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Lessons from Nuclear Reversal: Why States Reverse Ballistic Missile Policy

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Abstract

Nuclear reversal is the decision by a state, which has a nuclear weapon or the technical capabilities to produce a nuclear weapon, to give up their nuclear weapons program. This paper employs the tenets of nuclear missile reversal to the dismantling of ballistic missile programs through case studies of the six states (Argentina, Brazil, Egypt, Iraq, Libya, and South Africa) that have abandoned their missile programs since 1987. The study hopes to promote further research concerning the behaviors associated with abandonment of nuclear reversal to that of ballistic missile reversal. This research concludes that the principles of nuclear reversal do apply to ballistic missile reversal, in much the same way they explain nuclear reversal. There is no clear overarching explanation, with all of the tenets having merit in the abandonment of programs.

Introduction

Nuclear reversal is a relatively new phenomenon that has been explored throughout political science research. States that had the bomb, or the capability to make the bomb within a short period of time, sometimes give up their sovereign rights to do so. Literature suggests that there are several motivations that consistently apply to nuclear reversal- economic “bargaining” within the domestic regime, the resolution of external security situations, and new international norms which dissuade the development or production of nuclear weapons.

While scholars argue over which is the most salient aspect, or what weights to assign each of these explanations, they are widely accepted as being the most parsimonious considerations. Considering the explanatory power that nuclear reversal theory has, it is

essential to test the theory and know its depth. As of now, the theory has only been developed to pertain to nuclear reversal. There are other instances in the international arena that such a theory could be applied. In order to further test nuclear reversal theory, this study attempts to apply it to ballistic missiles through a case study of the states that have abandoned their ballistic missile ambitions after 1987.

Literature Review: Nuclear Reversal

Recently, the issue of nuclear reversal has been a salient topic in the discipline. Yet, the literature has not been fully developed, with only a few authors looking specifically at the incentive for nuclear reversal. Of the literature available, there are several key tenets identified that lead to nuclear reversal. Paul has conducted the most extensive look at nuclear reversal, with Levite's research backing up Paul's conclusions. They found that states are incentivized to give up nuclear weapons when their security needs are met, when a change in the domestic regime and state's security and economic interests change, and when new norms diminish the appeal of nuclear weapons. In this case, international pressure emanating from multiple sources, or just one source such as the hegemon, is included. Additionally, Kiernan's article seeks to employ the principle of economic bargaining to nuclear reversal over the preferred security literature. Kiernan looks at the "price" of nuclear weapons versus the state's "willingness to pay" and attempts to find the vantage point where the price is too high.

Paul has a situational approach, not black-boxing the interests of the state. He asserts that while norms have an effect on nuclear states, it is generally because it assures them a sort of mutual security. The impetus to join is really only when other states around the state in

question have joined, and the state possesses some notion of nuclear forbearance. Thus, norms are connected to security- and a state in a high security zone will not have incentives to join onto international coalitions or be incentivized to join onto regimes such as the NPT (Paul 2000).

Paul found that neither norms nor security fully explained the behavior of states in nuclear reversal or forbearance. Paul asserts the notion of “prudential realism”, whereby state interest directs them to act in their best interests, but those interests are not always driven through greater maximization of arms (Paul 2000). Thus, the national interests of the state may be shaped by nuclear non-proliferation norms, or other incentives.

Levite finds that earlier studies all assert nuclear reversal as being tied to “(1) the external security situation of a state improves or alternatives to nuclear weapons emerge that make them unnecessary; (2) a change occurs within the domestic regime and the state’s security and/or economic orientation (central planning vs. market economy); or (3) systemic or state-specific incentives, such as new norms, emerge that diminish the appeal of nuclear weapons” (Levite 2003: 10). Scholars differ in the weight they assign to factors, and often disagree over which domestic entity was the driving force for or against nuclear weapons acquisition. (Levite 2003).

Levite’s work supports Paul’s conclusion that there is no overarching explanation for nuclear reversal. In addition, Levite contends that there is considerable variation in the characteristics of the reversal processes themselves. He concludes that nuclear reversal is driven not by one factor, but by a combination of factors, and the exact combination of varies between the cases (or clusters thereof) and over time (Levite 2003).

Kiernan offers a hypothesis that is inclusive of security strategies, but with an emphasis on cost benefit analysis. He dubs this new hypothesis “the bargaining approach” adding structure and logical precision to the cost/benefit calculation by decomposing it into separate variables of “price” and “willingness to pay.” The price variable includes the security and political costs in retention of nuclear weapons, international pressure to renounce nuclear weapons, and structural factors such as the nature of international regimes. The willingness to pay is the function of the benefits states derive from nuclear ownership, as well as other subjective benefits. (Kiernan 2010).

Kiernan uses case studies to illustrate support for this economically based comprehensive hypothesis- South Africa, Brazil and Argentina, and Ukraine, Kazakhstan and Belarus.

For South Africa, De Klerk quickly ordered the unilateral demolition of South Africa’s nuclear stockpiles upon taking office- which seems inconsistent with the traditional raw security analysis. Kiernan argues that South Africa’s analysis of the price of maintaining the nuclear program was proving unsustainable, considering de Klerk’s sensitivity to international pressure. (Kiernan 2010).

The de Klerk regime believed there were now benefits of NPT membership: it would pave the way for technical cooperation with the West, as well as lend credibility to the country’s liberalization measures. The magnitude of those considerations radically minimized the regime’s willingness to “pay” for nuclear weapons. When international factors increased that price, the de Klerk regime moved toward nuclear disarmament (Kiernan 2010).

Brazil and Argentina pursued weapons capability for reasons of rivalry and prestige, as well as security considerations. The key factor in Brazil and Argentina's decisions to abandon their nuclear weapons programs was their eventual political rapprochement, or lessening of tensions between the two nations. Leadership and mutual economic engagement further improved relations. In 1990, both countries announced they would implement full-scope IAEA safeguards, followed by the signing the Treaty of Tlatelolco (nuclear weapons free zone in South America) and subsequent signing of the NPT (Kiernan 2010).

Economics, geography, and the Soviet legacy increased the sensitivity of Ukraine, Kazakhstan, and Belarus to Western pressure. In 1991, these three became independent states of the Soviet Union. The old Soviet system failed to provide prosperity and security, and the benefits of becoming "normal" countries were obvious. Accession to the NPT was seen as a way to demonstrate their new commitment to this normalization, as well as to obtain strategic and economic insecurity (Kiernan 2010).

Kiernan concludes through his analysis that while the traditional notions of security were still sound, and actually supported through his usage of the new bargaining hypothesis, that bargaining was apparent in all of his cases, and should be subjected to further study.

Thus, there are two radically similar and one slightly different take on nuclear reversal. Paul's work is reinforced by Levite's, while Kiernan's serves to reinforce both, while offering his own hypothesis about the bargaining process. Since all of these explanations hold merit, in order to fully understand the application of nuclear reversal theory to ballistic missiles reversal, all of them (in varying form) will be explored through the hypotheses.

Ballistic Missile Application

The circumstances surrounding the abandonment of nuclear weapons are quite similar to that surrounding abandoning a missile program. Both nuclear weapons and missiles are instruments of power that may be used as deterrent or compellant threats. They both serve to enhance the security of a state through raw power, and yet may undermine the security of a state due to sheer presence within a state. The norms surrounding their abandonment are strikingly similar- the Nuclear Non-Proliferation Regime was created to promote the incentivized states to refrain from weaponizing nuclear technology in exchange for assistance for developing civilian programs. In missile reversal, the counterpart to the NPT would be the Missile Technology Control Regime, initiated in 1987. Both the NPT and the MTCR were lead by US efforts to stem proliferation in the respected arenas. Thus, the connections between the nuclear reversal and the ballistic missile reversal of programs justifies a look into whether the theories applicable to nuclear reversal can explain state behavior in ballistic missile reversal.

Hypotheses:

Drawing on the current literature concerning nuclear reversal theory, three hypotheses were derived to explain nuclear reversal, and adapted to apply to ballistic missile reversal:

Hypothesis 1: If the external security situation of a state improves, then the state will reverse their ballistic missiles program. (Realist Explanation)

Hypothesis 2: If there are state-specific incentives, including global norms, convincingly diminish the appeal or availability of missiles/parts or tacit knowledge, then the state will reverse its ballistic missile program. (Norms Explanation includes hegemonic influence of the U.S.)

Hypothesis 3: If the state's price variable (including the security and political costs in retention of nuclear weapons, international pressure, and structural factors such as the nature

of international regimes) is greater than the willingness to pay (benefits states derive from nuclear ownership), then the state will reverse its ballistic missiles program.

Methods: Case Study

The Most Different Systems Design was employed to study missile abandonment. All of the cases share the same dependent variable; they all abandoned their ambitions for medium range or long range ballistic missile programs after 1987. There are six cases- Argentina, Brazil, Egypt, Iraq, Libya and South Africa. The cases have a history of development section, followed by a ballistic missile reversal portion, whereby the motivations and incentives for ballistic missile abandonment are explored.

Argentina

History of Development

Argentina began developing ballistic missiles for several reasons. After losing the Falkland/Malvinas Islands war to the British in 1982 and having conflicts with Chile over the Beagle Channel islands, Argentina had security concerns. Argentina's rivalry with Brazil and Brazil's expansion of their space program added to Argentina's threat perception. In addition, other factors such as political prestige and potential revenue from exports also motivated the missile program (NTI 2008).

Without the indigenous capability to develop a medium range ballistic missile, Argentina enlisted the aid of several European firms to work on the "Condor project". The Condor I was born in the late 1970s. The Condor was a single-stage, solid-fuel sounding rocket, with a range/payload capability of 100 km/400 kg (Global Security 2005).

After Condor I, Argentina moved on to desiring a medium range ballistic missile, dubbed the Condor II. The Condor II design was a much more sophisticated version of the Condor I; it

was a two-stage solid-fueled missile, which in its final design would have a more advanced guidance system. Iraq expressed interest in funding the Condor II project, provided that the resulting product would have a range at least five times that of the Condor I's 150 km range, and began a partnership in 1984. To avoid scrutiny, Iraq agreed to provide funding via Egypt for the Condor II program, using Egypt as a go between to Argentina. Saudi Arabia remained a "silent partner," financially supporting the program, hoping for completed missiles in return (NTI 2008).

In May 1991, Argentina's minister of defense announced the Condor II's demise. Iraq withdrew from the project in 1988, while its own missile program flourished. Argentine officials argued that the Condor II was part of a peaceful satellite launch program. In 1993, Argentina handed over most of the components of the secretive Condor II ballistic missile project to the US for destruction (Global Security 2005).

Ballistic Missile Reversal

The ballistic missile program declined for several key reasons. The impetuses to have the program, once laid to rest, became some of the reasons for dismantling it. A lessening of tensions between Brazil and Argentina assuaged some security concerns. The passage of the MTCR stemmed export ambitions, making the program economically unfeasible. In addition, the MTCR, along with specific pressure from the United States, quelled the program.

In 1989, Argentina's new president Carlos Menem took office. Shortly before taking power, Menem stated to the Argentine newspaper *La Nación* that Argentina "did not have the political capacity or the international standing to sustain the Condor missile" (NTI 2008). He took office facing an impending economic crisis- the inflation rate was 150% per month, and

the country \$4 billion in arrears in payments on its \$64 billion foreign debt (NTI 2008). Thus, the economics of the new administration played out to influence the abandonment of the project.

Finally, during a September 1989 visit to Washington that included a meeting with President George H. W. Bush, Menem was told unequivocally that Argentina risked losing U.S. credits and funding if it did not halt the Condor program. In the mid- to late 1980s, the United States began to grow concerned about the Condor II project. However, in 1987 the MTCR came into existence with France, Italy, and West Germany—all countries with firms participating in the Condor program—as members. The restriction on resources cut down on production. The United States subsequently increased pressure on Buenos Aires to dismantle the burgeoning Condor II project. (NTI 2008, Global Security 2005).

Further, Menem issued a joint declaration on missile technology in 1989 with the Brazilian president, Fernando Collor de Mello- the Argentine-Brazilian Joint Declaration on Bilateral Cooperation in the Peaceful Uses of Outer Space relaxed some of the tensions between Brazil and Argentina concerning missile and space technology (NTI 2008).

. Ultimately, the minister of defense announced Argentina's decision to adhere to the MTCR and announced that the Condor II made Argentina “more vulnerable, increased instability in other parts of the world, and compromised the nation's prestige” (NTI 2008). By 1993, the program was dismantled with aid from Spain. In November 1993, Argentina became an official member of the MTCR. (NTI 2008)

Brazil

History of Development

As one of the world's largest exporters of arms, Brazil's development of a space, as well as a missiles program, seems to have grown out of a desire to become a missile and technology exporter. In the 1960s, Brazil developed its space program which eventually produced the satellite launch vehicle (VLS) (FAS 1996).

The VLS - Satellite Launch Vehicle is the Brazilian Space Agency's main satellite launch vehicle. The medium-range ballistic missiles under development thereafter are based on the Sonda IV. The Sonda IV was produced indigenously by the National Institute for Space Research. This two-stage, solid-fuel missile underwent the fourth of five planned tests in the spring of 1989, readying the rocket for use in the VLS (FAS 1996).

Clearly, there was an issue with the marriage of the Brazilian space program and the military usage of the rockets. Hugo de Oliveira Piva, a former head of CTA (Centro Tecnico Aeroespacial) (Aerospace Technical Center), Brazil's premier missile lab, was one of the key players in the space program. Piva was caught in Iraq with a team of Brazilian missile experts when Saddam Hussein invaded Kuwait. Piva had a hand in developing the MB/EE and SS-series missiles Brazil was working on during the 1980s (The Wisconsin Project 1995).

Brazil's programs suffered from the lack of technological support from countries such as the U.S. "Our biggest concern is Brazil's export law," a senior U.S. official recently told the *Risk Report*. According to this official, "in the past, there has been a clear pattern of transfer of rocket technology to the Air Force, then to private companies, and then out of the country through exports. There isn't any technology for the space program that wasn't transferred into the missile program" (Wisconsin Project 1995).

In addition, two large civilian firms, Orbita and Avibras, were developing a series of missiles for export based on the work done by the National Institute for Space Research. Orbita was trying to develop a medium-range missile based on the Sonda-IV space rocket with foreign financing. As a missile, the rocket could carry a 500 kilogram payload up to 1,800 kilometers. Avibras, Brazil's largest weapon exporter, was also working on a line of surface-to-surface missiles known as the SS-300 and the SS-1000 (Wisconsin Project 2005).

Ballistic Missile Reversal

Brazil's motivations for missile reversal were security related, as well as priority induced. Brazilian President Fernando Henrique Cardoso said on August 18, 1995, "Brazil does not possess, nor does it produce or intend to produce, to import or export long-range military missiles capable of carrying weapons of mass destruction. We are presently developing, and shall continue to develop, space technology for exclusively peaceful purposes." (FAS 1996). As previously stated in the Argentina case study, the Argentine-Brazilian Joint Declaration on Bilateral Cooperation in the Peaceful Uses of Outer Space was signed in 1989. The agreement relaxed some of the tensions between Brazil and Argentina concerning missile and space technology, and lessened security concerns (NTI 2008).

The Brazilian Space Agency was put under civilian control in 1994, ending 20 years of military control of the space program. The shift of the more advanced Brazilian program to civilian control, and its top-level public commitment to peaceful uses of missile technology, may evidence the elimination of any potential threat from subsequent Brazilian missile technology developments and exports. (FAS 1996).

In effect, Brazil has been forced to make a choice. The big space rocket it is developing, the VLS, won't be able to compete with American, Russian, Chinese or European satellite launchers unless it is improved. Yet the VLS could not be improved without imports- and Brazil could not get the imports without giving up its missile program. " Previously, military control over the space program and an ambitious export program of short-range rockets had raised concerns that Brazil might develop ballistic missiles and export them to other countries (NTI 2009). "Our policy is not to support space launch systems in countries that are not members of the MTCR," says a U.S. official. Cardoso's decision to give up Brazil's missiles has been touted as a victory for export control (The Wisconsin Project 1995)

Constraints imposed by the MTCR and strategic technology embargoes have been credited as greatly slowing the progress of both countries' ballistic missile programs. Brazil curtailed the military potential of its space launch vehicle (SLV) program in the early 1990s and joined the MTCR in 1995.

Some analysts claim that Brazil's adherence to MTCR restrictions compromises the organization because Brazil's VLS wasn't canceled and dismantled as a condition of MTCR membership. States such as South Africa terminated a similar program before joining MTCR, and Argentina canceled its Condor II before acceding to NPT and joining MTCR. The concern about the program was that it could serve as a cover for a parallel ICBM program (FAS 1996).

Egypt

History of Development

After losing the 1948 Arab-Israeli War, the Egyptians became interested in developing safeguards against Israel. The indigenous program was developed using German V-2 technology and scientists until Nasser came into power, and dismantled the program.

However, after Israel's air dominance in the Suez War of 1956, Nasser reportedly realized the great potential of an indigenous missile production program. The program restarted again in earnest in 1960 (Bermudez 2010:49, NTI 2010).

The establishment of a ballistic missile production infrastructure was created through the conversion of existing arms and aircraft factories, and more importantly, the development of a ballistic missile test and launch facility (Bermudez 2010:48). Nasser's "missile bluff" was called in 1967 with the largely unsuccessful air display in the Arab-Israeli War. Early on in the war missiles were deployed but missed their targets and had little effect (NTI 2010). It seems as though the missile program and facility had descended into research status, rather than operational status (Bermudez 2010:48). With the lack of indigenous technological capabilities, Egypt sought to acquire ballistic missiles from a foreign power. Egypt looked to the Soviet Union, its largest supplier of arms (Sirrs 2006:20). FROG 7As and Scud Bs were provided by the Soviet Union (NTI 2010). Egypt's Scud B missiles were used to strike Israel in the 1973 Yom Kippur War (Missile Threat 2010). After 1973 the Soviets refused to cooperate with Egypt in further manufacture, tactical assistances, and providing parts for the Scud Bs, due to a cooling down in their relationship. Egypt looked elsewhere for partnership, and ultimately moved on to North Korea for assistance (NTI 2010)

Egypt was convinced that ballistic missiles would become increasingly significant, strategically as well as tactically, in future regional conflicts (Bermudez 2010:49). Since China seemed uninterested in working with Egypt, Egypt pursued a partnership with North Korea (NTI 2010). In 1979 or 1980, Egypt provided North Korea with the first Scud Bs. Using advanced construction materials and fuel design, the Project T missile is thought to maintain a 985 kg

payload equipped with high power explosives. Apparently, Cairo and Pyongyang have cooperated in Project T manufacture and development post 1980s: in February 1999, Cairo's *Al-Ahram* reported that "Egypt is continuing its efforts to develop and produce Scud-B missiles . . . In the first half of 1998 Egypt continued to acquire ballistic missile components and related equipment from North Korea" (Missile Threat 2010).

In 1979, Egypt signed a peace treaty with Israel in which both states agreed not to deploy or ready their forces for a potential conflict, and began. Nevertheless, some military rivalry between Egypt and Israel continued. Additionally, Egypt prepared for potential military confrontation with Sudan over the Nile and conflict with Libya (NTI 2010). The ongoing security dilemma, as well as the rivalry with Israel, kept the quest for ballistic missiles alive (NTI 2010).

Egypt began collaborating with Argentina and Iraq on the Badr-2000, or the Condor II as it was called in Argentina (which parallels the Argentine Condor II) in 1984. In September 1989, Assistant Secretary of State John Kelly testified to the House Foreign Affairs Middle East Subcommittee that Egypt had terminated its cooperation on the Condor II. Egypt reportedly dropped support due to lack of funding, domestic politics, interagency competition, and international pressure (Bermudez 2010:49).

Ballistic Missile Reversal

Ultimately, International pressure with the US as the helm to desist cooperation on the Condor II project was evident following the June 1988 attempted smuggling of 200 kg of carbon-carbon material from the US. Two Americans and two Egyptians were charged with attempting to ship the material to Egypt, in clear violation of United States export control laws.

An Egyptian-born United States citizen named Abdelkader Helmy was indicated. Helmy was an engineer at the Aerojet Solid Propulsion Company in California. He stated that he met with Egypt's defense minister, General Abdel Halim Abu Ghazala, where the general reportedly asked for his assistance in buying material for an Egyptian military research and development program (Stevenson 1988, Wisconsin Project 2000). In an interview, one of the defendant's lawyers, Marcus S. Topel, identified the program as a joint effort with Argentina and other states to develop medium-range ballistic missiles (Stevenson 1988). The material that was smuggled is used as a protective coating for ballistic missile warheads, and was allegedly destined for the Condor II program (FAS 1996).

Considering that high level Egyptian officials were implicated, the situation garnered a personal call from President Reagan to President Mubarak about the seriousness of the matter (NTI 2010).

Iraq

History of Development

Saddam Hussein's regime sought to develop a long-range ballistic missile capability for both conventional purposes as well as the delivery of weapons of mass destruction. Iraq began arming itself with short-range ballistic missiles in 1974 with an exogenous program, purchasing 819 Scud-B short-range ballistic missiles and 11 MAZ-543 transporter-erector-launchers (TELs) from the Soviet Union. The USSR and Iraq continued their partnership throughout the 1970s and 1980s, whereby the Soviet Union supplied Scuds, support equipment, propellants, and conventional warheads (NTI:A 2010).

The Scud Bs became strategically irrelevant with the Iran Iraq War in 1980. Iran was able to hit Baghdad with its current Scuds, due to its proximity to the Iran-Iraq border. Tehran's distance, however, from the border was twice the 300km range of Iraq's Scud-Bs. Iraq worked hurriedly to indigenously increase the Scud-Bs range, and by 1988 the 650km range Al-Hussein variant was operational. The Al-Hussein was the only Iraqi missile to be loaded with chemical and biological warheads (NTI:A 2010).

Despite initial successes, flight stability plagued Iraq's Scud modification program. In 1988, the Iraqis successfully test fired the Al-Abbas, a longer-range version of the Al-Hussein. However, they abandoned the program due to continued flight instability and poor missile guidance. The Al-Hijarah configuration suffered from similar flight instability problems, and was rarely used during the Persian Gulf War (NTI:A 2010).

In the early 1980s, Iraq expressed interest in funding the Condor II project. As previously shown in the Argentine case study, in order avoid scrutiny, Iraq agreed to provide funding via Egypt for the Condor II program, using Egypt as a go between to Argentina (NTI Argentina). By 1989, Iraq had spent at least \$400 million on the project, but was unable to produce the missile, lacking facilities. Following the Gulf War, Iraq declared to the United Nations that it had been unable to produce this missile, which inspectors later confirmed (NTI:A 2010).

Iraq began launching Al-Hussein and Al-Hijarah missiles at Coalition forces and Israel immediately following the start of the Coalition's air campaign in January 1991. While the majority of Iraqi missiles launched during the Gulf War were Al-Husseins, Iraq also fired 5 Al-Hijarahs. The missiles' success rate is unclear, since many broke up upon reentry (NTI:A 2010).

Following the Gulf War, Iraq attempted to work within the boundaries of UN Security Council's Resolution 687 (which proscribed a 150km range limit), while still maintaining technical expertise and missile manufacturing capabilities. Iraq experimented with shorter-range surface-to-surface missiles, including the Ababil and the Al-Samoud (NTI:A 2010).

Later, Saddam expelled inspectors from Iraq in late 1998. The inspection hiatus from 1999 to 2002 played a significant role in the Bush administration's belief that Iraq possessed both weapons of mass destruction and proscribed missile capabilities. Forced to depart prematurely on the eve of the 2003 U.S.-led invasion, inspectors were unable to determine the full extent of Iraq's missile program prior to the war. Later, the U.S. Iraq Survey Group (ISG) reported that Saddam had intended to produce long-range delivery systems, potentially to deliver weapons of mass destruction once the international community lifted the sanctions it had imposed on his regime after the Gulf War (NTI:A 2010).

Ballistic Missile Reversal

The Iraqi missile program was abandoned due to the post Gulf War international intervention in its program. The Iraq Survey Group concluded that post-1991 sanctions and monitoring had effectively eliminated Iraq's ability to both purchase and produce a long-range ballistic missile capability. Yet, the ISG report also noted that Saddam Hussein didn't intend to give up his pursuit of long-range missiles. Iraq invested in technology and infrastructure, retained experienced scientists as well as long-range designs on the books (NTI:A 2010).

The Persian Gulf War brought much of Iraq's missile program to a halt. Following Iraq's defeat in 1991, the UN Security Council implemented resolution 687, which prohibited Iraq from possessing ballistic missiles exceeding a 150km range. Inspectors rapidly destroyed most

of Iraq's missile capabilities. However, UN resolutions did not prohibit Iraq from retaining the scientists and infrastructure underpinning its past missile development successes. Continued monitoring would therefore be key in verifying that Iraq had not illicitly restarted its long-range missile efforts. In a letter to the UN Security Council dated 16 January 2010, Iraq announced its intention to sign the Hague Code of Conduct against Ballistic Missile Proliferation (NTI:A 2010).

Libya

History of Development

Libya's ballistic missiles program was largely exogenous, attempting to purchase missiles from foreign powers. However, Libya's attempts to acquire ballistic missile technology and associated systems go back to the mid-1970s. In 1976, Libya purchased around 80 Scud-B missiles and launchers from the Soviet Union, and two years later with the purchased 40 FROG 7 rockets and launchers. In the late 1970s, Libya also tried unsuccessfully to acquire SS-21 Scarab short range ballistic missiles from Moscow. During the late 1970s and early 1980s, Gaddafi also reportedly approached the Brazilian aerospace consortium Orbita about a potential sale of its MB/EE 600km range missile system. Orbita denied the transfer (NTI: B 2010).

In 1980, Tripoli signed a contract with the German firm Orbital Transport und Raketen AG (OTRAG, "Orbital Transport and Rockets, Inc.") to develop a missile infrastructure in Libya. [However, after two years of development efforts in Libya, and vary of Libya's military intentions, the West German government pressured OTRAG to cease operations in Libya (NTI: B 2010).

Libya's attempts to either purchase entire systems or develop an indigenous ballistic missile production capability continued throughout the 1990s. Reportedly, Libya paid over \$31 million to Iran in exchange for material and tacit technological knowledge with the aim of expanding the range of its Scud-B arsenal and finalizing the Al-Fatah project (NTI: B 2010).

According to the German Federal Intelligence Service, in January 1995 Libya and Iraq planned on joint ballistic missile development. German intelligence officials later revealed that a series of Scud test launches had taken place in the Southwestern Libyan Desert to increase the range of the missiles (NTI: B 2010)

In June 1999, Indian customs officials at the Northwestern port city Kandla boarded the freighter Ku-Wol San owned by Puhung Trading Corp. of North Korea. The officials discovered wooden crates designated "water refinery equipment" that actually contained an entire assembly line for Scud missile production. The shipment seized included missile nose cones, sheet metal for frames, heavy-duty hydraulic pressing machinery, warhead guidance systems, calibration and evaluation instruments, and missile engineering blueprints labeled Scud-B and Scud-C- heading for Libya (NTI: B 2010).

In November 1999, U.K. authorities seized another shipment of missile parts bound for Libya. At Gatwick airport a cargo flight to Libya via Malta carried 32 crates. The crates had been disguised as automotive spares, but actually contained Scud components of North Korean origins. Records indicate that a Taiwanese company had used forged documents to ship the missile components through Hong Kong (NTI: B 2010).

Although two decades had brought little success, Libya plugged along with its program. In 2000, China was accused of providing technical expertise to Libya's missile development

efforts. China reportedly agreed to supply Libya with a hypersonic wind tunnel, a crucial component for modeling and simulating missile development. On 6 April of the same year, Swiss authorities arrested a Taiwanese businessman at Zurich international airport for attempting to smuggle four Scud missile propulsion units in his luggage to Libya (NTI: B 2010).

Ballistic Missile Reversal

On December 19, 2003, Gaddafi announced that Libya would renounce its pursuit of WMD and long range ballistic missile capabilities. The US State Department-led teams arrived in Libya for the first time on January 18 of the following year. By the time the US and UK first teams left Libya on January 29, they had already eliminated some of the most proliferation-sensitive aspects of Libya's weapons of mass destruction and missile programs (DeSutter 2004: 4).

The inspections revealed that although Libya had been frantically trying to improve its ballistic missile capabilities, its efforts had been largely unsuccessful. Attempted purchases of medium range ballistic missiles or intermediate range ballistic missiles were repeatedly thwarted by pressure from the international community (NTI: B 2010).

The Libyan government announced that it had, of "its own free will," agreed "to get rid of these substances, equipment and programmes and to be free from all internationally banned weapons." Libya states that it had "decided to restrict itself to missiles with a range that comply with the standards of the MTCR- while also announcing its intention to comply with the Nuclear Non-Proliferation Treaty (NPT), and the Biological Weapons Convention (BWC). Finally, Libya announced that it intended to sign the IAEA Additional Protocol, as well as adhere to the Chemical Weapons Convention (CWC) (DeSutter 2004:3).

South Africa

History of Development

A certain amount of South Africa's short-lived ballistic program remains an enigma.

Although South Africa had developed short-range tactical missiles and rockets since the 1960s, a July 1989 test launch of what South Africa called a "booster rocket" confirmed Pretoria also had developed a missile program. U.S. intelligence sources noted similarities between the South African and Israeli missile programs, prompting speculation of a back-scratching arrangement between the two countries. Whether South Africa fully integrated its ballistic missile and secret nuclear weapons programs is still unknown (NTI: C 2010).

The Armaments Corporation (Armcor), South Africa's state-owned arms manufacturer, formed a subsidiary in 1978 called Kentron Missiles to work on the research and development of missile technology. South Africa developed the Republic of South Africa (RSA) missile series under a commercial space launch vehicle program. Armcor also designed nuclear devices that could be delivered by aircraft or an RSA missile. Five South African nuclear bombs were reportedly configured (NTI: C 2010).

To support its missile development program, South Africa developed an indigenous solid-propellant production capability. The RSA missile was still in development when Pretoria announced the dismantlement of its nuclear weapons program and its space program. According to some claims, the RSA-4 missile may have been capable of delivering a 700kg nuclear warhead from South Africa to any location (NTI: C 2010).

South Africa and Israel had a partnership in developing missile technology. South Africa provided Israel with the uranium and missile test facilities necessary for its strategic weapons

programs, while Israel shared advanced aerospace technology with South Africa. Armscor confirmed that the company had over the last six years built a missile test range at Overberg on the southern tip of South Africa with the aid of Israel. In 1989, U.S. intelligence sources reported that South Africa was close to launching a modified version of Israel's intermediate-range Jericho II. A U.S. Central Intelligence Agency assessment reportedly suggested that South Africa was also preparing to test the more advanced Israeli Shavit space launch vehicle, which could be converted into a 3,200km-range missile (NTI: C 2010).

In July 1989, Armscor announced that it had successfully tested a booster rocket from the Overberg test range. Others suggested that the test was of an intermediate-range missile and U.S. intelligence officials thought that a short-range missile with a rocket plume almost identical to Israel's Jericho II missile had been tested. The test missile flew 1,620 km southeast toward Prince Edward Island. After U.S. officials publicly stated in October 1989 that Israel was assisting South Africa in developing a medium-range missile, senior Israeli officials again tried to sidestep the issue. Later, Israeli sources confirmed cooperation with South Africa on a variety of projects, notably a joint development of a surface-to-surface missile armed with a nuclear warhead (NTI: C 2010).

Ballistic Missile Reversal

The MTCR and heavy pressure from the US is credited with ending South Africa's missile program as well as space program. Domestic concerns, such as the economic viability of the space program also played a role.

In June 1993 South Africa agreed to refrain from manufacturing long-range missiles and to dismantle its capability to produce large space rockets. By this time, South Africa had terminated the nuclear program and revealed its existence. President de Klerk announced the termination of the SRA-3 and SRA-4 space launch vehicle programs due to questions about the “commercial viability” of the South African space industry (NTI: C 2010).

In September 1991, the U.S. Federal Register notice announced sanctions against South Africa for importing ballistic missile technology from Israel, considering that U.S. law prohibits U.S. exports of aerospace technology to any foreign entity “exporting or importing missile technology in contravention of the MTCR” (NTI: C 2010). South African President F.W. de Klerk protested the sanctions to President George H. W. Bush. After bilateral discussions on the economics of space launch vehicles, the South African government announced that it would stop subsidizing the space launch vehicle program, with the hope of finding a way to making to economically feasible. The program folded shortly thereafter (NTI: C 2010).

According to some sources, South Africa was about a year away from perfecting a rocket capable of propelling nuclear, chemical, or biological warheads more than 1,200 miles. The prototype was based on the RSA-4 missile, canceled during its development phase. South Africa joined the MTCR in September 1995 (NTI: C 2010).

Conclusions

The case study analysis shows an interesting pattern. While 3 out of 6 states (Argentina and Brazil) highly support the Realist Hypothesis, 4 out of 6 states support the Norms Hypothesis, and 4 out of 6 states support the Bargaining Hypothesis.

Figure 1.1 Case Study Results

Hypothesis 1	Hypothesis 2	Hypothesis 3
Argentina	Argentina	Argentina
Brazil	Brazil	Brazil
South Africa	Egypt	Libya
	Iraq	South Africa
	South Africa	

Brazil and Argentina had mutual interest to reduce tensions with one another in the late 1980s. After some transparency into the opposing country’s missile and space programs, as well as increased dialogue and economic cooperation, the states had increased security, supporting the Realist Hypothesis. In addition, after the signing of the MTCR, the United States was involved with pressuring each state to give up its ballistic missiles, supporting the Norms Hypothesis. In addition, the US publicly embarrassed the Argentines with uncovering the smuggling of materials out of the United States for the Egypt/Argentina/Iraq Condor II Program. Finally, each state had to come to the point where they realized that being members of the MTCR would benefit them more greatly than possessing missiles would have benefited them, using the cost/benefit type Bargaining Hypothesis.

The Egyptian generally only supports the Norms Based Hypothesis. The US put major pressure on Egypt to discontinue working on the Condor II program, as stated above. Egypt did not gain any security from losing the missiles- Israel still has missiles in the region, as well as an ambiguous nuclear weapons policy. In terms of bargaining, Egypt still has a chemical weapons program as well as a questionable biological weapons program. The benefits of having such programs have clearly outweighed the cost in the international arena. The pressure the US was

putting on Egypt, as well as the constraints on the missile program due to the export controls under the MTCR, are much more indicative of the Norms Based model.

Iraq was basically forced to give up its missile program after the sanctions it suffered after the Gulf War in 1991 at the hands of the UN Security Council. It continued to have other programs, such as a chemical weapons program- which seems to fly in the face of the Bargaining Hypothesis. Regional security needs did not change the scope for Iraq considering the rise of Iran's program, and the ambiguous stance of Israel- thus, not satisfying the Realist Hypothesis.

Libya is an interesting case- while the state claims to have made the motion to give up its program by itself, it seems the international community was rather involved, considering the UK and US teams deployed there. However, the US also agreed that Libya took the lead in its own dismantlement- and signed various other international agreements such as the BWC, CWC, and NPT. Thus, I did not assign Libya as fitting the Norms Based Hypothesis, but the Bargaining Hypothesis. Libya decided that its actions renouncing weapons of mass destruction, as well as missile system, would benefit them more than the incentives to keep these systems.

Finally, South Africa seems to fit the Realist Hypothesis, as well as the Norms Based Hypothesis and Bargaining Hypothesis. South Africa gave up its missile system when it seemed that national security was better served without the missiles and nuclear weapons- the state was more vulnerable with them. De Klerk came in was more in tuned with international norms concerning missiles and weapons, and wanted the international community with South Africa, rather than against it. Finally, South Africa seems to perfectly fit the Bargaining Hypothesis. De Klerk was set upon gaining "normalization", and the benefits of South Africa joining the

international community outweighed the security utility that the missile systems would have afforded.

Thus, all hypotheses are amply supported by the cases offered. However, much like the work done by Levite and Paul, there is no real distinction as to which is more causal and which sets may have more weight than others.

Concerns and Further Research

While the research is sound, there may be some bias in the case studies due to the incentives of the sources of information to represent competing interests. Most states are not eager to admit that international conventions, much less the US acting as hegemon, gave them “religion” and caused them to end their missile ambitions. Similarly, international regimes such as the MTCR have a stake in claiming to have influenced states to give up weapons- the more successful the regime, the better the international standing. In addition, when the hegemon is heading up one of these regimes, it too has cause to over-inflate its influence. This research drew from several sources in order to mitigate the bias- some sources with a state- centric explanation for reversal, and some from an international viewpoint.

The robustness of the findings could be bolstered with statistical analysis of all of the cases of ballistic missile reversal, using the theories of nuclear reversal. While case studies hold a distinguished place in political science research, the marriage of quantitative and qualitative research is often helpful in identifying strengths and weaknesses within the theory.

Finally, the nuclear reversal theory could be applied in other research concerning weapons of mass destruction, namely chemical and biological weapons systems. Levite recommends this research be completed back in 2003 in his article “Never Say Never Again”,

and no research to date has been found by the author of this article. It would identify if nuclear reversal tenets apply to weapons of mass destruction, and in what capacity. For instance, perhaps international norms apply strongly to nuclear reversal, but only moderately to chemical weapons. This indication could signal to policy makers that perhaps assurances of security are a more beneficial route to get the state to reverse its chemical weapons program than pressure from an international regime.

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