-domain characteristic equation. Finally, time domain responses were determined by utilizing the inverse LaPlace transformation. These techniques will be employed in subsequent chapters of this report.

Overall, arms race stability under the Richardson equations is assured when mk<ab if there is perfect intelligence. When the two sides make errors in estimating the number of weapons in their opponents' arsenals, then stability is assured when mk<=(ab)/(MK) where m and k are the reaction coefficients, a and b are the cost constraint fractions, and M and K are the coefficients of perception. When hostility indices are set to zero, then the contenders eventually reduce their weapon inventories to zero, i.e. total and complete disarmament so long as mk<ab.

When hostility indices are set to values greater than zero, then each side eventually achieves some non-zero inventory of weapons even when mk<ab. The ultimate values increase dramatically as the difference between the product of reaction coefficients (k*m) and the product of cost constraint fractions (a*b) decreases. If the goal of either opponent is to maintain his force at a constant level even when not reacting to the other opponent's force size, then some positive value of hostility index must be enforced simply to provide for repair and maintenance costs of weapon components over time.

This summary of a two-way arms race has been provided to illustrate the interactions important in such a competition. Many of these interactions will hold in a three-way arms race, but some of the relationships will become more complicated, such as the stability criterion. Thus, this chapter has laid the foundation for examination of the reactions of three competitors.

3. Three-Sided Arms Races

The purpose of this chapter is to present one method of examining three-way arms races based on an expansion of Richardson's equation. The larger system of differential equations will be analyzed by utiilizing LaPlace transforms, root locus methods, and inverting the transforms back to the time domain. A stability criterion will be derived from s-domain equations.

3.1. EQUATIONS, TRANSFORMATION, AND STABILITY

As discussed in the previous chapter, the rate of growth of one opponent's inventory is based on his opposite's inventory, a cost constraint fraction, and a hostility index. In a three-way race, each contender would react to each of the other contender's weapon inventories. With three contenders, there are three differential equations,

8) $dX(t)/dt = k*Y(t) + j*Z(t) - a*X(t) + g$

9) $dY(t)/dt = m*X(t) + n*Z(t) - b*Y(t) + h$

10) $dZ(t)/dt = p*X(t) + q*Y(t) - c*Z(t) + i$

where all of the reaction coefficients are defined as:
k = X reaction to Y inventory, j = X reaction to Z inventory
m = Y reaction to X inventory, n = Y reaction to Z inventory
p = Z reaction to X inventory, q = Z reaction to Y inventory.

The cost constraint fractions for S, Y, and Z are a, b, and c, respectively. The hostility indices for S, Y, and Z are g, h, and i, respectively.

The above differential equations can be converted to a system of simultaneous algebraic equations in the s-domain by utility the LaPlace transform method.

11) $(s+a)*x(s) = k*y(s) + j*z(s) + G$

12) $(s+b)*y(s) = m*x(s) + n(z(s) + H$

13) $(s+c)*z(s) = q*y(s) + p*x(s) + I$

The parameters G. H, and I are functions of the hostility indices and the initial values of each inventory.

14) $G = (g+XI*s)/s,\ H = (h+YI*s)/s,\ I = (ki+ZI*s)/s$

In what is to follow, we will examine behavior in the s-domain when there is no hostility amongst contenders in the arms race. The values g, h, and i are difficult to define in a three-way competition since each parameter must somehow combine the hostility shown by a single contender toward two others. If it is assumed that all hostility indices are equal to zero, then G, H, and I represent the initial conditions for each contender's inventories (X, Y, and Z, respectively). Later, the effect of examining hostility indices will be treated in some detail.

The denominator, or characteristic equationa (CE) in the s-domain for the behavior of all three contenders is:

15) $CE = (s+a)(s+b)(s+c)-nq(s+a)-jp(s+b)-km(s+c)-jmq-knp.$

To enforce the condition that there are no roots in the right half plane (all roots are negative), the constant or lead coefficient in the characteristic equation must be greater that zero. This condition assures that the system is stable (provided that the initial choices of reaction coefficients do not cause any two-party instabilities), and no inventory increases without limit in the time domain. Thus, the criterion for stability is:

16) $\frac{jqm+npk}{abc} + \frac{nq}{bc} + \frac{jp}{ac} + \frac{mk}{ab} <= 1.$

In a three party arms race the condition for stability is more severe than in the two-way race. In a two-way race, only the term to the left of the inequality in equation 16 is in force. In the three-way race, all of the other combinations of reaction coefficients and cost constraint fractions come into play. In what follows, we attempt to comment on some of the limiting conditions imposed by this criterion for stability.

To gain a better understanding of the three-way criterion for stability, some sort of simplifying assumption may be in order. For example, let all of the ratios of reaction coefficients to cost constraint fractions (k/a, m/b, q/c, etc., etc.) be set equal to some fraction f, and assume further that all reaction coefficients are positive. This does not imply that a, b, and c are equal, but implies that the ratios are equal. Such an assumption does imply that the reaction coefficients of each contender to the others in the competition are equal (j=k, m=n, and p=q). Under this assumption, the maximum value of f that can be tolerated and still retain some form of stability is f<=1/2. In a two-way race, f<= 1. This result provides an indication of the increase in severity in the stability criterion for a three-way race as compared to that needed to enforce stability in a two-way confrontation.

In a three-way confrontation, some contenders may choose to ignore the activities of one other contender. Under such a condition, one of the reaction coefficients would be zero. In that case, the stability criterion would be relaxed. For example, if contender X decided to ignore th activities of Z, then j=0. Then the criterion for stability would become

17) $\frac{npk}{abc} + \frac{nq}{bc} + \frac{mk}{ab} <= 1.$

On the other hand, if one contender decided to have a negative reaction to another contender's activities in order to stabilize the three-way arms race, then the criterion for stability would be changed. For example, X might decide to dampen the arms race by reacting negatively to Z's inventory of weapons. In this case j<0. Taking this change into account, the criterion for stability would again be different.

17a) $\frac{npk-jqm}{abc} + \frac{nq}{bc} - \frac{jp}{ac} + \frac{mk}{ab} <= 1$

Such a reaction in a two-way race would assure stability, as shown in Chapter II. In a three-way competition, such actions may or may not assure stability. As the worst, the change in polarity of one reaction coefficient would loosen the condition for stability. At best, one negative reaction coefficient might stabilize a runaway arms race, if the magnitude of the coefficient were large enough. How large is enough? If the assumption holds that the ratio of reaction coefficients to the cost constraints are constant among all contenders, and if this fraction (f) is in the region 0.5<=f<=1.0, then stabilization of the arms race can be achieve if one contestant reverses polarity on just one reaction coefficient. For example, equation 17 would revert to a two-way criterion if all these assumptions were met. The mathematics seem clear, but the behavior of nations may not be so clear or at all predictable. Would one nation risk a negative reaction coefficient if the stakes were high? Comments on questions such as this one will be discussed later. For now, we procede to derive the behavior of the other contenders in a three-way arms race.

The function x(s), y(s) and z(s) all have the same denominator. The numerators are different as noted below.

18) Numerator of x(s) = $G[(s+a)(s+c)-nq]+H[jq+k(s+c)]+I[kn+j(s+b)]$

19) Numerator of y(s) = $H[(s+a)(s+c)-jp]+I[jm+n(s+a)]+G[np+m(s+c)]$

(20) Numerator of z(s) = $I[(s+a)(s+b)-mk]+G[mq+p(s+b)]+H[kp+q(s+a)]$

The numerators for all three functions x(s), y(s) and z(s) are different in that each one contains terms to capture the initial conditions and hostility indices of each competitor, as well as coefficients determining the relative importance of transient behavior of each contender in the time domain.

3.2. ROOTS OF CHARACTERISTIC EQUATIONS AND TIME-DOMAIN BEHAVIOR

In this section, roots of characteristic equations are examined through the use of the root locus technique[8,9]. First, we shall draw some general observations from a parametric treatment. Subsequently, numerical methods will be applied to examples.

The root locus technique is used to examine the movement of the roots of the characteristic equation. In a three-way arms race, the characteristic equation is rearranged into a somewhat different form.

$$21) \quad \frac{(nq+jp+mk)(s+L)}{(s+a)(s+b)(s+c)} = +1$$

where $L = (anq+bjp+cmk+jm\ q+npk)/(nq+jp+mk)$

In the parlance of the automatic control analyst, L is a zero, and there are three poles, a, b, and c. For this application, there is some difficulty in applying the root locus technique because the zero moves as a function of the "gain" (nq+jp+mk). Numerical solutions can be obtained by solving for the roots for various values of gain. From this analysis, any instability is directly the result of the lower cost constraint fraction when all reaction coefficients are positive. If one contender reverses polarity on one reaction coefficient, say k, then the arms race is not stabilized until

$$22) \quad |mk| > jp + nq.$$

If one of the principal contenders, say X, reverses polarity on both of his reaction coefficients, then the arms race is stabilized when

$$(23) \quad |mk + jp| > nq.$$

Under either of these conditions, the arms race will always be stable, but some of the behavior in the time domain may be quite oscillatory leading to negative values for some inventories. In this regard, Richardson's expanded equations may yield results that are difficult to interpret. What is the significance of a negative number of weapons?

Examples of a three-way race between Russia, U.S., and China are provided to illustrate the method of analysis. Other applications of the methods could include India, Pakistan, and China. In later analyses in this report, such examples will be considered as appropriate for addressing problems of weapon proliferation and arms races in the third world. The choice of
weapon type (nuclear, chemical, etc.) could be accomodated, but is the choice of the analyst and decision maker.

The first series of examples in this section are provided to indicate problems associated when an arms competition could get out of hand, i.e., all reaction coefficients are positive. Later, we will examine other possibilities.

When all contenders in a three-way arms race react positively to all of the other contenders' weapon inventories, the arms race may be stable, it may be marginally stable, or it may be unstable., The criterion for stability was derived earlier, and all three of these possibilities will be illustrated here.

A root locus of the s-domain characteristic equations would show the conditions for each of the situations outlined. To provide an example, a set of assumptions for Russia, the U.S., and China have been made. These assumptions are outlined in the following table.

Table 1 - Assumptions for a Three-Way Arms Race

Contender = Russia
- Reaction coefficient to U.S. = variable
- Reaction coefficient to China = 0.1
- Cost constraint fraction = 0.2
- Initial inventory = 3500

Contender = U.S.
- Reaction coefficient to Russia = 0.158
- Reaction coefficient to China = 0.05
- Cost constraint fraction = 0.3

Contender = China
- Reaction coefficient to Russia = 0.2
- Reaction coefficient to U.S. = 0.03
- Cost constraint fraction = 0.35
- Initial inventory = 500

In this table, operational nuclear warheads are of interest. An environment somewhat representative of conditions beyond START II is assumed. The reaction coefficients indicate that Russia is concerned about Chinese weapons, that the U.S. is concerned about reacting to growth in the Russian inventory of weapons, and that China has similar concerns. The U.S. and China have some modestlevel concern about the growth in each others' inventories. The cost constraint fractions indicate that Russia can obtain weapons at a cost that is less constrained than that of the other two contenders. The assumed inventory of each contender is shown in the table. Richardson's equations can accomodate assumptions to include the hostility of each contender. For this example, the initial value of each inventory is assumed to provide a measure of hostility without the addition of an extra parameter. The major variable of interest in the exammple will be the Russian reaction coefficient to the U.S. inventory of weapons, k.

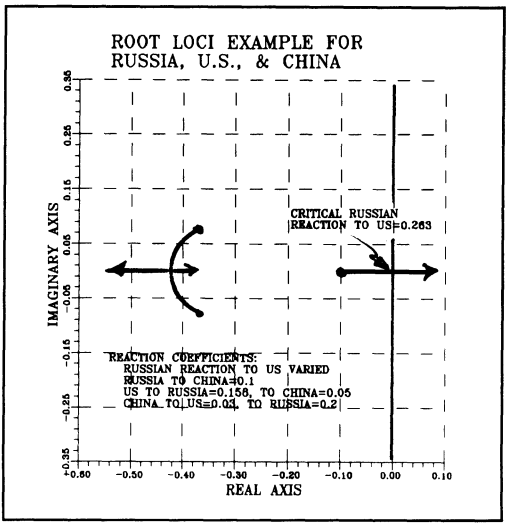

Figure 7

The root loci of the Russian, Chinese, and U.S. characteristic equation indicate various conditions of stability as a function of the Russian reaction coefficient. In the analysis to follow, the important variable is the growth of the Russian reaction to the U.S. inventory of weapons. All other reaction coefficients are assumed to be constant as indicate in Table 1. The s-plane consists of two axes which show the real and imaginary parts of the roots of the characteristic equation. When the Russian reaction coefficient to the U.S. (hereafter referred to as "gain") is zero, then the roots of the characteristic equation are indicated by dots. Figure 7 shows the movement of the roots of the characteristic equation as a function of the gain. There is a set of complex roots whoes real part is about 0.37. These roots indicate the reactions between the U.S. and China. The root that moves toward the imaginary axis is determined by the interaction of the U.S. and Russia. When the Russian reaction coefficient = 0.263, then the system unstable. is marginally stable. Below this value the system is stable. When this value is greater, the system is unstable

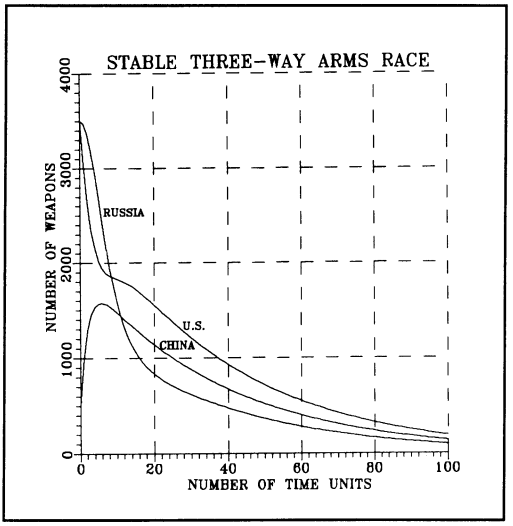

Figure 8

The movement of roots in this example will form the basis of the time domain behavior for all three contenders. When all roots lie in the left-hand s-plane, all exponential terms in the time domain will decay as time increases, and eventually approach total and complete disarmament. If hostility indices are assumed set to zero, and the Russian reaction coefficient to the U.S. inventory is at its critical value, all sides would retain some weapons, but the inventories of participants would not diverge with the passage of time. When the Russian reaction to the U.S. inventory exceeds its critical value, the arms race is on and all inventories would increase without limit with the passage of time. Later the effects of non-zero hostility indices will be illustrated.

The first example of responses in the time domain is based on the assumption that the Russian reaction coefficient to the U.S. weapon inventory is less than critical, about 0.18. Under these circumstances all inventories should eventually approach complete and total disarmament. Figure 8 is an example of the time domain response of all three contenders. Initially, China increases its inventory of weapons in response to the inventories of Russia and the U.S. As the inventories of the major contenders decrease, then the Chinese inventory begins to decrease as well. Since the U.S. reacts to inventories of both China and Russia, some effect of this action comes into play as China builds up its weaponry.

When the Russian reaction coefficient to U.S. weaponry reaches its critical value (about 0.263), then one root of the characterisitic equation is exactly zero. Under this condition, all contenders eventually would retain some weapons at some distant time. The behavior prior to reaching the final conditions is indicated in Figure 9. Initially, China builds up its inventory, and Russia reacts to this growth of its immediate neighbor. Eventually, the U.S. also reacts to the Chinese initiative. Finally, all three contenders' inventories reach some "steady state" condition. At this point, the U.S. and Russian inventories are similar in size, and the Chinese inventory is less that either of it competitors, but has increased substantially over its initial value. For all three sides to settle values which assure this behavior in the time domain may be quite tricky. The stability criterion indicated in equation 17 must be met exactly.

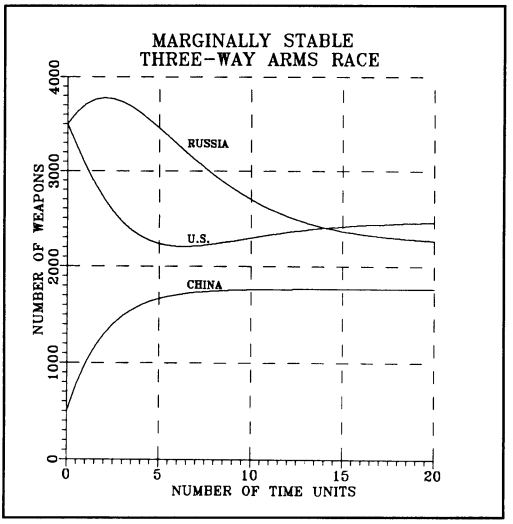

Figure 9

Some readers may observe the difficulty in assuring that the mathematical criterion for stability could be met in an uncertain world situation. Without some sort of mutual agreement

between all parties (an arms control accord, perhaps), reactions could easily get out of hand, even unintentionally. The solution to the Richardson equations does not guarantee convergence toward a stable situation, but only provides an indication of possible outcomes. To assure that arms growth is not unstable, some form of agreement would seem to be needed, along with provisions for monitoring compliance. The situation represented here may correspond to the desires of all of the nations involved to
retain some weapons as a form of assurance against the actions of other nations in a mult-polar world.

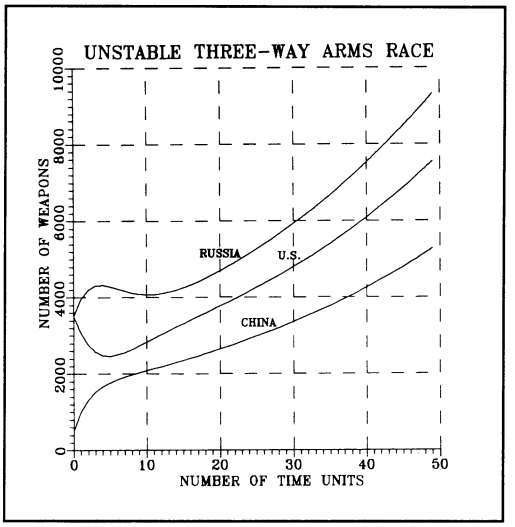

Figure 10

To illustrate concerns about exactly meeting the criterion for arms race stability, the next example is based on the assumption that the Russian reaction coefficient to U.S. weaponry is greater that the critical value. Under these conditions, there would be a runaway arms race over time, as illustrated in Figure 10. Initially, Russia reacts to the growth of the Chinese inventory, but starts to take account of the decrease in the U.S. inventory. Eventually, all inventories increase without limit. Results such as these should be avoided, if possible. While some readers may argue about the exact nature of the initial behavior, Richardson's arms race equations do seem to capture the danger of the long term behavior of nations in an upward competition. A radical change in policy by some of the contenders might reverse the long term trend illustrated in this example.

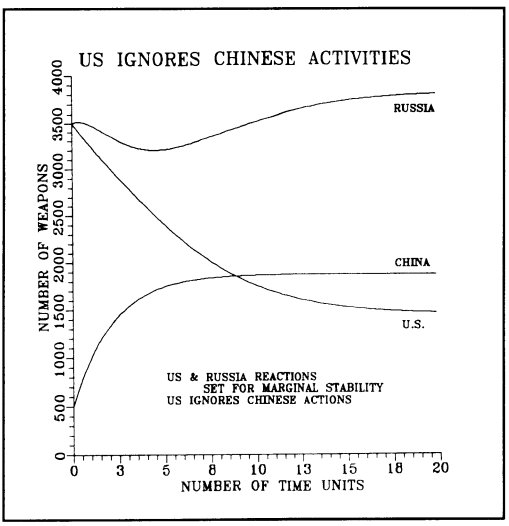

Figure 11

One policy change could be that the United States simply ignores any change or buildup in China, but does compete with Russia. Such an example is not likely from a political point of view, but is treated here to indicate one model flexibility. In this instance, Russia would take into account the inventories of both the U.S. and China and react to them. The reaction coefficients used in this example are slightly changed from those given in Table 1. For this example, the U.S. reaction coefficient to China is zero, and both the Russians and the U.S. react to each other to bring about a marginally stable condition. Under these conditions, China, the U.S., and Russia do not completely disarm, but would retain substantial inventories of nuclear weapons. Figure 11 indicates the time domain response under these assumptions. As the U.S. decreases its stockpile of weapons, Russia would momentarily decrease it weapons . As China builds up, Russia also follows suit. In the end, the U.S. retains fewer weapons than either China or Russia, and Russia maintains a superiority at all times. Some readers may question the

reality of such a situation, but the outcomes would be different if different reaction coefficients and cost constraint fractions were assumed. In this example, the U.S. reaction coefficient to Russian inventory and the Russian to the U.S. inventory were the same, 0.213. These values would result in a marginally stable arms race. All other values used were those given in Table 1.

In another example of a new policy, it was assumed that the U.S. did not react to either the Russian or Chinese inventories of nuclear weapons. The Russian reaction to China (and vice versa) were set equal to a value which would result in a marginally stable arms race between them. Under these assumptions, there would be a two-way arms race between Russia and China and the U.S. would gradually decrease its weapon inventory. The Russian reaction coefficient to the Chinese inventory was set at 0.265, and the time response of all parties is shown in Figure 12. In this case, the final conditions for Russia and China are about 2470 and 1860 weapons each, respectively. At the end of the time period shown, the U.S. inventory has diminished to about 175 weapons, and would continue to get smaller as time went on. Again, this example illustrates outcomes that may not be realistic, but is presented to show the variety of outcomes that are possible as different policies are brought into force. This particular figure is an extreme example of U.S. isolationism.

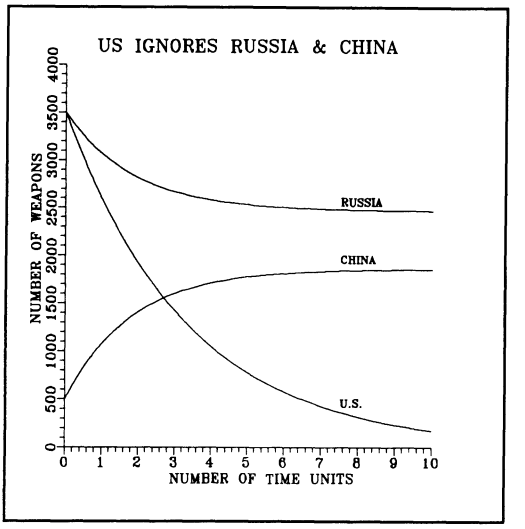

Figure 12

Figure 13 illustrates the effect if all three contenders have non-zero hostility indices. Each hostility index has been set so that if all reaction coefficients were zero, then each nation would maintain a constant inventory, i.e., the hostility index is the product of the cost constraint fraction and the initial inventory of weapons. The increase in inventories shown in the figure result from the reaction coefficients assumed as inputs. The race is stable, in that inventories do not diverge with time, but the end result would be to regain and surpass the original U.S. and Russian inventories prior to the START Treaty, and China would also possess a substantial number of nuclear weapons. The inclusion of hostility indices can dramatically affect the arms race outcome, if reaction coefficients are not reduced substantially below those assumed when hostility indices are zero.

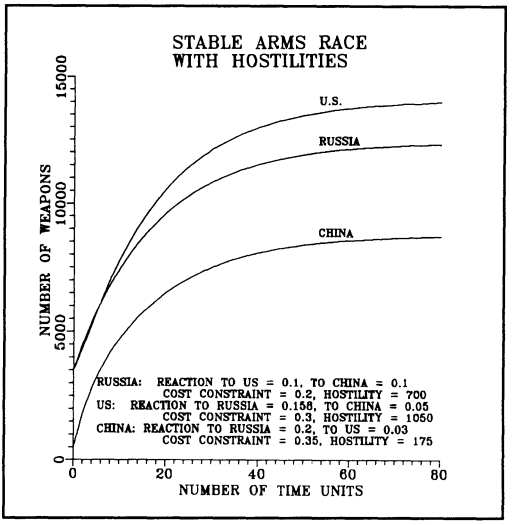

Figure 13

Do the expanded versions of Richardson's arms race equations capture the different possibilities of interest in the future? The answer to this question is "maybe." Many readers would question the idea that all sides would race toward total and complete disarmament. The main trick to solving dilemmas such as this one rest on providing

realistic input data for the equations. The analyst would need to consult accurate intelligence data over past times, and then derive coefficients that made the time histories of weapon inventories match these time histories. Projections into the near future might then be possible. The accuracy of the past time histories of weapon inventories may be uncertain, but these equations are easily manipulated to treat the effect of uncertainties in parametric terms. The effects of varying reaction coefficients and cost constraint fractions could then provide a range of results. The criterion for stability in a three-way arms race under Richardson's formulation is quite clear. When all of the terms in the stability criterion are exactly equal to unity, and all hostility indices are zero, then there is a marginally stable condition, i.e., all parties would retain some weapons. When all of the terms total up to less than unity and all hostility indices are zero, then all of the participants would engage in a race toward complete and total disarmament. It is this latter condition that causes concern to many analysts, and leads one to question the validity of solutions utilizing Richardson's formulation. This difficulty disappears when non-zero hostility indices are included in the calulations. Until the recent negotiations between the United States and the Former Soviet Union began and led to START II, even the author was skeptical that any race toward total disarmament was possible. Current trends indicate that some states of the Former Soviet Union may wish to retain nuclear weapons for their own protection. The three-way arms race model based on Richardson's equations may assist in analyzing the effect of poicy decisions in the future, particularly in relation to third world countries who may wish to develop or procure nuclear or other weapons of mass destruction. At the very least, this method of analysis will provide one insight into such situations. Other analyses such as the one in the next chapter may provide alternative views of a three-way competition.

4. Three-Way Catch-Up Races

The purpose of this chapter is to present a three-way arms race model that is different from Richardson's differential equations. Our purpose here will be to develop a model of behavior in which one competitor has already laid out plans for growth (positive, none, or negative) in his weapon inventory, and the other two contenders try to catch up by reacting to each aother and the first contender's inventory.

The behavior of the first contender in a game of catch-up is described by

23) $X(t) = k*t + G$

where G is the initial inventory of contender X. The rate of growth, k, may be positive, zero, or negative. The other contenders, Y and Z, react to contender X's inventory and to each other, with limits imposed by cost constraint fractions as developed in the previous chapters. In the catch-up model, the time domain behaviors are given by

24) $dY(t)/dt = m*X(t) + n*Z(t) - b*Y(t) + h$

and

25) $dZ(t)/dt = p*X(t) + q*Y(t) - c*Z(t) + i$

where all of the reaction coefficients, cost constraints, and hostility indices for contenders Y and Z are the same as in the previous chapter. The LaPlace transforms for these equations are

26) $x(s) = (k + Gs)/s^2$

27) $(s+b)*y(s) = m*x(s) + n*z(s) + H,\ H = (h+YI*s)/s$

$$28)\ (s+c)*z(s) = p*x(s) + q*y(s) + I,\ \ I = (i+ZI*s)/s.$$

Making appropriate substitutions to eliminate z(s), contender Y's s-domain behavior becomes

$$29)\ y(s) = \frac{[m(s+c)+np]*x(s) + H(s+c) + nI}{(s+b)(s+c) - nq}$$

and a similar equation for z(s) as a function x(s) can also be derived. Making these substitutions, the complete equations describing Y and Z's behavior become

$$30)\ y(s) = \frac{Hs^3 + (cH+nI+mG)s^2 + [G(cm+np)+mk]s + k(cm+np)}{s^2[(s+b)(s+c) - nq]}$$

$$31)\ z(s) = \frac{Is^3 + (bI+pG+qH)s^2 + [G(bp+mq)+pk]s + k(bp+mq)}{s^2[(s+b)(s+c) - nq]}\ .$$

A special case arises when k=0 in that the constant term in the numerator of equations 30 and 31 becomes zero. Under these conditions, the inventory of contender X will be a constant. The nature of the roots of the characteristic equation indicates that there may be an arms race between contenders Y and Z, and it may be unstable if nq>bc, as was noted in Chapter II. In the competition under examination here, the time history of all contenders would increase with time if k>0. If the arms race between contenders Y and Z is unstable, then this growth as a function of time will be exponential, e.g. exp(+E*t), where E is a positive root of the characteristic equation. If k>0, the time response of x(t) will be a linearly increasing function, and the other contenders will attmept to catch up, sometimes surpassing the inventory of contender X.

To illustrate the catch-up game between three contenders, we will assume that contenders X, Y, and Z are China, India, and Pakistan. The initial conditions of each inventory assumed here are based on some moment in time when China has 200 weapons, India has 20, and Pakistan has 10.

Contender X = China
- Rate of inventory growth = 10 weapons/time period
- Initial inventory = 200

Contender Y = India
- Reaction coefficient to X inventory = 0.2
- Reaction coefficient to Z inventory = 0.2 (varied)
- Cost constraint fraction = 0.2
- Initial inventory = 20

Contender Z = Pakistan
- Reaction coefficient to X inventory = 0.05
- Reaction coefficient to Y inventory = 0.2
- Cost constraint fraction = 0.3
- Initial inventory = 10

Table 2 - Example : Assumptions for a Three-Way Arms Race

A number of political assumptions are imbedded in Table 2. For example we assume that China has decided how many weapons will be needed to deter an attack by Russia or the U.S., and is executing these plans with a growth rate of 10 nuclear weapons each time period beyond its initial inventory of 200. India is reacting fairly strongly to China's inventory, since it views China as a potential attacker and is worried about future uncertainties. At the same time India is also worried about any

potential growth in Pakistan's arsenal. Pakistan is also reactive to India's arsenal of weapons as well. Since Pakistan has been the recipient of aid from China, its reaction coefficient is low, but still positive as a hedge against any changes in China's foreign aid policy. Against this background of assumptions, India is trying to catch up with China, but is also reacting rather vigorously to the inventories of both China and Pakistan. In the numerical examples to follow we assume that India's and Pakistan's reaction coefficient to each others' inventories are equal in magnitude. Such an assumption is merely a convenience, and different reaction coefficients can be accomodated within the catch-up model.

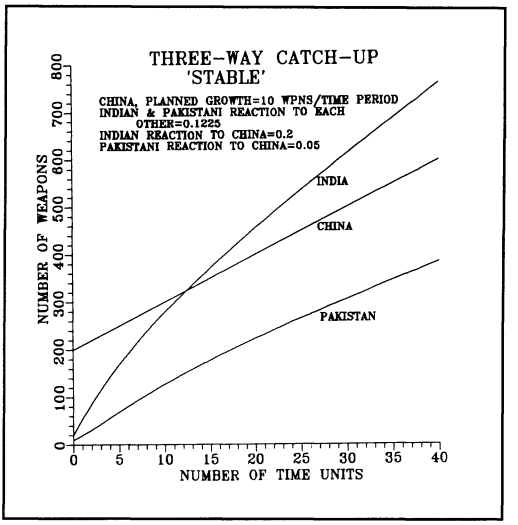

Figure 14

In our first example, it is assumed that the arms race between India and Pakistan is stable, i.e., n*q<b*c. China's steady increase in weaponry, however, results in increasing inventories of all parties. The "stability" leads to curves for India and Pakistan that are concave downwards, as illustrated in Figure 14. India's inventory eventually exceeds that of China because of the reaction coefficient selected for this example. Pakistan's rate of growth gradually evens out because it is not trying very hard to catch up with China, but is attmepting to keep pace with India's growth, but not very successfully. A larger Pakistani reaction coefficient to India's inventory could lead to a more comparable growth rate.

In a second example, it is assumed that the arms race between India and Pakistan is not stable, i.e. n*q>b*c. In this case, the growth of Indian and Pakistani inventories diverge exponentially and quickly surpass that of China, as illustrated in Figure 15. The time scale in this figure is four times as short as that in Figure 14, and the arms race is quickly getting out of hand due to the instability. Choosing a lower value for Indian and Pakistani reaction coefficients to each others' inventories would slow down the divergence. As long as the product of their reaction coefficients was greater than the product of their cost constraint fractions, the results would still diverge. Another way in which inventory growth rates could be diminished would be for China to reduce its planned increase in weaponry.

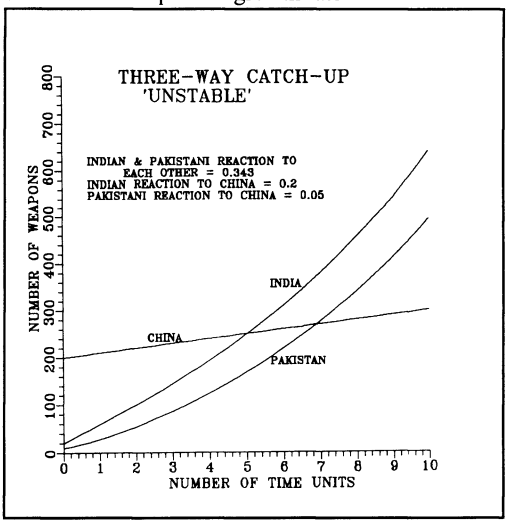

Figure 15

In the third example, we assume that China would not attempt to increase her inventory, but would maintain it at 200 nuclear warheads. If these warheads, or a substantial fraction of them were essentially invulnerable to attack, then this force might serve to deter a Russian attack, and meet China's needs for the future. Under these conditions, we further assume that the Pakistani and Indian reaction coefficients are such that n*q=b*c. Under these conditions, the arms race between India and Pakistan

would be labeled "marginally stable" in the terms defined by L. F. Richardson in a two-way arms race. In other words, all contenders should retain nuclear weapons, and none of them would decrease their inventories over time.

Figure 16 illustrates the outcomes of such assumptions. Using the same reaction coefficients as in the above examples, India's inventory surpasses that of China, but approaches a fixed value somewhat less than 300 weapons. Pakistan's inventory also approaches a fixed value of about 150 weapons with the passage of time.

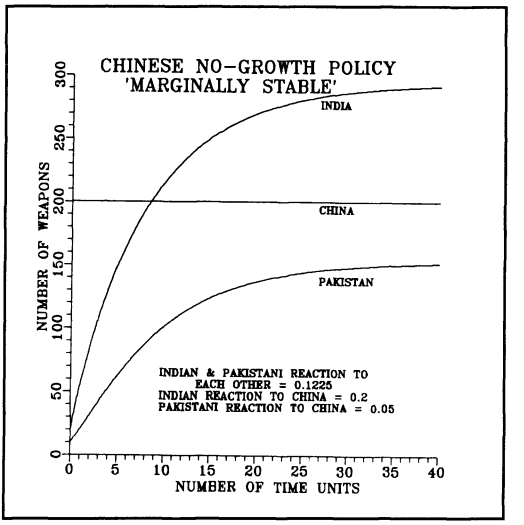

Figure 16

There is at least one other way in which contender X might choose to deploy his weapons over time. In the previous examples (China was contender X), there was either no growth over time, or the growth was linear with time. In this discussion, it will be assumed that contender X deploys his new weapons in a exponential manner, that is, the growth would be of the form $f(t) = 1 - \exp(-a*t)$. Under these conditions, the form of equation 23 would be changed, and the inventory of contender X over time would be

$$32)\ X(t) = G + (L-G)[1-\exp(-a*t)]$$

where G is the initial value of the inventory, and L is the final size of the inventory of weapons. The amount of growth would be represented by the quantity (L-G). The time constant for the increase in deployment is a. About 63% of the planned growth would take place in 1/a time units. The behavior of contender X in the x-domain would be given by

$$33)\ x(s) = \frac{Gs + aL}{s(s+a)}$$

The s-domain behavior of the other two contenders is of the form

$$34)\ \frac{f(s)}{K} = \frac{s^3 + a2*s^2 + a1*s + a0}{s((s+a)[(s+b)(s+c) - nq]}$$

The coefficients for each contender in this general form are given below. For contender Y,

$K = H$, the initial inventory

$a2 = a + c + (nI+mG)/H$

$a1 = [G(cm+np) + a(mL+cH+nI)]/H$

$a0 = aL(cm+np)/H$

Similarly, for contender Z, the coefficients are:

K = I, the initial inventory

$a2 = a + b + (pG+qH)/I$

$a1 = [aG(pb+mq) + a(pL+bI+qH)]/I$

$a0 = aL(bp+mq)/I.$

Comparison of the effects of this formulation of contender X's behavior with previous assumptions can be made by making a few assumptions about the planned growth of his inventory. For such an example we make the assumptions contained in Table 3 where China again plays the role of contender X. Values for India and Pakistan will remain the same as given in Table 2.

Contender X = China
Initial inventory = 200
Final inventory = 400
Deployment time constant = 0.1

The assumption fixing the deployment time constant in Table 3 indicates that about 63% of China's planned future deployment will take place in 10 time units. Thus, at the end of 10 time units, China's inventory would be about 200 + 0.63*200 or about 326 weapons.

In this example, we again assume that the arms race between India and Pakistan is stable, i.e. $n*q<b*c$. Specifically, it is assumed that n=q, and that $m*q=0.015$, well below the critical product of b*c (0.06). Figure 17 shows the time histories of all of the contenders. After 40 time units, China has nearly realized its planned growth in weaponry. India's high reaction coefficient to China's growth has let to an over-reaction. Pakistan's reaction to China is mild, since it was assumed small to capture the political effect of an alliance with a slight hedge against future uncertainty. The growth in Pakistan's inventory is primarily drivenby the increases in India's weaponry, which is in turn reacting to China.

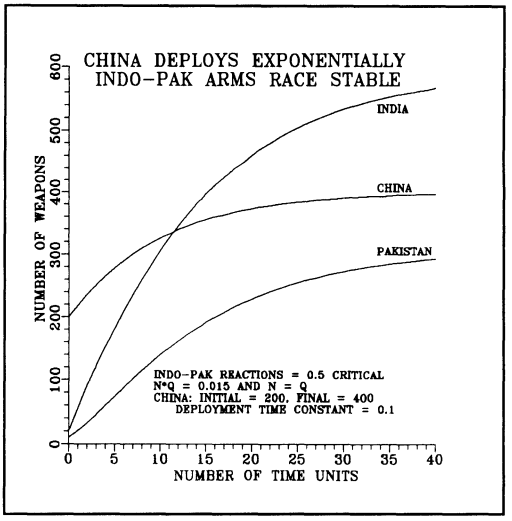

Figure 17

Under the assumptions of some of these examples, India would become a "major power" in the world, a goal of its policies, and would have to be dealt with as such. Pakistan, while not possessing as large an inventory as India or China, might also be considered a major power, particularly if it believed that China would come to its aid in case of an Indian attack. Even though Pakistan's inventory of weapons eventually is only about half of India's inventory, India might be deterred from attack if Pakistan's weapons were sufficiently survivable.

These examples were chosen to illustrate the employment of a three-way catch-up model. Other variations could include the selection of different reaction coefficients, different cost constraint fractions, or different growth rates in the lead contender's arsenal (Chinese, in the examples) and its time history. Results such as those presented here do provide

some indications of arms race outcomes where one contender executes plans, and the others attempt to catch up. Perhaps, this model may capture the behavior of nations such as China, India, and Pakistan and provide insights as to arms race outcomes under a variety of assumptions. The basic assumption underlying the catch-up model is that a lead participant has set his plans, executes them, and the other contenders try to catch up, reacting to the lead contender's build-up and to each other.

5. Entry Into an Arms Race

The purpose of this chapter is to examine whether or not the Richardson equations can be applied when one contender in either a two-way or three-way race has no weapons, but may have the means of producing them. Could the equations capture the decision to acquire the first (or subsequent) weapons?

The first step in such an examination of policy would be to set the initial inventory of one contender to zero. From this point on, the oerational analyst would need to derive reaction coefficients in consultation with political pundits who are experts on the region. In the following examples , the effect of various reaction coefficients is examined.

In a two-way arms race where Blue has no nuclear weapons, it is assumed that the hostility indices are set to zero. Figure 18 shows the variation of Blue's reaction coefficient to Red's inventory for two values, 0.1 and 0.2. Red's reaction to Blue's inventory is constant at 0.2. Two pairs of curves are the result indicating a highly reactive Blue contender (k = 0.2) or a not so reactive Blue contender (k = 0.1). If Blue is highly inclined to compete with Red, then the upper pair of curves indicates that an arms race could ensue. When Blue is slightly inclined to acquire a few weapons, then the final values of each inventory reach some "steady state" value. If Blue were of a mind not to acquire any nuclear weapons, then his reaction to Red's inventory would be zero. Under the assumption that Red's hostility index is zero, then Red's inventory would eventually decrease leading to total and complete disarmament. May analysts would doubt that such an eventuality would be realistic amongst two third world contenders such as India (Red) and Pakistan (Blue), for example.

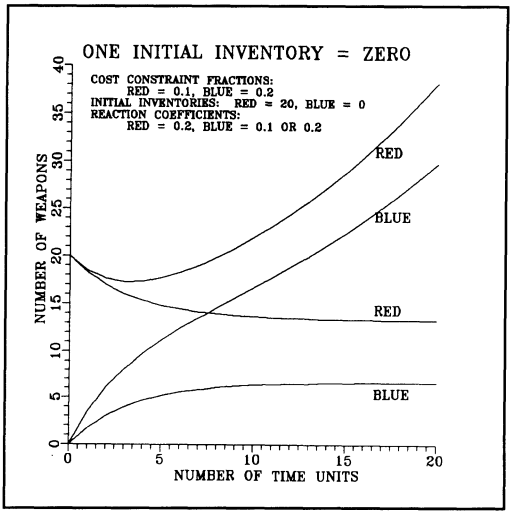

Figure 18

Assuming that there is some degree of hostility between two opponents such as India and Pakistan, then results different from the above example would emerge. To illustrate the effect of variations in reaction coefficients and increases in the hostility index of one opponent, Pakistan, Table 4 outlines some assumptions.

Contender	Cost Constraint Fraction	Reaction Coefficient	Initial Inventory	Hostility Index
INDIA	0.1	0.1	10	1.0
PAKISTAN (smaller)	0.2	0.05	0	0.3
(medium)	0.2	0.10	0	0.6
(larger)	0.2	0.15	0	0.9

Table 4 - Assumptions for Indo-Pakistani Arms Race

The assumptions are meant to indicate the relative values that might be observed concernig the behavior of Pakistan, and indicate the sensitivity of arms race outcomes. The variations and their effect are illustrated in Figure 19. In this figure, there are three pairs of curves corresponding to the smaller, medium and larger values of assumed Pakistani reaction coefficients and hostility indices. The decision by the Pakistani government whether or not to build nuclear weapons, and how many to build is quite dependent on their reaction coefficient and hostility index values. If Pakistan were not to react to the assumed initial inventory of India's nuclear weapons, then they would build none for themselves. The figure illustrates the variations in outcome if the Pakistanis were assumed to be somewhat to very inclined to build and deploy nuclear weapons in response to an assumed Indian inventory of 10 weapons. This example is meant to illustrate only the potential variations in motivations by the Pakistani government, and not to attribute any desire to proliferate weapons of mass destruction. In spite of this caveat, results such as those shown in the figure could give cause for alarm if any of the assumptions seem realistic.

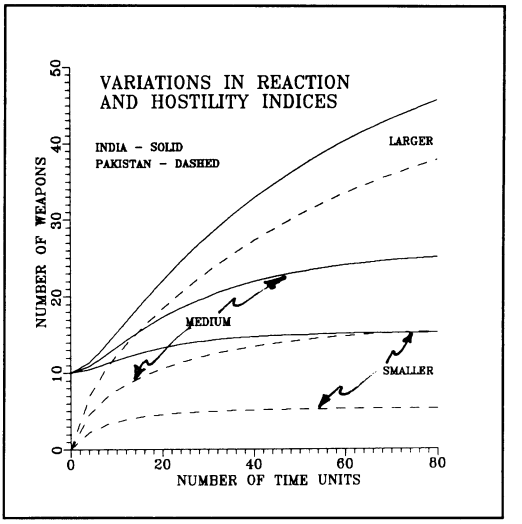

Figure 19

If a small nation such as Pakistan, were to consider developing a nuclear capability, then the actions of others such as India and China might influence this decision. In such a case, a three-way arms race might ensue and a three-way model might apply. Pakistan may decide to develop a nuclear capability or not. To examine the possibilities, it has been assumed that China has 300 nuclear weapons and will keep this number of weapons constant (no growth policy). It is assumed that India has built 10 nuclear weapons, and may build more in a reaction to China's stockpile.

Pakistan may decide to enter the nuclear arms competition or it may not. Figure 20 illustrates but two possibilities. If Pakistan enters the arms competition, then its reaction coefficient to India's growth might be 0.02 (a slight inclination) or 0 (no inclination). India, fearful of her northern neighbor with 300 weapons, could be desirous of matching China's weapon inventory. In this analysis, it is assumed that India's reaction coefficient to China's inventory is 0.1. India also has a similar reaction to any development of weapons in Pakistan. The cost constraint fractions assumed are indicated in the figure. Pakistan's cost constraint is assumed to be somewhat higher since it may face research and development costs that her neighbors have already undergone. Pakistan's reaction coefficient to Chinese weaponry is assumed to be zero - China is an ally, at least for the present. If Pakistan decides not to develop a nuclear capability, then

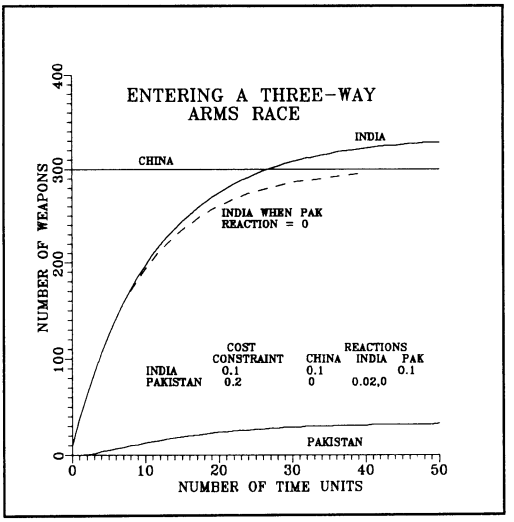

Figure 20

India would desire to catch up with China If Pakistan decides to develop a small inventory of nuclear weapons to deter an Indian attack, then India could eventually surpass the Chinese inventory of weapons simply because she is reacting to two opponents: China and Pakaistan. Thus, the catch-up model captures the competition between India and Pakistan, while China maintains a constant nuclear capability, presumably to deter Russian attacks.

The motivation of a nation to develop a nuclear capability or not to do so can be captured by the Richardson formulation of arms races. The parameter of interest is the reaction coefficient to other nations' activities. If the political environment is such that there is no desire to develop weapons of mass destruction, as assessed by political experts, then the reaction coefficient of a particular nation is set to zero. If there is any inclination to the contrary, then the reaction coefficient is set to a non-zero value. The higher the inclination, as assessed by political experts, the higher the analyst would set the value of the reaction coefficient. For example, if Pakistan did not really believe that China were an ally in the long term, she might hedge bets by including a small reaction to Chinese weapon inventories. If Pakistan were to be very suspicious of India's future in developing and deploying weapons of mass destruction, then an analysis including a higher reaction coefficient to India's weapon inventory would be appropriate. In these ways, operational analysts could examine variations in a two or three-way competition amongst third world nations and their aspirations.

6. Review and Commentary

The analytical methods developed in this report were aimed at possible examination of a number of issues. These include the arms race stability amongst two or three nations, the effect of hostility indices, the desire of one or two nations to catch up with a third, and the possible motivations of a single nation to enter into an arms competition. Each of these issues could be examined by the methods presented here.

6.1. ARMS RACE STABILITY

Under the analytical approach presented in this report, arms race stability has a strict mathematical definition. The criterion for arms race stability depends on the number of contenders.

When competition is limited to two contenders, then the criterion for arms race stability is

$$m*k < a*b$$

where m and k are the reaction coefficients and a and b are the cost constraint fractions of the contenders.

When competition includes three contenders, then the criterion for arms race stability is more complicated. The criterion then becomes

$$\frac{jqm+npk}{abc} + \frac{nq}{bc} + \frac{jp}{ac} + \frac{mk}{ab} < 1$$

where the parameters of interest are defined for each of the contenders, X, Y, and Z.

a,b,c = cost constraint fractions of X, Y, and Z
k = X reaction to Y inventory, j = X reaction to Z inventory
m = Y reaction to X inventory, n = Y reaction to Z inventory
p = Z reaction to X inventory, q = Z reaction to Y inventory

Stability criteria are independent of the hostility indices used in the Richardson equations, and are solely dependent on values of reaction coefficients and cost constraint fractions.

6.2. HOSTILITY INDICES

Hostility indices were included in the Richardson equations to provide some visceral indication of each contender's long range goals in relation to his competitors. In a modern day setting, the hostility index is a surrogate for the supply of funding to maintain an inventory of weaponry. If no funds were supplied for maintaining a force, then the force would decay exponentially according to some presumed failure rate. If a given nation were to maintain a constant force level while not reacting to any of its competitors' weapon inventories, then the hostility index would be the product of the cost constraint fraction and the initial inventory. For example, if the U.S. wanted to maintain a force of 1000 weapons and its cost constraint fraction were 0.2, the the hostility index should be set to 200. Under these conditions over time, the U.S. weapon inventory would be constant, provided it did not react to the growth of weapons in any other nation.

Hostility indices play an important role in the time domain solution to Richardson's equations. If the hostility indices of all contenders (two or three) are assumed to be zero and the arms race is stable, then the time domain solutions for weapon inventories will converge to zero. Under this set of assumptions, all contenders will have the goal of total and complete disarmament. If the hostility indices of all contenders are assumed to be non-zero and the arms race is stable, then the inventories of all of the contenders will approach some final steady state non-zero value. The eventual size of each inventory will be a strong function of the assumed hostility indices and the reaction coefficients.

If the arms race is marginally stable (mk=ab for two contenders), then the time domain behavior will vary depending on the value of hostility indices assumed. If all hostility indices are zero, then the inventories of all contenders will approach some steady state value over time. If hostility indices are greater than zero, then the weapon inventories of the contenders will diverge linearly with time. If the arms race is unstable, then all inventories will diverge exponentially with time whether or not hostility indices are zero or greater than zero.

6.3. EFFECT OF COST CONSTRAINT FRACTIONS

The cost contraint fraction is a parameter which can be viewed as an indicator of weapon reliability. The smaller the cost constraint fraction, the more reliable the weapon type considered. When reaction coefficients and hostility indices are set to zero in arms races with any number of contenders, the rate of weapon failures over time is determined by the magnitude of the cost constraint fraction (a), i.e., the inventory of weapons available for use is proportional to exp(-at). Which contender most contributes to arms race instability? Instabilities that occur as the reaction coefficients are increased are directly attributable to the contender with the lower cost constraint fraction. Extending this observation, the contender with the most reliable weapons, or those systems whose repair costs are the least, are at fault. Thus, arms races are dampened when mean times between failures are short, or when weapons have low reliabilities and funds for repair are in short supply.

6.4. PLAYING CATCH-UP

One alternative to analyzing an out-and-out three way arms race is to consider two nations competing with each other while trying to catch up or build enough weapons to deter a third contender. The approach to this problem presented in this report is a mild departure from the Richardson equations. The model may be useful in examining some third world conditions of competition.

The relations between China, India, and Pakistan suggested the formulation of this model. This framework fits perceived political conditions if: 1) China ignores the actions of India and Pakistan and has determined some number of weapons it believes will deter attacks by the superpowers, 2) India perceives that China has or will have enough weapons to start a potential war with India, 3) Pakistan is quite concerned about the potential growth of India's nuclear weaponry and wishes to hedge against the future prospect of losing China as an ally, and finally, 4) India and Pakistan have mutual concerns about

each another's weapon inventories. Such political conditions may exist in other parts of the world, if not now, in the future. The hope is that by adjusting cost constraints, hostility indices, reaction coefficients, and the growth plans of one nation, this model can be used to examine arms races amongst nations in the future.

6.5. DECIDING TO ENTER AN ARMS COMPETITION

Can the models presented in this report be used to examine whether or not a nation should procede on the path of procuring weapons of mass destruction? By modifying the initial conditions of one nation's inventory, i.e., setting it to zero, these models can be used to capture the essence of the political decision to embark along the path of procuring nuclear weapons. By capturing the essence, we mean that the political inclination to develop or not to develop weapons of mass destruction is embodied in a single parameter - the reaction coefficient. If a nation is not inclined to participate in an arms competition, then its reaction coefficient must be assumed to be zero. A non-zero reaction coefficient would indicate a lesser or greater degree of inclination to enter an arms competition, depending on whether or not a small or larger reaction coefficient is assumed.

6.6. OVERVIEW OF ANALYSIS

In reviewing the content of this report, the reader may wish to question the applicability of such methods in a changing world. The purpose of this report was to provide methods of examining possible arms races. At least part of this objective has been satisfied. To no one's surprise, we act as an advocate for applying these methods.

Developing solutions to Richardson's arms race equations provides a simple and direct method of analysis. Surprisingly, Richardson never provided explicit solutions to his proposed equations. Use of LaPlace transform and modern control theory techniques directly provide time domain solutions for a variety of conditions of practical interest. The simplicity of these methods of analysis provide another important feature: flexibility. As with any mathematical model, input parameters are important in determining results. Input data and internal parameters can be varied, thus leading to flexibility in terms of ease of varying parameters and noting their effects. The methods presented here are meant to capture the basic behavioral patterns of nations engaged in arms races, but not to include subtle nuances. The parameters describing national behavior include reaction coefficients to two other nations' inventories of weapons, a cost constraint fraction, and a hostility index. Other effects could be included in more detailed models, but the author suspects that quantifying the few parameters contained in Richardson's differential equations will be a challenging task along the road to understanding the potential outcomes of arms races, particularly those involving weapons of mass destruction.

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NEW PATTERNS IN THE ARMS RACE: SOME GUIDELINES

CHRISTIAN SCHMIDT
University of Paris - Dauphine
Place du Marechel De Lattre de Tassigny
75116 Paris, France

1. Data and evidence

One of the main consequences of the new international context is a drastic reduction of arms production. As for the military expenditures, the level reached in 1994 is almost about the level in the middle sixties (W.M.E.A.T., 1993 - 1994). The most spectacular drop is observed in the Eastern European countries followed by the NATO countries. As for the traditional major producers : the U.S. the standing armed forces are being reduced by about half from the eighties; in Russia funding for arms procurement has fallen by 90% in the last few years. The United States, for example, is reducing its production of combat aircraft for domestic use from 344 per year on average during the period 1973-1982 to only 20 per year in 1997-2000, according to various projections; in Russia, production will fall down from 614 combat aircrafts per year to 40 during the same reference periods; the average annual production for domestic use totaled 122 per year for the five main European producers (Britain, France, Germany, Sweden, and Italy) and will decrease to around 36 per year in the late 1990s. The Republic of China follows the same evolution, shifting from 350 aircraft per year in the period 1973-1983 to 70 now (see C.S.I.A. Studies in International Security, #7, 1994).

The demand for new production is more significant that this global observed trend for scrutinizing the international prospect of arms dynamics. By 1997, none of the seven major producers (the U.S. and Russia plus the five European countries) will be producing more than 25 aircrafts per year for domestic use - the prospect is even more impressive up to the year 2000, according to the programmes ordered. As for the United States or Russia, one can assert that the number of new aircrafts produced per year for domestic use is globally declining by about 90%. It must be noted that since most weapons systems have a life of 20-30 years, sometimes more, the deeper the cuts in the standing forces, the longer will be the period before replacement production is required. Replacement production could be suspended for 5, 10, or even 20 years. This is now the case for nearly all types of weapon systems in the United States and for most types in Russia.

At the same time, the size of the international market also decreases, According to U.S. A.C.D.A., the world arms trade is characterized by a sharp decline. The level of registered imports in 1993 represents a 70% drop from the peak of 1987. However, erratic movements can be observed in the agreements since 1992 - 1993. Therefore the recent evolution is disturbed and largely unpredictable. Anyway, differences appear from a region to another and still more significant from countries to countries in the same region. In the Middle East, major importers, such as Libya, have cut back very quickly after the Gulf War. On the contrary, countries such as Syria and Israel are reducing their inventories. In East Asia, the shares of the market change considerably in the last period. Whereas Vietnam, North Korea and Cambodia have quickly declined, South Korea, Taiwan, and above all, China have largely increased their relative shares.

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 297–305.

Number of combat aircrafts
Average production per year

	U.S.	Soviet Union Russia	China	5 major European Countries *
1973 - 1982	**344**	**614**	**350**	**122**
1997 - 2000 (projections)	**20**	**40**	**70**	**36**

* Britain, France, Germany, Sweden, Italy.
Source : Institute for Defense and Disarmament Studies.

Table 1

Finally, countries which are traditionally big importers of military equipment, such as Iran, Turkey, and Egypt, will have probably completed their major acquisition of new material by 2000. Thus, whilst the scale of the market possibilities becomes narrower and narrower it offers some new opportunities for the exporters.

In spite of all these difficulties, new trends emerge from the last few years. For the first time in recent history production for export is surpassing that of domestic use in the United States as well as in Russia. Such a trend will be reinforced in the near future according to the most reliable projections (S.I.P.R.I., A.C.D.A.,....). Furthermore, China, which still extends arms exportation, thanks to the very low cost of production there, is also now a major importer. Therefore, arms cuts and decreasing military budgets (cf. C.F.E.1, C.F.E.2, and Economic domestic constraints) all around, and mainly in the industrial arms producer countries, induce a bitter competition for exports in an international market whose format is continually decreasing. An interesting index is provided by the ratio domestic / Export arms production.

Ratio Domestic / Export production combat aircrafts

	U.S.	Soviet Union Russia	China	France
1983 - 1992	333 259	430 223	109 81	35 53
1993 - 2000 (delivered commands)	48 89	30 41	61 22	15 7

Source : Institute for Defense and Disarmament Studies, and S.I.P.R.I. estimations.

Table 2

2. A General Framework For Arms Dynamic Modeling

One can infer from this very broad picture five main features of arms dynamics for the next future. They are quite different from those observed in the arms race of the past and can be summarized as follows:

1) A general middle range trend of decreasing defense expenditures to be observed at a world level.

2) Cuts in national military budgets with significant differences from a country to another.

3) A complete reorganization of industrial arms production generated by the transformation of the defense format and the new international environment.

4) A strong incentive to export for the major arms producers both for industrial and political economy purposes.

5) A new distribution among the major suppliers of arms corresponding to the actual configuration of international tensions and instability.

The interactive relationship between the strategic and the industrial factors previously listed leads to a new type of dynamic which can be sketched by this schema:

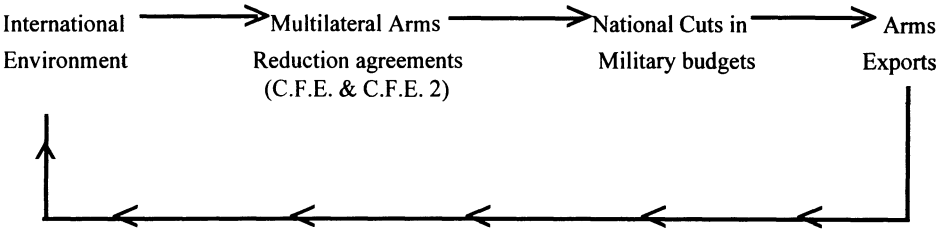

Figure 1

We propose some guidelines for modeling the process. The linkage between security variables and economic constraints operate through a general framework characterized by four (4) steps and a feedback loop. Let us point out the four steps:

1) From revising the international security perception to reorganize the military format of national defense.

2) From reshaping national defense to change the structure of arms production.

3) From restructuring arms industries to stimulate export management strategies.

4) From marketing the arms trade to increase international instability.

Starting from the present state of international affairs (1), the collective security is being modified (4) by means of arms dynamics mainly derived from economic considerations (2,3). So, the world disarmament process at large generates unexpected disturbances in the international security system.

The traditional ways of modeling arms dynamics is irrelevant to describe this phenomenon. Roughly speaking, the classical literature is dominated by two approaches. The first family of models is more or less derived from the well-known Richardson's equations:

$$(1) \quad \overset{o}{x} = a_1 y - a_2 x \pm a_3$$

$$(2) \quad \overset{o}{y} = b_1 x - b_2 y \pm b_3$$

where x and y are the levels of country X's and country Y's arms, x and y their rate of variations and a_1 , b_1 , a_2 , b_2 , a_3 , b_3 coefficients to be interpreted. All the models built on this basis exclusively refers to a dynamic interrelation between indexes of arms variations associated to two (or more) potential (or actual) adversaries (Schmidt, 1987). Indeed such kind of relationship is still to be observed between China and Taiwan. But there is no general evidence. The statistical comparison between South and North Korea's' imports provides, for instance, a major counter example. But, above all, such models do not take into account the role of major exporters and do not frame the economic process of arms trade.

The second family of models, labeled as "internal" or "incremental" is based on a still more simple mathematical structure derived from a linear equation like :

$$(3) \quad \overset{o}{x} = a_4 (x^* - x) + a_5$$

Where x^* is the expected level and $\overset{o}{x}$ the actual level and x the rate of variations of X's arms and a_4 , a_5 coefficients.

Those models do not integrate the international dimension of the phenomenon which is nowadays intricately related to the domestic constraints of the major producers linked to the market scale of arms industries.

The general framework corresponding to the present situation requires a much more elaborated and complex system based on two different dynamics : on one hand, the dynamic generated by the relationship between disarmament and arms production through the new strategic concepts; on the other hand, the dynamic linking arms trade in international market to international insecurity via the transformation of the import structure. The prerequisite of a comprehensive modeling of both dynamics is a better understanding of the processes which underlying in each case.

3. Quantitative Disarmament, and Schelling's Strategic Thoughts Revisited

Disarmament as a reduction in production in production for defense is only like the visible part of an iceberg. Beneath the surface we are starting to glimpse at a deeper transformation in the international system and this necessarily requires a remodeling of international security concepts. It is of interest that some political entities such as the Soviet Union and international organizations such as the WARSAW Pact, initially involved in disarmament talks, no longer exist, while others like NATO will soon be modified. At this point, the real problem is how to reorient economics in such a way as to improve the understanding and management of the emerging new strategic order.

Many questions arise which involve an economic expertise. These include : how to move from an international system dominated by deterrence through military threat to another where economic cooperation plays the key role; how to reshape the defense concept by taking into account its cost and the problem of burden sharing; and how to devise international institutions or agencies capable of promoting both security and economic welfare through an appropriate link. Their answers require to rethink several traditional concepts in this field.

A useful approach is to differentiate the time schedule. Disarmament in the narrow sense must be understood as a temporary state, even if it can be extended, while disarmament in a broader sense must be considered from the view point of a more permanent state of the world. Therefore the former refers

to the short or, perhaps, medium term, and the latter to the long-term investigation of trends. However, cuts in military budgets and conversions of industrial companies may have long-term consequences.

The arms reductions and weapons destructions currently programmed by the implementation of binding agreements are a relatively new phenomenon, quite different from the arms control treaties that were implemented in the 1970s through the SALT process. Furthermore there is no evidence of a symmetry in the economic impact of arms escalation and arms de-escalation.

Today, the analysis of major trends in national economics seems crucial in order to explain the rhythm for the cutting of military expenses and the direction to be taken for reshaping the security systems of the countries participating in the disarmament process. Thus, the solution for economic problem generated by disarmament in the narrow sense must be included in the quest for new rules of the game to be defined between the United States, the Commonwealth of Independent States and other Western as well as Eastern European countries, with disarmament being understood in the broad sense.

Schelling in his time was probably the first professional economist to analyze disarmament in the broad sense, using an original framework taken from economic and game theory. Starting from the basic idea that the fear of surprise attack in the early 1960s was the cornerstone of the doctrine of Mutual Assured Destruction (MAD), Schelling proposed to regard the East/West disarmament pattern from the viewpoint of the risk of such an attack, according to his own analytical definitions of a suprise attack (Schelling, 1960, chs 9 and 10). He later developed his views on the relationship between deterrence and arms control in a more detailed and elaborate fashion (Schelling and Halperin, 1961; Schelling, 1966). Though the time of the SALT Treaties is now over, the theoretical content of Schelling's contributions in that field is not obsolete.

In analyzing the way to minimize the risk of a surprise attack, Schelling stressed the difference between two kinds of situations. According to the qualification of the surprise attack as "deliberate" or as "accidental," meaning "unintended" at least in its final consequences, he emphasized the fact that the aggressor always has an interest in disguising the truth in the first case, while both sides have a common interest in conveying the truth in the second case. He consequently proposed different treatments for the two situations (Schelling, 1969, p. 247). By reference to the observed state of the Cold War, Schelling's analysis was most often limited to a dual opposition and devoted principally to the first category of surprise attack. In order to extend his ideas to the present state of international affairs, we must now reverse the priority and take into account more than two players.

We propose to elaborate on the notion of accidental surprise attack as a cause of international uncertainty when the "accident" is the result of a crisis in the decision-making system. The strategic relevance of this notion today's and for the next future can be supported by the following arguments : the international security is not provided by a strategic system under the control of two superpowers, the number of regional actors most often out of control have rapidly increased, the inadequacy of traditional concepts to face up to such kind of uncertainty is patent. Wrong perceptions, misapprehensions, and miscalculations are among the many cases easily illustrated from recent international experiences.

Crises in decision-making process generating uncertainty and instability can be classified in the four following main types according to game theory terminology.

Type 1. No set of rational actions exists for the players of the game.

Type 2. All the sets of available actions can be considered as rational by the players of the game.

Type 3. Sets of rational actions (and there are most often more than one) exist, but the information available to the players in the game does not allow them to choose rationally.

Type 4. One set of rational actions exists, but its choice leads the players of the game to a situation that is unsatisfactory for all of them.

All the four (4) types refer to rational decision-makers. Indeed, we assume that the players are willing

to act rationally, but they can not actually rationally succeed to implement a rational choice. As the rational decisions are more predictable, so uncertainty occurs when , for one reason or another, the players cannot or will not act rationally. Therefore we propose to speak of crises in rational decision-making systems that generate international uncertainty. Thus, type 1 can be labeled as "crises of instability", type 2 and type 3 as two variants of " crises of undecidability", and type 4 as " crises of perverse rationality" (Schmidt, 1994, p. 119).

Nash equilibrium provides a theoretical base to identify the different types of crisis listed above. Assuming that international situation to be observed is described by a non-cooperative game, "crises of instability" arise when there is no Nash equilibrium point corresponding to pure strategies. "Crises of undecideability"occur when there are many equilibrium points and no rational way for the players to select one of them. At the limit, all the states of the game are equilibria as in type 2. "Crises of perverse rationality" appears when the only Nash equilibrium point corresponding to dominant strategies leads to a sub-optimal and sometimes catastrophic outcome.

Crises of instability are relatively rare and there exist different ways to reduce their occurrence (cf the metagames' treatment). As for crises of perverse rationality, the best-known illustration is provided by the case of the prisoner's dilemma, which is extensively used in the international political literature. We prefer here to add some details about the "undecidability crisis."

A distinction must be made between two kinds of situations corresponding to two different factors of uncertainty. According to the first, each decision-maker knows the pay-off of the game; each knows his own preferences and the other's preferences. In other words, the players have complete information on the game. The origin of the difficulty of a rational choice of action is then related to the weakness of the classical assumption of rationality in non-cooperative games. Such situations have long been extensively studied by game theorists. Some well-known figures, such as the chicken and the stag-hunt games, provide illustrations of this category of two-player games.

Another situation exists when the decision-makers do not have complete information and where some or even all the players do not know the other's preferences. In these cases the decision-makers do not have sufficient information to identify the kind of game to which the actual game, unknown to the players at the beginning, belongs (cf hypergames, Schmidt, 1994). The latter category is far more frequent than the former, nowadays with the increasing number of regional players. Furthermore, international crises must often be framed by means of multigames and the assumption that the players know all the games they are playing becomes more and more controversial (cf Yugoslavia situation).

At this point, we should recall Schelling's treatment regarding the shared interest of knowing the truth in the case of accidental surprise attacks and bear in mind his suggestion to improve the conveying of truth among the parties. Thanks to recent achievements in game theory, we are now aware of the real complexity of "knowing the truth," when the content of the knowledge refers to interdependent information, as in the crises listed here. The risk of the occurrence of such crises of undecidability would decrease by increasing the domain of common knowledge. Until now, strategic information conveyed by satellites and other space systems was considered by each country or group of allies as strictly private information. Nevertheless such private information remains insufficient to guarantee against the occurrence of an unexpected action due to a crisis in the decision-making process, as long as the observed countries (1) do not know that they are observed and (2) do not know that their observer knows, and so on. A source of risk can obviously be found when the observed countries do not have sufficient information on their observers, therefore a first step to reduce the risk would be to share information of this kind.

What positive lessons for the industrial dimensions of disarmament? One can induce from this strategic analysis several trends for the reorientation of the arms production. First, the traditional alternative "deterrence verses protection" will be modified by a third term namely "information". "Inform", to "be informed" and "to make known to be informed" implies development of military electronic and space satellites sectors. On the contrary, classical vectors of nuclear as well as conventional threats are to be decreasing in connection with START II. Second, the format of the military deployment in the national territories is to be reduced and the possibilities for a quick reaction

abroad reinforced, which means cuts in armies but expansion in transportation capabilities. Third, the cost of weapons systems for observation and protection is higher than the cost of offensive weapons. As for example, no European country can support alone the financial burden of an AWACS production. The necessary development of such kind of programs for strategic purposes requires still more cuts in conventional forces.

Indeed, in the short term, the more visible impact of the Cold War end is an acceleration of the aggregate military cuts leading to arms industry restructuring and conversions. In the United States, for example, several programs mainly in army's acquisitions, Navy's upgrading systems and new aircrafts have been reduced. Some scenarios have been elaborated leading to reshape and reduce the size and the missions of the U.S. military forces on the middle run (Kaufmann and Steinbruner, 1991). But the most significant for the future will be a shift from a defense system to another one. One may already notice for instance that research and development will be subject to fewer cuts. Furthermore, some discrimination among industries are emerging now from strategic options still to be defined (Oden and Bishak, 1995).

4. Arms Exports Between Industrial Restructuring and International Insecurity

The main industrial effects of defense reduction is to be observed in the concentration process. As aircraft production has to be faced to both crisis in its military and civil activities, the aerospace sector has been the first to move in that direction. Lockeed's recent purchases operations, Mac Donnell Douglas reconcentration, and Martin Marietta's acquisition of General Electric provide various illustrations of this trend in the United States. In Europe also British Aerospace in Britain and D.A.S.A. in Germany show the tendency to consolidate the major aerospace production in a single national champion (Reppy, 1994).

A more detailed analysis reveals that most restructuring in the aerospace sectors are consolidation/defense oriented. Thus, Locheed has purchased GD's combat aircraft division, and Mac Donnell Douglas has sold a large part of its civil units to be concentrating in defense business. In France, Thomson-C.S.F. on its side has purchased military segments of European companies as Siemens and Phillips. Such industrial strategies may be surprising at first sight according to the expected cuts in military programs. The reintroduction of exports' prospects in the reasoning illuminates these observed strategies. Arms exports appear as a major policy to counterbalance the decreasing trend of military domestic procurements.

The picture of arms trade has been greatly modified in recent years, partly because the international environment has changed, partly because the business rules are not the same as in the golden age of the mid-eighties. One can summarize several of its main features as follows:

a) The markets take the form of oligopolistic competitive structures. Their dynamics are dominated by the supply side characterized by a fewer number of competitors.

b) Economic internal constraints in major exporters' countries generate a direct link between domestic policies (the conversion problems) and international marketing which exacerbates competition.

c) Military allies are often significant competitors in some of the strategic segments of the military markets. Most of the major exporters belong to the Atlantic Alliance inducing national tensions on that ground (cf U.S. and France commercial confrontation).

d) Russia and China are playing very specific roles in the international arms transfer. In Russia, the scale of the conversion problem puts a tremendous pressure for practicing dumping weapons marketing. The geostrategic position of China, as well as its economic situation, makes it both

a major importer and in the middle run, increasing exporter in the area in spite of a drop in the beginning of the nineties.

A first political consequence of this competitive dynamic of arms race is illustrated by the new geography of the major importers for the near future. According to the recent trends, the projections show a shift from the Middle East to East Asian countries. Up to now, South Korea, Taiwan, Pakistan and Iran must sustain or even increase their rates of import in 2000. Each of these countries is directly or indirectly connected to an area of conflict : the two Koreas, Taiwan and China, Pakistan and India, and above all, Iran, which is a major component of international destabilization.

Average Value of Annual Imports During The Period 1983 - 1992

India	Pakistan	China	South Korea	Taiwan	Iran
10,478	**3,571**	**3,428**	**2,871**	**2,732**	**2,582**

Estimations in Millions of U.S. Dollars 1990. Source S.I.P.R.I.

Table 3

Still more interesting information are provided by the examination of the deliveries and potential orders by producers for the next future (1995 - 2000) in specific markets,for instance, the major aircrafts. China is the first client of Russian material and the first exporter to Pakistan. Taiwan and South Korea have the two first positions in the United States exports. Taiwan is also the first importer of the French aircrafts. On the other hand, except for Saudi Arabia, the U.S. and Great Britain do not compete but share the market. Indonesia and Oman for instance are closed markets for British production. One can induce from this data, two extreme tendencies among the exporter's strategies. The first is a bitter competition illustrated by the U.S./French confrontation between the F-16 and the F-15 from Mac Donnell Douglas and the Mirage 2000 from Dassault. The second is an agreement of market sharing as between American and British companies in a large part of the Middle East countries. In both cases, the importers take the benefit of the situation. Anyway, a complex international network linking the major exporters to countries exposed to international crises is to be organized through the market dynamics.

The first temptation is to conclude from this survey that the arms production crisis in major producers countries tends to exacerbate regional conflicts and thus generate international instability. However, a definite conclusion is not so obvious. Arms exports may also be a way to control international crises as a "statecraft" possibility. But managing international crises by arms exports requires:

(1) To improve our knowledge of the relationship between the levels of armament and the degree of strategic stability in the region concerned;

(2) To relate more closely the typology of crisis in decision-making previously sketched with the arms transfer process.

Such investigations are necessary for understanding the feed-back loop of the general system (see Figure 1) and for modeling how it can be controlled. A next step in the research agenda.

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APPROACHES TO MATHEMATICAL MODELING OF THE PROCESS OF WORLD-WIDE STRATEGIC NUCLEAR CONFLICT USED IN THE FORMER USSR

SURIKOV ANTON VIKTOROVICH
2/3 Khlebnyy pereulok
Moscow 121069 Russia

ABSTRACT. Computer models of world-scale strategic nuclear conflict were developed in the Soviet Union to solve problems belonging to one of two classes: either direct problems or problems of optimization. Solutions of direct problems are estimates of probable results of hypothetical nuclear conflict between Russia and the USA in framework of pre-established scenarios of its beginning and development, pre-established options of structure and architecture of the sides' strategic offensive and defensive armaments, C-cubed-I systems, pre-established disposition of strategic armaments and their technical capabilities. Direct problems are widely used in Russia today. Therefore they are described in the paper in details. As an example of computer simulation of hypothetical US strategic nuclear strike against Russian strategic nuclear forces, some results of the simulation are given in the paper.

1. The Use Of Mathematical Models In The Former Soviet Union For Modeling Of World-Scale Russian-American Strategic Nuclear Conflict.

Computer mathematical models of world-scale strategic nuclear conflict as a rule were developed in the Soviet Union, as well as in the United States, to solve problems belonging to one of two classes: either so-called direct /priamyye/ problems or so-called inverted /obratnyye/ problems (problems of optimization). Solutions of direct problems as a rule are estimates of probable results of hypothetical nuclear conflict between the Soviet Union (Russia) and the United States in framework of pre-established scenarios of its beginning and development, pre-established options of structure and architecture of the sides' strategic offensive and defensive armaments, C-cubed-I systems, pre-established disposition of strategic armaments and their technical capabilities. Inverted problems are to be solved for purposes of optimization of either scenarios of Russian-American strategic nuclear conflict's beginning and development or structures and architectures of the sides' strategic offensive and defensive armaments, C-cubed-I systems of strategic force, or location of strategic force's facilities, or technical capabilities of strategic armaments. Inverted problems are more difficult for solution that direct ones are. The basis of inverted problems is represented by either direct problems themselves or results of multiple calculations of direct problems with the following formalization of the latter with assistance of one of the methods known in the highest mathematics.

It seems reasonable to pay additional attention to direct problems themselves because these are direct problems which were widely used in the former Soviet Union and are widely used in Russia today. Direct problems can be divided to two wide groups:

- problems of the first group request totality of interrelated methods and computer mathematical models for their solution and allow to imitate Russian-American strategic nuclear conflict in the framework of pre-established data. The solution will characterize and describe this imitation and

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 307–313.

will have casual /accidental/ character. After this stage results of several rounds of computer simulation can be processed with assistance of methods of statistic modeling, theory of probability and mathematical analyses. As a result researchers can calculate numerical and functional characteristics describing different aspects of the conflict's evolution. In other words the problems belonging to the first group are solved using statistical mathematical methods and methods of imitation;

- problems of the second group call for their solution knowledge of certain totality of numerical and functional characteristics describing different aspects of nuclear conflict's evolution. Solution of these problems allows to obtain probabilistic characteristics of Russian-American strategic nuclear conflict in framework of pre-established scenarios of its evolution, pre-established options of structure and architecture of the sides' strategic offensive and defensive armaments, C-cubed-I systems, pre-established disposition of strategic armaments and their technical capabilities. Problems belonging to the second group are solved as a rule with assistance of analytical methods and models.

It is easy to notice that problems belonging to the second group poses dignities along with deficiencies in comparison with problems belonging to the first group. High speed of the problems' computing along with the possibility to use rather low-powerful computers like IBM PCs for their computing is evident dignity of the former. This creates possibility to use these methods and mathematical models for qualitative assessments.

Comparative analyses of different scenarios of conflict's beginning and evolution, Comparative analyses of different options of structure and architecture of the sides' strategic offensive and defensive armaments, strategic C-cubed-I systems, location of strategic armaments of different types as well as engineering decisions used in development of strategic arms could serve as examples of such assessments. In other words solution of problems belonging to the second group can be used for optimization of forces with usage of computing of relatively restricted number of options. At the same time problems belonging to the second group in comparison with those of the first group have several essential deficiencies. Among them are relatively low accuracy and reliability of obtaining results, obtaining of relatively small number of numerical characteristics of casual value which in fact is the result of a variant of hypothetical strategic nuclear conflict between Russia and the United States. In addition to this some analytical models use as a raw data for computing information obtained with assistance of statistical imitation models and mathematical methods and transformed consequently to numerical parameters and functions (funktsional'nye zavisimosti).

In addition to this mathematical models of this type hardly can be used for purposes of training military officials. In other words it is difficult if possible at all to use these models in course of staff exercises, training of commanders and personnel of strategic nuclear force. It is hardly possible to use these models for study of the role of "human factor" in system of the strategic force's command in crises situations and conditions of real warfare.

In contrast imitation statistical models and mathematical methods served as training means effectively enough. That is why models of this type have being widely used in the former Soviet Union for purposes of training of commanders and personnel of strategic nuclear force and carrying out staff exercises. The analytical as well as statistical mathematical methods and models of strategic nuclear conflict between Russia and the United States are widely used for solution of problems of different classes in the current Russian Federation (as in the Soviet Union earlier) on leading enterprises of military-industrial complex and in research bodies of the Ministry of Defence.

Analytical models as a rule have axillar role in such process and statistical mathematical methods and models in the most part of cases are the primary tool for research in field of MODELING of hypothetical Russian-American strategic nuclear conflict in framework of pre-established scenarios of its beginning and evolution. The latter models are widely used as well for research of influence which different options of structure and architecture of strategic offensive and defensive armaments, C-cubed-I systems, pre-established disposition of strategic armaments have upon outcome of this specific case of hypothetical nuclear conflict.

Due to all above mentioned it seems reasonable to concentrate attention on discussion of imitation statistical models and mathematical methods themselves. The particular attention will be paid to models which are used for research of hypothetical options of Russian-American strategic nuclear conflict.

All imitation computer mathematical models describing process of Russian-American strategic nuclear conflict in their essence are multi-level models i.e. in a fact are complexes of interdependent computer mathematical models. Models of lower levels are designed to solve so-called particular micro-level problems.

One can include in the class of particular micro-level problems the following problems:

- modeling of missile strike against alone silo or mobile launcher of inter-continental ballistic missile (ICBM);
- modeling of missile strike against alone base of strategic bombers armed with long-range nuclear cruise missiles as well as the process of taking off bombers deployed on this base after receiving of the missile attack early warning signal and in conditions of threat of nuclear strike by in-coming advisory warheads;
- modeling of actions of space-based intelligence means engaged in tracking of alone mobile ICBM launcher of the opposite side and targeting of weapon systems;
- modeling of impact of striking factors (porazhyustchie factory) of high-altitude nuclear explosions and nuclear weapons of the third generation upon ballistic missile on flight trajectory;
- modeling of actions of an anti-submarine unites engaged in search and destruction of alone nuclear-powered strategic submarine (SSBN) of the opposite side;
- modeling of the process of transmission of signals of combat command and control to submerged SSBN and receiving of these signals, including case of difficult ice conditions in the Arctic region;
- modeling of impact of electromagnetic impulses (EMI) and nuclear weapons of the third generation upon means of communication and combat command and control engaged in the process of controlling of strategic operation;
- modeling of transition of alone signal and command of combat control through stimulated environment stimulated as a result of nuclear explosions;
- modeling of missile strike against alone C-cubed center or command post in case of emergent conditions;
- modeling of actions of alone means of ballistic missile early warning system (BMEWS) in conditions of missile attack;
- modeling of actions of informational system of anti-ballistic missile defence (ABM) system engaged in the process of tracking of ballistic missiles and their warheads and targeting combat complexes and means of ABM system;
- modeling of actions of alone means and combat complex of ABM system of different types of basing in the course of interception of ballistic missiles and their warheads on different parts of flight trajectory;
- modeling of actions of alone means and informational complex of anti-air defence (AD) system of different types of basing in the course of interception of cruise missiles;
- other problems of the same kind.

Results of computer simulations with assistance of low-level mathematical models designed to solve particular micro-level problems are to be mathematically processed and transformed to the form of functions (funktsional'nye zavisimosti) and numerical parameters. These two different types of processed results describe probabilistic character of results of computing mentioned micro-level problems. Functions and numerical parameters obtained are to be used later in computer simulation of higher-level problems.

A higher-level mathematical model is designed to be used in so-called interactive (dialogue) mode (i.e. with reserved possibility of multiple interference of a man of group of men in the process of computer simulation on certain its stages) in computing of so-called general macro-level problem. The

purpose of solution of general macro-level problem is to imitate one option of process of hypothetical strategic nuclear conflict between Russia and the United States. Particular options of structure and architecture of the sides' strategic offensive and defensive armaments, C-cubed-I systems, disposition of strategic armaments and their combat and technical capabilities are to be pre-established in this case.

Computing of general macro-level problem as a rule allows to obtain not only final result of hypothetical strategic nuclear conflict but as well the "schedule" of this conflict - i.e. detailed list and space-time parameters of events happened in the course of this alone imitation of strategic conflict.

Events have been modeling in the course of macro-level computer simulation in the following consequence. First of all problem of observation of Russian mobile missile complexes and mobile objects of C-cubed-I system by American space-based means are to be simulated. The second stage represent computer simulation of the optimal targeting of the US and their allies strategic forces aimed to destroy objects of Russian strategic nuclear forces (SNF), C-cubed-I system, BMEWS, high-level command of the SNF and block ICBM bases by the means of high-altitude nuclear explosions. Optimal schedule of the first nuclear strike against Russian objects are simulated on this stage too.

After that totality of functions and numerical parameters describing probabilities of certain results of particular micro-level problems along with generating casual numbers allows to imitate strategic nuclear attack of the United States and their allies against Russian objects. Computer simulation of anti-submarine activity of naval formations of the United States and their allies carried out parallel allows to model survivability of Russian SSBNs on combat patrol in the World Ocean by the moment of beginning of hypothetical strategic nuclear conflict.

Actions of high-level command, BMEWS, C-cubed-I system, transmission and receiving of signals on take-off of strategic bombers, launch of ICBMs in "launch on warning" mode and then launch of survived ICBMs and SLBMs of survived SSBNs in retaliate strike are modeled on the Russian side. The following stage of computing imitates transition of launched ICBMs and SLBMs through "screens" created by high-altitude nuclear explosions above probable areas of ICBMs and SLBMs launches. Flight of strategic bombers to zones of cruise missile launches and process of these missiles' launches are imitated on this stage too.

The following stage of computer simulation deals with the process of breaking of ballistic and cruise missiles as well as warheads of ballistic missiles through strategic anti-ballistic missile and anti-air defence of the United States and their allies. Possibility of existence of several layers of territorial ABM and anti-air defence of the United States and their allies as well as defence of certain objects, and presence of difficult jamming conditions and multiple false targets is bared in the mind as well. This leads to computer simulation of the process of optimization of targeting of ABM and AD combat means. After that result of firing of defensive means against each specific missile or warhead is modeled with usage of generators of casual numbers as well as totality of functions and numerical parameters describing probabilistic character of results of actions of ABM and AD informational and combat systems.

The final stage of computer simulation imitates the process of explosions of ballistic missile warheads and cruise missiles reached their pre-planned targets. Degree of destruction of targets in the retaliatory strike is simulated on this stage. All information obtained in the course of computer simulation is not only displayed on monitors and printed but also saved in specialized data-base for further usage for purposes of statistical as well as optimization modeling. This is an important feature of the described model.

External conditions and examples of practical use of computer mathematical models for description of hypothetical Russian-American strategic nuclear conflict are discussed in the following section.

2. Computer Simulation Of Hypothetical US Strategic Nuclear Strike Against Russian Strategic Nuclear Forces.

In order to assess influence which fulfillment of international agreement in the field of limitation of strategic offensive armaments will have upon Russian ability to deter effectively aggressive actions of possible adversaries against Russia one need assess degree of accordance of probable structure of Russian strategic force to approved plans of their use after fulfillment of those agreements.

One can use the following option of Russian strategic force's structure which is in good accordance with signed on January 1993 while never ratified Russian-American Strategic Arms Reduction and Limitation Treaty (START-2 Treaty):

Table 1. Possible option of structure of Russian strategic nuclear forces and architecture of US strategic offensive forces

	Russia	USA
ICBMs		
	105 RS-18M 360 RS-12M mobile 350 RS-12M silo (including 90 in RS-20 silos)	500 "Minuteman-3M"
SSBNs/SLBMs		
	6 RPK SN "Typhoon" (720 Wh on 120 SLBMs) 7 "Delfin" RPK SN (448 Wh on 112 SLBMs) 11 RPK SN "Kalmar" (528 Wh on 176 SLBMs)	18 "Ohio"-class SSBNs (1728 Wh on 432 SLBMs)
Heavy bombers		
	50 Tu-95MS (600 Wh) 10 Tu-160 (120 Wh)	20 B-2 (80 Wh) 75 B-1B (900 Wh) 36 B-52H (288 Wh)
TOTAL:	3241 Wh (1333 delivery means)	3496 Wh (1078 delivery means)

It is quite understandable that assessments of Russian ability to carry out retaliatory strike should be done for the "worst-case scenario". With this purpose results of analyses of consequences of hypothetical American strike against Russian SNF are discussed below from the point of view of its influence upon number of warheads which would be delivered to aim-points on American territory in retaliatory strike. Calculations are done for the case of strike by without increase of state of alert of American strategic offensive forces by ICBMs and SLBMs on regular combat duty.

Results of actions of American strategic bombers are neglected due to the fact that their durable flight time and easiness of detection of their flight to ALCM launch zones makes their participation in "out-of-blue" (i.e. in strike with only 15 - 20 minutes tactical warning before arrival of first in-coming warheads to their aim-points on Russian territory) strike hardly possible. In practice strike without increase of level of strategic offensive force's alert is the worst for Russia option of adversary's actions from the point of view of achieving by the adversary of initial surprise.

Quantity of American ICBMs and SLBMs are considered to be in accordance with approved plans of the American SOF build-up. Actions of restricted ERIS and HEDI ground-based ABM systems have been taken into account. Meanwhile it is considered that Russian forces were modernized with purpose to increase their capabilities to penetrate ABM defence. Calculations are done in interactive

regime bearing in the mind optimization of employment of American forces against objects of Russian SNF.

One should take into consideration that some essential simplifications have been done in the course of preparation of this specific example of MODELING of hypothetical American strategic nuclear attack due to which the results represent only semi-qualitative solution.

Table 2. Strike of US SOF

Type	BM	Wh	FOCD	L-Wh
Minuteman-3M	500	500	450	427
D-5/W-88	96	384	3 SSBN:288 BM	65 SLBM/260Wh
total Whh	884	738	738	687
C-4,D-5/W-78	336	1344	10 SSBN:960BM	216 SLBM/864 Wh
total Whl		1344	960	864
DELIVERED AT AIM-POINTS Wh:			687 Whh, 864 Whl	

Used abbreviations:
BM - number of delivery means;
FOCD - number of delivery means on combat duty;
L-Wh - number of warheads which will be launched on flight trajectories with consideration of probability of receiving of orders on combat employment by each specific launcher, and technical reliability of delivery means;
SSBN - nuclear-powered submarine armed with strategic ballistic missiles;
SLBM - submarine-launched ballistic missile;
Wh - number of warheads;
Whh - high-accurate warheads;
Whl - low-accurate warheads.

Table 3. Results of MODELING of hypothetical strike against Russian SNF

Type	BM	Wh	Wh-A	L-Wh
Typhoon	120 (6 RPK)	720 -		108
Kalmar	176 (11 RPK)	528 -	10 Whl -	126-182
Delfin	112 (7 RPK)	448 -		
total	408 (24 RPK)	1696		234-290
RS-18M	105	105	105 Whh	13
RS-12M2	360	360	582 Whh	23
RS-12M	360	360	40 Whl + 41 Whl + 763 Whl	
29-68				
Total	825	825	687 Whh + 844 Whl	65-104
Tu-95, Tu-160			10 Whl	
Total BM	1233	2521		299-394
Result of action of land-based ABMD				209-276

Used abbreviations:
BM - number of delivery means;
RPK - nuclear-powered submarine armed with strategic ballistic missiles;
Wh - number of warheads;
Whh - high-accurate warheads;
Whl - low-accurate warheads;
Wh-A- number of adversary's warheads used by the USA against these specific targets;

L-Wh - number of warheads which will be launched on flight trajectories with consideration of probability of receiving of orders on combat employment by each specific launcher, and technical reliability of delivery means.

One can imagine three possible options of targeting plan for Russian strategic nuclear forces. Each specific option meets discussed criteria of SNF use and is able to highly effectively deter the United States.

Table 4. Options of use Russian SNF against targets on the territory of the USA

Option of targeting plan		Number of aim-points	Necessary number of warheads delivered
I	"ultimate"	87	93
II	"superfluos"	110	124
III	"over-superfluos"	144	158

Therefore in the simulated example of hypothetical "worst-case" American nuclear strike against Russian SNF forces the discussed option of Russian strategic nuclear force's structure ensures delivery onto predestinated aim-points on the territory of the United States up to 70 to 320 per cent more warheads than it is required in accordance with discussed options of targeting plan. Computer simulation of actions of land-based anti-ballistic missile defence reduce the degree of superfluousness down to 20 to 190 per cent.

That proves certain superfluousness of the discussed option of the Russian SNF' structure for purposes of assuring of Russian ability to carry out retaliatory strike after first American strike when one used proposed criteria of strategic nuclear forces use.

Section 2.7

Quantitative : Proliferation

STABILITY, REASSURANCE AND NON-PROLIFERATION

ILAN AMIT
79 Gordon St.
Tel-Aviv 64388
Israel

ABSTRACT. Is reassurance an effective tool in the maintenance of proliferation stability? The question is studied by means of a simplified simulation model, in which proliferatory moves are decided by cost/benefit considerations, according to a utility function. One participant, called Stabilizer, is ready to reassure potential proliferators by offering a predetermined package, the blocking-payment, designed to encourage them to maintain the status-quo. A conceptual analysis of the model reveals certain weaknesses of reassurance, such as extortion and positive feedback. A quantitative simulation shows, rather surprisingly, that reassurance plays a limited role in combatting proliferation, as long as the costs and payments involved are reasonable. Still, reassurance is important, because no alternative mechanism seems more promising, given a non-belligerent, multi-polar world (with a leading superpower)

1. Introduction

1.1. PROLIFERATION STABILITY

A global or regional situation can be considered stable, with respect to nuclear proliferation, if no new nuclear powers are likely to emerge, while some veterans might quit. Stability in this restricted context need not coincide with overall strategic stability (see Adler (1992), pp. 10-14). Proliferation stability could arise as a result of autonomous state decisions, free from external intervention, or result from vigorous efforts by one or more concerned powers, trying to preserve or improve the status-quo.

1.2. SCOPE AND METHOD

This paper discusses the non-violent intervention issue, and some of its observed features, by means of a simple model of proliferation and its dissuasion. The first three sections develop the basic model, extend it in rudimentary time and introduce some geographical structure. Section 4 discusses alternatives to a single stabilizer, in the context of regional nuclear proliferation. The following two sections, 5 and 6, develop a more advanced version of the model and analyze some examples. Section 7 presents the simulation program and its results, which are evaluated with the help of additional runs. Finally a summary, describing the main conclusions, is given in section 8.

2. A Preliminary model

In a non-belligerent multi-polar world, nuclear proliferation may still be undertaken as a strategic hedge, for political prestige, or as a result of organizational interests and pressures (see Sagan (1994), for a

M. L. Best, Jr. et al. (eds.), Strategic Stability in the Post-Cold War World and the Future of Nuclear Disarmament, 317–330.

renewed discussion of the latter and Betts (1993) for an updated version of his classical discussion of proliferation motives). Nuclear proliferation entails some costs, political and economic, that could be offset by other political and strategic gains. The balance might be represented by means of a utility function, defined for each potential proliferatory state, that reflects its preferences, given the relevant costs and gains. A proliferatory move would be ventured if it maximized the expected utility over the corresponding horizon. Even when proliferation is chosen, it could still be avoided by a suitable "blocking-payment", offered to the would-be proliferator by an interested external party, the Stabilizer, on condition that the status-quo is maintained. Since economic resources are limited, a stabilizer will have only a finite capacity for making blocking-payments, after which proliferation may proceed unhampered, unless an alternative mechanism is employed.

2.1. REASSURANCE AND BLOCKING PAYMENTS

Curbing the demand-side of nuclear proliferation has often been discussed under "reassurance", etc. (see Roberts (1994), pp. 166-171, and OTA (1993), pp. 99-109). The measures indicated include supply of conventional arms, anti-ballistic missile defense, economic and technological aid, resolution of relevant political conflicts, and forging a strategic alliance. Most of these measures may be grouped together under "blocking payment".

2.2. STABILITY

A set of states may be called stable with respect to nuclear proliferation if, for any non-nuclear state, proliferation will not increase its (discounted) future expected utility, either without or with a Stabilizer's blocking payment. If all participants behave rationally, this requirement entails proliferation stability in the simple sense of maintaining the nuclear status-quo.

2.3. THE UTILITY OF PROLIFERATION

We introduce two utility functions U and W, representing the respective utilities of being NOP (non-nuclear power) and GP (global nuclear power). These utilities could differ for different states, but we take them to be identical for all. Instead, states may be distinguished by their initial capital stocks K. In addition, U and W will depend on N, the number of nuclear powers. If C is the cost of proliferation and P - the (predetermined) level of blocking-payments, then the difference:

$$D := W(K-C,N) - U(K+P,N) \qquad (1)$$

determines whether ($D>0$) or not ($D<0$) to proliferate.

2.4. FACTORS THAT INFLUENCE UTILITY

The difference $D(K,N,C,P)$ in (1) may be viewed as the utility of proliferation. We assume a positive dependence of D on the current capital stocks K, so that the propensity of rich countries to proliferate is greater. Next, we assume that D depends positively on the number N of current nuclear powers, because it increases, or might seem to increase, the need for a strategic hedge, as well as the apparent loss of prestige from staying non-nuclear. Clearly, D is negatively dependent on C and P, the dis-incentive for proliferation and positive incentive for non-proliferation, respectively.

2.5. IS REASSURANCE A PRICE?

The concept of a blocking payment suggests debiting the stabilizer and crediting the recipient. However, some forms of positive incentives do not behave like that, e.g. arms supply (if paid for) or a defense pact.

Nevertheless, the model will treat all blocking payments in the straightforward sense of simultaneous debit and credit, as if an exhaustible resource is being transferred.

3. Time

To introduce time, consider a two-stage scenario, early and late, where each stage represents a couple of years. Even this rudimentary concept of time raises several difficulties, that need to be dealt with in the model.

3.1. BARGAINING FOR MORE

Having invested in the maintenance of proliferation stability, the stabilizer could be under pressure to increase the blocking payment (each new case would set the opening position for the next). In order to avoid such bargaining and the corresponding loss-of-face, the Stabilizer could signal in advance his potential commitment, making it, so to speak, an integral part of the rules. That approach is adopted in the model - the level of the blocking payments is fixed in advance.

3.2. TIME "INCONSISTENCIES"

The two-stage scenario may encourage extortion, arbitrage and positive feedback, all by-products of the blocking payments, which may be viewed as time-inconsistencies:

3.2.1 Extortion. Repeated claims by the same country for blocking payments may be viewed as extortion under the threat of nuclear proliferation. Again, not all forms of reassurance are equally susceptible (e.g. a mutual security pact with the Stabilizer cannot be reiterated).

3.2.2 Arbitrage. The term applies to a gain resulting from circular financial transactions that do not alter the underlying situation. It could occur whenever a nuclear power collected the blocking payment at the early stage by de-proliferating, only to re-proliferate at the late stage. It might, as a result, return to its original situation with a capital gain P-C. That option could be eliminated by making $P=C$ (adopted in the model).

3.2.3 Positive Feedback. Reassurance could encourage proliferation if a blocking payment at the early stage enriched the recipient sufficiently to preclude further dissuasion. A blocking payment may thus induce a positive feedback upon later proliferation.

3.3. THE OPPORTUNITY TO PROLIFERATE

In order to reduce the impact of time-inconsistencies, we shall assume that states have only a small probability of proliferating at any given stage. This could represent a "window of opportunity", created by suitable political conditions, not normally under the protagonist's control. A repeated opportunity will then be unlikely in the short run, and extortion etc., though possible, would become rare. This will not be the case in the longer run, in which repeated opportunities do occur.

3.4. THE INITIAL CONDITIONS

If the Stabilizer is initially capable of dissuading any potential proliferator by a pre-determined blocking payment, then how could there be any additional nuclear powers to begin with? Without such additional powers, N would be 1 and the incentives for proliferation would remain weak. There are two possible remedies: First, some states could expand their economies during the early stage, until they could no

longer be dissuaded by the (fixed level) blocking payments at the late stage. In that case, an economic motive might "compensate", from the vantage point of the model, for the insufficient strategic motive to proliferate at the early stage. Fortunately, this approach does not seem to be supported by experience. Alternatively, the initial conditions could reflect an earlier world, where different rules-of-play prevailed, and where the motives for proliferation were stronger. The veteran nuclear powers, in their present-day capacity, could provide the required strategic motives, even at the early stage. This would suggest that the present proliferation problems are, at least to some extent, a relic of the Cold War.

4. Geography

Let the various states under consideration be represented as nodes on a graph, so that adjacent states are linked together. This token geography suggests a distinction between global nuclear powers, or g-powers, and local or l-powers. The former influence (strategically and politically) every state on the graph, while the latter influence only their neighbors. Other distinctions have been proposed, e.g. -a "bomb in the cellar" power, another that possesses only an airborne thermonuclear device, and a third, equipped with a nuclear missile force (Graham (1983) p.9), but their political significance in the present context seems doubtful. We must consequently modify the basic model to incorporate the new class of l-powers.

4.1. UTILITIES AND COSTS.

l-Powers will have a utility function of their own, V, together with a characteristic cost of (local) nuclearization and a corresponding blocking-payment (denoted by LC and LP, respectively).

4.2. NUCLEAR RIVALS

The argument N of the utility functions will, from now on, represent the number of nuclear powers, both g- and l-, which influence any given state. It comprises all g-powers as well as the adjacent l-powers, and might consequently differ for different states. We shall refer to them as nuclear rivals, for short.

4.3. LEVELS OF PROLIFERATION

The introduction of l-powers allows for two levels of proliferation: Becoming an l-power at the cost of LC, or a g-power at the cost of GC. An l-power may also proceed to become a g-power, at the cost of $GC - LC$. The corresponding blocking payments will be LP, GP and $GP - LP$, respectively.

4.4. THE UTILITIES OF PROLIFERATION

Whether or not the various proliferatory moves are beneficial to the actors will now be determined by the expected future value of utility differences (or proliferation utilities) analogous to (*), with obvious modifications (taking differences between the relevant destination and source utilities).

4.5. BLOCKING LOCAL PROLIFERATORS

Why should a Stabilizer spend political and economic resources to block a local proliferator that, not being an immediate neighbor, does not pose a direct nuclear threat? Several reasons could be suggested.

4.5.1 Global Escalation. During the Cold War, the superpowers' reasons for dissuading local proliferators were compelling. A successful local proliferator could, some day, provoke a local nuclear war, that might escalate, perhaps by misinterpretation, into a cataclysmic global nuclear exchange. A motive of a comparable strength no longer exists in the present world.

4.5.2 Contagious Spread. Local proliferation is obviously contagious, so that the local threat could ultimately arrive at the Stabilizer's doorstep. The process is, however, lengthy, or might be, and the Stabilizer could perhaps do better by concentrating his efforts exclusively on the crucial links in the contagious chain. Moreover, if all immediate neighbors of the Stabilizer were already nuclear, his sensitivity to local proliferation should considerably decrease, according to this interpretation.

4.5.3 Expediency. If every potential g-power must first become an l-power, and if dissuasion were much cheaper at the local level, then blocking local proliferators might be more expedient for a global Stabilizer. The premises, however, seem doubtful: If Japan went nuclear, it would not stop at the local level, nor could Singapore become a global nuclear threat, even if it were to become a local power first.

4.5.4 World Policing. Schelling (1992) p. 27 indicates another reason for blocking local proliferation - better management of regional conflicts, such as the 1990 Kuwait crisis. Schelling writes: "I leave it to the reader to imagine what use Iraq might have made of a few nuclear weapons, had it actually possessed such weapons during the last weeks of July 1990". A similar view, backed by a somewhat technical analysis, is expressed by Intriligator and Brito in an article on Nash bargaining between states armed with conventional or nuclear weapons (Intriligator and Brito, 1993).

4.5.5 Controlled Proliferation. Finally, there are those who question the soundness of dissuasion, especially at the local level. Mearsheimer (1990) argues that a "controlled" nuclearization of Germany could enhance stability in central Europe. The meaning of "controlled" is not specified, but it may be assumed to mean that Germany would limit itself to the role of a local nuclear power, in line with its dominant continental position. continuing this approach, Mearsheimer recently denounced the "false promise" of international institutions and international regimes, implicitly referring, inter alia, to the NPT (Mearsheimer, (1995)).

5. Collective Stabilization

It is doubtful whether non-proliferation in a multi-polar world, especially in the local context, can safely be entrusted to the political will and economic resources of a single Stabilizer. Indeed, the latter may find better use for those resources, or adopt an isolationist view with respect to other geographical regions, or else it might accept Mearsheimer's views about "controlled" proliferation. Besides, the very concept of a single Stabilizer reveals a uni-polar aspect of a (supposedly) multi-polar world. This section examines alternatives to the concept, which might eliminate some of these problems.

5.1. GROUP STABILIZATION

In a truly multi-polar world, collective- or group-stabilization would be a natural choice. The model could easily be modified, so that the role of Stabilizer would be shared among a group of states (such as the global nuclear powers, the G-7, or both). Yet they would have to agree about the blocking-payments and how to share their cost. This task could involve some well-known difficulties, such as free-riding and collective ranking of preferences, on top of mistrust and conflicting interests.

5.2. TABOO REINFORCEMENT

Another possible approach could be to abandon the blocking-payments altogether, in favor of maintaining an international climate in which the utility of proliferation would be kept very low. The model lends itself readily to such an approach, because the utility functions are taken to be common to all, so that the beliefs and values of one state are communicated to all others via the common utility. It is not at all clear whether a comparable mechanism exists in the actual international arena (while the ban

against slavery seems to hold without special incentives, the ban against biological weapons still needs monitoring and control). If successful, this approach could render any proliferatory move undesirable, on the strength of ones own utility, like a Club, in which proliferation is "not done". In part, this takes place already, and might be reinforced still further. But what about those who do not wish to join the Club, or believe they should be compensated for doing so?

5.3. DIS-INCENTIVES

Another (collective) mechanism that could help to modify the utility functions in the "right" direction could be to push up the costs of going nuclear, through concerted denial of technology and materials. Further indirect disincentives, such as trade restrictions, could also be applied. This approach is discussed in OTA (1994), pp. 98-99, where it is recommended for the shorter run, but is treated with some skepticism for the long term. It would need, according to the report, a strong political support to become an important factor in the maintenance of stability.

5.4. STABILIZATION BY INTERESTED PARTIES

Finally, a change could be introduced in the basic model, so that the single global Stabilizer will deal with global proliferators alone, but will be assisted by interested local parties, not necessarily nuclear, in dealing with local proliferation. Such a combination has indeed been active in the case of North Korea, where Japan and South Korea, themselves non-nuclear, shouldered part of the blocking payment. In contrast China, herself a nuclear neighbor, did not participate. This does not seem, however, to be a general rule. During 1957-1959, for example, Britain, already a nuclear power, was quite interested in blocking France's imminent nuclearization (see Melissen (1994).

6. A More Advanced Version

Let us piece together some of the additions and modifications to the basic model in order to arrive at a better understanding of nuclear proliferation when reassurance constitutes the main stabilizing instrument.

6.1. STATES AND PROLIFERATION LEVELS

Let a set S of states be given, together with a graph G of neighborhood relations. Each state of S may be either NOP (non-nuclear power), LP (local nuclear power, l-power) or GP (global nuclear power, g-power). These three classes define the possible proliferation levels for a state. A g-power influences (politically and strategically) every member of S, while an l-power influences only its immediate neighbors on the graph G.

6.2. PROLIFERATORY MOVES AND COSTS

At each time-step, every member of S has an opportunity, with a small probability p, of changing its proliferation level. A change from NOP to LP or GP carries a cost of LC or GC, respectively. The cost of a change from LP to GP is $GC - LC$. Such changes, or moves, are proliferatory. Moves in the opposite direction are de-proliferatory and carry no (significant) cost.

6.3. STABILIZATION

The class GP always contains at least one particular member, the Stabilizer, that is not given the opportunity to de-proliferate. Any state in NOP that is about to make a viable move to the class GP

(having been given the opportunity), is offered a blocking-payment of *GP* by the Stabilizer, if it renounces the move. The blocking-payment is contingent upon the viability of the move without this payment, i.e., its expected positive utility gain. The corresponding blocking-payment for a move from NOP to LP is *LP*. However, the latter payment is offered by the Stabilizer in conjunction with the immediate NOP-neighbors of the state in question. Together with the Stabilizer, each carries an equal share of the payment. Finally, the blocking-payment for renouncing a move from LP to GP, which is carried by the Stabilizer alone, is *GP - LP*.

6.4. THE UTILITY OF PROLIFERATION

Every state of *S* has a distinct utility function for each possible proliferatory level - NOP, LP and GP - designated *U(K,N), V(K,N)* and *W(K,N)*, respectively. The first argument *K* denotes the current capital stocks of the state. The second argument *N* denotes the number of nuclear powers influencing the state, i.e. g-powers and neighboring l-powers. Both arguments may vary from state to state (and between time-steps), but the utility functions themselves are supposed to be common. The utility of a proliferatory move from NOP to, say, GP is defined as *DNG*, where $DNG := W(K-GC,N) - U(K+GP,N)$. The utilities of the other proliferatory moves -DNL and DLP - are similarly defined. A de-proliferatory move from GP to NOP has the utility $DGN := U(K+GP,N) - W(K,N)$ (it is not the negative of *DNG*!). The utilities of the remaining de-proliferatory moves - *DLN* and *DGL* - are analogous.

6.5. THE DYNAMIC PROCESS

The working of the model is described in the following sub-sections.

6.5.1 Initialization. The process involves finitely many time-steps *T*. Initially, at step 0, the participating states are partitioned randomly among the 3 proliferation classes and a Stabilizer is designated in GP. Then each state is assigned an initial capital stock *K(0)*, together with a constant (positive or negative) growth rate *g*.

6.5.2 The Proliferation Loop. At each of the following time-steps the capital stock of every state are augmented by its growth rate: $K(t+1) = K(t)(1+g)$. Next, a random experiment (lottery), with probability *p* of success, is independently conducted for each state. If the experiment yields success, the utilities of the various proliferatory and de-proliferatory moves open to that state are calculated and the one, if any, with the highest positive utility gain is selected and the corresponding move performed (in case no move shows a positive utility gain, no move is made).

6.5.3 Adjusting for Proliferatory Moves. Whenever a state *s* makes a proliferatory move, its capital stocks are correspondingly decreased: $K(t+1) = K(t) - C$, where *C* is the relevant cost. If the proliferatory move was made from NOP to LP (making *s* a new nuclear power), the number *N* of nuclear rivals for every neighbor of *s* is increased by 1.

6.5.4 Adjusting for the Blocking-Payments. If *s* is de-proliferating, its capital is increased by the relevant payment, and that of the Stabilizer correspondingly decreased (if a nuclear power becomes non-nuclear, the number *N* of nuclear rivals of each of its neighbors is decreased by 1). Similar adjustments are made in the capital stocks of those states that refrained from a viable proliferatory move thanks to the blocking-payments and the corresponding stabilizers. In particular, if *s* has *M* NOP-neighbors, and refrained from moving-up to LP, then the capital adjustment for the Stabilizer, and for each NOP-neighbor, will be $K(t+1) = K(t) - LP/(M+1)$.

6.5.5 Resource depletion. Finally, the capital stocks of the Stabilizer are checked, after all outstanding payments on its part have been made. If it is seen to sink below a given fraction *f* of the original capital

stock, all blocking-payments for the subsequent time steps are set to zero until, if at all, the capital stock of the Stabilizer recovers to its original level. When such a moratorium takes place, the immediate neighbors also cannot contribute to the reassurance process. During such periods the only impediment to proliferation is its cost.

6.6. RATIONALITY OF THE PROLIFERATORY CHOICE

In the basic version of the model that involved just two time-steps, the decision to move was based on the future expected gain in utility resulting from that move. In the extended model, however, this is no longer practical. Indeed, the uncertainty concerning the future choices of the other parties, when even their opportunities are random, makes it impossible to calculate the relevant utilities, or assign probabilities to their possible values, in advance. Assuming that real decision-makers cannot possibly do better, we shall suppose that states are intrinsically short-sighted, and base their decisions on current utility gains. This approach implies that proliferation, like many other issues in public policy, cannot be truly rational, because of uncertainty, lack of information, insufficient prediction power, etc. Since a state must provide some explanation for its actions, at least to itself, it will tend to rely primarily on the balance of current gains.

7. Preliminary Analysis

7.1. THE UTILITY FUNCTIONS

We begin by specifying the utility functions of the participant states, in order to facilitate the analysis. Let $L = 1, 2, 4$ represent the proliferation levels NOP, LP and GP, respectively. The utility functions U, V and W may be labelled jointly as U and defined by:

(2) $$U(K,N) := AK^b / N^{c/l}, \quad l = 2L^d,$$

where A, b, c, d are constant parameters (b and c strengthen the relative weight of K and N, respectively, while d reduces or strengthens the gap between levels). The utility of a state increases with its capital stocks and decreases (politically) with the growing number of its nuclear rivals. However, the negative influence of these rivals may be reduced by making proliferatory moves, (which increase L and l, and consequently U also)

7.2. THRESHOLDS FOR SUCCESSFUL REASSURANCE

From (1) and (2) the following two thresholds for N, s_1 and s_2, are easily deduced:

(3) $$s_1 = (K/(K - C))^{bl/c}; \quad s_2 = ((K+P)/(K-C))^{bl/c}.$$

Whenever $N < s_1$, proliferation is not viable, even without reassurance. If $s_1 < N < s_2$, proliferation is viable, but may be blocked successfully. Finally, if $N > s_2$, reassurance will not prevent proliferation.

7.3. NUCLEAR MONOPOLY

If there exists, initially, a single nuclear power, it must be the Stabilizer, by assumption. In that case $N = 1$ for every state, irrespective of geography, because the Stabilizer is a global power. Since $s_1 > 1$, by (3), proliferation will not be viable, even without external reassurance. Hence the situation will remain stable and the nuclear monopoly will be maintained. Instability may arise only if there are initially two of more nuclear powers, a condition discussed in section 2.4.

7.4. GLOBAL VS. LOCAL STABILITY

Let us compare two situations in both of which all participating states, with the possible exception of the Stabilizer, are symmetrical. In one situation, or scenario, all states are local neighbors to one another, while in the other all are isolated and can exert strategic influence on each other only as global nuclear powers. Both scenarios are stereotypical, but may illustrate the contrast between local and global proliferation.

7.4.1 Numerical Assumptions. We assume that $b = c$ and $d = 1$ in (3), so that $l = 2$, by (2). Also let $LC = LP = K/6$, while $GC = GP = K/3$. In other words, local proliferation costs about 1/6 of capital stocks (probably a gross overestimate), while global proliferation costs twice as much, with corresponding levels of blocking payments. Note that the costs and payments may constitute a fixed part of the capital stocks only because the latter are equal, in this example, by symmetry, and because no economic growth is assumed to occur.

7.4.2 Consequences for Stabilization. Under such conditions $s_1 = 1.44$, $s_2 = 1.98$, for local proliferation, while $s_1 = 3.16$, $s_2 = 7.71$ in the global case. In consequence, the scenario of local proliferation cannot be stabilized once another nuclear power, beside the Stabilizer, initially exists. In contrast, the global proliferation scenario needs no external reassurance to stabilize, as long as the initial number of nuclear powers is less than 4. Between 4 and 7 initial powers (the Stabilizer included), reassurance can successfully be applied to block proliferation and maintain stability. Only for 8 or more global nuclear powers is instability unavoidable. The numerical values in the example are, of course, without empirical foundation. Nevertheless, they illustrate the gap between the stabilization of a scenario in which local proliferation is the dominant concern and another, in which one deals chiefly with global proliferatory moves. Reassurance is more effective in the latter case, because the economic stakes are higher, as well as the corresponding positive incentives.

7.4.3 Resource Depletion. Suppose that the Stabilizer has capital stocks of 2K, relative to the other participants, and that it can dedicate 1/4 of its resources for reassurance and the maintenance of stability. That would make it possible to make 3 *LP* blocking payments at the local level, or 2 *GP* payments at the global level (assuming that a payment is made as long as the allocated resources have not been depleted, even if after the payment they would). Consequently, the full stabilization potential of the global scenario cannot be realized, because of resource depletion. Still, stabilization in the global scenario may be maintained for a significant time, which is not the case with the local scenario.

7.5. REPEATED OPPORTUNITIES

Let the stabilizer possess an initial capital stock of 20, with all other participant states, assumed to be symmetrical, possessing an initial capital stock of 10. Again, no economic growth is stipulated. Let the fraction of capital allocated for reassurance by the Stabilizer be $f = 1/4$. Suppose that the participants are geographically isolated, so that only global proliferation is significant, and that $GC = GP = 3$. The parameters b, c, and d in (2) are again taken as 1, so that the exponent bl/c in (3) equals 2, for NOP states (L = 1).

7.5.1 Requirements for Stability. Initially, $s_1 = 2.04$, $s_2 = 3.45$. Suppose that initially 2 additional global nuclear powers, beside the Stabilizer, exist. At $t = 0$ any potential proliferator will have $N = 3$ nuclear rivals, so that $s_1 < N < s_2$. Consequently, every participant given a first opportunity will find proliferation a viable option, but will be dissuaded by the blocking payment of 3 units. Stability can thus be maintained, on condition that the thresholds s_1 and s_2 do not change.

7.5.2 The Collapse of Stability. Suppose that state A is given a second opportunity to proliferate. Its capital stocks have increased from 10 to 13, because of the first blocking payment. Consequently, the thresholds for A must be updated to $s_1 = 1.69$, $s_2 = 2.56$, so that $N > s_2$. Unlike the first opportunity, A cannot now be dissuaded from proliferating and becoming a 4'th g-power. As a result, $N = 4$ for every remaining state in NOP, whether it had its first opportunity or not, and dissuasion by reassurance becomes impossible. With time, this will lead to the total collapse of proliferation stability. It should be noted that, at least in the present context, the collapse of stability is engendered by a previous blocking-payment, illustrating a positive feedback effect of the latter upon proliferation.

8. Simulation

A computer program that simulates the advanced proliferation model has been written and run. The results are presented and evaluated below.

8.1. THE SIMULATION PARAMETERS

The set S consists of $NS = 10$ participant states, of which the first is the Stabilizer. Its initial capital stock is 20, while that of the other states is randomly chosen between 2 and 17, with uniform probability. No economic growth is postulated for the Stabilizer, but all other states are allocated at random economic growth rates of between -.1 and .2 per time-step. The utility functions are (2) and the corresponding thresholds given by (3). the cost C and the blocking-payment P are taken as 1 (for a move from NOP to LP), or 3 (from NOP to GP). The opportunity to proliferate is $1/NS$, so that there is one potential proliferator, on the average, for every time-step. The depletion factor for the Stabilizer is $f = 1/4$.

8.2. THE RUNS

Each run consists of $2NS = 20$ time-steps. To initialize it, the capital stocks, economic growth rates and levels of proliferation are assigned at random to states #2 - #10. Similarly, the token geography is randomly determined, with a probability of .15 for a neighborhood relationship. For each of the following time-steps the program counts blocking and proliferation events. If the stabilizer runs out of the fraction of resources allocated for reassurance, the run is stopped and the event count is correspondingly normalized. The run is repeated 100 times, with new random assignments each time. Finally, the mean frequencies of the above events per run are calculated.

8.3. RESULTS

The exponent d in (2) enhances the "attraction" of proliferation by increasing L and l, decreasing the denominator of the utility function and increasing the value gap between the levels. The coefficient b/c in (3) has a similar influencer. In the following table d and b/c take on independently the values 2/3, 1 and 3/2. For each of the 9 possible combinations 100 runs are performed and the mean event frequencies are shown.

Auto-desist (% of opps)	Blocked (% of opps)	Proliferated (% of opps)	Stabilizer depleted (% of runs)	Exponent *d*	Weight *b/c*
67.	5.9	27.	6.	0.67	0.67
69.	8.3	23.	15.	0.67	1.0
71.	8.2	21.	18.	0.67	1.5
70.	4.6	25.	5.	1.0	0.67
72.	5.8	22.	8.	1.0	1.0
70.	8.9	21.	12.	1.0	1.5
70.	5.9	24.	9.	1.5	0.67
72.	7.3	21.	14.	1.5	1.0
73.	8.1	18.	15.	1.5	1.5

Table A: Results for normal costs and payments

8.4. EVALUATION

According to Table A, most potential proliferators, about 70%, refrain from going nuclear because of autonomous cost/benefit considerations, independent of reassurance. The parameters of the utility function, which have been varied over a considerable range, exhibit only a modest influence on this result - less than 5%, both ways. Of the remaining states, those that find prolifeation a viable proposition, 70% or more are, ultimately, not dissuaded by reassurance. Just 30% or less (of the 30% that find proliferation cost-beneficial) respond positively to reassurance and maintain the status-quo.

8.4.1 Discussion. Resource depletion cannot account for the above outcome, because a run is terminated once depletion occurs, which, incidentally, happens rather rarely - in less than 1/6 of the simulation runs. The poor showing of reassurance cannot also be attributed to multiple opportunities that generate positive feedback, as indicated in section 6.5, because it persists even if each participant is (artificially) constrained to a single opportunity to proliferate per run. Such a constraint increases the relative frequency of auto dissuasion, because, on the average, the participants are worse off economically, when they consider proliferation (the explicit results have been omitted, for the sake of brevity).

8.4.2 Relative Costs and Payments. The marginality of reassurance in table A seems to result from the small size of the costs and payments, relative to the average capital stocks. Indeed, when these costs and payments become (unrealistically) higher, reassurance plays a more impressive role, probably because its contributions are relatively more significant. In parallel, the percentage of runs that are terminated by depletion also increases significantly. This can be seen in table B, in which the costs and payments have been doubled, relative to the more realistic Table A.

Auto-desist (% of opps)	Blocked (% of opps)	Prolfrated (% of opps)	Stabilizer depleted (% of runs)	Exponent *d*	Weight *b/c*
68.	9.3	23.	31.	0.67	0.67
69.	12.	19.	40.	0.67	1.0
77.	10.	13.	32.	0.67	1.5
70.	7.7	22.	29.	1.0	0.67
72.	10.	18.	31.	1.0	1.0
71.	14.	15.	44.	1.0	1.5
72.	8.0	19.	25.	1.5	0.67
71.	11.	18.	34.	1.5	1.0
74.	13.	14.	34.	1.5	1.5

Table B: Results for double costs and payments

9. Summary and Conclusions

The maintenance of proliferation stability by a leading superpower is analyzed in this paper with special emphasis on reassurance, or positive incentives for nuclear non-proliferation. The research tool is a simplified simulation model of the international arena, in which a utility function determines the viability of proliferation, once the necessary opportunity presents itself. The utility function has a common structure for all participants, depending on their capital stocks, number of nuclear rivals, and current levels of nuclearization. Several insights have been obtained from the conceptual discussion of the model, while others resulted from actual simulation runs.

9.1. REASSURANCE

There are three conceivable mechanisms for dissuading potential proliferators - compulsion, negative incentives and reassurance. The first is not really commensurate with a multi-polar, non-belligerent world. The second, though important, has been criticized by others for an apparent lack of effectiveness in the longer run. This warrants a serious look at reassurance, which tries, presumably, to tip the cost/benefit scales in favor of the nuclear status-quo.

9.1.1 Tangible Transfers. Some forms of reassurance, such as a defense pact, seem not to require the transfer of tangible assets to the recipient, but the rule seems to be that a transfer does take place. As a result, the capacity of any leading superpower to practice reassurance is subject to depletion.

9.1.2 Sharing the Burden. It is doubtful whether the cost of reassurance could be effectively shared among the superpowers, because of free riding and lack of enforcement agencies. However, in a regional context some concerned parties could perhaps be made to share in the cost and effort.

9.1.3 Abuse. It has been shown that reassurance is open to several types of abuse -bargaining for more, extortion and positive feedback, which could ultimately encourage proliferation. Several mechanisms

can be employed to reduce these dangers, but none is full-proof.

9.1.4 Rationality. The interdependence of the utility function on future decisions of others in an uncertain environment makes a rational choice about proliferation, in the sense of discounted future utilities, almost untractable. As a result, we suspect that such decisions are normally based on a myopic outlook, that views the current situation as a persistent datum.

9.1.5 Effectiveness. The contribution of reassurance to the overall meintenance of stability is not impressive, under plausible conditions. Most states find proliferation undesirable without further reassurance. Those that do will not be easily dissuaded by "reasonable" positive incentives, although some would. This situation might change if proliferation, and consequently also reassurance, would become more costly (perhaps as a result of negative incentives).

9.2. OTHER OPTIONS

While reassurance was analyzed with the help of a quantitative model, other options have been treated only qualitatively.

9.2.1 "Soft" Measures. One might try modifying the utility function of all participants, so that additional external incentives would not be necessary. Such a modification could perhaps be achieved by "soft" dis-incentives, such as bad reputation for alleged proliferation, based on a universal taboo. However, these dis-incentives would hardly affect "rogue" countries wishing to proliferate.

9.2.2 "Hard" measures. Stronger dis-incentives might require the use of force, either directly, to enforce compliance, or indirectly, to promote economic sanctions. As already mentioned, the first prospect does not suit a non-belligerent multi-polar world, while the second, like an economic cartel, is hard to maintain for long.

9.2.3 De-proliferation. It has been shown that this option is unlikely to occur under normal circumstances. An exception is provided by veteran nuclear powers that proliferated during the cold war. If they could be reassured sufficiently to de-proliferate, stability would be greatly enhanced, since the number of nuclear rivals would decrease.

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