

Deception in Covert Nuclear Weapons Development

A Framework to Identify, Analyze, and Mitigate Future Long-Term Deception Efforts

Brian J. Gordon

This document was submitted as a dissertation in March 2016 in partial fulfillment of the requirements of the doctoral degree in public policy analysis at the Pardee RAND Graduate School. The faculty committee that supervised and approved the dissertation consisted of James Bruce (Chair), Christopher Paul, and Gregory S. Jones. Michael Bennett served as an independent reader.



PARDEE RAND GRADUATE SCHOOL

For more information on this publication, visit http://www.rand.org/pubs/rgs_dissertations/RGSD370.html

Published by the RAND Corporation, Santa Monica, Calif.

© Copyright 2016 RAND Corporation

RAND® is a registered trademark

Limited Print and Electronic Distribution Rights

This document and trademark(s) contained herein are protected by law. This representation of RAND intellectual property is provided for noncommercial use only. Unauthorized posting of this publication online is prohibited. Permission is given to duplicate this document for personal use only, as long as it is unaltered and complete. Permission is required from RAND to reproduce, or reuse in another form, any of its research documents for commercial use. For information on reprint and linking permissions, please visit www.rand.org/pubs/permissions.html.

The RAND Corporation is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest.

RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

Support RAND

Make a tax-deductible charitable contribution at
www.rand.org/giving/contribute

www.rand.org

Abstract

On the second day of the Gulf War in 1991, U.S. defense officials claimed that air strikes the previous night had dealt a crippling blow to Iraq's small nuclear weapons program, though later analysis would find the program to be much larger than, and not as damaged as, it appeared. In March 1993, the South African government announced that it had not only researched the means to build nuclear weapons, but had in fact constructed a handful of the devices and then voluntarily disassembled them – all without the international community becoming aware of the weapons' existence. The Indian government would also surprise the world several years later, in May 1998, when they conducted a nuclear test of which U.S. officials first learned through CNN coverage.

In each of these cases, U.S. officials were aware of the state's desire for nuclear weapons and its potential capability to build them. That awareness was not accompanied by an understanding of the state's motivations for pursuing nuclear weapons, its intentions for their use, or the success the state was having in research and development (R&D). A lack of complete knowledge is understandable due to the extreme secrecy that surrounds such efforts. But each of these programs was protected by more than secrecy. Each involved a coordinated deception effort that spanned years, involved thousands of individuals, and confused the efforts of U.S. analysts to present policymakers with timely and accurate information.

Intelligence analysts, military planners, and scholars often define deception in strategic, operational, or tactical terms. This dissertation proposes that the long-term deception surrounding these R&D efforts is distinctive in its characteristics and calls for new methods mitigate its effects. A framework will be presented that allows an analyst to categorize observable signatures, formulate a judgement on whether long-term deception is taking place, and propose additional areas of collection that may yield evidence of R&D. Historical cases of non-nuclear and nuclear weapons R&D programs will be used to develop and test hypotheses related to the characteristics of long-term deception.

Though focused in this dissertation on nuclear weapons R&D, the analytical approach taken and the hypotheses identified are applicable to other forms of long-term deception as well. The goal of this study is to give analysts in any discipline an additional tool to categorize information and spot common themes that indicate deception. An understanding of common uses of deception, its coordination, and the observables that may reveal such deception will assist intelligence collection and analysis that seeks to identify covert nuclear weapons programs, and officials who require accurate and reliable information on such programs to develop sound policy.

Contents

Abstract.....	iii
Contents	v
Figures	vii
Tables.....	ix
Acknowledgments	xi
1. Introduction and Methodology	1
Research Goals	10
Methodology.....	10
Outline of the Dissertation.....	22
2. Long-Term Deception and a Framework for Analysis.....	23
Strategic Deception	27
Deception in Long-Term R&D Programs	42
The Framework	48
Conclusion.....	62
3. Case Selection, Hypotheses, and Analytical Approach.....	63
German Rearmament after Versailles (1919-1939).....	65
The Soviet Biological Weapons Program (1972-1990).....	72
Hypotheses	79
Theory-Confirming Cases	83
Nuclear Weapons Policy, Weapons Development, and Deception Goals.....	85
Conclusion.....	91
4. The Republic of India (1974-1998)	92
Historical Background.....	93
Program Elements	97
Motivation for Study	100
Threat Perception and Policy Goals	103
Relationship with the United States.....	107
Framework.....	113
Conclusion.....	124
5. The Republic of Iraq (1974-1995)	129
Historical Background.....	129
Program Elements	135
Motivation for Study	141
Threat Perception and Policy Goals	144
Relationship with the United States.....	147
Framework.....	150
Conclusion.....	157

6. The Republic of South Africa (1970-1993).....	163
Historical Background.....	164
Program Elements	169
Motivation for Study	173
Threat Perception and Policy Goals	175
Relationship with the United States.....	181
Framework.....	185
Conclusion.....	195
7. Analysis, Recommendations, and Conclusions	202
Analysis of Deception in Long-term R&D Programs	202
Analysis of the Framework	206
Evaluation of Hypotheses.....	215
Benefits of Analyzing Deception	224
Recommendations	229
Conclusion.....	233
Appendix A. German Rearmament (1919-1939)	235
Motivation for Study	235
Historical Background.....	237
Framework Analysis.....	249
Appendix B. The Soviet Biological Weapons Program (1972-1991)	256
Motivation for Study	257
Historical Background.....	259
Framework Analysis.....	272
Appendix C. The Kingdom of Sweden (1945-1968).....	280
Historical Background.....	280
U.S. Assessments of the Swedish Nuclear Program.....	286
Framework Analysis.....	287
Conclusion.....	289
Bibliography	292

Figures

Figure 2-1 Example R&D Program Timeline with Interactions.....	46
Figure 3-1 Goals, Strategy, and Objective Categories.....	86
Figure 4-1 India Timeline	120
Figure 4-2 India Goals, Strategy, and Objective.....	122
Figure 5-1 Iraq Timeline.....	154
Figure 5-2 Iraq Goals, Strategy, and Objective	155
Figure 6-2 South Africa Goals, Strategy, and Objective	193

Tables

Table 1-1 Case Selection Matrix.....	17
Table 2-1 The Deception Methods Matrix.....	38
Table 2-2 Definitions of Categories of Action	52
Table 2-3 Methods Matrix Modified for Long-Term Deception.....	56
Table 2-4 Lines of Effort, Definitions, and Examples.....	57
Table 2-5 Example Nuclear Weapons Deception Framework	61
Table 4-1 Diplomatic Aspects of Indian Nuclear R&D Deception	126
Table 4-2 Human Capital Aspects of Indian Nuclear R&D Deception.....	127
Table 4-3 Infrastructure Aspects of Indian Nuclear R&D Deception	127
Table 4-4 Special Material Aspects of Indian Nuclear R&D Deception.....	127
Table 4-5 Other Material Aspects of Indian Nuclear R&D Deception	128
Table 4-6 Test and Evaluation Aspects of Indian Nuclear R&D Deception	128
Table 5-1 Diplomatic Aspects of Iraqi Nuclear R&D Deception.....	159
Table 5-2 Human Capital Aspects of Iraqi Nuclear R&D Deception	160
Table 5-3 Infrastructure Aspects of Iraqi Nuclear R&D Deception	161
Table 5-4 Special Material Aspects of Iraqi Nuclear R&D Deception	162
Table 5-5 Other Material Aspects of Iraqi Nuclear R&D Deception	162
Table 5-6 Finance and Budgeting Aspects of Iraqi Nuclear R&D Deception.....	162
Table 6-1 Diplomatic Aspects of South African Nuclear R&D Deception.....	197
Table 6-2 Human Capital Aspects of South African Nuclear R&D Deception	198
Table 6-3 Infrastructure Aspects of South African Nuclear R&D Deception	199
Table 6-4 Special Material Aspects of South African Nuclear R&D Deception	200
Table 6-5 Other Material Aspects of South African Nuclear R&D Deception	200
Table 6-6 Test and Evaluation Aspects of South African Nuclear R&D Deception.....	201
Table 7-1 Combined Themes of Hypothesis-Generating Cases.....	208
Table 7-2 Common Themes between Hypothesis-Generating and Theory-Confirming Cases ..	209
Table 7-3 Distinctive Themes in the Theory-Confirming Cases.....	211
Table 7-4 Frequency of Data in Theory-Confirming Cases	212
Table A-1 Diplomatic Aspects of German Rearmament Deception	251
Table A-2 Human Capital Aspects of German Rearmament Deception	252
Table A-3 Infrastructure Aspects of German Rearmament Deception.....	253
Table A-4 Special Material Aspects of German Rearmament Deception	254
Table A-5 Other Material Aspects of German Rearmament Deception.....	255
Table A-6 Finance and Budgeting Aspects of German Rearmament Deception	255
Table A-7 Test and Evaluation Aspects of German Rearmament Deception	255

Table B-1 Diplomatic Aspects of Soviet BW Deception	275
Table B-2 Human Capital Aspects of Soviet BW Deception	276
Table B-3 Infrastructure Aspects of Soviet BW Deception.....	277
Table B-4 Special Material Aspects of Soviet BW Deception	278
Table B-5 Other Material Aspects of Soviet BW Deception.....	278
Table B-6 Finance and Budgeting Aspects of Soviet BW Deception	278
Table B-7 Test and Evaluation Aspects of Soviet BW Deception	279
Table C-1 Diplomatic Aspects of Swedish Nuclear Research.....	290
Table C-2 Infrastructure Aspects of Swedish Nuclear Research.....	290
Table C-3 Special Material Aspects of Swedish Nuclear Research	291
Table C-4 Other Material Aspects of Swedish Nuclear Research.....	291
Table C-5 Finance and Budgeting Aspects of Swedish Nuclear Research	291

Acknowledgments

There is not sufficient room in this section for me to adequately express the gratitude I have for the support provided by my committee throughout this process. Jim Bruce not only introduced me to the concept of deception, but also took time to chair the committee and provided valuable insight and historical perspective as I became a student of the topic. Chris Paul helped me tighten up the methodology and challenged me to be deliberate in how I structured and communicated the study, immeasurably improving the final product. Greg Jones provided invaluable advice on some of the more technical aspects of these weapons programs, but also read each draft chapter with great attentiveness and always responded with excellent feedback. Special thanks go to my outside reader, Mike Bennett, who, despite a trying and busy year, was always available to discuss my ideas and help me figure out what I was actually trying to say.

My engagement with my committee would have been much slower and less focused if not for the funding I received to support this work. The FY15 Project AIR FORCE Dissertation Fellowship Award allowed me to produce a proposal that paved the way for a successful research effort. Generous support provided by RAND's Intelligence Policy Center permitted me to delve deeply into the cases and to draw as much as I could from each one to form my conclusions.

This effort would have been impossible if not for those who made my time at RAND more enjoyable and successful. My colleagues Jonathan Wong, Ervant Maksabedian, Cameron Wright, Marlon Graf, and Jeremy Kurz provided more humor than one should expect from a quantitative PhD program. I'm also indebted for the assistance of Aziza Arifkhanova, Melody Harvey, Katie Loa, Mikhail Zaydman, and others who seemed to do their best work after working hours in the student area. Daniel Egel, Eric Robinson, COL Jon White, LTC John Jackson, LTC Russ Ames, and SFC Vic Cuomo made my experience in Afghanistan the most rewarding of my time at RAND.

Two others deserve special mention. Christa, for frequently reminding me there was more to life than this dissertation, and Horatio, who patiently listened through many brainstorming and writing sessions.

I firmly believe that the issue of proliferation is among the most serious facing the global community today. While the part of this issue I've chosen to analyze is perhaps arcane, I hope this research can provide some assistance to those who are tackling this challenge. So if you are reading this to better understand or build upon these topics, I sincerely thank you as well.

1. Introduction and Methodology

Nuclear weapons development is among the most secret policies and programs that governments have pursued since the dawn of the nuclear age. The research and development (R&D) programs necessary to build even the most basic nuclear weapons require a state to recruit personnel, build facilities, and acquire special material. Such programs may require testing a device or developing an entirely new military capability to deliver it, such as a new missile system. They may also require the forming of networks to illicitly procure components or materials in violation of international agreements. Experience shows that in the modern era these efforts take several years (sometimes decades), thousands of people, and the equivalent of millions of U.S. dollars. The enormity of this effort is largely due to two factors. First, a series of international agreements, most notably the Treaty on Non-Proliferation of Nuclear Weapons (NPT), restrict trade that would enable a faster development timeline and impose verification systems on signatories. Second, ongoing efforts by the diplomatic, intelligence, and military agencies of various world governments seek to deter, detect, and disrupt any attempt at nuclear weapons development.

Security has been an essential part of every nuclear weapons R&D program because the stakes have been so high for both the developer and those seeking to stop the effort. Proactive action to stop nuclear weapons development is as old as the programs themselves. A British commando attack on a Norwegian heavy water production facility in 1942 is considered to be the first military action to prevent nuclear weapons development (Fuhrmann and Kreps, 2010, p.832). Diplomatic and commercial actions can also thwart nuclear weapons R&D. These measures, less dramatic but more common, can still be a considerable penalty that any potential proliferator must consider. In August 1977, after the Soviet government identified what appeared to be preparations for a nuclear test in the Kalahari Desert, the international community agreed to take action against the South African government. The UN Security Council passed Resolution 418, a near-total arms embargo against South Africa in response to the perceived weapons development (Reed and Stillman, 2009, p.175). Since conventional arms were also included, the consequences were significant. South Africa's military was engaged against well-equipped and communist-backed insurgencies for the next ten years while lacking any straightforward foreign source for arms.

Few would challenge the premise that the United States has been at the forefront of efforts to prevent nuclear weapons proliferation. Its aggressive advocacy for the NPT, including the indefinite extension in 1995, as well as its support for programs such as the Container Security Initiative have arguably helped create a system of international norms and export controls and

have kept proliferation on the forefront of the global agenda. U.S. leadership in this area began soon after World War II, as world leaders recognized the enormous benefit of nuclear technology. President Eisenhower delivered his “Atoms for Peace” address at the United Nations in December 1953, and since that time states have concluded over 2,000 bilateral nuclear agreements to exchange nuclear knowledge and technology for peaceful purposes. The United States leads the world in these agreements with 396 as of 2009 (Fuhrmann, 2009, pp.7, 26). In this spirit the United States enthusiastically supported both the establishment of the International Atomic Energy Agency (IAEA) in 1957 as well as negotiations over what would become the NPT several years later.

In addition, U.S. officials established organizations within the U.S. government with the goal of stopping nuclear proliferation. Several agencies within the intelligence community have divisions specifically devoted to detecting and monitoring nuclear weapons development. Cabinet level departments also have organizations with nonproliferation representing at least part of their mission, to include the Defense Threat Reduction Agency (Defense), National Nuclear Security Administration (Energy), and the Bureau of International Security and Nonproliferation (State). These organizations bring considerable capability, human talent, and millions of dollars annually to the effort to prevent further spread of nuclear weapons.

Yet, for all this effort, proliferation has continued. It has not continued at the pace many have feared, but since the NPT came into force several states (some of which were NPT signatories) have pursued nuclear weapons and a handful of states have achieved their goal. Though there have been numerous successes such as the rolling back of the Libyan nuclear weapons program, there have also been failures for the United States in this area despite the resources devoted to the problem. This dissertation presents cases where U.S. analysts missed indicators of impending nuclear tests, underestimated the resources a state would devote to nuclear weapons pursuit, or assessed that certain technologies were too difficult or inefficient for a state to develop. Given such a mixed record, one could argue that the resources allocated by the U.S. government to this problem are insufficient or are not being used well.

Yet such a view underestimates the complexity of deterring and detecting R&D programs in states that are motivated to go to great lengths to pursue nuclear weapons. Intelligence agencies must ascertain a state’s natural resources and capabilities, law enforcement must disrupt illicit trafficking networks and front companies, and diplomats must determine whether a state perceives its security situation in such a way that pursuit of nuclear weapons might be seen as a viable option. Policymakers must use the information and analysis provided by these officials to determine realistic and effective means to inhibit nuclear weapons development. Though export controls, inspection regimes, and improved technology may assist these determinations, two factors significantly complicate them.

First, it is often difficult to accurately assess the security perceptions of another state's policymakers. In his analysis of India's nuclear program, George Perkovich identified four tenets of American nonproliferation policy: (2000, p.445)

- 1) External security concerns universally and decisively determine states' nuclear policies.
- 2) Proliferation and nonproliferation are two sides of the same coin, therefore to reverse proliferation it is necessary to "flip" or reverse the circumstances that initially brought it about.
- 3) Democracy's international security benefits tend automatically to support nonproliferation objectives.
- 4) The handful of states possessing nuclear weapons can secure themselves and the world indefinitely against the dangers of proliferation without striving to eliminate their own weapons.

Perkovich points out that while these tenets may hold in many cases, the case of India proved each of these assumptions on the part of U.S. officials to be false. Additionally, events in international security may have influence on a state's perception of nuclear weapons. States may believe they face a "quality vs. quantity" dilemma, realizing that possessing one nuclear weapon might be more impactful and cheaper than arming itself conventionally. The United States went to war with Iraq in 2003 partially based on suspected WMD development, and quickly won. It likely occurred to many other states that Baghdad may not have been invaded had it achieved its nuclear weapon development goal (Burrows and Windrem, 1994, p.27). As the research in this dissertation will show, there are numerous motivations for states to embark on nuclear weapons development. The distinctiveness of each case makes assessment of potential development challenging.

The second factor that complicates assessment of these programs is that the states embarking on such an expensive and risky R&D program do not limit themselves to passive protection of the program. These states must avoid confrontation – whether diplomatic or military – that will imperil their effort. In addition to international efforts, the U.S. agencies and resources dedicated to detecting the program make protection of the program more complex than simply hiding it. Governments secured early nuclear weapons programs during and immediately after World War II almost solely by denying their adversaries information about the program. Early U.S. facilities, such as those in Los Alamos, New Mexico and Hanford, Washington relied on their remoteness and controlled access to deny information. Today, controlled access and other denial measures are certainly necessary, but insufficient. States today must develop front companies

and clandestine channels for illicit procurement, build facilities with misleading layouts to mask their true function, and assign cover identities to scientists who travel abroad in search of technical information. In addition to concealing information, they must manipulate any signatures that might remain observable to a vigilant intelligence agency. In other words, states must deceive in order to protect their nuclear weapons programs.

Deception complicates the analysis of the intricate R&D enterprise necessary for nuclear development by manipulating observable signatures to degrade understanding or suggest alternate explanations. The level of deception required to protect these R&D programs focuses on the most senior levels of the target government in an attempt to influence national-level decision making. It requires establishment of an organization that can formulate a deception plan and ensure its consistent execution across several components of government (Shulsky, 2002, p.30). This coordination may be a detectable element regardless of a state's particular development path or deception efforts, and thus a vital clue for U.S. intelligence collection and analysis.

This dissertation seeks to develop a framework through which deception in large R&D efforts can be detected and its effects mitigated. Data from several case studies will be carefully examined to identify conditions in which various types of deception actions, including the coordination efforts needed to implement them, are observed. While focused on the R&D surrounding nuclear weapons, the approach developed will be applicable to other types of covert R&D. An understanding of common uses of deception, its coordination, and the observables that may reveal such deception will assist intelligence collection and analysis that seeks to identify covert nuclear weapons programs, and policymakers who require accurate and reliable information on such programs to develop sound policy. This effort begins with discussion of the two assumptions on which this research rests – that the IC must remain vigilant in this area because states will continue to consider pursuit of nuclear weapons, and that deception is now a necessary component of a nuclear weapons development program.

The Continuing Risk of Nuclear Proliferation

Fears over “waves” of nuclear proliferation have surfaced during several periods of the last century. President John F. Kennedy once predicted that within a few decades of his presidency approximately 20 states would have nuclear weapons (1960). Many also believed the end of the Cold War would lead to a wave of proliferation, as the bipolar international order collapsed and states sought additional means to ensure their security (Mearshimer, 1990; Huntington 1993).

A recent report by the U.S. Defense Science Board may appear as another in these predictions of mass proliferation. The report states that at no time since the end of the Cold War has there been as many actors, with such a range of motivations and capabilities, that threaten to

acquire nuclear weapons (2014, p.13). This, presumably, is meant to highlight the prospect of a terrorist group or other non-state actor obtaining nuclear weapons. But another warning included in the report is significant for purposes of this research. The report states that, “in some cases, nuclear forces are seen as the most affordable and effective alternative to deter superior conventional forces, i.e., nuclear weapons are viewed as a legitimate warfighting capability.” This stands in stark contrast to the Cold War theories of Mutually Assured Destruction applied to superpowers, and opens up the possibility of multiple scenarios that would motivate less powerful states to pursue nuclear weapons R&D.

Just as preventive actions against aspiring powers may convince other states that nuclear weapons provide a necessary protection, the efforts of the international community to separate these weapons, and the states that control them, from the normal may have adverse effects. The prestige gained by achieving the status of a nuclear weapons state may be coveted by states that do not feel they are given their due on the international stage. States possessing nuclear weapons have been given greater weight in foreign affairs, such as permanent membership on the UN Security Council, and additional influence in regional dialogue (Epstein 1977, p.21).

For several decades, scholars and analysts have attempted to construct models and frameworks to explain the motivation for nuclear weapons development. In one of the most widely cited, Scott D. Sagan argues for three models of proliferation – security, domestic politics, and norms, by which he means symbols and state identity (1997, p.55). Analyzing the case of South Africa, Peter Liberman identifies another potential motivation – organizational politics (2001, p.49). In this case, he argues, South Africa did not fit into any of Sagan’s models. But the weapons were pursued because various groups within the government and armaments establishment had incentive to pursue them and were able to work in secret. Each of these motivations, to some extent, is seen in the cases researched for this dissertation and many others have been proposed. What is important for this research is that motivations to pursue nuclear weapons, and the situations from which they come, remain powerful factors in international relations and within the governments of many states.

References on countering deception released by the CIA encourage analysts to consider motive, means, and opportunity when evaluating whether a deception operation is being conducted (CIA, 1995). We can think of nuclear weapons development in a similar manner. The means and opportunity have been significantly curtailed by the NPT and other international agreements, yet uranium and plutonium are still found throughout the world, researchers still study processes that may contribute to development, and the knowledge of how to manufacture these weapons cannot be un-learned. Therefore, as long as there are states with any of several motivations, there will be a risk of proliferation. The United States has been among the global community’s most engaged opponents of nuclear proliferation. It has encouraged states to join

instruments such as the NPT, has contributed significant resources to efforts that promote peaceful uses of nuclear technology while limiting the potential for weaponization, and has pressured potential and actual proliferators to cease their activity through diplomatic, economic, and military actions. If the spread of nuclear weapons is to be curtailed, the U.S. government must continue to be vigilant for indicators of nuclear weapons development throughout the world.

This vigilance is time- and resource-intensive. It can be extremely challenging to assess a state's potential for proliferation precisely because there are so many possible motivations and because history has shown that proliferators can be creative in overcoming technical hurdles. Many studies, and many approaches to nonproliferation, focus on the common required elements of a program. The production or acquisition of fissile material is an extremely difficult obstacle for most states to overcome in constructing a weapon and hence many prevention efforts focus on securing existing material and inhibiting the means to produce it. But there are common elements to how a program is run as well – elements that exist regardless of a state's natural resources or strength of its industrial sector. These necessary elements also provide an opportunity to identify, evaluate, and mitigate a state's drive to obtain nuclear weapons. Deception is one such element.

The Necessity of Deception in Nuclear Weapons R&D

By 1968, any state considering the development of nuclear weapons found itself in a much different environment than those that had developed during World War II or shortly thereafter. Consensus about the need to limit the spread of nuclear weapons had been building for several years when Ireland's foreign minister proposed the idea of the NPT in 1958. The treaty, opened for signature after ten years of negotiations, was hailed as a forceful statement on the part of the international community about the inherent risks of nuclear weapons.

But as history shows, it was not a total solution to the problem. From the standpoint of states that might, and often did, seriously consider nuclear weapons development there were grounds for objection. Two states included in this study objected for very different reasons – India because it viewed the agreement as discriminatory, and South Africa because it did not want to lose proprietary information to inspections. These states were squeezed in an agreement between the already-nuclear powers and countries that either had no interest or would never have the means to develop. Those two groups were concerned that states such as India, South Africa, West Germany, or Brazil would embark on R&D programs and structured the NPT to prevent such action (Epstein, 1977, p.17).

This left a group of states with at least the beginning of means and motive to develop nuclear weapons, but with no opportunity. Several states, including India and South Africa, chose not to

sign the NPT for the aforementioned reasons. But IAEA inspections and other scrutiny of nuclear development activity increasingly became the international norm and even these states were often compelled to declare that they intended to follow the spirit of the agreement. The NPT in its original form, however, left a potential solution to the opportunity problem whether or not a state was actually a signatory. The treaty originally amounted to somewhat of a “gentlemen’s agreement” where the IAEA would verify nuclear materials and activities that were declared by the state. But little provision existed to detect states that intended to make progress through undeclared activities (Baute, 2004, p.65).

States that intended to pursue nuclear weapons were therefore in a position to do what militaries have done through deception for many centuries – confuse, deny, and misdirect their adversary away from what they actually intend to do. This was likely always known to those who worked to uphold the NPT, but was made plain for all to see following the Gulf War in 1991. The IAEA had conducted inspections in Iraq, which was an NPT signatory, for years leading up to the conflict. But when the facilities were accessed following the cease fire, officials were surprised and deeply concerned at how far the Iraqi nuclear weapons program had progressed. Former Director of Central Intelligence and MIT professor John Deutch blames the limited way in which the IAEA was able to conduct its mission for this surprise, noting that at the time it focused only on material accountability in facilities declared by Iraqi authorities and that inspectors “did not have the responsibility for investigating or reporting the obviously high level of activity in the buildings surrounding those facilities” (1992, p.127). As shown in the Iraq case in Chapter 5, the inspectors’ narrow focus was certainly an issue. But the Iraqi program also evaded scrutiny due to carefully manipulating the information to which inspectors had access.

This should not be taken to mean that deceptive practices targeting the IAEA or other parties interested in preventing proliferation are easy. As previously mentioned, the United States devotes significant resources to detecting proliferation. Any deception that seeks to protect an immense and complex R&D effort must be effective against the intrusive intelligence means the United States is able to bring to bear. Some approaches to assessing these programs are among the oldest practices in intelligence. A former NSC official, William H. Tobey, recently disclosed to *Technology Quarterly* that accurate assessment of a Syrian nuclear facility was only possible from human sources. The facility had been built with a lowered floor and water pipes beneath the ground, so the structure appeared too short for the suspected purpose and lacked the tell-tale cooling tower – thus evading more technical means of collection (2015, p.12).

These are, however, extremely difficult programs to penetrate with human sources. Thus governments, intelligence agencies, and the IAEA have significantly improved their means of technical collection. Much of the publicly released information about the suspected Iranian

nuclear weapons program came from precise satellite imagery of various Iranian facilities. The monitoring of nuclear explosives testing has also significantly advanced. Analysts in the public domain estimate North Korea's nuclear test in 2006 was one-tenth of the size of the bomb that was used in Hiroshima – yet it was detected at stations as far away as central Africa (*Technology Quarterly*, 2015, p.10). These technological improvements complicate deception. States may now be forced to spend time and resources building facilities that mask their true purpose, such as the Syrian facility, or pursuing a program that does not require testing.

Beyond enhanced intelligence capabilities, proliferators face challenges from an increasingly interconnected world. Scientists of the caliber required for a nuclear weapons R&D program are now likely to be sufficiently established in their field that their colleagues in other countries have some knowledge of their expertise and research. Those colleagues may become suspicious if a scientist suddenly broke communication or became vague about projects. Similarly, instructors and students in programs relevant to nuclear weapons research are expected to attend conferences and publish papers. Failure to do so or to otherwise deviate from normal activities by such experts may indicate their involvement in a government program that seeks to shield them from foreign observers. For example, the Organizational Risk Analyzer (ORA) program, developed at Carnegie Mellon University, analyzes data associated with over 30,000 nuclear experts across the world. It notes publishing patterns, research collaborations, and institutional affiliations among other data in an attempt to ascertain whether certain specialists may be part of illicit activity (*Technology Quarterly*, 2015, p.11). Such data availability and analysis can provide advantages to those trying to see through denial and deception activities.

Export controls, inspections, and enhanced intelligence capabilities all have the effect of slowing a nuclear weapons R&D program down. The U.S. nuclear weapons program proceeded with relative speed compared to many programs that came after. The program was authorized by President Franklin D. Roosevelt in 1939 and was transferred to the U.S. Army in 1942. The first U.S. nuclear test occurred in July 1945. The weapon, in addition to a gun-type device that did not require testing, was used less than one month later. This stands in contrast to the programs analyzed for this dissertation. India took decades of nuclear research to conduct its peaceful nuclear explosion (PNE) in 1974, and then over twenty years more to test a weapon. Iraq never achieved the testing phase but by the time its program was interrupted by the Gulf War it had been researching enrichment processes and weapons designs for over fifteen years. The start of South Africa's program is difficult to pinpoint, but one potential starting point is the announcement of the uranium enrichment project and founding of the Uranium Enrichment Corporation in 1970 (Masiza, 1993, p.36). By this measure, the South Africans took twelve years to produce their first weapon.

Though these programs had tested nuclear weapons theory on which they could rely, they lacked the resources of the U.S. effort and the urgency of wartime R&D. Another explanation for the longer developmental timeline is the establishment of international norms and agreements such as the NPT that seek to prevent such development. These agreements forced would-be proliferators avoid interference from the international community while still having to conduct significant research. One top Iraqi scientist noted that even after obtaining what was thought to be sufficient information on centrifuges, the system failed the first time they tried to bring it up to the required RPM. He recalled, “the first [lesson] was that possession of designs alone would not lead us to a functioning centrifuge, just as having the pattern for a dress does not make one a clothing designer” (Obeidi and Pitzer, 2004, pp.71-72).

It is this international focus on the issue of nuclear proliferation that makes denial insufficient to protect a R&D program of the magnitude required for nuclear weapons. The NPT and international norms require declarations and accounting for material and activity. Advanced intelligence capabilities make it difficult to hide the activity. The lengthy timeline to achieve a weapon means the state doesn’t need to conceal the program for a brief period, but rather for years and possibly decades. The inescapable remedy for the proliferating state is to issue false declarations, misdirect and confuse intelligence agencies, and attempt to gain enough time to complete their R&D goal without interference.

The Clash of Bureaucracies

The interaction between the proliferator and the government or agency seeking to prevent its activity, which for our purposes will be the United States, is therefore a contest between two enormous entities, both requiring coordination and both prone to occasional mistakes. The first is the government and network of entities and people that are required to fund, research, acquire, and build the capability to produce a nuclear weapon. The second is the combined resources of diplomatic corps, law enforcement, and intelligence agencies seeking to deter and disrupt the first.

For the reasons previously discussed, one might be inclined to bet on the proliferation preventers. But while numerous victories have been achieved against the spread of nuclear weapons, history nonetheless shows us that proliferating states are capable of surprising the world and achieving victories of their own. Referencing the Iraqi weapons program prior to the Gulf War, David Kay stated that it “should stand as a monument to the fallibility of on-site inspections and national intelligence when faced by a determined opponent” (1995, p.85). Similarly, Director of Central Intelligence George Tenet testified to the Senate Select Committee on Intelligence in March 2000 that the increasing sophistication of denial and deception employed by adversaries of the United States, to include states looking to acquire nuclear weapons, was the first among reasons that surprises were likely in the future (2000). Denial and

deception are the only means by which the proliferators can level the playing field against an adversary with the intelligence resources of the United States. It has been an integral part of every nuclear weapons R&D effort, and will continue to be so in the future.

Research Goals

This research has three primary goals, briefly described here and explored in-depth in subsequent chapters. The first is to build upon the literature of strategic deception to address long-term R&D efforts such as nuclear weapons development. Strategic deception refers to the manipulation of information and signatures aimed at influencing decision making at the highest levels of government (Shulsky, 2002, p.17). The deception used to protect a nuclear weapons program would certainly fall into that category, as the government of the proliferating state is attempting to achieve its foreign policy, security, and weapons goals without interference. This research will focus on the coordination required to conduct strategic deception to conceal a long-term R&D program and will show that this coordination is a necessary, and potentially observable, element of nuclear weapons programs.

Second, this dissertation will propose a framework through which the actions of a state across the spectrum of R&D can be evaluated to assess whether deception is present. The framework will take into account the distinctiveness of each country's development and will be generalizable to other long-term R&D efforts. It will be used to examine two historical cases of deception in non-nuclear R&D, German rearmament between the world wars and the Soviet biological weapons program, to generate hypotheses about what we can expect to see when nuclear R&D cases are examined.

The third and final goal of the research is to develop a hypothesis that addresses what we can say about a state's foreign policy and security goals based on the type of deception it employs. The nuclear weapons cases show that each country's goals influenced the nature and path of its nuclear weapons development, which in turn dictated the way in which it pursued deception. One hypothesis will propose that we can follow that logic in reverse. If so, it would enable analysts who identify deception to project how the state is developing its nuclear capability and what they mean to achieve, thus giving U.S. officials valuable insight for their dealings with the proliferating state.

Methodology

To meet these goals, this dissertation will seek to develop theory as to how deception is employed, what its goals are, and how it serves the greater interests of the proliferating state. Two research questions will define the effort.

First – *can we detect deception in long-term R&D efforts?* This research shows that when conditions exist which make denial insufficient to protect an R&D program, deception is necessary for the program to proceed. In the case of nuclear weapons R&D, these conditions are created by the NPT and other agreements, the IAEA and its verification efforts, and the vigilance of governments and intelligence agencies. The deception required to circumvent these conditions results in identifiable signatures that can be observed and correctly assessed as deception if analysis is conducted across the spectrum of the R&D effort. Most notably, the coordination that is required for such a complex deception plan results in signatures that may be observed.

Second – *what, if anything, does the deception itself tell us about the state's motives and means?* The NPT and the international norms that have evolved regarding proliferation ensure that the pursuit of nuclear weapons is a foreign policy decision of the highest order. Authorization to conduct even exploratory nuclear activity that goes beyond that permitted under the NPT is a decision that entails significant risks for a government. These risks – being made a pariah state, sanctions, targeted military action, or even regime change – are far too great for an effort such as this to be anything other than deliberate and calculated by the time the government is involved.¹ As noted previously, the motives for pursuing these weapons are varied and distinctive to each state. Those motives will influence not only how the weapons are pursued (and perhaps which type of weapons are pursued) but also how the deception is crafted and executed. Some states may try for total concealment of the program prior to a test, others may want there to be an understanding that a capability exists but confusion over how far the program has actually progressed. Analysis of these different types of deception yields insight into the state's foreign policy and security objectives that may confirm or challenge what U.S. policymakers already believe.

Grounded Theory

There is little analysis in the public domain that addresses these questions and seeks to achieve these goals. This research attempts to draw lessons from the close examination of historical cases, develop theory, and then apply that theory to additional cases to test its validity. There are therefore no formal hypotheses proposed at the beginning of the research process. Instead, hypotheses will be generated and evaluated using a “grounded theory” approach, where systematic collection and analysis of data were used to drive the discovery and provisional verification of theory (Strauss and Corbin, 1998, p.12).

¹ Scientific organizations, on the other hand, might pursue knowledge for its own sake and in several cases in this research did just that. But eventually in this process the government must give its approval, and this is the point at which I argue it must be a deliberate and calculated action.

In their work on grounded theory, Anselm Strauss and Juliet Corbin describe three types of data coding that permit the development, testing, and refinement of theory: open coding, axial coding, and selective coding (1990). The first type, open coding, involves organizing points of data into as many categories as necessary to capture the data's characteristics. For any new data point that does not meet the definition of a category, the definition is modified or a new category is created (Gray, 2004, p.612). Open coding collected on two non-nuclear long-term R&D efforts, as well as preliminary analysis on two nuclear cases, resulted in the identification of seven lines of effort. These lines of effort include diplomacy, human capital, and infrastructure and will be detailed as part of the proposed framework in Chapter 2.

Axial coding establishes linkages between categories of information in respective cases. The data from the non-nuclear cases revealed several common areas of deception through axial coding, including diplomatic deception, common actions that were concealed, and common types of coordination. These common areas formed the basis of development for hypotheses. Selective coding provides insight into these linkages and provided insight not only on the hypotheses, but also on the common and distinctive themes found between the non-nuclear and nuclear cases. Identification of these themes in future cases will give analysts reference points for considering whether a state that is suspected of conducting covert R&D may be conducting a certain type of deception, and vice versa.

Propositions

Grounded theory calls for the use of propositions to guide the research effort in the absence of initial hypotheses. In this approach, the researcher develops propositions from preliminary research and then validates these propositions as new information is received during the course of the study (Rokkan, 1966, pp.19-20). Research on the non-nuclear cases and an informal survey of nuclear weapons efforts resulted in three propositions.

- 1) Though the pursuit of nuclear weapons occurs in circumstances distinctive to each state, common areas of deception will be observed. These common elements will be identified through sorting in the framework detailed in Chapter 2. Examples include steps in the R&D process that cannot be concealed or that the state does not wish to be concealed, signatures that are indicative of a nuclear weapons program but can be controlled, and coordinating actions within the bureaucracy.
- 2) Deception in these cases can be achieved by introducing ambiguity into the deception target's analysis – unlike shorter-term deception where ambiguity may result in unwanted attention. This is a significant difference from much of the literature on deception – particularly that which is focused on military operations. This was seen in evidence that

many elements of the deception target's government were aware of the program, yet consensus did not exist in sufficient strength to bring about any preventative action.

- 3) Deception in long-term R&D must be coordinated to be consistent and effective. This does not mean the plan must be executed flawlessly, rather that the proliferating state must have a "party line" about its intentions and capabilities, it must be able to communicate that line through multiple channels to the target, and it must be flexible enough to adjust to unforeseen events (such as accidents or key personnel defecting).

The research validated each of these propositions and each will be highlighted throughout the discussion of the cases and analysis of the data.

The Case Study Approach

This dissertation examines six cases of long-term weapons R&D. One of these cases, Sweden, is an exemplar of a situation where little or no deception took place. The remaining five cases entailed significant deception plans, though with different desired end-states.

Two groups of cases served to facilitate formation, refining, or validation of hypotheses – hypothesis-generating and theory-confirming cases (Lijphart, 1971, p.691-692). The hypothesis-generating cases are cases about which a significant amount of information is available through published research, archives, or available experts. These cases provide sufficient data for the framework so that the open and axial coding can be conducted. There are two criteria for qualification as a hypothesis-generating case. First, the case must consist of a long-term R&D effort focused on weapons development or production and that effort must have involved deception as to its existence or extent. The second criterion was a subjective evaluation that sufficient research existed as to yield significant data. An informal survey of technological or policy surprises that fit these criteria identified two ideal cases.

- 1) *German rearmament in the 1920s and 1930s.* Before and following Hitler's ascendancy to the post of chancellor, the German government consistently sought to evade the arms limitation requirements imposed upon it by the Versailles Treaty. Mihalka and Whaley, among others, have produced insightful research as to how the deception employed by Germany was conducted and how it coincided with German foreign policy goals (1980; 1984). The deception in this case was multi-faceted and dual-sided. Prior to 1934 the German deception focused on convincing the Allied powers, particularly the British and French governments, that it was not producing arms and was abiding by the treaty limitations. Then the message suddenly changed and the German deception focused on convincing the British and French that Germany was stronger than it actually was.

- 2) *The Soviet biological weapons program after the Biological Weapons Convention (BWC)*. The Soviet agreement on the BWC in 1972 did not end this weapons program, but instead compelled Soviet authorities to heavily compartmentalize it. Several researchers and authors, including a former deputy head of the program, Ken Alibek, have revealed many aspects of the Soviet BW program and have detailed the tight restrictions on knowledge of the program even among the most senior Soviet officials. Nonetheless, close to 60,000 people were engaged at one time or another in a program that, to a large extent, remained largely hidden from U.S. intelligence agencies (Alibek and Handelman, 1999, p.43). This case also includes an example of an unforeseen event, the Sverdlovsk anthrax outbreak in 1979 that Soviet officials sought to conceal due to its connection to the weapons program.

The Universe of Cases

Cases of nuclear R&D confirmed (or infirmed) the hypotheses developed through the framework. The bounding of the theory-confirming cases was an important process, since cases needed to possess minimum criteria for inclusion while having sufficient variability in time, region, and relationship with the United States. Defining a state as having had a nuclear weapons R&D program, or even as having achieved a weapon, is more complicated than one might think. Previously, metrics such as “possessing significant quantities of fissile material” or “test/no-test” have been used to categorize a state as nuclear weapons capable or not (Hymans, 2010, p.161). But this is a flawed approach for the purposes of this research. North Korea’s 2006 test was less than a kiloton despite having significant quantities of material, and South Africa built a handful of nuclear weapons without ever conducting a test. Therefore, three specific criteria bound the theory-confirming cases.

- 1) A state must have *pursued* nuclear weapons. Sonali Singh and Christopher Way have defined “pursuit” such that one (and only one) of three conditions must have been met (2004, p.866). First, a cabinet-level decision must have been made within the government to develop a nuclear weapons capability. Second, the state acquires or develops “single-use” technology – which would only be useful for development of a nuclear device. Third, a state makes a move towards weaponization. Weaponization is defined as activities “from device design to component engineering to nonnuclear testing that together provide assurance that the nuclear explosive will perform as intended” (LANL, 2007, p.6). It should be noted that these are criteria for the inclusion of a state in this research, not criteria for whether a potential proliferator is of interest to an intelligence agency. Deception can be undertaken before these criteria are met. For example, it is often difficult to identify a point at which a cabinet-level decision was made regarding nuclear weapons development. It is conceivable that

preparatory work is undertaken before this point and that the elements within the state undertaking it are deceptive about their activity. This would certainly be of interest to an intelligence analyst despite the state's policymakers not having formally decided to acquire a device. But for the purposes of this study, evidence must be seen of one of these three conditions to warrant inclusion in the universe of cases.

- 2) There is evidence that in the state's consideration of the costs and benefits of a nuclear weapons program, a negative impact on relations with the United States was a factor. North Korea, for example, would not be in the universe of cases under this condition. This is primarily because it can be assumed the North Korean program is meant to counter the United States, and hence any U.S. concerns would carry little weight. India does satisfy this condition because its development was focused on China and Pakistan but there is evidence that Indian officials were concerned about possible preemptive U.S. strikes against their facilities.
- 3) Finally, the five nuclear weapons states under the NPT were excluded. Three of these states (the United States, Great Britain, and the Soviet Union) developed their weapons programs directly from the Manhattan Project and other work conducted during the war and did so in an era when the prevention of proliferation while permitting nuclear capability was not complex. The fourth state, France, developed nuclear weapons capability in close consultation with American scientists and practiced virtually no deception. The fifth state, the People's Republic of China, developed with Soviet assistance and even when that assistance was withdrawn made little secret of its continuing development. The policy of the United States on proliferation became clear with the rollout of the Atoms for Peace program and the beginning of NPT negotiations in the 1960s. After this point, it would be apparent to any potential proliferator that pursuit of nuclear weapons would have a detrimental effect on relations with the United States. Therefore, the early development programs are excluded because those states may not necessarily have considered U.S. opposition to their development a foregone conclusion.

Six states are known to fit these criteria. They are India, Iraq, Israel, Pakistan, South Africa, and Taiwan. Argentina, Australia, Brazil, Sweden, South Korea, Yugoslavia, and Switzerland all certainly explored nuclear weapons development, but no evidence was found that they satisfied one of the conditions to have *pursued* nuclear weapons.²

² The Islamic Republic of Iran was not considered for this research. If Iran is pursuing nuclear weapons development then the resources required for analysis of this type are not likely to be available for public examination.

Case Selection

The selection of suitable cases from those listed above involved several factors. The first was the availability of information. Each one of these programs was among the most sensitive secrets in their respective states. Several – India, Israel, and Pakistan – still exist. But for each, some amount of information has become available over time, whether through declassification of documents or statements by former officials. India, for example, has been forthcoming about some aspects of their weapons development program and deception measures that allowed them to conduct a test in May 1998 without U.S. interference. By contrast, the Israeli government maintains an official position of opacity about their nuclear weapons program and – though several scholars and journalists have researched the program extensively – there are few official U.S. or Israeli accounts upon which reliable information can be drawn.

The time period in which the development took place was also a consideration. The deception targeting the United States is the main analytical focus for each of these cases. Therefore, episodes that are too close together in time may be problematic for internal validity. An intelligence agency may be susceptible to deception for a period of time due to other priorities; an administration may be more easily deceived in these areas because its focus was on domestic issues. By selecting cases with key actions occurring in different time periods, the common deception measures were better evaluated for their effectiveness.

The final consideration was the state's relationship with the United States. In military deception, the deception target is almost always an adversary. In the cases presented in this dissertation, the relationship, and hence the deception, is more nuanced. Some potential cases, such as Taiwan, are states with strong alliances with the United States and expectations for U.S. assistance in the event of conflict. Others, such as South Africa, had strained relationships with the United States and uncertainty as to whether they could rely on Washington's help in the event of a crisis. These differences would likely have significant impact at least in the diplomatic line of effort, hence cases with different types of relationships were chosen. Figure 1-1 shows an evaluation of the various criteria used for case selection. This selection consists of three cases: India, Iraq, and South Africa.

	Primary factors (suitability for research)			secondary factors (variance in research)		
	Official Info Available	Outside Info Available	Evidence of “pursuit”	Relevant Time Period	Relationship with US	Threat Perception
Criteria	Acknowledged (A)/Not ack but discussed (NA)/Secret (S)	Includes academic, think tank, etc.	Singh and Way definition of “pursuit” plus military control of program	Period reflects efforts for indigenous development only	Dependent / Allied / Strong / Strained / Adversarial	Global threats / regional / specific
India	A – Govt officials have spoken about the 1998 tests, less about previous efforts	NPIHP; NTI; significant research on capabilities and development	Acquired	1954-Present	Strong	Specific – China/Pakistan
Iraq	A – Govts have released materials, mostly focus on post-1991	NTI; ISG report detailing D&D; defectors	Saddam directed weapons development	1981-2003	Adversarial	Regional (and US)
Israel	NA – French assistance early; early US intel documents	Limited research; NPIHP; NTI	Presumed acquired	1949 – Present	Dependent	Regional
Pakistan	A – Govt admission of possession, but no elaboration	NTI; NPIHP; research based on conflict with India and stability concerns	Acquired	1972 – Present	Strained	Specific – India
South Africa	A – Govt admitted following dismantlement	NTI; NPIHP collaboration with Monash; significant scholarship	Acquired	1969-1993	Strained	Regional; Specific (supporting forces)
Taiwan	A – Officials acknowledged “program” but no other info	NTI; some scholarship due to distinctive legal status with NPT, etc.	Clear some efforts conducted. No conclusive evidence of actual decision.	1967-1977; 1987-1988	Dependent	Specific - China

Table 1-1 Case Selection Matrix

India (1974-1998)

India's nuclear weapons program was not only a statement on national pride and the discriminatory nature of nonproliferation controls, but also a reaction to Indian perceptions of a dangerous security situation and a reluctance to ally with either of the superpowers. India had skilled researchers studying topics related to nuclear weapons development prior to independence and state-funded research institutions soon after. But it was India's defeat in a border conflict with China in 1962 and the Chinese nuclear weapons test in 1964 that increased Indian interest in building a nuclear bomb (Ganguly, 1999, p.152). India stayed outside the NPT, claiming that the treaty was intended to perpetuate the power of the West and Soviet Union over the developing world. In 1974, India conducted its "peaceful nuclear explosion" (PNE), but any move towards nuclear weapons remained opaque until the mid-1990s. On several occasions starting in 1995, U.S. analysts detected nuclear test preparations in India and the U.S. government strongly protested to New Delhi, which cancelled the tests each time. However, in May 1998 a test was conducted that was a complete surprise to U.S. intelligence agencies and was the product of extensive deception on the part of India.

India certainly fulfills the requirement of pursuit of nuclear weapons by virtue of having conducted a successful government-ordered test of several devices. As for the second criteria, India considered China and Pakistan its primary security concerns. But it is clear that India was concerned about U.S. reaction to its nuclear activities based on its agreement to cancel tests in 1995 over U.S. objections. Even before the initial round of proposed tests, Indian officials expressed concern in internal debates that the United States would impose sanctions and lobby against the release of funds by the World Bank for development projects if the Indian program proceeded (Chengappa, 2000, p.392). Thus the United States was clearly a primary target of the Indian deception.

Indian nuclear weapons R&D occurred throughout the 1970s, 1980s, and 1990s but it came to the forefront of Indian political debate and security policy after the end of the Cold War. It may have been spurred by the aggressive advocacy of the United States to extend the NPT indefinitely, which was done in 1995. In any case, the Indian program entered its final stages before testing as the United States dealt with the aftermath of the end of the Cold War and a new global security environment. The relationship between India and the United States was cordial, though India was passionate about its non-alignment and its belief that "colonial states" had exercised too much power over too much of the world for far too long.

While much of the scholarship and research on the Indian nuclear weapons program centers on the 1998 tests, it was in fact a decades-long program that managed to maintain opacity up

until a newly-elected government chose to conduct a test and announce India's capability to the world. The Indian program conducted by highly trained scientists in well-funded facilities that were free from the interference of IAEA inspections and it largely excluded the Indian military until just before the 1998 test. The effort was secretive and relied on denial, until U.S. satellite imagery that exposed the 1995 and 1996 attempted tests forced the Indians to be deceptive as to their intentions.

Iraq (1974-1995)

The Iraqi nuclear weapons program is perhaps best known for what it wasn't doing – actively pursuing nuclear weapons prior to the 2003 U.S. invasion. It is thought of today as an evil plan by a brutal dictator, but Iraqi nuclear research and its steps towards weapons capability predate Saddam Hussein's rule and span multiple U.S. administrations and multiple phases of the U.S.-Iraqi relationship. The Iraqi R&D effort is an example of one that starts with scientific strides in the direction of a nuclear weapon without explicit government support. Iraq received its first research reactor from the Soviet Union in 1965 and signed the NPT several years later. However, many analysts believe that Iraq began to consider nuclear weapons as early as 1971 in response to Israeli development (Reiter, 2005, p.357). Iraqi R&D proceeded in secret but included the acquisition of a French materials test reactor, called Osiraq, in the mid-1970s. When Israel bombed and destroyed Osiraq in June 1981, Saddam Hussein ordered the nuclear weapons program reorganized and more deceptive measures began to be taken to protect Iraqi efforts. The deception continued even after agreements ending the 1991 Gulf War stipulated that the UN be granted access to all relevant Iraqi nuclear facilities. For the purposes of this research, the case ends in 1995 when Iraq admitted to enrichment research following the defection of Hussein Kamal.

Iraq is a case of a state that is “under the microscope” throughout much of its program but still attempting deception to conceal its efforts. In many ways, it was successful in these efforts though it is debatable how close the program got to achieving the desired weapon. Certainly, the program fits the conditions for pursuit of a nuclear weapon, since it is known that at least by December 1979 Saddam had given orders for the program to construct a device, if not earlier (Hamza and Stein, 2000, p.116). While Iraq was mainly concerned with the United Nations and Israel taking actions to stop their program, there is no doubt that they were concerned about the United States as well. Iraqi scientists traveled to the United States to buy components and seek information for the program, but were always given cover identities and background stories to evade scrutiny by U.S. customs officials.

The Iraqi case took place over twenty years when there was often broader defense cooperation with the United States, especially in the fight against Iran, but wariness of U.S. ties to Israel. The case provides an example of a state that was extraordinarily proficient in deception and, due

to having few natural and industrial resources, was forced to conceal a significant amount of foreign activity and experimentation in its pursuit of a nuclear weapon.

South Africa (1970-1993)

South Africa provides an example of a highly industrialized and well-resourced nuclear power sector that was partially converted to a nuclear weapons program. It is also a “cradle to grave” program, having been initiated and then completely dismantled by the South African government without outside interference. As a result, much of the documentation was destroyed but former government and program officials remain free and able to discuss their roles in the program and its broad timeline.

South African officials perceived significant and possibly existential threats from newly-independent regional states, their Soviet and Cuban backers, and leftist insurgent groups within their own territory. The Western security support that Pretoria desired was frequently in doubt due to objections over apartheid. South African officials particularly worried about support from the U.S. administration, which had initially supported action against Angolan and Cuban troops in the early 1980s but had then backed out under Congressional pressure. The belief that the United States could not be trusted to help Pretoria in the event of an existential crisis, and the mediocre performance of the South African Defence Forces fighting leftist groups, perhaps caused the government to turn to the nuclear option.

South Africa had enormous natural deposits of uranium and by the late 1960s had developed an indigenous method of enrichment. It refused to sign the NPT in order to prevent this method from being exposed to international inspections, and thus was able to build facilities covertly without interference from the IAEA. The program built an enrichment facility and secretly developed a weapon design, but in 1977 the discovery of test preparations and the resulting international outcry forced the South Africans to abandon the test. The resulting isolation and UN-enforced arms embargo did not deter their pursuit of nuclear weapons, but convinced them to be deceptive in their progress and intentions.

South Africa managed to produce six or seven nuclear devices and hence satisfies the requirement for pursuit of nuclear weapons. Additionally, it was not only chiefly concerned with the United States inhibiting the program but, as the discussion in Chapter 6 will show, one of the primary motivating factors for acquiring the weapons was uncertainty over U.S. policy in the region.. The program existed throughout the strongly anti-apartheid Carter Administration and the strongly anti-communist Reagan Administration and managed to keep the true motives and intentions of the South African government concealed from U.S. officials throughout that time.

Sweden – The Dog that didn't Bark (or Deceive)

One case included in this dissertation does not meet the criteria for case selection. Immediately following World War II, Sweden embarked on an effort to build a nuclear weapons capability, believing that the weapons would soon be in the arsenals of most advanced countries (Cole, 1994, p.7). In the 1940s and 1950s, Swedish scientists conducted preliminary research and facilities were constructed. Throughout this time, Swedish officials engaged their U.S. counterparts on issues surrounding the acquisition of these weapons, wanting to maintain their neutrality but also believing that their primary security threat came from the Soviet Union. As the NPT was debated and it became clear that norms were developing against the possession of nuclear weapons, Swedish officials abandoned the program and became enthusiastic supporters of nonproliferation efforts.

This case is highlighted in Chapter 7 and discussed in detail in Appendix C. It is one of the few cases of nuclear R&D where almost no deception was conducted. The Swedish program existed before the NPT and its safeguards were implemented, and Swedish officials were motivated by a desire for nuclear protection – whether from their own weapons or American ones – more than any national pride or independence-driven motivations. Therefore, while the program was certainly secret, Swedish officials did not manipulate information to confuse or mislead their U.S. counterparts. This case will be applied to the framework as an example of how states without deceptive measures may look when data is collected.

Analysis

The analysis conducted on the data is in the form of a cross-case synthesis. Specifically, the results of the research and sorting of data into the deception chart are examined to determine whether there was replication. There are two identified possibilities for this replication. First, common areas of deception may be identified. For example, every case may be found to have “concealed fact” over the possession of special nuclear material (direct replication). Second, differences in the cases will be examined to determine whether a deciding factor can be identified (theoretical replication). For example, in a case where the state has a poor relationship with the United States and low technological capability we may find that the state “reveals fiction” with regards to human capital. In other words, it invents cover stories for what its scientists are studying or why they are attending certain conferences or making certain inquiries. A state with a more friendly relationship with Washington and a more robust nuclear sector may not put effort into such a deception because the presence of that state’s scientists at various conventions may not pique the interest of the U.S. intelligence community. The results of this analysis will be detailed in Chapter 7.

Outline of the Dissertation

This dissertation presents a background on denial and deception, including a review of the relevant literature, as well as the framework that was developed for analysis of the cases. These are presented in Chapter 2. The hypothesis-building cases are then presented in the context of the framework and three hypotheses proposed. Those hypotheses are then tested by examination of the Indian, Iraqi, and South African cases in Chapters 4 through 6, followed by a presentation of the common and distinctive themes identified throughout the cases. A fourth hypothesis is then proposed that addresses what the different types of deception may tell policymakers and analysts about a proliferating state's foreign policy and security goals.

2. Long-Term Deception and a Framework for Analysis

The intelligence capabilities of the United States are among the most, if not the most, advanced in the world. As discussed in Chapter 1, multiple U.S. government agencies and subordinate organizations are engaged in the effort to prevent the spread of nuclear weapons and they are able to utilize the global reach of U.S. intelligence resources such as human assets, satellite imagery, and signals intercepts to provide the information they require from any part of the world. But as one analyst has noted, “one may conclude that the greatest test of intelligence systems is distorted light, not darkness” (Harris, 1970, p.20).

Desire for a greater understanding of deception on the part of states that might be engaged in nuclear weapons development has been acknowledged by some, but the efficacy of efforts to produce such knowledge is in doubt. In the 2005 report of the Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction, better known as the Robb-Silberman Report, the commission recommended “greater use of the analytical techniques that identify the impact of denial and the potential for deception. Analysts must understand and evaluate the effects of false, misleading, or even true information that intelligence targets may have injected into the collection stream to deceive the United States” (Robb and Silberman, 2005, p.410). But despite the formulation of numerous techniques to identify and mitigate D&D measures, skeptics remain unconvinced that analysts can use these techniques to see the next problem. One of the foremost scholars on deception, Michael I. Handel, sought to develop a theory of how one state manipulates information to surprise another but noted any such theory is “an excellent example of a theory that possesses strong explanatory power, but which forms a weak basis for prediction” (1977, p.462). It is the goal of this dissertation to add predictive power to this effort.

This chapter discusses the actions taken by proliferating states that seek to manipulate the observable signatures of their R&D program. It will cover relevant points about D&D concepts and will then discuss the actions and elements of strategic-level deception. Those actions and elements will be modified and built upon to define a new form of deception – long-term deception – that better describes the deception employed to protect nuclear weapons R&D programs. The chapter will conclude with the presentation of a framework by which analysts can assess whether they are seeing long-term D&D measures.

Denial and deception are often grouped together, but the two are distinct concepts. Though denial is an integral part of any deception scheme, each requires separate actions and has different intended effects. In the case of nuclear weapons development efforts, D&D requires

the meticulous shielding and masking of numerous signatures that are inevitably produced by such a wide-ranging and complex R&D program.

Denial

Denial is the concealing of fact from a target. The target of the denial may be an individual, agency, or government of a state that may seek to interfere with or stop one's plans. More specifically, denial is "activities and programs designed to eliminate, impair, degrade, or neutralize the effectiveness of intelligence...by depriving it of information it requires for a more complete and accurate understanding" (Bruce and Bennett, 2014, p.198). It has also been labeled as dissimulation, "those measures designed to hinder or deny the enemy the knowledge of an object, by hiding or disrupting the means of observation" (Bennett and Waltz, 2007, p.5). When studied in cases of weapons R&D, it is a category of actions that ranges from ingenious concealment of facilities to relatively simple program security.

The practice of denial is a familiar one to many who have been involved in government work. Security clearances, restricted areas on military installations, and compartmentalized programs are all examples of the denial of information to an adversary. In the early days of U.S. nuclear development, denial was conducted in large part by the location of facilities. An individual without proper authorization would have found it extremely difficult to approach Los Alamos, New Mexico in early 1944. With no airborne or space assets available, another state's only ability to see through the U.S. denial measures was to have a human asset with access to the denied information who was willing to provide it.

Effective denial of information is an integral part of deception because it limits the channels through which information is passed between the deceiver and the deception target. The more successful denial is, the more the target can be influenced through the remaining channels (Shulsky, 2002, p.20). In fact, without the ability to control key information, the deception cannot be conducted. For example, a state might practice denial with regards to a nuclear facility by building it in a remote location, refusing to allow visitors, and having strict security requirements for workers, as the United States did with Los Alamos and other Manhattan Project facilities. In the current era, if no information channels exist from the target to anyone who works in or who has visited the facility, the target may need to rely only on satellite imagery to determine the purpose and specifics of the facility. If the deceiver has confidence that all other information is denied, then manipulating signatures to make the facility appear the desired way to a satellite may make for effective deception – which is much simpler than issuing cover stories to workers, etc. Thus, while an effort in its own right, denial of information to the target is a critical part of a deception plan.

Deception

If denial is the withholding of information so the target cannot draw a conclusion, deception is the manipulation of information to supply an incorrect one. Bennett and Waltz define deception as “[t]hose measures designed to mislead the enemy by manipulation, distortion, or falsification of evidence to induce him to react in a manner prejudicial to his interests” (2007, p.5).

Numerous examples of deception operations exist, particularly in military operations. Well-studied deceptions include the Japanese masking of fleet movements prior to Pearl Harbor and the Allied effort to convince the German High Command that the real D-Day landings would take place at Pas de Calais (Wohlstetter, 1962; Whaley, 2007, pp.375-383). Both of these deception operations were successful, but they were military operations with finite time spans and were targeted to specific command and intelligence staffs. An R&D effort spanning years and possibly involving thousands of people requires a deception that can be sustained for a longer period over multiple lines of effort while being targeted to any policymaker, agency, or analyst that is paying attention at any particular time. Detection of such an effort will likely not come from “smoking gun” evidence, but rather from what former Iraq inspector David Kay argues is “evidence of motivations and intentions or an unease about an overall pattern of activity rather than any specific, observable deception” (1995, p.102).

Deception is certainly not a one-size-fits-all concept. The deception conducted before an infantry unit attacks a position, before a fleet leaves port for an operation, and to protect a nuclear weapons program have similar and very different characteristics. Students of military deception (MILDEC) are taught that poorly executed deception can pique an adversary’s interest and draw unwanted attention to an operation. It is this approach that Barton Whaley is referring to when he states that the goal of deception is to make the enemy “quite certain, very decisive, and wrong” (2007a, p.71). But is such an outlook realistic for a deception as lengthy and complex as one protecting a R&D program?

Donald C. Daniel and Katherine L. Herbig suggest that deception can be categorized into two different groups – ambiguity and misdirection, or A-type and M-type (1982, pp.5-6). A-type deception, which they refer to as the “less elegant” variety, confuses the target; whereas M-type deception “reduces ambiguity by building up the attractiveness of one wrong alternative.” Though MILDEC specialists would likely strive to avoid A-type deception, Daniel and Herbig argue that one of these approaches is not subordinate to the other, but rather that each is appropriate in different circumstances. Which one is most appropriate for our purposes? The answer is that at different times during long-term deception, both A-type and M-type are required.

When we consider long-term R&D programs, the deceiver's objective is often for the target to do nothing. In other words, "freezing" the adversary's response is often a favorable outcome for the deceiver (Sherwin, 1982, p.90). This is especially true when it comes to the "clash of bureaucracies." Fooling every analyst or every agency may not be possible, but setting conditions where the bureaucracy takes no action is an approach that we will see taken in all of the cases examined in this research. Freezing does not necessarily favor one of Daniel's and Herbig's deception approaches over the other. The Allied deception operations in support of the Normandy invasion in 1944 utilized misdirection in an attempt to keep German reinforcements from engaging in Normandy. Allied planners wanted German commanders (particularly Hitler) to be convinced the real invasion was in Calais and not move the Fifteenth Army despite the Allied landings. This is an example of M-type freezing.

In the Normandy case, Allied planners were well aware that the final decision on allocation of reserve units rested with Hitler, who was well-known to favor his own counsel. One part of the deception played on Hitler's admiration for Andrew Thorne, the British military attaché in Berlin from 1932-1935. Hitler believed that Thorne's experience and strategic acumen were unparalleled in the British Army – a view not necessarily shared in London. Thorne was made commander-in-chief of all British troops in Scotland in 1943. Hitler took this to mean an invasion of Norway was to be staged from there due to Thorne's appointment, which in Hitler's mind had no other explanation. He therefore kept 300,000 German troops in Norway uselessly for the remainder of the war (Foot, 2002, p.96). In this case, the deception was likely to be successful if one man was misled.

But when the goal is to influence a bureaucracy, or an elected government, it is unlikely everyone will be misled. Most senior decision makers do not have Hitler's political immunity or total control of national policy. The U.S. president, though commander-in-chief and perhaps having opinions about what another state intends to do, can face substantial pressure if other national leaders, the military, and the intelligence community disagree with his or her assessment. For the deceiver that is targeting the United States to protect a R&D effort, the bureaucracy must, at the very least, be frozen by the deception plan. In these cases it is more likely that A-type deception will be appropriate and, given the tendencies of bureaucracies to move slowly, freezing is often a very attainable goal. This bureaucratic freezing should be considered the default goal of these deception efforts, rather than the "gold standard" of belief in the deception and total concealment of the program (Kay, 1995, p.101).

This is evident in one nuclear case included in this study. In the weeks prior to the Gulf War in 1991 the issue of a possible Iraqi nuclear weapons program was part of the larger U.S. debate over going to war. The Iraqi deception efforts appear to have been effective and left the U.S. intelligence community unable to say convincingly how close the Iraqis were to a weapon. This

“vacuum of information” was noted by Washington reporters at the time as being responsible for contradictory claims from various officials. President George H.W. Bush and his aides were making claims that Iraq may be less than a year away from a weapon. Others, notably Senator Edward Kennedy of Massachusetts, claimed the realistic estimate was closer to 5-10 years away (Wines, 1990). Both views had credible evidence to support them. In this case, the defense and intelligence bureaucracies had been frozen by the Iraqi deception, leaving senior decision makers to rest on their own perceptions in evaluating the potential of an Iraqi nuclear weapons program.

Introducing this paralysis to a bureaucracy is especially effective when arms control agreements or international norms are being violated. History, and the cases used for this research, shows that political will is often lacking when it comes to sanctioning violations of multilateral regimes (Godson and Wirtz, 2000, p.431). States have often worked on and invested in an arms control regime to the point where they are unwilling to admit it was violated. This was true in several cases in this study – the Inter-Allied Control Commission that monitored German compliance with the Versailles Treaty, international experts that debated whether the Soviet Union was violating the BWC in 1979, and IAEA inspectors suspicious of Iraqi activity in the late 1980s. In each of these instances, some officials were reluctant or unwilling to admit treaty violations despite the evidence. It will be apparent as the cases are presented that states pursuing nuclear weapons, though at times engaging in misdirection, will consistently seek to introduce ambiguity into the bureaucracy of the deception target, rendering interference with the R&D program – whether military action or sanctions – unlikely.

In many ways, this deception is fundamentally different than that employed by a tactical unit for an immediate effect. The stakes are certainly higher for this deception and it will involve more people and more organizations. In the next section, we will examine this strategic-level deception.

Strategic Deception

Despite its utility, ambiguity in the bureaucracy is not the deceiver’s ultimate goal. It does not automatically translate into a policy of inaction on the part of the deception target. For that, the policymakers within the target’s bureaucracy must be either misled or “frozen.” Strategic deception is defined as that deception that “aims to manipulate elite perceptions in order to gain competitive advantage” (Heuer, 1981, p.294). It is practiced against the most senior levels of government and attempts to influence national level decision making. This effort involves the construction of a coherent story across the entire enterprise of government and, in the case of long-term R&D, industry. It is uncommon perhaps because it must only pertain to issues that a senior decision maker would deal with personally (Godson and Wirtz, 2000, p.425). Despite its

rarity, it is precisely because it involves issues of such importance that strategic deception is worthy of study to mitigate its effects.

Strategic deception is not without its skeptics. The Prussian military theorist Carl von Clausewitz argues in *On War* that the concepts of surprise and deception were tactical in nature and that strategic surprise does not work as it “approaches the higher levels of policy” (see Whaley, 2007a, p.71). His reasoning is that bureaucracies were just too unwieldy to coordinate on such an issue, and that inevitably information would leak that would reveal and ruin the surprise. But after conducting extensive research on historical case studies of deception, Whaley is more optimistic. He acknowledges the complex nature of the military and government bureaucracies and the impact of that complexity on deception, but he argues that deception can be built upon the inevitable disclosures of information by the bureaucracy (2007a, p.71). Further, if the deception builds upon the target’s preconceived notions or biases, some inadvertent disclosure of factual information by the deceiver’s bureaucracy will not be sufficient to change the target’s beliefs. The case research for this dissertation shows that Whaley is correct in his assertion that large, unwieldy bureaucracies can still perpetrate effective deception under the right circumstances and with proper coordination.

The Deception Target

The right circumstances are often brought about by the deception target itself. For the purposes of this research, the target was the United States in every case but one.³ Certainly, other states and organizations are targets of deception but focusing on the United States has several benefits. First, the United States is a leader in the nonproliferation effort with global military reach and significant diplomatic pull. Every state that has embarked on a nuclear weapons development program has done so with United States policy as a significant factor – whether the United States was a potential target for the weapons, an ally that might be lost if the program was discovered, or a country that may resort to sanctions and military strikes to prevent the acquisition of weapons. Second, the U.S. government and intelligence community represent a single-nationality bureaucracy that interacts on many issues at any given time, unlike an organization such as the IAEA that is multi-national and is focused on only a few issues. It is therefore more informative to study how the U.S. system is evaluated by others, how signatures it will see can be predicted and manipulated, and how that manipulation can affect the process by which U.S. officials set policy.

³ The exception is the case of German rearmament between the world wars. In that case, the British government was the deception target for purposes of this research.

The Target's Vulnerabilities

All states, and their bureaucracies, are vulnerable to deception to some extent. But what are the traits and circumstances that make a bureaucracy and its leadership vulnerable? Researchers, former officials, and practitioners of deception have offered numerous explanations for these vulnerabilities, which can be grouped into several categories.

The Difficulty of Changing Minds

It can be extremely difficult to change either the opinions of individuals within an organization or the collective group's opinion, especially when such a change would constitute upheaval or dramatic changes in the status quo. Handel has noted that consistently throughout history, the victims of surprise attacks have been those that were benefitting from and comfortable with the status quo (1977, p.472). When the Inter-Allied Control Commission, the group charged with monitoring German compliance with the Versailles Treaty, closed down in January 1927 it issued a scathing final report that stated "Germany had never disarmed, had never had the intention of disarming, and for seven years had done everything in her power to deceive and 'counter-control' the Commission appointed to control her disarmament" (Whaley, 2002, p.57). But that report was ignored by the Allied governments, which continued to debate the extent and significance of German rearmament right up until the invasion of Poland in 1939. One possible explanation is that any action to detect, disrupt, and end German rearmament was going to result in a reoccupation of German territory – an action few of the Allies, particularly Britain, was eager to consider. In her work on self-deception, Roberta Wohlstetter argued that British estimates of German aircraft numbers were consistently lower than reality in part because raising the estimate would have demanded a politically impossible course of action – hence the estimates were tailored to the government's reality (1979, p.56).

One can also struggle to change opinions when that effort goes against centers of gravity within an organization. Every bureaucracy has individuals or sub-groups that dominate its thinking – whether through actual policy or soft power – and convincing them to change their stance on an issue, or convincing others to break with their hierarchy, can be a near impossible task. The previously mentioned Allied effort to "freeze" German leaders prior to the Normandy invasion is an example of this. Though Hitler was fooled, and hence much of the German leadership structure was fooled, not all were. Field Marshal Erwin Rommel, considered one of the best strategic minds in Germany, was not convinced the Allies would land at Pas de Calais. One reason for his skepticism was that he noticed German reconnaissance flights were able fly over areas of England where troops were logically massing for an invasion at Calais, but German planes were completely unable to penetrate British airspace anywhere else. Despite believing that this was indicative of an Allied deception effort, he was unable to convince others to go against the prevailing opinions of Hitler (Bacon, 1998, p.10).

Hitler was known to be an extremely irrational strategic thinker and his personal control over Germany's war effort, including the decision not to reinforce Normandy after the Allied landings, worked to the Allies' benefit. But even rational and well-intentioned officials can have a similar impact on the bureaucracy that is supposed to be supporting them, perhaps more so in an age of instantly accessible information. Senior officials, especially those with extensive experience in a policy area or world region, have been known to place more faith in their own observations than in contradictory information that is brought to them from outside sources – even if it is compelling and voluminous (Godson and Wirtz, 2000, p.433). This tendency is only magnified in the information age. Richard Betts notes that many officials are overconfident in their ability to draw conclusions from raw data and that “underlies their fascination with current intelligence and their impatience with the reflective ‘interpretations’ of finished intelligence” (1978, p.68). Today, with more formal and informal sources of information at their fingertips, policy makers may be even more prone to believing they can make the best sense out of “facts.” Any reluctance to rely on finished intelligence may have significant impact on the assessment of nuclear weapons R&D, since we will see in the case studies that analysis of such programs will often rely on synthesizing information from various parts of the R&D enterprise.

Finally, senior officials are often operating with priorities in their agenda that they do not want interrupted – hence they may be prone to dismissing or downplaying anything that does not conform to that agenda. Wohlstetter's work on hindsight and foresight includes two excellent examples of this. The first is the Kennedy Administration's reluctance to see the Soviet Union as belligerent or aggressive in its policies due to a desire for de-escalation of the Cold War and the achievement of a test-ban agreement. They were therefore surprised on several occasions by aggressive Soviet actions. The second was the reluctance of Roosevelt and his advisors to recognize the threat of war in Asia in 1941, because they were so focused on Europe and did not want a war on two fronts (1965, p.699).

Biases

Senior officials are susceptible to the universally human fault of bias. This may manifest itself in a tendency to believe one source of information or one agency over another. It may result in an official favoring graphic evidence of imagery over the reports of human sources or synthesized intelligence products. Biases may also result in an official, or an entire bureaucracy, underestimating another state or group that they believe is incapable of accomplishing an objective, conducting an operation, or pursuing a technological goal.

The existence of these biases is among the most important pieces of information for a potential deceiver because they reveal a significant vulnerability. Recalling the previous discussion on the difficulty of changing people's opinions, it is easier for the deceiver to confirm the target's already-existing belief as part of the deception than it is to convince the target of

something new (Shulsky, 2002, p.30). Bennett and Waltz present three general forms of bias that are significant for intelligence analysts: cultural and personal biases, organizational biases, and cognitive biases (2007, p.71). Cognitive biases in particular have been the subject of significant research. Most notably, Richards Heuer categorized and explored the various types of these biases in his article on the cognitive process approach to strategic deception and counterdeception (1981). It is not possible to comprehensively cover the treatment of bias in these, and other, sources. What is important for this study is that an understanding of the target's biases presents the deceiver with fertile ground to develop and execute deception.

The opening of a conflict between Egypt and Israel is illustrative of deception that relies on bias. In the days leading up to the 1973 war in the Middle East, the Egyptians moved troops around their eastern frontier frequently while not actually undertaking any operations. The effect was to give the impression of an army that was disorganized and daily receiving contradictory orders for deployment. This supported pre-existing Western and Israeli views that Arab troops and their commanders were disorganized and often incompetent. The Israelis based their conflict scenarios on a 48-hour call-up for their reserve forces because they did not believe the Egyptians would be able to cross the Suez Canal in anything short of that time. The opening moves of the October 1973 war involved a very well-coordinated Egyptian attack across the Suez and would show Israeli leaders they had significantly underestimated their adversary (Amos, 1982, p.324).

The Cost of Responding

The third type of vulnerability on the part of the deception target is an issue related to overcoming policy and bureaucratic inertia, which is that responding to new information might be costly. From the 1973 example, the Egyptian military maneuvers communicated lack of coordination and confusion, but some did compel Israel to call up reserves and respond. The last episode of this prior to hostilities breaking out cost the Israeli government \$10 million U.S. dollars upfront just to have the required reserves called to active duty, in addition to the more hidden cost to the economy of workers missing days, etc. This created a reluctance within the Israeli government to act when they saw military activity on the Egyptian side (Amos, 1982, p.323). When considering potential nuclear weapons programs, this economic reality may be apparent in a reluctance to impose sanctions. Discovery of a nuclear weapons program often means suspension of trade and other lucrative activities with the potential offender. The desire to avoid such an impact may create vulnerability for the deceiver to exploit.

The Target's Advantage

At this point, one might be pessimistic about the chances for any state in the world to successfully mitigate deception in its dealings with other states. After all, the vulnerabilities discussed in the previous section are present in most major national systems and government

structures. But the target of the deception has two exploitable advantages. The first is a basic principle that the deception cannot be perfect. Whether the deceiver is presenting a replica, concealing information, or trying to divert attention to something else, the effort will never be flawless and hence detection is possible (Whaley and Busby, 2002, p.191). The examples already discussed show this. Rommel did detect something suspicious about Allied air defense against reconnaissance; the Egyptian Army did undertake activity – one result of which was to move equipment closer to the Suez Canal; the Japanese in 1941 and the Soviets in 1962 did undertake activity that indicated they were preparing to move against U.S. interests. This dynamic is present in the cases discussed in later chapters as well. Even as the deceiver manipulates the information that the target is seeing, it is also presenting the information required to correctly assess the situation.

The second advantage held by the deception target, particularly in cases of R&D, is that many efforts are so large that deception cannot possibly be comprehensive. This is evident in the nuclear cases selected for this study, and has been observed in studies of intelligence analysis relating to other R&D programs as well. An assessment of CIA analysis conducted during the Cold War concluded that despite hundreds of weapons programs pursued by the Soviet Union – missiles, submarines, bombers, air defense, and others – almost all were identified and assessed for how they would increase Soviet capabilities (Kerr and Warner, 2014, p.41). Even the Soviet Union, a closed society that tightly controlled defense information, could not avoid revealing enough about large defense R&D efforts to escape at least some assessment by U.S. intelligence analysts. In the case of nuclear R&D programs it is clear, primarily through declassified National Intelligence Estimates, that U.S. analysts had general awareness each of the efforts to be studied. These estimates show U.S. knowledge of India's potential to construct a nuclear weapon within a short timeframe, of Saddam Hussein's desire to show strength through acquisition of a weapon, and of South Africa's capacity to produce fissile material (CIA, 1983; 1984; 1988). More insight would likely be gained by examination of still-classified documents, but it can definitively be said that while long-term deception led to key conclusions about these programs that were incorrect, none of the programs was completely protected.

U.S. Vulnerabilities

The United States is certainly susceptible to the vulnerabilities previously discussed. In fact the U.S. government, to include its policy bureaucracy and intelligence community, has specific vulnerabilities that other states may not face. These will be significant to note when considering U.S. actions and responses in the forthcoming case studies.

First, the United States is more globally engaged than any other nation, and a significant part of this engagement is working with partners and close allies throughout the world. This engagement takes the form of mutual defense agreements, joint international military exercises,

information sharing agreements, and other mutually beneficial interactions between U.S. officials and their government, military, and intelligence counterparts. Due to these interactions, many countries and individuals around the world develop a familiarity with U.S. processes and organizational dynamics. A deceiver with knowledge of the target's organization, perceptions, ways of moving information, and procedures for resolving disagreements would have a considerable advantage in crafting a deception plan (Sherwin, 1982, p.155; Gerwehr, 2006, p.56). This insight has not been limited to long-term U.S. allies only. In two of the three nuclear cases for this research – Iraq and South Africa – the developing state benefitted from knowledge about U.S. capabilities gained before relations soured. It is logical to conclude that due to its high level of international engagements, the United States has a higher vulnerability for deception.

Second, and similar to the first point, the United States is widely examined for how it conducts its diplomatic, military, and intelligence affairs. Unauthorized disclosures, inadvertent releases of information, and even legally released information has given the public, and potential deceivers, insight into U.S. capabilities and internal government processes (Godson and Wirtz, 2000, p.432). This has only been amplified by the growth of electronic archives, search engines, and means of instant dissemination and has become, in the opinions of many intelligence practitioners, the biggest threat to the performance of U.S. intelligence agencies (Bruce, 2000, p.39). These disclosures have an effect similar to that of the international engagements, only perhaps more potent because the information is readily available to governments with which the United States would not choose to cooperate.

Besides the information gained by other countries, the active U.S. role in global affairs makes it likely that U.S. officials will face high costs (economic or other) for policy responses to deception, as discussed in the previous section. This is evident in one case used in this study. Iraqi nuclear weapons development was long-suspected by U.S. officials, who certainly knew that Saddam Hussein would acquire a nuclear weapon if he was able. However, the role of Iraq as a counter to both Iranian and Syrian influence in the Middle East was an important one for U.S. policy in the 1980s. Any move by the United States to sanction or strike Iraq in order to inhibit a nuclear weapons program would have significantly complicated U.S. policy in the region (Deutch, 1992, p.128). While there is little evidence that U.S. officials intentionally turned a blind eye towards Iraqi nuclear R&D efforts, it is noteworthy that those officials would not have been pleased to receive incontrovertible proof that Iraq was pursuing a nuclear weapon.

The final potential American vulnerability, and perhaps the one most difficult to articulate, is cultural vulnerability in the United States with regards to denial and deception. This was noted even by those involved with Allied deception in World War II. Some officials stated in interviews that while British officers tended to be more comfortable and patient with deception,

their American counterparts were consistently frustrated by the delay and had more of a “throw everything at ‘em” approach (Sarbin, 1981, p.167). There are many possible theories for this, all of which would be difficult to confirm. But it does seem apparent that somewhere within the American system of values is a belief that governments should be honest in their dealings with their citizens and with each other. One arms control expert noted “it is not an accident that other nations protect their secrets more efficiently than the United States. In many countries, denial and deception are state policy, a part of national strategy that is seldom successfully challenged by the media or well-meaning officials and diplomats” (Hansen, 2002, p.168).

Channels

The next logical part of the deception plan to discuss is the one by which information is received by the target – the channels. Barton Whaley describes channels as “transmit[ing] true information (signals), irrelevant information (noise), and relevant but false information (deliberate – disinformation, inadvertent – misinformation)” (2007a, p.9). Channels play a significant role in analysis of the cases and it is important to note Whaley’s assertion that they are “truth neutral.” Any channel can transmit true or false information, whether intentional or unintentional. Their value lies in the perception of the deceiver and target as to how reliable they are.

It is important to note that channels can exist solely for the purposes that we are concerned with or the transmission may be only a secondary purpose (Shulsky, 2002, p.19). Diplomatic contacts, satellite images, and meetings with intelligence sources are all potential channels in a deception plan and each exists primarily to transmit information. But other channels such as academic conferences or business contacts are also means of transmitting information, though they have primary purposes beyond this. These secondary channels are considerable assets and considerable vulnerabilities for both the deceiver and target. A deception plan that focuses only on primary channels may not control all of the information necessary to execute the plan and may show inconsistent signatures to the target. Similarly, a target that relies too heavily on the primary channels and ignores or does not seek information from secondary channels is more vulnerable to deception. An example of this is seen in the South Africa case, where the South African government had a cohesive and consistent message with regards to nuclear research, but South African scientists were privately boasting to their U.S. counterparts that their research was far more advanced than the official statements.

This is not to say that the secondary channels are the only source of opportunity and vulnerability. As discussed in previous sections, senior officials may believe that they have insights about a state and personal relationships with their counterparts based on past experiences, and they may be correct. These personal contacts are also primary channels through which either fact or fiction can be transmitted. This was evident in the case of India, where

senior U.S. officials were told directly that no test was being planned though the order had already been given. If used effectively by the deceiver, these diplomatic channels can bypass a skeptical intelligence community.

That intelligence community also provides channels that may be used for deception. One former analyst went so far as to argue that “when it comes to deception, intelligence is the problem, it’s not the cure. [Intelligence analysts] are the transmission belt for the other side’s deception, or at least a substantial part of it” (Feer, 1989, p.10). He went on to cite a World War II British deception planner who argued that as long as the target had a good intelligence service and a capability to react, the target could be fooled repeatedly. This is overstating the point. Intelligence channels are certainly vulnerable to carrying disinformation and misinformation, but without an intelligence capability the policymaker is left to his or her own devices to determine what is fact and what is fiction – intelligence is very much a part of the “cure” for deception.

This leads to one key for mitigation of deception by intelligence services. An intelligence-based primary channel may do considerable damage to the target if it is unchecked against other sources of information. This damage can come from a channel that is compromised, including an agent who has been doubled, or a channel that can be “fooled.” For example, a satellite image of a building that has been made to look like it has another purpose can be convincing to an analyst – especially if there are no other channels by which the analyst is receiving information. It is thus beneficial for the intelligence community, and the government as a whole, to develop several independent channels. This concept was most effectively advanced by R.V. Jones in his work on deception and practical joking, and it forms the basis for one of the key hypotheses in this research (Jones, 1978, p.26).

The Deceiver

In each of the cases analyzed, the deceiver plays a significantly larger role than the target. The method and timing of the deception are almost entirely in the deceiver’s hands and it is the deceiver’s perception of the need to embark on a risky R&D effort that necessitates the deception. Subsequent sections will address how a deception is formed and executed; this section focuses on the advantages and disadvantages faced by the deceiver.

The Deceiver’s Advantages

The deceiver enjoys two related advantages. The primary advantage is timing. The deceiver is normally able to proceed at an advantageous pace; whereas the target’s bureaucracy of policymakers and intelligence analysts must follow processes that are often very rigid. Roberta Wohlstetter observes, “there is always delay between the intelligence source and the evaluation center, and between the center and the final report to the decision-maker. Even then, the decision-maker may merely request more information before taking action. In the meantime, the

opponent moves forward” (1965, p.696). Additionally, bureaucratic processes affect timing. Information received by an intelligence agency must often be processed by analysts and bureaus specializing in a topic or region. It must also be synthesized by analysts whose role is to integrate the information with that collected by other agencies or sections, thus further delaying information flow. To some extent, arms control regimes such as the NPT attempt to mitigate this advantage. The required reports, conferences, and inspections – even if known well in advance – have the effect of putting the potential proliferator on someone else’s timeline and hence remove the advantage of total control of the process.

The second advantage is research. The deceiver has the ability to collect information on the target’s structure, processes, and tendencies while the target has limited opportunity to collect on any potential deception structure. A study of Soviet deception practices concluded that they were typically preceded by espionage specifically targeted to determining how the target receives, processes, and analyzes new information in an effort to craft the most effective approach to disinform (Ziegler, 1997, p.18). This advantage is significant for this research for two reasons. First, it is especially potent if the target does not have organizations or practices that maintain a high level of sensitivity to the potential of deception. Second, the best, and perhaps only, way for the target to mitigate this advantage is to proactively look for evidence that individuals or organizations are coordinating deceptive activities. Identification of this coordination would remove the time and space on which the deceiver depends to collect information about the target and effectively shape the deception.

The Deceiver’s Vulnerabilities

Despite the advantages of timing and planning, the deceiver does have significant vulnerabilities. The first is a mirror image of what was discussed as an advantage for the target. That is that an effort as large as a weapons R&D program has inherently observable signatures, and arguably no deception plan could be comprehensive and well-executed enough to completely shield the deceiver’s activities. With each action in the deception plan, the deceiver opens the door for two possible detections – incongruities about what is hidden and incongruities about what is displayed instead (Whaley and Busby, 2002, p.191). The deceiver cannot completely erase the evidence of the R&D effort, but can only hope to mask most of it while creating enough plausible explanations for the rest that the target cannot come to a conclusion.

The second vulnerability for the nuclear weapons R&D deceiver is that the issue of nonproliferation remains on the global affairs agenda almost consistently. While issues such as the Iranian nuclear program or the five-year NPT conferences may bring proliferation to the front pages for an amount of time, even when other subjects dominate the public discourse diplomats and scientists continue to work on nonproliferation issues. They are sometimes supported and sometimes criticized by a wide array of non-government organizations (NGOs) that focus on

these issues, collect data, and argue for more disarmament. All of this has the effect of not only keeping attention focused on the issue of proliferation, but perhaps even creating a certain amount of paranoia over single events.

For example a key event in the South Africa case, the detection of test preparations in 1977, is odd because by almost all estimates the South Africans should not have had sufficient fissile material for a nuclear device at that stage. Without that material, there was no apparent need to dig test shafts and undertake such preparations. Nonetheless, the sight of the preparations caused a global outcry to which the South Africans responded by claiming that they had no nuclear weapons. The reaction was deceitful since by then they did have a substantial R&D effort underway, but nonetheless the international community had made up its mind quickly after seeing the satellite images. When a suspected nuclear test was detected in September 1979 in the South Atlantic, suspicion again fell on the South Africans, though few believed they were capable of the detonation that had been detected. In their work on deception, Whaley and Busby quote a prominent art curator, Thomas Hoving, who stated that even expert art historians “surrounded by a plethora of odd and inexplicable works of art, sometimes get unreasonably paranoid and begins to see forgeries all over the art landscape” (2002, p.195). So it is with nonproliferation, where the global community often sees nefarious intent and may foil a deceiver’s plans with the slightest unplanned release of information.

The deceiver’s final vulnerability is one that does not receive significant attention in the literature on deception, but is a key to evaluating and understanding the deception used to mask R&D programs. While the timing of the program is generally an advantage to the deceiver, there is one instance when this is not the case. The fact that the R&D program must be protected for so long a time before a weapons capability is achieved means there is a significant chance that “wild card” events will take place over the course of the program which the deceiver cannot predict at the outset. Much of the work done in these programs is complex and dangerous and there is a risk that accidents will take place. The Soviet biological weapons program, which is discussed in-depth in Chapter 3, ran for several years with an effective deception plan. But an outbreak of anthrax in 1979 put Soviet officials on the defensive and compelled them to engage in a complex and ad hoc deception to avoid being caught violating a major arms control agreement. Such events cannot be anticipated, and require a consistent and effective deception plan to mitigate.

The Conduct of Strategic Deception

Having examined the key players in the deception plan and the methods by which information is transmitted between them, the deceptive actions themselves merit discussion. How are these deceptions actually conducted? This is a more difficult question than it might first appear. Though U.S. military services might have MILDEC guidance and planning staffs might have an

officer charged with planning deception, other parts of government have no such doctrine. When it comes to deception involving nuclear weapons R&D programs, it appears that the deception is based on necessity and conducted using experience from other information operations (see Bell, 2003, p.251). There is therefore little theory upon which to rely in describing how deception plans are executed. We can, however, describe the actions that make up a deception as well as the elements required for a successful deception plan.

First, the actions that make up the deception can be separated into four categories. Every piece of information transmitted from the deceiver to the target through a channel must be either fact or fiction. Also binary is whether the deceiver is acting to show information to the target or whether the actions are concealing information. Michael Bennett and Edward Waltz developed a matrix, shown in Table 2-1, which categorizes deception actions in this way.

REVEAL FACT • INFORMATION: ○ RELEASE OF TRUE INFORMATION THAT BENEFITS THE DECEIVER (E.G., THE DOUBLE BLUFF RUSE) • PHYSICAL: ○ DISPLAY REAL EQUIPMENT OR FACILITIES (E.G., IN ORDER TO BUILD A SOURCE'S CREDIBILITY)	CONCEAL FACTS • INFORMATION: ○ SECRECY (CLEARANCE PROGRAMS, PHYSICAL SECURITY, AND INFOSEC) ○ WITHHOLDING INFORMATION TO CREATE A FALSE OR MISLEADING IMPRESSION • PHYSICAL ○ CAMOUFLAGE, CONCEALMENT, SIGNAL REDUCTION (E.G., STEALTH DESIGNS AND MATERIALS, SPREAD SPECTRUM COMMUNICATIONS), DISGUISES, DAZZLING ○ NONVERBAL DECEIT
REVEAL FICTION • INFORMATION: ○ DISINFORMATION ▪ INCLUDES LYING: PROVIDING INFORMATION KNOWN TO BE UNTRUE ▪ DAZZLING (E.G. LARGE VOLUMES OF INFORMATION) • PHYSICAL ○ DECOYS, DIVERSION (FEINTS AND DEMONSTRATIONS), DUPLICATES, DISGUISES, DUMMY POSITIONS, EQUIPMENT, AND FACILITIES ○ NONVERBAL DECEIT	CONCEAL FICTION • INFORMATION: ○ SUPPRESS A LIE • PHYSICAL ○ HIDE A SHAM

Table 2-1 The Deception Methods Matrix

Source: Bennett and Waltz, 2007, p.52

A modified version of this table, tailored for long-term R&D programs, forms the basis of the framework used for analysis of cases throughout this research. Bennett and Waltz group these deception actions by whether they involve the transmission of information or a physical action on the part of the deceiver. But for the purposes of this dissertation, looking to build a

framework through which the efforts of a proliferating state can be analyzed, it is useful to further categorize these actions and information that must be manipulated. Four broad categories are apparent.

People

Efforts such as weapons R&D programs cannot function without multitudes of people being involved. In the case of the South African program, former leaders of the program estimate that a total of approximately 1,000 people were involved throughout the program's existence (Stumpf, 1995, p.6). These are individuals that must be granted security clearances and given access to secured sites to maintain effective denial. In many cases, such as when scientists are required to travel abroad for conferences or research, they may need to be granted cover stories or false documents as well. For a program with 1,000 people throughout its existence, that is already a large task with multiple potentially observable signatures. Estimates of manpower in the Soviet biological warfare program, when operating at peak capacity, are that 60,000 people were involved at any particular time (Alibek and Handelman, 1999, p.43).

The deceiver must not only be concerned with those immediately connected to the program, however. Referring again to the Soviet BW program, the funding was so significant and the program so secret, that special funding mechanisms were established at GOSPLAN, the Soviet economic planning committee, just for the BW program. While every other sector of the Soviet economy was managed by civilian bureaucrats at GOSPLAN, the BW program had separate and unique funding codes and was managed by a high-ranking general – an extremely unusual construct (Alibek and Handelman, 1999, p.43). Many in and associated with GOSPLAN likely observed these special procedures, even if they did not have any knowledge of their basis. Those individuals might be able to piece together the puzzle with enough additional information, or pass the knowledge to an intelligence agency that can.

Money

The abnormal accounting practices of the Soviet BW program is not an isolated example in the cases. Programs that pursue R&D of advanced weapons must spend significant amounts of money on facilities, material, and people. If the program needs to be protected by means of deception, more money will need to be spent on false facilities and other deceptive measures. As discussed in the previous section, analysts may not have direct knowledge of where money is going, but the knowledge that it is being moved in extraordinary ways might be combined with other data to be informative.

The analysis of financial actions was seen as a significant lesson learned to several who were involved with monitoring Germany's armaments sector between the world wars. Not only did the German government publish two budgets, one for public consumption and one for actual

accounting, but numerous methods were employed to move money to industrialists and corporations to fund rearmament. One British officer with extensive experience with this case noted that “money is the key to increased armaments and a careful scrutiny of any upward trend would justify a demand for explanations” (Whaley, 2002, p.78). Whaley added that such analysis must go beyond what is publicly released and probe deeply for fiscal deception.

Program Management

It is an understatement to say that a significant amount of research and work are required for a successful R&D program that would rise to the level of strategic deception. Rarely will one of these efforts be pursued by only one research group, only one institution, and only at one facility. More likely, it will require input and effort from experts and groups throughout the scientific and industrial sector. Despite the secrecy necessary to conduct strategic deception, these efforts will need to be monitored and organized.

Such management and coordination are particular vulnerabilities of R&D efforts. Other efforts are better able to compartmentalize and have various units act independently. For example, the Irish Republican Army (IRA) is well-known to have compartmentalized into active cells in an effort to thwart what had been highly successful British and Irish security measures. This culminated in the 1979 assassination of a prominent British official, Lord Mountbatten, that surprised even the IRA leadership because the cell that conducted the operation had planned and executed it independently (Whaley, 2007b, p.67).

The programs that require strategic deception cannot do this. They can compartmentalize, but the efforts still must be coordinated. Perhaps the most compartmentalized case in this study will be that of Iraq, where multiple teams of scientists were pursuing different methods of enrichment with no knowledge of each other’s actions. This led to considerable confusion on the part of UN inspectors trying to piece together details of the Iraqi nuclear effort. But though the scientific teams were ignorant of each other’s progress, Hussein Kamal and others in the regime were fully aware and were ensuring that each program got the resources it needed based on prospects for eventual success.

Perceptions and Intent

The final, and arguably most significant, category of actions and information is those that reveal how the deceiver perceives the situation and what they intend to do. Many, including former Iraq inspector David Kay, believe this category to be the only one that will be significant in the future for nuclear weapons R&D, since he believes proliferators are becoming increasingly effective at masking weapons pursuit with legitimate research (Kay, 1995, p.101). This is perhaps the most challenging category in which to observe signatures for two reasons. First, it is extremely difficult to see into a state’s decision making structure beyond what that state desires

to show. There have been instances of high-level sources within a government or signals intelligence that can provide insight on the perceptions and intent of senior officials, but such cases are rare.

The second reason this category is so challenging is that there are simply very few definitive signals given about this intent. In each of the cases, it is evident that governments and bureaucracies are not monolithic. One group may be pursuing goals that differ from another, one group may place a priority on one course of actions not shared by another. As Handel notes in his evaluation of the buildup to the 1973 Middle East War, “even the enemy’s military and political elite is uncertain about its own goals: more than one set of military, national, and political aims may, in fact, coexist” (1977, p.464). If this is true for decisions about war preparations, it is also certainly true about R&D programs. The beginnings of most of the programs in this study are shrouded in mystery not only because of government secrecy, but because even the program participants do not know when the decision was actually made. In such circumstances, signals given off by such activity can be extremely difficult for an intelligence analyst to observe and correctly identify.

The South African nuclear weapons program provides an example of this. One top official in the South African program noted that it was not a “spur of the moment” decision by a particularly militant official, but rather “a resolution that grew over many years on the basis of top level instructions given by many different government incumbents” (van der Walt, Steyn, and van Loggerenberg, 2003, p.xxiv). Another official from the same program related an episode to the author where President P.W. Botha was informed that South African scientists had conducted studies of the efficacy of designing tactical nuclear weapons and other technologies. This research went beyond the construction of several larger nuclear weapons that had been authorized by the government. An incensed Botha berated senior officials for having exceeded the bounds of the approved program, but eventually relented and permitted more theoretical studies (Stumpf, 2016).

The Structure of Strategic Deception

These actions are unlikely to be effective unless used within a plan that provides structure and direction. Abram Shulsky identifies five elements required to make strategic deception work (2002).

- 1) Strategic coherence: a single, coordinated message must be developed and disseminated throughout the various organs of government. National leaders, diplomats, scientists, and military leaders must have the same answer to questions such as “what is the purpose of your country’s research on uranium enrichment?” Perhaps it is this coherence that Clausewitz doubted in his rejection of strategic misinformation and each case in this

dissertation shows that officials and agencies do inevitably go off message. Nonetheless, those same cases show that effective strategic coherence can be achieved.

- 2) Organizational infrastructure: this is how strategic coherence is achieved across people and agencies with different levels of knowledge, viewpoints, and priorities. The message, and hence the deception, must be coordinated by an entity sufficiently powerful to get other senior leaders to fall in line. Often, this means the establishment of a new organization or the designation of a new official to accomplish this.
- 3) Channels: there must be a way of communicating the information from the deceiver to the target. These might include mutual channels such as diplomatic contacts, but can also include unilateral ones, such as a satellite used by the target's intelligence agency to monitor activity within the deceiver's facilities.
- 4) Understanding the adversary: deception is significantly enhanced by knowing how the target thinks. In the aforementioned example, Allied planners were aware of Hitler's control over German decision making and were also aware of his opinion of one particular commander. But this is not only "inside information" on an adversary, it can also include familiarity with an ally or partial ally. Insight into how the deception target's bureaucracy works, which channels respond quickly to input, and which channels are trusted and get information to senior officials is valuable knowledge (Sherwin, 1982, pp.74, 81). This information might only be known through past cooperation.
- 5) Feedback: this is an essential part of MILDEC and strategic deception, and one often overlooked. To conduct effective deception, the deceiver must be able to gauge whether it is having an effect on the target. If the desired effect is not seen, the deception must either be modified or abandoned before unintended consequences occur.

Deception in Long-Term R&D Programs

Is strategic deception actually what we are talking about when considering long-term R&D programs? Since strategic deception is that deception targeted at senior officials, and must involve topics with which they would personally be involved, we would assume that we will see each of Shulsky's five elements represented in the deception involved with such R&D efforts. Certainly some of the factors are present. The deceiver wants the target to act in such a way that the state's goals are achieved (usually permitting achievement of the capability). The deception is certainly targeted to policymakers, through analysts and intelligence agencies are also targets. It is also likely that any familiarity the deceiver has with the target is beneficial. But key differences also exist that suggests this deception is a separate type from strategic deception as

discussed in the literature. The similarities and differences between strategic and long-term deception merit further discussion.

Similarities

The first of Shulsky's elements is strategic coherence and this is certainly evident in examples of long-term deception. The NPT and export control regimes compel the state to have a policy on proliferation and weapons development. The issue of nuclear development is likely to come up during inspections, IAEA events, and events such as the NPT conferences. But it will also likely be a secondary topic in other diplomatic discussions as well as an occasional focus of intelligence analysis.

The challenge for the deceiver is that it is very unlikely that every channel will be controlled. The necessity for numerous officials to make statements on the topic, as well as events such as inspections, an undetected human source, or an accident of some type, means that it is almost certain over the long timeframe of the deception that information will be transmitted to the target through an uncontrolled channel. Thus, the "party line" must be crafted carefully enough that it stands up to inadvertent releases of information, or as Daniel and Herbig describe it, that the desired signals are competitive with inadvertently transmitted signals (1982, p.357).

South Africa provides an excellent example of this and will be presented in Chapter 6. South Africa's official policy was that it supported nonproliferation, but would not sign the NPT because inspections would reveal a proprietary enrichment process that South African scientists had developed. While denying the nuclear weapons program that it was actively pursuing, the South African government consistently stated that it was fully capable of designing and building a nuclear device for defensive purposes and actively promoted its uranium enrichment capabilities for commercial use. Hence, when scientists made references to enrichment research in front of their U.S. colleagues, it was plausible that there was a commercial motivation. When high-ranking military officials referenced powerful weapons to be used against communist forces, others could argue the statement only referred to potential weapons development. Even when the program was revealed, the line partially held because South African officials were able to *claim* that since no cities had actually been targeted, the weapons were only defensive.

Strongly connected to coherence in long-term deception, as it is in strategic deception, is organizational infrastructure. It is intuitive that the R&D effort itself requires sufficient infrastructure. But there also must be sufficient infrastructure to push the "party line" to the various officials who communicate it, establish extraordinary procedures when required, and react to unforeseen circumstances. Again using the South Africa example, a select group of government, scientific, and military officials was established, the Witvlei Committee, to set all

nuclear policy and coordinate efforts. This bypassed the State Security Council, which was highly unusual.

The channels are also similar between strategic and long-term deception. In the case of weapons programs that are in contravention of an arms control agreement, vulnerabilities will often be created by the channels of the verification mechanism. This is counterintuitive, since these verification methods are designed to prevent any manipulation of the agreement. But veteran arms control negotiator Lynn Hansen has observed that “One of the fundamental lessons learned by every arms control negotiator is that the verification regime set forth in the agreement or in a treaty also helps the violator to design means to subvert the verification process” (2002, p.169).

Finally, the concept of familiarity is as useful in long-term deception as it is in strategic deception. States that contemplate embarking on policies that will require deception over multiple years are invested enough to attempt to gain every possible advantage. This includes “mak[ing] it their business – and for some, a very high-priority business – to learn how U.S. and Western intelligence works” (Bruce, 2006, p.18). The knowledge can significantly aid in the formulation of policy, such as the South African belief that potential nuclear weapons use would spur U.S. intervention. It can assist in executing deception, such as with Indian understanding of U.S. satellite imagery capability prior to their 1998 tests. Finally, it can help to mitigate unforeseen problems, such as with the Soviet use of prominent American scientists to give credibility to their story of an anthrax outbreak based on contaminated meat instead of accidental release from a weapons laboratory.

The Distinctive Qualities of Long-Term Deception

Long-term deception is similar to strategic and other forms of deception in many key ways. But what is it about the doctrine and practice of this particular form of deception that separates it from others? This section highlights the differences that were revealed by studying deception in the dissertation’s five historical cases.

The Requirement for Surprise

Let us start with Whaley’s assertion that deception is meant to make the target “quite certain, very decisive, and wrong.” As previously discussed, in these larger forms of deception certainty and decisiveness are not necessarily requirements, since A-type deception and the “freezing” of the bureaucracy might be sufficient to meet the deceiver’s goals. But it seems logical that when acting on a shorter time scale, the deceiver at the very least needs the target to be wrong, the thus surprised as events unfold.

Surprise when it comes to long-term R&D efforts is a lofty, and perhaps unattainable, goal. The number of people, institutions, and processes involved are too great to be effectively concealed for a long period of time. A former head of the Israeli Armament and Development Authority, Dr. Zeev Boren, has stated that history shows technological surprise “out of the blue” is rare if not impossible and that often the issue is not intelligence or analysis of technological developments, but a lack of acceptance of the situation on the part of policymakers (see Handel, 1980).

The case of the Indian nuclear tests in May 1998 is an example of this. Considered by some as one of the more significant intelligence failures in recent history, the U.S. government quickly took action to determine how its intelligence community was caught by surprise by the first detonations. The report, known as the Jeremiah Report after the retired admiral who led the effort, included numerous recommendations to help the intelligence community avoid such failures in the future. But what was not discussed in-depth in the report was what would have been a somewhat contradictory claim – that the U.S. intelligence community had been aware that India had the technical ability to conduct a test at any time and had warned the Clinton Administration on that point repeatedly (Kerr and Warner, 2014, p.45). That India had this capability required some collection and analysis, but it was not a great analytical leap. They had detonated a nuclear device as the “peaceful nuclear explosion” in 1974 and had only increased their capabilities since that time. The Indians had also been caught preparing for nuclear tests in 1982, 1995, and 1996. It was likely not difficult to make the argument that a test could happen whenever the Indian government so chose.

In his work on building a theory of deception, J. Bowyer Bell argued that the target being wrong or surprised was not the goal of the deceiver at all, but rather the goal was an advantageous disposition of forces because the target had accepted the illusion as reality. He used the episode of the Trojan Horse as an example, stating “the Greeks did not care whether the Trojans were surprised when the soldiers came out of the horse, only that the gates were opened to victory” (2003, p.274). Though Bell’s argument is appealing, it is perhaps not well-served by an example of a short military operation. Can one imagine a circumstance where the Trojans are not surprised by Greeks jumping out of the horse, but still fail to stop them from opening the gates? In these short operations, surprise may not be the end-goal of the deceiver. But it is certainly a prerequisite for achieving that goal.

The longer timeline of the R&D effort changes this requirement for the deceiver and makes Bell’s analysis applicable to this type of deception. Bell is correct that the deceiver being able to act in the way he desires is the most important, possibly the only, metric for success in deception. The deceiver in this case does not need the target to be surprised necessarily, and does not need

the target to act in a specific manner. Freezing the target may be desirable and whether that is the result of confusion or incorrect certainty is irrelevant.

The goal of deception in these long-term cases is to gain an advantage in interactions with the target over the course of the program. These interactions may be predictable or unpredictable, and based on diplomatic, military, or intelligence channels of communication. The deception will be successful not if the program is completely concealed, nor if the target acts a specific way, but rather when the deceiver enjoys an advantage over the target during diplomatic exchanges, facility inspections, or test preparations. The historical cases in this research each show numerous examples of these interactions, the outcomes of which were influenced by deception. These examples include the Munich Conference in 1938, the 1980 Biological Weapons Convention conference when the Soviet Union was accused of pursuing a BW program, South Africa's test preparations at a site in the Kalahari Desert in 1988, and India's 1998 nuclear tests. In each of these cases, one state was practicing a sustained and long-term deception and the other's actions were influenced by that deception. In none of these cases is there evidence that the deception target was actually "surprised" by the deceiver's activity, but such surprise was not necessary for the deceiver to achieve its goals.

Figure 2-1 is an example timeline that will be used to show these interactions in each of the nuclear cases in this dissertation. Above the timeline are significant events in the course of the R&D program, including an unforeseen "wild card" outlined in red. Below the line are key interactions with the United States. It should be noted that these interactions are not always tied to events in the program, but may be part of larger interactions or routine exchanges. Wild cards, however, are likely to bring about additional interactions.

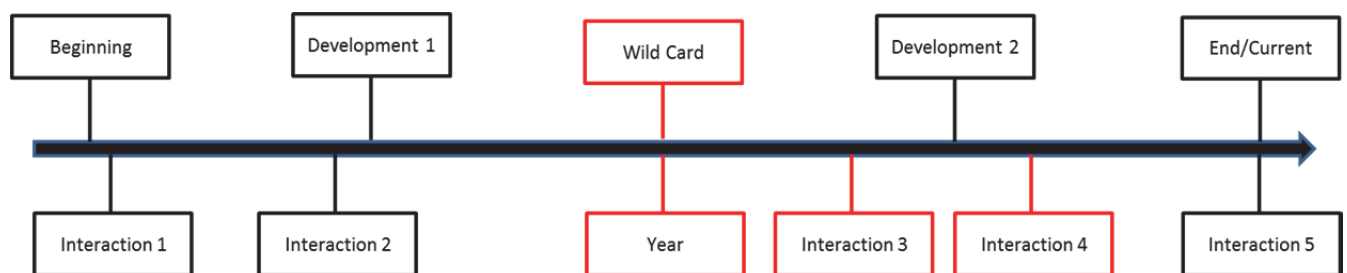


Figure 2-1 Example R&D Program Timeline with Interactions

Continuous Deception

Each of the examples of deception found in the review of relevant literature had a finite operational timeline. Japanese fleet movements were masked for several weeks prior to the December 7th attack, message traffic and troop movements were staged for fictitious army formations opposite Pas de Calais for several months prior to the D-Day landings, the Greeks

staged the horse to be found by the Trojans on the day they intended to attack through the open gates. Mirroring the limited timeline of the expected engagement, the deception was conducted for a brief period.

Such is not the case for deception protecting a long-term R&D program. In the cases presented, the deception is consistently executed for the duration of the program, in some cases years before and years after the actual R&D effort. The reason for this is that the deceiver is hoping to gain advantage in interactions with the target, but cannot be certain when those interactions will occur. Inspections may be conducted on short notice, satellites may be imaging facilities without the deceiver's knowledge, and officials may raise questions about the R&D program during meetings where other topics were on the agenda. Thus, the deception often cannot be employed or calibrated for a specific event but must be maintained constantly. This is a significant difference from MILDEC and other forms of deception.

This continuous deception is especially significant when wild card events take place. An effective continuous deception gives the deceiver the chance to mitigate the effects of a potentially disastrous unforeseen event. For example, the 1979 anthrax outbreak at Sverdlovsk threatened to expose Soviet research in biological weapons, result in condemnation at the 1980 BWC conference, and likely cost the Soviets much-needed nuclear arms reduction agreements with the United States. Their flexible (and audacious) deception in response to accusations that the anthrax outbreak was BW related deserves credit for sparing the Soviet Union embarrassment at the BWC conference and arms control complications. But it was only possible because the Soviet BW program had been protected by an effective and continuous deception program for decades by the time the Sverdlovsk incident took place.

Feedback

Due to the continuous nature of long-term deception, it differs from other deception in the importance of feedback from the target for the plan's success. This is the one of Shulsky's deception elements that differs significantly in long-term deception. As discussed previously, the deceiver normally needs to have feedback from the target to calibrate the deception. If it is just drawing attention, the deception needs to be stopped. If the target isn't noticing the deception, the channels need to be changed or the signal modified to make it more noticeable.

In long-term deception, there will certainly be opportunities for feedback when the deceiver can evaluate whether deception is having an effect. This can occur anytime one of these interactions between the deceiver and target take place. But there is no guarantee that this information will be evident to the deceiver. After years of deceptive measures aimed to make the British and French believe German military strength was significantly higher than it was, Hitler met with British Prime Minister Neville Chamberlain and French Prime Minister Edouard

Daladier in 1938 to diffuse a crisis in Czechoslovakia. Following an agreement to avoid hostilities, Chamberlain famously declared the deal meant “peace in our time” but history would remember the deal as a foolish act of appeasement that gave Hitler exactly what he wanted. The Germans would have no way of knowing, without a source to tell them the inner deliberations of the British cabinet, whether their deception had influenced Chamberlain’s position. In fact, while the deception was being conducted it is unlikely anyone could have predicted the crisis or the negotiations that led to the Munich deal. But the Germans might have guessed that they would need to negotiate with the British and French at some point and that if their deception was effective, the Allies would be overestimating German military strength and that would only serve to strengthen Hitler’s negotiating advantage.

Additionally, the deceiver might not know if the target is paying attention at any particular time. After having their test site preparations detected by satellite in 1995, Indian officials had a good idea of how to prepare the site in a manner that would not be detected if they decided to test in the future. As will be discussed in-depth in Chapter 4, they set to work as soon as the order came to prepare in 1998. But in 1998, the attention of U.S. analysts was not focused solely on India, if at all. Indian officials had no way of knowing whether U.S. analysts were examining photographs of their facilities or whether they were looking at all. They thus practiced deception “in the blind” with the only possibility of feedback being another notification from U.S. officials that they had detected suspicious activity. In MILDEC, deception must be planned such that the target will definitely get the desired message. In long-term deception, it is likely that the deceiver will not know whether the target is even paying attention.

For the analyst that is paying attention, the constant and coordinated deception effort presents a significant barrier to identifying and assessing a potential R&D program. Having discussed the tenets of deception and the distinctive attributes of long-term deception, assessment of such deception can be aided by a framework through which analysts can assess the potential of an illicit R&D effort.

The Framework

For several decades researchers have debated the efficacy of studying deception and examples of deception for predictive value. As mentioned previously, Whaley expresses optimism that “in theory, deception can always be detected, and in practice often detected, sometimes even easily. Most experts on military or intelligence deception, however, take the opposite view. They are the “pessimists” (Whaley and Busby, 2002, p.182). Among these pessimists is Roberta Wohlstetter, who in her study of signals in the Pearl Harbor and Cuban Missile Crisis cases stated, “in both cases, regardless of what the Monday morning quarterbacks have to say, the data was ambiguous and incomplete...The true signals were always embedded in the noise or

irrelevance of false ones. Some of this noise was created deliberately by our adversaries, some by chance, and some we made ourselves” (1965, p.705). Wohlstetter’s concerns are well-founded. The signals present as an R&D program is pursued are certainly lost in the noise if not categorized or analyzed in a logical manner. But if such an approach can be formulated, Whaley may be correct in his optimism that deception can be detected even in such secretive programs as nuclear weapons R&D. This framework is an attempt to draw predictive value from historical cases of nuclear and non-nuclear weapons R&D.

A British military historian has argued that an analyst seeking to counter deception has two requirements: 1) a macroscopic knowledge of the adversary, and 2) a microscopic analysis aimed at discovering inconsistencies (Dewar, 1989, p.195). Both requirements will be reflected in this approach. The framework is based on a qualitative sorting of information because the identification of deception relies on evaluation of indicators that are in some instances related and in others isolated. The indicator may be a vital clue to the presence of deception or part of the “noise.” These evaluations depend upon hypotheses about the actions and intentions of the potential deceiver and about the meanings of the indicators. This analysis is therefore a task more suited to human analysts categorizing and sorting information based on their macroscopic knowledge and experience rather than to a formula or automated evaluation of data (Moore and Reynolds, 2006, p.101).

The framework provides three benefits to the analyst, the intelligence community, and the policymakers they support. First, it permits a learning process to take place with a small number of potential cases. Researchers studying the ability of auditors to detect deception in corporate financial accounts have noted that in low base-rate tasks such as complex financial audits (or analysis of a potentially proliferating state), the agent has few opportunities to refine their approach and knowledge and improve performance in future cases (Johnson et al., 2001, p.367). A systemic approach built on historical cases gives analysts the chance to incorporate previous lessons into future analysis.

Second, the proper use of this approach may mitigate the problems of existing perceptions and new information being received at a pace that makes objective analysis difficult. In his analysis of deception and counterdeception, Richards Heuer noted the tendency that perceptions, once formed, are resistant to change. This potential vulnerability is exacerbated by the unsteady and sometimes incremental pace at which the analyst will receive new information about the potential R&D program or deception surrounding it. If new information that contradicts the analyst’s perceptions arrives in small doses or over a long period of time, it may be insufficient to reverse a perception (1981, p.297). This approach will mitigate this problem by allowing the analyst to see data collected on the program independent of time.

The final benefit is the framework's contribution to active analysis. Whaley notes that most analysis is passive – retroductive inference that will lead to inconclusive results if all of the key facts are not available to the analyst. It is extremely unlikely that the analyst will have access to all of the facts surrounding a potential nuclear weapons R&D program. In fact, the cases in this dissertation show that the deception target was able to see only a fraction of available information at any given time and that access changed over time. This approach facilitates active analysis, permitting the analyst to specify what types of information are required to arrive at a conclusion about deception and to generate intelligence requirements “specified by the analyst when the needed facts are believed to exist but have not been laid before her” (Whaley, 2007b, p.91). For example, the framework may indicate that a state similar to the one on which an analyst is focusing will need an extraordinary mechanism to allocate funds to the program due to a normally transparent budget process. If no such information currently exists for that particular state, the analyst can generate a request for information that will support the analysis.

Caveats

Two caveats bear mentioning prior to discussing the framework in-depth. The first is that, as in other areas of analysis, the effort to reduce the risk of surprise in detection of long-term deception in R&D programs is likely to increase the number of false alarms (Betts, 1978, p.63). The most aggressive collection against a state will likely result in significant data that is still incomplete and, in some cases, noise that has been mistaken for signal. As a result, it is possible that almost any state will appear to be deceptive if analyzed closely. The case of Sweden is included in this dissertation to address this issue. Sweden actively considered an indigenous nuclear weapons capability in the 1950s and early 1960s, prior to the NPT. While it does not meet the definition of having pursued nuclear weapons, the case is informative for us because Swedish officials did not engage in deception. They were open with their U.S. counterparts about their consideration of nuclear weapons capability and, though they practiced denial and made this sensitive defense R&D program secret, they were not deceptive. This case will be analyzed within the framework as an example of a state conducting activity across the nuclear R&D spectrum that is not being deceptive.

The final caveat applies not only to the framework, but to the study of deception in long-term R&D programs – particularly weapons programs. The presence of deception may not necessarily mean the presence of a R&D program. One goal of this research is to produce a way to analyze whether deception is taking place. This chapter and the one that precedes it have framed deception as a protection for a R&D effort, but the reverse is also possible. Deception can be employed to give the impression of R&D when none or very little actually exists. The most significant example is that of the WMD program in Iraq under Saddam Hussein. Knowing what events later revealed about the Iraqi WMD program, one former intelligence official articulated what many policymakers and analysts had earlier reasoned about Iraqi deception this

way: “we know Saddam Hussein had [WMD] in the past; he is a lying and evil-intentioned dictator; and his D&D efforts in all WMD-related areas are pervasive. Iraq’s effective D&D, therefore, is evidence for a weapons program, not against it” (Bruce, 2006, p.20). Bruce uses this as an example to show that the correct assessment of deception taking place may still lead to incorrect conclusions – a lesson that analysts should continue to bear in mind.

Categories of Actions

Bennett’s and Waltz’s Deception Methods Matrix, shown in Table 2-1, provides the categories of actions in the framework. Each category is defined and discussed in this section, with particular emphasis on the “Conceal Fiction” category, which will be elaborated upon for purposes of this framework.

Reveal Fact

It may seem counterintuitive that the transmission of truthful information plays such a prominent role in deception. Yet in each case, the revealing of fact is essential to the success of the deception. Revealing fact is generally seen in a deception for one or more of four reasons. The first is to establish and give credibility to channels upon which the target depends – channels that will later be used to transmit information to the deceiver’s benefit (Bruce and Bennett, 2014, p.201).

The establishment of such credibility may be a long process if the channel is not already trusted by the target. Unless the channel is one designed, built, and deployed by the target – such as a satellite – then a considerable amount of true information will need to be transmitted through the channel for every false message (Moose, 1982, p.146). This is especially true with human sources, who will need to establish their access and bona fides with the target in order to be an effective deception channel. When Britain established the XX Committee during World War II to manage German agents who had been doubled and would be used to deceive Berlin, MI5 was quick to argue at one of the very first meetings of the committee that the military services would need to provide a significant amount of true information to keep the Germans from uncovering the deception (Howard, 1995, p.9). Such support was likely very painful for military services trying to win a war while keeping casualties as low as possible.

Deception Action	Definition
Reveal Fact	The intentional or unintentional transmission of true information from the deceiver to the target
Conceal Fact	An action intended to prevent the transmission of true information from the deceiver to the target
Reveal Fiction	The intentional transmission of false information from the deceiver to the target
Conceal Fiction	The protection of the deception plan through actions internal to the deceiver, without intentional transmission of information

Table 2-2 Definitions of Categories of Action

The second circumstance for the revealing of truth is one where the information is completely truthful at the time of its release, and only deceptive later and in a different context. This is often a case of a deception plan taking advantage of an action of opportunity. One example of this comes from the months leading up to Pearl Harbor. The Japanese press was vocal in its hostility to the United States and American presence in Asia. In numerous prominent newspapers there were increasingly violent declarations of the need for Japan to expand south throughout 1941. There was nothing deceptive in these statements; Japan had every intention of expanding southward. But as war approached and U.S. officials became increasingly concerned about Japanese actions, these statements contributed to a sense that Japan's focus was Southeast Asia rather than a push eastward into the Pacific (Wohlstetter, 1965, p.694). There was nothing intentionally misleading about these truthful statements, nor were they the only thing that shaped U.S. opinion on Japanese intentions, but they were a small and, at the time, honest part of a larger deceptive campaign.

A third category of factual revelation is one that simply is true and that the deceiver intends to be true – but the target is unwilling to accept. While perhaps not part of a deception plan, these factual statements are significant events in the historical cases. Many times there is no evidence whether information is transmitted intentionally or whether it is released by mistake or an official that strays from talking points. In a surprising number of examples, the target observes the signal and simply ignores it. An excellent example of this is statements by candidates in India's 1998 elections that a nuclear test should be conducted and would be if their party (the BJP) was victorious. As Director of Central Intelligence George Tenet later noted, "we did not sufficiently accept that Indian politicians might do what they had openly promised – conduct a nuclear test, as the incoming ruling party had said it would. The lesson learned is that sometimes intentions do not reside in secret – they are out there for all to see and hear" (Tenet, 2007, p.45).

This third category can differ from Bennett's and Waltz's treatment of revealing fact. Over the course of a long-term R&D program, the analyst will observe numerous true signatures. Some of these may be intentional on the part of the deceiver and, as Bennett and Waltz highlight, the foundation of the deception plan (2007, p.52). But others will be factual signatures that the deceiver simply cannot do anything about. To use the previous example, the BJP could not afford to lose votes by having a softer national security platform – including nuclear weapons development. Hence, from the point of view of the deceiver, this is a factual signature that they must live with. These two types of factual signatures – intentional and unavoidable – are distinct. But from the analyst's point of view in real time, there is likely no way to distinguish between factual data transmitted in support of a deception plan and that which is transmitted because it cannot be hidden. Thus factual data that is not part of the deception plan may still be a valuable lead for the analyst and it is included in this definition of "reveal fact."

The fourth and final category of revealing fact is especially pertinent in understanding the difference between long-term and other forms of deception. Mistakes are inevitable with any effort as large as a deception to protect a R&D program, and can happen in military and other shorter forms of deception as well. In one example from the case research, an Iraqi scientist ostensibly studying cadence programs for slow-spinning rotors used in the oil industry was observed running models at far higher speeds that were applicable primarily for uranium enrichment (Obeidi and Pitzer, 2004, p.104). In another example, four South Africans employed by the cover organization for the nuclear weapons program were arrested in the United Kingdom for attempting to violate sanctions and arms control laws (Pabian, 2015, p.35). In a shorter-term deception, such events may cause the deceiver to evaluate whether the operation can continue. But such events are inevitable in a long-term effort and can be pivotal to identifying the effort if observed and recognized by analysts.

Conceal Fact

Previous sections of this chapter have focused on denial of information by the deceiver to the target. By definition, deception must include denial because the deceiver's ability to manipulate signals seen by the target is dependent on the deceiver's ability to control which signals are shown (Shulsky, 2002, p.16). Denial will be evident in almost every facet of the R&D programs examined in this dissertation, to include illicit procurement of material and equipment, the hiding of relationships between key organizations, and the careful selection of facility locations to either be inaccessible or mixed in with other irrelevant work.

Reveal Fiction

The transmission of false information to the target, or simulation, is the most intuitive category of deception action. Deceivers have used statements, uniforms, and even operation names as

false signals to the deception target. In the case of one well-known historical case, the Cuban Missile Crisis, the Soviet Union issued winter clothing to troops embarking ships for transport to Cuba and named the overall operation ANADYR, after a river flowing into the Bering Sea (J. Hansen, 2002, p.50). The intent was to give any potential observer the impression that a tropical island was the last place on which the operation would be focused.

Conceal Fiction

This dissertation proposes that the “conceal fiction” category is the key to understanding long-term deception. As it is shown in Table 2-1, the “conceal fiction” category is vague. This reflects the fact that this quadrant is fundamentally different than the other three. This difference is perhaps not significant for many types of deception and hence was not further explored in Bennett’s and Waltz’s research (Bennett, 2015). In long-term deception, the difference is significant.

In each of the other categories, efforts are directed at the deception target. In one way or another, the action deals with the transmission of a signal from the deceiver to the target. In the “reveal” cases, this action permits transmission of a factual or fictitious signal. This is either honesty or simulation. In the case of concealing fact, the deceiver attempts to block transmission of the signal completely. These actions are still concerned with the transmission of information. But actions in the “conceal fiction” category are designed to protect the deception itself. Nothing in the action directly pertains to the transmission of a signal. As purely internal actions, there would, ideally for the deceiver, be no signals transmitted at all. This research will show, however, that signatures may be observable to the alert analyst.

One illustrative example of this type of action is the exclusion of certain elements within the deceiver’s government from knowledge of the R&D effort – despite (or because of) the fact that those officials will need to answer questions relating to the program. Several experienced intelligence and arms control officials have noted that, in the case of nuclear weapons R&D, it is neither “necessary nor politically desirable to have a national-level policy decision; there would be no need to inform the foreign ministry...”(Deutch, 1992, p.125). In other words, the “government” is not deciding to embark on a nuclear weapons program, only part of the government. And the other part is intentionally kept ignorant of the program, particularly the group that must make the most public statements and meet with foreign counterparts on the topic. This technique of foreign ministry exclusion has proven to be an effective one, since despite an awareness of this possibility most officials tend to see other governments as monolithic and assume that the foreign ministry’s position is the position of the government as a whole (Jervis, 1968, p.476).

One might be surprised at how frequently this technique is employed. The Soviet ambassador to the United States in 1962 was not told of the placement of missiles in Cuba and strenuously denied their existence to U.S. officials (Dobrynin, 1995, p.74). The Egyptian foreign minister was at the United Nations in New York in the days leading up to Egypt's attack on Israel in 1973 and was seeking a diplomatic solution, unaware of Egyptian military plans (Amos, 1982, p.326). Foreign ministries are not the only ones who find themselves excluded from the "big picture." War plans issued for the Japanese Navy on November 5th, 1941 included detailed plans of operations in Southeast Asia but omitted any mention of Pearl Harbor, the plans for which were only communicated verbally. Other Japanese military commanders were given plans that were entirely false (Bruce and Bennett, 2014, p.199). Finally, other extraordinary measures might be taken to exclude normally cleared personnel within the bureaucracy. None of the normal administrative assistants were used in the planning for Soviet deployment of missiles to Cuba in 1962. Instead, a colonel in the Ministry of Defense with good penmanship handwrote the entire plan, and Khrushchev received it in that form in July (J. Hansen, 2002, p.49). None of these actions is designed to transmit or block a signal to the deception target. But an alert intelligence agency that has developed collection resources should seriously consider the possibilities if any of these incongruities are detected.

In addition to the incongruities that might be observed from this split in the deceiver's bureaucracy, another aspect of this extraordinary layer of security is apparent. The effort must be coordinated and managed by some entity within the deceiver's bureaucracy and this coordination will result in visible signatures. This is the core of the argument that long-term deception is distinctive among types of deception in that intelligence agencies have the time to detect this coordination and, even if other indications of R&D programs are absent, can conclude the deception is taking place.

One of the largest sources of signatures is the coordinating entity. In order for a deception to be conducted that involves the number of people and organizations, the amount of money, and the number of actions required for a weapons R&D program, there must not only be a group within the government that is aware and making decisions, but also one that is actively coordinating the deception. This group (or individual) must have sufficient power within the bureaucracy to decide who has access to the information and how the various groups will act within the deception plan (Shulsky, 2002, p.30). Examples of such powerful organizations are found in all of the cases presented in this study. To illustrate this concept at this point, we can again consider the XX Committee in Britain during World War II. The Twenty Committee did not run double agents or directly operate against the German intelligence services, but its role was to obtain approval for the information to be passed back to Berlin through the double agents, and liaison between the various intelligence services, the military, and the home defense committee (Howard, 1995, p.8).

REVEAL FACT • INFORMATION: ○ RELEASE OF TRUE INFORMATION THAT BENEFITS THE DECEIVER. ○ RELEASE OF INFORMATION THAT CANNOT BE CONCEALED OR MANIPULATED. ○ INADVERTENT RELEASE OF TRUE INFORMATION. • PHYSICAL: ○ DISPLAY REAL EQUIPMENT OR FACILITIES ○ DISPLAY REAL EQUIPMENT OR FACILITIES THAT CANNOT BE HIDDEN ○ INADVERTENT REVEALING OF EQUIPMENT OR FACILITIES	CONCEAL FACTS • INFORMATION: ○ SECRECY (CLEARANCE PROGRAMS, PHYSICAL SECURITY) ○ SELECTIVE WITHHOLDING OF INFORMATION • PHYSICAL: ○ CAMOUFLAGE, SIGNAL REDUCTION
REVEAL FICTION • INFORMATION: ○ DISINFORMATION (LYING, PLANTED INFORMATION) • PHYSICAL: ○ DECOYS, DIVERSIONS	CONCEAL FICTION • INFORMATION: ○ ISSUING OF FALSE INFORMATION TO OWN GOVERNMENT OFFICIALS AND PRESS • PHYSICAL: ○ SPECIAL RESTRICTIONS ON PERSONNEL ○ WITTING OF THE DECEPTION (MONITORED PHONE CALLS, RESTRICTED TRAVEL)

Table 2-3 Methods Matrix Modified for Long-Term Deception

Table 2-3 represents the deception methods matrix modified to reflect what has been discussed regarding long-term deception. Much of it is the same as the original matrix, but both the “reveal fact” and “conceal fiction” blocks contain examples of measures that are highlighted in the cases presented. These include political campaign statements, the establishment of controlling entities within the government and the issuing of false information to certain parties as well as extraordinary security measures instituted to protect the R&D program. Many of these actions, particularly in the “conceal fiction” category, may not be intentionally signaled to the deception target, but may be detected by an alert intelligence agency.

Lines of Effort

These actions can also be categorized by how they relate to the R&D program itself. An informal survey of historical cases of nuclear weapons development programs revealed several lines of effort essential to these programs. A review of the hypothesis-building cases refined these lines of effort. This section will briefly describe each of them.

Line of Effort	Definition	Examples
Diplomatic/Public Relations	The transmission of information, direct or indirect, from the deceiver to a target government or public. This includes statements or activities intended to be noticed by the target's intelligence services.	Public statements, treaties, official press releases
Human Capital	Effort pertaining to the selection, development, and employment of personnel necessary for the program	Recruitment, training, relocation, cover stories
Infrastructure	The system enabling the development and production of weapons	Industry, laboratories, factories
Special Material	Material that is essential to weapons development and the deception, either because it is "single-use" or because it is specifically banned by agreement	Toxins, U-235, Pu-239, smallpox outside one research facility (Soviet BW), aircraft (Germany)
Other Material	Material that is essential to weapons development, but not necessarily banned (and hence not necessarily part of deception). This would include many "dual-use" components.	Frequency converters, precision machinery, metal components with certain tensile strength, laboratory equipment
Finance and Budgeting	The allocation of funding through normal or extraordinary budgeting processes	Annual budget, economic plan, government actions to generate revenue (bonds/notes)
Test and Evaluation	Actions designed to measure the effectiveness of the weapons including the establishment, maintenance, and concealment of testing facilities.	Test sites, controlled detonations, test flights, "shakedown" cruises

Table 2-4 Lines of Effort, Definitions, and Examples

Diplomacy and Public Relations

States conducting long-term deception will almost certainly need to have a diplomatic and public affairs aspect to the deception plan. In the case of nuclear weapons R&D, membership in the NPT regime and interactions with the IAEA will force deception in this line of effort since states must go on record as to their nonproliferation policies, nuclear efforts, and capabilities. The cases studied for this dissertation indicate that this only increases once the slightest suspicion of nuclear research exists, since both the United States and IAEA soon begin to press officials on the status of their program.

This line of effort is particularly significant for long-term deception because of its similarity to strategic deception. Of all of the lines of effort, it is the diplomatic effort that most easily goes directly to the deception target's policymakers. It is thus an extremely powerful line of effort in shaping the perceptions of the deception target.

Human Capital

One of the most valuable elements of a R&D program is the personnel engaged in the research, testing, maintenance, and security of the program. As discussed previously, in the case of the Soviet BW program the number of personnel is estimated to have exceeded 60,000. Estimates of personnel involved in the smaller nuclear programs studied tend to be between 1,000 and 2,000. The state may need to take several actions with regards to human capital. Individuals must be educated and trained. This may include establishing capability at universities, funding students

in relevant disciplines, recruiting graduates, and employing researchers in relevant disciplines. But all of those activities must be undertaken ostensibly for non-weapons purposes.

Additionally, many specialists will need to publish and attend international conferences not just to improve the research process but because their absence would be conspicuous. In some cases, program participants may need to be given cover identities for trips abroad to avoid detection by intelligence services. In each of the cases presented, a large amount of effort in the deception plan is devoted to protecting the R&D program's human capital.

Infrastructure

A significant amount of infrastructure is required for a long-term weapons R&D program, especially a nuclear one. Examples of this include uranium mining, milling, and enrichment facilities, laboratories, research reactors, and capabilities for the storage and handling of nuclear material. This line of effort is a major focus of the deception effort because it is a major focus of the deception target's intelligence services. Channels such as satellite imagery focus on infrastructure and inspectors from organizations such as the IAEA take careful note of what facilities exist and for what possible purpose. The deception actions surrounding infrastructure include constructing covers to shield activity from satellite imagery, buildings that appear to have innocuous purposes, and the establishment of corporations and ostensibly non-government groups that build and manage sites associated with the program.

Special Material

Special material is that which is required for the R&D program but is also of particular interest to observers. This could be for two reasons. First, the material may be "single-use" and have no purpose other than the objective of the R&D program. Therefore, possession is an indication of intent that the deceiver may not want to transmit. The second possibility is that the material, whether single-use or not, is prohibited or restricted by international agreement. We will see in subsequent chapters that examples include some types of airframes prohibited in Germany by the Versailles Treaty, pathogen research prohibited by the Biological Weapons Convention (BWC), and various types of fissile material.⁴

It should be noted that the restriction may not apply to the state directly, but may be an international norm. Neither India nor South Africa were parties to restrictions on fissile material, but both at least needed a response to inquiries about their production and use of such material. It is this restriction that often places a state in a position where deception is required.

⁴ This framework is designed to be generalizable to other forms of long-term R&D requiring deception. One integral step in modifying it for such use is to identify what required material is restricted in some way so that the definition of "Special Material" can be appropriately framed.

For the purposes of considering special material in this framework, the definition conforms to that of special nuclear material so designated by the U.S. Nuclear Regulatory Commission for both security and public health purposes. The most significant of these materials is uranium-235 (as part of uranium enriched to at least 20%), and plutonium-239. The acquisition of this fissile material is considered by some to be the most difficult step in the acquisition of a nuclear weapon. In general, acquiring plutonium is considered to be faster and require less sophistication on the part of the proliferator, though the weapon design needed to use of plutonium is more complex and likely requires testing (LANL, 2007, p.4). Using highly enriched uranium (HEU) allows for a “gun-type” weapon that may not require testing, but uranium enrichment is not only difficult but often very detectable.

Other Material

As significant as the special material is, there is a great deal more specialized material required to pursue a R&D program that can also be applied to other purposes more acceptable to the international community. While it is possible that the deceiver acquires this material quietly or under false pretenses, possession of it does not immediately indicate intent.

For the nuclear cases, this line of effort covers an extensive amount of material and includes items such as centrifuge components, frequency converters, metal components of certain tensile strengths, and precision machinery with relevant applications. Many of these items are referred to as “dual-use” commodities and their trade is limited by export control regulations in many countries.

Finance and Budgeting

Long-term weapons R&D programs are expensive propositions for a state. In the case of a nuclear weapons program, it is extremely costly whether the program and materials are purchased from another state or whether the development is mostly indigenous. In either case, a significant portion of the government’s budget will be allocated, directly or indirectly, towards this R&D effort.

For a state conducting long-term R&D this is a line of effort where at least denial, and likely deception, will be necessary. If the government is one where budgets and funding information are not publicly released, it will be easier to keep the funding stream a secret though extraordinary measures will likely still need to be instituted – as seen in the example of GOSPLAN and the Soviet BW program. If the budget is publicly released, the allocation must either be hidden in other programs, such as civilian nuclear energy and weapons programs, or an entirely different and secret budget must also exist with accurate accounting. This latter scenario was the case in interwar Germany, which gave the German government the ability to hide defense appropriations from the allies through a series of deceptive accounting practices.

Testing and Evaluation

The final line of effort involves anything required to test the weapon or measure the results of a test – to include preparation of a test facility. This is a particularly significant line of effort for nuclear weapons R&D. The nuclear cases in this dissertation show that there is little chance today that a state could test a nuclear weapon and not have it be detected. Thus the decision of when to test and how to prepare for it significantly impacts the state's deception goals and methods. A state may also choose to develop weapons that it is confident do not need to be tested in an attempt to keep the program concealed.

The Preliminary Framework

The categories of action and lines of effort were combined to form the chart in Table 2-5. The chart was then populated with examples for each block pertaining to nuclear weapons development based on case research already done and brainstorming. Table 2-5 will be the template used in each of the cases for data sorting. The common and unique blocks and deception methods are then determined from the information in the cases, in an effort to determine the predictive value of this approach.

Analysis of the data obtained from the two non-nuclear cases through this framework is the basis for the hypotheses used in this dissertation. At the conclusion of each case study, a case-specific version of Table 2-5 is presented for that case with examples for each category found. Those tables are then compared as part of a cross-case synthesis to hypothesize the conditions in which common and unique deception measures are employed.

	Reveal Fact	Conceal Fact	Reveal Fiction	Conceal Fiction
Diplomacy	- IAEA declarations 123 Agreements - NPT Conference activities - Public statements	- Incomplete public statements - Withholding of internal decision making process - Incomplete declarations	False explanation of activities	- Withhold deception plan details from own personnel - Provide false information to own personnel - Appropriate personnel briefed on deception (officials, scientists, intel)
Human Capital	- University activities and partnerships - Training for specialists - Laboratory research - Conferences, info exchanges	- Conceal individuals' tasking - Conceal reason for research	- Establish fronts for research and work (companies, labs) - Fabricate research goals and results	- Take steps to conceal links between science and defense establishments - Falsify govt support for research - Provide fictitious motivation for info exchanges and conference attendance
Infrastructure	- Submit to inspection regimes - Build visible structures - Public announcements	- Deny access during inspections - Build unobservable structures (underground or camouflaged)	- Mislead during inspections - Build false structures - Build misleading observables - Conduct false activity	- Move personnel for false reasons - Conceal results of false activity - Discard products of manufacturing processes
Special Material	Declare possession	- Hide possession - Hide attributes of material (ex: enrichment level)	- Mislead during inspections - Falsify disposition documentation - Falsify amounts	- Establish facilities for post-diversion storage - Enlist help of technical personnel (cover story)
Other Material	- Declare controlled material - Public relations (parades, demos) - Efforts w/legitimate use of dual-use components	- Hide acquisition - Hide destination of imported materials - Hide use of dual-use components - Hide affiliation of procurement agents	- Mislead on amount of material - False destinations for components	- Store excess material at special location with higher access restrictions - Brief appropriate personnel on true reason for material acquisition
Finance and Budgeting	State support of research institutions, universities, and industry.	Compartmentalize and classify budget for R&D programs.	Use of front companies to mask state funding for acquisition networks.	Finance personnel authorized to divert funds from budgeted requirements to secret programs.
Test/Eval	- Lab activities - Conventional weapons testing	- Hide extent of testing - Hide results - Hide location of testing - Mask seismic and other signals	- False testing purpose - False results - Attribute activity to other states	- Measures to protect populace in the event of accident but conceal the reason - Brief appropriate personnel on deception timeline

Table 2-5 Example Nuclear Weapons Deception Framework

Conclusion

Barton Whaley characterizes “optimists” and “pessimists” in his assessments of how scholars and practitioners view strategic deception. Roberta Wohlstetter, a “pessimist” in this context, notes in her study of the deception surrounding the Pearl Harbor attack that policymakers and intelligence agencies faced too many barriers in detecting and mitigating deception to include compartmentalization, wishful thinking, volume of information, and background “noise” (1965). Former intelligence analyst Cynthia Grabo has been equally pessimistic about the utility of studying historical examples to mitigate deception, stating that “such a study will only reinforce a conclusion that the most brilliant analysis may flounder in the face of deception and that the most expert and experienced among us on occasion may be as vulnerable as the novice” (Grabo, 2002, p.119).

While not taking issue with the challenges highlighted by Wohlstetter and Grabo, this study shows that they are surmountable challenges if approached in a logical and systematic manner. Moreover, they are challenges that need to be surmounted, since the deception that is being analyzed in these cases is that which conceals and protects programs that represent the gravest threats to U.S. national security and global stability.

Long-term deception is a unique form of the practice, but nonetheless shares many common traits with military and strategic deception. Drawing on those common traits and accounting for what is distinctive, this dissertation presents a framework that facilitates the logical and systematic approach analysts need to take R&D program analysis. If predictive value can be found in historical cases and analysts can be given insight as to what deceptive actions to look for in future situations, the United States and international community may gain an additional advantage against those who seek to circumvent the desire of the international community to halt the spread of the world’s deadliest weapons.

3. Case Selection, Hypotheses, and Analytical Approach

Analysis of historical cases of long-term deception is inhibited by a significant challenge: these R&D efforts are among the most sensitive efforts undertaken by a government and are often not openly and authoritatively examined, even decades after the program's termination. This is certainly true of nuclear weapons R&D programs, the discovery of which can entail sanctions and diplomatic repercussions for the state, even well after the fact. Thus, any examination of historical cases is limited by the volume and reliability of the available information.

This limitation hinders the inductive formulation of hypotheses that address how the deceptions protecting these programs are executed and what signatures might be observable. Without the ability to comprehensively look at R&D programs and the government actions that enable them, development of theory about how these programs and actions might appear in the future is extremely challenging. One solution to this methodological challenge is to find programs and cases that are largely comparable to nuclear weapons R&D efforts, but have more information available about them.

In his work on the use of case studies and the comparative method, Arend Lijphart identifies such cases as "hypothesis-generating," which are intended to formulate hypotheses that will be later tested among a larger number of cases (1971, p.692). The cases used for testing the hypotheses are referred to as "theory-confirming" cases. For the purposes of this study, hypothesis-generating cases need to be examples of long-term R&D programs with lines of effort that are similar or comparable to those identified in Chapter 2 (diplomatic, human capital, infrastructure, special material, etc.) and where deception was employed.

After an informal survey of potential cases it was apparent that the hypothesis-generating cases would need to be bounded in a manner similar to definition of the universe of nuclear cases discussed in Chapter 1. The survey first focused on military or military-driven programs that resulted in technological surprise. Two examples that were surveyed were the construction of ironclad warships during the U.S. Civil War and the Soviet Union's launch of Sputnik in 1957. Private sector and criminal examples, such as the 2001 Enron scandal and the rapid expansion of the Colombian cocaine trade in the mid-1970s, were also promising. But the research risk inherent in developing hypotheses from activities in different countries and time periods, and with different reasons for being deceptive, necessitated restricting the potential cases to those where R&D was the activity. While the results of this research may be applicable to cases such as Enron and the drug trade, such cases might result in hypotheses that are not applicable to or

informative about the theory-confirming cases. The survey resulted in three additional bounding characteristics.

First, the R&D must be restricted or prohibited by an external mechanism, typically a treaty. This is necessary because it is what makes denial insufficient and deception necessary in these programs. A R&D effort to develop a more advanced bomber or a more reliable rifle for infantrymen may be very secret, but will not necessarily call for long-term deceptive measures. When such R&D is prohibited by an agreement to which the government has acceded, then more elaborate security measures are necessary and any potentially observable signatures must be covered by deception if possible. Additionally, this external restriction is what creates the “special material” line of effort. If nothing required for the R&D program is restricted in procurement, then a major class of observable signatures is not relevant. The presence or potential of these “special material” signatures are necessary to formulate hypotheses that will be applicable to nuclear weapons R&D programs.

Second, deception must have been employed and the proof of the deception must be incontrovertible. This is an intuitive but important requirement. If the R&D program was not protected by a long-term deception plan, then no useful hypotheses are likely to be generated no matter how similar the case is to ones that will be analyzed later.

Third, sufficient data must be available from the hypothesis-generating cases to have reasonable confidence that the important aspects of the R&D program are known. This is the reason why these cases are necessary in this approach. While no treatment of an effort this large and complex can be completely comprehensive, the hypothesis-generating case must have data available for the majority of categories within the framework if realistic hypotheses are to be formulated.

An informal survey was conducted of potential R&D cases that meet these criteria resulted in two with the best potential of yielding testable and relevant hypotheses – the rearmament of Germany between World Wars I and II and the Soviet biological weapons program following the signing of the BWC in 1972. Both of these R&D efforts faced external restrictions. In the case of Germany, it was the limitations imposed by the Allies as part of the Versailles Treaty, while in the Soviet case it was the BWC that prohibited possession of and research on certain biological agents and toxins. Deception was practiced in both cases but for different reasons. The Germans were compelled to be deceptive because the Versailles restrictions also called for an organization to inspect German facilities to ensure compliance. The BWC had no such inspection regime but the Soviets had to be concerned over U.S. efforts to detect their weapons programs through human, imagery, and other intelligence means. Finally, sufficient research material exists for both cases. Several researchers have examined the case of German rearmament and a few have

even focused specifically on the deception surrounding German activity. The Soviet BW program has been researched by both academics and journalists and that research has been enhanced by the memoirs of several former program officials.

Both of these cases are discussed in-depth in appendices to this dissertation. This chapter presents the relevant data from these cases that contributed to hypothesis generation. Three categories of data emerged from the research that corresponded to a logical sequence of deception. Each data point pertained to the formation or management of deception, communication of deception, or some form of result. The resulting categories of data were therefore: 1) coordination, 2) channels of information, and 3) interactions. The identification of these categories proved to be the first step in hypothesis development.⁵

German Rearmament after Versailles (1919-1939)

The agreement to end the hostilities of the First World War between Germany and the Allied powers, known as the Versailles Treaty, was more than a peace agreement. With it, the Allies hoped to ensure that Germany could never again threaten Europe with armed force. When it was signed in 1919, the Versailles Treaty contained unprecedented restrictions on Germany's ability to produce arms and maintain a military. It was a harsh punishment by officials, particularly in London and Paris, who believed that German aggression had caused the destructive conflict. It was almost immediately circumvented by German politicians, military officers, and industrialists.

The case of German rearmament prior to World War II is distinctive in that it is a case where the deceiver both downplayed and exaggerated activity over the course of the deception. While many may associate German rearmament with the rise of Hitler and the Nazi Party, the reality is that the German government initiated deception and rearmament almost immediately after the signing of the Versailles Treaty. Several researchers attribute the harshness of the Versailles restrictions with spurring an already latent desire to arm Germany on the part of government officials, industrialists, and military officers (Whaley, 1984; 2002). For their part, Germany's neighbors did little to allay the fears of German officials over disarmament. France, in particular, entered into security agreements with Poland, Romania, Czechoslovakia, and

⁵ The potential of the two selected cases to generate hypotheses is based on the availability of research and evidence about the cases. Any program of a size and duration comparable to these cases would require similar traits. The first is that it would need to be managed by more than one individual. Second, basic communications theory dictates that information must be transmitted from sender to receiver. Third, the fact that the program is "forbidden" in some way implies some form of interaction between the parties, whether it is solely diplomatic or an inspection or auditing regime. Therefore, I believe that any case meeting the bounding criteria and about which enough information could be collected would result in similar categorization of data into coordination, channels, and interactions, and hence similar hypotheses.

Yugoslavia – publicly encircling a Germany with no legal means to build competent armed forces (Suchenwirth, 1968, p.ix).

The German effort to deceive about rearmament can be broadly separated into two phases. In the first phase, the Germans sought to salvage what infrastructure they had remaining from before Versailles, initiate programs to keep individuals in the armed forces or ready for immediate recall, and build some foreign connections that would facilitate future development. All of this had to be accomplished despite the presence of the Inter-Allied Control Commission, the group of Allied military officers charged under the terms of the treaty with monitoring Germany's disarmament. This group was in place in Berlin by 1920 and was extremely active, at one point conducting over 800 inspections in a six-week period during 1924 (Whaley, 1984, p.9). Despite this level of activity, the monitoring effort faced several challenges. Airframes and valuable factory equipment were smuggled out of Germany and into Holland and other neutral countries, out of the jurisdiction of the Commission. The Commission's officers spent significant time and effort chasing down rumors that apparently were started by the Germans themselves to be misleading. Finally, the liaison organization formed by the German government obfuscated and delayed at every opportunity. The arms inspectors were eventually withdrawn in 1927, having abundant suspicion but little proof of German cheating.

Germany also entered into cooperation with the Soviet Union, a partnership that was not anticipated by the Western European governments. The Soviet regime was willing overlook previous animosity with Germany and sign defense agreements with Berlin. These agreements included actions that were forbidden for Germany under Versailles, including the establishment of an aircraft training and testing facility in Lipetsk, Russia where German pilots, technically discharged from the armed forces for the duration of their training, established and maintained proficiency in air operations. The pilots and aircraft developed at Lipetsk would be essential to the establishment of the Luftwaffe several years later. Numerous deceptive measures were employed by both Berlin and Moscow to cover these activities, and the Allies were unaware of the extent of this cooperation. Strategic theorist Michael I. Handel notes that the Western Europeans should have been more aware of the shared objectives of Germany and the Soviet Union, stating "After coming up against the obstinate and short-sighted bitterness of England and France in the wake of World War I, they have no alternative but to turn to each other. For this reason alone, the Western powers should not have been so surprised by the ensuing German-Soviet accord" (1980, p.75). German and Soviet deception surrounding their agreements and their subsequent cooperation helped ensure that Britain and France remained unaware.

The second phase of the German deception was an abrupt change from the first. Beginning in 1935, the Germans "switched from dissimulative deception that concealed facts of secret preparations to simulative deception that concealed weakness" (Whaley, 2002, p.68). In this

year, Germany announced the return of conscription as well as the establishment of the Luftwaffe – which was immediately touted as being (miraculously) larger and more capable than almost any other air force in Europe. The strength of all of Germany's armed forces would be exaggerated in this period, most notably its navy and air force. The effect was almost immediate, especially on British public opinion. Many British politicians had been downplaying German capability for several years and Hitler's deception gave the appearance of the sudden emergence of a Luftwaffe equal in strength to the Royal Air Force (Watt, 1956, p.156). In reality this was not the case, but Germany's simulative deception would impact key events for the next several years, to include the reoccupation of the Rhineland in 1936 and the Munich Conference in 1938.

German Deception Measures

Secondary research on the German rearmament and analysis of the resulting data using the framework resulted in numerous examples of German deception relevant to the formation of hypotheses. These examples are presented in the following sections. A full treatment of the case of German rearmament is presented in Appendix A. All data used in the analysis is sorted within the framework in Tables A-1 through A-7.

Coordination

Several measures undertaken by the Germans are evidence that a broad deception plan was coordinated by elements within the German government, both prior to and following the installation of Hitler as chancellor. As early as 1921, the Germans identified a vulnerability in aircraft production. Only four companies existed that could produce aircraft for German use and one of them (Fokker) had smuggled its infrastructure into Holland. The Versailles restrictions, and hence the attention of the Inter-Allied Control Commission, focused heavily on aircraft production capability. Realizing the increasing necessity of aircraft for battlefield success, the German government took steps to evade the Commission's attempts to remove this capability. The government financially backed the establishment of the Rohrbach Metal Aircraft Company, a branch office of which was located in Copenhagen and outside the jurisdiction of the Commission (Whaley, 2002, p.51). Rohrbach would serve as a means to fund and coordinate aircraft development for the German government without Allied interference.

Efforts to facilitate rearmament were not limited to the private sector. Successive Weimar Republic chancellors in the 1920s sought to fund naval rearmament through deceptive measures in the legislature. Naval funding proposals were presented to legislators during annual budget debates with significant overcharging for equipment and services. Once approved, the surplus money was then secretly allocated to programs that were not admitted to the Commission or included in the proposals (Whaley, 2002, p.53). This rearmament technique involved significant coordination, because the chancellor and his immediate staff had to prepare fictitious funding

requests with the assistance of the Navy staff, and then had to approve the use and allocation of the extra money. This coordination of deceptive budget practices would continue into the 1930s. The defense budget was split into the “white” plan (which was approximately 340 million marks in 1936) and the “black” budget (which was over 3 billion marks). These “black” amounts and their uses did not appear in the official budget or any other official documents released by the German government but were nonetheless allocated to R&D projects throughout the defense establishment (Suchenwirth, 1968, pp.159-160). These measures required significant coordination within the bureaucracy of the chancellor’s office, defense ministry, and German industry.

Measures were taken to facilitate this coordination that might have resulted in observable signatures. In 1926, when the Commission was still in existence and on the ground in Germany, the German Defense Ministry quietly created a position for the purpose of coordinating multiple private firms that were engaged in secret R&D efforts supporting armor improvements and production (Whaley, 2002, p.55). This individual, an engineer named Ernst Kniepkamp, worked to avoid redundancy amongst the half dozen firms that were researching new means of protective armor to new models of tanks. Hitler expanded this coordinating ability within the ministry in April 1934 by creating the Central Bureau for German Rearmament to coordinate efforts across the spectrum of defense (Whaley, 2002, p.64). This was a remarkable action to take over a year before official renunciation of the Versailles Treaty, though with withdrawal of the Commission several years earlier there is no evidence that British or French officials were aware of this new organization and effort.

One additional example is noteworthy in the category of coordination because it is seen in several cases examined throughout this research. Officials from Germany’s Foreign Ministry interacted often with their British and French counterparts and the subject of alleged rearmament was frequently raised. In the early 1930s, several of these diplomats voiced frustration to Berlin with their inability to negotiate in good faith because they were unaware of the German government’s actual policy on rearmament (Mihalka, 1980, p.53). Exclusion of groups within the deceiver’s government, often within the Foreign Ministry, from knowledge of R&D programs is perhaps the clearest example of the coordination of deception. In these instances, a knowledgeable group within the government deliberately excludes other high-ranking officials from the truth about policies about which they would normally be aware. This is done partially to maintain secrecy or security, but also with the intent to have those officials convey deceptive information to the target without their knowledge.

Information Channels

Several important aspects of the German case involve the channels through which information is passed between the deceiver and the target. One already-discussed example was the

Commission, which was likely the best channel through which the Allies were able to assess German activity. The withdrawal of the Commission in 1927 removed that channel and left the Allies without such insight – a theme that appears in several other cases in this study.

In the 1930s, as German industry increased rearmament and Hitler planned an aggressive foreign policy, the German government appears to have paid more attention to manipulating the channels through which the Allied governments received their information. This was particularly true in dealing with the press, and German actions towards journalists consisted of both revealing and concealing critical information. In May 1937, a new aircraft factory complex in Orenienburg was opened and presented to foreign officials and large contingents of journalists. The factory complex had been built with its own fire department, anti-aircraft defenses, and bomb shelters (Whaley, 2002, p.72). One might think such a facility, built in expectation of coming under attack by hostile forces, would be a sensitive area and not presented publicly. But the Germans likely intended two messages. The first was that the plant had an obvious massive production capacity, and that was certainly noted by the visitors. The second, and more subtle message, was intended for the British and French governments. This message was that such facilities were impervious to interference from bombing and, if necessary, would be able to augment Luftwaffe strength quickly in the event of hostilities.

German factories were not always so accommodating, however. On several occasions in the 1930s, journalists were invited to visit factories of the massive Krupp industrial network. The journalists would be escorted throughout the facility, then invited to leave their cameras and other equipment in a holding area while they were served a lavish lunch. While dining, German engineers would irradiate the area where the cameras were left, thus ruining the film. The Germans were concerned that, despite their best efforts, photographers may capture drawings left on desks or on boards that would indicate the development of prohibited and sensitive weaponry (Whaley, 2002, p.58).

The armed forces also manipulated channels of information, particularly as ship construction increased in the 1930s. In some instances, this was simply an attempt to deny information to Allied observers. In the case of the German Navy, officials were particularly concerned with Britain's naval intelligence service, which actively attempted to estimate German naval construction and capabilities as well as monitor the various naval limitation treaties that were in force. Some measures instituted by the German Navy were relatively simple. In December 1933, work began in building enormous huts at the Deutsche Werke shipyard to cover exposed slipways. It was in these facilities that production of the first 250-ton U-boats would commence shortly thereafter (Maiolo, 1999, p.110). Conversely, the navy showed information as well. As they completed shakedown cruises and initial operations, German warships were frequent visitors at foreign ports in the years leading up to World War II. A visit by the *Deutschland* to

Gibraltar in February 1937 was covertly photographed through the scuttles of a British ship also in the harbor (Maiolo, 1996, p.34). It is unclear what made the British act covertly, since the Germans must have assumed that a ship anchored in a British-aligned port would certainly be subject to surveillance and assessment. Nonetheless, the German ship stayed for several days.

Not all of the information deliberately transmitted by the German Navy was factual. Admiral Erich Raeder, the navy commander, oversaw an enormous shipbuilding effort that was supposedly restricted by the terms of Versailles and several tonnage treaties that had been reached internationally as well as between Britain and Germany. These treaties did not have anything more than token verification mechanisms, instead relying on the voluntary reporting of information with corroboration by naval attachés and other officials. In several documented cases, the German Navy staff sent spurious technical data on ships under construction or recently launched (Maiolo, 1996, p.37). When matched with observations from various British officials who observed the German ships, analysts at the British Admiralty had difficulty determining information such as gun size, draught, and armor thickness that would be crucial in the approaching conflict.

Germany's rearmament deception involved both revealing and concealing factual and fictitious information. But a key element of the effort was the manipulation of information channels. When the Commission was operating in Berlin, it was the primary channel of information and the Germans sought to control what it observed. Once the Commission was gone, the Germans made use of embassy officials, journalists, and public relations events to transmit some information and took actions such as covering construction facilities and tampering with photographic film to block transmission in other cases.

Interactions

Once Hitler was in power and pursuing an expansionistic foreign policy, the German government had numerous interactions with other European governments, particularly the British government, in which deception played a vital role. Perhaps most prominent among these are the military interactions – episodes where London had to decide on a policy in response to German military activity. In 1936, Hitler moved to reoccupy the Rhineland, a move that was met with considerable consternation in Paris and London. To do this, the relatively weak Wehrmacht could only deploy approximately 3,000 troops, far less than could be mustered by Britain and France to counter the move if they so chose. But due to a sustained deception on Wehrmacht strength and significant tactical deception in troop movements, British intelligence estimated German strength at 35,000 troops. French government officials estimated over 265,000 (Whaley, 2002, p.70). Both of these estimates were too large for either government to seriously contemplate military intervention to stop the move, and the Allies' reluctance showed itself in the tepid official reactions from both countries.

This deception would be repeated several years later during the annexation of Austria. The Luftwaffe, still a relatively weak and small force, excelled at quickly repainting aircraft and having them take off again to appear as a different aircraft. It flew bomber missions with no bombs available for actual use and maintained an almost continuous presence in the air over Austria in the weeks leading up to the annexation. A German official later described the effect this had on the Austrians and the most likely interveners, the French: "Of course, large numbers of impressionable Austrians were enthusiastic about the Luftwaffe, which they viewed as a symbol of Germany's strength. At this juncture, and to an even greater degree than was true elsewhere, France finally realized that the Luftwaffe had become a factor with which to be reckoned" (Suchenwirth, 1968, p.193). As France chose not to intervene in the annexation in any way, it appears that Paris continued to view German military strength as surpassing its own.

These poor military estimates had a potentially significant impact on key diplomatic interactions as well. Hitler was employing a policy of aggression and bluster – one he could only pull off if the Allies chose not to actively counter him. Thus, British and French assessments of German military strength were of interest to more officials than those in the military. At the highest levels of government, policymakers were forced to choose options partially based on their beliefs of whether Hitler was bluffing and what could be done to call him on it. No other interaction exemplifies the benefit of years of German deception better than the Munich Conference in 1938.

The Munich Conference lives in history as an example of poor statesmanship and appeasement. While it is impossible to know exactly why the various actors involved made the decisions they made, we do at least know what they were told entering the meetings. The world-famous American aviator Charles Lindbergh was a frequent visitor to German aircraft factories and Luftwaffe units. German officials went to great lengths to charm Lindbergh and convince him of aircraft capabilities and numbers that were greatly exaggerated. As the crisis built leading to the Munich Conference, Lindbergh advised the British and French governments that engaging the Germans militarily would be suicide with the relative state of their air forces. There is no direct evidence that these warnings affected Prime Minister Neville Chamberlain in his dealings with Hitler, but it is known that he traveled to Munich carrying Lindbergh's reports (Whaley, 2002, p.75).

Air forces were not the only poorly assessed units. At the time of the Munich Conference, French intelligence estimated Wehrmacht strength at ninety divisions plus thirty in reserve. In fact, there were only forty-two divisions with seven in reserve, but the Germans had made an extensive show of moving units around and creating activity and traffic to give the impression of higher numbers. Whaley summarizes the state of the German forces in this way, "The bottom

line is that the Wehrmacht could not have succeeded against Czechoslovakia and France, let alone if the UK and USSR had joined” (1984, p.63). While there are arguably numerous reasons why the British and French governments took the position they did at Munich, it is possible that they would have chosen to call Hitler’s bluff if they had accurate assessments of German strength relative to their own. In any case, the German deception of several years provided an advantage to Hitler at this critical point in European history.

The Soviet Biological Weapons Program (1972-1990)

The second case selected to generate hypotheses also involved long-term circumvention of an arms control agreement. But the R&D effort supporting the Soviet Union’s biological warfare (BW) program differs from that of the German rearmament effort in one key aspect. In the Soviet case, the external restriction was the BWC – an agreement to which the Soviet Union had voluntarily agreed but which had no independent verification mechanism. This lack of verification would give the Soviets sufficient confidence to embark on a massive R&D effort to perfect numerous strains of biological agents for use on the battlefield and even for delivery by ICBM.

The urgency with which Soviet scientists approached the BW program cannot be overstated. They worked to give their country what they believed to be a crucial edge in any conflict with the United States, often driven by the knowledge of Western advances in molecular and genetic engineering and the perception of the USSR’s disadvantage in nuclear arms. Ken Alibek, a former senior official in the Soviet BW program who later defected to the United States, compares the program to the Manhattan Project in terms of importance for the overall defense effort. The statistics he cites support this. According to Alibek, the program involved over 60,000 people and more than adequate funding, even in the leanest of fiscal times (1999, p.43). Despite several incidents that threatened to publicly expose the program and embarrass the Soviet government, the BW R&D effort survived the fall of the Soviet Union and there are concerns that it exists to this day.

Soviet scientists were familiar with numerous naturally occurring pathogens and had long been vaccinating humans and animals against them or otherwise mitigating their effects. Some accounts state that Soviet commanders attempted to employ BW against German troops during World War II, but their efforts were unsuccessful. It is likely that Soviet BW efforts were jumpstarted in 1945 when Soviet forces captured personnel and documents from the advanced Japanese BW R&D effort in Manchuria (Alibek and Handelman, 1999, p.36; Mangold and Goldberg, 1999, p.44).

The United States also pursued these weapons, but by 1969 had decided to abandon the effort to develop offensive BW. President Nixon publicly renounced such weapons and diplomatic work continued on the BWC. For their part, the Soviets were skeptical that the United States, with such significant scientific resources, would give away such an advantage. The Soviet government signed the BWC in 1972 fully intending to continue BW efforts, but many in its scientific community assumed the Americans were being just as duplicitous (Guillemin, 2002, p.30).

Soviet scientists realized soon after the BWC signing that their efforts to further develop BW would be conspicuous if not masked. The answer was to create an ostensibly civilian organization, Biopreparat, which would appear to be part of the Soviet pharmaceutical industry. The Biopreparat workforce would consist mostly of military officers but with civilian titles and identity papers. They would be able to attend international conferences, publish papers, and conduct more open research. But in reality the majority of Biopreparat's efforts would be focused on BW R&D efforts at secret sites throughout the Soviet Union.

The deception continued in this manner for several years. Stocks of pathogens legally held by the Soviet Union for research under the BWC were quietly moved to laboratories where they were tested and modified to suit weapons parameters. Scientists worked diligently to create vaccines for pathogens, then pathogens that could fight through the vaccines, then versions of these pathogens that could survive delivery on an ICBM. In 1979, however, an accident threatened to bring the entire program into the light. Filters at an anthrax research facility near the Siberian town of Sverdlovsk were accidentally left open and anthrax spores were blown into the populated town.⁶ Within days there was a major outbreak of illness in the city, significant enough to come to the attention of expat newspapers in Europe. Queried as to the nature of the problem, Soviet officials engaged in a massive coverup that utilized aspects of their long-term deception plan with ad hoc measures to keep the international community guessing just enough.

The Soviet BW case offers the opportunity to study deception in a state that had significant control over information. It shows that when a state is able to practice denial effectively, and international agreements lack verification, even large programs can be protected by deception. It also shows that unforeseen "wild card" events, such as Sverdlovsk, can threaten that deception. But if the deception was meticulously maintained and is sufficiently flexible, even these wild card events can be weathered and the R&D program effectively protected.

⁶ There remains a lack of consensus on how the accident actually took place. But this explanation appears to be the most plausible, though there are no corroborated accounts of why this occurred in open literature.

Soviet Deceptive Measures

As with the German case, secondary research was conducted on the Soviet BW case to identify relevant data points for examination in the framework. Illustrative examples of those data points are discussed in this section. A full treatment of the research is presented in Appendix B. All data used in this research is sorted within the framework in Tables B-1 through B-7.

Coordination

The Soviet system of government put Moscow in the position to institute measures that would deny outsiders information about the BW program. Soviet society was closed, controlled, and kept even Soviet citizens from traveling to areas where they had no pressing interests.

Therefore, several measures were observed that functioned to conceal the activity of the BW program, but which required the knowledge or active participation of other parts of the Soviet government.

One example comes from the need to route material and information to various members of the program. The BW program was not acknowledged in any official correspondence, but instead was known as a “post office box institute” because any material being sent to the program for any purpose would only be addressed in this manner. For this reason, the BW program was sometimes referred to as A-1968 because this was the box number (Leitenberg and Zilinskas, 2012, p.60). In another example, the Ministry of Justice was directed to establish a special office to provide legal services and court functions to BW program personnel assigned to weapons facilities. These facilities were often closed to the outside and workers were restricted in their ability to travel. These legal services ensured their special circumstances were taken into account (Ellis and Kiefer, 2004, p.73). It is unlikely that anyone at the Justice Ministry openly questioned why these services were required; nonetheless the establishment of extraordinary administrative procedures is a common theme in coordination of these programs.

Ministerial coordination was also used to reveal fiction as part of the BW program’s deception plan. The Ministry of External Trade was directed to establish clandestine overseas trading missions that were used to import animals and equipment into the Soviet Union for use in BW testing (Alibek and Handelman, 1999, p.27). This was a more complex measure than it might first appear. Not only did these trade missions need to carefully coordinate their story so that they were engaged in ostensibly legal trade, but BW program officials had to provide direction to the Ministry to ensure the correct commodities were obtained. All of this had to be conducted in such a manner as to not reveal the true purpose for the imports.

Some purely internal coordination measures resulted in potentially observable signatures as well. The Soviet state economic planning committee, GOSPLAN, controlled the allocation of

funds for every program in the Soviet budget. This work was conducted by civilian bureaucrats and covered every effort from defense programs to agricultural improvements. But for the BW program, the budget was considered too sensitive to leave in the hands of those bureaucrats and was instead administered with separate funding codes by military officers. According to Alibek, this was the only program administered in this manner (1999, p.43). While GOSPLAN officials were almost certainly not aware of what the program in question actually consisted, they certainly did know that something out of the ordinary was being conducted. Such information, if known to an intelligence agency, might provide the impetus for further examination of other collected material.

One example of coordination is very similar to one found in the German case. There was a group of high Soviet officials who were knowledgeable about the BW program, but they were deliberate in not including numerous other officials who would normally have been aware of such a potentially diplomatically damaging effort. Alibek provides details of the ramifications of this exclusion in one telling example. When U.S. and British diplomats delivered a demarche to the Soviet Foreign Ministry over suspected BW research in 1989, the Foreign Minister angrily demanded to be briefed on what was happening in this research effort, apparently completely surprised by the Western allegations. One Soviet official who managed a major part of the BW program joked with Alibek that the Foreign Minister “apparently doesn’t like learning from foreigners what is going on in his government” (1999, p.149). Once again, foreign ministry officials were on the outside looking in on a deception protecting a major R&D effort.

Information Channels

Despite the closed nature of the Soviet system and the efforts to conceal the BW program, numerous channels of information regarding the Soviet research effort existed. Some were manipulated by the Soviets and some were the result of wild card events. One channel was the professional relationships between scientists and institutes in the Soviet Union and their Western counterparts. Biopreparat was created to manage these channels, but its management could not mitigate the factual transmission of information that would result in observable signatures for the BW program.

In one instance, exchanges between laboratories were indicators. The Byelorussian Research Institute of Epidemiology and Microbiology in Minsk was a frequent collaborator with the Institute of Tropical Medicine in Antwerp, Belgium. In the early 1980s, the Belgians supplied variants of the Ebola and Marburg viruses with which the Soviets had no experience to Minsk for research. Presumably, samples were passed to the BW program virology site in Zagorsk for further study and possible incorporation into the weapons program (Leitenberg and Zilinskas, 2012, p.93). Nothing was illegal about the transfer between the Belgian and Soviet facilities and no evidence was found that either the Soviets or the Belgians tried to conceal it in any way. But

it was an indicator of Soviet research priorities that could have been seen by intelligence agencies and placed in its proper context with knowledge of Biopreparat's role as a facilitator between Soviet research institutions and the BW program.

Following the establishment of scientific exchanges and inspections in the 1980s, activities that had not been mandated by the BWC, an additional channel developed between Soviet and Western scientists – one not controlled by the Soviets despite their best efforts. Western scientists visiting Soviet research facilities were sometimes suspicious of what they were being shown but never came away with “smoking gun” evidence, instead believing their entire time in the Soviet Union was carefully controlled and their interactions with their Soviet counterparts carefully scripted by Moscow. But, as will be seen in other cases, these interactions between highly trained specialists from the Western and Soviet sides resulted in some exchange of truthful information. One Western inspector commented that his Soviet counterparts were often eager to make the point that, no matter what the public perception was, the Soviets were ahead of the West in many research areas – ones with BW applications. These comments “were not said in the general meetings where tape recorders were going, but they were done in the corridor discussions as we were moving to and from different places” (PBS, 1998a). Such interactions result in observable signatures and only take place when the diplomacy of the case permits.

The desire of the Soviet scientists to make such comments may be understandable given the efforts by their government to conceal their achievements. The research conducted as part of the BW R&D effort necessarily included many legitimate advances in areas such as vaccination and pathogen mitigation. Former Soviet BW officials have noted that in many cases these discoveries were made before similar ones of Western scientists that were published and received acclaim. But due to secrecy restrictions, the Soviet researchers could not publish or announce their findings (Domaradskij and Orent, 2003, p.116). The clearly advanced state of Soviet research in this field, evident in the institutional exchanges and inspections conducted with Western counterparts, makes the absence of published research an indicator. As will be seen in other cases, some publishable results should have been seen from years of advanced and supposedly peaceful research.

Soviet actions regarding information channels between scientists were not limited solely to revealing and concealing factual information. They also used their scientific community and recognized medical journals to transmit false information that the Soviets knew would be given credibility by its presentation in this manner. Several such instances surround the 1979 anthrax incident in Sverdlovsk. In one example, two prominent Soviet scientists appeared to bolster the official government line that the anthrax came from contaminated meat by publishing an article in a supposedly independent and peer-reviewed journal. The article argued that anthrax outbreaks in animals had occurred in the Sverdlovsk region 159 times between 1936-1968 and

hence this was a plausible, even likely, source of the outbreak (Bezdenzhnykh and Nikiforov, 1980; see Mangold and Goldberg, 1999, p.76). Nikiforov was also instrumental in spreading the Soviet government message by conducting presentations featuring autopsy photos of Sverdlovsk victims, specifically photos of the intestinal tracts that showed infection, during a tour of the United States. When asked for photos showing the victims' respiratory tracts or lungs, he responded that he had forgotten to bring them (Gumbel, 1991b). A more in-depth discussion of these actions, their acceptance by some in the U.S. scientific community, and their impact is presented in Appendix B. For the purposes of this section, it is important to note that Soviet officials recognized that certain channels of communication (journals and presentations to colleagues) existed with established credibility and that were presumed in the United States to be independent from government tampering. This was not the case, and Soviet officials utilized these channels and the naiveté of several U.S. scientists to confuse analysis of what had actually taken place at Sverdlovsk.

Interactions

The Soviet manipulation of some of these channels influenced the interactions between the Soviet and U.S. governments. The most obvious example of this also comes from the Sverdlovsk anthrax incident in 1979. As concern grew within the U.S. government that the accident had involved a secret research facility and weaponized anthrax, Moscow directed its diplomats to respond to any questions or pressure regarding the incident by blaming “misinformation agencies” of Western governments. In addition to the journal articles and presentations by Soviet scientists, Moscow invited several prominent U.S. researchers to visit Sverdlovsk as well as a handful of institutes. At least one of the U.S. researchers had a recent history of being critical of U.S. government claims regarding BW research in the Soviet Union and his public statements following discussions with Soviet colleagues remained critical. As U.S. diplomats continued to press their Soviet counterparts for answers about R&D in this field for several years, he wrote “Contrary to the U.S. government version, there is no evidence of inhalatory anthrax...It is clear that the U.S. version of the Sverdlovsk anthrax outbreak is in need of careful and objective review” (Meselson, 1988, p.6).

The Sverdlovsk outbreak was a mystery in 1979 and the evidence available in the United States was certainly not conclusive enough to solve it. But as U.S. analysts offered assessments and degrees of confidence to policy makers the effect of their message was diluted by the Soviet deception. The sustained and consistent Soviet message that contaminated meat sold on the black market caused the outbreak, aided by the criticisms of U.S. subject matter experts, resulted in a U.S. bureaucracy suspicious but unsure of what had happened or what should be done about it.

In March 1980 a conference was held by all of the signatories of the BWC to review progress on BW disarmament. During this conference, U.S. diplomats accused the Soviets of covering up the anthrax incident. Predictably, the Soviets were infuriated and issued strong denials. But U.S. officials had so little faith in the evidence behind their accusations that, faced with Soviet consistency in denial and alternate explanations for the incident, they chose not to argue the point before the entire convention. When a draft declaration was circulated at the end of the conference that stated the BWC had never been violated, the United States did not object to the wording despite accusing the Soviets of just such an action only days prior. The declaration was adopted (Gordin, 1997, pp.451-452). The acceptance of blatant and widespread violation of the BWC by the Soviet Union so soon after agreement on the BWC likely would have had disastrous effects on nonproliferation in this area. The United States and other NATO countries may have been forced to call for the addition of mandatory inspections to the treaty, which would likely not have been accepted, or for the treaty's total dissolution (Leitenberg and Zilinskas, 2012, p.395).

The impact of this interaction went beyond the issue of biological weapons, and it is important to consider the Soviet deception in the context of other issues between the superpowers. President Carter and Secretary Brezhnev signed the second round of Strategic Arms Limitation Talks (SALT II) agreements in June 1979 and those agreements were immediately submitted to the U.S. Senate for ratification. Arms control opponents in Washington searched for any evidence that could be used in arguments against agreement with Moscow on nuclear arms reductions. Some SALT opponents did seize on rumors about Sverdlovsk in early 1980 to argue that the Soviets could not be trusted in any aspect of arms control (Leitenberg and Zilinskas, 2012, pp.423-424). While SALT II was never ratified, it became U.S. policy to honor the agreement. Had the Soviet BW program been decisively exposed in 1980, it may have placed considerable pressure on Presidents Carter and Reagan to not adhere to any arms control agreements.

Thus, the Soviet government was gambling with the BW program and the deception protecting the program was also protecting diplomatic initiatives in other areas of arms control. This is the most important contribution of the Soviet BW case to this research. The Soviet deception plan did not shield the presence of an R&D effort from U.S. analysts. Several analysts had warned of such a program that violated the BWC for several years before Sverdlovsk (PBS, 1998b). But it did give Soviet officials an advantage in dealing with U.S. accusations of treaty violations. This deception could not hold forever and could not withstand every wild card event.⁷ It gave Moscow the ability to pursue what some considered a vital weapons program as well as ensuring that other pressing arms control initiatives remained intact.

⁷ The program was eventually unraveled by the defections of high-level officials and then by the emigration of several others after the collapse of the Soviet Union.

Hypotheses

The three themes – coordination, channels, and interactions – yield hypotheses that can be tested with the theory-confirming cases. This section presents these hypotheses.

Coordination

Any effort as large as the R&D programs being considered requires coordination. This is even more certain if the effort is approved, funded, and managed by a government bureaucracy – a bureaucracy that must also develop and present a diplomatic message that confirms or conceals the R&D. Failure to coordinate effectively may yield results such as mismatched capabilities (e.g. a weapon constructed without effective means of delivery) or multiple lines of effort towards the same goal. The deception plan must be similarly coordinated between various elements within the bureaucracy and failure to do so will result in detectable incongruities. One example of such an incongruity comes from David Kay, the Chief Weapons Inspector for the UN in Iraq following the first Gulf War. In 1991, officials from Iraq’s nuclear program explained that Iraq had acquired numerous export controlled components in an attempt to address a stage separation issue in conventional SCUD missiles – in other words, the component acquisitions had nothing to do with a nuclear program. When inspectors checked this with officials from Iraq’s missile program, those officials stated unequivocally that the stage separation issue had never been addressed in a manner requiring those particular components. Unfortunately for the Iraqis, the cover story had not been coordinated between the two weapons programs and hence it was easy to dispel (2016).

Several examples of coordination within the deception plan were referenced in the preceding sections, all of which involved the deceiver’s bureaucracy. In both cases, there were examples of special organizations being established to coordinate activity within the R&D program and those organizations functioned secretly or with false purposes. In the German example, the Central Bureau for German Rearmament was hidden within the Defense Ministry in 1934. Biopreparat was the organization created in the Soviet Union, both to coordinate aspects of the BW program and provide a fictitious civilian front to the research effort. Detection of the new German group or an understanding of the true nature and purpose of Biopreparat would have provided an analyst with an indicator that covert work was taking place.

In addition to creating new organizations within the bureaucracy, key functions were also altered in unusual or unprecedented ways. This was particularly true in funding mechanisms. The common Weimar Republic practice of overestimating costs within the navy budget and then using the excess funds as resources for undeclared activities is one example of this, as was the Nazi-era practice of “white” and “black” budgets with vastly different amounts for various

programs and defense spending in general. The Soviet BW program provided an example on a more micro level, where GOSPLAN funding of the program was handled exclusively by military officers and this was the only such program known by several officials to be administered in this manner. Again, these are observable signatures that might be seen with assets in the right place, even if those assets cannot provide information on the actual R&D effort.

Finally, both cases exhibited the theme of the “group within the group.” Highly-placed officials within the bureaucracy, in these cases the respective foreign ministries, were excluded from knowledge of the R&D program, and hence from the full picture of the government’s security perceptions and foreign policy goals. The observable signature from this type of action is an incongruity between the statements of the deceiver’s officials and actual activity. If the analyst has the means to see either disagreement between groups within the deceiver government or knows that officials seem to be ignorant of certain facts regarding the program, this could be an indication that a larger effort is underway and deception is protecting it.

While none of the signatures identified from coordination are obvious or “smoking gun” evidence, they are potentially observable and, if detected, indicate that closer scrutiny is warranted. They are necessary products of the actions the deceiver must take to manage its bureaucracy and ensure the consistency of the deception and R&D program. While hidden, they cannot be completely concealed by the deceiver and therefore they yield the first hypothesis.

- ***H1: The coordination of deception will result in observable signatures.***

It is logical that efforts spanning the bureaucracy on this scale require coordination in some form, so it is expected that with the benefit of hindsight such coordination will be visible in the theory-confirming cases. The ability to validate or strengthen this hypothesis will depend upon whether an argument can be made that such signatures might have been observable at the time. For example, it may not be possible for an intelligence agency to determine whether scientists are conducting research on their own or whether the government is involved in an R&D program. One would need a very highly placed source or perhaps a signals intelligence capability to know whether the interaction between high government officials and scientists is directing a nuclear weapons effort. If, on the other hand, a special committee is formed of high officials from the government, military, and scientific sectors then the signature becomes more observable. More potential human sources will be aware of the coordination in addition to signals and other types of intelligence.

Channels

The clearest theme that emerges from the examples of information channels is that verification mechanisms significantly increased the effort required to deceive. In Germany, the presence of the Inter-Allied Control Commission until 1927 compelled German industrialists to move their infrastructure out of Germany and the armed forces to create false enlistment practices. The German government continued to pursue rearmament even with the presence of the Commission and achieved some success, but the Allies had visibility of many of these efforts. The research shows that once the Commission left in 1927, assessment of German intentions and progress was greatly reduced. Thus, as Hitler decides several years later to project exaggerated strength for his army and air force, there was uncertainty in London and Paris as to how accurate their information was and precious few means by which they could corroborate their information.

In the Soviet example, the BWC provided no verification mechanism so the BW program initially only had to evade detection by Western intelligence services. During this period there is little evidence that U.S. and other Western analysts accurately assessed the size and extent of the program – even after the Sverdlovsk incident. However, we see that once site visits and other interactions are initiated later in the program Soviet scientists mention their progress to their Western counterparts and the lack of published research becomes conspicuous once the sophistication of the research is understood.

R.V. Jones, a British physicist and World War II-era intelligence officer, argued that increasing the number of communication channels placed a burden on the deceiver to maintain the deception (see Whaley and Busby, 2002, p.197). The second hypothesis argues that this principle holds for long-term deception and the cases will show that the more ways the target can get information the more likely the deception will not protect the program.

- ***H2: The existence of multiple channels increases the complexity of deception and the likelihood that the target will have an understanding of the R&D program.***

Many of the cases contain events where the number of channels between the deceiver and target changes. This was true of the withdrawal of the Inter-Allied Control Commission in Germany and the introduction of visits to potential BW laboratories in the Soviet Union. If such changes in the theory-confirming cases result in no discernable change in the general knowledge of the target, no validation or refinement of this hypothesis will be possible from these case studies.

Interactions

As discussed in Chapter 2, it is in the interactions between the deceiver and the target that the primary difference between long-term deception and other types can be found. Both of the hypothesis-generating cases contain examples of the advantages that can be gained by executing a coherent and consistent deception plan. In the case of Germany, the Munich Conference in 1938 saw Hitler gambling that he could engage in an aggressive foreign policy and that others, particularly Britain and France, would not take steps to prevent his actions. His odds were improved by a sustained deception that had convinced many in the British and French policy making elite that he was stronger than he actually was and that any military move to stop him would be costly. We cannot know the weight given to various factors in the decision processes of participants such as British Prime Minister Neville Chamberlain. A decade of debates about German rearmament may have had an effect, as might the reports of Charles Lindbergh commenting on the sheer size of the Luftwaffe, its professionalism, and the German capacity to produce airplanes. But British confidence that the Allies' combined power was sufficient to challenge German strength almost certainly would have had an impact on Chamberlain's actions during what would become known as a defining event in European history.

The 1980 BWC conference is less historic than Chamberlain's appeasement of Hitler and rightly so. But the impact of the Soviet deception was similar to that in the German case. The understanding among U.S. officials that the Soviet Union had violated the BWC almost from the agreement's inception could not be translated into a diplomatic or policy victory for the United States. There were other considerations to not pressing the issue of Soviet cheating on the BWC, such as not wanting to give ammunition to arms control opponents in the United States and fears that the entire BWC regime would collapse. But the U.S. administration's inability to effectively argue that the Soviets were cheating took away any choice as to how to proceed and any leverage with the Soviets to compel them to shut down their program.

It should be noted that in both of these cases the target "knew" of the R&D effort. The British did have conflicting assessments of German armed forces strength, but knew that massive rearmament was under way and in several cases had accurately assessed German progress. Likewise, the United States was aware that the Soviet Union was violating the BWC somehow, but was unaware of the magnitude of the effort. Some would argue the target's knowledge in both of these cases renders deception a failure or irrelevant. These cases show, however, that even if the R&D effort is not entirely concealed there are real policy consequences for the target resulting from effective deception. If this is a useful and appropriate way to consider long-term deception, then similar interactions will be seen in the nuclear cases. This yields the third hypothesis that will be considered.

- ***H3: Successful long-term deception will benefit the deceiver by providing an advantage during discrete interactions with the target over the course of the program, even if the program itself is not entirely concealed.***

None of the programs contained in the theory-confirming cases were completely concealed from U.S. officials. Insight into or validation of this hypothesis depends on the identification of interactions where a plausible argument can be made that deception gave the proliferator an advantage. One such interaction, the conversations between Indian and U.S. officials leading up to the 1998 tests, has already been discussed and fits this criterion. If similar interactions exist in the Iraqi and South African cases, they may support this hypothesis.

Impacts of Hypothesis Validation

Validation or additional refinement of these hypotheses will complement the framework as well as provide intelligence analysts and scholars with insight into how long-term deception can be mitigated. Validation of the first hypothesis, the presence of observable signatures resulting from coordination, provides focus for intelligence collection efforts that may yield corroborating evidence of a program or indications that a potential program merits closer scrutiny. If the second hypothesis, the benefit of multiple channels for the target, is validated it supports an argument that more aggressive engagement and intelligence collection is beneficial when countering long-term deception. It also dispels the belief that a single “high-quality” channel of information, such as satellite imagery, negates the need for collection from multiple sources. Any support of the third hypothesis found in the theory-confirming cases will provide analysts and researchers with a basis to consider what constitutes deception “success.” It may lead to a greater understanding of why deceivers undertake these activities and how officials in those states weigh the risks of this course of action.

Theory-Confirming Cases

Three cases of nuclear weapons R&D – India, Iraq, and South Africa - are presented in Chapters 4 through 6. There are two sources of data in this study. Interviews were conducted with several subject matter experts in the cases examined and deception in general. These conversations focused on exploring topics on which the experts had published in greater depth and, in the case of deception and intelligence community experts, ideas on how to shape relevant lessons and recommendations from the research.

The majority of data came from secondary research of published journal articles, books, and interviews as well as declassified documents from the U.S. intelligence community. Three considerations should be kept in mind with regards to the secondary research material. First, as

previously stated, the programs being researched for the theory-confirming cases were highly secretive R&D efforts. In the case of India, the program is ongoing and nuclear weapons presumably still a part of the Indian defense strategy. While many researchers and journalists have conducted excellent analysis of these programs, it is likely that much of the material remains unknown. The pertinent question is whether that unknown information would substantially change the study's findings. Sufficient data exists to characterize each R&D effort, identify its distinctive characteristics, and identify themes that bind the three. The three hypotheses will also be addressed by the data that was found. It is likely that access to additional information might yield additional insights, but would be unlikely to change the conclusions found.

The second consideration is that each of these R&D programs has a distinctive element on which much of the research focuses. For South Africa, it was the voluntary dismantling of the weapons program. In the case of Iraq, it was the intrusive inspections imposed by the cease-fire agreement ending the 1991 Gulf War. For India the distinctive characteristic, especially among U.S. researchers, is the May 1998 nuclear tests and the lack of warning that intelligence agencies provided. Each of these elements figures prominently in the overall case analysis and yields valuable insight, but the data available for the cases is sometimes concentrated around that element. This was true of the Soviet BW case, where a significant amount of data was available surrounding the 1979 anthrax incident at Sverdlovsk and less data was available concerning the rest of the program. The only remedy available for this is to scope the cases as broadly as possible and to highlight data from other instances within the case in the course of the chapter. Within the framework, data is sorted without regard to whether it is attached to one of these episodes and hence the data in the deception charts may be skewed. But this is not unlike the experience of the intelligence analyst. Wild card events will result in more signatures – the key is to categorize and consider them in such a way that they connect to other, previously underestimated or misunderstood data points.

Finally, declassified U.S. intelligence documents were used where they were available. Nothing in the case study presentations is intended to critique the performance of U.S. intelligence agencies in their assessments of these R&D programs. Such a critique would not be possible using only declassified material and is not a desired result of this research. But a discussion of the general knowledge of the U.S. intelligence community regarding a R&D program is a necessary component of evaluating whether interactions between officials from the two states were or could have been potentially impacted by deception. Many of the declassified documents are National Intelligence Estimates (NIEs) or other material meant for policymakers. As noted by BW researchers Milton Leitenberg and Raymond Zilinskas, NIEs provide valuable information but at the same time exclude back-and-forth exchanges, arguments, and other expressions of opinions by analysts and subject matter experts that might present a more accurate

picture at what was known (2012, p.345). These documents do, however, show the consensus among analysts and agencies. In this study, they will be utilized to give a general idea of what was thought. For example, analysis of what the U.S. intelligence community knew about the Iraqi nuclear weapons program in the 1980s will focus on the understanding of Saddam Hussein's desire to lead the Arab world, his anger over Israeli nuclear capability, Baghdad's concern that it could not conventionally defeat Iran, and the presence of highly capable researchers and scientists in Iraq. It is not known whether analysts had direct knowledge of Iraqi efforts to develop numerous enrichment processes, but we can infer from the continuing mention of Iraq as a possible nuclear weapons proliferator that the intelligence community was generally aware of Baghdad's desires and intentions, if not their actual progress.

Each case chapter contains a section on the historical background of the nuclear weapons R&D effort in that state, as well as a summary of the relevant R&D program elements. The program elements are those proposed by Roy E. Horton in his analysis of South Africa's weapons program: 1) raw materials, 2) the ability to obtain weapons-grade material, 3) trained personnel and adequate facilities, and 4) the capability to acquire and manufacture components (1999, p.4). Two additional program elements facilitate analysis of the hypotheses. The first is the capability to test, which was a key factor in all three cases. The second is how the program was managed. The importance of program management varies between the cases, but in two – Iraq and South Africa – the structure of the R&D management bureaucracy was a pivotal component of the deception. The discussion of the historical background and program elements is not intended to be exhaustive. Rather, it is intended to give the reader a sense of how the R&D program developed, how the state perceived its international standing and the inherent risks involved with pursuing nuclear weapons, and how the United States interacted with the state and evaluated its nuclear weapons potential.

Chapters 4 through 6 present the common and distinctive themes found in the cases as well as data within the framework proposed in Chapter 2. The framework analysis includes a more detailed treatment of the potentially observable signatures, categorized by whether the action was intended to reveal or conceal information and whether it involved fact of fiction. Each chapter concludes with the case's relevance to the three hypotheses.

Nuclear Weapons Policy, Weapons Development, and Deception Goals

Analysis of the distinctive aspects of each case necessarily involves categorizing the state's goals for its weapons program, perceptions of its security situation, decisions regarding research paths and development of nuclear weapons, strategy for deception, and objectives for action on the part of the United States. A broad categorization of these aspects, based on a review of general literature and a preliminary analysis of the theory-confirming cases, is shown in Figure 3-1.

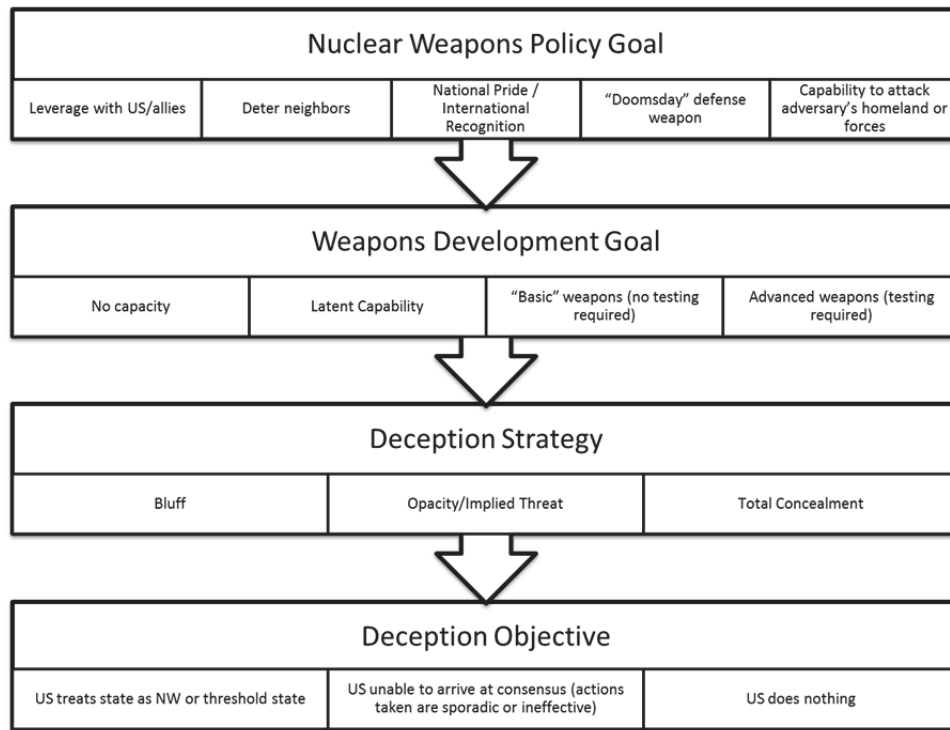


Figure 3-1 Goals, Strategy, and Objective Categories

In addition to articulating why and how each state went about pursuing nuclear weapons, these categories address the third research goal stated in Chapter 1, which was to develop a hypothesis that addresses what we can say about a state's foreign policy goals based on its deception. The three nuclear cases show that a logical flow exists from identification of nuclear weapon policy goals to the objective of deception. A fourth hypothesis is presented in Chapter 7 that asks whether identification of deception methods can be used to project nuclear weapons and foreign policy goals. The categories found in Figure 3-1 are not mutually exclusive; each case has several goals in each category and in one case the goals underwent a sudden change. This categorization of goals shows that not every state pursues nuclear weapons for the same reason, in the same manner, and with the same end-state in mind. Misdiagnosis of a state's motivations and intentions may lead to critical policy errors by U.S. officials.

Nuclear Weapons Policy Goals

Case research resulted in five categories of goals for nuclear weapons policy. The first is leverage with the United States or other allies. This is not an intuitive reason for nuclear weapons development, but will be seen clearly in the case of South Africa. In this category, the state has no direct strategic or tactical need for nuclear weapons when considering the threats to its security. But the belief that the potential use of such weapons will compel a reluctant or

ambivalent ally to come to the regime's aid was seen in the South African case has sufficient justification for embarking on a nuclear weapons program.

The second, and a more intuitive, goal is the deterrence of neighbors. This goal is found in cases where a state is conventionally weak or surrounded by potential adversaries that could overwhelm it. In this research it is seen in the cases of India and Iraq, both of whom faced near adversaries that had defeated them before. India lost a conflict with China in 1962 that, combined with China's nuclear test two years later, helped inspire New Delhi's desire for nuclear weapons capability. China's collaboration with India's archrival Pakistan on nuclear weapons and other defense development also led to a belief that India required deterrence capability on this level. Iraq had not been defeated by Iran but had failed to win against Iranian revolutionary forces. Saddam Hussein, acting as dictator over a society with a large and restive Shi'a population, considered this failure to win equivalent to defeat. Additionally, his tense relations with the Gulf Arab states and his animosity towards Israel created a tenuous security situation for Baghdad. Possession of a nuclear weapon would deter Iranian forces, Arab sheikhs, and the always-present threat of Israeli military action.

The deterrence value of nuclear weapons speaks to the fact that these devices are more than just weapons to be used in war. In addition to deterrence, states can claim a considerable amount of national pride in developing and possessing nuclear weapons. This is true even of the United States, the only country to use nuclear weapons in a conflict. The site of the first full-scale plutonium production reactor, B Reactor in Hanford, WA, is now a National Historic Landmark. Scott D. Sagan notes that nuclear weapons are more than weapons, they are "political objects of considerable importance in domestic debates and international bureaucratic struggles and can also serve as international normative symbols of modernity and identity" (1997, p.55). The desire to show that a state has the capability to build a nuclear weapon is present in each of the three cases that will be analyzed. If it was not a primary motivator of the government authorizing the R&D program, it was certainly a motivator for many of the scientists working within the program.

On the scarier end of the spectrum are goals that would involve actual employment of nuclear weapons. One such category is having nuclear weapons as a "doomsday" defense. Together with national pride this is likely the most common goal for nuclear weapon states. Rather than focus on nearby states that need to be deterred, this goal is oriented purely towards keeping the regime in power. Any external force that threatens to topple the government must account for the possibility that these weapons will be employed. Perhaps the most easily illustrated example of this is the unacknowledged nuclear weapons capability of Israel. Presumably, if the countries surrounding Israel conducted a coordinated attack, one that appeared likely to succeed, the Israeli government would have the option of countering such a move with

nuclear weapons – making the cost of such a conflict unacceptably high. This was likely a significant motivation for Israeli nuclear weapons development. Each of the cases in this study also subscribes to this goal to some extent. The most obvious is Saddam’s regime in Iraq, which clearly existed under a constant perception of threat and wanted every means of insurance it could obtain.

The final category of nuclear weapons goals is the capability to attack the adversary’s homeland or forces. The only historical example of this goal is the United States. While the race for nuclear weapons was a critical effort in World War II, the successful testing of the weapon and its use against Japan were not motivated by deterrence or as a “doomsday” weapon. Rather, it was intended to remove the fighting will and capacity of the adversary and save the need for a costly invasion of the Japanese homeland. As the opinion of the international community regarding nuclear weapons has evolved, it has become very unlikely that a state would employ a nuclear weapon in a purely offensive manner. Perhaps irrational regimes such as North Korea entertain this notion, but it is more likely that such a set of goals has been relegated to the past.

Weapons Development Goals

There is more than one path to acquiring nuclear weapons. The decision of how to proceed, if a state actually has a choice, is determined by several factors. The first is the natural resources available to the state, whether they are resources within the state’s borders or material that can be reliably acquired. The second factor is whether the state’s already-existing capabilities fit with the weapon. If a state does not have an air force that can reliably deliver a nuclear weapon it may need to develop smaller and more advanced warheads for missile delivery. These factors are practical, but examination of the three cases indicates that weapons development is also related to policy goals.

The first weapons development goal is not seen in any of the cases in this study, but does have one well-known example. It is the goal of not developing a weapon at all. As stated previously, the presence of deception does not necessarily mean the presence of a nuclear weapons program and this development goal reflects that reality. States may consider it too costly or too risky to actually pursue development, but may derive benefit from others believing they have the weapons or not being sure. Iraq in the period before the 2003 invasion is an excellent example of this. There is consensus that Saddam had no capability to develop a weapon at that point, but he had no desire to appear any weaker in the face of Iran and other challenges than he already had. He was thus still engaged in interactions regarding nuclear weapons, but with no intention (or ability) of actually developing the capability.

More common than having no intention to develop is what will be called “latent capacity.” Under this weapons development goal, the state seeks to get as close to the ability to construct a

nuclear device as it can without incurring any penalty from the international community or other external sources. The NPT makes this an attractive option for many states that do not wish to rule out the necessity of nuclear weapons at some point in the future. Such a state might advocate and pursue a robust civilian nuclear energy program, complete with enrichment and reprocessing capabilities, in order to get as much of the knowledge and infrastructure in place for a time when the decision to pursue nuclear weapons is made (Deutch, 1992, p.125). Among the cases in this study, India is the best example of this. Following the “peaceful nuclear explosion” of 1974, the Indians obviously had the capability to aggressively pursue and develop nuclear weapons, but instead settled for steady improvements in their nuclear infrastructure and preparations for the time when a government would decide to move ahead with the weapons program.

When the decision has been made to actually produce a weapon, the state still faces several choices. This dissertation focuses on two paths to a nuclear weapon – “basic” and “advanced.” One very important difference between these two categories is that if the weapon’s design is “advanced,” then testing will be required to ensure its reliability – an action that is “technically desirable but politically risky” (Deutch, 1992, p.123). The reason it is politically risky is that the quality of monitoring equipment, especially that used to supporting monitoring for the Comprehensive Test Ban Treaty, is so advanced that it is extremely unlikely that a nuclear detonation of any size will be conducted in secret anywhere in the world (Hymans, 2010, p.174).

This has significant implications for the deception plan. If the deceiver is pursuing a nuclear weapon design that requires testing, then they must assume that at that point there is no longer a reasonable expectation of opacity or concealment. The difference in the approach to testing will be seen in two case examples – South Africa and India. In the South African case, nuclear weapons were developed but their policy goals did not require testing and therefore a basic “gun-type” weapon sufficed, though they were capable of pursuing more advanced designs. In the case of India, a test was required to meet their policy goals and they pursued more advanced and versatile weapons designs.

Deception Strategy

Deception is not a one-size-fits-all concept. It can be practiced with different methods and with different goals. As with the areas of nuclear weapons policy and development, the case research revealed a basic categorization for deception strategy in these R&D efforts.

The first strategy is a logical match to the goal of not developing. A state may have an incentive to bluff about its possession of nuclear weapons. There are paradoxical incentives for pursuing nuclear weapons if the state can achieve them or convince others that they have achieved them. These incentives include a “seat at the table,” demonstration of political

independence and scientific achievement, and self-reliance (Epstein, 1977, p.21). If a state sees these incentives but does not have the means to develop quickly, deception can be practiced in the reverse direction of how it is normally seen and the state can bluff about a capability. We see evidence of this in the hypothesis-generating cases with the Germans transmitting information to make it appear as if they have capabilities and numbers in their armed forces that they did not have. This is also arguably the deception strategy of Saddam Hussein before the 2003 invasion, when he seemingly attempted to create the impression in the minds of Tehran and others that he had or was close to having a weapons capability.

The second category is “opacity or implied threat” and logically matches well with the weapons development goal of “latent capability.” It is also possible to have a fully developed nuclear weapons capability and have this as a deception strategy, as is likely the case with Israel. This deception is restricted by the necessity or choice of testing which, as previously discussed, will remove any opacity or implication from the threat. This is still an attractive option for many current and aspiring nuclear powers, however. Testing, which used to be the mark of a successful weapons program, is no longer a necessity in what is referred to as the “second nuclear age,” or the period following international nonproliferation agreements (Hymans, 2010, p.168). South Africa certainly fits this category, as did India for many years prior to its decision to conduct a test in 1998. It is likely that some activity will be noticed and some true information will reach the target, but for this strategy the deceiver just needs to maintain some doubt as to its actual capabilities.

The final category is total concealment and is the one that many consider the metric for success in deception. Self-explanatory, this strategy is a deception to hide the very existence of the R&D effort. It is arguably implausible over the long-term, but two of the three case studies have followed this strategy. India adopted this strategy in 1998 when it decided to conduct a nuclear test and knew that the United States would intervene if it detected the preparations. Iraq also followed a total concealment strategy following the Israeli bombing of the Osiraq reactor, realizing that any detection of its nuclear weapons R&D effort would result in fast military action. It is doubtful that either of these deceptions could have been conducted over the long-term and with success in the pursuit of nuclear weapons, through the Iraqi deception did last for several years.

The goal of the deception in these cases was to influence the actions of the United States. There are three logical options for this action, ranging from the United States treating the state as a nuclear weapons state without cause – of which there are no examples – to the United States simply doing nothing because it has no knowledge of the R&D program or it has no viable alternatives. The middle option is for U.S. policy to be sporadic and ineffective – at times seeking to prevent nuclear weapons development and at times paying no attention or looking the

other way. Again, the cases present numerous examples of U.S. reaction to potential nuclear weapons development on this scale.

Conclusion

The hypothesis-generating cases of German rearmament and the Soviet BW program provide valuable insight into what can be expected when assessing a major R&D program within the proposed framework. Analysis in each of the theory-confirming cases focuses on the three hypotheses. Additional analysis seeks to categorize the distinctive nuclear weapons policy and development goals as well as the deception strategy for India, Iraq, and South Africa. This analysis will serve to confirm or dispute the hypotheses and will permit the formulation of relevant recommendations for the analysis of future potential nuclear weapons R&D programs.

4. The Republic of India (1974-1998)

“It’s not a failure of the CIA. It’s a matter of their intelligence being good, our deception being better.” – G. Balachandran, Indian nuclear researcher (May 15, 1998)

The May 1998 nuclear tests in India were an embarrassment for the U.S. intelligence community as word quickly spread that senior U.S. officials had only learned of the tests when they saw CNN reports. Congressional committees immediately called for an outside review of what had caused the failure of warning. The Indian government had no illusions that the event would be immediately detected and it was apparent that the test was intended as an announcement that India had taken its place among the nuclear powers. What took longer to become apparent was that the Indian government had engaged in a significant deception to cover its preparations – a deception that consisted not only of covert test preparations but also decades of opacity as to its nuclear capabilities and intentions.

Just two months before the 1998 tests, the Bharatiya Janata Party (BJP) had come to power in parliamentary elections. The BJP had included development of an Indian nuclear deterrent as part of its manifesto for almost four decades. The new BJP prime minister, Atal Vajpayee, had spoken publicly on several occasions after the Chinese nuclear test in 1964 that “the answer to an atom bomb is an atom bomb, nothing else” (Sharma, 1998, p.30). This stance had not been pervasive throughout the Indian government in the decades between the Chinese and Indian tests. In fact, Vajpayee’s predecessor as Prime Minister, Inder Kumar Gujral, had frequently spoken out against nuclear weapons development, arguing “we will end up being only a beggar with a pistol. It is far more important to banish poverty and make India literate” (Chengappa, 2000, p.405). Gujral’s and Vajpayee’s strong opinions on nuclear weapons development make them outliers among Indian officials between 1964 and 1998, most of whom were vague on their stances in public. Administrations in New Delhi gave no indication whether they were pursuing a weapon or not.

This case covers the period from 1974, when India conducted its peaceful nuclear explosion and showed it had the technological capability to produce a weapon, to 1998 when India declared itself to be a nuclear weapons state by testing. India considered itself an advanced and capable country that was not treated with the appropriate respect by the international community and that faced significant regional security threats. Its nuclear weapons development advanced slowly over several decades, but was motivated to test in the mid-1990s by the very nonproliferation efforts intended to stop it. To continue the development without interference, India was forced to both conceal its progress and deceive about its intentions.

Historical Background

Indian nuclear development pre-dated Indian independence. Cambridge-trained physicist Homi J. Bhaba convinced the wealthy and powerful Tata family to fund a research institute shortly before India became independent and afterwards convinced Prime Minister Nehru to give state support to the effort (Ganguly, 1999, pp.149-150). Bhaba's institute conducted high-quality research in numerous nuclear topics, but the Indian government's position was firm on nuclear disarmament and the immorality of nuclear weapons.

That position softened following China's nuclear test in 1964 (Paul, 1998, p.5). India and China had fought a border war two years earlier that resulted in a humiliating defeat for the Indian Army and New Delhi had no reason to believe tensions would not remain high. India was compelled not only by security considerations, but also by national pride, to research capabilities that would permit it to move down the path to nuclear weapons capability. Ten years later, in 1974, India would conduct its first nuclear detonation – the “peaceful nuclear explosion” (PNE).

The PNE resulted in something of a policy shock for the Indian government for two reasons. First, the potential utility of PNEs was regularly discussed within the international community – including between U.S. and Indian scientists. Many saw PNEs as having benefits for operations such as mining and dredging and believed the pursuit of such capability to be peaceful and legitimate. Second, Indian scientists did not consider explosive device used in the PNE a “weapon” because it was in no way deliverable or reliable in that way. Prime Minister Indira Gandhi authorized the experiment and was certainly pleased when it succeeded. But she was surprised at the strength of international condemnation over the event (Tellis, 2016). This condemnation may have convinced New Delhi that any future nuclear R&D would be assumed to be geared towards weaponization, and would hence needed to be conducted more covertly. To the rest of the world, it appeared as if India had demonstrated a *de facto* weapons capability with its PNE in 1974. A quarter century later, many who were shocked and alarmed at the Indian test would need to be reminded that India had proved its capability to detonate a nuclear device decades before.

India's nascent interest in nuclear weapons did not fit comfortably with its overall foreign policy. Successive Indian governments had maintained a consistent policy of non-alignment in the Cold War and professed a belief that the superpowers' possession of the immoral nuclear weapons was another method of domination over weaker and lesser developed states. Initiatives such as the NPT were not seen in New Delhi as efforts to prevent the spread of the world's deadliest weapons, but rather as the means to ensure only certain powers possessed that capability. India refused to sign the NPT on the grounds that it was discriminatory against

developing nations and remained ambiguously nuclear, but such a position could not last indefinitely.

In 1984, Rajiv Gandhi became prime minister following the assassination of his mother. Interested in science and technology issues in general, Gandhi allocated significant resources to Indian nuclear research to include the weapons program. According to Ashley Tellis, the nuclear weapons program accelerated during this time but truly gained steam several years later. Around 1987, information began to leak about Chinese assistance to the Pakistani nuclear weapons program. The Indian government considered this information credible and Prime Minister Gandhi came to believe that the United States cannot prevent Pakistan from acquiring a weapon as many in New Delhi had previously hoped. By 1990 these concerns were shared throughout the higher levels of the Indian government and there was a clear conviction that an Indian weapon is necessary (2016). The only choice facing Indian officials was whether to declare their efforts or keep them undeclared. Perhaps partially due to the unexpected condemnation in 1974, the government chose to continue nuclear R&D in secret and follow a policy of opacity.

However, this opacity was sometimes impossible to maintain due to both international and domestic events. Internationally, the Comprehensive Test Ban Treaty (CTBT) came to a vote in September 1996 and forced India to take a position either for nonproliferation or for its own ability to develop if it so chose. India was in a diplomatic quandary, faced with a decision of whether to sign an agreement it intended to openly break later or bring about more international suspicion over its nuclear ambitions. It voted against the treaty, Pakistan abstained, and the world was put on notice, or reminded, that India and Pakistan were both considering the nuclear option (Chengappa, 2000, p.401).

Two years later nuclear weapons became a domestic campaign issue in India. Despite the BJP's consistent advocacy for nuclear weapons capability, its tone softened during the campaign in early 1998, stating only that it wanted to exercise the option to "induct" nuclear weapons if necessary (Perkovich, 2000, p.407). But this softening of tone masked a sea change in Indian nuclear weapons policy. Such masking is typical when leadership changes as new leaders may initially support current policies during a transition period (Handel, 1980, p.65). But events would compel the new BJP government, and Prime Minister Vajpayee, to make a radical change to India's approach of nuclear opacity.

The 1998 Tests

Vajpayee's seemingly dual opinions and statements on nuclear weapons in many ways mirror India's policies. Following a visit to Hiroshima in 1982, Vajpayee penned a poem that denounced the horror and immorality of nuclear weapons, but later backed up his 1964 parliamentary statements by declaring "Hiroshima convinced me that the world respects only the

strong and has no patience for the weak” (Chengappa, 2000, p.7). When briefly occupying the post of Prime Minister in 1996, Vajpayee ordered nuclear tests to proceed, but they were subsequently canceled when his premiership collapsed after just 13 days. This was not the only time that nuclear tests had been planned and the BJP was not the only group in Indian politics lobbying for a nuclear capability.

Indian nuclear testing was conducted at a site called Pokhran, a remote location in the Thar Desert of northwest India. The site had been in use for several decades as a weapons testing site and had been the location of the 1974 “Smiling Buddha” PNE event. It was therefore known to U.S., IAEA, and other officials as well as intelligence agencies. Despite frequent pauses in the Indian nuclear weapons program and the concerns of many Indian officials about international reactions to a test, orders were given to test on three known occasions prior to 1998. In 1982, 1995, and 1996 test preparations were conducted at Pokhran and all three times those preparations were detected. In each instance, the test was canceled after diplomatic objections. In 1995, the U.S. ambassador personally delivered Washington’s objections and shared a satellite image with Indian officials that had clearly showed test preparations (Talbot, 2004, pp.37-38). The lesson was clear that India would need to be more careful in future preparations. A unit of the Indian Army, the 58th Engineer Regiment, was assigned to Pokhran with the task of developing ways to conceal future test preparations – particularly from satellite imagery (Chengappa, 2000, p.16). All of this occurred before the BJP government came to power.

There was support for a nuclear weapons capability from several key groups within India. The scientific and defense communities, notably the Defence Research and Development Organization (DRDO) and the Bhabha Atomic Research Centre (BARC), supported the application of decades of work and research that had been done to get India to the threshold of being a nuclear power. By the mid-1990s, many at these organizations and throughout the government feared that the indefinite extension of the NPT, for which the United States had been aggressively lobbying, threatened to perpetuate what was seen as nuclear discrimination between the nuclear weapon states and the rest of the world. Additionally, the Indian public was concerned that India was dealing with threats from both China and an increasingly nuclear (and Chinese supported) Pakistan. Any concerns held by the public or policy elite that India would be ostracized for testing were outweighed by the perception of immediate threat. A *Times of India* editorial articulated this sentiment: “A drowning man will grasp even a thermonuclear device to stay alive. And he isn’t going to think of the consequences” (see Perkovich, 2000, p.422).

Thus the Indian public and nuclear research complex was supportive of nuclear testing and a new and hawkish BJP government was brought into office in March 1998. Despite the seeming inevitability of an Indian test, it was an unexpected event that appears to have spurred the timing of the decision. On April 6th Pakistan tested an intermediate-range ballistic missile, named

Ghuri (Ganguly, 1999, p.170). There was understandably a large amount of concern throughout Indian government and society over this event. Accounts of Vajpayee's decision to test vary but one authority on the Indian program, George Perkovich, cites the widely reported date of April 10th as the one on which Vajpayee directed the test be conducted, just four days after Pakistan's provocative test (2000, p.412). This date would have significant repercussions for analysis of the Indian deception plan.

The various involved parties sprang into action. Scientists received calls at their residences asking for them by cover names and signaling them to travel to Pokhran by circuitous routes. Once they arrived, many were dressed in army fatigues to mask the sudden influx of civilians to the test site. Soldiers from the 58th Engineers carefully ran wiring and then covered up their work with bushes and dirt. They went so far as to construct a soccer field next to a test shaft and play nightly games to give the impression that nothing significant was happening. Materials and components were moved to Pokhran in small, unguarded convoys so as to arouse no suspicions. On May 11th, India was able to detonate a nuclear device without having been detected by the intelligence agencies that had always caught them before.

Though news organizations had already broke the story, Prime Minister Vajpayee announced the successful tests. Jaswant Singh, a BJP politician who was to hold both the foreign and defense ministerial posts, stated that India had gained "much needed strategic space and [had broken] free from the new nuclear paradigm that had come into existence in the nineties. Don't forget the 1996 CTBT was proceeded by an extension of the NPT, unrevised and indefinite, which meant that a nuclear monopoly had been perpetuated for eternity" (Chengappa, 2000, p.434). The Indian deception had allowed the government to conduct a test and declare India a nuclear power. There were celebrations in the streets of New Delhi and the BJP daily newspaper issued a special edition on the nuclear accomplishment.

By some reports, the deception continued following the tests and those celebrating in the streets were among the targets. Five tests were conducted – three on May 11th and two on May 13th – and some researchers have noted a discrepancy between the claims of the various yields and what was actually recorded. Monitoring stations reported readings significantly below what should have been seen for three detonations of the yield that the Indians claimed on May 11th (Barker et al., 1998, p.1968). There was no seismic data recorded during the two tests on May 13th, though based on Indian claims of yield there should have been. While there is little doubt that a nuclear event took place, it is possible that the devices were not as effective as anticipated (Jones, 2000, p.7).

Though the lack of confirmation through seismic monitoring may have cast doubt on the reliability of Indian weapons, it was clear after the May 1998 tests that India had the capability to

acquire the necessary materials, construct a weapon, and detonate it. Arguably, only a weapons test could have communicated this capability effectively. The 1974 PNE had not been sufficient for deterrence, since both China and Pakistan had continued to develop their nuclear capabilities since that time. Realizing that opacity would not achieve their goals and knowing a nuclear test was required, the Indian government had to deal with the fact that U.S. and other intelligence agencies were paying attention to their R&D program and would act to stop a test on the sub-continent.

Effective deception was employed to permit India to conduct the test that would achieve its goals. But the tendency to limit discussion of the Indian R&D program and its deception to the May 1998 tests does not do justice to the Indian effort. For several decades India pursued a nuclear weapon through illicit acquisition of material, modification of knowledge and materials for the civilian nuclear power program, and secret interactions between defense and scientific institutions. India maintained a stance of nuclear opacity while considerable research efforts were underway and its deception plan maintained the program's security. Though the May 1998 tests are often considered a "kickoff" to the Indian nuclear weapons program, nuclear researcher Gaurav Kampani notes that all available evidence on the Indian nuclear weapons R&D program indicate that the 1998 tests were the "culmination of India's weaponization program, not a decision to begin weaponization" (1998, p.15).

Program Elements

Information about the internal workings of the Indian nuclear weapons program is scarce. Unlike the Iraqi and South African cases, the Indian nuclear weapons program is still a vital defense program for New Delhi and former officials do not frequently speak, nor has documentation been officially released. In addition, India was never a signatory to the NPT and therefore, while the Indian government made statements that supported the goals of nonproliferation, there is not a collection of declared information to draw upon in describing the Indian nuclear weapons program. However, using Air Force researcher Roy Horton's four elements of a nuclear weapons program – raw materials, ability to obtain weapons-grade material, trained personnel and adequate facilities, and capability to acquire, manufacture, and test components – we can categorize enough available information to get a sense of how the Indian program was run (Horton, 1999, p.4).

Raw Materials

From the earliest days of its nuclear program, India has required uranium to operate reactors for both peaceful and military uses. This uranium has been imported or mined from indigenous deposits discovered in the 1950s. Due to India not being a signatory to the NPT, safeguards have

applied to material at certain facilities only, thus leading to some confusion about India's peaceful and military uses of its material. India's nuclear weapons program has focused since its inception on the use of plutonium as the fissile material for its weapons. This made India's fissile material problem not one of uranium enrichment, as we will see in other cases, but one of operating reactors that produced plutonium – reactors that required heavy water to operate.

The operation of these reactors provided some of the first indications that India had greater designs for its nuclear program than scientific exploration and civilian energy, with heavy water being among the first identifiable markers. Though reactors had been obtained from foreign suppliers, India struggled to produce its own heavy water supply. Its admitted supply of heavy water fed its demand until 1983, when the MAPP-I reactor was started without safeguards. By some calculations, operation of this reactor should have put India 68 tons short of heavy water if it only had the amount it had declared. This deficit was exacerbated in August 1985, when the MAPP-II reactor was started – thus putting India almost 300 tons short of heavy water, based on its own declarations of import and production. As one analyst summarized, “India in effect has been running reactors on water it does not admit having” (Milhollin, 1986, p.163).

There is no official resolution on who would have been supplying the Indians with heavy water. Commonly named suspects are the Soviet Union and China (Milhollin, 1986, p.174; Burrows and Windrem, 1994, p.357). Though both would have been taking enormous diplomatic risks in discovered (and China was a regional security rival), both also could have used the hard currency that such an arrangement likely would have provided. Certainly, a significant amount of raw materials were required for India to pursue nuclear weapons, but its evident illicit procurement of heavy water provides an example of a potentially observable signature.

The Ability to Obtain Weapons-Grade Material

As previously discussed, India was the recipient of significant foreign assistance despite the program being the model for national self-reliance (Abraham, 1998, p.95). In the 1950s, Canada supplied a 40 MW “Cirus” reactor on the condition that it be used for peaceful purposes. This reactor, located at BARC, formed part of the foundation of the Indian nuclear program, the other part being a chemical reprocessing plant for plutonium separation at Trombay (Dhanda, 2010, p.256). However, there were no IAEA safeguards on the Cirus reactor at any time and no accounting was made of any plutonium produced from it. Presumably, plutonium produced from the Cirus reactor was used in the 1974 PNE, but India claimed that its agreement with Canada did not preclude the use of such material in “peaceful” nuclear detonations (Albright, 1993, p.12). Soon after the PNE, BARC began producing plutonium cores for use in weapons (Kampani, 1998, p.14). India was thus able, very early in its program, to produce weapons-grade material for use in weapons free from inspection or interference.

It is noteworthy that Indian researchers do not seem to have relied on their 1974 sources for long. One estimate states that between the establishment of the Department of Atomic Energy in 1954 and 1991, India spent \$2.3 billion U.S. 1991 dollars on its nuclear weapons program, with much of it allocated to purchasing and building reactors and the infrastructure that supports them. This not only likely supplied Indian weapons builders with increasing amounts of fissile material, but also made India a potential partner for several states looking to explore or pursue nuclear weapons. By 1991, India was attempting to export reactors to Cuba, Argentina, Egypt, Iran, and Syria (Burrows and Windrem, 1994, p.356).

Trained Personnel and Adequate Facilities

This category is extremely difficult to evaluate due to the fact that the Indian nuclear weapons program is still in existence and is still kept secret by the Indian government. India has a robust and high-quality university system and scientific sector. It produces well-trained scientists and technicians every year in fields that would be applicable to nuclear weapons production. Both BARC and DRDO are prominent in the Indian scientific establishment and recruit regularly so we can assume the weapons R&D program has sufficient manpower and talent to sustain and expand it according to government direction.

BARC and DRDO have been identified as spearheading the Indian weaponization effort, but they are not the only laboratories involved. According to Indian government accounts, three other labs contributed to functions such as “arming, fusing, safety interlocks, and flight trials” in various stages of the R&D program (Kampani, 1998, p.15). We can also therefore assume that sufficient partnerships exist between the government, institutions such as BARC and DRDO, and more private institutions that permit collaboration on the program. This partnership was likely strengthened with the designation of a coordinator for nuclear weapons R&D in 1989, a move that served to “semi-formalize” the relationships between officials in numerous government and research organizations that were actively contributing to the nuclear weapons R&D effort (Kampani 2015).

Capability to Acquire, Manufacture, and Test Components

The 1974 and 1998 events proved that India had the ability to conduct all three of these activities satisfactorily. As mentioned previously, Indian scientists were able to acquire the necessary raw materials to build and operate reactors and produce fissile material from those reactors. The 1974 PNE was an important statement for India to make in terms of its regional security, but also fulfilled a vital testing role for Indian scientists. It proved that they had many of the concepts necessary to construct a nuclear weapon correct (Malik, 1998, p.200). Following the PNE, New Delhi chose to continue making progress in these areas but not to aggressively move towards

nuclear weapons development. The approach was categorized by Tellis as “keeping the option open” (2001, pp.12-13).

The Indian government built and maintained an establishment to produce fissile material as well as develop and enhance weapons designs, all while refraining from a political decision on whether to actually produce a weapon. But developments outside India would begin to show that the “keeping the option open” policy was unlikely to be effective indefinitely. Pakistan was also pursuing nuclear weapons but its scientists had a key advantage over their Indian counterparts. As they collaborated with Chinese weapons designers in the 1980s, the Pakistanis received information on warhead designs that were already tested. The Indians, despite the PNE, could not be absolutely sure their designs worked. Therefore, while successive prime ministers had different attitudes toward the nuclear weapons program and uneven progress continued, the realization that India would need to test to have a credible deterrent must have been made apparent by the assistance Pakistan was receiving.

Motivation for Study

The Indian case presents an opportunity to study a case of nuclear R&D that developed over several decades independent of an arms control regime. India was proudly non-aligned during the Cold War, but certainly had a strong relationship with the United States. That relationship was strained by India’s nuclear weapons pursuit but was not broken by the surprise of the May 1998 tests.

Common Case Features

The Indian case contains several pertinent themes that we will see in other cases and can expect in future development cases. The first is that the nuclear weapons R&D effort in India was arguably not the result of malevolent intentions but a compensation for weakness. The defeat by China in 1962 followed two years later by that country’s nuclear test resulted in a permanent apprehension in New Delhi as to Chinese intentions. That apprehension was only heightened by China’s assistance, both nuclear and conventional, to Pakistan. But unlike both the Chinese and Pakistani programs, the Indian program was not guided by the military. In fact, the Indian program was derived from its civilian power program and the military was largely excluded from Indian nuclear policy making (Chellaney, 1994, p.167). This is similar to the case of South Africa, where the defense forces had little involvement in the nuclear program.

Deception is often considered a military concept and part of military doctrine, therefore one might assume a lack of military involvement would result in a disorganized or ineffective deception. In India this was not the case. As with both the nuclear and non-nuclear cases in this study, the Indian case exhibits coordination of the deception plan that allowed it to be effective

for several decades. This will be discussed when the case is analyzed through the framework later in this chapter, but for now we can take the example of Defense Minister Fernandes during the 1998 tests. Fernandes was not informed of the tests until almost a month after the decision to conduct it. During that time, he had made several statements denying any impending tests – denials that to him were true but were known to be false by the Prime Minister and several of his advisors. This is a commonly observed theme in long-term deception and is reminiscent of several of the examples presented in the discussion on concealing fiction in Chapter 2.

Despite the length and coordination of the Indian deception, it was not consistently effective and this is also common among the cases. Test preparations in 1982, 1995, and 1996 were detected. The U.S. detection in 1995 was particularly damaging, and helpful, to the Indians because the United States lodged a formal protest complete with the evidence of Indian preparations captured by satellite imagery. It was at this point that the Indians began employing deception through the work of the 58th Engineers and other measures. This was also the case in both Iraq and South Africa. The Iraqi program became more deceptive following the Israeli attack on the Osirac reactor, while the South Africans took their program more “underground” when their activity was detected at their test site in 1977.

Distinctive Case Features

The Indian case is distinctive for two reasons. The first reason is that in order to achieve their policy goals, the Indians had to conduct a nuclear weapons test. In many ways, this need defines the Indian nuclear weapons program and the deception created to protect it. The deception needed to ensure opacity as to India’s broader intentions and total concealment as to their testing intentions until the devices were detonated. Following that, the deception could be discarded.

Though India’s path to nuclear weapon development is similar to that of South Africa in many ways, it is noteworthy that despite two episodes of test preparation the South Africans never conducted one. The Indian deception contrasts with the South African case in that the South Africans had to maintain a level of opacity that was neither open acknowledgment nor total concealment. They had to maintain this for the duration of the program, which was obviously unknown during the development. India, by contrast, was opaque while making gradual progress on a weapon but then only had to conceal the program completely for enough time to make it to the test once that decision was made. This particular episode of the Indian case is reminiscent of military deception, where a specific objective drives the deception.

The second distinctive quality that India has within this study is the robust relationship with the United States. Though India was non-aligned and there were some policy differences, the relationship was generally more involved than the U.S. relationship with either Iraq or South Africa. While proliferation was not always the main topic of conversations between U.S. and

Indian officials, it was often somewhere on the agenda since, as both non-aligned and a non-signatory to the NPT, India was a target for aggressive U.S. lobbying on NPT and CTBT accession.

The Indian deception gave New Delhi the advantage in several of these interactions throughout the course of the program. Though it was known that India had a considerable capability and had already conducted the PNE, U.S. officials were often confused by Indian terminology and unsure of whether the steady weaponization progress or the statements on nuclear immorality were the actual government policy.

Pursuit of Nuclear Weapons

This case is an excellent example of a small-group cabinet level decision and a calculated deception plan. For this reason, assessment of the timing of key decisions is extremely difficult. As stated previously, it is unclear exactly when the decision to test was made in 1998 but April 10th is a date frequently cited by researchers. That decision was made by a small group around the Prime Minister only, all of whom were BJP members. The Defense Minister was not informed until May 9th, two days before the test. The foreign minister and three chiefs of the armed services, as well as the president, were not informed until the day before the test (Sharma, 1998, p.30).

This exclusion of the wider bureaucracy was certainly an integral part of the Indian deception in 1998. But the test episode was brought about by a sustained policy of opacity from even before the 1974 PNE. Details of when key decisions as to the pursuit of nuclear weapons were made are not available, but it is reasonable to assume that a decision on weaponization had taken place by 1989 at the latest, likely inspired by Indian intelligence reports on Pakistani progress in nuclear and missile development that year (Kampani, 2015; Tellis, 2016). Two indications point to this decision taking place at that point. First, a “coordinator” for the nuclear weapons program was designated by the prime minister to manage the semi-formal network of bureaucrats and technicians that were facilitating the program. This marked a change from the direct management from the prime minister’s office that had previously been utilized. Second, by 1989 the Indian Air Force had modified aircraft for delivery of a nuclear weapon and had developed techniques for aerial delivery (Kampani, 2015). As will be discussed later in this chapter, the Indian military was only informed about the progress on nuclear weapons slowly and in stages, so the 1989 air force development is a sign that by then the weaponization was firmly decided upon. Since the development and testing of aircraft and pilots for delivery of nuclear weapons would have taken several years, this indicates that India was engaged in concealing its program well before the test preparations in the 1990s.

Threat Perception and Policy Goals

Though many aspects of the Indian nuclear weapons effort remain concealed or confusing, it is clear that the motive for India's pursuit of nuclear weapons cannot be reduced to one reason. Nuclear researcher and international relations professor William Walker defines the four elements of the Indian nuclear paradigm in this way: (1996, p.61-62)

- 1) India is on its own – alliances with foreign powers are unattainable or untrustworthy.
- 2) Nuclear weapons confer status, security, and leverage.
- 3) The NPT is primarily an instrument of great power politics, and only secondarily an instrument of collective security.
- 4) Nuclear weapons are immoral.

This paradigm is useful in thinking about India's nuclear weapons decisions over several decades. New Delhi found itself isolated but opposed to any alliance that might remedy its isolation. It recognized the enormous power and prestige of a nuclear weapons capability while believing the weapons themselves were inconsistent with Indian values. These contradictions explain why Indian nuclear weapons development progressed unevenly over time and why successive Indian governments voiced opposition to nuclear testing while not limiting the option for future officials.

Nuclear Weapon Policy Goals

It is difficult to rank India's nuclear weapons policy goals, but we can say that without the perception of a real and urgent threat it is doubtful India would have devoted the resources to such a program. Additionally, due to its non-aligned status and aversion to alliances, it is unlikely that India has ever intended its nuclear weapons capability as a mechanism to bring others into future conflicts on its behalf. We can therefore begin an assessment of Indian policy goals with deterrence of its regional competitors.

Deterrence against Neighbors

The 1974 PNE was a statement that India took its independence, capabilities, and right to scientific pursuit seriously. But Thomas Reed and Danny Stillman argue in their book *The Nuclear Express: A Political History of the Bomb and Its Proliferation* that "A quarter-century later, however, the term 'peaceful purposes' was redefined to mean 'keeping the peace in the face of Chinese and Muslim disrespect'" (2009, p.236). India's survival depended upon keeping that peace, since several conflicts with Pakistan and the 1962 clash with China showed the Indian armed forces were unlikely to decisively overpower either adversary through conventional means. Indeed, if India did not develop nuclear weapons and prove its capability it would be at a nuclear disadvantage as well. As noted previously, the Chinese had continued development after

their test in 1964 and Indian officials were well aware that the Pakistanis had been recipients of Chinese nuclear knowledge.

Seen from this perspective, the objections of the international community and the lobbying of the United States for the NPT and CTBT must have seemed unreasonable to many Indian officials. Former BJP official Jaswint Singh expressed his frustration with the international community's nonproliferation stance concerning India, stating "if the permanent five's possession of nuclear weapons increases security, why would India's possession of nuclear weapons be dangerous? If the permanent five continue to employ nuclear weapons as an international currency of force and power, why should India voluntarily devalue its own state power and national security?" (1998, p.43). That the primary mechanism of international nonproliferation, the NPT, protected the nuclear status of one of India's regional adversaries and failed to punish the transfer of knowledge and material to another regional adversary certainly perplexed and angered multiple Indian governments. Some scholars have argued that in this situation "the intensification of international measures *against* nuclear weapons has paradoxically led to the intensification of political support *for* nuclear weapons within India (Walker, 1996, p.65).

In general, however, India enjoyed good relations with the major countries of the world and was skilled at navigating the East-West divide of the Cold War while remaining non-aligned, a practice it continued after the fall of the Soviet Union. These good relations provide a clue as to the seriousness with which Indian officials perceived their strategic situation. It was likely, perhaps inevitable, that there would be international condemnation of India if it conducted a nuclear test and possibly even sanctions. The debate over conducted tests in the mid-1990s included predictions by the Finance Minister and others that the United States would probably impose sanctions, lobby the World Bank against releasing funds for development projects, and possibly conduct a preemptive military strike (Chengappa, 2000, p.392).

The decision to test in the face of these potential repercussions and the potential souring of important relations with other states actually provides significant insight into the importance of India's regional security perceptions in its decision to develop nuclear weapons. The concern over Chinese and Pakistani capabilities and intentions created a deep sense of unease in Indian officials, and a need to ensure India would stay secure and independent in its policies. The 1998 tests signaled that these security concerns outweighed any worry over the diplomatic consequences of such an act (Tellis, 2001, p.76).

National Pride and International Recognition

After the 1974 PNE, government critic Raj Thapar wrote "Hate as I did every bit of nuclear experimentation, convinced that it was a sad and cruel waste for starving countries such as ours, I

couldn't escape the current of glee that streaked through me at the thought of what other nations would say – they wouldn't be able to kick us around as before” (Abraham, 1998, p.1). Speaking over 20 years later after the 1998 tests, Jaswint Singh was more direct – “One-sixth of humanity just took its rightful place under the sun” (Chengappa, 2000, p.18).

As compelling as the case that concerns over China and Pakistan pushed India to develop and test nuclear weapons is, the explanation of national pride is also compelling. Several scholars have argued that India's “strategic elite” focused less on deterrence and more on the symbolic value of the weapons before and after the test (Dhanda, 2010, p.258). The comments of Thapar and Singh reflect themes found in what many Indian elites were saying at times of Indian nuclear achievement, whether they were in government, opposition, or general society.

It is difficult to quantify national pride, but Gaurav Kampani made an interesting observation while arguing that pride was a more convincing explanation for the 1998 tests than security concerns. Indian diplomatic efforts following the tests at first, predictably, sought to reduce or avoid consequences. Indian diplomacy after that phase would make a significant argument for national pride. If India had tested primarily out of concern over China and Pakistan, one might think that their first efforts would be confidence building measures (CBM) with Beijing and Islamabad, so that all states would understand Indian capability and procedures could be established to avoid inadvertent use or unnecessary escalation. But little if any CBM work was done by New Delhi in the months following the test. Instead, Indian officials focused on attaining recognition as a nuclear weapon state within the larger international community (Kampani, 1998, p.17).⁸ These efforts included campaigning to become a permanent member of the UN Security Council, which continues to this day.

Defense and Attack

It is certainly conceivable that Indian nuclear weapons development was motivated by a genuine intention to use the weapons in wartime, whether in a defensive or offensive capacity. Since the program is still in existence, it is impossible to judge whether these weapons currently figure into Indian war plans, but it is not clear that they did at the time of the tests in 1998. One indication of this is a conflict that, due to events in both participants in 1998, caused considerable concern throughout the world.

India and Pakistan went to war in 1999, after both had already tested nuclear weapons. That these were not employed might be attributed to responsibility and restraint on both sides. But it is also possible that one or neither side was prepared to use them, despite the tests. One senior

⁸ As with other explanations of Indian motivations, this one is also not entirely satisfactory. Kampani was correct about India's initial prioritization of nuclear recognition over CBM, but it eventually focused on such measures with Pakistan, resulting in the two countries agreeing on the Lahore Declaration in February 1999.

Indian defense official revealed several years later that at the opening of the conflict, the Indian Air Force still was unaware what types of weapons were available, how many weapons there were, and what they were expected to do with those weapons (Kampani, 2014, p.103). This is surprising given the earlier discussed information about preparations for nuclear delivery being conducted by the Indian Air Force in the 1980s, but if true it is indicative that following the 1998 nuclear tests, the Indian government still did not have a clear doctrine for using the weapons in an offensive or defensive manner.

Weapons Development Goal

India's nuclear weapons status following the 1974 PNE can best be described as "latent opacity." Had weaponization been aggressively pursued following the PNE it certainly would have been achieved and deployed well before the mid-1990s. Following the successful PNE, the New Delhi government did not immediately reject the notion of obtaining nuclear weapons, it just repeated objections to nuclear weapons in general and their use for leverage by the great powers. Hence while Indian weapons development may not have been consistently concerning from 1974 to 1998, the international community certainly had awareness about India's potential and a lack of awareness about India's actual intentions.

New Delhi's perceptions changed following the realization of China's assistance to Pakistan and the weapons development goal changed from latent opacity to a desire for advanced weapon – one that required testing. Jaswint Singh's view is that this was not a matter of national pride or expediency but a security imperative due to the threats faced by China and Pakistan, and that if electoral points were all that was desired a simple device would have accomplished that (1998, p.49). This may have been true, though the public celebrations following the announcement of the test are rarely found for the nuclear programs of "latent opacity" states that do not conduct impressive tests. Additionally, if the 1998 tests are seen only as demonstrations of military effectiveness, their effect was somewhat lacking. As previously noted, the success of the tests is in dispute. Neither the results of the tests nor India's delivery capability at the time should have caused excessive worry for China, which was frequently invoked as one of the primary reasons India had to go nuclear (Kampani, 2014, p.110).

It is extremely difficult to assign weights to the various factors that drove the Indian desire for advanced weapons. But there are two likely factors that contributed. First, India was using plutonium from its reactors for fissile material and hence did not have to generate a new infrastructure to move to implosion weapons. Second, it was inevitable that India would conduct a nuclear test at some point. Despite Singh's arguments, politics likely had an impact on this decision. The BJP and other parties in the Indian government did have an incentive to show that they were tough on defense and able to ensure Indian security. It also may have been the case that faced with two nuclear adversaries, one of which had already tested and the other able to test

at any time, Indian officials believed that being opaque as to their nuclear capabilities would not be sufficient. In any event, other states pursuing nuclear weapons were limited in their options by an inability to conduct a test. Such was not the case for India. The resources it could bring to the nuclear weapons R&D effort and its desire to conduct a test made advanced implosion weapons the most attractive choice for planners in New Delhi.

Relationship with the United States

The relationship between India and the United States was generally cordial throughout the period of Indian pursuit of nuclear weapons. India's non-aligned status sometimes created tension in the relationship, as did U.S. overtures towards Pakistan for assistance in fighting first Soviet forces in Afghanistan and then Islamic extremists. In terms of nuclear issues, U.S. officials were generally aware of Indian capabilities and also aware that India might perceive significant benefits to acquiring weapons. They hoped that India, which had refused to sign the NPT, could be convinced that its interests could be protected without "going nuclear" and aggressively lobbied India to support the indefinite extension of the NPT as well as the CTBT. Though it did not deter India's pursuit of nuclear weapons, the U.S. approach did have an effect on Indian officials. As mentioned previously, several cabinet-level officials in New Delhi expressed reservations that the United States would penalize India in every way possible for embarking on a weapons program, including possibly conducting preventative military strikes (Chengappa, 2000, p.11).

U.S. officials communicated their concerns even during the highest-level interactions with the Indian government, and the Indian response throughout much of the 1980s and 1990s was opaque. During a May 1994 summit with President Clinton, Prime Minister Rao refused to make any assurances on the issue of Indian nuclear weapons. According to a U.S. diplomat, Rao's body language clearly communicated that the United States would have to live with ambiguity in this area (Chengappa, 2000, p.389). Interestingly, following the 1994 meetings with the United States, the BJP, still in opposition, publicly stated that India should pursue nuclear weapons to "prevent our neighbors and superpowers from intimidating us" (see Talbott, 2004, p.34).

The nuclear aspects of the relationship took a bad turn the following year with the discovery of Indian preparations for a nuclear test. The U.S. ambassador to India, Frank Wisner, was in Washington for consultations when the CIA presented him and other U.S. officials with satellite photographs showing cables being run in tunnels at Pokhran, indicating a nuclear test was being planned. Wisner arranged to have several of the photographs sent to the U.S. embassy in New Delhi and confronted Indian officials with the photographs upon his return (Talbott, 2004, pp.37-38). Though Indian officials may have been willing to tolerate U.S. reaction after a test, they

were evidently persuaded that continuing their preparations was not in their best interests. They also learned that the United States was watching, how they had been detected, and that more advanced deceptive measures would be required in the future should they prepare for tests again.

One deceptive measure that seems to have been effective for several years was the use of terminology by Indian officials that left their U.S. counterparts confused. As early as 1990 this effect was noted by a U.S. ambassador that was attempting to ascertain India's position on missile technology and their goals for their indigenous program. He found it difficult to determine the Indian strategy based on "a degree of inarticulateness among both policy makers and military" (see Chengappa, 2000, p.375). This confusion continued in nuclear matters through the 1990s.

A 1996 statement by Prime Minister Gujral was particularly confusing to U.S. analysts. He commented that "at the moment the agenda to weaponize our nuclear capability is not there...What we have done is retained the nuclear option. In that sense, we have opted for the status quo approach." Disagreement arose about what this statement indicated regarding Indian nuclear weapon development. Did Gujral's "weaponization" referring to a technical definition of developing and testing payloads, or did it have a broader definition of producing nuclear weapons that might be used in conflict (Tellis 2001, pp.174-175)? Knowing the answer to that question would indicate what the "status quo" was considered and would be very insightful as to Indian nuclear planning, but there is no evidence that the answer was forthcoming. Finally, U.S. officials were confused by BJP electoral promises in 1998 to "induct" nuclear weapons into the Indian arsenal. Tellis argues that the use of terms such as "induction" and "weaponization" by Indian officials referred to the establishment of infrastructure and doctrine to surround the nuclear weapons program (2016). Former Deputy Secretary of State Strobe Talbott believes the use of the word "induct" was intended in part to confuse Americans and other outsiders, stating "The vow to 'induct' the bomb left open the possibility, at least as understood in Washington, that India might declare itself a nuclear weapon power without testing" (2004, p.43). As discussed previously, it is unlikely that officials from any Indian party seriously considered declaring India nuclear without proving it through a test.

As the 1998 tests approached, there was less ambiguity about Indian communications with U.S. officials, though the topic of nuclear weapons remained consistently on the agenda. In March, shortly after the BJP's electoral victory, senior foreign policy advisor N. N. Jha informed U.S. embassy officials in New Delhi that the new government would be conducting a comprehensive review of Indian nuclear security policy over its first 3-6 months in office and that no testing or key decisions would be undertaken until the review was complete (Graham and Hansen, 2009, p.45). Secretary of Energy Bill Richardson visited New Delhi on April 14th, likely after Prime Minister Vajpayee had authorized the tests. His discourse with Indian officials

continued to be filled with vague language and terminology, but Richardson wanted direct confirmation. Asking Defense Minister Fernandes whether there would be any surprises on nuclear testing, Richardson was told “absolutely not.” This message was backed up by the visit of a senior Foreign Ministry official to Washington two weeks later who, when asked by Undersecretary for Political Affairs Thomas Pickering if India would continue to exercise constraint in its nuclear program, replied that it would (Talbot, 2004, p.48).

These interactions between U.S. and Indian officials in 1998, as well as the display of satellite photographs to Indian officials in 1995, would become part of the folklore surrounding the intelligence surprise of the May 1998 tests. That U.S. officials were surprised by the tests is not in dispute, but many took this to mean that U.S. officials had no idea India was as far in their nuclear weapons program as the testing phase or that any tests were being considered. Clearly, the U.S. government was aware in a general sense of the state of Indian nuclear weapons, hence the repeated talking points in interactions between U.S. and Indian officials. An assessment of what the U.S. intelligence community knew about the Indian program places the May 1998 test surprise in the proper context.

How the United States Assessed the Program

The Indian nuclear weapons program fits what intelligence professionals refer to as a “hard target.” Though U.S. government and corporate interests were involved in Indian civilian nuclear development from early in the program, and the 1974 PNE certainly showed that the Indians were capable of nuclear detonations, it was nonetheless very difficult for U.S. analysts to see into the program. One reason was the significant and effective wall that existed between the nuclear civilian and weapons programs. But as noted by former Director of Central Intelligence George Tenet, it was mostly due to the fact the Indian scientists did much of the heavy lifting on their own and without foreign assistance (2007, p.45). Much of the U.S. assessment of the Indian weapons program remains classified, presumably due to the ongoing nature of the program and the U.S. relationship with India. However, some released information does provide a sense of how U.S. analysts thought about the means, motives, and opportunities of India in pursuit of nuclear weapons capability.

Understanding of Means

U.S. analysts had a good general sense of Indian capabilities based on knowledge of the civilian nuclear program, but they were also aware that Indian research efforts far exceeded that necessary for the generation of power and that regional events were driving those efforts. A declassified assessment from 1963 references India’s defeat by China the previous year and states a belief that India was “actively improving its overall capabilities in the nuclear field,

possibly in anticipation that a future decision to develop an operational nuclear capability may be required” (CIA, 1963, p.9).

The May 1974 PNE confirmed the progression of Indian nuclear capability and led to another round of assessments. Based on the declassified documents, those assessments were less sure about Indian intentions but indicated that India would continue to make slow but steady progress if the program was consistently resourced. A 1981 assessment contained two specific warnings about Indian progress. First, it noted that a review of Indian scientific journals indicated a consensus that PNE was still useful and was vital to Indian economic development. The assessment argued that if India held to the PNE explanation for its research, it might be able to obtain critical items for that stated purpose and without the Soviets insisting on full-scope safeguards (CIA, 1981, pp.2-3). Second, the report noted that India had a complete nuclear fuel cycle consisting of two parallel but self-contained “loops,” and that facilities in only one of those loops were safeguarded, with other facilities falling under safeguards depending on the status of the material being used at any given time. Specifically, it noted that plutonium separated from unsafeguarded fuel at the Tarapur reprocessing plant would be outside safeguards, as would plutonium produced from the Cirus reactor. The report concluded by stating that India would have the ability to produce at least 100 kilograms of unsafeguarded plutonium, much of which would be weapons-grade material (CIA, 1981, p.5). In sum, declassified portions of CIA assessments indicate a lack of certainty on Indian strategic intentions but an understanding of increasing Indian weapons production potential that was not being held in check by safeguards.

These assessments were highly classified and many others remain so today. But although Indian nuclear weapons development was not a “front-page” story much of the time, it was raised with U.S. policy makers outside of intelligence estimates. As early as May 1989, CIA Director William Webster warned lawmakers that India was attempting to purchase beryllium and that his analysts believed this indicated an intention to build a hydrogen bomb (Burrows and Windrem, 1994, p.374). In the same period, U.S. analysts were aware that India had two missiles, the medium-range Agni and the short-range Prithvi, in the testing stages that would represent an improvement in warhead deliverability over planes of the Indian Air Force (Talbot, 2004, p.21). As mentioned previously, the U.S. ambassador to India was unable to ascertain from Indian officials what their overall goals for their missile programs were (Chengappa, 2000, p.375). As India continued its development without convincing explanations as to its intent, U.S. intelligence attention (and satellites) continued to focus on Indian activity.

Understanding of Motives

The understanding of why India would want to produce a nuclear weapon is less clear in the non-redacted sections of released assessments. The understanding that is revealed focuses on the perceived threat of China to regional security. Early in the Indian program, a CIA report

assessed that India's dominant psychological and political traits led to opposition of a weapon program. However, the same report notes that India would closely monitor developments with China and that a Chinese test would likely change India's stance (CIA, 1961, p.9). This analysis turned out to be remarkably prescient. One year after the report, China would defeat India in their border conflict, thus reinforcing New Delhi's fear of being overpowered. Three years after the report, China would conduct its own nuclear test.

The focus on China as the primary driver of Indian nuclear weapons ambitions does not waver through subsequent released assessments. A later report argued "China – not Pakistan – is perceived as the major long-term threat to Indian security. This perception has propelled New Delhi to reject the Non-Proliferation Treaty and full-scope safeguards in order to retain the nuclear weapons option" (CIA, 1981, p.iii). It is not possible to see any supporting evidence that the author gives for this assessment, though it is interesting that the assessment seems to disregard parity with Pakistan as a primary motivation for nuclear development. Also omitted are non-security reasons for NPT rejection – such as the belief that the United States and other nuclear weapons states were not holding up their end of the agreement. Nonetheless, though assessment of Indian motives do not appear to be as well-developed as assessments of Indian means, they do appear to give policy makers a clear sense that India had policy reasons to pursue nuclear weapons that were not being addressed.

Understanding of Opportunity?

We should not expect imagery and other sources and methods of intelligence analysis pertaining to issues such as the Indian nuclear weapons program to be declassified and released to the public for some time. But in this case, a review of commercial imagery provides an opportunity to surmise what might have been visible to the U.S. intelligence community. After the 1995 test detection two analysts at Lawrence Livermore National Laboratory, Vipin Gupta and Frank Pabian, conducted an assessment of activity in and around the Pokhran test facility using commercial imagery to assess its effectiveness for future comprehensive test ban monitoring (1997).

Their assessment used indicators such as the presence of secured and non-secured railway stations and the layout of buildings and parade grounds to establish the facility as military (p.126). Additionally, topographical changes were mapped out to identify the probable location of the 1974 PNE and to establish that activity at the site was different than that seen in advance of other non-nuclear tests. They concluded that activity had taken place between March 1995 and March 1996 at the same range that had conducted the PNE, that the activity was military based on perimeter security and building layout, and that the activity was more than what had taken place during other munitions testing (p.139). Though it is unknown exactly what U.S. intelligence analysts saw leading up to the 1995 incident, we can assume that it was similar in

nature to what Gupta and Pabian found using commercial satellite imagery. This means it was also similar to what Indian officials came to understand had given their efforts away and would need to be concealed for their next attempt.

In an interview with the author, Ashley Tellis proposed an additional angle to “opportunity” of which U.S. officials may have been unaware. A previous section discussed Talbott’s belief that the terminology used by Indian officials was deceptive. Tellis argues that many on Talbott’s staff for those discussions had a fundamental misunderstanding of how the Indian government intended to deploy nuclear weapons. He believes that U.S. officials assumed India would follow the U.S. model and release the weapons to military units charged with their delivery, who would then need some form of code or verification from the government in order to carry out a pre-planned operation with them. Instead, the Indian government at the time intended to secure the weapons in components. If use was deemed necessary by the Prime Minister, the components would be taken to the appropriate air force base, assembled, and verbal directives would be issued that stated the target city. Tellis believes that Talbott and the other U.S. negotiators were confused by Indian terminology because they saw the Indian decision as whether or not to construct a weapon. Instead, the Indian decision was whether to develop doctrine to support the use of a weapon as well as an associated infrastructure (2016).

Assessments Leading up to May 1998

Participants in the 1998 nuclear tests would go to considerable lengths to mitigate the risk of detection through analysis such as that conducted by Gupta and Pabian. Many of these measures will be discussed when the framework is presented in subsequent sections. They were undertaken with the understanding and concern that U.S. satellites and other collection assets were focusing on Pokhran and that analysts would conduct the same assessments as they had in 1995.

Despite the best efforts of Indian government officials, scientists, and the 58th Engineers, the activity could not be completely masked. Constant power disruptions plagued the test site, so the engineers moved generators from a location three kilometers away to a much closer position, but did not have the time to conceal them and were forced to hope that satellites would not notice (Chengappa, 2000, p.422). In fact, U.S. satellites could see the move and other indications of an impending test. One researcher argues that imagery was available that clearly showed an impending test six hours beforehand, but CIA analysts were not looking because they were not on alert (Perkovich, 2000, p.418). This was prominently alluded to in the independent assessment conducted following the tests to answer why the U.S. intelligence community had missed the test indications. The head of the review, Admiral David Jeremiah, stated that “there is an awful lot of stuff on the cutting room floor that we have not seen” (1998). In his review of the Indian deception journalist Raj Chengappa offers an explanation as to why analysts missed

this evidence, arguing that CIA cost cutting inhibited consistent coverage. He alleges that North Korea, Iraq, and Eastern Europe were receiving 24/7 coverage, but not India (2000, p.427).

Discussion of U.S. assessments leading up to the 1998 tests is not offered as a judgment on the intelligence community. Rather, it is to reinforce one of the central messages of this research – that deception, no matter how well planned and executed, depends to some extent on the actions of the deception target and to some extent on fortune. A systematic assessment of observable signatures can indicate the presence of deception and constitute an argument for allocation of collection resources – in this case consistent imagery analysis.

Framework

The results of an extensive review of secondary sources were categorized according to the framework presented in Chapter 2. This section will contain a brief description of the data found in each of the four categories of deception effort. The presentation of data in the following sections is not exhaustive, but meant to give the reader a sense of the type of measures employed. Though many of these data points have been described previously in this chapter, they are repeated here so that the reader can see how each of the actions fits into the larger deception effort. The relevant data is presented in Tables 4-1 through 4-6 at the end of the chapter. No data was identified from the “Finance and Budgeting” line of effort.

As with U.S. assessments of the Indian nuclear weapons program, sources on the program itself are difficult to find. The exception is the May 1998 decision to test and the preparations for carrying out the order. As a result, the framework analysis for this case is heavily slanted toward the Spring of 1998, when the 58th Engineers were preparing Pokhran, materials were being covertly moved from laboratories and storage around the country to the test site, and scientists were traveling incognito on circuitous routes to arrive undetected. In 2000, just two years after the tests, Indian journalist Raj Chengappa wrote a book that extensively looked at the Indian test preparations and the deception surrounding them, titled *Weapons of Peace: The Secret Story of India's Quest to be a Nuclear Power*. Apparently Chengappa had nothing to fear from revealing such secrets, judging by the number of high-ranking officials he was able to speak with on the record about the program, the testing, and the deception. Having achieved its goal of testing a nuclear weapon without U.S. interference, India seems to have been willing to let everyone know how it was done. Chengappa's book is an authoritative account, and much of the data used in the framework for this case comes from his research, though other sources were consulted and data was corroborated where possible.

Reveal Fact

Indian officials were consistently opaque concerning the prospects for nuclear weapons development when discussing the issue with the U.S. counterparts over several decades. One example is the previously discussed May 1994 summit between Prime Minister Rao and President Clinton, where the Indians communicated that the United States would have to live with a latent capability but that no urgent plans existed for weapons development. Indian scientists also made comments alluding to the capability of development and the fact that the decision was merely one of politics and logistics – not capability. Commenting on the length of time it would take India to assemble a nuclear weapon in 1990, the chairman of the Atomic Energy Commission implied it would not be a lengthy process, stating “in how much time we make it, will depend on how much time we get” (Albright, 1993, p.12). This tacit acknowledgement of capability spanned several Congress Party governments and may have conditioned U.S. officials to believe that BJP leaders would act in a similar manner once in power – at least for a time. Despite BJP campaign statements about nuclear weapons, there appears to have been a belief among U.S. officials that time was on their side, perhaps that the BJP would need time to settle in or that their statements were just campaign trail bluster. Regardless, truthful Indian statements on nuclear weapons development played a pivotal role in the deception surrounding the program.

Several such statements involved India’s position on the NPT and CTBT. As previously discussed, India had long believed that the NPT was an instrument of great power politics and was discriminatory against countries such as India. The 1995 push to indefinitely extend the NPT only solidified this resolve among the Indian policy making elite. In 1996, a similar issue arose with the CTBT. India’s belief that agreement to the CTBT would forever close the door on its nuclear weapons option led New Delhi to show its hand more than the usual line of opacity and come out against the treaty during deliberations. When it was put to a vote in September of that year, India voted against and thus made a strong statement that it continued to strongly consider a weapons program and maintaining that option was worth incurring the displeasure of the international community, particularly the United States.

After the BJP electoral victory, the party’s public statements about nuclear testing were toned down and seemed to reflect the message that U.S. officials were being told – that the new government would carefully assess its nuclear options. But there were some truthful indications that, if not plainly observable, might have been seen with the right assets in place. For example, *The Organizer*, which was the official mouthpiece of the BJP, issued a special issue on “Nuclear India” that was delivered to newspaper offices just one hour before the announcement of the tests (Sharma, 1998, p.30). Sighting of this newspaper would not have provided a warning for U.S. policy makers and analysts, but considering that the foreign and defense ministers were only

informed of the tests in the two days prior to the tests this special edition is an interesting anecdote. Someone within the BJP ordered the issue and others worked on it – presumably those who ordered it knew something that some of the most senior officials in the Indian government did not. The preparation of the “Nuclear India” issue was a truthful signature that does not appear to have been observed by the United States, but might have been.

The revealing of fact prior to the 1998 tests was to be one of the most frustrating takeaways from the episode for U.S. intelligence officials. Though deceptive statements were certainly made by New Delhi, any honest assessment of U.S. efforts was forced to conclude that truthful statements were not given sufficient weight by U.S. analysts. As Tenet stated several years later, “We did not sufficiently accept that Indian politicians might do what they had openly promised – conduct a nuclear test, as the incoming ruling party had said it would. The lesson learned is that sometimes intentions do not reside in secret – they are out there for all to see and hear” (2007, p.45).

Conceal Fact

Despite the many truthful indicators on the part of New Delhi, it was simultaneously engaged in a massive concealment operation to hide its program and intentions. Pokhran itself had been chosen as a test site for the nuclear program because it was one of the few available locations with scarce habitation. While the inhabitants of a nearby town were accustomed to seeing military vehicles and hearing strange noises from the test range, they were also accustomed to not speaking about what they saw. Such a remote location had its disadvantages, however, in that large numbers of people and specialized equipment would need to be moved there without attracting notice if a nuclear test were to be conducted. Overcoming these disadvantages would be a significant part of the deception surrounding the 1998 tests. Scientists took circuitous routes throughout the country and used false names to travel in case intelligence agencies were monitoring their movements. Material, such as plutonium from storage vaults in Mumbai, were moved in non-descript army convoys that were lightly guarded (Chengappa, 2000, p.420).

At the test site, the 58th Engineers were busily executing the deception plan for the site, which included the concealing of signatures that had been the undoing of previous planned tests. Cables were laid by a motor-grader, which creates a furrow as it moves and places the cable within it. Soldiers then carefully replaced the sand and vegetation surrounding the new cable line so that no change would be detected if satellite images were compared. All vehicles were disbursed to assigned parking locations throughout the Pokhran complex and even outside of it during the day. Each night, a complex system of movement was followed so that vehicles could be used, then returned to their innocuous locations and the tire tracks covered before the sun rose and exposed the desert to imagery (Chengappa, 2000, p.427). However, soldiers were not the only ones practicing concealment during the 1998 tests. Senior Indian scientists decided to

explode all three devices simultaneously on the first day of testing despite the logistical challenges of such an approach. Their intent was to mask the seismic signal so that it would be difficult for observers to determine the yield of each individual device (Perkovich, 2000, p.426).

The Indian concealment was more than facilitating nuclear tests and Pokhran. One measure that was instituted early during the Indian nuclear weapons program was that the Atomic Energy Commission, the organization in charge of all nuclear energy research and activity in the country, was kept publicly separate from DRDO, the military's R&D group. In reality, the two organizations were pooling their resources and efforts in support of the nuclear weapons R&D program, but it was believed that any public link would be a red flag to curious intelligence organizations. Hence, the liaison activity was classified at an extremely high level (Chengappa, 2000, p.23). In other areas, red flags were not as meticulously avoided. As discussed in the earlier section on raw materials, the start-up of the MAPP-II reactor in August 1985 brought India to an observable deficit in its stock of heavy water. While the Indian government did not conceal the operation of reactors requiring heavy water, it provided no explanation for how it obtained or produced sufficient quantities. This has led some researchers to speculate that India illicitly imported the water from another state (Milhollin, 1986, p.173).

Reveal Fiction

The confrontation with the United States over testing in the mid-1990s convinced the Indians that concealing their activity would not be sufficient security for their program and the required testing. They therefore undertook extensive deceptive measures to manipulate the signatures that would be seen by analysts and prevent further interference with their R&D program. However, India had been practicing deception on a smaller scale for some time as it attempted to build the infrastructure required for nuclear weapons production.

Several large Western firms, including Siemens, MTI, and the Digital Equipment Corporation provided assistance to India for tasks later found to be tied to the nuclear weapons effort, but about which the firms claim to have been deceived. In one instance, Siemens was examined over their role in providing a computerized fluid mixing system for the heavy water manufacturing process to be used in India's production plant in Hazira between 1986 and 1991. Such a sale would have been an export control violation, but Siemens claimed that they were deceived about the true purpose of the facility and that the Indians had only made vague statements about an ammonia plant. Their spokesman said "The consumer never tells details of the process to the supplier of the system... That would be similar to revealing the Coca-Cola formula" (Burrows and Windrem, 1994, p.358). This logic must have been infuriating to nonproliferation officials and activists, since verifying end-use is considered to be a responsibility of the supplier and is a foundation of nonproliferation regimes. Whether willingly

deceived or not, it is apparent that the Indians were able to mask the true purpose of much of their desire infrastructure improvement from Western suppliers.

Closer to the Pokhran tests, deception was conducted to mask the signatures associated with the effort. On April 9th, allegedly one day prior to the order to conduct the tests, Prime Minister Vajpayee formed a task force that would examine the formation of a national security council to enunciate a nuclear doctrine (Chengappa, 2000, p.31). This was part of the diplomatic line given to U.S. officials that the Indian government was conducting a 3-6 month review of nuclear policy before deciding on a way ahead. Another part of that line was statements such as that made by Defense Minister Fernandes to reporters on March 21st and to U.S. officials later, that India had no need and no intention to conduct nuclear tests in the near future (see Perkovich, 2000, p.408). In the *Conceal Fiction* section we will discuss the details of these statements, but for now we can say that, while Fernandes believed he was making a true statement, his message was deceptive and had been manipulated by the Prime Minister and his closest advisors.

One additional deceptive measure is noteworthy because, while the ultimate deception target remained the United States and international community, its immediate targets were Indians. In the days prior to the tests, meteorologists and seismic experts across the country were asked to monitor their equipment because Pakistan was expected to conduct a test soon and their data might be helpful for Indian officials to use to augment their own observations (Chengappa, 2000, p.423). There is no evidence that New Delhi believed Pakistan was planning an imminent test, but the extra data from outside sources would still be beneficial for the assessment of the Pokhran tests.

At Pokhran, numerous deceptive measures were taken. India's top scientists were gathering at the test facility to oversee final preparations but it was feared that a sudden influx of civilians would be a red flag to imagery analysts. Therefore, all of the scientists were issued military fatigues in an attempt to maintain a fiction that a conventional test was the only activity taking place at the facility. The soldiers of the 58th Engineers were in charge of preparing the site for the tests, including laying cables and extra security measures. But they also ensured these actions would not be noted by satellites. One task included reshaping the mounds of dirt created when cables were laid or when the shafts themselves were sealed. The soldiers oriented the new mounds of dirt to the wind so that they would not appear different in photographs than sand mounds that were naturally occurring. Finally, when not on duty the soldiers relaxed by playing soccer at a field that had constructed next to one of the shafts. The assumption was that no analyst would believe such activity would be permitted so close to a live weapon already placed in the shaft (Chengappa, 2000, p.20).

Conceal Fiction

Despite the nightly soccer games, soldiers in the 58th Engineers must have been frustrated by some of the security measures surrounding their assignment to Pokhran. Those making phone calls home were accompanied by junior officers and their conversations monitored to ensure nothing about their assignment or the tests was revealed. They were also informed that anyone in the unit found to be asking too many questions would be immediately transferred to a less desirable assignment (Chengappa, 2000, p.25). These extraordinary measures, very unusual for a unit in the Indian Army, are part of the internal security and coordination that made the deception possible.

The concealment of fiction in a deception so large begins at a much higher level than that of soldiers making phone calls and it begins much earlier in the process of nuclear weapons development than before a test. One of the primary requirements of a long-term deception plan is having a group with sufficient knowledge and sufficient organizational clout to run the program and the deception. In the case of India, this group was formed in the Prime Minister's office as the R&D effort progressed. By the early 1980s, the Prime Minister was advised on nuclear issues by a small number of technical and policy confidants to the exclusion of rest of the bureaucracy. Brahma Chellaney describes the dynamic as being one where “*nuclear diplomacy* is the domain of the external affairs ministry, but *nuclear policy* is virtually the exclusive prerogative of the prime minister, who relies heavily on the country's top nuclear scientists for guidance” (1994, p.168).

Kampani's research on the organizational dynamics of the Indian nuclear program provides more insight. He found that throughout the 1980s the group upon which the Prime Minister relied on for nuclear policy was a “loose network of nuclear and defense scientists” that also sometimes included principal and cabinet secretaries. In 1989, Defense Secretary Naresh Chandra was designated as the coordinator for nuclear policy across the government (Kampani, 2014, p.93). As noted previously, the designation of this coordinator served as a “semi-formalization” of this loose network (Kampani, 2015). This construct of an inner circle around the prime minister, coordinated by one trusted official, would continue into the BJP government in 1998.

One group noticeably absent from the discussion of nuclear policy making is the military. Similar to what will be seen in the South Africa case detailed in Chapter 6, the Indian armed forces were largely left out of nuclear discussions. There is no evidence that even as late as the mid-1990s Indian Army and Navy planners had any knowledge of a potential nuclear deterrent and did not include such a possibility in war plans or exercises (Tellis, 2016). Several officials have claimed that civilian distrust of the military led to a decision to exclude officers from

knowledge of the nuclear program and input. But Chandra later offered a slightly different account, arguing that the armed forces had been excluded due to the civilian officials' desire to keep the program secret – something they believed would be impossible if too many military officers were included (Kampani, 2014, p.93). This would seem to be confirmed by an interview between Kampani and Air Chief Marshal S.K. Sareen, in which the former air force chief stated that he was informed privately by Prime Minister Rao in 1996 that India possessed nuclear weapons and up until that point, no air chief had ever been officially notified (2014, p.94). Sareen's claim seems hard to believe, particularly considering that, as previously discussed, the Indian Air Force was modifying aircraft and practicing nuclear weapons delivery in the 1980s. But it is possible that the existence of the weapons was widely perceived to be fact, but not officially known.

The “group within the group” nature of Indian nuclear decision making was evident in the lead up to the 1998 tests as well. BJP officials close to the prime minister consulted no officials from outside the BJP at all (Perkovich, 2000, p.404). This was especially significant for Defense Minister George Fernandes, who as previously discussed was a member of a BJP-allied party and was not told about the impending tests until May 9th. Fernandes had made repeated statements to the media that India had no intention to test a nuclear weapon and had also said as much to U.S. officials after Prime Minister Vajpayee had made the decision. Vajpayee's exclusion of Fernandes was likely intentional, since it was certain that in his capacity as Defense Minister he would be questioned about the new government's nuclear intentions.

Timeline

Figure 4-1 is an abbreviated timeline of Indian actions in pursuit of nuclear weapons and interactions with the United States, similar to the example timeline presented in Chapter 2. Above the timeline are significant events in the course of the Indian R&D program, below the timeline are interactions with the United States.

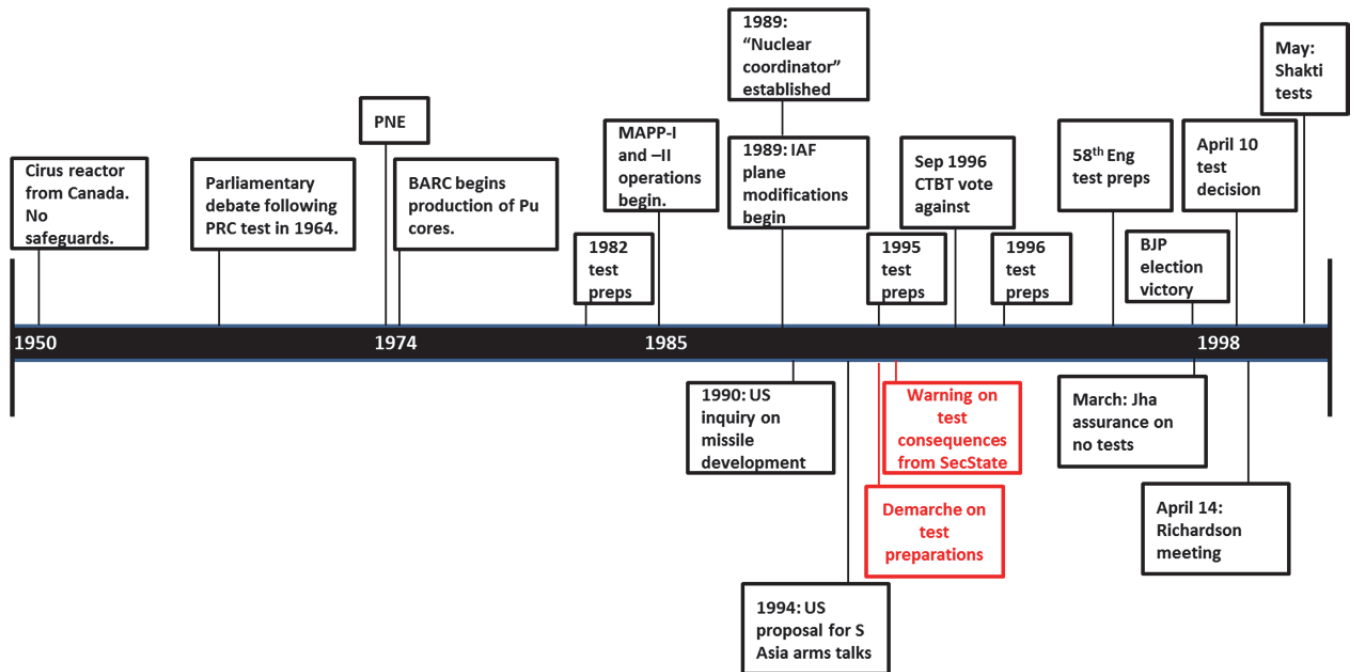


Figure 4-1 India Timeline

The interactions with the United States shown in Figure 4-1 reflect the significance of the Indian nuclear tests in the 1990s. There is relatively little insightful data on U.S.-Indian interactions pertaining to nuclear weapons development prior to 1990, though presumably the topic was discussed. But as the NPT and CTBT discussions picked up steam, India's reluctance to agree with the U.S. position brought renewed suspicion over New Delhi's nuclear intentions. The largest effect of deception takes place between the 1995/1996 test attempts and the 1998 tests. After receiving a demarche from the United States over test preparations observed by satellites, Indian officials became more deceptive and the 58th Engineers worked to deny and deceive with regards to preparations at Pokhran. Despite this change in approach, the timeline makes clear that India put the required elements in place for an effective deception plan for decades prior to the Pokhran tests.

Deception Strategy and Objectives

The Indian government's ability to conceal and be opaque about its nuclear weapons program was aided by two realities. The first was that research for the weapons program was a small subset of a larger and legitimate nuclear power program. The second was that this small research effort was managed directly by the Prime Minister's office and was coordinated mostly by verbal orders (Tellis, 2016). Rather than a large and complex effort under the guise of a nuclear power program, the Indian weapons program was instead a small effort that could be managed by a handful of officials.

As with other cases we will examine, the Indian deception strategy changed over time. It can be characterized as opacity in the decades following the 1974 PNE, followed by total concealment in the 1990s. Kampani defines the Indian opacity as “characterized by a low level of weaponization, insulation of the nuclear bureaucracy from other branches within the government, non-articulation of formal doctrine, non-integration of nuclear weapons into the armed services, and no overt deployment of nuclear forces” (1998, p.14). Of all of these, the weaponization is perhaps the most significant. Arguably, based on information in the public domain, the rest of the conditions remain true. It is still unknown whether India really has a nuclear doctrine or the extent to which nuclear weapons have been integrated. The real change occurred in weaponization. Following 1974, India appears from the outside to have stopped its R&D efforts (though this is certainly not the case). It had the infrastructure, the human capital, could produce the required material, and yet did not field a nuclear device or conduct any testing for another 24 years.

It was the need to test that changed India’s deception strategy to total concealment and that need was driven by changes in the international diplomatic climate. It is arguable that India’s regional concerns and Pakistani nuclear development were always going to result in an Indian weapon being produced and that New Delhi would see the need to conduct a test to announce its possession. But the issue was brought to a head by efforts to establish the CTBT and indefinitely extend the NPT in the mid-1990s. India could not join these efforts and then conduct its test without significant repercussions, but its refusal to sign was conspicuous. It was therefore compelled to prepare to test while having attracted significant attention to its nuclear program. The United States showed that it would intervene diplomatically, and possibly militarily, to stop a nuclear test on the sub-continent. Hence, total concealment of the R&D effort and test preparations became India’s strategy until the test could be conducted.

The Indian objective was for the United States to do nothing at all, and preferably not even notice Indian preparations until the test was conducted. Unlike the South African case, where inconsistent U.S. actions could be tolerated over time, the Indians might have had a sense that U.S. officials would be so alarmed by the introduction of nuclear weapons into the India-Pakistan mix that they would decisively act to stop proliferation in this case as soon as it was detected. This would explain why the R&D effort and test preparations were pushed so far towards concealment, rather than aiming to “freeze” the U.S. bureaucracy.

Figure 4-2 depicts the goals and methods employed by the Indians to protect their nuclear weapons program.

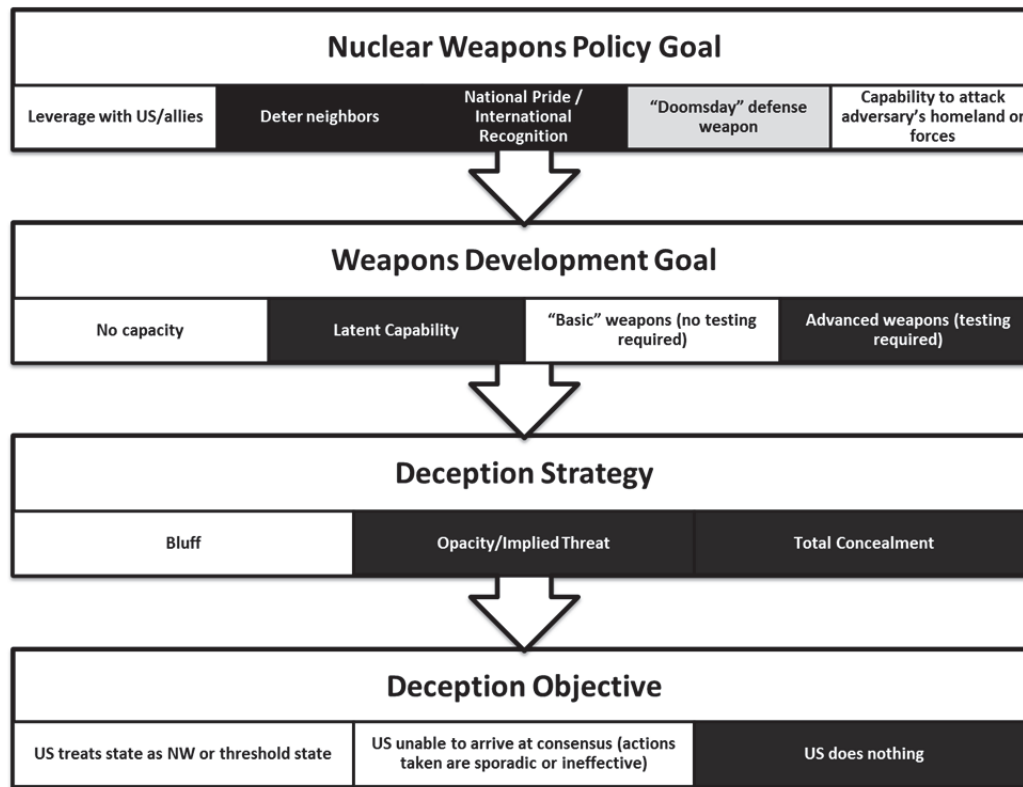


Figure 4-2 India Goals, Strategy, and Objective

Hypotheses

The Indian case yields several insights into the hypotheses for this research.

H1: The coordination of deception will result in observable signatures.

India's deception plan was clearly coordinated by the small group of officials surrounding the Prime Minister who were aware of the progress made since 1974 and able to guide the direction of the research on the weapon itself and delivery systems. Prior to the 1998 tests, this group was also aware of Prime Minister Vajpayee's intention to conduct a test and the efforts required to keep the test secret. This group's execution of the deception is reflected in the "conceal fiction" measures identified during the case research. The significance of these "conceal fiction" measures is that, though they protect the deception plan and the R&D program, they result in potentially observable signatures – incongruities between what is expected and what is seen or confusion on the part of those who should be in the know. The example of cabinet-level officials not being informed of plans to test is a common one across most of the cases and is evident here in the misleading statements made by Defense Minister Fernandes.

An additional incongruity is the assignment of the 58th Engineer Regiment to a task about which the Defense Minister has no knowledge. Certainly, the Defense Minister in a parliamentary system such as India's is not aware of all troop movements. But the 58th had to be operating with the knowledge of the ministry bureaucracy. The unit had to be fed and equipped, and had to have a "cover" reason for its work in Pokhran. Logically, someone within the Indian defense ministry must have approved these measures and a military commander must have been aware of the assignment the 58th was filling. These officials must have known the reasons for the assignment or must have been aware that they normally would have, and in this case did not. In either case, a signature was created that something extraordinary was taking place with the 58th Engineers.

These signatures are not likely to be readily apparent to an intelligence agency. But cultivation of sources and methods that would inform the analyst of extraordinary measures within the bureaucracy is a measure that could help mitigate such long-term deception efforts in the future.

H2: Multiple channels increase the complexity of the deception and the likelihood that the United States will have an understanding of the R&D program.

India was not a signatory to the NPT and was not under a regular inspection regime throughout the course of its nuclear weapons R&D program. Some Indian facilities operated under safeguards when using safeguarded material, but those that were key to the success of nuclear weapon production were not safeguarded. U.S. analysts were aware of this, but did not have any insight into Indian activity in those facilities that is reflected in the declassified and released assessments.

U.S. and other Western corporations were involved in building and renovating facilities in India and may have provided information about those facilities to the U.S. intelligence community or the IAEA. No evidence was found in the case research that indicated these firms were approached, but it is certainly conceivable that they were. Regardless, the involvement of private groups in activities associated with nuclear weapons R&D is a critical channel of information that should not be ignored in the future.

Finally, the U.S. intelligence community gained critical information about Indian activity via satellite imagery in 1995 and 1996. That channel of information was neutralized by effective Indian deception efforts (and U.S. inattention) in 1998, permitting the surprise of the May 1998 tests. This indicates the U.S. intelligence community was completely reliant on this imagery as its only channel of information. Cultivation of additional sources, and hence additional channels of information, may have mitigated the effectiveness of Indian deception.

H3: Successful long-term deception will benefit the deceiver by providing an advantage during discrete interactions with the target over the course of the program, even if the program is not entirely concealed.

Finally, U.S. officials interacted with their Indian counterparts regularly. When the intelligence community was able to ascertain Indian intentions, the U.S. officials were given a decisive advantage and were able to convince the Indians to desist from nuclear activity at least temporarily. Once deception mitigated the channel of satellite imagery, U.S. officials were at a disadvantage and were apparently fooled by Indian statements about reviewing nuclear policy and not testing.

It is clear from the case research that U.S. officials were aware of Indian nuclear capabilities – the concealment of the capabilities was not necessary for the Indians to achieve their goals. What was necessary was the concealment of intentions. Indian officials had to continue interacting with U.S. officials on a regular basis while avoiding a repeat of the 1995 demarche. The deception plan orchestrated by New Delhi permitted an advantage in the 1998 interactions that allowed the nuclear test to proceed.

Conclusion

The case of India's nuclear weapons R&D program is one of a "slow-burning" program with a capacity that was widely understood for decades. Following the 1974 PNE, India's ability to detonate a nuclear device was not in doubt, its strategic concerns were well understood, and its message in refusing to sign the NPT was received. But for two decades the international community, and the United States in particular, was content to live with a latent Indian capability. The initiative to extend the NPT and negotiate the CTBT served as a catalyst for India's decision to conduct a nuclear test and the U.S. detection of its test preparations forced its nuclear weapons program to be deceptive.

The facts that U.S. analysts missed truthful signals from the Indian government and policy elite, and that opportunities to detect the 1998 tests were missed, are undeniable. But the U.S. policymaking establishment as a whole was fooled by the statements and promises of a new government, by the cunning measures employed by Indian Army engineers, and by a small group within the Prime Minister's circle that was able to manipulate what U.S. officials were seeing.

From 1974 to 1995 the Indian government had to keep its slowly developing nuclear weapons program from becoming an obvious reality and a political problem, and it did. After 1995 it had to get that program to the point where a successful test could be conducted and India

could take what it perceived as its rightful place among the world's nuclear powers. It failed in 1995, but employed effective deception to ensure that the May 1998 tests were not only possible, but a complete surprise to U.S. officials.

	Fact	Fiction
Reveal	* Statement by PM Rao during 1994 summit that US would have to live with Indian nuclear ambiguity. * July 1996 announcement of the reversal of India's position on the CTBT. * BJP promise to "induct" nuclear weapons during 1998 campaign. * Frequent statements by Indian officials that bomb assembly would not take long, once the country decided to do so. * BARC announces steps to protect public against nuclear fallout and effects in April 1998 (senior BARC leadership aware of upcoming tests) * BJP party paper publishes special "Nuclear India" issue, delivered to newspaper offices one hour prior to the tests.	* Movement of Prithvi missiles close to the Pakistani border in March 1997 possibly conducted to divert US attention away from Pokhran. * PM forms task force to work on composition of a national security council and enunciate a nuclear doctrine on April 9th. * Uncleared personnel (seismologists and meteorologists) told to be on alert prior to test due to possibility of Pakistani tests. * US embassy and Sec Richardson informed by Indian officials that they were reviewing nuclear policy for the next 3-6 months and no tests were planned in that time [March 1998]. * Defense Minister statement in March that no testing was needed at this time.
Conceal	* Development of a missile program without articulation of how the missiles would be employed. * Comments by former PM (Gujral) that weaponization is not currently on the agenda [1996]. Confusion over the Indian use of terms such as "weaponization" and "inducting."	* Other political parties (outside BJP) not consulted on decision to test.

Table 4-1 Diplomatic Aspects of Indian Nuclear R&D Deception

	Fact	Fiction
Reveal		* Top scientific officials donned fatigues for site visits to Pokhran in the months leading up to the test.
Conceal	* Scientists involved in the testing took circuitous routes to Pokhran and disguised their identities to travel to the test site. * 58th Engineer Regiment relocated to Pokhran to conduct deception operations around the site.	* 58th soldiers accompanied by officers when making phone calls home to ensure nothing unauthorized was said. * Defense Minister informed of tests on May 9th, service chiefs and foreign secretary on May 10th, president informed the night before. * Starting in 1989, the PM designated one coordinator for nuclear activities (at the time it was the MinDef) * No air force chief was officially informed about the program until 1996, despite the Air Force having responsibility for delivery.

Table 4-2 Human Capital Aspects of Indian Nuclear R&D Deception

	Fact	Fiction
Reveal		
Conceal	* Relationship between AEC and DRDO highly classified. * Special train car designed to carry the Agni missile to make it difficult to detect during transport.	

Table 4-3 Infrastructure Aspects of Indian Nuclear R&D Deception

	Fact	Fiction
Reveal	* Operation of reactors despite a gap between required and declared heavy water supplies. No explanation for discrepancy.	* Construction of heavy water facility aided by Western companies. Vague Indian statements about an ammonia plant when questions were asked.
Conceal	* Plutonium transported from Mumbai to test site by non-descript army convoys with light guard. * Smuggling of heavy water from Europe, Soviet Union, and China throughout the 1970s and 1980s.	

Table 4-4 Special Material Aspects of Indian Nuclear R&D Deception

	Fact	Fiction
Reveal	* Modification of Indian Air Force platforms to deliver nuclear weapons in 1989. * Open purchasing of beryllium leads to DCI warning that India may be pursuing a hydrogen bomb in May 1989.	
Conceal		

Table 4-5 Other Material Aspects of Indian Nuclear R&D Deception

	Fact	Fiction
Reveal		* Football field constructed next to one shaft with games played every night to give the appearance that nothing of importance was taking place there. * Fencing not built around test site prior to event, only "Danger, Mined Area" signs used. * Placed "Water Position" and "Dozer Cadre Training" signs at the positions of new shafts. * Constructed mounds oriented to the wind so they would be indistinguishable from naturally-occurring mounds.
Conceal	* Cables at Pokhran laid by motor-grader, which created a furrow and placed the cable in it. * Vehicles disbursed to locations throughout the complex during the day, used at night for test preparations, and redisbursed to mask activity from satellites. Tracks recovered with fresh soil. * Pokhran chosen due to scarce nearby habitation. * Smoke canisters regularly lit off to conceal activity around the site. * Buildings constructed with anthropomorphic features in sandy brown to merge them with terrain. * Sub-kiloton tests to generate computer data on reliability. This approach was used to get around CTBT restrictions. * All three devices detonated simultaneously (May 1998) in part to mask the signal so it would be difficult for others to determine yields.	

Table 4-6 Test and Evaluation Aspects of Indian Nuclear R&D Deception

5. The Republic of Iraq (1974-1995)

“Iraq seems to have learned early that effective deception can be based on a defeat or loss – much faster than the victors learned that every victory contains the seeds for self-deception.”
– David Kay (1995)

The Iraqi nuclear weapons program is distinctive in that it is perhaps best known for its non-existence following the 2003 invasion by the United States. But the actual nuclear weapons R&D effort undertaken by Iraq from the mid-1970s until several years after the Gulf War was carried out by talented and enterprising scientists, often working under austere conditions and brutal management. It was supported generously by the Iraqi government, and abetted by Western individuals and firms that enjoyed significant profits from the illicit trade. As with the other cases examined in this research, the Iraqi R&D effort was forced to be deceptive after a key event proved that concealment alone was not sufficient to secure the program. The Iraqis not only continued their R&D program knowing the world was watching, but continued to be deceptive even after the United Nations had placed inspection teams in Iraq with (mostly) unrestricted access to the program’s personnel, facilities, and documentation.

This case study will cover the time period from Iraq’s campaign to acquire plutonium-producing reactors in the mid-1970s to the defection of Hussein Kamal in August 1995. With Kamal’s defection, the Iraqi government was forced to admit that it had a nuclear weapons R&D program focused on putting a nuclear warhead on an intermediate-range ballistic missile. Though Iraqi deception and obfuscation certainly continued after this point, this round of admissions by Baghdad removed all doubt that Iraq had aggressively pursued nuclear weapons capability.

Historical Background

Though the Iraqi nuclear weapons program is normally associated with Saddam Hussein, it predates his rule by several years. Iraq received its first reactor from the Soviet Union in 1967, the IRT-5000, and signed the NPT shortly thereafter. As with several other programs, movement towards a nuclear weapon capability started small and possibly on the initiative of individual researchers. Reportedly around 1975, two Iraqi scientists began calculations and testing the production of Plutonium-239 using the IRT-5000 reactor (Khadduri, 2003, p.69). It would have taken decades to produce sufficient material for a weapon, but nonetheless Iraqi scientists were already learning core skills that would be useful as a weapons program progressed.

Exactly when the Iraqi government made a decision to pursue, or even just explore, nuclear weapons is unclear. Some scholars argue that the government began to consider the possibility as early as 1971 (Reiter, 2005, p.357). Others who were involved with the program note that there was definitely official direction to pursue R&D issued by Saddam in December 1979, possibly motivated by the Islamic Revolution in neighboring Iran (Hamza and Stein, 2000, p.116). Most likely, the research efforts started small at nuclear facilities, various members of the government had differing opinions about the merits and feasibility of the program, and Saddam authorized it officially in 1979. What is more certain is that Iraqi nuclear efforts drew significant attention during the 1970s. Israel was particularly wary while many in Europe saw a business opportunity presenting itself.

According to Khidir Hamza, a former scientist within the Iraqi R&D program, the deception employed in the early 1970s was paper thin. Hamza refers to a 1974 trip to France to negotiate the sale of a new reactor as “an elaborate put-on, suitable for Gilbert and Sullivan. Why would Iraq, sitting on a sea of oil, be investing hard-earned millions in nuclear power? On the face of it, our cover story didn’t pass the smell test, but as we would soon learn again and again, nobody cared. Everybody wanted our money” (2000, p.81). Not all potential suppliers were as cynical as Hamza believed. Italy refused to sell Iraq a version of their Cirene reactor. The French did agree to sell Iraq a reactor, but not the gas-graphite reactor (which would have been a substantial source of plutonium) and reprocessing plant that the Iraqis wanted. Instead, they agreed to supply a materials testing reactor, called Osiraq, which would be fueled with uranium that would be monitored under the NPT and agreement with the French government. Despite these conditions, many both inside and outside Iraq saw more nefarious purposes for the reactor. Then-Vice President Saddam Hussein is reported to have called the acquisition of Osiraq “the first actual step in the production of an Arab atomic weapon” (see Reiter, 2005, p.357).

Osiraq and Operation OPERA

The acquisition of Osiraq is an example of how much perceptions of events can differ between parties. Israel was immediately concerned about the French sale of Osiraq. The first Israeli concern was that Osiraq was a materials testing reactor, which they considered too expensive and too powerful for a country that was not producing reactors of its own. The second Israeli concern was the highly enriched uranium, supplied by France, that would be necessary to operate Osiraq (Feldman, 1982, pp.116-117). Early Israeli efforts to halt the delivery included sabotage of Osiraq components before they were shipped from France and the assassination of an Egyptian scientist working on the Iraqi program in Paris. Despite these measures, Osiraq was constructed and placed into service at the Tuwaitha Nuclear Research Center near Baghdad.

The French promise to monitor operations at Osiraq, as well as the IAEA safeguards under which Iraq was supposed to be operating, evidently did little to calm Israeli fears. If the safeguards could be circumvented in some way, Osiraq would produce fissile material albeit very slowly. Israel's consideration and eventual decision to conduct a preemptive strike on an operational nuclear facility was based on the belief that safeguards were ineffective and would not stop Iraq from nuclear weapons R&D (Feldman, 1982, p.118). Planning for an air strike began in earnest following the election of Prime Minister Menachem Begin in 1977.

The Israelis would not get to Osiraq first, however. Iran also understood the potential dangers of a nuclear-armed Iraq and conducted an airstrike against Osiraq eight days into the Iran-Iraq War, on September 30, 1980. A CIA report shortly after the raid assessed that only secondary buildings were hit, however, and that Osiraq was still functional (CIA, 1980, p.1). Israel would need to conduct its own strike if it were to be assured of the facility's destruction. It did so on June 7th, 1981 as Operation OPERA, an air strike conducted by eight Israeli F-16s. The raid was a significant embarrassment for Baghdad. The Osiraq reactor was put out of commission without the Israelis losing a single plane.

The utility of preventive strikes such as the one conducted against Osiraq continues to be debated. One point that this case will show to be valid is that such actions make the argument for why the potential proliferator should acquire nuclear weapons and only reinforces the proliferator's desire to do so (Ford, 2004, p.3). The raid on Osiraq would have a significant impact on Iraqi R&D and also on the deception the Iraqis would use to protect it. Former weapons inspector David Kay would later write "The strength of the Iraqi denial and deception program is that it was anchored in a real fact – *the Israeli destruction of the Osirak nuclear reactor*. This piece of reality was reinforced by the accompanying sympathy that this attack engendered in the West and the desire of those who carried out the Osirak attack, as well as those who admired the technical skills it demonstrated, to believe that it had dealt a decisive blow to the Iraqi nuclear program" (1995, pp.87-88).

Iraqi R&D after Osiraq

Whatever the motivations and intentions of the Baghdad government were in acquiring Osiraq and conducting nuclear R&D, its intention after the attack was clearly to pursue nuclear weapons capability. There was international outcry following the Israeli attack. Many argued that it constituted a breach of sovereignty that could not be excused, others believed that striking a functioning nuclear facility was irresponsible. Many in the nonproliferation community were concerned that the strike was conducted against a safeguarded facility – if being a signatory to the NPT and accepting safeguards did not allow a country to conduct nuclear research and operations without fear of military strikes then what would?

Iraq appears to have been acutely aware of the role of victim that many appeared to be assigning. Some in Baghdad evidently argued for withdraw from the NPT and an aggressive weapons program. But Dr. Jafar Dhia Jafar, a Western-trained nuclear physicist at the Iraq Atomic Energy Commission (IAEC), argued to Saddam Hussein that withdrawal from the NPT would only prove Israel right about Iraqi intentions and that if they stayed “on the inside” of the process they could better learn how to be deceptive and acquire a nuclear weapon without further interference (Burrows and Windrem, 1994, p.41). Saddam followed Jafar’s advice and Iraq seemingly embraced the NPT even more. Inspectors were welcomed at the remaining Tuwaitha facilities twice a year and potential suppliers in the West were not scared off by the Iraqi weapons aspirations.

Despite the public face of Iraqi nonproliferation policy, the reality was that the Osiraq raid had made Saddam Hussein even more determined to acquire a nuclear weapon, if less capable. The Iraqi nuclear weapons R&D effort would need to start largely from scratch while welcoming intrusive inspections. A flood of resources poured into the program. According to Hamza, the R&D program expanded from 500 people to over 7,000 in span of five years in total secrecy (see Cirincione, 2002, p.273). Estimates of Iraqi funding of the R&D program put spending at \$400 million U.S. dollars prior to Osiraq, then over \$10 billion in the 1980s following the attack (Tamsett, 2004, p.72).

Such estimates are difficult to verify, but what is clear is that while the Israeli airstrike may have significantly slowed Iraq’s nuclear weapons progress it did nothing to remove the goals and motivations behind it. According to former UN Chief Weapons Inspector David Kay, after Osiraq the Iraqi nuclear program followed “a careful and calculated deception of very high quality” to conceal itself while pursuing acquisition of a weapon (2016). For the remainder of the 1980s, Iraqi scientists would scour the world for the necessary knowledge and materials to meet an increasingly aggressive timeline for weapons production. The details of the program during this period and how it was assessed outside Iraq will be discussed throughout this chapter. While consensus on the success and potential of Iraq’s R&D effort is elusive, it is clear that after years of work and some amount of success the program was derailed not by detection or by not meeting its goals, but rather by Saddam’s unpredictable behavior and policy decisions.

The Gulf War

By many accounts, the widespread international condemnation of Iraq and Saddam Hussein following the August 1990 invasion of Kuwait caught the dictator by surprise. When it became clear that condemnation might turn to military intervention by a broad coalition, Saddam sought to turn to a “silver bullet” as he had in the past. The Iraqi nuclear R&D program was ordered to initiate a crash program to produce a weapon for use against Coalition troops as soon as possible. At this stage, the only fissile material available for use in such a weapon was enriched uranium

that was under safeguards and hence would be quickly missed. Such an effort would have been easily detectable and never truly got off the ground, nonetheless Iraqi scientists stepped up their efforts to achieve nuclear weapons capability (Obeidi and Pitzer, 2004, pp.132-135).

There had long been suspicions of Iraq's nuclear intentions and the lack of decisive actions in the 1980s to stop the effort is indicative that the international community either wasn't sure or didn't place sufficiently high value on stopping the effort to intervene. The first concrete measure of the effectiveness of Iraqi deception was seen on the morning of January 18th, 1991. On that morning, the morning after the initial bombing by Coalition forces, senior Iraqi scientists claim that they were pleasantly surprised by the impact on their facilities. The Tuwaitha Nuclear Research Center, the site of Osiraq raid and the only well-known facility in the entire nuclear program, had only received slight damage (Burrows and Windrem, 1994, p.28). The Tarmiya facility, which had been designated as "possible nuclear" by Coalition targeters but also "possible missile," had received moderate damage from a plane that hit it as a target of opportunity when its primary mission was scratched (Kay, 2016). The numerous remaining facilities were almost completely unscathed. Time would show that this was not a strategy on the part of the Coalition or an aberration – U.S. analysts, as well as IAEA and UN officials, had very little understanding of the Iraqi nuclear R&D effort.

As part of the agreement ending the conflict, Iraq consented to UN inspections of facilities and armaments throughout the country. But the Iraqis had no intention of being forthcoming with many of their activities. Former inspector Scott Ritter referred to the total deception effort as "immense," and it included Iraq failing to declare any aspects of its nuclear or biological weapons programs – in addition to not declaring numerous ballistic missiles, launchers, and chemical weapons (1999, p.33). Kay characterizes the Iraqi approach during this period as "waiting the inspectors out," and believes they destroyed equipment they could not hide while keeping as much together as possible, believing they could reconstitute the program once inspectors left (2016). Inspectors pursued leads on a potential nuclear program despite the Iraqi non-declaration and by May 1991 were starting to understand the extent of their misconceptions. While not fully understanding the entire R&D effort, it nonetheless became apparent to inspectors that there had been an ambitious enrichment program and that international controls on materials and technology had utterly failed to keep Iraq from making crucial acquisitions (Davis and Kay, 1992).

Iraq's efforts at deception would continue for years even with inspectors on the ground. By 1994, the UN Commission (UNSCOM) would be frustrated by what one journalist would describe as "shell games within shell games" that hid documentation, materials, facilities, and personnel from UN inspectors. UNSCOM personnel were soon openly expressing frustration

that their leads had dried up but enormous gaps still existed in their understanding of Iraqi efforts (Gellman, 1998b).

By June 1995, the inspection effort seemed to be at a standstill. Inspectors were “largely satisfied” with information about the nuclear program through they acknowledged there were many unanswered questions (Black, 2000, p.122). But in August the inspectors, and the international community as a whole, would catch a break. Hussein Kamal, who had been the coordinator of much of the nuclear weapons R&D effort as well as the deception masking it, defected to Jordan and brought with him key information about what had taken place in the program. One bit of information he shared serves as an example of how misled inspectors continued to be. Kamal revealed that “Dr. Muhammad” was the head of the centrifuge program – a position that U.S. analysts believed had been filled by someone else entirely. Inspectors soon sought interviews with the newly-identified individual and much of the Iraqi deception began to unravel (Albright, 1998, p.49).

Baghdad was forced into revealing more of its activities in an effort to get in front of the allegations it was sure Kamal would bring. These revelations are detailed extensively in David Albright’s 1998 article “Masters of Deception.” The Iraqi government soon admitted, for the first time officially, that it had an extensive and well-funded nuclear program with the mission of putting a nuclear warhead on an ICBM. It admitted having brought a German centrifuge expert to Baghdad with classified materials that had given Iraqi scientists significant insight into how to construct the centrifuges and solve several problems that had frustrated the program. It was not a complete *mea culpa* on the part of Baghdad, however. The government would also claim that it had shut down the program in April 1991 and that Kamal himself had independently sought to continue it and mislead the UN and IAEA inspectors (1998, p.50). The April abandonment of the program by the government would later be found to be untrue.

Assessments of Progress

One enduring legacy of the effectiveness of Iraqi deception in this case is that years later experts could not easily come to consensus about how far the program had progressed – despite access to facilities and documentation as well as extensive interviews with Iraqi officials. David Albright and Mark Hibbs argued early in the process of inspections that Iraq was five to ten years away (1991c, p.17). Estimates seem to have shortened as inspections continued and some of the deception was uncovered. Imad Khadduri, who worked within the program, claims that Iraq was 10-20% of the way towards completion of a device (2003, p.122). David Kay has stated his belief that Iraq was likely 18 to 24 months away from a crude device and three to four years from an advanced deliverable device, while other researchers have estimated anywhere from six months to two years (Kay, 1995, p.85; Ellis and Kiefer, 2004, p.9).

The bottom line is that for many years experts with significant experience, inspectors who were on the ground, and even former program officials differed on their assessments of the progress and potential of the Iraqi nuclear weapons R&D program. This is a direct result of a carefully crafted and aggressively executed deception plan that kept officials, analysts, and inspectors in the dark despite unprecedented access.

Program Elements

To examine what is known about the Iraqi program, we will use the same categorization from other case chapters that defines the program elements as: 1) raw materials; 2) the ability to obtain weapons-grade material; 3) trained personnel and adequate facilities; and 4) capability to acquire, manufacture, and test (if necessary) components (Horton, 1999, p.4).

Raw Materials

The Iraqi nuclear R&D program appears to have focused on multiple sources of material, rather than the most prevalent or easiest to obtain as the Indian and South African programs did. Iraq had some natural resources for this effort and the infrastructure to make them usable. With Belgian assistance, a yellowcake production facility was constructed at al-Qaim in western Iraq (Duelfer, 2004, p.11). Additionally, a uranium dioxide plant was constructed west of Mosul at a facility that also housed the means to produce uranium tetrachloride (Blix, 1991, p.28). Uranium tetrachloride is a key ingredient in one process of enrichment pursued by Iraq – electromagnetic isotope separation (EMIS). Despite this infrastructure, Iraq was not able to mine a significant amount of uranium and struggled to find the raw material to feed its enrichment attempts throughout the life of the program. One CIA report in 1979 noted that Iraq had been investing in uranium mines in the Central African Republic, likely in an attempt to gain more access to material (CIA, 1979, p.6).

The raw material in Iraq's possession did not necessarily suggest one type of weapon over another, and it appears Iraqi scientists investigated both gun-type and implosion weapons. Most analysts believe that the implosion type was more realistic due to the large amount of fissile material required for a gun-type weapon, but Iraqi scientists struggled to perfect the explosive charges that would keep the implosion effect uniform (Albright and Hibbs, 1991c, p.19; Cirincione, 2002, p.274). David Albright and Mark Hibbs estimated that with the amount of material Iraq had on hand as of the Gulf War, either weapon design option would have been too heavy and bulky for any delivery method of which the Iraqis were capable (1991b, p.22).

The Ability to Obtain Weapons-Grade Material

Regardless of how much raw material Iraq was able to obtain, it faced significant hurdles in producing weapons-grade material. As with many nuclear weapons R&D programs, fissile

material was assessed as Iraq's greatest challenge in acquiring a weapon (CIA, 1979, p.1). As previously discussed, the Iraqis originally wanted to purchase a gas-graphite reactor from France in 1974, which would have been more useful for plutonium production than Osiraq, but the French government refused to approve such a sale. Iraqi hopes for the use of Osiraq as a smooth path to weapons-grade material took another hit in 1980 when the French attempted to renege on part of the agreement that involved supplying Iraq with 93% enriched uranium for Osiraq. French scientists had developed a way to use 18% enriched uranium, called "caramel," to fuel the reactor and wanted to supply this instead (Khadduri, 2003, p.74). The French believed caramel was "proliferation resistant," but the Iraqis refused to amend the contract and accept caramel and the French did provide HEU for Osiraq's operation (CIA, 1983, pp.2-3). This refusal should have been a red flag for Iraqi intentions, and may have been. The section of the 1983 CIA report that discusses the Iraqi refusal to accept caramel is heavily redacted.

The Iraqis pursued every possible means of obtaining weapons-grade material that had any promise at all, including some methods that surprised U.S. analysts. One worth noting, due to the confusion it caused analysts, is EMIS. It is possible that Jafar Dhia Jafar urged Iraqi scientists to research EMIS based on his previous experience working with similar techniques at CERN in Switzerland during the 1970s (Obeidi and Pitzer, 2004, p.53). EMIS, if it could be achieved as a viable enrichment technology, promised to be exactly what the Iraqis required. It was a technology that had been around for decades but was generally not considered efficient enough to be a viable path for a modern country. A 1982 report by Los Alamos National Laboratory speculated that the use of calutrons, used in EMIS, was a viable option for a country with cash, sufficient electrical energy, and a large labor pool. The report listed 20 countries that were suspected of researching EMIS and the use of calutrons, but Iraq was not one of them (Albright and Hibbs, 1991b, p.20).

Iraqi scientists set about circumventing export controls and information restrictions to investigate EMIS. They did not have to be deceptive. They quickly discovered that over 160 patents that pertained to EMIS were registered by participants in the Manhattan Project who originally worked on the process. At the time, these patents could be obtained from the World Intellectual Property Organization in Vienna, and Iraqi scientists found them to be "the actual designs, processes, and descriptions of vital components of the EMIS" (Khadduri, 2003, p.100). As it turned out, EMIS was a loophole in the export control regime. It was considered so inefficient as to be unsuitable for modern nuclear weapons R&D. Analysts at Lawrence Livermore National Laboratory later dismissed the suspicions of their counterparts at Oak Ridge that Iraqi facilities were EMIS because they did not accept that the Iraqis would pursue "stone age technology" (see Burrows and Windrem, 1994, p.45). But that estimation of efficiency was based on equipment from an earlier generation. When the Iraqis used modern computers, fiber-

optics, and computer-assisted manufacturing to increase reliability and precision, EMIS became a viable enrichment option (Davis and Kay, 1992, p.23).

U.S. analysts caught a break when they invited John Googin, a 69-year-old veteran of the Manhattan Project, to Vienna to look at photographs of possible Iraqi nuclear sites. He selected one picture of a site with a calutron and remarked that it was just like a building that he used to work in (Hedges and Cary, 1991). By the time analysts were aware of the EMIS effort, it was very large and very advanced. Iraq had built its first EMIS-dedicated facility at Tarmiya to the north of Baghdad and then built a replica of that facility in al-Sharqat. Though Tarmiya had been built with some foreign assistance, al-Sharqat was built by Iraqis only and was completely unknown until revealed to inspectors by the Iraqi government (Albright and Hamza, 1998, p.10). David Albright estimates that these two facilities had the potential to produce 25-100kg of weapons-grade uranium, but problems with some of the equipment hindered their efficiency (2002).

As stated previously, Iraq pursued many potential avenues of enrichment. The IAEC also decided to embark upon a gaseous diffusion effort. This process involves turning uranium oxide into gaseous uranium hexafluoride, then sending through some form of “diffuser” that filters different isotopes. This effort experienced significant delays and changes in personnel and leadership, but for a time at least became a favorite of Hussein Kamal and others close to Saddam (Obeidi and Pitzer, 2004, pp.58-59). This approach also relied on what were thought to be outdated or inefficient practices and, while ultimately unsuccessful in producing sufficient fissile material for a weapon, showed that intelligence agencies can sometimes overlook explanations that do not conform to conventional wisdom. For their part, the Iraqis went to great effort to conceal these efforts and not provide U.S. analysts with any information that might change their pre-existing beliefs.

Trained Personnel and Adequate Facilities

Many scientists involved in the Iraqi nuclear weapons R&D effort were world-class researchers with excellent credentials in their fields. But the state of Iraqi industry and infrastructure was such that foreign assistance would be required to have any chance of acquiring a nuclear device. This requirement had the potential of running Iraq afoul of its NPT commitments and export control regimes. Thus, the Iraqi program sought to contact foreign suppliers, specialists, and businesses in covert or deceptive ways to obtain the information and equipment it needed.

One important aspect of the Iraqi R&D effort was that it was comprised of multiple competing organizations. The EMIS and gaseous diffusion enrichment efforts, for example, were completely separate and only the most senior officials knew about both. Therefore, the program was not a small one contained in a secret facility, but rather had numerous facilities

throughout the country, employing by some estimates over 20,000 people (Kay, 1995, p.86). Many of these personnel had to be trained outside Iraq and these foreign engagements, though necessary, were risky. In one instance, an engineer was dispatched to a U.S. firm ostensibly to study the cadence program for rotors used in the oil industry. When the student developed a model for rotors spinning at 50,000 rpm, too fast for petroleum applications and more appropriate for nuclear weapons work, a younger U.S. engineer inquired about why such a model was necessary. Iraqi officials feared they were exposed, but evidently the U.S. engineer never reported his concerns to his superiors (Obeidi and Pitzer, 2004, p.104).

Capability to Acquire, Manufacture, and Test Components

Foreign connections were even more necessary for the acquisition of necessary components and these connections often involved cloak-and-dagger skills from scientists not normally known for such activity. Following the Israeli assassination of one of the program's senior scientists in Paris and other threats to Iraqi officials overseas, Iraqi scientists were issued false passports for their travels and never traveled under the same name twice (Hamza and Stein, 2000, p.143).

Their activities overseas involved both research and purchasing. When purchasing was particularly risky, the Iraqis utilized third-country nationals to avoid suspicion. In one instance, an Indian sales representative was engaged to acquire export controlled lasers. Iraqi officials on false passports met the Indian on a layover in the Miami airport and exchanged a briefcase with \$30,000 in it for the lasers, then both parties caught their flights (Khadduri, 2003, p.85).

The Iraqis also engaged U.S. corporations and academic institutions for information on standards and research services. Several examples will be discussed in subsequent sections. But these connections often entailed very involved deceptive measures. In one instance, officials at one U.S. company were reluctant to conduct business with the Iraqis due to concerns that they were not, in fact, from the Ministry of Industry as they claimed. The Iraqis invited the Americans to Baghdad and met them in the conference room of the Ministry of Industry, which seemed to satisfy the Americans and they concluded their deal (Khadduri, 2003, p.107).

Iraqi scientists also sought out and engaged individuals who could provide services and information, believing that they were safer than approaching an established company. In one significant example, they approached Karl Heinz Schaab, a disaffected machinist in Germany who owned a small company with his wife and supplied numerous components below the black market price (Obeidi and Pitzer, 2004, p.120). Additionally, Hussein Kamal engaged the "Nassr Establishment" to handle some aspects of illicit procurement for the program. The Nassr Establishment was a network of Iraqi front companies used to circumvent sanctions and export restrictions for various commodities. Those companies were also used to engage suppliers,

particularly in Europe, in support of the nuclear program (Obeidi and Pitzer, 2004, pp.90-91).

The involvement of Nassr was not restricted to approaching companies for components. In one instance, a Nassr official was appointed to the Technology Development Group (TDG), a London-based Iraqi procurement firm. TDG then acquired in 18% share in Swiss firm Scmiedemeccanica AG, which produced components useful in the centrifuge program. Nassr officials were able to invest in companies such as this one that were then compelled to provide components in violation of export controls (Albright and Hibbs, 1991c, p.24).

Help from the United States

The amount of interaction Iraqi officials had with entities within the United States is noteworthy, considering it was eventually the United States that was most involved with trying to work out the details of the Iraqi program. First, a significant amount of business was done legally. In the five years leading up to the Gulf War in 1991, the U.S. government approved the sale \$1.5 billion worth of computers, electronic equipment, and machine tools that could be used in a nuclear program (Albright and Hibbs, 1991c, p.19). This is not surprising if one recalls that in the 1980s, though Iraq was pursuing a nuclear weapon despite its NPT obligations, the United States was somewhat supportive of Baghdad as a counter to the Islamic Revolution in Iran. Hence, such purchases were not unusual or inexplicable.

Iraqi officials went beyond what the U.S. government would approve, however. Iraqi scientists visited the University of Virginia in 1988 to obtain information on magnetic centrifuges. The Iraqis claimed to be from the University of Baghdad and conducting research on rotational dynamics, again a critical area for the petroleum industry. They were welcomed by UVA professors and library staff and, for the most part, given access to the information they requested (Obeidi and Pitzer, 2004, p.76). In other cases, the Iraqis presented themselves as government officials but from the Ministry of Oil instead of anything defense-related. Sometimes the Iraqis were able to save themselves some of the work and contract the research. In 1982, Iraqi scientists attended a conference in San Diego, CA and inquired to several attendees about solid state track detectors. Not having any luck, they found the business card for a research librarian and hired her to compile articles. They paid \$200 for a comprehensive list of articles with no questions asked as to the purpose of the research (Khadduri, 2003, p.84).

In sum, the Iraqi program spent significant resources and took significant risk to train personnel and acquire the necessary components to advance the program. They were deceptive in concealing the identities of their personnel, their affiliations, and certainly their purposes for acquiring the components and knowledge they sought. Additionally, they employed an extensive network of front companies to illicitly acquire components and invest in companies that could provide the necessary assistance for Iraq's pursuit of nuclear weapons.

Program Management

The Iraqi R&D effort was a complex system of organizations and personnel involved in separate research efforts – often without any knowledge of other aspects of the program. The highly compartmentalized and bureaucratic nature of the effort was typical of defense programs in the Saddam era – with every action requiring documentation with the proper signature and only the most senior officials having an overview of the entire effort (Kay, 2016). It was managed by both scientific and political officials close to Saddam Hussein. Saddam expressed great interest in the program and its progress, and often imposed deadlines that were almost impossible to meet for a program struggling to gather the necessary resources in total secrecy.

The evolution of these organizations is effectively detailed in numerous sources, most notably the Comprehensive Report of the Special Advisor to the DCI on Iraq's WMD, better known as the Duelfer Report (2004). One organization particularly relevant was the Ministry of Industry and Military Industrialization (MIMI), which was established in May 1988 and was headed by Hussein Kamal. At its peak, MIMI oversaw and coordinated approximately 60 separate organizations connected to various efforts in Iraq's WMD program (al-Marashi, 2003, p.60). MIMI, and Kamal in particular, came to be in charge of much of the Iraqi nuclear R&D effort, which was gradually consolidated into a program deceptively named "Petrochemical-3" or PC-3.

Other organizations were more directly involved in the deception effort. The "Special Security Organization," or Amn al-Khas, was identified by several former program participants as being the coordinator of the denial and deception efforts both before and after the Gulf War. This organization was headed by Saddam's son, Qusay. Iraq's general intelligence service, al-Mukhabarat, had both covert operations and covert procurement units assigned to the WMD effort, and presumably the nuclear weapons program within it. Military intelligence also played a role as well as the "Emergency Forces," which provided security for the various facilities in the program (al-Marashi, 2003, p.52). All of these operated under the oversight of Qusay and the Special Security Organization. Following the 1991 war, these efforts morphed into what UN inspectors would come to call the "concealment mechanism." After Kamal's 1995 defection the Iraqi government would reveal more about the concealment than it previously had, but it continued to allege that Kamal ran these efforts on his own. UNSCOM, however, would identify not only the organizations discussed here, but also elements of the Special Republican Guard as being part of the "concealment mechanism" (Black, 2000, p.124). This would constitute a collection of organization far too widespread to be operating under the authority of anyone but Saddam Hussein.

Motivation for Study

The case of Iraq provides insight due to the unique circumstances of foreign intervention during the course of the program. The Israeli strikes that destroyed Osiraq and the cease fire agreement that ended the 1991 war are bookends for a program that sought to provide a nuclear weapon to a small and poor country already exhausted by conflict with Iran. The effort to conceal the program even as UN inspectors traveled through the country can be considered an example of deception at its most persistent, and arguably most clever.

Common Case Features

This case has several similarities to other cases studied. Some of the broader themes of a one-party state governed by a minority group, living in a “rough neighborhood,” and needing to project a powerful image both to foreign and domestic audiences to maintain regime legitimacy are seen in Iraq and the other cases. But there are two similarities in particular that merit discussion.

First, the Iraq case is similar to that of German rearmament in that there was an outside group mandated by a negotiated settlement to investigate and observe the program. It is the only one of the nuclear cases with this common link. The Versailles negotiators had no precedent to draw upon when determining how Germany would be monitored for its compliance with the treaty-imposed arms reductions. Similarly, though the UN Security Council had dealt with issues of conflict and its aftermath for several decades, it had never imposed a disarmament plan on a still-sovereign country as part of a peace settlement. It created UNSCOM to do exactly that (Gellman, 1998b). The IAEA, which had long conducted inspections mandated as part of agreed-upon arms control accords, had not entered a country that was forced to accept intrusive inspections. In this case, arms inspectors entered Iraq as unwelcome guests who were charged to do the work of the victorious side in a war (Ritter, 1999, p.32).

The effect, both for and against success in deception, was significant. Unlike pre-war IAEA inspections, the monitors were not chauffeured to elaborate lunches, taken on shopping excursions, and otherwise distracted for much of the inspections. By many accounts, UNSCOM inspectors were serious about their task and unwilling to be deterred. On the other hand, though they weren't leading the inspectors around the Iraqis became very proficient at determining the inspectors' movements, slowing them down, and moving evidence before it could be seized.

Another common element of this case is not often discussed in memoirs of the various officials or scholarly research. Similar to India, the Iraqis had some sense of the array of technology from which they had to conceal their program. U.S. support to Iraq during the Iran-Iraq War in the 1980s was uneven throughout the conflict, but it did include providing Iraqi

officials with information from aerial and signals intelligence that would have informed how communications could be protected and facilities constructed in a deceptive manner. It is likely that, at the very least, this understanding provided Iraqi officials with a frame of reference for how their R&D effort needed to be concealed from Western intelligence agencies (al-Marashi, 2003, p.58; Kay, 2016).

Distinctive Case Features

There are two distinctive features of the Iraqi case that are noteworthy. The first and most obvious one is that it was interfered with more than any other case researched. The Israeli attack against Osiraq has already been discussed. Additionally, an assassination campaign was undertaken by Israel to target officials in the program when they traveled outside Iraq. Many observers believed this to be an effective counterproliferation measure. "Israel's message that it would take extreme measures to prevent Arab nuclear acquisition should register with foreign technicians considering participation in such enterprises. They should realize that such participation is a rather risky proposition" (Feldman, 1982, p.126). While Iraq's program was certainly slowed down by Israeli efforts, it is a stretch to say that this point of view was vindicated. As we have already seen and will see in more examples in subsequent sections, the destruction of Osiraq did not dissuade Iraq's nuclear ambitions and Israeli assassinations did not deter Iraqi scientists from traveling overseas or foreign specialists from offering their services.

Another distinctive aspect of the Iraqi program is perhaps related. Of all the programs researched, this was the one that strove most consistently for total concealment and the one that came closest to achieving it. Though Saddam made some comments referring to an Arab bomb in the 1970s, there does not appear to be a period covered by this case where Iraq wanted the United States to have an understanding that it had a weapon or an active program. Following the Osiraq bombing, Iraq's policy was to play the victim, support the NPT, and continue the effort clandestinely. This was only made possible by the lack of access to Iraqi sites for arms control inspectors.

In this sense, it is similar to the case of Soviet BW efforts. That program also aimed for total concealment and was also conducted in a closed society with state control over media and travel. Just as the Soviets built large complexes for BW development and kept foreigners and others away, the Iraqis did the same following Osiraq. Both states knew that no matter what local inhabitants believed to be happening, there was little chance that they would speak of it, or even have the opportunity to get the information out. The relative success of both deception efforts may not have been entirely coincidental.

Former UNSCOM inspector Scott Ritter believes that during a period of warming relations in the 1980s, the KGB provided Iraqi intelligence groups with detailed training on strategic

camouflage, particularly with regards to Iraq's military programs and operations. The KGB shared its knowledge of Western reconnaissance capabilities, especially those of the United States. It also taught the Iraqis keys for the speedy evacuation of personnel and equipment from facilities prior to airstrikes. This was to be a significant lesson for the Iraqis. The evolution of air warfare and cruise missiles made many of the Soviet lessons obsolete – but rapid egress of people and equipment from facilities became a vital skill in the Iraqi denial and deception plan (1999, p.75).

Deception Examples

Whether Soviet-inspired or indigenously produced, Iraqi deception measures were creative, audacious, and usually well-executed. Any discussion of the unique aspects of the Iraqi case must include highlighting some of the methods employed by the Iraqis to conceal their program and then confuse UNSCOM inspectors.

Two methods in particular deserve mention for their widespread use. The first came, at least partially, from the Soviet training and was designed to mitigate U.S. and Western imagery assets. Prior to the Gulf War, Iraqi engineers perfected the techniques of constructing a building within a building to mask its features (Tuwaita), deliberately constructing buildings made for the same purposes to look different (Tarmiya and al-Sharqat), hiding power and water feeds to mislead as to facility use (Tarmiya), and diminishing the perceived value of a facility by having an apparently low level of security and a lack of defenses (Tarmiya). All of this was conducted expertly by the Iraqis, who also made a practice of moving all the materials necessary for this effort at night and by circuitous routes to evade any potential observers (Kay, 1995, p.94).

The second method was more diplomatic in nature. The Iraqi government, particularly following the Gulf War in 1991, made a habit of deliberate disclosures that still masked their total capacity. This often involved sacrificing portions of the program that were less successful for presumably more successful ones, or revealing activities that the Iraqis assumed were already known. The nuclear program was of such value that on several occasions Iraqi officials revealed information about chemical or biological weapons activity to distract inspectors who had been ready to focus on nuclear issues (Burrows and Windrem, 1994, p.53). One example of this practice within the nuclear weapons R&D program concerned the centrifuge development effort, which was mainly located at a facility called Rashdiya. The Iraqis decided in 1991 to declare a portion of the activity at Rashdiya, but not all. They constructed false walls in the facility, removed key equipment, destroyed the ventilation system, and decontaminated – all in an effort to make it appear as though a very small research effort was taking place. They also revealed a larger centrifuge facility at a location called al-Furat. This was done to deflect the attention of inspectors focused on centrifuges. Since German and British companies had worked on the

construction of al-Furat, Baghdad officials figured it was known to the inspectors and their governments anyway (Albright, 1998, p.48).

Pursuit of Nuclear Weapons

Due to the preponderance of evidence from former regime and program officials, it is clear that Iraq meets the threshold of pursuit of nuclear weapons for this study. As mentioned previously, the Iraqi government considered nuclear weapons perhaps as early as 1971 but certainly after the Islamic Revolution in Iran in 1979 (Hamza and Stein, 2000, p.116; Reiter, 2005, p.357). The Osiraq raid certainly seems to have reaffirmed the desire to acquire nuclear weapons for Saddam Hussein and the rest of the Iraqi governing elite. Jafar Dhia Jafar, who had been considered a regime opponent and had been under house arrest for several years, was released in recognition of his technical abilities and placed in charge of the Tuwaitha Nuclear Research Facility in September 1981, an action that many Iraqi scientists consider the actual start of the nuclear weapons program (Khadduri, 2003, p.83). For its part, prior to its removal in 2003, the Saddam-era government only eventually came to admit that had decided to build a nuclear weapon in 1988, with a goal of completion by the summer of 1991 (Albright, 2002). Clearly, that was understating the level of effort and concealing that work that began only months after Osiraq.

Threat Perception and Policy Goals

Saddam Hussein's government faced several challenges, both internal and external. It was a Sunni and Arab nationalist government presiding over a state where the majority of inhabitants were not Sunni. It faced the Islamic Revolution of Iran to the east, a restive Kurdish population to the north, wealthy Arabs that looked down upon the Baghdad government to the south, and the insult of Israel to the west. Arguably, Saddam's brutality exacerbated each of these challenges.

The threat from Iran was particularly vexing in Baghdad. Fears that Islamic fundamentalism would spill across the border, or that the Iranian government would stoke discontent among Iraq's Shi'a population, compelled Saddam to antagonize the Tehran government and to launch an attack on Iran that would stalemate into the eight-year Iran-Iraq War. The threat of what was happening in Iran also refocused Saddam's attention on the nuclear weapons program. Based on his statements as vice president in the 1970s, he already believed there was utility to an Arab bomb and believed Iraq should be the one to develop it. But program officials have stated that following the Iranian revolution he gave more specific direction and more resources to the Iraqi nuclear R&D effort (Hamza and Stein, 2000, p.116). It should also be noted, as discussed previously, that Tehran understood the significance of Iraqi research efforts. It conducted a strike on Osiraq only eight days into the Iran-Iraq War, though the effect, as noted previously, was only to damage secondary buildings (CIA, 1980, p.1)

The threat posed by Israel is more difficult to define. Certainly, Israel's existence and military dominance were frequent topics of Saddam's statements and speeches. But how much of this was political bluster and how much was a real fear over Israel's capabilities is difficult to ascertain. The Iraqis were well aware of Israel's capability and resolve to interfere in the nuclear weapons R&D effort, having suffered the setback with Osiraq and the assassination program against Iraqi scientists. Saddam also appeared to be aware that he did not have a reciprocal capability and was angered by the disparity. As late as July 1990, one month before the invasion of Kuwait, he stated to French journalists that "We do not have nuclear weapons, but we would see no problem in a Western nation helping us to develop nuclear arms to help compensate for those owned by Israel" (Albright and Hibbs, 1991c, p.16). Nuclear weapons hence became one measure of strategic parity with Israel. This was likely true not only for the Iraqi populace but for elements within the armed forces that were disheartened by the war with Iran but upon whom Saddam depended for support.

Nuclear Weapons Policy Goals

Saddam likely had several goals that drove his desire for nuclear weapons. He consistently showed himself to be interested in any capability that would give him supremacy over others – whether nuclear, chemical, biological, or conventional. Given his total control over Iraq's policies during this period, it is difficult to hypothesize exactly what was intended if Iraq had ever actually acquired a nuclear weapon. However, based on his willingness to use chemical weapons against Kurdish civilians and Iranian troops, it is reasonable that his interest in having a nuclear weapon may have gone farther than simply wanting to be a nuclear state.

Deterrence against Neighbors

As mentioned previously, Saddam found himself surrounded by potential adversaries as a result of history and his own policies. All would have preferred someone else in control in Baghdad. His inability to defeat the Iranians militarily and keep the restive Kurds in check resulted in his resorting to chemical weapons use in both cases. His conflicts with the Gulf Arab states and Israel resulted in the invasion of Kuwait and the conflict where even Israel was a target of Iraqi missiles.

Despite conflict with and frequent defeat by these groups, Saddam maintained his grip on power until the 2003 invasion. But with a functioning nuclear weapon, any of these regional actors would have had to tread more carefully in their dealings with the dictator. One can imagine how an Iraqi nuclear weapon achieved in 1989 would have complicated U.S. reaction to the invasion of Kuwait the following year. It is unlikely a conventional ground war with a coalition of nations would have been possible to expel the Iraqis from Kuwait. Gaining this advantage in dealing with his adversaries was almost certainly among the reasons Saddam was interested in nuclear weapons.

National Pride and International Recognition

It is clear that pride and recognition played a part in the Iraqi desire for nuclear weapons. But this manifested itself differently than in the other cases researched. In the Iraqi case, the desire was not simply Iraqi pride but pan-Arabism. Saddam himself alluded to this frequently in his public statements, particularly before becoming president. One example is the previously cited quote about Osiraq being the first step in the production of an Arab atomic weapon (Reiter, 2005, p.357). This is also reflected in the statements made concerning Israel and the lack of parity between its capabilities and those of the Arab states. It has been well-documented that Saddam dreamed of being a pan-Arab leader, his desire for nuclear weapons and parity with Israel would have served his dream.

Additionally, the Iraqi case has more of a domestic angle to it than the other cases. Though the BJP in India stood to gain public support if it tested soon after coming to power, Saddam was dealing with an army and population that at times questioned his capabilities. As the Iran-Iraq War dragged on in stalemate, taking increasingly precious resources to maintain the war effort, Saddam was forced to take steps that showed he was a competent and capable military and national leader. The successful pursuit of such a technologically advanced and powerful weapon would have enhanced his credentials in this area.

Defense of the Regime

As previously stated, it is difficult to know the actual motivations and intentions behind a state's pursuit of nuclear weapons. It is impossible to know whether they would have been used in certain situations. An advancing army on Pretoria or New Delhi may have provoked the use of Indian or South African nuclear weapons, but we cannot know for sure. Thankfully, the Iraqi case did not provide an example of this, since the weapon was never achieved. But again drawing on examples of Saddam's behavior to infer his intentions, Mahdi Obeidi's account of the sudden order to commence a crash program in 1990 is telling. Following the international condemnation of his move into Kuwait in August 1990 and the increasingly loud calls for action to correct the situation, Saddam ordered a program into action to produce a weapon using safeguarded enriched uranium (2004, pp.132-135). Perhaps Saddam hoped that such an easily detectable move would force the international community to hesitate in their reaction to the invasion, but more likely he wanted to have a weapon in case armies began rolling across his borders.

Capability to Attack Adversary's Homeland or Forces

Would Saddam have used such a weapon on offense? Again, it is impossible to know for certain. U.S. analysts were certainly concerned about this possibility regarding the Iraqi nuclear R&D effort. Saddam's history of looking for a "magic bullet" to give him victory was well-known and these weapons may have provided such an opportunity (Tyler, 1990). Chemical

weapons were certainly used in offensive situations so we must at least allow for the strong possibility that if Saddam had a nuclear weapon, a means of delivery, and an immediate benefit he might have opted for its usage. It is arguable that a desire for at least having this option was another motivation for pursuing nuclear weapons.

Weapons Development Goal

Though assessment of Iraq's nuclear weapons goals entails some hypothesizing, the weapons development goals are easier to ascertain. First, it is likely that Saddam would have been satisfied with any type of weapon. In this case, the weapons development goal was not driven by goals of any other kind. Instead, it was driven by resources. The primary problem for the Iraqi nuclear weapons program throughout the program's existence was having sufficient fissile material and that issue alone seems to have driven their choice of design.

Iraqi scientists knew that implosion weapon required less fissile material but also realized they would need to master the use of explosive charges to keep the implosion effect uniform. Sources indicate they continued to struggle with this requirement throughout the program's existence (Cirincione, 2002, p.274). Once UNSCOM was established, inspections were conducted at the Nuclear Design Center and PC-3 Headquarters in Baghdad in an attempt to understand how Iraqi officials were planning to pursue weapons development. Documents from those inspections indicated that the production of both HEU and plutonium were planned, but that the clear emphasis was on making a deliverable implosion-type weapon (Albright, 1998, p.47).

Relationship with the United States

There is unfortunately little source material regarding the interactions between U.S. and Iraqi officials regarding the latter's nuclear weapons program following the Osiraq attack. Hence, it is difficult to evaluate the Iraqi deception for effectiveness. But there are two indicators that provide insight. The first, as with other cases, is how the intelligence community evaluated the Iraqi nuclear weapons effort. This will be discussed in the next section.

The second measure of effectiveness is the legal means through which the Iraqis were able to gather information and procure equipment from U.S. sources. As stated previously, the U.S. government approved the sale of over \$1.5 billion USD of computers, electronic equipment, and machine tools to the Iraqis that had uses within a nuclear weapons program (Albright and Hibbs, 1991c, p.19). Though U.S. intelligence agencies were assessing Iraqi intentions and actions regarding nuclear weapons development and law enforcement agencies were detecting illicit procurement activities, U.S. officials were nonetheless comfortable enough to approve these

sales – indicating that at the very least the Iraqi deception was providing U.S. officials with enough “cover” to approve lucrative business transactions.

How the United States Assessed the Program

The U.S. intelligence community’s knowledge of the Iraqi nuclear weapons R&D program would prove to have ramifications beyond those in the other cases. The insight provided by the intelligence community would impact not only diplomatic interactions and possibly sanctions, but the military action initiated in January 1991.

Understanding of Means

Those more familiar with the debate over Iraqi WMD during the lead up to the 2003 invasion may be surprised to learn how little attention the topic received in the 1980s. Several researchers note how few resources seem to have been devoted to a state known to be a proliferation threat. William Burrows and Robert Windrem point out that in June 1990 the Defense Intelligence Agency (DIA) had only two analysts assigned to look at Iraq issues. By comparison, it had 42 analysts working POW/MIA issues from the Vietnam War (1994, p.26). This may be unfair, since other agencies may have had significantly more resources devoted to Iraq and DIA’s main customer would have an interest in other issues. But the point remains that despite the Israeli strike on Osiraq, or possibly because of it, the intelligence community does not appear to have considered the Iraqi nuclear proliferation threat to be particularly ominous in the 1980s.

During Congressional testimony in April 1991, the head of DIA’s Nuclear Energy Division highlighted U.S. knowledge of only two Iraqi nuclear sites – Tuwaitha and the al-Qaim superphosphate mine where uranium ore was mined and processed into yellowcake. Additionally, he acknowledged that even some safeguarded fuel was unaccounted for, but asserted that there were no facilities unaccounted for that could be used to recover HEU from the fuel (DIA, 1991, p.2). But this assertion is not confidence-inspiring, given that there was far more to the Iraqi infrastructure than just the two sites mentioned. Some discussion that appears to allude to other sites has been redacted from the released version of the talking points, but it does not appear to be a sufficient amount to indicate many other sites were discussed.

This testimony indicates the generally low level of comprehension of the Iraqi nuclear weapons effort by the intelligence community. Though not widely known at the time of the testimony, Coalition estimates of battle damage from air strikes on the nuclear program were significantly inaccurate based on these assessments. Coalition air planners identified only two sites of interest out of the 20 later identified by UNSCOM, possibly Tuwaitha and al-Qaim. As a result, the damage to the nuclear weapons R&D effort was not nearly as great as assessed by the U.S. Department of Defense following the bombing (see Ellis and Kiefer, 2004, p.170).

In one example, the Tarmiya facility was identified as a secondary target of interest and not given priority. It was hit with munitions from a U.S. aircraft that had been shifted from another mission that was canceled. Only the largest building was hit with a handful of rockets, but U.S. reconnaissance noted an enormous Iraqi response. Hundreds of people began removing equipment from the buildings as soon as the fires were out. Tarmiya was then moved up the list and hit in a subsequent air strike (Davis and Kay, 1992, p.24; Kay, 2016).

Understanding of Motives

If the details of the Iraqi infrastructure and facilities were not well understood by the U.S. intelligence community, the motivations of the Baghdad regime generally were. Whether adequately resourced or not, U.S. analysts appear to have been aware of Iraq's (specifically Saddam's) desire to be a leader in the Arab world and must have also been aware of the repeated statements referencing Israeli nuclear capability made by Iraqi officials. This was reflected in an early CIA report that stated "Iraq's nuclear ambitions are an outgrowth of its determination to establish and secure itself as a major force in the Arab world" (CIA, 1979, p.5).

That same 1979 CIA report also spoke to an important point of knowledge about Iraqi intentions and means. It argued that the nuclear research being undertaken by Iraq was of limited civilian value. Specifically, it pointed out that there were no apparent economic benefits to the Iraqi effort and that priority had been given to efforts that would yield no immediate benefit upon completion (CIA, 1979, p.6). We know that in 1979 this discomfort with Iraqi plans for its nuclear program was felt in many capitals. The international community, and the U.S. intelligence community, seemed to be generally aware that Iraq was moving down the path of nuclear weapons but did not feel an urgency to find out exactly what actions were being taken.

Several years later, another CIA report would conclude that Iraq still wanted a weapon but following the destruction of Osirac would be forced to obtain it in secret. It stated "[Iraq] now appears resolved to get on with its nuclear program, but with more attention to covertness and physical security" (CIA, 1983, p.7). This analysis was certainly accurate, since at the same time the Iraqis were working hard to establish secret facilities, send specialists overseas for training with cover stories, and issue senior scientists false passports so they could travel without arousing suspicion.

In sum, this case is similar to others studied in that the U.S. intelligence community had a general grasp of the presence of a program and the motivation for carrying it out, but not the in-depth knowledge that might have convinced a policymaker to follow a preventative course of action. In this particular case, the lack of understanding would also result in an air campaign that would be largely ineffective and removing Iraqi nuclear capability.

Framework

The results of an extensive review of secondary sources are categorized according to the framework presented in Chapter 2. This section will contain a brief description of the data found in each of the four categories of deception effort. Though many of these data points have been described previously in this chapter, they are repeated here so that the reader can see how each of the actions fits into the larger deception effort. The relevant data is presented in Tables 5-1 through 5-6 at the end of the chapter. No data was identified from the “Test and Evaluation” line of effort.

Reveal Fact

Iraqi officials sought to reveal as little of their actual efforts as possible. It was likely believed, based on the experience with Osiraq, that any release of information would be followed by economic or military preventative action. However, there were several types of true signatures that were observable. The first, previously discussed, was a series of statements made by senior Iraqi officials, most prominently Saddam Hussein, that the Arab world needed to have a weapon to counter Israel (CIA, 1981b, p.3). These statements were most prominent early in the program and appear less frequent after the Israeli attack.

The second category of true signatures was only enhanced after the Osiraq raid. As part of its NPT obligations, Iraq’s Tuwaitha facility was inspected by the IAEA twice yearly. Though Iraqi scientists were certainly engaged in clandestine research efforts, the inspectors were shown some of the actual state of Iraqi nuclear technology when inspecting the facility. Following the destruction of Osiraq, they were shown that the reactor could not be salvaged – thus removing the concerns of many about fissile material acquisition. Such relief may have been premature, but nonetheless inspectors were getting factual, if incomplete, information during the inspections (Thorne, 1992, p.16).

Finally, true signatures were observable in the actions of prominent Iraqi scientists during this time period. In the 1970s, Iraq was almost entirely dependent on foreign education and training to produce top-quality researchers in the relevant disciplines. As the program went “underground” following Osiraq, this largely changed. An almost completely indigenous education path was set up for many disciplines, to include undergraduate and graduate training as well as credible doctorate-level training in many fields. While the program did clandestinely send specialists for training courses under the cover of other efforts such as petroleum engineering, the main components of an individual’s training were shifted from overseas to Baghdad. The Iraqi explanation for this change in policy was that they believed Israel would attempt to kill or injure any Iraqi scientist they believed might have a part in nuclear research, hence Baghdad wanted to keep its people safe at home (Kay, 2016). This shift from sending

personnel overseas for education to keeping them in Iraq was a signature that could not be hidden. However, Kay points out that little effort was devoted to tracking these individuals, their theses, and the work that was coming out of Iraqi institutions (1995, p.95).

Conceal Fact

The examples of Iraq concealing fact through denial and signature management are far more numerous and span the lifetime of the program and the period of UNSCOM inspections. One of the earliest examples of concealment following Osiraq involved export control violations. In March 1982 Iraq imported over 139,000 kilograms of yellowcake from Niger without declaring it. Around the same time it imported over 27,000 kilograms of uranium dioxide from Brazil, also without a declaration. At the time, neither Brazil nor Niger were NPT parties, but Iraq was a party to the treaty and was obligated to report such transactions (Blix, 1997, p.26). In another instance, a shipment of export controlled maraging steel was sent to Dubai legally, but then separated into three shipments and moved secretly across the Saudi desert without proper documentation and without the Iraqi government declaring its receipt (Obeidi and Pitzer, 2004, p.105).

Infrastructure accounts for the largest number of denial activities found in the Iraq case. At two facilities, Tuwaitha and Rashdiya, the very layout of the facility was a concealment measure. In both facilities, walls were constructed to give the impression that certain buildings were not part of the facility, roads were winding and disorienting, and trees were planted to obscure certain buildings. IAEA inspectors to Tuwaitha before the war and UNSCOM inspectors at both locations after the war would be confounded by the layout of the area (Kay, 1995, p.94; Albright, 1998, p.48). The buildings themselves were also utilized in concealing information. At several facilities, buildings with redundant purposes were shaped differently. Additionally, some buildings were constructed with dual uses. One building contained the most significant equipment of the EMIS enrichment effort and produced window frames for civilian use (Burrows and Windrem, 1994, p.43). At the al-Atheer facility, the Iraqis installed not one but two false floors prior to UNSCOM inspections. Their thinking was that inspectors might suspect one false floor and break through, but not two. Their reasoning worked. UNSCOM inspectors broke through to the second floor, but finding no contamination moved on (Albright, 1998, p.48). Finally, immediately after the 1991 bombing the Iraqis declared several buildings at several sites too dangerous and immediately demolished them before the arrival of inspectors. When inspectors did arrive, they found that rubble and debris from other structures had been mixed in to conceal the configuration and use of the original building (Albright, 1998, p.46).

Reveal Fiction

Prior to the 1991 Gulf War, Iraqi officials attempted to convince various Western governments and corporations of fictions designed to protect the nuclear R&D effort. As discussed previously, officials often presented themselves as being affiliated with the Ministry of Industry or the Ministry of Oil when asking about processes or inquiring about procurement that would be related to these ministries. In one case, U.S. businessmen were suspicious of credentials from the Ministry of Industry, so the Iraqis brought them to Baghdad and met with them in the Ministry's conference room – which had been made available for the occasion (Khadduri, 2003, p.107). Iraqi scientists were also deceptive about their specific needs when they thought it would allay suspicions. At one point, Iraqi scientists told German businessmen that they wanted to acquire specific equipment for the purification of tungsten, which was chosen because it purifies at roughly the same temperature as uranium. The Iraqis noted that the Germans were visibly amused by this suggestion, but went ahead with the deal anyway (Hamza and Stein, 2000, p.209).

Much of the Iraqi effort to reveal fictitious signatures to inspectors and the U.S. government came from the Baghdad government's various declarations. The Iraqi government claimed that the Rashdiya facility buildings had been turned over to a private company manufacturing agricultural equipment, though inspectors found Rashdiya to be a key facility for the centrifuge program. Additionally, the Iraqis claimed that no formal decision had been made to pursue nuclear weapons, which was found to be false in documents uncovered by inspectors, and that Hussein Kamal had singlehandedly pursued the project without the knowledge of the Baghdad government, which was hardly credible. When caught smuggling EMIS equipment out the back gate of a military base, the government conceded an EMIS program existed, but denied that uranium enrichment was its goal (Albright, 1998, p.47). Albright notes one final and interesting Iraqi government declaration. When pressed on the role of their German connections in centrifuge development, the Iraqis claimed that they met an expert in Munich who showed them some drawings and that Iraqi agents later broke into his house and stole them. It was later discovered that the expert had, in fact, been brought to Baghdad and had willingly provided the information for a fee (Albright, 1998, p.49).

Conceal Fiction

Iraqi efforts to construct, coordinate, and execute a deception plan for the nuclear weapons R&D program were complex. As early as 1985, and likely with Soviet assistance, the general and military intelligence agencies had formed a standing committee to coordinate strategic concealment and deception efforts (Ritter, 1999, p.76). The Soviet Union would later distance itself from Saddam's government and the KGB liaison would cease, but before it did Hussein

Kamal's Special Security Organization (SSO) became involved in the committee meetings. Following the departure of the Soviets, the SSO took the lead in the concealment of Iraq's military industry in general, including the nuclear weapons R&D program, as the "Weapons Control and Maintenance Committee" (Ritter, 1999, p.77).

Kamal and the SSO imposed strict compartmentalization on the nuclear R&D program. To conduct research on centrifuge technology the "Engineering Design Directorate" was created and housed at a Ministry of Agriculture research site at Rashdiya. This was the site previously referenced that had walls constructed to make some of the facility appear to be in a different compound. Kamal made clear to participants in this program that the IAEC was not to be informed about these enrichment efforts. Hence, many participants in the Iraqi nuclear program were unaware of other major lines of effort (Obeidi and Pitzer, 2004, p.63). Besides compartmentalization, additional and extraordinary security measures were imposed. All information pertaining to the program was kept on special paper, not used in any other known part of the Iraqi bureaucracy, that would indicate if it had been photocopied. Aliases were also assigned for the research of scientific and technical information. Scientists would request materials using a cover name, with the first name being the department from which the request came and the last name being the actual first name of the researcher who requested it. This practice was instituted to make it difficult for any staff member to determine who was conducting certain research, and so that if the research lists were ever leaked, foreign intelligence agencies would not be able to identify specific program participants (Khadduri, 2003, p.108).

Following the 1991 war and the imposition of inspections on the Iraqi government, coordination of the continuing deception became paramount. The Oversight Committee was an organization formed by Saddam and headed by trusted advisor Tariq Aziz. Its task was to act as a liaison between the international inspectors and the Iraqi establishment. Similar to the German liaison organization with the Inter-Allied Control Committee, the tolerance of UN officials for this organization was an enormous benefit to the Iraqis. It "ran interference" for Iraqi scientists, keeping them from direct contact with UNSCOM to the greatest extent possible (Obeidi and Pitzer, 2004, p.144). Less public was the Concealment Operations Committee, headed by Saddam's son Qusay. This organization was designed to hide documents, computer programs, and equipment related to Iraq's WMD, including nuclear, efforts (see al-Marashi, 2003, p.52). UNSCOM was aware of these organizations and focused on uncovering their attempts at denial and deception.

Timeline

Figure 5-1 is a simplified timeline showing key events in the course of the Iraqi nuclear weapons program. Above the timeline are events within the program, while below are key interactions between the United States and Iraq during this time. The timeline is not comprehensive, but

meant to show how the program progressed and when U.S. and Iraqi officials dealt with key issues.

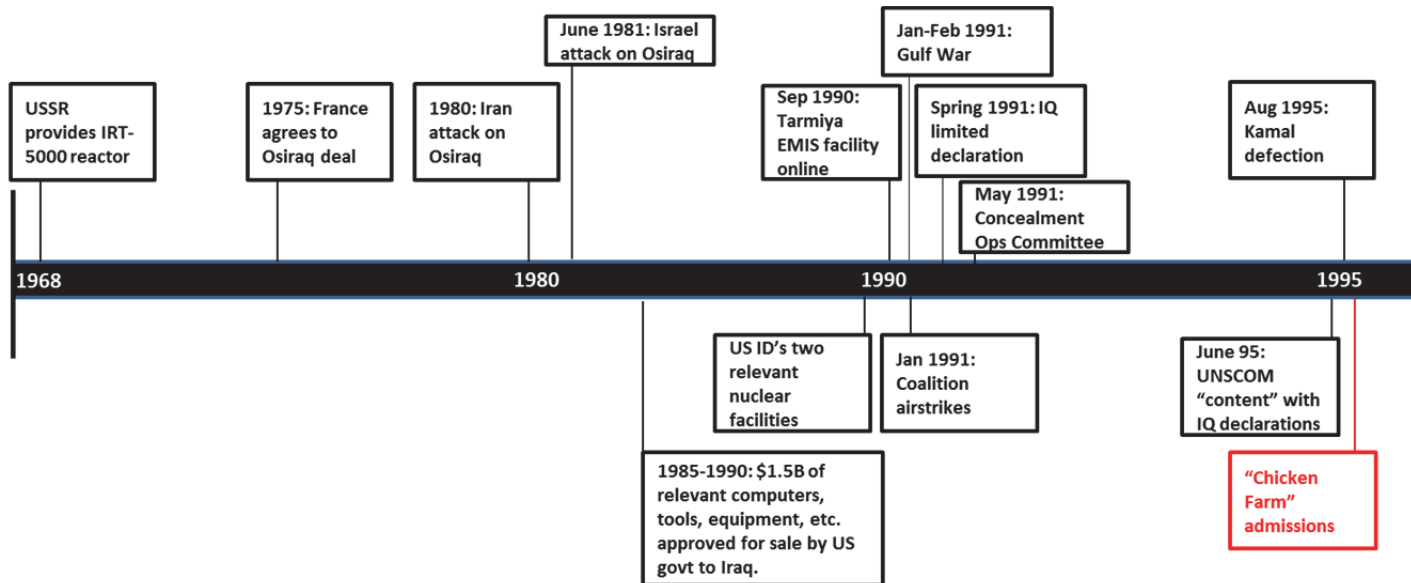


Figure 5-1 Iraq Timeline

There is no evidence of extensive interactions between U.S. and Iraqi officials concerning the latter's nuclear program prior to the Gulf War. Even as the Osiraq sale was completed between France and Iraq, there are few examples of strong U.S. statements either for or against it. Israeli officials were informed in 1980 that, while the United States was a superpower and committed to nonproliferation, it was not all-powerful and nuclear efforts were very difficult to counter (Ford, 2004, pp.20-22). This ambivalent message likely contributed to Israel's decision to undertake a preventative strike.

That message certainly indicates that U.S. attention was elsewhere. This may explain the approval of business transactions that supported the Iraqi nuclear program in the mid-1980s as well as the intelligence community's inability to correctly identify key Iraqi sites and efforts. Unlike in other cases, this inability would not put U.S. officials at a disadvantage during diplomatic interactions, but instead would result in incomplete target lists for Coalition pilots during the Gulf War and confusion as to how much of the Iraqi nuclear program had been destroyed following the air campaign. Years of on-the-ground inspections would be required just to partially clarify this confusion.

Deception Strategy and Objectives

The Iraqi deception strategy was total concealment of the entire program. The Israeli strike on Osiraq showed the consequences of permitting even a suspicion of nuclear weapons activity.

Iraq's approach of protesting the Israeli action against a safeguarded facility and arguing that they continued to adhere to the NPT meant that no margin for error was possible. Such an approach was incompatible with any sort of opacity or implied threat. Thus, total concealment was the only option if the Iraqis wanted to continue their pursuit of nuclear weapons. Similarly, the only logical objective for the Iraqis with regards to the United States was for Washington to do nothing at all.

Without the Gulf War, a successful Iraqi program may have looked similar to that of India. Its choice of an implosion design would have likely required testing to ensure reliability. Aware that any overt sign of nuclear weapons effort may result in preventative action, but also aware that possession of a nuclear weapon may take military action off the table for its adversaries, the Iraqis may have sought to keep the program completely undetected until able to conduct a test. Several former Iraqi officials claimed that the plan had been to acquire several weapons and then conduct a test to announce Iraq's nuclear status. Had Iraqi scientists been able to solve some of their challenges and develop a weapon faster, the strategic calculus in the Middle East might have been dramatically different.

Figure 5-2 depicts the goals and methods employed by the Iraqis to protect their nuclear weapons program.

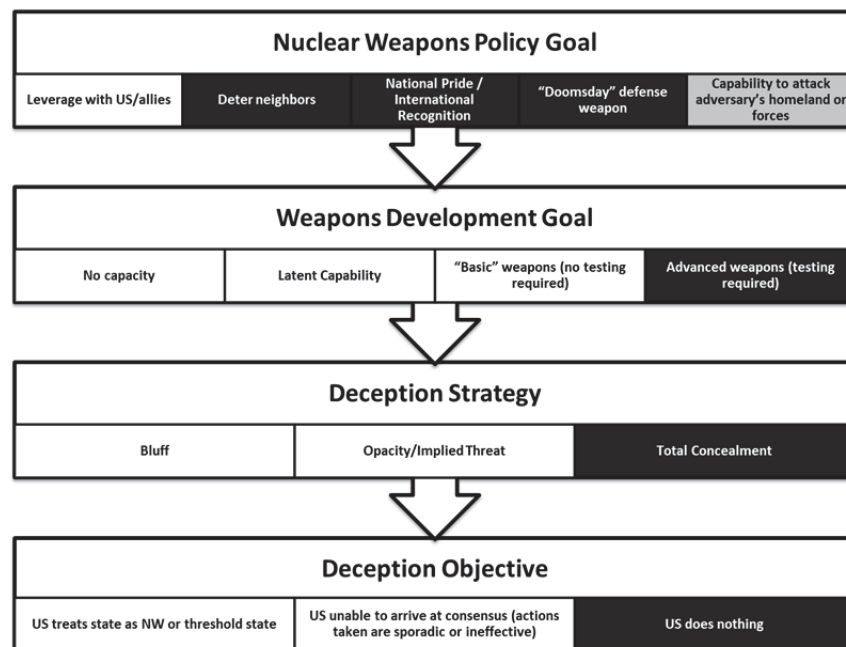


Figure 5-2 Iraq Goals, Strategy, and Objective

Hypotheses

The Iraqi case yields several insights into the research hypotheses.

H1: The coordination of deception will result in observable signatures.

UNSCOM inspectors expended significant effort to identify the “concealment mechanism” of the Iraqi program after they arrived in 1991. The Concealment Operations Committee managed Iraqi scientists and technicians who had become proficient at moving materials quickly, deconstructing and reconstructing facilities, and providing alternate explanations for their activities. The discovery of the Concealment Operations Room in Baghdad and interviews with Iraqis “caught in the act” provided information about the coordination that was enabling Iraqi deception during the UNSCOM period.

Such analysis would have been extremely challenging prior to the war due to the closed nature of Iraqi society. But signs of coordination did exist. The involvement of the Nassr Establishment in illicit procurement was one such sign. Also, the repeated visits of Iraqi officials to U.S. companies and academic institutions with the changing of identities as they traveled indicated a coordinated program and would have been seen without sources within Iraq. If sources could have been cultivated within Iraq, additional coordination such as the aliases established for research requests and the support of other organizations, such as the Ministries of Industry and Oil, to cover the procurement efforts of the R&D effort may have been seen. Though certainly challenging for an intelligence agency to detect, there were observable signatures resulting from the coordination of deception that could have provided clues to Iraqi intentions and activity.

H2: Multiple channels increase the complexity of the deception and the likelihood that the United States will have an understanding of the R&D program.

The primary channel of information on the Iraqi nuclear weapons program prior to the Gulf War appears to have been the inspections conducted per Iraq’s NPT obligations. If there were human or other sources providing information to the intelligence community during this period, those records have not been declassified and released. Kay recalls that to his knowledge, the U.S. government had no human source in a position to reveal insight into activities of the Baghdad regime in general or the nuclear R&D program specifically (2016). Nor could IAEA inspectors provide such insight. Though inspections were taking place throughout the course of the program, the Iraqis found them easy to manipulate prior to the Gulf War. Without free access throughout the country, the Iraqis were able to manipulate the information seen within the inspections. The tactics used to do this included claiming certain areas off-limits due to bomb damage, filling the inspectors’ agendas with superfluous events like elaborate meals or

sightseeing excursions, and delaying their movements around Baghdad so that they would have less time to ask questions.

This changed with the formation of UNSCOM. Now on the ground permanently, ostensibly able to move without government escort, and receiving information from various countries' human, imagery, and signals intelligence, the post-war inspection regime had many more channels through which to receive information. Though the Iraqi deception effort remained robust and was partially effective, UNSCOM was able to wear down the Iraqis and discover key points of data that had eluded pre-war inspectors. The Iraqi deception was not able to withstand Kamal's 1995 defection, partially because too much information had already been obtained by UNSCOM. Hence, an increase in channels resulted in more deception but also provided greater understanding of the nuclear weapons program and took away the deceiver's ability to withstand "wild card" events.

H3: Successful long-term deception will benefit the deceiver by providing an advantage during discrete interactions with the United States over the course of the program, even if the program is not entirely concealed.

In this case, through the actual progress of the program was concealed the intent and possibility of R&D were not. Pre-war U.S. intelligence assessments correctly understood Saddam's desire to be a leader in the Arab world and his belief that a nuclear counterweight to Israel was necessary. But the Iraqi concealment of the nuclear weapons R&D effort was sufficient to reduce the prominence of this issue on the U.S. agenda. U.S. officials appear to have been more concerned with the confrontation with Iran and with efforts to counter Soviet influence in the region. Saddam's war and his initial willingness to side with the United States pushed any doubts that may have been had about proliferation to the back burner. The approval of billions of dollars of dual-use component sales by the U.S. government was made possible only because Iraqi efforts to disguise their continuing nuclear weapons program were successful.

Conclusion

The Iraqi nuclear weapons deception effort had a high bar for success. It had to keep the R&D program hidden from the West, and Israel in particular, while maintaining good relations and keeping aid flowing from the United States for the war with Iran. Despite the near impossibility of this task, the deception itself can be considered successful for three reasons. First, following the destructive Osiraq raid the Iraqis were able to keep their program running and even made considerable progress in some of their efforts. Second, as a whole the program survived the Coalition bombing campaign in January 1991 well. Some damage was received but had on-the-ground inspections not been part of the cease fire agreement the program likely could have reconstituted and continued its progress. Third, the international community was surprised by

the depth and progress of the Iraqi program following the war. Though assessments of how close the Iraqis were to weapon production vary widely, it is conceivable that they could have reached the testing phase without certainty on the part of U.S. officials. Armed with a functioning nuclear weapon, Saddam's regime would have been far more difficult to contain.

Of all the cases, Iraq represents perhaps the most intuitive set of factors. Much of the Iraqi effort was based on denial of information and closing off facilities and personnel from the outside world. The only possible successful outcome was total concealment. And, though U.S. intelligence analysts were aware of Iraqi interest in and experimentation with nuclear weapons concepts, they appear to have been deceived more completely prior to the Gulf War than they were in other cases. Though Iraqi nuclear weapons R&D is now more associated with the 2003 invasion and though it was not ultimately as successful in developing a weapon as the Indian and South African cases, it is important for intelligence analysts and students of intelligence to understand that it was Saddam's ill-advised invasion of Kuwait and its aftermath that stopped the Iraqi nuclear weapons program, not U.S. actions.

	Fact	Fiction
Reveal	* Repeated Iraqi statements on the need for an Arab weapon to counter Israeli nuclear capability. * "Known" information obtained from Iraq's IAEA declarations and semi-annual inspections of Tuwaitha prior to war. * Annual declarations to IAEA on safeguarded facilities and materials.	* Declared EMIS program, but stated that HEU production was not its purpose. * Declared that nuclear research was only a feasibility study and that no decision on weapons development had been made. * Claim that buildings outside the brick walls had been turned over to an agricultural machinery firm (Rashdiya). * Claim that Iraqis visited a German centrifuge expert in Munich and went to his home to look at drawings, later broke in and stole them (untrue, German had traveled to Iraq). * Claim that Kamel independently continued the nuclear program. * Claim that program ended and was formally abandoned in April 1991. * US corporate representatives met in conference room of Ministry of Oil to support fiction the ministry was the true client.
Conceal	* Information volunteered about other weapons and missile programs to steer conversation away from nuclear program. * IAEA inspector itineraries controlled tightly to ensure little free time. Inspections rushed, dinners and cultural tours scheduled daily. * Iraqis released "calculated concessions" where non-essential or outdated components would be sacrificed to convince inspectors of cooperation. * Iraq did not declare 426 drums of yellowcake from Niger in March 1982, nor did they declare 27kg of UO2 from Brazil in 1981 and 1982.	* "Governmental committee" established "to reduce the effect of NPT violation to the minimum." * Following 1991 war, "Oversight Committee" was established to be a liaison with UN inspectors, and to keep Iraqi scientists from the inspectors as much as possible. * Concealment Operations Room operated by Special Security Organization in its Baghdad headquarters to coordinate the avoidance of UN inspections.

Table 5-1 Diplomatic Aspects of Iraqi Nuclear R&D Deception

	Fact	Fiction
Reveal	* Training and education moved from foreign-based in the 1970s to almost entirely indigenous in the 1980s.	* Supplied "Dr. Muhammad," the head of the centrifuge program, with a cover story about working for MIMI. * Iraqi scientists claimed to be from University of Baghdad during a 1988 visit to UVA to discuss rotor dynamics. * Scientists claimed to be from the Ministry of Oil during visits to a US contractor that worked on rotational cadence programs. * Iraqi scientists placed at various international centers to gain expertise in relevant disciplines for centrifuge work. Always claimed to be students from the Ministry of Oil.
Conceal	* Iraqi students sent to multiple countries to study multiple disciplines so that close coordination would have been required to see themes that were being studied. * Foreign contractors used to construct most facilities, but al-Sharqat was constructed only by Iraqis. * Scientists issued new passports each time they traveled abroad so foreign intelligence agencies could not easily track their movements and identify them as program participants.	* Internal security prevented any member of NW program from unauthorized contact with foreigners. * Aliases established for internal research requests for compartmentalization. First name would be the code for the relevant department, second name would be the first name of the researcher. * Placement of scientists in "unreal career paths" to keep team integrity when inspections became too intrusive (post-1991).

Table 5-2 Human Capital Aspects of Iraqi Nuclear R&D Deception

	Fact	Fiction
Reveal		* Nuclear program referred to only at Petrochemical-3 or PC-3. * Buildings with redundant purposes shaped differently. * Plants constructed with dual purposes (one contained baghdatrions but also produced window frames). * Replicas of key sites were built many kilometers from original site. * Facility value diminished by apparent low security or lack of defenses (Tarmiya). * al-Jazeera UO2 facility referred to only as "the wax plant" by Iraqis.
Conceal	* Key documents stored in railway car with door welded shut, car moved continuously. * Certain buildings in Tuwaitha quickly scheduled for demolition due to bombing damage. * Rubble from other buildings added to some wreckage sites to confuse as to purpose of the buildings. * At al-Atheer, Iraqis installed two false floors prior to inspections, correctly guessing inspectors would only remove one. * Rashdiya complex divided by brick walls, giving the impression some buildings were located in a separate compound. * Following samples being collected, buildings were disassembled, topsoil removed, and buildings reconstructed within two weeks. * Multiple project codes used for each task with the intent of confusing any intelligence service that came into possession of the documents. * Tuwaitha facility disguised by circuitous internal road network and trees blocking many buildings to give inspectors the impression they had seen more of the facility than they had. * Power and water feeds hidden to mislead as to building use (Tarmiya). * Critical equipment moved only at night.	* Irregular documentation procedure established to control documents. Special paper used to prevent photocopying. * Establishment of the "Directorate of Studies" in 1982 to pursue weapons-grade materials without alerting international monitors. * Special Security Organization established under Hussein Kamal to pursue gaseous diffusion and centrifuge options - separate from IAEC. * Istachbarat (military intelligence) and Mukhabarat formed a standing committee to coordinate strategic concealment and deception efforts as early as 1985. Later ran by the SSO.

Table 5-3 Infrastructure Aspects of Iraqi Nuclear R&D Deception

	Fact	Fiction
Reveal		* Iraqis substituted tungsten for uranium in explanations for buying purification equipment, since tungsten is purified at roughly the same temperature (though Germans did not buy the story).
Conceal	* Unilateral destruction of weapons and material prior to declaration following the Gulf War. Metal melted down into ingots for other uses, so inspectors could not match material to the destroyed weapons.	

Table 5-4 Special Material Aspects of Iraqi Nuclear R&D Deception

	Fact	Fiction
Reveal		* Purchase of rotational cadence simulation program handled through the Ministry of Oil.
Conceal	* Required foreign components purchased covertly - often using cash. * Maraging steel covertly bought and shipped to Dubai. Moved through the Saudi desert into Iraq in three shipments. * Export controlled items acquired in small quantities. Believed that if detected, the appearance would be of an early-stage program not progressing quickly. * Shipping crates had shipper and destination blacked out or labels removed once in Iraq, in case they were seen by inspectors.	

Table 5-5 Other Material Aspects of Iraqi Nuclear R&D Deception

	Fact	Fiction
Reveal		* Iraqi investors "saved" businesses that were having financial difficulty, particularly in Europe. Then they used their production capability or as a front for acquiring other material.
Conceal		

Table 5-6 Finance and Budgeting Aspects of Iraqi Nuclear R&D Deception

6. The Republic of South Africa (1970-1993)

“If these things continue and don’t stop the time will arrive when South Africa will have no option, small as it is, but to say to the world: So far and no further, do your damndest if you wish.” – Prime Minister B. J. Vorster (1977)

The case of South African nuclear weapons development is distinctive in that it is the only known case of a state possessing nuclear weapons and voluntarily dismantling those weapons and its program. South Africa’s nuclear weapons program was marked by ingenuity in development of enrichment processes, pragmatic weapons design and construction, and opaque statements concerning capability - the latter continuing even years after the program was stopped. Beginning in the 1970s, communist-aligned governments filled the vacuum left by withdrawing colonial powers in southern Africa and the world increasingly ostracized Pretoria due to its apartheid policies. The South African nuclear establishment sought to produce weapons that would give the regime an invaluable “ace in the hole,” made possible by an indigenously developed means of uranium enrichment. As South African scientists perfected this technique and methodically began to design gun-type nuclear weapons, the South African government exercised meticulous denial measures to keep the effort secret.

This case covers the period from 1970, when South Africa made its uranium enrichment project public, until 1993 when the Pretoria government announced that the program and weapons had been dismantled. For the first seven years, it appears efforts to protect the program were based on denial of information. But in 1977, Soviet intelligence services detected what appeared to be preparations for a nuclear test at a remote facility in the Kalahari Desert. The test was abandoned after diplomatic pressure from the United States, and despite South Africa’s protestations that no nuclear weapons program existed, the UN Security Council imposed a comprehensive arms embargo soon thereafter. From this point on, the South African program employed extensive deception to protect their intentions for nuclear weapons development and deployment. Declassified documents show that the U.S. intelligence community was generally aware that the South Africans had valid weapon designs and U.S. analysts had good estimates of the amount of fissile material South Africa was producing. But it would be a mistake to judge the South African deception a failure based on these estimates. South Africa’s deception did not completely conceal the weapons program from the United States, but it kept U.S. officials in the dark as to South Africa’s nuclear doctrine and intentions.

Historical Background

Despite significant research interest in the South African nuclear weapons program, scholarship of the program is difficult due to a lack of available resources. The Pretoria government took several years to dismantle its program and weapons once a final decision was made, and took several more years before publicly admitting that the program had existed at all. In that time, program managers meticulously destroyed the blueprints and records that would provide the greatest insight into how the program developed and functioned (van Wyk, 2010b, p.562). However, numerous former participants in the program have been willing to speak about the effort, its goals, and its successes. One effect of the termination of the program is that many of those who were most involved with it are now at universities or in the private sector, remain available for comment, and are willing to discuss their role in depth. These commentaries, together with records of interactions between South African, U.S., and IAEA officials, give us some insight into a program that many believe to be among the most successful indigenous nuclear weapons programs. A brief overview is provided here to facilitate analysis of the deception later in this chapter.

South Africa's involvement with nuclear weapons predates their use. As early as 1944, British officials, including Winston Churchill himself, made inquiries regarding the size and accessibility of South Africa's uranium deposits. As the military need for uranium was revealed to the world in August 1945, and the potential for nuclear power became clear soon after, South African officials became aware of the benefits of this particular natural resource. In these early days, the United States was heavily engaged with Pretoria on this issue, and the 1950s saw many South African scientists studying in the United States under the "Atoms for Peace" program (Masiza, 1993, p.35). The South Africans appear to have had three main interests in this period. The first was in exploitation of their natural reserves of uranium, both for their own use and for export to countries that would be pursuing nuclear technology. Second, they were interested in nuclear power for domestic energy needs. Finally, they were interested in PNE, which both U.S. and Soviet officials advocated to support mining and other industrial activities (Reed and Stillman, 2009, p.172).

When it came to nuclear weapons, however, Pretoria's public stance was firm. South Africa supported nonproliferation norms as they were increasingly discussed in the early 1960s and was a founding member of the IAEA. However, in 1964 Prime Minister Hendrik Verwoerd chose not to participate in NPT negotiations. Several scholars argue that the decision to not participate in NPT negotiations, and ultimately not to be a signatory in 1968, is indicative of an early recognition that nuclear weapons might be an option for South Africa. Two prominent South African nuclear researchers, Jo-Ansie and Anna-Mart van Wyk, cite internal documents from the Verwoerd administration that indicate keeping this option open, long before any formal weapons

development was taking place, was one reason for not participating in the NPT process (2015, p.34). Others are more convinced that it was not simply an option. Peter Liberman points out that the South African government could not have been blind to the fact that a successful PNE program was a *de facto* nuclear weapons capability and argues that the South African government's "abstention from the NPT, its approval of the [PNE] program despite the diplomatic and economic drawback of PNEs, and its decision to maintain tight secrecy on the program might all seem to suggest that nuclear weapons were always the intended goal" (2001, p.50). Despite its refusal to sign the NPT, however, South Africa pledged to support the spirit of the document and to keep the IAEA informed of its nuclear activities (vanWyk and vanWyk, 2015, p.38).

Besides keeping the nuclear weapons option open, there is another explanation for South Africa's NPT refusal and it helps explain its stated policy of compliance without recognizing the treaty. Seeking to exploit their significant reserves of natural uranium for export and domestic use, South African scientists developed an aerodynamic separation process to enrich uranium that they claimed to be unlike any other. If effective, this process would permit South Africa to sell low enriched uranium on the world market, particularly in Europe where demand was high. Though the United States and South Africa at this point still had an open dialogue on nuclear issues, Washington was surprised by the announcement of the new enrichment technique and that the South Africans were building a facility outside Pretoria at a place called Velindaba to conduct the enrichment (vanWyk, 2007, p.200). This facility, known as the Y-Plant, conducted its first operations in 1974. This indigenous enrichment process would become the cornerstone of the South African nuclear weapons program. It is debatable whether the process and the Y-Plant were resourced with the goal of producing a weapon. But by several accounts the process developers, with or without direction, were soon attempting to enrich uranium to higher and weapons-grade levels (Kelley, 1996, pp.29-31).

As this development was continuing, South Africa's security situation was beginning to resemble its officials' worst fears. Many South Africans believed that they had been singled out for international condemnation since the country's founding due to apartheid and Pretoria's administration of South West Africa, now Namibia (van der Walt, Steyn, and van Loggerenberg, 2003, pp.2-3). Portugal's withdrawal from colonial rule in Angola and Mozambique in 1975 put the government of Prime Minister John Vorster in a precarious position. Not only did he continue to face international condemnation over apartheid, but these newly independent African states were sympathetic to the left-leaning African National Congress (ANC) (Reed and Stillman, 2009, p.171). Vorster was thus in a position of having to deter and combat a communist-backed insurgency with which many of his own citizens might sympathize while not being able to rely on help from the West, particularly the United States, due to apartheid. Meanwhile, uranium enrichment and progress toward a weapon design continued in secret.

In August 1977, Soviet intelligence sources detected what appeared to be preparations for a nuclear test in a remote location in the Kalahari Desert. The Soviets shared the information with the United States, which agreed with the Soviet assessment. The United States may have already been aware of the activity. At least one South African who was on site at the time claimed an unmarked light aircraft had overflown the site and then been tracked flying over the border and landing in Botswana. The aircraft had then been identified as belonging to a U.S. official stationed at the embassy in Pretoria (Stumpf, 2016). It is unclear whether U.S. officials were planning to confront the South African government over this discovery or whether their hand was forced by corroborating Soviet evidence, but regardless the diplomatic consequences for Pretoria were immediate. The United States demanded a suspension of the activity, and the South Africans complied while denying that a nuclear test was being planned – or even that they had a nuclear weapons program. On November 4, the UN Security Council unanimously passed Resolution 418, a mandatory and near-total arms embargo against South Africa.

Though the Kalahari test site was certainly remote, the lack of any concealment led some to be suspicious as to whether the South Africans were making a “dummy” site for some reason. One assessment from Lawrence Livermore National Laboratory cited the bold airfield markings, clear perimeter patrol roads, and overzealous security precautions and stated, “No attempt has been made to minimize or conceal this site’s presence. Therefore we must conclude that, whether the site is real or dummy, there was no political concern about the site’s being discovered” (1977, p.45). Dr. Waldo Stumpf is a former AEC official who would later be Chief Executive Officer of the organization during the nuclear program’s dismantlement. In correspondence with the author, he claimed that there was no intended nuclear test at the Kalahari test site in 1977 because sufficient HEU did not exist at the time to permit such a test. Instead, Stumpf states that the site was being prepared for the detonation of a simulated device containing natural uranium (2016). The motivation for such an action will become clear in later sections when possible South African deterrent strategies are discussed.

The diplomatic blowback from the site’s discovery and the passage of UNSCR 418 must have soon convinced the South Africans that future efforts would need to be better concealed, as evidenced by increasingly deceptive nature of the South African program following the 1977 incident. Several years later, Richard K. Betts conducted an analysis of South Africa’s nuclear incentives and concluded there was no current danger of proliferation, but that could rapidly change as Pretoria faced fewer disincentives and had increased capabilities (1979). In fact, South African officials by this time were actively, though more covertly, pursuing a nuclear weapon. The first prototype was completed in April 1982 (Reed and Stillman, 2009, p.181). After working out some technical problems, the first operational device was completed in

December of that year and devices followed at the rate of approximately one per year based on the ability of the Y-Plant to supply fissile material (Stumpf, 1995, p.5).

The Kalahari test site was to figure prominently in the South African weapons program again. In August 1988 a cease-fire was reached in the Angolan Civil War, a conflict that had come to involve Cuban troops and had frustrated the South African government and military. Several months went by before a follow-on agreement to redeploy Cuban and Angolan troops from positions threatening South African territory was reached and throughout this time the government in Pretoria worried about the possibility of surprise attack by Cuban tank brigades. During this period, test preparations were once again observed at the Kalahari site (Pabian, 1995, pp.8-9). There is debate as to whether these preparations occurred in 1987 before peace negotiations, or afterwards prior to the actual troop withdrawal. Regardless, the international reaction to these preparations was muted compared to the outcry in 1977. The reason, which will be detailed in this chapter, is that after the 1977 Kalahari test site discovery the South Africans embarked on a coordinated deception designed, in part, conceal South African intentions for nuclear weapons employment, if not the existence of the weapons themselves.

Dismantling the Program

Apart from being one of very few nuclear weapons programs to actually achieve success, the South African program is often studied and referenced due to its distinctive role as being the only known program that has been dismantled after producing a weapon. Much of the background of this decision and its ramifications is not pertinent to this research, but some elements of the dismantlement and its aftermath are informative when considering the South African deception. The mild surprise of IAEA officials upon inspecting South African facilities and continuing concerns over accounting for fissile material show deception can cause questions and hesitation even over a program about which the international community purports to be aware.

With the Cold War winding down and the long-standing regional conflicts nearing resolution, South African politicians increasingly concerned themselves with the future of South Africa's government and their desired reintegration into the international community. Soon after President F.W. de Klerk's election in September 1989, he informed the officials coordinating South Africa's nuclear weapons program that the weapons, and the program, would be completely dismantled as the country would be moved toward free elections (Stumpf, 2016). However, anticipating that South Africa would eventually accede to the NPT and not wanting to complicate diplomatic efforts by admitting the program's existence, he stipulated that the dismantling effort would be as secret as the development effort (Albright, 1994, p.46). AEC officials drew up detailed plans and the effort began in February 1990.

The first indications that foreign observers appear to have had about the sea change in South African nuclear policy was the closing of the Y-Plant in 1990 (Albright, 1994, p.40). Analysts interpreted this move as signaling that, at the very least, South Africa would not be constructing any devices in the future requiring HEU. However, questions remained about what devices already existed and how far the program had progressed. As discussions about NPT accession continued, IAEA officials visited South African facilities in 1991 and, despite the total dismantlement of the program having been completed, quickly deduced that a significant weapons program had existed. Their concern focused on the large inventory of HEU that had been produced at the Y-Plant and was being stored at Pelindaba. Since the program had not been revealed publicly, the South African government insisted on confidentiality and the IAEA, satisfied that no current program currently existed, kept its concerns to itself (Albright, 1994, p.38).

This HEU would be one of two causes for concern surrounding the South African weapons program, even after Pretoria made a public admission in March 1993. After initial concerns that such a large amount of material had been produced, analysts later worried that it was not enough. A State Department report detailed U.S. concerns that while the amount of HEU the South Africans claimed had been produced at the Y-Plant was “right down the middle” of U.S. projections, it was considerably less than the plant’s capacity (1993, p.1). This same report noted that South African officials had supplied explanations for why the Y-Plant did not operate at peak efficiency for much of its time, nonetheless concerns over additional and unaccounted for material remained.

The second cause for concern was the extent of potential foreign involvement in the South African program. This involvement, long rumored even while the program was in operation, was dismissed by de Klerk during his public admission of the program in 1993 (Reed and Stillman, 2009, p.183). Many researchers, and intelligence agencies, have doubted this claim. A mutual defense and cooperation pact was agreed to by Israel and South Africa in 1974 and a few years later the two exchanged Israeli tritium for South African yellowcake. Additionally, memoranda declassified by the South African government in 2003 indicate that arms deals made with Israel were intended to compliment a nuclear weapons program. In one, a senior South African Defence Forces (SADF) officer recommends acquisition of the JERICHO weapon system from Israel and indicates an understanding that this could serve as a delivery system for nuclear warheads (Armstrong, 1975). Finally, U.S. intelligence agencies noted several AEC employees who were dismissed from the organization once the weapons program was shutdown later threatened to reveal the foreign sources of components if not given their severance pay (DIA, 1994, p.24).

None of these concerns involved South Africa retaining a nuclear weapons capability after dismantling their weapons. But they show that a program that was “known” to exist by U.S. intelligence agencies still had considerable mystery to it that continued long after the program was dismantled and publicly revealed. It was the South Africans’ manipulation of information – selectively revealing and concealing their actions and capabilities – that led to continuing questions over the amount of fissile material produced and the extent to which foreign assistance was received.

Program Elements

To examine what is known about the South African program itself, we will use the same categorization from previous chapters that defines the program elements as: 1) raw materials; 2) the ability to obtain weapons-grade material; 3) trained personnel and adequate facilities; and 4) capability to acquire, manufacture, and test (if necessary) components (Horton, 1999, p.4).

Raw Materials

In terms of raw materials, the South African nuclear weapons program focused on uranium. As noted previously, South Africa had a significant natural advantage in building a nuclear weapons program due to extensive natural deposits of the mineral throughout the country. The CIA’s Office of Scientific Intelligence estimated in 1971 that South Africa had produced 4,000 tons of uranium oxide the previous year, representing approximately 20% of the total Free World output and placing it only behind the United States and Canada (CIA, 1971, p.2). But it was still necessary, either because enrichment processes were not efficient enough or because other weapons types were being explored, to obtain raw materials abroad. At certain points during the program, the need for this acquisition impeded progress. After providing the Safari-I research reactor in the mid-1960s, the United States provided the HEU required to operate the reactor. In 1975, however, the U.S. government suspended shipments of HEU due to concerns over the construction of the Y-Plant and fears of a potential weapons program. In response, South Africa began to develop illicit procurement networks in the United States and Europe in an attempt to acquire the necessary materials (Albright, 1994, p.39).

Scholars and government officials have alleged that at this point another significant step was taken in South African nuclear weapons development. Reliance on South Africa’s own natural resources without advanced reactor technology meant that South African scientists were limited to developing devices requiring uranium. But South African officials saw many parallels between their own security and diplomatic situation and that of Israel. They also saw an opportunity for a mutually beneficial exchange. There is reliable documentation that in 1977, South Africa imported 30 grams of tritium from Israel in exchange for the export of 600 tons of uranium oxide (Lieberman, 2004, p.54). Acquisition of tritium would have permitted South

African scientists to explore boosted-fission weapons. Perhaps even more significant, some South African officials later claimed that the agreements with Israel to obtain tritium included the promise to allow Israeli tests at South African sites (Reed and Stillman, 2009, p.175).

The Ability to Obtain Weapons-Grade Material

As noted previously, South Africa invested considerable resources to develop the means to enrich their own stock of uranium to support weapon development. This effort began in the 1960s when the Atomic Energy Board, which would later become the AEC, began to research the means to either separate plutonium or enrich uranium (Albright, 1994, p.39). From the early stages of research it was clear that uranium was the more cost-efficient means for South Africa and hence the method that would become its aerodynamic enrichment process would be developed for use in the new Y-Plant at Velindaba. This plant would produce its first HEU in 1978.

The HEU produced by the Y-Plant in 1978 was enriched only to 80%, not the 93% considered to be weapons-grade HEU in the United States. But the enrichment level was close to the likely enrichment of the uranium used in the bomb dropped on Hiroshima, hence South African scientists were convinced that it was “good enough for a first generation gun-type weapons” (Reed and Stillman, 2009, p.176). This difference, together with uncertainty about the plant’s actual output potential, would contribute to confusion on the part of U.S. analysts as to how many weapons the South Africans were capable of building with the HEU they had on hand (LLNL, 1977, pp.61-62). For their part, the South Africans stated that they expected the Y-Plant to help them sell enriched uranium to any non-communist country who wanted to do business. Information was released that indicated the plant could produce up to 50kg of HEU per year for this purpose (Fischer, 1994, p.208). Several years later, however, South African officials had changed their message on Y-Plant production. On a Johannesburg television program in 1986, the executive director of the AEC, Dr. Wynand de Villiers, stated that the 3.25% level of uranium enrichment currently being conducted was insufficient for a nuclear weapon (Masiza, 1993, p.42). This remark was clearly deceptive, since by that point South Africa had already produced 3-4 weapons containing HEU.

Trained Personnel and Adequate Facilities

South Africa benefited from initial nuclear training in the United States, a robust academic and industrial sector, and freedom from IAEA inspections in developing the personnel and facilities necessary to pursue nuclear weapons. In addition to the Y-Plant for HEU production, several facilities were constructed specifically for the weapons program, most notably the facility known as “Advena” where weapons were constructed. With no inspections to circumvent, the South Africans were able to maximize the efficiency of these facilities. Advena, for example,

was later found to contain a precision-coordinate machine that had been obtained legally from Italy, though presumably later diverted for use in the weapons program (Pabian, 1995, p.13). When possible, however, an opposite approach was taken. Other machinery at the Advena facility was relatively simple and low-tech, permitting South Africa to avoid detection from procurement of controlled items. Officials later stated that their approach was to "...compensate for lower-quality machine tools with very good machinists, although this strategy sometimes slowed the program down" (Albright, 1994, p.41).

These specialists made up the majority of personnel in the South African nuclear weapons program, which remained relatively small throughout its existence. According to Stumpf approximately 1,000 people, all South African-born nationals, were involved throughout the program's existence with 250 people being involved at any one time (1995, p.6). Presumably, many more individuals were aware of the general aims and accomplishments of the program, to include construction workers, security guards, and clerical staff. But strict secrecy laws and procedures existed throughout the program and little information was ever publically released. Despite this secrecy, there were references made to the program by even senior personnel involved. In an interview with a U.S. Air Force researcher, Dr. Frederick Lamb of the University of Virginia stated that during visits with AEC counterparts in South Africa, the AEC scientists would occasionally make private remarks about their nuclear research and seemed to be pursuing their efforts with an attitude of "...wanting to show the world what South Africa can do" (Horton, 1999, p.6).

Capability to Acquire, Manufacture, and Test Components

The final element of the program is the capability to acquire, manufacture, and test components. The success of the South African nuclear weapons program leaves no doubt as to this capability, with the possible exception of testing – which was interrupted in 1977 and evidently cancelled in 1988. By the time the South African government decided to dismantle the program in 1989, there could be no argument that it had been largely successful. It had produced, by some estimates, approximately 900 lbs of HEU and tested a variant of the Jericho-2 missile successfully. Most importantly, it had constructed and safely stored six weapons (Reed and Stillman, 2009, p.182).

Program Management

This success was possible due to the distinctive means by which the South African nuclear weapons program was managed. The goals of the South African government, which will be explored in-depth later in this chapter, required a specific nuclear capability rather than the most advanced weapon possible. The weapons development program existed somewhat within, and somewhat covered by, an advanced and significant nuclear power industry. Though the South

African government certainly subsidized research and work on technologies that could lead to more advanced weapons, the goal of a reliable nuclear device that was relatively cheap and could be constructed without too many indicators to the international community was foremost among management's priorities (Kelley, 1996, p.36).

Initially, all nuclear-related work and research appear to have been the purview of the AEC. It was AEC scientists and administrators who shepherded the operation of the Safari-I reactor, development of the aerodynamic uranium enrichment process, the Y-Plant, and the design of what would become South Africa's gun-type nuclear device. But after the 1977 Kalahari test site discovery, South African government officials made the decision to shift responsibility for production of nuclear devices to a more "businesslike" organization, experienced with armaments and the efforts that would be required to circumvent international arms embargoes and export controls (Reed and Stillman, 2009, p.176).

The new group in charge of the weapons program was a long standing and trusted partner of the government. The South African Armaments Corporation (ARMSCOR) was in charge of supplying conventional arms to the SADF as well as R&D efforts. Due to continuing international sanctions, ARMSCOR had developed proficiency in indigenous development and reaching out to sympathetic foreign parties for assistance. Its R&D portfolio "[cut] across the boundaries of industry, of University faculties, and Research councils of South Africa, all aimed at leading edge technologies" (van der Walt, Steyn, and van Loggerenberg, 2003, p.51). Unlike the AEC scientists, the ARMSCOR personnel assigned to the projects were mostly engineers with extensive military experience and their philosophy towards the program focused on reliability, safety, and security rather than any innovation or design improvement (Albright, 1994, p.43). It was an ARMSCOR facility for guided missile system development (Kentron) that was eventually retooled and built up into the Advena facility, and scientists and engineers deemed indispensable to the weapons program were quietly transferred from AEC to ARMSCOR and eventually to Advena (van der Walt, Steyn, and van Loggerenberg, 2003, p.78).

The AEC, meanwhile, would continue research into more advanced concepts, such as implosion devices and boosted-fission weapons. Following the transfer of weapons production and numerous key personnel to ARMSCOR, the AEC continued to coordinate relevant research at South African universities as well as pursue its own work (LLNL, 1977, p.33). A September 1985 program review by the government concluded that seven nuclear devices would be built and also that "only limited work (mostly theoretical) was allowed to continue on more advanced concepts such as implosion weapons and lithium-6 production" (Stumpf, 1995, p.6). Thus, the AEC would find its influence over the nuclear weapons program quickly and rapidly diminished and conducting research in which the SADF and government were not interested and were

reluctant to fund (Horton, 1999, p.27). Nonetheless, this AEC “sideshow” research would play a significant role in the South African deception.

Motivation for Study

Examination of the South African nuclear weapons program case is beneficial for this research for several reasons. First, it is a “cradle to grave” case so the entire life cycle of an R&D program is available for study. Second, there is an abrupt change in the approach of the South African government to securing the program after the 1977 discovery of the Kalahari test site. Prior to this event, the program relies largely on denial of information with only token deceptive measures. After the discovery, the South Africans took numerous deceptive measures to achieve their goals.

Common Case Features

This case shares several common attributes with other cases – attributes that we can expect to see in future development cases. This is particularly true in the areas of diplomacy and infrastructure. Diplomatically, South Africa found itself in a position of needing to support the principles of nonproliferation and nuclear responsibility while embarking on its own weapons program. Its refusal to sign the NPT was based on protection of proprietary enrichment technology – but the South African government pledged to uphold the spirit of the treaty. India was also a non-signatory to the treaty, though as discussed in Chapter 4 its objection was based more on fairness to economically developing nations. Voicing support for the principles of the NPT, both South Africa and India disclosed limited information about their capabilities – information that was perhaps factual but not complete. In South Africa’s case, this was information about the efficiency of the aerodynamic enrichment process and the capabilities of the Y-Plant, which were disclosed to dispel rumors but also led to confusion within U.S. intelligence agencies as to how much fissile material was being produced.

A second similar diplomatic theme is that South Africa was primarily concerned with the perceptions of U.S. officials concerning their program. South African officials were aided in this by not having to contend with mandatory IAEA inspections of their facilities, but they did have to contend with ongoing interactions with a U.S. government that, despite changes in administration, was consistently opposed to any South African nuclear weapons capability. The South African deception, as with deception in similar cases, was designed to ensure U.S. opposition remained only rhetorical.

Several common themes exist with regards to infrastructure. The origins of the South African nuclear weapons program were in a well-resourced and capable nuclear power infrastructure. The program’s initial participants and proponents were scientists and technicians. The military,

similar to the Indian case, only became involved much later in the R&D process. The South African establishment may have drawn inspiration from India's May 1974 PNE. The event coincided with the continuing collapse of colonial rule in southern Africa and Prime Minister Vorster's decision to keep South African scientists working on possible military applications, including a test of a gun-type weapon without fissile material and funding for the construction of the Kalahari test site (van Wyk, 2010b, p.564). The infrastructure of the South African program was similar to other cases as well. Despite its advantages in natural resources and ingenuity in developing techniques, it was still necessary for South Africa to obtain machinery and other components from foreign sources. In this the South Africans acted similarly to the Iraqis, who often procured machinery that was less than state-of-the-art in order to avoid detection (Albright, 1994, p.41). Officials in both programs seem to have assumed, and were likely correct, that intelligence and law enforcement agencies would be less vigilant about technology considered to be second-rate.

Distinctive Case Features

Despite these similarities, the South African case, like all cases of nuclear weapons development, has distinctive characteristics that are not seen elsewhere but may be in the future. First and foremost among these is that the foreign and security policy goals of South Africa led to a weapons program with limited objectives and deception plans highly tailored to evoke specific U.S. actions. South Africa's diplomatic dilemma was that it wanted to avoid being ostracized from Western nations while being capable of deterring its regional adversaries (Betts, 1979, p.104). In this case these "regional adversaries" were leftist military and paramilitary groups within southern Africa and within South Africa's own borders – adversaries not generally deterred using nuclear weapons. There was no nuclear weapon that would counter the African National Congress (ANC), no delivery system with which South Africa could threaten the USSR or Cuba for their support of leftist groups, and use against Cuban or East German troops risked intolerable reprisals from the Soviet Union and the international community (Fischer, 1994, p.215; Stumpf, 2016). One of South Africa's primary intentions was to coerce assistance from Western countries, particularly the United States, in the event that the Pretoria regime was in danger. The South African government believed it was entitled to this assistance, but was aware that due to its apartheid policies many Western countries were reluctant to provide security guarantees. This approach relied on a suitable surprise of the discovery of South African nuclear weapons capability – if it was not a surprise the United States might not be alarmed enough to intervene, if it was too much of a shock then Washington might decide the South African government should not be saved. Rather, an "understanding" that the weapons were possible and could quickly be constructed was what the South African government attempted to cultivate. These policy and security goals will be discussed in-depth later in this chapter, but South Africa's intended effect of weapons development is certainly a distinctive aspect of this case.

Second, South Africa developed an indigenous enrichment technique. Many consider the acquisition of fissile material to be the highest obstacle to overcome in nuclear weapons R&D. The South Africans were able to enrich their own uranium in their own facility without interference or inspections. As stated previously, Pretoria's objection to the NPT was framed in economic terms – that this enrichment process would be compromised by foreign inspectors at South African facilities. Whether this was the true South African motivation or a cover for intent to develop nuclear weapons, the freedom of movement enjoyed by South Africa due to these resources and capabilities is distinctive among states that have pursued nuclear weapons.

Pursuit of Nuclear Weapons

South Africa is certainly within the universe of cases for this study due to its actual development of nuclear weapons. However, it is unclear when the actual cabinet-level decision was made to pursue the weapons program. A managing director of the Uranium Enrichment Corporation has stated that discussions of PNEs occurred as early as 1971, but that “defense people” were not involved until 1975. Former AEC CEO Stumpf believes that there was no interest in weaponization until the late 1970s (Lieberman, 2001, p.52). The preparation of the Kalahari test site and acquisition of tritium from Israel in 1977 suggests that at least by then a decision had been made. What is known is that after Prime Minister P.W. Botha's election in September 1978, he quickly addressed a way ahead for the nuclear weapons program. In a cabinet committee meeting on October 31st, it was decided that the AEC and ARMSCOR should work together and pursue an operational nuclear device (van der Walt, Steyn, and van Loggerenberg, 2003, p.42). This appears to have been less a decision and more a formalization of processes and work approved earlier. Six months before this meeting, as Defense Minister, Botha had approved a three-phase strategy for use of South Africa's nuclear weapons (Stumpf, 1995, p.5). This three-phase strategy is the best indicator we have of the perception and goals that drove South Africa to pursue the bomb.

Threat Perception and Policy Goals

Even when examining a program where many decision makers and participants have discussed it freely, it is challenging to ascertain the exact reasons why the program was conceived, resourced, and pursued. In his assessment of the South African nuclear weapons program, David Albright noted that the motivating factors may never be fully understandable to outsiders and that this is especially true when South African officials explain that the weapons were never intended for use or integrated into the country's armed forces (1994, p.37). One researcher recalled a conversation with a senior South African official where it seemed that the weapons were seen as an abstraction, with no concrete idea for their use – hence various officials within the South Africa government likely had their own ideas about whether there was any plausible scenario for use of the weapons (Lieberman, 2015).

What was concrete in the South African decision making apparatus was the “three-phase strategy,” an expensive and risky gamble that South African leaders hoped would bring Western assistance in their regime’s hour of need. The three-phase strategy was developed and debated for over a year by a working group chaired by ARMSCOR. The group consisted of foreign policy, technical, and military experts and even consulted a theologian (Liberman, 2001, p.56). The strategy envisioned South Africa revealing its nuclear weapons program in the following manner:

- Phase I – Uncertainty: The South African government would not publicly comment on the existence of a nuclear weapons program, but would release some information and make references to the capability to construct one (with the possible exception of test preparations in 1987, the South African government remained in this phase for the duration of the program).
- Phase II – Covert Acknowledgement: The South African government reveals its possession of nuclear weapons to Western governments, particularly the United States, to spur their support against communist-backed insurgents threatening the Pretoria regime.
- Phase III – Demonstration: Public acknowledgement of the program with some form of test.

This strategy is one of the best examples of a concept referred to as “catalytic deterrence,” which consists of a state using its nuclear arsenal to compel the actions of an “ambivalent ally” rather than an adversary (Goodson, 2012, p.209). Reportedly, South African leaders had taken careful note that the possibility of Israeli nuclear weapons employment appeared to have spurred U.S. assistance during the 1973 Yom Kippur War (Liberman, 2001, p.62). Regardless of how the strategy was inspired, numerous senior South African officials insist to this day there was no target selection for the weapons or even serious debate about their potential use. Stumpf points out that for the majority of the duration of the nuclear weapons program, South African forces were involved in a “bush war” with the Angolans and their Cuban allies in which there was no concentration of troops that would have made the tactical use of nuclear weapons effective (Stumpf, 2016).⁹

⁹ In the same correspondence, Stumpf also shared the substance of a meeting he had with a former Cuban Minister of Foreign Affairs, Mr. Fidel Castro Ruz, in December 2010. He stated the Ruz told him Cuban forces had been split into small groups operating far apart beginning in 1985 because Cuban officials believed South Africa to have the capability of delivering nuclear weapons. If true, this is an indication that while the weapons themselves may not have been practical to use in the “bush war,” the perception of their existence did have a practical effect on the ground.

Arguments that no offensive use was ever intended also center on the likely consequences of such use. As noted previously, several former officials stated that everyone involved with the program knew such use would be suicidal for the Pretoria government. Others within the government seem to have advocated this total no-use policy as well. Even late in the life of the program, notes from the Department of Foreign Affairs on NPT accession indicate that there were voices within the government arguing that any use of nuclear weapons “amounts to a no-win assurance of self-destruction for those whom the nuclear device is designed to ultimately protect” (DFA, 1988, p.3).

It should be noted, however, that while the three-phase strategy is now known to have been official government policy at the time, the gun-type weapons produced by South Africa could have been used for more than testing and may have been more deliverable than was understood for many years. In a review of a former South African official’s recent book on the program, Jeffrey Lewis observes that the new information presented indicates the South African warheads were deliverable by a television-guided glide bomb and are not the bulky bombs that some officials, and some well-known photographs, have indicated (Lewis, 2015). It is reasonable to assume that if South Africa was going to demonstrate its nuclear capability as part of a catalytic deterrence strategy, it would need a deliverable weapon, since following a South African nuclear test, refocused U.S. assets would quickly ascertain if Pretoria had no realistic delivery means (Lieberman, 2015). Having a weapon that was reliable and deliverable results in the possibility of use in a crisis, even if officials currently claim there was no serious consideration of this.

Stumpf disputes the viability of weapons delivery, claiming that an ARMSCOR specialist informed him at the time that the weapons would take 12 to 18 months of redesign and rebuilding to be deliverable. The specialist stated that the issue, in addition to their bulkiness and weight, was the lack of arming and firing systems that did not require an external electrical supply (which would exist in a test). Thus these weapons, even if the size and weight issues were addressed, were not reliable enough to actually employ (2016). It is unlikely that these disputes will be definitively resolved in the near future. The difficulty in doing so more than twenty years after dismantlement is a testament to the effectiveness of South Africa’s ability to compartmentalize its nuclear weapons program and control the information that was known about it.

The formulation and adherence to such a policy as the three-phase strategy over multiple governments and two decades may appear unlikely. However, it should be recalled that South Africa in this period of history was essentially a one-party state with continuity as its defining characteristic (Long and Grillot, 2000, p.29). According to Long and Grillot, there was broad consensus over the general issues of foreign and security policy among white South Africans and little of the public debate or scrutiny that may have exposed the program or led to the election of

officials with different viewpoints. Hence, while we can only rely on the testimony of former officials for insight into government thinking during this period and can assume that some scenario of actual weapons use was foreseen if not admitted to at this point, it is plausible that Pretoria pursued nuclear weapons largely to influence U.S. policy if the need arose.

Nuclear Weapons Policy Goals

We can therefore list “leverage with the United States” as the first and foremost policy goal of the South African nuclear weapons program. The question is how this goal would shape South Africa’s deception. Albright refers to the South African strategy as a “strategy of uncertainty” and points out that the utmost secrecy would be required for the approach to be effective (1994, p.38). Albright is correct that the concealment of key information, or more broadly the control of key information, was essential to the success of the South African strategy. But two conditions made “utmost secrecy” insufficient for success.

Leverage with the United States

First, as the South Africans learned in 1977, concealing the program alone was not going to be effective. Not only did they need to contend with U.S. and IAEA curiosity about their capabilities, but the presence of Soviet-backed and Cuban troops in southern Africa meant that Soviet analysts were monitoring what they could see of the weapons program as well. Therefore, moving forward from this point the South African program would need to contend not only with U.S. and Soviet imagery capabilities but also with the U.S. perception that South Africa had been caught nearly testing once and that South Africa’s security situation was not improving. Pretoria must have assumed that the United States would be alert and had multiple means by which they could detect the necessary work of nuclear development. Hence, utmost secrecy would not adequately protect the program.

Second, it is possible that South African officials realized that should they need to proceed to Phase II – privately informing the United States of their weapons capability – having that be a complete revelation may have been counterproductive. U.S. officials may be so shocked by the prospect of South African nuclear weapons that they conclude some form of regime change in Pretoria was necessary. Whereas, if the United States had an understanding of the program broadly but then was surprised by its advanced state, it would see that Pretoria had, to that point, been a responsible nuclear power.

The Kalahari test site provides an example of this. According to interviews with a former ARMSCOR official, Dr. Andre Buys, some in the South African leadership were convinced by the strong U.S. reaction to the 1977 Kalahari discovery that the “revelation” approach might shake the United States into intervening in the future (Lieberman, 2001, p.61). But this was hardly a revelation for U.S. officials. CIA estimates as recently as the year before suggested that

repeated statements by South African officials about a nuclear weapons program, given the South African culture of secrecy, may have been intended for a U.S. audience (CIA, 1976, pp.1-2). Arguably, what spurred the aggressive U.S. response was less about “revelation” and more that they had been confronted with evidence of the test preparations by the Soviets, and had to do something. When U.S. analysts would detect renewed preparations themselves ten years later, the U.S. response was far more muted.

These conditions – lack of success in concealment and the need to have the U.S. be aware of the program in a deniable way – show why deception was necessary in the South African case. If leverage with the United States was the primary driver for this ambitious and costly R&D program, then an approach more nuanced than “utmost secrecy” was required to maintain its security.

Deterrence against Neighbors

While the United States may have been the primary audience for the South African nuclear weapons program, it was not the only one. Despite the comments by South African officials about suicidal weapons employment and those by scholars about the lack of deterrence value against insurgencies, the South Africans clearly wanted countries such as Angola, Mozambique, and Zimbabwe, as well as their supporters, to know it had the capability. This was first forcefully communicated in May 1974 as colonial rule in southern Africa was beginning to collapse. Following the successful test of a projectile at Somchem, the AEB (forerunner to the AEC) publicly announced that it had the capability to build a bomb (van Wyk, 2007, p.202). This was certainly an overstatement, since South Africa was not yet producing sufficient HEU for such a device, but nonetheless it was clear in which direction South African research was heading and how an initial device might look.

An additional clue to the intent of deterring and intimidating neighbors was the delivery systems pursued by the South African government. As early as 1976, the South African government announced that their air force had been conducting test runs on nuclear weapons delivery using Buccaneer bombers (CIA, 1984, p.17). Less publicly, the South Africans developed a television-guided air-to-surface bomb that reportedly was modeled after the Israeli “Blue Bat” system that would be capable of delivering the devices ARMSCOR was producing (Lieberman, 2004, p.55).

Finally, South African officials continued to make “surprise” statements at just the right times. In 1988, during an extremely tense period prior to the Cuban withdrawal from southern Angola, Foreign Minister Pik Botha made a surprise comment at a press conference in Vienna that South Africa was able to make a nuclear weapon if it desired (Pabian, 1995, p.8). This continued the South African practice of individual government officials alluding to a program without

explicitly confirming it. With the world knowing that South Africa possessed only bombers and short-range missiles, it was clear that whatever deterrence theorists may argue, if South African nuclear weapons were to be used their targets would be nearby.

National Pride and International Recognition

Despite these foreign policy goals and concerns, several scholars have pointed out that when the initial decisions to move down the path of nuclear weapons capability were made, South Africa was not facing this dire security situation. Anna-Mart van Wyk notes that “The white minority governments in neighbouring Mozambique, Rhodesia, and Angola effectively kept the small cohort of ANC guerillas from easily penetrating South Africa and the proxy wars of the Cold War had not yet reached Southern Africa” (2010b, p.563). She cites instead the motivations of national pride and Afrikaner nationalism as explanations for why weapons development proceeded. The previously mentioned observations by Dr. Frederick Lamb that South African scientists were “wanting to show the world what South Africa can do” also support this (Horton, 1999, p.6). This is a more powerful explanation if one places the “decision” to go nuclear early. Van Wyk cites the decision has happening around 1973, which is earlier than many officials admit (2010b, p.563).

Even if the decision was made later, however, it is likely that national pride and maybe some resentment over the country’s isolation, were drivers of the program. Some decision had been made prior to preparing the Kalahari test site in 1977, but the swift reaction of the international community may have contributed to a “humiliation factor” in motivating the South Africans to complete the program. Parallels can be drawn to Iraq’s decision to urgently pursue weapons following the destruction of Osirak (Pabian, 1995, p.5). Such events can provide impetus to a program and it is clear that the South Africans felt somewhat ill-treated following passage of the UN arms embargo and international condemnation. So whether one “starts” the program earlier or later, national pride is a likely motivator for South Africa’s nuclear weapons program.

Weapons Development Goals

South Africa’s weapons development goals are simple to characterize when compared with other weapons programs. As stated earlier, the South African government sought a basic weapon that was cheap and reliable (Kelley, 1996, p.36). Design of a gun-type weapon was well within the abilities of South African scientists and by 1977 one had been produced, though as with other nuclear weapons programs the device was done before there was sufficient fissile material to make it operational (Albright, 1994, p.41). It was possibly, as claimed by Stumpf, a “dry run” test of this device that was planned for the Kalahari test site in 1977 (thus perhaps permitting the South Africans to claim honestly it was not to be a nuclear event).

As ARMSCOR took over production of the gun-type weapons, it improved reliability but not potency. For the most part, the design remained the same as one device per year came off the assembly line. Meanwhile, the AEC continued theoretical research on technologies for more advanced weapons, but none neared construction. South Africa's weapons development goals were simple – in order to execute the three-phase strategy the country only needed a working device. Its potency or size was not a significant factor. Having achieved this in 1982, South African design programs proceeded almost no farther.

Relationship with the United States

South Africa's relationship with the United States was complicated throughout the period of its nuclear weapons program. The program itself, anti-apartheid sentiment, distrust, and a desire to fight communism in Africa all combined in different amounts and at different times to make a relationship that, in any particular year, was a mixture of support and displeasure on the part of the United States. The lack of trust that this inspired in the South African government was to be a significant factor in their pursuit of a nuclear weapons capability.

As previously discussed, U.S. involvement with South Africa's nuclear development was extensive in the years following World War II. South African scientists were trained in the United States and numerous exchanges took place under the Atoms for Peace program. In August 1963, however, diplomatic relations took a downturn when President John F. Kennedy instituted an arms embargo against South Africa, partially to show support for newly independent states in Africa and to protest Pretoria's apartheid policies. Predictably, Pretoria was displeased with the decision and expressed some offense. But one silver lining for them was that nuclear assistance was not included as part of the embargo. Researchers have pointed out that in retrospect this was a mistake for a U.S. administration increasingly focused on proliferation. The continued nuclear assistance as South Africa struggled to keep pace in conventional capabilities would inadvertently boost South Africa's desire for nuclear weapons (van Wyk, 2007, p.199). The most significant assistance during this period was the building of the Safari-I reactor, which was inaugurated in 1965. To bring it into operation, numerous South African personnel were trained at Oak Ridge National Laboratory and ten U.S. corporations were involved in the supply of enriched uranium and plutonium, source materials, by-products, and the import of materials for reprocessing (van Wyk, 2007, p.198). This operation of Safari-I, as well as the knowledge of the personnel trained to operate it, were major contributors to the general knowledge and experience needed by the South Africans to pursue their indigenous enrichment process and additional research.

The United States monitored increasing South African nuclear progress with wariness while being alternately vocal and restrained regarding apartheid. The announcement of the

aerodynamic enrichment process resulted in another tightening of U.S. assistance rules in 1975, this time including the export of fuel for the Safari-I reactor. During the same period, South Africa and the United States, specifically the CIA, were cooperating to defeat leftist guerillas throughout southern Africa, but particularly in Angola. Though it was well understood that the guerillas were receiving foreign assistance, the United States was unaware of the extent to which Cuba was supplying troops and material to support the guerillas' fight against South African troops. When the presence of significant Cuban forces disrupted CIA-South African plans and the Ford Administration requested more funds in 1975, Congress took notice of the escalating conflict, decided the CIA was unlikely to achieve results, and severely limited assistance for anti-communist efforts in Angola. Viewed through South African eyes, the United States had "lost its nerve" and the lesson learned was that the West was unwilling to do what it took to stand up to communism in that region of the world (van der Walt, Steyn, and van Loggerenberg, 2003, pp.3-4).

The Carter Administration took office with a decidedly hostile view of apartheid and its relations with the Pretoria government were not eased when the Soviets produced the evidence of the Kalahari test site preparations in 1977. Prime Minister Vorster stated explicitly to President Carter that South Africa had no nuclear device, was not planning to have one, and was not planning to test one (Fischer, 1994, p.209). When U.S. officials demanded that the test site be shut down, the South Africans, according to their Minister of Foreign Affairs, informed the Americans that the Kalahari facility had no relevance to South Africa's nuclear program and they would therefore not consider abandoning it (Botha, 1977, p.3). These statements were clearly misleading and there is no evidence that U.S. officials accepted them. On the contrary, U.S. support of the November arms embargo in the Security Council indicates that Washington had every reason to believe that South Africa had a program and had been preparing for a test.

President Ronald Reagan did not reverse U.S. policy concerning apartheid, but his administration was convinced that further isolation of South Africa was unlikely to achieve U.S. goals in the region. South Africa remained a bulwark against communism in Africa and the administration sought to provide what assistance it could while still expressing disapproval over apartheid policies – all while South African scientists were continuing to covertly build their device. The Reagan Administration restarted nuclear cooperation in some areas. U.S. companies exported large amounts of dual-use items in 1982, mostly intended for use in the Koeberg nuclear power reactor. Technical and maintenance services worth approximately \$50 million were provided for Koeberg alone in 1983 (van Wyk, 2010a, pp.109-110).

The late 1970s saw both Congress and the international community demanding that U.S. administrations curtail assistance to Pretoria in protest over nuclear development, Angola, and apartheid. But by 1983, South Africa was able to restart some nuclear cooperation with the

United States, despite the U.S. government being generally aware of the nuclear weapons program. This cooperation was a product of South African deception surrounding its nuclear weapons capability – a deception that sought to leave the United States generally aware of a program, but not faced with conclusive evidence in the public domain.

How the United States Assessed the Program

How aware was the U.S. government of the South Africa's means and motives to pursue nuclear weapons? In general, the intelligence community appears to have been aware of South Africa's desire to develop and had good estimates of its capacity to produce fissile material. Less understood were the motives for development. Though several reports that have since been declassified refer to the possibility that Pretoria would use a nuclear device for leverage with the United States, it does not appear to be an opinion that gained significant traction.

Understanding of Means

Research into PNEs, the 1974 projectile test, and contacts between U.S. scientists and their counterparts gave U.S. officials an understanding that the South Africans were beginning to master many of the technologies necessary to manufacture a nuclear device. Their refusal to join the NPT was another concerning indicator that South Africa at least wished to leave the option of a nuclear device open. That refusal was based on the aerodynamic enrichment process that was to be conducted at the new Y-Plant facility, and U.S. intelligence agencies focused on estimating the plant's capabilities. One assessment, conducted at approximately the time the Y-Plant fully came online, assessed that the size of the facility indicated it was intended to support a weapons program. It justified this assessment by pointing out that the annual output was less than what would have been required to run Safari-I or the Koeberg power reactor, hence the intention was likely for smaller amounts enriched to higher levels (CIA, 1978, pp.4-5).

In 1984, a NIE, *Trends in South Africa's Nuclear Security Policies and Programs*, summarized what the intelligence community knew about South Africa's intentions and progress to date. With no visible activity since the alleged nuclear test preparations in 1977, the report offered a possibility for where South African nuclear weapons development stood, stating "...it is possible that South Africa has leapfrogged the testing phase and is concentrating on weaponizing and delivery of its nuclear explosives device" (CIA, 1984, p.16). This was precisely the approach taken by the South Africans, who by this point were constructing their second device. Additionally, the NIE was close to accurate in evaluating that the South Africans had sufficient HEU for two to four weapons depending on how they were designed. It did not indicate a consensus that South Africa had already assembled the weapons.

Analysts did not only take information about South Africa's nuclear capability into account. The same 1984 NIE noted that SADF's performance in Angola had been less than adequate,

observing “In addition to having been overwhelmed by the magnitude of the Soviet and Cuban involvement in Angola, military officials also identified serious deficiencies in materiel, communications, and logistics” (CIA, 1984, p.5). This lack of conventional capability was rightly noted in the estimate, since South Africa anticipated facing communist-backed governments and insurgencies in southern Africa for the foreseeable future. Poor conventional capabilities can also be catalysts for pursuit of a nuclear weapon.

Understanding of Motives

Declassified documents provide no evidence that U.S. officials considered themselves to be the main “targets” of the South African nuclear weapons program. While not often explicitly stated, the analysis implies that national pride was the most likely motivation for developing the weapons. An interagency assessment that was submitted by the National Intelligence Officer for Africa in 1977 noted that analysts saw no reason for the South Africans to abandon their “long-standing program” and no credible threat from the West that would cause them to do so. Rather, “threats would, in our judgment, be more likely to harden South African determination” (Parmenter, 1977, p.ii).

Other entities within the intelligence community also believed that pride and perhaps a “can-do so will-do” attitude were likely motivators. A report from Lawrence Livermore National Laboratory stated that weapons development in South Africa “will likely stem from internal political and bureaucratic considerations rather than the more easily observable balance of regional military force” (1980, p.7). As stated previously, these topics were not typically a part of South African political discourse and the National Party was firmly in control – exempt from having to modify and defend its nuclear policies to electoral challengers. The “internal political and bureaucratic considerations” referred to are therefore unclear, but U.S. analysts seem to have had an understanding that they would have difficulty in observing the drivers of South African nuclear decision making.

This internal decision making would be driven by a distrust of U.S. assistance, resentment over embargoes and criticisms from the West, and a belief that the white minority regime had to take extraordinary measures to ensure its survival. It would be facilitated by the three-phase strategy, which would allow South Africa to use low-technology machines and processes to build cost effective weapons. It would be made possible by the formulation and execution of a deception plan that permitted South African officials to effectively control and manipulate the signatures that were observable by U.S. analysts.

Framework

The results of an extensive review of secondary sources are categorized according to the framework presented in Chapter 2. This section will contain a brief description of the data found in each of the four categories of deception effort. Though many of these data points have been described previously in this chapter, they are repeated here so that the reader can see how each of the actions fits into the larger deception effort. The relevant data is presented in Tables 6-1 through 6-6 at the end of the chapter. No data was identified from the “Finance and Budgeting” line of effort.

Reveal Fact

South African officials alluded to their pursuit of nuclear weapons on several occasions, sometimes directly with U.S. officials and sometimes through statements to the media. Conceivably, some of these statements were mistakes or officials saying more than they were permitted or intended to. But as noted in the 1976 assessment, the culture of the white South African government was for secrecy and concern for security. The pattern of statements by South African officials may have indicated that at least some of the information release was intentional and that the United States was the intended audience (CIA, 1976, pp.1-2). These factual statements served the dual purposes of giving the United States an understanding that the capability and mindset existed in South Africa and intimidating the newly independent states that South Africa felt were becoming threats to its security.

Diplomatically, South Africa revealed factual information about its nuclear weapons program to communicate capability and declare their security concerns. For the former, several statements indicated that South Africa had or was actively pursuing capability. Two notable examples are the announcement that Buccaneer bombers were beginning to practice delivery of nuclear weapons and the 1988 Vienna announcement by the Foreign Minister that South Africa possessed the capability to build a weapon if it wished to do so (CIA, 1984, p.17; Pabian, 1995, p.8). Both of these announcements were simultaneous to significant security threats. The announcement about the Buccaneers occurred as newly independent African states were beginning to threaten South Africa’s stability, while the Vienna announcement was made over concerns of Cuban and Angolan troops striking into what is now Namibia. In terms of security concerns, South Africa’s refusal to sign the NPT had morphed from a commercial objection in the 1970s to a security one in the 1980s, and South African diplomats were provided with guidance to explain these security concerns. In one set of talking points, the author points out that South Africa is under continuous threat from communist-backed groups and cannot sign the NPT “...and thus set the minds of our would-be attackers at rest” (DFA, 1981, p.2).

The isolation of South Africa inhibited contact between Western and South African scientists. Nonetheless, several instances of revealing fact were found. One is the previously mentioned instance of South African scientists informally discussing their nuclear research to visiting Western colleagues, though there is no evidence which indicates whether this was intentional or unauthorized disclosure (Horton, 1999, p.6). Analysts at Lawrence Livermore noticed another data point with significant relevance to those examining potential nuclear development programs. They noted that between 1968 and 1974, the number of scientific articles by South African authors with relevant topics to nuclear weapons development more than doubled, from 86 in 1968 to 187 in 1974 (1977, p.34). This is a factual indication that increasing numbers of scientists are conducting increasingly advanced work in the relevant fields.

South Africa's resources and capabilities meant it was in the rare position to reveal fact about special material and did so in two notable cases. In 1980, South African officials announced that they had produced 45% enriched fuel for the Safari-I reactor to permit its continued operation (Cochran, 1994, p.36). This constituted the bulk of separative work required for weapons-grade uranium and thus served as a factual announcement that South Africa was able to produce this material. In addition, the enrichment process that had been developed by South African scientists and not explained to the world became a diplomatic problem as South Africa constructed the Y-Plant facility. To diffuse speculation, factual details were leaked about the process and its capabilities (Kelley, 1996, p.33). Though not all of the information was accurate, much of it was and the intent of its release was clearly to announce South Africa's actual capability to enrich uranium and provide the product for potential customers.

Finally, factual information about the South African program was revealed in a manner that will likely be found in most long-term programs – inadvertently or by mistake. As discussed in Chapter 2, the inclusion of such mistakenly transmitted information in the “Reveal Fact” category is one difference between analysis of long-term deception and other forms of deception. Frank Pabian has identified two examples of mistaken factual revelations in the South African case (2015). The first was the arrest by UK authorities of four South Africans employed by Kentron, a management organization of the nuclear weapons program, in March 1984. These individuals were arrested for violating arms control embargoes relating to Buccaneer bombers, the planes that would be tasked with delivering South Africa's weapons. These individuals were released on bail with the promise of the South African government that they would be returned to Britain for subsequent hearings, but Pretoria reneged on the promise later that year. In the second instance, South African and Israeli military officers visited an environmental monitoring station on Marion Island in the Antarctic in 1986. Their purpose was to conduct a survey for building an airstrip to handle large cargo aircraft to support establishing a test monitoring station for unspecified purposes. The scientists working at Marion were instructed not to discuss the

visit with anyone – a directive they ignored when they revealed the visit to the *London Observer* out of fears that their station would be converted to use for the weapons program. These inadvertent factual revelations, if detected by an analyst, are important clues in the identification of long-term deception.

Conceal Fact

As with any significant defense R&D program, the South African nuclear weapons program relied on a substantial amount denial across most lines of effort to keep the program secret. Prior to the Kalahari test site discovery in 1977, the concealing of fact about the program was the primary means of information security. After 1977, the manipulation of information would be more prominent, but South Africa would continue to go to great lengths to conceal many aspects of its program.

Much of this concealment focused on the element of human capital. The development program required approximately 200 specialists at any time to be employed, and many were prominent in their fields both before and after their involvement with the program. Many more individuals knew the extent to which the country was mining uranium and the work that was being conducted at the Y-Plant, along with numerous other ancillary services to the weapons program. To ensure that these specialists, many of whom would not have had military or other national security backgrounds, were bound to maintain secrecy about the project, the South African parliament passed the Nuclear Energy Act in 1982 (Masiza, 1993, p.39). The act made it illegal to reveal any information concerning uranium reserves and actual or potential output – an act and form of classification restricted specifically to the nuclear weapons program. The identities of program employees were protected as well. After the establishment of ARMSCOR's Advena facility – a facility used only for nuclear weapons production – personnel who were transferred from AEC or other ARMSCOR sections were transported to the site for work in white minibuses with frosted windows to mask their identities. They were not allowed to speak about their work in the facility or associate publicly with each other or Advena (van der Walt, Steyn, and van Loggerenberg, 2003, p.80).

Much of the South African concealment came in the area of infrastructure – particularly facilities. They were greatly aided in this effort by not being subject to mandatory inspection regimes. The Advena facility itself was an effort to conceal fact. It was built in a compound previously used for the testing of motor vehicles for SADF. The only clue to its secrecy is a large embankment that was created to block the view from a nearby public highway. Otherwise it is completely nondescript. In fact, there were almost no external features of note on Advena buildings at all. ARMSCOR managers blocked proposals to put communications equipment on the roof to avoid attracting attention (Albright, 1994, p.43). The concealment of the Advena facility extended beyond the facility itself to the additional (“non-special”) material required for

a weapons program – the machinery and manufacturing capability. As noted previously, machinery that was acquired from foreign sources was often not state-of-the-art in the belief that its acquisition would not arouse the suspicions of the already-suspicious intelligence community. They were thus able to conceal their procurement activities and avoid detection (Albright, 1994, p.41).

Finally, South Africa conducted significant denial in concealing its testing facilities and preparations. This is certainly true of the 1977 tests, which were conducted in a remote location on a test ranged ostensibly owned by the SADF. In the mid-1980s, additional activity occurred at the test site. As the situation in the Angolan Civil War was deteriorating, the South African government believed moving to Phase II or III of their strategy might be necessary. They therefore asked ARMSCOR to determine how quickly the Kalahari test site could be prepared. ARMSCOR personnel constructed sheds about the test shafts so that the shafts could be inspected at length without being susceptible to overhead imagery. When the shafts were discovered to be mostly filled with water, the water was pumped into containers and then moved by truck to be dumped at night, so that satellites would not see damp ground around the site (Albright, 1994, p.45). As a result of these measures, the South Africans were not confronted with evidence of test preparations and forced on the diplomatic defense as they had been in 1977.

Reveal Fiction

South Africa made numerous statements and conducted numerous actions that were fictitious throughout the program and even after the program had ended. Their intent was to confound both Western and Soviet intelligence agencies that were intent on identifying the extent to which South Africa was succeeding in its pursuit of nuclear weapons.

On the diplomatic front, the overall approach that South Africa took to its deception plan is best summarized by the NIE that stated, "...South Africa has followed a policy of calculated ambiguity with respect to its nuclear options by intimating that it has the capability to produce nuclear weapons while disavowing any interest in doing so" (CIA, 1984, p.15). Of course, by 1984 the disavowing of any interest had become fictitious as the first device was completed by ARMSCOR two years prior. Fictitious statements by South African officials had long been the norm with regards to the nuclear program. The most blatant example was Prime Minister Vorster's declaration to President Jimmy Carter in 1977 that South Africa did not have a nuclear device, which was likely technically true, and was not planning to have one, which was certainly not true. It is arguable that this diplomatic fiction continued after the program was terminated. In the public announcement of the program on March 24, 1993 by President F.W. de Klerk, he stated that the program had been entirely indigenous and not received any foreign assistance, but this is extremely unlikely (Reed and Stillman, 2009, p.183). At the very least, the acquisition of tritium from Israel in exchange for yellowcake implies some foreign relationship, as does the

threat by former program members to reveal foreign connections if not given back pay (DIA, 1994, p.24).

The testing phase of development, whether conducted to obtain data or as a diplomatic measure, required South Africa to broadcast false information to protect the test. South African officials began searching for a suitable test site in 1973, basing their selection on remoteness and distance from borders but also geological and environmental criteria. The site was selected and purchased by the government, but since it was feared that AEC involvement would be a tip-off the SADF actually paid for the site and developed it as a military facility – despite not having actual control of its management or use (van der Walt, Steyn, and van Loggerenberg, 2003, p.39). SADF's involvement did not end with its ostensible administration of the site. Decoy artillery pieces were placed around the site in 1977, and live-fire exercises were planned to explain activity around the test site in both 1977 and 1988 (van der Walt, Steyn, and van Loggerenberg, 2003, p.40; Albright et al., 2011, p.3).

Perhaps the most interesting instance of revealing fiction in this case came in the area of infrastructure and, at least in the beginning, was likely unintentional. Following the shift of responsibility for weapon production to ARMSCOR, the AEC continued work on the technology for implosion weapons though, as discussed previously, this was not a well-funded effort. But the AEC work was conducted close to the Y-Plant and it was the natural (to Western minds) progression of nuclear research. It therefore did not appear as if AEC's role had been reduced as much as it had become even more secret, and the effort continued to draw U.S. attention. In fact, because ARMSCOR was not conducting any upgrades to the weapon design but only manufacturing them in well-concealed facilities, the AEC effort left more signatures for intelligence agencies to observe. The documents declassified by the IC do not indicate the extent to which U.S. analysts were fooled by this, though it appears that they did believe the South Africans were pursuing implosion technology. Former U.S. weapons engineer Robert Kelley observed that the supposedly significant AEC effort was “a good reminder that the obvious may not be the important part of the story” (Kelley, 1996, p.37).

Conceal Fiction

It is a main argument of this dissertation, and part of its first hypothesis, that for such a large effort as a nuclear weapons development program, effective deception requires coordination in order to conceive of intentional actions and take advantage of unintentional ones. These measures are intended to secure the program and its deception plan and differ from the information in the first three categories in that they are not intended to be observed or specifically shielded – they are internal actions. They do, however, leave signatures that are potentially observable and hence provide a means by which analysts can identify the deception and the program it protects.

In researching the South African case, these signatures are seen in two areas. The first is in the exceptional security measures taken around the program. Interviews of and memoirs by former program participants refer to extraordinary security around the program, including concentric security zones in each of the facilities (van der Walt, Steyn, and van Loggerenberg, 2003, p.85). Additionally, ARMSCOR and SADF established a new and specific document management system for the program that was reportedly comprehensive and well beyond anything in the defense or research sectors (Gould, 2009, p.118). Once ARMSCOR opened the Advena facility, a special joint security team was formed to handle the required special security clearances, physical security, and cover stories for employees (van der Walt, Steyn, and van Loggerenberg, 2003, p.80). All of this may just be considered protection of the program. But these were extraordinary security measures instituted for personnel and facilities where scientific work was being conducted. They were therefore 1) beyond the security one would find on SADF bases or in other government facilities, and 2) imposed on scientists and others who would only be subjected to such measures if their research was exceptionally important. Even if an intelligence agency could not penetrate this security, the knowledge that these extraordinary measures were taken and to whom they applied would be a significant indicator.

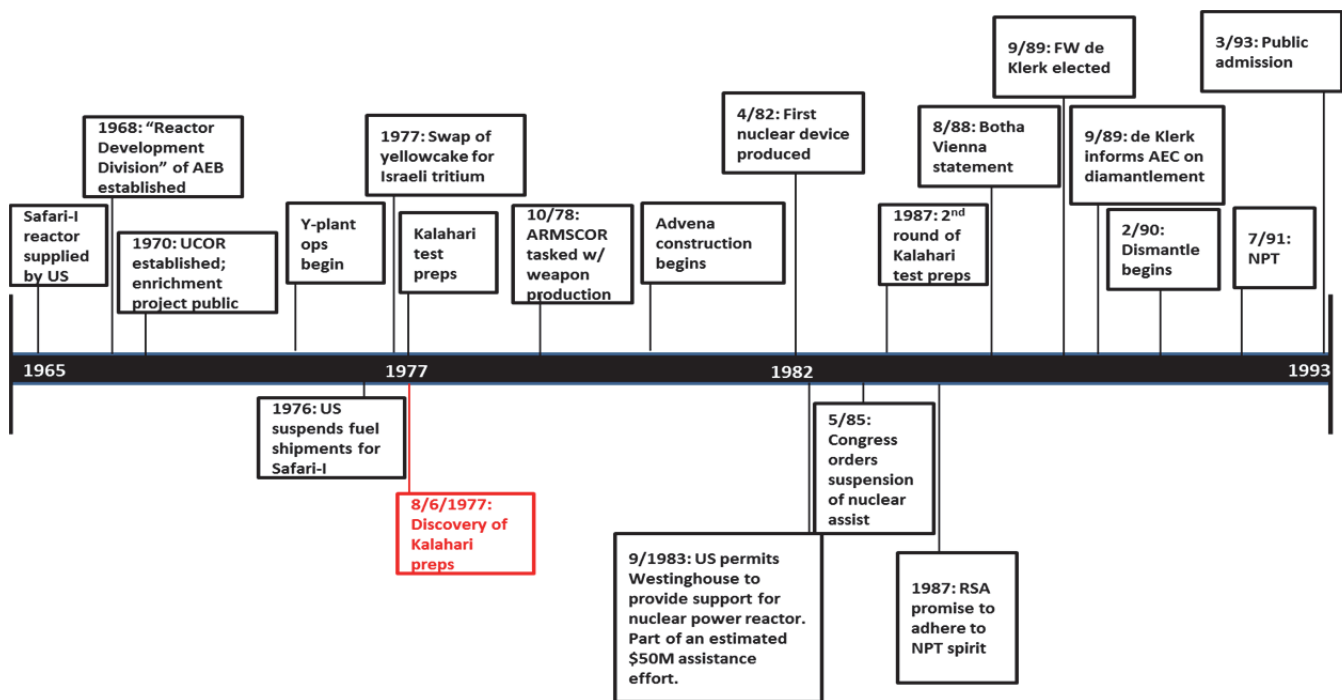


Figure 6-1 South Africa Timeline

Coordination was required on a higher level as well. During Vorster's administration, it appears that most decisions on nuclear weapons rested with the Prime Minister himself and a close circle of advisors. Shortly after his election, Botha formed what would be known as the "Witvlei Committee" to be a steering committee for nuclear weapons issues. This cabinet-level committee was hand-picked and initially consisted of Botha, the ministers of defense, foreign affairs, minerals and energy, and finance as well as the chiefs of ARMSCOR, AEC, and SADF (van Wyk, 2010b, p.566). Such ministerial committees may be interesting, though not particularly unusual. But in this case, the Witvlei Committee was a significant deviation from normal business in the South African government. Decisions made by the committee were communicated directly down through ARMSCOR, AEC, or SADF channels without the knowledge of the rest of the cabinet or the State Security Council – an almost unheard of construct in the South African system (Lieberman, 2001, p.66). If an intelligence agency was able to learn that decisions involving significant funds and personnel were being made and disseminated in such an unusual way, even if it could not discover the details this knowledge may provide a vital clue in determining that deception is taking place.

Timeline

Figure 6-1 is a simplified timeline showing key events in the course of the South African nuclear weapons program. Above the timeline are events within the program, while below are key interactions between the United States and South Africa during this time. The timeline is not comprehensive, but meant to show how the program progressed and when U.S. and South African officials dealt with key issues.

Though U.S. and South African officials interacted frequently, there are only a handful of interactions significant for our purposes. The suspension of fuel for Safari-I and the discovery of the Kalahari test preparations both occur when South Africa is relying primarily on denial to keep their weapons development efforts secure. Following the 1977 incident, when more deception is employed by South Africa, interactions over the nuclear program are less contentious – though the U.S. anti-apartheid policy certainly led to tense relations in several periods.

The effect of deception is demonstrated by two events on the timeline. First, the U.S. government granted permission for Westinghouse and several other U.S. companies to do business with the South African nuclear power industry, mainly in support of the Koeberg nuclear power reactor. There were several restrictions based on this assistance and there is no evidence that it aided the nuclear weapons program in any way. Nonetheless, it is difficult to find an example of a state with which the United States engaged this amount of nuclear cooperation that was so strongly suspected of being a proliferator. Fuel shipments for Safari-I were suspended in the mid-1970s when it became clear South Africa was going to start enriching

uranium on its own, whereas seven years later nuclear cooperation was permitted despite the IC believing South Africa was still pursuing weapons. This is only possible because of the deniability of the program that existed in 1983 but not in 1975.¹⁰

Another notable event on the timeline is one that is not there. The 1977 discovery of the Kalahari test site preparations and the subsequent arms embargo were significant events that have been discussed throughout this chapter. But a second round of test preparations in 1987, spurred by South African concerns over Cuban troops in Angola, has no corresponding response. This time, Soviet sources did not detect the test preparations and U.S. officials were not cornered into condemning South African actions. The deception efforts that had masked both the program and the test preparations left U.S. officials “discretion in any response” (Pabian, 1995, p.9).

Deception Strategy and Objective

The South African deception strategy falls into the category of opacity and implied threat. As noted in the NIE, the South Africans took an approach of “calculated ambiguity,” building upon what the United States already knew about the South African nuclear sector and the country’s capabilities (1984, p.15). The occasional statements by South African officials about their capability and willingness to build a device if provoked were matched to their repeated warnings that the situation in southern Africa was bad and getting worse. There is no evidence that they ever explicitly admitted having a weapon to U.S. officials, which would be in line with the three-phase strategy. The official statements were only outright falsifications when the South Africans were cornered, specifically after the 1977 test discovery. Otherwise, South African officials chose their words very carefully to communicate their capability and their intent to protect their regime.

The United States was not the only concern of South African officials and their deception strategy also entailed implying the threat of nuclear weapons. Comments such as those at the start of this chapter by Prime Minister Vorster and those by Foreign Minister Botha during the 1988 negotiations over Angola were part of this strategy. It was also supported by South African actions. The selective release of information about the Y-Plant was meant to defuse rumors of uranium enrichment on a massive scale, while communicating that South Africa had the capability to enrich unchecked by the NPT or on-site inspections. The announcement that SADF Buccaneer bombers had been practicing the delivery of nuclear payloads in 1976 was also designed to communicate the threat of South African nuclear capability to newly independent states in the region.

¹⁰ This assistance was eventually suspended by Congress in 1985, but apartheid was the impetus of that restriction, rather than concerns over continued nuclear development.

South Africa's objective for U.S. actions was to have Washington be "frozen" and unable to take a definitive stand against the program. Expressions of concern by U.S. diplomats were acceptable, as long as definitive preventative action was not taken that would stop the nuclear weapons program.

Figure 6-2 depicts the goals and methods employed by the South Africans to protect their nuclear weapons program. Each of the goals and methods discussed is indicated. The Nuclear Weapons Policy Goal of "Doomsday Defense Weapon" is grayed because there is no evidence that the South African government made preparations for employing the weapons in a defensive role. But as discussed earlier, investments in the development of delivery systems and construction of the weapons in such a way as to make them deliverable (despite what was said publicly) indicates that this was, at least, a possibility that was considered.

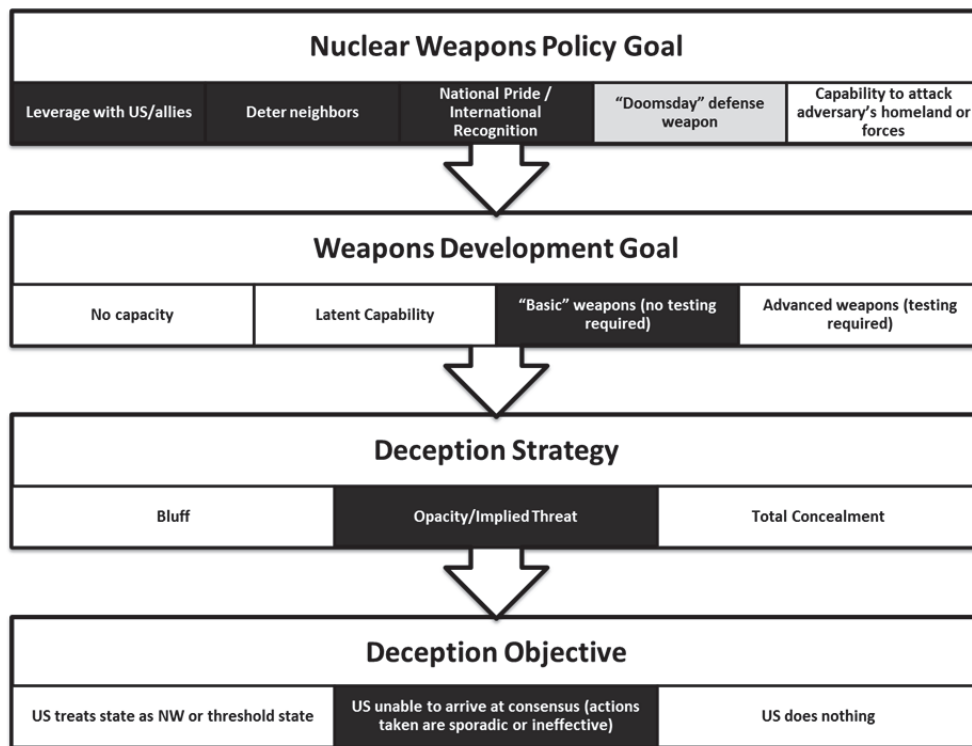


Figure 6-2 South Africa Goals, Strategy, and Objective

Hypotheses

The South African case gives us several insights into the hypotheses.

H1: The coordination of deception will result in observable signatures.

There is no evidence that U.S. analysts were aware of the increased security measures around ARMSCOR, Advena, and other groups related to the weapons program. Nor is there evidence they were aware of the Witvlei Committee and the coordination that came from the Prime Minister's office and differed from that normally provided to ARMSCOR and SADF. If there were sources that provided this information to the IC, the records have not been declassified. But such sources could conceivably have been cultivated and could in future cases. Numerous high and low level officials would have been aware of the unusual nature of both the security measures and coordination, and if they could not have provided the details to the intelligence community they could have alerted analysts that something very unusual was taking place outside of the AEC implosion research.

H2: Multiple channels increase the complexity of the deception and the likelihood that the United States will have an understanding of the R&D program.

At first glance, this case appears to do little to support this hypothesis. However, we can think of the U.S. understanding of the South African program in three periods. First, from immediately after World War II until the suspension of cooperation in the early 1970s, the United States was generally aware of what the South Africans were working on. The intelligence community was knowledgeable about South African uranium reserves, their desire to compete on the world market for exporting nuclear fuel, and their desire to develop a domestic nuclear energy capacity. South African efforts to develop PNE capability were not only known to the United States but encouraged. The exclusion of nuclear cooperation from the 1963 arms embargo undoubtedly helped South Africa's pursuit of nuclear weapons but also permitted continued U.S. involvement. Most, if not all, of this information came through multiple channels of governmental and commercial engagement.

The second period, as South Africa commissions the Y-Plant and the United States withdraws cooperation and assistance, results in fewer channels. The only access to the indigenous enrichment method is what South Africa chooses to reveal and there is no evidence that the intelligence community had verifiable knowledge that South African scientists had developed a design for a gun-type nuclear device, though some assessed that they most likely had the capability to do so. Thus, the Kalahari test site is selected and prepared with no apparent confirmation by U.S. analysts. The Soviet satellite photos come as a shock to the Carter Administration and the United States is compelled to support the arms embargo.

The third period results in an improvement of U.S. analysis. We can assume that increased U.S. scrutiny of the nuclear program follows the 1977 Kalahari incident, but so does cooperation with the South African government in countering leftist groups in the region. Contacts between intelligence and military entities of the two countries likely resulted in some of the “general accuracy” of assessments seen particularly in the 1984 NIE. Increased commercial contacts with the nuclear industry may have provided some insight as well. Having more channels does not mean certain success, however. In this particular case U.S. analysts appear to have been misled by the increased communication channels. Attention was focused on the implosion research at AEC and not on the actual threat of gun-type weapons at Advena. Nonetheless, in this third period with more channels available U.S. understanding of the program did improve.

H3: Successful long-term deception will benefit the deceiver by providing an advantage during discrete interactions with the United States over the course of the program, even if the program is not entirely concealed.

The South Africans did gain benefit by achieving opacity regarding their nuclear weapons program. The renewed assistance in the early 1980s provided a boost for their stagnant nuclear power industry and, despite the arms embargo and sanctions due to apartheid, they continued to construct nuclear devices without being countered by the United States.

Thankfully, the South African government was never forced into the second and third phases of their strategy and U.S. officials were not forced to decide whether to intervene to stop the potential use of nuclear weapons. It is difficult to predict how U.S. officials would have responded to a South African request for assistance with nuclear weapons as leverage. The possession of the weapon would likely not have come as a surprise, though officials would have had to quickly ascertain how serious and realistic the South African threat was.

If South Africa’s deception had been mitigated ahead of this phase, U.S. officials could have privately assured Pretoria of assistance or conversely informed them that no assistance would be given under threat. Either way, U.S. officials could have argued for a halt to the nuclear weapons program by stating the conditions under which they would consider providing assistance in the future.

Conclusion

The South African deception was meant to ensure that there was not a repeat of the 1977 diplomatic disaster. The South Africans’ goal for U.S. action was to have the United States do nothing at all over their continuing progress toward a weapon, though the South African government likely would have settled for a lack of consensus that limited U.S. action. This case

is complicated by the fact that anti-apartheid legislation resulted in adverse U.S. actions toward South Africa on several occasions that were not related to the nuclear weapons program. But as long as the United States was in a position to be surprised and concerned (though not, as discussed, overly shocked) when the South Africans approached them in a moment of crisis, the South African deception would have been successful. Judging by the fact that the U.S. intelligence community does not seem to have identified the South African three-phase strategy and its implications for policymakers, we can say that even without the crisis the South Africans accomplished their goals.

	Fact	Fiction
Reveal	* Pronouncement (1988) by PM Botha that RSA could make nuclear weapons if it desired. * SAAF public statements (1976) that Buccaneer bombers practicing nuclear delivery. * Comments by Army CoS (1968) that RSA was prepared to manufacture nuclear arms. * AEB announcement that it was capable of producing a bomb following projectile tests in 1974. * Vorster 1975 announcement that Y-plant had gone into operation. * RSA refusal to place Velindaba under safeguards to protect proprietary technology. * SADF chief Sep 1979 statement that enemies may discover RSA had weapons they did not know about. * Arrests of four Kentron employees in the UK for arms control violations involving Buccaneer aircraft (March 1984). * Statements to the US that RSA was threatened by Soviet and other forces and would not sign NPT to set the minds of attackers at rest.	* Vorster statement to Carter in 1977 that RSA did not have weapons and was not planning to have or test one. * Suggestion that 1979 incident was accident on a Soviet Echo-II. * Denial or rumors that French assistance had been offered on weapons technology (revealed by Gerhardt). * Exec Chair of AEC states in 1986 that RSA enrichment is advanced, but 3.25% currently being performed is insufficient for weapons. * Initial ARMSCOR press release indicated Kalahari test site reopened and shed constructed in 1987 (before Angola peace talks). Was not actually done until 1988. * Statement by RSA FM that Kalahari test site had no connection to a nuclear program. * Statements in 1981 to US officials that RSA would adhere to the spirit of the NPT.
Conceal		

Table 6-1 Diplomatic Aspects of South African Nuclear R&D Deception

	Fact	Fiction
Reveal	* RSA received extensive assistance and training from abroad in the 1950s and 1960s, so nuclear knowledge was clearly present as country began to focus on weapons. * Between 1968 and 1974, the number of nuclear-related scientific articles by RSA scientists more than doubled.	
Conceal	* Scientists transported to Advena facilities in minibuses with frosted windows so they would not be observed working in the new facility. * Nuclear Energy Act (1982) makes it illegal to divulge any information concerning uranium reserves, or actual/potential output without permission. * Supplementary oaths administered to nuclear program personnel for non-disclosure. * Clearance system and security management shifted from SADF to ARMSCOR once decision to pursue a weapon was made.	* Joint security team established at Advena for clearances, cover stories, and physical security. * Establishment of Witvei Committee by Botha to coordinate decisions on nuclear devices. * Cabinet and State Security Council not informed of the nuclear weapons program.

Table 6-2 Human Capital Aspects of South African Nuclear R&D Deception

	Fact	Fiction
Reveal	* Establishment of the Uranium Enrichment Corporation in 1970. * Visit by RSA and Israeli military officers to Marion Island to develop plans for a runway capable of landing heavy transport aircraft to support a testing support facility in 1986.	* Weapon engineering facility with Girotek known as "Circle Facility" in an attempt to confuse its identity with Kentron Circle, a recruiting and procurement front for the nuclear weapons program. * Holes to vent accidental explosions in the Advena building disguised to appear as ventilation shafts. * ARMSCOR work focused on safety and production, not follow-on development. Meanwhile AEC continued to draw attention of Western intelligence services with its focus on advanced designs and proximity to the Y-plant HEU facility. * Reactor Development Division noted in AEB materials as being responsible for "applications of nuclear technology in the broad sense." * Reactor Development Division overtly focused on breeder reactors, but that research was inconsistent with large facilities.
Conceal	* Advena facility completely non-descript. The only clue to secrecy is a large embankment made to obstruct the view from a nearby roadway. * Advena managers blocked proposals to put communications gear on the roof to reduce signature. * ARMSCOR and SADF security personnel instituted a document system that classified almost everything Top Secret, assigned control numbers, and prohibited any photocopying. * Directive to Marion Island scientists not to discuss the RSA/Israeli visit in 1986 with anyone.	* Concentric layered security at each facility to secure program. Up to five levels at the most sensitive sites.

Table 6-3 Infrastructure Aspects of South African Nuclear R&D Deception

	Fact	Fiction
Reveal	* RSA leaked details of the Velindaba enrichment plant to diffuse speculation (the plant was known to most of the world but its capabilities were not).	
Conceal		

Table 6-4 Special Material Aspects of South African Nuclear R&D Deception

	Fact	Fiction
Reveal		* Acquisition of precision-coordinate machine from Italy done legally, but the machine was diverted to Advena for weapons development. * RSA worked through "Gamma Systems Associates," a subsidiary of US firm International Signals Corporation, to acquire dual-use components through shell companies starting in 1975.
Conceal	* Development of the Jericho-2 missile with Israel. * Advena facility had few and simple machines. RSA did not want to be detected purchasing more advanced equipment.	

Table 6-5 Other Material Aspects of South African Nuclear R&D Deception

	Fact	Fiction
Reveal		* RSA scheduled the test of a new conventional rocket near the Kalahari test site in 1977 to divert attention. * Military again conducted exercises near test site in 1980s to divert attention from test preps. * AEB identified Kalahari test site, but land was purchased and run by SADF as a military facility. * Decoy artillery pieces and military vehicles placed near Kalahari test sites to give the appearance of a conventional range.
Conceal	* Water removed from test shaft during mid-1980s preparations couldn't be dumped, so it was put in containers and taken away by truck at night. * JARIC brought in to assist with re-rigging and instrumenting the Kalahari site due to their familiarity with satellite imagery. * Attempt to conduct a test at the Kalahari site (1977). * Shed built over one Kalahari test shaft to prevent notice. * Crash breakdown of the Kalahari test site following discovery by satellite in case inspections were conducted.	

Table 6-6 Test and Evaluation Aspects of South African Nuclear R&D Deception

7. Analysis, Recommendations, and Conclusions

This dissertation was guided by three research goals. Those goals were to build upon the literature on strategic deception specifically with regards to long-term efforts, to develop and test a framework for the analysis of possible long-term R&D efforts involving deception, and to propose a hypothesis that addresses what the analysis of deception might tell us about a state's foreign policy and security goals. This chapter addresses each of these goals, evaluates the findings of the research, and makes recommendations for the study and analysis of long-term deception in the future.

Analysis of Deception in Long-term R&D Programs

India, Iraq, and South Africa each pursued nuclear weapons for numerous reasons. Some of these reasons were distinctive to the particular state but many were common. Four broad themes emerged during the case study research and capture the motivations that may drive states to pursue nuclear weapons in the future:

- 1) **The perception that security threats cannot be overcome with only conventional means.** A state's conventional capabilities may be insufficient and an upgrade that would make them more effective may be too costly or not practical for the state. The case of India is a good example of this. The Chinese defeat of India in 1962 and New Delhi's lack of confidence that it could decisively defeat Pakistan made nuclear weapons acquisition a more attractive option.
- 2) **Uncertainty as to defense assistance in the event of attack.** The defense policies of many states during and after the Cold War have been defined by their belief in whether allies would come to their aid when required. A state may find itself without allies that can provide assistance, or may not have faith in the promises of an ally. South Africa is one example of a state that believed the West, particularly the United States, should assist it if required. But Washington's continuing rhetoric on apartheid left South African officials unsure. Nuclear weapons can be a way to gain leverage on an ambivalent ally or a means to ensure the ally's assistance is not required.
- 3) **National or ethnic pride.** An advanced and accomplished society may bristle at the prospect of not achieving scientific breakthroughs that others have – particularly when such achievements are codified in agreements such as the NPT, as was seen with India.

Additionally, governments or individual leaders may seek to lead their regional or ethnic groups and attainment of such powerful weapons may be one way to make that claim. Such was the case with Saddam Hussein in Iraq, who desired to lead the Arab world and believed nuclear weapons would give him legitimacy against the Saudis in standing up to Iran and Israel.

- 4) **The belief that nonproliferation agreements (and other arms control regimes) should not stop states from being able to defend themselves.** This is particularly strong when the state believes that norms are being unevenly enforced. This was evident in two cases. The Iraqi government made repeated statements against what it viewed as light treatment of Israeli nuclear weapons development by the United States. Indian officials argued that China – a NPT signatory – had not been deterred in any way from providing nuclear weapons assistance to Pakistan.

Each of these motivations remains present in international relations today. Several states, including Iran, arguably face security threats that their conventional capabilities would not be able to overcome if required. Events such as the Russian incursion into Ukraine and Chinese actions in the South China Sea have several U.S. allies questioning whether the United States is a truly reliable defense partner. Ethnic divisions in several regions, most notably the Middle East, continue to create a space for leaders wishing to position themselves as leaders with moral authority both within and beyond their borders. National governments, as well as the United Nations, continue to be accused of turning a blind eye to transgressions by some states while taking a firm stance against suspected nefarious plans by others. It is clear from these themes that numerous motives for development of nuclear weapons remain. States with established scientific communities and infrastructure now have access to the theory and process behind the various paths to a weapon. Multiple potential motives and multiple types of weapons development result in a range of means to be deceptive in order to protect the R&D effort.

Chapter 1 detailed the assumption that deception is a necessary part of every nuclear weapons R&D program now and for the foreseeable future due to several factors, including international nonproliferation regimes and advancements in intelligence and monitoring systems. Nothing in the research conducted for this dissertation contradicted that assumption. In each case that was considered or included in the study, there was evidence that some form of coordinated deception had taken place. The only exception was Sweden, which will be discussed later in this chapter when the framework itself is evaluated. In the 1950s, the Swedish government was largely forthcoming with U.S. officials about its consideration of nuclear weapons development. Had the Swedish government been faced with the choice to pursue nuclear weapons only after the emergence of nonproliferation regimes and modern intelligence capabilities, it either would have immediately decided not to pursue the weapons or would have

had to have been deceptive. To do otherwise would have resulted in Swedish nuclear R&D becoming a significant dominant issue between the two countries – an uncomfortable development for Swedish officials attempting to maintain good relations with both East and West during the Cold War. Stockholm would have had to do its best to keep discussions of nuclear weapons off the table or abandon its nascent program.

However, the mere identification of deception as a necessary component of a nuclear weapons R&D program results in few actual recommendations. As detailed in Chapter 2, deception comes in numerous forms, with different goals, methods, and features differentiating these forms. Perhaps most prominent among these features is the length of time involved in the deception. In traditional MILDEC, deception is focused on eliciting a specific desired response from the target that will facilitate the achievement of a specific objective. It is therefore usually a short-term effort in which the deceiver seeks to misdirect, rather than confuse, the target.

One might argue that long-term deception, rather than being a coherent concept, is simply “lots of little deceptions.” It is true that there is often not a coherent plan or a single coordinating element from the beginning of these deceptions. Governments and policy priorities change, and other issues become more significant. Many events happen in the course of the R&D program by chance. All of these changes, often unforeseeable at the start of the deception effort, influence whether the deception will ultimately be successful (Mihalka, 1980, p.24). In these cases, officials responsible for planning and managing deceptive activities often begin with a situation already in progress. For example, nuclear weapons research may have progressed beyond a point that can be admitted, or the target’s policymakers and intelligence agencies may already be suspicious. While coordinating complex activities across the bureaucracy, the long-term deceiver must adjust to changing conditions in the international and domestic environments and adapt the deception as the R&D program evolves. There are likely to be periods where aggressive disinformation is necessary and other periods where the planner will seek to transmit as few signals as possible – whether factual or fictitious. Thus, even to the deceiver long-term deceptions may not appear to be coherent concepts. They are indeed “lots of little deceptions” strung together.

The point of view of the intelligence analyst must be entirely different. The intelligence analyst seeks to deconstruct and mitigate the deception by detecting incongruities in the story or observing convincing signatures that the deceiver was unable to conceal or manipulate. To the analyst, there is little to be gained by looking at long-term deception as something with a coherency that can only be observed with hindsight. An analyst working in 1938 London to evaluate Berlin’s claim that it had fielded Europe’s most advanced air force would have been poorly served by limited the scope of the data considered only to the duration of Hitler’s government or an arbitrary timeframe. If Germany truly possessed this capability, pilots would

have had to be trained and given proficiency, raw materials would have needed to be produced, aircraft would have had to be assembled and tested, and airfields would have needed to be constructed. These actions, and the deceptive measures used to protect them, would have resulted in observable signatures – signatures that would be missed if the analyst took a time-limited or non-systematic approach to finding and evaluating information.

There are proven analytic techniques to bring to bear in the assessment of isolated events, many of which take deception into account.¹¹ But if the analyst considers events only as isolated and disconnected then he or she is susceptible to the effects of long-term deception. The Indian claim prior to the 1998 tests that a comprehensive review of nuclear policy was taking place that would preclude testing for at least several months is one such example from the research. Taken on its own, this development is logical and credible. A new party taking control of government, a lack of clarity in nuclear weapons capability and policy, and a recent history of U.S. wariness all combine for a good opportunity for New Delhi to pause and consider its next move. U.S. officials seem to have evaluated the Indian claims this way.

As discussed in Chapter 4, this claim of a pause in nuclear policy was perhaps the most directly misleading diplomatic action of the Indian deception and when placed in context appears less credible. The Indian government had attempted nuclear testing in 1995 and 1996 before being discovered by the United States and that had followed New Delhi's refusal to agree to the CTBT or NPT extension in the same period. In addition, Prime Minister Vajpayee's consistent statements on the necessity of nuclear weapons for India and the BJP's 1998 campaign rhetoric all pointed towards a government policy of testing. In the framework utilized throughout this dissertation, all of these actions were "reveal fact" actions that were not hidden from U.S. analysts. Identification of preparations at the Pokhran test site either through satellites or human sources would have strengthened the argument that India was preparing to test. In the context of these signatures that were observed over a period of time, a "nuclear pause" does not appear as a logical and sensible action but as a policy reversal by a newly-elected government that had promised to acquire nuclear weapons.

A systematic assessment of the signatures that an analyst observes from a state over a period of time is the only means by which a long-term deception effort can be identified and mitigated. Over the course of the time required to research and develop a nuclear device, the deceiver will

¹¹ One such method is analysis of competing hypotheses (ACH), which is described in detail in Richards J. Heuer's *Psychology of Intelligence Analysis* (2007). This technique involves developing as many reasonable hypotheses as possible to address the question of interest. The available evidence is then considered with regards to each of the hypotheses to determine the relative likelihood of each hypothesis and how sensitive the conclusions are to the various pieces of evidence. Deception can be considered through this approach by making one or more hypotheses reflect the possibility that the evidence is meant to deceive the analyst. This technique may be appropriate and effective in evaluating the potential that an event is, in fact, deception.

be unable to prevent every incongruity from becoming visible. Whether due to bureaucratic friction, wild card events, or physical activity such as test preparations these incongruities give intelligence analysts their best opportunities to identify deception. Though not likely to be “smoking gun” evidence of a R&D program, such evidence will make the case for increased scrutiny of the deceiver’s activity. The framework presented and used in this dissertation is one means of conducting a systematic assessment of signatures.

Analysis of the Framework

This framework assists the analyst in categorizing data from across the potential proliferator’s efforts in a logical manner. As discussed previously, it places events such as the fallacious Indian claim of nuclear review in context. It also counters the challenge of maintaining alertness while analyzing long-term programs. Analysts and agencies may be unable to stay focused on an area or issue for an extended period of time, particularly if the issue is not in the forefront of policy debates. This was also evident in the case of India, as it appears that analysts were not closely monitoring Pokhran for test preparations despite having detected them just two years prior at the same site. This oversight is understandable, since by 1998 other priorities had surpassed potential Indian development. But it shows the difficulty in maintaining focus when resources and assets are limited. An analytical approach that relies not on continuous monitoring but on capturing information that has been collected through various channels over time can mitigate this issue.

While identifying trends of deception that might otherwise be missed, the framework also serves as a check against tendencies on the other end of the analytical spectrum –oversensitivity to deception. Heuer states that policymakers and analysts can be “attracted to deception as an explanation for otherwise incongruous events, because this explanation imposes order and reason on an otherwise disorderly set of data, and it enables us to attribute deviousness and malevolence to our enemies” (1981, p.319). The framework should mitigate this tendency to a large extent. It provides structure to the analysis, provides the opportunity to recognize coordination and place it in context, and identifies gaps in knowledge without which definitive statements on the potential proliferator’s actions cannot be made. The analyst can then request collectors focus on particular areas of the proliferator’s activity.

This dissertation used the proposed framework not only to formulate hypotheses, but also to determine where common themes existed in cases of long-term R&D that differed in time, country, and even the intended type of weapon to be developed. The categorization of similar data points from the various cases resulted in generalized statements that reflected the basic action without the case-specific particulars. For example, “establishment of the Special Security Organization to pursue gaseous diffusion” in Iraq and “establishment of the Central Bureau for

German Rearmament” in the German case would both fall under “task force or organization created to coordinate the program across sectors or ministries.” A separate example is that of false identities. The posting of a German military attaché in Moscow under a pseudonym, the issuance of false passports to Iraqi scientists so they could travel to other countries to pursue procurement leads, and the false military ranks and pseudonyms given to Indian scientists involved with test preparations at Pokhran are all examples of “cover identities for individuals who would not normally require them.” When categorized in this manner, the data from the two hypothesis-generating cases yielded examples from every category of action within the framework, as can be seen in Table 7-1. The framework is thus a comprehensive way of sorting collected information relevant to a R&D program if sufficient visibility of signatures exists.

Next, the themes were evaluated to determine which were common to both the hypothesis-building and theory-confirming cases. It was not necessary for the theme to be found in more than one case to satisfy this condition, just one (at a minimum) from each category. While not every category within the framework continued to show themes, the majority of the categories and themes were found to be common between the nuclear and non-nuclear cases, as can be seen in Table 7-2. This shows the framework and analytical approach may be insightful for various types of long-term efforts. Some modification will be required specific to the program goals and definition of “special material;” nonetheless such an approach will benefit the analyst by permitting the logical sorting of information and identification of areas that require more collection.

One reason why cases were grouped into the “theory-confirming” category was that less data was available about them, particularly regarding the inner workings of the case’s R&D program. We can therefore expect to see gaps between what was expected based on the hypothesis-generating cases and what has actually been observed or researched. In Table 7-2, the themes that were present in the hypothesis-generating cases but not in the theory-confirming cases are highlighted in red. These differences merit closer examination.

The most striking difference between the two tables is the lack of data in the “Conceal Fiction” column for the Special Material, Other Material, Finance and Budgeting, and Test and Eval lines of effort. This is partially attributable to the coding rules that were established for the research. For example, the use of the Nassr Establishment in Iraq as a means of illicit procurement could logically be counted as an internal action in the Special Material and Other Material lines of effort. But because Nassr affected multiple lines of effort in different ways, it was coded as part of Infrastructure – the overall system enabling the R&D. Regardless, it is clear that information in this category was available in the hypothesis-generating cases but not in the theory-confirming cases. Possible explanations include the data existing and not being seen or a fundamental difference in the nuclear R&D cases that makes those categories not applicable.

	Reveal Fact	Conceal Fact	Reveal Fiction	Conceal Fiction
Diplomacy	* Release of information in line with international agreement permitting some possession of materials or research * Official statements condemning disparity in technology or capabilities between states. * Collaboration with other states * Changes in government policy * Comments by officials not reflected in broader government policy	* Establishment of unacknowledged facilities and/or organizations * Failure to disclose possession of material as required by agreements	* Structured sharing of information (guided tours of facilities, presentations with no independent sources of information) * Government statements contradicting evidence * Claims that research and efforts only peaceful in nature.	* Confusion or ignorance within the deceiver's diplomatic corps * Other parties or political groups excluded from the decisionmaking process.
Human Capital	* Unexplained proficiency or accomplishments for personnel within program * Establishment or increased resource allocation to training institutions	* Lack of expected articles, reports, or commentary from experts involved in program * Families/associates unaware of individuals' locations * Lack of identifiable training pipeline	* Cover identities for individuals who would not normally require them	* Compartmentalization, creation of a "group within the group." * Additional CI/security involvement * Additional benefits for specialists (increased pay, special privileges, etc.)
Infrastructure	* Creation, maintenance, or diversification of industrial organizations with state backing * Construction of new facilities	* Self-contained facilities * Facilities in remote or illogical locations * Covers and other means of visual obstruction * Concealed relationship between organizations	* Establishment of organizations with concealed ties to the government * Organizations with general, nondescriptive, or illogical names and mission statements * Sites and buildings configured to appear innocuous	* Task force or organization created to coordinate the program across sectors or ministries * Designation of special or high-security areas within facilities that would appear unnecessary for the building's stated purpose.
Special Material	* Public displays of weapons or systems * Public government statements or documents * Treaty declarations	* Illicit acquisition of materials * Activity in facilities that are protected from observation	* Masking of military activity as civilian * Mislabeling of material * False declarations	* Controlling organization for illicit acquisition that understands actual needs of program and generates legend for deception
Other Material	* Change in acquisition or production of raw materials * Export restrictions on necessary components * Increase in indigenous production of "dual-use" components	* Illicit acquisition of materials	* False overseas organizations for illicit or false acquisition of necessary components * Fraudulent acquisition of equipment through other ministries or entities.	* Controlling organization for illicit acquisition that understands actual needs of program and generates legend for deception
Finance and Budgeting	* Budgets showing state support of military and scientific research	* Program funding through other ministries or organizations * Use of excess funds in budget for programs not specified in public documents	* Misrepresentation of budget requirements	* Organization or individuals designated to conduct resource allocation counter to that in approved documents
Test and Eval	* Support systems that are not restricted are visible and periodically used/tested	* Applications of support systems not revealed * Full capabilities concealed * Testing in remote or unsuspected locations * Shielding of test facilities from overhead imagery.	* False declaration of capabilities * False markings on equipment * Alternate explanations for test facility * Explanations for impact of testing (explosions, accidental outbreaks, etc.)	* Coordinating authority to ensure testing conducted and explained effectively

Table 7-1 Combined Themes of Hypothesis-Generating Cases

	Reveal Fact	Conceal Fact	Reveal Fiction	Conceal Fiction
Diplomacy	* Release of information in line with international agreement permitting some possession of materials or research * Official statements condemning disparity in technology or capabilities between states. * Collaboration with other states * Changes in government policy * Comments by officials not reflected in broader government policy	* Establishment of unacknowledged facilities and/or organizations * Failure to disclose possession of material as required by agreements	* Structured sharing of information (guided tours of facilities, presentations with no independent sources of information) * Government statements contradicting evidence * Claims that research and efforts only peaceful in nature.	* Confusion or ignorance within the deceiver's diplomatic corps * Other parties or political groups excluded from the decisionmaking process.
Human Capital	* Unexplained proficiency or accomplishments for personnel within program * Establishment or increased resource allocation to training institutions	* Lack of expected articles, reports, or commentary from experts involved in program * Families/associates unaware of individuals' locations * Lack of identifiable training pipeline	* Cover identities for individuals who would not normally require them	* Compartmentalization, creation of a "group within the group." * Additional CI/security involvement * Additional benefits for specialists (increased pay, special privileges, etc.)
Infrastructure	* Creation, maintenance, or diversification of industrial organizations with state backing * Construction of new facilities	* Self-contained facilities * Facilities in remote or illogical locations * Covers and other means of visual obstruction * Concealed relationship between organizations	* Establishment of organizations with concealed ties to the government * Organizations with general, nondescriptive, or illogical names and mission statements * Sites and buildings configured to appear innocuous	* Task force or organization created to coordinate the program across sectors or ministries * Designation of special or high-security areas within facilities that would appear unnecessary for the building's stated purpose.
Special Material	* Public displays of weapons or systems * Public government statements or documents * Treaty declarations	* Illicit acquisition of materials * Activity in facilities that are protected from observation	* Masking of military activity as civilian * Mislabeling of material * False declarations	* Controlling organization for illicit acquisition that understands actual needs of program and generates legend for deception
Other Material	* Change in acquisition or production of raw materials * Export restrictions on necessary components * Increase in indigenous production of "dual-use" components	* Illicit acquisition of materials	* False overseas organizations for illicit or false acquisition of necessary components * Fraudulent acquisition of equipment through other ministries or entities.	* Controlling organization for illicit acquisition that understands actual needs of program and generates legend for deception
Finance and Budgeting	* Budgets showing state support of military and scientific research	* Program funding through other ministries or organizations * Use of excess funds in budget for programs not specified in public documents	* Misrepresentation of budget requirements	* Organization or individuals designated to conduct resource allocation counter to that in approved documents
Test and Eval	* Support systems that are not restricted are visible and periodically used/tested	* Applications of support systems not revealed * Full capabilities concealed * Testing in remote or unsuspected locations * Shielding of test facilities from overhead imagery.	* False declaration of capabilities * False markings on equipment * Alternate explanations for test facility * Explanations for impact of testing (explosions, accidental outbreaks, etc.)	* Coordinating authority to ensure testing conducted and explained effectively

Table 7-2 Common Themes between Hypothesis-Generating and Theory-Confirming Cases

Perhaps the clearest example of “Conceal Fiction” in these lines of effort from the hypothesis-generating cases was the alternate means of funding established in both the German rearmament and Soviet BW cases. In Germany, the excess funding of Navy programs and separation of budgets into “white” and “black” versions were potentially observable internal actions (Suchenwirth, 1968, pp.159-160). In the Soviet case, the separate mechanism established within GOSPLAN was sufficiently unusual as to merit notice by others involved with managing the Soviet budget (Alibek and Handelman, 1999, p.43). It is illogical to say that such actions were unique to the German and Soviet cases or not applicable if a state’s R&D is nuclear in nature, yet the researched yielded almost no data points in the Finance and Budgeting line of effort from the nuclear R&D cases and no common themes in this category at all. Presumably India, Iraq, and South Africa all had means of moving funds to the R&D program that were extraordinary and clandestine. Furthermore, if special material, other or dual-use material, and testing are parts of the R&D program then the same coordinating activity that is facilitating the diplomatic, human capital, and infrastructure internal activities is likely facilitating this activity as well. Therefore, the absence of theory-confirming case data in these “Conceal Fiction” categories attests to the difficulty in collecting such data, but does not mean that such signatures do not exist.

One additional theme that was not found in the nuclear cases was a lack of expected journal articles and other research by experts involved in the program. This was certainly true of the Soviet BW program, which kept numerous world-class experts in microbiology, virology, and other disciplines from publishing and sharing their work. It did not hold true for the nuclear R&D cases. Iraqi scientists were not publishing but also do not seem to have been considered leaders in their fields. There is no mention of any notice being taken that Iraqi scientists were not generating the expected amount of research. Whereas in the South African case, analysts at Lawrence Livermore National Laboratory actually noted an increase in published research on topics relevant to nuclear weapons production at the time when it appears the effort to design a device was underway (LLNL, 1977, p.34).

This may be a key difference between the various types of R&D efforts. In the German case, which was focused on production of conventional weapons, there would be little reason to focus on the research of Ph.D. candidates and scientific journals. A survey of such activity would be unlikely to reveal work on a new ICBM or stealth fighter technology. In the case of biological weapons, such high-level research can only be conducted when in possession of materials and pathogens that are tightly controlled by international agreement. Any noticeable research in these topics must be explained without arousing suspicion. Since that is difficult to do for most countries, the state would have an incentive to hide such research. But in the case of nuclear R&D, many of the relevant topics have general uses in other areas. Research in physics,

metallurgy, and many other disciplines has applications in the medical, industrial, and energy sectors as well. Keeping such research completely controlled is an indicator itself, as seen in the Livermore analysis. Thus this is one category where a substantive difference between the types of cases was found and the theme of withheld research does not appear in the nuclear cases.

Analysis of the nuclear cases yielded several themes that were not found in the hypothesis-generating cases. These themes are shown in Table 7-3.

	Reveal Fact	Conceal Fact	Reveal Fiction	Conceal Fiction
Diplomacy		* Vague statements about the purpose of research or extent to which it has been pursued.		
Human Capital	* Shift from foreign to indigenous training of personnel.	* Irregular use of foreign/native personnel (construction of facilities by native personnel when normally constructed by foreign contractors).		
Infrastructure				
Special Material				
Other Material	* Changing capabilities in other efforts, such as delivery systems.	* Illicit improvement in capabilities in other efforts, such as delivery systems.	* Diversion of equipment for unapproved purposes.	
Finance and Budgeting				
Test and Eval				

Table 7-3 Distinctive Themes in the Theory-Confirming Cases

This analysis resulted in several relevant points. The first is that no distinctive nuclear-only themes were identified in the Special Material line of effort, despite special nuclear material being a focal point of program assessments. The explanation for this is that special material in all of the cases was defined as material prohibited by treaty or convention. Whether the material in question was airframes in Germany, pathogens in the Soviet Union, or special nuclear material, the concept of needing to acquire the material through illicit means due to treaty restrictions is the same throughout the cases. The tighter and broader the material restrictions in an arms control agreement, the more the proliferator will be compelled to undertake deception as seen in Table 7-2.

A second noteworthy element of Table 7-3 is the theme of supporting systems in the Other Material line of effort. These points were not seen in the hypothesis-generating cases, though presumably they would be seen in a case of biological or chemical weapons development in a state that also needed to develop delivery systems. This is a reminder that the development of a weapon alone does not constitute capability, and the means to deliver and even the development of doctrine may also lead to signatures. In his research in Indian nuclear development, Gaurav Kampani noted that the development of delivery systems, in this case ballistic missiles and capable strike fighters, did not match the timeline of nuclear device development (2014, p.88). This is an important note for analysts of suspected nuclear programs. Assessment of these

efforts should coincide with assessment of whether the state possesses or is developing means of delivery.

Finally, a very basic analysis was conducted of the data seen in the three theory-confirming cases. Table 7-4 shows the frequency with which data was seen in each category of the framework in these cases. Green indicates all three cases are represented, yellow indicates two cases, orange one case, and red indicates no data was seen. The most significant categories are those that contain information in all three cases and those that contain none.

	Reveal Fact	Conceal Fact	Reveal Fiction	Conceal Fiction
Diplomacy	Green	Yellow	Green	Yellow
Human Capital	Yellow	Green	Yellow	Green
Infrastructure	Orange	Green	Yellow	Yellow
Special Material	Yellow	Yellow	Yellow	Red
Other Material	Orange	Yellow	Yellow	Red
Finance and Budgeting	Red	Red	Orange	Red
Test and Eval	Orange	Yellow	Yellow	Red

Table 7-4 Frequency of Data in Theory-Confirming Cases

All three theory-confirming cases showed coordination of deception in the Human Capital line of effort. This coordination included management of the specialists involved with the program, extraordinary rules limiting personnel from contact with foreigners or even with their own families, and selection of personnel within the government to have knowledge of the program. This line of effort is central in denial as well, with all three cases exhibiting signatures involved with concealing factual information about the personnel involved with the program.

In general, the Diplomacy, Human Capital, and Infrastructure lines of effort appear to provide significant factual and fictitious information to the deception target. However, there were significant data points in the other four lines of effort as well. Given the presence of data in almost all of the categories in the hypothesis-generating cases, it is likely that in any given case potential signatures exist in each of these categories. The lack of available data may indicate the

difficulty in gathering information in these areas. If observed, however, analysts would be greatly aided in their efforts to identify deception and the presence of a R&D program.

Sweden – The Dog that didn't Bark (or Deceive)

The framework appears effective in categorizing information and identifying areas for further research to identify deception. But it is prudent to ask whether analysis of any advanced state with infrastructure and a thriving scientific community would not also appear to be deceptive with such an approach. To address this, research included an additional case that involved a nuclear weapons R&D program but that was not deceptive.

Though now a firm supporter of nonproliferation regimes and efforts, Sweden initially explored nuclear weapons after World War II. Sweden has many similarities to the other nuclear cases in this dissertation, though it does not meet the definition of “pursuit of nuclear weapons” that would otherwise qualify it for this research. The Swedish government never made a cabinet-level decision to construct a nuclear device; in fact the Swedish government went to some lengths to avoid making any such decision. There is no evidence Sweden focused on developing single-use technology, nor did it make a move toward weaponization. Nevertheless, Swedish scientists, supported by the government, did conduct several years of research into the design and construction of nuclear devices. Facilities were planned and constructed to support a potential nuclear weapons program. Military planners projected the impact of Swedish nuclear weapons on future conflicts and began to develop doctrine for the use of such weapons. Finally, and distinctive to this case, Swedish diplomats and military attachés communicated their consideration of nuclear weapons development to their U.S. counterparts. Though the Swedish R&D program was highly secret, no deception was employed to keep the United States from knowing Swedish intentions and capabilities.

An extensive literature review of the Swedish nuclear weapons effort is presented in Appendix C. The information in this chapter describes how the program differed from those that employed deception and how this appears when analyzed through the framework. Tables C-1 through C-6 show the results of the research within the framework. When placed within the framework, the data on the Swedish R&D program shows a noticeable lack of information in the “Reveal Fiction” and “Conceal Fiction” categories. In fact, the only possibly deceptive action was in framing the research as a civil protection program. That is disputed by some scholars, who point out that civil protection was the purpose of the research approved by the government while actual nuclear device design was undecided. Arguably, this action was more a function of a distinctive decision process rather than an attempt to protect the program through deception.

The Swedish nuclear weapons program, despite being only exploratory in nature, had many of the same traits as the other nuclear weapons R&D efforts researched for this dissertation. But

we see in this framework and in the description of the program in Appendix C that there is little to no deception. Organizations such as Atomenergi and the government's Atomic Weapons Committee were named appropriately. Multiple channels were established by the Swedes to communicate with the U.S. government regarding their potential desire for nuclear weapons and the option to develop indigenously. Most importantly, Swedish officials did not seek advantage over their U.S. counterparts by manipulating information. Certainly, their program was secret and much of the information on it was concealed from the United States and their own public, but they were not deceptive. Categorizing information known about the Swedish effort in the framework shows this. Other potential R&D programs that are handled in a similar nature should not produce false positives for deception.

Framework Conclusions

This framework is an effective way to categorize information in a logical manner that will aid an analyst in "building a case" that covert R&D is taking place. It provides three advantages. The first is that by categorizing the coordinating activities under "conceal fiction" when they are observed, it provides context to other information received. Knowledge of an extraordinary funding or decision making process may, by itself, not indicate anything. It is lost in the "noise" of observed signals. But knowing that such mechanisms exist and observing activity in the other lines of effort gives the analyst the opportunity to see through the "noise" and see these coordinating activities in context. It may provide the lead the analyst needs to identify the larger R&D program.

The second advantage is that this framework operates largely independent of time. Data that has been received over a significant amount of time can be categorized by effort and action type rather than on a timeline and a "big picture" of the effort can be seen. This is not to say that methods such as Analysis of Competing Hypotheses (ACH) on individual data points are not appropriate and their acceptance throughout the intelligence community indicates they are effective against more immediate deception. But when facing long-term deception, analytic techniques focused on individual episodes of time risks missing the linkages between smaller actions. This framework assists the analyst in assessing the totality of the effort over time rather than at a point in time.

Finally, the framework assists in active analysis. Barton Whaley notes that passive analysis is retroductive inference and constitutes the bulk of analysis that is conducted in the intelligence community. But such analysis is inconclusive if all of the key facts are not available. In programs as secret and protected as nuclear weapons programs, it is unlikely the analyst will ever have all, or even most, of the important facts. Active analysis means the analyst is proactive, proposing specific questions on which collectors can focus and generating new intelligence requirements (2007b, p.91). Active analysis can happen if the analyst knows he or she *should* be

seeing something and has no information available. The hypothesis-generating and theory-confirming cases in this study show the areas in which actions should be seen. If any of those areas are unseen, such as the gap in the Finance and Budgeting line of effort discussed previously, the analyst can generate requests for information based on this framework.

Again, the framework does not provide “smoking gun” evidence of a nuclear weapons R&D effort. But it can provide these advantages to an analyst tasked with informing policymakers on one of the hardest analytical targets.

Evaluation of Hypotheses

For the purposes of this dissertation, the framework’s primary purpose was development and testing of hypotheses. The chapters for each case presented analysis of these hypotheses specific to that state. In this chapter, the discussion focuses on the areas of the R&D program where actions relevant to each hypothesis were observed in an effort to guide future analytical efforts.

H1: The coordination of deception will result in observable signatures.

This hypothesis was validated by the evidence seen across the cases. As discussed in Chapter 2, the “Conceal Fiction” action category encompasses coordinating activity. These actions were not part of the revealing or concealing of any signal to the deception target, but rather were internal actions that, if observed by the target, indicate coordination is taking place. Each of the theory-confirming cases exhibited such actions and those actions can be categorized in four ways.

Extraordinary Measures or Activity

In the discussion of the Soviet BW program in Chapter 3, the unusual measure of military control of BW funds within GOSPLAN resulted in a potentially observable signature within the Finance and Budgeting line of effort (Alibek and Handelman, 1999, p.43). This is an example of an action that was known by many within the system, even if the exact reason was not apparent. Observation of such actions by the target, if correctly placed in context, may indicate that a high-level deception is being conducted.

Examples of this type of action exist in each of the three theory-confirming cases. One such action in the case of India was the monitoring of communications between soldiers in the 58th Engineers Regiment while they were stationed at Pokhran (Chengappa, 2000, p.25). Reactions to the monitoring indicate this was not an established practice within the Indian Army. The soldiers, officers conducting the monitoring, and most importantly the family members not getting a normal amount of information from the soldiers likely appreciated that the 58th was engaged in a particularly sensitive task – even if they did not know what the task was. In the case of Iraq, one example of these unusual procedures was the alias system for researchers within

the nuclear R&D program to obtain materials from library and archive services. The system of assigning a pseudonym that identified the researcher and the department was instituted as a security mechanism to protect the identities of those within the program (Khadduri, 2003, p.108). Finally, in South Africa “joint security teams” were established within the ARMSCOR facility not just for physical security, but also to establish and maintain cover stories for research being conducted as well as the administration of special security clearances for ARMSCOR employees (van der Walt, Steyn, and van Loggerenberg, 2003, p.80). Such teams were not seen in other South African R&D and defense programs.

Organizations Dedicated to Deception

The establishment of Biopreparat, the organization that covered Soviet BW R&D efforts, is perhaps the clearest example of an organization created specifically for deception. Biopreparat was ostensibly a civilian organization and part of the Soviet pharmaceutical sector. But its main purpose was to provide a cover for the scientists and research effort involved with the BW program. It permitted Soviet institutions to establish cooperative relationships with Western counterparts and it provided an explanation for Soviet research.

The Iraq case also showed examples of organizations that were established to conduct deception. Some of these were known to Western officials and some not. Perhaps the earliest example is the establishment of the Directorate of Studies to pursue weapons-grade materials without alerting IAEA monitors in 1982 (Obeidi and Pitzer, 2004, p.53). This organization, not known outside Iraq at the time, was proof that the Iraqis intended to pursue a nuclear weapon even after the destruction of the Osiraq reactor. Several years later, possibly while cooperating with Soviet advisors, the Iraqis established another organization. This one was a coordinating committee of intelligence organizations specifically to direct deception with regards to the nuclear weapons program, again evidently unknown to Western officials (Ritter, 1999, p.77). Better known to inspectors after the Gulf War was this organization’s successors, the Oversight Committee formed as a liaison to UNSCOM and the more clandestine Concealment Operations Committee. Both of these groups sought to convince inspectors that no credible nuclear weapons program existed (al-Marashi, 2003, p.52; Obeidi and Pitzer, 2004, p.144). South Africa provides an example of an organization used to conduct deception that was not established for that purpose. In this case, the transfer of responsibility for weapons production to ARMSCOR ensured that a group more familiar with evading arms embargos and other restrictions would be in charge of deceptive measures to protect the South African program.

The Group within the Group

Every case researched for this dissertation contained examples of groups within the proliferator’s bureaucracy being excluded from knowledge about the R&D program – an exclusion that created a potentially observable incongruity. In the hypothesis-generating example of German

rearmament, Foreign Ministry officials protested that they could not communicate with their British and French counterparts over arms because they knew they were unaware of Berlin's true policy (Mihalka, 1980, p.52). Similarly, former Soviet official Ken Alibek admits that Biopreparat officials did not share vital information with Soviet diplomats who requested clarification on Soviet activity with regards to the BWC violations alleged by the United States (Mangold and Goldberg, 1999, p.108). This left officials in the Soviet Foreign Ministry, including the minister himself, less aware of Soviet research efforts than Western officials.

The theory-confirming cases of nuclear R&D contain these examples as well, each discussed in detail in the respective chapters. The most notable is that of India's Defense Minister making repeated statements that a nuclear test was not imminent in 1998. These statements were truthful for him only because the Prime Minister and other BJP officials "in the know" did not disclose their plans to the minister – despite the involvement of members of the Defense Ministry in the deception (Sharma, 1998, p.30). Though this was an action of a newly-elected government, it continued a long-standing practice. Senior Indian military officers, including those from the air force that would be charged with delivering the weapons in the event of use, were excluded from knowledge of the R&D program well into the 1990s (Kampani, 2014, p.94). South Africa provides an example of this concept on the level of groups within the bureaucracy. The Witvlei Committee was comprised of cabinet-level officials who were informed about the nuclear weapons R&D program and authorized its activities. But this chain of command excluded the State Security Council that filled that role for other defense programs and kept many members of that council in the dark about what was arguably the country's most expensive and politically dangerous R&D effort (Lieberman, 2001, p.66).

In conclusion, the hypothesis that coordination of the deceptive efforts surrounding a R&D program results in observable signatures is supported by the data from the nuclear weapons cases. These signatures are not being transmitted through channels of communication to the target, hence it is incumbent upon the target to develop the ability to see such signatures through human, signals, and other forms of intelligence.

H2: The existence of multiple channels increases the complexity of deception and the likelihood that the target will have an understanding of the R&D program.

In many kinds of deception, a high number of channels is a double-edged sword for the deceiver. The existence of multiple channels gives the deceiver the opportunity to choose the most effective ones through which to transmit signals and the opportunity to freeze the target's bureaucracy or compel the target to act in the desired manner. But in the case of long-term deception involving a program that is likely to be generally known or suspected by the target, the presence of multiple channels provides the opportunity for the target to see activity in multiple lines of effort. It increases the intelligence analyst's ability to provide context to individual data

points and hence increases the burden on the deceiver to ensure a coherent deception message. In the hypothesis-generating and theory-confirming cases there are examples of periods where inspections and connections between subject matter experts created multiple channels and other periods where an analyst had only one channel through which to obtain information about the deceiver's efforts. Additionally, unforeseen or "wild card" events created channels of communication between the deceiver and target that provided an opportunity for the target to gain a better understanding of the R&D program. As with the first hypothesis, several categories of the data found to validate this hypothesis are apparent.

Inspections

The existence of inspections while the R&D effort was taking place is perhaps the most intuitive way to categorize the programs researched. Both cases used for generation of hypotheses were inspected and free from inspections in different periods. In the German case, the Inter-Allied Control Commission conducted inspections to verify compliance with the Versailles restrictions until being withdrawn in 1927. Though it did not uncover direct evidence of German deception, it did compel the Germans to undertake costly efforts to hide their activity – such as moving aircraft production facilities to Holland and establishing a covert air training facility in Russia. Following the withdrawal of the Commission, it became easier for German officials to build isolated facilities and conduct R&D out of the sight of Allied military attachés – the only official presence left to monitor German rearmament. In the Soviet case, the BWC had no intrusive enforcement mechanism attached and therefore Soviet BW personnel had no concern over sites being visited or inspected by Western officials. This changed in the late 1980s, when continuing protests by Western governments led Moscow to agree to permit visits by Western experts. These experts quickly suspected that more had been taking place in the Soviet laboratories than had been admitted.

The impact of inspections is seen in the theory-confirming cases as well. Neither India nor South Africa were NPT signatories during their development of nuclear weapons and both benefitted from freedom from an intrusive inspection regime. In both cases, U.S. officials understood the potential for nuclear weapons development and early progress due to collaborative efforts in both the public and private sectors. South Africa released some information about the Y-Plant and its enrichment capabilities but withheld most of the relevant information as the United States reduced its nuclear cooperation. In the case of India, some Indian facilities did operate under safeguards but those most relevant to the nuclear weapons program did not and the Indian government did not discuss their activity in-depth or permit any form of inspections.

The case of Iraq is more similar to that of Germany and is a warning that inspections do not guarantee visibility if not conducted effectively. As discussed in Chapter 3, Allied officers

certainly provided their superiors with actionable information on areas of German deception but they were unable, despite numerous unannounced inspections, to obtain “smoking gun” evidence sufficient to spur action by their governments. The liaison unit established by the German defense ministry ostensibly ensured that the Commission had access to everything, everyone, and every place it required but in reality ensured that sufficient notification was obtained prior to site visits and that responses to information requests were as plodding as possible.

Iraq was a signatory to the NPT and played on its supposed adherence to the agreement for international sympathy following the Osiraq raid. But IAEA inspectors in Iraq were delayed on their site visits, subjected to long introductory meetings where no useful information was obtained, and taken on lengthy sightseeing visits to historical Iraqi sites by their government handlers. Whatever the suspicions of these experts regarding Iraqi nuclear weapons development, they were unable to obtain evidence of Iraqi actions. After the Gulf War, however, intrusive inspections succeeded in breaking down the Iraqi deception. Though delayed significantly by Baghdad’s coordinated attempts to hide their previous nuclear weapons R&D, the persistence of UNSCOM inspectors led to numerous discoveries of concrete evidence of Iraqi actions. In summary, while inspections constitute a vital channel of information for the target they are only effective if vigorously pursued. If not, they provide at best a vague suspicion of activity.

Single Source

Reliance on only one (or very few) sources is a recurring theme that is often tied to whether inspections are taking place, but also includes other forms of collecting information on potential R&D. This was very difficult to directly see in analysis of the theory-confirming cases due to the necessity of only surveying declassified materials for insight into U.S. assessments. However, in all three of the cases it appears that such a situation existed for analysts. For example, David Kay notes that at the time of the Gulf War the U.S. government did not have a single human source within the Iraqi government that could provide credible information on Iraqi nuclear intentions or activity (2016). Policymakers and analysts were thus reliant on the results of IAEA inspections – which Iraq effectively manipulated – for insight into the program. The isolation of Baghdad following the war limited opportunities to recruit sources, or to even meet prominent Iraqi scientists and gain a sense of their work on an unofficial level.

Isolation also reduced the number of available channels in the South African case. As discussed in the previous section, the U.S. government began limiting cooperation with South African nuclear authorities due to concern over uranium enrichment and objection to Pretoria’s apartheid policies. Following the dismantlement of the program, South African claims of the amount of HEU produced were lower than production potential. The concerns of many U.S. analysts on this point indicate they were unaware of problems experienced at the Y-Plant in

August 1979 and the shutdown's effect on HEU production (Stumpf, 1995, p.4). While it cannot be definitively stated without access to information on sources available to U.S. analysts at the time, it appears that the U.S. intelligence community did not have access to information about South African HEU production while the process was ongoing.

As discussed in the India case in Chapter 4, the actions of the 58th Engineers and other involved personnel were geared towards deception through satellite imagery. This was logical since the evidence provided to New Delhi following the thwarted 1995 test was based on satellite imagery. That this deception was successful and U.S. officials were surprised by the 1998 nuclear tests indicates that U.S. analysts were relying exclusively on imagery for their assessments of the Indian program. It is possible that human or other sources actually gave U.S. officials warning and no intervention was undertaken to protect the source, but highly unlikely. U.S. intelligence officials were widely criticized for their failure to alert policymakers to the tests and others were criticized for poor management and oversight of the intelligence community. Now seventeen years later, someone with knowledge of such an alert would presumably have sought to set the historical record straight. The more likely explanation is that only one primary channel of information existed upon which analysts could draw.

Wild Card Events

Unforeseen events are a central part of the interactions between U.S. officials and their counterparts. But these wild card events also constitute sudden and unexpected channels for transmission of factual and fictitious information. The best example of this was the anthrax outbreak in Sverdlovsk discussed as part of the Soviet BW case in Chapter 3 and Appendix B. In that instance, a coherent and sustained deception by Soviet authorities was sufficient to get through the incident without needing to admit to a BW program or have “smoking gun” evidence presented that convinced the international community. The Soviet program was not as successful in withstanding the unforeseen defections of key program members in the late 1980s and early 1990s. These, especially the defection of Vladimir Pasechnik to the United Kingdom in 1989, led to increased diplomatic pressure on the Soviet government to open numerous sites to visits and explain what had been researched.

This is similar to a key event in the Iraqi nuclear weapons program. Several incidents in the life of this program might be considered wild cards, but the final one covered in this study is the 1995 defection of Hussein Kamal to Jordan. An integral player in the coordination of deception for the Baghdad government, Kamal's defection compelled the Iraqi government to be more forthcoming about its activities and intentions, including its research into putting a warhead on an IRBM (Albright, 1998, p.48). These unexpected events not only led to pivotal interactions between government officials, but also provided analysts with the means to see into the R&D program that did not exist before.

Multiple channels of information create opportunities and challenges for both the deceiver and the target. But examination of the hypothesis-generating and theory-confirming cases indicates that in long-term deception the presence of multiple channels favors the target. When a proliferator can refuse access to facilities, limit the target to one or very few information channels, and build a deception that mitigates wild card events the deception has been shown to be more effective at misleading or freezing the target's policymaking elite.

H3: Successful long-term deception will benefit the deceiver by providing an advantage during discrete interactions with the target over the course of the program, even if the program itself is not entirely concealed.

A distinctive feature of effective long-term deception is the deceiver's advantage over the target during interactions. This benefit exists even when the deceiver does not completely conceal the underlying effort. Both hypothesis-generating cases included interactions where the deceiver gained an advantage over the target based on a coherent and sustained deception despite any knowledge the target might have had about the deceiver's R&D efforts. The theory-confirming cases showed this to be true in nuclear cases as well.

Face-to-Face Interactions

The most basic of interactions between the deceiver's officials and those of the target is in face-to-face meetings conducted at high levels. An example of such a meeting and the deception surrounding it was provided by the 1938 Munich Conference in the case of German rearmament, where British and French officials confronted Hitler on his aggression in Czechoslovakia. The Allied officials were disadvantaged to the extent that they appear to have believed the reports of their intelligence services, some of which greatly overestimated German military strength and concluded that the combined forces of the Allies would be unable to deter Hitler.

Another example is the previously discussed 1998 claims by Indian officials to their U.S. counterparts that a comprehensive review of Indian nuclear security policy would take at least six months and that no testing would take place during that time. These included statements by the Defense Minister as well as the Prime Minister's senior foreign policy advisor (Talbot, 2004, p.43; Graham and Hansen, 2009, p.45). Such assurances managed to convince the U.S. government that no test was imminent and analytic resources were kept focused on other areas of the world. It thus must have been a shock to have been notified of the tests only weeks later, and likely very little consolation that the information had been withheld from these senior Indian officials as well.

Downplaying

One advantage provided by long-term deception is that it raises the cost of proactive interference by the target to an unacceptably high level. More simply put, other policy issues become more

important to the target and more likely to yield tangible results. In the case of German rearmament, the British and French governments were informed that Germany was almost certainly violating the terms of the Versailles Treaty as early as the withdrawal of the Commission in 1927. But neither state was willing to contemplate the aggressive, expensive, and potentially destabilizing actions that would have been required to stop German activity. As long as there was sufficient ambiguity to permit delaying action, both governments seemed content to let the situation play out and focus on other domestic and foreign policy concerns.

The case of Iraqi nuclear weapons development is similar. Following the bombing of the Osiraq facility, there are indications that U.S. analysts continued to “check in” on the Iraqi program from time to time, though focus on the issue appears inconsistent. Despite being aware that Iraqi R&D efforts in the late 1970s were of limited civilian value and that Saddam continued to be irritated by the lack of an Arab answer to Israeli nuclear weapons, the intelligence community did not identify much of the Iraqi effort (CIA, 1979, pp.1, 6). Some in the public sphere believed the Osiraq bombing effectively wiped out any potential for Iraqi nuclear weapons development, and some analysts may have believed the same thing. But another explanation is that other events and issues simply became more important than a program without obvious progress. Iraq was countering the Islamic revolution in Iran and, for various periods in the long conflict between the two, was being supported by Washington. The deception that protected the Iraqi R&D program provided enough cover so that other issues pushed nuclear weapons development out of the spotlight. The result, as discussed in Chapter 5, was an obviously poor understanding of the program as airstrikes began in 1991.

International Opinion

Finally, interactions are not always exclusively between the deceiver and the target. In several cases, the opinion of the international community was pivotal in determining whether proliferation could be stopped. The Soviet BW case provides an example of this with the 1980 conference on the BWC. It was during this conference that the United States had the opportunity to accuse the Soviet Union of violating the BWC and base its accusation on the Sverdlovsk anthrax incident. However, the Soviet deception held and the United States was forced to back off its claim. The Soviet BW effort continued for several more years without outside interference.

International opinion became a key issue in the South African case as well. The 1977 discovery of the Kalahari test preparations compelled the United States to condemn the activity and support an arms embargo against South Africa. While U.S. officials were certainly concerned over the potential nuclear test and strongly objected to apartheid, the pressure from the international community and convincing proof of the test preparations removed any policy options other than embargo. However, suspected preparations at the site in 1987 did not spark

international outrage. This second round of test preparations may have been a tactic to get the attention of the United States, but they were conducted artfully enough that the UN Security Council and other states remained unaware (van Wyk, 2010a, p.112). For various reasons, no action was taken against South Africa for this activity and in fact peace negotiations were successfully concluded a short time later. The conduct of deception in this case removed the international opinion that had previously forced action.

This third hypothesis was supported by data in the theory-confirming cases. As discussed in Chapter 3 when the hypotheses were introduced, the target “knew” of the R&D program in both of the hypothesis-generating cases, though not the scope of the programs and not key information that was obfuscated by deception. This remained true with the theory-confirming nuclear cases. The capabilities and intentions of India, Iraq, and South Africa were broadly understood by the United States, though program scope, progress, and motivations often appear to have been misunderstood. This misunderstanding led to missed opportunities or policies that may have been pursued without adequate understanding of the situation.

Among these is the belief that the BJP would not conduct a nuclear test until a doctrine review was completed in the case of India. In Iraq, the sale of \$1.5 billion USD of computers, tools, and equipment with potential benefit to a nuclear weapons program was approved by the U.S. government over the course of Iraq’s R&D effort. Additionally, the Coalition target list for air strikes during the 1991 Gulf War showed a lack of appreciation for the extent and complexity of the Iraqi program and permitted Iraqi officials to salvage much of their work and hide it for several years. Finally, South Africa also benefitted from substantial U.S. assistance with its civilian nuclear power program while clandestinely stockpiling nuclear devices and stood ready to force the hand of U.S. officials to intervene in a conflict if the Pretoria regime felt itself on the verge of being overrun. This hypothesis is an often overlooked aspect of long-term deception that is critical to understanding why the identification and assessment of deception is important for analysis.

Conclusions on Hypotheses

Each of the three hypotheses generated by analysis of the German rearmament and Soviet BW cases was supported by data in the theory-confirming cases. These hypotheses show policymakers and analysts that long-term deception can be identified and mitigated and also that failure to do so may result in significant disadvantage. Perhaps most importantly, a general understanding that a program exists is not sufficient to ensure that policymakers are adequately prepared to interact with their counterparts and make informed decisions. Key information about motivation, intent, and scope of the program may be protected by deception despite the existence of the program being known to the target.

Benefits of Analyzing Deception

The presence of a nuclear weapons R&D program is not the only insight that identification of deception may provide. One of the research goals of this dissertation, outlined in Chapter 1, is to explore the benefits of analyzing the deception itself. As noted previously, Barton Whaley stated that one of the main problems with intelligence analysis is that the camouflage, in this case the deception, is not analyzed for its own sake (2007a, pp.77-78). What would be the benefit of analyzing the deception in nuclear weapons R&D efforts beyond mitigation of the deception?

One answer pertains to the figure on goals, strategy, and objectives introduced as Figure 3-1 and repeated in each of the case study chapters. This figure graphically depicts basic categories of nuclear weapons policy goals, weapons development goals, deception strategies, and deception objectives.

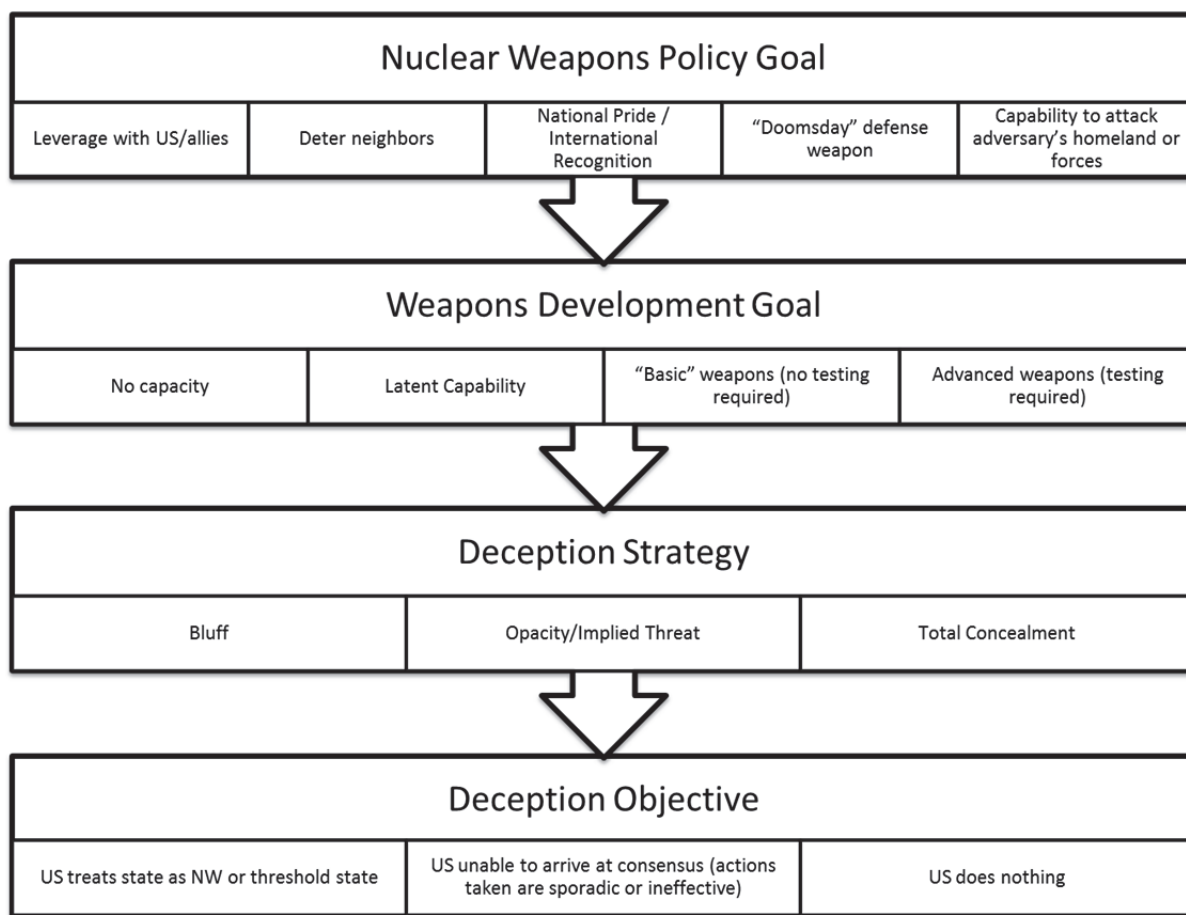


Figure 3-1 Goals, Strategy, and Objective Categories

If a state's motivations for nuclear weapons development can be definitively stated, then in combination with knowledge of the state's natural resources a confident assessment of their

weapons development goal is possible. The reverse is also true. If an analyst knows with confidence that a state feels the need to conduct a test, wants a weapon but doesn't feel the need to test, or is content to hold progress with a latent capability, then he or she can formulate an assessment of the state's overall foreign policy and nuclear weapons goals.

This dissertation has argued, and shown in three case studies, that deception is always present in modern nuclear weapons R&D efforts. It has also shown that different types of deception are practiced to protect these programs and that these deceptions have varying objectives and measures of success. Can the nature and goals of a state's deception also provide insight into weapons development and nuclear weapons goals? In other words, can the flow in Figure 3-1 be reversed and, with knowledge of the deception, can the analyst project the deceiver's overall goals? Such analysis would address Whaley's assertion that it is useful to analyze the deception for its own sake.

This consideration requires the formulation of a new hypothesis. The theory-confirming cases must be converted to hypothesis-generating cases since non-nuclear cases will be too different in their goals and how they are conducted to provide relevant information in this area. Figure 3-1 and its variations in the case study chapters yield the following hypothesis:

- ***H4: Through identification of deception type, analysts can provide policymakers with insight as to what the proliferator hopes to achieve in upcoming interactions with the United States.***

With only unclassified analysis of three cases, this dissertation cannot validate or invalidate this fourth hypothesis. But two of the cases, India and South Africa, do provide insight into how such a study could be set up and pursued. This will be briefly discussed in this section to highlight the possibilities for this research approach.

The distinctive features of the Iraq case make it less relevant to this particular discussion. The Iraqi case shows nuclear weapons R&D in its most difficult environment, facing continuous international scrutiny and, following the 1991 war, intrusive on-site inspections. It is therefore the least nuanced of the cases and the least informative for this fourth hypothesis. As noted in the analysis of Chapter 5, the Iraqi program is similar in many ways to India's second deception phase where total concealment was the only option. Additionally, the nuclear weapons policy goals in the Iraq case were the goals of one individual, Saddam Hussein, and based on his diplomatic and WMD track record he likely would have pursued any of the five categories of goals found in Figure 3-1 depending on the circumstances of the moment. Thus in this discussion the Iraq case is a reminder that deception, while always present in nuclear weapons R&D, is not a "silver bullet" but rather an important clue in assessment of these programs.

India

The presentation of India's R&D program in Chapter 4 argued that deception was conducted by the Indians in two distinct phases. In the first phase, Indian officials sought to be opaque with U.S. officials as to their capabilities and intentions and ensure that Washington took no definitive action that would interfere with any further Indian development. This approach appears to have been recognized and understood by U.S. officials. Former Deputy Secretary of State Strobe Talbott acknowledged this understanding when discussing South Asia arms control talks proposed by the United States in 1994, stating "by proposing the discussions, our government was tacitly signaling a willingness to live with India's and Pakistan's undeclared, untested, and undisputed nuclear capabilities rather than insisting on formal accession to the NPT" (2004, p.33).

Inaction on the part of the United States was facilitated by opacity that resulted from the Indian deception – a deception that included measures such as heavy compartmentalization of the program even among senior officials and refusal to explain reactor operations despite a deficit in declared stocks of heavy water. Knowing that India would be unlikely to build a HEU-based weapon due to factors such as its investment in plutonium-producing reactors, the path on Figure 3-1 (shown in Figure 4-1 in the India chapter) can be followed from "Opacity/Implied Threat" under deception strategy to "Latent Capability" under Weapons Development Goal. In other words, in this phase India would not be able to test a weapon with its current deception strategy and was unlikely to build a non-testable one. Further, India's overall nuclear weapons policy goals are likely to be a combination of "Deter neighbors" and "National Pride." India had no desire for a defense alliance with the United States (the "Leverage with US" goal), but wanted its regional adversaries China and Pakistan to know it was close to having a weapon if the need arose. New Delhi further wanted to make the point to the international community that the NPT and other similar regimes were inherently discriminatory and that India had the means to join the nuclear club if it so desired. As shown in Chapter 4, all of this was well-understood by U.S. policymakers and analysts at the time.

The second phase of Indian deception began around 1995 with the U.S. push for indefinite extension of the NPT and agreement to the CTBT. Facing a situation where it might be barred by treaty from having nuclear weapons in perpetuity, the Indian government sought to conduct a nuclear test of an implosion weapon prior to agreeing to these initiatives. The depiction of Indian government goals in Figure 4-1 thus changed. The desire for U.S. inaction remained the same. But such inaction was unlikely in the face of a nuclear test, as India discovered when it prepared to test in 1995 and 1996. Thus, New Delhi's deception strategy had to be shifted to "Total Concealment." While there may be scenarios in which total concealment by deception and latent capabilities in weapons development are compatible, they were not for India. To conceal their efforts completely and not construct a weapon would mean losing any deterrent

value gained by opacity. Since analysts should have been aware that a non-test weapon was unlikely in India's case, the shift to total concealment strongly indicates the decision to construct and test a nuclear device. Of course, that change in weapons development also entails a shift in nuclear weapons policy to having a "doomsday" defense weapon or an offensive attack capability, depending on doctrine and means of delivery.

The May 1998 tests were a surprise to the U.S. intelligence community, but as established by inquiries after the incident U.S. officials had the requisite knowledge that New Delhi had made moves towards constructing a device and testing it several years before. Despite this, they accepted Indian explanations that no test was planned and that a top-down review of nuclear policy was underway that would prevent any further progress for the foreseeable future. Competing priorities led to imagery assets not being focused on the Indian test site and BJP pledges to conduct a test were dismissed as campaign bluster. Each of these actions is understandable if considered in isolated events. But analysis of the deception itself, including commitment to active analysis across the Indian lines of effort, would have shown that the Indian approach to deception remained total concealment and hence New Delhi's underlying motivations for testing and declaring its nuclear weapons program had not changed.

South Africa

Analysis of the various goals of the South African program, presented in Figure 6-1, highlights the distinctive nature of South African motivations to develop nuclear weapons. The objective of South African deception following the 1977 discovery of the Kalahari test site was for the United States to not arrive at a consensus that would permit definitive action. It was not necessarily that the South Africans wanted the United States to do nothing at all. With the continuing conflict in southern Africa against leftist groups and Cuban forces, Pretoria wanted the United States to intervene when and if needed and the deception was intended to establish the foundation of such an intervention. The United States had to be kept from interfering with the R&D program, but it should not be completely blind to the possibility of a South African nuclear weapon. The understanding of the potential of a weapon would hopefully spur Washington to pressure the Soviet Union and others into limiting aid for leftist groups and engaging in peace talks.

Therefore, South Africa's deception strategy was to be opaque about the weapons program and this is a critical point. One could argue that total concealment was the goal, based on ARMSCOR's production and stockpiling of gun-type weapons that seemingly went completely undetected by the United States. But while this was the main part of the South African program, it was not the only one. Continued work on implosion technology and more advanced weapons designs continued to draw the attention of U.S. analysts but not the total support of South African officials. Occasional statements by cabinet-level officials and military leaders about

South African nuclear capabilities also contributed to an approach of opacity rather than concealment. Had more advanced weapons, ones that required testing, been the actual goal than such statements by South African leaders would have been ill-advised clues to continued development and observed test preparations may have been interpreted as South Africa testing the reliability of a weapon. Instead, the opacity provided by the deception was intended to give U.S. officials a general understanding of South African capabilities without the evidence that would have required action.

As with the Indian case, the difference between opacity and total concealment in deception is significant. Opacity cannot protect a R&D effort that requires testing of the weapons, at least not in the later stages of development. If an analyst understands that opacity is the actual goal of the South African government then information about continued implosion research is less important, at least in the immediate future. Knowing South Africa's capability to mine and enrich uranium, attention then must be focused on the possibilities of latent capability – which was a certainty given knowledge that South Africa had already produced a gun-type design – and production of weapons that did not require testing. The possibility of clandestine assembly of nuclear devices using HEU is a more prominent possibility when the program is considered through the lens of deception.

Whether the weapons were actually being assembled or the capability was being maintained, the slow progress on more advanced weapons highlights the nuclear weapons goals on the left side of the spectrum in Figure 3-1. Deterrence of other regional powers and nationalism are likely motivations, though neither are completely satisfactory. But examination of the goal of leverage with the United States yields possibilities. If that is one nuclear weapons goal of the South African government, then continued U.S. resistance to providing assistance to Pretoria would encourage development of weapons that did not require testing – a task made possible by South Africa's ability to enrich uranium. A scenario where South Africa stockpiles several such weapons and maintains a test site for a demonstration, if required, becomes more plausible when considered in this way.

Leverage as a primary motivation was briefly mentioned in one declassified NIE, as discussed in Chapter 6. But there is no evidence that this motivation was further explored or expanded upon. Analysis of the South African deception, knowledge of weapons development capabilities, and inference of potential nuclear weapons goals may have bolstered that line of analysis. Most importantly, it could have given U.S. policymakers an indication that South Africa may have already produced nuclear weapons and may have been intending to use them to involve the United States in its conflict.

Observations

It is beyond the scope of this dissertation to adequately address whether analysis of deception can result in reliable insight on the nuclear weapons policy goals of the deceiver, and hence its foreign policy and security goals as well. But evaluation of the possibility of such insight is the logical next step from this research. Having established that deception is present in nuclear weapons R&D programs, that it is conducted in ways specific to the deceiver's perceptions and circumstances, and that it can be evaluated over a long-term period rather than only in sequential episodes, the next step is to determine whether policymakers can be told with confidence that such analysis has resulted in the identification their counterpart's likely policy goals. The relationships between the sets of goals depicted in the various levels of Figure 3-1 are inexact. States that pursue nuclear weapons are often driven by several motivations simultaneously and other factors, such as natural resources or existing infrastructure, influence the path of weapons development and deception. But there are logical relationships between these types of goals that may provide perspective and perhaps viable alternative explanations to the analyst.

Though this research approach requires refinement before it can adequately address the fourth hypothesis, the benefit of pursuing such refinement and research are clear. This research would require the examination of as many cases of nuclear weapons R&D as possible and preferably on the classified level. With such insight, the tiers and categories of these goals could be further refined and the relationships between them examined more closely.

Recommendations

The four hypotheses articulated in this dissertation suggest recommendations for future intelligence efforts and research. These recommendations must be qualified with a reminder that only unclassified research was permitted in this study. It is possible, and perhaps likely, that further examination of classified material would result in additional recommendations or changes to those proposed. Nonetheless, recommendations resulting from the hypotheses and analysis in this study merit discussion.

1) Recognize that long-term deception is fundamentally different from other forms and adjust research and analysis accordingly. The introduction of the concept of long-term deception in Chapter 2 included examples of distinctive qualities that separated this activity from other forms of deception. Among the qualities suggested were the requirement for surprise, the continuous nature of the effort, and a frequent lack of feedback as to the effects of deception. The subsequent analysis of the theory-confirming cases showed each of these to present in each case. As discussed earlier in this chapter, this effort may be considered as multiple smaller-scale deceptions. But if the analyst is to consider the entire R&D effort through a framework such as the one proposed, this deception must be seen as a coherent, though fluid, process. It is a process

that is not adequately defined and explored by the existing literature on deception and analytical techniques.

2) Continue research and evaluation of deception through continued case study research. This is a logical next step to address the limitations just mentioned. This dissertation was only able to examine unclassified and declassified sources, thus limiting not only the data gathered on each of the programs but also limiting understanding of what the U.S. intelligence community believed to be true about each R&D program in its various stages. In addition, all cases where states pursued nuclear weapons should be analyzed in such a manner to ascertain whether there are additional themes that were not identified in these three cases.

Additional research need not be limited only to states conducting nuclear R&D. Another reason to continue this research is to make it generalizable to other types of long-term deception. With modifications to the lines of effort, non-governmental and non-R&D deceptions could be studied that might yield valuable and applicable insights. Among the interesting corporate candidates for such research would be the Volkswagen emissions scandal of the last several years, the Enron accounting scandal in 2001, and the WorldCom scandal of 2002. Each of these involved the broad themes that have been discussed in this chapter to include deception over several years, a “group within the group” of knowledgeable officials, inspection regimes, and manipulation of information. Investigation of these corporate examples may result in themes not apparent when focusing on governments.

3) Strive to not become reliant on single channels for information on R&D efforts. The second hypothesis stated that the presence of multiple information channels increases the complexity of the deception and favors the target. The analysis of the theory-confirming cases validated this hypothesis. Intelligence analysts and managers should remain wary of utilizing only one channel for analysis of a potential proliferator’s activity. Satellite coverage of facilities or test sites may provide real time and convincing information as to a state’s R&D activities. But if this satellite is the only source of information, the deceiver’s task is significantly simplified. If, however, imperfect information from other sources is being synthesized in a logical manner then the deceiver’s task becomes more difficult. The framework proposed in this dissertation is one method by which this synthesis can be conducted.

4) Employ a team of analysts dedicated to denial and deception to conduct assessments of long-term efforts that may involve deception. As stated earlier in this chapter, one benefit of this framework approach is that it partially mitigates the effect of time in the analysis. The totality of information collected over several years can be considered in way not possible through other analytical approaches. But this can be a difficult exercise for analysts that are concerned with the day-to-day tasking and production that are the core missions of many intelligence

agencies. This analysis requires access to information from across the spectrum of state activity and intelligence collection spanning several years. It is likely to be a painstaking process requiring frequent interaction between the analytical team and collectors. A key part of these interactions will be the analytic team highlighting areas where incongruities should be visible, but where there is little visibility.

Active analysis – the process by which analysts make such requests for additional information previously discussed in the “Framework Conclusions” section – is an integral part of detecting long-term deception. Heuer observed that “any systematic counterdeception program must focus primarily on problems of analysis, only secondarily on collection” (1982, p.61). This is perhaps overstated. The approach used in this research is one that focuses on improving analysis, but it also shows the clear symbiotic relationship between collection and analysis. Without clear analysis, signatures are observed and information collected without full recognition of its value. Without knowing where to look, collection may be haphazard, may not provide the information necessary to detect deception, or may prove to be a channel susceptible to manipulation by the deceiver. A mindset and approach of collaboration between collector and analyst are critical to countering deception in these long-term efforts. This collaboration would be enhanced by involving a dedicated group of denial and deception analysts in the effort.

One example of the benefit of further study occurred during this research. One distinctive and recurring feature of long-term deception that was evident in the case research was not apparent beforehand – the high cost of long-term deception. In general, deception has been considered to be a cost-effective approach. This is particularly true with MILDEC, where costs are not only economic but also reflect the commander’s ability to keep friendly casualties low. This assumption is so strong that in the first comprehensive study of deception in warfare commanders such as Napoleon and those in World War I who had favored direct and high casualty strategies were completely excluded from consideration (Liddell-Hart, 1954). But long-term deception differs in its cost-effectiveness and this difference may be pertinent to a contemporary example.

At the time of this study, it was not possible to conduct a meaningful unclassified assessment of the nuclear weapons R&D effort of the Islamic Republic of Iran, though the Iranian R&D program and the agreement reached between Tehran and various world powers were an everyday news item during much of the period of research. However, the scarcity of definitive unclassified information and the complete lack of unclassified U.S. intelligence assessments make such analysis impossible. One argument can be made about the alleged Iranian program from this research, however. If there is a relevant message from analysis of the theory-confirming cases it is that states wishing to prevent proliferation should not be afraid of deception on the part of proliferators. This is counterintuitive but a potentially significant

finding of this research that was not foreseen and had no corresponding hypothesis. Each of us is averse to being deceived by instinct and experience. In military doctrine, deception is a lethal concept. Whaley's research has shown that if a military commander has deception effectively employed against him or her, defeat is likely imminent (2007a). How, then, can deception be viewed as a potentially positive development?

Each of the nuclear weapons R&D programs studied in this dissertation achieved some success while conducting deception and two actually acquired nuclear weapons capability. But all would have made faster progress if permitted to only practice denial. India would have conducted their nuclear tests when they first wanted to conduct them – years before the actual event. South Africa could have produced weapons with its fissile material without suffering an arms embargo and needing to construct additional facilities for weapons production and storage. Iraq would have had time to study the production of Osiraq and devise ways to acquire fissile material without detection by IAEA inspectors. Iraq, more than the other two cases, was forced to devote precious and scarce resources of all types to an enormous effort of compartmentalization and concealment. Given the choice, a proliferator would choose to develop a weapon in an unknown facility, with unaccounted for fissile material, using specialists with whom no one can speak – thus controlling the pace of development and any eventual roll out of the weapon. States forced to be deceptive are in response mode. They spend resources, slow down their program, expend time and effort on coordination, and risk a loss of credibility from discovery.

In the summer of 2015, many critics of the Joint Comprehensive Plan of Action agreement made with Iran argued that such a deal gives time and space to Iran to pursue a nuclear weapon. There are certainly legitimate and reasonable criticisms of the Iran nuclear deal, but this research shows the argument of providing time and space is the opposite of what we can expect. The state pursuing nuclear weapons primarily using denial has time and space, as monitoring of the program only takes place through a small number of channels, such as the lens of a satellite. Making a state engage in deception to continue its pursuit of nuclear weapons forces the use of precious resources, provides more channels of information, and forces them to show observable signatures to coordinate and execute such deception. Given the choice between isolating a state and imposing inspections (even if limited), inspections should always be strongly considered in this context.

This difference of cost-effectiveness between long-term deception and other forms is a significant finding. Long-term deception may be required for a state to achieve its goals. But it is costly, risky in terms of discovery, and appears to be the second choice of the government in each of the cases. Analysts should consider deception a possibility in states that appear to be blocked from their preferred course of action with regards to long-term R&D efforts.

Furthermore, international agreements that compel potential proliferators to practice deception are useful – even if the proliferator decides to continue to pursue nuclear weapons. The resources spent conducting deception will be resources not allocated to completing the effort. As was seen in the case of Iraq, if sufficient pressure is brought to bear the effort required for deception can preclude any further progress on the weapons themselves.

Conclusion

The issue of nuclear proliferation is going to have a place on the global security agenda for the foreseeable future. Thankfully, predictions that scores of countries would have nuclear weapons by the 21st century have proven untrue. But proliferation has taken place outside of and despite the NPT. The array of intelligence agencies and methods focused on the issue of nonproliferation has scored several victories, many known and many unknown. Despite this several states have developed or come perilously close to developing nuclear weapons. They have achieved this despite the restrictive environment by being deceptive in their actions and by manipulating the signatures that would reveal their programs.

Efforts to detect proliferation must necessarily focus on the requirements and activities common to each development case. Many circumstances are distinctive in each developing state, so the focus on issues such as fissile material serves to replicate the abilities and expertise of the intelligence community across cases. Analysis of potential deception must be one of these focuses. It is common to every case and neutralizes not only the ability to detect nuclear weapons R&D but also the diplomatic and military responses that are meant as last resorts to keep a state from acquiring a nuclear weapon.

The research conducted for this dissertation addressed the overall goals of the project. The three hypotheses developed from the examination of the German and Soviet cases were validated by the data found in the cases of India, Iraq, and South Africa. This was possible, despite the difficulty in researching such secretive programs, in part because the proposed framework proved to be an effective way of identifying and categorizing relevant data. It yielded insights into what was common among all forms of large-scale and long-term R&D programs requiring deception and what might be distinctive to nuclear weapons cases. Finally, it showed that a link potentially existed between the deception and the goals of the deceiver that might be exploited if further research is focused on this issue.

Dismissal of deception efforts as hopeless to completely conceal a nuclear weapons R&D program, and hence inconsequential, is too limited of an approach. It risks missing the key benefit of this deception – advantage over U.S. officials in interactions during the course of the R&D program. Intelligence is meant to provide policymakers with the means to make the most

informed decisions possible. Mitigating the risk of those officials operating at a disadvantage to their counterparts in a proliferating state is an essential element of preventing these states from achieving success in their efforts.

Appendix A. German Rearmament (1919-1939)

“You should not feel that we believed what you told us. Not one word you uttered was true, but you delivered your information in such a clever way that we were in a position to believe you. I want to thank you for this.” – departing British naval inspector to his German counterpart (1927)

At the conclusion of World War I the Allied powers, most notably Britain and France, were resolved that Germany not be capable of the aggression they believed had brought about such a destructive conflict. As part of the agreement to end hostilities with Germany, commonly known as the Versailles Treaty, the Allies imposed significant restrictions on German ability to produce arms and field an effective military force. The Inter-Allied Control Commission was established to ensure compliance with these restrictions. It was largely staffed by British and French military officers who would be headquartered in Berlin and empowered to inspect German facilities and records for any violations.

The belief that Versailles could bring about complete German disarmament and that the Commission could enforce such a regime would prove to be naïve. Many today associate German cheating on the Versailles arms control restrictions with Hitler and his aggressive policies in the 1930s. However, the German circumvention of Versailles started almost as soon as the treaty restrictions were made public. Industrialists, former military officers, and successive chancellors in the new Weimar Republic had incentives to maintain German military capabilities and took steps to do so while avoiding condemnation by the Allies. Hitler’s policies necessitated a change in the German rearmament effort. The rebuilding of German capabilities and the deception to mask these efforts continued. But the Nazi government also began to deceive in order to project strength where it had very little. The rearmament of Germany, its deception to both conceal and project strength, and the inability of the Allies to develop policies to effectively counter these efforts would have significant and disastrous consequences.

Motivation for Study

The case of German rearmament provides an opportunity to examine long-term deception perpetrated by successive governments over the course of twenty years in order to influence a target’s understanding of military and industrial capabilities. This effort involved politicians, soldiers, industrialists, and financiers on the German side as well as politicians, arms inspectors, intelligence agencies, and journalists on the Allied side. But its significance extended beyond the facts of what Germany was building and how many soldiers it had enrolled in its army. In

his extensive study on German rearmament between the world wars, Michael Mihalka argues that this is a case where deception was used in a systematic manner to project an image of military force that directly supported long-term political objectives (1980, p.2). During the Weimar Republic era, this meant building Germany a military capability to counter the policies of other European powers that wished to keep the country weak and unable to influence events on the continent – while avoiding sanctions or other penalties that would result from conclusive proof that the Versailles restrictions were being violated. Following the Nazi rise to power, these goals changed to projecting an image of military strength that concealed the weakness of Germany's ill-prepared armed forces. Therefore, analysis of the deception itself also provides insight into Germany's strategic goals during this period and its interactions with other states as it pursued those goals. Perhaps foremost among these states was the United Kingdom, which was a primary target of the German deception.

The British government and public of this period also provide some insight into how long-term deception is executed. The government, a parliamentary democracy with a strong civil service to maintain continuity, was notably small for one that was concerned with issues and obligations throughout the world. Security concerns throughout the British Commonwealth, political issues arising from colonial government or normal interstate interactions, and the protection of British commercial interests combined to create a complex, and often conflicted, system of foreign policy development (Hall, 1976, p.478). Thus, while with the benefit of hindsight the issue of German rearmament appears to be one of the most significant faced by the British government during this time, it was in fact one of many pressing issues – and one with no easy solution.

In addition to the complexity facing the British foreign policymaking establishment, a foundational element of British democracy also impacted London's ability to deal with German rearmament. Elected British officials were compelled to focus on the most pressing issues in public discourse at any particular moment. Too much attention to abstract or long-term issues may have cost them political support or brought about a no-confidence vote. Hence, focusing on German rearmament in the midst of issues such as a global depression was frequently unrealistic. Conversely, politicians were often able to make use of the issue of German rearmament, particularly following Hitler's appointment as chancellor. Numerous British officials, Winston Churchill prominent among them, were consistent in their warnings of the dire consequences of what they were sure was aggressive and effective rearmament. Time would show that while Churchill and others of this period were right to warn of the German threat, they greatly overestimated Germany's progress in rebuilding its armed forces.

This brief description of the state of the British government provides two reasons for selection of this case. First, such a situation is beneficial for the deceiver. German deception

planners and practitioners were able to exploit these traits to increase the odds of success. Inattention and inability to focus on long-term problems aided German concealment of their arms buildup and helped ensure that any response to revelations in this area would be muted. For example, we will see in subsequent sections that the warnings of the Inter-Allied Control Commission that Versailles was certainly being violated resulted in little to no response from the British government. In addition, British officials themselves became somewhat complicit when the German deception transitioned to projecting false strength. The constant declarations of German power by officials such as Churchill served to provide a non-German voice to the argument that London was unable to interfere with Hitler's political aims (Mihalka, 1980, pp.101-102).

The second reason that this case is relevant is that many U.S. officials today would recognize the predicament in which the British policymakers found themselves. The global commitments and engagements of the United States also distract U.S. officials and analysts and force them to prioritize between short-term and long-term issues as well as those considered to be most important by the public. Therefore, careful analysis of this case within the analytical framework proposed in this dissertation may reveal significant insights for a U.S. audience in addition to relevant hypotheses for the study.

Historical Background

The Versailles Treaty was the most critical factor in how German rearmament was conducted. The peace agreement between Germany and the Allied powers contained several controversial elements. One of the foremost was the requirement for Germany to almost completely disarm. Unlike many arms control initiatives, the Versailles requirements were not meant to keep Germany on par with its neighbors and competitors, but rather to ensure Germany could be easily overpowered by them. Barton Whaley points out that even in this simple requirement the treaty was a complete failure. He states, "Indeed, its very harshness proved a spur to German politicians, soldiers, and industrialists, who proceeded with deliberate care to evade its provisions" (1984, p.1). He might have added that this spur was almost immediate. German industrialists, in particular, acted quickly to preserve their production capabilities.

The new Weimar government, though confronting significant domestic and economic issues, was not blind to the precariousness of their security situation. Germany was still a large and central power in Europe that would be unable to take a passive stance in European affairs and yet would have no military backing to its foreign policy. This precariousness was highlighted by France's pursuit of security agreements with Poland, Romania, Czechoslovakia, and Yugoslavia – thus adding to the German government's feeling of encirclement and vulnerability (Suchenwirth, 1968, p.ix). It soon became apparent to German officials that a military capability

would need to be developed and it would require deception. Whaley analyzed this effort in three time periods that will be used to provide historical context to Germany's covert R&D effort (2002).

Arms Control Evasion (1919-1926)

In the initial period following the conclusion of the Versailles Treaty, the German R&D effort was masked by an active evasion of the new restrictions. This was necessary due to the presence of the Inter-Allied Control Commission in Berlin, which had the authority to travel throughout Germany to conduct site inspections. The Commission was initially both well-staffed and active, conducting over 800 inspections during a six-week period in 1924 (Whaley, 1984, p.9). However the work of the Commission was undermined in two ways. First, the German government was permitted to establish a liaison organization ostensibly to facilitate access for the Commission. In reality, it functioned to obfuscate the information received by the Commission and tip off sites and officials before inspectors could arrive. Second, the Commission was distracted by constant rumors of German activity that, while false, nonetheless had to be investigated. One example included allegations that the Krupp arms corporation was disguising banned (and very large) cannon to be stored upright and appear as factory chimneys. Another rumor alleged that baby carriages were being produced that could be disassembled and rebuilt into machine guns. Neither of these allegations was true, but the Commission spent significant time on both (Whaley, 1984, p.35).

Aircraft were a primary concern of those who drafted the Versailles arms restrictions. The only category of equipment that Versailles specifically forbade Germany from possessing was the F-7 biplane, produced by the Fokker aircraft company. Shortly after the arms restrictions became known, Anthony Fokker began the process of moving his entire aircraft plant and fortune to Holland, his native country. His belief was that Holland would remain neutral in the efforts to curtail the German arms industry, especially since Germany had historically done extensive arms-related business with Dutch firms. Fokker's factory inventory was hidden in barns and stables throughout the countryside and was then covertly placed on trains to be moved across the border. Staging was rigged under tarps to hide the outline of an aircraft. Some aircraft were left out to be seen by inspectors from the Commission, but Fokker managed to save 220 aircraft, including 120 F-7 fighters, 400 engines, and \$8 million U.S. dollars of material from destruction or confiscation (Whaley, 2002, p.47).

The Fokker relocation was just one example of the significant amount of deception that focused on activity outside of Germany, and hence outside the jurisdiction of the Commission. In 1921, the Rohrbach Metal Aircraft Company was established with the backing of the German government. Its office in Copenhagen operated free of inspection or interference from the Commission. Rohrbach facilitated the acquisition of raw materials to be used in fighter and

bomber development (Whaley, 2002, p.51). Similarly, the German Navy funded the establishment of a Dutch firm, Inkavos, in 1922 to coordinate the work of U-boat development that was planned outside Germany over the next several years (Maiolo, 1999, p.109). Inkavos provides a rare known example of a target's utilization of a deceptive measure for its own ends. The British Secret Intelligence Service (SIS) was able to recruit a human source within Inkavos that provided London with significant information on German plans to develop and build U-boats abroad.

The German government also negotiated security agreements to facilitate their R&D and training efforts. Germany and the Soviet Union concluded secret military agreements in 1922 that would significantly impact German R&D. British officials, and their French counterparts, were unaware of these agreements partially due to the secrecy surrounding some of the negotiations, but also because they did not consider the possibility that the benefits of such an accord would outweigh the recent animosity between Berlin and Moscow. Michael Handel observes that by 1921 both Germany and the Soviet Union faced two options. The first was to re-engage with the Western democracies, the second was to turn to each other for assistance. For Germany's part, the aggressiveness of the Versailles restrictions left little room for engagement with the West. Had the situation been viewed objectively by British officials, they would perhaps not have been surprised that Berlin and Moscow saw each other as viable security partners and may have actively sought information on such diplomatic initiatives (1980, p.75).

As part of the agreement, Germany established a defense liaison office in Moscow, headed by a German officer using a pseudonym. In addition, Russian and German authorities established an aircraft training and testing facility at Lipetsk, Russia where German pilots and plane designs would be developed away from the prying eyes of the Commission. All personnel assigned to Lipetsk, as well as officers at the liaison office in Moscow, were discharged from the German military for the duration of their time in the Soviet Union and would be reactivated upon their return to Germany. By 1926, the secret roster of pilots available for the German air force contained approximately 180 names, which was insufficient for the number of aircraft that the Defense Ministry planned to produce. Former pilots were recruited into a newly established refresher program and civilians were recruited to fill the gap as well. After initial training at the Commercial Flying School in Germany, the trainees were brought to Lipetsk to conduct specialized military training (Suchenwirth, 1968, p.26).

The Soviet government granted permission for the establishment of a German customs office at Lipetsk in order to clear parts and shipments outside normal points of entry in Germany that may have been under observation. The aircraft to be used at Lipetsk were flown there as "mail planes" or crated and transported by sea to Leningrad, then by rail to Lipetsk. All of this was

done to avoid notice by the Commission or Allied officials in countries such as Poland through which shipments would travel (Suchenwirth, 1968, pp.28-30).

The German air force R&D effort also benefitted from successive instances of weakening the Versailles regime – often undertaken by the Allies willingly. A relaxation of restrictions on limited performance aircraft for Germany in 1922 facilitated the increased recruitment of pilots and the establishment of a Commercial Flying School. Even more significantly, the Paris Air Agreement of 1926 granted Germany the ability to produce fighter-type aircraft to participate in competitions and attempts to break records (Mihalka, 1980, p.45). Although military aviation was still banned, the planes produced ostensibly for this purpose would be prototypes that would be further developed at the secret Lipetsk facility. The growing German aviation industry would provide the manpower for the new air force. This aviation industry was almost entirely maintained by the government. The aviation staff of the Defense Ministry was disguised as the “Army Command Inspectorate of Weapons Schools” and one of its first acts was to absorb 120 former army and navy pilots into the military. False job descriptions, secret training pipelines, and the placement of pilots in service with Lufthansa or in “advertising squadrons” disguised this increase in trained personnel (Whaley, 2002, p.53).

The restrictions of the Versailles Treaty also extended to the German Navy. Most naval development would take place after this period, but the foundation of the covert rebuilding was established while the Commission was still in place. Under the terms of the treaty, the navy was permitted to maintain several aircraft and air stations to be used for mine clearance operations in the North and Baltic Seas. In 1924, navy funds were quietly used to establish a civilian company in Berlin, Severa, which would ostensibly conduct commercial flights and tow targets for naval gunnery practice. In reality, Severa conducted flight and observer training for naval personnel and built up the German Navy’s reconnaissance and general air capabilities (Suchenwirth, 1968, p.42). Research on this case resulted in no evidence that the Commission was aware of Severa’s actual role in naval training. In addition, during this time German companies established extensive contacts with banana plantations in Central and South America. The German government successfully argued that it needed to build merchant ships with sufficient speed to transport bananas and other perishable goods from these regions to Germany. These ships were built to be easily converted into surface raiders and several saw such action after hostilities began in 1939 (Whaley, 1984, p.28).

Much of this naval buildup was disguised by deception at the highest level of the Weimar government. Each year as legislators began the annual budget debate, the chancellor’s office and Defense Ministry would submit naval budget requests that vastly overcharged for items such as parts and labor. This practice was used through several successive governments in the 1920s and 1930s. When legislators approved the budget, these excess funds would then be diverted to fund

secret programs outside the budget, such as the aforementioned air training and the emerging U-boat design program (Whaley, 2002, p.53). If these budget actions were detected by the Commission, the inspectors were not able to convince their respective governments that this was definitive proof of German circumvention.

Rearmament (1927-1935)

In 1927, the inspectors of the Inter-Allied Control Commission were withdrawn from Berlin as issues other than German treaty compliance had come to the forefront and the cost of maintaining such a staff became unsustainable. By this point, the Weimar government had taken quiet steps to circumvent restrictions on total number of personnel under arms, weapons and aircraft production, and training activity. But while progress was made in all of these areas, the Germans were forced to be deceptive to avoid providing incontrovertible proof to the Commission that the Allied governments would be compelled to act upon. Though the Commission as a whole believed that Germany had consistently violated the terms of Versailles, its reporting had seemingly fallen on deaf ears in London and Paris and no “smoking gun” evidence had been obtained.

In disbanding the Commission the Allies not only removed pressure on the German government to be covert in their R&D efforts, but also removed their best source of information on German activity in this area. Following 1927, it appears the British in particular relied only on reports from military attachés at their embassy in Berlin – officers who were part of the diplomatic community and whose access and movements were well-known and often controlled. Whaley notes that the British government had very little outside information to assist in this effort. The foreign press corps in Berlin did not aggressively pursue stories of a military build-up and German firms were careful to limit their foreign contacts to German-owned firms or firms in countries where they would benefit from keeping German connections secret such as Spain and the Soviet Union (2002, p.65).

Meanwhile, Germany built upon its efforts in the preceding years by launching several new R&D initiatives. In February 1929, naval planners announced a ship that was within the Versailles limitations but still represented a powerful advance in German seapower – the 10,000 ton “pocket battleship.” Eight were approved for construction the following year. Though this number violated the original Versailles restrictions, the Germans cited a previous Allied decision that Germany could build two vessels to be laid up in case of accidental loss or the need for extended repairs (Maiolo, 1999, p.99). Just ten years after imposing the restrictions, the Allied governments appeared to be losing the ability to keep up with German development and the various compromises to which they had agreed.

Development and construction of U-boats also dramatically increased during this period. Beginning in 1927 Igewit, a privately-owned engineering firm in Berlin, began to coordinate development of three U-boat prototypes at shipyards in Finland, Holland, and Spain. These shipyards also produced frames for U-boats that were smuggled into Germany to be assembled if ever required (Maiolo, 1999, p.109). German U-boat commanders and crews were also permitted to train on U-boats constructed in these shipyards – thus improving crew proficiency outside the visibility of the Versailles powers (Whaley, 2002, p.54). Over the next several years, U-boat construction was largely transferred to German shipyards, though it was still concealed from Allied observation. In December 1933, workers began installing large huts over the slipways at the Deutsche Werke shipyard in preparation for the beginning of construction on 250-ton U-boats the following year (Maiolo, 1999, p.110). In late 1934, the Germania Werft yards began construction on a batch of U-boats in slipways that had been shielded from outside view. The ID numbers of six minesweepers that were supposedly under construction at the shipyard were painted on the fencing surrounding different parts of the facility to give any observer the impression that was the only construction taking place (Maiolo, 1999, p.110).

The Germania Werft shipyard was a privately owned component of the German arms industry and many such companies were active during this period. The massive Krupp industrial complex was particularly involved in the German government's rearmament efforts. Following Versailles, Krupp had diversified into production of goods such as typewriters and baby carriages but it retained skilled workers, sometimes transferring them to subsidiaries outside Germany, for a time when arms production could again be pursued. That opportunity arrived as the Commission inspectors were withdrawn. Within Germany, Krupp factories began to secretly design the next generation of German weapons while concealing their work from any observers. On several occasions, journalists visiting Krupp facilities were treated to lavish lunches during their tours, not realizing that Krupp workers were irradiating the film in their cameras in a separate room to ensure no evidence of weapons R&D was gained. Outside Germany, Krupp acquired foreign companies to advance German R&D goals. In Sweden, Krupp acquired Bofors cannon subsidiary and A. B. Landsverk, the latter becoming pivotal in tank development for the army (Whaley, 2002, p.56). Another Krupp subsidiary, this time an iron ore company in Holland, was used to "buy" surplus artillery pieces from the German Army. The pieces were stored in Holland while Krupp transferred engineers and technicians to make modifications to the guns and design improvements. When the Allies figured out the scheme in the 1930s, the Dutch government refused to take action against a "private corporation." Germany had managed to hide its existing artillery and expand it in violation of the Versailles restrictions (Whaley, 1984, p.11).

German air capabilities continued to develop during this period as well. But perhaps the most significant event with regards to German air power did not involve R&D at all. In June

1933 the German government, now firmly in Hitler's control, announced that foreign bombers had circled Berlin and dropped leaflets. It was alleged by the government, though admittedly with little evidence, that the bombers came from the Soviet Union. In fact, no such event had taken place at all. But Hitler used the manufactured episode to argue that Germany was completely defenseless in the air (Whaley, 2002, p.63). The air force had continued to expand rapidly following the establishment of the aviation staff, covert training pipelines, and the secret testing and training facility in Lipetsk. The workforce of skilled technicians and engineers supporting the expansion of the air force grew from approximately 4,000 when Hitler became chancellor in January 1933 to 20,000 one year later. It would be almost 72,000 by June 1935. In addition, the Reich Labor Service oversaw the construction of multiple new aviation facilities in remote locations. Since the facilities had not existed during World War I and were not near any population centers, Allied military attachés were largely unaware of the existence of these new facilities (Suchenwirth, 1968, p.121).

By the end of this period, it was clear that German rearmament would continue to violate arms control agreements. In December 1934, designers informed the head of the German Navy, Admiral Erich Raeder, that the "optimal fighting ship" could not be constructed within the current treaty specifications. Raeder approved violating the treaty restrictions by proceeding with plans for a 42,000 ton displacement battleship capable of 28-30 knots. Since a ship this size would be observable once launched, the Admiralty announced an incorrect draught to hide the excess displacement (Maiolo, 1996, p.40). Construction commenced on these powerful battleships the following year. Signs in Berlin also pointed to a more aggressive phase of rearmament. Hitler, now chancellor, quietly created the Central Bureau for German Rearmament in 1934 to coordinate the various efforts across the Defense Ministry (Whaley, 2002, p.64). He also pursued a naval agreement with Britain that, if followed, would maintain British naval supremacy but which also signified a new environment where Germany could be engaged on security issues beyond the Versailles restrictions. The agreement was signed in June 1935 with Hitler referring to the signing of the naval pact, and the ushering in of this new era of cooperation, as the "happiest day in his life" (Mihalka, 1980, p.38).

Rearmament and Bluff (1935-1939)

Mihalka points out that Hitler's joy was not due to the spirit of cooperation with Great Britain, but rather to the belief that granting the British naval supremacy through the agreement meant they would give him latitude to act as he wished in the east, including Czechoslovakia. German planners nonetheless continued to prepare for renewed antagonism with Britain and France (1980, p.38). It would not be long until it was made clear that German foreign policy could not be reconciled with the desires of the Allies.

Later in 1935, several British cabinet ministers were scheduled to meet with Hitler regarding, among other issues, rearmament. The release of a white paper from the British foreign office that was critical of German actions prompted Hitler to cancel the meeting under the pretext of having a bad cold. Shortly thereafter, the German government appears to have decided to drop its efforts to conceal any buildup. It announced that conscription was being reinstituted and that Germany, in fact, did have a functioning and powerful air force (Watt, 1956, pp.155-156). These developments were alarming enough, but Watt argues that the real agitator of British public opinion was Hitler's startling claim that German air power was already superior to the Royal Air Force, contradicting claims made by Prime Minister Baldwin only one month prior. How could the Germans have built up an air force to exceed that of the British Empire so quickly and so quietly?

The answer, obvious with hindsight, was that they hadn't. Whaley observes that the nature of German deception changed in this period from dissimulative actions that concealed facts of secret preparations to simulative actions that projected strength. He further proposes that "the only German fear, now that the Army and Luftwaffe were brought into the open, was that they would be seen for what they were, weak instruments of Hitler's aggressive foreign policy" (2002, p.68). It seems illogical that consensus at the time would have Germany militarily crippled by the Versailles restrictions and then, only a short time later, militarily superior to Britain and France. While many individual officials came down on one side or the other of this argument, British policy as a whole seems to reflect acceptance of both realities – downplaying any potential of German rearmament for over a decade and then suddenly resigned to accept an inability to counter German policies with force.

The Luftwaffe was perhaps the most impactful part of this deceptive projection of strength. In his analysis of the German deception, Mihalka provides an interesting insight into the effect the target can have on the effort. "Often, the victim publicly commits himself to positions and thus eases the work of the deception planner. The British and French fears over the effect of strategic bombing pointed Hitler to the Luftwaffe as the major instrument of deception" (1980, p.111). The Luftwaffe had built upon the foundation of training and equipment established in the 1920s and had aggressively expanded in the 1930s, due in large part to Hermann Goering's dual positions as Minister of Aviation and Hitler's deputy in the Nazi Party (Suchenwirth, 1968, p.51). Despite this buildup, the Luftwaffe was still caught more unprepared than its leadership would have preferred by the announcement of its existence.

Directed to display its capabilities following Hitler's announcement, the Luftwaffe engaged in significant deception to mask its weakness. Impressive displays and fly-overs were conducted in Berlin for the benefit of both the German population and foreign observers. Many of those observers would have noted the large numbers of strategic bombers involved. However, many of

these were not bombers at all. Aging Ju-52 transports had been repainted to appear newer and with bomb bays to give the impression they were bombers, when in fact Luftwaffe planners had canceled development of a strategic bomber and no such aircraft would be ready in the foreseeable future (Suchenwirth, 1968, p.57). In addition, many fighters included in the fly overs, particularly the He-51 and Ar-65 fighters Allied military officials feared were the backbone of this new air force, were unarmed and did not have suitable weapons or timing mechanisms to permit firing through a propeller (Whaley, 1984, p.57).

Other aircraft were used expressly for deception. The Do-17 “Flying Pencil” bomber defeated numerous non-German fighters in speed competitions. British and French observers surmised that the Germans had a bomber that could outrun any fighter the RAF or French Air Force would field. What they did not realize was that the Do-17 was a one-of-a-kind model that had been hand made. The actual bombers being produced required smaller engines and were not nearly as fast (Whaley, 2002, p.72). Similarly, the He-100 fighter broke several records after its public unveiling. French air officials were invited to tour the He-100 production line and their German counterparts casually stated that the second and third production lines were already underway. The Ministry of Propaganda also lauded the He-100’s accomplishments and referred to it as the next generation model of a previously fielded aircraft. In reality, the Luftwaffe had decided the He-100, though fast, was not suitable for its needs some years previously and had not selected it for production. Those aircraft that were breaking records and being seen by French officials were only prototypes (Whaley, 2002, p.73).

One aircraft with which the Allies actually should have been concerned was the He-111 bomber. At the time of the announcement of the Luftwaffe’s existence, and He-111 model was in service with Lufthansa. It was shown to accommodate ten passengers total, with an empty compartment amidships that was advertised as a passenger smoking lounge. The smoking lounge was, in reality, the bomb bay planned for the He-111’s actual purpose. Such deception extended to ground force development as well. The first armored vehicle fielded for the German Army by Daimler-Benz was named “Grosstraktor 11” to make it appear as agricultural machinery (Whaley, 2002, p.56).

As with most deceptions, however, there was a significant amount of reality that the German government could not, or would not, hide. In May 1937, the first aircraft produced by a new factory at Oranienburg were presented to the press and foreign military attachés. The aircraft were likely as impressive as the examples previously cited, but the real story was the facility itself. The foreign visitors were visibly impressed with the complex that featured anti-aircraft guns, its own fire department, and bomb shelters (Whaley, 2002, p.72). The message was very clear – German aircraft production capability was able to withstand any strategic bombing campaign the British or French could mount. In addition, as tensions with Britain and France

mounted in the late 1930s, Hitler's directives to dramatically increase the size of the Luftwaffe led to observable signatures for attentive analysts. The German government placed restrictions on the export of machine tools, ball bearings, and other essential products to support the Luftwaffe expansion in 1937. It also acquired significant amounts of steel and aluminum suited for aircraft production. At one point it was acquiring 15,600 tons per month for this purpose, compared with 29,700 tons per month for construction activity across all other sectors in Germany (Suchenwirth, 1968, p.83).

There were public indications of the German buildup in the other services as well. In February 1937, the pocket battleship *Deutschland* conducted a port visit to the British port of Gibraltar – one of numerous visits by German ships to Allied or neutral ports during this period. During this visit, it was covertly photographed through the scuttles of a British ship and the photos provided to the technical intelligence section of the Admiralty in London (Maiolo, 1996, p.34). The pocket battleships, ships that were controversially constructed during the period of the Versailles restrictions, were unknown entities to British and French naval analysts but such visits provided opportunities to estimate their displacement, armor, and weaponry.

German naval development was not without its fiction, however. As part of the Anglo-German naval agreement, both sides provided some technical information to the other and it is clear that by 1937, only two years after signing the treaty, the German data provided to London was greatly misleading. Most significantly, the December 1937 declaration of ships under construction by Germany included the battleships *Bismarck* and *Tirpitz* as being capable of 26 knots with 80,000 horsepower. In reality, both ships were to be capable of 30 knots with 160,000 horsepower. A four knot difference may not appear significant. But German naval strategy in the 1914-1918 war had been to stay close to the northern German coast and wait to engage the British fleet *en masse*. Battleships capable of such high speeds indicated a change in German strategy. These ships, together with the U-boats known to be under development and construction, could now be dispatched to the Atlantic to attack supply convoys vital to British survival. Hence, such information was of vital importance to analysts within the British Admiralty and as early as 1937 Britain's naval intelligence directorate correctly projected this change in German strategy (Maiolo, 1996, p.38).

Despite being dominated by the Nazi Party, the German government in the 1930s still retained many practices of the Weimar Republic, one of which was the responsibility to publish the government budget to the greatest extent possible. One would assume, therefore, that attentive military attachés could search such documents for indicators as to how the German military R&D effort was focused and progressing. The budget as released to the public was known as the “white” budget. The white budget was approximately 210 million marks in the mid-1930s, increasing to 340 million in 1936. But this was not the most accurate accounting of

government funds. A simultaneously developed “black” budget was the actual reflection of government spending during this time and it totaled three billion marks in 1936. This amount did not appear in any public document; nonetheless both budgets were generated by the same offices and distributed throughout government (Suchenwirth, 1968, pp.159-160). The existence of a separate budget is an indication of German deception, even if the document itself could not be obtained.

One final element of the German rearmament merits inclusion in this discussion, an element that ostensibly contained deception but was well understood by foreign observers. German involvement in the Spanish Civil War was not limited to support of an ideology. By treaty, Germany was unable to commit forces to the conflict, so members of the German armed forces being deployed to Spain were given false travel documents, Spanish currency, and Spanish uniforms upon arrival. The German government committed a substantial number of “volunteers” and material in order to test equipment, raise proficiency, and develop tactics. Whaley claims that in thirty-two months of combat, the German intervention resulted 14,000 experienced pilots, air crew, tank, and anti-aircraft crew as well as validation of equipment such as the Bf-109 and 88-mm gun and tactics such as saturation bombing. All of this was accomplished while being “deniable at the formal diplomatic level” (1984, p.62).

Assessments of German Rearmament Efforts

As with each of the other cases in this study, assessment of the scope and quality of the deception target’s intelligence estimates presents a significant challenge. In this case it is not classification and secrecy that is the barrier, but rather time and the politicized nature of the issue as it was happening. This is particularly true of the British government. As mentioned previously, many British politicians took positions on German rearmament as part of an overall foreign policy platform. Those who downplayed the threat arguably facilitated Germany’s ability to continue its concealed development. Those who consistently warned of the perils of German rearmament may have at times succeeded in drawing attention to a pressing security issue. But they may also have created an atmosphere where German military power was presumed to exist and little could be done about it, when in fact Germany remained significantly weaker than Britain and France and action was possible. Journalists and leading newspapers also took sides on this issue. The British press in the 1930s was particularly prone to reporting inflated numbers on German aircraft construction – numbers that were partially the result of German misinformation to the foreign press corps in Berlin (Mihalka, 1980, p.62). Such conditions may exist whenever a long-term R&D effort is a public and politicized issue.

Another challenge in understanding how the British understood German rearmament is that there are few examples of what those in the United States would know as National Intelligence Estimates. Different parts of the British government made evaluations on their respective areas

of expertise with varying degrees of accuracy. It has already been extensively noted that estimates of German air power were largely inaccurate. By contrast, the Naval Intelligence Division used human sources, imagery, and calculations to arrive at reasonably accurate projections of German naval construction (Maiolo, 1999, p.111). These calculations used projections of hull size and shape, armor thickness, and speed to estimate displacement. In January 1937, analysts used this approach to conclude that the Germans, Italians, and French were all cheating on naval agreements by building ships approximately 3,000 tons over the allowable displacement. But such estimates were too “rough” to provide Cabinet and other senior officials with the ability to confront or denounce these other governments (Maiolo, 1996, p.41). British officials found themselves in a position familiar to their later U.S. counterparts concerned with nuclear weapons development – general knowledge of the deceiver’s activity without sufficient information to counter the deceiver’s policy.

This inability to counter German policy was apparent in several instances during this time period. The uncertainty as to German military strength, combined with the effective use of operational deception by German commanders, resulted in missed opportunities for Allied intervention. This is perhaps the best measure of assessments of German rearmament and the consequences of not being able to mitigate deception.

The reoccupation of the Rhineland by Hitler’s Wehrmacht in 1936 is one such example. The Wehrmacht entered the territory with only 3,000 soldiers and several of the German commanders were resolved to quickly retreat if any British or French resistance materialized. But spurious radio signals, dummy formations, and extra vehicular traffic confused Allied observers as to the strength of the German force. British intelligence believed there to be approximately 35,000 German troops in the Rhineland, the French believed closer to 265,000 (Whaley, 2002, p.70). Neither country had the strength or will to resist a force as large as that they believed to be fielded by the Wehrmacht. While the operational and tactical deception employed by German commanders is an important part of this episode, such deception would have been far less likely to succeed if the British and French governments had better understanding of overall German strength.

A similar episode occurred two years later, though this one would have more far-reaching effects. The crisis over Hitler’s desire to invade Czechoslovakia alarmed European leaders, including Britain’s Neville Chamberlain and France’s Edouard Daladier. Whaley documents the events leading up to the crisis and the perceptions of the British and French governments in his book *Covert German Rearmament, 1919-1939*. Allied leaders, hoping to avoid confrontation with Hitler, met with him in Munich in a conference that would become synonymous in international relations with appeasement of an aggressor. But they entered into discussions with Hitler with unrealistic assessments of German strength. French intelligence counted ninety

divisions in the Wehrmacht with thirty more in reserve. In reality there were only forty-two divisions with seven in reserve – a force unlikely to be able to defeat the combined French and Czech forces even without British assistance. Chamberlain entered the conference carrying estimates of German air strength that came from reports by Charles Lindbergh, who had been courted and charmed by German air ministry officials and led to believe Luftwaffe strength was considerably higher than reality. Partially as a result of these inaccurate assessments, Hitler was able to threaten Chamberlain and Daladier with mobilization of his forces when the reality was that he had already mobilized to the greatest extent possible (Whaley, 1984; 2002).

The result, a near-total capitulation on the part of the Allies, is well-known and Hitler has been credited with a masterful deception of the British and French leaders. But similar to the Rhineland occupation, this deception was only possible in the environment that years of German simulation and dissimulation had created. Though the governments, policies, arms control restrictions, and immediate objectives had changed, German deception concerning the rebuilding of its military capabilities, as Whaley states, “gave Hitler an instrument that he could either build, in ten to fifteen years, into a major military force or, even more quickly, into a plausible bluff force” (1984, p.100). He chose the latter and until his army invaded Poland in September 1939, no European leader believed his country capable of calling Hitler’s bluff.

Framework Analysis

The data points identified in the course of this research are categorized in Tables A-1 through A-7 at the end of this appendix. A substantial amount of data was found in each of the four categories of action. The significance of this data to the dissertation is discussed in-depth in Chapter 3.

Actions that revealed factual information concerning German rearmament occurred primarily during the period following the Nazi takeover of government. Previously discussed actions such as the opening of the Oranienburg aircraft factory complex, the acquisition of raw materials and restrictions on exports of vital components, and visits by new German warships to foreign ports all had the effect of transmitting factual information to the Allied governments. Conversely, much of the “conceal fact” actions take place during the Weimar period or in the early days of Hitler’s government. These actions include the initial movement of Versailles-restricted weapons and material outside the country, the establishment of dummy corporations to coordinate actions outside Germany, the construction of air bases in remote areas, and the shipyard modifications to make construction work less observable from the outside.

The German rearmament also involved a significant amount of fictitious actions throughout this twenty-year period, many of which resemble actions taken in other cases researched for this

dissertation. The disguising of the aviation staff as the Inspectorate of Weapons Schools is similar to the vague or misleading names given to key organizations in other long-term deceptions such as the Directorate of General Studies in Iraq or the Witvlei Committee in South Africa. The establishment of front companies for acquisition of material, extraordinary funding measures, and misleading declarations of capabilities are also similar.

Perhaps most significant for this study, common actions were found in the case of German rearmament concerning coordination of the deception itself in three areas. The first was the designation of individuals or establishment of new organizations for the express purpose or coordination across the bureaucracy. This was seen in the 1926 establishment of a position on the Defense Ministry staff to coordinate secret armored research across the various industrial firms conducting the work as well as the creation of the Central Bureau for German Rearmament a year prior to the renunciation of the Versailles Treaty in 1935 (Whaley, 2002, p.64). The second theme was the establishment of extraordinary bureaucratic procedures to facilitate resourcing the covert rearmament effort. It is most prevalent in the Nazi period, when the defense budget was separated into the “white,” or public, budget and the “black,” or actual budget (Suchenwirth, 1968, pp.159-160). Such a move required significant cooperation across several government entities and likely produced significant observable signatures if the Allies had visibility into such practices. Finally, we see in this case a third theme common to several others – the lack of knowledge and clarity across the government. The frustration of Foreign Ministry representatives regarding their lack of understanding of the actual government policy on rearmament, and hence their inability to speak intelligently with their British and French counterparts on the issue, is an indication that part of the government is concealing an activity (Mihalka, 1980, p.52). This is also seen in the case of Soviet biological warfare development, where the Foreign Ministry was also surprised at revelations of a program, and in the case of the 1998 Indian nuclear tests when it was the Defense Minister who was not informed of the pending tests.

The German rearmament following World War I is an example of long-term deception that spans several governments, changes in policy, and significant unforeseen events for both the deceiver and the target. Despite these changes and the broad spectrum of R&D and production that encompassed the rearmament, the case provided examples of observable signatures within the framework, particularly in the area of concealing fiction, which aided in the formulation and development of hypotheses.

	Fact	Fiction
Reveal	* Treaty of Rapallo between Germany and USSR in 1922 sets stage for military collaboration * Public announcement of the Luftwaffe in 1935 * Air demonstration over Berlin in 1935 featuring over 400 aircraft * Display of German air facilities for British officials and agreement on exchange of information (Jan 1937) * Tour of German air production facilities for head of French Air Force (August 1938) * Withdrawal of Germany of the League of Nations in 1933 to avoid public rearmament debate * Pact of Paris (1926) permitting the production of high-performance aircraft for racing and competitions. Also details an inspection regime. * Declaration of the building of two additional warships under a March 1920 agreement permitting Germany to lay up two vessels for parts or replacements	* Aircraft flown over Rhineland (1936), then repainted and flown again to increase numbers perception * June 1941 report on Goebbels disclosing Germany would soon invade England * Removal of papers citing Goebbels from circulation once it was known foreign correspondents had seen them * Goebbels "disgrace" and leaking info (cover for <i>Barbarossa</i>) * "Foreign aircraft" leaflet drop on Berlin (June 1933) * German report to British on Luftwaffe numbers (lower than reality) * False radio traffic and troop movements to make Austrian government believe invasion imminent (Feb 38) * Implication that foreign bombers that had circled Berlin and dropped leaflets were Soviet * Lindbergh given extensive tour of Luftwaffe facilities that pads actual number of active aircraft * May 21 Reichstag speech: "Germany has neither the intention nor necessity nor the means to participate in a new naval rivalry." * Many aircraft in 1935 Berlin demonstration were transports, but painted to appear as heavy bombers.
Conceal	* Germans move to the Austrian border and into Austria with very little warning (March 1938) * Krupp personnel covertly irradiate film of journalists visiting factories to ensure photos that may include drawing boards cannot be developed. * Establishment of a Defense Ministry liaison office in Moscow, kept secret due to restrictions on foreign military missions.	* German Foreign Ministry representatives discussing Versailles restrictions realize they are unable to negotiate in good faith, since they are unaware of actual rearmament plans or status. * Heinkel informed that conversations about He-100 mass production are for French consumption, to make it appear that the Luftwaffe is more advanced and numerically superior than reality.

Table A-1 Diplomatic Aspects of German Rearmament Deception

	Fact	Fiction
Reveal	* Reichswehr absorbs 120 former Army and Navy pilots following Flying Corps disbandment * Spain, Turkey, Finland permit German crews to test purchased U-boats (thus providing training for German personnel) * Defense Minister establishes U-boat school in Kiel within days of Hitler's ascension "to provide officers and men for the first submarines to be built in Germany,." * Open use of short-term enlistments to circumvent personnel caps. Germans respond with delaying negotiations to Allied objections.	* German airmen killed in Lipetsk accidents passed customs in coffins marked "machine parts" * Commercial pilots used to man many of the Berlin demonstration planes because Luftwaffe did not have sufficient number (1935) * Pilots of recon flights dressed in Lufthansa uniforms * Establishment of "Commercial Flying School" to provide pilots, radiomen, technicians * German liaison officers in Moscow given pseudonyms to conceal military affiliation
Conceal	* Establishment of joint flying school at Lipetsk kept secret (1925) * Lipetsk trainees resigned from armed forces for duration of training, then reactivated upon return to Germany * Skilled workers transferred to other Krupp plants in and out of Germany to wait until arms production could recommence * Military flying component merged with Lufthansa, pilots designated as reserve aviation group * Military instruction included in Lufthansa training program * Defense Ministry exceeds limit on pilot training by arranging for 40 officer candidates per year to receive training before formally joining * Red Army's tank center at Kazan used for secret German training and testing of armored vehicles beginning in 1927 * Defense Ministry decision to stop publishing officer lists and classify them as "secret" (1932) * Roster of trained pilots suitable for military service classified "secret" * Establishment of secret training program for retired and former pilots in 1926	* Luftwaffe CoS protested Milch's release of information and accused him of treason. Since Milch remained in role, we can assume it was deception, that Hitler/Goering were in on it, and that the CoS was not.

Table A-2 Human Capital Aspects of German Rearmament Deception

	Fact	Fiction
Reveal	* Krupp diversification into typewriters, baby carriages, etc. following Versailles restrictions * Reichswehr Flying Corps disbanded in 1920 * Government maintained civilian aviation industry, including establishment of Lufthansa * Rohrbach Metal Company established in 1921 with the backing of the German government * Orenienburg aircraft factory presented to public and diplomats in 1937, along with bomb shelters, fire department, etc. * Construction of plants for hydrogenation of bituminous and soft coal for fuel	* Registered trading companies provided cover for military shipments between Germany and USSR * Workshops on some secret Luftwaffe bases disguised as "farm buildings" * Reichswehr aviation staff disguised as "Army Command Inspectorate of Weapons Schools" * Pilots organized into "advertising squadrons" * Krupp acquired two Swedish dummy corporations to produce tanks * Udet and Milch (and others) imply that He-100 will be mass produced * "Inkavos" set up as Dutch shipbuilding firm in 1922 using German state funds. Purpose was to continue U-boat development outside Germany * Private engineering firm in Berlin (Igewit) used by government to direct development of U-boat prototypes (1927-1932) * ID numbers of six minesweepers under development at Germania Werft painted outside U-boat assembly buildings (minesweeper construction was permitted) * Rechlin aviation facility camouflaged as "Testing Station Rechlin of the Reichs Formation of the German Aviation Industry" * Civilian company (Severa) established in 1924 to conduct observer training. Concealed as a company paid to tow targets for AA drills * Establishment of holding company to circumvent Swedish laws on foreign ownership of munitions factories
Conceal	* Fokker moves aircraft plant and fortune to Holland to evade restrictions * Rohrbach Metal Company office established in Denmark * HD-17 recon plane developed in a rented hangar outside the Heinkel facility * Hitler directs Admiral Raeder to maintain absolute secrecy about U-boat development program (1934) * Large huts constructed to cover exposed slipways at Deutsche Werke (U-boat assembly) in 1933 * German naval command takes direct control of development in 1934 (cuts off British and French info sources) * German government subsidizes the building of a Junkers aircraft factory outside Moscow * Rechlin aircraft testing base kept secret - built after WWI and not accessible by main traffic arteries * Additional airfields for Luftwaffe buildup constructed in areas with little outside traffic, rather than where they made tactical sense * Production facilities built in remote areas, not in areas where more economic benefits would be seen	* Defense Ministry appoints an engineer for "express purpose of coordinating the various industrial firms engaged in secret armored research and development" (1926) * Creation of the Central Bureau for German Rearmament to coordinate efforts (April 1934)

Table A-3 Infrastructure Aspects of German Rearmament Deception

	Fact	Fiction
Reveal	* German government lifts restrictions on stockpiling aircraft in 1930 * He-100 used to break 60 mile course record * Some F-7 frames left in open to be inspected by Allied officials (F-7 specifically restricted by Versailles) * Do-17 "Flying Pencil" defeats numerous non-German fighters in competitions * He-100 breaks several speed records * Navy presents a six-year building plan to Reichstag in 1930 that includes eight pocket battleships (only six permitted) * Visits by German ships to foreign ports throughout the 1930's * German Navy maintained handful of aircraft and naval stations for mine clearance operations, only ops permitted by Versailles * Classified aircraft designs begin to be shown at public demonstrations following 1935 Luftwaffe announcement	* Aircraft used in Rhineland (1936) despite not having synchronizers for guns/props * Aircraft braking speed records incorrectly identified as variants of Luftwaffe fighters in production * Aircraft designed specifically for breaking speed records incorrectly labeled as fighter variants * Fokker manager makes report of smuggling attempt in another location as train approaches Dutch border to distract authorities * Airframes being moved on trains made to look like other cargo using metal tubing and boards * Daimler-Benz first armored vehicle named "Grosstraktor 11" to make it appear as heavy agricultural machinery * German recon flights over neighboring states disguised as commercial flights * Lufthansa advertises midships "smoking section" of the He-111. Actually a bomb bay for military variant. * Do-17 show aircraft specially designed and built by hand. Regular version does not possess capability to break speed records, etc. * False declaration for draught on what would become <i>Bismarck</i>. Draught was the only non-observable signature that could be manipulated. * German aircraft moved to Lipetsk moved as mail plane. * Navy aircraft given detachable landing gear - one for sea and one for ground. * Navy business with foreign banana plantations as excuse to build merchant ships that can be easily converted to raiders.
Conceal	* Factory inventory of F-7s hidden in barns, stables, etc. * Fokker aircraft parts transferred to Holland in 60-car train * Naval aircraft stored in Stockholm by warehouse firm owned by a former German Navy commander * U-boat frames prefabricated in Finland, Holland, and Spain. Smuggled to Germany to be assembled when needed * Germany redesigns pocket battleship in response to French development of Dunkerque cruiser. Did not respond to British RFIs about changing development * Second batch of U-boats assembled at Germania Werft in Nov 1934 in concealed facilities * "Sale" of German artillery pieces to Dutch iron ore company to hide from Allied inspectors. Dutch firm almost wholly owned by Krupp.	

Table A-4 Special Material Aspects of German Rearmament Deception

	Fact	Fiction
Reveal	* Increase in steel and aluminum required for aircraft production when Hitler orders the Luftwaffe expanded five-fold in 1938 * Air Ministry Technical Office empowered to restrict exports of machine tools, ball bearings, and other essential products to support Luftwaffe expansion. * Rapid increase in import of Brazilian zircon ore (used only for gun steel) after Hitler becomes chancellor.	
Conceal		

Table A-5 Other Material Aspects of German Rearmament Deception

	Fact	Fiction
Reveal		* Navy overcharges for parts and other items in annual budget requests over several years (Weimar and Nazi governments) * Use of Mefobills, special IOUs used to pay industrialists for weapons development. Accepted in Berlin by a dummy corporation for payment.
Conceal	* Excess funds allocated to Navy used to fund secret projects not included in budget * Mefobill dummy corporation backed by two ministries and national treasury. Discounting of IOUs by Central Bank keeps payments "off the books." * Government secretly feeds interest-bearing notes to the Reichsbank, allowing for \$750 million in a special black fund for defense spending by 1936.	* "Blue budget" diverted from public budget to fund the aviation section of the Defense Ministry from 1925-1933. * 1930's budgets split into "white" (210M) and "black" (3B) which did not appear in the Reich budget or any other public document.

Table A-6 Finance and Budgeting Aspects of German Rearmament Deception

	Fact	Fiction
Reveal	* Air involvement in military exercises and sea trials for warships regularly conducted.	* Naval aircraft painted with Swedish markings for test flights * German declaration of speed/horsepower for <i>Bismarck</i> and <i>Tirpitz</i> in 1937 inaccurate. Declared 26kts/80K but was actually 30kts/160K.
Conceal	* Naval aircraft shipped to Sweden for testing * Intervention in Spanish Civil War allows for training of 14,000 personnel, testing of equipment, and development of tactics - all diplomatically deniable.	

Table A-7 Test and Evaluation Aspects of German Rearmament Deception

Appendix B. The Soviet Biological Weapons Program (1972-1991)

“Such a program can only be as good as its scientists. The challenge was to find scientists willing to lead secret lives.” – Biopreparat Deputy Director Ken Alibek

In May 1980 the World Health Assembly declared that smallpox, a disease that had killed millions of people over centuries, had been eradicated. This achievement was hailed as a global victory and a feat of cooperative international effort. But a small group of Soviet officials also saw an opportunity for military advantage. Since the smallpox vaccine carried a moderate amount of risk, eradication of the disease meant suspending mandatory vaccinations – and hence an increasing amount of vulnerability to the disease in the future. As the officials prepared the latest Five Year Plan for the Soviet biological weapons (BW) program, smallpox was added to the list of pathogens to be modified for weapons use (Alibek and Handelman, 1999, p.111).

Moscow’s BW program was shrouded in secrecy. In 1972, the Soviet Union had joined most other countries of the world in signing the Biological and Toxin Weapons Convention (BWC), which fully came into force in 1975. The BWC prohibits R&D for the purpose of weaponization involving numerous pathogens, but permits some stocks to be maintained for peaceful scientific research. Soviet officials believed the West, and particularly the United States, would never forego the advantage gained from its progress in microbiology, virology, and other related disciplines. Fearful of ceding any advantage to the United States in any potential means of conflict, Moscow continued its R&D on BW without interruption.

Soviet officials and scientists were aware that while the program had to be highly compartmentalized and secret, some contacts would need to be made with foreign pathogen banks, governments, and private companies. The Soviet Union would also need an answer for where its highly educated and trained scientific elite in these fields were working and conducting their research. The Soviet government therefore founded Biopreparat, ostensibly a part of the Soviet pharmaceutical industry, to conduct research on pathogens and develop vaccines and other protective measures. In reality, the majority of “civilian” scientists of Biopreparat were military officers who were very much involved in offensive efforts such as the weaponization of smallpox.

Motivation for Study

The Soviet BW case is an example of a government with extensive abilities to control and manipulate information using deception to protect a highly complex and highly dangerous weapons program. It also shows the impact of unforeseen “wild card” events and how effective deception can protect a program even in such circumstances. The stakes for the Soviet government were high. Discovery of the BW program would not only have resulted in diplomatic condemnation and possible economic sanctions, but also in the derailing of other arms control initiatives that many Soviet leaders believed to be essential to their country’s security. This point is critical to understanding how important the Soviet leadership must have believed the BW program to be, and how important it was to them that the world be deceived to protect it. Agreements such as SALT II, signed by President Carter and Secretary Brezhnev in June 1979, were imperiled by revelations of Soviet BW development. Rumors of such a program allowed SALT opponents to denounce the Soviets as untrustworthy and hold up ratification by the U.S. Senate (Leitenberg and Zilinskas, 2012, p.423-424).

Former Biopreparat official Ken Alibek, whose memoirs and interviews provide much of the data for this case, describes this importance of the program and keeping it secret in dramatic terms. He points out that Americans had hid behind “a similar veil of secrecy when they launched the Manhattan Project to develop the first atomic bomb. Biopreparat, we believed, was our Manhattan Project” (Alibek and Handelman, 1999, p.14). The effort was certainly enormous for such a secretive program. Alibek claims that at its height it employed approximately 60,000 people in facilities across the country and that Biopreparat had a significant budget and money to pursue new construction even during the fiscally-constrained Gorbachev era. This was necessary because R&D was not the BW program’s only task. Unlike nuclear weapons, pathogens such as smallpox and plague had limited shelf lives (approximately 6-12 months) in the weaponized form, hence there was a need for continuous production (Tucker, 1999, p.3).

Perhaps the most significant contribution of the Soviet case to this research, however, is the occurrence of wild card events through the course of the program. Despite the meticulous control of Biopreparat and the Ministry of Defense over the BW program, several incidents occurred that tested the effectiveness of the Soviet deception. In some cases deception permitted the BW program to continue its work, in other cases it was less effective. Examination of these cases provided not only data for the framework, but insight into how deception can impact the interactions between states that greatly aided in the development of hypotheses.

Shortly before the BWC was negotiated in 1972, a smallpox outbreak occurred in the small city of Aralsk on the shores of the Aral Sea in present-day Kazakhstan. A city-wide quarantine and mass vaccinations eventually stopped the outbreak, but not before ten people mysteriously

became infected and three died. The circumstances of the outbreak are detailed in a secret report prepared by Soviet authorities at the time and discussed in a paper by Jonathan B. Tucker and Raymond A. Zilinskas for the Center for Nonproliferation Studies titled *The 1971 Smallpox Epidemic in Aralsk, Kazakhstan and the Soviet Biological Warfare Program* (2002). A scientific research ship conducted a month-long cruise of the Aral Sea in July 1971, stopping at two dozen research stations. During the final five days of the cruise, a female researcher became ill with a fever and chills, and was immediately taken home by family when the ship returned to Aralsk. Though the researcher recovered, her small brother and other children in the area fell ill – but no other crewmembers of the research vessel became sick.

The Soviet conclusion was that the ship had traveled closer than permitted to a BW testing facility on an island in the Aral Sea during a smallpox field test on or about July 30th. Though U.S. intelligence agencies were aware of past use of the island for BW research, there is no evidence that this smallpox outbreak was ever detected (Tucker and Zilinskas, 2002, p.11). In this case, Soviet denial measures were effective. The city of Aralsk was closed off, citizens were cautioned against disclosing anything that was suspected to have caused the outbreak, and the existence of the facility and its testing was successfully concealed.

Deception was less effective in countering other wild card events, notably defections by senior Soviet personnel. Two in particular merit mention. The first was the April 1978 defection of UN diplomat Arkady Shevchenko – the highest ranking Soviet official to defect to the United States. As part of his debriefing with U.S. intelligence agencies, Shevchenko claimed that the Soviets had been cheating on the BWC from the beginning, and that their agreement to the convention was only a ploy in the hopes that they could continue to develop without competition. While in time Shevchenko was proved correct in his assertions, the strict compartmentalization makes his knowledge of the program unlikely (Mangold and Goldberg, 1999, p.65). In fact, when the program was more reliably revealed a decade later, senior Foreign Ministry officials, including the minister, were surprised to learn of it. It is therefore unlikely that Shevchenko would have known, but nonetheless his accusations resulted in increased U.S. scrutiny of the evidence that the Soviet BW program was continuing.

Revelations concerning the BW program in the late 1980s also came from a somewhat unreliable source. In 1989, a senior Soviet biologist named Vladimir Pasechnik defected to the United Kingdom while on official travel in Western Europe. Pasechnik eagerly told U.S. and British intelligence officials about Soviet efforts to weaponize pathogens. According to Alibek, this information was hearsay because Pasechnik had never been involved in weapons production and hence could not have provided reliable information (1999, p.150). Nonetheless, Pasechnik was able to give his questioners one item that was reliable – the revelation that Biopreparat was not a civilian pharmaceutical effort but rather part of the BW program. This fact alone told U.S.

intelligence officials that the Soviet BW effort was significantly larger than they had previously believed. Within a short time, both the U.S. and British governments delivered formal protests to the Soviet Foreign Ministry that resulted in a gradual acknowledgement of some of the BW program's activities. The Soviet deception effort was unable to surmount the increased scrutiny brought about by defections of officials who were willing to talk about the BW program – even if their information was not actually known to them. The increased scrutiny following Shevchenko's 1978 defection would become significant one year later when rumors began to circulate about a suspicious outbreak of anthrax in a remote Soviet city called Sverdlovsk. This incident was the most significant test of the Soviet BW deception and will be discussed in detail later in this appendix.

Historical Background

The Soviet Union had considered the use of BW in conflicts for decades before the BWC was negotiated. Alibek quotes Marshal Kliment Voroshilov, the head of the Soviet military in 1938, as warning that any aggressor who used biological or chemical weapons against the Soviet Union would find the Soviets prepared to counter with similar weapons on the aggressor's soil. As events turned out, Voroshilov's prediction did not come to pass. When Soviet forces allegedly attempted to use tularemia against German troops it was on Soviet soil at Stalingrad. The attempt backfired and Soviet soldiers and civilians became sick well outside the city. At this point, Soviet planners narrowed their consideration of BW employment to "far targets" (Alibek and Handelsman, 1999, pp.30-34). On the technical side of the effort, the end of the war provided a significant boost to Soviet R&D in this area. Soviet troops moving into Manchuria in 1945 captured Japanese facilities that had conducted extensive work in BW and had surpassed anything Soviet scientists had achieved to date. Moscow increased its efforts with this new information while conducting a propaganda campaign that accused, with some justification, the United States of protecting Japanese war criminals with vital information that could aid its own BW program (Mangold and Goldberg, 1999, p.44).

Though perhaps not prominent in the public perception of East-West competition, BW was one area in which Soviet and U.S. scientists raced to provide their respective governments with the upper hand as the Cold War progressed through the 1950s and 1960s. However, the aversion to such weapons that had been agreed to by many nations following World War I remained. As the international community worked to develop arms control norms and agreements in nuclear, chemical, and conventional arms an initiative was also pursued to ban the development and use of pathogens as weapons. The 1972 BWC was the culmination of that effort. The agreement was not a difficult one for the United States. President Richard Nixon had renounced the offensive use of BW in 1969 and ordered the U.S. program halted. Following the signing of the BWC, the United States government made a significant show of destroying pathogen samples

and laboratory equipment as well as providing tours through previously classified facilities. The Soviet government only issued a statement that they had not possessed biological weapons (Harris and Paxman, 1982, pp.218-219).

The U.S. government framed its view of BW and its objection to their use in moral terms. Officials in the Soviet defense establishment approached the issue with more pragmatism. Their refusal to halt BW work despite signing the BWC was not based in gaining an advantage against an unprepared United States, but rather in the belief that the United States was continuing its work as well. Soviet officials did not believe that the United States would abandon a weapons program into which so many resources had been invested and that had a symbiotic relationship with research in the scientific community. Those who believed U.S. R&D continued may have had their arguments bolstered by a U.S. intelligence operation. A long-term double agent run by the FBI over several years persuaded Soviet military intelligence officers that the United States continued to operate a secret offensive BW program. The motivation for such an operation is unclear, but it is conceivable that this disinformation from the U.S. side was seen as evidence that confirmed Soviet fears (Guillemin, 2002, p.30).

Even without such disinformation, suspicious Soviet officials could make a reasonable argument for the BW program. Government officials and scientists throughout the Soviet system were aware that the West was making rapid advances in molecular biology and genetics that outpaced any achieved in Soviet laboratories. The perceived unlikelihood of the United States ignoring the military advantage of such advances was an initial impetus for maintaining a large BW program (Rimmington, 2000, p.7). Over time, additional incentives would appear to officials who saw the threat from the United States in these terms. The development of the Strategic Defense Initiative in the 1980s threatened to mitigate the Soviet Union's capability to conduct a nuclear strike. In such circumstances, a program such as BW may have offered the best defense to counter any Western aggression (Rimmington, 2000, p.8).

The U.S. perceptions of Soviet efforts in BW were not as alarmist. In fact, though U.S. officials had general knowledge of a Soviet biological R&D effort, including the use of the BW testing facility in the Aral Sea, there does not appear to have been significant analytic attention paid to the prospect of Soviet BW development in the years following the BWC. One reason may have been that nuclear issues tended to dominate many arms control discussions during those years, but another problem may have been mirror imaging. Initial intelligence on the Soviet BW efforts in the years following World War II indicated work on a similar set of pathogens as the ones on which the U.S. offensive program focused. Analysts may have assumed that Soviet program would have a similar structure to that of the U.S. one, and seeing no evidence of such a program following the signing of the BWC, appear to have concluded that a large-scale BW effort did not exist (Ellis and Kiefer, 2004, p.70). But the restrictions of the

BWC and the need to have some interaction with Western scientists and institutions to advance the BW program led the Soviets to undertake a large and long-term deception to conduct R&D in several fields relating to BW.

Biopreparat

Several Soviet officials argued in the wake of the BWC that a civilian organization would be most appropriate to continue BW work. One argued to the Defense Ministry that such a move would actually enhance the security of the program, hiding it in plain sight. Construction of new facilities could be explained by an openly published order to expand the civilian biotechnology sector (Leitenberg and Zilinskas, 2012, p.65). The result was Biopreparat, a civilian pharmaceutical organization which was established by Kremlin decree in 1973 and served as an umbrella for several institutes and laboratories throughout the Soviet Union. Its work was not entirely covert. Several Biopreparat facilities conducted research on vaccines and biotechnology that did support pharmaceutical needs (Tucker, 1999, p.4). But Biopreparat's main purpose was the BW program and its civilian status acted as a deceptive cover to its real functions.

Many of Biopreparat's "employees" were, in fact, military officers and graduates of institutes focused on molecular biology, weapons design, and other areas of knowledge essential to the program. They were issued additional identity documents identifying them as civilians and their ranks and military associations remained highly secret. This restriction on disclosing military affiliation was so strong that it persisted long after the individual's involvement with Biopreparat. A former laboratory director in Obolensk stood for election to a district council many years after his retirement and the collapse of the Soviet Union, but there was no reference to his army background in any information provided to voters in support of his candidacy (Rimmington, 1999, p.90). Not only would this cover provided to scientists confuse any intelligence agency investigating the organization, but it also allowed these individuals to attend conferences and interact with the world scientific community without the stigma of being a military scientist. These connections significantly aided the R&D effort (Alibek and Handelman, 1999, p.22). This practice was not without its observable signatures, however. One former BW program official noted that the actual civilians employed in these institutions soon realized who was a military officer undercover, and hence who was engaged in secret work. Strangely, this was because the military officers were given two paychecks – one from the civilian organization and one from a "separate, secretive office" that most staff could not access (Leitenberg and Zilinskas, 2012, p.235).

In addition, the Biopreparat organization itself could act without suspicion. Since it was a civilian organization, it was able to request and obtain samples from foreign microbe banks for further research, a procedure completely in line with BWC requirements. As an example, in 1982 Biopreparat requested a vaccine-resistant strain of tularemia from one such bank and it was

provided with no questions ever being asked (Alibek and Handelman, 1999, p.26). That same year, Biopreparat hosted the First International Conference on Metabolic Plasmids in Tallinn, Estonia. Twenty-two foreign scientists, including several from the United States, attended with 110 Soviet researchers. There is no evidence that anyone in the United States understood Biopreparat's true purpose at this point. In fact, the conference was staged to bolster the organization's legend as a civilian R&D institution (Leitenberg and Zilinskas, 2012, p.159). Not all activities visible to the outside world were in line with being a civilian institution, however. Journal subscriptions and even visits to Moscow libraries were carefully controlled by the security services and restricted to only the most senior officials. The belief was that any U.S. observation of these activities might allow intelligence agencies to discern the general direction of Biopreparat research (Domaradskij and Orent, 2003, p.157).

Despite its ostensibly civilian status, Biopreparat had links to several Soviet ministries that may have been apparent with closer inspection. Its actual headquarters was vaguely and inaccurately labeled the "Main Directorate of the Council of Soviet Ministers." The Ministry of External Trade was directed to establish clandestine overseas trade missions to acquire animals for testing and laboratory equipment (Alibek and Handelman, 1999, p.27). Its administrative personnel were provided by the Ministry of Medium Machine Building, which also controlled the Soviet nuclear weapons complex and in some cases acted as an intermediary for funding and other resources (Moodie, 2001, p.69). But the majority of Biopreparat's funding came from the Ministry of Defense and was administered in an unusual way. The Soviet budget was managed by GOSPLAN, the state economic planning committee. Every program and line of funding in every sector of the Soviet economy was managed by civilian apparatchiks. According to Alibek, the BW program was different. It was managed using different types of funding codes by a high-ranking army officer (1999, p.43). This type of unusual administrative action was observed in several other cases analyzed in this dissertation as well.

Biopreparat advanced the Soviet BW R&D program through the 1970s taking advantage of its civilian cover and assistance from these other ministries. But it was not the only actor in the BW effort. Another offensive BW program that focused on infecting livestock was administered by the Ministry of Agriculture and was also kept secret for the life of the program. The state security apparatus conducted its own BW research that resulted in products such as those used to poison defectors in the West. This program was run through the Ministry of Health (Rimington, 2000, p.2). Finally, the Ministry of Defense administered a BW effort separate from Biopreparat that remained almost completely unknown to outsiders even after the fall of the Soviet Union (Zilinskas, 2006, p.47).

This Defense Ministry BW program ran large laboratories throughout the Soviet Union that were self-contained, often with living quarters and schools within the compound itself as many

Soviet industrial enterprises were during this period. This extended even to the legal system. The Ministry of Justice was directed to establish a special office to provide legal services and special courts for personnel involved by these weapons institutes (Miller, Engelberg, and Broad, 2001, p.230). While the isolation of these institutes undoubtedly served to maintain their security, extraordinary measures such as the establishment of special schools and courts also expanded the number of individuals and organizations involved in their management.

The personnel assigned to these facilities were among the most educated and highly qualified in the Soviet system. As alluded to in the opening quote by Alibek, they were world-class scientists and researchers who were willing to work in secret and remote locations to further the goals of the BW program. But an accident at one of these facilities would bring significant attention to the Soviet BW program and would be the greatest test of the deception devised to protect it.

Sverdlovsk

In October 1979, a newspaper serving Russian immigrants in West Germany began to publish stories about a mass casualty event in Novosibirsk. After more information from relatives and new arrivals was received, the location was changed to Sverdlovsk and event was specified as an explosion at a military camp in April of that year that had “infected hundreds” (Harris and Paxman, 1982, p.220). Within a few months, the CIA had interviewed contacts within the Soviet émigré community and Soviet Jews who had immigrated to Israel. One interview resulted in an account from a doctor who had been at the site and claimed the victims had difficulty breathing and presented with symptoms consistent with inhalation anthrax (Mangold and Goldberg, 1999, p.74).

The U.S. government confronted Moscow over the outbreak through several channels. These demands for clarification were based on the seriousness of the event, but also likely spurred by the continuing suspicions of U.S. officials and analysts over Soviet BW efforts. There were two sources of U.S. skepticism. First, the BWC lacked any verification mechanism, meaning that states only self-reported their lack of BW R&D without being compelled to submit to any type of inspection. Second, analysts within the intelligence community warned of an offensive BW program in the Soviet Union as early as 1975 based on “all source” intelligence, concerns that even found their way into the open press (Beecher, 1975). One of these analysts, Gary Crocker of the State Department’s Bureau of Intelligence and Research, admitted later while they felt certain there was a Soviet BW effort at this point, they were unaware of the extent and size of the program (PBS, 1998b).

The Soviet response to U.S. inquiries was to announce that an outbreak of intestinal anthrax had occurred from contaminated meat sold illegally by private vendors in the Sverdlovsk region

(Harris and Paxman, 1982, p.221). This explanation would later be expanded considerably. The Soviets acknowledged that 64 civilians (but no military) had died though U.S. intelligence analysts put the number at 200-300 (Leitenberg, 1992, p.10). Soviet scientists later claimed the anthrax had been traced to a meat processing plant in nearby Aramil and came from bone meal produced at the facility. Two men were prosecuted for slaughtering sick cattle and sheep and selling the meat in violation of veterinary regulations (Meselson, 1988, p.2). In their assessments, U.S. analysts cast doubt upon these stories. Crocker later stated that the large unknown military facility in Sverdlovsk was immediately suspect. He argued that if it were truly a “disease control” facility, why was no one writing and publishing on such topics from Sverdlovsk (Marshall, 1988, p.384)? The coincidence of proximity of this facility to the anthrax outbreak, according to several U.S. analysts, was too coincidental. Further pressed by doubting U.S. officials, the Soviets presented their evidence that intestinal anthrax had broken out in the region.

Seeking to appear open in their investigation and put years of speculation to rest, the Soviets invited a team of prominent American scientists to visit and review the evidence in 1986. The team was led by Dr. Matthew Meselson, a professor at Harvard University specializing in genetics and molecular biology. Dr. Meselson was in a unique position to lead such an effort. In the 1960s he had been instrumental in arguing against continued U.S. BW development and had been a champion of the movement that resulted in the BWC. The team consulted with Soviet officials and reviewed the records presented by these officials. Meselson was also invited to review CIA reporting on Sverdlovsk, but expressed doubts on the conclusions reached by analysts. He observed that all of the reports were “second-hand reporting” and that the lack of mention of intestinal anthrax “cast doubt on the veracity of the sources” (Miller, Engelberg, and Broad, 2001, pp.77-78). Several years later, Meselson invited Soviet scientists on a short speaking tour of U.S. universities and medical associations to present the evidence that the outbreak was from contaminated meat. Following these discussions, Meselson stated “Contrary to the U.S. government version, there is no evidence of inhalatory anthrax...It is clear that the U.S. version of the Sverdlovsk anthrax outbreak is in need of careful and objective review”(Meselson, 1988, p.6).

Researchers Tom Mangold and Jeff Goldberg state in their review of the incident, “What had begun as a local cover-up in Sverdlovsk now became an international fairy tale, a fiction of breathtaking audacity” (1999, p.76). This deception was based on three types of information: 1) the actions and records of personnel in the city during the outbreak; 2) the population infected; and 3) the objectivity and expertise of the Soviet scientific establishment. Each of these areas merits discussion.

Actions and Records in Sverdlovsk

Several facts that became known following the outbreak and that were presented by the Soviet speaking tour in 1988 supported the Soviet explanation of events. As previously discussed, Soviet authorities were able to trace the outbreak back to contaminated bone meal at the Aramil facility which allegedly infected cattle and sheep, which were then slaughtered and illegally sold on the black market by two individuals who were later prosecuted. This story held up prior to the collapse of the Soviet Union, mainly due to the impossibility of checking the facts. Once greater access to individuals and places was available following the collapse, the story became implausible. A Wall Street Journal reporter spoke with workers and officials who contradicted these stories in 1991. The director of the facility stated that what was alleged was impossible. First, Aramil only received bone meal shipments with the appropriate certificates of quality. It did not produce bone meal and distribute it for any reason. Second, the facility director stated that in 1979 Aramil did not make any sales to private individuals, only state organizations (Gumbel, 1991c). In addition, the two individuals charged with illegal distribution were fined 100 rubles and given a one-year suspended jail sentence. A judge in Sverdlovsk told the reporter this punishment was “purely token” by Soviet justice standards, especially for an offense that killed scores of people (Gumbel, 1991a).

The Soviet authorities presented death certificates with the cause of death listed as intestinal or cutaneous anthrax to the families of victims. That information was released officially through the Soviet government to Meselson’s team and other parties, but it was also shared informally by the families and word spread that local and expert physicians had certified these causes of death. Alibek later claimed, however, that the physicians who visited the families, presented these death certificates, and informed grieving widows of the cause of death were not doctors at all but rather KGB officials impersonating physicians (1999, p.75). This corresponds with information gathered by Russian journalists after the Soviet collapse that large numbers of KGB and military personnel had worked in Sverdlovsk for some time after the outbreak and had confiscated medical records of the victims from hospitals and families (Leitenberg, 1992, p.11).

The actual doctors on scene for the outbreak were aware of the truth that pulmonary and inhalation anthrax were the culprits but the autopsy records and photographs only reflected intestinal and cutaneous infection. During the 1988 speaking tour, one Soviet physician used autopsy photographs of victims’ intestinal tracts during his presentation. When questioned at one point whether photographs of the lungs and respiratory tracts were available, he simply stated that he had forgotten them but that they showed no infection (Gumbel, 1991b). But with the new openness policy only two years later, Russian journalists were able to debunk this story as well. Two local doctors working in a Sverdlovsk hospital during the outbreak planned to author a report on the incident and one planned to use the evidence collected for a doctoral dissertation. But after the U.S. government accused Soviet officials privately of covering up

work prohibited by the BWC, KGB officials came through the facility to collect and destroy any actual evidence. These doctors managed to hide stomach and lung samples of several victims as well as photographs of their respiratory tracts (Gumbel, 1991b; Gordin, 1997, p.464). Meselson and several members of his team were invited to visit Sverdlovsk itself in 1992, at which time they were shown the autopsy photographs clearly indicating inhalation anthrax (Miller, Engelberg, and Broad, 2001, p.134).

The Infected Population

The victims themselves were a vital part of the Sverdlovsk mystery. The first to die was a normally healthy 46-year-old man whose widow later claimed he had been diagnosed with bacterial pneumonia. After the post-mortem, the doctors changed the cause of death to sepsis from anthrax (Gumbel, 1991b). These records were presumably “scrubbed” once Soviet officials realized it was an anthrax outbreak. Nonetheless, the initial cause of death could not have come from an intestinal infection. As noted previously, the Soviet government claimed only 64 individuals died from infection though later evidence suggests that this 46-year-old was the first of approximately 200 victims.

The demographics of the victims was a source of speculation for years following the incident and presented Soviet authorities with facts that needed to be explained. First, it is important to understand that “Compound 19,” as the anthrax development facility was officially known, had been built outside the city of Sverdlovsk in 1947 but that the city had expanded to surround it. By 1979 it sat in a residential and industrial part of the city (Mangold and Goldberg, 1999, p.67). It would be discovered later, though not admitted by Soviet authorities in their evidence or presentations at the time, that most of the victims worked or lived in the Chkalovsky district of Sverdlovsk, which was adjacent to Compound 19 (Leitenberg, 1992, p.10).

Meselson’s 1988 account of his review of evidence with Soviet authorities and their visit to the United States includes several facts that were admitted by the Soviets but that raised flags for analysts. Almost all of the patients treated for anthrax were adults, only one child was infected and that was not a fatal case. In addition, the Soviet authorities revealed that two-thirds of the victims were men. The Soviets explained this to Mendelson by referencing a “custom of reserving available meat for the adult family member doing the heaviest labor and to the fact that children have their main meals in schools that serve only inspected meat” (1988, p.5). In 1990, family members of the two of the victims disputed this, stating that everyone in the family had eaten the same food but only one person had been infected (Gumbel, 1991b).

Only the timeframe of the outbreak received more attention than the demographics of the infected population. The Soviets claimed that April 4th had been the first day that a victim had been hospitalized and the last day was May 19th (Meselson, 1988, p.4). Those who assumed the

outbreak was caused by weapons research seem to have assumed that some sort of explosion would have caused the spread of the anthrax. But this was seemingly impossible given the timeline of the infections. Soviet scientists argued that had there been some sort of explosion or sudden release, there would have been a rash of cases in three to four days. The gradual rise in cases to a peak, and then the trailing off of new cases over six weeks, was more indicative of the contaminated meat explanation where the meat was being stored in people's homes and consumed gradually (Marshall, 1988, p.384).

Several explanations were proposed. A CIA team hypothesized that the first wave had come from an accidental release of anthrax spores into the air, causing several rapid cases as expected. The subsequent cases over the next several weeks could then have come from eating meat contaminated by the initial event. This would have explained both the longevity of the outbreak and would have provided several cases of intestinal anthrax to support the Soviet story. This hypothesis was supported by something that could not be shared with the public or Soviet government – imagery of cleanup operations surrounding Compound 19 to include washing down of buildings, removal of topsoil, and repaving roads (Leitenberg, 1992, p.11). There are two problems with this explanation. First, it does not support the demographics of the infected population. If the later cases came from sources such as contaminated meat then the infection rates of women and children should have risen, but they did not. Second, anthrax that is consumed or exposed via the skin is rarely fatal in humans. Inhalation anthrax is fatal in the majority of cases, but only rarely occurs in nature (Mangold and Goldberg, 1999, p.68). If a “second wave” from another source was to blame, the mortality rates should have changed but there is no evidence that they did.

Another potential explanation was difficult to assess due to the lack of experience in such topics in the West. As just mentioned, inhalation anthrax is extremely fatal but very rare in nature, thus making it a very efficient but easily identifiable weapon. It is also a condition that is not often studied outside its military applications. Since the United States abandoned its offensive BW program in the late 1960s, and other Western countries did not have such programs, very little was known in the West about how the condition progressed. Two studies had been conducted in 1956 and 1966, but they were not widely known or disseminated as the Western offensive programs ended. These studies indicated that anthrax could remain dormant in the lungs for as long as 90 days after infection, and then produce a “delayed fatal infection” (Guillemin, 2002, pp.27-28). This may be the reason why some individuals were infected at the time of the initial dispersal, probably in early April, but were still developing symptoms in mid-May.

A third, and chilling, explanation also existed. The Soviet BW program was working to make pathogens suitable for weaponization and resistant to vaccines. Scientists were

manipulating the genetics of the pathogens to achieve their ends and experimenting with them to determine success. It is therefore possible, even likely, that any anthrax spores released from Compound 19 were unlike those found in nature and would not have the traits that have been observed in other cases. There may be other reasons, unknown to scientists, why certain individuals were infected and not others, or why the infection may have been dormant in some individuals. There is simply no way of knowing whether this is the case. But this possibility weakens any argument that the outbreak *could not* have been caused by an accidental release from Compound 19 due to the longevity of the outbreak.

The Soviet Scientific Establishment

The third aspect of the Sverdlovsk deception was based on the Soviet scientific community and its relationship with colleagues in the United States. This relationship was greatly influenced by the attitudes and beliefs of the U.S. scientists with which the Soviets worked to present their version of the Sverdlovsk incident.

Dr. Meselson had long been a critic of any country conducting offensive BW R&D, but also of U.S. accusations of Soviet non-compliance with the BWC. Much of this appears to have been due to fundamental differences between the ways in which scientists and intelligence analysts process and present information. Referring to the intelligence community's requests for estimates and assessments on the Soviet BW program, Meselson stated "If you've got to have an answer and you're willing to have a forty percent chance of being wrong, ask somebody else" (Miller, Engelberg, and Broad, 2001, p.80). It is certainly reasonable to expect some disconnect between those accustomed to working with empirical evidence and those who practice the "art" of intelligence analysis.

Meselson's differences with the intelligence community extended beyond methodology. In his primary article on the Sverdlovsk investigation he wrote "What is clear is that the best way to protect the mutual interest of the US and USSR in maintaining and strengthening world-wide restraints against the hostile use of biology is to foster a policy of open laboratories and free communication among biological scientists" (1988, p.6). This statement overlooks, intentionally or not, the foreign affairs specialists and intelligence analysts who were doing much of the work on BW issues and the Sverdlovsk incident. His colleague and wife Dr. Jeanne Guillemin went further, stating "For want of alternatives, academic researchers remain best suited to do the independent applied science that characterized the Sverdlovsk investigation. Our academy and our tenure system are still the best protections for scholars who bring the scientific ethos to government issues" (2002, p.34). Though many intelligence analysts would object to this statement, Meselson's and Guillemin's points that trained and tenured scientists are the best individuals to maintain the BW arms control regime and investigate any issues that arise are arguable. But these points entirely depend on the assumption that they are interacting with

colleagues operating under the same system and rules. If their Soviet counterparts were not upholding the same standards or not operating with the same freedom of inquiry and expression provided by tenure in the United States, then such collaboration would result neither in honest exchanges nor effective policy options.

Meselson's primary contact in the Soviet government was Dr. Pyotr Burgasov, a Deputy Minister of Health who had been dispatched to Sverdlovsk to coordinate efforts following the outbreak. Burgasov would also lead the Soviet delegation for the speaking tour in the United States in 1988 and presented the theory from the outset that the anthrax infections were intestinal and had come from infected meat. He was an accomplished and highly educated physician, and presumably one of those with whom Meselson believed collaboration would ensure the effectiveness of the BW arms control regime. Burgasov shared much of the Soviet information with Meselson, including the statement that Compound 19 was a facility that researched infectious diseases. But he claimed to be unaware of the details of this research and said that such questions were more appropriate for the Defense Ministry (Meselson, 1988, p.6). However, it is unlikely he was not aware of the activity at Sverdlovsk. Burgasov was not only a physician, but also a former army officer who had once been assigned to Compound 19. Though he maintained his story that meat had caused the outbreak long after *glasnost* and journalists had discredited it, his experience and his presence on the ground to coordinate the cover-up make it highly unlikely he was ignorant (Mangold and Goldberg, 1999, p.78).

Burgasov traveled to the United States with two colleagues in 1988 to present Soviet findings on the Sverdlovsk incident at Johns Hopkins University, the National Academy of Sciences, and the American Academy of Arts and Sciences among others, accompanied by Meselson. Burgasov and two colleagues, Vladimir Sergiyev and Vladimir Nikiforov, presented their findings and took questions in each of the venues. During one session Nikiforov, a clinician who had treated numerous Sverlovsk victims and had attended most if not all of the autopsies, was explicit in stating that he had neither seen nor been told of any cases of lung infection (Marshall, 1988, p.384). In addition, he brought autopsy photographs that clearly depicted infection in the intestinal tracts of victims, but claimed to have "mistakenly forgotten" to bring any photos of the respiratory tracts and lungs of the victims (Gumbel, 1991b). Certainly anyone in the group who was looking for empirical evidence should have been skeptical at claims that such a critical piece of evidence had been accidentally left in Moscow. Alibek, who was not directly involved in Sverdlovsk because Compound 19 was not a Biopreparat facility, was skeptical that the 1988 speaking tour would be successful. He did not believe Soviet authorities had credible explanations for the longevity of the outbreak (why would people keep eating privately bought meat with all of the public health messages?), or for the demographics of the infected population. Nonetheless, he claims to have been later informed that the trip was a resounding success (Alibek and Handelman, 1999, pp.85-86). There is little evidence of the extent to which U.S.

audiences actually accepted the Soviet story. But that story was presented by highly trained specialists who had been on the ground during the outbreak, facilitated by a renowned scientist from Harvard University, and could be countered only by U.S. officials who were unable to cite their evidence due to its classification (Marshall, 1988, p.383).

Another issue with the assumption of Soviet objectivity arose from published articles that were also cited as evidence. In his writing on the incident, Meselson refers to two Soviet publications. One was a journal article describing the arrest and prosecution of the two individuals charged with distributing the contaminated meat in Sverdlovsk. The second was the original article detailing the tracking of the source of the outbreak, co-authored by the same Dr. Nikiforov who would later be invited to come to the United States and present his findings. This article takes the reader through the infecting, slaughter, and sale of the animals on the black market and also makes the point that anthrax outbreaks in animals had occurred in the Sverdlovsk region 159 times from 1936-1968 (Bezdenzhnykh and Nikiforov, 1980). Meselson seems to accept this story, at least pending further investigation. But he also asks why no official or private scientists bothered to contact either of the authors at their professional addresses to engage in the collegial exchange of information that he believes to be critical to preventing BW proliferation, though he admits in the Soviet system the scientists likely could not have corresponded openly (1988, p.6).

One reason that official entities may not have contacted the authors was that in this circumstance, no matter their expertise and training, they were not credible. This article proves that in the Soviet Union, the publication of an article in a scientific peer-reviewed journal did not have the same implication of objectivity and non-interference that Meselson enjoyed in the United States. During a return visit to Moscow following the collapse of the Soviet Union, Meselson's team met with Dr. Nikiforov's son, who with his father's passing had taken possession of significant material relating to the outbreak. The younger Nikiforov claimed that Soviet authorities had bullied his father into repeating the meat contamination story but that the additional autopsy photos, those "forgotten" in 1988, should have indicated to the elder Nikiforov that the infection was inhalatory in nature (Guillemin, 1999). Dr. Burgasov, meanwhile, merely repeated his assertions that contaminated meat had caused the incident.

Observations on Sverdlovsk

This admittedly brief summary of a highly complex scientific mystery is not intended as an accusation of Meselson or his colleagues. As a purely scientific inquiry, the empirical evidence surrounding the 1979 anthrax outbreak in Sverdlovsk is contradictory and a more complete picture has only emerged over time. Instead, the point of highlighting this incident is that the issue extended beyond the purely scientific. By accepting the evidence presented to them by Soviet colleagues as valid, Meselson and his team became unwitting accomplices to a deception

that was intended to deflect accusations of BW development and freeze any potential official U.S. response.

The Soviet deception surrounding the 1979 anthrax outbreak in Sverdlovsk was a complex and high-stakes operation for the Soviet government. While it may appear to be of limited use in a study focused on long-term deception, this effort was only possible due to the foundations established by the consistent and coordinated deception surrounding the Soviet BW program. This coordination is evident in Burgasov's role following the outbreak and in acting as a point of contact with Meselson, in the publication of the 1980 journal article detailing the history of anthrax outbreaks and the origins of the 1979 one, and the 1988 speaking tour with its selective presentation of evidence. Channels are also an important part of this deception. The Soviets had a significant advantage in controlling channels of information in 1979 and throughout the 1980s. The story only collapsed, and this section of the appendix could only be written, due to the work of Russian and U.S. journalists following the collapse of the Soviet Union, when Moscow no longer controlled information channels.

The effects of the Sverdlovsk deception were two-fold. First, it did complicate the U.S. response to the incident and impact the interactions between U.S. and Soviet officials. At the March 1980 BWC conference, the U.S. delegation did make a statement referring to the incident and the likelihood that the outbreak came from a prohibited BW program, an accusation that led to vehement Soviet denials. But the Americans' lack of faith in their own evidence led them to press the issue no further. When the draft conference statement was circulated, the U.S. delegation did not object to a statement that the BWC had not been violated since its implementation – directly contradicting the previous U.S. position (Gordin, 1997, pp.451-452). At the second BWC conference in 1986, the issue of Sverdlovsk was again raised, but only as a desire for the United States to use the consultative process in the BWC to discuss the possibility of a Soviet offensive BW program (Leitenberg and Zilinskas 2012, p.371). The ability of the Soviets to advance a plausible alternate explanation limited U.S. policy alternatives.

The U.S. intelligence community does not appear to have been fooled by the deception, however. The second impact of the Sverdlovsk incident was that, despite the lack of smoking gun evidence, it refocused attention on the Soviet BW program. U.S. intelligence agencies had advanced their knowledge of Soviet BW efforts beginning with U-2 flights in the 1950s, but despite the allocation of considerable resources, a detailed understanding of the program eluded the U.S. government (Luxow and Hoptman, 1965, p.19; Leitenberg and Zilinskas, 2012, p.133). According to Crocker, that changed following the Sverdlovsk incident (PBS, 1998b). U.S. analysts were able to gradually obtain more convincing information about the BW R&D effort, finally coming to an understanding of how vast the effort had been.

Framework Analysis

The data points identified in the course of this research are categorized in Tables B-1 through B-7 at the end of this appendix. Those data points that come from the Sverdlovsk incident are preceded by an “SO” designation. A substantial amount of data was found in each of the four categories of action. The significance of this data to the dissertation is discussed in-depth in Chapter 3.

Much of the factual information revealed during the Soviet BW program came through relationships and interactions with Western colleagues. The volume and quality of such information varied according to how these interactions took place. The deceptive nature and tight security of Biopreparat prevented a large amount of factual information from getting out, but the BW complex’s reliance and collaboration with the West did provide some clues. Institutions such as the Byelorussian Research Institute of Epidemiology and Microbiology in Minsk had long-standing relationships with Western laboratories, in this case the Institute of Tropical Medicine in Belgium. In the early 1980s, the Belgians provided the Soviet institute with variants of the Ebola and Marburg viruses for study – which was permissible under the BWC. What was not permissible was the passing on of these viruses to the Soviet BW virology center in Zagorsk, a move that Western observers would likely not have seen (Leitenberg and Zilinskas, 2012, p.93). Nonetheless, monitoring the provision of BW-related material to Soviet institutes might have provided some clues as to what was being researched, but very little in terms of definitive proof.

In the late 1980s, however, factual revelations would prove to be more useful. Following the diplomatic protests of the West after the Pasechnik defection and other events, the Soviet government agreed to what many had always felt lacking from the BWC regime – inspections of Soviet laboratories and storage facilities. Western experts traveled to remote locations throughout the Soviet Union to examine facilities and engage their Soviet counterparts, often for the first time. Many of these Western scientists were surprised that the Soviet specialists, away from the general meetings where tape recorders were running, were often boastful of their accomplishments despite the research being obviously offensive in nature (PBS, 1998a). Though perhaps shocking at the time, this is understandable. The Soviet scientists were anxious to show their Western counterparts that in many ways they were ahead of them technologically and had made significant advancements – advancements that their government had withheld from the world. This would also be seen when U.S. scientists began to reengage South African nuclear specialists after an absence of several years. As with the Sverdlovsk incident, once the number of channels was increased factual information began to be revealed.

The withholding of scientific advancements may have been the most painful part of the concealing of fact in the Soviet BW deception. Former officials have since shared details of a system where gifted and driven Soviet researchers made significant plague vaccination discoveries significantly before Western scientists, but had their research classified and were forbidden to announce or publish it (Domaradskij and Orent, 2003, p.116). Literally more painful were the hidden vaccinations required for Soviet researchers. Alibek recounts how many Biopreparat employees were given smallpox vaccinations on their buttocks because they would be meeting and interacting with foreigners and there would be no easy explanation for the telltale scar left by the injection (1999, p.120). Measures such as these concealed Soviet precautions that would not have been necessary with a legitimate program. Finally, the facilities themselves were concealments. The Soviet Union had the advantage of vast expanses of sparsely populated territory where facilities could be established out of sight. Perhaps the greatest example was Resurrection (or Rebirth) Island, the island in the Aral Sea that was the source of the 1971 smallpox breakout. This site was selected because it was cut off from any unauthorized entry, completely surrounded by Soviet territory, and was large enough to house the 1,000 troops and 400 chemical/biological protection troops that maintained security on the island (Mangold and Goldberg, 1999, p.45).

Despite such an advantage in capability for denial, the officials running the BW program recognized the need to present disinformation to protect the program. The vague naming of institutions such as the “Main Directorate of the Council of Soviet Ministers,” which was actually Biopreparat’s headquarters, is one such example (Alibek and Handelman, 1999, p.10). Biopreparat’s alleged purpose of civilian pharmaceutical research was another fiction, enhanced by actions already discussed such as hosting the plasmids conference in Tallinn in 1982. BW facilities themselves were also used to transit fiction. Several were designed and constructed deceptively. One example was the State Research Center for Applied Microbiology in Obolensk, which was designed in layout and appearance to look like a sanatorium to confuse any satellite imagery (Domaradskij and Orent, 2003, p.183). Of course, the Sverdlovsk incident provides considerable number of examples of revealing fiction – from articles placed in scientific journals to autopsy reports, much of the evidence presented by Soviet authorities was false.

Finally, the data on the Soviet BW program shows a substantial amount of coordination, or concealing fiction, as well. The extraordinary funding practices through which GOSPLAN managed the BW program is one such measure, as is the creation of a separate classification system – “Series F” – for the most sensitive Biopreparat work. With only a handful of officials cleared for such information, this new classification served as the forming of a “group within a group” of officials who were aware of the information and normally cleared individuals who realized they were being excluded (Leitenberg and Zilinskas, 2012, p.69). In addition and as was seen in several of the nuclear cases examined in this dissertation, high government officials who

would have normally known of a military R&D effort this large were excluded. In this case, it was the Soviet Foreign Ministry and the minister himself who were surprised to learn of the extent of the BW program from demarches presented by Western diplomats (Mangold and Goldberg, 1999, p.108).

The Soviet BW program was a massive and complex effort that constituted a significant risk for the Moscow government. It was protected by a deception plan that was meticulously maintained through control of information channels and compartmentalization of information. It is also an example of a long-term deception that successfully withstood a “wild card” event, the Sverdlovsk anthrax outbreak. While Sverdlovsk was damaging to Soviet prestige and credibility, the deception employed to obfuscate the incident served to keep the Soviet government from being conclusively accused of BWC violations. This “emergency” deception would not have been possible without the foundation being established by a deception effort that had lasted decades. This, too, was seen in nuclear cases – particularly the case of India with regards to the 1998 tests and Iraq at the start of the 1991 Gulf War. For the purposes of this dissertation, the Soviet BW case provided invaluable insight and helped form hypotheses involving multiple channels of information and the impact of long-term deception on interactions between government officials.

	Fact	Fiction
Reveal	* Agreement to keep legal amounts of strains for research * 1938 MinDef comment that BW attack would be countered in kind * Deployment of expert teams to counter outbreaks in India * SO: Release of hospitalization information * SO: Release of location of largest outbreak cluster * SO: Release of outbreak demographics (only one child infected) * Indignation that US was not prosecuting Japanese BW war criminals to advance their own program * SO: Claim that Western scientists not sufficiently familiar with intestinal anthrax to comment on symptoms	* SO: Accusation of Western disinformation agency plot * Post-BWC statement that USSR had not possessed BW * SO: Articles in local press about "Siberian sore" * SO: Fliers warning residents to stay away from "unofficial" food sources * SO: Destruction of more than 100 stray dogs * SO: KGB officials posing as doctors deliver false death certificates to families * SO: Autopsy photos showing intestinal lesions * Claims that inspection team would need to quarantine for time if certain facilities entered * Story that frozen corpses with smallpox had been discovered in Siberia * SO: Peer-reviewed medical articles about role of privately-owned farm animals in outbreak * SO: USSR Govt listing of 96 anthrax cases total. * SO: Claims that no inhalation anthrax was observed * SO: Claim no contaminated meat came from official sources * SO: Claims a contaminated meat sample seized at police checkpoint *SO: Claim a factory had received infected carcasses and sold them *SO: Explanation that only one child was sick due to custom of giving meat to hardest working family member *SO: Claim there were no military casualties during outbreak * SO: Peer-reviewed journal article about frequency of anthrax outbreaks * SO: Soviet elaboration about facility improperly producing bone feed being distributed to privately owned animals *SO: Inhalation anthrax would have killed many people quickly, then tapered off. Instead, new cases after two weeks * SO: Cause of death for one of first cases changed from "bacterial pneumonia" to "sepsis from anthrax" after initial post-mortems *SO: "Criminals" who sold infected meat arrested and charged * Biopreparat hosted intl conference in 1982 to push credentials as civilian agency
Conceal	* Inspection drivers order to drive slowly between sites, reduce "official" time * Vodka and cognac stockpiled at inspection sites. * Stepnogorsk kept off official maps * Concealment of seizure of Japanese BW information * Identification of "illnesses" among US/UK inspectors to keep them from entering certain facilities	* SO: "Criminals" convicted of selling infected meat given light fines and suspended jail time. "Very light" sentences. * Soviet Foreign Minister (and large portion of diplomatic bureaucracy) unaware of the BW program

Table B-1 Diplomatic Aspects of Soviet BW Deception

	Fact	Fiction
Reveal	* Lab officials boasted of accomplishments in front of US/UK inspection team, though several "accomplishments" would not have been possible without BWC violation	* Biopreparat personnel given "cover identities" as civilian scientists * Biopreparat personnel never wore uniforms * Issuing of second internal passport for Biopreparat personnel * Biopreparat personnel able to attend international conferences as civilians * Guards at lab gates and facilities were never in uniform * Biopreparat personnel issued instruction manual with answers to every anticipated question prior to inspections
Conceal	* Scientists not permitted to inform families of where they were going (Resurrection Island testing) * Smallpox workers confined to special dormitories guarded by KGB * Scientists given smallpox vaccine in buttocks to hide scar * Biopreparat workers at many sites restricted to vacationing together at state holiday camps * Ministry of Justice established a special office for legal and court services for personnel employed by weapons institutes * Secret transfer of military personnel to civilian program. Officials hid military backgrounds from official biographies * No academic work on disease control from experts in Sverdlovsk, despite the prominence of the institution in the Soviet research system	* CI unit established at every lab * "Closed legend" formulated to explain why certain research was taking place to those without a need to know * Administrative and support personnel brought in from Ministry of Medium Machine Building * Anti-plague scientists unaware of offensive program, but offensive scientists kept aware of AP for "legend." * KGB monitoring of involved personnel and research. * Vaccines supplied to medical personnel in Resurrection Island marked only with dosages, not with names * Military scientists identified by colleagues because they received normal paycheck and an additional one from "secret" section. * New classification level established for BW program (Series F)

Table B-2 Human Capital Aspects of Soviet BW Deception

	Fact	Fiction
Reveal	* Some Biopreparat facilities engaged in legal civilian work	* BP HQ labeled as "Main Directorate of the Council of Soviet Ministers" * Civilian org status used to obtain samples from foreign microbe banks * Fictional blueprints drawn up for biodefense facility with strict security measures (for inspection purposes) * Fictional government directive issued for highest biosafety measures at all facilities (for inspection purposes) * Special units (engineers, etc.) created to supervise construction of phantom facilities and prepare blueprints * Open CC decree calling for advancement in civilian biotechnology sector, used to explain the rapid expansion of facilities and creation of Biopreparat
Conceal	* Several major BW facilities established near large towns and population centers * Laboratories self-contained with schools, etc. * Communications between Biopreparat HQ and labs always encrypted * Contact between Biopreparat and MoD only at HQ level, no coordination permitted between lab personnel * Selection of Resurrection Island because it was on a lake surrounded by Soviet territory * Secret institutes referred to only by "Post Office Box."	* Special unit (Spec CM Against Foreign Engineering Intel) established to ensure nothing labs did was visible to outside world * Special task force formed to coordinate deception plans between various ministries * MoH given lead to Flute, existence of which is almost entirely unknown in BW program * Creation of inter-agency council to coordinate BW activities * Medium Machine Building not included on council of overwatch, despite giving significant admin support * All Biopreparat facilities had special rooms for F series meetings and designated storage spaces for F level documents only

Table B-3 Infrastructure Aspects of Soviet BW Deception

	Fact	Fiction
Reveal	* SO: Extensive decontamination around Compound 19 after accident. Includes burning buildings, removing topsoil, repaving roads. * Soviet use of toxins in Afghanistan	
Conceal	* Experts returned from fighting outbreak in India with strain of smallpox uniquely suited to weaponization * Large, empty rooms that obviously used to hold major equipment observed during inspections * Scientists order to dispose of tons of anthrax stocks in 1988, due to fears that increased openness would lead to discovery.	

Table B-4 Special Material Aspects of Soviet BW Deception

	Fact	Fiction
Reveal		* Front trading associations established overseas by Ministry of External Trade to import animals and equipment for testing.
Conceal		

Table B-5 Other Material Aspects of Soviet BW Deception

	Fact	Fiction
Reveal		
Conceal	* MoH centers doing AT research given special funding for weapons-oriented genetic research * Biopreparat funding continued to come almost exclusively from MoD	* Special department created within Gosplan to handle funds for BW program. Ran by military officer instead of civilians. * Deception task force given \$400K to create cover identity for BW effort and demonstrate civilian character of the work.

Table B-6 Finance and Budgeting Aspects of Soviet BW Deception

	Fact	Fiction
Reveal		
Conceal	* Resurrection Island facility established for testing * Soviet use of missile tests to test warheads with bio-simulants (not revealed to Western countries)	

Table B-7 Test and Evaluation Aspects of Soviet BW Deception

Appendix C. The Kingdom of Sweden (1945-1968)

Sweden has been a dedicated supporter of nuclear nonproliferation efforts since the NPT was negotiated in the 1960s. This, combined with Stockholm's policy of neutrality throughout the Cold War and its lack of extraterritorial military activity, might make one doubt that this country ever contemplated development or purchase of a nuclear weapon in the years following World War II. In fact, it was the desire to remain neutral – and uncertainty of how that policy could be maintained in a nuclear and bipolar world – that arguably led to consideration of the benefits of nuclear weapon acquisition.

The Swedish government perceived that it would not be able to counter potential security threats, particularly a Soviet invasion as part of a larger offensive in Europe, with its conventional arms. Furthermore, it was unsure of how much support it could expect from others, including the United States. It had a robust industrial and scientific community as well as a highly proficient arms industry and significant natural deposits of uranium. What Sweden did not face in the 1950s and early 1960s was an international agreement limiting nuclear weapons R&D. It was not compelled to mislead inspectors or circumvent export control regimes. Extensive and effective denial was practiced to keep this vital and expensive R&D effort secret, but the Swedish government did not attempt to manipulate indicators of what it was doing and was even forthcoming with U.S. officials about its nascent nuclear weapons program.

Historical Background

In July 1945, a U.S. delegate inquired with the Ministry of Foreign Affairs in Stockholm about the status of uranium deposits throughout Sweden. British diplomats had made similar inquiries and Swedish officials were initially confused about the urgency of such questions until the use of the atomic bombs one month later made the new value of this resource clear (van Dassen, 1998, pp. 6-7). Swedish policymakers had long been accustomed to pursuing foreign policy and defense goals without significant public debate. Important issues in these areas had traditionally been decided by a pragmatic policymaking elite (Cole, 1994, p.92). Thus, they were perhaps less concerned with news of the horror of the bombings in Japan than with what the weapons meant for Swedish defense policy. Swedish defense officials had initially considered radar to be the most significant technological achievement to come out of World War II, but they were also convinced by the bombings of Hiroshima and Nagasaki that nuclear weapons would be pursued by many countries and that their natural deposits of uranium and advanced scientific sector gave Sweden a considerable advantage (Agrell, 1990, p.158).

As early as December 1945 a senior official in the Swedish scientific establishment recommended to the government that their program reverse the process by which the United States had developed its nuclear weapons. Instead of creating an energy program from a weapons one, they would focus on generation of nuclear power and have weapons development be a side effect (Jonter, 2010, p.63). The initial approach was to mine uranium to be used in heavy water reactors. This would permit Sweden to produce plutonium at low prices and without having to engage foreign suppliers. It should also be noted that this was a largely indigenous effort. Though the Swedes sought cooperation from the United States, United Kingdom, and France with various technologies it largely kept the effort independent (Cole, 1994, p.8).

The program started slowly. The number of adequately educated and trained personnel and the amount of available industrial resources were initially very low following disruptions in the education system and general economy brought about by the war (Cole, 1994, p.22). But the effort had the support of numerous groups and high officials within the government. Many within the Swedish defense establishment, like many throughout the world, believed nuclear weapons to be the next generation of tools in armed conflict – weapons that many nations would soon have. The weapons study group within the Ministry of Defense focused on U.S. doctrine as well as concepts such as deterrence, retaliation, and flexible response in shaping their recommendations. But civilian officials within the ruling Social Democratic Party (SAP) did not buy into the concept of nuclear weapons as fully, instead believing that these “concepts were the language of great power arrogance” (Cole, 1994, p.54).

In 1954, a Defense Ministry study concluded Sweden’s non-aligned policy would be best maintained by the acquisition of nuclear weapons. The debate over a potential nuclear R&D program had been limited to a small group of politicians, military officers, and technical specialists but at this point it grew to include senior members of the SAP and other bureaucrats within the government, though the media and Swedish public were not informed of the program (Jonter and van Dassen, 2005, p.231). In May of the same year, shortly after the United States tested its hydrogen bomb, the Swedish parliament held its first debate on the issue of nuclear weapons. Prime Minister Tage Erlander acknowledged a program of nuclear weapons research focused on developing ways to defend the country from the effects of a nuclear attack. He made no mention, however, that part of the research focused on Sweden’s ability to develop weapons of its own (Jonter, 2010, p.68).

Erlander withheld information about the possibility of nuclear weapons development from much of the government and all of the public, but he may have been more concerned with the effects of the program on the government itself than with condemnation from the international community or a domestic audience. Erlander was aware that some within the SAP sided with

those in the defense establishment who believed non-alignment was ensured by Sweden having its own nuclear deterrent while others believed the weapons would make such neutrality impossible or that the weapons were simply beyond Sweden's reach. Erlander could not afford a public dispute within the SAP, hence through 1955 and 1956 the debate on nuclear R&D was well-protected and compartmentalized (Agrell, 1990, p.163).

Meanwhile, Swedish officials at various levels engaged their U.S. counterparts on the subject of security guarantees and cooperation. Such discussions began shortly after World War II ended and are described by Paul M. Cole in his work on the Swedish nuclear program from material in U.S. archives. He points out that it is unclear whether the Swedes involved in these conversations documented them with their superiors, but the uniformity of the views expressed indicates they represented official policy (1994, p.65). Initially, conversations about U.S. security guarantees to Sweden were "low-key, informal discussions between U.S. and Swedish military officers." Though U.S. officials were supportive of Swedish defense against the Soviet Union, and Swedish officials were adamant about maintaining neutrality despite guarantees, the parties differed in their view of potential nuclear weapons cooperation. Cole states that Swedish defense planners believed the United States would eventually provide or sell nuclear weapons to Sweden as it had done with conventional weapons. This view was likely bolstered by the U.S. provision of dual-use missile systems to Norway and Denmark (Jonter and van Dassen, 2005, p.237).

However, such a policy was impossible for Washington. By U.S. law, a mutual defense agreement was required before any U.S. assistance that might facilitate nuclear knowledge can take place. No such agreement existed between the United States and Sweden. U.S. reluctance was only solidified as nonproliferation policy continued to develop in the late 1950s. Officials in Washington reasoned that if a peaceful and democratic country such as Sweden were to acquire weapons, especially with U.S. assistance, it would be diplomatically impossible to argue the necessity of nonproliferation to other states (Jonter, 2010, p.70). Despite these emerging facts, Swedish officials continued to make inquiries about nuclear assistance as late as 1960.

With no progress in obtaining a weapon or weapons guarantee from the United States, Swedish planners continued to evaluate possible paths to an indigenous capability. In 1958, now four years after debate within the government over a nuclear weapons program began in earnest, Swedish scientists and military planners presented two potential nuclear programs to parliament. One, the "device program," entailed construction of a nuclear device with a prototype being ready by 1966. The second program, the "protection program," also involved nuclear weapons research but centered on civil defense measures, as Prime Minister Erlander had presented to the parliament previously. Cole notes that this construct is unique among cases of nuclear weapons R&D. The Swedish nuclear effort would have a primary and secondary goal. "The primary goal

would be to determine how awareness of the principles of nuclear weapons operations would contribute to Sweden's defenses in the event Sweden was attacked with atomic bombs. The secondary goal would be to derive information on how to construct nuclear weapons during investigation into the primary goal" (1994, p.106).

Postponing and Deciding

This situation appears to be conducive to long-term deception. Analysts may even see the dual program nature of the Swedish effort as deceptive itself and suspect that the "protection program" was merely a shield and the actual decision had already been made. But the actions of the Swedish government show this was not the case. Cole's research indicates that throughout the 1950s and early 1960s, a pattern of debate over the "device program" was established where the Swedish military made formal requests for authorization to acquire nuclear weapons. The government would postpone the decision while still authorizing research for the protection program as well as some activity specific to devices. Two reasons are cited for postponement. First, there would be insufficient fissile material to build a device for several years. Sweden's plutonium was being produced slowly in a reactor also being used for civilian power. A military plutonium production facility had been approved but was not yet online. Hence, reluctant politicians had an excuse to argue that no decision was yet necessary (1994, p.99). Second, many SAP officials were likely waiting to see how international nonproliferation efforts would proceed and how successful they would be.

In the early 1960s the Swedish government reached a point where a decision on pursuit of nuclear weapons was finally necessary. But it does not appear to have been a difficult one for three reasons. First, there was an emerging international consensus on nonproliferation and the SAP leadership was anxious for Sweden to have a leading voice in the movement. As negotiations over the NPT opened, Sweden took part with no evidence that it was a subterfuge of any kind. The decision to sign the NPT was formally made in 1968 and that same year the Swedish government began liquidating the entities that had been focused on the device program (Jonter, 2010, p.80).

The second factor was cost. By 1961 it had become apparent that a nuclear weapons program would far exceed allowable defense budgets, which were already stretched by an extensive conventional modernization program (Agrell, 1990, p.166). Additionally, the Agesta reactor, dual-tasked to provide civilian energy and fissile material, was producing only 20kg of plutonium per year. A second reactor, Markiven, was slated to be built and focus solely on plutonium production but would not provide sufficient material to build the first bomb until 1970. Even Swedish military planners soon began to consider the cost of operating these facilities to exceed the benefit (Cole, 1994, pp.100-102). Additionally, a planned effort to mine uranium was abandoned due to a sharp decline in world market prices that made the facility

unable to compete commercially. The Swedish government instead concluded an agreement with the United States to import enriched uranium and shifted its focus to light water reactors (van Dassen, 1998, p.16).

Finally, the argument for the preservation of neutrality with possession of nuclear weapons appears to have been rejected over time. Swedish policymakers faced a reality that their nuclear weapons would never be deliverable against the United States (nor could they conceive of actually desiring such a capacity). Instead, they were only useful to stop a Soviet invasion by use on the Soviet homeland. Logically, a Swedish R&D program would not communicate neutrality to the world, but rather the reality that Stockholm's security perceptions were more in line with those in the West. Thus Swedish military planners who had made this their central argument for nuclear weapons acquisition could no longer advocate for the device program (Cole, 1997, p.247).

The decision to accept the NPT signaled the end of any Swedish nuclear weapons aspirations, unlike countries such as Iraq which signed and continued efforts clandestinely. Experiments on implosion continued in the early 1970s, and led Swedish journalists to later allege that the government had continued its R&D in violation of its stated policies and agreements. But researcher Wilhelm Agrell argues such a conclusion is inaccurate. He points out that the program could not be immediately abandoned because it was, in reality, primarily a research program on civil defense against nuclear weapons. The Swedish government also wished to transfer the staff to other institutions and projects, which took time. He states, "In 1972, when the curtain finally went down, the only thing left of Swedish nuclear weapons research was a small staff maintaining a thin competence, empty laboratories, and a huge amount of information in the archives" (1990, p.169). We have thus far discussed only the political history of the Swedish program, but examination of the organization and facilities involved in Swedish nuclear R&D will reveal that this reduction in effort was considerable.

Organizations

In addition to the Defense Ministry, three organizations were significant in Swedish nuclear weapons R&D. The Swedish National Defense Research Institute (FOA) was founded in 1945 to coordinate defense-related research arising from World War II. Soon a separate group, the Committee on Atomic Energy, was formed within FOA to supervise nuclear research in the country that might have defense applications. In addition, a firm called Aktiebolaget Atomenergi was formed in 1947 for industrial nuclear research and, though civilian, it would coordinate closely with FOA and the Committee on Atomic Energy in its efforts (Cole, 1994, p.9). Atomenergi, following a common corporate model in Sweden, was 57% government owned at its formation with the rest of the shares being split between 24 Swedish companies from the energy, mining, steel, and engineering sectors (Jonter, 2010, p.63). Jonter also notes

that the division of responsibilities between FOA and Atomenergi was not a clear division between military and civilian activities; instead they shared and collaborated on projects to maximize use of the country's limited resources. Not all of this collaboration was open. The head of research for Atomenergi directed the planning effort for the indigenous civilian nuclear program, which also happened to coincide with the military's goals. It was later revealed that his official, Sigvard Eklund, was "working in secret" for the supreme commander of the Swedish Armed Forces at the time (Johansson, 1986, p.32). Through such connections, it was assured that Swedish nuclear planning would not rule out development of a device.

Early in this planning process, Atomenergi concluded that the import of fissile materials would be cheaper. But in the interests of diplomacy, even in the pre-NPT period, a complex diversion scheme would be necessary. Though Swedish officials were already making veiled comments about nuclear weapons capability at this point, they were presumably concerned that public exposure of their efforts may result in Soviet repercussions or cause the intra-government debate that Prime Minister Erlander would later fear. Hence, it was decided that device research would focus on an implosion weapon that would utilize plutonium produced in Swedish reactors (Cole, 1994, p.31). Swedish officials chose a more expensive and longer indigenous process over a faster, cheaper and more deceptive one.

Facilities

The most prominent of the Swedish nuclear facilities was a small heavy-water reactor in Agesta, which went into operation in late 1962 or early 1963. Its primary purpose was civilian power generation, but it was also Sweden's first substantial means of producing plutonium for military purposes. Estimates of this production capacity center around approximately 20kg per year, an amount that led the military to conclude it was not worth the cost. A second reactor at Marviken was planned solely for military use, which would have produced sufficient fissile material for a weapon by 1970 (Cole, 1994, p.30).

Unfortunately for those striving to produce fissile material for a possible Swedish weapon, the economics were against these efforts. Marviken was never put into operation due to hesitation over pursuing a weapon and the high cost of operation, the project was completely abandoned in 1970. In addition, Agesta supplied power to a small civilian community but was shut down in 1974 – again due to a high cost of operation (Jonter and van Dassen, 2005, p.233). A site on the west coast of Sweden was selected and purchased in 1963 for construction of a reprocessing facility, which would not have been required for the civilian program for some time. But the facility was never constructed due to high costs (Johansson, 1986, p.32). Swedish officials chose a location for uranium mining at Ranstad in 1960, but by the time the first operational tests were completed in 1965 the world market prices had sunk so low that the facility could not compete commercially. As a result, the Swedish government concluded an

agreement with the United States for importing uranium in 1966 and thereafter the Swedish nuclear energy sector focused on light-water reactors (van Dassen, 1998, p.16). Without a definitive government decision to pursue a nuclear weapon, none of these projects was justifiable with the resources available to the program. In their analysis of the program, Jonter and van Dassen cite several researchers who have argued that Sweden would have been able to produce a weapon in six months at the time they abandoned their program. But while Swedish scientists had perhaps acquired sufficient theoretical knowledge, the lack of facilities would not have permitted such a timeline (2005, p.238).

U.S. Assessments of the Swedish Nuclear Program

The time passed since the termination of the Swedish R&D program permits a more accurate look at U.S. perceptions of the effort than is possible in other cases. As early as 1949, the CIA was assessing Swedish intentions but believed that Stockholm was not working on a bomb and instead its interest “lies in developing a cheap source of power since Sweden possesses virtually no coal” (Cole, 1994, p.10). Later assessments focused on plutonium production and the government’s decision process. A NIE completed as the Swedish government was “deciding not to decide” assessed that Sweden could produce its first weapon using only indigenous resources by 1961 and that up to 65 weapons could be produced by 1967. The same NIE states that although “a vocal minority opposes equipping Sweden’s armed forces with nuclear weapons, public opinion in general appears to support the government view that nuclear weapons are essential to Sweden’s defense” (CIA, 1957, p.5). This last claim is interesting. First, there is no evidence in the literature that the Swedish government had presented a consolidated view that such weapons were necessary at this point. Second, this claim provides a rare opportunity to see a dissent in the declassified records. A State Department rebuttal to a similar assertion the following year argues that the NIEs were going too far in implying there was consensus between the leaderships of various factions within the government with regards to nuclear weapons. It states instead that only one party had shown a clear preference for the weapons and the rest were undecided (1958, p.1).

Subsequent estimates refrained from giving the impression that the Swedish government was unified on this topic of nuclear weapons. A NIE issued several years later included an assessment that no clear-cut decision had been made in Stockholm and that while “high quality” nuclear research continued, the high costs and opposition within the SAP have kept the government from making any decision (CIA, 1960, p.9). A third NIE, again after the passage of several more years, identified the other factor previously discussed that prevented a government decision. It states that Stockholm’s final decision on whether to take steps to develop a nuclear weapon will likely be based on the extent of nonproliferation and disarmament trends in the future (CIA, 1963, p.10). Perhaps the most indicative evidence of the perceptions of U.S.

officials is the April 1960 decision by the National Security Council (NSC) to definitely reject requests from Swedish officials to provide them with nuclear warheads. The NSC's decision was apparently based on the opinion that Sweden would never develop the weapons indigenously and the United States could not be responsible for proliferation (Jonter and van Dassen, 2005, p.237).

In conclusion, U.S. officials and analysts had a generally accurate idea of the state of the Swedish nuclear weapons R&D effort. There was confusion on the unity of the government on the issue and early assessments of warhead production were far greater than what were actually possible. But by 1960, when the NSC made its decision, U.S. officials were aware of the prohibitive cost of the weapons program and the Swedish government's reluctance to pursue it. This is not surprising due to the lack of deception that was employed by Sweden in protecting the program. The United States had signed an agreement for civil nuclear cooperation in 1955 and was familiar with Swedish facilities and the organizational construct of their effort. In addition, Defense Department officials were engaged by their Swedish counterparts regularly on whether nuclear weapons assistance could be provided and had an understanding of how prohibitively expensive Swedish warheads would be (Cole, 1994, p.46). The 1963 NIE that stated Swedish development would be based on nonproliferation trends was not the result of clandestine reporting. The prime minister had informed the U.S. ambassador that Sweden had the capability to develop a weapon but was looking to see how the nonproliferation regime played out before making a decision (Cole, 1997, p.243).

Framework Analysis

Due to the non-deceptive nature of the Swedish nuclear weapons R&D program, we can expect the framework to appear significantly different than in the other cases used for this study.

Reveal Fact

The majority of data found in this case is in this category. The prime minister's openness with the U.S. ambassador in 1963 is just one example. Swedish defense officials, in addition to openly asking their U.S. counterparts whether nuclear warheads would ever be sold or given to Sweden, also asked whether announcements of Swedish weapons development would have an adverse effect on U.S.-Swedish relations (Cole, 1994, p.37). Professional military journals in Sweden also openly discussed such issues. Beginning in the mid-1950s, these journals contained reviews of U.S. nuclear policy and development, all of which were available to outside observers (Cole, 1997, p.237).

Another interesting signature was present in the Swedish case that differed from other cases. As stated in the "Organizations" section, FOA contained a group called the Committee on

Atomic Weapons to conduct its research into a potential weapons program. Within the Defense Ministry, the coordinating group was called the “Nuclear Device Group” (Jonter, 2010, p.75). These names are straightforward, unlike groups such as the “Directorate for General Studies” or the “Witvlei Committee” found in other cases, where the purpose and mission of the group was being concealed. These Swedish groups may not have been prominent or produced readily observable signatures, but no deception was undertaken to misinform as to the work in which they were engaged.

Conceal Fact

It is not the argument of this case study that the Swedish nuclear weapons program was open in its operations, only that it was not deceptive. The program was, in fact, a highly secret defense R&D effort. One of the most secret elements was the degree of cooperation between the civilian and military authorities. As noted earlier, Atomenergi’s head of research was secretly engaged with senior military officials during the planning of the nuclear program. More formally, a secret memorandum of cooperation between the civilian and military research efforts was approved by the cabinet in 1950 (Johansson, 1986, p.31). This mixing of the military and civilian efforts was also reflected in the allocation of resources to the program. Budget documents from the period reflect the strict compartmentalization of the program and yield little insight into how much money and effort was actually spent (Cole, 1994, p.21). Perhaps the starkest example of concealment came from Prime Minister Erlander himself during the 1954 parliamentary debates, which he made no mention of the device research option while talking extensively about nuclear research for civil protection (Jonter, 2010, p.68).

Revealing and Concealing Fiction

The only potential instance of misdirection in the Swedish program was the research conducted under the theme of “protection” that was geared towards producing a weapon. Cole cites this defining of the protection program as deceptive, since many of the technical aspects of the program did not differ from weapons research (1994, p.107). This is true and was certainly convenient for the Swedish government. But it is clear from accounts of the government debates at the time that many who were opposed to building a weapon on moral or strategic grounds were willing to devote resources to an effort based on protecting the population. Rather than provide a cover for a weapon program, the protection program allowed the government to postpone making any decision at all until it needed to (Jonter and van Dassen, 2005, p.233). We can assume that any deception regarding the name and purpose of the program would have been accompanied by a coordinated message to U.S. (or other international) officials reinforcing that deception. No evidence of such claims was found. Hence, Cole’s explanation, while plausible, is not likely. No other data points in these categories were found in the literature.

Conclusion

Sweden's consideration of acquiring nuclear weapons indigenously provides an example of a nascent program that did not need to be protected by deception. It is possible that Swedish officials interacting with Soviet counterparts were more misleading in their statements, but nevertheless the organizations involved in the effort and the methods of construction of the various facilities were not deceptive in nature – and were as visible to Soviet observers as they would have been to those from the United States. Its benefit for this research is to highlight areas of deception in the other cases, such as the naming of organizations, and show that an analyst categorizing information according to the framework will not achieve a “guilty verdict” each time.

	Fact	Fiction
Reveal	* Senior Swedish officials making the case to US counterparts for provision of US nuclear weapons. * Inquiry as to whether an official announcement on weapons development would adversely affect US security assistance. * SAP 1959 report statement that it was more important to reduce the risk of war than increase deterrent power. * Professional military pubs began publishing articles and reviews pertaining to nuclear policy, particularly US nuclear policy, in mid-1950s. * PM informs US ambassador in 1963 that Sweden can develop easily, merely an option in case nonproliferation regime did not work out. * PM admission in May 1954 that Sweden had conducted research to protect itself from nuclear attack.	
Conceal	* Nuclear decisionmaking restricted to small inner circle within government. Parliamentary committees largely excluded. * PM does not acknowledge during 1954 debate that FOA was conducting research on weapons production.	

Table C-1 Diplomatic Aspects of Swedish Nuclear Research

	Fact	Fiction
Reveal	* Largely independent research program, but foreign assistance was sought from the US, UK, and France. * FOA created to consolidate and coordinate military research, tasked to oversee NW program. * Atomenergi established in 1947 to pursue industrial nuclear research. * Committee on Atomic Energy formed under FOA in 1945. * Atomenergi 57% state controlled, the remaining control given to 24 Swedish companies.	
Conceal	* Memo of cooperation between civilian and military research efforts secretly approved at cabinet level in 1950.	

Table C-2 Infrastructure Aspects of Swedish Nuclear Research

	Fact	Fiction
Reveal	* Agesta reactor used for civilian power but also plutonium production. * SAP 1964 decision to stop planning efforts for nuclear facilities and mothball Agesta and Marviken due to costs.	
Conceal	* Chose to mine uranium from indigenous low-grade ore at high costs rather than import it and face restrictions. * Acquired five tons of heavy water from Norway for use in R1 "with no question asked."	

Table C-3 Special Material Aspects of Swedish Nuclear Research

	Fact	Fiction
Reveal	* Swedish inquiries on purchase of advanced US missile systems, including at least one (BOMARC) that US forces used only with nuclear warheads.	
Conceal		

Table C-4 Other Material Aspects of Swedish Nuclear Research

	Fact	Fiction
Reveal		
Conceal	* State financial support to program efforts masked by compartmentalization. * Civilian and military programs "mingled," making resource allocation difficult to trace.	

Table C-5 Finance and Budgeting Aspects of Swedish Nuclear Research

Bibliography

Abraham, Itty. *The Making of the Indian Atomic Bomb: Science, Secrecy, and the Postcolonial State*. New York, NY: Zed Books, 1998.

Agrell, Wilhelm. "The Bomb That Never Was: The Rise and Fall of the Swedish Nuclear Weapons Programme." In *Arms Races: Technological and Political Dynamics*, edited by Nils Peter Gleditsch and Olav Njolstad, 154-74. London, UK: Sage Publications, 1990.

al-Marashi, Ibrahim. "How Iraq Conceals and Obtains Its Weapons of Mass Destruction." *Middle East Review of International Affairs* 7, no. 1 (March 2003): 51-65.

Albright, David. "India and Pakistan's Nuclear Arms Race: Out of the Closet but Not in the Street." *Arms Control Today* 23, no. 5 (June 1993): 12-16.

Albright, David. "South Africa and the Affordable Bomb." *Bulletin of the Atomic Scientists* 50, no. 4 (1994): 37-47.

Albright, David. "Masters of Deception." *Bulletin of the Atomic Scientists* 54, no. 3 (May/June 1998): 39-43.

Albright, David. "Iraq's Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War." <http://isis-online.org/isis-reports/detail/iraqs-programs-to-make-highly-enriched-uranium-and-plutonium-for-nuclear-we/9>. October, 2002. Accessed June 21, 2015.

Albright, David, Paul Brannan, Zachary Laporte, Katherine Tajer, and Christina Walrond. "Rendering Useless South Africa's Nuclear Test Shafts in the Kalahari Desert." Institute for Science and International Security, 2011.

Albright, David, and Khidhir Hamza. "Iraq's Reconstitution of Its Nuclear Weapons Program." *Arms Control Today* 28, no. 7 (October 1998): 9-15.

Albright, David, and Mark Hibbs. "Hyping the Iraqi Bomb." *Bulletin of the Atomic Scientists* 47, no. 2 (March 1 1991a): 26-28.

Albright, David, and Mark Hibbs. "Iraq's Nuclear Hide-and-Seek." *Bulletin of the Atomic Scientists* 47, no. 7 (September 1 1991b): 14-23.

Albright, David, and Mark Hibbs. "Iraq and the Bomb: Were They Even Close?." *Bulletin of the Atomic Scientists* 47, no. 2 (March 1 1991c): 16-25.

Alibek, Ken, and Stephen Handelman. *Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World - Told from inside by the Man Who Ran It*. New York, NY: Random House, 1999.

Amos, John. "Deception and the 1973 Middle East War." Chap. 14 In *Strategic Military Deception*, edited by Donald C. Daniel and Katherine L. Herbig, 317-34. Elmsford, NY: Pergamon Press, 1982.

Armstrong, R.F., Lieutenant General, "The Jericho Weapon System," Admiral H. H. Biermann, Pretoria, South Africa, March 21, 1975.

Bacon, Donald J. "Second World War Deception: Lessons Learned for Today's Joint Planner." In *Wright Flyer Paper*. Maxwell AFB, AL: Air Command and Staff College, 1998.

Barker, Brian, Michael Clark, Peter Davis, Mark Fisk, Michael Hedlin, Hans Israelsson, Vitaly Khalturin, *et al.* "Monitoring Nuclear Tests." *Science* 281, no. 5385 (September 25 1998): 1967-68.

Baute, Jacques. "Timeline Iraq: Challenges and Lessons Learned from Nuclear Inspections." *IAEA Bulletin* 46, no. 1 (June 2004): 64-68.

Beecher, William. "Soviets Feared Violating Germ Weapons Ban; Photographic Evidence Cited." *Boston Globe*, September 28, 1975.

Bell, J. Bowyer. "Toward a Theory of Deception." *International Journal of Intelligence and Counterintelligence* 16, no. 2 (2003): 244-79.

Bennett, Michael, interview with the author, July 24, 2015.

Bennett, Michael, and Edward Waltz. *Counterdeception Principles and Applications for National Security*. Boston, MA: Artech House, 2007.

Betts, Richard K. "Analysis, War, and Deception: Why Intelligence Failures Are Inevitable." *World Politics* 31, no. 1 (October 1978): 61-89.

Betts, Richard K. "A Diplomatic Bomb for South Africa?". *International Security* 4, no. 2 (1979): 91-115.

Bezdenezhnykh, I.S., and V.N. Nikiforov. "An Epidemiological Analysis of the Incidences of Anthrax in Sverdlovsk." [In Russian]. *The Journal of Microbiology, Immunology, and Epidemiology*, no. 5 (May 1980).

Black, Stephen. "Verification under Duress: The Case of UNSCOM." In *Verification Yearbook 2000*, edited by Trevor Findlay, 115-29. London, UK: VERTIC, 2000.

Blix, Hans. "Report on the Fourth IAEA on-Site Inspection in Iraq under Security Council Resolution 687." Vienna: International Atomic Energy Agency, 1991.

Blix, Hans. "Fourth Consolidated Report of the Director General of the International Atomic Energy Agency under Paragraph 16 of Security Council Resolution 1051 (1996)." New York, NY: United Nations Security Council, 1997.

Botha, R.F., "Draft Letter and Aide Memoire in Respose to U.S. Allegations of Planned Nuclear Test," Pretoria, South Africa, September 30, 1977.

Bruce, James B. "The Consequences of Permissive Neglect." *Studies in Intelligence* 47, no. 1 (2000): 39-49.

Bruce, James B. "Denial and Deception in the 21st Century: Adaptation Implications for Western Intelligence." *Defense Intelligence Journal* 15, no. 2 (2006): 13-27.

Bruce, James B., and Michael Bennett. "Foreign Denial and Deception: Analytic Imperatives." Chap. 12 In *Analyzing Intelligence: National Security Practitioners' Perspectives*, edited by Roger Z. George and James B. Bruce, 197-214. Washington, DC: Georgetown University Press, 2014.

Burrows, William E., and Robert Windrem. *Critical Mass: The Dangerous Race for Superweapons in a Fragmenting World*. New York, NY: Simon & Schuster, 1994.

Central Intelligence Agency. *Nuclear Weapons Production in Fourth Countries: Likelihood and Consequences*, Washington, DC, 1957.

Central Intelligence Agency. *Likelihood and Consequences of the Development of Nuclear Capabilities by Additional Countries*, Washington, DC., 1960.

Central Intelligence Agency. *Nuclear Weapons and Delivery Capabilities of Free World Countries Other Than the US and UK*, Washington, DC, 1961.

Central Intelligence Agency. *Likelihood and Consequences of a Proliferation of Nuclear Weapons Systems*, Washington, DC, 1963.

Central Intelligence Agency. *Atomic Energy Activities in the Republic of South Africa*, Washington, DC, 1971.

Central Intelligence Agency. *South Africa Again Rumored to be Working on Nuclear Weapons*, Washington, DC, 1976.

Central Intelligence Agency. *South Africa's Nuclear Options and Decisionmaking Structures*, Washington, DC, 1978.

Central Intelligence Agency. *Iraq's Nuclear Interests, Programs, and Options*, Washington, DC, 1979.

Central Intelligence Agency. *National Intelligence Daily - October 1, 1980*, Washington, DC, 1980.

Central Intelligence Agency. *Indian Nuclear Policies in the 1980s*, Washington, DC, 1981a.

Central Intelligence Agency. *Interagency Intelligence Assessment: Implications of Israeli Attack on Iraq*, Washington, DC, 1981b.

Central Intelligence Agency. *The Iraqi Nuclear Program: Progress Despite Setbacks*, Washington, DC, 1983.

Central Intelligence Agency. *Trends in South Africa's Nuclear Security Policies and Programs*, Washington, DC, 1984.

Central Intelligence Agency. *India's Potential to Build a Nuclear Weapon*, Washington, DC, 1988.

Central Intelligence Agency. "Note 10 - Tradecraft and Counterintelligence."
http://www.au.af.mil/au/awc/awcgate/cia/tradecraft_notes/note_10.htm. December, 1995.
Accessed August 14, 2014.

Chellaney, Brahma. "India." Chap. 7 In *Nuclear Proliferation after the Cold War*, edited by Mitchell Reiss and Robert S. Litwak, 165-90. Washington, DC: Woodrow Wilson Center Press, 1994.

Chengappa, Raj. *Weapons of Peace: The Secret Story of India's Quest to Be a Nuclear Power*. New Delhi: Harper Collins Publishers, 2000.

Cirincione, Joseph. *Deadly Arsenals: Tracking Weapons of Mass Destruction*. Washington, DC: Carnegie Endowment for International Peace, 2002.

Clausewitz, Carl v., *On War*, ed. Michael Howard and Peter Peret, Princeton: Princeton University Press, [1832] 1984.

Cochran, Thomas B. "Highly Enriched Uranium Production for South African Nuclear Weapons." *Science & Global Security* 4 (1994): 33-48.

Cole, Paul M., *Sweden Without the Bomb: The Conduct of a Nuclear-Capable Nation Without Nuclear Weapons*, Santa Monica, Calif.: RAND Corporation, MR-460, 1994.

Cole, Paul M. "Atomic Bombast: Nuclear Weapon Decision-Making in Sweden, 1946-72." *The Washington Quarterly* 20, no. 2 (1997): 233-51.

Daniel, Donald C., and Katherine L. Herbig. "Deception in Theory and Practice." Chap. 16 In *Strategic Military Deception*, edited by Donald C. Daniel and Katherine L. Herbig, 355-67. Elmsford, NY: Pergamon Press, 1982.

Daniel, Donald C., and Katherine L. Herbig. "Propositions on Military Deception." Chap. 1 In *Strategic Military Deception* edited by Donald C. Daniel and Katherine L. Herbig, 3-30. Elmsford, NY: Pergamon Press, 1982.

Dassen, Lars v. "Sweden and the Making of Nuclear Non-Proliferation: From Indecision to Assertiveness." Stockholm, Sweden: Swedish Nuclear Power Inspectorate, 1998.

Davis, Jay C., and David A. Kay. "Iraq's Secret Nuclear Weapons Program." *Physics Today* 45, no. 7 (July 1 1992): 21-27.

Defense Intelligence Agency. *Talking Points for Briefing to House Energy and Commerce Committee - Subcommittee on Oversight and Investigations*, Washington, DC, 1991.

Defense Intelligence Agency. *South Africa Nuclear Program in Turmoil*, Washington, DC, 1994.

Department of Defense, Defense Science Board, *Assessment of Nuclear Monitoring and Verification Technologies*, Washington, DC, 2014.

Department of Foreign Affairs, Republic of South Africa, "A Balanced Approach to the NPT: ARMSCOR/AEC Concerns Viewed from a DFA Standpoint," Pretoria, South Africa, 1988.

Department of State, Bureau of Intelligence and Research. *South Africa: Nuclear Case Closed?* Washington, DC, 1993.

Department of State, untitled Memorandum from US Embassy Stockholm in Response to NIE 100-2-58, Stockholm, Sweden, 1958.

Deutch, John M. "The New Nuclear Threat." *Foreign Affairs* 71, no. 4 (1992): 120-34.

Dewar, Michael. *The Art of Deception of Warfare*. Newton Abbot, UK: David & Charles, 1989.

Dhanda, Suresh. "Nuclear Weapons Programmes of India and Pakistan: A Comparative Assessment." *South Asian Survey* 17, no. 2 (September 2010): 255-81.

Dobrynin, Anatoly. *In Confidence: Moscow's Ambassador to America's Six Cold War Presidents*. Seattle, WA: University of Washington Press, 1995.

Domaradskij, Igor V., and Wendy Orent. *Biowarrior: Inside the Soviet/Russian Biological War Machine*. Prometheus Books, 2003.

Duelfer, Charles A. *Comprehensive Report of the Special Advisor to the DCI on Iraq's WMD, Volume II*, Washington, DC, 2004.

Ellis, Jason D., and Geoffrey D. Kiefer. *Combating Proliferation: Strategic Intelligence and Security Policy*. Baltimore, MD: Johns Hopkins University Press, 2004.

Epstein, William. "Why States Go - and Don't Go - Nuclear." *Annals of the American Academy of Political and Social Science; Nuclear Proliferation: Prospects, Problems, and Proposals* 430 (1977): 16-28.

Feer, Fred S., *Thinking-Red-in-Wargaming Workshop: Opportunities for Deception and Counterdeception in the Red Planning Process*, Santa Monica, Calif.: RAND Corporation, P-7510, 1989.

Feldman, Shai. "The Bombing of Osiraq - Revisited." *International Security* 7, no. 2 (1982): 114-42.

Fischer, David. "South Africa." Chap. 9 In *Nuclear Proliferation after the Cold War*, edited by Mitchell Reiss and Robert S. Litwak, 207-30. Washington, DC: Woodrow Wilson Center Press, 1994.

Foot, M. R. D. "Conditions Making for Success and Failure of Denial and Deception: Democratic Regimes." Chap. 4 In *Strategic Denial and Deception*, edited by Roy Godson and James J. Wirtz, 95-128. London, UK: Transaction Publishers, 2002.

Ford, Peter S., *Israel's Attack on Osiraq: A Model for Future Preventative Strikes?* thesis, Naval Postgraduate School, 2004, Monterey, Calif.

Fuhrmann, Matthew. "Spreading Temptation: Proliferation and Peaceful Nuclear Cooperation Agreements." *International Security* 34, no. 1 (Summer 2009): 7-41.

Fuhrmann, Matthew, and Sarah Kreps. "Targeting Nuclear Programs in War and Peace: A Quantitative Empirical Analysis, 1941-2000." *The Journal of Conflict Resolution* 54, no. 6 (Dec 2010): 831-59.

Ganguly, Sumit. "India's Pathway to Pokhran II: The Prospects and Sources of New Delhi's Nuclear Weapons Program." *International Security* 23, no. 4 (Spring 1999): 148-77.

Gellman, Barton. "Arms Inspectors 'Shake the Tree': UNSCOM Adds Covert Tactic." *Washington Post*, October 12 1998a.

Gellman, Barton. "A Futile Game of Hide and Seek: Ritter, Unscm Foiled by Saddam's Concealment Strategy." *Washington Post*, October 11 1998b.

Gerwehr, Scott. "Cross-Cultural Variation in Denial and Deception." *Defense Intelligence Journal* 15, no. 2 (2006): 51-78.

Godson, Roy, and James J. Wirtz. "Strategic Denial and Deception." *International Journal of Intelligence and Counterintelligence* 13, no. 4 (2000): 424-37.

Goodson, Donald L. R. "Catalytic Deterrence? Apartheid South Africa's Nuclear Weapons Strategy." *Politikon: South African Journal of Political Studies* 39, no. 2 (August 2012): 209-30.

Gordin, Michael D. "The Anthrax Solution: The Sverdlovsk Incident and the Resolution of a Biological Weapons Controversy." *Journal of the History of Biology* 30 (1997): 441-80.

Gould, Chandre. "The Nuclear Weapons History Project." Chap. 4 In *Paper Wars: Access to Information in South Africa*, edited by K. Allen, 88-121. Johannesburg: Wits University Press, 2009.

Grabo, Cynthia M. *Anticipating Surprise: Analysis for Strategic Warning*. Washington, DC: Joint Military Intelligence College, Center for Strategic Intelligence Research, 2002.

Graham, Thomas, and Keith Hansen. *Preventing Catastrophe: The Use and Misuse of Intelligence Efforts to Halt the Proliferation of Weapons of Mass Destruction*. Stanford, CA: Stanford Security Studies, 2009.

Gray, David E. *Doing Research in the Real World*. Thousand Oaks, CA: Sage, 2004.

Guillemin, Jeanne. *Anthrax: The Investigation of a Deadly Outbreak*. Berkley, CA: University of California Press, 1999.

Guillemin, Jeanne. "The 1979 Anthrax Outbreak in the USSR: Applied Science and Political Controversy." *Proceedings of the American Philosophical Society* 146, no. 1 (2002): 18-36.

Gumbel, Peter. "Sverdlovsk -- What Really Happened?: Anthrax: The Survivors Speak." *Wall Street Journal*, October 23 1991a.

Gumbel, Peter. "Sverdlovsk -- What Really Happened?: Death in the Air." *Wall Street Journal* 22 (October 22 1991b): A20.

Gumbel, Peter. "Sverdlovsk -- What Really Happened?: The Anthrax Mystery." *Wall Street Journal*, October 21 1991c.

Gupta, Vipin, and Frank Pabian. "Investigating the Allegations of Indian Nuclear Test Preparations in the Rajasthan Desert." *Science & Global Security* 6, no. 2 (1997): 101-88.

Hall, Hines H. "The Foreign Policy-Making Process in Britain, 1934-1935, and the Origins of the Anglo-German Naval Agreement." *The Historical Journal* 19, no. 2 (1976): 477-99.

Hamza, Khidir, and Jeff Stein. *Saddam's Bombmaker: The Terrifying inside Story of the Iraqi Nuclear and Biological Weapons Agenda*. New York, NY: Scribner, 2000.

Handel, Michael I. "The Yom Kippur War and the Inevitability of Surprise." *International Studies Quarterly* 21, no. 3 (September 1977): 461-502.

Handel, Michael I. "Surprise and Change in International Politics." *International Security* 4, no. 4 (1980): 57-85.

Hansen, James H. "Soviet Deception in the Cuban Missile Crisis." *Studies in Intelligence* 46, no. 1 (2002): 49-58.

Hansen, Lynn M. "Arms Control: Focus on Denial and Deception." Chap. 6 In *Strategic Denial and Deception*, edited by Roy Godson and James J. Wirtz, 167-80. London, UK: Transaction Publishers, 2002.

Harris, Robert, and Jeremy Paxman. *A Higher Form of Killing: The Secret Story of Chemical and Biological Warfare*. New York, NY: Hill & Wang, 1982.

Harris, William R., "Counter-deception Planning: Strategy and Organization," unpublished RAND Corporation research, 1970.

Hedges, Stephen J., and Peter Cary. "Saddam's Secret Bomb." *U.S. News World Report*, 1991, 34-41.

Heuer, Richards J. "Strategic Deception and Counterdeception: A Cognitive Process Approach." *International Studies Quarterly* 25, no. 2 (June 1981): 294-327.

Heuer, Richards J. "Cognitive Factors in Deception and Counterdeception." Chap. 2 In *Strategic Military Deception*, edited by Donald C. Daniel and Katherine L. Herbig, 31-69. Elmsford, NY: Pergamon Press, 1982.

Horton, Roy E. "Out of (South) Africa: Pretoria's Nuclear Weapons Experience." In *Counterproliferation Series*. USAF Academy, CO: USAF Institute for National Security Studies, 1999.

Howard, Michael. *Strategic Deception in the Second World War*. New York, NY: Norton, 1995.
Huntington, Samuel P. "The Clash of Civilizations?". *Foreign Affairs* 72, no. 3 (Summer 1993): 22-49.

Hymans, Jacques E. C. "When Does a State Become a "Nuclear Weapon State?". *The Nonproliferation Review* 17, no. 1 (March 2010): 161-80.

Jeremiah, David E., statement at press conference, Washington, DC, June 2, 1998.

Jervis, Robert. "Hypotheses on Misperception." *World Politics* 20, no. 3 (April 1968): 454-79.

Johansson, Thomas B. "Sweden's Abortive Nuclear Weapons Project." *Bulletin of the Atomic Scientists* 42, no. 3 (March 1986): 31-34.

- Johnson, Paul E., Stefano Grazoli, Karim Jamal, and R. Glen Barryman. "Detecting Deception: Adversarial Problem Solving in a Low Base-Rate World." *Cognitive Science* 25, no. 3 (May-June 2001): 355-92.
- Jones, Gregory S., "From Testing to Deploying Nuclear Forces: The Hard Choices Facing India and Pakistan." Santa Monica, Calif.: RAND Corporation, IP-192, 2000.
- Jones, R. V. "The Theory of Practical Joking - an Elaboration." *Bulletin of the Institute of Mathematics and Its Applications* 11, no. 1 (January/February 1975): 10-17.
- Jones, R.V. *Most Secret War*. London: Hamilton, 1978.
- Jonter, Thomas. "The Swedish Plans to Acquire Nuclear Weapons, 1945-1968: An Analysis of the Technical Preparations." *Science & Global Security* 18 (2010): 61-86.
- Jonter, Thomas, and Lars van Dassen. "Making Historical Surveys of States' Nuclear Ambitions." *The Nonproliferation Review* 12, no. 1 (March 2005): 225-70.
- Kampani, Gaurav. "From Existential to Minimum Deterrence: Explaining India's Decision to Test." *The Nonproliferation Review* 6, no. 1 (1998): 12-24.
- Kampani, Gaurav. "New Delhi's Long Nuclear Journey." *International Security* 38, no. 4 (Spring 2014): 79-114.
- Kampani, Gaurav, interview with the author, December 7, 2015.
- Kay, David, interview with the author, January 19, 2016.
- Kay, David A. "Denial and Deception Practices of Wmd Proliferators: Iraq and Beyond." *The Washington Quarterly* 18, no. 1 (1995): 83-105.
- Kelley, Robert E. "The Iraqi and South African Nuclear Weapons Programs: The Importance of Management." *Security Dialogue* 27, no. 1 (March 1996): 27-38.
- Kennedy, John F., "Third Nixon-Kennedy Debate," October 13, 1960.
- Kerr, Richard J., and Michael Warner. "The Track Record of CIA Analysis." Chap. 3 In *Analyzing Intelligence: National Security Practitioners' Perspectives*, edited by Roger Z. George and James B. Bruce, 39-55. Washington, DC: Georgetown University Press, 2014.
- Khadduri, Imad. *Iraq's Nuclear Mirage: Memoirs and Delusions*. Toronto: Springhead, 2003.
- Lawrence Livermore National Laboratory, Special Projects Division. *South Africa: Motivations and Capabilities for Nuclear Proliferation*, Livermore, Calif., 1977.

Lawrence Livermore National Laboratory. *Proliferation Analysis and International Assessments*, Livermore, Calif., 1980.

Leitenberg, Milton. "A Return to Sverdlovsk: Allegations of Soviet Activities Related to Biological Weapons." *Contemporary Security Policy* 12, no. 2 (1991): 161-90.

Leitenberg, Milton. "Anthrax in Sverdlovsk: New Pieces to the Puzzle." *Arms Control Today* 22, no. 3 (April 1992): 10-13.

Leitenberg, Milton, and Raymond A. Zilinskas. *The Soviet Biological Weapons Program: A History*. Cambridge, MA: Harvard University Press, 2012.

Lewis, Jeffrey. *Revisiting South Africa's Bomb*, <http://www.armscontrolwonk.com/archive/1200544/revisiting-south-africas-bomb/>. December 3, 2015. Accessed December 7 2015.

Liberman, Peter. "The Rise and Fall of the South African Bomb." *International Security* 26, no. 2 (Fall 2001): 45-86.

Liberman, Peter. "Israel and the South African Bomb." *The Nonproliferation Review* 11, no. 2 (2004): 46-80.

Liberman, Peter, interview with the author, November 30, 2015.

Liddell-Hart, B. H. *Strategy: The Indirect Approach*. New York, NY: Praeger, 1954.

Lijphart, Arend. "Comparative Politics and the Comparative Method." *The American Political Science Review* 65, no. 3 (Sep 1971): 682-93.

Long, William J., and Suzette R. Grillo. "Ideas, Beliefs, and Nuclear Policies: The Cases of South Africa and Ukraine." *The Nonproliferation Review* 7, no. 1 (Spring 2000): 24-40.

Los Alamos National Laboratory. *Nuclear Weapons Development: From Decision to Delivery*, Los Alamos, NM, 2007.

Luxow, Wilton E., and Julian Hoptman. "The Enigma of Soviet BW." *Studies in Intelligence* 9 (Spring 1965): 15-20.

Maiolo, Joseph A. "'I Believe the Hun Is Cheating': British Admiralty Technical Intelligence and the German Navy, 1936-39." *Intelligence and National Security* 11, no. 1 (1996): 32-58.

Maiolo, Joseph A. "The Admiralty and the Anglo-German Naval Agreement of 18 June 1935." *Diplomacy & Statecraft* 10, no. 1 (1999): 87-126.

Malik, J. Mohan. "India Goes Nuclear: Rationale, Benefits, Costs, and Implications." *Contemporary Southeast Asia* 20, no. 2 (August 1998): 191-215.

Mangold, Tom, and Jeff Goldberg. *Plague Wars: The Terrifying Reality of Biological Warfare*. New York, NY: St. Martin's, 1999.

Marshall, Eliot. "Sverdlovsk: Anthrax Capital?". *Science* 240, no. 4851 (April 1988): 383-85.

Masiza, Zondi. "A Chronology of South Africa's Nuclear Program." *The Nonproliferation Review* 1, no. 1 (Fall 1993): 35-55.

Mearshimer, John J. "Back to the Future: Instability in Europe after the Cold War." *International Security* 15, no. 1 (Summer 1990): 5-56.

Meselson, Matthew S. "The Biological Weapons Convention and the Sverdlovsk Anthrax Outbreak of 1979." *FAS Public Interest Report* 41, no. 7 (September 1988): 1-6.

Ministry of Foreign Affairs, Republic of South Africa, Directive on Discussions of Nuclear Matters with United States Authorities," Pretoria, South Africa, 1981.

Mihalka, Michael, *German Strategic Deception in the 1930's*, Santa Monica, Calif.: RAND Corporation, N-1557-NA, 1980.

Milhollin, Gary. "Dateline New Delhi: India's Nuclear Cover-Up." *Foreign Policy*, no. 64 (Autumn 1986): 161-75.

Miller, Judith, Stephen Engelberg, and William Broad. *Germs: Biological Weapons and America's Secret War*. New York, NY: Simon & Schuster, 2001.

Moodie, Michael. "The Soviet Union, Russia, and the Biological and Toxin Weapons Convention." *The Nonproliferation Review* 8, no. 1 (Spring 2001): 59-69.

Moore, David T., and William N. Reynolds. "So Many Ways to Lie: Complexity of Denial and Deception." *Defense Intelligence Journal* 15, no. 2 (2006): 95-116.

Moose, Paul H. "A Systems View of Deception." Chap. 6 In *Strategic Military Deception*, edited by Donald C. Daniel and Katherine L. Herbig, 136-50. Elmsford, NY: Pergamon Press, 1982.

Mukherjee, Anit, George Perkovich, and Gaurav Kampani. "Correspondence: Secrecy, Civil-Military Relations, and India's Nuclear Weapons Program." *International Security* 39, no. 3 (Winter 2014): 202-14.

Obeidi, Mahdi, and Kurt Pitzer. *The Bomb in My Garden: The Secrets of Saddam's Nuclear Mastermind*. Hoboken, NJ: John Wiley and Sons, 2004.

Pabian, Frank V. "South Africa's Nuclear Weapon Program: Lessons for U.S. Nonproliferation Policy." *The Nonproliferation Review* 3, no. 1 (Fall 1995): 1-19.

Pabian, Frank V. "The South African Denuclearization Exemplar." *The Nonproliferation Review* 22, no. 1 (November 2015): 27-52.

Parmenter, William. "South Africa: Policy Considerations Regarding a Nuclear Test," 1977.

Paul, T.V. "The Systemic Bases of India's Challenge to the Global Nuclear Order." *The Nonproliferation Review* (Fall 1998): 1-11.

Perkovich, George. *India's Nuclear Bomb*. Berkeley, CA: University of California Press, 2000.

Public Broadcasting System, transcript of interview with Dr. Frank Malinoski, *Frontline*, October 1998a.

Public Broadcasting System, transcript of interview with Gary Crocker, *Frontline*, October 1998b.

Reed, Thomas C., and Danny B. Stillman. *The Nuclear Express: A Political History of the Bomb and Its Proliferation*. Minneapolis, MN: Zenith Press, 2009.

Reiter, Dan. "Preventative Attacks against Nuclear Programs and the 'Success' at Osiraq." *The Nonproliferation Review* 12, no. 2 (July 2005): 355-71.

Rimmington, Anthony. "Fragmentation and Proliferation? The Fate of the Soviet Union's Offensive Biological Weapons Programme." *Contemporary Security Policy* 20, no. 1 (1999): 86-110.

Rimmington, Anthony. "Invisible Weapons of Mass Destruction: The Soviet Union's BW Programme and Its Implications for Contemporary Arms Control." *The Journal of Slavic Military Studies* 13, no. 3 (2000): 1-46.

Ritter, Scott. *Endgame*. New York, NY: Simon & Schuster, 1999.

Robb, Charles S., and Laurence H. Silberman. "The Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction." Washington, DC, 2005.

Rokkan, Stein. "Comparative Cross-National Research: The Context of Current Efforts." In *The Use of Quantitative Data in Cross-National Research*, edited by Richard L. Merritt and Stein Rokkan. New Haven, CT: Yale University Press, 1966.

Sagan, Scott D. "Why Do States Build Nuclear Weapons?: Three Models in Search of a Bomb." *International Security* 21, no. 3 (Winter 1997): 54-86.

Sarbin, Theodore R. "Prolegomenon to a Theory of Counterdeception." Chap. 7 In *Strategic Military Deception*, edited by Donald C. Daniel and Katherine L. Herbig, 151-76. Elmsford, NY: Pergamon Press, 1982.

Sharma, Kalpana. "The Hindu Bomb." *Bulletin of the Atomic Scientists* 54, no. 4 (July 1 1998): 30-33.

Sherwin, Ronald G. "The Organizational Approach to Strategic Deception: Implications for Theory and Policy." Chap. 3 In *Strategic Military Deception*, edited by Donald C. Daniel and Katherine L. Herbig, 70-98. Elmsford, NY: Pergamon Press, 1982.

Shulsky, Abram. "Elements of Strategic Denial and Deception." Chap. 2 In *Strategic Denial and Deception: The Twenty-First Century Challenge*, edited by Roy Godson and James J. Wirtz, 15-39. New Brunswick, NJ: Transaction Publishers, 2002.

Singh, Jaswant. "Against Nuclear Apartheid." *Foreign Affairs* 77, no. 5 (September 1998): 41-52.

Singh, Sonali, and Christopher R. Way. "The Correlates of Nuclear Proliferation: A Quantitative Test." *The Journal of Conflict Resolution* 48, no. 6 (Dec 2004): 859-85.

Strauss, Anselm, and Juliet M. Corbin. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Thousand Oaks, CA: Sage, 1990.

Strauss, Anselm, and Juliet M. Corbin. *Basics of Qualitative Research, Second Edition*. Thousand Oaks, CA: Sage, 1998.

Stumpf, Waldo. "South Africa's Nuclear Weapons Program: From Deterrence to Dismantlement." *Arms Control Today* 25, no. 10 (Dec 1995): 3-8.

Stumpf, Waldo, email discussion with the author on deception in the South African nuclear weapons program, January 1, 2016.

Suchenwirth, Richard. *The Development of the German Air Force, 1919-1939*. USAF Historical Studies, edited by Harry R. Fletcher New York, NY: Arno Press, 1968.

Talbott, Strobe. *Engaging India: Diplomacy, Democracy, and the Bomb*. Washington, DC: Brookings Institution Press, 2004.

Tamsett, Jeremy. "The Israeli Bombing of Osiraq Reconsidered: Successful Counterproliferation?" *The Nonproliferation Review* 11, no. 3 (2004): 70-85.

Tellis, Ashley, interview with the author, January 22, 2016.

Tellis, Ashley J., *India's Emerging Nuclear Posture: Between Recessed Deterrent and Ready Arsenal*, Santa Monica, Calif.: RAND Corporation, MR-1127-AF, 2001.

Tenet, George. *At the Center of the Storm: The Cia During America's Time of Crisis*. New York, NY: Harper, 2007.

Thorne, Leslie. "IAEA Nuclear Inspections in Iraq." *IAEA Bulletin* 1 (1992): 16-24.

Tucker, Jonathan B. "Biological Weapons in the Former Soviet Union: An Interview with Dr. Kenneth Alibek." *The Nonproliferation Review* 6, no. 3 (1999): 1-10.

Tucker, Jonathan B., and Raymond A. Zilinskas. "The 1971 Smallpox Epidemic in Aralsk, Kazakhstan, and the Soviet Biological Warfare Program." In *Center for Nonproliferation Studies Occasional Papers*, edited by Scott Parrish, 71. Monterey, CA: Monterey Institute of International Studies, Center for Nonproliferation Studies, 2002.

Tyler, Patrick E. "Specialists See Iraq Unlikely to Build a-Bomb in near Future." *Washington Post*, November 8 1990.

U.S. Senate, Senate Select Committee on Intelligence, *Current and Projected Security Threats to the United States*, Washington, DC, U.S. Government Printing Office, 2000.

The Economist Staff, "The Nuke Detectives," *Technology Quarterly*, September 2015, pp. 10-13.

Villiers, J.W. de, Roger Jardine, and Mitchell Reiss. "Why South Africa Gave up the Bomb." *Foreign Affairs* 72, no. 5 (December 1993): 98-109.

Vorster, B.J., Speech to the Congress of the National Party of Cape Province, Cape Town, South Africa, August 24, 1977.

Walker, William. "India's Nuclear Labyrinth." *The Nonproliferation Review* 4, no. 1 (Fall 1996): 61-77.

Walt, Richardt v. d., Hannes Steyn, and Jan van Loggerenberg. *Armament and Disarmament: South Africa's Nuclear Weapons Experience*. Pretoria: Network Publishers, 2003.

Watt, D. C. "The Anglo-German Naval Agreement of 1935: An Interim Judgment." *The Journal of Modern History* 28, no. 2 (1956): 155-75.

Whaley, Barton. *Covert German Rearmament, 1919-1939*. Frederick, MD: University Publications of America, 1984.

Whaley, Barton. "Conditions Making for Success or Failure of Denial and Deception: Authoritarian and Transition Regimes." Chap. 3 In *Strategic Denial and Deception in the 21st Century*, edited by Roy Godson and J. J. Wirtz, 41-94. London, UK: Transaction Publishers, 2002.

Whaley, Barton. *Stratagem: Deception and Surprise in War*. Boston, MA: Artech House, 2007a.

Whaley, Barton. *Textbook of Political-Military Counterdeception*. Washington, DC: Foreign Denial & Deception Committee, National Intelligence Council, 2007b.

Whaley, Barton, and Jeffrey Busby. "Detecting Deception: Practice, Practitioners, and Theory." Chap. 7 In *Strategic Denial and Deception*, edited by Roy Godson and James J. Wirtz, 181-222. London, UK: Transaction Publishers, 2002.

Wines, Michael. "Hard Data Lacking on Iraqi Nuclear Threat." *The New York Times*, November 30 1990.

Wohlstetter, Roberta. *Pearl Harbor: Warning and Decision*. Stanford, CA: Stanford University Press, 1962.

Wohlstetter, Roberta. "Cuba and Pearl Harbor: Hindsight and Foresight." *Foreign Affairs* 43, no. 4 (July 1965): 691-707.

Wohlstetter, Roberta. "The Pleasures of Self-Deception." *The Washington Quarterly* 2, no. 4 (1979): 54-63.

Wyk, Anna-Mart v. "Ally or Critic? The United States' Response to South African Nuclear Development, 1949-1980." *Cold War History* 7, no. 2 (2007): 195-225.

Wyk, Anna-Mart v. "Apartheid's Atomic Bomb: Cold War Perspectives." *South African Historical Journal* 62, no. 1 (2010a): 100-20.

Wyk, Anna-Mart v. "South Africa's Nuclear Programme and the Cold War." *History Compass* 8, no. 7 (2010b): 562-72.

Wyk, Jo-Ansie v., and Anna-Mart van Wyk. "From the Nuclear Laager to the Non-Proliferation Club: South Africa and the Npt." *South African Historical Journal* 67, no. 1 (2015): 32-46.

Ziegler, Charles A. "Intelligence Assessments of Soviet Atomic Capability 1945-1949: Myths, Monopolies, and Maskirovka." *Intelligence and National Security* 12, no. 4 (1997): 1-24.

Zilinskas, Raymond A. "The Anti-Plague System and the Soviet Biological Warfare Program." *Critical Reviews in Microbiology* 32 (2006): 47-64.