Nasser and the Missile Age in the Middle East

Owen L. Sirrs

Contemporary Security Studies

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This book demonstrates how Egypt's persistent efforts to acquire long-range surface-to-surface missiles from the early 1950s to the present day provide an important case study in the field of proliferation studies. It commences with Cairo's initial forays into indigenous rocketry with the successful recruitment of German scientists who had prior experience in Hitler's V-1 and V-2 missile projects. The book then demonstrates how Israel directed its formidable security apparatus to collect intelligence on and defeat Egypt's missile ambitions through covert action. It explores how this intelligence sparked a political crisis in Israel, an event which triggered fresh Israeli demands to the West German government to order the scientists' recall and a determined effort to engage the US in resolving Israel's security dilemmas. The concluding chapters examine the use of Egyptian missiles in the wars with Israel, the ill-starred Egypt–Iraq–Argentina Condor II program of the 1980s, and Cairo's most recent efforts to acquire North Korean No Dong missile technologies.

Drawing on material from recently declassified US government documents, this volume demonstrates how Egypt's missile program not only played an instrumental role in cementing the US–Israeli national security relationship but also formed the basis for present day efforts to counter missile proliferation. The concluding chapter highlights several important lessons concerning the global proliferation of ballistic missile technologies.

This book will be of great interest to scholars of proliferation, international relations, the Middle East, disarmament and security studies in general.

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All errors and omissions are mine alone.

Introduction

On 21 July 1962, Egyptian President Gamal Abdel Nasser led a motorcade of government ministers and journalists to Wadi al-Natrun, a lonely strip of desert near the Cairo–Alexandria highway that was best known for its Coptic Christian monasteries. When the buses and limousines arrived at their destination, the party was separated into two groups: the journalists were escorted to an observation stand while Nasser and his entourage descended into a nearby dugout. All had been told by Egyptian press representatives to expect a dramatic event.

It was already midmorning. The heat reflecting off the sand was steadily rising although a few scattered cloud banks occasionally veiled the rising sun and brought welcome shade to those below. As the correspondents shifted uneasily in their seats, no one knew the precise reason for this journey. They did know that summer was the worst time of year to descend to the veritable blast furnace of the Libyan Desert. They had also been told that the promised event at Wadi al-Natrun would kick off a week of festivities celebrating the tenth anniversary of the 1952 Egyptian revolution.[1]

Finally, at 0950 Cairo time, an explosion was heard several miles from the journalists' bivouac. A single missile-shaped projectile was seen lifting into the clear desert sky where, in the words of one US correspondent, "it pierced a long, white cloud bank and later, in plain view, slowly arched to the north – toward the Mediterranean."[2] Three other launches occurred within thirty-minute intervals before the correspondents and government representatives were crowded back on to buses for the return trip to Cairo. As they headed for Cairo, Egyptian government radio began to trumpet a resonating message: "the United Arab Republic has entered the missile age."[3]

Gamal Abdel Nasser had taken his country on its first tentative steps into the missile age that July morning at Wadi al-Natrun. In the aftermath of those launches, Israel and the United States were forced to grapple with the security implications of Cairo's ballistic missiles. Were these rockets for prestige – veritable giant firecrackers to ignite a country's celebration of its independence, as Washington officials appeared to believe – or were

they something altogether more sinister, as held by Tel Aviv? Even as international observers began to weigh in on both sides of this debate, Egypt staged a giant military parade, unveiling multiple copies of the missiles tested at Wadi al-Natrun. The missile age had dawned in the Middle East, and the Wadi al-Natrun tests sparked a regional missile race that continues to this day in a belt of countries extending from Egypt to Iran.[4]

Ballistic missiles are a seemingly ubiquitous presence in the world today. According to a recent report by the United States National Air and Space Intelligence Center, over twenty-five countries have ballistic missiles; many of those countries are located in a critical "arc of instability" that stretches from Libya through Israel and Iran to Pakistan and India.[5] Further compounding this formidable problem is the fact that the Middle East in particular has seen more than its share of ballistic missile activity, from Egyptian and Syrian rocket attacks against Israel in 1973 to the infamous "war of the cities" between Iran and Iraq, and Saddam Hussein's missile launches against Israel and Saudi Arabia during the first Persian Gulf War. According to W. Seth Carus, the Middle East is the "most dangerous area for missile proliferation."[6]

Egypt was one of the first countries in the Middle East to examine the feasibility of researching, developing, and producing its own rockets and missiles. As this history details, Egypt's forays into rocketry date back almost to its first war with Israel in 1948, when Egyptian arms suffered a resounding defeat on the battlefield. In the aftermath of that clash, Cairo sought artillery rockets and, later, ballistic missiles both to offset Israel's qualitative military edge and to threaten Israeli population centers. Despite Cairo's considerable investment in indigenous missile programs, it relied primarily on Soviet-supplied artillery rockets and Scud missiles during the 1973 Arab–Israeli war. Although Egypt's home-grown rocketry programs were marked by failure, Cairo now produces its own Scud missiles at a plant near Cairo.[7] Across the span of decades, from the early 1950s to the present day, the Egyptian leadership persists in the belief that long-range rockets are necessary for contingencies involving Israel. This fact carries a salient lesson for Middle East missile proliferation: absent a peace settlement that embraces all of Israel's neighbors and the Palestinians regional arms control initiatives that restrain the growth of missile forces will have little prospect for success.

Key questions

Key question #1: How did Egypt's efforts to acquire rockets influence Middle East regional and international policies?

The book places Egypt's ballistic missiles within the broader context of its periodic wars with Israel and its relations with the United States, the

Soviet Union, and other powers. It shows how ballistic missile programs can impact regional and international politics even if they are never actually deployed or used in battle.

Key question #2: What modern proliferation lessons can be derived from Egypt's experience with ballistic missiles?

The book argues that Egypt's ballistic missile projects comprise an excellent case study to aid understanding of the broader problem of ballistic missile proliferation. Subsumed within this question are others which are dealt with throughout the text:

- What motivates Egypt to acquire ballistic missiles? Specifically, what factor or combination of factors induces the Egyptian leadership to invest considerable amounts of scarce resources in ballistic missiles? Have these motivations changed over time? Do they influence Cairo's missile acquisition policies today?
- What have been Cairo's missile acquisition strategies? How did the Egyptian government proceed with the acquisition of ballistic missiles? What sources did it access for expertise and equipment? What technical specifications did the Egyptian government seek in terms of range and missile accuracy? Did that acquisition strategy change? What was Egypt's missile acquisition strategy in the 1970s? Today?
- What counter-proliferation strategies work? Coercion or intimidation? Arms control? Incentives? Supplier agreements?
- How effective was Egypt's indigenous missile production program? Did it accomplish its goals?

Any study of ballistic missile proliferation is not complete without acknowledging the crucial role of weapons of mass destruction in missile development. With its chemical and biological weapons programs, Egypt is no exception to the general rule that many states developing or acquiring ballistic missiles also pursue weapons of mass destruction. As this history demonstrates, Egypt pursued chemical – and possibly biological – weapons in tandem with its ballistic missile programs, although it is not clear if Cairo ever developed chemical warheads for its missiles. On the other hand, unlike some missile powers, including the United States, Russia, China, India, Iraq, Iran, and Pakistan, Egypt has never seriously entertained a nuclear weapons capability.

Methodology

On one level, this book represents historical research. It is a case study of how one significant Middle East power attempted to acquire ballistic missiles over a span of fifty years. In a chronological fashion, this book traces

Egypt's ballistic missile programs from the 1950s to the present. On another level, this is a study in counter-proliferation. The book analyzes the effectiveness of several counter-proliferation strategies and their impact on Egyptian missiles. It stresses that Egypt has defied most attempts to restrain its missile ambitions and will have a sizable ballistic missile inventory for the foreseeable future. The Missile Technology Control Regime (MTCR) has had a mixed record against Egypt. The same can be said for bilateral US diplomatic approaches.

The analytical content of this book relies on the works of Aaron Karp, Janne Nolan, Seth Carus, and Steve Fetter. Karp offers a framework to study ballistic missile programs with his description of "soft" and "hard" technologies underpinning ballistic missile programs.[8] He also answers a critical question: does proliferation matter? Nolan's book studies ballistic missile proliferation, and the military significance of these weapons in a regional context.[9] Carus analyzes how ballistic missiles have been used in conflict; he also offers tangible policy steps to control the proliferation of these weapons.[10] Steve Fetter examines the linkages between ballistic missile programs and weapons of mass destruction.[11] If anything, those linkages are even more important today than they were when Fetter wrote his article in 1991.

What these books lack, however, is the systematic, detailed treatment of a single country's missile program. For example, while we have a sophisticated knowledge of American, Soviet, and British missile programs, there are relatively few studies of North Korean, Indian, Iranian, Chinese, or even French ballistic missile programs. This study attempts to address part of that need by analyzing in depth the experiences of one developing world country as it researched, developed, produced, and acquired ballistic missiles over a fifty-year period.

Structure

This book answers the key questions in seven chapters, which are arranged both chronologically and thematically. The eighth chapter looks at some broader issues pertaining to the problem of ballistic missile proliferation.

The first chapter details the earliest beginnings of the Egyptian missile program when Cairo turned to a German rocket pioneer named Rolf Engel to help it develop and produce a relatively simple battlefield support rocket. This first foray into rocket technology foundered when Egypt sought missiles with greater ranges following the 1956 Suez War. Cairo's unsuccessful efforts to acquire complete rocket systems from the Soviet Union and other countries are analyzed next; the chapter concludes with Egypt's return to an indigenous missile program built around the skills and talents of another group of German rocket scientists. The chapter's conclusions illustrate Karp's point that incremental development of indigenous missiles and the "soft technologies" of program manage-

ment, finances, and organization can be important bellwethers of success for a given missile program.[12] Finally, the chapter evaluates some of the motives underpinning Egypt's pursuit of missiles, including prestige and military utility.

Chapter 2 examines the management structure of the Egyptian General Aero Organization, which produced Cairo's first (and only) indigenous rockets. The chapter shows how Cairo set up procurement networks in Europe and North America to support its missile program's material and personnel needs. Not surprisingly, Egypt's neighbor and rival, Israel, took a definite interest in this missile project; the chapter demonstrates how Israeli intelligence soon had a man on the spot in Cairo to spy on the program. This chapter examines at length the first two indigenous missiles, and highlights how guidance and control problems stymied Egypt's efforts from the beginning. Finally, this chapter shows how Nasser used his missiles to showcase the accomplishments of his government and offset his slow decline in Egypt and the Arab world. The chapter's conclusions focus on the hard technology aspects of missile development and Egypt's crucial reliance on foreign talent to design and build its missiles, among other topics.

Chapter 3 demonstrates how Israel responded to Egyptian missiles through a campaign of assassination and intimidation against the German scientists and their families. When that campaign was derailed by the arrests of two Israeli agents in Switzerland, Israel decided to publicize its concerns through the domestic and foreign media. The ensuing wave of hysterical media accounts of Egypt's missiles and its supposed chemical, biological, and nuclear capabilities touched off a political crisis in Israel. Some Israelis used the controversy to justify their country's acquisition of nuclear weapons and the missiles to deliver them. The chapter concludes with some general observations on the impact of Nasser's missile program on Israeli–West German relations, the linkage between ballistic missiles and weapons of mass destruction, and the use and abuse of intelligence.

Chapter 4 is concerned with the impact of Nasser's missiles on West German relations with Egypt and Israel. In response to pressure from Jerusalem, Bonn attempted to lure the scientists out of Cairo with promises of lucrative and challenging work in Europe. The Federal Republic also warned other scientists of the risks associated with working for Nasser. West Germany was never able to find a mechanism that would allow it to legally prevent the travel of its citizens to countries like Egypt, nor could it revoke their citizenship. The controversies generated by the missile project had their consequences for West Germany's relations with Israel and Egypt. The Nazi Holocaust against the Jews compelled the Federal Republic to maintain a sensitive relationship with Israel; however, Cold War necessities drove Bonn to try and maintain close relations with the Arab world as well. The West Germans were particularly concerned that East Germany might establish diplomatic ties with countries in the

Middle East. In the end, this delicate balance was disrupted, and West Germany's Middle East policy was effectively neutralized when Cairo established ties with East Berlin.

Nasser's missile project also preoccupied US policymakers. Chapter 5 examines how the Kennedy and Johnson Administrations attempted to restrain the unconventional arms race in the Middle East. One American proposal was deceptively simple: Nasser would abjure further production of his ballistic missiles in return for an Israeli pledge to refrain from developing a nuclear weapon. In a series of discussions with Nasser, US officials learned that Egypt was not prepared to surrender its ballistic missile program – even if it could prevent Israel from acquiring a nuclear weapon. For its part, Jerusalem continued to stress the looming danger posed by Cairo's missiles in talks with Washington. Egyptian missiles were both a military and a psychological threat, Israeli policymakers insisted, and Israel required American missiles to offset this danger. The lessons for modern proliferation in this chapter are manifold: there are linkages between ballistic missiles and nuclear weapons, which are examined at length; the dialogue with Nasser not only revealed the crucial problem of guidance and control, it also demonstrated how Nasser's domestic audience effectively restrained his ability to negotiate away his primitive missile program; and multilateral treaties aimed at controlling the spread of advanced weapons like ballistic missiles can only work when the broader causes of regional conflict are ameliorated.

Chapter 6 traces the reasons behind the decline of Egypt's indigenous missile program. It demonstrates how West German incentives and Israeli coercion convinced many of the German scientists, engineers, and technicians to return home. Other contributions to the collapse of the missile project were Egypt's scarce financial and personnel assets, poor management practices, and inability to overcome the challenge of developing a viable missile guidance mechanism. Egypt's defeat in the Six Day War terminated its indigenous missile project; in the years following this war, Egypt sought and received battlefield support rockets from the Soviet Union. On the eve of the 1973 war with Israel, Cairo finally received what it had long requested from its Soviet patron: the Scud short-range ballistic missile. Although Egyptian rockets and missiles could not stave off military defeat in the 1973 war, Cairo remained convinced of the utility of ballistic missiles and later pursued Scud reverse-engineering projects with North Korea. The chapter concludes with an analysis of the reasons behind Egypt's failure to produce missiles indigenously, the value of coercion and incentives as counter-proliferation tools, and Cairo's persistence in trying to acquire a viable long-range ballistic missile capability.

The seventh chapter links the past with the present. Not entirely satisfied with its missile reengineering project with North Korea, Egypt approached Argentina and Iraq to work on a two-stage ballistic missile called Condor II. At the same time that the Condor II project got under-

way, the United States and key allies were taking their first steps toward establishing a missile technology suppliers group called the Missile Technology Control Regime (MTCR). The United States made the Condor II a focus of its efforts to stem the proliferation of ballistic missiles and weapons of mass destruction in the late 1980s. Under what must have been significant US diplomatic pressure, Cairo eventually assured Washington that it had terminated its involvement in the Condor II; however, work continued on this weapon throughout the 1990s. Missiles once again entered into the dialogue between Egypt and the United States when Cairo acquired the 1,300-kilometer No Dong medium-range ballistic missile from North Korea. The chapter concludes with an assessment of the value of multilateral and bilateral diplomacy in terminating a missile program. It also examines the costs of a modern missile program, the links between missile payload, costs, and weapons of mass destruction, and Condor's heavy reliance on US-only technologies like carbon-carbon and specialized steel.

The eighth and last chapter examines the Egyptian missile program from the broader perspective of fifty years of history. Egypt's experiences with rocketry, coupled with those of other countries' missile projects, are used to deduce the following lessons for global proliferation:

Lesson #1: States acquire ballistic missiles for political as well as military reasons.
Lesson #2: There is a link between ballistic missiles and weapons of mass destruction.
Lesson #3: Missile experts are often overlooked in evaluating a missile program.
Lesson #4: It is difficult to control the activities of missile scientists.
Lesson #5: Incentives can delay or cripple a missile program.
Lesson #6: Coercion can work when linked with other counter-proliferation strategies.
Lesson #7: Treaties are one of the best means to control ballistic missile proliferation.
Lesson #8: Bilateral US diplomacy is perhaps the best tool to counter missile proliferation.
Lesson #9: Selective controls may be a viable alternative.
Lesson #10: Indigenous development is the most challenging option facing a proliferator.

Literature and limitations

Counter-proliferation analyst Joseph Bermudez argues that although Egypt became the first-developing world country to produce ballistic missiles, "less is known about Egypt's program than any other country in the Middle East."[13] Indeed, the paucity of documents on the various Egyptian

ballistic missile projects has been a major hurdle in writing this book. Very little information is available about the CERVA rocket effort except for scattered references in Israeli intelligence sources. As for Nasser's indigenous ballistic missile program, US intelligence and national security documents present a valuable and previously unexploited source of information on the Al Zafir, Al Kahir, and Al Ared missiles. Still, there is little or no data on the German scientists who helped develop these missiles, and we can only guess what ultimately caused the missiles to fail. As for Egypt's later efforts to acquire ballistic missiles, we know very little about Cairo's cooperation with Pyongyang to reverse-engineer the Scud. Even with the ground-breaking work by Alan Friedman, Kenneth Timmerman, and others on Condor II, the network supporting this missile in the 1980s and the ties between its sponsors are still a closed book. It is difficult to ascertain to what extent US diplomacy influenced the decisions of Argentina and Egypt to suspend work on this program. The secrecy surrounding Egyptian missiles persists to this day: few reports are available regarding Cairo's probable procurement of the No Dong. We do not know if Egypt has ever flight-tested its Scud C, Vector, or No Dong missiles, but one thing is evident, even with the heavy veils of government secrecy: Egypt will continue to devote significant human and financial resources to acquiring or developing ballistic missiles with ever greater ranges and accuracies.

A key limitation of this book is the author's lack of access to Arabic-language sources. The Egyptian press is subject to government controls and its journalists have little incentive to unearth the embarrassing details of failed missile projects. Still, future analysis of the Egyptian missile program will benefit greatly from consulting Egyptian newspaper accounts, particularly those from the Nasser period when the program was a showcase of the government's capabilities. Arabic-language sources could shed valuable new light on the domestic support behind Egyptian ballistic missiles. This is particularly true of the indigenous effort, where Nasser and his colleagues made much of their achievements in this field.

Similarly, additional research into Israeli sources would unearth new details on the Isser Harel "scientist scare" of the early 1960s; Israeli information might address gaps in our understanding of how that country spied on and attempted to neutralize the missile threat. Finally, the history of the Israeli ballistic missile program awaits the intrepid researcher. We have only some intriguing comments by Ezer Weizmann to indicate that Nasser's flight tests of the Al Zafir and Al Kahir missiles inspired Jerusalem to seek its own ballistic missiles from France. What we lack is a better understanding of how Israel's and Egypt's missile programs played off each other over the course of forty years of war and peace in the Middle East.

A note on definitions

According to W. Seth Carus, a ballistic missile is "an unmanned rocket-powered weapon. It is powered during the initial launch stages, but not during the descent. As a result, it follows a curved, or ballistic, trajectory once gravity takes over."[14] This definition fits virtually all the missile and rocket systems in this study; therefore, the terms "rocket" and "missile" are used interchangeably throughout this book, although some might quibble that missiles differ from rockets because they are guided.

1 Genesis

Like many countries interested in acquiring ballistic missiles, Egypt began with an artillery rocket program. Given its paucity of scientific and technical talent, Cairo turned to German scientists steeped in the knowledge gained from World War II missile programs to develop this rocket. Although it showed some initial promise as a weapon, the CERVA rocket was doomed by bureaucratic ineptitude, the 1956 Suez War, and Egyptian impatience with the limited strategic applications of an artillery rocket. After it disbanded CERVA, Egypt turned to the Soviet Union for rockets and possibly ballistic missiles. Rebuffed by Moscow, Cairo once again examined the possibility of indigenously producing ballistic missiles with the help of German scientists. In the Stuttgart Institute for the Physics of Jet Propulsion, Egyptian recruiters found all the requisite talents for their missile program.

We do not know when Egyptian President Gamal Abdel Nasser decided to pursue an indigenous ballistic missile capability, nor do we know what specific event prompted that decision. But we can make a safe guess that the 1956 Suez War likely triggered Egypt's interest in long-range rocketry even though the sources on Egyptian decision-making during this period are scarce. Egypt's interest in artillery rockets and possibly ballistic missiles almost certainly predated Nasser and his 1952 Egyptian revolution.[1] The origins of Egyptian rocketry date back to the aftermath of the first Arab–Israeli war of 1948–1949, when Egypt's royalist government examined tactical rockets to offset Israel's military prowess. The performance of the Egyptian armed forces in this war had been tarnished by allegations of corruption, indolence, and incompetence.[2] One consequence of Egypt's poor showing on the battlefield was a crash program in improving the operational and tactical capabilities of the armed forces.[3] Stymied by the US–United Kingdom–France Tripartite Declaration of 1950, which embargoed arms to the Middle East, Egypt's King Farouk turned to another source that was only too willing to help Cairo reconstitute its shattered military capabilities: West Germany. Soon Bonn's Economics Ministry authorized the departure of seventy-one military and naval experts

who arrived in Cairo in January 1951 to train the Egyptian army and navy in armored warfare, explosive ordnance disposal, naval gunnery, and commando tactics. Among those tasked with training the Egyptian military under Farouk and his successors were General Wilhelm Fahrmbacher, Captain Theodor von Bechtoldsheim, Major General Oskar Munzel, and Gerhard Mertens.

Fahrmbacher was the chief adviser to the Egyptian army. Born in 1888, he had extensive experience leading men in battle: not only had he fought in World War I, he also served in the interwar *Reichswehr* and commanded army groups in World War II. At war's end, Fahrmbacher was imprisoned by the French until 1950 when, after his release, he accepted the job of rejuvenating the Egyptian army.[4] Von Bechtoldsheim was tasked with reviving the fortunes of the Egyptian navy, while Munzel, a veteran Panzer commander, helped develop the new Egyptian armored formations. For his part, Gerhard Mertens was the architect of Egypt's new parachute unit.[5]

Although the Egyptian assignment may have been financially rewarding to these officers, differences with their client quickly clouded the arrangement. According to one account, Munzel and von Bechtoldsheim frequently expressed their frustration with their Egyptian colleagues; Munzel eventually quit in disgust.[6]

At the same time that the military experts arrived in Egypt, another West German team was helping develop an Egyptian arms industry. Spearheading this effort was the former general manager of the Skoda arms production works and the Hermann Goering Steel Mills, Dr Wilhelm Voss. Dubbed by one source the "uncrowned ambassador" in Cairo, Voss became influential in Egyptian government circles.[7] Not only was he entrusted with developing Egypt's military industrial complex, Voss also had the mission of creating a "small caliber rocket" for the Egyptian army. Since Voss had no practical experience in rocketry, he turned to another German known to us today only as Herr Fuellner to recruit several German rocket scientists for the effort.[8]

The historical record is sparse on this period in Egypt's rocketry program. According to one source, Fuellner's team made some initial progress; however, by early 1952, the Egyptian government was beginning to express interest in a longer-range missile.[9] A ballistic missile proved too ambitious for Fuellner, whose rocket project soon foundered over a lack of specialized steel, propellant ingredients, and fuses. A test flight of the new rocket in 1952 failed to impress Fuellner's Egyptian customers, who demanded that the entire program be placed under state control. Fuellner rejected this proposal and, as a consequence, was forced to leave the country along with some of his rocketry experts.[10]

Following Fuellner's departure, a new company, known by its French acronym CERVA – for Compagnie des Engins à Réaction pour Vol Accéléré (Jet Engines for Accelerated Flight Company) – was set up as a

joint military–civilian firm with research and development facilities reportedly located at the al-Mazah airfield, outside Cairo.[11] CERVA had a board of directors headed by another elusive figure, the Count de Lavison.

Even as CERVA began its work, events in Egypt's domestic political arena took a dramatic turn. On the night of 22–23 July 1952, the Committee of Free Officers, a group of junior army and air force officers, seized power in a relatively bloodless coup. Stranded in his Alexandria palace, King Farouk was forced into exile in Italy, taking with him whatever he could store on his yacht.

The new junta, which styled itself the Revolutionary Command Council (RCC), soon got down to the difficult business of governing Egypt. Although General Mohammed Naguib was the nominal ruler of the new Egypt, real power was wielded behind the scenes by men junior to Naguib in rank. Indeed, the motive force behind the coup was a young army officer by the name of Gamal Abdel Nasser. Among Nasser's closest followers in the Committee of Free Officers were names later to be made famous in Egyptian history: Abdel Hakim Amer, Nasser's closest associate, and Anwar Sadat. Significant for the rocket program and Egyptian national security policies, the formative experiences of many Free Officers were forged in the disastrous war with Israel. This shaped their thinking with regard to military modernization and the need to handle the Israeli threat.

In its first years in power, the RCC embarked on a radical reform plan which included extensive land reform, the reorganization (and eventual banning) of Egypt's political parties, and purges of the civil service. On 18 June 1953, the RCC ended the fiction of the regency by declaring Egypt a republic. Thus, by a stroke of a pen, Egypt's tradition of monarchy, which extended back to Pharaonic times, was finally laid to rest.

Egypt's new government had ambitious plans for the armed forces as well. Nasser and his cohort made much of the corruption and bureaucratic incompetence that had plagued their country's war effort against Israel. Not only did they force some 450 officers to retire, but, with an eye to a key constituency, they raised military salaries, improved military health care, and issued new uniforms to the rank and file. Compulsory service was introduced as the regime sought to militarize society. In addition to these personnel policies, the junta placed special emphasis on accelerating Farouk's military industrialization program and carrying out his military modernization plans. A new ammunition factory was built, as well as Gomhuriya (Republic) training aircraft. New quays were built for the navy, even though that service's loyalties during the coup were suspect to the plotters.[12]

In addition to retaining many of Farouk's ex-*Wehrmacht* advisers, Nasser also approached the head of West German intelligence, Reinhard Gehlen, to help organize and train the Egyptian security services.[13]

According to one Gehlen biographer, the German intelligence chief could not spare of any of his own officers, so he recruited Otto Skorzeny to accept the mission in Egypt. Skorzeny, a Hitler favorite who spirited Benito Mussolini out of captivity, was then living in Spain, where he had successful business interests. Skorzeny assisted Nasser for about a year, and upon his departure from Cairo, left the Egyptian security and intelligence services in the care of some former SS and Gestapo men.[14] The West German-trained Egyptian intelligence services later had a few successes against the main enemy in Israel; they also fomented disturbances in several Arab countries, including Jordan and Iraq.[15]

The RCC carried out Farouk's military industrialization plans as well. Dr Wilhelm Voss, the mastermind behind Egypt's drive for indigenous arms production, was appointed by General Naguib as the director of the Central Planning Board and primary consultant to the War Ministry. Egypt's new rulers also provided new impetus to the rocketry program with the assignment of Rolf Engel to head up the CERVA team.[16]

Born in 1912, Engel was an early enthusiast in the field of rocketry and spaceflight. In 1928 he attended a meeting of the German Society for Space Travel (*Verein Für Raumschiffahrt*) in Berlin where he met the future star of German and American rocketry, Wernher von Braun. A year later found Engel involved in the Rocketport (*Raketenflugplatz*) Berlin, which experimented with small rockets. While von Braun was lured away by a contract to work on ballistic missiles for the German army, Engel pursued amateur rocketry until April 1933, when he was arrested for corresponding with French and American rocketry experts. After his release from prison that same year, Engel continued to associate with amateur rocketry groups. Even so, as the German army extended its monopoly of rocket research, Engel was effectively frozen out of his abiding passion. From 1935 to 1942, he was an active participant in Nazi student groups and the SS. In late 1942, Engel was disciplined by his superiors for lying about his academic credentials (he took to calling himself Dr Engel, even though he had, as Michael Neufeld points out, only three semesters of junior college education). Sent to Danzig, Engel decided to resurrect his rocketry career by specializing in solid-propellant rockets. By spring 1943, not only had he established himself as an SS rocket expert with his own firm, he worked on a variety of SS rocket projects, including 8-centimeter-diameter solid-propellant, fin-stabilized rockets, larger, 15-centimeter solid-propellant rockets and an anti-aircraft rocket. In August 1944, Engel became head of the test division in Pibrans, Czechoslovakia of the Waffen-Union Skoda-Brunn, an SS-influenced firm with responsibilities for arms production, owned by the Third Reich. It was here that he probably met Wilhelm Voss.[17] At the end of World War II, Engel was hired by the French Office National d'Études et de Recherches Aéronautiques to direct a team working on the Véronique rocket.[18]

Assisting Engel was a German electronics expert named Dr Paul

Goercke, who, in addition to his CERVA work, helped the Egyptian air force to develop a nationwide radar network.[19] Together, Engel, Goercke, and several others tinkered on a 1.5-meter rocket that most likely was built around a solid-propellants motor. Several flight tests were conducted, but technical difficulties and supply problems similar to those that afflicted Herr Fuellner's efforts hindered further progress. Nonetheless, the Egyptian government was steadily developing the infrastructure to support CERVA's efforts, including the Sakr factory to house the CERVA team and the Egyptian Astronautical Society, founded on 8 September 1953.[20]

CERVA's attempt to create a battlefield rocket for the Egyptian army did not go unnoticed outside of the country. Having fought a war with Egypt in 1948, the new state of Israel was very interested in Farouk's and Nasser's militaries and, in the late 1940s, Israel's intelligence services established an underground network in Egypt both to encourage Jews to emigrate to Israel and to develop fifth-column capabilities should a conflict arise again. Implementing some of these efforts was Unit 131 of the Intelligence Department of the Israeli Defense Forces General Staff.[21] According to historian Samuel Katz, Unit 131's mission was to execute covert missions against Israel's neighbors:

> Unit 131's operatives were to be sleeper agents according to the classic definition; they were to act as a base, a friendly bastion in enemy territory, to assist other agents who were to be dispatched into the target nation. The intelligence they gathered was to be of a passive nature, and they were not – under any circumstances – to risk their cover in order to obtain information.[22]

In the early 1950s, the head of Unit 131 was Lt Col Motke Ben-Tsur, a veteran of Israel's pre-independence, underground army, the *Haganah*, and a company commander during the 1948 war for independence. As Ben-Tsur's officers analyzed the Egyptian problem in 1951–1952, they decided to infiltrate Cairo's growing German community with a 26-year-old Austrian Jew named Avri El-Ad.

On paper, most of El-Ad's credentials looked solid. Born in Vienna as Avraham Seidenwerg (he changed his name upon reaching Palestine), El-Ad witnessed the 1938 *Anschluss* with Nazi Germany from the Hofburg Palace. At the age of 13, he immigrated to Palestine, leaving his mother behind to perish in Hitler's death camps. In 1939, El-Ad took the oath of the *Haganah*, and in 1942 he joined the *Palmach*, an elite Jewish force created in cooperation with the British Special Operations Executive. Trained in commando tactics and intelligence collection, El-Ad was a member of the *Palmach*'s German platoon, a unit whose mission was to collect intelligence and create disorder behind enemy lines. During Israel's

war for independence, El-Ad protected critical convoys bound for besieged Jerusalem.[23]

Up until this point, El-Ad's résumé seemed promising; however, there was a blemish on his record: the theft of a refrigerator, which resulted in his demotion from major to private.[24] At the time he was recruited by Ben-Tsur, El-Ad was unemployed, depressed, and newly divorced. Still, the problem of theft aside, El-Ad seemed to hold promise as an intelligence officer, and he was eventually hired by Ben-Tsur for the Egyptian job. In preparing for his mission, El-Ad was trained in building and operating transmitters, cryptology, martial arts, explosives, small arms, and concealment. He also developed the cover of a former SS officer named Paul Frank. In March 1953, Avri El-Ad/Paul Frank was sent to West Germany to establish his bona fides and to seek employment with German firms interested in pursuing business opportunities in the Arab Middle East.[25]

After a suitable interval in West Germany, Paul Frank received his orders from Unit 131: enter Egypt, establish a base as a businessman, create an infiltration network for other spies, and set up a sleeper network. Although he does not mention it in his memoirs, El-Ad's later actions indicate he was also ordered to collect intelligence on the German military advisers and rocket experts.[26]

Shortly after his arrival in Cairo, Paul Frank established ties with Germans associated with Egypt's military training and industrial programs, including Baron Theodor von Bechtoldsheim, the former German navy captain who was advising the Egyptian navy. Frank also met Dr Count Willi von Kubie, a young scientist with degrees in chemistry and nuclear physics. Significantly, von Kubie was an employee with Rolf Engel's CERVA, and it was from von Kubie that Frank learned that CERVA was starved for critical materials. Von Kubie introduced Frank to a key CERVA engineer named Kurt Hainisch, who, during a meeting at Cairo's Nile-side Semiramis Hotel, revealed that CERVA needed specialty steels (presumably for rocket airframes and warheads). Frank promised to assist CERVA with his German industrial contacts; this intelligence was quickly relayed back to Tel Aviv.[27]

In February 1954, Frank returned to Europe with the goal of lining up investors for a Suez-to-Cairo oil pipeline. He carried Hainisch's CERVA wish list, which included rocket fuses and a mechanism for "exploding" rocket warheads, and arranged to buy surplus German arms for the Egyptian military.[28]

When Frank returned to Egypt a few weeks later, he continued his friendship with von Kubie. Indeed, the German scientist became Israel's most important source of information on the CERVA rocket. As CERVA's official photographer (a surprising occupation given his scientific credentials), von Kubie was able to provide Frank with pictures of the rocket, which he said had a range of several miles. So effective was von Kubie's information that Unit 131 made CERVA a "number one" priority

in 1954. Fortunately for Israeli intelligence, von Kubie was beset by financial problems: he was eager to sell pictures of CERVA rocket blueprints to a German or Austrian firm despite Frank's advice to avoid selling CERVA secrets. As El-Ad narrates in his memoirs: "[D]espite my eagerness, I delayed. The material was dynamite. Once I would have taken a risk to acquire it, but now that I was sure I had it, Willi could wait."[29]

Baron von Bechtoldsheim introduced Paul Frank to Engel, who at this time lived in a heavily guarded villa in Heliopolis. During their first meeting, Frank gleaned several important details about Egypt's rocketry efforts: Engel was struggling to maintain CERVA's independence from government bureaucrats; the program apparently had progressed beyond research and development, since Engel requested Frank's help in procuring machine tools for mass production; Engel mistrusted his staff, including Hainisch; and Engel's most significant challenge was obtaining rocket propellants. Later, Engel took Frank on a tour of his rocket factory, and attempted to recruit the spy for work on his rocket project.[30]

Frank was busy on other fronts as well. He exploited a budding friendship with General Fahrmbacher to learn more about Egypt's plans for expanding its army. In spring 1954, Frank accompanied the German general on a tour of Egypt's Sinai defenses. According to El-Ad's account, Fahrmbacher showed him a sensitive map of Egyptian military positions and argued that the Egyptians were not prepared for war with Israel. Prophetically, Fahrmbacher reiterated his belief that Egypt needed to hold the strategic Mitla Pass against any attack from the east.[31]

That May, Frank received an urgent call from his Unit 131 handlers to proceed to Paris. Before his departure, Frank attempted to close out negotiations with Engel for some $240,000 worth of machine tools. It was during this meeting that Engel mentioned that CERVA's chairman, Count de Lavison, was not only Jewish but sabotaging the CERVA rocket for "Jewish interests." He asked Frank to research de Lavison's background, hinting that this could be useful in jeopardizing the Count's relations with his Egyptian employers. Frank promised to look into the matter. Still, CERVA's internal squabbles aside, Frank believed "the Egyptians had a tactical rocket; a guided missile would come next."[32] As he waited to board his ship in Alexandria, Frank was greeted by von Kubie, who transferred the CERVA rocket blueprints on microfilm.[33]

When his cruise ship reached Italy, Frank was met by an Israeli official who did not wait to emphasize Israel's increasing concern with Egypt's rocket program. Frank also learned the Mossad had obtained the blueprints of the CERVA rocket plant in Heliopolis. Later, in Paris, Frank had a critical meeting with Unit 131 commander, Lt Col Ben-Tsur, who informed his spy that Israel was very concerned about the prospects of a British military withdrawal from the Suez Canal. For Israel, the British served a very useful purpose, acting as a buffer between Israel and the Egyptian army. Moreover, by occupying the strategic Canal Zone, the

British also ensured that the waterway was available for Israeli shipping. Ben-Tsur reiterated that the British must be given the excuse to retain control of the Suez Canal. To that end, he ordered Frank to bomb British, US, and Egyptian targets in Egypt to undermine British and American confidence in Egyptian stability. From Jerusalem's perspective, such unrest might be enough to persuade London that a continued military presence in the Suez Canal Zone was a necessity. Foreshadowing a future Israeli strategy, Ben-Tsur added that the network might be ordered to assassinate some key German and Egyptian officials, including Nasser, Fahrmbacher, and von Bechtoldsheim.[34] Interestingly, Engel was not on this list.

Upon his return to Egypt, Frank subordinated his intelligence work to activating a sleeper network of young Egyptian Jews, who carried out the bomb attacks. As the bombing campaign began, Frank quickly learned that one of the key problems facing the conspiracy was a lack of explosives, and to solve this problem, Frank took the ridiculous expedient of raiding a CERVA bunker. Late one night, Israel's most valuable spy in Egypt was reduced to breaking into a rocket bunker and stealing explosives for a sabotage mission.[35] It was in this slipshod manner that Israel's ill-omened Operation Susannah began to unravel. Indeed, crucial tradecraft mistakes by Frank led Egyptian intelligence to the network. While Frank escaped Egypt, his colleagues were either executed or sentenced to jail terms that did not end until 1968.[36]

The fallout from Operation Susannah ricocheted throughout the corridors of power in Jerusalem and forced the resignation of Defense Minister Pinhas Lavon. In later years, as he attempted to clear his name, Lavon was to argue that he did not authorize the sabotage mission in Egypt and that he was the victim of a cover-up. For his part, El-Ad tells us in his memoirs that he participated in the cover-up to shield his boss, Colonel Binyamin Gibli, and Moshe Dayan as well. El-Ad believes his later imprisonment in Israel for "security reasons" was motivated in part by the need to enforce his silence on a scandal that was to be known to posterity as the Lavon Affair.[37]

What is more important for this story is that Israel burned a very valuable source of intelligence on the nascent Egyptian missile program for a questionable political expedient. One is left to ponder how Israeli intelligence might have better accomplished its goals in Egypt if it had simply left El-Ad/Frank to continue spying on the German community there. Then again, given Frank's lapses in elementary tradecraft (he visited his agents in their homes, among other errors), he probably would have run foul of Egyptian security sooner rather than later. Moreover, as Katz makes clear, Unit 131's mission was to develop sleeper networks; intelligence collection was a secondary priority.[38]

The sources are scarce on the slow death of the CERVA rocket. Some assert that Nasser lost interest in the project and allowed it to lapse. As for

the main actors in CERVA, the record is notable for its gaps. For example, we have no information on Count de Lavison, while Rolf Engel seems to fade from the history with little effect. Although he reportedly remained in Egypt until 1957, Engel did not play a known role in Egypt's later efforts to acquire ballistic missiles, although he may have introduced the Egyptians to his old friends at the Stuttgart Institute.[39] Engel reappeared in Italy and West Germany before retiring in 1971–1972 as the head of the space division of Messerschmitt Bölkow Blohm (MBB).[40] Dr Goercke departed Egypt in 1954, followed by Voss in 1956. Significantly, and with the tantalizing details of a machine tool deal aside, we have little evidence to support El-Ad's assertion in his memoir that Egypt had developed an artillery rocket. This weapon certainly never reached any battlefield. More plausibly, at least one source believes that the Egyptian government began to express greater interest in ballistic missiles and was willing to terminate the rocket project for that more ambitious goal. In any case, the story of CERVA's failure was not a promising start to Egypt's rocket ambitions.[41]

While CERVA declined, Egypt was headed toward more turbulent waters. Indeed, 1956 proved to be a fateful year for Nasser. On 16 May, he recognized Communist China, thereby irking a United States already angry over Egypt's 1955 purchase of arms from Czechoslovakia. On 19 July, Washington rescinded its offer to help fund Nasser's dream: the construction of a second dam at Aswan. A few days after that, Nasser nationalized the Suez Canal, declaring that Canal revenues would be used to fund the dam. This action drew the firm opposition of Britain and France, which held key interests in the suddenly disenfranchised Suez Canal Company. While they attempted to negotiate with Egypt, both countries also plotted with Israel for a more violent solution to the impasse.

On 29 October, Israeli armies invaded the Sinai. This triggered an ultimatum by France and the United Kingdom to both parties to refrain from hostilities. When that ultimatum ran out, British and French forces landed at Port Said and conducted aerial bombardments of Egyptian airfields and other targets. When the United Nations Security Council finally imposed a ceasefire on 7 November, Israel occupied virtually the entire Sinai Peninsula, while British and French troops controlled the northern exit of the Suez Canal. Outclassed on the ground, at sea, and in the air, Egypt's military was rendered incapable of defending the country. Indeed, at the cessation of hostilities, mediated in large part by the United States, Cairo had lost numerous aircraft both on the ground and in the air, while its army had been decisively routed. There are no reports of Egyptian rockets playing any role in this war.[42]

Explicit international pressure – notably that of the United States and the Soviet Union – forced Britain and France to withdraw their forces from the Canal Zone. Although his military had suffered reverses on the

battlefield, Nasser made much of his "victory" over Britain, France, and Israel. In a series of speeches, he proclaimed before the Arab street that he had "shattered" the French and British empires and "forced" the Israelis to relinquish Sinai. Nasser's stock soared in the Arab world after Suez: his credentials as a pan-Arab leader and key figure in the Nonaligned Movement were considerably enhanced following the withdrawal of his enemies from Egypt.[43]

While the realities of Nasser's political victory over the Tripartite Alliance were clear, the dismal performance of Egyptian arms once again forced another rethink of Egyptian military strategy, doctrine, tactics, and technology. Clearly, Fahrmbacher, Munzel, and the other German advisers had failed to bring about a substantial improvement in the quality of Egyptian fighting units. The air force was particularly deficient, although the army had a poor showing against the Israelis as well. The salient features of Egypt's new strategy review rested on several assumptions, including continued confrontation with Israel, the need to deter Israeli and possibly Western aggression, and a dedicated effort to enhance Cairo's leadership position in the Arab world. Having established the broad direction of his policy toward Israel, Nasser then directed his military leaders to produce a coherent plan that would guide Egypt's future arms procurement, doctrine, and training requirements. Part of that procurement plan was based on the important assumption that the Soviet Union and its Eastern Bloc allies would supply new weapons and military technology. As Nasser was to concede several years later, this was the first serious examination of Cairo's military strategy and policy since the Free Officers overthrew King Farouk in 1952.[44]

Despite the Egyptian air force's (EAF's) dismal showing in 1956, air power played a vital role in Nasser's plan of continued confrontation with Israel. Cairo sought Soviet Il-28/Beagle light bombers and Tu-16/Badger medium bombers both to threaten Israeli cities and deter future attacks on Egypt.[45] But these bombers must have represented only one factor in Nasser's determination to confront and deter the Jewish state. Although the EAF absorbed large numbers of Il-28s to replace those lost in combat, manned bombers were clearly going to be a diminishing asset against Israel's skilled fighter pilots and growing fleet of French-built air interceptors. As both Cairo and Jerusalem ratcheted up their arms race, the struggle for air supremacy became a predominant theme, where MiG was matched against Mystère, and the ability of Egyptian bombers to penetrate Israeli airspace was increasingly in doubt.[46] Clearly, something other than bombers was necessary if Egypt was to retain a capability to penetrate Israeli airspace and strike Israeli cities. It was probably in this context that the idea of an Egyptian ballistic missile program was born.

Nasser and his generals wanted something more than an artillery rocket. Indeed, they sought a ballistic missile that would give them an assured capability to strike at Israel and boost Egypt's leadership creden-

tials in the Arab world and the emerging Nonaligned Movement. From Nasser's perspective, missiles had a domestic appeal as well, for here was a tangible sign of the progress of the revolution, a proof that even a downtrodden, underdeveloped land of peasants could possess the ultimate credential of the space age: the ballistic missile. Thus, it was probably a combination of factors – domestic, foreign, and post-1956 security needs – that propelled Cairo toward acquiring ballistic missiles. The need for domestic acclaim and the aspirations to lead the Arabs probably spurred Egypt's interest in developing and producing an indigenous jet fighter as well.

Yet the painful military and economic consequences of the Suez War stood between Nasser and a ballistic missile. In the immediate aftermath of that conflict, the Egyptian budget was devoted to repairing war damage and reconstituting the nation's armed forces. These budgetary pressures helped convince Cairo to abandon the tactical rocket program and to send the German scientists home.[47] So far, the cheaper option seemed to be acquiring those long-range rockets outright rather than developing them indigenously and it may have been with this understanding in mind that the Egyptians began to shop around.

According to a 1963 US Intelligence Community Estimate, Egypt demonstrated "intense interest" in guided missiles during the late 1950s and early 1960s and had approached "most of the missile producing nations of the world."[48] Although, the term "guided missile" included surface-to-surface missiles (SSM) and surface-to-air missiles (SAM), it is clear from the context of this Estimate that SSMs were the key element of Egypt's acquisition efforts. The Estimate did not detail the countries approached or the weapons desired; however, in a 1964 report on the Japanese missile program, the US Central Intelligence Agency (CIA) noted Egyptian interest in acquiring unspecified Japanese missiles.[49] Other sources reported Egyptian inquiries into Soviet battlefield rockets during this time.[50]

Since the Soviet Union was Egypt's primary source of arms, Nasser and his generals predictably turned to Moscow for battlefield rockets and possibly ballistic missiles. Mohammed Hassanein Heikal, close confidant of Nasser and former editor of the influential Egyptian newspaper *Al Ahram*, describes one Egyptian attempt to acquire missiles in his book, *The Cairo Documents.* In this book, Heikal reproduces correspondence between Nasser and Soviet leader Nikita Khrushchev that touched on long-range rockets, among other things. In an April 1959 letter to Nasser, Khrushchev attempted to clarify a misunderstanding that apparently arose during a meeting the previous July:

> Probably, Mr President, you will also remember well that when you approached me with the proposal that we supply you with medium-

> range bombers and intermediate-range rockets, I remarked that the territory of your country was so small that you would find it difficult to use these weapons.[51]

The Soviet leader noted that during this meeting, he had asked for Nasser's definition of "intermediate-range rocket" to which the Egyptian replied fifty to seventy kilometers. The Soviet leader then noted that *his* intermediate-range rockets could travel some 4,000 kilometers. Egypt could appeal to the Soviets, Khrushchev added, if it ever needed these long-range weapons for its security. This comment probably did not please the touchy and sovereignty-conscious Egyptians. Yet the Soviet leader only added salt to the wounds when he noted that Moscow's grounds for refusing to transfer these weapons to Cairo hinged on a Soviet fear that Egyptian "excitement" at possessing rockets could result in "undesirable actions," including war.[52] Stung by Khrushchev's patronizing tone, Nasser fired off a rebuttal, stating that he had requested "rockets" with a range of some 50–70 kilometers, not medium-range "missiles." He suggested that an error in translation accounted for the misunderstanding.[53]

This curious exchange raises more questions than it answers. Why did Khrushchev raise the issue of his new long-range missiles if Nasser had not asked for them in the first place? Further, why would the Egyptians request "rockets" with a 50–70 kilometer range when such weapons did not exist in the Soviet inventory at that time? The standard BM-21 artillery rocket had a range of 20–22 kilometers while the Frog-1 battlefield rocket had an estimated range of only 32 kilometers. Nasser may have been putting out feelers for the SS-1A/Scud with a range of 80–150 kilometers. This system, the progenitor of the notorious Scud Bs that fill many arsenals today, was first seen in a 1957 Moscow military parade and may have attracted Egyptian interest.[54]

Egypt's attempt to acquire Soviet rockets had reached a dead end. As Khrushchev had put it so eloquently, the Soviets were not interested in transferring rockets that would tempt Egypt to escalate regional tensions with Israel. Moscow's refusal to release even battlefield rockets like the Frog highlighted Cairo's dilemma in obtaining these weapons. Thwarted by foreign powers reluctant to sell their rockets, Egypt had few alternatives but again to explore the possibility of designing and producing its own ballistic missiles.

When it returned to the path of indigenous rocket development, Cairo probably did so with several important lessons from the CERVA effort firmly in mind. While Egypt desperately needed foreign expertise to guide its research and development, German rocket scientists like Engel and Goercke would not be enough for the new program. As CERVA's severe growing pains revealed, Cairo needed a physical infrastructure such as test stands, laboratories, chemical mixers, and specialized machine tools to

build even the simplest rocket designs. Furthermore, scientists and infrastructure were expensive acquisitions, an important consideration for a cash-strapped government with grandiose ambitions to dam the Nile, electrify its villages, nationalize the land, and sustain an arms race with Israel. The years that had elapsed since Rolf Engel was recruited to head up CERVA had not significantly altered Egypt's slim prospects for producing rockets. The fundamental shortage of scientists and skilled technicians persisted. Only the most rudimentary infrastructure had been established in Heliopolis to support rocket research, and much of the equipment had lain dormant. If Egypt was going to be successful in fulfilling its missile ambitions, it would have to recruit foreign scientists, train Egyptians in rocketry, and acquire the means to research, develop, test, and eventually produce missiles.

Some time in late 1958 or early 1959, the Egyptian government implemented the key policy decisions that funded and executed the ballistic missile program. A Bureau of Special Military Programs was established under the aegis of Nasser's closest confidant, Abdel Hakim Amer, to exercise oversight for the rocketry and indigenous jet trainer and fighter projects. All of these ambitious efforts relied heavily on West German and Austrian technical assistance.[55]

West Germany proved fertile ground for Egyptian recruiters, for the late 1950s was a period of extended unemployment for missile experts throughout western Europe. The great surge in postwar rocket development – fueled largely by German scientists captured after World War II – had entered a lull. France, an early recruiter of German rocketry talent, was exploring manned bombers for its future nuclear weapons delivery system, while the United Kingdom's efforts were hamstrung by tight budgets and a seeming inability to produce a delivery platform for its nuclear weapons. Many of the UK's most ambitious postwar missile projects, like the *Blue Streak*, never left the research and development phase.[56] West Germany was still hobbled by the restrictions imposed on its aviation and rocket research after the war: Bonn did not have an organized space program until 1962 and lagged behind its British and French partners in space vehicle research and development.[57] West Germany was also home to unemployed scientists who had recently been discarded after the Soviets and French had exhausted their knowledge of rocketry and aviation. In short, West Germany was a buyer's market for would-be rocket enthusiasts like the Egyptians, who took prompt advantage of the opportunities that lay before them.[58]

One Egyptian recruiting team was based in the military attaché's office in Bern, Switzerland and led by a Swiss–Egyptian engineer, arms merchant, and Nasser crony named Hassan Sayed Kamil. Kamil established two front companies in Zurich that were to act as brokers for Cairo's urgent aviation and rocket *matériel* requirements such as specialized steels, electronic components for guidance, propellant mixtures, and laboratory

equipment.[59] He also had a hand in recruitment. It was Kamil's office that placed ads in several West German and Austrian newspapers, the substance of which read: "Aviation works in North Africa seeks specialists of all types."[60] Responses to these advertisements were sent to a Zurich post box handled by Kamil. It was through this method that Cairo acquired the skills of the Austrian aviation engineer Ferdnand Brandner, who was to direct the jet trainer and jet fighter efforts. A recent cast-off from the Soviet Union, Brandner had extensive contacts in the German aviation engineering community that were to prove beneficial for the Egyptian rocketry effort as well. Together with Kamil, Brandner recruited technicians and engineers from Daimler Benz and the technical universities of Aachen, Munich, Berlin, Vienna, and Graz.[61]

Another Egyptian recruiting team was headed by a former air force intelligence officer named 'Isam al-Din Mahmoud Khalil. General Khalil, described by one author as a "tall, paunchy man with receding curly hair, a walrus mustache and a smile as beguiling as Nasser's," had earned his notoriety – and Nasser's trust – when he betrayed a conspiracy of royalists plotting to overthrow the Egyptian regime in 1956.[62] He also previously had recruited Germans for Engel's CERVA team, and, according to one associate, he "knew how to argue with them."[63]

It was during one of these recruiting missions in West Germany that either Kamil or General Khalil met with Dr Engineer Bruno Eckert, manager of the Jet Engines Department for Daimler Benz. In response to Egyptian queries about German rocket experts, Dr Eckert informed his visitors about several associates who worked at a jet propulsion research institute in Stuttgart. This revelation was a major development in the first Egyptian ballistic missile program.[64]

General Khalil visited the Stuttgart Institute for the Physics of Jet Propulsion in late 1959, where he discovered the future nucleus of the Egyptian missile design team: Dr Eugen Sänger (program management), Dr Wolfgang Pilz (propulsion); and Dr Paul Goercke (guidance and control). One author described the Stuttgart Institute as a "greenhouse of bitter, frustrated scientists,"[65] and there is little doubt that many of the Stuttgart researchers were disgruntled due to the West German government's lack of interest in space research and rocketry. Not surprisingly then, Khalil was successful in signing secret contracts with Sänger, Pilz, and Goercke, as well as twenty of their technicians for assistance in developing rockets for Egypt. Apparently these were part-time consulting contracts, with the Germans retaining their jobs at the Stuttgart Institute and working in Cairo while on vacation.[66] According to Sänger, the scientists' activities were covered under the rubric of space flight lectures at Cairo University:

> I was asked in the spring of 1960 by the Egyptian government to give lectures at Cairo University and help the country by doing consulting

work on meteorological sounding rockets. I was told: "the Israelis now have sounding rockets that can go up to 200 kilometers. We, too, would like sounding rockets going up more than 200 kilometers." I saw no difficulty and consulted with the Egyptians by visiting them every two months with two of my colleagues: Wolfgang Pilz and Paul Jens Goercke.[67]

Eugen Sänger

Sänger was a fortuitous find. Born in Bohemia in 1905 and trained at the Technical University of Vienna, he had conducted pioneering research in the fields of liquid-engine design, the mixing of powders with rocket fuels for improved thrust, and reusable space vehicles. Like Rolf Engel, Sänger was a member of the German Space Travel Society and a rival of Wernher von Braun; however, whereas von Braun went on to work for the German army, Sänger was employed by the German Air Ministry. In the mid-1930s, Sänger conducted feasibility studies in liquid oxygen/diesel oil engines and an exoatmospheric vehicle called Silver Bird that was theoretically capable of traveling enormous distances at hypersonic speeds.[68] With the onset of World War II, Sänger collaborated with his wife, Dr Irene Bredt, in converting the Silver Bird concept into a hypothetical long-range bomber for the Luftwaffe. Dubbed the Amerika Bomber, this system was based on a rocket-propelled sled that would boost an airframe down a three-kilometer track and into the upper atmosphere, where it would "skip" across the region between air and space before descending to drop its payload on American cities. So revolutionary were many of the theories backing Silver Bird and the Amerika Bomber that NASA considers Sänger to be the father of the reusable space vehicle, a family of platforms that includes the Space Shuttle and the X-15.[69]

At the end of World War II, Sänger and Bredt moved to Paris, where they had been recruited by the French Arsenal de l'Aéronautique as consultant engineers for a ramjet project. Later, they worked with Rolf Engel on Véronique, a test bed for early French rocket technologies.[70] Around this time, the Soviet dictator Josef Stalin had learned about the Amerika Bomber through his spies in Germany and ordered his secret police to locate and abduct the designers. Fortunately for the Sängers, the head of the NKVD kidnapping team decided to defect instead.[71]

Sänger and his wife appeared to enjoy their work in France. He turned down a proposal by the former German V-2 program manager, Walter Dornberger, to work on a rocket plane project for the Bell Aircraft Company.[72] While the French work was challenging and lucrative, especially compared to the dearth of aerospace research in postwar Germany, Sänger and his scientific colleagues were frustrated by the tumult of France's postwar political scene. According to Sänger's wife,

> the strenuous reconstruction of the French aviation industry during the first years after the war naturally allowed no scope for far-reaching and expensive projects such as an orbiting space vehicle. Besides, the frequent changes of government prior to the accession to power of General de Gaulle by no means encouraged continuity of current projects. For example, one evening we would convince Government representatives by a successful experiment of the suitability of a launching rocket with an alcohol–water mixture as fuel, only to be told next morning that a new government had again canceled all liquid rocket engines.[73]

By 1954, Véronique program funds had temporarily dried up, and many German scientists, including Sänger, found themselves unemployed. Fortunately, the Stuttgart Institute for the Physics of Jet Propulsion was established that same year and needed a director.

The West German government had founded the Stuttgart Institute to resume work on aviation research projects that had lain dormant since the end of the war. Fifteen industrial firms, including Daimler Benz, several technical universities, and the state of Baden-Württemberg joined the Federal Government in funding the Institute's aviation research.[74] While aviation was allowed, rocketry was still banned in accordance with the 1945 Allied–German Armistice Agreement, and it was this ban that frustrated Sänger the most. Although he experimented with ramjets and steam catapult propulsion systems for his Silver Bird sled, Sänger regarded his work at Stuttgart as "modest" and unsatisfying.[75] According to Dornberger, Sänger "fumbled around at the Institute with all kinds of things. But the hardware which everyone in this field is a fanatic for, he could not get in Germany."[76]

Sänger did earn some recognition for his work at Stuttgart, including the coveted Hermann Oberth medal for space research; however, his name was not tied to the dramatic new advances in rocket research then being conducted in the United States by Wernher von Braun. Author Michel Bar-Zohar cogently portrays the state of Sänger's career at this time:

> Whereas other German scientists like Werner von Braun had covered themselves with glory in the eyes of the world by launching rockets, satellites, and spaceships, Sänger had had to content himself with the directorship of the third-rate Stuttgart Institute.[77]

Given this record of frustrated ambition, Dr Sänger warmly welcomed General Khalil's offer to build rockets for Egypt. Now, at last, this venerable pioneer of German rocketry had the opportunity to design and build rocket systems of his own. Moreover, to sweeten the deal, the Egyptians had added a proposal to build a satellite as well.[78]

The Egyptian government found in Eugen Sänger a scientist with many of the requisite credentials to design ballistic missiles. Nonetheless, the mileposts in Sänger's career highlighted a weakness that either the Egyptians were oblivious to or simply chose to ignore: Eugen Sänger was a dreamer, not a doer. Dornberger described this tendency as a failure to carry out what were otherwise ground-breaking ideas:

> He always tested and tried but he never carried it through. When some mishaps happened, you know, he lost a bit of interest and went on to something else. He was very creative but he lacked the desire to see something through.[79]

Sänger was clearly going to be the guiding hand behind Egypt's missile effort. But the real work of missile design, testing, and production was going to fall on his associates: Drs Wolfgang Pilz and Paul Goercke.

Wolfgang Pilz

Whereas Eugen Sänger had earned a modest share of fame, Wolfgang Pilz was something of a nonentity. Wernher von Braun, who knew him, cruelly referred to Pilz as one of the "lesser lights" at Peenemünde, the German rocket research center which produced Hitler's V-1 and V-2 "Vengeance Weapons."[80] Others were a little more generous, at least with Pilz's appearance and personality. One writer described him as a "propulsion expert who has deep blue eyes, the wavy silver hair of a matinee idol . . . a moody Werther of the Atomic Age."[81]

Whatever his limitations, Wolfgang Pilz did possess practical experience in designing and building rocket propulsion systems, having worked on Germany's missile programs from 1943 to 1945. The record is incomplete regarding Pilz's wartime work; there is a hint that he helped develop the Waterfall (*Wasserfall*) surface-to-air missile at Peenemünde.[82] In any case, at the end of the war, he was among a group of German scientists who were transferred to the British Zone in Germany and tasked to assemble and launch a series of V-2 rockets from the North Sea port of Cuxhaven. These launches – conducted under the code name Operation Backfire – involved some 500 Germans and 1,500 British military personnel before London canceled the project at the end of 1946.[83]

Even as the British lost interest in German ballistic missiles, the French were aggressively ramping up their effort to develop and produce long-range rockets and missiles of their own. Not only did the French aggressively recruit over 100 German missile scientists, including Rolf Engel, Eugen Sänger, and Wolfgang Pilz, they also laid the foundations for missile research and development. In May 1946, Colonel Jean Jacques Barre helped establish the Laboratory for Ballistic and Aerodynamic Research (known by its French acronym LRBA) in the Normandy town of

Vernon. Presaging the Egyptian program that followed fifteen years later, Barre established two scientific and engineering teams: one researched missile guidance, while the other was responsible for propulsion. As the Franco-German teams commenced work on sounding rockets based on the V-2 design, the French government cast about for a suitable test site. Colomb-Bechar, in the heart of colonial Algeria, became the base for subsequent French missile and rocket flight tests.[84]

By 1949, LRBA's efforts produced a sounding rocket called Project 4213. Renamed Véronique (for VERnon-électrONIQUE), variants of this system formed the basis for some of France's rocket research efforts over the next twenty years. Just as with the V-2, missile guidance became a critical priority for the Véronique project and, by one account, Wolfgang Pilz played a vital role in France's earliest forays into this area.[85] It was Pilz who came up with the idea of using cables and explosive bolts to stabilize the missile early in flight. Not surprisingly, this relatively primitive guidance system was one of Pilz's key contributions to Egypt's rocketry program.[86]

Wolfgang Pilz worked on Véronique and other French projects from 1946 to 1956. Unlike the British, the French provided suitable financial and professional incentives to keep their German rocket scientists content and gainfully employed. It was during his Vernon sojourn that Pilz worked alongside Israeli scientists who had been invited to participate in French rocket research. The historical ironies in Middle East rocketry run deep.[87]

By 1957, French government interest in rocketry had diminished and greater emphasis was being placed on manned bombers to carry France's future nuclear deterrent. With some lack of foresight, one Secretary of State for Air left little doubt as to his government's intentions on the future of rocketry during a 1956 speech to the French National Assembly:

> [T]he ballistic and semi-ballistic missiles have been the subject of preliminary studies only, which have demonstrated the complex technical difficulties and the extremely high cost. These results lead us to believe that the medium- and long-range bomber will remain the most reliable retaliatory weapons for a long time to come.[88]

Probably as a result of this shift in priorities, Pilz and several other colleagues were released from Vernon, though Pilz was later to assert somewhat disingenuously that he had left France because the Normandy rains had made him "melancholy."[89] Researcher Bar-Zohar believes Pilz's exit from France was linked to a salary and housing dispute with his French employers. Apparently, Pilz felt that his skills were underappreciated by the bureaucrats in Paris.[90]

Pilz soon found a job at the Stuttgart Institute with his old friend Eugen Sänger, who put him in charge of the propulsion shop.[91] Ever the enthusiast, Pilz, like Sänger, chafed at the restrictions placed on rocket research

by the German government. In April 1960, not long after he had been hired by the Egyptians, Pilz submitted a memo to several West German federal ministries proposing a three-stage satellite launcher. Symptomatic of West Germany's anemic aerospace policies of this time, Pilz's proposal drew no response from Bonn.[92]

Paul Goercke

The third Stuttgart scientist recruited by General Khalil had earlier ties to Egypt. In fact, electronics expert Paul Goercke was hired by Rolf Engel in 1953 to assist with the CERVA project, and later stayed on in Egypt to work on radars and other assignments.[93] One writer, who met Goercke in Cairo, described him as a man with the "benign features, close-cut gray hair and square head of a physics professor."[94] According to de Gramont, Goercke worked at Peenemünde until the end of the war, when he was recruited by the French and moved to Vernon.[95]

A close collaborator with Pilz, Goercke joined the Stuttgart Institute when France suspended work on some of its rocketry programs. At Stuttgart, he directed the electronics department, where the focus was on aircraft guidance and control components. Along with Sänger and Pilz, Goercke signed a nominal contract as a lecturer at Cairo University but his real work was to design a functioning guidance package for Egypt's ballistic missiles.[96]

Besides Sänger, Pilz, and Goercke, who formed the senior triumvirate of the missile design team, Khalil also hired several other Stuttgart associates, including Hans Kleinwachter (who was involved in guidance), Walter Schuran (airframes), Manfred Heide, Peter Schutz, and others.[97]

By spring 1960, General Khalil had acquired the key players for his country's ballistic missile design team. The recruiting effort had been almost too easy: virtually all the expertise necessary to design rockets resided at Stuttgart. Furthermore, that expertise was despondent and in desperate need of a challenge. In essence, Egypt's missile needs were an excellent match for frustrated German ambitions. What remained to be seen was whether these disparate talents could successfully mesh in designing and building Nasser's long-range rocket.

Key question #1: How did Egypt's efforts to acquire rockets influence Middle East regional and international policies?

It is still too early in this history to answer the first question posed by the study. We do get a hint of the importance that Israel attached to the CERVA project when El-Ad tells us that the rocket had become a top priority for Israeli military intelligence. Still, Israel did not undertake any concrete measures against CERVA or its scientists; Engel is not among those listed as potential Israeli assassination targets when El-Ad was

ordered to implement Operation Susannah. As for the US and Great Britain, neither country showed much interest in Farouk's and Nasser's rocket program. At bottom, given their limited range and small payloads, artillery rockets tend to be ignored by those who would control missile proliferation, and Egypt's CERVA rocket was no exception to this rule.

Key question #2: What modern proliferation lessons can be derived from Egypt's experience with ballistic missile programs?

This chapter demonstrates the value inherent in incremental missile development, the crucial role of soft technology, and the critical decision facing those states that must choose between indigenous missile development and acquisition of missiles from abroad. In addition, this early stage in Egyptian rocketry highlights some of the motives underpinning missile proliferation.

Incremental development

As researcher Aaron Karp notes in his study of ballistic missile proliferation, artillery rockets are, for many countries, the first step in a ballistic missile program.[98] At first glance, Egypt fits nicely into Karp's incremental model of missile development where a country slowly acquires more advanced technologies and capabilities as it progresses from crude, unguided, short-range rockets to ballistic missiles.[99] Possessing little in the way of an aviation industry or even scientific talent, Egypt's first venture into rocketry was necessarily modest. CERVA was a good start; however, war and probable government impatience, among other things, crippled it before it could enter production. Ultimately, Egypt's failure to develop the CERVA rocket fully was to come back and haunt it as it tried to skip a step on the development ladder and proceed to a very ambitious ballistic missile program. Cairo probably could have put its resources to better use if it adopted a more gradual approach to rocketry, completing the CERVA project and perhaps tinkering with sounding rockets before proceeding to the much more challenging ballistic missile effort.

There are several examples today of missile powers who pursued an incremental development strategy in their rocketry programs. France is probably the best example of a country that developed its expertise over several different missile designs as well as variations within each design. North Korea's incremental approach to ballistic missile development is demonstrated by its proficiency in reengineering Scud-type missiles and then proceeding to develop Scud variants with ever greater ranges. In many ways, Pyongyang has effectively reached the design limits of the Scud and will have to pursue a new design if it is to proceed any further in long-range rocketry.

Soft technology

According to Karp, rocket hardware is only one part of the equation for any would-be missile proliferators. Other, "soft technology" ingredients such as personnel, finances, and organization are almost as important in determining the success of a budding rocketry program.[100] Karp believes that program management in particular is one of the most difficult challenges for a proliferator; in his view it is the best "insurance" for the successful development of an indigenous missile design.[101] Given these demanding criteria, one can only conclude that the CERVA project fell far short of the soft technology requirements. As El-Ad narrates in his memoirs, Engel clashed with one of his chief engineers while harboring anti-Jewish doubts about his boss, de Lavison. Lines of authority seemed to be another problem plaguing CERVA and its predecessors, with Egyptian government officials clashing with Herr Fuellner, and Engel striving to work under CERVA's mixed civilian/military board of directors. As if these problems were not enough, CERVA also faced some serious resource challenges, lacking specialty steels, fuses, and propellants; however, it isn't clear if these shortages were due to export restrictions, budget constraints, poor planning, or all three together. Clearly, CERVA's management, finances, and personnel were problematic and probably helped dictate its eventual failure.

Soft technologies are a difficult aspect of missile development to master. The would-be missile developer must set up durable program management that is capable of taking a missile program from cradle to grave. The team must have access to adequate finances and trained staff, and the program manager must be able to blend these requirements into a successful missile strategy. Soft technology – or the lack of it – provides clues to the failure of Egypt's missile program as well as those of Libya and Zaire.

Acquisition strategies

The 1950 Tripartite Declaration by the US, Great Britain, and France, which banned arms sales to certain Middle East countries, prevented Egypt from acquiring rockets from these sources. Moreover, Cairo's antipathy for Moscow precluded its acquisition of rockets from the USSR. Egypt then turned to West Germany, from which it imported rocket expertise to produce the CERVA artillery rocket. Cairo eventually grew tired of CERVA and killed the program in the aftermath of the 1956 war. At first, the Egyptians turned to the Soviets for rockets. When they were rebuffed by Moscow, the Egyptians once again examined the feasibility of an indigenous missile program. Cairo returned to the Germans as its optimal source of rocket talent, and in a single institute it found veterans of Nazi German and French rockety programs who were eager for new horizons.

Whether to develop an indigenous missile or acquire systems from abroad is a critical decision point in any missile program. Some countries, like Yemen and Saudi Arabia, have procured their missiles and related handling equipment from foreign suppliers. Egypt and Pakistan have procured missiles from abroad while at the same time indigenously developing their own systems. Finally, there are those powers, like India and Israel, whose programs are, for the most part, based on indigenous designs.

Motivations

We do not know precisely what motivated King Farouk and, later, Gamal Abdel Nasser, to pursue rockets but one can postulate several theories as to why Egypt sought a weapon that is at once technically daunting and resource intensive. According to a number of researchers, nations tend to acquire ballistic missiles for their inherent prestige, their speed and ability to penetrate known defenses, and their military utility.[102]

Prestige

W. Seth Carus notes the clear link between a nation's ability to develop and produce its own ballistic missiles and national prestige: indeed, in his view the two are intrinsically linked.[103] The benefits to the missile producer are palpable, since indigenous missiles are "a confirmation of modernization" by demonstrating that a country has developed the same technologies as those of the great powers. With its aspirations for Arab world leadership and regional power status, Egypt was – and remains – a clear-cut case of a country that acquires, develops, and produces ballistic missiles in part for prestige. Whether it was King Farouk or Gamal Abdel Nasser and his more grandiose plans to develop a missile capable of reaching Israel, Egypt has always been partial to rocketry. Nasser, in particular, sought rockets to put his country at the forefront of the Arab world, enhance his standing among Egyptians, and maintain a hostile atmosphere with Israel. The prestige argument for an Egyptian missile program will unfold in greater detail throughout this study.

Speed and penetration

Enshrined in these concepts is much of the awe that seems to enshroud the ballistic missile. After all, here is a weapon that, even today, faces no effective countermeasures. At the simple touch of a mythical button, one state can violate the sovereignty of another with none of the encumbrances of highly trained aircrews, bewildering arrays of aircraft ordnance, or the need for electronic warfare techniques to evade air defenses. More importantly, the ballistic missile's assured penetration and speed confers

upon its owner something much greater than strike value: it offers a viable deterrent, which is a much sought-after commodity in the ever volatile Middle East. According to Janne Nolan, the missile's tremendous speed only improves a country's ability to launch surprise attacks and makes the defender's job more difficult.[104] The World War II V-2 raids and the 1990–1991 Gulf War Scud attacks demonstrated the missile's political and psychological edge as a weapon of terror. Its high speed and virtually assured penetration capability are undeniable military advantages.

Military utility

The paradox of the ballistic missile when measured against the manned bomber is that the former sacrifices payload capacity, accuracy, and range for a more predictable capability to hit its target. To put it another way: ballistic missiles deliver less explosive with reduced accuracy than manned bombers and usually over shorter distances as well.[105] Some authors, like John Harvey, support this view and make the case that aircraft can penetrate defended airspace with acceptable losses.[106] Still, missiles remain a weapon of choice for many states. For Egypt, ballistic missiles became a natural response to increased Israeli air and air defense capabilities which blunted the effectiveness of Cairo's bomber force. From Egypt's perspective, its inability to hold Israeli urban areas at risk denied it a crucial deterrent against another 1956-style attack.

2 Prototypes and testing

Upon their arrival in Cairo, Sänger, Pilz, and the other scientists must have been overwhelmed by Egypt's primitive technical infrastructure. To rectify this, Cairo relied on a network of European companies to funnel parts, tools, and propellants to its 333 Factory in Heliopolis. Israel seems to have known about Egypt's missile program from the very beginning. As it did with Avri El-Ad, Israeli military intelligence sent a case officer with German cover to spy on the rocket scientists. Although Israeli pressure forced Eugen Sänger to resign from the project, the Egyptian rocket program proceeded anyway, and flight tests were conducted with at least two models. Nasser made much of his new missiles in a parade, but US policymakers were not impressed.

Researcher Lewis Frank divides the Egyptian missile program into three chronological phases, starting with research and development, and extending through prototype testing to production. According to Frank, Phase 1 began in 1959 with the recruitment of foreign scientific and technical expertise:

> Skilled and semiskilled technicians, nonexistent in the underdeveloped UAR [United Arab Republic or Egypt], were needed to give life to the program and translate designs into flight-rated hardware. Approximately ninety to one hundred technicians were recruited from West Germany and Spain … plus some from Austria and Switzerland.[1]

Armed with "personal luggage designs" of missiles based on the German V-2 and Wasserfall rockets, the French Véronique, or unwanted paper proposals submitted to the West German government, Sänger, Pilz, and Goercke arrived in Cairo in 1960 under a cloud of secrecy. Their involvement with the Egyptian missile effort was to be a part-time affair: they maintained their employment at Stuttgart but availed themselves of Germany's generous vacation policies to make frequent trips to Egypt. Indeed, a chartered airplane was on constant call at Stuttgart's

Echterdingen Airport to ferry the scientists to Cairo, where they delivered public lectures on space flight at Cairo University. Behind the scenes, of course, they were quietly laying the groundwork for rocket development.[2]

The Cairo that greeted the German rocket scientists in 1960 was a vibrant metropolis of nearly four million. Writer James Aldridge paints a picture of what Sänger, Pilz, and Goercke must have seen when they arrived at Cairo International Airport:

> What you see now when you step out of a hot, crackling jet on Cairo's airport and drive through the streets in the airline bus is a thoroughly modern city with the usual skyscrapers, thick-necked traffic, nervous taxis, neon lights, buses, trams, metros, department stores, boutiques, cafes, street sellers.[3]

The cosmopolitan Cairo that was so familiar to Engel, Fahrmbacher, and Frank was beginning to disappear as the city's European and Jewish minorities continued their flight from Nasser's Egypt.[4] There were some remnants left of the German community, with some serving as advisers to the Egyptian government; however, Fahrmbacher's military team was long gone.

As for Nasser, he was still riding on the crest of a political tidal wave which had swept him to the leadership of the Arab world after 1956. In Iraq, Arab nationalists had murdered a royal family which had long opposed Nasser's regional designs. In Syria, Nasser laid the first plank of his pan-Arab vision by merging Egypt with that country to create the United Arab Republic in 1958. At home, Nasser maintained the loyalty of much of the Egyptian public, although his German-trained intelligence services kept a close watch on public attitudes and crushed dissent when necessary. As for ballistic missiles, they meshed nicely with Nasser's desire to maintain his leadership of the Arab world. He undoubtedly looked forward to the day when he could unveil his missiles to surprised Arabs and an alarmed Israel.

The early management structure of the missile project was relatively simple and quite efficient by all accounts. Indeed, in designing its new, more streamlined management chain, Cairo may have tried to avoid replicating some of the problems that plagued the CERVA effort. With unobstructed access to President Nasser, General Khalil was the direct conduit between the Egyptian government and the German scientific team. Khalil also headed up the Egyptian General Aero Organization, which oversaw the factories associated with the missile effort.[5] Dr Sänger exercised overall program management responsibilities while individual German scientists directed separate component departments. Pilz directed the engine development department, Goercke and Kleinwachter tinkered with guidance mechanisms, and Walter Schuran likely had a role in airframe

design.[6] Secondary to their duties as department heads, the German scientists also trained their Egyptian counterparts in rocketry. In fact, the paucity of trained Egyptian engineering talent proved to be a formidable obstacle throughout the missile project and a challenge that was never adequately resolved. As one American observer noted in 1963:

> With such a rapid buildup coupled with a thin background of experience, Egypt has had to rely largely upon experienced European engineers and technicians. Egyptian engineers, however, are being trained and schooled by the Europeans, both in the classroom and in on-the-job training procedures.[7]

The lack of trained staff was not the only challenge facing Sänger and his cohort as they surveyed their new Egyptian prospects. They must have been struck by the rudimentary nature of Egypt's technical infrastructure when they first inspected the proposed facility for the country's new missile program. Located in Heliopolis, this site started out as a sanitarium for English rheumatism patients before serving as the headquarters for Rolf Engel's CERVA project. By 1960, the facility was occupied by the State Aircraft Factory which churned out turbo-propeller Gomhuriya trainers for the Egyptian air force. Although there are only scant details on the early days of this facility – renamed Factory 333 in 1961 – considerable time and effort must have been devoted to converting the State Aircraft Factory into a viable rocket research, development, and production facility. At a minimum, this hub of Egypt's missile effort would have required workshops, laboratories, chemical mixers, testing and handling apparatus, precision machine tools, steel, and specialized chemicals, all of which must have been in short supply in Nasser's Egypt.[8]

Egypt was not alone in confronting the challenges of building a missile program on such meager human and technical foundations. As historian Iris Chang describes in her study of Tsien Hsue-Shen, the father of China's ballistic missile effort, China commenced its drive to acquire rockets under conditions that must have been similar to Egypt's own rocketry forays in the early 1960s:

> There were no factories in China that could easily produce the complex materials they would need. There were no major wind tunnels, no engine test sites or launch sites, no university research institutes devoted to jet propulsion. There were not even indigenous textbooks on the subject … The early staff of the missile academy labored under makeshift conditions. It was not unusual to see engineers laboring at night in crowded corridors lit by a single bulb.[9]

Unlike the Chinese, however, Cairo could not rely on the skills of Egyptians educated in the West to form the core of its scientific–technical team.

Furthermore, Egypt lacked China's access to older-generation rockets like the Soviet R-2 upon which scientists could perform research and reverse engineering. Indeed, Nasser's Egypt had to import virtually everything from abroad.

Given its lack of resources, the Egyptian government established a secret procurement network in several European countries to support the Sänger team's urgent *matériel* and technical talent requirements. One aspect of this network was the use of front companies to procure missile-related parts and tooling from European and American sources. Nasser confidant Hassan Sayed Kamil, already noted for his role in recruiting scientists and technicians, registered at least two dummy corporations in Zurich on behalf of the Egyptian government. The first outfit – Mechanical Corporation or MECO – was founded in 1952 on behalf of the Egyptian War Ministry to assist in the development of an Egyptian arms industry, while the second firm, Machines, Turbines, and Pumps (MTP), was established in 1960. Both organizations served as crucial conduits, drawing on an intricate and still largely unknown network of European firms with names such as Linda, Patwag, and Unverzagt to supply the parts, tools, and labor requirements of the jet trainer and missile programs.[10]

In addition to Kamil's corporations, which appear to have been geared primarily for Egypt's aviation programs, another front company was established in 1960 to serve the exclusive needs of the rocket team. Conveniently located next to the Stuttgart offices of Egypt's United Arab Airlines, the INTRA Commercial Company was directed by an individual named Heinz Krug, who also happened to be a former business manager for Sänger's Stuttgart Institute. Both Wolfgang Pilz and Paul Jens Goercke were business partners in Krug's lucrative business. One of INTRA's most important responsibilities was acquiring the rights to foreign patents related to rocket engines and guidance mechanisms. It also subcontracted technical work to private laboratories throughout West Germany, including one facility in the Bavarian town of Loerrach run by Hans Kleinwachter, an old friend of Goercke. Kleinwachter's lab was to loom large in Egypt's missile program, since it was tasked with the crucial assignment of developing a viable guidance and control mechanism.[11]

INTRA apparently encountered few difficulties obtaining export permits from West Germany and other European states. As one author put it, the vast array of parts and tooling that was funneled to Cairo on weekly United Arab Airlines flights could not be directly linked to weapons development.[12] Indeed, in the decades before the creation of a Missile Technology Control Regime, individual governments like West Germany's were solely responsible for maintaining and policing lists of technologies deemed too sensitive for export. During this period, few, if any, expressed any real interest in restricting missile parts and technology transfers to the developing world.

Despite the ease with which it acquired missile-related goods and know-how, Cairo established a rudimentary code system to disguise its steady stream of missile and aviation parts shipments. Boxes shipped to Egypt were labeled as "technical equipment for airplane maintenance," while communications between Cairo, INTRA, MECO, and MTP used simple cover terms such as "buttons," "red," or "iron" to veil references to engine parts, gyroscopes, or individuals.[13] Clearly, the Egyptians were not taking any chances with their crucial supply nodes, especially as foreign interest in their missile program was bound to grow.

Indeed, at least one other party was quietly observing Hassan Sayed Kamil and General Mahmoud Khalil as they journeyed through central Europe recruiting scientists and establishing procurement networks. As we have seen, Israel's intelligence services had been collecting information on Egyptian rockets since the early 1950s, although their intelligence assessments were generally skeptical about Cairo's ability to build a rocket.[14] Despite this skepticism, Israeli intelligence continued to collect against the Egyptian missile effort, dispatching teams to France and West Germany, and at least one case officer to Egypt.

Former Mossad employee Peter Malkin is best known for his role in capturing Nazi fugitive Adolf Eichmann; however, he also wrote briefly about spying on Wolfgang Pilz in his 1990 memoir *Eichmann in My Hands*. Unfortunately, Malkin's memoirs are vague as to the timing of his operation against Pilz: the chronological outline of the memoirs suggests the Pilz mission preceded the May 1960 abduction of Eichmann from Argentina. Furthermore, certain details in the memoir could lead the reader to surmise that Malkin was sent to Germany in late 1959 or early 1960, perhaps only days or weeks after Pilz had signed a contract with the Egyptians. If this is true, one can conclude that Mossad was extremely effective in tracking the movements of the Egyptian scientist recruiting teams from the earliest days of Nasser's new missile project.

According to Malkin, spying on Pilz was a complex undertaking, involving detailed surveillance work on the scientist's associates and their routines as well as determining the best methods for obtaining Pilz's research data. Malkin says he identified at least four research laboratories in West Germany that supported Pilz. When Malkin's team broke into several apartments, including Pilz's, they discovered little of value, with the exception of some fake identification cards and passports. It was at this juncture that Malkin decided to break into Pilz's laboratory in Cologne.[15] After several failed attempts, Malkin finally succeeded in breaking into the laboratory, where he photographed a substantial amount of material, including "blueprints for liquid-fuel rocket engines."[16]

Israeli intelligence gathering was not restricted to West Germany. In January 1961, Israeli military intelligence Unit 131 dispatched one of its most promising intelligence collectors to penetrate Cairo's tight-knit but

growing community of German and Austrian expatriates.[17] Bearing his actual name, Wolfgang Lotz, this case officer was particularly well prepared for his mission. Like Avri El-Ad before him, Lotz had a German background and extensive wartime experience. Born in Mannheim, Germany in 1921 to a German Jewish actress and a father employed in the theater business, Lotz relates in his memoirs that this background in the theater was to serve him well later in Egypt when he was called upon to play the role of the bon vivant and witty raconteur.[18]

In 1933, Lotz's mother – now divorced – emigrated with her son to Palestine. Although she eventually found work in the theater, she found her new life as a pioneer in Palestine difficult. It certainly was a far cry from the glitz and glitter of Berlin. By contrast, her son quickly adapted to his new life. Not only did he change his name to Ze'ev Gur-Aryeh, he also joined the *Haganah* at the age of 16.[19] When World War II broke out, Lotz joined the British army, where he underwent commando training. Given his aptitude for languages (he knew Arabic, German, Hebrew, and English), Lotz was transferred to Egypt and spent the war years as an interrogator in the North African theater. At the end of the war with Germany, Lotz returned to the *Haganah*, where he fought the first Arab–Israeli war in 1948 as a lieutenant in command of a platoon of new immigrants.[20] At the end of the war, Lotz stayed on in the Israeli Defense Forces and served in the 1956 war as a major.[21]

After Suez – and two marriages and two divorces – Lotz was recruited by Unit 131. He was a particularly good catch for Israeli intelligence, as he narrates in his memoirs: "Because of my German background I could easily be passed off as a German. I was blond, stocky and thoroughly Teutonic in gesture, manner and looks. I was a hard drinker and the very epitome of an ex-German officer."[22] The parallels with Avri El-Ad's career are only too obvious. They highlight Unit 131's propensity to using German and Austrian Jews in missions directed against Egypt.

The Unit 31 training regime was rigorous, and Lotz soon learned his new trade, including how to create and service dead letter drops, how to shake hostile surveillance, how to communicate via code, and how to recruit potential spies. He also learned about the complexities of Egyptian politics, for it was understood early on that this country was to be his future theater of activities. Toward that end, Unit 131 constructed a new legend for Lotz, whereby he did not immigrate to Palestine in 1933 but stayed on in Germany, where he eventually joined Erwin Rommel's Afrika Korps. This was a wise choice, for Lotz was very familiar with the Korps, having interrogated German POWs in North Africa for the British during World War II. After war's end, the "new" Wolfgang Lotz (he retained his name even under cover), emigrated to Australia, where he became a successful breeder of thoroughbred race horses. Still, the call of his German homeland beckoned and, despite his apparent successes in Australia, Lotz returned to Germany.[23]

Like El-Ad, Lotz spent some time in West Germany, establishing his cover as a former *Wehrmacht* officer. He changed addresses frequently to confound those who would attempt to break down his legend. According to Yossi Melman and Dan Raviv, Lotz's cover may have been carefully coordinated with West German intelligence, which was equally interested in the activities of German scientists in Egypt.[24] In December 1960, Lotz drove over the Alps to Genoa, where he purchased a first class ticket on an Italian liner bound for Egypt.[25]

Upon arrival in Cairo, Lotz immediately began a search for local riding clubs. With the help of a hotel manager, he was soon introduced to the Cavalry Club in Gezirah, one of the most prominent social institutions of the Egyptian military caste and the virtual second home of many officers. Lotz soon made friends with the honorary president of the Club, Youssef Ali Ghorab, who was also a general of police. Lotz's background in horses allowed him to enter the exclusive world of Egyptian military officers and their peers in the security services, and he made contacts that were to serve him and his Israeli masters well in the months ahead. Lotz particularly made use of his budding friendship with General Ghorab, whom he showered with expensive gifts; he also befriended General Fouad Osman, a military intelligence officer who was entrusted with the security of his country's ballistic missile program. General Osman would occasionally slip his new German friend a detail or two on problems plaguing the missile project.[26]

Despite the significant progress in his professional career, Lotz was a lonely man during his first months in Egypt.[27] He was also oppressed by the air of paranoia that seemed to permeate official Egyptian circles. Indeed, before departing for Egypt, Lotz learned everything he could about the dreaded *Mukhabarat* – Eygpt's intelligence service – and the difficulties of pursuing espionage in a country where the secret police were all-knowing and all-powerful. In fact, whatever their shortcomings abroad, Nasser's intelligence agencies were quite effective at home. They were pervasive at all levels of Egyptian society, and virtually everyone could be a real or potential police informer. According to Lotz (and he had first-hand experience), "Egyptian internal security was, and still is, among the most active and ruthless in the world."[28] Perhaps Skorzeny's and Gehlen's former SS and Gestapo officers were in part responsible for that reputation.

The technical capabilities of the Egyptian security services were equally formidable, ranging from hidden microphones to phone taps and radio direction-finding equipment. In fact, Lotz learned from an American diplomat that his first apartment in the Cairo suburb of Zamalek had a bug concealed in the telephone. Unwisely, Lotz disconnected the device only to have a telephone "repairman" reinstall it the next day.[29]

In one sense, Lotz was not alone in Egypt, for espionage seemed to permeate the social scene in Cairo and Alexandria. He reports that case

officers and agents from the world's major intelligence services were heavily engaged in spying on the Egyptians, the German aviation and rocket specialists, and each other. Anxious to preserve Egypt as a pro-Western state in the region, Reinhard Gehlen had his personal representative in Cairo to liaise with Egyptian intelligence and to collect intelligence on the Soviet arms shipments that were entering the country.[30]

In May 1961, Lotz traveled to France, where he met his handler at a rendezvous in Paris, a favorite meeting ground for Israeli military intelligence. During this meeting, Lotz transferred several unspecified documents and photographs. In return, he received more money, a code book, and a transmitter that was conveniently concealed in the heel of a riding boot. In addition, Lotz's most important intelligence collection targets were spelled out during his time in Paris: they included Egyptian military installations and the expected arrival of the German and Austrian aviation and rocketry experts.[31]

These instructions in hand, Lotz returned to Egypt via the Orient Express and another Mediterranean ferry. His journey was cut short, however, by a sudden marriage to a German woman whom he met on a train to Stuttgart. Lotz's apparently rash act was compounded by his confession to his wife that he was an Israeli intelligence officer, an act which was completely in contradiction to all that he had learned during his training in Israel. Lotz was indeed cognizant of his apparent recklessness, for as he confides in his memoirs, a hasty marriage at the beginning of a major mission was a portentous act. Still, he was confident that his new wife would fit in well with his cover as an expatriate German horse breeder in Egypt.[32] Raviv and Melman offer an alternative explanation for Lotz's sudden marriage: they quote unconfirmed reports that Lotz's wife was a German spy, and her liaison with Lotz was arranged by West German and Israeli intelligence.[33]

Lotz and his wife, Waltraud, soon settled into a comfortable existence in Cairo. Their first home was an apartment located on the island of Zamalek. Sudanese gatekeepers provided modest security for the Lotz residence, performed a variety of odd jobs, and, as Lotz notes, reported to the secret police on the latest doings of their employers.[34] Waltraud was also introduced to the whirl of her husband's active social life, which consisted of horse racing and convivial, alcohol-soaked get-togethers at the homes of Lotz's influential Egyptian friends. In sum, Wolfgang Lotz was well on his way toward cultivating an extensive network of valuable contacts in Egyptian political circles, in the police and security services, in the armed forces, and among the German and Austrian rocketry experts.

One person whom Lotz targeted was Johann von Leers, Joseph Goebbels' right-hand man, and Cairo's most prominent Nazi. While Lotz was not particularly interested in von Leers himself or the fact that he had opportunistically converted to Islam and changed his name to Omar Amin, he was interested in von Leers' social contacts. Indeed, von Leers

was to be Wolfgang Lotz's primary conduit to the aviation and rocketry experts who attended his parties and consumed his alcohol. It was at von Leers' social functions that Lotz met the cream of Egypt's expatriate Germans, including the notorious Dr Eisele, wanted in several countries for his role in the Holocaust, and certain experts whom Lotz believed were working on producing biological warheads for Egypt's rockets. Conveniently for Lotz, von Leers himself made no attempt to hide his conviction that Wolfgang Lotz was a former officer in Hitler's SS. Recognizing the inherent value of such a cover in approaching pro-Nazi Egyptians, Lotz only feebly denied von Leers' whispered allegations. He later "confirmed" this story by planting documents detailing his supposed SS past where Egyptian intelligence was certain to find them.[35] As with El-Ad only a few years earlier, the SS affiliation only added to Lotz's allure and ability to forge meaningful relationships within Cairo's German community and among Egyptian officers.

In addition to exploiting his growing circle of Egyptian and German friends, Wolfgang Lotz relied on his powers of direct observation to gather critical intelligence for Israel. He patronized a horse track in Heliopolis, which not only was conveniently located near a major military base but possessed a fifteen-foot observation tower as well. It was from that tower that Lotz was able to reconnoiter the movements of tanks and other armored vehicles in the adjacent base. Furthermore, Lotz convinced some Egyptian officers to allow him to stable his thoroughbreds at another military installation: the Abbasiya barracks.[36] Finally, Lotz leased his own horse farm, complete with stables, show ring, and a race track. Located outside of Cairo in the Nile Delta, that farm was not only a popular meeting place for prominent Egyptians and Germans, it was also located within a few kilometers of a crucial Israeli intelligence target: just over the sand dunes from the race track was the Wadi al-Natrun rocket test site.[37]

Even as Wolfgang Lotz penetrated the German expatriate community, the rocket design team was settling in at Factory 333 and turning paper designs into crude prototypes. Indeed, a solid nucleus was being established in Heliopolis, supported by a growing body of German and Austrian technicians. By one estimate, Factory 333 boasted a staff of 1,000, including over a hundred foreign scientists, engineers, and technicians in 1961.[38] Nasser's missile dreams were beginning to take shape as the program transitioned to the prototype development phase. But at that point, Israel unveiled a surprise.

In the early morning hours of 6 July 1961, Israel launched a solid-propellant, 220-kilogram rocket called Shavit II 100 kilometers into the atmosphere from a launch pad outside Tel Aviv. In a terse public statement that accompanied the launch, the Israeli government announced that the "multistage, unguided rocket" was for "ionospheric weather testing."

Israeli Prime Minister David Ben-Gurion, who attended the launch, later told his cabinet that Israel's bold foray into rocketry had taken "the wind out of the sails of President Nasser." Some Israeli political commentators were less generous, ascribing the launch to political motivations. Ben-Gurion's Shavit II, in their view, was little more than an "election rocket" to boost the ruling Mapai Party's political fortunes on the eve of August 1961 Knesset elections.[39]

The exigencies of Israeli politics notwithstanding, Ben-Gurion's comments to his cabinet suggest the Israeli government was motivated more by its Egyptian adversary than domestic matters when it launched the Shavit. First, there was no Shavit I. By naming its rocket Shavit II, Israel probably sought to instill the notion that it had *already* launched an earlier version of this rocket. Second, Israeli intelligence analysts may have believed that Nasser's goal was to launch missiles on the ninth anniversary of his 23 July 1952 revolution. Ben-Gurion sought to spoil Nasser's propaganda coup by launching first; he also used the Shavit II launch to demonstrate Israel's status as the pre-eminent technological power in the Middle East.

At some point prior to the Shavit II launch, Cairo approached NASA and the Zimney Corporation of California for some sounding rockets, but the US had refused to meet Cairo's urgent delivery request.[40] In fact, Cairo had probably learned of Shavit II, and tried rapidly to acquire a US rocket to pre-empt the pending Israeli launch. In an ironic twist, Israel suspected Egypt of doing precisely the same thing, but managed to fire its rocket first. As a *Times* of London correspondent believed,

> The timing of the UAR request and the subsequent decision to buy the rockets privately strongly suggests that Cairo became aware of Israel's progress in developing its rocket only fairly recently and hastily tried to initiate a similar program on its own.[41]

So where did this leave the indigenous Egyptian ballistic missile program? No prototype could be successfully launched by summer 1961, a factor which undoubtedly sparked the sudden interest in ready-made US sounding rockets. General Khalil summoned Eugen Sänger to his office and showed him pictures of the Shavit II. What type of rocket is this? demanded an anxious Khalil. Only a weather rocket, Sänger replied. But Khalil was not satisfied. Sänger's team had to work faster, he insisted, or Egypt was going to be left behind.[42]

Even as Cairo digested the implications of Israel's successful rocket launch, Israel's intelligence services continued to work against Egypt's missile program. At some point in 1961, Mossad chief Isser Harel believed he had enough information on what the Germans were doing in Egypt to approach his German counterpart, Reinhard Gehlen, head of the

Bundesnachrichtendienst – or Federal Intelligence Service. Armed with intelligence collected by Malkin, Lotz, and others, Harel accused Gehlen of ignoring the German scientist problem. The German spy boss deflected this criticism, insisting that he was using the scientists to gather intelligence on Egypt for the benefit of Bonn and its allies. Isser Harel was not swayed by this argument. He warned Gehlen that the Mossad would take action if the scientists did not return to Germany. Gehlen's response to this threat is not known.[43] In any case, Gehlen had not only become more sympathetic to Israel since his first dalliance with Nasser in the early 1950s, he was particularly disturbed by Cairo's tilt toward Moscow, as well. According to one Gehlen biographer, Bonn's intelligence chief believed that Israel was crucial to maintaining the West's position in the Cold War Middle East.[44]

West Germany's concern about Israel, Egypt, and the Cold War made it more responsive to Israel's demands. Bonn's foreign ministry promised to take action when confronted by an Israeli/French démarche on the activities of German scientists in Egypt. And the West Germans delivered on that promise.[45] At some point in the autumn of 1961, German officials confronted Dr Sänger and demanded explanations for his activities in Egypt. Sänger replied that he lectured Egyptian scientists on his holidays, adding that the Federal Government was well aware of his activities and had raised no objections.[46] As Deutschkron puts it, "On the contrary, every assistance given by Germans to Egypt was considered a strengthening of the bonds between Egypt, an influential development country, and the Federal Republic, handicapped by the East–West conflict."[47]

Sänger's comments did highlight a serious foreign policy dilemma for the West Germans. While they now acknowledged Israel's importance for the West, the Germans were equally concerned about the prospects of pushing Cairo closer to the Eastern Bloc. The potential for a serious rupture in Bonn–Cairo relations was real, since the West German government was then taking tentative steps toward establishing full diplomatic relations with Israel. More specifically, at the back of Bonn's fears was the possibility that the unpredictable Nasser would establish relations with East Germany.

In early November 1961, the West German Federal Minister of Transport sent a letter to Dr Sänger, which demanded the scientist's resignation from the Stuttgart Institute. This letter informed Sänger that his work for Egypt "exceeded the extent of the subsidiary work his contract [with the Stuttgart Institute] permitted him to undertake," adding that it was "politically unwise" of Sänger to cooperate on an Egyptian government contract.[48] On 7 November, Eugen Sänger resigned from the Stuttgart Institute. He also resigned from his Egyptian position, although he reportedly managed to skim some 200,000 marks as his share from the Egyptian missile acquisition business.[49]

The West German government offered Sänger substantial incentives: in

addition to consulting for MBB Junkers on a delta-winged vehicle called RT-8-01, Sänger became the director of the newly created Department of Space Research at West Berlin Technical University in January 1963. The latter position, funded in part with Federal Government grants, was one result of Bonn's new emphasis on space research. It was also tacit recognition that many German scientific projects had been neglected in the recent past.[50]

After his resignation, Sänger held a number of press interviews where he insisted on the peaceful nature of his Egyptian work, speculated on Nasser's motives, and highlighted West Germany's deficiencies in scientific research. On the issue of his contract with the Egyptians, Sänger was adamant that he worked "on nothing else but peaceful rockets."[51] Sänger cautioned that the Egyptian rocket prototype lacked any guidance mechanism: "Although in principle the rocket could be launched into an inclined flight, there is no way of knowing with accuracy where it will impact … So I can't imagine how it would be used for military purposes."[52]

Sänger argued Egyptian missiles were "more a matter of prestige for Nasser."[53] If Cairo desired a militarily useful rocket, he observed, such an effort would require several more years of research and development. Sänger did not shrink from holding Bonn culpable for the work of German scientists on Nasser's missile projects. As *The Times* reported,

> German scientists, [Sänger] said, would never have gone to Egypt if the Federal Government had been able to offer them the chance of real research at home. "For my collaborators, there were no practical opportunities for rocket research," he said. "In Egypt, one was helped greatly."[54]

Whereas Sänger accepted a German government demand to resign his Egyptian and Stuttgart posts, Wolfgang Pilz and Paul Goercke quit the Stuttgart Institute and moved to Cairo. Only Krug and Kleinwachter were left behind in West Germany to continue their respective work at INTRA and the laboratory at Loerrach. Sänger's resignation resulted in a reshuffling of assignments at Military Factory 333. Pilz took Sänger's place as program manager, while Walter Schuran replaced Pilz as head of the propulsion systems department.[55]

Eugen Sänger had hinted that the work in Egypt was stimulating as well as challenging. Indeed, by the end of 1961, the missile program had transitioned from chalkboard designs to actual prototype testing. Meanwhile, reports continued to leak out of Cairo regarding rocket testing, including one test in May that had been observed by Nasser himself. Later that summer, a high-altitude research rocket had reportedly exploded after rising more than a kilometer into the atmosphere.[56] Meanwhile, on the

ground, at least two more rocket-related facilities had been completed or were under construction, including the Kader Factory in Heliopolis, which was probably linked to guidance systems work, and another unidentified facility which handled liquid-fuel and explosive production. A Swiss firm had conducted wind tunnel tests on prototype models, while an Egyptian procurement team was seeking American range instrumentation equipment, according to the US Defense Intelligence Agency (DIA). This instrumentation most likely was intended for the Wadi al-Natrun flight test range near Wolfgang Lotz's horse farm.[57]

Indeed, engine and probable flight tests were taking place at Wadi al-Natrun on a regular basis, as Wolfgang Lotz informs us in his memoirs. Guiding his Arab stallions around the sand dunes near the test site, the Israeli spy diligently recorded both the time and frequency of the launches.[58] The data was then transmitted back to Israel via a transmitter hidden in a bathroom scale.

In a possibly apocryphal Mossad report, one missile flight test nearly killed Egyptian armed forces commander-in-chief Marshal Abdel Hakim Amer. According to the source, "the rocket turned around in midair and nearly landed on the head of Marshal Amer, who was seen running for his life." If true, this report undoubtedly originated from Lotz, Israel's most valuable source on the Egyptian missile program.[59]

The United States also had observers reporting on rocket launches in Egypt. According to former case officer Ray Close, a CIA office in Alexandria kept its headquarters informed of any rocket vapor trails observed in the vicinity of the city. Still, as far as the CIA base in Alexandria was concerned, the missile program was peripheral to the more pressing problem of tracking Egyptian Whiskey class submarines and surface ship activity at the nearby naval base of Ras al-Tin.[60]

Reports of Egyptian captive and short-range tests were emerging in the press as well. At the time of Eugen Sänger's resignation, the *Times* correspondent in Cairo discussed rumored "successful" rocket experiments that had taken place over the previous six months.[61] As always, Egyptian officials declined to comment on those tests or the types of rockets involved. Later, this newspaper reported on a February 1962 rocket flight test seen by "thousands" in Cairo. The correspondent noted that Egyptian officials at Cairo International Airport had clearly not been informed about these tests, since they had closed the airport for two hours while conducting an investigation of the incident. One can well imagine the confusion if pilots had not been notified prior to launch.[62]

Even as sketchy details began to emerge on the early Egyptian missile tests, few outside the German–Egyptian design team would have been aware that guidance – or the lack of it – had become a crucial obstacle to further development. Both Goercke in Cairo and Kleinwachter at his lab in Germany had examined guidance options to surmount this formidable technological barrier but with little success. Not surprisingly, Goercke and

Pilz's shared work on France's Véronique experimental rockets offered at least a temporary solution for Egypt's guidance dilemma. Ordway and Wakeford describe Véronique's wire guidance device best in their study on missiles:

> Four cables, attached to outriggers mounted on the fins and to a drum located beneath the launch pad, unwind as the rocket ascends. These cables stabilize the Véronique until sufficient velocity is attained to ensure that aerodynamic fin stabilization is present. At a predetermined altitude (about 180 feet) explosive bolts are ignited by a timer and the outrigger separates.[63]

When the nascent Al Zafir (Victor) model was first tested at Wadi al-Natrun, it used this French system of wire guidance. Later Al Zafir variants apparently used a simplified wire stabilization system with a single 60-meter cable fastened to the tail of the rocket preventing the system from going unstable early in flight. While the wire guidance package sufficed for an experimental rocket like the Véronique, it was not going to be adequate to put a surface-to-surface missile anywhere near its target.[64] Recognizing the serious limitations of this technique, Pilz directed his guidance team to examine the accurate but far more technically complex guidance system which had been pioneered by the German V-2 rocket scientists. Unfortunately for the Egyptians, none of the hired German guidance experts appeared to have more than a basic knowledge of V-2 guidance, which involved an intricate mechanism of pendulums, gyroscopes, and graphite thrust rudders. By asking for a V-2-type guidance and control system, Pilz made an already difficult challenge nearly insurmountable.[65]

These thorny guidance problems aside, the German–Egyptian rocket team had made considerable progress on two ballistic missile prototypes by spring 1962, the aforementioned Al Zafir and its larger sister Al Kahir (Conqueror). Both systems borrowed heavily from the Véronique design, although they were substantially more powerful and supposedly capable of greater ranges and accuracies. Al Zafir and Al Kahir were intended to form the basis of Egypt's budding surface-to-surface missile threat to Israel.

DIA speculated that the smaller missile, Al Zafir, could have a "maximum" range of 350 kilometers as opposed to Cairo's later claim of 430 kilometers. Preliminary DIA analysis cautioned against even the 350 kilometer figure, noting that a militarily useful payload would significantly decrease the range of this nominal weapon.[66] Later, a Special National Intelligence Estimate (SNIE), drafted by the CIA and coordinated throughout the US intelligence community, would downplay Al Zafir's range still further. The SNIE authors observed that a militarily insignificant 60-kilogram high-explosive warhead might permit Al Zafir to travel

its advertised 430-kilometer range; however, a larger warhead of would probably drive Al Zafir's range down to only a few tens of kilometers, effectively rendering this system ineffective as a strategic weapon.[67]

Al Zafir measured 5.5 meters in length and 76 centimeters in diameter, compared to Véronique's respective dimensions of 7.3 meters and 53 centimeters. The system had a simple wrapped-sheet airframe, flared skirt, and four fixed wings. According to DIA, Al Zafir was a "single stage, liquid fueled, unguided rocket, developed from the design of a French sounding rocket." As with the Véronique, Al Zafir's engine consisted of a single chamber fueled by a combination of kerosene and white fuming nitric acid (WFNA) as an oxidizer.[68] Lewis Frank reported *Zafir*'s engine as capable of producing between 27,000 and 36,000 kilograms of thrust, although this figure seems much too high compared to Véronique's thrust figure of 3,630–4,530 kilograms.[69] The SNIE assessed that Al Zafir's liquid propellants consisted of a WFNA oxidizer and turpentine. According to the SNIE authors, the Egyptians might transition to a WFNA/hydrazine mixture in order to improve thrust and, by extension, range and/or payload capability.[70]

The second prototype, Al Kahir, was essentially an Al Zafir but on a larger scale. DIA believed Al Kahir was "generally similar" to an "improved" German V-2, although the rocket's characteristics made it a rough – albeit larger – approximation of the Véronique as well.[71] Cairo publicists would later claim that Al Kahir could deliver a 680-kilogram warhead over 600 kilometers; however, the US intelligence community disputed that figure and concluded that Al Kahir "probably" could deliver a 220-kilogram payload some 370 kilometers.[72] According to DIA, Al Kahir was 12 meters in length with a 120-centimeter diameter. A single-stage design, this rocket used a probable mixture of nitric acid and kerosene or turpentine to deliver an estimated 36,280–40,800 kilograms of thrust through a four-nozzle cluster at the rear of the vehicle.[73]

As discussed earlier, guidance and control systems on both weapons were rudimentary at best. The SNIE identified "elements of a crude guidance system in 1962"; these were probably references to the primitive Véronique-type guidance system described above.[74] Other observers later noted that Egypt was using a combination of "V-2 type control vanes in the efflux" and the Véronique wire guidance package.[75] At this stage in the development process, it was still not clear if the German–Egyptian team was making any progress in developing a more reliable guidance system. The SNIE projected a rather optimistic Circular Error Probable (CEP) – or accuracy – of about 9–20 kilometers by 1963.[76] Clearly, both Al Zafir and Al Kahir were still test vehicles in 1961/1962, and far from being operationally deployable as viable long-distance weapons.

The gross limitations of his crude rocket prototypes did not deter Nasser from insisting on a public flight test by July 1962. Always with an eye to public spectacles that could boost Egypt's image and his reputation,

Nasser wanted to unveil his new achievements on the eve of the tenth anniversary of the 23 July 1952 Egyptian revolution. Having been upstaged by the Israelis the previous year, Nasser was not taking any chances. Rather than conducting flight tests on 23 July, a predictable occasion, the media-savvy Egyptian leader chose 21 July as the day in which he would reveal Egypt's new rockets to the world.

Some fifty foreign reporters, mostly from the Eastern Bloc, were invited to watch a "spectacle" at a location in Egypt's Libyan Desert known as Wadi al-Natrun. And, as we have seen, those correspondents were not disappointed either, for, in the space of two hours, four rockets of two distinct variants had risen into the hot summer sky and disappeared in the direction of the Mediterranean Sea.

As Nasser rode back to Cairo from the test site, he stopped by the roadside and offered a rare chat with the correspondents who had accompanied him. In fact, this was to be the Egyptian president's first press conference with Cairo's foreign correspondent community in three years. When asked by one journalist about the purpose of his new missiles, Nasser coyly responded with a question of his own: "What is the purpose of a rocket?" He then elaborated, noting that the military significance of rockets lay "in the range they reach." A Lebanese reporter next asked Nasser for the range of his new missiles. "Just south of Beirut," the President replied, in a reference to Egypt's apparent capability to strike at the entire territory of Israel. Nasser also informed the journalists that he intended to mass-produce his missiles, including two-stage variants, in the near future. He did not fail to note that the rockets were made in Egypt, and he vigorously denied the possibility that his weapons would be eventually equipped with "atomic" warheads.[77]

As their president hosted the foreign press corps at Wadi al-Natrun, the Egyptian populace had been told to expect a surprise. Cairo radio had been playing martial music for at least two hours before the launches when the government-controlled Middle East News Agency (MENA) announced that the United Arab Republic had entered the "missile age" and joined the front ranks of the missile-producing nations.[78] MENA provided scant details on the launches, other than that the first rocket struck its target over 600 kilometers away. Following the announcement, the government unleashed its long-planned celebration: mass youth rallies accompanied by gymnastics, water shows, boat races, and fireworks were staged in the larger cities. A chartered plane rained candy and free Egyptian Railway tickets over Cairo. A new mosque was dedicated to that Kurdish vanquisher of Crusaders, Saladin.[79]

"The newspapers today were in a frenzy of jubilation," observed the *New York Times* correspondent in Cairo. Indeed, the government-monitored press was not far behind MENA in trumpeting Egypt's new achievement. *Al Gomhuriya* boasted that the missile tests represented

Egypt's "glory and future," while *Al Akhbar* highlighted the psychological impact that the new missiles would have on Egypt and its enemies. Tellingly, the *Al Akhbar* article emphasized a point that must have been on Nasser's mind when he launched the ballistic missile program after the defeats of 1956: "We have recovered our faith in ourselves," the article stressed. "The staff of the Israeli embassy in Paris mourns and the Jews of New York are frightened."[80]

The editors of *Al Akhbar* undoubtedly were disappointed when the Israeli government and press downplayed the impact of Nasser's missiles on Israel's security. David Ben-Gurion briefed the Israeli cabinet in his capacity as Defense Minister and highlighted the role played by foreign scientists in building Egyptian missiles. A cabinet spokesman wryly noted that the Prime Minister's report "did not make the ministers happy."[81] The *Jerusalem Post* commented that Cairo's new MiG-21/Fishbed jet fighters and Tu-16/Badger bombers were a "far greater threat to Israel than any ballistic rocket in an experimental stage."[82]

While the Israeli government publicly downplayed the significance of the Egyptian missile launches, there was turmoil behind the scenes. The future president of Israel, Ezer Weizmann, reportedly affirmed later that the apparently successful Egyptian missile launches convinced Jerusalem that it needed to accelerate its own ballistic missile acquisition:

> We started working on the [MD-620 Jericho ballistic missile] in 1962 . . . We started when Abdul Nasser fired his Zafir . . . in July 1962. And we convened a meeting at 12 midnight. I was Air Force Commander, Shimon [Peres] was Deputy Minister, and everyone got into a panic . . . [T]his helped develop the [Jericho] missile.[83]

Other Israeli commentators conceded that Nasser had achieved a propaganda success, although they denigrated the military effectiveness of his "experimental" weapons. Reuters' sources observed that Jerusalem would use Egyptian missile tests to press the West for guided missiles "to defend Israel against possible rocket attack."[84] While no such system existed then or even now, Israel had requested the US Homing All the Way Killer (Hawk) surface-to-air missiles to counter the Egyptian bomber threat. Ultimately, however, even the most confident Israeli could not ignore the message that lay behind Nasser's missile tests. As *The Times* put it, the "most disturbing factor of the development was Nasser's intention to destroy Israel."[85]

American reaction to the missile tests was desultory. Newspapers reported the development without comment, and their editorial staffs refrained from giving any opinions, critical or otherwise. A CIA Current Assessment dated 22 July described the launches as "by and large a propaganda stunt of the kind in which Nasir [*sic*] excels." The Assessment added that "the launchings actually have little significance in terms of any real scientific or military capability."[86]

The Israelis and Americans could ignore his missiles, but Nasser was not going to waste a good opportunity to proclaim the successes of his revolution. On 22 July, he told an estimated 300,000 Egyptians gathered in Republic Square that their country had made substantial progress since the overthrow of King Farouk. "We are no longer defenseless," he affirmed. "Israel attacked us and we had no weapons," he declared. "In 1955 we made arms deals with Czechoslovakia and the USSR. That was one stage of our preparedness." It was clear that his new missiles and jet fighters were the next stage in Egypt's war preparations: "We have new weapons," Nasser promised. "You will see them in a military parade tomorrow." "Some other things," he added elliptically, "we cannot show." This speech was vintage Nasser. He appealed to Egyptian nationalism with his references to Egyptian-made missiles and jet fighters, while the reference to "other things" was cleverly designed to keep Israel guessing as to what Cairo still had up its sleeve.[87]

On 23 July, Gamal Abdel Nasser delivered on his promises of a grand military parade. For three hours, as peasants and city folk danced in the streets to a hymn composed in honor of Egypt's success in rocketry, a vast array of military equipment was paraded through Cairo. Nasser took the salute from a reviewing stand on the Nile corniche as T-55 tanks, self-propelled howitzers, and towed artillery rumbled past. Overhead, the jet engines of Egypt's new Tu-16s, MiG-19/Farmers, and the "homegrown" HA-200 jet roared as these aircraft cut swathes above the city. But everybody's attention was riveted on the missiles. Twenty of them trundled past, mounted on crude, makeshift pylons and transported by flatbed trucks. Both the Al Zafir and Al Kahir models were displayed, painted in a two-tone black and white scheme that evoked the V-2 or the Véronique rockets. Each missile was draped with red, white, and black bunting, representing Egypt's national colors.[88]

Standing at Nasser's side was his fellow Free Officer, long-time associate, and rival, commander-in-chief of the armed forces, Marshal Abdel Hakim Amer. In a speech that followed the parade, Amer rained imprecations down upon Israel, which, in his words, was "an openly aggressive imperialist base, threatening peace." "Our enemy," Amer averred, "spares no effort to obtain modern armaments to guarantee its military supremacy." Israel's threat to Arab security had increased, Amer noted, after that country had "set up a large nuclear reactor in a mysterious manner that shows it intends to use the reactor for non-peaceful purposes." This, of course, was a direct reference to the Franco-Israeli reactor at Dimona, which was about to produce plutonium for Israel's nuclear weapons program.[89] Amer then proceeded to discuss how the Egyptian military required the most modern equipment to meet the Israeli threat. He asserted that the Egyptian armed forces were the "strongest and most efficiently trained forces in Africa and in both the Near and Middle East." Amer did not fail to note how "Arab long-range rockets" fit into the calcu-

lus of handling Israeli "threats." He praised his military and civilian scientists, who "realized overwhelming victories" in building the ballistic missiles and the HA-200/Al Kahir jet as well. "Our scientists have crowned this victory," he proclaimed, "by launching long-range missiles announcing the entrance of our country into the space age."[90]

The parade was a miniature replica of the May Day arsenal displays in Moscow. And just as with the Soviet spectacles, Egypt's new missiles were the undeniable stars of the show. The Egyptians even commissioned a postage stamp, depicting an Egyptian rocket ascending into the stars, while the leadership dropped hints that work was proceeding on a two-stage missile with even greater range. Nasser's propaganda triumph was now complete.[91]

Still absorbing the implications of Egypt's apparently successful missile tests, official Washington took a guarded view of Nasser's latest display of military might. In a memorandum to McGeorge Bundy, President Kennedy's Special Assistant for National Security Affairs, the State Department argued that the "latest development" did not "significantly" alter the regional balance of power. The Department admitted that the launches and subsequent parade were "a psychological coup for Nasser vis-à-vis his Arab rivals as well as Israel."[92]

US and European press provided extensive coverage on the parade, emphasizing Amer's harsh anti-Israeli rhetoric and highlighting the display of Egypt's new missiles. The *New York Times* and *Times* of London carried simple "just the facts" stories in their respective columns; however, the Munich newspaper *Abendzeitung* only added more confusion to the origins of Nasser's missiles. According to this paper, the four missiles tested on 21 July were actually sounding rockets purchased from the United States and prepared by the German scientists. While this journal noted the recruitment of German rocket experts through "Swiss firms", it appears to have mixed one story – Cairo's interest in US sounding rockets – with another – the 21 July missile launches.[93] Sänger himself was quoted in the Israeli press at this time doubting that Nasser could even produce missiles of 600-kilometer range as the Egyptians claimed. And who else outside of Egypt could have known more about the problems plaguing Nasser's missiles than the man who presided over their genesis?[94]

Key question #1: How did Egypt's efforts to acquire rockets influence Middle East regional and international policies?

Egyptian missiles, even in their infancy, produced reactions in Israel, the United States, and West Germany. Cairo's international procurement network combined with Nasser's use of the missiles for propaganda purposes meant that these weapons could not be easily ignored, particularly by Israel.

Israel's intelligence collection against Nasser's new missile project could

date back to 1959, when Cairo was recruiting missile and aviation talent in Europe. As it did with Avri El-Ad and the CERVA project, Israel sought to infiltrate the German émigrés in Egypt with a German-speaking case officer. According to several accounts, that officer, Wolfgang Lotz, was quite successful in collecting useful intelligence on the missile scientists and their work. There is strong evidence indicating that Egypt and Israel's missile programs worked in competition with each other. Israel certainly knew enough about the Egyptian missiles to accelerate the launch date of its own indigenous sounding rocket, the Shavit II. Recognizing the propaganda value of being the first state in the region to launch a rocket, Israel stole a march on its Egyptian rival. Dismayed, Cairo pressed for US sounding rockets, and most likely pushed its German scientists harder. There is some evidence indicating that Nasser's missile launches spurred the Israelis to acquire the MD-620 Jericho ballistic missile from France; this was an important early development in the Middle East ballistic missile race. Israel also recognized early on that the center of gravity of Nasser's missile program was the German experts. Consequently, the Israeli foreign ministry and the Mossad pressed their West German counterparts to recall Sänger, Pilz, and the others from Cairo. In the case of Sänger, these efforts were successful.

There is only limited evidence of American intelligence collection on Cairo's rocket effort. While there appears to have been some emphasis on Nasser's missiles, at least from the CIA's office in Alexandria, other priorities took precedence. US national security officials generally were not impressed with the Egyptian rockets, and some believed these weapons were as yet another propaganda ploy on Nasser's part. Overall, at this stage in the history, the missiles played no discernible role in Washington's regional policies.

As for West Germany, there appeared to be some recognition in Bonn that more information was required on the activities of Sänger and company in Egypt. West German officials, including Reinhard Gehlen, were troubled by Nasser's apparent drift toward the Eastern Bloc; they compensated for this by forging a closer relationship with Israel. There is some evidence to suggest that West German intelligence helped Wolfgang Lotz establish his cover for Egypt; they may have sent an intelligence officer of their own to Egypt to complement assets already in place. Bonn also proved amenable to Israeli and French diplomatic pressure when it demanded that Sänger, Pilz, and Goercke cease their activities in Egypt and return home.

Key question #2: What modern proliferation lessons can be derived from Egypt's experience with ballistic missile programs?

This chapter yields a few new lessons for modern missile proliferation in the following areas: soft technology, hard technology, reliance on foreign

rocketry talent, rates of development, diplomatic pressure, space research as a cover for ballistic missile activities, motivations behind acquiring ballistic missiles, and missile acquisition strategies.

Soft technology

Aaron Karp notes that there are no hard and fast rules for the development of a rocket, but he does identify certain rules that each missile program must get right, including the soft technologies of management, personnel, and finances, as well as the hard technologies of "rocket science," namely the physics, chemistry, and engineering associated with rocketry.[95] In the Egyptian case, Cairo managed to get some things right, particularly in recruitment of the necessary scientific and technical expertise to build ballistic missiles. In other areas, like guidance, Egypt's efforts were less promising.

It appears as if the Egyptians had absorbed some of the lessons of the CERVA project in the area of soft technology. They used a top-down approach to management with a strong, centralized team centered around Eugen Sänger at first and, later, Wolfgang Pilz. As Karp stresses, successful rocket programs rely on a single program manager in the early years of development and, by all accounts, Egypt satisfied this prerequisite.[96] When we look at Egypt's finances for this project, the record is incomplete: Cairo certainly laid the groundwork for parts and personnel acquisition through INTRA, MECO, and other companies; however, there are no signs that the program was well or poorly funded. It certainly seems to have been better off financially than its CERVA predecessor.

Hard technology

As for hard technologies, several details of Egypt's rocket program come to light. First, we know that Sänger's team settled for liquid over solid propulsion. While solid propellants have many advantages, they tend to produce less thrust and are more difficult to master. Indeed, with the possible exception of the much smaller CERVA rocket, Egypt eschewed solid propellants until the 1980s, when it pursued the Condor II project with Argentina and Iraq. Second, the record shows that guidance was an early obstacle for the Sänger rockets. The Véronique system of wire guidance and explosive bolts was not going to deliver meaningful accuracies; consequently, Pilz instructed his guidance experts to design a V-2 type guidance package as a replacement. Yet this clearly taxed the resources of the Egyptian–German team, and one cannot escape the lesson spelled out by Janne Nolan's study of developing world ballistic missile proliferation: "highly accurate guidance systems present a formidable technological barrier for most developing countries."[97] Egypt's guidance problems most likely have been replicated in numerous other countries pursuing indigenous ballistic missile capabilities.

Reliance on foreign talent

One lesson for modern proliferation is Egypt's heavy reliance on foreign scientific and technical talent to produce its rockets. Indeed, Cairo could not have produced even crude surface-to-surface missiles such as Al Zafir or Al Kahir without the assistance of German scientists and technicians: Egypt simply lacked the trained talent to proceed with an indigenous weapons program, particularly in rocketry and aviation. As DIA told its Pentagon audience in early 1963, German specialists designed the missiles and German technicians played a prominent role in their construction.[98] Although the German scientists demonstrated a capability to produce crude prototypes of ballistic missiles for Nasser, they themselves represented a critical vulnerability, a fact that was not lost on Israel. It took some Israeli (and French) diplomatic pressure to convince Bonn to offer sticks and carrots to the German scientists in Cairo. In the case of Eugen Sänger, the West German government fired him from the Stuttgart Institute, but Sänger soon found a job with MBB Junkers; we can safely assume that the West German government had a hand in his professorship in space research. As we shall see later on, recruiting foreign-trained scientists was to be a hallmark of the Chinese, Indian, and Iranian missile programs among others.

Development rate

What is striking about this Egyptian missile effort is the speed with which the program progressed. In the space of little more than a year, Sänger's team was able to design, develop, and test two prototypes for Egypt. What was the secret of Sänger's apparent success? The Stuttgart scientists undoubtedly relied on their experience with the V-2 and Wasserfall programs as well as the Véronique to design their Egyptian missiles. Some, like Pilz, probably brought their own designs with them to Egypt. The lesson for modern proliferation is this: if a country can hire missile experts with the requisite experience in propulsion, guidance, reentry vehicles, and warheads, and if it has access to the necessary materials, it can significantly compress the timeline between blueprints and actual flight testing.

Diplomatic pressure

This case so far demonstrates that diplomatic pressure on a missile program can sometimes work indirectly through a third party. In this case, France and Israel pressured West Germany into action against its scientists in Egypt. The West German government offered a combination of inducements and punishments to lure the most important scientist, Eugen Sänger, back to Germany. The other members of Sänger's team resigned their Stuttgart posts and moved to Cairo. As we shall see in Chapter 7, US

diplomatic pressure helped break apart the Argentine–Egyptian–Iraqi Condor II program in the 1980s, although diplomacy has been noticeably less successful in tackling the modern scourge of missile proliferation: North Korea.

Space research as cover

Egypt, like many other countries after it, used space research as a cover for its missile program. Eugen Sänger, Wolfgang Pilz, and Paul Goercke were recruited to teach astronautics at Cairo University. Sänger, for one, always insisted that he never designed weapons for Egypt: only simple sounding rockets. Still, despite the creation of an Egyptian astronautics society in 1953, Egypt was never to develop a full-fledged space program to help mask its weapons program. On the other hand, India, Brazil, and Israel later used civilian space programs to acquire or develop the needed technologies for their military programs.

Motivations

Chapter 1 touched on the concept of prestige as a key driver behind a country's interest in ballistic missiles. This chapter reinforces the idea that Nasser viewed rocketry in part as a tool to cement his leadership over the Arabs and as a means of buttressing his appeal among the Egyptian public. Nasser made much of his missiles: he test launched them before an international audience, and paraded them down the streets of Cairo. As Karp puts it, the first test of any missile system is usually seen as tangible proof that a country has "arrived" on the world stage.[99] Egyptian state radio and print media certainly emphasized this idea following the test launches of July 1962. A government's perception of prestige is also influenced by its domestic and international environments. In the case of Egypt, the missile program appealed to Cairo's sense of regional leadership. The missiles were "symbols of power"[100] which not only marked Egypt's sense of special place in the Arab (and African) world, but demonstrated the Egyptian leadership's determination to accelerate the military confrontation with Israel. On another level, Nasser needed missiles to showcase his personal power and prestige, which had suffered when Syria withdrew from the United Arab Republic in September 1961. By 1962, even ballistic missiles could not disguise the fact that Nasser's star was no longer in the ascendant.[101]

Missile acquisition strategies

Nolan illustrates three such strategies in her study of missile proliferation and the developing world: modifying space launch vehicles, producing missile prototypes in local defense industries, and modifying imported

missiles.[102] In the case of Egypt, Cairo sought to produce its missiles in defense industries that were quite primitive at the start. Moreover, Egypt had to rely heavily on foreign expertise to develop and produce its prototypes. Later, Egypt acquired complete systems from the Soviet Union and modified them with the help of North Korea. In any case, there is little doubt that Egypt has expended considerable sums over the past forty years as it tried to acquire either the means to develop its own ballistic missiles or systems from abroad.

3 Jerusalem responds

Cairo's missile tests and military parade elicited a strong Israeli response that included assassination, intimidation, and an information operations campaign. The activities of Israeli intelligence officers triggered a political crisis in Israel and generated tensions in Israel's relations with West Germany and Switzerland. The campaign against the scientists in Egypt highlighted Israel's fears that Nasser's missiles would be linked to weapons of mass destruction. In fact, Israel's leaders used the Egyptian missile program as justification for their own nuclear weapon and ballistic missile ambitions.

Following the flight tests and the July 1962 parade, the Egyptian missile issue transitioned from a purely local concern with periodic Israeli interest to a problem with greater ramifications internationally. Israel's concerns about Nasser's missiles were to spike sharply as it pressured the West German and American governments to address the Egyptian missile program. From the Israeli standpoint, what had started out as a competition to determine who could launch a sounding rocket first had suddenly assumed more sinister overtones. Shimon Peres framed this perspective when he observed that

> The rockets the Egyptians have launched constitute a serious threat to Israel. They have inaugurated a new era in the Middle East. The advent of these modern weapons has radically changed the nature of the danger that lies in wait for us and the measures we have to take to protect ourselves from it.[1]

Indeed, what had started out as a poorly disguised Egyptian effort to acquire long-range weapons had now become the focus of a mini-crisis as Israel put its anti-missile campaign into high gear.

Despite Israel's feigned indifference to Nasser's missile tests and military parade, there were heated discussions behind the scenes. The country's security establishment engaged in finger-pointing and loud denials of responsibility in the weeks following the missile demonstrations,

and the intelligence services came in for their share of the blame too. Part of the problem seems to have been Israeli complacency. As Deutschkron states, Israeli intelligence simply did not expect significant results from Nasser's part-time, "no name" German scientists: "None of the men could have been an expert of international renown, which may be ascertained by the fact that they had not received offers of posts in more advanced and wealthier countries."[2]

Others reported that the problem didn't lie in intelligence collection but in assessment. Indeed, as this book has demonstrated in the preceding chapters, Israeli intelligence officers had already amassed a wealth of information on Egyptian missiles, including those reports from Wolfgang Lotz in Cairo; however, the Israelis apparently did not task analysts with putting together a coherent assessment of all that intelligence until the July 1962 tests warranted a closer look.[3]

Few could accuse Mossad chief Isser Harel of ignoring the myriad threats that loomed large over the state of Israel. In fact, he had made a career out of identifying and neutralizing Israel's adversaries. Born in Russia in 1912 as Isser Halperin, Harel, like so many other émigrés of his time, had changed his name upon arriving in Palestine. A member of the *Haganah*, Harel first started collecting intelligence on Israel's ultra-Orthodox Jewish community. Later, after the founding of the Israeli state, Harel would put his domestic surveillance skills and knowledge of Israel's Jewish and Arab communities to work as director of Shin Bet, the country's domestic intelligence service. In 1952, Prime Minister David Ben-Gurion made Isser Harel the second director of the Mossad. From that auspicious year until Harel's resignation in March 1963, the Mossad was to experience some of its most brilliant successes, crowned by the capture of fugitive Nazi death camp official Adolf Eichmann. But when Egyptian missiles were splashed across the front pages of Israel's newspapers and heatedly discussed in the Cabinet, all of those early successes had been temporarily forgotten. Some believed that the vaunted Mossad had failed. Isser Harel's and the Mossad's reputations were suddenly on the line.[4]

Israeli intelligence moved quickly. At the end of July – only days after Nasser's military parade – Isser Harel had established a special unit within his agency, dedicated to the Egyptian rocket issue.[5] For its part, Israeli military intelligence – known by its Hebrew acronym "Aman" – summoned Wolfgang Lotz to gauge his knowledge of Nasser's missiles. Lotz was also ordered to obtain detailed lists of names and addresses of all the German and European scientists who were working on Egyptian military projects.[6] Lotz probably arrived in Paris with two documents that provided crucial information on the state of the missile project. The first contained microfilm details of Egyptian guidance systems for ballistic missiles. As Eisenberg, Dan, and Landau relate, "to their immense satisfaction the Israelis learned just how much trouble the Egyptians were having in finding a reliable guidance system."[7] The second document proved to be far more

important and controversial. Its contents were later to be handled as evidence in a Swiss courtroom and subject to the scrutiny of skeptical American officials. This document was a 24 March 1962 letter from Wolfgang Pilz to Kamil Azzaz, the Egyptian director of Factory 333. In this letter, Pilz asked the Egyptian government for 3.7 million Swiss francs in order to buy parts and equipment for 500 "Type-2" rockets and 400 "Type-5" rockets.[8] One researcher states that the Pilz–Azzaz letter was offered as proof of the Mossad's formidable capabilities during a meeting between Isser Harel and Ben-Gurion on 16 August 1962. During that discussion, Harel pressed for immediate action against the German scientists in Cairo. He recommended that Ben-Gurion raise the stakes with Bonn by personally asking West German Chancellor Konrad Adenauer to recall the Cairo Germans. Ben-Gurion hesitated. Unlike his intelligence chief, who had become convinced the Germans were once again trying to exterminate Jews, the Prime Minister was reluctant to risk a sensitive relationship with Bonn over the matter of German citizens working in Egypt.[9]

Ben-Gurion's reluctance was no doubt reinforced by the distinctly different message he was hearing from his Director of Military Intelligence, Major General Meir Amit, and Deputy Defense Minister Shimon Peres. Not surprisingly, in a country with competing intelligence bureaucracies, Israel's military intelligence analysts differed with Mossad over the threat posed by Egypt's missiles. Historian Steven Stewart reflects a useful but distinct Department of Military Intelligence (DMI) bias when he writes about the missile analysis dispute in his book *The Spymasters of Israel*. According to Stewart, Meir Amit downplayed the Egyptian missile project in discussions with Peres; he affirmed that Cairo's missiles as yet posed no substantial threat to Israel.[10] Besides, Amit observed, Egypt was encountering significant difficulties with missile guidance and was "nowhere near solving them."[11]

General Amit found a receptive audience in Peres, who not only agreed with Aman's assessment but conveyed it to the Prime Minister. As one of Ben-Gurion's "young lions," Peres was entrusted with managing Israel's sensitive arms relationships with Paris and Bonn. In his discussion with Ben-Gurion, Peres argued against taking a hard line with Adenauer, especially when Israel was in the process of negotiating an arms deal with Bonn. Peres also said there was little to gain in compromising Adenauer with potentially embarrassing revelations about West German citizens building weapons for Cairo. As an alternative, Peres recommended a low-key approach.[12]

With Ben-Gurion's blessings, Peres sent an oral message to German Defense Minister Franz Josef Strauss on 17 August 1962, which highlighted Israel's concern with the scientists in Egypt and delicately questioned Bonn's professed ignorance of their activities. Peres reminded the Germans that the scientists were working against Bonn's strategy of pursuing closer ties with Israel; he concluded with the fervent hope that the

Federal Republic would curtail the activities of its more controversial citizens in Egypt.[13] Strauss's response was long on vague promises and short on detail. He affirmed, without specifics, that Bonn would seek to prevent its scientists from aiding Nasser in his quest for advanced weapons. In an attempt to soothe his worried Israeli counterparts, Strauss reassured them that Wolfgang Pilz was "absolutely below the current standard of his field."[14] Bonn's apparent lack of concern coupled with Israeli fears about Egypt's advances in missile technologies served to nurture Jerusalem's growing conviction that a more proactive strategy was necessary to bring Nasser's Germans to heel.

Meanwhile, Wolfgang Lotz quickly responded to the renewed emphasis on the Egyptian missile program and by September 1962 he had returned to Paris with the name and address of every German scientist working in Cairo.[15] Identifying the scientists and their immediate families was an integral aspect of the Israeli intelligence services' stepped-up campaign against the missile effort, for the Israelis recognized that the scientists represented the true center of gravity in the Egyptian missile program. As one Israeli intelligence analyst observed,

> It is rare for there to be one man who is so precious to the other side, so irreplaceable, that his death would seriously affect the outcome of any struggle save for in the very short term. But the Egyptian scientists fell precisely into that category – scientists don't grow on trees.[16]

Given their importance, the scientists became the target of an Israeli campaign of intimidation and assassination known as Operation Damocles.

Prime Minister Ben-Gurion probably delayed his authorization of Operation Damocles until he received a response to Peres's message from Bonn. When the German government did not take immediate action against the scientists, the Israeli Prime Minister granted approval for the anti-scientist campaign. Aman chief General Amit reportedly did not voice any objections to the operation, although he still believed that the Mossad was hyping the Egyptian missile threat.[17] On the other hand, Israel's Foreign Minister, Golda Meir, was not sanguine about the limitations of Nasser's missile capabilities: she strongly backed Harel's anti-scientist strategy, advocating "all-out war against the scientists, as if they were fully fledged Nazis."[18]

As soon as he had obtained Ben-Gurion's approval, Isser Harel promptly flew to Europe to meet the operatives who would implement Operation Damocles, including former Stern Gang member and future prime minister of Israel, Yitzhak Shamir. Harel decided personally to supervise and manage his operation from a roving headquarters that transited through several European cities as the campaign against the scientists got underway.[19]

Heinz Krug, manager of the INTRA front company, was the first

victim. On 11 September, a man described by German police as a "swarthy stranger with an Oriental cast of features," entered INTRA's offices on Munich's Schillerstrasse, and thirty minutes later exited the office with Krug. The following day, Krug's wife reported her husband missing. The subsequent police manhunt eventually discovered Krug's "mud-spattered" Mercedes in the Munich suburb of Solln. Around the same time, an anonymous caller phoned the police and reported Krug's death without elaboration. Heinz Krug's body was never found. With the exception of that one phone call, there were no indications of foul play. This man had, quite simply, vanished from the face of the earth.[20]

On 27 November, Wolfgang Pilz's secretary, Hannelore Wende, was sorting mail at Factory 333 in Heliopolis when she came across a bulky air mail envelope addressed to Pilz from a return address in Hamburg. When Wende opened this letter, it exploded, permanently blinding her in one eye and damaging her hearing. Dr Pilz escaped unharmed.[21] The following day, a large package marked "special book rate" and addressed to Brigadier General Kamil Azzaz, director of Factory 333, exploded, killing five Egyptians and injuring another six. An investigation of the sender – a Stuttgart publisher – yielded little information other than that this publisher did not exist.[22] Following the two letter bombs, the Egyptians stepped up security, X-raying every package that entered Factory 333; however, Damocles had the desired effect, for the German scientists and technicians in Cairo were suddenly forced to reconsider their Egyptian employment. As Stewart puts it, "suddenly, the plush-lined life these scientists had settled into didn't seem so comfortable after all."[23]

Abductions and letter bombs were not the only means by which Israel's intelligence services carried out their war against Nasser's missile program. Other, more subtle methods were adopted, including threat letters addressed to the scientists and their families. One such letter, posted by Wolfgang Lotz with Egyptian postage, warned the recipient that his work in Cairo was being closely monitored. While scientists were building rockets in the United States, Europe, or even Russia, the letter intoned, at least those governments had no intention of being the first to use these "terrible" weapons in war. The same could not be said of Egypt:

> It is impossible to believe . . . that the government which you are currently serving so brilliantly can ever be prompted by similar considerations. There can be little doubt that once the weapons systems you are helping to build have been perfected, they will be used in order to wipe Israel from the map.[24]

The Israeli government, the letter continued, did not believe that Nasser could be appealed to with reason, since he "irrationally" believed he could emerge from a war with Israel unscathed. The letter urged its reader to resign from his Egyptian position, since Israel would never allow Egypt to

produce weapons capable of destroying Israel's cities. "Individual Israelis," the note warned, "worried for the security of their country must seek out and if necessary, destroy individuals of other nationalities whose work could reduce the dream of 2,000 years to ashes."[25]

Other letters were more abrupt:

> We are writing to tell you that your name now appears on our black list of German scientists employed by Egypt. We would like to think that you care for the safety of your wife, Elizabeth, and your two children Niels and Trudi. It would be in your interest to cease working for the Egyptian military.
>
> – The Gideonites[26]

The next target for Isser Harel's hit team was the West Germany-based guidance and control expert, Dr Hans Kleinwachter. In fact, Harel reportedly was "obsessed" with eliminating Kleinwachter, whose work was indispensable to Cairo's missile ambitions.[27] On 12 February 1963, the Mossad chief spent a cold winter's night huddled in a car with Shamir and another Mossad agent waiting for Kleinwachter to emerge from his laboratory in the Bavarian town of Loerrach. Kleinwachter related the next sequence of events in an interview with an American journalist:

> I was on my way home from my laboratory. I entered a small lane and spotted a car waiting there with three passengers inside. One got out and came towards me. Through the window he asked, "Where is the home of Dr. Schenker?" Suddenly, he raised a gun and fired. The bullet smashed the window and tore a hole through my thick woolen scarf. I grabbed the gun, and turned the muzzle aside and tried to draw my own pistol from my pocket.[28]

Dr Kleinwachter's attacker fled in a getaway car. Shortly after the shaken scientist entered his house, he received an anonymous phone call in French. The message was curt and very much to the point: "Those who devour Jews choke on them." German police later found the getaway car only 100 meters from the site of the assassination attempt. Inside the car, the police found a passport bearing the name of Ali Samir, a captain in Egyptian intelligence. Unfortunately for the Israelis, this attempt at deception was a bust, for the real Ali Samir coincidentally had been interviewed by a German magazine in Cairo on the very day of the Kleinwachter assassination attempt.[29]

Despite his close shave with death, Hans Kleinwachter was not dissuaded from working for Nasser. Only a few months after the assassination attempt, he said he had no intention of ceasing his Egyptian work. Dr Kleinwachter was also bitter at what he considered Bonn's feeble reaction to those who tried to kill him. He admitted to being "fearful" of another

assassination attempt by Israeli agents and, for that reason, he refused to move to Cairo. In May 1963, Kleinwachter went to Bonn in a fruitless attempt to raise his concerns with Chancellor Adenauer. He insisted his Egyptian work was for peaceful purposes; he did not consider it morally reprehensible to assist Cairo in its rocketry efforts.[30]

Although the attempt on Kleinwachter failed, the Mossad continued to probe against what it perceived to be a key vulnerability in Cairo's rocket plans: the guidance and control experts. With Kleinwachter on his guard after narrowly escaping death, the Mossad turned to Cairo-based scientist Dr Paul Goercke as the next target for its anti-scientist campaign. But for the Goercke mission, Isser Harel tried something different: rather than use letter bombs, or assassination, the Mossad chief decided to get at Goercke through his daughter. Surprisingly, Harel turned to a recent defector from Egypt named Otto Joklik to head up the Goercke mission. This mysterious individual was to play a unique and bizarre role in Nasser's missile program.[31]

Initially hired by Nasser's special weapons expert, General Khalil, for his reputed expertise with gamma rays and the medical applications of cobalt, Joklik later informed the Mossad that he developed radiological weapons for the Egyptians. Indeed, he stated he had attempted to acquire cobalt-60 from West German, Canadian, and Indian sources on behalf of the Egyptian government. Some time in October or November 1962, Joklik fled Egypt, "horrified at being part of a plot to exterminate Israel." Upon reaching Europe, Joklik offered to sell what he knew about Egyptian weapons programs to the Israelis. He said he had been tasked by Dr Wolfgang Pilz to obtain radioactive sources for a secret weapons project.[32]

The Mossad initially suspected that Joklik was a dangle – or Egyptian lure – and he was flown to Israel, where he underwent interrogation. Joklik's allegations were alarming, to say the least, for he revealed that the Egyptians were preparing to build radiological devices for use with their surface-to-surface missiles. According to Joklik, General Khalil had established two unconventional programs: the first, called "Ibis," was an effort to fill missile warheads with radioactive substances – the so-called "garbage bomb." Joklik's attempts to acquire cobalt-60 were integral to this effort, which aimed at "poisoning" Israel's atmosphere, food, and water with radioactive particles. The second program, known as "Cleopatra," was an effort to produce an Egyptian atomic bomb with highly enriched uranium derived from Dutch or German centrifuges.[33]

Other Joklik revelations were equally bizarre: he reported overhearing a plan by General Khalil to bribe British Royal Air Force officers into defecting to Egypt with planes laden with nuclear bombs. According to Joklik, this plan, seemingly drawn straight from the pages of a James Bond novel, was outrageous even by Egyptian standards.[34]

Joklik's reports of Egyptian unconventional weapons undoubtedly convinced the Mossad to escalate its campaign against Nasser's Germans. In

fact, it is plausible that the Joklik information contributed directly to the letter bomb decision and the assassination attempt on Kleinwachter. At any rate, Isser Harel did not share his new source with anyone outside of Mossad. According to Raviv and Melman, Shimon Peres quickly learned about Harel's sensitive new source through contacts of his own, and demanded access to Joklik for a Ministry of Defense interrogation team. Harel refused. It was not until Peres threatened resignation that Prime Minister Ben-Gurion compelled his intelligence chief to cooperate. In his capacity as Defense Minister, Ben-Gurion assigned the Joklik debrief to Benjamin Blumberg, the shadowy director of the Defense Ministry's equally mysterious Science Liaison Bureau – or Lakam, as it is known by its Hebrew acronym. Lakam was, and is, entrusted with gathering and analyzing scientific intelligence, including that related to nuclear matters. It also has a role in shielding Israel's Dimona reactor from outside scrutiny. With their expert insight into nuclear issues, Lakam analysts interviewed Joklik and quickly found sufficient grounds to dispute his claims and his academic credentials.[35]

Isser Harel was not deterred by the Defense Ministry skeptics. For reasons that are not clear today, the Mossad director decided to use Joklik as a means of approaching Paul Goercke's daughter. Accompanied by a probable Mossad operative whose cover name was Josef Ben-Gal, Joklik flew to Switzerland, where he planned his meeting with Heidi Goercke.

Some time at the end of February 1963, lawyer Heidi Goercke was approached by a stranger while she walked home from work in Freiburg, West Germany. This stranger said his name was Otto Joklik and that he had been an acquaintance of her father in Cairo. He urged the woman to fly to Cairo at his expense and persuade her father to return to Germany immediately. Joklik also warned that an unspecified Israeli "organization" would "take measures" if Dr Goercke did not resign his Egyptian post. Heidi was given three days to mull over this request, at which time both parties agreed to meet again in Basel, Switzerland. When Joklik left, Heidi Goercke called a number her father had given her in the event of an emergency. That number reached a former *Wehrmacht* officer, who quickly notified the German police.[36]

On 2 March 1963, Heidi, accompanied by her younger brother, met Joklik and Ben-Gal at the Drei Könige Hotel in Basel, which was the scene of several congresses in the early Zionist movement.[37] According to later remarks by the Swiss public prosecutor, Heidi had been under police observation from the time she left the Basel train station until the end of her meeting with Joklik. Accounts of Heidi's conversation with Joklik and Ben-Gal differ. In one version of the meeting, Joklik bluntly informed the woman that her father had to stop working for the Egyptians "unless he wants to end up like Eichmann." Joklik added that he would give Heidi's father another chance, since Paul Goercke was not a Nazi. Pilz, on the other hand, was a Nazi, and a "criminal" who, in Joklik's words, could not

be spared. Joklik and Ben-Gal would later deny in a Swiss court ever making threats against Heidi or her father. Tapes of their conversation in the Drei Könige Hotel were not produced as evidence in court. Despite Joklik's threats – or perhaps because of them – Heidi promised nothing. She did agree to meet Joklik and Ben-Gal again in three days.[38]

The Swiss police did not give Joklik and Ben-Gal another three days. Both were arrested in Zurich for violating Swiss neutrality laws and conducting illegal activity on behalf of a foreign state. It was not until nearly two weeks later on 15 March that the Swiss government officially announced the arrest of two Israeli "agents," without providing much background for the arrests.[39] According to a *New York Times* correspondent, the arrests were "connected with the attempt to kidnap Dr Hans Kleinwaech [*sic*] 'a German scientist conducting research on electronic steering systems for missiles on behalf of the United Arab Republic's Defense Ministry.'"[40] Thus, the first reports on the Joklik case were marked by confusion and uncertainty. It was not until 19 March that the Basel public prosecutor clarified the matter by highlighting Joklik's ties with Heidi Goercke and her father during a press conference. That same day, the prosecutor in Freiburg informed the Swiss Justice Ministry that the Loerrach court had issued warrants for the arrest of Joklik and Ben-Gal. Both were accused of playing a role in the Krug disappearance and the Kleinwachter assassination attempt. Krug's wife even said she knew Joklik well, and that this man had been a guest at her house. For its part, the Egyptian embassy in Bern issued a press release that criticized the dangers posed to German scientists by Israeli agents.[41]

On 22 March, Bonn formally requested extradition of Joklik and Ben-Gal from Switzerland, emphasizing that both men were believed to have links to the Kleinwachter assassination attempt. Interestingly, Krug was not mentioned at all. The Swiss denied the extradition request, and in mid-April issued charges of their own against Joklik and Ben-Gal for conspiracy and coercion. The trial date was set for June. Between April and June, the Joklik/Ben-Gal arrests would trigger a crisis in Israel's domestic politics that would lead to the resignation of Isser Harel and a test of David Ben-Gurion's political acumen.[42]

Isser Harel's personal representative in Europe, Joe Ra'anan, later was heard to comment that he had been nervous about the entire Goercke operation. Ra'anan watched as his associate Ben-Gal was arrested by the Swiss police in Zurich, and quickly transmitted the bad news to Tel Aviv.[43] On 8 March, Harel brought this development to the attention of his prime minister. From Israel's perspective, the one cause for optimism was the fact that the Swiss government still had not publicly announced the arrests or the charges being brought against the two men. Ben-Gurion therefore ordered that the Joklik affair be kept secret – at least for the short term – while Israel attempted to negotiate a back-room deal for Joklik's and

Ben-Gal's release. As an extra incentive for Swiss cooperation, Israel would agree to remain silent on the potentially embarrassing role of Swiss-registered companies in Cairo's missile efforts. Unfortunately for Israel, Egyptian intelligence probably leaked the Joklik arrest story before a deal with the Swiss could be struck and Bern was forced to confirm the arrests.[44]

At this juncture, Harel decided to go public. On 16 March, he convened a secret meeting of the editors of Israel's largest newspapers and provided them with the general details of the Joklik/Ben-Gal incident. The following day, he briefed three journalists from *Ha'aretz*, *Ma'ariv*, and *Yedioth Acharonot*, throwing in details of the German firms involved in Egyptian missile projects, and encouraging these journalists to investigate further. Foreign correspondents were also brought in and given the Mossad's not-for-attribution take on the Swiss arrests. The Mossad goal in organizing these meetings was patently clear: decades before the term "spin" came to be applied to the concept of shaping news to fit a political line, Israel was putting its own perspective on the Joklik affair.[45]

Harel's revelations of German involvement in building Cairo's missiles, chemical, biological, and radiological weapons triggered a torrent of sensational press reports about Egyptian "atom bombs," "fatal microbes," even "death rays."[46] Israeli government radio cast the first stone, reporting on 16 March that German scientists were working in Egypt "producing" and "perfecting" weapons "prohibited and condemned by international law." The radio reported that these scientists were helping Cairo develop a "cobalt warhead" for Egypt's Al Kahir surface-to-surface missile that "would scatter radioactive particles over large areas."[47] That such stories triggered a wave of anti-German sentiment was hardly surprising in a country with a population only twenty years removed from the Holocaust. "The Germans must recognize that Israel cannot watch silently how Germans construct rockets for Nasser, destined for the destruction of the state of Israel," admonished the *Jerusalem Post*.[48] *Ha'aretz* was blunt: if Israel was forced to use "unconventional weapons" of its own to defend itself against Egypt, the editors reasoned, then the fault lay with the German government.[49] The Mossad's role in fomenting this press campaign was especially evident in those press accounts that carried – and embellished – Otto Joklik's Ibis and Cleopatra allegations. Even the *New York Times* highlighted the rumored Egyptian attempt to develop nuclear warheads for its missiles, referencing Otto Joklik by name and briefly describing his work for the Egyptians.[50]

Hitherto, the Israeli public knew relatively little about Nasser's missile plans, save what it could glean from periodic reports in the domestic and international media. Many Israelis were therefore mystified when the Joklik/Ben-Gal affair broke out, bringing with it allegations of Egyptian experiments with ballistic missiles as well as chemical, biological, radiological, and nuclear weapons. The public was largely ignorant of Cairo's

rocket program; it was therefore susceptible to hysterical press accounts. As Bar-Zohar observes, "the truth behind the sensational headlines was much less startling . . . but the Israeli man on the street read, nevertheless, that he was in dire danger."[51]

The Israeli uproar confused the Egyptians among others. According to Heikal, Gamal Abdel Nasser could not understand the outcry in Israel over his German-made rockets. The bewildered Egyptian president is recorded by Heikal as telling US ambassador John S. Badeau that if the Russians and the Americans could have their German scientists, why couldn't the Egyptians have theirs?[52]

Feeling the bite of public pressure, the Israeli government began dropping hints on 19 March that it would soon make "disclosures of the most horrible nature" about Egyptian weapons projects unless the Swiss government relented in sentencing Joklik and Ben-Gal. The Minister of Public Works was even more direct in public comments. "The survivors of the death camps," he promised, "will not look on passively while German neo-Nazis in the services of the Cairo Dictator prepare the destruction of Israel."[53]

Pressure was brought to bear on Ben-Gurion by his foreign policy team. Foreign Minister Meir recommended that a special envoy be sent to German Chancellor Adenauer, requesting that West Germany drop the extradition requests against Joklik and Ben-Gal. Since Ben-Gurion was vacationing on the shores of Lake Tiberias at this time, Harel agreed to relay Meir's proposal to the Prime Minister himself. With the support of Peres and his other disciple, Moshe Dayan, Prime Minister Ben-Gurion rejected Meir's recommendation: Adenauer could not interfere in a court extradition order nor could he deny foreign work to his citizens.[54]

The Joklik/Ben-Gal arrests, coupled with the press revelations of Egyptian advanced weapons development, revealed the growing rifts that were developing within the Mapai Party over German policy. Foreign Minister Meir and her supporters took a hard line on the scientist issue, warning that Nasser's missiles posed a serious threat to Israel's national security. Ben-Gurion, Peres, and Dayan predictably were more skeptical of Egyptian capabilities; they also sought to ensure a steady flow of German military assistance to the Israeli Defense Forces. Ultimately, however, the Prime Minister could not bridge the growing gulf that was emerging within his cabinet. These schisms make Ben-Gurion's decision to stay at Lake Tiberias while the Knesset debated his volatile German policy somewhat surprising in retrospect.[55]

The split in the ruling Mapai Party over German policy became evident during a 20 March session of the Knesset. With the Prime Minister still on vacation, the German scientist debate fell on the shoulders of Foreign Minister Meir. Ben-Gurion could not have chosen a worse candidate to defend his vulnerable rapprochement with Germany.[56] Golda Meir referred to Pilz, Goercke and the others as an "evil crew" motivated only

by a "lust for greed" and a "Nazi inclination of hatred for Israel." She reiterated that the links between Egypt and the Nazis were a far from novel development and that Cairo continued to serve as a "principal center and asylum for Nazis." But the Foreign Minister saved her harshest invective for Bonn. In her view, the West German government bore direct responsibility for the German scientists since

> these scientists and technicians are its citizens. The German government cannot remain indifferent to the fact that 18 years after the fall of the Hitlerite regime which brought about the destruction of millions of Jews we once again find members of that people responsible for acts designed to destroy the state of Israel within which the survivors of the holocaust have been gathered.[57]

Meir demanded that the Germans put a stop to the scientists' activities through whatever means necessary. "The German government must accept responsibility," she noted, since Bonn had a "duty" to halt the "wicked pursuits of its citizens" and terminate their Egyptian contracts. The crux of the matter was that those citizens were not only developing "offensive" missiles but also weapons "banned by international law." Although Meir did not mention Ibis or Cleopatra, it was clear from the context of her remarks that she had Joklik's atom bombs and radiological bombs in mind.[58]

According to Bar Zohar, a "frenzied debate" quickly followed the Foreign Minister's speech. The Communist Party called for a "settling of accounts" with West Germany, while a Mapam member fretted about Egyptian development of a "death ray." Herut leader Menachem Begin poured scorn upon Prime Minister Ben-Gurion: "You sent machine pistols to the Germans," he raged, "and now the Germans are sending microbes to our enemies." Sensing that the debate was quickly sliding into dangerous waters, Golda Meir castigated Begin for his comments, adding primly that it was beneath her dignity to respond to them.[59]

The Knesset debates eventually boiled down to a resolution on the German scientists issue, which, in many ways, was even tougher in tone and substance than Meir's speech. Adopted with a nearly unanimous vote (only the Communists abstained), the resolution declared that the work of German scientists and technicians in Egypt was a "danger to the security of Israel and its population." It added that the German people "cannot exempt itself" from responsibility for the actions of its citizens in Cairo and concluded that it was the "duty of the German government to put an immediate end to this dangerous activity of its citizens and take all steps required to prevent this cooperation with the Egyptian government."[60]

The rhetoric emanating out of Israel triggered angry responses in Cairo. On 21 March, the Egyptian Information Minister denied receiving any German assistance in obtaining nuclear weapons.[61] The West German

embassy in Cairo admitted having "friendly contacts" with the German scientists and technicians; however, it, too, denied any knowledge of German involvement with an Egyptian nuclear weapons program.[62] As international observers noted, although Egypt had been at the center of Israel's fears, much of Jerusalem's most barbed criticisms were aimed at Bonn. The *New York Times* informed its readers on 21 March that

> The denunciation of the United Arab Republic, Israel's arch enemy, and of the German scientists working there were to have been expected. What seemed new was the vehemence of the criticism of the West German government and people and of the policy of rapprochement with Germany nurtured by Premier David Ben Gurion.[63]

Bonn's initial reaction to Israel's criticism was mild. The German authorities said they had attached "considerable significance" to Golda Meir's appeal in the Knesset but added that they had no "legal means" of stopping German citizens from working in Egypt. One Bonn official said that a law barring scientists from working abroad would be discriminatory; others conceded that the Federal Republic would examine options to discourage its scientists from pursuing overseas weapons work.[64]

The following day, Egyptian and German officials continued to voice their reactions to the Meir speech and the Knesset resolution. The Egyptian Information Minister decried the acts of certain "Zionist agents [who] have undertaken criminal actions against families of German experts who cooperate with the UAR." This minister confidently asserted that Israel was probably motivated by "displeasure" with Egypt's "scientific and technological progress."[65] West German reactions were more strident than the previous day, with Bonn asserting its disapproval of those Germans abroad who "contribute to increased regional tensions." Nonetheless, German officials observed that they could not establish with "certainty" whether German technicians were helping Egypt develop and produce "aggressive rockets." If this was occurring, it was not with the "knowledge or approval of the Federal Government." Denials aside, a German government spokesman later seemed to contradict the earlier line when he admitted to a "maximum of 11 German experts … working in Egyptian rocket production."[66] On 25 March, Bonn again categorically denied that its citizens were helping Egypt produce weapons of mass destruction. A study of available evidence by German government analysts did not substantiate Israel's accusations, officials observed, adding that German scientists were engaged in little more than developing jet engines and "small" missiles, whatever that qualification meant.[67]

Behind the scenes, German government officials apparently were scrambling for information to rebut the Israeli charges. When the German Foreign Ministry asked the Israelis for tangible evidence of Egyptian WMD programs, they responded that all appropriate documents had been

passed to the German Defense Ministry. When approached by their Foreign Ministry peers, the Defense Ministry announced that it would not surrender the Israeli documents out of fear of risking Israeli sources in Egypt. Moreover, Strauss's Defense Ministry added that it concurred with Israel's request for controls on German scientists abroad. Thus thwarted in its quest for information on Pilz, Goercke, Schuran, and company (although it presumably had some information on these individuals from its embassy in Cairo), the Foreign Ministry concluded that no Germans were working on WMD projects in Egypt. In an exchange with a US diplomat, one Foreign Ministry official affirmed the presence of four Germans working on Nasser's rockets. These Germans were assisted by two Austrians and six East Germans "of unknown allegiance."[68]

The West German Foreign Ministry not unexpectedly viewed the unfolding dispute with Israel from the perspective of the East–West conflict. Wedded to the Hallstein Doctrine, which stipulated that Bonn would refuse to recognize those countries that established diplomatic ties with its East German rival, West Germany regarded Egypt as a valuable pawn that had to be lured away from the Eastern Bloc. As one Foreign Ministry official informed his American counterpart, Bonn was reluctant to compel the German scientists to return from Cairo, since the Egyptians would then turn to Moscow for help and the "West would be the loser." This same official noted that the Germans intended to deal with Israel's rocket worries by asking its Cairo embassy to gather information on the rocket scientists and determine which, if any, were interested in alternative employment at home. At this juncture, that was going to be the extent of Bonn's involvement in alleviating Israel's problems.[69]

On 26 March, the German scientists themselves presented their perspectives on Israel's charges. In West Berlin, Dr Eugen Sänger denied involvement in any "arms development" during his stay in Egypt. According to Sänger, he had visited Cairo in 1960 on a short-term contract to lecture university students in "aviation and space problems." He added that his "presence there had nothing to do with the construction of weapons of any kind."[70] Meanwhile, Sänger's former colleagues in Cairo gathered at an Egyptian television studio and firmly declared the Israeli allegations were a "blatant lie." In response to questions from Egyptian journalists, Dr Pilz and Dr Goercke admitted to training Egyptian engineers in rocketry; however, they did not discuss their more significant work in developing Nasser's long-range rockets. They denounced Israeli threats against themselves and their families and insisted that they were merely helping Egypt develop a space program.[71]

While Bonn mulled over its responses to Israeli demands and the scientists insisted on their peaceful intentions, all was not going well for Ben-Gurion and his associates in Israel. Golda Meir's speech, the Knesset debates, the Knesset resolution, and the over-hyped media reports of Egyptian radiological bombs were wreaking havoc on Israel's outreach

policy to West Germany. Shimon Peres rushed back from Paris amidst the uproar, sensing trouble for arms deals he was negotiating with Bonn. Peres criticized Isser Harel's "speculative reports" and ordered Israeli Military Intelligence to reexamine the entire Egyptian rocket threat as well as the evidence of Cairo's chemical, bacteriological and nuclear weapons work. The result of this investigation was a virtual replay of what had transpired the previous August: Aman once again questioned Mossad and the degree of danger posed by Egyptian WMD programs.[72] Aman's research department surmised that there was insufficient evidence to assert that German scientists were working on unconventional weapons in Egypt. Aman concurred with Lakam's earlier assessment that Otto Joklik was a "crook" or "charlatan" and that the Ibis and Cleopatra programs were essentially "unworkable."[73] Not surprisingly, given his earlier clashes with Isser Harel over the Egyptian missile issue, Aman chief Major General Amit echoed the sentiments of his analysts. Indeed, Amit was "positively contemptuous" of the Egyptian rocket threat and relayed these views to Ben-Gurion.[74]

For his part, Peres urged the Prime Minister to throttle back the anti-German campaign, given the danger of a serious rupture in Israeli–German relations. According to Deutschkron, German Defense Minister Strauss was already circulating rumors that Israeli polemics against Bonn could kill some secret arms deals. A key Strauss aide who was in Israel at the height of the fracas met with Ben-Gurion at his vacation residence on Lake Tiberias and presumably relayed German concern at rising anti-German sentiments among the Israeli populace.[75]

Ben-Gurion did not return to Tel Aviv until 24 March. In fact, the Prime Minister had other considerations at stake than a bruised relationship with West Germany. He was then in the midst of delicate negotiations with several left-wing parties to lure them into the Mapai fold.[76] Furthermore, Ben-Gurion knew that by terminating the anti-German campaign he would aggravate the growing rifts that had developed within his cabinet not only over German policy but the future of the Israeli military as well. Israel's national security establishment was at the time engaged in a debate that pitted nuclear weapons advocates Peres and Dayan against Mapai veterans such as Golda Meir, who viewed the atom bomb as a fatal drain on Israel's limited resources. In this context, close relations with the Germans meant more than just small arms contracts; it also yielded crucial German parts and tooling for Israel's secret Dimona reactor then under construction in the Negev Desert.[77]

On 24 March, Prime Minister Ben-Gurion finally returned to Tel Aviv, summoned Isser Harel to his home and expressed his concerns with the Joklik arrests and the ensuing uproar. The following day, both men met and again disputed the effectiveness of the anti-German campaign. Harel insisted that the Germans were morally responsible for the actions of their citizens in Cairo, while Ben-Gurion argued that he could not risk his

German policy over the activities of a few scientists. Ben-Gurion then demanded a full accounting of the Mossad's role in fomenting and manipulating anti-German sentiments before the Knesset's Defense and Foreign Affairs Committee. Harel refused and submitted a resignation letter instead.[78] Golda Meir supported Harel during the standoff with the Prime Minister and announced her intention to resign, although she never carried out this threat. Meir did reject Ben-Gurion's demand that the Knesset reverse its 20 March resolution, and she was supported by the cabinet as well. Only Moshe Dayan, then serving as Agriculture Minister, supported his Prime Minister's unpopular and increasingly isolated position.[79]

Despite resistance from Golda Meir and influential Mapai members, Ben-Gurion still had enough political clout to reverse the anti-German campaign. On 29 March, the *New York Times* said that Israel's prime minister was "angered" at the Israeli press focus on Egyptian "bacteriological" and chemical weapons programs. The anti-German sentiments "went further than was warranted by the public charges made 10 days ago by Foreign Minister Golda Meir and the Knesset." According to the correspondent, it was "increasingly apparent" that the Israeli government was attempting to "undo the damage" and "play down" the propaganda campaign. Officials were now acknowledging that "hard proof" of chemical or bacteriological weapons was not available. Furthermore, the government admitted that it never intended to be put in a position where this "hard proof" would have to be produced.[80] An "informed source" told a *Times* correspondent that Prime Minister Ben-Gurion was "highly displeased" with the anti-German campaign and had "decided on dismissals." *The Times* noted Israeli press hints that Golda Meir may have exaggerated in her 20 March speech to the Knesset, especially since the government could not produce any evidence to substantiate her claims. Other observers noted a marked drop-off in Israeli media reporting on the Cairo Germans.[81]

On 31 March, Isser Harel's resignation was made public, although he was not mentioned by name. Ben-Gurion announced the resignation during a cabinet meeting in which he also criticized the anti-German "propaganda onslaught." According to the press, the new Israeli position was that Bonn and the German people were not directly culpable for the actions of the German scientists. The cabinet also distanced itself from Harel's "unofficial" briefings that were responsible for sparking "inflammatory" media accounts of chemical and biological warfare developments in Egypt.[82]

Isser Harel's resignation over the German scientists affair triggered a political crisis in Israel. On 1 April, three opposition parties joined in calling for an extraordinary session of the Knesset, which was in its Passover recess. Another party was threatening to bolt from the ruling coalition, while its affiliated newspaper castigated Mapai for Harel's

resignation. That resignation, the paper observed, "was likely to be interpreted as expressing the reservations of the highest government authority . . . to publicly place the responsibility on Germany for what is being done by its citizens in preparing a war of destruction against Israel." Six days later, the Knesset convened to discuss the opposition's call for a debate on the Mossad chief's resignation and German policy in general. One by one, members of the Liberal, Communist, Herut, and Mapam parties accused the Prime Minister of violating the 20 March resolution; they also questioned the circumstances surrounding the Harel resignation. Ben-Gurion rebutted the criticisms and called for moderation, observing that the goal of the "Egyptian dictator" was to destroy Israel, and the assistance Nasser was receiving from West German nationals "should not throw us off our balance." Ben-Gurion urged the Knesset to act responsibly and allow the various Knesset committees to deal with the problem, since there were "numerous things" which could not be mentioned in public forums.[83] On 8 April, Ben-Gurion's Mapai party foiled the opposition's demands for a full debate on the German scientists issue by a 67–47 vote. The only statement to emerge from this test of political wills was an affirmation that the Cabinet Security Committee would discuss the problem after Passover.[84]

As tensions simmered over the Harel affair and the German rapprochement strategy, another voice in David Ben-Gurion's cabinet sought to strike a compromise. On 12 April, the war hero and Ben-Gurion disciple Moshe Dayan published an article in *Ma'ariv* which established what he regarded as an undeniable link between missiles and nuclear weapons.[85] "No army has ever produced [missiles]," Dayan wrote, "only to carry conventional warheads." Dayan believed it likely that Nasser would produce nuclear warheads for two reasons: first, these weapons would contribute to Nasser's dreams of a pan-Arab state stretching from the Atlantic to the Indian Ocean. Second, they would provide the means with which Egypt could wipe Israel off the map. Egypt's nuclear weapons need not be sophisticated either, Dayan noted. Even "primitive" nukes (he presumably meant radiological weapons) would allow Cairo to join what the author called the "anteroom of the nuclear club." Dayan warned Israelis to be under no illusions about world opinion, since the great powers would not step forward and thwart Nasser's nuclear ambitions. Having led his readers to this despondent conclusion, Dayan then made it patently clear that only Israel could and would handle the problems posed by an Egyptian nuclear weapon:

> Even if there has not been tangible evidence that the Egyptians were working on the production of nuclear weapons with the connivance of the German scientists and technicians, we may suppose without too much risk of error that they are intending to do so . . . I am in complete agreement with those who think we should do our utmost to

> prevent German scientists and technicians – and those from other countries – from helping with the "developments" in Egypt.[86]

Lest he go too far in his advocacy of Isser Harel's Operation Damocles, Dayan injected a note of caution. It must be "strongly emphasized," he insisted, that the "German people and their government" not be "confused" with the work of Pilz and the other scientists in Cairo. "It is a false identification," he observed, "that can only do us harm." Thus, in one paragraph, Dayan had quickly reinforced his prior endorsement of the Ben-Gurion line on Germany, namely that there was no link between the German government and the activities of German "experts" in Egypt. Dayan had his eye on a much higher prize than merely foiling Nasser's ambitions. The *Ma'ariv* article was carefully constructed to leave the reader with the inescapable conclusion that Israel must rely on its own resources to defend itself against its many potent enemies. Dayan left little doubt that Israel had to do more than merely intimidate German scientists. Israel required unconventional arms of its own, Dayan argued, thereby explicitly endorsing Israel's secret nuclear weapons complex then under construction in Dimona:

> In the coming era, the rocket age, our own armaments and the power of our own army are what will dissuade Nasser from starting a war. We must devote our efforts to the strengthening and improvement of those armaments and that power . . . In the era of rockets with conventional and unconventional warheads, we must diligently develop those weapons so that we don't lag.[87]

Dayan's thesis is significant not only for its pointed endorsement of an Israeli weapons of mass destruction program; it also establishes the linkage between ballistic missiles and nuclear warheads. That reasoning – later to be echoed by the United States in its regional arms control initiative – would project even more attention on Gamal Abdel Nasser's primitive rocket project. The missile–nuclear weapons linkage governed Israel's strategic thinking, for as Dayan argued quite cogently in *Ma'ariv*, a nuclear weapon required a viable delivery system. Dayan did not need to look far for pertinent examples, since the superpowers were demonstrating to the Israelis and other interested parties that a long-range ballistic missile was the ultimate delivery platform for a nuclear weapon.

According to researcher Avner Cohen, Egypt's nascent missile development effort had a direct bearing on Israel's decision to adopt a new security doctrine based on a nuclear weapon.[88] Once this new doctrine was adopted, Shimon Peres had the green light to contract with Marcel Dassault for a missile feasibility study that would eventually result in the MD-620 or Jericho missile. With its two stages, solid-propellant motors, 750-kilogram warhead, 235–500-kilometer range, and accuracy, the Jericho

was a far more sophisticated system than its Egyptian cousins. Indeed, variants of this weapon still serve as the cornerstone of Israel's strategic missile inventory.[89]

While the Israelis fought their internal debates over their new security doctrine, Otto Joklik and Josef Ben-Gal awaited trial in Switzerland. Both men were undoubtedly relieved by the Swiss Justice Ministry's decision to deny the West German extradition request. The Swiss attributed their denial to insufficient German evidence linking Joklik and Ben-Gal to the Kleinwachter murder attempt.[90] One month later, Joklik and Ben-Gal were given their day in court, where Joklik testified under oath that the German scientists in Cairo were attempting to acquire "capsules" of strontium and cobalt for use with ballistic missile warheads. In language reminiscent of the Knesset resolution and Golda Meir's speech, Joklik alleged that Egypt intended to use these substances to "poison Israel's atmosphere." When asked to prove these claims, Joklik provided what he alleged to be $100 million worth of invoices, receipts, and bills of lading for the Egyptian advanced weapons program. He testified that Egypt had purchased cobalt-60 and had it shipped to Dr Isis Khalil, reputed to be the sister of the Egyptian missile program official, General Mahmoud Khalil. Joklik also produced a letter allegedly written by the director of the Egyptian arms industry to Dr Wolfgang Pilz that revealed a plan to equip Egyptian missiles with cobalt warheads. Finally, Joklik presented to the court the infamous letter from Pilz that supposedly detailed Egyptian plans to produce 900 missiles at Factory 333 by 1970. When questioned in the Swiss court about his reasons for fleeing Egypt, Joklik replied that his departure was due to Cairo's "de facto intention" to "exterminate the Jews."[91]

In their indictment, Swiss prosecutors highlighted Joklik and Ben-Gal's "grave threats" to Dr Paul Goercke, although both men denied issuing any threats. Joklik further insisted that he did not violate Swiss export laws when he acquired a "radiation measuring instrument" for Egypt several years earlier. Yet even the prosecutors were sympathetic to the defendants, despite highlighting Joklik's deficiencies as a scientist and questioning the validity of his academic credentials. One prosecutor even summed up his case by confessing that Ben-Gal's acts were "understandable," since the German scientists were developing a weapon that "should disturb not only Israel but the whole world, especially since the weapon being discussed had already appeared in public in a Cairo military parade." In the prosecutor's view, Ben-Gal had acted with "justified concern for his country" and should be sentenced to no more than a three-month suspended sentence. For Joklik, the prosecutor recommended a fine and a hundred-day suspended sentence.[92]

The presiding judge concurred with the prosecutor's remarks, and acknowledged that Egypt's ballistic missile "offensive" compelled Israel to

react in a manner that was not "necessarily lawful." Even so, both men were sentenced to two months for time served.[93]

The Joklik/Ben-Gal trial proved to be a blessing in disguise for Israel. Although Otto Joklik's credibility had been seriously eroded by the end of the proceedings, his revelations in court of Egyptian advanced weapons were projected to an international audience through the print media and radio. In fact, Otto Joklik's success in justifying his cause before the Swiss court convinced some Egyptians that he must have been an Israeli plant all along. As one unidentified Egyptian official ruefully noted, "when I think of how he fooled us it brings tears to my eyes. The only thing he was an expert on was science fiction."[94]

Key question #1: How did Egypt's efforts to acquire rockets influence Middle East regional and international policies?

Even at this stage in the history, we can make a preliminary judgment that Nasser's drive to acquire ballistic missiles carried consequences for the Middle East. They certainly had an impact on Israel, where Nasser's missile tests and parade resulted in disputes by Israel's security establishment over who failed to warn about the advances in Egyptian rockets. Although Israeli intelligence collection on Nasser's rockets was generally good, its assessments seemed to have been lacking. Moreover, the fissures within the Israeli intelligence establishment over the effectiveness of those missiles did little to alleviate the unease in Israel's leadership, which felt it could not take any chances when it came to Egypt and advanced weapons. It is in this light that we can better understand why the Israeli leadership unleashed Operation Damocles against the scientists, their families, and their Egyptian employers.

Operation Damocles was derailed in part by the work of the Swiss police, who arrested two agents involved in intimidating one of the scientists' family. In order to secure the release of its operatives in Switzerland, the Mossad decided to take its case against Nasser to the public. The ensuing uproar shook the Israeli political establishment and eventually led to the firing of the Mossad chief. Thus, what had started out as an effort to create what were relatively crude missiles with little or no guidance telescoped into a regional and international problem that impacted on the Israeli, Swiss and West German governments. More importantly, Dayan and his followers in the Israeli security establishment used Nasser's missiles to justify Israel's creation of a nuclear deterrent and the means to deliver it.

Key question #2: What modern proliferation lessons can be derived from Egypt's experience with ballistic missile programs?

Several lessons for counter-proliferation can be derived from the events described in this chapter. First, and most important, is an assessment of

the link between ballistic missiles and weapons of mass destruction. Second is the use of intimidation as a counter-proliferation strategy. Finally, this case offers an interesting perspective on the uses and abuses of intelligence, which is certainly a timely topic today, in the aftermath of the Coalition invasion of Iraq.

Missile/WMD link

Moshe Dayan was prescient when he described the natural linkage between ballistic missiles and unconventional weapons, and the experience of the superpowers, Great Britain, France, China, India, Pakistan, Iraq, North Korea, and Israel itself, bear out Dayan's prophecy to the letter. Others have pointed out the natural "synergism"[95] between missiles and nuclear, chemical, or biological weapons. Carus highlights the "ominous" fact that developing-world countries with weapons of mass production programs usually have ballistic missile projects as well.[96] Fetter opts for the cost–benefit approach in his study, where he demonstrates that ballistic missiles generally are not a cost-effective way of delivering conventional explosives to a target, especially when compared to aircraft.[97] In a significant caveat, Fetter affirms that, relative to aircraft, missiles are cost-effective only at very short ranges or if anti-aircraft defenses neutralize a high percentage of attacking aircraft.[98]

So where does Egypt fit into this missile–WMD linkage? First of all, our knowledge base on Egyptian WMD programs is sparse. This is certainly true of nuclear weapons, where we know very little about Cairo's nuclear ambitions, particularly in the 1950s and 1960s. Cordesman offers a hint when he affirms that Egypt decided to pursue nuclear and chemical weapons after the 1956 war.[99] Another nuclear proliferation analyst, T. V. Paul, argues that Egypt was slow to develop even a civilian nuclear research program, let alone a nuclear weapons program.[100] He concludes that the Egyptian perspective on nuclear weapons is something of an anomaly in the field of counter-proliferation studies: "the Egyptian inability to acquire a rudimentary nuclear capability in the face of active Israeli nuclear pursuits remains a puzzle for proliferation analysts."[101] Karp notes that few countries have followed the Egyptian example in overlooking the connection between nuclear weapons and missiles.[102] Given this record, many analysts agree that Egypt never consistently pursued nuclear weapons; however, it probably examined the possibility of radiological weapons at some point in its confrontation with Israel.

While the picture is vague on Egypt's nuclear weapons program, its chemical weapons program is less ambiguous. According to Cordesman, Egypt may have acquired left-over British stocks of mustard gas from World War II; it most likely acquired the capability to produce this agent by the early 1960s.[103] Egypt also used chemical weapons against Yemeni royalists in the 1960s.[104] While Cairo likely possessed chemical munitions

that could be delivered by aircraft and artillery, it is not clear if the Egyptians successfully weaponized chemical agents for ballistic missiles in the 1960s. Egypt would have to overcome material and technical difficulties to succeed in delivering chemical weapons by missiles, including specialized reentry vehicles, a release mechanism, and, preferably, cluster munitions.[105] There is no reliable information on an Egyptian biological weapons program, although it is probably safe to assume that Nasser's scientists researched one.

From Israel's perspective, Egypt's anti-Israeli rhetoric, the legacy of two wars, and Nasser's aggressive pursuit of ballistic missiles left no doubt that Cairo ultimately sought nuclear and chemical weapons. Israel's strong reaction to Nasser's missiles was driven by fears (legitimate or otherwise) of a linkage between those missiles and Egyptian weapons of mass destruction projects. Although the Joklik revelations of an Egyptian nuclear and radiological weapons program eventually proved to be a fiasco, important Israeli leaders such as Dayan nonetheless pondered the implications of an Egyptian nuclear or radiological weapon, and how Israel should respond to this threat. In Dayan's case, highlighting an apparent Egyptian chemical, biological, or nuclear threat served two purposes: it put international pressure on Cairo to desist from advanced weapons, and it justified Israel's nascent and secret atomic weapons program to skeptics within David Ben-Gurion's cabinet.

As for David Ben-Gurion, he harbored no illusions that Cairo's missiles ultimately were intended to deliver nuclear warheads on Israel. In a 1963 interview with the American journalist C. L. Sulzberger, the former prime minister offered his perspective on Egypt's missiles and alleged nuclear weapons ambitions. According to Sulzberger, Ben-Gurion hinted "grimly" that Israel could have been experimenting with military atomics at Dimona. Nuclear energy could never be ignored, Ben-Gurion insisted, "because Nasser won't give up." He reasoned further that Nasser would not risk war with Israel until Cairo could be certain of a victory, and only nuclear weapons could guarantee that victory. Egypt had a "large desert" in which to test its advanced weapons, he observed, whereas Israel did not.[106]

With the limited evidence available, we can nonetheless conclude that the Egyptians most likely intended to tip their ballistic missiles with unconventional warheads. As an Egyptian adversary, Israel certainly could not ignore this possibility and it acted violently against the scientists who designed the WMD delivery systems. Leaving the important ballistic missile–WMD linkage aside, we cannot ignore the other factors that played an equal role in motivating Nasser to pursue ballistic missiles: prestige and the demands of the Egyptian polity, and a limited capability to strike Israel with an assured-penetration weapon. Concerning this latter point, Egypt sought ballistic missiles to offset the inability of its bombers to penetrate Israel's formidable integrated air defense system and preserve a deterrent against Israel.

Strategies for countering the proliferation of advanced weapons vary widely, from international treaties banning or controlling production, such as the Chemical Weapons Convention, to multilateral export control mechanisms exemplified by the Missile Technology Control Regime (MTCR). Alternatively, states may resort to simple bilateral agreements that restrict or ban the use of certain classes of weapons. The Intermediate Nuclear Forces Treaty is a pertinent example where two countries agreed to eliminate a certain class of ballistic missile.

Intimidation as strategy

In 1962, the state of Israel did not have the luxury of an international treaty to limit or curtail the production of Egyptian ballistic missiles. In fact, the MTCR and the global recognition that ballistic missiles posed a serious threat to regional security were still decades in the future. German and Swiss companies could funnel considerable amounts of technical expertise and specialized tooling to Factory 333 without fear of violating any domestic or international agreements. Further, the prospects for any regional peace settlement were grim. Confronted by the dangers of a ballistic-missile armed Egypt, convinced that those weapons were destined to deliver weapons of mass destruction, and lacking the restraints of international or bilateral agreements, Israel is perhaps unique in the annals of counter-proliferators by turning to covert violent action as the optimal instrument to tackle its Egyptian proliferation problem. That instrument was directed against the most vulnerable link in the Egyptian missile program, namely the German technical advisory team in general and the guidance and control experts in particular. It is still too early in this history to assess whether covert action was successful in Israel's counter-proliferation objectives; however, we can sketch the broad outlines of that strategy, which attempted to intimidate the scientists through assassination, letter bombs, and death threats.

Heinz Krug was the first victim of Operation Damocles. A key figure in the Egyptian missile parts and labor procurement system, Krug's disappearance undoubtedly created numerous short-term supply problems for the missile development effort, although there is no written evidence to document this point. The next assassination target was a vital player in developing a working guidance and control system for the Al Kahir and Al Zafir rockets. As such, Hans Kleinwachter did work that was essential in improving the military effectiveness of these weapons, a fact known to the Mossad and underpinning their justification for the murder attempt. Still, Kleinwachter survived the assassination attempt and continued to work for Cairo.

Letter bombs represented another aspect of Operation Damocles. Initially, the use of such weapons was lethal, with the maiming of Pilz's secretary and the deaths of at least five Egyptian Factory 333 workers.

Egyptian security reacted quickly to this threat, scanning all inbound correspondence through an X-ray machine. Although one bomb was discovered before it exploded, there is no record of additional letter bomb incidents in Egypt.[107] Again, the underlying purpose of these bombs was to intimidate – auguries of the threats looming over the scientists, their families and associates in Cairo. They generated an atmosphere of unease and fear, disturbing the hitherto tranquil – and idyllic – existence of Cairo's German expatriate community. It is interesting to note that letter bombs were never used against targets in Germany, and one can surmise that this was an implicit red line that the Israelis did not want to cross, considering the damage it could inflict on West German–Israeli relations.

The Mossad threat letters probably reached all those identified by Israeli intelligence to be working on the Egyptian missile program. Therefore, coupled with Krug's disappearance, the assassination attempt on Kleinwachter, and the letter bomb campaign, these letters may have been the most effective weapon against the scientists. Indeed, the message in the letters was quite blunt: others have suffered, and you and yours will, too, unless you cease your Egyptian work and return home.

When threat letters were insufficient to deter the German scientists, the Mossad decided, in at least one case, to try personal emissaries instead. It was in this context that the Joklik/Ben-Gal mission was born. That mission, of course, failed to achieve its objective in convincing Dr Goercke that a return to Germany was in his best interest, but it did generate worldwide attention through a much-publicized trial. Significantly, Dr Goercke was one of two leading guidance and control specialists in the Egyptian missile program.

Ultimately, the Israeli intimidation and assassination campaign was a rather crude method of intimidation; its primary contribution to Operation Damocles was in demonstrating that Israel meant business, and serious consequences could be inflicted on those who continued to work on Cairo's missile projects. Israel was to revisit some of these coercive methods in the future.

Using intelligence

This case offers an interesting perspective on the use and abuse of intelligence. At the heart of the Israeli political crisis in the spring of 1963 was the use of uncorroborated and probably unreliable intelligence derived from a single human source. Despite misgivings by Israeli military and scientific intelligence analysts over the reliability of the information and the motivations of its source, the Mossad leaked it anyway to the press. This leak created a press sensation over Nasser's missiles and alleged nuclear, biological, and radiological weapons programs. The leak triggered Israeli public outrage against West Germany for failing to rein in its citizens; it also exposed serious rifts within the ruling party over foreign and

national security policy. In the end, Prime Minister Ben-Gurion had to expend political capital in repairing the damage inflicted on his West German policy by the leaks, and by the Knesset resolution against West Germany. His damage control provoked the resignation of the Mossad chief, aggravated tensions within the cabinet over German policy, and sparked an effort among opposition parties to force an emergency session of the Knesset. For Ben-Gurion himself, the scientists affair undoubtedly was a factor that led to his resignation in June 1963. An Israeli journalist best summed up the results of the Harel revelations in a *Ha'aretz* editorial written after the public furor over Cairo's resident German community had died down:

> The mobilization of public opinion has gone hand in hand with disgraceful manifestations. The worst of all is the panic that has seized Israel and which now appears ridiculous. The description given in the Knesset of the Egyptian death ray, hissing and devouring everything in its path, seems borrowed from the adventures of Flash Gordon.[108]

As today's headlines demonstrate, the use and abuse of intelligence is a perennial theme in international politics. In the most recent case, the United States and United Kingdom went to war with Iraq on the basis of intelligence reports that were insufficiently or improperly analyzed by their respective intelligence communities. Moreover, as the Mossad used faulty intelligence to justify its campaign against the German scientists in 1963, both Washington and London highlighted Saddam Hussein's alleged possession of chemical and biological weapons to justify their war against him.

4 Bonn's dilemmas

Egypt displayed a two-stage rocket in 1963, and there were rumors that Cairo wanted to put a satellite into orbit the following year. Series production of the Al Kahir and Al Zafir rockets probably began, although the German–Egyptian scientific team was unsuccessful in acquiring or producing adequate guidance and control mechanisms. In response to pressure by the Israeli government, the Federal Republic of Germany embarked on a counter-proliferation strategy in 1964–1965 that consisted of incentives to attract the scientists back to Europe and warnings to those who persisted in working for Nasser. The West German government never found a constitutional mechanism that would allow it to revoke citizenship or ban the foreign travel of scientists with skills in rockets, chemicals, and other military projects. The missile project and the controversies it generated contributed to the decline in Bonn's relations with Cairo and other Arab capitals. The establishment of full diplomatic relations between West Germany and Israel spurred several Arab countries to cut their ties with Bonn in 1965.

The United Arab Republic celebrated the eleventh anniversary of its revolution on 23 July 1963 with another military parade that included newly acquired SA-2/Guideline surface-to-air missiles, PT-76 amphibious tanks, anti-aircraft guns, tanks, and heavy artillery as well as MiG-17/Frescos and Tu-16/Badger aircraft. The Egyptians once again paraded their surface-to-surface missiles, including Al Kahir, mounted on a flatbed truck, and Al Zafir, which was seen for the first time on a dedicated mobile erector launcher.[1] According to US intelligence, this launcher was equipped with a cradle that extended over the cab, and a blast bucket at the rear. Hydraulics lifted the cradle and missile into a vertical launch position. The launcher, based on a six-wheeled Soviet ZIL truck chassis, was crucial to Al Zafir's effectiveness, since the range limitations of this weapon restricted its operational use to militarily vulnerable areas near the Egyptian–Israeli border.[2]

While military equipment, a mounted camel unit, and a notional Palestinian army recruited from Gaza refugee camps marched by, the Egyptian

armed forces chief of staff, Marshal Amer, delivered a speech lauding his country's technical achievements. "We have gone a long way since last year upon the road of technical progress," he asserted, "and achieved sure success in the manufacture of missiles and Arab jet planes." According to Amer, another symbol of Egypt's military-technical prowess was the development of the Arab world's first submarine, which was to be "tested" within fifteen days.[3] This latter assertion was a subtle departure from the truth, since Cairo had turned to the Soviet Union for export versions of its Whiskey class diesel submarines.

Submarines and mobile missile launchers aside, the undoubted highlight of the 1963 parade was a new, two-stage ballistic missile called Al Ared – or *Pioneer*. At least four of these missiles, painted a uniform gray and covered with black, white, and red bunting, were paraded along the Cairo corniche and past the official reviewing stand. Some Egyptian propagandists declared that this formidable new missile could carry a 4,000-kilogram payload over a range of 580 kilometers, while others asserted that 1,000 kilometers was a more accurate figure. Although these officials insisted that Al Ared had been "successfully" tested "several times," they were coy about the missile's intended purpose. The official line was that Al Ared was no more than a "space research rocket," although its presence in a military parade was not explained.[4]

The Al Ared story was covered by several newspapers and journals. The *New York Times* quoted Washington sources as saying that Al Ared would probably not have a "major impact" on the regional balance of power, although one official astutely referred to this system as a "psychological weapon" that could spark a new round in the Middle East arms race.[5] A British aviation journal regarded Cairo's announcement of "successful" Al Ared tests with some skepticism, noting the formidable technical challenges inherent in stage separation and second-stage ignition.[6] For their part, US intelligence agencies downplayed the military value of Al Ared, concluding that this system was based largely on a combination of Al Kahir and Al Zafir rockets as its respective first and second stages. From the US intelligence community's perspective, Al Ared was "largely for propaganda purposes." A US Special National Intelligence Estimate concluded that Al Ared could be a space launch vehicle for a small Egyptian satellite, given its limited military payload capabilities.[7] All this was assuming, of course, that Al Ared was a legitimate launcher or weapons platform: some in the United States and elsewhere were inclined to believe that this two-stage behemoth was little more than a hoax. Significantly, the Egyptians never treated the foreign correspondent community to footage of actual Al Ared launches, nor was the missile ever seen deployed on a working transporter-erector-launcher.[8]

Reports of a German technical advisory team working on an Egyptian small satellite program had been circulating in 1963 and probably spurred the SNIE's speculation that Al Ared was destined to be a space launch

vehicle. According to one source, a predominantly German research and development team was examining the possibility of building a small satellite called Al Negma – or Star. This satellite would be boosted into a 480 kilometer orbit by either an Al Ared rocket or a three-stage Al Ared variant.[9] The influential *Aviation Week and Space Technology* magazine also reported on the Al Negma program, adding that the satellite's payload was intended to examine the earth's electromagnetic field. This journal concluded that the political aspects surrounding Egyptian satellite development were perhaps more important than technical accomplishments or scientific research:

> The satellite package has a primary mission of dramatically demonstrating Egypt's paramount role within the Middle East, its position of leadership within the "neutralist" bloc and its general technical surge under the aegis of President Gamal Abdel Nasser.[10]

This was heady stuff. What greater propaganda feat could Nasser achieve than to have Egypt, land of peasants and erstwhile playground of the great powers, join the superpowers in successfully building and launching a satellite? The temptations for the Egyptian leadership must have been irresistible.

Both British and American technical experts noted the serious infrastructure liabilities confronting Egypt's satellite program, including the fundamental lack of ground stations for satellite tracking, monitoring, and data readout.[11] Not surprisingly, the Egyptian Supreme Committee for Space Research soon issued a public recommendation that the United States be approached to build a satellite tracking station in Egypt. From Cairo's vantage point, the advantages of such a proposal would be twofold: Washington would possess another tracking station in its global network, while Egypt would have a dedicated facility to handle Al Negma operations.[12]

The Al Negma satellite probably was a marriage of interests between an overly ambitious Egyptian government and Wolfgang Pilz, who had once dreamed of building satellites for the West German government. As Egyptian officials speculated on a launch date timed to coincide with the twelfth anniversary of the Egyptian revolution, Al Negma probably was another distraction for a German team already bedeviled by thorny guidance problems and an intensive Israeli intimidation and assassination campaign.[13] Nasser and Pilz could dream of Egyptian satellites crossing the heavens, but the fact remained that three years after their recruitment, the German rocket scientists had not produced a viable ballistic missile.

The grandiose visions of a satellite program and multi-staged missiles aside, the Egyptian missile project probably entered its production phase by late 1963 or early 1964.[14] The need for research and development scientists was beginning to diminish and Cairo now had a growing requirement

for skilled and semiskilled technicians to handle the new machine tools at Factory 333. As G. Harry Stine details in his history of the intercontinental ballistic missile, there are distinct differences between development and production engineers, with the former constantly striving to perfect the product, while the latter are more concerned with "punching out product" and simplifying the design for production purposes.[15] If the history of the German V-2 is any guide, the Al Kahir and Al Zafir programs probably entered production with numerous technical flaws, including the lack of a reliable guidance and control system to direct the missiles to their target. As one analyst observed, an Al Kahir aimed at Tel Aviv was far more likely to land in the Mediterranean or on Jordan than on its intended target.[16] Given these problems, the Egyptian production effort must have been subject to numerous halts while design faults were worked out: in the case of the V-2, Stine tells us that over 60,000 engineering changes were made to the basic design while the missile was in full production.[17]

Even as small numbers of missiles entered production in Factory 333, some German rocket scientists found sufficient grounds to justify their continued stays in Egypt. Of course, Dr Goercke's skills were vital to overcoming the guidance and control impasse, while Dr Pilz likely had his Al Negma satellite project to contemplate. Besides, if it was not a hoax, Al Ared was still under research and development, and Pilz's management abilities were necessary to see this missile project through to completion.

In some ways, life wasn't bad in Cairo for the German scientists. Although the threat of assassination by an Israeli hit team forced them to carry pistols and special identification cards, the scientists did enjoy the comforts of air-conditioned villas in Maadi or Heliopolis as well as the elegance of Cairo's country club scene. Pilz and Kleinwachter often rode horses in the desert near the Giza pyramids or fished in the Red Sea, although they had bodyguards in constant attendance.[18] One journalist who was granted access to some of the German scientists in 1962 or early 1963 summed up the lifestyle of the missile team "aristocrats":

> The estimated 450 German scientists, engineers, and technicians who work for Nasser today live in an atmosphere combining luxury and fear . . . After hours they lead a carefree, fun-loving life . . . At carnival time they nostalgically caroused at a "Rhine Carnival" party in the Nile Hilton Hotel. The blond giants loafing in the sun or diving off the high board at the Heliopolis Sporting Club look like incongruous leftovers from Afrika Korps days. With their air-conditioned penthouses, their sports cars and their special imports of sausages and other delicacies from Hamburg, they are the inheritors of the opulence of King Farouk's days . . . The three rocket men are coddled specialists who know they will always be in demand, like the German princes who once filled the vacancies on European thrones.[19]

Payment terms were more than adequate, with Pilz and Goercke receiving the equivalent of $3,000–$5,000 per month in a mixture of Egyptian pounds and Swiss francs.[20]

Ample salaries were not the only reason that the German scientists stayed on in Cairo. One writer observed that the "greatest attraction in working for Nasser lies in the power and responsibility involved."[21] He might have added that these scientists were also in search of meaningful work which simply wasn't available in West Germany at this time. As we have seen, Wolfgang Pilz was an ambitious scientist with aspirations to building three-stage, inexpensive rocket launchers for a hypothetical German satellite program. When his proposals went unanswered by Bonn bureaucrats, Pilz accepted a job in Egypt, where, despite the frustrating inadequacies of local scientific talent, he was the unquestioned king of a missile fiefdom. Ultimately then, the money was good but, from the perspective of Pilz or Goercke, the work probably was even better.

Meanwhile, in Bonn, the West German government slowly awoke to the realization that there were serious shortcomings in its avionics and space research policies. This recognition was triggered in part by the Sänger–Operation Damocles imbroglio and by the creation of the European Space Research Organization in June 1962. In response to these events, the Federal Government established a formal space program in 1962, with funds for several ambitious projects, including fully recoverable research rockets, high-energy propulsion systems for the European Launcher Development Organization, an aerospace transporter, and a satellite. Even Eugen Sänger was brought in from the cold to become Professor of Astronautics at the Technical University of Berlin in March 1963.[22]

The establishment of a federally funded and centralized space program represented only one aspect of Bonn's strategy to deal with wayward scientists. As early as August 1962, the Federal Science and Research Ministry was working on a plan to convince the Cairo experts to return to West Germany. Among the proposed incentives were higher salaries, decent living conditions, and challenging work.[23] In March 1963, physicist Dr Karl-Heinz Gronau returned to Germany after spending nearly three years conducting research on fuels for Pilz's missile team. The German government hailed Dr Gronau's return as the first tangible sign that the incentives program was working, although Gronau later told the press that his return was triggered by the expiration of his Egyptian contract. In fact, Gronau became something of a public relations problem for Bonn when he highlighted the mixed messages he received from the German embassy in Cairo. According to Gronau, he and two other German nationals approached the German military attaché for guidance, expressing concern with recent Nasser threats against Israel. The attaché told his compatriots to remain in Egypt, since Bonn could not afford to have the Russians take

over Cairo's missile project. Given previous comments by German officials that reflect a similar pattern of Cold War thinking, Gronau's story certainly sounds plausible.[24]

Bonn relied on more than just material incentives to bring the Cairo Germans home. In 1963, it distributed letters and circulars to the scientists, warning them that they were "playing with [their] lives" by continuing their work for Nasser. Although West Germany was obviously not going to take drastic action to force the scientists' return, it strongly implied that others would, and, given the recent history of Operation Damocles, there was no doubt who those "others" were.[25] Bonn also struck at the scientists by withholding funds from research institutes that supported their activities. For example, a research group cut all ties with Dr Kleinwachter's laboratory at Loerrach after the German government threatened to curtail its funding. Bonn also canceled government contracts with German firms found to be supplying the Egyptian missile project.[26]

The Israelis pressed the Germans for more than incentive programs and suspended contracts. Jerusalem wanted greater government restrictions on scientist travel, even the repudiation of citizenship for those Germans in Egypt who did not return home by designated deadlines. The German government questioned the legality of travel restrictions, although its opposition parties disagreed.[27] On 2 April 1963, Dr Carlo Schmid, Vice President of the Bundestag, leader of the Social Democrats, and co-author of the West German Basic Law – or constitution – declared that the work of the German rocket scientists in Egypt violated the constitution. Schmid cited a clause in that document which banned those "acts tending to disturb the peaceful coexistence of nations or leading to the preparation of an offensive war." In Dr Schmid's view, there was no doubt that the work of German rocket scientists in Cairo was increasing the danger of war in the Middle East.[28]

Schmid also condemned the recent Mossad campaign against Krug, Kleinwachter, and the others, adding that the Bonn government had to make it clear to the Israelis that the Mossad's acts were incompatible with amicable relations with the Federal Republic. Schmid's comments were echoed by other opposition Bundestag members who urged the recall of the rocket scientists without spelling out precisely how that was to be accomplished.[29]

By late April 1963, Bonn still found itself immersed in the German scientist problem. In response to a letter sent by the US Anti-Defamation League (ADL) of B'nai Brith, urging "moral safeguards lest freedom turn into license," the West German Foreign Minister noted his government's efforts to stop the activities of Pilz and company in Egypt. According to this official, Bonn was "exploring" ways of taking action against the "uncontrollable and irresponsible activities" of these scientists.[30] What the Foreign Minister was hinting at in his April letter to the ADL took shape in May with the creation of an Inter-Party Bundestag Committee, which

would examine legal mechanisms to restrain the rocket experts. This committee went to work on draft legislation that would ban any overseas work by German citizens on chemical, biological, or nuclear weapons without prior permission by the Foreign Ministry. Those currently abroad and engaged in this type of work were "grandfathered," that is, they would have six months in which to file for a Foreign Ministry permit. If these individuals did not apply for or receive such permission, they could be arrested upon their return to Germany.[31]

This draft never emerged from committee. Citing possible violations of the constitution, the ruling Christian Democratic Union (CDU) objected to the legislation. German law, party officials argued, could not limit the movement of German citizens, regardless of their activities in other countries. Furthermore, the CDU insisted that the bill's provisions were not sufficiently extensive to fulfill its objectives. The CDU's critics suggested that the party was bowing to pressure from Egypt and other Arab states. At any rate, the draft was quietly shelved as the German political parties pondered other options.[32]

Meanwhile, West German Defense Minister Franz Josef Strauss traveled to Israel shortly after the bill was suspended. Strauss's trip, prompted by an invitation from David Ben-Gurion in his capacity as defense minister, was intended to explore the possibility of establishing full diplomatic relations between the two countries. In addition, Strauss probably intended to limit the damage caused by Bonn's failure to address the scientist issue completely. During his meetings with the Israelis, Strauss denied that Arab pressure had anything to do with the decision to cancel the draft legislation. He admitted that Bonn sought "good relations" with the Arabs and warned that other states could not tell the Federal Republic what it "should or should not do." Strauss denigrated the work of the German rocket scientists in Cairo: Soviet or US ballistic missiles, he noted, were "much more modern than what these old-fashioned German scientists, long behind in technical progress, can develop." Strauss acknowledged that the work of these scientists could increase regional tensions and provoke "slow change" in the Middle East balance of power. It was for that reason, Strauss reassured his hosts, that the work of these experts "should be stopped." Finally, the German Defense Minister held open the promise of official ties between Bonn and Tel Aviv. It was time for a "definite solution" to the ambiguous state of affairs linking both countries, he said.[33]

Israel was not mollified by German overtures, and continued to press for action on the Cairo scientists. By late June, the Bundestag parties were attempting to work around the problems that killed the previous draft bill banning German weapons work abroad. On 28 June, three Bundestag parties unanimously passed a motion instructing the government to prepare a new bill that would restrict German activities in foreign military programs. Following the passage of this motion, the Bundestag went into its summer recess, leaving the Israelis disappointed with what they saw as

German words in place of action. Golda Meir told the Knesset that she "hoped" Bonn would move more quickly on recalling the scientists in Egypt. She did allow that the West German government was finally beginning to show some signs of responding to Israel's concerns.[34]

Israeli disappointment notwithstanding, the Bundestag motion led to the establishment of an inter-ministerial commission with representatives drawn from the Foreign, Justice, Interior, Economic Affairs, and Economic Cooperation ministries. As with the earlier attempt at legislation banning citizens' activities abroad, the Commission soon foundered over contradictory clauses in the Basic Law. Whereas one article explicitly permitted the right of travel for all German citizens, Article 26 was equally specific in forbidding activities that "disturb the peaceful relations between nations" such as "aggressive war." There was little doubt that Nasser's missile programs fell under the rubric of offensive weapons, but how could Bonn recall Wolfgang Pilz or Walter Schuran if such travel was guaranteed by the Federal constitution? How could the Commission distinguish between scientific activities that had inherent dual uses, such as nuclear energy or biological research? Furthermore, could not a scientist respond by simply adopting the citizenship of another country?[35] Pilz and Goercke seemed to have taken preliminary steps towards Egyptian citizenship when they permanently moved to Cairo.

As with any constitutional dispute, the Commission attempted to forge a compromise. It proposed that the government pass a law forbidding Germans to work on unsanctioned foreign military projects. In addition, the Commission proposed an amendment to existing passport laws that would allow the government to revoke the passport of any individual working abroad on "unauthorized" weapons work. Still, that compromise had its critics among those who insisted that the Basic Law could not be contravened by restricting the movements of German citizens. Furthermore, some representatives in German industry reportedly cautioned against any perceptions of yielding to Israeli demands, fearing that these could harm valuable commercial ties with the Arabs.[36]

By August 1963, Israeli patience was wearing thin. From Tel Aviv's perspective, German squabbling over the constitutionality of restricted foreign travel was nothing more than dithering, while the real problem – German scientists working on Egyptian missiles – remained unresolved. On 16 August, Levi Eshkol, Ben-Gurion's successor as prime minister, was interviewed on West German television. His message to his German audience was rather blunt and guaranteed to engender debate. "If sons of the German people who are burdened with the murder of six million Jews" helped others in their plans to destroy the state of Israel, he insisted, "then the crime is infinitely greater." Surrounded by enemies on all borders, Israel was making it patently clear that whoever aided its enemies – directly or indirectly – was guilty by association. Germany ran the risk of implicitly falling into Israel's "enemy" category.[37]

With the Israelis clearly impatient for action, West German policymakers finally agreed on a broad strategy to deal with the German scientists problem by 1964. In the fall of that year, Bonn renewed its efforts to lure back the second-tier scientists in Egypt. Those efforts were crowned with success when reports surfaced that Walter Schuran and Paul Goercke had returned to Germany in late 1964 or early 1965. Schuran, Goercke and five technicians reportedly took jobs with the Messerschmitt-Bölkow-Blohm (MBB) firm. By May 1965, some thirty scientists, engineers, and technicians had left Nasser's missile program for more attractive offers in Europe. Virtually all of those who left during this time period had been enticed by lucrative salaries and by promised work in the European aerospace field. Not to be left behind, Wolfgang Pilz also considered departure, although he linked this to a guarantee from the West German government that he would be safe from Israeli hit teams. Another source suggested that Dr Pilz had requested an "exorbitant" salary as well.[38]

Progress in the German government's scientist incentive program paralleled a general warming trend in West German–Israeli relations. As Josef Joffe argues in an article on Bonn's Middle East policies, West Germany's growing tilt toward Israel was based in large part on moral obligations to the state of Israel and political debts to the United States.[39] In the case of the former, Bonn and Jerusalem began a clandestine trade in arms in the late 1950s, which blossomed to the point that by 1960, West German Chancellor Konrad Adenauer promised Ben-Gurion some DM200 million worth of arms and some DM2 billion in credits.[40] As for the United States–West German relationship, Washington had agreed to supply Israel with weapons, but it sought to avoid incurring the wrath of the Arabs in doing so. Consequently, in one significant arms deal with Israel, Washington agreed to sell Jerusalem its most advanced tank, the M-48 Patton, provided that these came from West German stocks. German Chancellor Ludwig Erhard agreed to this transfer, although some of his advisers prophetically warned about the consequences for West Germany's relations with the Arab states.[41] Diplomatically, by late 1964, West Germany and Israel were in the advanced stages of establishing full relations.

Even as Bonn and Jerusalem began to develop a framework of warmer ties, Egyptian–West German relations predictably were rapidly heading towards a precipice. Part of the problem was that the M-48 tank deal became public knowledge by autumn 1964, and many Arab governments conveyed their anger that Bonn would aggravate the arms race in the Middle East.[42] West Germany attempted to placate all sides by offering to cease supplying arms to Israel and increase its aid to Egypt in return for full diplomatic relations with Israel. Israel and the Arab states refused this deal.[43]

The contentious Egyptian missile problem lay close to the heart of the looming crisis in West German–Arab relations, and the precipitating

moment came with the arrest, trial, and imprisonment of Israel's spy in Egypt, Wolfgang Lotz.

In the spring of 1964, Lotz and his wife traveled to Europe, ostensibly to sell thoroughbred horses to a wealthy Italian buyer and to seek medical treatment for Waltraud's "non-malignant brain tumor."[44] Once their business with the Italian was completed, the Lotzes journeyed to Paris, where Wolfgang met his new handler from the Mossad (the year before, Unit 131 was transferred from Israeli military intelligence to the Mossad).[45] After two days of intensive debriefings, the handler announced his complete satisfaction with Lotz's work, especially in the crucial area of Egyptian rocket bases. The Israeli intelligence official then proceeded to issue new taskings: the Mossad was particularly interested in collecting additional intelligence on Karl Knupfer, the man who apparently was selected to replace Paul Goercke as the director of the missile guidance department. According to Mossad sources, Knupfer was busy recruiting new assistants in Europe.[46]

Unlike Eugen Sänger or even Wolfgang Pilz, not much is known of Karl Knupfer. Lotz tells us he was an excellent engineer, who, like his predecessors, enjoyed the benefits of a well-paid position and a relatively luxurious life style in Egypt. Moreover, according to Lotz, Knupfer cared little for politics as long as he was paid on time and in the right amount. In his personal life, Knupfer was somewhat shy and withdrawn; he reportedly did not have any social contact with his subordinates outside of work and he was also fairly strict with them. Still, Knupfer's introversion didn't really matter, for as Lotz points out in his memoirs, his primary source of information on Knupfer was not the man himself but his wife, Marlis. Recognizing Knupfer's potential value to the missile program, Lotz deliberately made the Egyptians suspicious of their new guidance expert by suggesting that he disliked the Nasser regime.[47]

Three weeks after receiving his instructions from the Mossad, Lotz coincidentally met two of Knupfer's new assistants on the Trieste–Alexandria ferry. Ever the prodigious intelligence collector, Lotz approached one of the men as he sat alone at the ship's bar. After a round of discreet questions and answers, Lotz was able to ferret out that his new contact's name was Erich Traum, that Mr Traum was an electrical engineer, and that he was going to work for the Egyptian government on a six-year contract. Several days later in Cairo, Karl Knupfer's wife, Marlis, confirmed to Lotz that Traum and the other colleague were in fact hired as her husband's senior assistants. Lotz had been particularly diligent in his efforts to establish a relationship with the Knupfers, and in his memoirs, he says he was successful in eliciting information from them on the missile program.[48]

Up until now, Israeli clandestine activities in Egypt could be characterized as a success, although Jerusalem unwisely risked their best spy in Egypt by ordering him to take part in the letter-bombing campaign. That indiscretion aside, Wolfgang Lotz had penetrated the innermost sanctums

of the missile program by befriending the key German rocket scientists and influential Egyptian security officials. Nevertheless, for all of Israel's espionage accomplishments, she was about to face a modest setback in the person of Caroline Bolter.

Hitherto, Wolfgang Lotz was probably the only Mossad case officer directed exclusively against the German aviation and rocketry experts in Egypt. Flushed with Lotz's success in Egypt, Israeli intelligence decided to send another intelligence officer out to Cairo to pry secrets out of the expatriate Germans. Lacking the poise and discretion of Lotz, this new collector, named Caroline Bolter, quickly made it apparent to all discerning observers that she was too interested in gleaning details about the rocket program. Not only did she attempt to strike up friendships with the scientists and their families, Bolter repeatedly attempted to steer casual conversations toward the rockets, their numbers, and their locations. Caroline Bolter was not only hampered by her blatant attempts to gather sensitive information, but Lotz tells us she frequently lapsed into Yiddish when drunk.[49]

Like Lotz, Caroline Bolter set her sights on Karl Knupfer and his wife. She joined the Heliopolis Sporting Club, where she was frequently seen in the company of Ms Knupfer. Ms Bolter's apparent lack of training soon caught up with her when she was caught by Ms Knupfer taking pictures of Karl Knupfer's office, where he kept blueprints and other documents. Informed by his wife about Caroline Bolter's miscues, Karl approached his close friend Wolfgang Lotz and told him about his suspicion: Ms Bolter, it seemed, was an Israeli spy. Worried about the implications of Bolter's possible arrest for his own position, Lotz promised to raise the Bolter issue with his contacts in Egyptian intelligence, adding that surveillance would be immediately placed on Ms Bolter's activities. Knupfer was appeased.[50]

The following morning, Lotz sent an urgent message to Mossad, urging them to remove Caroline Bolter from Egypt immediately. The indiscreet spy was promptly removed, and Lotz could breathe a temporary sigh of relief.[51]

Throughout 1964 and early 1965, Lotz continued to collect intelligence on the rocketry and aviation experts in Cairo. He even used the occasion of his wife's birthday to invite several German and Austrian engineers to his villa in Giza. It was hardly a coincidence that many of these men were involved in building Nasser's HA-300 jet, a project that was years behind schedule and dangerously over budget. Although their salaries were handsome, frustrations with the Egyptians ran high among the aviation experts: many lamented the poor facilities and the atmosphere of fear that seemed to pervade throughout the expatriate community following Operation Damocles. Furthermore, just as guidance proved to be a formidable obstacle for the missile project, so did engines pose a significant impediment for the jet program. Lotz learned that repeated static tests of the engine resulted in failure, although the director of the engine department insisted

that the problems lay with the airframe. In the end, however, the biggest problem for the HA-300 – as it was for the missile program – was the steady erosion in technical talent. One by one, the engineers and technicians were resigning their contracts and returning to Europe. Apparently, working in Egypt was no longer as attractive or lucrative as it used to be.[52]

The end came quickly and decisively to Wolfgang Lotz's career as a spy in Egypt. Only a few days after Waltraud's birthday, the Lotzes took a trip to the north-western Egyptian town of Mersa Matruh to visit Lotz's old friend Youssef Ghorab, who had been promoted to governor of Egypt's Western District. Accompanying the Lotzes on this trip were Waltraud's parents and the Knupfers. Two days later, on the afternoon of 22 February 1965, the party returned to Cairo. After saying goodbye to the Knupfers, Lotz, his wife, and her parents returned to the Giza villa, where they were promptly arrested by Egyptian security agents.[53]

Once the secret police had forced him into his house, Lotz continued to plead vigorously both his innocence and his ignorance of the espionage charges that were being leveled against him. Lotz resorted to name-dropping in the vain hope that his influential friends could bail him out once again. But all this was to no avail, for Lotz quickly learned that General Ghorab, General Osman, and Colonel Sabri had all been arrested as suspects in his spy ring. Lotz's hopes that he could bluff his way out of his predicament were further dashed when the Egyptian security men opened up his bathroom scales and revealed his secret transmitter. Later, the Egyptians showed Lotz transcripts of some of his coded messages to Israel. The game was over. Lotz proceeded to cooperate with his captors, albeit on a selective basis.[54]

How did Lotz get caught? Who turned him in? How did this well-trained collector err? Wolfgang Lotz indicates in his memoirs that his transmissions to Israel had been intercepted by "agents of another power," which, given Egypt's reliance on the Soviet Union for weapons and intelligence training could only mean the Soviet KGB or GRU. Only a month before Lotz's arrest, another former Unit 131 spy, Eli Cohen, had been captured in Damascus, probably as a result of successful Soviet intercepts of his transmitter. Raviv and Melman believe that the Soviets had devised new and more sophisticated radio direction-finding equipment, and had passed on their expertise to the Syrians and the Egyptians. Unlike his counterpart in Egypt, Cohen was to be hanged for his activities in Syria a few months later.[55]

Wolfgang Lotz was interrogated in the classic Soviet fashion, facing a barrage of questions from a rotating team of intelligence officers and security officials, who employed a predictable good cop, bad cop routine. All of these questions were directed at him as he faced powerful lights that were clearly designed to disorient and intimidate him. As his interrogation proceeded, Lotz soon learned that his adversaries had bought into the rumors that he was a former officer in Hitler's SS. In fact, the Egyptians

even suggested that the Israelis had used Lotz's supposed past in the SS in order to blackmail him into spying for them. Lotz did little to disabuse his captors of these notions, sensing that his German past could save him from the gallows.[56]

As a measure of his importance to the Nasser regime, Lotz was personally interviewed at times by the chief of the *Mukhabarat* himself, Salah Nasr. Nasr attempted to trick his captive into revealing information that would, he assured him, be withheld from the Egyptian prosecutor-general. Lotz says he refused to fall for this ploy. Later, Nasr forced Lotz to write a statement, confessing that he had been behind Isser Harel's letter-bomb campaign. The discovery of igniters in the same bathroom scales that disguised the transmitter only heightened Egyptian suspicions that Lotz was behind the letter bombs. In his statement, Lotz confessed to sending threat letters, although he alleged that he did not know that some contained explosives.[57] Lotz was interrogated for thirty-three days. Upon the conclusion of these sessions, he was transferred to a prison, where he met the lawyers who would handle his defense in the upcoming show trial. One was an Egyptian national, while the other was a German citizen sent by the Mossad to reassure their top spy that he had not been forgotten.[58]

From 27 July to 21 August 1965, the Egyptian public was treated to the public spectacle of a major espionage trial. In addition to the three foreign defendants (Lotz, his wife, and Franz Kiesow), there were transcripts of Lotz's messages to Israel, demonstrations of the secret transmitter, impassioned pleas by the prosecutor for a death sentence, and equally firm appeals by the defense for leniency. Although much of the trial proceeded in a fairly predictable manner, Lotz was surprised when the prosecutor introduced a letter by a German lawyer representing Wolfgang Pilz and some other German rocket experts. That letter demonstrated that Pilz's investigative team had done its homework, for it revealed Lotz's authentic past, including his mother's emigration to Palestine and his service in the Israeli military.[59] Armed with this story, the Egyptian government could have easily pieced together all the remaining pieces of Lotz's identity. Inexplicably, they did not. The prosecutor and the presiding judges refused to pursue the matter any further, much to Lotz's obvious relief.[60]

Still, the trial prosecutor did attempt to link Wolfgang Lotz clearly to the letter-bomb campaign. Transcripts of Lotz's secret communications to Israel were produced that patently revealed a tie between Lotz and the letter bombs. Other transmissions purported to demonstrate that Lotz was keeping a close watch on the German scientists in Egypt, monitoring their arrivals and departures for his masters in Jerusalem.[61]

When the sentences were passed down by the judges, the sense of disappointment among some in the courtroom was palpable. Wolfgang Lotz, the Israeli spy who had unearthed many of Egypt's most closely held military secrets and engaged in a campaign to kill her citizens and foreign

servants, was given life imprisonment and a DM330,000 fine. As for his wife, she received a sentence of three years and a DM10,000 fine for aiding and abetting her husband's activities. Finally, Franz Kiesow, an associate of the Lotzes who accompanied them on that trip to Mersa Matruh, was pronounced innocent of all charges.

Subsequent to his conviction, Wolfgang Lotz was delivered to the notorious Tura prison outside Cairo, which was renowned for housing several high-profile political prisoners, including Hassan Ismail Hodeiby, head of the outlawed Muslim Brotherhood, several Egyptian officers accused of spying for the United States and the United Kingdom, and other Egyptian nationals who were imprisoned for "political sedition." Among Lotz's closest confidants within Tura prison was Victor Levy, a young Jewish man who had been implicated in Avri El-Ad's Operation Susannah.[62] Still, despite its unsavory reputation, the Tura prison was to be Wolfgang Lotz's relatively comfortable home for the next two years as broader political – and eventually military – trends shaped the wider world of Israeli–Arab and Arab–European relations.

Bonn was aware of Wolfgang Lotz's activities through the agency of Reinhard Gehlen's Federal Intelligence Service (BND), which helped train and equip Lotz for his mission; however, the Lotz/Kiesow arrests caught the West German government off guard.[63] Lotz only compounded the problem for the West Germans when he revealed under the interrogation that one of his accomplices was the BND's representative to Egypt, Gerhard Bauch. Soon Bauch himself was under the control of Salah Nasr's *Mukhabarat* and facing interrogation; however, he was released a few days later at the personal request of Reinhard Gehlen's deputy.[64]

The Lotz and Bauch arrests could not have come at a worse time for Egyptian–West German relations. West Germany had been walking a delicate tightrope for several years, trying to balance its moral commitment to Israel against its desire to prevent Soviet and East German inroads into the Arab Middle East. Officially, Bonn was wedded to the Hallstein Doctrine, which stipulated that any recognition of East Germany by another state would be perceived in Bonn as an "unfriendly act tending to deepen the partition of Germany."[65] In practical terms, this meant that Bonn attempted to win Arab allegiance and non-cooperation with the Soviet Union by financial inducements and a tacit understanding that it would not fully recognize Israel.[66] By 1965, this delicate balance began to break down. As the West Germans and the Egyptians sparred over the M-48 tank deal and amid rumors of a full diplomatic relationship between Bonn and Jerusalem, East German leader Walter Ulbricht entered the picture. In February 1965, he accepted Nasser's invitation to visit Egypt in the first trip outside of the Soviet Bloc by an East German leader. This drew an angry reaction from Bonn. Chancellor Erhard fulminated against Nasser's hosting of Ulbricht during a speech to the Bundestag:

> We have always proved by our deeds that we were serious about preserving our friendship with the Arabs. We therefore have a right to ask what proof there is of Egyptian friendship. Those who treat Ulbricht as the head of a sovereign state make a deal with those who split the German nation.[67]

In the end, Bonn's anger had little effect. With exquisite timing, Ulbricht was treated to a full state welcome in Cairo and a meeting with Nasser on 24 February, two days after the Lotz/Kiesow arrests in Giza. In Bonn, the Erhard cabinet debated a range of responses, including the complete severing of ties with Egypt. Unwilling to take that drastic step, the ministers eventually settled for a reduction in economic aid for Cairo and more steps to repatriate the Cairo scientists. In this vein, they agreed to circulate letters and pamphlets in German scientific establishments, warning possible recruits for Nasser's weapons programs about the dangerous consequences that could befall them. Even so, these were tepid responses and only served to highlight Bonn's caution. The Hallstein Doctrine was not invoked and Nasser essentially got away with the Ulbricht visit without any serious consequences. Howard Sachar believes that economics played a role in shaping Chancellor Erhard's lack of assertiveness during the Ulbricht affair. Sachar states that, by 1965, almost one quarter of the Federal Republic's exports were going to the Arab world, a not inconsiderable figure in Bonn's foreign trade portfolio.[68]

Eventually, the West German government took a stronger stand against Nasser's dalliances with East Berlin. In May 1965, Chancellor Erhard and Prime Minister Eshkol exchanged letters that established formal diplomatic relations. Within hours, Nasser's Egypt joined ten other Arab states in severing ties with the Federal Republic.[69]

Walter Ulbricht, Wolfgang Lotz, and the establishment of diplomatic relations between West Germany and Israel each contributed in large part to the eventual collapse of Cairo's ties with Bonn. Yet lurking behind the scenes of this diplomatic mess were the specter of German scientists and the Egyptian rocket program, which only added a new layer of friction to the troubled state of affairs between Cairo, Bonn, and Jerusalem. It was to take several years before the breach in Egyptian–West German relations was repaired.

Key question #1: How did Egypt's efforts to acquire rockets influence Middle East regional and international policies?

This chapter has demonstrated in some detail how the Federal Republic of Germany responded to the Egyptian missile program. Nasser's rockets certainly played their part in the saga of Bonn's growing friendship with Israel and the decline of West German–Egyptian relations. Indeed, by responding to Israeli entreaties to recall its scientists from Egypt, the West

German government could please neither Jerusalem nor Cairo. The former believed that the Germans were not doing enough to prevent the spread of dangerous expertise to a regional opponent, while the latter was not pleased that Bonn's scientist incentive program was draining its missile project of badly needed talent.

The Egyptian missile program directly contributed to a constitutional debate in the West German Bundestag over whether the country could put limitations on the travel of its citizens. Ultimately, the government decided instead to lure the scientists back with incentives rather than revoking their citizenship. It also warned them of the dangerous consequences of working for Nasser's military projects. This debate over constitutional restrictions on freedom of travel was to plague the German government later, when its citizens were involved in weapons of mass destruction programs in Libya and Iraq. It is a problem that is seemingly without a solution for a democracy like Germany; undoubtedly it afflicts Russia and other former Soviet states as well, as they try to prevent the loss of scientific expertise to countries like Iran and North Korea.

In the end, Egyptian missiles played their part in the collapse of West German–Egyptian relations and Bonn's ties to the Arab world. As we have seen, West Germany's efforts to lure back its citizens from Egypt probably irritated the Egyptians, who saw a ballistic missile program as a national right. The arrest of Wolfgang Lotz and other German nationals for spying on Egypt only aggravated an already sour relationship which culminated with Bonn's establishment of diplomatic ties with Israel in 1965 and the subsequent break in relations between the Federal Republic and much of the Arab world. At bottom, Bonn was caught in a trap of its own making. It was unable simultaneously to diplomatically isolate the German Democratic Republic in the Middle East, pursue a sensitive arms relationship with Israel, and meet the demands of its American ally.[70] Nothing symbolizes the numerous contradictions in Bonn's Middle East policy better than its intelligence relationships with Egypt and Israel. While Reinhard Gehlen helped train the Egyptian intelligence service, he also assisted the Israelis in infiltrating Wolfgang Lotz into Egypt to spy on West German citizens engaged in producing missiles aimed at Israel. The German-trained *Mukhabarat* apprehended both Lotz and Gerhard Bauch in Cairo, forcing the BND to appeal to the Egyptians for Bauch's release.

Key question #2: What modern proliferation lessons can be derived from Egypt's experience with ballistic missile programs?

Important lessons can be derived from the events of this chapter in several areas: the psychological impact of ballistic missiles on regional balances of power; incentives were probably the most successful tool in luring back the German scientists from Cairo, although they probably worked in tandem with Israel's coercion strategy; West Germany's tactics against those firms

cooperating with Egypt's missile program presaged later efforts at export controls; Bonn was never able to develop a constitutional mechanism that would allow it to control the movements of its scientific community; staging is a crucial developmental step in long-range ballistic missile programs; Egypt, like many other powers that succeeded it, attempted to disguise its missile program behind the cover of space research.

Missile pyschology

Karp highlights the psychological impact of ballistic missiles in his 1996 study of missile proliferation. Ballistic missiles matter, he writes, "because of the fears they elicit – fears that arise almost independent of their particular armament."[71] In the case of Egypt, the psychological impact of ballistic missiles most likely was one of the motivating factors behind Nasser's decision to acquire them. Cairo's 1962 and 1963 military parades were planned to intimidate Egypt's enemies and magnify the military and technical accomplishments of Nasser's United Arab Republic. Indeed, by rolling their missiles through the streets of Cairo, the Egyptians were only taking a page out of Moscow's Cold War play book; they used their Revolution Day to flaunt their military, and the vaunted surface-to-surface missiles figured prominently in those demonstrations.

On another level, these parades served as a sort of symbolic dialogue between the Egyptian regime and its people. The Egyptian populace looked up to Nasser not only because he was a spellbinding orator who spoke in the vernacular of the common man, but because he symbolized their aspirations for Egyptian leadership of the Arab world. The Egyptian leadership in general and Nasser in particular drew upon this Egyptian pride of place in the Arab and African worlds and used ballistic missiles to symbolize Egypt's technical and political prowess. On a regional level, Nasser was the manifestation of the expansive unification dreams of the Arab people, as Said Aburish puts it in his biography of the Egyptian leader:

> In 1956, Nasser filled a historical void in the lives of all Arabs who had been waiting for things to change since World War I. By action and word, Nasser hooked into their minds and hearts, the only Arab leader ever to do that. He, the man from nowhere, represented hope, and the hope became the gospel of daydreamers.[72]

In this wider pan-Arab context, Nasser's missiles were as much political symbols as military tools.

Still, the grand military parades tended to build up expectations, and Cairo, too, seemed to be caught in a trap of its own making. Every 23 July, the leadership had to produce some new technical marvel to reassure its Egyptian and Arab faithful that the revolution was still marching

inexorably towards the future. In 1962, Nasser may have sought to make up for the September 1961 secession of Syria from the United Arab Republic when he unveiled his Al Zafir and Al Kahir missiles as well as his Messerschmitt-designed jet trainers. In 1963, the stage was only slightly less spectacular: Egypt paraded its nominal, two-stage Al Ared but failed to stage a public test flight of this system. This latter omission left many observers questioning whether Al Ared was in fact a developed system, a prototype, or a hoax. The year witnessed other prestige weapons, many of which, like the submarine, were supposed to be a "first" of their kind in the Arab world. The 1963 demonstration naturally raised questions about what Cairo could do for an encore in 1964. This probably accounts for the rumors that Cairo intended to launch a satellite by July of that year.

And building a satellite would have been a tremendous technical feat. If Egypt could demonstrate a capability to build, launch, and operate its own satellites, it would join the ranks of the most advanced countries in the world. And Nasser perceived the immediate propaganda value of a rumored Egyptian satellite, even if his scientists were never likely to complete the project. In an Egypt characterized by recurrent "triumphs," such as a nationalized Suez Canal, a High Dam, an indigenous jet fighter, and "Egyptian-made" missiles, a satellite would be the ultimate symbol, the veritable pinnacle of the Revolution's tangible successes. What all this suggests is that the propaganda and psychological value of Al Kahir, Al Zafir, and Al Ared were just as important as the military factors motivating their creation. While it is true that Egypt actively sought a means of penetrating the formidable defenses of the Israeli Air Force, it also wanted a psychological edge in using these missiles to exhibit Egypt's technical skill and leadership credentials to both the Arab states and the newly emerging nations of Asia and Africa.

From a military standpoint, its missiles could hardly be considered viable weapons by late 1963. Although Cairo apparently had made some progress in establishing a missile research infrastructure, including critical ground support equipment, its scientists still could not develop an effective guidance package. But did those military shortfalls really matter? As Karp points out, even those missiles which have limited utility as weapons can be politically valuable, "affecting regional perceptions of a country's power and its willingness to use it."[73]

Missiles continue to be a psychological as well as a military weapon. In strange echoes of the Egyptian military parades of the 1960s, the Islamic Republic of Iran trundles out its Shahab-3 missile on the anniversary of its war with Iraq. If there is any doubt as to their intended purpose, these missiles carry banners promising the prompt destruction of the state of Israel. Other countries are quick to perceive the symbolic value of ballistic missiles, including Pakistan and India, which do not disguise the fact that they are developing, testing, and producing missiles intended primarily for each other.

Incentives as strategy

Much of this chapter has been about how the West German government attempted to resolve its "renegade scientist" problem. The first strategy undertaken by Bonn was to offer material incentives to the scientists in the form of high-paying and challenging work. The creation of a national space program not only fulfilled West Germany's obligations to the European Space Research Organization, it probably was an implicit acknowledgement that Bonn had to do more to retain the highly specialized skills of its rocket and aviation scientists. This strategy was largely successful in luring back scientists to Germany, as demonstrated by the return of Gronau, Schuran, and Goercke; it probably crippled the Egyptian missile program as a result.

Could a scientist incentive strategy work today? In the case of unemployed former Soviet rocket scientists, incentives may be the only means of luring them out of controversial missile projects in Iran and North Korea. Indeed, these scientists are the modern-day versions of the unemployed German rocket experts of Nasser's era. Still, the problem lies in convincing Russia, Ukraine, Belarus, and the others that missile proliferation is a problem and that it is in their best interest to restrain it. In other countries, like India, Egypt, and Israel, national missile programs no longer rely on extensive foreign support and are therefore largely immune to incentive strategies. Finally, there are those powers, like Saudi Arabia, which appear to eschew indigenous development and prefer to acquire complete missiles from foreign sources.

Export controls

Bonn's second strategy attacked the support networks in West Germany that funneled expertise, tooling, and parts to the Egyptian rocket effort. In an early attempt at missile export controls, the German government terminated contracts with those firms doing business with Factory 333. It also warned scientists about the negative consequences of continued work on Nasser's missiles. Although Operation Damocles had been terminated by early 1963, no one in Bonn or Cairo was aware of this fact: for all they knew, the proverbial Israeli sword still hung over the necks of the German scientists. This strategy presaged formal unilateral and eventually multilateral initiatives to restrain the spread of missile technologies and materials to other countries. The Missile Technology Control Regime, of which Germany is a partner, is an agreement among suppliers to prohibit the proliferation of missiles above a certain range and warhead size; it also prevents the diffusion of those technologies which could be used in ballistic missile programs.

Banning travel

The third counter-proliferation strategy was more complex from a legal standpoint. Reacting to considerable Israeli pressure, the Bundestag grappled with the legal dilemmas of banning West German citizens from working on foreign weapons projects. By fall 1963, Bonn had failed to produce a legally sustainable bill, and the notion of restricting travel abroad appeared to be in limbo. In fact, this last strategy defined the effective limits of counter-proliferation policy for a modern, Western-style democracy like Bonn's: a state could control exports of certain sensitive goods; however, it could not legally control the movements of its citizens. The diffusion of technical knowledge facilitated by the work of German scientists abroad was to be a nagging problem for Bonn in the decades ahead. It is certainly a problem for Russia and other post-Soviet states today, as they try to restrain their unused scientific talent from migrating to countries like Iran or North Korea.

The staging challenge

Al Ared was supposed to be a two-stage space launcher or ballistic missile, although there are no details on whether this missile actually flew. For many countries, staging is a natural phase in the progression from artillery rockets to ICBMs; however, it presents a serious technical challenge which, in the Egyptian case, may have been insurmountable. In general, staging must not only be carefully timed, it also involves complex procedures, including engine cut-off, first-stage release, and second-stage ignition.[74] Karp believes that stage separation is the most daunting technical problem for rising missile powers and points to staging problems in the Indian and Israeli programs to reinforce this argument.[75]

Space program or ballistic missile program?

Chapter 2 dealt briefly with the close linkage between space and ballistic missile programs. Egypt was one of the first developing-world countries to see the inherent prestige of making space vehicles and satellites. Iran, among others, has carried on this tradition by promising to put national satellites into orbit atop "indigenously" produced rockets. Some countries, like India, Brazil, and Pakistan, have used their space programs to acquire critical technologies and develop their military missile program. Unlike India or Israel, Egypt never followed through on Nasser's grandiose dreams of building space launchers and the Arab world's first satellite. Financial shortfalls and the paucity of technical talent probably doomed these programs; they may have been hampered by program management shortfalls as well. Indeed, Egypt never again revisited the heights it achieved in the early 1960s, when its ambitious leadership promised to put an Egyptian satellite into space.

5 Washington mediates

The role of Cairo's ballistic missile program in US–Egyptian relations during the 1960s has not been adequately analyzed in the secondary literature.[1] This can be attributed in part to secrecy laws, which have shielded many documents from public scrutiny. The United States did not declassify the bulk of its official correspondence from this time period until 1995, when the State Department released a substantial volume of embassy cables, intelligence assessments, and various memoranda, which included new details on a concerted American effort to limit the spread of weapons of mass destruction in the Middle East.[2] At the heart of this proposal was a deceptively simple arrangement whereby Egypt would forego ballistic missile development in return for an Israeli pledge to refrain from building nuclear weapons. Washington would be an honest broker, ensuring that Egypt and Israel were compliant with their obligations. The following chapter analyzes this arms control proposal in the overall US–Egypt relationship; it also places this initiative in the context of ballistic missile counter-proliferation strategies.

Although Washington greeted the 1952 Egyptian revolution with guarded optimism, its relations with Cairo plummeted during the first Eisenhower Administration when Nasser purchased weapons from Czechoslovakia in 1955 and publicly rejected the pro-Western Baghdad Pact. US policymakers refused to fund the High Dam at Aswan, forcing Egypt to turn to the Soviets, who were more than happy to fund the project and improve relations with the Arab world's most important state. Cairo's ties with Washington soured further when Nasser steered his country into the front ranks of the Nonaligned Movement and sought to become a voice for the Arabs as well as the newly independent states of Africa and Asia. Eisenhower's Secretary of State, John Foster Dulles, suspected that Nasser was behind coup plotting in Iraq, Syria, and Jordan, and by the mid-1950s Washington regarded the Egyptian leader as its number one enemy in the Middle East.[3]

This atmosphere of mistrust and unease began to lift by the end of the second Eisenhower Administration, when the United States began to see some advantages in Nasser's aggressive stand against Egyptian and Syrian

communists. In November 1958, Eisenhower approved a National Security Council (NSC) Directive which, *inter alia*, recommended a normalization of relations with Egypt. With the Cold War firmly in perspective, the policy directive suggested that the US examine "the extent to which greater US cooperation with the UAR might serve to limit UAR contacts with the Soviet bloc."[4] Consequently, American rhetoric toward Egypt began to soften and relations showed considerable improvement with the 1960 election of John F. Kennedy. The Kennedy team was committed to more amicable ties with Cairo to wean Nasser off his dependency on Moscow.

To spearhead his new approach to Nasser, Kennedy chose an outsider as his ambassador to Cairo. John S. Badeau was one of that unique breed of Arabists who received his first taste of the Middle East as a missionary in Iraq. Later, he formed a lifelong affinity for Egypt and her culture, both as an educator and president of the American University of Cairo. It was from this vantage point that Badeau glimpsed several of the pivotal moments in modern Egyptian history, including the British humiliation of King Farouk outside the Abdin Palace in 1942, the 1952 Black Saturday riots which targeted British and Western interests in Cairo, and the July 1952 revolution. Badeau's extensive background in Egypt, coupled with his experience with foreign assistance projects, made him an ideal candidate for the Cairo post. His outsider status to the United States Foreign Service was echoed in several other Kennedy ambassadorial nominations, including John Kenneth Galbraith in New Delhi and Edwin Reischauer in Tokyo.[5]

Badeau's familiarity with foreign assistance programs served him well, for Nasser's Egypt was the beneficiary of a large amount of US food aid. In fact, Badeau records in his memoirs that at one point in the early 1960s, one-third of all Egyptians were eating food grown in America. Between 1958 (when the Eisenhower Administration initiated a change in its Egypt policy) and 1964, the United States funneled over one billion dollars to Egypt. Cairo reciprocated these gestures: Badeau reported greater access to Nasser, while the latter appeared to tone down his anti-US rhetoric by 1962.[6]

Still, the US–Egypt rapprochement needed time before it could remove some of the chill engendered by previous events. For its part, the Kennedy Administration rather optimistically assumed that it could pursue several objectives in the Middle East, even though these goals were often in direct contradiction. Such was the case with Washington's Arab and Israeli policies, where it sought to maintain close ties with both Israel and the conservative monarchies of Saudi Arabia and Jordan, although these states were opposed to each other. Furthermore, the United States sought an improved relationship with Nasser even though he was regarded with deep suspicion by Washington's Saudi and Jordanian allies and outright hostility by Israel. Finally, the United States frustrated many of its allies by restricting arms exports to the region, even in the face of the significant Soviet arms build-up in Egypt.

As Shimon Peres relates in his memoir, *David's Sling*, Washington's policies frustrated Israeli policymakers, who viewed arms deals as a means of cementing a closer security relationship with the Americans.[7] From Israel's perspective, by refusing arms deliveries, the United States was not only rebuffing Jerusalem's requests for greater security cooperation, it also was refusing to redress the security imbalances caused by large-scale Soviet arms exports to Egypt. One particular bone of contention for Israel in the late 1950s and early 1960s was Washington's refusal to export its new and highly lethal Hawk surface-to-air missile (SAM) system to Israel. The Israelis viewed Hawk as crucial to protecting their cities from Egypt's growing fleet of Il-28/Beagle and Tu-16/Badger bombers.[8]

Worried about provoking a regional arms race and still generally wedded to the provisions of the 1950 Tripartite Declaration, which prevented the export of weapons to the Middle East, Washington was reluctant to sell Hawk to the Israelis. In a 4 August 1960 letter to Israeli Prime Minister Ben-Gurion, Eisenhower's Secretary of State Christian Herter spelled out Washington's fears that a Hawk sale could disrupt the Middle East balance of power. Although Herter acknowledged that Hawk was "purely defensive," he cautioned that its export to Israel could encourage an "outside power" to equip the Arabs with missiles, "including perhaps missiles with surface-to-surface capability." Therefore, in Herter's view, since Hawk could not defend Israel from a ballistic missile attack, acquisition of this system would be "wasted-time and a heavy expense."[9]

United States officials recognized that a Hawk sale would be a matter of grave concern to Arab security officials, since this weapon could render Cairo's bomber fleet obsolete. The US reasoned that Egyptians might seek out alternative weapons systems such as surface-to-surface missiles to compensate for the diminishing capability of their bombers to penetrate Israeli airspace. In the logic of the Middle East arms race, Hawk would defeat Badger but ballistic missiles could trump Hawk.[10] The US Acting Secretary of State drove home this point in a prophetic 26 August 1960 letter to the British ambassador in Washington:

> We feared that supplying the Hawk to Israel might stimulate the UAR to the acquisition of a missile capability from the USSR. The Hawk, although purely a defensive weapon, is highly effective against aircraft . . . Therefore, the UAR, to counter this, might seek to obtain a long range missile capability from the USSR against which the Hawk would have no effect. If this indeed were the result, the Middle East would have moved into a new cycle of the arms race, the missile age.[11]

At first, the Kennedy Administration showed no inclination to deviate from Eisenhower's "No Hawk" pledge. In a May 1961 meeting with Kennedy in New York City, Prime Minister Ben-Gurion repeated his arguments for Hawk by invoking Egypt's growing fleet of bombers and the

new deliveries of MiG-19/Farmer interceptors as threats. The President responded by noting that Hawk had been approved for sale to only a few countries; a sale to Israel, he cautioned, could lead the Arabs to acquire air-to-ground or even ground-to-ground missiles as a response. The US would continue to "watch the situation," Kennedy promised, although this probably did not reassure his Israeli visitor.[12]

Israel rejected these American arguments, and persisted in calling for release of Hawk. In May 1962, Deputy Defense Minister Peres met with senior Pentagon officials to reexamine Israel's request for this weapon. This time the Israelis used the recent Egyptian acquisition of MiG-21/Fishbed fighters and the SA-2/Guideline SAM to justify their request. Israel's peaceful intentions, Peres noted, were advertised by the fact that it sought defensive weapons, whereas the Arabs were acquiring purely offensive systems such as bombers. But this new pitch was still not selling Washington on the idea of transferring its most capable SAM to Israel. Moreover, the fear of sparking a regional arms race loomed large in the US foreign policy establishment. In a memorandum summing up the Peres visit, one Pentagon official referenced a DIA assessment which suggested that Egypt might buy Soviet missiles as a response to Hawks in Israel.[13]

By August 1962, the Hawk sale to Israel no longer hinged on a Soviet ballistic missile transfer to Cairo, for Nasser had demonstrated one month earlier with his flight tests that, Hawk or no Hawk, Egypt was going to produce its own surface-to-surface missiles. Accordingly, on 21 August, Israeli Foreign Minister Meir raised the Egyptian missile issue with the Americans for the first time during a meeting with Kennedy's Special Assistant and advisor on Jewish affairs, Myer "Mike" Feldman. Meir told Feldman that she had evidence of an Egyptian purchase of German-built missiles. The total cost of this project, she added, was £250 million sterling. She concluded that Cairo had demonstrated its "real intentions" toward Israel with this missile purchase; however, Meir did not comment further, nor did she ask for American action at this time.[14]

Although Golda Meir apparently missed an opportunity to solicit US help against the Egyptian missile program, others within the Israeli government quickly pounced on the missiles to justify new American arms sales to Israel. On 22 September, Finance Minister Levi Eshkol told a US audience that Israel could not mistake Nasser's rockets for "an idle propaganda boast," adding that Israel was left with few options other than to persuade Nasser that it retained an unspecified deterrent against Egypt. As Eshkol put it, "the distance from Tel Aviv to Cairo, as the rocket flies, is the same as from Cairo to Tel Aviv." Five days later, Washington announced its decision to sell Hawk SAMs to Israel.[15]

The Egyptians were not caught totally off guard by the Hawk announcement. As John Badeau relates in his memoirs, President Kennedy informed Nasser of his decision by dispatching a special emissary to Egypt. According to Badeau, when Nasser was reached at a villa

in Alexandria, he indicated his appreciation for the advance notice of the sale, even if he did not like the decision itself.[16] Having registered its displeasure, Cairo decided to test the waters of the Kennedy Administration's new Middle East policy by instructing its military attaché to request release of Hawk for Egypt as well. In a premonition of the looming storm clouds on the horizon of American–Egyptian relations, the attaché warned that Washington's refusal to release Hawk to Cairo would have an "adverse impact" on bilateral relations. The US rejected this request shortly afterwards, citing concerns with Egypt's Soviet Union ties, which presumably meant that it feared Hawk secrets might be sold to Moscow.[17]

Thus, the saga of the Israeli Hawks had come to a close. For Jerusalem, it was a critical watershed in its relations with the United States, for it marked the first significant American arms transfer to Israel. As for Egypt, that country's acquisition of new Soviet bombers in the aftermath of the 1956 war had created the impetus for Israel's interest in Hawks; however, by acquiring Hawk, Israel nullified Egyptian bombers and accelerated Cairo's ballistic missile efforts. If Nasser could no longer threaten (and deter) Israel with his costly bomber force, then he was going to turn to a weapon that had assured penetration capability against even the most formidable US-built SAMs – the ballistic missile. Thus, by selling Hawk, Washington had plugged one hole in Israel's security bulwark but inadvertently helped open another.

Although the Hawk dispute had been laid to rest, Egyptian missiles proved to be a more enduring concern for both Israel and the US. Golda Meir raised the Egyptian missile program during a 27 December 1962 meeting with President Kennedy at his estate in Palm Beach, Florida. During this exchange, Meir told the President that Israel had been aware of the missile project since 1960, although she did not explain why the Israelis had failed to raise this issue in earlier discussions with the United States. She also highlighted apparent Egyptian research into radiological weapons, asserting that Cairo was preparing to fill its missile warheads with radiological substances sufficient to "contaminate the land for years and years." This latter piece of information was clearly based on the recent debriefs of Otto Joklik; for the first time, the United States was being exposed to the suspect and unproven allegations of this discredited scientist. Indeed, Washington's reaction to the Meir radiological weapons story must have been a mixture of puzzlement and concern. The US needed time to digest the implications of this disturbing new information before it could give the Israelis an adequate response.[18]

Possibly in response to Meir's allegations, the CIA examined the issue of Egyptian weapons of mass destruction and long-range delivery capabilities in an 8 January 1963 assessment entitled "UAR Delivery Capability for Nuclear, Biological, and Chemical Weapons." According to this

assessment, Egypt "might" deploy a "few" ballistic missiles by 1964, provided that it received parts shipments from abroad and the German scientists continued their work for Nasser. Addressing Golda Meir's claims, the CIA affirmed that Egypt did not have the infrastructure to support nuclear weapons and "almost" no capability to produce biological arms. The assessment indicated that Cairo had acquired a small stock of "toxic" chemical munitions from a Soviet Bloc source, although it did not describe the nature of this weapon. The CIA made no reference to any chemical stocks that may have been left behind by the British.[19]

DIA was also tasked to come up with an assessment on Cairo's weapons of mass destruction capabilities and, on 24 January, Brigadier General Linscott A. Hall, DIA's Assistant Director for Processing, delivered this assessment to the White House. The DIA's findings did not differ significantly from those of the CIA. It highlighted the fact that the missile program relied heavily on German specialists for design and construction, while essential rocket components were purchased from abroad. DIA did not believe that Egypt had the capacity to build a nuclear warhead for either the Al Kahir or Al Zafir missiles: "while [Egypt] does have a small research reactor and an associated research program, both are so small as to preclude their having any potential for nuclear weapons development." According to DIA, neither Cairo's missiles nor its nuclear research program would "have a significant effect on the purely military balance in the Middle East." While Egypt probably could deploy a "small number" of missiles by 1964, this number was too low to be of any military consequence. Egypt's lack of a nuclear weapon would, in DIA's view, "sharply limit" the effectiveness of its missiles; however, the assessment acknowledged that Nasser's missiles could be valuable both for propaganda and "psychological warfare."[20]

Closely allied with the discussion in the Kennedy Administration over Nasser's missiles and unconventional weapons were growing intelligence indications that Israel was intent on acquiring a nuclear weapon. Those ambitions date back almost to the founding of the state of Israel, as Cohen states in his history of Jerusalem's nuclear weapons program.[21] Indeed, as we have seen with Dayan's *Ma'ariv* article, the possession of atomic bombs and a security alliance with one or more Western powers were the subjects of considerable debate in Israeli national security circles in the late 1950s and early 1960s. Initially, Israel turned to France to fulfill these security objectives, since relations between Paris and Jerusalem were especially close during this time. Not only were French officials sympathetic to the ideals behind the Israeli state, they shared with Israel a common enemy in Arab nationalism and Gamal Abdel Nasser. Paris fretted about the implications of Nasserism for its restless colony in Algeria, while Jerusalem grappled with the formidable challenges posed by armed Arab opponents to its north, east, and south.[22]

In 1956, on the eve of the Suez War, Shimon Peres secured French cooperation on a small research reactor to be built near Tel Aviv. A year later, this agreement was upgraded to a much larger plutonium reactor and an underground plutonium-extraction plant. This latter facility was vital to Israel's nuclear weapons ambitions since it allowed Jerusalem to produce the crucial ingredients for a nuclear weapon. Shortly after this agreement was signed, French contractors began work at a remote site in the Negev that would eventually become known to the world as Dimona.[23]

Israel was not a US nuclear proliferation concern until 1958, when U-2 aerial reconnaissance flights revealed the construction of a mysterious facility in the Negev near the town of Beer Sheeba. CIA photo interpreters assessed this facility as a "probable" reactor; however, it was not until 1960 that additional information, including ground photography by US military attachés, determined that Dimona was a nuclear-related facility. Despite these findings and persistent Israeli secrecy surrounding its activities, the Eisenhower White House demonstrated little interest in Dimona. As Cohen relates, the suspect Israeli nuclear weapons program was to be treated as a "special case" in US–Israel relations and in American counter-proliferation policy.[24]

While Eisenhower showed little interest in Dimona, President Kennedy was committed to controlling the spread of nuclear weapons technology. He put non-proliferation concerns at the top of his foreign policy agenda and showed considerable interest in the mounting intelligence on Israel's nuclear ambitions. Indeed, Kennedy saw Israel as a promising case where nuclear non-proliferation policies could be put to the test, since Jerusalem maintained close ties with the United States. Rather optimistically, the Kennedy team assumed that Israel would accept American political influence and respond positively to US nuclear proliferation concerns. Consequently, after lengthy negotiations, the US demanded, and was granted, limited inspection rights to Dimona, although it was never permitted to see the most sensitive part of the facility. Thus began a prolonged, complex, and deceptive dance that extended well into the late 1960s, where Jerusalem would grant Washington limited access to Dimona while consistently denying any interest in nuclear weapons. The Kennedy Administration chafed at the restrictions imposed on its observer team by the Israelis but nevertheless maintained the facade of "inspections" until they were dropped by President Johnson.[25]

By the time Egyptian missiles became an important item in US–Israeli relations, the Dimona project was well underway. Confronted with Israeli stonewalling over the purpose of Dimona, Washington saw Nasser's missiles and the reactions they engendered in Israel as an opportunity to stall or terminate Israel's nuclear weapons program. If Israel was going to insist on hyping the Egyptian unconventional weapons threat, the reasoning went, then Washington was going to propose regional arms control as a means of ameliorating those concerns.

One of the key officials involved in developing a new Middle East arms control plan was a 40-year-old former CIA senior intelligence analyst named Robert W. Komer. Educated at Harvard, Komer joined the new CIA in 1947 as a Near East intelligence expert. In 1961, he was transferred to the Kennedy National Security Council as a staffer for sensitive Middle East issues. A fierce bureaucratic fighter and consummate insider (he was later nicknamed "Blowtorch Bob" by an American ambassador to South Vietnam), Komer well understood the value of information and secrets inside the Washington Beltway. These skills were to prove invaluable as he navigated the divisions within the US foreign policy establishment, the pro-Israel lobby on Capitol Hill, and the formidable egos and agendas of men as different as Gamal Abdel Nasser and Levi Eshkol.[26]

On 9 February 1963, Komer forwarded the findings of a State Department Policy Working Group to President Kennedy. In a cover memo, Komer recommended a quiet American approach to Cairo and Jerusalem to determine if either was willing to enter into a "tacit" US-sponsored arms control initiative. The success of the initiative would be enhanced by the concerns expressed by Israel and Egypt over the spread of advanced weapons to the Middle East. As Komer noted, "Israel was complaining to us about UAR rockets and radiological warfare [while] Nasser worried over Israeli biological weapons and their nuclear reactor."[27]

This initiative apparently sat in bureaucratic limbo, for it was not until 22 March that Komer submitted another memorandum to the President on the topic of Israeli nuclear weapons and Egyptian ballistic missiles. Komer's latest memo no doubt was inspired by the 19 March Knesset resolution condemning the activities of the German scientists in Cairo and Isser Harel's Ibis and Cleopatra revelations. In this memo, Komer explained recent events in Israel by linking Operation Damocles to Israel's covert nuclear program:

> Israel's current campaign publicizing German technical help to UAR suggests not only genuine Israeli concern but also that they: (1) are trying to justify their agent operations in Europe [i.e. Joklik]; and (2) may also be attempting to create justification for going ahead on their own nuclear program.[28]

Komer informed Kennedy that the Egyptians were developing surface-to-surface missiles but cautioned that these weapons were "far less menacing" than the Israelis alleged. He also highlighted the lack of any intelligence to substantiate Israeli claims that the Egyptians intended to equip their missiles with cobalt or strontium-90 warheads. Komer's memorandum concluded with the suggestion that State's "tacit arms control" plan offered the most promising means to forestall an Egyptian–Israeli unconventional arms race.[29]

Kennedy reacted favorably to Komer's recommendations. On 26 March,

he issued National Security Action Memorandum (NSAM) 231 which instructed the State Department to generate proposals aimed at stemming the development of advanced weapons in the Middle East. NSAM 231 would serve three general objectives: to prevent the spread of nuclear weapons to the Middle East, to respond to Israel's security concerns over Egyptian missiles, and to maintain the fragile relationship with Cairo.[30] On 3 April, Kennedy revealed the substance of NSAM 231 in a press conference. In response to questions on the work of German scientists in Egypt, Kennedy replied that there was no doubt that these experts were working on "missiles, air engines, and air frames." Such work, he added, would "affect the tensions in the Middle East." In a warning to Israel, the President reiterated his "strong opposition to the introduction or manufacture of nuclear weapons" in the region. In these statements, Kennedy not only reaffirmed his commitment to nuclear non-proliferation, he also offered explicit linkage between Egyptian missiles and nuclear weapons. This linkage lay at the heart of the State Department's arms control initiative.[31]

Two days later, Shimon Peres, who was in Washington to negotiate the final terms of the Hawk sale, raised the Egyptian missile issue during a meeting with Myer Feldman. Feldman then surprised his visitor by inviting him to a meeting with President Kennedy that was not on the agenda. Peres detailed his short, jocular exchange with the President in his memoirs:

> He asked how we were getting on with our requests, and I said that I had come to ask him for a few "Hawks" on behalf of the "doves" in Israel. "In that case," he said, "you can have them. We've got plenty of hawks and we can afford to supply a few even to our friends."[32]

Peres's first meeting with Kennedy apparently did not move past pleasantries; however, during a second session on 6 April, the President addressed Cairo's missile production effort. He asked Peres whether Jerusalem's concern over the German scientists was genuine, hinting that Israel might be using the scientists to score propaganda points against its enemies. Kennedy also asked if the important aspect of the matter was the missiles or the warheads they carried.[33] In response to this query, Peres admitted that ballistic missiles without nuclear warheads were of "doubtful value," but added that in the context of the Middle East, conventional warheads could be "highly damaging." The Egyptians, he argued, would probably see these missiles as their "salvation, for a missile was after all a bomb-carrying plane without a pilot."[34]

This difference in perspective between Washington and Jerusalem over the utility of Egypt's missiles was to persist in subsequent bilateral discussions. On the one side was the United States, which believed that Nasser's rockets were less than viable weapons in the absence of unconventional warheads. On the other side were Israeli allegations that Egypt was in fact pursuing weapons of mass destruction.

Egyptian missiles and advanced weaponry were becoming a domestic political issue for the Kennedy Administration as well. Concerns over Nasser's missile force and alleged radiological warheads were expressed in the US Congress, which probably was influenced by Israeli lobbying and Isser Harel's press campaign. On 5 April, six senators drafted a letter urging President Kennedy to pressure Bonn into recalling the German scientists from Egypt. The senators noted that the United States was indirectly facilitating the missile program by funneling food and technical assistance to Cairo.[35]

One New York Representative and member of the House Foreign Affairs Committee wrote a letter to the Secretary of State calling for the withdrawal of the German scientists from Egypt. The Undersecretary of State for Political Affairs, Averell Harriman, drafted a response to this letter which was subsequently published in the *New York Times*. In his reply, Harriman downplayed the German presence (there were only "10 or so" scientists) in Cairo, emphasizing that the scientists would return to Germany if ordered to do so. Should the German scientists leave, Harriman warned, they could be replaced by Soviet Bloc experts who were equally competent to fulfill Cairo's missile requirements. In language familiar to the West German government, Harriman cautioned that any pressure over the scientists could force the Egyptians "into greater reliance on the USSR." Harriman did not refrain from criticizing Israel either, noting that it was pursuing missiles of its own. The United States needed to bear this in mind, he observed, when it examined "an effective amelioration" of this "worrisome and complicated problem."[36]

Ultimately, Harriman's letter reflected Washington's delicate high-wire act on Middle East policy. As with West Germany's Middle East policy, the United States' paramount goal was containing Soviet influence in the region, even if that meant turning a blind eye to the activities of the missile scientists in Egypt. While the US certainly did not want to damage its close relationship with Israel, it also sought to avoid jeopardizing a carefully wrought and tenuous rapprochement with Nasser. As Harriman wrote in his letter, the United States was "guided by necessity for maintaining a condition of peace in the Near East for dealing *evenhandedly* with all states concerned [emphasis added]."[37]

Senator Hugh Scott of Pennsylvania was not mollified by the Harriman letter. He insisted that Washington could do more to alleviate "the potentially explosive situation" in the Middle East. Instead of taking action, he complained, "our government is doing almost nothing." As the congressional commentary demonstrated, some on Capitol Hill were not sold on the Kennedy Administration's Egypt policy, especially after the recent missile tests and parades, as well as the furor in Israel over Egyptian radiological bombs.[38]

Criticized by Congress at home and nervous Israelis abroad, the Kennedy Administration proceeded with its secret Middle East arms control

initiative by sending Robert Komer to Cairo in mid-April 1963. The purpose of Komer's mission was twofold: to plumb the Egyptian perspective on the regional arms race, and to gauge whether Nasser was even prepared to contemplate an arms control proposal. Komer and US Ambassador to Egypt John Badeau met Nasser on 15 April at one of the presidential palaces in Cairo.

Komer and Badeau initiated the discussion by emphasizing Kennedy's "great concern" over the escalating arms race between Israel and the Arab states. Komer also tried to allay Nasser's suspicions that his visit was linked to the recent "flap" in Israel over Cairo's German scientists. He cited the Harriman letter to Congress as evidence of Washington's intent to conduct an "evenhanded" approach to regional tensions. The United States, he insisted, simply wanted to help the Middle East avoid "new and unpredictable" developments such as ballistic missiles and nuclear weapons.[39]

Nasser responded by highlighting the history of Egyptian–Israeli relations from 1948 through the 1956 war. From Nasser's perspective, this period of extended conflict demonstrated that Israel could not be trusted. He denied Komer's assertions of "evenhandedness," because he was well aware of Washington's close relationship with Israel. Nasser predicted that Egypt's "legitimate" security needs only made a regional arms race "inevitable."[40] Responding to Komer's reference to advanced weapons, Nasser informed his visitors that Israel's arms build-up forced Egypt to do the same: if Israel had one biological warfare laboratory, Egypt had to have two; if Tel Aviv conducted a missile test, Cairo must do the same. Although he did not deny researching a radiological bomb, Nasser insisted that Israel was planning to use "radiological products" in missile warheads. Israel's nuclear weapons development did not escape his notice either: in a reference to Dimona, Nasser said he was aware of "an unspecified Israeli nuclear installation." Since Israel was proceeding with nuclear weapons, the President observed, Egypt had to "research" this capability as well. Komer later addressed this action–reaction complex in his memorandum to Washington: "Nasser implied, without saying so directly, that the UAR was moving into military applications of nuclear energy because it was convinced that the Israelis were doing so."[41]

Komer reminded Nasser that arms races created insecurity not security. The United States had learned this difficult lesson in its dealings with the Soviet Union, and both superpowers were now attempting to resolve their differences through arms talks at Geneva. He then raised an economic argument against Egyptian and Israeli WMD programs: neither country could afford sophisticated new armaments programs over and on top of their already significant financial outlays for defense.[42]

Nasser appeared deaf to these arguments. Once again, he turned the spotlight on Egypt's need to maintain military parity with Israel, while drawing on Komer's reference to US–Soviet arms talks for an example of

his own. Although the Egyptians would never attack Israel, they still lived in constant fear of "Israeli aggression." As a result of this "aggression" Egypt had promulgated a "deterrent" strategy. In Komer's words,

> Just as we were developing a capability to strike back and destroy the USSR even after it had launched the first attack on us, so he [Nasser] too was developing a capability which would permit him to strike back in revenge if attacked by Israel.[43]

In this brief monologue, Nasser offered a clue as to his motivation for developing long-range missiles: Israel's "aggression," he argued, compelled Cairo to develop a deterrent that was capable of delivering a punishing retaliatory blow. He hinted that Israel's suspect nuclear weapons program was driving his arms build-up, including missiles. As Nasser informed Komer, if Israel was acquiring a nuclear capability, then Egypt "might have to attack" in self-defense. He warned that Cairo would even occupy the Negev (and presumably the Dimona facility) if necessary.[44]

Brushing this threat aside, Komer returned to the American arms control initiative. The United States was concerned about the implications of a Middle East arms race, especially one that involved new, advanced capabilities, and, as a consequence, Washington hoped that Nasser would be open to suggestions on how Egypt could avoid a costly arms race with Israel. Nasser responded cautiously: of course, Cairo would be receptive to US ideas; however, he could not place Egypt's security in the hands of a third party. After all, Nasser asked, had he not seen what United Nations inaction had done to the Arabs in Palestine?[45]

Nasser then switched gears. Validating the fears of Eisenhower-era policymakers, he linked the US sale of Hawks to his decision to acquire ballistic missiles. He said that the Hawk neutralized his bomber force and therefore canceled out Egypt's ability to deter Israel. Komer did not buy into this line of thinking: if Cairo acquired missiles, he warned, Israel would appeal to the West for assistance. Just as Cairo's acquisition of bombers forced the Hawk sale, Komer added, the United States might then find itself "compelled to repair an imbalance." On the other hand, if Israel acquired a "new capability," Komer concluded, "it would be logical [for Egypt] to approach [the] USSR for similar arms." Although the American side left this "new capability" vague, they undoubtedly were referring to the acquisition of nuclear arms. In fact, Komer enunciated this nuclear arms danger more clearly in a 30 April memo to National Security Advisor McGeorge Bundy: "The real threat to Israel's security lies in the UAR acquisition of guided missiles and nuclear weapons over next several years. Nasser will undoubtedly go this route so long as Israel seems to be doing the same."[46] The shadow of Dimona loomed large over the Middle East security landscape.

While Komer engaged the Egyptians on arms control, the Kennedy Administration's problems with Congress over Egyptian missiles refused to go away. On 1 May 1963, twelve senators spent the better part of two hours criticizing US development assistance to Egypt. Senator Javits of New York called for a defense pact with Israel and a "sharp change" in the State Department's policy of dealing "evenhandedly with friend and foe" in the region. Washington should phase out its foreign aid program to Egypt, Javits suggested, until Cairo agreed to abandon its missiles. Senator Morse of Oregon said that Egypt was "dead wrong," adding that the United States was actively assisting countries that were "a threat to the whole world." While Senator Humphrey of New Hampshire shied away from any direct criticism of the Administration (he was majority whip for the Democrat-controlled Senate), he did press for a United Nations arms embargo on all states in the Middle East.[47]

In the end, polemics in the Senate over Egyptian missiles did not kill the Egyptian economic aid program: surplus US wheat continued to flow into Egypt, as did considerable quantities of feed grain and dairy products. Still, the senators were holding the Administration's vaunted "even-handed" Middle East policy up for close public scrutiny. Egypt's continued development of long-range missiles clearly was not endearing it to the congressional committees responsible for authorizing Egyptian aid.

As with many foreign policy initiatives in Washington, the US intelligence community supported the State Department's Middle East arms control plan with an 8 May 1963 Special National Intelligence Estimate (SNIE) entitled "The Advanced Weapons Programs of the UAR and Israel." This assessment projected the "likely developments" in Egyptian and Israeli unconventional weapons projects; it analyzed their impact on the Middle East as well.[48]

According to the SNIE, Israel could produce a "limited" number of missiles with a 460-kilometer range, 1,800-kilogram payload, and "elementary" guidance system within two years. This assessment was contingent upon "full access" to French technology, parts, and testing facilities. The SNIE authors were referring to the MD-620/Jericho ballistic missile, although this system was never mentioned by name.[49] As for Egypt, the SNIE highlighted that country's efforts to develop missiles with ranges of 370 kilometers. Despite Cairo's "many difficult" problems, the SNIE authors believed Egypt could deploy a "small number" of missiles by mid-1964, assuming continued German technical assistance and a constant flow of parts. Still, the assessment downplayed the effectiveness of Nasser's Al Kahir and Al Zafir rockets, noting that

> The military value of such a weapon would be small. However, the UAR has a missile program going and has gained experience in the production of missiles. With access to outside help and components, it probably could in a few years produce a more effective weapon.[50]

Regarding nuclear, chemical, and biological weapons, the Estimate affirmed that neither Egypt nor the other Arab states would be capable of producing nuclear weapons at any time in the "near future." The SNIE did note that Israel and Egypt could produce "small quantities" of chemical or biological warfare "devices" for "clandestine use," although neither could make a radiological bomb. Ultimately, the SNIE said that Egyptian advanced weapons were being developed primarily for prestige purposes:

> The purely military significance of any missile system either Israel or the UAR could produce is likely to be modest ... although if Israel develops a nuclear bomb its military capability will be greatly increased. The political and psychological impact of the advanced weapons programs is more important than the purely military effort and is already being felt.[51]

The SNIE's conclusions fed directly into the State Department's arms control initiative. Indeed, only a few days after the SNIE was published, the Assistant Secretary of State for Near Eastern and South Asian Affairs, Phillips Talbot, provided an outline of the evolving arms control plan to Secretary of State Rusk. The central premise of the plan – Egyptian missiles for Israeli nuclear weapons – remained unaltered from the draft Komer wrote for Kennedy two months earlier; however, the new version added incentives for both parties to cooperate, especially Israel. Among Nasser's gains would be a canceled Israeli nuclear weapons project, a halt to Jerusalem's accelerating missile development program, and an opportunity to divert scarce resources from the military to Egypt's development needs. The initiative would let Nasser retain his existing missile stockpile while allowing him to burnish his credentials as a statesman opposed to nuclear tests and proliferation. Meanwhile, Prime Minister Ben-Gurion would win a carefully calibrated security guarantee from the United States, which had long been a central pillar of his nation's security policy. Overall, the memo noted optimistically, the initiative would enhance Israeli security by ameliorating a disturbing new development in the regional arms race – Nasser's missiles.[52]

The plan's scheme of operations was quite succinct: both sides would agree not to develop, test, manufacture, or import either nuclear weapons or ballistic missiles; and both would allow US officials "prompt access" to suspect nuclear or missile production facilities. Refusal to allow such access would be considered *prima facie* evidence of a violation, although penalties were not described.[53] Talbot's memorandum also spelled out an implementing mechanism that would be comprised of five elements. First, the President would designate a secret emissary agreeable to both sides. Second, that emissary would approach Nasser first, since it was believed that Egyptian cooperation would induce the Israelis to be more amenable to the plan. Third, the State Department initiative would place initial

emphasis on nuclear weapons and ballistic missiles. If both sides demonstrated confidence in the arrangement, the plan could be extended to include chemical and biological weapons. Parenthetically, radiological weapons were not regarded by the State planners as a "serious threat," since they were not mentioned. The fourth element emphasized that this was not a formal arrangement: the State Department recognized that the plan required flexibility and secrecy in order for it to be successful. Finally, the Americans would offer peaceful atomic energy and "space programs" as a "prestige sweetener" for both sides to cooperate.[54]

In another memorandum, the State Department Working Group offered additional details on the burgeoning arms control initiative. The President's emissary to Nasser and the Israeli prime minister was to avoid making any economic commitments to either party. He would also discourage any direct talks between the parties, although this seemed unlikely, given the vast gulf that separated them. The Working Group acknowledged many of the concerns that would likely trouble Nasser before he signed the plan, including the domestic Egyptian consequences of an apparent peace with Israel, and the sense of "selling out" to the US. Both of these were sure to harm Egyptian notions of sovereignty. The memo warned that Nasser would probably suspect that the American initiative was born out of the controversy over the German scientists. It also recognized that the agreement would effectively "starve" Egypt's appetite for new weapons. Finally, the memo gloomily concluded, Nasser might reject the idea outright, since Franco-Israeli cooperation on nuclear and ballistic weapons was likely to continue in any event.[55]

So why would the Egyptians agree to the plan? The Working Group had certainly done an admirable job of detailing all the reasons why Cairo would reject their initiative. In State's view, the secret of success lay in an appeal to Egyptian notions of "prestige" and public spectacle. According to the planners, who echoed the intelligence community's earlier conclusions, "The UAR's present missiles are largely show pieces which it might retain for that purpose. Present UAR missile development would be redirected toward prestigious outer space programs."[56] Whether Cairo was entirely motivated by prestige or would even accept a vague US space program offer remained to be seen. Noteworthy was the linkage made even at this time between ballistic missile development and space research.

These doubts aside, the State Department decided to proceed with the arms control plan. On 16 May, Secretary of State Rusk forwarded the relevant Working Group documents to Kennedy. Among those documents was a plan of action, a negotiating tactics memo, a draft letter from Kennedy to Nasser, and an options paper for US talks with Israel. No one appeared especially troubled about Nasser's anticipated reactions to the plan or the generally negative tone of his prior discussion with Robert Komer. Apparently convinced that the Egyptians would buy into the plan

for prestige, incentives, and an opportunity to forestall Israel's nuclear and missile programs, the State Department Working Group focused instead on the Israelis. The planners anticipated that Israeli Prime Minister Ben-Gurion would require an additional reward for his cooperation, namely a formal American security guarantee to the state of Israel.[57]

Once Kennedy approved the documents, the US policy machinery moved toward implementing the scheme. On 27 May, only eleven days after Rusk had forwarded the Working Group plan, Kennedy sent a letter to Nasser announcing his intent to send a special envoy to Cairo for arms control discussions. This was followed by the appointment of that emissary on 4 June, when Undersecretary of State George Ball and Assistant Secretary of State Talbot offered the job to John J. McCloy.[58]

McCloy was very much the man for the job. A graduate of Harvard Law School and a World War I veteran, McCloy later served as Assistant Secretary of War during World War II. Following the surrender of Japan, McCloy, the quintessential Minister without Portfolio, moved on to a number of important assignments, including president of the International Bank for Reconstruction and Development (the forerunner of the World Bank) and High Commissioner to Germany. When Kennedy was elected president in November 1960, he selected McCloy as his point man for disarmament affairs. This impressive résumé aside, McCloy was on record as stridently opposing the creation of the state of Israel, a stance which did not seem to enter the calculations of the State planners when they designated him as Kennedy's representative to Nasser and Ben-Gurion.[59]

On 15 June, McCloy, Talbot, Komer, and others met Kennedy at the White House to discuss strategy for the upcoming meeting with Nasser. Following a general discussion on the Israeli security guarantee, the participants switched over to Egypt and its advanced weapons projects. Kennedy, troubled by the possible problem of verification measures, asked whether the United States could track nuclear or missile developments in Egypt. CIA director John McCone pointed out that aerial photography and "other means" could provide some capability to monitor developments in Egypt. McCone doubted that US intelligence could discover all aspects of Egypt's research and development efforts, but was confident that missile or nuclear weapons production could be detected.[60]

McCloy chimed in at this point, noting that "mutual inspection" of both sides was clearly necessary for the scheme to work. Furthermore, the US had to make it clear to Nasser that the new arms control initiative was not a "Zionist plot," but a framework designed to alleviate Egypt's and Israel's security dilemmas. McCloy then raised another point: what should he do if Nasser wanted to discuss only the nuclear controls aspect of the plan rather than missiles? After all, the Egyptian leader seemed to be "enamored" of missiles "largely because of the prestige they gave him in the Arab world." Kennedy didn't appear too concerned: if the agreement had to be limited to just nuclear weapons then that would not pose too

many difficulties for him. Besides, the President reasoned, missiles "were not much good" without nuclear warheads, so their presence in the inventories of either side did not present a "great new military capability."[61]

Indeed, unless the US side believed that a security guarantee would absolutely clinch the deal with Israel, it is difficult to follow the American logic here. As it was originally conceived, the McCloy initiative was predicated on a simple exchange: Egyptian missiles for Israeli nuclear weapons. In Kennedy's reformulation, this quid pro quo could be removed and Egypt would trade a nonexistent nuclear program for Israel's burgeoning Dimona complex. The US probably was misreading the intentions of both sides. While Egypt may have intended to tip its missiles with chemical warheads, for the moment those missiles represented a potential means of delivering an assured strike on Israel. At this juncture it had no nuclear infrastructure capable of even researching the bare essentials of an atomic weapon. For its part, Israel was not going to trade its nuclear ambitions for a lackluster Egyptian missile project or a nonexistent Egyptian nuclear program.

As McCloy made preparations for his trip to Cairo, Komer offered his own "personal slant" on how to deal with Nasser. In Komer's opinion, McCloy should highlight the security advantages that Nasser would derive from the American initiative, namely that Israel would deny itself a nuclear capability that it was "much more closer [*sic*] to realizing" than Egypt. Nasser should be reminded that the United States would probably have much less leverage over a nuclear-armed Israel than it did in 1956 at the height of the Suez Crisis, when it essentially forced Israel out of Sinai. Nasser should be warned that if Egypt gained missiles, then the United States would not be able to resist Israeli requests for a similar capability. Komer stressed that Nasser needed confidence that the US could deliver a viable ban on nuclear weapons and ballistic missile development. To this end, Nasser should be notified of the priority Washington placed on regional arms control, and be reassured that the US would act against Israel's extensive missile and nuclear research links with the French.[62] In Komer's view, Nasser's rockets were essentially useless, since they were not equipped with nuclear warheads. As he put it to McCloy, "We doubt missiles alone without nuclear warheads make much sense except as psychological weapons and we doubt the USSR would give nuclears to Nasser any more than we would."[63] In sum, McCloy was to tell Nasser that the US offer was the best opportunity Egypt would ever get to trade off relatively useless missiles for Israel's burgeoning atomic bomb effort.

On 28 June 1963, McCloy and US Ambassador to Egypt Badeau met Gamal Abdel Nasser at one of the palaces taken from King Farouk. Contrary to his John Foster Dulles-induced image as the Arab "Bad Boy," the Egyptian president was courteous, receptive, and thoughtful throughout his meeting with the Americans. During the course of his discussions, Nasser revealed some of his motivations for acquiring ballistic missiles. Nuclear weapons were not at the top of his list.[64]

McCloy started by emphasizing the serious economic consequences of Egypt's and Israel's pursuit of advanced weapons. These "fantastically expensive armaments," would stifle economic development by choking off scarce human and capital resources. Given the costly nature of this new arms race, President Kennedy had asked McCloy to present an arms control proposal to the Egyptian government. Under this proposal, Cairo would abjure the production and use of atomic weapons and check the "further development or use of offensive missiles." The proposal, McCloy added, would not include any specific agreement or arrangement with Israel: Nasser would retain his current missile capabilities, while his adherence to the proposal could be kept secret "as the circumstances warranted."[65] McCloy then told Nasser that both the United States and Israel were aware of the "real efforts" Cairo was making in missile development. Egyptian progress, he noted, had triggered a "vigorous reaction in Israel," and that country might be tempted to "manufacture material for nuclear weapons" if Egypt continued to develop and produce new missiles. In a move that would irritate Komer and others, McCloy avoided making any further reference to an Israeli atomic bomb, and this omission effectively removed much of the incentive for Egyptian cooperation on the US initiative.[66]

Nasser stalled. He said he needed time to consult with his advisers, especially Marshal Amer. This hesitation aside, Nasser did offer what he called his "immediate reactions" to the McCloy initiative. First, why was the United States floating the proposal at this time? Second, why was Egypt being singled out among the non-nuclear powers for a non-proliferation agreement? Third, Nasser foresaw problems in verifying and enforcing the conditions of the agreement. He was particularly concerned by the inspections and their implications for Egyptian sovereignty. Finally, he viewed the American proposal as connoting a direct Egyptian–Israeli bilateral arrangement. As some in Washington had predicted, any agreement with the US and, indirectly, with Israel, could irreparably damage Nasser's reputation with the Egyptian public and his military. The idea of any bilateral treaty with Israel was still anathema to the Egyptian ruling establishment.[67]

Nasser's reaction to the McCloy mission wasn't uniformly negative. The President offered a counterproposal whereby, in response to a written request by Kennedy, he could offer the following in writing: Egypt had no intention of developing and producing nuclear weapons; Egypt had no intention of attacking Israel. In essence, Nasser's first pledge was hollow since he really did not have a nuclear weapons program to give away. As for the second pledge, it was predicated on trust, something that was in short supply between Egypt and the United States and Egypt and Israel."[68] The Egyptian president did not include his missile programs in his counterproposal. In fact, he informed his American guests that he needed those missiles to "offset" Israel's SAMs, a reference to Tel Aviv's recent acquisition of Hawk. Without ballistic missiles, Nasser observed, Egypt would

possess no "counter threat" to Israel. Clearly, from his perspective, the American characterization of Hawk as a "defensive" weapon was a moot point.[69] Nasser also was quite candid about the shortcomings of his missiles. As McCloy detailed in a cable summarizing the discussion:

> He said his missiles were designed only for high explosives. He had sought without success to find something more powerful than TNT but he could not find anything between TNT and a nuclear warhead ... His guidance system was a very simple one, non-electronic with a margin of error from one percent to five percent.[70]

Nasser's point about pursuing a warhead with a greater destructive power than TNT is an important one: was he validating at least some of the Joklik allegations and was he deliberately misleading the Americans as to his true intentions and capabilities? Nasser was also surprisingly frank in discussing his guidance system problems, especially considering the suspicion with which he regarded the US–Israel "special relationship." After all, how could he be certain that these military secrets would not be passed on to Israel? Still, Nasser's mild characterization of his missile guidance problems considerably understated the extent of the difficulties his engineers were encountering in this area.

Although he had already mentioned his reservations about the US verification scheme, Nasser pressed McCloy for details on the proposed inspections. McCloy replied that such inspections would be "unobtrusive," involving only a limited number of technical experts, who would visit "critical sites." In response, Nasser said he did not see much use for nuclear site inspections, since his reactor was not capable of producing "nuclear war material." Nasser then inquired into the American missile inspection plan. McCloy parried this question, noting that inspection and verification were a matter for future technical discussions.[71] At this point the first meeting with Nasser adjourned. The President had already highlighted his intent to discuss the US proposal with his closest military advisors. Although Nasser's response had been rather disappointing for the Americans, the US delegation probably held out hope for a more successful second meeting with the Egyptians.

Three days later, on 30 June, McCloy and Badeau met with Nasser once again. Contrary to the hopes of the American team, the Egyptian president was less accommodating in this second meeting than in the first one, leading to the likelihood that Amer and other hardliners had stiffened his position. Nasser said he could not enter into an agreement with Washington, because such an agreement would constitute an infringement of Egyptian sovereignty. Nasser was particularly concerned with the inspection and verification provisions of the proposal: while Egypt rejected a bilateral arrangement with the United States, the President stated, he could accept a "collective" agreement based on a United Nations pro-

posal. Just as the State Department Working Group planners had feared, Nasser suspected that the American initiative was motivated solely by the Israeli "propaganda campaign" against Egypt and the German scientists. In other words, Israel was accomplishing through its American friends what it could not accomplish through assassination, threats, or press wars.[72]

In response, McCloy fell back on the threat of Israel's nuclear weapons research program, stressing that it was in Nasser's "real interest" if US inspections of the Dimona reactor continued. Those inspections, he added, would offer Nasser a potential check on Dimona's operations. Nasser agreed on this point. Badeau then posed the crucial question: what would Nasser do if he learned that the Dimona reactor was producing weapons-grade material? The response was chillingly laconic: ". . . protective war . . . We would have no other choice."[73] Switching to the verification regime, Nasser said he could not accept any inspection of his missiles or their production facilities. McCloy later surmised that this statement covered all inspection proposals, be they American or United Nations in origin. Nasser declared that he would not greatly increase his missile inventory. He acknowledged the need to continue "work on his missile guidance systems," admitting that such work was "all very expensive." Cairo was well aware of the expenses related to producing missiles, Nasser assured the Americans; therefore, he would not expand his missile force "except insofar as he was compelled to preserve the military balance." At that point, Nasser's meeting with McCloy was over.[74]

This second meeting obviously did not live up to Washington's expectations. Nasser had unequivocally rejected all aspects of the US plan, and demonstrated little willingness to examine any compromises. Still, McCloy tried to put a positive spin on these dismal proceedings, concluding in his cable to Washington that Nasser would "give the matter more thought."[75]

On 1 July, Badeau cabled his summary and personal assessment of the discussions to Washington. Badeau admitted the "opening round" was both "difficult" and "speculative," but he cautioned against undue pessimism. After all, he reminded his Washington audience, disarmament discussions between Israelis and Arabs were no less fraught with "security, emotional, and technical problems" than similar talks between Americans and Soviets. He urged Washington to recognize its limits: mere diplomatic suasion was not going to secure Egyptian compliance with the American proposal. Furthermore, the United States needed to keep the tenor of these discussions in proper perspective. The McCloy talks would have been impossible two years ago, given the level of distrust between Cairo and Washington. In his view it was significant that Nasser had not greeted the American proposal with "quick-trigger pat responses."[76] Nasser's refusal to engage on the US initiative was based "almost entirely on political rather than military and financial considerations," Badeau continued. In the ambassador's judgment, the Egyptian president's rejection was

driven first by Egyptian and Arab public opinion, second by mistrust of any deals involving Israel, and third by wariness of any deals with the great powers. Badeau was also impressed by Nasser's "frankness" in discussing the shortcomings of his missile program. In fact, he continued, the US Embassy had been seeking such information through "intelligence contacts" in Cairo but with little success.[77]

Badeau was more optimistic about Nasser's proposal to exchange letters with Kennedy on nuclear matters. He argued that this proposal could mark a significant shift away from Cairo's commitment to driving Israel into the sea. "That Nasser even suggested [the] possibility of [a] public statement," Badeau continued, "is most remarkable in view of attacks on him in recent months." The ambassador felt that greater emphasis should be placed on a nuclear deal and he recommended that Kennedy send a letter to Nasser, sounding out his views on renouncing nuclear weapons. Finally, Badeau said that McCloy should not continue on to Tel Aviv as planned, but return to Washington and brief the President on the outcome of his meetings. It was imperative that Israel not be given the opportunity to reject the US proposal "out of hand."[78]

Badeau also understood that Nasser was not prepared to bargain away his missiles. It was with this realization in mind that Badeau recommended the linkage between nuclear weapons and ballistic missiles be severed: "we should not forego [agreements]," he observed, "for [the] sake of working [a] much more difficult and problematical rocket deal." In the end, Badeau was hard pressed to put a positive assessment on the McCloy–Nasser meetings, although his cable concluded with the cheery reminder that the key outcome of the talks was their "fullness, frankness, and moderation."[79]

Not long after Badeau drafted his cable, Robert Komer prepared a summary of the McCloy mission for Kennedy. Like Badeau, Komer was inclined to look at the meetings in a positive light. In his opinion, nothing in the exchanges suggested that Nasser had "closed the door" on arms control. For Komer, the highlights of the meeting included Nasser's "frank revelation" that he had no nuclear capabilities and his candor in talking about the poor guidance in his missiles. He was also comforted by the fact that Cairo was not planning to produce missiles beyond "crude V-2 type missiles with simple guidance and a probable high explosive warhead." Komer sensed from the McCloy sessions that Nasser was more concerned with the political atmospherics surrounding his missiles than their military value.[80] Komer expressed disappointment with McCloy's handling of the mission, regretting that McCloy did not adequately emphasize to Nasser Washington's strong fears of Israeli work on nuclear weapons. The only way to restrain Egypt, Komer believed, was reiterating to Nasser how much progress Israel was making on nuclear arms. He seconded Badeau's recommendation against approaching the Israelis until Nasser's anti-nuclear proposals were clarified.[81]

Komer's sense that McCloy had failed to communicate his full brief to Nasser was shared by others: on 7 July, the State Department cabled its embassy in Cairo, asking Badeau to meet Nasser and raise the points McCloy had missed. The ambassador was to emphasize not only Dimona's strong potential for fulfilling Israel's nuclear ambitions, but the link between Nasser's missiles and Israel's pursuit of nuclear weapons as well. Indeed, the ambassador was to reiterate that Cairo's continued work on missiles only provided further justification for Jerusalem's nuclear program. Nasser had to be made aware of the negative impact his missiles were having on Israel's and Egypt's future security. Another point to consider was the success of Israel's campaign to gain propaganda points from Cairo's missile tests and parades:

> Public disclosure of the UAR missile program has lent itself to exploitation by others and given them a handle with which to launch their propaganda campaigns. We have tried to avert this … as for example, in Secretary Harriman's letter of April 12 to six US Senators. This letter was not well received by Israel. Despite such actions on our part, others will view UAR's missiles as being capable of carrying nuclear weapons and will give credence to Israel's charges.[82]

It is not clear from the public record whether Badeau was successful in arranging a meeting with the Egyptian president. If that meeting did take place, it apparently did not result in any progress for the arms control plan, nor did it reveal any changes in the Egyptian government's position.

The summer of 1963 passed by in Washington with little apparent progress on the Middle East arms control scheme. The ball was now in Nasser's court as he pondered Kennedy's request for clarification on nuclear arms. Since Washington had not obtained an agreement with Cairo, it could not seek Israeli adherence to the plan. From Israel's perspective, nothing had changed at all since the missile problem had first been broached with the Americans the previous year: Nasser's missiles were still being built and Washington continued to pursue rapprochement with Egypt. Consequently, the Israelis began to press the Americans once again about the Egyptian missiles, only this time Jerusalem was seeking redress in the form of new American arms deliveries. On 9 September 1963, Prime Minister Eshkol urged his ambassador in Washington to seek "new deterrent weapons, including surface to surface missiles of the kinds that the Egyptians have" from the Americans.[83]

Foreign Minister Meir pressed Israel's concerns during a 30 September 1963 meeting in Washington with Secretary of State Rusk, where she highlighted the work of Egypt's German scientists "in the field of poison gases, missiles, etc." She alleged that the Egyptians had recently used "poison" and mustard gas against the royalist forces in Yemen. In response to

Rusk's question about Egyptian missile guidance, Meir admitted that such systems were primitive; however, she said she had recent indications that Cairo was resolving at least 50 percent of its missile guidance and control problems. Offering no scientific evidence or methodology to back her assertions, Meir affirmed that these improvements would enable the Egyptians to hit Tel Aviv with 50 percent of the missiles launched. She estimated that Cairo would have "accurate missiles in quantity" by 1965.[84] Meir then shifted her comments to nuclear weapons. Israel had evidence of Egyptian research in atomic bombs, and much of that evidence was produced during the trial of Otto Joklik in Switzerland. The Joklik papers, she continued, demonstrated repeated attempts by Nasser to procure cobalt and other radioactive materials from foreign sources. Rusk inquired whether Israel had any information on the location of factories linked to Egyptian radiological and chemical weapons programs. Meir said it did.[85]

A few days after her meeting with Rusk, Meir raised her country's concerns about Egyptian missiles and unconventional weapons in a speech before the United Nations General Assembly (UNGA). She urged UN members not to remain "indifferent" to Arab preparations for war with Israel. As evidence of these preparations, Meir cited the "constant stream" of arms for Arab powers and the work of "mercenary German scientists" in Egypt. The Middle East arms race was a danger to regional peace and stability and it absorbed scarce resources that could be better used for socioeconomic development.[86] Meir's plea fell on deaf ears, for the UNGA did not take action against the accelerating Middle East arms race. From Israel's perspective, which was already highly skeptical of the UN's role in resolving conflict, the United States remained the most receptive audience for its security concerns. That responsiveness was tested on 12–13 November 1963 in Washington, when the two countries exchanged intelligence on the Egyptian military.

During the first intelligence exchange session, the Israeli delegation, consisting of the Deputy Chief of Staff for the Israeli Defense Forces (IDF), Yitzhak Rabin, and the Deputy Chief of Military Intelligence, Colonel Yariv, offered the Israeli position on the Egyptian order of battle, advanced weapons, and overall military threat. Not surprisingly, missiles figured prominently in these discussions.[87] According to Yariv, Egypt's acquisition of missiles was motivated by a number of requirements, including increased striking power against Israel, disruption of Israel's ability to mobilize its reserves, increased prestige for Cairo in the Arab world; and the addressing of current military capability gaps.[88] Yariv then produced a document that purportedly highlighted Egypt's intent to produce 500 Al Kahir and 400 Al Zafir missiles. The precise nature of this document or its contents is not explained in the summary minutes of the exchange. Nevertheless, it most likely was that same Pilz "invoice" for 900 missiles produced at the Joklik trial the previous spring. Yariv also produced a chart

which depicted the various Egyptian organizations involved in missile research, development, and production. This document identified missile procurement channels in Germany, such as INTRA-Munich and an Egyptian military purchasing mission in Cologne.[89]

Additional Israeli documents outlined the stages in Cairo's missile development effort, estimated missile accuracy, and production targets. The Israelis believed the Egyptians had produced 80–100 missiles with a 20-kilometer circular error probable (a measure of accuracy) by 1963. Based on known Egyptian facilities and anticipated delivery of machine tools from the Unverzagt firm in Stuttgart, Yariv assessed that Cairo would have 240 missiles by the end of 1964, 500 in 1965, and 1,000 by the end of 1968. If the machine tool delivery were prevented, he speculated, the figures could be adjusted to 160–200 missiles by 1964 and 240–300 by 1965.[90]

Moving on to other matters, the Israeli delegation admitted that Cairo "appears to have shelved its plans for radiological warfare," although the Egyptians maintained a "continuing interest" in these weapons. Whether Jerusalem actually had intelligence indicating a cessation of Egyptian interest in radiological bombs or was merely covering up for the lapses in properly assessing Otto Joklik's credibility was left unsaid. Still, there was little doubt in the minds of the Israelis that Egypt was researching the "military aspects" of atomic energy. They believed that this research would only accelerate once a 75–200MW power reactor had been completed with the help of Soviet technicians.[91]

Cairo wasn't neglecting chemical or biological warfare. According to Yariv, there were no "concrete advances" in Egypt's biological warfare program, although the Egyptians were interested in this warfare area. The Israelis alleged Egyptian production of chemical weapons; however, specific types were not detailed in the summary memorandum. Significantly, the Israelis believed that Cairo was capable of mating a chemical warhead to its ballistic missiles.[92]

At this point in the exchange, General Rabin began a presentation on the military implications of Egyptian missiles. These missiles, he began, increased Egyptian confidence in launching an attack against Israel. Of particular concern to the IDF was the "operational advantage" of ballistic missile attacks in disrupting Israel's mobilization plans. Cairo no longer needed its bomber pilots, Rabin reasoned, since the deep strike mission had now been assumed by the missile force. In conclusion, General Rabin affirmed that the only counter to increased Egyptian confidence in attacking Israel was a parallel force of Israeli long-range missiles. It was with this context in mind, he added, that Tel Aviv was requesting 100 US-built Pershing I surface-to-surface missiles.[93]

The US reaction to the Pershing request is not recorded. Senior Israeli officials, including Eshkol and Meir, had already issued vague requests for American ballistic missiles, although this probably was the first time that

Pershings had been specifically requested by name. In asking for Pershing I, Jerusalem was clearly starting negotiations from its optimal position, since this weapon had only recently been introduced into the US Army and its accuracy would greatly exceed any system that Israel could obtain from France. In comparison with the primitive Al Kahir missile, the two-stage, solid-fuel Pershing was vastly superior in reliability, accuracy, and range.[94]

The second session of the intelligence exchange commenced with a critique of the Israeli presentation by Lieutenant General William W. Quinn, US Army, and the first Deputy Director of the Defense Intelligence Agency.[95] General Quinn said that the Israeli assessment of Egyptian missile capabilities was "somewhat overly optimistic," since US intelligence doubted whether Cairo could ever resolve all the obstacles involved in developing, producing, and deploying a viable missile. Moreover, Washington did not believe that Nasser would expend the tremendous resources necessary to support a 900-missile force "unless he is convinced it will result in more than a psychological weapon." Given Cairo's undeniable problems with missile accuracy, Quinn added, its missiles were ineffective as weapons.[96]

General Quinn did emphasize those points of agreement between Washington and Jerusalem on the Egyptian missile threat. Nasser clearly would continue researching unconventional weapons, although the US side doubted his capability to produce an "all-out" effort. In Quinn's view, the Egyptians currently did not have a nuclear weapons capability, while their chemical and biological warfare efforts were "on a very limited scale."[97] These points of agreement did little to disguise the lack of concord in the US and Israeli positions. For example, the Israelis had already demonstrated their concerns with a future Egyptian nuclear weapons capability, even if Cairo did not possess such weapons. In addition, while Washington emphasized the "very limited scale" of Egyptian chemical and biological warfare capabilities, the Israeli delegation had already asserted that Cairo had developed chemical warheads for its new missiles. These were significant analytical differences, and they masked the more significant disagreements over broader Egyptian military capabilities that awaited further discussion.

General Quinn downplayed Israel's surprise-attack scenario, which postulated that Egyptian missile strikes could disrupt Israeli mobilization schedules and leave Israel open to invasion. In order for such an attack to be successful, the general reasoned, Cairo would have to follow missile strikes with carefully synchronized ground and naval assaults. He added that Egypt's capability to wage a general conventional offensive would be regulated by a number of factors such as political climate, full mobilization of the logistics base, and build-up of forces in the Sinai. Any of these factors, Quinn argued, could be detected by Israeli intelligence, allowing time for full mobilization of the IDF's reserves.[98]

Upon the conclusion of General Quinn's critique, a general discussion ensued. The US doubted whether Egyptian missiles, hampered as they were by poor accuracy, could hit Israeli airfields and cities before a "friendly power" came to Tel Aviv's assistance. A US Defense Department official questioned the capability of Nasser's missiles against military targets. Besides, another US participant demanded, how could Egyptian missiles be countered by Israeli missiles? The Israelis admitted they had many gaps in their intelligence collection posture on Egypt but agreed that Egyptian missiles would have a psychological rather than a military significance, at least for the next two years or so.[99]

Assistant Secretary of State Talbot then offered his summation of the exchange. He submitted that both sides appeared to agree on the limited capability of Cairo's missiles; that if Israel obtained its own missiles, Egypt was likely to turn to the Soviets for improved ballistic missiles; and that Cold War exigencies tended to cause more security problems for Israel than Egyptian missiles alone. Therefore, Talbot concluded, the United States would welcome any Israeli ideas on limiting arms proliferation to the Middle East. This was a clear push for the McCloy initiative, even though Washington had not formally presented it to Jerusalem yet. Furthermore, it was a subtle hint that Pershings were not in Israel's immediate future.[100]

Israel's ambassador to Washington, Avraham Harman, offered his conclusions on the discussions. In the area of missiles, while he agreed there was little difference over Egyptian capabilities, he stressed that the Egyptians had missiles in their inventory and a cadre of experts to improve their capabilities. Harman countered the American argument about production targets, insisting that the economic costs associated with missile production were of little concern to Cairo. Israel continued to fear the consequences of an Egyptian missile build-up for regional stability, Harman added. The ground truth from his perspective was clear: Egypt possessed long-range missiles, and its current capabilities in this area were superior to those of Israel.[101]

While the Israelis had little success in selling their view of Egyptian missile capabilities to the US State Department, Defense Department, and the intelligence community, they encountered even greater resistance from Robert Komer at the NSC. During his 14 November session with General Rabin, Minister to Washington Mordechai Gazit, and others, Komer downplayed any notion of an operational Egyptian ballistic missile capability. As he put it in a summary memorandum,

> We doubt that the UAR now has an operational missile capability with 80–100 missiles or would spend the more than $500 million it would take to build a 1,000 missile inventory by 1968. We don't have convincing evidence that [the] UAR is going ahead with that kind of production, or can achieve a militarily effective system even if they do.[102]

In Komer's view, Cairo had little use for 1,000 missiles, since it could achieve the maximum psychological effect with a missile force of 100.[103]

Komer had a good memory too. He seized on Israel's sudden reversal of position on the radiological threat that emerged during the intelligence exchange, and criticized Israeli intelligence for "overselling" Egypt's unconventional weapons capabilities to the Israeli government. He observed that Eshkol and Meir had talked about alleged Egyptian advances in nuclear, chemical, and radiological warfare without sufficient evidence to substantiate their case.[104]

General Rabin responded to these criticisms by falling back on the talking points he had raised earlier during the intelligence exchange. He agreed that Egypt's missiles were psychological; however, the real danger lay in Nasser's "overconfidence." With his growing missile force, the Egyptian leader might be tempted to launch a quick strike, regardless of the capabilities of his weapons. The real question from Rabin's standpoint was what his country must do to deter an attack by Egyptian missiles. He was particularly struck by the fact that Nasser had put his missiles into production despite their shortfalls. This seemed to indicate that the Egyptians regarded the mere possession of these weapons as a major asset. Israel required missiles, he suggested, to counter Cairo's "psychological" edge in possessing missiles of its own.[105]

But Komer was not buying this "confidence" argument, emphasizing that Egypt was not likely to be "dangerously overconfident" about its "homemade weapons." Surely, Komer pressed, Egyptian scientists could draw their own conclusions about the accuracy, reliability, and salvo capacity of their Al Kahir and Al Zafir rockets? As Komer stated in his summary, "would they really think they could fire off 1,000 or even 500 of these ... within twelve hours, or even 48?" Far from seeking a strike advantage, Komer concluded, Egypt was after the "generalized prestige" and the "psychological advantage" of being the only Arab state to build its own missiles and aircraft. Why build 1,000 "primitive" missiles, he queried, merely to prove this point? Rabin disagreed: Egypt was looking for military advantage, he insisted, and missiles were fundamental to Nasser's war aims.[106]

Komer then asked the Israelis about their own missile plans, including a possible deal with the French aviation producer Marcel Dassault. Rabin replied that while it was true that Israel was interested in missiles, no procurement decisions had been made. He denied the American charge that Israel had decided to buy its missiles from foreign sources.[107]

While Robert Komer attacked some of the premises underpinning Jerusalem's arguments, others such as *New York Times* editorialist C. L. Sulzberger seemed to be more susceptible to Israeli blandishments. On 20 November 1963, Sulzberger wrote an editorial that echoed many of Israel's concerns about Egyptian advanced weapons projects. It also

focused on Israeli claims of an Egyptian radiological, or "garbage," bomb, even though the Israeli military had by now backed off this claim. Cairo could produce such a weapon within two years, Sulzberger emphasized, and this would negate any disadvantages inherent in Egypt's poor missile guidance and control. Indeed, the resulting fallout could be disastrous for Israel regardless of where the missile warhead exploded. Sulzberger painted the image of a victimized Israel in grim prose: "Geiger counters would then detect spreading fallout and the entire region, which includes a huge population fraction and key airfields, would ultimately have to be evacuated."[108]

"No outsider can confirm Israel's assumptions," Sulzberger admitted. Nonetheless, if those assumptions were true, the security implications would be "enormous." For example, Israel would strive to obtain missiles and even attempt to build "atomic devices" at its Dimona reactor. Sulzberger depicted a gloomy scenario, involving Egypt's new radiological weapons: a border war between Egypt and Israel soon heats up; Cairo fires a salvo of ballistic missiles; Israel believes these missiles are tipped with "garbage bombs" and evacuates its metropolises. Sulzberger then asks: "Does the United States, after verifying Israel's claim, send a Polaris submarine to destroy Cairo and Alexandria?"[109] Even if Washington was so disposed to retaliate for Egypt's attacks, he continued, Polaris strikes on Egyptian cities would hardly reassure those Israelis whose cities would now be "poisoned for years." Given the uncertainties of the United States' commitment to Israel, Sulzberger concluded, Jerusalem believes it must have its own "deterrent."[110]

C. L. Sulzberger's editorial is not a complete rendition of Israel's security arguments. Indeed, he questions whether Israel has correctly gauged Nasser's true intentions. Even so, his dramatic doomsday scenario of Egyptian radiological bombs "poisoning" Israeli cities does leave a broad hint of Israel's ongoing quest for a US security guarantee. He said that if Washington was unequivocal in its support for Israel's security requirements, such as announcing retaliation for Egyptian attacks on Israel in advance, then perhaps Jerusalem would ease up on developing the fundamentals of its own deterrent: ballistic missiles and the atomic bomb.[111]

Israeli missile developments were apparently on Robert Komer's mind as well, for the day after Sulzberger's editorial appeared in print, Komer met with the Israeli Minister to Washington, Mordechai Gazit, to discuss the "possible repercussions" of Israeli missile acquisitions. Komer believed that the US had done a convincing job of highlighting the weaknesses crippling Nasser's missile programs during the intelligence exchange. Therefore, if Nasser wanted to waste money on useless weapons, he reasoned, why would Israel "follow suit?" When Gazit responded by invoking the Israeli people's "deep concern" for the missile threat, Komer

recommended that the Israeli government educate its people about the true dimensions of that threat. Furthermore, Komer repeated his argument that an Israeli acquisition of advanced missiles would only pressure Cairo to seek "good" missiles from the Soviet Union. At any rate, Komer concluded, ballistic missiles were not "militarily effective" without nuclear warheads.[112]

"We were ships passing each other in the night," wrote Komer about his meeting with Gazit. That metaphor might be extended to the entire US–Israel security dialogue on Egyptian missiles. Where Washington saw a hypothetical psychological threat to Israel, Jerusalem saw a weapon which could disrupt its mobilization timetables or poison its cities with radioactive fallout. Where the United States believed that economics would restrict Nasser's missile ambitions, Israel saw an unbridled desire for a 900+ missile "fleet" capable of swamping the Israelis' defenses and will to fight. Finally, where Washington doubted the utility of an Israeli missile acquisition, Jerusalem was already pursuing a future nuclear deterrent based on missile delivery systems.[113]

Following the round of exchanges with the Israelis, the US National Security Council sought an update from the intelligence community on Nasser's missile capabilities. A key motivating factor behind this request was the need to counter Israeli arguments on missiles. Komer said as much in a memorandum to National Security Advisor Bundy, reiterating that the United States did not "see UAR rocket developments as posing [the] threat [the] Israelis claimed." In addition, one cannot preclude another motivation for the SNIE, namely that Komer may have requested the Estimate to rebut those within the administration who were predisposed to accept Israeli claims at face value.[114] In the end, this new SNIE delivered on Komer's aspirations for it. In succinct prose, the estimators provided several important key judgments on Nasser's missile efforts: that the deployment of 900 missiles was unlikely; that the Egyptian missiles lacked military value; that the missiles had psychological value; and that tensions in the region would rise.

US intelligence analysts doubted whether the Egyptian leadership had arrived at any "definite decision" on missile quantities. Assuming Israel's evidence of 900 missiles was true, the SNIE estimated that such a requirement would cost in the magnitude of some $400–$600 million. Over 50–75 percent of that figure would have to come from scarce foreign currency reserves, and

> [s]uch expenditures, on top of the large requirements for other parts of the defense budget and for the economic development program, would be an extremely heavy burden on the foreign exchange resources of a country which is likely to be in difficult economic straits for the foreseeable future.[115]

The SNIE concluded that Cairo probably could not deploy more than "a few hundred" missiles in five years; the final number could even be "substantially lower."[116]

Should Egypt field these missiles, the SNIE downplayed their near-term value due to poor accuracy and lack of nuclear warheads. The estimators assessed the circular error probable of Cairo's ballistic missiles to be in the neighborhood of 8–16 kilometers. This poor accuracy limited the effectiveness of any Egyptian counter-force attack on Israeli airfields. In fact, the SNIE estimated that 200 missiles with 454-kilogram high explosive (HE) warheads and a circular error probable (CEP) of 1.9 kilometers would destroy no more than 15 percent of aircraft parked in open areas. This percentage would decrease sharply for aircraft shielded by revetments.[117]

The SNIE authors were more equivocal in tackling Jerusalem's assertions that a barrage of missiles could disrupt Israel's mobilization effort at the commencement of hostilities. A particularly "heavy" attack on casernes "probably would" disrupt "some mobilization"; however, such an attack would have to involve Egyptian air force Tu-16/Badgers, one of which could carry the payload of twenty Al Kahir missiles. Yet even these strikes would be of little military value, for as the SNIE stated:

> In view of the inaccuracy and limited reliability of the missiles, the inherent difficulties of launching a large number of missiles, and the probable inadequacies of Egyptian crews, we believe it extremely unlikely that the UAR would be able to mount a missile attack which could do enough material damage to disrupt seriously an Israeli mobilization effort.[118]

The SNIE concluded that Nasser's missiles were more significant for their psychological impact than their inherent military value. Indeed, these missiles had already had a "considerable psychological effect" on Israelis, who were "acutely aware" of their country's small size and vulnerabilities. The SNIE acknowledged Israeli fears that the mere possession of an assured strike against Israel could embolden Cairo to take "greater risks," including a "surprise attack" on Israel; however, despite this psychological edge, the Estimate did not believe that an Egyptian missile attack would "seriously" demoralize the Israeli populace.[119] According to the SNIE, although Israel's leaders probably did not "fully believe" their propaganda, they did have a "real fear" of future Egyptian missile capabilities. This set the stage for Jerusalem's decision to acquire its own ballistic missiles. The SNIE mentioned Israel's 1962 contract with France for 250 solid-propellant missiles with a range of about 463 kilometers and a CEP of 800 meters.[120]

The Estimate echoed the concerns expressed by Assistant Secretary of State Talbot and Robert Komer that Cairo would turn to Moscow in response to Israeli atomic weapons development. The estimators believed

that Soviet assistance could include missiles capable of reaching Israel; however, Moscow "probably would not" provide the Egyptians with nuclear weapons.[121]

Robert Komer was pleased with the Estimate. In early December 1963, he forwarded a copy to his boss, National Security Advisor McGeorge Bundy, noting that the document "fully backs" the view that Egypt's missiles did not live up to the billing the Israelis were giving them. As an example, Komer observed that the SNIE debunked the allegation that a well-timed missile attack could disrupt Israeli mobilization and leave that country vulnerable to sudden attack. "We're left with the psychological impact," Komer told Bundy, admitting that this posed a "problem" for the Israeli government. Indeed, how could this government "explain to [the] Israeli people that all those UAR missiles really don't count?"[122] Komer urged Bundy to reject Israel's recent acquisition of French-designed ballistic missiles. Such an acquisition, he warned, would pressure Cairo to obtain "really good missiles" from the Soviet Union, as opposed to the "junk" it currently possessed. Ultimately, in Komer's view, missiles and nuclear bombs were a lethal brew that would only escalate the Middle East arms race to "dangerous" levels.[123]

Komer and Bundy did not have to wait long to impress their views upon the Israelis. On 10 January 1964, Israel's ambassador to the United States, Avraham Harman, met Bundy and Komer at the NSC's offices in the Old Executive Office Building. During this meeting, Harman pressed for those weapons that Prime Minister Eshkol had requested the previous year, including ballistic missiles to meet a "growing" Egyptian missile threat. In response to Bundy's query about Israel's rationale for acquiring missiles, Harman affirmed that his country had already provided ample evidence of Egyptian missile "stockpiles," which he characterized as posing "a real psychological and military threat for Israel." That threat, he added, forced his country to seek similar missiles as a deterrent. Sticking to the line laid out by Komer and the SNIE, Bundy denied any military advantage for Nasser's missiles; however, he did admit they constituted a possible psychological problem. Still, Bundy continued, this psychological edge hardly justified an expensive Israeli investment in French missiles. As the US memorandum of this conversation affirmed, "We simply didn't see Nasser's missiles as posing the kind of threat that would require a major Israeli investment in anyone's missiles in return."[124]

Komer made his views known as well, particularly his point about the low military value of Egypt's Al Kahir and Al Zafir rockets. He stated that not only did the US not agree with Israel's 900–1,000 Egyptian missile estimate, it also did not believe that inaccurate missiles equipped with conventional warheads could hinder Israel's mobilization efforts.[125]

Assailed by Bundy and Komer, Harman fell back on the "overconfidence" argument raised by General Rabin the previous November.

"Possession of a missile force," he cautioned, could encourage Cairo to be "more aggressive than purely military calculations would justify." Bundy interjected that missiles without nuclear warheads were not "meaningful." According to Bundy, Israel's acquisition of missiles, coupled with its "existing nuclear potential," would only aggravate the regional arms race. In the face of this opposition, Harman could only retort that he did not want to discuss his country's missile plans with the United States. Israel needed its own "deterrent power," he declared, and his government needed to demonstrate to the Israeli people that it was coping with the Egyptian missile threat.[126]

Not surprisingly, Harman was not pleased with his discussions at the NSC. He later told Myer Feldman that he was "disturbed" by the discussions with Bundy, for the National Security Advisor kept steering the discussion to missiles and urged that Israel "deny itself" missiles. "Israel would be at a serious disadvantage," Harman said, "if they could not have at least 100 missiles." While Feldman did not appear swayed by Harman's complaints, he did ask the ambassador whether Israel had negotiated a deal to purchase missiles from France. Harman averred that he "did not know."[127]

Israel's best efforts notwithstanding, it was Jerusalem's missile plans, not Cairo's, that were near the top of the agenda when a senior US Defense Department delegation visited Israel in February 1964. Among other things, this delegation had the unpleasant task of informing the Israelis that Washington would not sell Pershing missiles to them. The reasons cited had all been hashed out before, including the importance of avoiding another regional arms race. Once again, the Americans reiterated what they saw as the fundamental linkage between ballistic missiles and nuclear warheads, and given this linkage, the US was naturally interested in Israel's nuclear plans as well as its intent to buy missiles.[128]

Deputy Defense Minister Peres sidestepped that query and moved immediately to the Egyptian rocket threat. He reminded the US delegation that his country needed "retaliation" missiles because of the psychological value of Nasser's rockets. Prime Minister Eshkol reinforced this point: Israel was afraid of even Egypt's "bad" missiles, he conceded, although this begged the question as to why Cairo was expending sums on these bad weapons. Then Eshkol held out a semblance of a carrot: Israel would stop "thinking about missiles" if Egypt stopped producing Al Kahirs, Al Zafirs, and Al Areds. He also suggested that a transfer of US-built missiles to Israel would add extra incentive for Nasser to stop building missiles.[129]

Levi Eshkol did not mention nuclear weapons in this proposal, but the US side would not let Dimona go unmentioned. One Pentagon official said that the Pershing I missile sought by Israel was only useful with nuclear warheads and, according to the US embassy cable, Eshkol "looked aghast" at this statement. He paused, then urged his American visitors not to "persuade us to put nuclear warheads on them."[130]

The matter of an Israeli missile program was taken up again several days later during a meeting in Washington between the new Israeli Foreign Minister, Abba Eban, Ambassador Harman, McGeorge Bundy, and Robert Komer. This time, the Israelis were willing to grant that Cairo's missiles possessed "little military value." That said, Israel had to contend with the "real psychological hazard" of these weapons. Eban insisted that Israeli missiles could pose a "psychological counter" to Egypt's missiles by bolstering Israeli public morale and discouraging Nasser from contemplating a surprise missile and bomber attack on Israel.[131] Bundy was not convinced. In his opinion, Nasser's missiles "seemed to be more for parades than a serious military weapon." He did allow that the Egyptian leadership might "over-estimate" their military strength but what Bundy really wanted to talk about was Israel's nuclear weapons, not differences of opinion over Cairo's rockets. As before, the Israelis were prepared to offer little information on their long-term plans for Dimona, even though nuclear weapons were the key American proliferation concern. From the standpoint of some US officials such as Komer, the Israelis were using Egyptian missiles as a red herring to disguise their nuclear weapons program. In this manner, another US–Israeli official exchange terminated inconclusively.[132]

Egyptian missiles continued to be a topic of discussion in US–Israeli strategic talks in 1964. When President Johnson's special adviser for Jewish affairs, Myer Feldman, made preparations for a trip to Israel in March–April 1964, he was briefed on the Egyptian missiles issue by Robert Komer. In a 23 March 1964 memorandum to Feldman, Komer expressed his hope that Feldman would turn the Israelis off any idea of acquiring their own ballistic missiles. Once again, Komer drove home the linkage between Israeli missile acquisition and a possible Egyptian missile procurement from Soviet sources. Jerusalem should be notified that although Washington doubted the Soviets would give Nasser the atomic bomb, "they might put Soviet missile bases in the UAR." Was it "worth incurring such risks," Komer asked rhetorically, "for the deterrent advantage of being able to lob a few conventional warheads into Cairo?"[133]

Komer advised Feldman to convince the Israelis that their estimates of Egyptian missile strength were inaccurate. According to Komer, the "Israelis have no evidence that 900–1,000 UAR missiles are in the cards." He insisted that this figure was a "sheer guess," demonstrating that he was not swayed by the Pilz–Azzaz letter that first triggered the 900-missile story. US experience in producing missiles, Komer added, gave it a unique insight into the problems the Egyptians would undoubtedly encounter with their program. Those problems would ultimately temper any illusions of a 1,000-missile inventory. As he wrote,

> And here is one field where we, with our own vast missile experience and intensive study of the Soviets, are a lot more competent than our

> Israeli friends. They have very little basis for evaluating program cost or the immense complexity of deploying, controlling, and salvoing a 1,000 missile force . . . We feel that the Israelis have simply closed their ears to our effort to clue them.[134]

Komer also urged Feldman to raise the matter of Israeli "evasiveness." Indeed, Israel's unwillingness to discuss Dimona or its missile plans was "precisely what creates uncertainty on our part," he concluded.[135]

If Feldman conveyed Komer's concerns about Dimona and missiles to the Israelis, this is not clear from the official summary of his talks. Feldman did suggest that the Israelis hold off purchasing French ballistic missiles, adding that the United States knew of a procurement of at least twenty-five missiles up to that point. Prime Minister Eshkol vaguely hinted that Israel would not procure additional missiles, except what was necessary to maintain a rough parity with the Egyptians. The Prime Minister also announced that he would cancel his missile program if Nasser did the same. Finally, Eshkol appeared to leave the door open for "consultations" with the US on future Israeli missile procurements.[136]

Whereas Eshkol seemed cooperative in the first meeting with Feldman, he was more recalcitrant during a second session. He vehemently rejected Feldman's argument that Egypt would turn to the Soviets for missiles if the Israelis carried out their Dassault buy. He also exhibited growing frustration with the dialogue. "Why should we always step back?" Eshkol demanded, especially when his country would only produce "a few dozen" missiles in a year or so. Besides, the Prime Minister reminded Feldman, Israel had to be concerned, given Egypt's use of "gas warfare" in the Yemeni civil war. He asked what guarantees Israel had that Cairo wouldn't tip its missiles with chemical weapons?[137]

Feldman replied that President Johnson's military advisors would not believe Israeli arguments that American intelligence assessments on Egypt were incorrect. "Then we are in [a] bad situation," the Prime Minister concluded. Eshkol also backed off from his previous promise to consult with Washington on additional missile acquisitions from France. America's request that Israel forswear missiles was "almost inhuman," Eshkol complained. According to Feldman and the US ambassador to Israel, the Prime Minister had made it "clear" that Israel would only halt its ballistic missile buy if Egypt "ceased" its missile development program. No mention apparently had been made of Dimona and Israel's suspected atomic bomb efforts, at least not in this cable.[138]

If Levi Eshkol was frustrated by his inconclusive talks with Feldman, he may have viewed his upcoming trip to the Johnson White House with more optimism. That meeting took place on 1 June 1964, with Peres, Komer, Feldman, and others in attendance. Neither party avoided the contentious Egyptian missile issue for long. Indeed, it was President

Johnson who observed that since Cairo's missiles were likely to "remain feeble" through 1970, Israel should not overreact to this threat and inadvertently accelerate the arms race with the Arabs. Even so, the President reassured his visitors, Israel could "always count on the United States in an emergency."[139]

For his part, Eshkol made repeated references to Nasser's missiles. He once again proposed to refrain from building or acquiring missiles if Egypt agreed to do the same. Unfortunately, he added, the Egyptians had plans to build "hundreds" of missiles, and cited recent Egyptian purchases of specialized steel as evidence that they planned to accelerate missile production. Finally, the Prime Minister put the Egyptian missile program in stark terms to the President:

> We cannot afford to lose. This may be our last stand in history. The Jewish people have something to give to the world. I believe that if you look at our history and at all the difficulties we have survived, it means that history wants us to continue. We cannot survive if we experience again what happened to us under Hitler.[140]

Johnson's response to this appeal is not recorded. We do know that he insisted on international inspections of Israel's Dimona reactor in order to "calm" the Arabs and decelerate the regional missile race.[141] We also know that he was sympathetic to Israel's predicament and was more generous than his predecessors with arms transfers to Israel.

During this discussion, Peres expressed his worries over future Soviet arms deliveries to Egypt. This was a point that Komer was quick to jump in on since it agreed with his own position. As Komer summed up the President's meeting with the Israeli Prime Minister, "that is our point too – if Nasser thinks Israel is getting better missiles than he has, and is not reassured on Dimona, he'll be forced to pay Soviet prices to get missiles." In his summary memorandum of the conversation, Komer also urged Johnson to pressure the Israelis into accepting International Atomic Energy Agency (IAEA) safeguards on Dimona. This would "diminish Nasser's incentive to get exotic weapons help from the USSR," he concluded.[142]

Thus, as its strategic dialogue with Israel continued to encounter difficulties over different appraisals of Nasser's missile program, Washington was now considering a policy linking international inspections of Israel's nuclear reactor to decreasing the export of "exotic" arms from Moscow to Cairo. In the end, everyone was using Egyptian missiles for their own ends: Israel saw them, at least in part, as a useful lever to extract arms and a security guarantee from the United States; they also served to justify Jerusalem's decision to go nuclear. US policymakers saw the benefits of a prospective Soviet missile transfer to Egypt as a means of enforcing an inspections regime over a suspicious Israeli reactor.

While it wrangled with the Israelis over the sale of Pershing I missiles and the production targets of Egyptian missile factories, Washington did not neglect its dialogue with Cairo. By late February 1964, Secretary of State Rusk had submitted a memorandum to President Johnson outlining the results of the McCloy talks with Nasser. The Egyptian response to those talks was "not entirely negative," Rusk informed the President; however, the talks had stalled over Nasser's unfulfilled promise formally to repudiate building an atomic bomb. The Secretary of State recommended renewed contact with Cairo on arms limitations. If the Egyptians balked, then, at a minimum, the US had better justification for giving Israel tanks and other new weapons. In conclusion, Rusk asked for Johnson's permission to probe Nasser's intentions further. If Johnson agreed, Assistant Secretary of State Talbot would lead a mission to Cairo with the goal of reviving the arms control agenda. Talbot would "impart assurances" to Nasser on the most recent US inspection of Dimona as well.[143]

President Johnson's authorization of the Talbot mission took several days to work its way through the State Department and White House bureaucracies. On 29 February, State informed its embassy in Cairo of the Talbot mission and the intent to renew arms control talks with the Egyptians. The new mission hinged on two objectives: first, inform Nasser that Johnson shared Kennedy's concerns over the regional arms race, especially in the area of missiles and nuclear arms; second, assurances were to be delivered to Nasser about Dimona. Somewhat paradoxically, the mission objectives were to convince Nasser that his missile program was self-defeating while, at the same time, communicating US concerns with the proliferation of advanced weapons like missiles to the region. Indeed, Nasser might emerge from the meetings with the impression that his missile production was justified, what with all the attention it was receiving in Washington.[144]

Although Dimona was mentioned in passing, the thrust of the new US initiative had changed somewhat from the original McCloy mission. Building on Levi Eshkol's promise to refrain from building missiles if Egypt did the same, the new American mission was no longer predicated on a nuclear weapon for missile exchange but a missile-for-missile agreement. As the cable put it, State sought a "tacit understanding on missiles." The US embassy in Cairo was to examine the possibility of "mutual restraint" for Israel and Egypt in the arena of advanced weapons in general, but ballistic missiles in particular. To that end, Nasser was to be pressed on a previous statement that Egypt was not planning to build a large missile force.[145]

With these instructions in hand, Assistant Secretary of State Talbot met Nasser on 4 March 1964 for two hours of talks on arms control and regional security. Talbot began the meeting by reiterating the Johnson Administration's concerns with the Middle East arms race, adding that Egypt's missiles had a "clearly unsettling effect." This development,

Talbot warned Nasser, was driving the Israelis toward new arms purchases in order to redress the perceived security imbalance. The specter of the Israeli nuclear program was also invoked: although Washington had no hard evidence of Israeli nuclear weapons production, Israel could still "acquire such capability in [the] future," Talbot warned.[146] Echoing the conclusions reached in the US–Israel intelligence exchange, Talbot noted that Egypt's "improved V-2s" could constitute a significant psychological threat. He added that this could be mitigated somewhat if Egypt kept the number of missiles produced at low levels. On the other hand, if Cairo opted for a large missile inventory and Jerusalem followed suit, both sides would gain nothing in security and lose much in wasted resources. The US was well aware from its own experiences that missiles were an extremely costly endeavor.[147]

Talbot then drew Nasser to the purpose of the meeting. US–Soviet efforts at arms control could serve as "useful guides" for both Egypt and Israel, particularly in the area of missiles. To that end, Talbot recommended a "tacit understanding" on controlling the growth of missile inventories. Egypt need not fear an overly intrusive verification regime; indeed, mutual restraint coupled with an unspecified "unobstructive understanding on verification" could serve both sides' interests. As for Dimona, Talbot said that if Cairo accepted IAEA safeguards on its future nuclear reactors, Washington would have greater "leverage" to put Dimona under similar coverage. A true "statesmanlike advance" would be a letter from President Nasser to President Johnson, affirming that Egypt did not intend to develop or acquire nuclear weapons.[148]

Nasser, who was cordial and relaxed up to this point, interjected, stressing that Israel lay at the heart of any problems afflicting US–Egyptian relations. There was no point in discussing arms limitation, since the Arabs did not trust Israel. Talbot replied that any agreement would cover only future weapons, not armaments currently in the arsenals of both nations. This remark did not mollify Nasser, who said that Egypt had pursued ballistic missiles since 1960 because it needed a deterrent against Israel's growing military power. Furthermore, since Cairo could not rely on the Soviets or the US for arms, it had little choice but to produce its own missiles and aircraft.[149]

Nasser also offered some highly revealing insights into the status of his missile program. He said he did not have a plan for his missiles, so he could not produce a bottom line on how many missiles he intended to produce. In fact, numbers were of little concern to Cairo at the present time because the performance of its missiles was far from adequate. As Nasser told Talbot, his missiles were not "very accurate, and inaccurate missiles aimed at Israel might hit Jerusalem or Amman."[150] The President agreed with the US that small numbers of ballistic missiles retained psychological rather than military advantages. He was well aware that his missiles could deliver only "a ton or so" of explosive, while aircraft were

probably more effective. Still, Egyptian bombers were no longer much of a deterrent since Washington began shipping Hawks to Israel.[151]

For Nasser, nuclear weapons were another matter altogether. He reminded Talbot of his previous discussions with McCloy, during which he declared that Egypt had no intention of producing nuclear weapons. In his view, the use of such weapons against Israel would be detrimental to the Arab nation, since nuclear fallout undoubtedly would affect adjacent Arab states. Nasser would affirm his "no nukes" pledge in a letter to President Johnson. As for IAEA controls on Egyptian reactors, those "might be possible . . . in time."[152]

In his cable to Washington, the Assistant Secretary noted that his failure to get a number out of the Egyptians on missile totals did not necessarily indicate Cairo's intent to mass-produce rockets. Indeed, given Egypt's acknowledged technical problems in building missiles, Nasser may have been waiting until he had better negotiating chips. Alternatively, Talbot suggested, Nasser was playing a waiting game to see what he could flush out of Washington and/or Jerusalem in the future.[153]

The State Department was not prepared to give up on Nasser. In early May 1964, it cabled its Cairo embassy, highlighting the need to maintain dialogue with the Egyptians on arms control. The embassy was instructed to inform its Egyptian contacts that their country could not beat Israel in a missile race. The embassy was to seek Egyptian cooperation in halting missile production in return for a similar cessation in the Franco-Israeli missile effort. Ambassador Badeau was to inform Nasser of the Dassault missile deal and suggest that an Israeli missile stockpile would add further incentive to Jerusalem's nuclear weapons capability. Nasser "would be foolish not to consider seriously" a mutual restraint mechanism with Israel. Little or no mention was now made of Dimona: the flawed missile–nuclear weapons linkage apparently had been dropped. Now the focus was on a much simpler missile–missile agreement. Or was it that simple?[154]

Badeau met Nasser on 8 May 1964 to discuss these matters and others. As instructed, he informed the Egyptian leader about the Dassault project, and pressed for a tacit, bilateral Egyptian–Israeli agreement to cease missile development and production. With Levi Eshkol's assurances to Johnson and Feldman in mind, Badeau told Nasser that the chances were good of an Israeli freeze on rocket development; rather optimistically, he believed that Israel would eschew nuclear weapons development as well.[155]

Nasser's reaction to the news of the Franco-Israeli missile cooperation is not detailed in the cable. If he was concerned, he apparently did not reveal these worries to the American envoy. Nasser did repeat his pledge to write a letter to President Johnson assuring him that Egypt would refrain from pursuing nuclear weapons, but he offered no comment on the missile plan.[156]

Cairo's unwillingness to engage in Washington's missile initiative did

not discourage Johnson Administration officials. High-level interest was reflected in a mid-May memorandum from National Security Advisor Bundy to the President which bluntly stated that Israel could put nuclear warheads on its missiles whereas Egypt could not.[157] For its part, the State Department told Ambassador Badeau to raise the missile initiative with Nasser once again. The ambassador was to spell out the likelihood of Israel's deploying nuclear-tipped missiles as a means of encouraging greater Egyptian cooperation. If Nasser hesitated, State instructed, Badeau should stall for time and try to solicit Egyptian interest in specific aspects of the plan "at some later date."[158]

The results of Badeau's new meeting with Nasser are not known from the public record; however, we do know that State told the ambassador to make one final attempt to secure Egyptian cooperation on the missile issue. On 30 May 1964, the State Department instructed the embassy in Cairo to push harder on Nasser for an agreement. According to Washington's perspective, the salient facts of the case were patently clear: Egypt was the first state in the region to opt for missiles; Egypt was continuing to develop these systems; Israel was seeking its own rocket inventory; in addition, Jerusalem would probably seek "more lethal warheads" to deter the Arabs, and Israel might practice restraint if Egypt did the same. Reflecting the general sense of optimism in Washington, the cable airily surmised that controls on missiles could retard nuclear developments and vice versa.[159]

Having already been rebuffed or ignored during previous meetings with Nasser on the thorny missile issue, Badeau was now instructed to give arms control yet another try. On 8 June, the ambassador had his end-of-tour meeting with Nasser. This "farewell" visit started on a promising note, for Nasser declared he would accept IAEA safeguards once his Soviet-designed reactor had been built. But the President was still recalcitrant on missiles, offering no new changes in his position, save a firm denial of a German report that Cairo had developed nuclear warheads for its missiles. Nasser continued to highlight the linkage between the Hawk delivery and Egypt's missile production, noting that Cairo deemed missiles necessary to counterbalance the advantages Israel derived from Hawk. From Cairo's vantage point, the Hawk sale effectively rendered the Egyptian bomber fleet obsolete; in that case, deterrence could only be assured by long-range missiles.[160]

The only hint that Nasser betrayed of a possible tilt toward arms control came near the end of the meeting. According to Badeau's version of events, the President affirmed that his challenge was to "bring about a halt in missile increments" without leaving himself vulnerable to the accusation that he, the champion of Arab nationalism, had sold out to foreign interests. This was either a surprising admission of the Egyptian leader's limited diplomatic maneuvering room or another attempt to make the persistent Americans realize that Cairo was not interested in arms control.[161]

In his comment on the meeting, the ambassador insisted that the US "nail down" Nasser on his "no nukes" and IAEA pledges; however, he refrained from commenting on Nasser's missiles statements. In a telling observation, the ambassador affirmed that Nasser more usually reacted than acted; therefore, any arms proposal would have to be initiated by the American side and submitted for Egyptian response.[162]

President Nasser carried out at least one of his pledges. On 26 July 1964, he wrote a letter to Johnson, informing him that Egypt had no inclination to introduce the "terrifying danger" of nuclear war into the Middle East. He insisted that his people had neither the willingness nor the resources to commit to "weapons of total destruction" programs. Naturally, State Department lawyers were quickly absorbed in debate over what the letter really meant. For example, did Nasser's "weapons of total destruction" statement cover radiological, biological, and chemical weapons? These differences in interpretation needed clarification, the lawyers observed.[163]

While the lawyers quibbled, senior State Department policymakers viewed the Nasser letter as justification for reactivating the McCloy mission. On 12 August, Secretary of State Rusk informed President Johnson that McCloy had agreed to probe Nasser's views once again. Secretary Rusk spelled out the goals of McCloy's mission succinctly in a memorandum for President Johnson:

> The purpose of the present probe is to pursue the question of restraining the surface-to-surface missile rivalry between the UAR and Israel. Mr McCloy's objective is to let Nasser know we believe we can convince Israel to exercise nuclear and missile self-denial if Nasser will limit his acquisition of major offensive missiles to the number he has now or to a low ceiling.[164]

Curiously, Rusk and his advisors either did not recognize, or were unwilling to acknowledge, that Nasser's letter made no mention of restraining the missile race. Not surprisingly, then, the second McCloy mission did not start on an auspicious note. Hitherto, Nasser had betrayed few signs that he was inclined to scale back or halt his production of ballistic missiles. Nuclear weapons, which greatly exceeded Egypt's scarce financial and scientific resources, were one chip that could be easily bargained away. Missiles, on the other hand, were simply not for sale.

Thus it was that on 28 September 1964, Special Emissary McCloy met President Nasser for the third and last time in Cairo. McCloy's pitch was not substantially different from that of Ambassador Badeau a few months before. He highlighted the looming Israeli missile threat, adding that President Johnson's missile proposal would effectively level off any further advances in either Israeli or Egyptian missiles. McCloy addressed Nasser's sovereignty concerns: the United States did not propose a formal

bilateral or trilateral agreement that would negatively impact on Egypt's role as leader of the Arab world. What the US did propose was an informal, unilateral action on the part of Egypt to curtail the growth of its missile force. Finally, Egyptian "assurances" to the US on this issue could be either written or oral.[165]

President Nasser read the proposals. Then he turned to the Special Emissary and stated that the problem in the Middle East was not missiles but Palestine. "Nothing can stop the arms race or change the atmosphere in the Middle East except solution of [the] Israeli 'problem.'" It was "fatuous" to assume that any agreement on missiles would solve the basic problems surrounding the creation of the state of Israel. This sudden alteration of the agenda from a simple agreement on missile production to resolving the region's most intractable problem was not guaranteed to buoy American optimism. But Nasser had other discouraging things to say.[166] "Missiles were now very close to the heart" of the Egyptian army. While his officers had no interest in nuclear weapons, they did regard the new missiles as symbols of Egyptian strength and confidence. In a revealing statement, Nasser noted that the missile program was a counter to the sense of insecurity suffered during the 1956 war. Missiles carried strong political implications, the President warned, and he wanted McCloy and President Johnson to be aware of this.[167]

Although we do not know the extent to which domestic politics limited Nasser's policy options on missiles, we can assume that he stood to lose a great deal to Amer and other hardliners if he was perceived as being soft on Israel. For whatever reason, political or military, the Egyptian president wasn't prepared to negotiate away his missile program, no matter how many warts afflicted it. McCloy and the new American ambassador to Cairo, Lucius D. Battle, finally got the message. The president of Egypt was not going to risk his public image or standing with his army over a missile deal with the US and Israel. Having talked tough to Israel, Nasser apparently had to act tough as well if his standing in the Arab nation were to survive intact.[168]

Despite the setback suffered during the meeting, McCloy wasn't deterred from salvaging something from his failed mission. The day after his talk with the Egyptian president, the Special Emissary drafted a written statement which presumably would offer the Egyptian government a ready-made proposal to approve or reject. It is not known if this statement was ever submitted to Nasser or whether it met with any official response. As prepared by McCloy, the statement read as follows:

> The United Arab Republic wishes to provide assurances that its efforts to develop surface-to-surface missiles have been undertaken only for the purposes of self-defense. As a result of its missile development program, the UAR is now in a position to create a large missile force should it be necessary. It will be appreciated that the question

> whether the UAR should decide such a force is necessary for national defense will be strongly affected by the course others in the area may follow. In the long run, the UAR hopes that the real value of the missiles it has developed will be for the role they can play in furthering Man's knowledge of outer space.[169]

Upon returning to Washington in early October, McCloy met with Undersecretary of State Harriman, Assistant Secretary Talbot, and other officials to discuss his meeting with Nasser. In McCloy's judgment, Nasser was "less suspicious" than at the June 1963 meeting. He interpreted Nasser's comments from a positive perspective, noting that the Egyptian president did not reject the US proposals outright. Nasser was quite frank in laying out his apparent domestic political problems with the American arms control proposal. As for the Israelis, Nasser had made no comment on Dimona and he displayed no visible reaction to the news that Israel had obtained French missiles. As McCloy put it, "there seemed to be an almost casual acceptance of this development."[170]

In this manner, the United States' first attempt at controlling the spread of weapons of mass destruction to the Middle East came to an end. While the endeavor had a positive objective, it ultimately foundered on two insurmountable obstacles: first, the Israelis were simply not interested in negotiating away Dimona and its promise of a future nuclear weapons deterrent. Second, regardless of Israeli advances in nuclear or missile technologies, Nasser bluntly refused to accept any negotiations on the size of his primitive ballistic missile force.

Key question #1: How did Egypt's efforts to acquire rockets influence Middle East regional and international policies?

This chapter demonstrates that Nasser's missile ambitions had international as well as regional consequences. Cairo's pursuit of long-range missiles capable of reaching Israel prompted Jerusalem to turn to West Germany, the United Nations, and the United States for help. In this manner, Egyptian missiles became a standard feature of the dialogue between the US and Israel at a critical juncture where Israel was trying to deflect American attention away from its Dimona nuclear research facility, and where Jerusalem was seeking closer security ties with Washington. Egyptian missiles became the motivation for Israel's request for US Pershing I missiles, for example.

In their quest for a US security guarantee or weapons from Washington, Israeli officials were not averse to exaggerating the threats posed by Nasser's missile program. From the initial "discovery" of the Egyptian missile effort to its "exposure" to American and European officials, Israel stressed its belief that Egyptian missiles posed a clear and present danger to its security. In a real sense, Nasser's missiles had become a pawn in the

budding Israeli–US security partnership; they motivated and accelerated that relationship to Israel's satisfaction. Along with radiological weapons and chemical munitions, ballistic missiles were invoked in a veritable revolving door of threats that underpinned Israeli requests for arms and security guarantees. While the US downplayed the dangers posed by Egyptian missiles, Israeli officials were particularly adept at locating new threats on which to hang their arms requests.

Another, more subtle strategy, may have lurked behind Israel's incessant focus on Cairo's ballistic missiles: the need to neutralize Washington's attempts at rapprochement with Egypt. During a June 1963 official exchange with German counterparts on the Egyptian missile project, a US diplomat voiced such suspicions of Israeli motives:

> The issue went far beyond the role of the Germans in the rocket program, to what Israel hoped to get and by what means. *It wanted to weaken Western ties with Egypt* and to create a security relationship with the US that would serve as a complete deterrent against Arab attack for the indefinite future. It wanted this relationship to encompass a written guarantee, joint military planning, and access to US military equipment. It wanted the Arabs to know about this relationship. [Emphasis added.][171]

The United States tried to use Nasser's missiles to restrain the proliferation of weapons of mass destruction and their delivery systems to the Middle East. With an eye to the greater proliferation challenge, namely Israel's nuclear weapons program, the Kennedy and Johnson Administrations embarked on arms control initiatives which, in one version, would have traded Egyptian missiles for Israeli nuclear weapons. In a way, US policymakers were turning the tables on their Israeli counterparts by using Israel's hyped-up claims of Egyptian missile effectiveness to justify regional arms control.

Nasser's missiles played their part in US–Egyptian relations in the early 1960s. Several US diplomatic teams visited Cairo to sound out Nasser's views on controlling the regional arms race. The Egyptian leader's tepid reception of the American proposals should not disguise the fact that considerable progress had been made in the US–Egyptian diplomatic dialogue since the low point of the Eisenhower Administration. For example, it is inconceivable that the McCloy mission to Cairo could have been accomplished barring the improvement in US–Egyptian relations accomplished by the Kennedy foreign policy team. Indeed, Nasser was quite frank in his discussions with American officials, pointing out some of his motivations for acquiring missiles and detailing his problems with missile guidance and control.

Egyptian missiles also entered the American domestic political arena, thanks to Isser Harel's media campaign, the political controversies that

campaign engendered in Israel, and probable Israeli lobbying on Capitol Hill. As this narrative has shown, several US politicians used the controversies created by Egyptian missiles to attack the Kennedy Administration's effort at rapprochement with Egypt. At bottom, the Kennedy team could not bridge the gap between a blossoming (and congressionally approved) relationship with Israel (which included advanced weapons like the Hawk and the M-48) and a desire to wean Nasser's Egypt off its dependence on the Soviet Union. In this vein, missiles played their part both in drawing the United States and Israel into a closer security relationship and in dividing Washington and Cairo from a better understanding of their respective goals and interests.

The early 1960s mark the high-water mark of US–Egyptian relations. Whereas John F. Kennedy sought to improve that relationship and even used it to try and implement some of his arms control policies, Lyndon Johnson was hostile to Nasser and pursued close strategic and military ties with Israel.[172] Indeed, in 1965, the Johnson Administration discontinued the food aid to Egypt that proved so controversial in Congress, while propping up regimes it believed threatened by Nasserism. The Kennedy and Johnson Administrations' different approaches to Egypt reflect a general ambivalence in Washington about Gamal Abdel Nasser and his place in the East–West conflict. According to David Lesch, official Washington never settled on whether Nasser was an anti-communist asset in the Cold War Middle East or an antagonist to US regional policies.[173] It would not be until Anwar Sadat, the expulsion of Soviet advisers from Egypt, and the aftermath of the 1973 Arab–Israeli war that Egyptian–US relations would enter a new, more amicable phase.

Key question #2: What modern proliferation lessons can be derived from Egypt's experience with ballistic missile programs?

This chapter reveals several important lessons for modern ballistic missile proliferation. First, it illustrates the linkages between nuclear, chemical, and biological weapons and ballistic missiles as their delivery systems. Second, it examines the domestic political motivations for ballistic missile design, development, and acquisition, and the impact of the proliferation of other weapons systems on ballistic missile acquisition. Finally, this chapter also highlights the role that multilateral treaties could play in restraining the spread of advanced weapons to the region.

Link between missiles and nuclear weapons

In their approach to the Egyptian missile and Israeli nuclear problems, United States policymakers were guided by their own arms control experiences with the Soviet Union. In Washington's eyes, ballistic missiles were useful and relevant insomuch as they served as a delivery vehicle for a

nuclear weapon. Such an assessment of the relative values of missiles and nuclear weapons has been given extensive treatment in the secondary literature and seems to be borne out by the experiences of the United States, the Soviet Union, France, the United Kingdom, China, India, Pakistan, and Israel.[174] Fetter, for one, argues quite persuasively that nuclear weapons are a natural fit for many missile programs.[175]

Karp offers a different argument – one that more closely fits Egypt's experience with nuclear weapons and long-range delivery systems. He points out that ballistic missiles *sui generis* can be a potent symbol for a government that seeks them.[176] He tries partially to refute the arguments of those who highlight the inefficiencies of missiles relative to aircraft by arguing that, in the face of formidable air defenses, the inefficiencies become less apparent.[177] At various junctures in this history we have seen how Israel's advanced interceptors and burgeoning ground-based air defenses effectively negated Egypt's bomber fleet. It was those diminished capabilities, coupled with Egypt's inability to deter Israel by holding Israeli cities at risk, which drove Cairo to acquire ballistic missiles even if they could only deliver conventional payloads. We have also seen in this chapter how willing Nasser was to sign away (admittedly symbolically) his option for a nuclear weapon. The Egyptian experience demonstrates that ballistic missiles need not always be (but usually are) linked to nuclear weapons. As Karp puts it: "The only example of a government maintaining one weapon option after surrendering the other voluntarily is Egypt, which has been much keener on ballistic missiles than nuclear weapons. Egypt's ballistic missile programme is anomalously non-nuclear."[178]

While the Egyptian example (and that of Saudi Arabia, Syria, and others) makes it clear that some countries do not pursue ballistic missiles as carriers of nuclear warheads, the same does not hold true for chemical or biological warheads. The linkages between ballistic missiles and non-nuclear WMD programs are numerous and one need only acknowledge a few, as the table 5.1 shows[179]

Still, as Karp points out, even those missiles equipped with chemical or biological warheads cannot compensate for some of the basic inefficiencies

Table 5.1 The linkages between ballistic missiles and non-nuclear WMD programs

Country	*Ballistic missiles*	*Chemical weapons*	*Biological weapons*
Egypt	Yes	Yes	?
Iraq (pre-2003)	Yes	Yes	Probably
Iran	Yes	Yes	Probably
Syria	Yes	Yes	Yes
Pakistan	Yes	Probably	Probably
Saudi Arabia	Yes	?	No
Yemen	Yes	No	No

of conventionally armed missiles. Moreover, even though chemical or biologically equipped missiles can be more devastating in effect, they may well be less reliable than their conventionally tipped cousins.[180]

As we have seen from previous chapters, Egypt was developing a chemical weapons capability in the 1960s and probably continues to pursue chemical weapons today. What is not clear is whether Cairo has overcome the technological hurdles inherent in successfully weaponizing chemical agents for delivery by a ballistic missile.

Domestic motivations for missiles

Karp notes that the greatest impact of missiles is their use as "political instruments" in peacetime.[181] He further describes the ballistic missile as a "symbol of power" and a valuable source of "psychological" coercion against enemies.[182] Such terms apply to Egypt's quest for ballistic missiles. As we have seen in earlier chapters, missiles became a centerpiece of Cairo's annual demonstrations of its power and prestige. They satisfied Egypt's – and the wider Arab world's – longing for symbols of power and prestige, particularly in the bitter struggle against Israel and colonial oppression.

During the course of Nasser's dialogue with the United States, the missile program's ties to Egyptian domestic concerns became apparent. Twice during his discussions with the Americans, Nasser pointed out that he needed to consult or be responsive to the needs of others within his government, including Abdel Hakim Amer. In his last talk with McCloy, Nasser made it clear that he did not have the negotiating room to bargain off an expensive prize project of his military. Amer, Salah Nasr, and others would have been central figures in any military objections to a deal with the US and, by extension, Israel.

The ability of any country to negotiate an arrangement restricting its ability to possess prestigious weapons will be bound by domestic political forces that might not be easy to discern. In the case of Egypt, we can sense Amer's presence behind the scenes, although Nasser makes few references to his long-term companion and competitor. Furthermore, Nasser politically could not accept any arrangement that he saw as an infringement of Egyptian sovereignty (jealously guarded after that nation's experience with British occupation) or its ability to threaten Israel. Having riled the Arab masses with promises of a united Arab nation and an eradicated Israel, Nasser simply was not willing to expend the political capital to entertain even a highly favorable arrangement where he could trade his missiles for an Israeli nuclear program. On another level, one can anticipate that Pakistan's and India's ballistic missiles are firmly rooted in public support and approval. The same might be said of Iran, whose public probably views the Shahab-3 medium-range ballistic missile as a necessary weapon against the United States, Israel, and Iraq.

Conventional arms proliferation and ballistic missiles acquisition

As this chapter has shown, some Washington policymakers believed that a particular weapons system – in this case the Hawk – could be transferred to Israel because it was purely defensive in nature. What Washington perceived as defensive was seen as destabilizing in Cairo. As some US officials appreciated at the time, Egypt viewed the Hawk not as a defensive weapon to safeguard Israeli airspace, but as an inherently destabilizing system that canceled out its expensive investment in medium bombers. From Egypt's perspective, its degraded ability to penetrate Israeli airspace would in turn reduce its capacity to deter Israel from future, 1956-style invasions of the Sinai Peninsula.

Treaties as a form of counter-proliferation

Karp lists four general counter-proliferation categories in his study of the spread of ballistic missile technologies. Those categories include: unilateral initiatives, negotiated arms control agreements (Intermediate Nuclear Forces Treaty, START I), conflict resolution, and export controls.[183] To these, one could add covert action such as that undertaken by Israel against Egypt in the early l960s.

This chapter demonstrates the pitfalls of negotiating an arms control agreement when the two belligerent parties generally are unwilling to conduct any meaningful dialogue with each other. Moreover, the asymmetries in Egypt's and Israel's military capabilities added a further brake on negotiating an effective arms control arrangement. As the United States discovered in its attempt at controlling the spread of ballistic missiles and weapons of mass destruction to the Middle East, Egyptian missiles were a poor bargain for Israel's renunciation of nuclear weapons. Neither party was interested in arms control, even when Cairo theoretically had its one (and only) opportunity to prevent Israel from becoming a nuclear power.

Another curb on the US arms control initiative was the incessant realities of the Arab–Israeli struggle. As Nasser made clear at several points in his dialogue with the US officials, Egypt's unresolved conflict with Israel stood in the way of any meaningful arms control arrangement. In the case of NATO and the Warsaw Pact in the 1980s, the groundwork for the Intermediate Nuclear Forces (INF) agreement had been established by Washington and Moscow only after a long, protracted negotiating process that, in a real sense, began several decades before. Using the INF and the Egypt–US talks as a precedent, it is difficult to predict any degree of success for an arms control arrangement in South Asia, barring a broader political understanding between Pakistan and India that includes Kashmir. As for the Middle East, countries like Syria are unlikely to agree to arms

control with Israel until the Golan Heights and possibly the broader Palestinian question are resolved.

As for Egypt, we do not really know what considerations guided Nasser's rejection of the McCloy initiatives. The broader conflict with Israel certainly is one reason for Cairo's reluctance to engage on arms control. Nasser could have been stalling for time, hoping that the guidance problems in his missiles could be worked out and his negotiating position thereby improved. Nasser hinted at this problem during his last talk with McCloy; however, we cannot determine if those fears were legitimate or convenient cover for Egypt's rejection of the American proposal. Finally, the United States may have inadvertently escalated the value Nasser attached to his missiles precisely because Washington was expressing such a great interest in them. If the US regarded Egypt's missiles as "junk," this seemed to belie the flurry of initiatives aimed at curtailing the further production of such junk. This was clearly a mixed message, at best.

6 Enter the Scud

By the mid-1960s, Egypt's efforts to produce an indigenous ballistic missile had reached a dead end. The reasons for this failure are manifold: on the one hand, West German incentives and Israeli coercion took their toll on the rocket scientists in Cairo. On the other, Egypt's limited resources, coupled with its poor management practices and inability to recruit talent in missile guidance, had an equal if not greater impact on the project's demise. Egypt's defeat in the 1967 war with Israel finally terminated the second indigenous missile project, and in the years following this war, Egypt sought and received battlefield support rockets from the Soviet Union. On the eve of another war with Israel, Cairo finally received what it had long requested from its Soviet patron: the Scud short-range ballistic missile. Egypt's use of rockets and missiles against Israel in the 1973 war yielded few military or political dividends; however, Cairo remained convinced of the utility of ballistic missiles, as evidenced by its work with North Korea to reverse engineer and improve the Scud B.

The cumulative effects of Israeli and German diplomatic efforts, combined with the Mossad's intimidation campaign, began to take their toll on Nasser's missile program by late 1964. The scientists and engineers employed by Factory 333 were particularly hard hit: many were lured back to West Germany by enticing job offers with firms; others lived in perpetual fear of Israeli assassination teams. Cairo responded to the loss of Schuran, Goercke, and possibly Kleinwachter by stepping up its search for their replacements in West Germany and the Eastern Bloc. According to one diligent journalist, who combed through several months of Cairo's English daily, the *Egyptian Gazette*, a large number of German families were placing "want" ads for apartments and houses in early 1965. The suburb of Maadi was especially sought after, given its favorable location, modern amenities, and close proximity to the aircraft plant at Helwan and the missile facility in Heliopolis.[1]

The loss of Schuran, and eventually Pilz, could be partially compensated for by the fact that the airframe and propellant systems of at least two missiles, the Al Kahir and Al Zafir had been established. As these

missiles moved into production, the need for scientists and designers diminished. The same could not be said for missile guidance and control, where Goercke and Kleinwachter were absolutely essential for the success of the program; neither was yet successful in solving Egypt's guidance and control problems. After Goercke and Kleinwachter departed, Cairo continued trying to recruit scientific and engineering talent capable of solving the guidance problem until the program's demise in 1967.

According to Wolfgang Lotz's memoirs, the Israelis were aware of Egypt's new efforts to recruit engineering and technical expertise abroad. According to one report, a delegation of West German scientists and technicians was preparing to depart for work in Egypt when it received a number of pamphlets in the mail, highlighting the poor living conditions in Egypt. These individuals probably were aware that by agreeing to work for Nasser they risked incurring the wrath of Israel.[2]

Israel's attempts to thwart Egypt's recruiting campaign extended to the United States as well, where, in early 1965, reports began to emerge of an Egyptian attempt to hire some West German technicians trained by Litton Industries. Apparently, these technicians had been hired and trained in anticipation of a contract that was never executed; their skills in electrical systems would be of considerable value to the Egyptian missile program as it tackled its daunting guidance problems.[3] American officials soon grew irritated by the continuing press revelations of the "Litton Germans" and rumors of other US firms' involvement in helping Cairo build missiles. In January 1966, a senior State Department official convened a meeting with an Israeli diplomat to discuss allegations in a British newspaper that the US Cubic Corporation was aiding in the development of Nasser's missile program. In some articles, the newspaper said that the CIA was using Cubic as a front for gathering intelligence on Egyptian missiles. While the US official acknowledged that Cubic had sold "electronic" equipment to Cairo, an examination of the export license applications filed by Cubic indicated that the company was selling a variety of electronic equipment that was readily available through any commercial catalogue. Given this, Washington could not refuse a license to export this equipment to Egypt. If the United States refused to grant an export license because of the possible missile applications of the equipment, it would have to do the same for the entire Middle East. That would "adversely affect US commercial interests."[4]

Undersecretary of State George Ball sent a letter to the Israeli embassy on 1 February 1965, informing it of Washington's displeasure with the media reports on Cubic. "We are disturbed at continued press campaign about alleged role [of] Cubic Corporation in [the] UAR rocket program," the letter stated. It added that Secretary of State Rusk had already assured the Israelis that Cubic was not involved in providing a missile telemetry system to the Egyptians. Therefore, the letter added, the continued media focus on this issue led State to conclude that the press campaign had the

"tacit approval" of the Israeli government and was further "stimulated by Israeli leaks." Ball's letter expressed the hope that Jerusalem would take the necessary actions to halt "further sterile and misleading publicity." In a conciliatory gesture, Ball concluded with assurances to Israel that the United States and other countries were interested in the "problem" of technology diffusion to other countries.[5]

A vast security system awaited those who moved to Egypt and commenced work on its military projects. The key scientists were provided with bodyguards, their mail was routinely examined for bombs, and their addresses and phone numbers were suppressed. This was hardly the Egypt of Red Sea fishing trips, horseback rides to the Pyramids, and sunbathing at the Nile Hilton that Goercke, Pilz, Kleinwachter, and company had enjoyed in the early days. Indeed, a tangible air of paranoia permeated the scientists' activities by the mid-1960s. Pilz, for example, was photographed teaching a class of budding Egyptian technicians with a pistol strapped around his shoulder. Undoubtedly, this strict security environment did not benefit the recruiting drive.[6]

In January 1965, Wolfgang Pilz gave voice to the gnawing fears of his staff during an interview with a journalist at the Heliopolis Sporting Club. Pilz was unrepentant about his work for Nasser, although a bodyguard hovered nearby throughout the discussion. Unlike Sänger, who preferred to indulge in the belief that he was working on weather rockets, Pilz did not hide the fact that his work was related to military matters. As he bluntly told another interviewer, "We're obviously not making sticks of barley-sugar!" Pilz also denied allegations of anti-Semitism and Nazi Party affiliations. After all, he argued, had he not worked for years at French rocket research laboratories alongside Israeli scientists? "I have nothing against the Jews," he concluded. "I am merely a scientist and I have nothing to do with politics."[7] Unfortunately, Wolfgang Pilz was not alone among the German wartime rocket scientists in drawing a nonexistent distinction between science and politics.

In a revealing statement, Pilz affirmed that he and his colleagues were prepared to return to West Germany; however, this was predicated on Israel's meeting three conditions. First, the Israelis must guarantee the personal safety of the returning Germans and their families: as Pilz dryly observed, "I do not want to go home and then be murdered in the streets of Bonn." Second, Israel would have to confess "on some official level" to its involvement in the anti-scientist campaign. Finally, and most improbably, Jerusalem would have to pay "appropriate compensation" to those scientists injured as a result of Mossad operations.[8] Not surprisingly, Pilz's demands fell on deaf ears. In Israel, a Foreign Ministry spokesman dismissed his comments, and declared that all relevant discussions on the scientists would be handled through Bonn not Pilz. Naturally, this spokesman denied any knowledge of Israeli responsibility for Krug's disappearance or

the letter bombs; with that declaration, any talk of an Israeli guarantee to Pilz and the other scientists was quickly and effectively squelched.[9]

In his January 1965 press interview, Pilz indicated that the combination of West German political pressure and Israeli intimidation was taking its toll on him. He reportedly was depressed. Moreover, he was troubled by Nasser's dalliances with the East German government and agitated by periodic suggestions from his Egyptian masters that East German scientists and technicians might be more suitable – and less politically rancorous – candidates for Cairo's rocket and jet aircraft programs. Pilz told his Egyptian employers that he would not work for or with East Germans under any conditions. Not surprisingly then, by July 1965, rumors were circulating that Pilz had quietly left Egypt and returned to West Germany in June. His lawyer, Dr Alfred Seidl, subsequently confirmed that his client had not negotiated a new contract with the Egyptian government and was living "somewhere" in West Germany. His new occupation was not disclosed.[10]

With Pilz's departure in mid-1965, virtually all the senior scientists first associated with Nasser's missile program were gone. Sänger had quit early on in the project. The loss of Schuran, Goercke, and Kleinwachter only contributed to the erosion in Egypt's scientific pool. But the departure of Pilz, the guiding hand behind much of the work on Al Ared, Al Kahir, and Al Zafir, must have been especially damaging to Egypt's missile ambitions. Pilz was later rumored to be in China, working on that nation's missile program.[11]

Another sign of the missile program's decline was the absence of these missiles from all 23 July military parades after 1966. Significantly, the Egyptians never again hosted public launches of their missiles like the staged event of July 1962 in the Western Desert. So what was going wrong?[12]

Nasser was disarmingly honest when he mentioned accuracy as the source of his missile problems during the March 1964 meeting with Assistant Secretary of State Talbot. The departure of guidance experts Goercke and Kleinwachter undoubtedly aggravated those problems yet further. Both Israeli and American intelligence identified missile guidance as the greatest obstacle hindering further development of Cairo's rocket effort. The primitive wire-guidance system adapted from France's Véronique rocket was obviously insufficient to produce militarily relevant accuracies in Al Kahir and Al Zafir.

In July 1966, the Cairo daily *Al Akhbar* boldly proclaimed that Egyptian scientists "now have the ability to guide and control missiles on a par with their American and Soviet counterparts." Egypt, the paper proudly asserted, now stood sixth in the world in missile production.[13] But this was sheer hyperbole, and even the Israelis had to confess to their American friends that guidance and control were stalling the Egyptian rocket

project. During a May 1966 meeting with the US ambassador to Israel, Prime Minister Eshkol provided his country's latest intelligence assessment on Nasser's rockets. Guidance problems plagued the Egyptians; however, the Israeli assessment warned, if Egypt successfully produced a gyroscope it could deploy up to sixty operational missiles by 1967. Even if this number was wildly optimistic, it was still a far cry from the 900-missile estimate offered by the Israelis only three years earlier.[14]

While Washington agreed with certain parts of the Israeli intelligence assessment, it believed that Egypt was facing "structural and design problems," as well as escalating costs associated with missile research and development. The United States therefore did not concur that Egypt could deploy operational missiles even if it produced effective gyroscopes.[15]

The State Department did find an opportunity to revive the old unconventional arms control initiative. Dimona was now dropped completely from the agenda, and the proposed agreement would merely swap an Egyptian pledge to abandon missile development for an Israeli one. Somewhat optimistically, State believed that a combination of Israeli progress in missile development coupled with Egypt's technical and financial difficulties would finally lure Cairo to the negotiating table. As an instruction to the US embassy in Cairo indicated, the Egyptian leadership might well be prepared to negotiate,

> what with the lagging progress of its current missile program, its growing economic headache generally, and the prospect that . . . Israel will probably be in position to deploy offensive missiles long before the UAR can demonstrate a capability to do so.[16]

One year later, on the eve of the Six Day War, the American prognosis for Egypt's missile program had not improved. In a memorandum to President Johnson, Undersecretary of State Nicholas Katzenbach reported that Nasser's missile project had "reached a virtual standstill." Not only had Cairo's attempts to recruit new scientists and engineers failed, the majority of its scientific talent had departed and all flight testing had been effectively suspended. In State's view, the Egyptian rocket project would not be completed for at least another decade, given its current rates of development. No mention was made of Egypt's advertised success in creating guidance components worthy of American or Soviet manufacture. For all intents and purposes, Nasser's missile effort had ground to a complete halt.[17]

Katzenbach informed President Johnson that the lack of progress in the Egyptian rocket project could yet facilitate an arms deal with Israel. Pinning his hopes on Prime Minister Eshkol's assurances that Israel would not take deliveries of the Dassault MD-620 missile for another year or so, the Undersecretary suggested a revival of the moribund "tacit" agreement on missile restraint. Unfortunately for all concerned, the June 1967 Six

Day War between Israel and its neighbors put a final nail in the coffin of an unconventional arms limitation deal in the Middle East.[18]

The fundamental development challenges plaguing Cairo's missile program extended to its jet fighter project as well. As early as summer 1965, the aviation program was said to be in a "state of anarchy" and on the verge of "total collapse." Not only was the fighter project down to three months of essential materials, some 100 of the original 450 experts had left the program the previous spring. To complicate matters yet further, the Egyptian government briefly put a hold on the departure of another 200 scientists and engineers who began packing their bags after Cairo failed to pay their salaries. Finally, the program's technical manager, Ferdinand Brandner, had unsuccessfully tendered his resignation after his Egyptian employers refused to reinstate some of his employees.[19]

Most of the immediate problems stemmed from the fact that Nasser's Swiss middleman, Hassan Kamil, and the Egyptian government were bickering over payments. Cairo claimed that Kamil was withholding some $1.4 million in salaries for the European scientists and engineers, as well as an additional $350,000 for procurement of parts and machine tools. As a consequence of this impasse, the Egyptian government had suspended payments to Kamil, obliging the latter to instruct the experts to return home. Anxious to prevent the total disintegration of the aviation program, the commander of the Egyptian air force, Marshal Sidky Mahmoud, personally intervened with Brandner and convinced him to stay. Kamil's role as middleman was, for all intents and purposes, terminated; however, the problems associated with producing both the trainer and the jet fighter were far from over. In fact, Egypt never fulfilled Nasser's vision of developing and producing the Arab world's first jet aircraft.[20]

In his discussions with the United States, Gamal Abdel Nasser was quite frank in his admission that the intractable conflict between Israel and its neighbors – not ballistic missiles – was the real security challenge in the region. Events in 1966 bear this out, for in that year a series of clashes between Israeli and Syrian forces, as well as Palestinian guerrilla attacks, increased tensions along Israel's northern and eastern borders. On 3 November 1966, Egypt and Syria put aside their differences and concluded a defense pact. Perhaps because of this pact, the number of terrorist incidents against Israel increased; Syrian and Israeli forces engaged in a number of artillery and small-arms exchanges, and on 7 April 1967, Israeli Mirages shot down six Syrian MiG-21/Fishbeds with no losses. The next sequence of events is a little less clear. Most accounts agree that in intelligence exchanges with its Egyptian and Syrian clients, the Soviet Union highlighted information indicating a build-up of Israeli forces near the Syrian border.

Between April and May, Soviet blandishments and Egyptian suspicions of Israeli behavior convinced Nasser he must intervene to alleviate Israeli

pressure on his Syrian partner. On 14 May, he ordered his forces into the Sinai Peninsula. Two days later, Nasser demanded that the United Nations remove its truce-observer troops from the Sinai, and on 18 May the UN complied. At this point Egyptian forces were in direct proximity to Israel: Nasser added to the pressure by announcing the closure of the Straits of Tiran, which effectively denied an Israeli outlet to the Red Sea. On 5 June 1967, the Israeli Air Force delivered the first blows in the Six Day War.

The war was a debacle for Egyptian arms. The air force was virtually wiped out on the ground, while the army was rapidly overrun in the Sinai by a series of lightning Israeli advances. Significantly, the Israeli Air Force strikes on Egyptian air force bases lifted the immediate danger of a strategic threat to Israel by destroying all thirty of Egypt's Tu-16/Badger and twenty-seven out of forty Il-28/Beagle bombers.[21] At no time did Egypt enjoy even local air superiority, and its bombers were unable to penetrate Israeli airspace and bomb targets in Israel proper. On the ground, as Israeli tanks reached the banks of the Suez Canal on 8 June, a pall of utter defeat and demoralization hung over the Egyptian military establishment.

So where were the missiles, those invincible harbingers of an Egyptian assured response against the Jewish homeland? After all, the United States Defense Intelligence Agency had estimated Egypt's missile inventory on the eve of the war to be ten Al Kahir and ten Al Zafir missiles, while the Israelis still stuck to their estimate of one hundred missiles.[22] Yet despite those numbers, little or nothing was heard of Egyptian surface-to-surface missiles during this conflict. Certainly none of them hit Israel proper. Louis Frank and *Aviation Week and Space Technology*'s sources believe that some missiles were launched at Israeli forces in the earliest days of the conflict. Given what we know of Egypt's accuracy problems, Frank's statement that nine Al Kahirs or Al Zafirs were launched in a "panic" on 5 June but "went awry" seems to hold some validity.[23] On the other hand, Joseph Bermudez argues that no missiles were launched at all.[24] Either way, the record is clear that the once ominous Al Kahir and Al Zafir rockets which trundled through the streets of Cairo were of no military consequence. As one journalist noted, the Israelis did not even bother to target Factory 333 in this war "because it was felt that the missiles in their present stage of development posed no threat."[25] Egypt's future armed forces chief of staff, Saad el-Shazly, later recorded his disappointment with the failure of the indigenous rocket program during the 1967 war:

> The non-appearance of Egypt's much-heralded secret weapon, the Al Kahir missile, is a sordid tale, I regret to say. Al Kahir had been part of Egyptian folklore since word first leaked in the early 1960s that Egypt had its own short-range ballistic missile made in Egypt … When we lost in 1967, of course, the questions started: "Where was Al Kahir?" No answers came.[26]

The Six Day War was a devastating defeat for Egypt that profoundly influenced its relations with the Soviet Union, the United States, and the Arab world.[27] Gone were the halcyon days when Egypt could lead the Arab world against Israel single-handed. Gone were the days when Egypt could aspire to leadership of the Afro-Asian world. Gone were the days when Egypt could balance its relations with the Soviet Union against its ties to the United States. Indeed, for Nasser, the Six Day War left few politically acceptable options other than to move toward a closer relationship with his primary benefactor, the Soviet Union, particularly in the arms and security arenas. At a regional level, Egypt's defeat also led to its rapprochement with the conservative Arab monarchies.[28] Nowhere was this realignment more apparent than at the September 1967 Arab summit conference in Khartoum, when along with the infamous "no war, no peace, no negotiation" resolution against Israel, Nasser agreed to accept Saudi and Kuwaiti financial assistance and influence. Henceforth, Nasser was to be a more moderate, more dependable neighbor for Saudi King Faisal, much to the consternation of the Arab radical bloc.[29]

In Egypt itself, the Six Day War not only humbled Nasser personally, it also exposed the rifts in his relationships with some old Revolutionary Command Council comrades. Sensitive to the Egyptian and Arab streets, Nasser announced his resignation on 9 June during a state television appearance in which he also nominated an old associate, Zakaria Mohieddine, as his successor. As one of Nasser's biographers points out, this was a "piece of theater" guaranteed to strike a chord in the Egyptian public, for how could Nasser's resignation not be perceived as anything but a yielding to Israeli demands?[30] In response to massive demonstrations and a resolution by the People's Assembly calling for his reinstatement, Nasser agreed to remain as president a day later. While he continued to demonstrate his uncanny ability to ride the wave of public approbation even in the midst of a humiliating defeat, Nasser also responded to his population's demands for retribution against Abdel Hakim Amer, the man closely linked to Egypt's poor performance in the 1967 war. Amer and several high-ranking officers, including the commander of the air force, and the Minister of War were put on trial for conspiracy to overthrow the regime; on 14 September 1967, Amer committed suicide. With Amer's death, and the trial and imprisonment of other senior officers, Nasser had the political room to terminate the indigenous missile program which had long been close to the heart of the Egyptian officer corps.

At home, Nasser was forced to implement austerity measures due to war damage, Israeli occupation of oil fields in the Sinai, and the loss of Suez Canal revenues. Moreover, one historian estimates that defense expenditures absorbed nearly a quarter of Egypt's national income between 1967 and 1970.[31] Those expenditures probably would have been even higher had it not been for massive infusions of technical and material help from the Soviet Union. According to Israeli observers, a constant

stream of Soviet airlifts was ferrying large numbers of disassembled MiG-17s, MiG-19s, MiG-21s, and Su-7s to airfields in Egypt in the weeks immediately following the war.[32] In fact, according to one estimate, some 80 percent of Cairo's wartime losses had been replaced by Moscow by fall 1967.[33] With those weapons came Soviet advisors: only days after the ceasefire, the USSR sent its army chief of staff, Marshal Matvei Zakharov, and a large team to assist the Egyptians in rebuilding their military. Eventually, over 15,000 Soviet instructors were sent to Egypt to train at virtually all levels of the armed forces down to the battalion.[34]

Soviet advice and new weapons probably shaped Egypt's approach to rocketry as well. As we have seen, the Egyptian government terminated its indigenous program, and this could have been on the recommendation of Soviet advisors. Researcher Joseph Bermudez reports that the Egyptian Armed Forces Technical Institute took over the remaining copies of the Al Zafir and Al Kahir missiles, which were withdrawn from service.[35] The Egyptian Missile Command, which had been established in 1964 or 1965 to the Soviet model, was rapidly downgraded in priority as the government shifted its focus to reconstituting the shattered army and air force.[36]

While the indigenous rocket program was shelved, Egypt used its enhanced relationship with the Soviets to acquire battlefield rockets. In the month immediately following the Six Day War, reports began to emerge in the West of an anticipated Egyptian receipt of the Soviet Frog-7A/Luna battlefield support rocket.[37] This had not been the first time that Cairo had requested the Frog, for Nasser probably sought either the Frog or the Scud from Moscow in 1958–1959. According to an Egyptian general captured by the Israelis in 1967, Abdel Hakim Amer requested and apparently received permission for three brigades of Frog-2s during a late-1965 trip to Moscow.[38] Subsequent to Amer's trip, several Egyptian artillery experts were sent to the Soviet Union to receive training on the Frog; however, these weapons were not delivered until after the 1967 war.[39] Moscow may have been reluctant to release the Frog to Egypt because of fears of destabilizing the Middle East: as one researcher noted, Egypt could have threatened some Israeli urban centers with these weapons from bases in the Gaza Strip.[40] In the post-Six Day War borders, Frogs could not threaten Israeli cities from Egypt's new defensive positions along the west bank of the Suez Canal.

Bermudez believes that Egypt received its first Frog brigade some time in 1967.[41] Others suggest that Nasser was able to upgrade the 1965 delivery from Frog-2s to Frog-7s during a 1968 visit to the Soviet Union.[42] Either way, the thirty-six Frog rockets and the attendant launchers that were delivered after the Six Day War represented the first transfer of a rocket system to the Middle East.[43] Moreover, they gave Cairo something it did not have before: a guaranteed deep-strike interdiction capability that its bombers and fighters simply could not provide. While Frogs did not alter

the strategic landscape between Egypt and Israel, they did give Egypt a long-sought rocket capability and a prestige weapon for its annual military parades.

While Glassman correctly points out that the sale of the Frog to Egypt satisfied Egypt's long-standing request for a deep-strike capability, Cairo continued to press Moscow for the Scud.[44] In Nasser's view and that of his generals, the Frog was a tactical weapon capable of influencing events in the battlefield while the Scud was a strategic weapon capable of threatening Israeli cities. Concerned about antagonizing the United States and inflaming hostilities in the Middle East, Moscow refused to sell the Scud – at least for now.

One author has rightly characterized the 1967–1973 period as a continuation of the Six Day War by other means.[45] In the immediate aftermath of the Arab defeat, each side began to test the other's resolve and capabilities. One example was Egypt's sinking of the Israeli destroyer *Eilat* on 21 October 1967, which triggered an Israeli attack on Egypt's second-largest oil refinery near the city of Suez. During this early phase of "no war," Israel relied heavily on its air force to deliver retaliation strikes on Egyptian targets; Egypt had no effective means of retaliation.

Buoyed by Soviet support and frustrated by the lack of diplomatic progress in retrieving the Sinai, Nasser declared a "war of attrition" in March 1969. His objectives in doing so were three-fold: to focus international (particularly US) attention on the Arab–Israeli problem and the territories occupied by Israel, to showcase Egypt's resolve to fight Israel before an Arab audience, and to exhaust Israel by forcing her to defend her vastly extended frontiers from Palestinian guerrillas and Egyptian artillery and commando attacks. The weakness in Nasser's strategy was his failure to control the skies over Egypt and his lack of an assured capability to hit Israeli cities. Egypt was to feel these shortfalls in full measure as the Israeli Air Force systematically destroyed Egyptian air defenses, army units near the Canal, and economic targets throughout the Nile Valley. At some point, Israeli strike aircraft attacked Egypt's Missile Factory 333 in Heliopolis, although the damage from this raid is not recorded.[46]

There are no reports that Egypt's Frog rockets were used in the attrition war. As for the Il-28 light bombers, Egypt used these aircraft against Sinai targets, with perhaps two shot down by Israeli interceptors.[47] At no time during this punishing conflict did Nasser have what he really wanted, namely a ballistic missile that was capable of holding Israeli cities at risk. As the attrition war progressed, the Egyptian leader was forced to ask for more air defense equipment from Moscow and, in a move that must have been especially galling to Nasser, a request for Soviet troops to operate his new air defenses. The first sign that Soviet pilots were manning MiG-21 aircraft came in April 1970, when an Israeli Mirage pilot heard Russian being spoken between two MiG-21 pilots.[48] Subsequently, Israel

discontinued its deep-penetration raids out of fear of clashing with Soviet-piloted aircraft. Even so, there were several engagements between Soviet and Israeli fighters in which Israeli pilots bested their Soviet rivals – at least according to the Israeli record. It was perhaps this danger of escalation that convinced the Soviets to pressure the Egyptians into halting the attrition war in August 1970. Still, the underlying causes of conflict between Israel and Egypt remained unresolved.

Gamal Abdel Nasser died of a heart attack on 28 September 1970, and with his passing, ended an era in Egypt's regional leadership aspirations and pan-Arabist ideology. His funeral was a true spectacle of the public's adoration, and his cortège was attended by millions, who lined the streets of Cairo and mourned his passing. No other Egyptian leader since has been able to captivate the Egyptian and broader Arab world's attention as Nasser could. No other Egyptian leader has possessed Nasser's prodigious gift for oratory. Nasser's successor, Vice-President Anwar Sadat, was an original member of the Revolutionary Command Council and an enigma to Egyptians and foreigners alike. Indeed, Sadat's ability to maintain a low profile helped him steer clear of the political minefields of the Nasser era, only to emerge victorious in the internal power struggles that followed Nasser's death. Although it was not immediately apparent, Sadat was determined to take Egypt in a fundamentally different direction than that of his predecessor both in terms of Egypt's social and economic policies and, eventually, its foreign policy.

On the surface, the Egyptian–Soviet security relationship seemed stable in the years immediately following Nasser's death. Arms continued to flow into Egypt, and thousands of Soviet advisors trained the Egyptian armed forces at the tactical and operational levels of war. When Egyptian officials asked for 150 additional Frog rockets and the Scud B ballistic missiles, Moscow agreed to the first request (deliveries took place in 1972), but still refused to transfer the Scud.[49] With the new Frog deliveries, the Egyptians reportedly deployed their 64th Artillery Brigade, consisting of Frog rockets and their launchers, to positions along the west bank of the Suez Canal.[50] These rockets joined a rapidly growing arsenal of Soviet-supplied arms, including towed and self-propelled artillery, T-55 and T-62 main battle tanks, SA-2/Guideline, SA-3/Goa, and SA-6/Gainful SAMs, bridge-laying equipment, MiG-21/Fishbed, MiG-19/Farmer, and the Soviet Union's latest anti-tank guided missiles.

This vast array of weaponry was being readied for Sadat's ambition of retaking the Sinai by force, recasting Egypt's foreign policy toward the West, and pursuing what he termed an "equitable peace" with Israel. As the first step in this plan, Sadat expelled some 15,000 Soviet advisors on 17 July 1972, ostensibly because Moscow refused to sell certain categories of offensive weapons, including Scuds, SS-4/Sandal (with a 1,800 kilometer range) ballistic missiles, Tu-22/Blinder bombers, and MiG-23/Flogger and MiG-25/Foxbat fighters.[51] Despite this set-back in Egyptian–Soviet rela-

tions, the USSR continued to funnel a substantial volume of weapons to Egypt as Sadat prepared for the next phase in his plan: war with Israel.

In his memoirs, Sadat records that the expulsion of the Soviet experts was necessary before he could carry out his plans to cross the Suez Canal. He believed that the Soviets, while they improved the fighting capabilities of his armed forces, only stood in the way of a new and necessary war against Israel.[52] In the weeks following the departure of the Soviets, Sadat ordered his War Minister to convene the Supreme Council of the Egyptian armed forces and prepare for hostilities as early as November 1972.

Lieutenant General Saad el-Shazly was a central figure in producing the Sinai war plans. As the chief of staff of the Egyptian armed forces, he was responsible for planning and executing the operation that would send the Second and Third Field Armies across the Suez Canal against Israel's Bar Lev fortification system. Thus, General Shazly was understandably very interested in obtaining long-range fire suppression and deep-strike interdiction weapons, including artillery, tactical rockets like the Frog, and Scud ballistic missiles.[53] While the Frogs could strike Israeli command and control and logistic nodes, there were only limited numbers of these valuable weapons in Egypt's arsenal, and their range added an additional constraint. Given these limitations, the Egyptian military decided to dust off its Al Kahir and Al Zafir rockets, which had lain dormant since the Six Day War.

In his memoirs, *The Crossing of the Suez*, General Shazly has much to say about the "sordid tale" of Egypt's missile project. Prior to his assignment as chief of staff, Shazly notes that he knew very little about the old, German-designed rockets, other than what he could glean from the military parades. As chief of staff, Shazly was granted access to the secret documents that marked the murky labyrinth of those weapons, and he reports being "appalled" at the "shameful" details of "wasted millions, the secret suspension of work, [and] the deception thereafter by authorities to admit the truth." In sum, the General notes, the missiles had been "written off" and their technical teams disbanded.[54]

Even so, General Shazly was forced to consider the use of these weapons in his Suez Canal crossing operation, and in September 1971, he ordered that some missiles be brought out of storage and tested at a firing range. According to Shazly, the performance of these weapons was abysmal: the seemingly formidable Al Kahir rocket, which Nasser once trumpeted as the weapon that could hit targets "south of Beirut," was in fact nothing more than a giant glorified mortar with a range of about five miles; however, unlike a mortar, the rocket weighed over 2,540 kilograms and was notoriously inaccurate. Indeed, both range and direction were controlled by tilting the alignment of the launch pad. After a series of test fires, Shazly was understandably skeptical of the weapon's capabilities. Although its sheer size and powerful warhead could create craters some

27 meters wide and 11 meters deep, the limited range and dreadful accuracy made this weapon a threat to Egyptian troops. Shazly summed up this missile best when he noted that "apart from the destructive power of its warhead, Al Kahir was medieval."[55]

Despite the embarrassing limitations of the Al Kahir and Al Zafir rockets, the Egyptian Armed Forces Technical Institute nonetheless refurbished both the missiles and their launchers in 1971. Bermudez reports that the Institute produced a launcher that was capable of firing four of the smaller Al Zafir missiles. On the eve of the 1973 war, Egypt had four Al Kahir launchers and twenty missiles, and four Al Zafir launchers and eighty missiles.[56]

Recognizing the embarrassingly limited capabilities of its "home grown" rockets, Cairo continued to press Moscow for release of the Scud. Finally, in early 1973, the Soviets relented and agreed to transfer two Scud B brigades of twelve transporter-erector-launchers each. The reasons for the Soviet decision are not clear: perhaps they sought to restore the position they had enjoyed in Egypt prior to Sadat's expulsion of the Soviet advisors. In any case, the first Scuds began to arrive in April 1973, and they were accompanied by a group of Soviet instructors, who guarded them as well. Together, the Scud launchers and missiles constituted Egypt's 65th Artillery Brigade, which probably was situated somewhere near Cairo and the central command authorities.[57]

With a range of 280–300 kilometers and a circular error probable of 400 meters or so, the Scud was a vast improvement over Al Kahir or Al Zafir. On the negative side for Egypt, the Scuds were sold subject to strict political constraints on their use. According to Victor Israelyan, a Soviet diplomat who helped negotiate the transfer, the Scuds were "practically under full Soviet control," with stringent use restrictions put into effect.[58] Despite these restrictions, some believe the transfer of the Scuds to Egypt convinced Sadat that he could now prepare for war with Israel, since such weapons might deter Israeli Air Force deep strikes on the Egyptian heartland.[59]

According to one source, as the Scuds began to arrive in Alexandria for transshipment to the interior, the 65th Artillery Brigade was created to accommodate them. By August 1973, the Brigade apparently had progressed to the point where it could participate in an army exercise. Such speed in assimilating a weapon of the Scud's complexity could not have been achieved without the large Soviet advisory team that guarded them.[60]

Therefore, on the eve of the October 1973 war, Egypt had a mixed bag of long-range strike weapons. As in the Six Day War, Cairo's ability to use its Tu-16/Badger medium bombers was hampered by its inability to penetrate Israel's air defenses. The Frogs offered a reasonably accurate weapon, but their range restricted their use to tactical applications. The approximately eighteen Scud missiles and nine launchers then in Egypt's inventory promised so much more, with a range that could encompass

southern Israel; however, they were subject to Soviet restrictions, and Cairo regarded them as strategic weapons for use in certain contingencies such as external threats to the regime. As for Al Kahir and Al Zafir, after years of development and untold millions of Egyptian pounds, these systems offered little more than a mortar shell with a very large warhead.[61]

On 6 October 1973, the Egyptian military achieved surprise when it successfully crossed the Suez Canal and penetrated Israel's Bar Lev line. Israel's bid to defeat the Egyptian lodgment on the east bank of the Canal with aircraft and tanks initially suffered repeated setbacks due to Egyptian use of Soviet-made anti-tank guided missiles and a screen of interlocking surface-to-air missile sites. It was not until Egyptian forces moved outside that defense screen (in a bid to relieve pressure on the Israeli–Syrian front) that Israeli strike aircraft began to make their influence felt. On 18 October 1973, Israeli forces exploited a weakness in the lines between the Egyptian Second and Third Armies and crossed over to the west bank of the Canal. By 24 October, when a final ceasefire took effect, the Egyptian Third Army was virtually surrounded.

Egyptian rockets and missile systems performed with mixed results in 1973. Bermudez believes that sixty to seventy Frogs were fired at Israeli command posts in the Sinai from positions on the west bank of the Canal, and these weapons apparently had some success in disrupting Israeli command and control and intelligence collection facilities in the early days of the war.[62] For example, Israel's senior officer in charge of Southern Command was forced to fly to two different command posts during the early hours of the war because of repeated Frog and air strikes.[63] Frogs were later used in harassment attacks and missions against the Israeli bridgehead across the Canal, but with no success.[64] Virtually all of the Al Kahir and Al Zafir missiles were fired at Israeli battlefield targets by 7 October, but there is no indication that they were successful in their limited fire suppression role. Shazly says their performance was "predictably disappointing."[65]

On 16 October, as the battle started to turn against Egypt, Anwar Sadat delivered a warning to Israel in a speech before the Egyptian People's Assembly. "Our Egyptian rockets, of the Zafir type, which can cross Sinai," he warned, "are now on their pads ready to be launched." "They would reach the farthest depths of Israel," he added. By issuing this statement, Sadat most likely was warning the Israelis not to use their air force against Egyptian cities and targets beyond the Canal war zone.[66] What is not clear is why Sadat made reference to the Al Zafir; if he had mentioned Scuds, his warning may have had more of the deterrent effect desired. In any case, the Egyptians continued to press the Soviets for "exclusive right" to use the Scuds and to allow Egyptians to operate them. According to Israelyan, when the Soviet ambassador to Egypt was presented with this request by Sadat, he replied: "Why do you want to have additional headaches with these missiles, Comrade President? Don't you have

enough problems of your own?" In general, the Soviet Foreign Ministry was much more reluctant than its Defense Ministry to agree to the Egyptian request to use Scuds.[67]

It was not until 22 October in the waning hours of the war, when the Israelis had completed their stranglehold on the Egyptian Third Army, that Sadat asked for and received Soviet permission to fire three Scud missiles. According to Sadat's account, he went into the operations room and ordered two missile attacks at Deversoir, scene of the Israeli bridgehead. Sadat recorded in his memoirs that

> I wanted Israel to learn that such a weapon was indeed in our hands and that we could use it at a later stage of the war; even though Israel had in fact realized from the moment the war broke out that we meant and did what we said.[68]

In Israelyan's book, the Soviet ambassador to Cairo then passed Sadat's request to the Soviet Foreign Ministry; when he failed to reach anyone there he called Soviet Defense Minister Grechko. Grechko yelled: "Go the hell ahead and fire it!" Only minutes after the Scuds had been launched, the Soviet Foreign Minister ordered his ambassador to cancel Grechko's order, but it was too late.[69]

At least three Scuds were fired, although it is not clear if any targets were hit. In any case, it did not really matter, for the purpose of the launches was political not military. Sadat probably intended to signal to the Israelis his willingness to use this weapon next against Israeli cities if the Israelis continued their advance on the west bank of the Canal. According to Israelyan, the Soviet ambassador and the residual Soviet military advisory team in Egypt believed the launches had a "political impact," particularly since they demonstrated the extent of Moscow's support for Cairo.[70] As Glassman affirms, "The firing of the Scuds, though virtually unnoticed in the Western press, was an event of extreme significance. The rockets were, after all, the key Soviet contribution to the assured strategic deterrent long desired by Sadat."[71] Glassman reiterates that the US saw the Scud launches, combined with troop movements, naval augmentation in the Mediterranean, and establishment of an airborne command post in the southern USSR, as unmistakable signs of a more direct Soviet involvement in the war.[72] While the launches may well have been interpreted by Washington as a demonstration of Soviet resolve, they did not play a role in the military outcome of the war.

The 1973 war was the second stage in Anwar Sadat's plan to reshape Egyptian national security policy. In the wake of the war (that Egypt insisted it won), Sadat believed he now had the basis for a peace settlement with Israel and a rapprochement with the United States. Sadat's stunning foreign policy achievements, including his historic trip to Jerusalem and speech before the Israeli Knesset in 1977 and the Egypt-

ian–Israeli peace treaty of 1979, were built upon the basis of Egypt's respectable performance in the 1973 war. With the conclusion of peace, the rationale behind Egypt's need for a large military establishment that included ballistic missiles seemed to be undermined; however, as subsequent history demonstrates, the Egyptian military continued to be one of the largest and, with US assistance, one of the most modern in the Middle East. Moreover, the conclusion of hostilities with Israel certainly did not diminish Cairo's appetite for ballistic missiles.

By the mid-1970s, the Egyptian ballistic missile and rocket inventory probably consisted of at least twenty-four Scud transporter-erector-launchers and an unknown number of missiles, which comprised the 65th Artillery Brigade.[73] There are no reports indicating that the Al Zafir and Al Kahir remained in Egypt's ballistic missile order of battle after the war; their tepid performance in that conflict probably relegated them to bunkers or cave complexes outside Cairo. Egypt continued to employ the Frog as a tactical weapon in its frontline forces; it is not clear if the Soviets replaced all the rockets expended during the 1973 war.

At some point in the mid- to late-1970s, the Egyptian military decided to reexamine its Scud B inventory with an eye to improving its capabilities. Bermudez suggests that the impetus for this appraisal could have been Moscow's refusal to sell Scud and Frog parts.[74] Moscow's decision can be seen as one consequence of the poor state of Egyptian–Soviet relations during this period as Cairo repaired its relations with the West and moved to diversify its arms suppliers. If Bermudez's supposition is correct, Egypt's decision to upgrade its Scuds marks a new chapter in its ballistic missile development.

In the early 1980s, Egypt approached China and North Korea for assistance in developing its own ballistic missiles. While the Chinese showed no interest, the North Koreans were responsive, since they sought ballistic missiles for their own confrontation with the United States and South Korea. At some point, Cairo and Pyongyang formed a partnership that would reverse engineer Egyptian-supplied Scuds and then search for ways to improve the weapon's range and accuracy.[75] It is in this manner that North Korea was introduced to rocketry, with such dangerous consequences for regional conflicts today. Indeed, we can logically trace Pakistan's Ghauri and Iran's Shahab-3 medium-range ballistic missiles directly to those Egyptian Scuds dissected by North Korean engineers in the 1980s.

What did Egypt get out of its agreement with North Korea? Bermudez suggests that Cairo was privy to all of the results obtained from North Korean rocket research, including the improved Scud Bs that came off the North Korean production lines in the late 1980s.[76] In addition, there were reports that North Korean technicians were helping Egypt build an improved Scud B production plant near Cairo in the late 1980s.[77] In May 1991, US intelligence sources hinted that Egypt was negotiating with

North Korea for a Scud C, a weapon with a 500–600-kilometer range and 450-kilogram warhead.[78]

While Egypt relied on North Korean engineering and technical expertise to make parts for and improve its Scuds, its leadership approached the French firm Société Nationale des Poudres et Explosifs (SNPE) in 1983 to help produce a replacement for the Frog-7A. The Egyptian Sakr firm, part of a large complex of military industries that includes Factory 333, reportedly committed up to half of the $100 million research and development costs with SNPE in 1988. For its part, SNPE researched and developed solid-propellant motors, while Sakr was responsible for warheads, transporters, and fire control mechanisms. The result of their joint effort was the Sakr-80, a spin-stabilized, unguided rocket with an estimated range of 80 kilometers. As with the Frog, the Sakr-80 was intended for use against command and control nodes (like those hit by Egypt in October 1973), air defense sites, troop and armor concentrations, and follow-on forces. To fulfill this role, the rocket was to be fitted with one of three warhead types: the first carried 950 bomblets for anti-armor and anti-personnel roles; the second contained sixty-five anti-tank mines; the third had a high explosive warhead with an intervening layer of spherical balls capable of penetrating 14mm of steel at a range of 30 meters. The projected launchers were either the 8×8 ZIL 135 truck used by the Frog-7A, or a T-54/55 chassis with four rockets in containers mounted on top of the vehicle.[79]

Little is known about the actual fielding of the Sakr-80. Indeed, scant public mention has been made of this system since researcher Gerard Turbe was granted interviews with the Sakr chairman and top SNPE executives in the late 1980s. Given Egypt's poor track record with indigenous and semi-indigenous rocket programs, it is conceivable that this rocket never graduated beyond the research and development phase.

Key question #1: How did Egypt's efforts to acquire rockets influence Middle East regional and international policies?

This chapter reveals how Egypt's relentless pursuit of ballistic missiles eventually led it to acquire battlefield support rockets and, later, Scud ballistic missiles from the Soviet Union. Cairo's embarrassing defeat in the Six Day War served as the catalyst for its decision to terminate the indigenous missile program and renew its efforts to acquire complete systems from Moscow. The Soviets complied with some of the Egyptian requests, provided they did not fundamentally alter the balance of power in the Middle East. It is with this concern in mind that we can understand why the Soviets were willing to sell the Frog battlefield support rocket with its limited range, but not the Scud, which would have allowed Egypt to hit Israel from its post-1967 borders.

Nasser, Sadat, and their generals continued to press the Soviets for release of the Scud and possibly the 1,800 kilometer range SS-4/Sandal.

Moscow's refusals to sell these and other weapons (including the Tu-22/Blinder bomber) provided Sadat with the excuse he needed to expel the Soviet advisors in 1972. That expulsion in turn may have convinced the USSR to sell the Scud to Egypt on the eve of the 1973 war. With the acquisition of the Scud, Sadat and his high command may have calculated that they possessed a weapon capable of deterring Israel from deep strikes against Egypt; the Scud transfer may have given Cairo the confidence to initiate the war.

North Korea enters the picture in the years following the 1973 war. By transferring the Scuds to Pyongyang for reverse-engineering, Egypt played a conspicuous role in instigating the North Korean missile proliferation problem. In return, Egypt sought and apparently obtained some capability to produce Scuds of its own. This latter capability marks an important milestone in Egypt's missile ambitions, for Cairo reportedly now possesses the capability to produce ballistic missiles free from most forms of international pressure.[80]

The record is not complete on the impact Egyptian missiles may have had on the United States and Israel. US officials demonstrated markedly less concern with Nasser's missiles by the late 1960s, although there was some talk of reviving the arms control initiative between Egypt and Israel. Another series of US government document declassifications likely will shed new light on the American perspectives on the Egyptian missile project during the crucial 1966–1973 period. Of particular value will be those documents detailing how the United States assessed the Soviet Scud transfer and whether some of those missiles were in fact tipped with Soviet nuclear warheads, as alleged by some in the period immediately following the 1973 war.[81]

Key question #2: What lessons can we derive for modern missile proliferation from Egypt's missile programs?

The outstanding lessons for modern proliferation covered by this chapter include the reasons behind the failure of Egypt's second attempt to produce rockets indigenously, the value of certain counter-proliferation strategies, and Cairo's use of ballistic missiles in wartime.

Reasons for failure

Egypt's attempt to research, develop, test, and produce indigenously a rocket capable of reaching Israel most likely collapsed due to management deficiencies, insurmountable technical challenges, and successful counter-proliferation strategies employed by West Germany and Israel. Karp emphasizes the central importance of "soft technologies" to the successful development of an indigenous ballistic missile program.[82] Among these soft technologies are such difficult to measure concepts as program

management, technical expertise, and leadership. The first chapter of this book has already demonstrated how Egypt's first indigenous rocket program failed due to core deficiencies in program management and lack of resources. In the case of the Al Kahir, Al Zafir, and Al Ared programs, multiple soft-technology problems come to light.

Shortage of talent

Egypt apparently never acquired or internally developed the requisite scientific talent to make its missile program work. This was particularly true in the crucial guidance and control arena, where Goercke, Kleinwachter, and others never successfully developed a mechanism to guide the missiles in flight.

Failure to develop and retain talent

The record is silent on those Egyptian scientists and technicians who worked on the indigenous project. Given Cairo's reliance on German scientists, it is clear that such homegrown talent was in short supply during the early 1960s. For a variety of reasons, including German incentives, terminated contracts, and the premature transition of the missile projects to production status, Egypt also failed to retain the necessary services of its German rocket scientist pool. This undoubtedly had a negative impact on the program and contributed to its failure. Later, Egypt turned to North Korea, presumably because it (Egypt) lacked the necessary expertise to reverse-engineer (and ultimately produce) its own Scuds. That assistance from North Korea was decisive in Cairo's production of a Scud B production capability and acquisition of the Scud C. Cairo's stark inability to cultivate and develop its own rocketry experts after five decades of work stands as the single most glaring failure in its missile program.

Poor program management

Joseph Bermudez attributes some of the failures of Egypt's second indigenous program to "gross mismanagement."[83] In reviewing the available records on the rocket program, it is hard to disagree with his assessment. General Shazly's account reiterates how the Egyptian leadership squandered "millions" on this project and then refused to admit the truth of its failure.[84] Egyptian management deficiencies cannot be underestimated, for as Karp emphasizes, program management is perhaps the single greatest guarantee of the success of an indigenous ballistic missile program.[85] One can only conclude from the admittedly limited sources at hand that Egypt failed to develop and maintain a management structure capable of guiding a program as complex as a ballistic missile from research to production.

Too many missiles, not enough resources

Egypt did not follow an incremental development strategy. It attempted to pursue a technically challenging weapon before it had successfully mastered a more simple system like the CERVA battlefield support rocket. To compound its problems, the Egyptian leadership then elected to pursue not one but three (and maybe four) ballistic missile variants at near simultaneous intervals. Given its already sparse native talent pool and its tight resource base, Cairo clearly exceeded its capabilities, with the result that all three missile programs ultimately failed to meet their developmental milestones. Later, Egypt abandoned the indigenous path to missile acquisition and focused its research and development efforts on reverse-engineering the proven Scud design. Yet even here Egypt required considerable North Korean assistance.

Strong and continuous leadership

This is another one of Karp's prerequisites for a successful ballistic missile program.[86] Unfortunately, this is the one area where it is difficult to obtain any reliable information upon which to form a judgment. Based on Nasser's comments to US diplomats, it can be assumed that while Egypt did pursue some aspects of a successful top-down approach to missile development, the rivalry between Nasser and the political faction supporting Abdel Hakim Amer may well have retarded the development of the missile program. Indeed, Amer's reported cronyism and corruption probably seeped into the rockets program itself, given Shazly's revelations. Significantly, it was not until Amer's death, the neutralization of his support base, and Egypt's defeat in 1967 that Nasser apparently had the political strength necessary to terminate the indigenous missile project.

Soft technologies aside (and they are by no means insignificant), the single greatest hard-technology hurdle facing Egypt was guidance and control. As the 1962 flight tests showed, Cairo was capable, at the research and development stage, of creating some of the prerequisites of a rocket: those missiles were boosted into flight by liquid-propellant engines, they flew down range (we do not know how far), and they may even have carried a crude warhead. These were not mean accomplishments for a country as poor in technical expertise and infrastructure as Egypt was in the 1960s. That said, this history clearly shows that the Egyptian–German rocketry experts never resolved the significant challenge of guidance and control. Failure to address this problem can be attributed to Egypt's inability to recruit the talent necessary to develop guidance mechanisms. It may also be due to difficulties encountered in acquiring the gyroscopes and other technical means critical to guidance.

Shazly's account makes it clear that guidance and control effectively limited Cairo's Al Kahir and Al Zafir rockets to crude battlefield

bombardment roles. They were not even capable of battlefield interdiction tasks as a result of their wild inaccuracies. Given this background and the extensive history outlined in this and previous chapters, it can be concluded that guidance and control contributed to the death of the indigenous missile program in Egypt.

Incentives

West Germany's efforts to lure its scientists and engineers back to lucrative jobs in the Federal Republic apparently paid dividends. By the mid-1960s, Egypt was forced to find scientific and technical talent capable of filling the places vacated by Schuran and Goercke. When Pilz departed, virtually all of the original Stuttgart team had left Egypt. Some of this talent probably required no replacement, since the rocket program had transitioned to the production phase, which required new skill sets. On the other hand, the loss of Goercke and presumably Kleinwachter put a serious crimp on Egypt's ability successfully to develop and produce a guidance mechanism for its rockets.

Incentive programs like those employed by Bonn in the mid-1960s are a successful counter-proliferation tool against those rocket programs that rely heavily on imported expertise. The key is to offer challenging work and lucrative salaries in the home country or reliable allies. As the next chapter and the conclusion to this book show, West Germany was forced to revisit its "rogue" scientist problem in the 1970s and 1980s. The rogue rocket scientists of the new millennium are those former-Soviet engineers, technicians, and scientists who are being lured to rocketry programs in Iran or North Korea. Unlike West Germany, the post-Soviet states lack the financial or technical resources to retain their unemployed or underemployed rocket experts. To prevent rogue states like North Korea, Syria, or Iran from developing medium-range ballistic missiles or even intercontinental ballistic missiles is going to require incentive programs and monitoring in those former Soviet republics that still have large pools of unused missile talent.

Intimidation and coercion

Israel's intimidation and coercion strategies cannot be discounted when reviewing the failure of the Egyptian missile program. As Pilz made clear in his mid-1960s interview, the German rocket experts had been badly rattled by the disappearance of Heinz Krug, the assassination attempt on Hans Kleinwachter, the letter bombs, and the warnings issued by Israeli intelligence. These coercive pressures may well have worked in tandem with West German inducements to force the scientists home. The utility of coercion and intimidation as counter-proliferation strategies today is less obvious. Undoubtedly, a closed society like North Korea's can shield its

rocket scientists from intelligence-collection efforts, let alone intimidation or coercive measures. The same is probably true of the Iranian or Syrian missile programs, which actively attempt to disguise the identities and whereabouts of their native and non-native rocket experts. In sum, Egypt's sloppy security practices of the 1960s are not being replicated in the major missile programs of today, and even an intelligence community as sophisticated as Israel's would be hard-pressed to succeed in penetrating the Iranian or Syrian missile programs.

Egyptian missiles at war

Egypt's record with rockets and missiles in combat is mixed. While Frog-7A rockets apparently had some success in targeting Israeli command and control nodes in 1973, the same is not true of the employment of ballistic missiles. If Al Kahirs and Al Zafirs were fired in 1967, they did not prevent Israel from seizing the Sinai Peninsula and besting the Egyptian military. In 1973, these same systems were employed in a bombardment role with little or no influence on Egypt's successful crossing of the Suez Canal. As for the Scud, Sadat ordered three to be fired at Israeli lines in the last hours of the war. Although these launches had no impact on the military defeat for Egypt, they were largely intended as signals to Israel of Cairo's intent to escalate the hostilities to include Israeli cities if Egypt were pressed too hard. We do not know if the Scuds deterred Israel from striking Egyptian cities or moving its forces further westward, but it is safe to assume that Scuds entered Israel's military planning once they were identified as being present in Egypt.

Egypt certainly emerged from these wars with the firm conviction that rockets and missiles were highly valuable weapons. There is limited evidence to indicate that Egypt believed that missiles played a useful role in the 1973 war: one of Shazly's successors as armed forces chief of staff told American journalists in 1975 that surface-to-surface missiles like those fired by Egypt in that war were expected to grow in importance.[87] Further, Cairo's subsequent efforts to modernize and upgrade its Scuds in concert with North Korea, coupled with its attempt to develop a replacement for the Frog, are testimony to Egypt's continued pursuit of these weapons and its high confidence in their capabilities. Few if any countries held a negative view of the ballistic missile or rocket in combat as a result of the 1973 war. To the contrary, many rocketry programs (Egypt's included) accelerated in the 1970s and 1980s. The 1980s "war of the cities" between Iran and Iraq, combined with Iraq's use of ballistic missiles against Saudi Arabia and Israel during the first Gulf War, demonstrated the apparent value of ballistic missiles as psychological weapons of terror; they also showed how, with improvements in accuracy, developing-world missiles could be used against military targets.

7 The Condor II and No Dong projects

During the 1980s, Egypt continued to cooperate with North Korea on several Scud-related missile projects. It also approached Argentina and Iraq to work on a two-stage ballistic missile with an 800–1,000-kilometer range, called Condor II. Yet even as the Condor II project got underway, the United States was taking its first steps toward establishing a multilateral missile technology suppliers group called the Missile Technology Control Regime (MTCR). Armed with the MTCR and exploiting its close bilateral relationships with Egypt and Argentina, the United States made the Condor II a focal point of its efforts to stem the proliferation of ballistic missiles and their technologies. Although Egypt told US officials in the late 1980s that it had terminated its involvement in the Condor program, work apparently continued in secret throughout the 1990s. In the new millennium, the latest missile-related controversy between Cairo and Washington involves Egypt's acquisition of the 1,300-kilometer No Dong medium-range ballistic missile from North Korea.

In the late 1970s, when Sadat's Egypt examined upgrading its Scud and Frog inventories, another country with regional leadership aspirations was entering the rocketry field. Argentina probably first examined an indigenous missile program in 1977–1978, when its military dictatorship faced a border dispute with Chile, a simmering feud with the United Kingdom over the Falkland Islands, and a rivalry with Brazil for leadership of South America. Some within Argentina's military leadership may well have viewed missiles as a prestige weapon that could be a valuable export earner as well.[1]

The politically influential Argentine Air Force was assigned the task of researching, developing, and eventually producing a sounding rocket which presumably would constitute the basis for further research into ballistic missiles.[2] Much as Egypt discovered in the 1950s and 1960s, Argentina quickly learned that it could not produce a missile without significant outside technical and material assistance. It was with this limitation in mind that the air force turned to Messerschmitt-Bölkow-Blohm (MBB) for help. Researcher Kenneth Timmerman believes that former

Nazis in the employ of the Argentine military were invaluable go-betweens who established the air force–MBB relationship at this time.[3] Another source asserts that West German Chancellor Helmut Schmidt personally intervened to ensure that MBB was given the Argentine contract.[4]

MBB directed the air force to work through a consortium called Consen, which was based in Zug, Switzerland and staffed in part by former MBB employees. How MBB and Consen worked together on Condor I and, later, the Condor II is not known; Consen was part of the intricate, complex arrangement that girded the entire Condor program and baffled intelligence analysts in North America and Europe. We do know that Consen, not MBB, quickly became the primary player in a project that eventually was called Condor I. Consen technical design engineers, recruited in part from MBB, moved to Argentina in 1981 to commence work on a missile design and research center located near the city of Córdoba.[5]

Two years later, in 1983, Consen's engineers reportedly had completed the design of the Condor I missile and began to order the necessary equipment to build a prototype. As it was originally envisaged, the Condor I was a solid-fuel, single-stage rocket capable of lifting a 400-kilogram payload to an altitude of 70,000 meters. The air force had a ballistic application for this missile as well, for MBB sent the head of its weapons programs to help Consen with the design of what must have been the Condor I's warhead.[6]

Consen also helped Argentina line up subcontractors for the project. The Italian firm SNIA Bpd was given a contract in 1981 to develop the Condor I's motor, while the French defense electronics firm Sagem worked on an inertial guidance package. The German firm MAN was to provide the chassis for a transporter-erector-launcher (TEL), while the Swedish company Saab-Scania developed a cab for the TEL. Altogether, the Condor I was a multinational enterprise, although West German firms figured prominently.[7]

Condor I never flew. Apparently there was a static motor test in 1983; however, external events quickly led to the suspension of this project in favor of a much more ambitious undertaking.[8] Nevertheless, Argentina's quiet efforts in rocketry did attract the attention of two Middle East powers with growing missile programs to augment their regional leadership credentials. Those two countries were Hosni Mubarak's Egypt and Saddam Hussein's Iraq.

For Argentina, its 1982 defeat at the hands of the British military in the Falkland Islands dispute was a bitter blow. From the dictatorship's perspective, the Condor I missile project was insufficient to meet the demands of national prestige and power projection since it could not hit the Falklands. Accordingly, after the 1982 defeat, the air force established

a secret committee which was tasked with examining how a missile could be tipped with a nuclear warhead. In addition, the air force decided to suspend work on the Condor I in favor of a successor system with the range to hit the Falklands.[9]

Around this time, Iraq was in search of a partner to share the technical burden of developing an advanced ballistic missile.[10] Mired in a protracted and bloody war with Iran, Iraq sought a missile that could reach the capital cities of its principal antagonists, Iran and Israel. With these goals in mind, senior Iraqi missile developers contacted Colonel Luís Guerrero of the Argentine Air Force in 1984, explaining that Iraq needed a missile with at least five times the range of the 100-kilometer Condor I, so it could reach important targets in Iran or Israel. Guerrero recommended a two-stage missile that would use the smaller Condor I as a second stage, but warned the Iraqis that such a project would attract attention from Iran, the United Kingdom, and the United States, once they started to acquire missile-related technologies.[11] The Iraqis suggested Egypt's Defense Minister, Field Marshal Abdel Halim Abu Ghazala, as a useful third party who could procure missile technologies for Baghdad and Buenos Aires without attracting the attention of Iraq's and Argentina's enemies. Under this arrangement, Iraq would provide much of the funding for the new missile, dubbed Condor II, Egypt would act as a procurement agent, and Argentina would offer up its European network and accumulated technical expertise. Each party would obtain the technical results from the project, including designs and, eventually, prototypes.[12]

Emblematic of the complicated relationships that underpinned the entire Condor II project is Egypt's involvement. While Timmerman's version stresses that Egypt was brought into the Condor partnership after Iraq, Bermudez believes that Egypt may have approached Argentina as early as 1982, and on its own initiative signed a memorandum of understanding with Buenos Aires to develop the missile jointly. Iraq joined later, in 1984, with the funding that Egypt and Argentina lacked.[13] According to Bermudez and journalist Alan Friedman, Cairo's motivation for approaching the Argentines was multifaceted. On the one hand, Egypt believed it had to have an upgraded missile such as the Condor II to cope with the burgeoning Libyan missile project and Israel's 1,000–1,500-kilometer Jericho II ballistic missile.[14] In addition, the Egyptians most likely also sought the Condor II for prestige reasons and missile technology.

In any case, on 15 February 1984, the Egyptian Defense Ministry signed a contract with a Consen affiliate called IFAT for joint development of the Condor II missile with Argentina.[15] At this point, Egypt offered technical consulting and procurement, with the expectation that it would receive missile technologies and prototypes in return. Some sources aver that Egypt and Iraq expected to receive 200 Condor IIs each, although it is not clear if this was to come from domestic or Argentine production.[16]

In Argentina, the missile program weathered the end of military rule in

1983. The air force notified the new civilian leadership about the Condor II; however, the new government was in no position to counter powerful, entrenched military interests for control of a program as sensitive as Condor. In fact, according to Karp, the Alfonsín government had little influence over the missile project, and the air force "acted much like a sovereign state" as it negotiated separate agreements with Egypt, Iraq, and European contractors.[17]

The procurement network supporting the Condor II illustrates the "unprecedented complexity of the arms supply relationships" supporting a modern missile program.[18] Not surprisingly, the Condor II procurement system mirrored Condor I's. Once again, Consen was called upon to manage the technical aspects of the missile effort. Under Consen, a multinational assortment of companies provided support to different parts of the missile. MBB provided consulting services on guidance systems and program management, while SNIA Bpd was tasked with developing rocket motors. The French enterprise Sagem worked on guidance and control and West Germany's MAN was to provide mobile launchers. In addition to the principal subcontractors, Consen was supported by numerous subsidiaries with names like Consen SAM in Monaco, Consen Investment, Consen Projekt AG, IFAT, Desintec, Delta Systems, Delta Consult, Transtechno, and so on.[19] Several of these companies had relationships with MBB as well as Consen in Switzerland. Indeed, Consen's links with MBB were complex and often difficult to discern. For example, Consen hired several missile experts from MBB, but these officials continued to work in MBB-provided facilities.[20]

Egyptian Defense Minister Abu Ghazala was responsible for his country's contribution to the Condor II missile project.[21] A veteran of three wars (he fought in 1956, 1967 and 1973), Abu Ghazala commanded the respect of his officers and enlisted men. Typical of many Egyptian officers of his era, Abu Ghazala was trained in the Soviet Union, though, in a sign of Egypt's changing foreign policy under Sadat, the future defense minister also trained in the United States. Between 1976 and 1979, he served as his country's military attaché to Washington, and it was during his sojourn there that he developed a close relationship with American officials and a reputation for being partial to the US. Upon returning to Cairo in 1979, Abu Ghazala was named director of military intelligence, a post which he occupied until 1981, when Egypt's new president (and Sadat's successor), Hosni Mubarak, appointed him to head the Defense Ministry.[22]

It was Abu Ghazala's close relationship with Washington that Iraq and Argentina hoped to exploit when they asked him to head up the procurement wing of the Condor II. To accomplish this, the Defense Minister set up an office in his ministry called Ballistic Missile Egypt (BME). BME's chief engineer was Colonel Fuad al-Gamal, and this officer had access to a

web of military attaché offices in Europe and North America for the procurement of technologies and technical talent. One overseas BME office in particular – that of the Austrian-based Colonel Ahmed Hussam el-Din Khairat – was especially important, since it served as a liaison with IFAT and other subsidiaries of the Consen network.[23] According to one account, Khairat shared offices in Salzburg with IFAT and Consen.[24]

Egypt's primary conduit to the Condor program, IFAT, was engaged in a variety of sensitive missile acquisition projects. In March 1984, an IFAT employee approached the US firm Honeywell and proposed several joint projects. The first would assess possible payloads for a ballistic missile, while the second project would be a "pre-design study" for a fuel–air explosive (FAE) warhead for a ballistic missile. Timmerman describes an FAE best when he states that "an FAE bomb case is packed with a compressed liquid fuel mixture, which is ignited in midair by two pyrotechnic charges. The first dispenses the fuel into the air . . . a second charge ignites it."[25]

Egypt's (and, by extension, Argentina's and Iraq's) interest in fuel–air explosives sheds some light on the Condor II's payload limitations. As it was designed, Condor II had a payload of 500 kilograms, a relatively small capacity when compared to the Scud, which can deliver 1,000 kilograms to a target.[26] Moreover, given its relatively high costs (projected at $33 million per missile), Condor II was an expensive delivery platform for a conventional high explosive warhead.[27] These cost/payload restrictions, together with the greater destructive power of the FAE, help to explain why Cairo was entrusted with the mission of obtaining FAE technologies from the United States.

Honeywell officials expressed some concern about both IFAT's bona fides and the sensitivity of FAE know-how; however, they did agree to produce an unclassified report on how an FAE could be developed into a militarily relevant payload for a ballistic missile. While the report did not instruct its customer on how to build an FAE, it did establish a conceptual framework within which to study FAE warhead designs.[28]

The same year that IFAT approached Honeywell for FAE consulting work, the Egyptian military offered to buy some 9,000 Vietnam-era CBU-72 fuel–air explosive bombs from a Nevada stockpile. The Egyptian Defense Ministry said it needed these weapons to clear minefields, and to substantiate its case it provided maps of those areas it proposed to demine. On the face of it, the Egyptian request had an air of plausibility about it. After all, parts of Egypt were infested with mines – lethal remainders from World Wars I and II and three conflicts with Israel. Even so, on 12 August 1985, the US State Department's Office of Munitions Control advised against the sale. No more was heard in public of Egypt's quest for FAE weapons and technology.[29]

Egyptian interest in US technologies was not limited to fuel–air explosives. From his office in Salzburg, Colonel Khairat called upon the services

of an old friend named Abdelkader Helmy, who not only was a naturalized American citizen but a rocket propulsion expert with a US security clearance.[30] Once Helmy agreed to procure technologies for Egypt, Khairat's orders began to flow in. Among the items requested by Egypt on behalf of the Condor consortium were the following:

- Technologies relevant to strap-down inertial guidance systems.
- Carbon-carbon and ceramic-ceramic to protect the reentry vehicle during descent.
- A test stand capable of accommodating motors and engines weighing up to 20,320 kilograms. This stand included a closed-circuit television and sensors to analyze the test.
- A variety of chemicals for solid propellant manufacture, including aluminum powder, cyanox, hydroxyl-terminated polybutadiene (HTPB), curing agents, and epoxies.
- 21,540 metric tons of managing steel for motor casings.
- Microwave telemetry antennas.[31]

Colonel Khairat also used Helmy to procure certain software technologies necessary for missile research and design. Using an Ohio-based contact of Helmy's named James Huffman, Khairat located a software developer in Huntsville Alabama who was capable of meeting some of Egypt's needs. In April 1986, Khairat and an IFAT employee traveled to Huntsville, home to the US Army's missile and rocket programs, where they asked the software company to build a package for ballistic missile design and trajectory analysis. They also requested a proposal for a guidance production facility. The response was $6.5 million for everything except the production plant. The developer added that the most expensive item on the proposal was the "thrust termination" software, which would require wind tunnel testing.[32] Thrust termination is an integral part of the missile staging process, and it must be carefully sequenced with the ignition of the next stage. For the members of the Condor group, staging was a key developmental milestone that would have to be met if the two-stage Condor II was to be any success.

Colonel Khairat and his IFAT colleague registered no apparent reaction when the Huntsville software developer told them that his proposal was contingent upon receiving the export licenses from the US government. Timmerman believes the Egyptian team simply used the proposal to shop for the software packages elsewhere.[33]

As the Condor II program entered the mid-1980s, key features began to emerge. Most importantly from the standpoint of its sponsors, the missile had a projected range of 800–1,000 kilometers. This would allow it to hit targets in Tehran, Tel Aviv, the Falkland Islands, or Libya, depending on the user. Second in importance was its 500-kilogram payload, which, as noted earlier, was quite small and inefficient when used with conventional

high explosives.[34] Fuel–air explosives were one solution to the payload problem; however, the Middle East parties to the Condor II probably intended to mate the missile with chemical and biological warheads as well.

Other characteristics of the Condor II included a proposed circular error probable of 800 meters.[35] Given that this missile never entered full flight testing it is not clear if the Condor II ever achieved this degree of accuracy. Indeed, several sources affirm that the program never successfully solved the guidance and control problem despite its reliance on proven European engineering firms.[36] In any case, the 800-meter CEP was insufficient for the missile to hit militarily relevant targets, like command and control bunkers or airfields, with high explosive. This drove its planners to seek other, more destructive warhead packages, such as the FAE and possibly weapons of mass destruction. The Condor II would have used a wheeled chassis for improved survivability. Finally, as noted earlier, Condor II was designed around a solid-propellant first stage and a liquid-propellant second stage. This was later changed to a solid-propellant second stage, which significantly increased program costs, as new "staging and thrust termination" technology had to be designed and flight tested.[37]

One thing that stood out was the missile's close resemblance to the 1,800-kilometer US Pershing II intermediate-range ballistic missile. A highly accurate weapon with the ability to hit hardened targets throughout the Warsaw Pact countries and the western part of the Soviet Union, Pershing II was NATO's response to the Soviet deployment of the SS-20/Sabre to eastern Europe in the late 1970s. Michael Hardin, a former CIA senior analyst on missile proliferation, described Condor II as a "direct derivative" of Pershing II, although he did not elaborate.[38] It is not clear if Consen was able to access Pershing II blueprints through its West German or Italian contractors who worked on the American missile, or if Consen could have superficially copied the general schematic of Pershing II based on publicly available information. Either way, Condor II was a big step forward technologically for its partners who, in the case of Egypt and Iraq, had Soviet-supplied Scuds designed in the 1950s, or, in the case of Argentina, nothing at all.

The year 1982 was to be a fateful one in ballistic missile proliferation. Not only did Argentina begin contemplating a weapon capable of reaching the Falkland Islands, but the Reagan Administration issued a National Security Decision Directive that was aimed at countering the spread of ballistic missiles and their related technologies to the developing world.[39] At this time, the principal suppliers of concern were the Soviet Union and several west European states, although the US also was concerned about indigenous programs in India, Taiwan, and South Korea, to name but a few. Argentina's budding Condor I may have been an additional program of concern.

One year later, the Reagan Administration proposed containing the spread of missiles and technologies in meetings with close allies, including the United Kingdom, Canada, Japan, France, West Germany, and Italy. Karp reports that these initial discussions were friendly; however, as the partners commenced negotiations on a list of proscribed missile technologies, the issues became more complex and contentious.[40] Several of the negotiating parties, including West Germany, Italy, and France, were home to companies working on lucrative contracts for the Condor consortium. Another challenge facing the negotiators was the difficult delineation between ballistic missiles and space launch vehicles, since the two rely on many of the same technologies. Even so, by March 1985, the diplomats had ironed out most of their disputes and a few countries began to observe restrictions on missile technologies. President Reagan was one who ordered his country to follow missile restrictions even before the agreement came into effect.[41]

The efforts of the United States and like-minded powers to stem the tide of ballistic missile proliferation paid off on 16 April 1987 when the US and some of its closest allies formally signed the Missile Technology Control Regime (MTCR). Unlike other counter-proliferation treaties and conventions, the MTCR is a relatively informal agreement that calls upon its members voluntarily to refrain from transferring sensitive missile technologies and completed systems to other powers.

As of 2004, the MTCR has grown to include thirty-four members, who include most of the world's missile producers.[42] The MTCR's "red line" for missiles is a payload of 500 kilograms or more and a range of 300 kilometers or greater. Each member is called upon to establish export control policies for their ballistic missile, cruise missile, unmanned aerial vehicle, sounding rocket, and drone programs. Such systems fall under Category I of the annex to the MTCR, which also includes major subcomponents like motors, engines, and guidance components. Approval for Category I transfers is supposed to be "rare" and "there will be a strong presumption to deny."[43] Category II items are more difficult to control, since many are dual-use in nature, with civilian as well as military applications. In examining Category II exports, MTCR members are asked to consider the following criteria:

- Is the recipient pursuing weapons of mass destruction?
- What is the purpose of the recipient's missile and space programs?
- What impact would the sale have on the buyer's development of delivery systems for WMD?
- What is the credibility of the buyer's stated purpose in acquiring the item(s)?
- Does the transfer conflict with any multilateral treaty?

MTCR members are to obtain assurances from the recipient that the technologies or materials will be used for the purpose claimed. The recipient

must also pledge to refrain from transferring the technology to third parties. There are no MTCR multilateral penalties for a technology transfer outside the regime's guidelines; however, some countries, such as the United States, have domestic laws in place to sanction those who export MTCR-controlled items to countries perceived as threatening American national security. The US has, for example, sanctioned Egyptian firms for buying and selling missile-related technologies with North Korea.[44]

No sooner was the ink dry on the MTCR than the United States set its sights on the Condor II program and its extensive network of foreign suppliers. In October 1987, American diplomats approached the French government to highlight the participation of French firms in the Condor II effort. According to Timmerman, the United States expressed particular concern about the French firm Sagem, which was designing an inertial guidance system for the missile.[45] In diplomatic parlance, the American action with the French was a démarche; however, it is not clear if the French ever took measures against Sagem's dealings with the Condor II consortium. Washington also asked Rome to restrain the work of the Fiat affiliate SNIA BpD, which was developing solid-propellant motors for the missile. An Italian investigation into this company apparently came up empty; however, the US did bar SNIA BpD from American defense contracts for six months. Some sort of compromise eventually was reached with the Italians, and in April 1988, SNIA BpD was once again permitted to bid and work on American contracts.[46]

By the end of 1987, the Condor II program was emerging from secrecy. On 21 December 1987, the *Financial Times* carried an article that suggested the missile could significantly alter the balance of power in the Middle East. As for Argentina, the article warned, that country clearly sought the Condor II to hit targets in the disputed Falkland Islands. The newspaper's sources, some of whom probably were from British intelligence, said Egypt and Argentina had worked on this program for about five years; no mention was made of Iraq. British officials told the newspaper that they became aware of the Condor II when Israeli counterparts brought it to their attention earlier in the year.[47] This was a strange admission of intelligence failure, given that this weapon was capable of hitting British targets in the Falklands and that one of the acquiring parties, namely Iraq, was on the fast track to become the pre-eminent Arab military power. With its access to a worldwide network of spies and sensors, it is inconceivable that the United Kingdom did not learn about Condor II earlier.

Later, on 21 December 1987, an Argentine Air Force spokesman commented on the *Financial Times* article. He said the missile in question was "not for military purposes," but "to put into orbit satellites for domestic use." Experimental work of an unspecified nature was being carried out by the Armed Forces Technical and Scientific Investigation Institute, but that was all the information that Argentina was willing to provide. It was not to

be the last time that Argentine officials would insist on the peaceful applications of their missile program.[48]

US efforts to restrain ballistic missile proliferation received a serious blow in early 1988, when Washington's Saudi ally acquired a "small number" of DF-3A/CSS-2 intermediate-range ballistic missiles from China.[49] As several analysts were quick to note, this represented the first time that a missile of this range had been introduced to any developing-world country, and the consequences of this sale rebounded in the corridors of power in Washington.[50] In acquiring these large and relatively inaccurate (CEP of 2,000 meters) missiles, Saudi Arabia most likely was responding to rival Iran's use of ballistic missiles against Iraq during the "war of the cities." Not surprisingly, given that Saudi Arabia and Jordan were the only significant countries in the Middle East without missiles, Riyadh sought missiles of its own and may have invested "billions" in the Condor program, according to at least one source.[51] Before approaching China for the CSS-2, Saudi Arabia's request for Lance missiles had been turned down by the United States.[52] With the CSS-2, Riyadh possessed a 3,000-kilometer missile that would allow it to hit targets throughout the Middle East, the southern Soviet Union, and parts of southern Europe.

Around the same time that Saudi Arabia acquired the CSS-2 and dismayed US counter-proliferation efforts, an incident occurred in Cairo that raised memories of the 1960s-era campaign against the German scientists. A bomb exploded in front of a car that was supposed to transport West German and Italian technicians to work near Cairo.[53] On 27 May 1988, a remotely detonated explosive destroyed an empty car in France that belonged to an executive with ties to the Condor II program. An anonymous telephone caller told a French news agency that a group called the "Guardians of Islam" was responsible for the bomb and added that this pro-Iranian group had destroyed the car because of the owner's work for Iraq.[54] While it is not implausible that Iran could have launched the attack, the more likely culprit is Israel, which definitely had both the capability and the intent.

Washington's campaign against the Condor II supplier network was not restricted to démarches against US allies. A federal investigation of Abdelkader Helmy and his Egyptian contacts began in early 1988 when a confidential source offered the United States government some "very sketchy" information that may have been provided by Israeli intelligence.[55] An Egyptian diplomat traveling under the names Fouad Mohammed and Fouad Algamal visited Helmy in Sacramento in mid-March 1988. Together, Helmy and the diplomat flew to Washington with two boxes which may have contained carbon-carbon, a compound used in making missile nose cones, leading edges of aircraft, and rocket nozzles. After dropping the boxes off at an Egyptian embassy facility, Helmy and Algamal checked into a hotel where Defense Minister Abu Ghazala and

his entourage were staying during talks with American officials. At this point, Algamal showed up as a member of Abu Ghazala's staff under the name of Brigadier Yehye Algamal. Algamal was later identified as an acquisition expert on Abu Ghazala's personal staff.[56] He most likely was the same Fuad al-Gamal who worked for Ballistic Missile Egypt.

On 25 May 1988, as the evidence of Helmy's activities mounted, an American court ordered a wiretap of his home and office. Two days after the wiretaps were put in place, US law enforcement intercepted a call between Helmy and Colonel Khairat in Austria, in which the latter commented on the 27 May car bombing in France by a supposed pro-Iranian group. Khairat hinted that Israel initiated the attack, and for several days he avoided his office out of fear of assassination. For his part, Helmy had no doubt that "the Jews" were responsible for unspecified threats against the Austrian part of the Condor II network.[57]

On 1 June, Helmy phoned Rear Admiral Abdel-Rahim Elgohary, a senior procurement official at the Egyptian embassy in Washington, and learned that Elgohary did not want to ship several tons of rocket propellants to Cairo. Bewildered, Helmy reminded Elgohary that when the "minister" was in Washington "the month before last," there were discussions regarding "things that are controlled and cannot be exported." Elgohary complained that he did not anticipate the delivery of some six or seven tons of chemicals. Helmy said that the "minister wants the cargo shipped no matter what" and that Elgohary must deliver the propellants on the next military flight for Cairo.[58]

From his vantage point in Salzburg, Colonel Khairat told Helmy he would call Elgohary to expedite the shipment. On 3 June, the US intercepted a call from Khairat to Helmy, in which the former summarized his discussion with Elgohary. "I told him [Elgohary], 'I'm calling you from the ministry in order to deliver you a message from our father and from our grandfather, who was at your end earlier . . .' " US investigators later concluded that the "minister," "father," and "grandfather" were references to Abu Ghazala.[59]

On 14 June, approximately 430 pounds of carbon-carbon were shipped to an Ohio warehouse and readied for onward delivery to Baltimore. The material had been purchased by James Huffman, who often served as Helmy's procurement agent. A day later, Huffman informed Helmy that an Egyptian air force C-130 would depart Baltimore Washington International Airport on 24 June, and arrangements had been made to put the material on that flight.[60]

On 24 June, as the box containing the compound was about to be loaded on to the C-130, the US Customs Service struck. An Egyptian embassy official, Lieutenant Colonel Mohammed, was detained, but then released after he asserted his diplomatic immunity. Abdelkader Helmy and his wife were arrested at their home near Sacramento, while Huffman was seized near Waldorf, Maryland. Altogether, five individuals – Helmy

and his wife, Huffman, Colonel Khairat, and Lieutenant Colonel Mohammed – were charged with conspiracy, unlawful export of controlled items, and money laundering in a twelve-count indictment.[61]

Federal law enforcement officials demonstrated in court documents the substance of their case. Along with the wiretaps, they alleged that Egyptian diplomats made payments of more than $1 million to Helmy, while the conspirators falsely labeled boxes containing sensitive material to evade US export laws. Investigators also produced Helmy's handwritten notes that had been found in his trash and which detailed work with carbon-carbon materials, rocket exhaust nozzles, and a microwave telemetry antenna system.[62] American officials told the press that in addition to the carbon composite, the Egyptians planned on illegally exporting over thirty tons of chemicals and 400 sheets of specialized steel, which would be used to make motor casings and airframes. The Pentagon said that Cairo was trying to produce the Pershing II's propulsion system, and noted that MBB and SNIA BpD were both subcontractors in the Pershing II program.[63]

In an ironic turn of events, just five days after the Helmy arrests, the United States and Israel took a step toward neutralizing the danger posed by ballistic missiles when they signed a memorandum of understanding to research and develop jointly an anti-ballistic missile system called Arrow. While the US Secretary of State said this missile was "very desirable" and contributed to Israel's ability to deter war, Arab reaction was predictably critical. An Arab League spokesman insisted that Arrow would only be used as a "pretext to maintain Israel's nuclear capabilities" and reinforced Washington's commitment to Jerusalem's qualitative military edge.[64]

Meanwhile, the fallout from the Helmy affair continued. In July, the Egyptian air force commander postponed an official trip to Washington, probably as a result of the Helmy arrests.[65] On 11 July 1988, for reasons that are still not clear today, Ballistic Missile Egypt formally terminated its contract with IFAT.[66] On 13 July, Cairo refused to waive diplomatic immunity for Rear Admiral Elgohary and Lieutenant Colonel Mohammed.[67] But the most troubling development for Egypt was the rumor circulating in the American media that Defense Minister Abu Ghazala was personally involved in the affair. On 19 August, the *Washington Post* carried a story linking Abu Ghazala to those references to "minister" and "grandfather" in the wiretaps. According to this newspaper, the State Department was extremely sensitive to Abu Ghazala's association with the case and demanded that the Justice Department delete all references to him in the indictment.[68]

As the Helmy trial got underway in autumn 1988, the defendant's lawyers argued that Abu Ghazala had recruited their client for smuggling activities. They alleged that Helmy had met the Defense Minister twice and that Abu Ghazala said the United States approved of his plan to export the equipment and materials to Cairo. According to Helmy's

attorneys, Abu Ghazala had approached the State Department and "struck a deal" whereby Egypt would conduct its own investigation into the affair and share the results with the United States. The lawyers expressed their belief that this separate Egyptian report put the blame squarely on Lieutenant Colonel Mohammed and Rear Admiral Elgohary of the Egyptian embassy.[69]

An additional document that emerged in court was a DIA assessment of the Condor II missile. In this evaluation, DIA said it became aware of Helmy's work for Egypt as early as June 1986, and as the investigation into Helmy's activities commenced, DIA assisted the US Customs Service with intelligence and counter-proliferation expertise. DIA affirmed that the technologies sought by Helmy were consistent with the requirements of a ballistic missile: the chemicals were most likely for solid-propellant motors, while the carbon-carbon probably was destined for missile nose cones. In DIA's view, the documents seized from Helmy, combined with the materials procured by his smuggling, led to only one conclusion: Helmy was involved in procuring materials for a ballistic missile.[70]

DIA also analyzed the Condor II missile. It said that this missile, with a range of 1,000 kilometers and 500-kilogram payload, represented "a significant improvement over the currently assessed missile capability of Egypt."[71] So far, progress on the Condor II project had been slow because the partners lacked the ability to develop the necessary technologies indigenously. This paucity of technical infrastructure and skill forced the Condor II countries to rely on the procurement of technologies and materials abroad. "Without the activities of Dr Helmy and his coconspirators," DIA assessed, "completion of the Condor missile program is doubtful."[72] Finally, DIA concluded that introduction of the Condor II would "increase regional tensions" and fuel local arms races.[73] In this vein, DIA warned that the Condor II might provoke Israel and Iran into pre-emptive strikes against Condor II infrastructure or convince them to accelerate their own missile programs.[74]

The MTCR was in place. The French, Italian, and probably West German authorities had been subject to démarches regarding the activities of their citizens in the Condor II. Under heavy US pressure, the Saudis had signed the Nuclear Nonproliferation Treaty and pledged not to use their CSS-2 ballistic missiles first.[75] Still, American officials believed that additional measures were required to stem ballistic missile proliferation.

In December 1988, the *New York Times* reported that Washington was exploring ways of ameliorating some of the negative effects of ballistic missiles on the Middle East.[76] In an eerie echo of the 1960s-era efforts to limit Egyptian and Israeli ballistic missiles, the new proposal would invite Egypt and Israel to separate talks in Washington. As a preliminary step toward a broader arrangement that would encompass other countries in the Middle East, the United States would call on Jerusalem and Cairo to

take "small steps," like prior notification of missile launches during tests or military exercises.[77] The newspaper believed that the incoming Bush Administration would most likely embrace the proposal, though there were dissenting voices within the Reagan Administration. The Pentagon opposed an original stipulation of the proposal that would have called on Egypt, Israel, and other states to make a "no first use" pledge regarding their ballistic missiles. The Defense Department reportedly believed that such a pledge could undermine NATO's position of possibly using nuclear weapons first in Europe. US Defense Department officials also resisted inserting language into the proposal that would have imposed range and payload restrictions on Middle East missiles. Not surprisingly, other Reagan Administration officials believed that the Pentagon had gutted the proposal of its most important provisions.[78]

It is not evident whether this missile control arrangement survived the end of the Reagan Administration. At a minimum, the 1990–1991 war with Iraq would have derailed any prospects of broadening the arrangements to include other Middle East states. It is possible that Egypt and Israel have quietly agreed to certain confidence-building measures like prior notification of missile tests, but this cannot be confirmed. Still, such an arrangement seems to fit Cairo's and Jerusalem's complex, occasionally acrimonious, but nonetheless enduring relationship.

In the spring of 1989, as Egyptian President Mubarak was preparing for his state visit to Washington, reports surfaced in the American media of an Egyptian effort to enhance its chemical weapons capability.[79] These articles likely were intended to pressure Cairo into scaling back its weapons of mass destruction and missile programs. According to these reports, Swiss and US officials acknowledged that Egypt had taken a significant step forward in producing chemical weapons when it acquired elements of a chemical plant from the Zurich-based company, Krebs AG. The company said it had withdrawn from the project, and reiterated that it did not knowingly help Cairo acquire chemical weapons. Still, as one US official ruefully noted, "all the stuff is there now. It is too late." A State Department spokesman reiterated American "concerns" about the sale of sensitive equipment with dual-use applications.[80]

Pressed hard by the media reports of an Egyptian chemical weapons capability and the US spotlight on countering the proliferation of ballistic missiles and WMD, Egyptian President Mubarak gave an interview to a journalist on board his personal train on 1 April 1989. Mubarak said he intended to confront Egypt's congressional critics and restore Washington's confidence in Cairo during his trip to Washington. He said he would deny allegations that his country was seeking chemical weapons: "The Americans are making a grave mistake," he said. "We don't lie … We have no chemical weapons … You should not put us on the same level as Libya." Mubarak said he was "shocked" by US insinuations that the Krebs plant was intended to produce chemical weapons. He did not deny

Nasser's use of chemical weapons against Yemeni royalists in the 1960s, but he reiterated that Egypt had no chemical weapons.[81]

The usual diplomatic niceties aside, the Bush Administration and Congress must have delivered a blunt message to Mubarak on his missile and WMD programs when he visited the United States in early April 1989, for within days of his return to Cairo, Mubarak removed Defense Minister Abu Ghazala from his post and appointed him to the politically powerless position of personal advisor to the president. Although Abu Ghazala's embarrassing association with the Condor II missile project and the Helmy smuggling network played a role in his ouster, seasoned Egypt watchers had anticipated this showdown between Mubarak and his increasingly powerful and popular defense minister for some time.[82] Mubarak probably mistrusted Abu Ghazala because of the latter's popularity within the Egyptian military and with the public. In any case, with the potentially dangerous Abu Ghazala out of the way, Mubarak could consolidate his power and put the Helmy affair behind him.

The Helmy business was drawing to a close in the United States as well. On 9 June 1989, Abdelkader Helmy pleaded guilty to one count of illicit exporting in return for having his other charges dropped.[83] A few weeks later, Helmy's associate, James Huffman, pleaded guilty to a conspiracy charge in a deal with prosecutors that involved dropping his other charges.[84] As for Lieutenant Colonel Mohammed and Colonel Khairat, they were never tried in an American court for their roles in the Condor II smuggling effort. On 6 December 1989, Helmy was sentenced to 46 months in prison, fined $358,690 and ordered to forfeit some $500,000 he had earned from his illicit dealings with the Egyptians. Helmy's judge said the case was not a "cloak-and-dagger" affair but an example of "greed."[85] As for Huffman, he was sentenced to 41 months and fined $7,500 for his role in what the judge described as a "large, complex, intricate conspiracy."[86]

The arrest, trial, and sentencing of Abdelkader Helmy and his associates, combined with the fall of Abu Ghazala and the American diplomatic approaches to the Europeans, heralded the breakup of the Condor II partnership. Even before the Helmy arrests, there were signs that Iraq was unhappy with the direction the missile project was taking. According to Friedman, from 1987 onward, Baghdad suspected Egyptian and Argentine go-betweens of making unwarranted profits off Iraq's financial contributions to the program.[87]

In setting its sights on the Condor II program, the United States focused on the two countries over which it could exert leverage: Argentina and Egypt. As early as September 1988, the US asked Argentina to terminate the Condor II.[88] In September 1989, Argentina's President Carlos Menem visited Washington, where he was told Argentina could lose American aid if it did not pull out of the Condor II project.[89] Two years later, after what must have been a great deal of internal wrangling

between the civilian politicians and the military, the Argentine defense minister announced that his country would dismantle or recycle all the key components of its missile program. He also announced Argentina's decision to adhere to the MTCR, which it signed in November 1993.[90]

While Argentina represents an unqualified success story for Washington's counter-proliferation efforts, the record for Egypt, America's top Arab ally, is mixed. In September 1989, a senior US State Department official told a congressional panel that Egypt had "terminated its cooperation" with Iraq on the Condor II. Egyptian officials apparently had conveyed assurances to American diplomats that they had withdrawn from the program.[91] We can also assume that Washington applied significant pressure on Cairo, including threats to slash military aid, to extract a pledge out of Egypt to cancel the Condor II. Nonetheless, reports persist to this day from US intelligence agencies that Egypt has continued to work on the Condor II on its own. The US National Air and Space Intelligence Center notes an Egyptian missile called Vector, which bears a strong resemblance to the Pershing II, in a recent publication.[92] In a 1998 report to Congress on WMD and advanced conventional munitions, the Director of Central Intelligence wrote that "Egypt continues its efforts to develop and produce . . . the two-stage Vector short-range ballistic" missile.[93]

Cairo's quarrel with Washington over the Condor II did not end its quest for ballistic missiles. Although the MTCR and US pressure helped kill the international Condor II partnership, they could not stop Egypt from continuing its cooperation with North Korea on a variety of Scud-related projects. According to a variety of sources, Cairo now has the capability to produce its own Scud-B missiles with technology obtained from Pyongyang. Israeli sources claim that Egypt also has the 500–600-kilometer Scud-C, which it obtained from North Korea.[94] As Egypt entered the new millennium, its missile programs continued to complicate its relationship with the United States and Israel. Whereas the contentious issues of the 1990s were Scud Bs and Cs as well as the Condor II/Vector, the acrimonious topic of 2000–2004 has been Egypt's apparent acquisition of 1,300-kilometer No Dong missile technologies from North Korea. Despite denials from senior Egyptian officials, including President Mubarak, US intelligence reports suggest that Cairo obtained the technology for the No Dong from Pyongyang.[95] Others estimated that there were 50–300 North Koreans in Egypt helping that country with its Scuds and probably its No Dong program as well.[96]

Egypt's motivations for acquiring the No Dong are complex. From a military perspective, this missile allows Cairo to target Israel from launch sites further inside Egypt. Yet the No Dong's presumed accuracy problems limit Egypt to hitting large targets like cities unless it opts for chemical or biological warheads. Perhaps the political motivation is the most important, for it is here that we can trace Cairo's desire for a large, long-range ballistic missile back through the Condor II to the Al Ared in the

mid-1960s. Big missiles count in the Middle East (as elsewhere), and even if Egypt never parades the No Dong along the Nile corniche, its leaders can take comfort in leaks and rumors that their country has joined Saudi Arabia, Iran, Israel, and possibly Syria in possessing 1,000-kilometer-plus missiles. We may be a long way from Nasser's call to unify the Arabs, but Mubarak's Egypt still harbors the dream of leading the Arab people toward a future of armed might, pride, unity, and dignity.

Key question #1: How did Egypt's efforts to acquire rockets influence Middle East regional and international policies?

In the 1980s, Egypt's foreign missile connections had progressed beyond its reliance on the Soviet Union for complete rocket and missile systems. This transition was due in large part to an Egyptian foreign policy that increasingly aligned Cairo with the Western powers, even though many of those same powers refused to assist it in building missiles. While the North Korean connection would begin to pay dividends from the mid-1980s onwards, Egypt still sought an advanced missile with a 1,000-kilometer-plus range and a militarily relevant accuracy. Recognizing its own technical and financial limitations, the Egyptian leadership understood that it could not produce this missile on its own. Therefore, Egypt asked (or was asked) to participate in Argentina's nascent Condor II program.

Condor II truly was an international missile with international implications. Born out of an agreement between Middle Eastern and South American powers, this missile was developed with the extensive assistance of an impressive array of top defense contractors in western Europe and North America. Even though it never emerged from the research and development phase, the Condor II undoubtedly provided some of the impetus for the 1987 Missile Technology Control Regime (MTCR). In fact, the MTCR was developed with the specific aim of neutralizing programs like Condor.

As far as the United States was concerned, Condor II was the centerpiece of American ballistic missile counter-proliferation efforts in the 1980s. Indeed, Washington most likely viewed this missile as the perfect case to test the capabilities and willingness of certain MTCR signatories to restrain their companies from participating in foreign missile projects. Not surprisingly then, given the Condor II's apparent demise, US officials later cited this missile as an example of Washington's successful campaign against ballistic missile proliferation.[97] American policymakers and intelligence analysts viewed this missile as a destabilizing weapon that could upset delicate balances of power in regions as far apart as South America and the Middle East. It was with this prospect in mind that US diplomats initiated démarches against France, Italy, and probably West Germany over the activities of those countries' citizens in the Condor II consortium.

Israeli officials certainly were concerned about what Iraqi Condor IIs

could have meant for their own security. Although today we lack the breadth and depth of sources on Israeli responses to regional missile programs that existed for the 1950s and 1960s, there are hints here and there of Jerusalem's actions behind the scenes against Condor II. For example, there are the British claims that Israeli officers tipped them off to the existence of Condor. It also is likely that Israel undertook a limited campaign of coercion in the bombs that destroyed the two cars in Egypt and France. In the end, however, Israel seemed content to have the United States take the lead in combating the Condor through the MTCR and bilateral discussions with European officials.

If Condor II had been completed, it would indeed have had a destabilizing impact on the Middle East and South America's southern cone. Compared to the Scuds in Egypt's and Iraq's inventories, the Condor II was a much more advanced weapon with a more reliable solid-propulsion system, formidable range, mobility, and accuracy. Analyst Michael Hardin says Iraqi Condor IIs would have been more resistant to detection and interception efforts by US Patriot SAMs during the 1990–1991 Gulf War.[98] Indeed, the Condor II's mere presence in Iraq might have influenced Coalition planners during the run-up to Operations Desert Shield and Desert Storm. If Argentina had completed the Condor II, Brazil might have accelerated its own missile programs to compensate. That in turn might have disrupted or delayed the détente between the two powers that continues to this day. Robert Walpole, the former National Intelligence Officer for Strategic Programs, perhaps summed it up best when he told the US Senate Foreign Relations Committee in 2000 that had Condor II "come to fruition, it would have made the No Dong and the Taepo Dong I look like toys."[99]

Key question #2: What lessons can we derive for modern missile proliferation from Egypt's missile programs?

The case of Egypt and the Condor II offers excellent lessons for the field of counter-proliferation studies. The Condor was the first test case for the Missile Technology Control Regime (MTCR); it also highlighted the capabilities – and limitations – of US diplomacy. It shows that Egypt continues to pursue ballistic missiles after fifty years in the business, while at the same time demonstrating North Korea's prominent role as a missile proliferator. Finally, the Condor II nicely illustrates the costs of building an advanced ballistic missile, the implications of that missile's payload limitations, and the missile's reliance on the United States for core technologies.

MTCR in action

While the MTCR is not as restrictive as the Nuclear Nonproliferation Treaty or the Chemical Weapons Convention, it demonstrated its

relevance when used against the Condor II. Given this missile's heavy reliance on western European suppliers, the MTCR was in a perfect position to strangle the Condor systematically contractor by contractor. The MTCR forced West Germany, France, and Italy to confront the activities of their companies in the Condor program by devising consistent national export laws. For that reason alone, the MTCR can be given some of the credit for killing this missile. Janne Nolan highlights the role that supplier restrictions can impose on a missile project: "As the collapse of the Condor program illustrated, the costs of missile development in countries with undeveloped industrial sectors or with severely limited resources can be raised to unacceptable levels by the concerted efforts of suppliers."[100]

Its successes aside, however, the MTCR's weaknesses are only too apparent in North Korea. Even as the MTCR has throttled back the missile ambitions of several countries, Pyongyang emerged in the 1990s as the top proliferator of completed missiles and missile-related technologies. In addition to Egypt, North Korea has exported its No Dong missile to Pakistan and Iran. North Korean Scuds, modeled after those original Egyptian missiles in the early 1980s, have also found their way to countries as diverse as Yemen, Syria, and Libya.[101]

Value of bilateral US diplomacy

The Condor II case also demonstrates that traditional US bilateral diplomacy can be effective when used with countries over which Washington exercises leverage. The relevant documents illustrating how the United States conducted its diplomacy with Argentina and Egypt are still classified; however, with the limited information available, American diplomacy appears to have been very effective against Argentina, which not only terminated its role in the Condor II but later joined the MTCR. It can be assumed that Egypt's participation in this missile project formed the basis of many heated discussions between Cairo and Washington. Those talks forced Egypt into the position of agreeing to end its participation in the Condor II, even when it had no intention of doing so. Undoubtedly, when the relevant documents are declassified fifty years from now, we will learn about how Washington handled the transfer of No Dong technologies in its diplomacy with Cairo.

What is surprising is that Egypt is willing to risk its close and beneficial relationship with the United States for a ballistic missile program that has yielded remarkably few dividends over the past five decades. Clearly, the Egyptian leadership perceives a political and military value in ballistic missiles that outweighs the occasional complaint and threat from Washington. Whether it is Al Ared or No Dong, the Egyptians continue to seek a 1,000-kilometer-plus weapon that is more survivable than its short-range cousins and conveys greater power and prestige.

Egyptian indigenous capabilities

After forty or more years of researching, developing, producing, and using ballistic missiles in combat, Egypt still has only a limited capability to produce its own missiles. Cairo brought to the Condor II program neither Iraq's financial resources nor Argentina's European network. All it could contribute was a supposed entrée to the United States, some missile expertise, and possibly its access to Saudi money. When it was forced to renounce Condor II by Washington, Egypt continued to work on the project covertly. That secrecy might explain why it is not known if this missile has ever been flight-tested in Egypt. Alternatively, the same dearth of financial and technical resources that plagued Al Zafir, Al Kahir, and Al Ared likely afflict Vector as well. In the end, all Egypt has to show for its investments in capital, personnel, and time is an ability to produce the Scud B, an "ancient" missile by today's standards, but nonetheless ubiquitous in the world's missile armories.

Missile development costs

A system as advanced as Condor II illustrates the costs associated with developing a ballistic missile. According to Karp, Argentina and Egypt, but mostly Iraq, invested some $4–$5 billion in Condor II research, development, and infrastructure from 1984 to 1991.[102] In addition to Iraq, Saudi Arabia reportedly contributed a significant amount of money to this project, which would have required another $1 billion to complete.[103] The final yield could have been as high as $33 million per missile, a steep figure that is roughly comparable to the costs of some strike aircraft, which are not only reusable but can carry far more ordnance. Evidently, the Condor consortium sought this missile for political as well as purely military reasons.

With $33 million earmarked for a missile with only a 500-kilogram payload, it is fairly obvious that this "gold plated" missile was not destined to carry a high-explosive warhead – at least not for Egypt and Iraq. Cairo's attempt to acquire fuel–air explosive technology provides one clue to Egyptian thinking on how to overcome Condor II's payload limitations. Given Egypt's chemical and possibly biological weapons programs, it is safe to assume that Egyptian Condor IIs might eventually have carried chemical or even biological warheads. The same was particularly true of Iraq – at least before its 1990–1991 war. Missile payloads (and costs) can offer clues to the ultimate purpose of the system. In a missile as expensive as Condor II, chemical and biological warheads were, in many ways, a logical fit.

Reliance on foreign technologies

The activities of Abdelkader Helmy demonstrate how reliant the Condor consortium was on certain technologies, such as carbon-carbon, missile propellants, and maraging steel. Apparently, these materials could not be obtained in western Europe, where Consen could have acquired them. If 400-plus Condor II missiles were to be built as planned, it is difficult to see how all that carbon-carbon, specialized steel, and chemicals could have escaped the scrutiny of US Customs and national security officials. Ultimately, Condor II was a gamble on building an advanced ballistic missile under the eyes of the international community which the missile's sponsors lost.

8 Proliferation lessons

This book rests on two interlocking themes. The first posits that Egypt's efforts to acquire ballistic missiles influenced regional and international politics beyond the actual military value of the missiles themselves. The second theme emphasizes those lessons for ballistic missile proliferation that can be derived from the Egyptian case. The purpose of this final chapter is to examine these themes from the broader perspective of Egypt's five decades in rocketry. The experience of other ballistic missile proliferators will be used for comparison and to emphasize certain points in the text.

Key question #1: How did Egypt's efforts to acquire rockets influence Middle East regional and international policies?

Over the past fifty years, the Arab Republic of Egypt has relentlessly pursued the acquisition of rockets, and these ambitions have had an impact on an impressive array of countries from Argentina to North Korea. But Cairo's missile programs have played a special role in Egypt's relations with the United States, Israel, West Germany, the Soviet Union, and several other powers.

United States

The United States did not get involved in Egypt's ballistic missile programs until Israeli pressure forced it to do so. Up until the early 1960s, US intelligence analysts and policymakers downplayed Nasser's missiles as little more than showpieces for military parades. Only when Israeli officials impressed on their American counterparts their dire predictions for Egyptian missiles and weapons of mass destruction did Washington finally step up its interest and involvement. The American response to Israel's concerns was an unconventional arms control proposal which, in one version, would have traded further progress in Egypt's missile efforts for an Israeli agreement to refrain from developing nuclear weapons. Later versions of the plan dropped the Israeli nuclear program and proposed

cuts in the Egyptian and Israeli missile stockpiles. For a number of reasons, Nasser accepted none of the US initiatives, although he did issue a written statement to Washington disavowing Egyptian nuclear weapons.

US interest in Egyptian missiles quickly dissipated by the mid-1960s. Furthermore, Washington's diplomatic leverage over Nasser – never significant – had eroded significantly under the Johnson Administration, when Egypt turned more increasingly to Moscow, and the United States angered Cairo by transferring large quantities of arms to Israel. Washington certainly could not pressure Egypt politically or economically when Cairo acquired Soviet battlefield support rockets and, eventually, Scud short-range ballistic missiles from Moscow during the period between the Six Day War and the 1973 Arab–Israeli war.

Throughout the 1970s and 80s, Washington's relationship with Cairo improved substantially. As a reward for its peace treaty with Israel, Egypt became the recipient of large amounts of American aid, including sophisticated weapons such as the F-16 fighter and the M1A1 main battle tank. With that arms transfer program came greater American leverage and influence over Egypt. Although US policymakers seemed to turn a blind eye to the Egyptian–North Korean missile cooperation effort (at least in the beginning), they did force Egypt to terminate its participation in the Condor II project. Thus, for Egypt, the paradox was that while it could use a steady infusion of American arms to flex its regional prestige and political–military muscle, that same US relationship seriously hampered Cairo's ballistic missile ambitions.

Yet even the leverage afforded by billions of dollars in arms and aid has its limits, for throughout the 1990s, Cairo pursued the Condor II independently under the Vector program. In the new millennium, the latest ripple in Egyptian–US relations is the former's apparent acquisition of No Dong medium-range ballistic missile technologies from North Korea. Indeed, while Washington's relations with Cairo have been marked by amity and a common perspective on many issues, ballistic missiles constitute one of the few areas in Egyptian–US relations where there has been consistent discord. Seen from the outside, it is sometimes difficult to fathom why Egyptian President Mubarak, a key Arab moderate with a strong stake in regional stability, is willing to risk his valuable US-relationship for North Korean missiles of doubtful reliability.

Israel

As for Israel, its goals and strategies are consistent with regard to Egyptian missiles. From 1948 to 1979, Jerusalem regarded Egypt as its most formidable opponent, and even in the aftermath of their 1979 peace treaty, both countries continue to regard each other with the suspicion and unease characteristic of a cold peace. For several decades, an Egypt armed with rockets or ballistic missiles was unacceptable to Israel, particularly

when those missiles could be mated with unconventional warheads. Consequently, Israel used its intelligence services to spy on Egyptian rocket scientists and its diplomatic instrument to pressure Cairo's European suppliers of missile technology and expertise. In certain cases, Israel decided that diplomacy alone was insufficient to stop Egypt's missile programs, and took direct action, to include assassination, car bombs, threat letters, and letter bombs. These activities are a good gauge of Israel's determination to stop Egypt's missile efforts.

Israel's strategy was partially successful in defeating the 1960s' Egyptian missile program whose Achilles heel was the European supplier network. When Egypt turned to the Soviet Union for rockets and ballistic missiles, Israel's leverage was substantially reduced, and Jerusalem could only watch powerlessly as Cairo took receipt of Scud missiles on the eve of the 1973 war. When Egypt joined Argentina and Iraq in the multinational Condor II program, Israel's leverage was restored and it undoubtedly pressured the European network to withdraw from participation in this missile project. When Egypt turned to North Korea for upgraded Scuds and production technology, it found a partner that was not susceptible to Israeli pressure. As Egypt's missile program entered the new millennium, Israel's security planners likely recognized that, peace treaty aside, Egypt continued to build or procure ballistic missiles with the military objective of deterring and retaliating against Israel. Perhaps more importantly, the Egyptian program may have become more self-reliant: the only significant outside source of support is North Korea and that country is quite immune to Israeli diplomacy. Absent significant North Korean assistance, Egypt probably would lack the capability to develop and produce its own advanced ballistic missiles with militarily relevant accuracies.

West Germany

From the early 1950s until the late 1980s, when Egypt nominally withdrew from the Condor II project, West Germany was drawn into Cairo's missile ambitions. At first, Bonn was motivated by a desire to lure Egypt away from the Soviet Bloc. Consequently, it formally assisted King Farouk and, later, Nasser, in modernizing the Egyptian military and providing the expertise to develop an artillery rocket. Later, when Nasser pursued indigenous ballistic missiles, Bonn turned a blind eye to the activities of its scientists as they traveled to and from Cairo. It was not until Israel applied diplomatic pressure that West Germany contemplated strategies to bring its scientists back. In the end, West German incentives coupled with Israeli coercion and Egypt's failure to produce a viable guidance system contributed to the failure of this missile program.

West Germany's efforts to straddle irreconcilable policies of close relations with Israel and political and economic arrangements with the Arab world were seriously challenged by Nasser's missile program. While Bonn

tried to placate Jerusalem by exploring ways of luring the scientists back to West Germany, it was wary of antagonizing Nasser by crippling his missile program. Ultimately, Bonn's delicate balancing act failed when West Germany sold M-48 tanks to Israel, Nasser invited the East German leader to Egypt, West Germany established formal diplomatic relations with Israel, and Egypt and other Arab states severed relations with Bonn.

The inability of the West German government to develop a constitutional mechanism regulating the travel of its missile and weapons expertise came back to haunt it in the 1970s and 1980s when West German rocket scientists and chemical experts helped Egypt, Argentina, and Iraq with their Condor II, Iraq with its chemical weapons, and Libya with its OTRAG rocket and chemical weapons plant at Rabta. West Germany's accession to the Missile Technology Control Regime in 1987 forced it to create and enforce laws restricting the sale of missile-related technologies; however, the problem of retaining highly trained missile experts likely remained.

The challenge for West German foreign policy during this period is that it failed to appease the Israelis, who were alarmed by the work of German firms in Libya and Iraq, and the Arabs who resented Bonn's economic and political assistance to Israel. Still, in the new millennium, Berlin seems to have put some of the controversial work of its scientists aside as it pursues valuable trading relationships with the Arab states and sensitive ties with Israel at the same time. Given new export controls and the international attention now directed at the proliferation of ballistic missiles and weapons of mass destruction, it is unlikely that German firms will ever again be as heavily involved in a project like Condor II or Rabta. Instead, the new source of missile and WMD expertise for export resides in North Korea, Pakistan, and unemployed scientists from the former Soviet Union.

Soviet Union

At first, the Soviet Union was a restraining force in Egypt's missile pursuits. From the late 1950s through the 1960s to the early 1970s, Moscow refused to sell ballistic missiles to Egypt, although it did transfer some Frog battlefield support rockets after the Six Day War. The Soviets apparently were motivated by concerns that an Egypt armed with Scuds might well be tempted to use them against Israeli cities and provoke a conflict. Moscow might have feared that Egyptian use of missiles could have increased the risk of escalating a conflict to include the superpowers. It probably was not until Sadat expelled the Soviet advisors that Moscow reconsidered its missile export policy to Egypt. Significantly, while the Soviets transferred the Scud, they did so subject to strict controls that they did not impose on later missile deliveries to Iraq or Syria. Moreover, Moscow never sold the 1,800-kilometer SS-4/Sandal to either Egypt or any other Middle East power, recognizing that such a transfer

would have left the Soviets open to accusations of destabilizing the Middle East.

After the 1973 war and Egypt's turn to the West, the Soviet Union seems to fade out of the picture. While it probably transferred the remainder of the Scuds ordered before the 1973 war, the Soviet Union never again played a known role in Egypt's missile program. Much of this may have been due to poor relations between Cairo and Moscow, and Egypt may have been dissuaded from buying Soviet missiles by its new ally in Washington. Thus, while other Soviet clients such as Syria bought the SS-21/Scarab in the 1980s, Egypt relied on its new partnership with North Korea to reverse engineer the much older Scud.

Other countries

Several other countries emerge occasionally in this history. In western Europe, French, Italian, and Swiss firms sold expertise and technology to Egypt during the different phases of its indigenous missile project and the Condor II program. In Asia, North Korea continues to be a valuable source of much of Egypt's missile expertise and will likely support Egyptian missile programs in the future. During the 1980s, Egypt forged a durable arms relationship with Iraq in which both traded missile expertise and cooperated on projects like Condor II; however, those relations reached their nadir in the 1990s when Egypt joined the anti-Saddam coalition that ousted Iraq from Kuwait. While the future of Egyptian–Iraqi relations at the time of this writing remains unclear, it is unlikely Iraq will pursue ballistic missiles any time soon. Finally, Egypt's missile ambitions even extended to South America when it joined Argentina and Iraq in developing the Condor II.

Across the span of fifty years, Cairo's missile programs have never been limited to Egypt alone. Given its lack of missile expertise and technical and industrial infrastructure, Egypt has always been forced to rely heavily on foreign help and technologies, from the CERVA, Al Kahir, Al Zafir, and Al Ared to the multinational Condor II project of the 1980s and the No Dongs of this decade. Although Cairo probably has developed some expertise and capabilities of its own, its reliance on foreign, especially North Korean, technical skill will continue.

Key question #2: What lessons can we derive for modern missile proliferation from Egypt's missile programs?

Since Egypt was one of the first countries in the developing world to acquire surface-to-surface missile technology, its experiences offer an excellent case study in ballistic missile proliferation. The remainder of this chapter expands upon the following missile proliferation lessons:

Lesson #1: States acquire ballistic missiles for political as well as military reasons.
Lesson #2: There is a link between ballistic missiles and weapons of mass destruction.
Lesson #3: Missile experts are often overlooked in evaluating a missile program.
Lesson #4: It is difficult for democracies to control the activities of their missile scientists.
Lesson #5: Incentives can help delay or cripple a missile program.
Lesson #6: Coercion can work when linked with other counter-proliferation strategies.
Lesson #7: Treaties are one of the best means to control ballistic missile proliferation.
Lesson #8: Bilateral US diplomacy is currently perhaps the best tool to counter missile proliferation.
Lesson #9: Selective technology controls may offer a viable alternative.
Lesson #10: Indigenous development is the greatest challenge option facing a proliferator.

Lesson #1: States acquire ballistic missiles for political as well as military reasons

Several proliferation experts, including Harvey and Rubin, argue that ballistic missiles offer few military advantages that advanced combat aircraft do not already possess. Indeed, these analysts emphasize that modern fighters such as the F-16 can deliver more ordnance over greater distances than most ballistic missiles.[1] Yet even if we acknowledge that aircraft are more useful than missiles in terms of total ordnance delivered and efficiency, how can we explain the ballistic missile proliferation problem? There must be something in the inherent nature of rockets that makes them a viable option in the eyes of many regional powers. In the case of Egypt, Syria, and probably Iran, Israeli air defenses most likely are capable of punishing would-be transgressors to such an extent that fighter aircraft are no longer a viable option. In this case, ballistic missiles like the SS-21/Scarab, Shahab-3, or the Scud offer a means of striking at (and presumably deterring) Israel that aircraft lack. In the Egyptian example, Nasser more than once told his American visitors that the US transfer of the advanced Hawk surface-to-air missile to Israel nullified his Il-28 and Tu-16 bomber fleets and forced him to pursue ballistic missile programs in response. Today, Egyptian military planners may assume that their impressive fleet of F-16s probably is incapable of penetrating Israeli airspace should a war with that country arise. Only extended-range Scuds like the Scud C or even the No Dong permit Egypt to strike at Israeli cities from launch sites safely within Egyptian borders.

In addition to assured striking power, there are other characteristics

which make ballistic missiles a valuable commodity in many developing-world crisis areas.

Deterrence

Initially, it doesn't really matter if these missiles are tipped with nuclear, chemical, biological, or conventional warheads: most ballistic missile customers seek a weapon that can hit their neighbors with a relatively high degree of success. By possessing such a capability, these states assume they can deter some types of aggression directed against them. In the case of Syria, that country has armed itself with ballistic missiles, many of them probably tipped with chemical warheads, to deter Israeli deep strikes on the Syrian interior and retaliate with attacks on Israeli military and civilian targets if deterrence fails. Given its poor track record against the Israeli Air Force, Syria undoubtedly places little faith in the ability of its Soviet-supplied aircraft to penetrate Israeli airspace and deliver ordnance on target. In Damascus's view, only ballistic missiles offer an assured deterrent to Israeli attack on Syrian strategic targets such as economic assets, leadership bunkers, and weapons of mass destruction.

Although there is an argument that aircraft, not missiles, can deliver nuclear payloads reliably to target, the Indian and Pakistani cases suggest that missiles will be the chosen vehicle for their nuclear weapons. Again, neither country lacks for aircraft capable of delivering nuclear weapons; however, both likely consider their ballistic missiles to be the primary nuclear weapons delivery system. Pakistan probably believes that by tipping its Ghauri or Shaheen ballistic missiles with nuclear weapons it can deter an Indian attack by delivering an assured strike on Indian cities or military targets. Similarly, we cannot readily explain New Delhi's construction of the Agni medium-range ballistic missile without considering the possibility that this missile or a variant will constitute a delivery system for a nuclear weapon. Given the limited numbers of nuclear weapons in either Pakistan's or India's inventory, both likely believe that missiles offer the most reliable means of delivering these weapons to their targets.

Even though its aircraft probably could penetrate the airspace of virtually all its neighbors, Israel apparently believes it needs ballistic missiles to deliver nuclear payloads. From Jerusalem's perspective, despite the proven capabilities of its air force, nuclear-tipped Jericho II ballistic missiles offer the best means of deterring its enemies in Tehran, Damascus, and elsewhere.

Psychology

Closely allied with the deterrence motivator is the widely held perception that missiles can wreak terror on civilian populations far in excess of their actual military capability. Again, this is true whether these missiles carry

nuclear, chemical, or biological payloads – or not. From the V-2 strikes on London during World War II through the Iran–Iraq "War of the Cities" to the Iraqi missile strikes on Israel and Saudi Arabia in 1991, ballistic missiles seem to represent the worst of mankind's primordial fears about instant death raining down from the heavens.

The Israeli politicians' reaction to Isser Harel's news that Nasser possessed ballistic missiles betrayed a latent fear that Egypt had obtained a weapon capable of striking Israel; those concerns were aggravated by the appreciation that Israel's vaunted air force had no means of stopping Egyptian missiles. One cannot discount the fact that the news about ballistic missiles was coupled with rumors about Egyptian nuclear and biological research and probably only aggravated the fear yet further.

Iran offers another example of the psychological effect of ballistic missiles. In this case, Iran exchanged missiles with Iraq at various stages in their war and in one instance a substantial portion of the population of Tehran fled the city to evade missile attacks. Having learned the psychological edge offered by even conventionally armed ballistic missiles, Iran procured its own Scuds from Libya and later North Korea. Moreover, it has paraded its No Dong-derivative Shahab-3 medium-range ballistic missiles through the streets of Tehran, with large banners proclaiming its intent to wipe Israel off the face of the map. For Iran, missiles are yet another tool in the multifaceted struggle with Israel.

Prestige

Nasser and his generals undoubtedly enjoyed their military parades, which featured the latest developments in Egypt's ballistic missile development effort. Egypt's leaders could take comfort that their missiles *meant something*, what with the reactions they engendered in Israel and those anxious American diplomats trekking to Cairo with arms control packages for Nasser's consideration. Later, Egypt tried to build upon that prestige symbol of its ballistic missile programs by declaring its intention of building a satellite program. Carus puts the prestige value of indigenous ballistic missiles best when he states that

> More important than the possession of missiles, however, is the ability to develop and produce them. Such capabilities are a confirmation of modernization because they signify that a country has access to some of the same technologies critical to the superpowers.[2]

Several decades after Nasser's attempt to build his own ballistic missiles, Iraqi dictator Saddam Hussein extolled the "triumphs" of his country's scientific programs when he displayed his ballistic missiles at the 1989 Baghdad International Exhibition for Military Production. The message was quite clear: having vanquished the Iranian hordes, Saddam was

preparing to assume Nasser's mantle as leader of the Arab world. Al Abbas, Al Abid, Al Hussein, and other missile systems were visible totems of Iraq's growing power and prestige.

To return to Iran: the Islamic Republic makes no attempt to disguise its medium-range ballistic missiles. Iranian television frequently covers Shahab-3 launches, and these images can evoke the memory of Nasser's 1962 missile launches in the desert north of Cairo. Tehran also parades its Shahab-3 during its Armed Forces Day, boldly informing its neighbors, the United States, and Israel that it can strike distant targets with impunity. Both Iran and Nasser's Egypt maximized the political value of their respective missiles by parading them and launching them before the public eye. For both countries, ballistic missiles were a sign that they had arrived on the world stage as prominent regional powers. Significantly, Iran has taken its missile ambitions to the next step by proclaiming its intent to build and launch a satellite.

Saudi Arabia probably acquired the CSS-2 intermediate-range ballistic missile from China because it perceived a serious threat from Iran's growing inventory of ballistic missiles. Another factor motivating this controversial purchase was prestige, the sense of Saudi Arabia as a regional power with aspirations to leading the Islamic and Arab worlds. Although Saudi Arabia has been discreet about owning the CSS-2, there are no doubts among neighboring states that Riyadh possesses a system capable of ranging the entire Middle East. For the Saudi government, the CSS-2 is a useful tool of Saudi security and a valuable prestige item that marks Saudi Arabia's status as a regional power.

Collectively, it is these factors of assured strike, deterrence, psychology, and prestige that drive the proliferation of ballistic missiles to the developing world today. While advanced jet aircraft continue to find their way into developing-world inventories, many states still believe that ballistic missiles offer the most reliable means of deterring aggression and retaliating when deterrence fails.

Lesson #2: There is a link between ballistic missiles and weapons of mass destruction

Steve Fetter makes a highly persuasive argument that ballistic missiles and weapons of mass destruction are inextricably linked since missiles are an "exceptionally inefficient vehicle for the delivery of conventional munitions." He further notes that the nuclear powers rely on missiles almost exclusively as the delivery systems for their nuclear weapons.[3] The experiences of numerous countries appear to confirm Fetter's missile–WMD linkage, from the United States and the Soviet Union during the Cold War to China, India, France, the United Kingdom, Israel, and Pakistan among others.

In the case of Egypt, the record is mixed. While this country may have

worked on chemical warheads for its ballistic missiles, we cannot make this assertion with any certainty. As for biological weapons, it is unclear if Egypt has ever made significant progress in this area. While Cairo probably dabbled with nuclear weapons at various stages in the 1960s, it lacked the motivation of Israel, Iraq, and Iran to acquire these weapons. Thus, in some ways, Cairo is an anomaly in the world of rocketry and nuclear weapons. Despite fifty years of missile research, development, testing, and use in war, Egypt never developed a nuclear weapon to match its ballistic missile program. But this exception seems to prove the rule: for one thing, Egypt may have developed chemical warheads for its missiles (thereby confirming the argument), and, for another, numerous other countries have developed ballistic missile programs in tandem with their nuclear weapons efforts, including Israel, India, Pakistan, China, and North Korea. Indeed, there is no known nuclear weapons power today that does not have a ballistic missile program as well.

Ballistic missiles will continue to be associated with weapons of mass destruction. As countries in volatile regions like the Middle East search for new ways of enhancing their prestige and deterring adversaries armed with WMD, they will turn to ballistic missiles as the most reliable delivery systems for their own weapons of mass destruction.

Lesson #3: Missile experts are often overlooked in evaluating a missile program

It is clear from this history that Gamal Abdel Nasser would never have been able to build rockets as quickly as he did without the critical assistance of the German rocket scientists. Indeed, any country that seeks to design, develop, and produce its own ballistic missiles will have to develop the requisite scientific talents at home or obtain them from abroad. In the case of Nasser's Egypt, this was accomplished through the recruitment of the scientists at the Stuttgart Institute. Nasser did not have the time or the patience to educate Egyptian rocket scientists – that would come later. In 1959–1960, he needed an Egyptian missile as soon as possible to meet an anticipated Israeli threat. Only foreign scientists could make Cairo's missile ambitions a reality.

The Egyptian missile program really began to founder when several key scientists, including Paul Goercke and Wolfgang Pilz, returned to West Germany. Although the departures of these scientists helped sound the death knell for the Egyptian missile program, the problem of proliferating unique, missile-related scientific talent to known developing-world missile projects persists to this day. In fact, the recruitment of Eugen Sänger, Wolfgang Pilz, and the others reverberates with familiar echoes when we consider the histories of other rocket scientists, including: Tsien Hsue-Shen, father of the Chinese ballistic missile program; Lutz Kayser, German architect of Zairian and Libyan rocket efforts; Gerald Bull, the

genius behind Saddam Hussein's artillery and rocket projects; and Vadim Vorobei, a Russian rocket scientist who recently worked on an Iranian long-range ballistic missile project.

Tsien Hsue-Shen

As Iris Chang narrates in her history *Thread of the Silkworm*, Tsien Hsue-Shen was an instrumental figure behind the Chinese ballistic missile program. Born near Shanghai in 1911, Tsien won a prestigious scholarship to study aeronautical engineering at the Massachusetts Institute of Technology. Disenchanted with MIT's approach to the aviation sciences, Tsien later migrated to the California Institute of Technology, where he studied under Dr Theodor von Karman, head of the Guggenheim Aeronautical Laboratory at Cal Tech. A brilliant scientist, Tsien was a pioneer in jet propulsion and aerodynamics, experimenting with rockets at the same time that Eugen Sänger was dreaming about his Silver Bird in Germany.[4] Indeed, perhaps inspired by Sänger's vision, Tsien himself became a proponent of "transcontinental rocketliners" which could travel from New York to Los Angeles in less than one hour.[5]

Along with von Karman, Tsien traveled to defeated Germany at the end of World War II, where he studied the German V-2 program and interrogated top rocket scientists like Wernher von Braun. In 1949, he returned to Cal Tech as the Robert Goddard Professor of Jet Propulsion, but not long after, Tsien fell afoul of the McCarthy-era anti-Communist witch hunts. Suspected of pro-communist leanings and amid hints of espionage for the People's Republic of China (PRC), Tsien was denied access to classified US military projects and subjected to constant FBI surveillance. In 1955, he was deported to the PRC in exchange for American POWs detained by the Chinese during the Korean War.[6]

The Chinese government certainly is not reticent about Tsien's enormous contributions to its national defense. At one time, he shared podiums with the likes of Chairman Mao and was held in the highest regard in Beijing for, equipped with all the resources of the new Communist state, Tsien Hsue-Shen not only created China's first satellites, he also presided over the development of his country's first ballistic missiles. As Chang notes, Tsien is as well known in China as Wernher von Braun once was in the United States.[7] In fact, a 1999 report by the US Congress on the proliferation of American military and commercial technologies to the PRC appropriately calls Tsien the founding father of his country's ballistic missile force.[8]

Lutz Kayser

Lutz Kayser was a gifted yet underemployed student of Eugen Sänger who followed his mentor into selling his talents to foreign powers. In the early

1970s, Kayser formed a private company based in Stuttgart called Orbital Transport und Raketen Aktiengesellschaft, or OTRAG for short. Like Pilz ten years before him, Kayser believed he could develop an inexpensive launcher to put satellites into orbit. Eventually, he found a buyer for his idea in Zaire's Mobutu Sese-Seko, the notoriously corrupt ruler of an equally notoriously impoverished country in central Africa. Fueled by dreams of creating a "Cape Canaveral of Africa," Mobutu signed a deal with OTRAG which effectively ceded 38,000 square miles of Zaire for rocket testing.[9]

While working in Zaire, Kayser supervised at least two successful flight tests of his OTRAG launchers. Still, pressure was building on Mobutu to cancel the deal, especially from the Soviets, who suspected Zaire of building ballistic missiles for use against the pro-Soviet regime in neighboring Angola. In April 1979, Mobutu abrogated his contract with OTRAG and the firm eventually relocated to Libya, where it catered to the missile dreams of Muammar al-Qadhafi, the self-styled heir to Nasser. Additional flight tests took place at a site south of Tripoli; however, political pressures were once again exerted on OTRAG, this time from the United States and Morocco. Although OTRAG supposedly suspended its Libyan operations in 1987, the company or its remnants apparently played a quiet role in that country's ballistic missile program several years later.[10]

Gerald Bull

A genius in ballistics, Gerald Bull was born and educated in Canada. Driven by a desire to create an artillery gun that could place a satellite in orbit at minimal expense, the enigmatic Dr Bull soon clashed with his country's bureaucrats and parsimonious budgets.[11] As with many of his countrymen, Bull took his skills to the United States, which not only provided him with the resources to carry out his gun tests but made him a citizen as well.[12]

Dr Bull eventually fell afoul of US trade sanctions on the apartheid regime in South Africa. Pleading guilty to charges that he illegally sold artillery shells to Pretoria, Bull served a six-month jail term.[13] But it was Bull's work for Baghdad that caused the greatest concern in Washington and Jerusalem, for, once again, this scientist was pursuing his lifelong dream of creating a "super gun" to put a small satellite into orbit. While Bull may have regarded this "Project Babylon" as a space research concern, others, including the Iraqi government and the Israelis, quickly recognized the military potential behind this gun. More importantly, from Israel's perspective, Bull was also consulting on Iraq's three-stage Al Abid rocket. As with the super gun, Al Abid was billed as a satellite launcher by Baghdad, and Bull probably used that excuse to justify his work on Al Abid's first stage. Others, however, were not convinced of Al Abid's peaceful purposes: after receiving several warnings that went unheeded,

Gerald Bull was assassinated outside his Brussels apartment building in March 1989. His killer has never been identified.[14]

Vadim Vorobei

The collapse of the Soviet Union in 1991 and the end of the Cold War brought about sweeping changes to the old Soviet arms industry. When the Russian economy shifted to the long-neglected civilian sector and the armed forces faced a period of deep budget cuts, thousands of weapons scientists, engineers, and technicians found themselves underemployed or out of work. As with their German counterparts of the late 1950s, this new generation of disgruntled rocket scientists began to find work in emerging Middle East missile programs. One of those scientists is Dr Vadim Vorobei, a prominent figure in the Moscow Aviation Institute.

In 1996, Vorobei was recruited by an Iranian delegation to deliver a series of lectures on rocketry to Iranian university students. He was probably unaware of the fact that, thirty-five years before, several West German scientists were recruited to do exactly the same thing in Egyptian universities. Upon arrival in Iran, Vorobei was, in the words of his interviewer, "amazed by the number of foreign missile scientists wandering openly through Tehran."[15]

For five years Vorobei worked on Iranian missile projects in cooperation with other scientists from his country. In words that might have applied to Egypt's first missile program, Vorobei described the Iranian project as a "huge mess." Moreover, he suggests that the impetus behind Tehran's recruiting efforts in Russia may have been partly for show: "The Iranians took people who were needed and people who weren't needed. There was something artificial about it. They were trying to show that a lot of Russians were working for them and everybody should be scared by it."[16]

Vadim Vorobei is part of what reporter Michael Dobbs calls the "underground railroad" of Russian scientists working on Iranian nuclear and missile programs.[17] Although Vorobei downplays his Iranian work, US intelligence agencies undoubtedly believe that Russian scientists like him are playing a crucial role in furthering Iran's dreams of a long-range ballistic missile capability.[18]

The real question is: what can the United States and other countries do about the Lutz Kaysers, Gerald Bulls, and Vadim Vorobeis of this world? How can highly skilled scientists be deterred or dissuaded from work on foreign missile projects? The Egyptian case study offers a few solutions.

Lesson #4: It is difficult for democracies to control the activities of their missile scientists

As Michael Dobbs relates in his report on Vadim Vorobei, Russia exercises travel restrictions on its most prized weapons designers.[19]

Presumably, Vladimir Putin's Moscow has both the leverage and the wherewithal to back up those restrictions. For their part, the United States and several European countries exercise some control over the foreign travel of certain scientists as a consequence of their access to classified weapons programs. Notification and approval of foreign travel are part and parcel of this process; however, as the case of Vadim Vorobei or Gerald Bull demonstrates, the ability of these states to enforce these regulations is actually rather limited. If a scientist has made up his or her mind to work abroad, there is little Washington, Moscow, or London can do about it unless they can act on intelligence of the scientist's intent to move or deny citizenship after the fact.

As for scientific talents and technical experts who have not signed government forms for access to secret projects, the sky is pretty much the limit. As the government of West Germany discovered in the early 1960s and again in the 1980s, its power to compel Sänger, Pilz, and company into rejecting their Egyptian contracts was constrained by the West German constitution. In fact, the Federal constitution guaranteed their right to free travel and the Bundestag was ultimately unable to overcome this impasse. The case of Lutz Kayser and the activities of the MBB engineers on the Condor II project only reinforce the relative powerlessness of democratically elected governments to control the movements of their citizens. In short, constitutional democracies can do little more than discreetly monitor those highly trained scientists and engineers who have accepted some limitations on their travel as the price of their government work. As with West Germany, they can offer incentives to retain those scientists already employed on missile-related projects and lure back others who have pursued work abroad.

Lesson #5: Incentives can help delay or cripple a missile program

Incentives appear to be one method of retaining scientific talent and discouraging the brain drain of certain skills abroad. As the West German government discovered, post-World War II restrictions on certain scientific fields like rocketry were a major source of irritation for scientists skilled in these areas: Sänger, Pilz, Goercke, and the others chafed at the limitations imposed by government fiat on their work. Lack of official interest in the aerospace sciences undoubtedly contributed to this discontent as well, for, as we have seen, Wolfgang Pilz could not interest Bonn bureaucrats in his proposal to build a cheap, three-stage satellite launcher.

Under pressure from Israel and the media, the West German government came to realize that incentives were the optimal solution to this problem. A national space program was set up, which eventually absorbed the talents of Eugen Sänger when he assumed the newly created chair of astronautics at the Technical University of Berlin.[20] Similarly, Schuran,

Goercke, and others were lured home with promises of challenging work and competitive salaries. In sum, the Federal Republic eventually did what it should have been doing all along: creating a viable, national aerospace research infrastructure to challenge the abilities of men like Pilz who had been trained to serve the Nazi war machine.

This lesson can also be applied to other countries, like Canada, which developed extensive wartime industries but failed to exploit their potential in the postwar period. The case of Dr Bull, who was forced to seek his fortune abroad, is symptomatic of chronic shortsightedness among Ottawa bureaucrats, who, incidentally, also terminated advanced aircraft projects like the CF-105 Arrow. Much of the expertise resident in the Arrow program migrated to the United States in search of work and higher salaries.[21]

Incentives will play a pivotal role in keeping scientists like Vadim Vorobei at home and working on more benign projects than Iranian ICBMs. The United States has been playing an important role in this regard through the Nunn-Lugar Cooperative Threat Reduction program. Much more needs to be done in this area to prevent Russia's top-level scientific expertise from migrating to America's "Axis of Evil" of Iran and North Korea.[22]

Unfortunately, punitive measures such as imposing sanctions on Vadim Vorobei's Moscow Aviation Institute often only aggravate the proliferation problem. Denied access to potential US contracts and joint ventures with American firms, the Institute's scientists often have nowhere to turn but the rogue states. Ultimately, the United States and its counter-proliferation partners may need to rethink some aspects of their sanctions policies, especially if the end result is only to accelerate that which they seek to prevent. A subtler approach would likely be more effective than knee-jerk employment of the sanctions sledgehammer, especially in a country that is clearly vital to American interests like Russia.

Incentives were probably the most successful tool that Bonn employed to repatriate many of the German scientists working on Egyptian missile projects. Meaningful work with good compensation was the best response to the German proliferation problem; however, intimidation played a role in killing the Egyptian rocket effort as well. Indeed, there are some cases where a scientist or engineer cannot be lured home by the promise of money or challenging work.

Lesson #6: Coercion can work when linked with other counter-proliferation strategies

Israel responded to the emerging Egyptian missile threat in the 1960s by employing its diplomatic and clandestine instruments of national policy. The latter were certainly effective in coercing the German scientists into returning home as well as dissuading others from accepting Egyptian

contracts. The methods employed ranged from explicit written threats to more extreme measures such as letter bombs and assassination. Judging from Wolfgang Pilz's comments to an American journalist in 1965, these intimidation tactics definitely helped stall Egypt's drive to acquire ballistic missiles.

Several decades later, Gerald Bull received similar threats from anonymous sources that many believe to have been Israeli.[23] Bull ignored these warnings, the end result being his bullet-ridden body sprawled across the front door of his Brussels apartment. The Bull assassination seemed to track closely with the Mossad's techniques and procedures. He was first given explicit warnings through a variety of means that his life was in danger. When he chose to neglect those admonishments and continue his artillery and missile work for Iraq, he paid with his life.

Israel probably continued its methods of coercion with car bomb attacks against those associated with the Condor II project. Such methods seemed to have an effect on the Egyptian attaché in Austria, who feared assassination for his work on acquiring sensitive missile technologies from the United States. Still, in the case of the Condor II, Israel decided to eschew assassination and letter bombs, limiting itself to threats and diplomacy to help terminate this missile project.

Before 11 September 2001, few would have suggested that the United States employ intimidation and assassination as a tool to prevent scientists from contributing to rogue-state weapons of mass destruction programs. Yet in the aftermath of the collapse of the World Trade Center and the attack on the Pentagon, the idea does not seem so outlandish. Fewer Americans may be skittish about employing coercion to delay, and hopefully neutralize, Syrian, Iranian, or North Korean WMD programs. On the other hand, the problems posed by coercive tactics are many. First, several key countries of proliferation concern, including North Korea and Iran, are closed to American diplomats. Hence, they are relatively immune to US coercion and intimidation tactics directed against their scientists. Second, many missile proliferators have learned valuable lessons from the past and have not only kept their scientists' identities secret but presumably guard them closely as well. Third, these scientists probably do not travel as much as their predecessors, a fact that further shields them from assassination, coercion, or recruitment by intelligence agencies.

Still, a carefully crafted coercion program built on reliable intelligence could work when coupled with incentives to lure scientists out of the proliferation country of concern. The key is to offer both a stick and a carrot to make the scientists halt their activities. This strategy worked in the 1960s, and there is no reason to suppose that it could not work now. But coercion alone will not prevent Iran or North Korea from acquiring advanced missiles. Something more is required and that is where treaties and bilateral US diplomatic initiatives can help.

Lesson #7: Treaties are one of the best means to control ballistic missile proliferation

In 1987, an important point was reached in combating missile proliferation. Not only did the United States and some of its closest allies adopt the Missile Technology Control Regime, but Washington and Moscow signed a landmark treaty in the history of ballistic missile proliferation. Known as the Intermediate-Range Nuclear Forces (INF) Treaty, this agreement effectively banned an entire class of weapons from the arsenals of both countries. At the stroke of a signature, the Soviet SS-20/Sabre IRBM, the Pershing II IRBM, and the ground-launched cruise missile were either destined for the scrap heap or to serve as museum pieces.

The keys to the success of the INF agreement were multifaceted, complex, and long in gestation. For starters, both sides built on a lengthy dialogue that stretched back over several decades from the Kennedy era Partial Test Ban Treaty through the SALT talks of the Détente period, to the START process of the 1980s. Moreover, Washington and Moscow had developed verification measures that both could accept. But perhaps most importantly, the INF Treaty was the result of two visionary leaders, Mikhail Gorbachev and Ronald Reagan, who successfully exploited a thaw in their relations to bring about important change in arms control.

All of these factors were missing a quarter century earlier when the United States attempted to broker an unconventional arms agreement between Egypt and Israel. Nasser's rhetoric may have so constrained his room for political maneuver that any agreement would only have doomed him to charges of "selling out to the Zionists." For their part, the Israelis undoubtedly would have been uninterested in trading off their country's future nuclear deterrent in the incomplete Dimona reactor for questionable Egyptian rockets. In Jerusalem's view, however concerned they might be about Nasser's missiles, that concern did not equate to the tremendous military potential vested in their nuclear facility. Finally, while Israel signaled a willingness to exchange its MD-620 missile for a halt in Egyptian missile production, we can never be certain if this offer was sincere or was just part of the opening gambit for future arms requests from the Americans.

Furthermore, political issues aside, Nasser's Egypt clearly had some nagging questions and concerns about verification. Notoriously prickly about what he perceived as his nation's sovereign rights, Nasser informed his American interlocutors that verifying any arms agreement with Israel would automatically infringe on Egyptian sovereignty. Indeed, Cairo probably did not have the confidence that Washington could play the part of honest broker, especially since the Americans had been stepping up arms sales to Israel at the time.

Ultimately, the greatest obstacle in the path of an Egyptian–Israeli agreement on banning unconventional weapons was the wider security

implications of the Arab–Israeli conflict. It would take two and a half more wars before Egypt and Israel were prepared to sign a peace treaty, and even today the prospects for arms control in the Middle East seem as remote as ever. It would take a considerable suspension of disbelief to imagine Iranian diplomats sitting beside their Israeli counterparts to negotiate cuts in the Shahab-3 and Jericho II inventories. On the other hand, India and Pakistan may be closer to the point where they could conceivably negotiate an agreement which caps – if not eliminates – their inventories of medium-range ballistic missiles. At least their leaders are talking to each other.

Lesson #8: Bilateral US diplomacy is currently perhaps the best tool to counter missile proliferation

US bilateral diplomacy has a mixed track record when it comes to Egyptian ballistic missiles. Although Washington had little leverage over Cairo in the 1960s and early 1970s, Sadat's turn to the West combined with the Israel–Egypt peace treaty and subsequent US military assistance rapidly increased American influence over Egypt in the 1980s. The United States used this leverage to force Egypt to cancel its participation in the Condor II. There are also indications the US exerted significant diplomatic pressure on Egypt to stop a sale of No Dong missile engines in 2001.[24] Overall, bilateral diplomacy and the threat of suspending deliveries of weapons and other assistance are Washington's primary tools to slow the development of Egypt's medium-range ballistic missile program.

American diplomacy has had successes elsewhere as well. In the case of Argentina, Washington's pressure not only convinced Buenos Aires to terminate the Condor II project, it also persuaded Argentina's leadership to sign the MTCR. With China, persistent US efforts helped persuade that country to adhere to the MTCR and it has made a bid for membership in the Regime. Finally, American diplomatic pressure combined with threats and warnings, appears to have convinced the North Koreans to refrain from flight tests of their latest long-range missiles.

Although Egypt is not a complete American diplomatic success story, US diplomacy has worked effectively in other parts of the world. In the absence of an agreement whereby countries formally renounce the development or acquisition of ballistic missiles, United States diplomacy will be one of the best weapons against missile proliferation for the foreseeable future. Naturally, such policies usually work best where American leverage is greatest, i.e. where Washington retains a mixture of carrots and sticks to persuade the proliferator to change its ways. In the case of some countries like Iran or Syria, however, the United States has little ability to persuade those countries directly to cease development of long-range ballistic missiles, although it might rely on European allies to exert their influence. Such is certainly the case with the Iranian nuclear program, where

Washington has opted for a behind-the-scenes role as Germany, France, and the United Kingdom try to pressure Iran into ceasing uranium enrichment.

Lesson #9: Selective technology controls may offer a viable alternative

We have already mentioned the INF Treaty as an example of a successful missile counter-proliferation agreement. The same year that the INF was signed, the Missile Technology Control Regime came into effect. To date, the MTCR has enjoyed some modest victories. For example, it helped kill the Argentine–Iraqi–Egyptian Condor II project by giving the United States ammunition in its diplomacy with the missile's European backers. The MTCR also undoubtedly discouraged some other countries from exporting missile-related systems and technologies to the developing world.[25] Still, the MTCR is a regime, not a formal treaty, and thus the onus is on its individual signatories to monitor compliance with the agreement and its export restrictions. As a consequence, MTCR members have bickered over provisions of the agreement, especially in the dual-use arena of space research technologies.[26] As a measure of the regime's shortcomings, some countries, notably Iran and Syria, have expanded their missile programs and inventories throughout the MTCR's existence. Part of this regime's problem is that one key proliferator, North Korea, is not a member.[27]

A brief glance at the MTCR's Category II list of controlled technologies offers another perspective on the problem. Among the various items with definite missile applications, like solid-fuel propellant components, nuclear effects protection, and specialized composites for warhead design, we find other technologies that are more clearly dual-use in nature, such as structural materials, computers, software, and so on. As noted above, what one MTCR member views as inherently missile-related may not be so regarded by another member.[28]

Yet by understanding some of the MTCR's limitations, one can envision an additional treaty or regime that is more narrowly focused on missile guidance and control technologies. As Egypt's experiences attest, guidance and control is probably the greatest single obstacle to ballistic missile development. In the case of Iran's missile program, Vorobei reiterates that Tehran, too, is experiencing serious problems in these areas. As told to an American correspondent in late 2001:

> "They [the Iranians] created an engine, but not a proper guidance system," Vorobei said, pointing to the failure of two out of three tests of the Shahab-3. "They don't have any real metallurgical industry of their own. Their only hope is to steal something from neighboring countries, but they can't steal everything."[29]

The parallels with the 1960s Egyptian missile program are more than coincidental. Guidance and control capabilities – or lack thereof – make or break ballistic missile programs. A benefit to those who combat missile proliferation is the fact that guidance and control problems are only aggravated in longer-range systems like the Shahab-3 or North Korea's Taepo Dong missiles. Indeed, the guidance system for the Shahab-3 must be several orders of magnitude more sophisticated than those envisioned for Egypt's Al Kahir if this system is to ever be militarily meaningful. The challenges posed by controlling guidance and control technologies are daunting. Defining the technology to be controlled is just one challenge. Another is putting some sort of meaningful controls on components like GPS, which are widely available in the commercial market. North Korea, the worst proliferator today, already has developed indigenous guidance and control packages for its Scud derivatives. Still, a regime or formal treaty focused exclusively on guidance and control technologies might be easier to monitor than the MTCR, and potentially more effective down the road. It could put a halt to some developing-world ballistic missile programs, while denying others the ability to acquire technologies that would improve the accuracy of their existing missile systems.

Lesson #10: Indigenous development is the greatest challenge for a proliferator

Writing in 1967, Lewis Frank predicted that Egypt's experience with indigenous ballistic missile development would "likely serve as a precedent for other Third World countries anxious to acquire advanced weapons."[30] In the end, however, history did not bear out Frank's predictions: while India, Brazil, Israel, and others did develop their own ballistic missiles, Egypt's indigenous program reached a technical and financial dead end by the mid-1960s. Stymied by insurmountable guidance and control problems, the hemorrhaging of scientific talent, and the Six Day War, Egypt had little choice but to put the entire project on ice.

Many other countries eschewed indigenous rocket development and followed Egypt's later example in acquiring Scud or Scud derivatives. In fact, this system is easily the most widely proliferated missile in the world today and can be found in the inventories of countries as diverse as North Korea, Yemen, and Iran.[31] North Korea was particularly adept at reverse-engineering Egyptian-supplied Scuds in the 1970s, and then producing Scud derivatives in its own factories. Later, Pyongyang became a major proliferator of Scud missiles, technology, and production lines in the 1990s. Many of the ballistic missile "headaches" afflicting American military planners in the Persian Gulf and the Korean peninsula are directly related to North Korean (and, ultimately, Egyptian) Scud derivatives such as the No Dong and Taepo Dong missiles.[32]

While Al Kahir and Al Zafir highlighted the perils of indigenous ballis-

tic missile development, a few countries nonetheless pursued this option anyway. As Timothy McCarthy notes, Indian missile research began around the same time as Egypt recruited the Stuttgart scientists; however, unlike Cairo, New Delhi has pursued a consistent program of rocket research, which has resulted in the Prithvi SRBM and Agni MRBM/IRBMs.[33] Similarly, Beijing's missile program is largely the result of indigenous designs and production teams and China has exported its missiles to allies, such as Pakistan.

Still, its failures aside, the Egyptian experience with indigenous design and development contains many important lessons for would-be missile developers. First, such an effort requires substantial investments in human capital, especially in the areas of aerodynamics experts, chemists, physicists, structural and avionics engineers, and other skilled technicians. Second, the project demands enormous capital investments in physical infrastructure, such as production plants, training and testing facilities, research laboratories, precision machine tools, and instrumentation ranges. Third, as the Indian case demonstrates, a successful indigenous missile program takes time, lots of patience, and the political will to surmount the numerous technical challenges that will crop up along the way. A short list of those challenges would include guidance and control mechanisms, turbo pumps (for liquid-fuel engines), chemical mixing and setting (for solid-fuel motors), stage ignition and separation, warhead separation, and ablative materials to protect the warhead during reentry.

The Egyptian case demonstrates that only a few countries will have the human capital, financial resources, managerial expertise, and infrastructure to produce their own ballistic missiles. In the case of the Middle East, Israel stands out as the only regional power with the capability to research, design, develop, test, and produce its own ballistic missiles. Iran, Egypt, Syria, Yemen, and Saudi Arabia have all acquired their missiles or missile production capability from other countries. With the possible exception of Iran, none of these countries is likely to produce its own wholly indigenous ballistic missiles in the next ten years, although a few, including Egypt, likely will continue to tinker with Scud or other derivatives. The days of the Al Kahir or Al Zafir are long in Egypt's past. The 1950s-era Scud is Egypt's future.

Notes

Introduction

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5 Washington mediates

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