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# Beyond the Rubicon: Command and Control in Regional Nuclear Powers

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## Abstract

What factors explain the origins of command and control systems in emerging nuclear powers? Why do some states implement robust administrative, physical, and technical controls over their nuclear arsenals, while others limit safeguards against nuclear use?

The nature of a state's nuclear command and control systems underpin the deterrent capacity of a state's nuclear arsenal, determine the likelihood of accidental or unauthorized nuclear use, and affect the likelihood of conventional conflict escalating across the nuclear threshold. Despite the importance of command and control systems for nuclear stability and security, however, detailed analysis on the sources of nuclear command and control remain scarce outside the context of the Cold War superpowers. Current explanations of command and control in regional nuclear powers are largely built upon lessons from the U.S. nuclear experience, but these explanations prove unpersuasive under empirical scrutiny.

In this dissertation, I analyze the origins of command and control systems in regional nuclear powers. My dissertation makes three broad contributions to the study of nuclear strategy and operations. First, I develop a typology of nuclear command and control systems that measures the administrative, physical, and technical controls that a state deploys over its nuclear arsenal. With these indicators, I identify three ideal types of command and control that categorize command and control frameworks by when political leaders delegate the capability to use nuclear weapons to lower-level commanders: delegative control systems that delegate nuclear use capability during peacetime, conditional control systems that delegate nuclear use capability early in crises, and assertive control systems that delegate nuclear use capability late in crises.

Second, I provide a theoretical framework that incorporates three variables to explain variation in command and control arrangements across regional nuclear powers: the presence of a conventionally superior adversary, the severity of domestic threats to the political regime, and the level of military organizational autonomy. This framework generates specific predictions for command and control outcomes in regional nuclear powers and identifies the conditions under which each variable influences command and control systems.

Third, I evaluate my argument and a series of alternative explanations with a combination of historical and primary source material. Specifically, I draw upon archival and original interview data with political and military elites from India, Pakistan, and apartheid-South Africa to describe and explain nuclear command and control arrangements in these states. By employing extensive primary source evidence to evaluate the competing perspectives, my dissertation offers the descriptive accuracy and theoretical leverage necessary to explain command and control arrangements in regional nuclear powers.

# BEYOND THE RUBICON:
# COMMAND AND CONTROL IN REGIONAL NUCLEAR POWERS

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# CHAPTER 1

## INTRODUCTION

What factors explain the origins of command and control systems in emerging nuclear powers? Why do some states implement robust administrative, physical, and technical controls over their nuclear arsenals while others limit safeguards against accidental and unauthorized nuclear use?

Command and control systems refer to a state's operational procedures for the management, deployment, and potential release of nuclear weapons.[1] As such, command and control frameworks represent the core institutions responsible for managing nuclear operations. Despite the importance of these systems for nuclear arsenal safety, security, and reliability, however, researchers are yet to provide an empirically based account of the origins of command and control in emerging nuclear nations. Indeed, detailed study on the sources of command and control remains scarce outside the context of the Cold War superpowers.[2] A review of the recent literature on nuclear strategy and proliferation supports this observation, noting that "Almost no attention has been focused on support, command and control, and the policy apparatus of nuclear capabilities."[3]

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[1] This definition borrows from Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, N.J.: Princeton University Press, 2014), p. 4.

[2] Cold War-era studies include: Bruce G. Blair, *Strategic Command and Control: Redefining the Nuclear Threat* (Washington, D.C.: Brookings Institution Press, 1985); Paul Bracken, *The Command and Control of Nuclear Forces* (New Haven, C.T.: Yale University Press, 1983); Ashton B. Carter, John D. Steinbruner, and Charles A. Zraket, eds., *Managing Nuclear Operations* (Washington, D.C.: Brookings Institution Press, 1987); Peter Douglas Feaver, *Guarding the Guardians: Civilian Control of Nuclear Weapons in the United States* (Ithaca, N.Y.: Cornell University Press, 1992).

[3] Erik Gartzke and Matthew Kroenig, "Nukes with Numbers: Empirical Research on the Consequences of Nuclear Weapons for International Conflict," *Annual Review of Political Science*, Vol. 19 (May 2016), p. 408.

To date, theoretical frameworks developed by Peter Feaver and Scott Sagan over twenty years ago remain the most direct attempts to explain command and control in emerging nuclear nations.[4] These studies emphasize a fundamental challenge facing command and control systems known as the "always/never dilemma," in which decision-makers "want a high assurance that the weapons will always work when directed and a similar assurance that they will never be used in the absence of authorized direction."[5] Importantly, these studies demonstrate that any effort to guarantee the reliability of a nuclear arsenal undermines the safeguards against accidental and unauthorized nuclear use, while any attempt to increase the safety and security of an arsenal makes nuclear forces more vulnerable to an adversary's first strike.[6] As a result, states face severe tradeoffs in arsenal safety, security, and reliability when establishing command and control systems.

These foundational studies identify two ideal types of command and control that seek to address the challenges of the always/never dilemma: first, assertive control systems that centralize nuclear weapons under political authority; and second, delegative control systems that give lower-ranking military commanders the authority and ability to use nuclear weapons.[7] Assertive control prioritizes ensuring that nuclear weapons are never used without authorization, while delegative control guarantees that an arsenal is always prepared for use by emphasizing the reliability and responsiveness of nuclear weapons. Existing theories extend lessons from the U.S. nuclear experience to explain variation in command and control arrangements along the

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[4] Peter D. Feaver, "Command and Control in Emerging Nuclear Nations," *International Security*, Vol. 17, No. 3 (Winter 1992/93), pp. 160-187; Scott D. Sagan, "The Origins of Military Doctrine and Command and Control Systems," in Peter R. Lavoy, Scott D. Sagan, and James J. Wirtz, eds., *Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, and Chemical Weapons* (Ithaca, N.Y.: Cornell University Press, 2000), pp. 16-46.
[5] Feaver, "Command and Control in Emerging Nuclear Nations," p. 163.
[6] Ibid., pp. 163-165.
[7] Sagan, "The Origins of Military Doctrine and Command and Control Systems," p. 36. For an elaborated discussion on assertive and delegative control, see Feaver, *Guarding the Guardians*, pp. 7-12.

assertive/delegative framework, including explanatory factors such as a state's security environment and patterns of civil-military relations.[8]

The frameworks proposed by Feaver and Sagan provide the most systematic attempts to conceptualize and explain how states develop command and control systems in response to the always/never dilemma.[9] Nevertheless, I argue that the existing literature on nuclear command and control suffers from three shortcomings.

First, the traditional assertive/delegative conceptual framework overlooks an important distinction between command and control arrangements across nuclear states. Specifically, the assertive/delegative framework views command and control decisions as fixed in time: states either assert control over nuclear forces or delegate nuclear use capability to peripheral commanders. For nuclear weapons to be deliverable, however, all states must eventually decide to delegate control to lower-level military operators. The appropriate question when classifying command and control systems is therefore not *whether* states delegate nuclear use capability to lower levels of command, but rather *when* such delegation occurs.

Second, existing arguments fail to specify the conditions under which different variables influence command and control decisions. As a result, existing theories are largely indeterminate. For instance, when reviewing existing explanations for nuclear command and control, Vipin Narang asks, "when a state's security environment predicts one form of command and control, but its civil-military structure predicts another, which variable is determinate and under what circumstances?"[10] Although the current literature offers several competing

[8] Feaver, "Command and Control in Emerging Nuclear Nations"; Sagan, "The Origins of Military Doctrine and Command and Control Systems."
[9] Specifically, Vipin Narang labels Feaver's work as "the best theoretical treatment of how nascent nuclear states balance the so-called always/never problem." Narang, *Nuclear Strategy in the Modern Era*, p. 26.
[10] Ibid.

explanations for how particular factors influence command and control outcomes, no existing argument identifies how states resolve competing pressures.

Third, due to a paucity of evidence from regional nuclear powers when scholars developed their theoretical frameworks, the existing literature on nuclear command and control is almost exclusively built upon deductively derived lessons from the U.S. experience.[11] Recent research, however, demonstrates that the opportunities and constraints confronting regional nuclear powers differ significantly from those faced by the U.S. during its formative nuclear period.[12] For instance, whereas the U.S. and Soviet Union engaged in a decades-long nuclear arms race supported by massive financial expenditures, other nuclear states often face a wide range of domestic and external security threats and experience financial constraints when developing nuclear doctrine. In the absence of evidence from beyond the Cold War superpowers, current understandings of command and control in emerging nuclear powers are built upon uncertain empirical foundations.

My dissertation addresses the three challenges facing the current academic literature on nuclear command and control. First, I develop a conceptual framework that identifies three ideal types of command and control: *delegative* command and control systems that grant lower-level military commanders the ability to use nuclear weapons during peacetime; *conditional* command and control systems that maintain centralized political control during peacetime, but rapidly delegate nuclear use capability early in a crisis; and *assertive* command and control systems that tightly manage nuclear operations deep into crises. My conceptual framework accounts for the

[11] Feaver notes this challenge, stating: "Reliable data on existing or developing systems of command and control in emerging nuclear nations are scarce." Feaver, "Command and Control in Emerging Nuclear Nations," p. 160.
[12] On the potential problems of extending lessons from the U.S. Cold War experience to other nuclear states, see Narang, *Nuclear Strategy in the Modern Era*, pp. 1-8.

timing of delegation with respect to the onset of a crisis and identifies observable institutional indicators of command and control systems that allow analysts to systematically classify command and control arrangements in regional nuclear powers.

Second, I develop a theoretical framework that incorporates three variables to explain command and control arrangements in emerging nuclear powers: first, the presence of a conventionally superior adversary; second, the severity of domestic threats to the political regime; and third, the level of military organizational autonomy. This framework generates falsifiable predictions for command and control outcomes and specifies the conditions under which each factor shapes command and control arrangements in nuclear states.

Third, I evaluate my argument with evidence from several regional nuclear powers. Specifically, I describe and explain nuclear command and control systems in India, Pakistan, and apartheid-era South Africa. I employ historical, archival, and—for each case—original interview data with political and military elites. By incorporating extensive primary source data, my dissertation provides greater descriptive reliability and allows for an empirical evaluation of my theory and the alternative explanations.

This chapter proceeds in two sections. First, I provide a review of the existing literature on nuclear proliferation and strategy to identify several theoretical gaps in the literature and to demonstrate the contributions of my dissertation to these research programs. I show that current explanations of command and control in regional nuclear powers are built upon faulty theoretical underpinnings, primarily due to an attempt by scholars to generalize lessons from the U.S.'s Cold War experience without empirically evaluating the viability of these assumptions in regional nuclear powers. In large part, this reliance on Cold War insights persists due to an emphasis on the study of nuclear proliferation, rather than systematic analysis on the post-

proliferation behavior of nuclear states. Within this section, I also show how my project contributes to the long-standing optimist/pessimist debate by providing empirical evidence to evaluate the claims of each camp. Second, I provide an overview of the plan of the dissertation. This section outlines the theoretical and empirical chapters that I provide to support my claims.

## Literature Review

My dissertation contributes to three research programs within the broader field of nuclear strategy and operations. First, my project builds upon the literature on nuclear posture by providing an explanation for a core operational component of nuclear behavior in the post-proliferation phase. Second, my research focuses on regional nuclear powers and shows that these states face a set of structural and domestic constraints unlike those faced by the Cold War superpowers. I argue that these constraints shape nuclear decision-making in meaningful ways. Finally, I contribute to the longstanding optimist/pessimist debate, which questions the degree to which continued proliferation is dangerous for stability and security. For each research program, I provide a review of the literature, evaluate the state of the debates, and identify the contributions of my dissertation.

### *Nuclear Proliferation and Posture*

One major research program to which my project contributes is the growing literature on nuclear posture.[13] The recent development of research on nuclear posture is significant in two

[13] For the original statement on nuclear posture, see Vipin Narang, "Posturing for Peace? Pakistan's Nuclear Postures and South Asian Stability," *International Security*, Vol. 34, No. 3 (Winter 2009/10), pp. 38-78.

regards. First, the nuclear posture research program notes that, while scholars have extensively evaluated the causes of nuclear proliferation, far less has been done to explain how states behave once they have acquired nuclear weapons.[14] Although scholars and practitioners broadly agree that further nuclear proliferation is undesirable, Iran's development of nuclear capabilities and North Korea's rapid expansion of warheads and delivery platforms provide contemporary evidence that states still strive to develop nuclear capabilities and the spread of nuclear weapons is likely to continue.[15] The overemphasis on proliferation studies has detracted from our understanding of how states such as Iran and North Korea will behave in the post-proliferation phase. As a result, both scholars and practitioners are underprepared for engaging with the prospective challenges of continued proliferation.

The nuclear posture research program is built upon a simple but important insight: the danger of nuclear proliferation is not merely that more states possess nuclear weapons, but rather that the ways in which states deploy and manage their arsenals after acquiring nuclear weapons influence the likelihood of nuclear use. By focusing on the physical capabilities, deployment patterns, and command and control systems of nuclear states, the nuclear posture research program offers an opportunity to address a series of important questions left unanswered by

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[14] Several significant arguments include: Dong-Joon Jo and Erik Gartzke, "Determinants of Nuclear Weapons Proliferation," *Journal of Conflict Resolution*, Vol. 51, No. 1 (February 2007), pp. 167-194; Scott Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," *International Security*, Vol. 21, No. 3 (Winter 1996/97), pp. 54-86; Etel Solingen, *Nuclear Logics: Contrasting Paths in East Asia and the Middle East* (Princeton, N.J.: Princeton University Press, 2007); Christopher Way and Jessica L. P. Weeks, "Making it Personal: Regime Type and Nuclear Proliferation," *American Journal of Political Science*, Vol. 58, No. 3 (July 2014), pp. 705-719. For useful overviews of the proliferation literature, see: Mark S. Bell, "Examining Explanations for Nuclear Proliferation," *International Studies Quarterly*, Vol. 60, No. 3 (September 2016), pp. 520-529; Scott D. Sagan, "The Causes of Nuclear Weapons Proliferation," *Annual Review of Political Science*, Vol. 14, No. 1 (June 2011), pp. 225-244.

[15] R. Scott Kemp has recently argued that supply-side controls on proliferation are unlikely to prevent proliferation. Instead, any nonproliferation effort must manage to reduce the demand for nuclear weapons. As stated here, however, certain states maintain desires for nuclear weapons, and proliferation is likely to persist. See R. Scott Kemp, "The Nonproliferation Emperor Has No Clothes: The Gas Centrifuge, Supply-Side Controls, and the Future of Nuclear Proliferation," *International Security*, Vol. 38, No. 4 (Spring 2014), pp. 39-78.

proliferation studies.[16] By extension, the study of nuclear posture challenges a prevalent assumption in international relations theory of "existential deterrence," which posits that the mere possession of nuclear weapons constrains aggressive behavior in nuclear states, and also fosters robust deterrence of conventional and nuclear conflict.[17] Studies of nuclear posture challenge the assumption of existential deterrence by showing that states demonstrate a wide range of behaviors after acquiring nuclear weapons and that different nuclear doctrines have unequal effects on the effectiveness of conventional deterrence.[18]

A second advancement made by the nuclear posture literature is the incorporation of capability-centric arguments into a behavioral framework. Researchers often devote attention to the size and quality of a state's physical nuclear arsenal when evaluating nuclear powers.[19] In such accounts, however, physical capabilities are the primary explanatory variables for nuclear

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[16] These three aspects of posture—capabilities, deployment patterns, and command and control procedures—are drawn from Narang, "Posturing for Peace?", p. 41.

[17] For the original statement on existential deterrence, see McGeorge Bundy, "The Bishops and the Bomb," *New York Review of Books*, June 16, 1983. For an existential deterrence argument, see Marc Trachtenberg, "The Influence of Nuclear Weapons in the Cuban Missile Crisis," *International Security*, Vol. 10, No. 1 (Summer 1985), pp.137-163. Existential deterrence also lies at the core of arguments in favor of "the nuclear revolution," which argues that the mere possession of nuclear weapons provides sufficient deterrence to protect a state from external aggression. For influential examples, see: Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, N.Y.: Cornell University Press, 1989); Kenneth N. Waltz, "Nuclear Myths and Political Realities," *American Political Science Review*, Vol. 84, No. 3 (September 1990), pp. 731-745.

[18] For instance, Mark Bell demonstrates that the acquisition of nuclear weapons can lead to a broader range of foreign policy outcomes than simple emboldenment. A state may become more aggressive regarding existing goals, expand its goals to incorporate new objectives, seek independence from the influence of its allies, bolster the credibility of an alliance, become more steadfast during conflict, or even become more willing to compromise during conflict. The central point of Bell's argument is simple, yet significant: different nuclear states engage in a diverse set of behaviors after proliferation. For a discussion of the ways in which nuclear weapons may change foreign policy, see Mark S. Bell, "Beyond Emboldenment: How Acquiring Nuclear Weapons Can Change Foreign Policy," *International Security,* Vol. 40, No. 1 (Summer 2015), pp. 87-119. On the deterrent effectiveness of different nuclear postures, see Vipin Narang, "What Does It Take to Deter? Regional Power Nuclear Postures and International Conflict," *Journal of Conflict Resolution,* Vol. 57, No. 3 (June 2013), pp. 478-508.

[19] See, for example, Keir A. Lieber and Daryl G. Press, "The End of MAD?: The Nuclear Dimension of U.S. Primacy," *International* Security, Vol. 30, No. 4 (Spring 2006), pp. 7-44; Keir A. Lieber and Daryl G. Press, "The Nukes We Need: Preserving the American Deterrent," *Foreign Affairs*, Vol. 88, No. 6 (November/December 2009), pp. 39-51; Waltz, "Nuclear Myths and Political Realities." For a recent debate on the importance of numerical nuclear superiority for crisis bargaining, see: Matthew Kroenig, "Nuclear Superiority and the Balance of Resolve: Explaining Nuclear Crisis Outcomes," *International Organization*, Vol. 67, No. 1 (January 2013), pp. 141-171; Todd S. Sechser and Matthew Fuhrmann, "Crisis Bargaining and Nuclear Blackmail," *International Organization*, Vol. 67, No. 1 (January 2013), pp. 173-195.

state behavior, and scholars deemphasize the processes of arsenal management. The nuclear force structure of a state is an important point of connection between the proliferation and posture literatures, but it must be incorporated into a broader behavioral scheme in order to provide an explanation for variation in foreign policy outputs.[20] Studying the more holistic system of how these capabilities are managed and deployed strengthens inference regarding how a state might operate in practice, rather than merely estimating that state's intentions.[21] This more complete understanding of nuclear behavior is essential to developing policy-relevant empirical findings and exemplifies the value of continued research on nuclear posture.

The study of nuclear posture represents significant progress in the field of nuclear strategy and operations, but several extensions of the debate merit further consideration. Notably, research to date has largely focused on the effect of different nuclear postures on deterrence outcomes.[22] This perspective, however, only addresses one dimension of state behavior in the post-proliferation period.[23] Beyond studying the effects of nuclear posture on the efficacy of deterrence, further research is needed to understand the broader spectrum of how a state's nuclear posture affects its foreign policy behavior. In practice, measuring deterrence outcomes

[20] See Erik Gartzke, Jeffrey M. Kaplow, and Rupal N. Mehta, "The Determinants of Nuclear Force Structure," *Journal of Conflict Resolution*, Vol. 58, No. 3 (April 2014), pp. 481-505 for a definition of and argument on the sources of nuclear force structures.

[21] Peter Feaver notes the shortcomings of a purely capability-centered study of nuclear strategy, stating that "these measures are useful for estimating what a new nuclear nation might *intend* to do with its arsenal," but they fail to account for "how the nuclear organization itself might *in fact* behave." Feaver, "Command and Control in Emerging Nuclear Nations," p. 160. Emphasis in original.

[22] See, for example, Vipin Narang, "What Does It Take to Deter?".

[23] One notable exception to this statement is provided by Mark Bell, who offers a theoretical framework for explaining why states pursue different strategies after acquiring nuclear weapons. Bell argues that three structural factors explain the variation in nuclear doctrines after proliferation: first, the presence of territorial threats; second, allies and security guarantors; and third, trends in relative power ratios between a state and its rivals. These factors are both substantially and sequentially important in Bell's framework—states make different decisions regarding their foreign policy outputs by first evaluating existential threats, then evaluating external security guarantees, and finally estimating the relative power trends vis-à-vis their adversaries. On these points, see Mark S. Bell, "Nuclear Opportunism: A Theory of How States Use Nuclear Weapons in International Politics," *Journal of Strategic Studies*, Vol. 42, No. 1 (January 2019), pp. 3-28.

ultimately reveals more about an adversary's cost-benefit calculations than it shows regarding the behavioral changes within a nuclear-armed state. Although the research on deterrence outcomes analyzes an important dimension of nuclear proliferation, the nuclear posture research program requires additional analysis of behavioral foreign policy outputs to help scholars and policymakers understand the conditions under which nuclear proliferation is most dangerous for regional and international security.

My dissertation contributes to the nuclear posture research program in three ways. First, by providing a theory of nuclear command and control systems, I extend the logic of the nuclear posture research program to explain an important dimension of nuclear strategy and operations. This shifts the study of nuclear posture beyond its current focus on deterrence outcomes and captures an understudied institutional aspect of nuclear doctrine. Second, I supplement structurally based explanations of regional power nuclear foreign policies with domestic level factors.[24] By modeling the effects of internal factors such as domestic threats to the political regime and the level of military organizational autonomy, I strengthen the theoretical foundations of the nuclear posture research program and identify the specific conditions under which each factor shapes command and control outcomes in emerging nuclear nations. Third, my project highlights the importance of operational level factors for nuclear strategy. Recent work within the nuclear posture research program has shown that the viability of a state's nuclear strategy is dependent upon its operational capabilities. For instance, although a significant

[24] Mark Bell's work on the behavior of nuclear states after proliferating represents the best example of a work in nuclear posture that explains variation in foreign policy outputs. However, all three of the factors that explain foreign policy outcomes in Bell's typology—threats, alliances, and relative power ratios—are structural. Bell explicitly notes that other factors are also likely to shape foreign policy decisions, stating: "Other plausible explanations might exist for the ways in which nuclear acquisition affects foreign policy – perhaps identifying variables in the domestic politics of the state, or the psychology of particular leaders, or international norms." Ibid., p. 25.

portion of the literature on nuclear strategy views secure second-strike capabilities—the ability to survive an adversary's preemptive strike and respond with nuclear force—as easily obtainable,[25] scholars have recently shown that technological advancements and operational challenges undermine the basis of this assumption.[26] I build upon this observation by showing that the operational decisions states make regarding nuclear command and control systems significantly shape the survivability of second-strike capabilities and the strategic options available to states make for promoting arsenal reliability.

*Regional Nuclear Powers*

A second research program to which my dissertation contributes is the analysis of regional nuclear powers. Although several scholars have identified the arrival of a "second nuclear age," most theories of nuclear strategy and operations are built upon lessons from the U.S. and Soviet Union during the Cold War.[27] Regional nuclear powers, however, face different

[25] For examples, see: Charles L. Glaser, *Analyzing Strategic Nuclear Policy* (Princeton, N.J.: Princeton University Press, 1990), pp. 95-97, 320; Charles L. Glaser and Steve Fetter, "Counterforce Revisited: Assessing the Nuclear Posture Review's New Missions," *International Security*, Vol. 30, No. 2 (Fall 2005), pp. 84-126; Charles L. Glaser and Steve Fetter, "Should the United States Reject MAD? Damage Limitation and U.S. Nuclear Strategy toward China," *International Security*, Vol. 41, No. 1 (Summer 2016), pp. 49-98; Robert Jervis, *The Illogic of American Nuclear Strategy* (Ithaca, N.Y.: Cornell University Press, 1984); Jervis, *The Meaning of the Nuclear Revolution*.

[26] Important works include: Owen R. Cote, Jr., "Invisible Nuclear-Armed Submarines, or Transparent Oceans? Are Ballistic Missile Submarines Still the Best Deterrent for the United States?", *Bulletin of the Atomic Scientists*, Vol. 75, No. 1 (January 2019), pp. 30-35; Owen R. Cote, Jr., *The Third Battle: Innovation in the U.S. Navy's Silent Cold War Struggle with Soviet Submarines* (Newport, R.I.: Naval War College Press, 2003); Brendan R. Green and Austin Long, "The MAD Who Wasn't There: Soviet Reactions to the Late Cold War Nuclear Balance," *Security Studies*, Vol. 26, No. 4 (Summer 2017), pp. 606-641; Keir A. Lieber and Daryl G. Press, "The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence," *International Security*, Vol. 41, No. 4 (Spring 2017), pp. 9-49; Austin Long and Brendan Rittenhouse Green, "Stalking the Secure Second Strike: Intelligence, Counterforce, and Nuclear Strategy," *Journal of Strategic Studies*, Vol. 38, Nos. 1-2 (January 2015), pp. 38-73.

[27] For examples, see: Paul Bracken, *The Second Nuclear Age: Strategy, Danger, and the New Power Politics* (New York, N.Y.: Times Books, 2012); Colin S. Gray, *The Second Nuclear Age* (Boulder, C.O.: Lynne Rienner, 1999); Toshi Yoshihara and James R. Holmes, eds., *Strategy in the Second Nuclear Age: Power, Ambition, and the Ultimate Weapon* (Washington, D.C.: Georgetown University Press, 2012).

opportunities and constraints than those that faced the U.S. and Soviet Union, including smaller arsenals, conventional and nuclear regional adversaries, and often weaker domestic political institutions.[28]

Existing explanations of the origins of command and control in regional nuclear powers require revision for three reasons. First, because much of the literature was developed before the most recent wave of proliferators operationalized their nuclear arsenals, existing explanations of regional nuclear power command and control systems are highly deductive and lack extensive evaluation with evidence from these states.[29] Second, scholars have mistakenly applied assumptions from the United States experience to regional nuclear power decision-making in ways that misguide the analysis. For instance, assuming strong civilian control of the military overlooks the role of politically influential military organizations in some regional powers, which may shape nuclear decision-making. Third, attempts to extrapolate lessons from the U.S. case to regional nuclear powers have facilitated the omission of influential variables that shape the behavior of recent proliferators, such as the availability of third-party nuclear patrons and domestic threats to the ruling political regime.[30] As a result, the Cold War foundations underlying current explanations of command and control in regional nuclear powers are empirically thin and potentially theoretically misleading.

The problems of extending Cold War insights to modern nuclear states create challenges for both the descriptive and explanatory dimensions of research on command and control

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[28] On these points and for a discussion on how the "Cold War hangover" negatively affects the study of contemporary proliferators, see Narang, *Nuclear Strategy in the Modern Era*, pp. 1-8.
[29] These recent proliferators include India, Pakistan, and North Korea. Many explanations were also researched before South Africa's 1993 statement revealing that it had decommissioned its nuclear arsenal.
[30] On the unique role of third-party patrons in the nuclear strategy of regional nuclear powers, see Narang, *Nuclear Strategy in the Modern Era*, pp. 31-34.

systems in regional nuclear powers. Descriptively, these problems are apparent in the conceptualization of command and control. The concept of command and control entered the academic mainstream in the mid-1980s, but its study quickly fell out of favor with the collapse of the Soviet Union in 1991. As a result, Cold War lessons dominate the conceptual work on command and control, and the "Cold War hangover" appears to be particularly pronounced in the description and analysis of command and control in regional nuclear powers.[31] Theorizing on nuclear matters became seemingly obsolete in the post-Cold War environment and advancements in the understanding of command and control systems slowed dramatically. For this reason, employment of the concept often lacks resonance within the broader literature and persists without a unified definition.[32]

For example, early works by Paul Bracken and Bruce Blair define command and control in general terms, incorporating a variety of components such as physical controls, institutional patterns of decision-making, and information processing.[33] These broad definitions, however, do not systematically identify the institutional dimensions of command and control arrangements, which further precludes an explanation of how these institutions affect political behavior. Neither Bracken nor Blair offers a concrete method for operationalizing and measuring the concept of command and control,[34] which inhibits the systematization of the concept, clarification of key

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[31] On the "Cold War hangover," see ibid., pp. 1-8.

[32] For a discussion on the criteria of concepts and conceptualization, see John Gerring, *Social Science Methodology: A Unified Framework*, 2d ed. (Cambridge: Cambridge University Press, 2012), pp. 107-140, especially pp. 117-119 as it pertains to the resonance of a concept.

[33] Bracken defines command and control systems as "an arrangement of facilities, personnel, procedures, and means of information acquisition, processing, and dissemination used by a commander in planning, directing, and controlling military operations." Bracken, *The Command and Control of Nuclear Forces*, p. 3. Blair defines command and control more broadly as "$C^3I$," or "command, control, communications, and intelligence." See Blair, *Strategic Command and Control*, especially chapter 1.

[34] Bracken does identify the importance of political institutions in this process. He states, "For ensuring that a military commander does not start a nuclear war on his own…the restraints are more institutional than physical." Bracken, *The Command and Control of Nuclear Forces*, p. 23. The core of the critique here, however, is that

indicators, and scoring of cases in a systematic and replicable manner.[35] These studies offer valuable contributions to the study of U.S. command and control arrangements, but the lack of a systematized concept prevents scholars from extending their analyses to regional nuclear powers.

Noting these shortcomings, Peter Feaver proposed a definition of command and control on a spectrum of assertive and delegative control, which represent a high degree of civilian control over military affairs and greater decision-making autonomy for the military, respectively.[36] By identifying a specific spectrum along which command and control can be measured, Feaver fosters greater conceptual precision for the study of command and control. Creating this spectrum also allows Feaver to tie the concept of command and control directly to the literature on civil-military relations, especially Samuel Huntington's work on civilian control of the military.[37] This is an important contribution because the concept of civil-military relations substantially overlaps with command and control, but previous work only indirectly identified this relationship. The decision to delegate control of nuclear assets, for example, is an inherently political process that captures a central component of civil-military relations: the delegation of *de facto* power from a superior power to a subordinate entity.[38] Nevertheless, general theories of

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speaking of institutional control in the abstract is insufficient to identify the importance of key institutional features when classifying command and control arrangements.

[35] This approach—systematizing a concept, specifying the indicators, and systematically scoring cases—derives from Robert Adcock and David Collier, "Measurement Validity: A Shared Standard for Qualitative and Quantitative Research," *American Political Science Review*, Vol. 95, No. 3 (September 2001), pp. 529-546.

[36] For a full explanation of assertive and delegative control, see Feaver, *Guarding the Guardians*, pp. 7-12.

[37] Huntington's model of civil-military relations is characterized by two ideal-types: objective and subjective civilian control. Objective civilian control aims to reduce the political power of the military. For Huntington, reducing the ability of the military to influence politics entails "professionalizing" the military, meaning that civilians allow the military to specialize in military affairs without civilian intervention. Subjective civilian control, in contrast, is the institutional involvement of civilians in military endeavors. For example, this involvement can take the form of hierarchical political institutions or constitutional provisions. For a full discussion of objective versus subjective civilian control, see Samuel P. Huntington, *The Soldier and the State: The Theory and Politics of Civil-Military Relations* (Cambridge, M.A.: Belknap, 1957), pp. 80-97.

[38] Feaver specifically maps this form of delegative control onto subjective control, stating that it "connotes the essential element of that form of control: a bequeathal of de facto power to an otherwise subordinate element." Feaver, *Guarding the Guardians*, p. 7.

civil-military relations do not clearly specify the relationship between civilians and military leaders in the institutional management of nuclear weapons. By reframing patterns of command and control along a spectrum of assertive and delegative control, Feaver's model provides an opportunity to capture both the institutional and civil-military aspects of command and control systems.

This model, however, also faces challenges when applied to regional nuclear powers. A central problem for Feaver's framework is its presupposition of civilian control over the military. This problem is further compounded by attempts to portray civil-military dynamics within the principal-agent framework, where civilians behave as principals and military operators serve as agents. For the U.S., the strategic interaction and hierarchy of civil-military relations is a core feature that facilitates principal-agent analysis; however, the assumption that nuclear decisions are universally administered by civilians is empirically inaccurate in several cases.[39] Pakistan, for instance, has a long history of military involvement in political affairs, especially the development and management of the state's nuclear program.[40] Consequently, this framework may fail to capture political-military dynamics at work in regional nuclear powers.

An overreliance on lessons from the U.S. experience also presents problems for the dominant explanatory frameworks for command and control in regional nuclear powers. Although twenty-five years have passed since its publication, Peter Feaver's landmark work on command and control in emerging nuclear nations remains the most direct attempt to explain

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[39] Peter D. Feaver, *Armed Servants: Agency, Oversight, and Civil-Military Relations* (Cambridge, M.A.: Harvard University Press, 2003). For a helpful overview of principal-agent models, see Gary J. Miller, "The Political Evolution of Principal-Agent Models," *Annual Review of Political Science*, Vol. 8 (June 2005), pp. 203-225.
[40] Samina Ahmed, "Pakistan's Nuclear Weapons Program: Turning Points and Nuclear Choices," *International Security*, Vol. 23, No. 4 (Spring 1999), pp. 178-204; Sebastien Miraglia, "Deadly or Impotent? Nuclear Command and Control in Pakistan," *Journal of Strategic Studies*, Vol. 36, No. 6 (December 2013), pp. 841-866; Naeem Salik, *Learning to Live with the Bomb: Pakistan: 1998-2016* (Karachi: Oxford University Press, 2017), pp. 133-176.

command and control in new nuclear states.[41] When developing his argument, however, Feaver faced a severe paucity of empirical data on regional nuclear power command and control systems. The most recent nuclear event at this time was India's "peaceful nuclear explosion" in 1974, which was not followed by another openly-acknowledged nuclear test until India and Pakistan formally tested nuclear weapons in 1998.[42] As a result, Feaver was forced to extrapolate lessons from the U.S. experience and established a deductively-derived framework for explaining the origins of an emerging nuclear state's command and control systems.[43] Since this argument was first proposed, however, no systematic attempt has been made to evaluate the empirical veracity of the framework. Consequently, the conventional wisdom on command and control in regional nuclear powers is built upon unproven theoretical and empirical foundations.

My dissertation employs evidence from regional nuclear powers to improve research on command and control systems in two ways. First, I systematize the concept of command and control along a series of institutional dimensions to help scholars compare and analyze nuclear operations across emerging proliferators. By doing so, I provide a conceptual framework independent of assumptions regarding a state's patterns of civil-military relations or nuclear force structure that facilitates evaluation of the potential for accidental or unauthorized nuclear use. Second, the use of extensive primary source data from regional nuclear powers allows me to test the explanatory power of my theory and the existing explanations for command and control.

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[41] Feaver, "Command and Control in Emerging Nuclear Nations." Vipin Narang recently labeled Feaver's argument as "the best theoretical treatment of how nascent nuclear states balance the so-called always/never problem." Narang, *Nuclear Strategy in the Modern Era*, p. 26.

[42] India's permanent representative to the United Nations at the time of the test asserted that India's test was "conducted exclusively for peaceful purposes" and "had no military or political implications." For the full statement, see Rikhi Jaipal, "The Indian Nuclear Explosion," *International Security*, Vol. 1, No. 4 (Spring 1977), pp. 44-51.

[43] Feaver notes this challenge, stating that: "Reliable data on existing or developing systems of command and control in emerging nuclear nations are scarce." Feaver, "Command and Control in Emerging Nuclear Nations," p. 160.

With these data, I am able to evaluate the extent to which Cold War frameworks should inform the analysis of command and control in emerging nuclear nations and offer an alternative explanation that captures domestic and international factors that shape regional nuclear power decision-making to a greater extent than the Cold War superpowers.

*Nuclear Optimism and Pessimism*

A third stream of literature to which this project contributes is the debate between nuclear optimists and pessimists.[44] The concept of command and control systems is central to this longstanding debate. The core disagreement between optimists and pessimists centers on the likelihood of nuclear use by emerging nuclear powers, whether intentionally or unintentionally.[45] Proliferation optimists emphasize the outcome-based stability of nuclear states by focusing on the ability of nuclear weapons to suppress the concerns of escalation.[46] Because nuclear arsenals inhibit conflict by providing robust deterrence, optimists advance the outcome-based conclusion that nuclear weapons have inherently stabilizing qualities. For a nuclear optimist, smaller arsenals are easier to manage and can easily be made survivable via rudimentary concealment measures that promote safeguards against nuclear use, which reduces the need for states to delegate launch authority to peripheral commanders in order to promote arsenal survivability.

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[44] This project provides a basic distinction between optimists and pessimists. For a more nuanced description of specific camps within each group, see Peter Feaver, "Neooptimists and the Enduring Problem of Nuclear Proliferation," *Security Studies*, Vol. 6, No. 4 (Summer 1997), pp. 93-125.

[45] This discussion provides a basic distinction between optimists and pessimists. For a more nuanced description of specific camps within each group, see ibid.

[46] For examples of nuclear optimism, see David J. Karl, "Proliferation Pessimism and Emerging Nuclear Powers," *International Security*, Vol. 21, No. 3 (Winter 1996/97), pp. 87-119; Jordan Seng, "Less is More: Command and Control Advantages of Minor Nuclear States," *Security Studies*, Vol. 6, No. 4 (Summer 1997), pp. 50-92;" Scott D. Sagan and Kenneth N. Waltz, *The Spread of Nuclear Weapons: An Enduring Debate*, 3d ed. (New York, N.Y.: W.W. Norton, 2013), pp. 3-40, 82-111, 157-174, 180-200; Kenneth N. Waltz, *The Spread of Nuclear Weapons: More May Be Better*, Adelphi Paper No. 171 (London: International Institute of Strategic Studies, Autumn 1981).

Furthermore, because other states realize that a first strike cannot entirely destroy an adversary's nuclear arsenal, even the smallest of arsenals provides a state with reliable security from external aggression.[47]

In stark contrast, proliferation pessimists assert that the spread of nuclear weapons has dangerous implications for regional security.[48] Members of the pessimist school contend that these states are not content to trust in existential deterrence and consider attacks on their arsenal a real possibility.[49] This suggests that proliferators with small arsenals fear for the survivability of their nuclear capacity and increase the potential for nuclear accidents by delegating authority to lower levels of authority. To a much greater degree than optimists, pessimists focus on the potential for command and control failures that lead to accidental or unauthorized nuclear use. This school notes three potential points of failure: first, emerging nuclear nations are likely to experience significant technical difficulties in establishing command and control systems; second, nuclear confrontations generated "near misses" in the Cold War context and are likely to do so in new nuclear states; and third, these concerns afflict certain proliferators to a greater degree than others.[50] These three points suggest that command and control systems are

[47] This characterization of nuclear optimism coincides with Peter Feaver's definition of neooptimism. I mention the original works on nuclear optimism—what Feaver terms "paleooptimism"—in passing because modern scholars of nuclear optimism and pessimism are both critical of the simplistic existential deterrence arguments of paleo-optimists. As Feaver notes, however, the essence of the neooptimist argument is still built upon the logic of existential deterrence. Feaver, "Neooptimists and the Enduring Problem of Nuclear Proliferation." On the command and control advantages of small arsenals, see Seng, "Less is More." On the ability of small arsenals to deter preventive nuclear attacks, see Karl, "Proliferation Pessimism and Emerging Nuclear Powers."

[48] For examples of nuclear pessimism, see Feaver, "Neooptimists and the Enduring Problem of Nuclear Proliferation;" Scott Sagan, "The Perils of Proliferation: Organization Theory, Deterrence Theory, and the Spread of Nuclear Weapons," *International Security*, Vol. 18, No. 4 (Spring 1994), pp. 66-107; Sagan's chapters in Sagan and Waltz, *The Spread of Nuclear Weapons.*

[49] Feaver, "Neooptimists and the Enduring Problem of Nuclear Proliferation," pp. 104-112.

[50] These three points are derived from ibid., p. 97.

technologically demanding, and that the robustness of these systems is likely to be challenged by crises or simple accidents.[51]

The optimist/pessimist debate began in earnest in the early-1980s, when Kenneth Waltz challenged the widespread acceptance of nuclear pessimism amongst scholars and policymakers alike.[52] Waltz argued that the spread of nuclear weapons encouraged conventional military stability between the great powers, and as a result, U.S. policymakers should support the proliferation of nuclear weapons.[53] This argument became more influential over time as scholars increasingly cited a "nuclear revolution," which argues that the destructive power of nuclear weapons makes military victory impossible, thereby reducing the incentives for aggression and fostering peace and stability.[54] By the early-1990s, nuclear optimism gained support from notable scholars such as John Mearsheimer and Stephen Van Evera, although with certain qualifications to Waltz's original argument.[55]

Perhaps the most influential response to the optimist perspective came from Scott Sagan, who demonstrated an extensive history of near misses during the development of the U.S. arsenal

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[51] On the challenges of "normal accidents" to command and control systems, see Scott D. Sagan, *The Limits of Safety: Organizations, Accidents, and Nuclear Weapons* (Princeton, N.J.: Princeton University Press, 1993).
[52] At this point in time, influential works on nuclear pessimism included: Lewis Dunn, *Controlling the Bomb: Nuclear Proliferation in the 1980s* (New Haven, C.T.: Yale University Press, 1982); and Leonard Spector, *Nuclear Proliferation Today* (New York, N.Y.: Vintage, 1984). Proliferation pessimism also served as a motivating principle for U.S. counterproliferation efforts throughout this period. On the history of U.S. counterproliferation policies, see Francis J. Gavin, "Strategies of Inhibition: U.S. Grand Strategy, the Nuclear Revolution, and Nonproliferation," *International Security*, Vol. 40, No. 1 (Summer 2015), pp. 9-46.
[53] For the original argument, see Waltz, *The Spread of Nuclear Weapons*.
[54] The "theory of the nuclear revolution" was most clearly articulated by Robert Jervis in: Jervis, *The Meaning of the Nuclear Revolution*. Earlier arguments, however, did share important dimensions of this logic. For examples, see: Bernard Brodie, ed., *The Absolute Weapon: Atomic Power and World Order* (New York, N.Y.: Harcourt, 1946); Thomas C. Schelling, *Arms and Influence* (New Haven, C.T.: Yale University Press, 1966).
[55] Mearsheimer, for example, argued that the U.S. should narrowly support proliferation in Germany to promote conventional stability in the post-Cold War era. See John J. Mearsheimer, "Back to the Future: Instability in Europe After the Cold War," *International Security*, Vol. 15, No. 1 (Summer 1990), pp. 8, 38-39. Van Evera generally promotes the general stability of nuclear deterrence, and also supports proliferation in Germany. See Stephen Van Evera, "Primed for Peace: Europe after the Cold War," *International Security*, Vol. 15, No. 3 (Winter 1990/91), pp. 12-14, 54.

and provided a theoretical basis for expecting the same challenges to affect emerging proliferators.[56] Scholars continued to debate the logic underpinning each camp's claims in light of evidence from the U.S. experience, but by the end of the 1990s, the optimist/pessimist debate had stalled and deep theoretical divisions remained.[57]

As a result of the pause in the optimist/pessimist debate, several theoretical issues persist for each position. For example, nuclear optimism is effectively an extension of the existential deterrence literature. Although nuclear weapons certainly provide significant deterrent value, two major problems remain with optimist accounts. First, conventional and sub-conventional conflicts may occur under the nuclear shadow, and escalation from the conventional to the nuclear level remains possible.[58] Indeed, the South Asian experience has demonstrated that nuclear weapons may facilitate low-level conflict that creates significant instability.[59] Second, even if a state's arsenal provides robust deterrence against aggressive action by an adversary, it does not necessarily follow that the state will assume safer, more assertive patterns of command

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[56] On this point, see Sagan, *The Limits of Safety*, and Sagan, "The Perils of Proliferation."

[57] Major works from this period of the debate include: Feaver, "Neooptimists and the Enduring Problem of Nuclear Proliferation;" Peter D. Feaver, Scott D. Sagan, and David J. Karl, "Correspondence: Proliferation Pessimism and Emerging Nuclear Powers," *International Security*, Vol. 22, No. 2 (Fall 1997), pp. 185-207; Karl, "Proliferation Pessimism and Emerging Nuclear Powers;" and Seng, "Less is More." Additionally, the first edition of the classic debate between Scott Sagan and Kenneth Waltz was published during this timeframe. See Scott D. Sagan and Kenneth N. Waltz, *The Spread of Nuclear Weapons: A Debate* (New York, N.Y.: W.W. Norton, 1995). Although the debate has not fully reemerged, some recent work has reevaluated the optimist/pessimist debate. See, for example: David J. Karl, "Proliferation Optimism and Pessimism Revisited," *Journal of Strategic Studies*, Vol. 34, No. 4 (August 2011), pp. 619-641; Matthew Kroenig, "The History of Proliferation Optimism: Does It Have a Future?", *Journal of Strategic Studies*, Vol. 38, Nos. 1-2 (January 2015), pp. 98-125.

[58] For instance, Peter Feaver shows that nuclear optimists understate the possibility for preventive wars that affect new and would-be proliferators. Specifically, he cites the United States' preventive war against Iraq's arsenal and Israel's preventive strikes against Egypt and Iraq to demonstrate that emerging nuclear powers can become embroiled in conventional disputes that may ultimately have nuclear consequences. Feaver, "Neooptimists and the Enduring Problem of Nuclear Proliferation," p. 106.

[59] Pakistan has undertaken several sub-conventional offensive military actions since India and Pakistan both formally tested nuclear weapons in 1998. The general understanding of this behavior is that, by promoting destabilization, Pakistan hopes that an external state (likely the United States) will arbitrate the dispute between India and Pakistan in a way that the conventionally inferior Pakistan could not obtain on its own. On this strategy, see: S. Paul Kapur, "India and Pakistan's Unstable Peace: Why Nuclear South Asia Is Not Like Cold War Europe," *International Security*, Vol. 30, No. 2 (Fall 2005), pp. 127-152; Narang, "Posturing for Peace?".

and control. If a state believes that it can deter its immediate adversaries from nuclear use, regional nuclear powers—especially those with smaller arsenals—may still feel threatened by the potential for a debilitating conventional first strike.[60] This perspective also precludes the potential for domestic-level factors to meaningfully shape nuclear decision-making processes and ascribes nearly all explanatory power to structural factors. Despite optimists' claims that existential deterrence will guarantee stability, states may still have incentives to adopt command and control systems that increase the likelihood for accidental or unauthorized nuclear use.

Nuclear pessimism also suffers from one significant theoretical shortcoming. Specifically, pessimists fail to explain why some states are more likely to adopt command and control systems that are vulnerable to failure. Although nuclear pessimism provides a compelling critique of nuclear optimism and offers reasons for concern regarding future proliferators, this school of thought fails to offer guidance on which states will be most susceptible to command and control failures. Regional nuclear powers have adopted a wide range of command and control frameworks, with some states placing significant emphasis on safe and secure nuclear management procedures. Without a more detailed theoretical basis, nuclear pessimists cannot anticipate the conditions under which states are most likely to adopt command and control frameworks that facilitate accidental or unwanted nuclear use.

In addition to these broader theoretical issues, both sides of the optimist/pessimist debate suffer from a lack of empirical engagement. Although the optimist/pessimist debate provides a useful framework for analyzing the dangers of nuclear proliferation, both camps are often highly stylized and rarely subject their hypotheses to rigorous empirical testing. Instead, advocates for

[60] This is particularly true for states with adversarial relations to great powers. For example, North Korea may view its small arsenal or its supporting command and control systems as vulnerable to a preemptive conventional strike by the United States. Feaver, "Neooptimists and the Enduring Problem of Nuclear Proliferation," p. 107.

each perspective primarily engage in highly deductive theorizing with small samples of evidence that comport with the proposed argument. Optimists support their argument by noting the absence of nuclear conflict between states, while pessimists detail the history of near-misses for nuclear accidents to demonstrate that inadvertent nuclear use can occur.[61] However, neither argument systematically substantiates its claims with evidence from recent proliferators. In the absence of reference to regional nuclear powers, these theories fail to provide generalizable conclusions and cannot offer guidance to policymakers on how to engage emerging nuclear powers. To gauge the potential dangers of future proliferation, more systematic, empirically-driven research must be done in the context of regional nuclear powers to determine the conditions under which nuclear mismanagement is most likely.

My dissertation advances the optimist/pessimist debate in two ways. First, I contribute an empirical dimension to the debate in order to evaluate the predictive capacity of each argument. Importantly, I employ evidence from regional nuclear powers, including India, Pakistan, and apartheid-era South Africa. In addition to the general value of conducting empirical evaluation of the arguments, these cases are particularly useful, as they represent the proliferators whose behavior the optimist/pessimist debate sought to predict. Second, by establishing a theoretical framework to explain variation in command and control arrangements, I offer a systematic approach for evaluating the likelihood of nuclear mismanagement in regional nuclear powers. I focus on a series of institutional dimensions that allow policymakers to anticipate which countries are vulnerable to accidental or unauthorized nuclear use. Although my argument lends some support for the nuclear optimism perspective by showing that the majority of nuclear states

[61] These differing approaches are visible in Sagan and Waltz, *The Spread of Nuclear Weapons*. The same division is apparent in a debate on nuclear stability in South Asia. See Šumit Ganguly and S. Paul Kapur, *India, Pakistan, and the Bomb: Debating Nuclear Stability in South Asia* (New York, N.Y.: Columbia University Press, 2010).

pursue command and control frameworks that seek to reduce the likelihood of accidental or unauthorized use, I also provide support for the nuclear pessimism school by showing that severe conventional security threats cause states to adopt nuclear management practices that prioritize arsenal reliability over the safety and security of nuclear weapons.

**Plan of the Dissertation**

The preceding review of the literature on nuclear strategy and operations suggests that a revised approach is needed for evaluating command and control in emerging nuclear powers. In this dissertation, I offer an empirically falsifiable framework for measuring and explaining command and control in regional nuclear powers. The remaining chapters of the project proceed as follows. Chapter 2 presents the conceptual and theoretical frameworks of my argument. In this chapter, I describe my operationalization of the concept of command and control, develop the logic underpinning my theoretical framework, and outline a series of alternative explanations. Chapters 3 through 5 provide case-based analysis of India, Pakistan, and South Africa. For each case, I descriptively characterize command and control arrangements, evaluate the empirical validity of my theory, and consider the explanatory leverage of the alternative explanations. Chapter 6 concludes the dissertation by summarizing the project's findings and contributions, briefly evaluating the generalizability of my theory, and identifying avenues for future research.

# CHAPTER 2

## COMMAND AND CONTROL IN REGIONAL NUCLEAR POWERS

In this chapter, I develop a theory of command and control in emerging nuclear powers. I argue that three factors determine command and control frameworks in nuclear states: first, the presence of a conventionally superior adversary; second, the severity of domestic threats to the political regime; and third, the degree of military organizational autonomy. These variables, however, produce divergent pressures on command and control systems that require states to make tradeoffs between the imperatives of arsenal reliability, safety, and security. My theory specifies the interactions and sequencing of these variables to produce falsifiable predictions for command and control outcomes and identifies the conditions under which states optimize their arsenals in favor of reliability versus safety and security.

This chapter proceeds in four sections. First, I operationalize the concept of command and control. In this section, I highlight the dilemmas and tradeoffs inherent to nuclear management operations and provide a new conceptual framework for classifying command and control arrangements. Second, I develop the theoretical framework of my argument. This section establishes the three variables included in my theory, describes the theoretical underpinnings of each variable, and provides a decision-theoretic framework that models how these factors interact to explain command and control outcomes. Third, I establish the logic and observable implications of three alternative explanations to my argument. Finally, I describe the empirical strategy employed in this study.

## Conceptual Framework: Nuclear Command and Control

Command and control systems are the operational means by which a state plans the management, deployment, and potential release of nuclear weapons.[1] As such, these systems are responsible for ensuring a state's nuclear arsenal is effectively prepared for launch if needed, while also safeguarding against potential mismanagement that could result in unwanted nuclear use. Although command and control issues are central to understanding the dangers of proliferation, detailed analysis on the origins and effects of these systems remains scarce outside the context of the Cold War superpower competition.[2]

In this section, I address two dimensions of the academic literature on nuclear command and control systems. First, I discuss how the competing imperatives of arsenal security, safety, and reliability produce opposing pressures on command and control decisions. Second, I explain how different patterns of command and control address these tradeoffs and present a framework for classifying command and control systems.

### *The Always/Never Dilemma*

The most fundamental tension in command and control systems is the always/never dilemma.[3] This dilemma lies at the core of command and control decisions and is characterized

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[1] Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, N.J.: Princeton University Press, 2014), p. 4.
[2] Significant studies include: Bruce G. Blair, *Strategic Command and Control: Redefining the Nuclear Threat* (Washington, D.C.: Brookings, 1985); Paul Bracken, *The Command and Control of Nuclear Forces* (New Haven, C.T.: Yale University Press, 1983); Ashton B. Carter, John D. Steinbruner, and Charles A. Zraket, eds., *Managing Nuclear Operations* (Washington, D.C.: Brookings, 1987); Peter Douglas Feaver, *Guarding the Guardians: Civilian Control of Nuclear Weapons in the United States* (Ithaca, N.Y.: Cornell University Press, 1992).
[3] Peter D. Feaver, "Command and Control in Emerging Nuclear Nations," *International Security*, Vol. 17, No. 3 (Winter 1992/93), p. 163; Jordan Seng, "Less is More: Command and Control Advantages of Minor Nuclear States," *Security Studies*, Vol. 6, No. 4 (Summer 1997), p. 55.

by a pair of contending considerations that confront states when establishing nuclear management frameworks: decision-makers simultaneously seek to guarantee that nuclear weapons *always* launch when political leadership orders nuclear use, while also ensuring that nuclear weapons are *never* used without proper authorization.

Three competing imperatives underlie the tensions posed by the always/never dilemma. First, nuclear weapons must be reliable—whenever political leaders authorize the use of nuclear forces, they must be successfully deployed. Second, a nuclear arsenal must be safe—weapons should not detonate accidentally due to poor handling or flawed design. Third, nuclear weapons must be secure—nuclear forces should not be launched without authorization from the proper authorities.[4] Importantly, however, each of these imperatives is subject to challenges that exacerbate the always/never dilemma.

The primary threat to arsenal reliability is the risk of decapitation.[5] Nuclear decapitation refers to the ability of an adversary to launch a first strike that disables a state's ability to respond with nuclear force, whether by destroying warheads and delivery platforms or by disrupting command and control systems so that coordinating retaliatory strikes becomes impossible.[6] To protect against decapitation and bolster arsenal reliability, states must ensure that the physical arsenal and communication links to decision-makers survive an initial attack long enough to enable nuclear retaliation.[7] Fears of decapitation are particularly pronounced in regional nuclear powers, which typically have moderately sized arsenals and low levels of redundancy built into

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[4] These three requirements are developed at length in Feaver, "Command and Control in Emerging Nuclear Nations," p. 163; Peter Stein and Peter Feaver, *Assuring Control of Nuclear Weapons: The Evolution of Permissive Action Links*, CSIA Occasional Paper No. 2 (Cambridge, M.A.: CSIA Publications, 1987), p. 8.
[5] John D. Steinbruner, "Nuclear Decapitation," *Foreign Policy*, No. 45 (Winter 1981/82), pp. 16-28.
[6] On the distinction between arsenal and command vulnerability, see John D. Steinbruner, "National Security and the Concept of Strategic Stability," *Journal of Conflict Resolution*, Vol. 22, No. 3 (Spring 1978), pp. 411-428.
[7] Feaver, *Guarding the Guardians*, p. 13.

command and control arrangements. For example, recent analyses on the nature of a potential U.S.-China conflict underscore this concern and emphasize how U.S. military operations may degrade China's nuclear retaliatory capacity, thus incentivizing escalation by China to ensure arsenal reliability and prevent nuclear decapitation.[8]

Nuclear safety is challenged by the prospect of accidental use, which entails the unintentional launch of nuclear weapons due to mishandling, poor design, or some other unintended cause.[9] Previous work on nuclear management provides numerous examples of near-accidents, and recent experiences highlight the persistence of these concerns.[10] For example, in 2007 the United States Air Force accidentally loaded six nuclear weapons onto a B-52 bomber aircraft at Minot Air Force Base in North Dakota, transported the weapons to Barksdale Air Force Base in Louisiana, and allowed the warheads to remain unprotected on the runway for approximately ten hours before Air Force personnel noticed that the bombers were carrying nuclear weapons.[11] This episode demonstrates that even in a country with robust command and control institutions and decades of experience conducting nuclear operations, nuclear accidents remain an important threat to safe command and control practices.

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[8] On the potential for U.S. operations in the Western Pacific to produce militarized escalation with China, see: Charles L. Glaser and Steve Fetter, "Should the United States Reject MAD? Damage Limitation and U.S. Nuclear Strategy toward China," *International Security*, Vol. 41, No. 1 (Summer 2016), pp. 49-98; Joshua Rovner, "AirSea Battle and Escalation Risks," policy brief 12 (San Diego, C.A.: University of California Institute on Global Conflict and Cooperation, January 2012), pp. 1-5; and Caitlin Talmadge, "Would China Go Nuclear? Assessing the Risk of Chinese Nuclear Escalation in a Conventional War with the United States," *International Security*, Vol. 41, No. 4 (Spring 2017), pp. 50-92.

[9] For a full discussion of accidental use, see Feaver, *Guarding the Guardians*, pp. 13-15.

[10] For examples of near-misses and broader discussions on accidental nuclear use, see: Bruce G. Blair, *The Logic of Accidental Nuclear War* (Washington, D.C.: Brookings Institution Press, 1993); Scott D. Sagan, *The Limits of Safety: Organizations, Accidents, and Nuclear Weapons* (Princeton, N.J.: Princeton University Press, 1993); Eric Schlosser, *Command and Control: Nuclear Weapons, the Damascus Accident, and the Illusion of Safety* (New York, N.Y.: Penguin, 2014).

[11] Josh White, "In Error, B-52 Flew Over U.S. With Nuclear-Armed Missiles," *Washington Post*, September 6, 2007.

Nuclear security faces the problem of unauthorized use, which refers to when the custodians of nuclear weapons—typically military forces—use nuclear weapons without proper authorization from political leadership.[12] Unauthorized use can occur through one of two pathways. First, an individual or group could purposefully subvert the chain of command to use nuclear weapons without official approval from senior leadership. This pathway envisions a scenario where a lower-level political or military commander "goes rogue" and contravenes national policy by unilaterally electing to use the nuclear weapons under his or her control without proper authorization. Second, during a moment of crisis, a field commander may perceive defeat as imminent and elect to use nuclear weapons to prevent being overrun or losing control of nuclear weapons to the adversary. During such crises, military operators may face a "use them or lose them" scenario, where lower-level commanders elect to use nuclear weapons without consulting higher levels of authority. Rather than an intentional subversion of national policy, this pathway envisions a scenario in which lower-level military commanders with legally obtained launch authority respond to military threats with nuclear force without communicating with higher-level leadership. This concern is prevalent in states such as Pakistan, which has developed theater nuclear forces and likely predelegates decision-making autonomy to peripheral commanders.[13]

Proliferating states aspire to develop measures that fully promote reliability, safety, and security when fashioning command and control systems. However, the measures available for addressing these considerations reveal the core tension of the always/never dilemma: any effort

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[12] Feaver, *Guarding the Guardians*, pp. 15-18.

[13] On Pakistan's theater nuclear weapons, see Jaganath Sankaran, "Pakistan's Battlefield Nuclear Policy: A Risky Solution to an Exaggerated Threat," *International Security*, Vol. 39, No. 3 (Winter 2014/15), pp. 118-151. For an alternative perspective, see Mansoor Ahmed, "Pakistan's Tactical Nuclear Weapons and Their Impact on Stability," (Washington, D.C.: Carnegie Endowment for International Peace, June 30, 2016).

to ensure the reliability of a nuclear arsenal directly challenges the safeguards against unwanted nuclear use, and any attempt to increase the safety and security of an arsenal make nuclear forces more vulnerable to decapitation. For instance, if decision-makers predelegate launch authority to lower-level commanders to reduce the time required to respond to an attack and improve arsenal survivability, then fewer layers of authorization are required to use nuclear weapons and the potential for unwanted nuclear use increases. Alternatively, leaders can implement administrative steps guaranteeing oversight and require safety measures to be built into nuclear weapons as protection against unwanted nuclear use. These measures, however, increase the time required to respond to an attack and the arsenal becomes more vulnerable to decapitation. As these examples demonstrate, the always/never dilemma continuously forces states to make significant tradeoffs when operationalizing their nuclear arsenals.

### *Typology of Nuclear Command and Control*

Command and control systems represent a state's institutional approach to promoting the reliability, safety, and security of its nuclear arsenal. As such, these institutions serve as a direct resolution of the always/never dilemma.[14]

Scholars traditionally measure command and control frameworks along a spectrum of assertive and delegative control.[15] Assertive control describes systems where political leadership

[14] As Peter Feaver notes, a state's chosen patterns of command and control serve as a *de facto* resolution of the always/never dilemma, and the dilemma still obtains for states, regardless of whether decision-makers explicitly acknowledge or understand the challenges presented by the always/never dilemma. Feaver, "Command and Control in Emerging Nuclear Nations," p. 168.

[15] For an elaborated discussion on assertive and delegative control, see Feaver, *Guarding the Guardians*, pp. 7-12. Another approach uses positive/negative control in lieu of delegative/assertive control, respectively. I employ the more commonly used terminology of assertive and delegative control. In addition to the general acceptance of the assertive/delegative framework, the terminology of positive/negative control is often used inconsistently. John Steinbruner, "Choices and Tradeoffs," in Carter, Steinbruner, and Zraket, eds., *Managing Nuclear Operations*, p.

maintains a high degree of administrative control over nuclear decision-making processes and extensive physical control of the arsenal. Through these measures, assertive patterns of command and control increase safeguards against unwanted nuclear use. By doing so, however, a state's arsenal becomes more vulnerable to preemption due to the slower mobilization and response times produced by the multiple layers of authentication required to prepare and deploy nuclear forces. These authentication requirements also create nodes at which launch orders may fail to transmit or receive validation. As a result, assertive patterns of command and control are predisposed to "fail safe" or "fail impotent"—if command breaks down during a crisis, operators are likely to default to the non-use of nuclear weapons.[16] These measures strongly favor the "never" side of the always/never dilemma and prioritize safety and security at the expense of reliability.

Delegative control, in contrast, grants peripheral military actors with a high degree of decision-making autonomy and physical custody of weapons. These patterns of command and control provide military operators with the administrative autonomy and physical custody of nuclear weapons necessary to guarantee rapid response to potential threats. Although delegative control increases arsenal readiness, it also reduces the steps required to conduct a nuclear launch and facilitates the accidental or unauthorized use of nuclear weapons. Delegative control is subject to "fail deadly" during crises—if communications between political leaders and peripheral military commanders are severed as hostilities escalate, operators are likely to default

539. For examples of studies that frame command and control debates in terms of positive/negative control with inconsistent meanings, see: Feroz Hassan Khan, "Nuclear Command-and-Control in South Asia during Peace, Crisis, and War," *Contemporary South Asia*, Vol. 14, No. 2 (June 2005), pp. 163-174; and Seng, "Less is More."

[16] Although "fail safe" and "fail impotent" both result in the non-use of nuclear weapons, the concepts describe separate processes. An arsenal that fails safe is intentionally designed to guarantee that nuclear weapons are not used if command breaks down. An arsenal that fails impotent may intend to launch nuclear weapons under certain crisis conditions, but the disruption of command prevents a launch from occurring.

to the use of nuclear weapons. Delegative control favors the "always" side of the always/never dilemma and promotes arsenal reliability but offers fewer protections for arsenal safety and security.

The assertive/delegative framework remains the most widely accepted approach for conceptualizing command and control arrangements.[17] This framework, however, overlooks an important distinction between command and control outcomes in nuclear states. Specifically, the assertive/delegative framework views command and control outputs as fixed in time: states either assert political control over nuclear forces or delegate authority to peripheral commanders. In practice, however, because military operators are ultimately required to deliver nuclear weapons, all states must delegate control at some point to conduct a nuclear strike. I argue that the appropriate question when classifying command and control systems is therefore not *whether* states delegate nuclear use capability to lower levels of command, but rather *when* such delegation occurs.

Reframing the concept of command and control to account for the timing of delegation with respect to the onset of a crisis allows analysts to better identify the potential avenues through which nuclear accidents and escalation may occur.[18] As I demonstrate in the discussion below below, the challenges to arsenal reliability, safety, and security differ significantly depending on how states conduct nuclear operations during the transition from peacetime to crisis management. Command and control systems function best during peacetime, but these

[17] For a recent example employing the assertive/delegative framework, see Jeffrey G. Lewis and Bruno Tertrais, "The Finger on the Button: The Authority to Use Nuclear Weapons in Nuclear-Armed States," Occasional Paper No. 45 (Monterey, C.A.: James Martin Center for Nonproliferation Studies, February 2019).
[18] In his original framing of assertive and delegative control, Peter Feaver notes that an accurate assessment of command and control "requires an estimate of how the nuclear organization itself might *in fact* behave, particularly during a crisis." Feaver, "Command and Control in Emerging Nuclear Nations," p. 160. Emphasis in original.

systems face severe pressures that challenge nuclear stability and political oversight of nuclear operations as crises emerge.[19]

Political leaders possess three options for when to delegate the ability to use nuclear weapons: first, during peacetime; second, early in a crisis; or third, late in a crisis. Rather than creating an entirely new conceptual framework for command and control systems, I modify the existing assertive/delegative framework to identify three ideal patterns of command and control that correspond to these temporal categories, respectively: delegative, conditional, and assertive. Building upon the traditional assertive/delegative framework allows me to maintain conceptual resonance within the broader literature, while also emphasizing the temporal aspects of nuclear management operations to make each pattern of command and control more analytically distinct.[20] I also maintain the traditional assertive/delegative framework's emphasis on the delegation of nuclear use ability, rather than authority, as the *de facto* ability to use nuclear weapons more directly represents the challenges posed by the always/never dilemma.[21]

Whereas earlier research built upon the assertive/delegative framework includes measures of *de facto* obedience of the military to civilians as indicators of command and control arrangements, my framework separates the two concepts to isolate the potential effects of civil-military relations on command and control outcomes.[22] Earlier frameworks force an assumption

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[19] On the challenges to command and control produced by crises, see: Blair, *The Logic of Accidental Nuclear War*; Christopher Clary, *Thinking about Pakistan's Nuclear Security in Peacetime, Crisis and War* (New Delhi: Institute for Defense Studies and Analyses, 2010); Kurt Gottfried and Bruce G. Blair, eds., *Crisis Stability and Nuclear War* (New York, N.Y.: Oxford University Press, 1988); and Richard Ned Lebow, *Nuclear Crisis Management: A Dangerous Illusion* (Ithaca, N.Y.: Cornell University Press, 1988).

[20] On the importance of conceptual resonance, see John Gerring, *Social Science Methodology: A Unified Framework*, 2d ed. (Cambridge: Cambridge University Press, 2012), pp. 117-119.

[21] Peter Feaver writes that delegative control entails "a bequeathal of de facto power to an otherwise subordinate element." Feaver, *Guarding the Guardians*, p. 7.

[22] For an example that includes civil-military dynamics as a component of command and control systems, see Feaver, "Command and Control in Emerging Nuclear Nations," p. 171.

**Table 2.1. Patterns of Nuclear Command and Control**

| | Assertive | Conditional | Delegative |
|---|---|---|---|
| Administrative controls | Centralized use capability | Peacetime centralization, crisis decentralization | Decentralized use capability |
| Physical controls | Components dispersed and de-mated | Components highly proximate | Components assembled and mated |
| Technical controls | Extensive PALs or PAL-equivalents | Bypassable | Absent or minimal |
| Timing of delegation | Late-crisis delegation | Early-crisis delegation | Peacetime delegation |
| Primary threats to control | Decapitation | Unintended escalation | Accidental or unauthorized use |

of clear civilian supremacy onto regional nuclear powers and complicate the task of isolating the effect of civil-military relations on the development of command and control systems. By removing this assumption, I distinguish the center-periphery tensions underlying command and control decisions from the measurement of civilian control of the military.

I focus on three institutional dimensions to operationalize the concept of command and control: administrative, physical, and technical. These three institutional dimensions provide observable indicators of nuclear management operations that aggregate together to characterize nuclear command and control arrangements. Table 2.1 summarizes the differences between assertive, conditional, and delegative command and control systems along these institutional dimensions.

Administrative control refers to the doctrinal centralization or delegation of authority for conducting nuclear operations. Command and control systems are characterized by one of two general patterns of administrative control: centralized or decentralized. Centralized control

establishes a series of standard operating procedures (SOPs) that dictate actors' behavior during a crisis, and aims to guarantee that nuclear weapons serve the overarching political interests during crises by specifying detailed plans for a wide array of contingencies.[23] Decentralized control, in contrast, predelegates launch authority to subordinate actors and grants peripheral operators greater authority to mobilize and deploy nuclear weapons without requiring higher political approval.

Physical control encompasses two aspects of nuclear force management. First, physical control describes the degree to which nuclear systems are conjoined or separated. Nuclear warheads can be separated from detonating devices and fully-assembled weapons can be de-mated from delivery platforms, rendering nuclear forces inoperative until the various components are combined and assembled.[24] Second, physical control entails the degree to which nuclear components are geographically dispersed. Disassembled nuclear components may be stored in close proximity to facilitate rapid response or spread across geographic space to inhibit unauthorized mobilization and theft.[25]

Technical controls include technological or mechanical locks that prevent nuclear weapons from being armed, accessed, or launched without authorization. Permissive action links

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[23] On the potential for nuclear operations to assume a logic of their own separate from political oversight, see Paul Bracken, "Delegation of Nuclear Command Authority," in Carter, Steinbruner, and Zraket, eds., *Managing Nuclear Operations*, pp. 352-372.

[24] Nuclear warheads contain the explosive nuclear material, such as uranium or plutonium. Detonation devices initiate the fusion or fission process that causes the nuclear material to reach critical mass. Delivery platforms are the land-, air-, or sea-based systems used to launch nuclear weapons.

[25] Physical separation reduces the likelihood of actors stealing or transferring a fully operational nuclear weapon, which creates barriers to nonconventional threats such as nuclear terrorism. For an analysis of the prospects for nuclear terrorism through theft or other means, see Matthew Bunn, Martin B. Malin, Nickolas Roth, William H. Tobey, *Preventing Nuclear Terrorism: Continuous Improvement or Dangerous Decline?* (Cambridge, M.A.: Project on Managing the Atom, Belfer Center for Science and International Affairs, Harvard Kennedy School, March 2016).

(PALs) offer an example of a common technological measure used to control nuclear assets.[26] Modern PALs are electronic locks built into nuclear weapons that prevent the firing sequence from occurring unless disabled by entering the appropriate electronic code. Nuclear weapons equipped with PALs will not function until the proper code is entered and the lock is removed, and some PALs are designed to destroy critical components of the nuclear weapon if an actor tampers with the lock or repeatedly enters the wrong code. States without modern PAL technology can accomplish similar control over nuclear assets through mechanical locks, which physically block the arming process until the locks are removed.[27] For smaller devices such as nuclear artillery shells, locks may also be used to secure the entire weapon within a storage container.[28] In addition to controlling physical components of an arsenal, states can use technological controls to prevent a weapon from being fired. For instance, permissive enable systems (PESs) operate in the same manner as PALs, but whereas PALs prevent the warhead from detonating, PESs prevent operators from launching nuclear weapons until they enter a separate authorization code.[29] Unless PESs are disabled, even fully operational nuclear weapons cannot be launched.

These indicators of administrative, physical, and technical control allow for the differentiation of assertive, conditional, and delegative command and control systems. Assertive control describes systems where political authorities delegate control late in a crisis. Administratively, political leaders exercise highly centralized oversight and management of

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[26] On the history and utility of PALs, see: Donald R. Cotter, "Peacetime Operations: Safety and Security," in Carter, Steinbruner, and Zraket, eds., *Managing Nuclear Operations*, pp. 46-51; Stein and Feaver, *Assuring Control of Nuclear Weapons*. For further information on PALs and additional technical controls, see Robert S. Norris and William M. Arkin, "U.S. Nuclear Weapons Safety and Control Features," *Bulletin of the Atomic Scientists*, Vol. 47, No. 8 (October 1991), p. 48.
[27] Cotter, "Peacetime Operations," pp. 49-50; Feaver, *Guarding the Guardians*, pp. 17-18.
[28] Cotter, "Peacetime Operations," pp. 47-49.
[29] Feaver, *Guarding the Guardians*, pp. 209-210.

nuclear operations. Physically, nuclear warheads are typically de-mated from delivery platforms and geographically dispersed. Technical controls such as PALs further guarantee centralized political oversight by preventing nuclear weapons from being accessed, armed, or launched without political authorization.[30] Importantly, technical controls separate the administrative control of nuclear forces from the physical possession of nuclear weapons, allowing leaders to promote safety and security deep into crises when peripheral operators may otherwise obtain greater influence over nuclear operations.[31]

These measures make assertive command and control systems highly resilient against accidental and unauthorized nuclear use. By withholding launch authority late into crises, however, assertive control arrangements are susceptible to decapitation and may fail safe. If command breaks down during a crisis, operators are likely to default to the non-use of nuclear weapons. In contrast to delegative and conditional control, arsenal reliability is generally low in assertive command and control frameworks.

Conditional control refers to states that delegate the ability to use nuclear weapons early in a crisis. During peacetime, conditional control centralizes administrative authority, physically de-mates and disperses nuclear weapons and delivery platforms across some distance, and employs at least modest technical controls on nuclear weapons. In the early stages of a crisis, however, states with conditional control procedures rapidly assemble deliverable nuclear weapons and delegate the ability for nuclear use to lower-level nuclear commanders. Through these measures, conditional control attempts to promote arsenal safety and security during

[30] Ibid., pp. 17-18.
[31] Cotter, "Peacetime Operations," p. 46.

peacetime while also developing procedures that rapidly increase arsenal readiness to guarantee arsenal reliability.

Conditional control systems face three challenges that are distinct from the problems confronting delegative and assertive control systems. First, the process of delegating authority and increasing arsenal readiness early in a crisis may signal malign intent to an adversary.[32] Actions such as mating warheads to delivery platforms and placing these weapons under military command may serve defensive purposes, but an adversary would likely view these efforts as offensive in nature. Second, as political leaders reduce physical and technical barriers to use and delegate authority to lower levels, the military obtains significant influence in nuclear operations. This rapid inclusion of military influence severely weakens political oversight and increases the likelihood that national policy and military operations would diverge.[33] Third, the problems of signaling malign intent and weakened political control both occur in a crisis setting, where actors face pervasive uncertainty and the likelihood of misperception increases dramatically. Although conditional control systems seek to balance arsenal safety, security, and reliability by maintaining centralized control during peacetime, the process of delegating control early in a crisis generates external and internal pathways to unwanted crisis escalation.

Delegative control describes command and control arrangements where political leaders delegate nuclear launch capability to peripheral commanders during peacetime. Administratively, the delegation of nuclear use capability demonstrates a decentralized command and control structure. At all times, military operators possess physical control of nuclear

[32] Bruce G. Blair, "Alerting in Crisis and Conventional War," in Carter, Steinbruner, and Zraket, eds., *Managing Nuclear Operations*, pp. 75-78.
[33] On the need to include military organizations during alerting procedures and the concomitant challenges of doing so during alerting procedures during a crisis, see ibid., pp. 113-119.

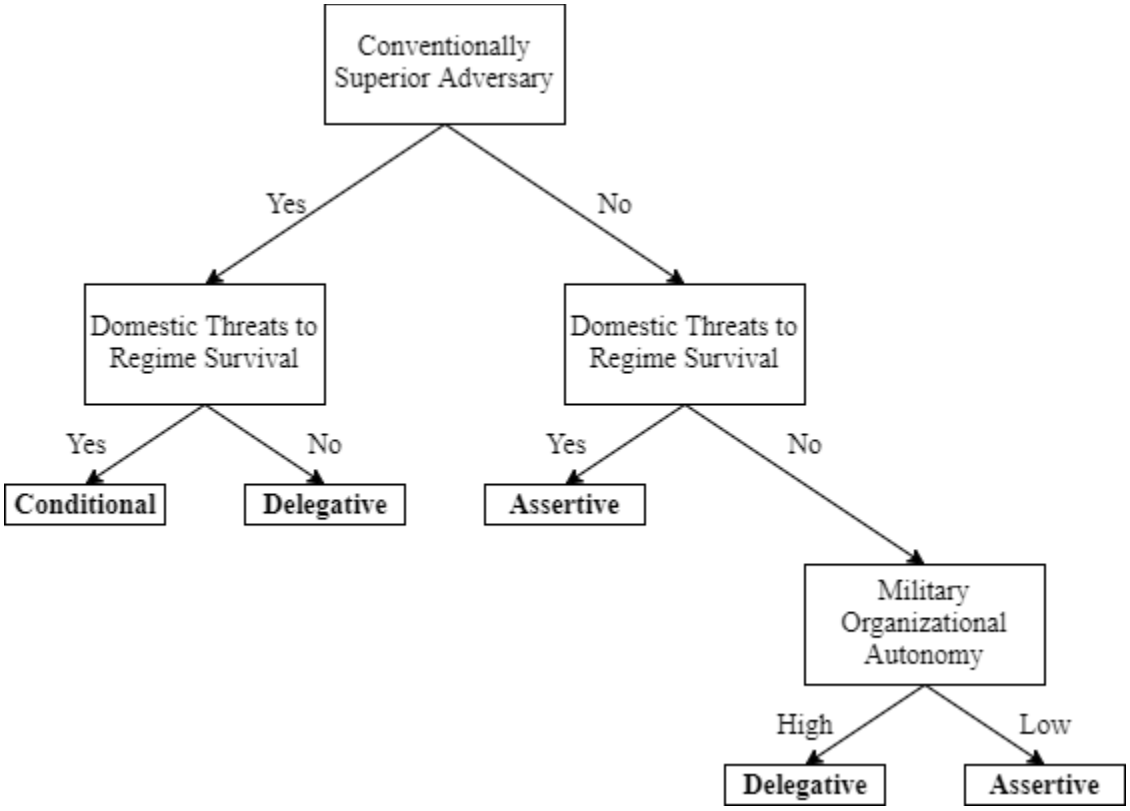
warheads and delivery platforms. These components are unconstrained by technical controls such as permissive action links (PALs) to guarantee that the custodians of nuclear assets can use nuclear weapons under any circumstances without requiring direct approval from senior leadership.

Combined, these administrative, physical, and technical dimensions of delegative control strongly improve arsenal reliability. The core challenge for delegative command and control arrangements is the risk of unwanted use, as states employing delegative control rely almost exclusively upon the professionalism of peripheral military actors to avoid accidental and unauthorized use. As a result, states employing delegative command and control systems face persistent challenges to the safety and security of nuclear weapons.

## Command and Control in Emerging Nuclear Powers

I develop a theoretical framework that incorporates three variables to explain a state's command and control arrangements: first, the presence of a conventionally superior adversary; second, the severity of domestic threats to the political regime; and third, the degree of military organizational autonomy. This framework generates falsifiable predictions for command and control systems in emerging nuclear powers and specifies the conditions under which each factor shapes command and control arrangements. In this section, I present a decision-theoretic framework that shows how these three variables interact to produce command and control outcomes and develop the logic and observable implications of each variable in the theory. Figure 2.1 provides a graphical representation of the theoretical framework.

**Figure 2.1. Theory of Nuclear Command and Control**




*Conventionally Superior Adversary*

The first node of my theory asks: does the state face a conventionally superior adversary? The presence of a conventionally superior adversary represents an immediate and existential threat to state security that severely constrains a state's options when establishing command and control frameworks. As Vipin Narang notes, this condition represents "one of the most binding—if not *the* most binding—security environment[s] a state can face."[34]

The concept of a conventionally superior adversary entails two necessary components. First, the adversary must possess decisive superiority—whether quantitative or qualitative—in

[34] Narang, *Nuclear Strategy in the Modern Era*, p. 35. Emphasis in original.

conventional military capabilities.[35] Second, the adversary must be geographically proximate, with limited distances required to conduct offensive operations and favorable terrain that facilitates offensive action.[36] States with approximate conventional parity or defensively advantageous terrain such as mountainous borders or wide water boundaries can rely on conventional military forces to deter and defeat a numerically superior adversary. In contrast, states facing an adversary with in-theater superiority and traversable terrain that enables offensive military operations experience an existential threat that the militarily inferior state cannot offset through conventional means. Instead, these conditions force the conventionally inferior state to rely on its nuclear arsenal to deter conventional threats and limit the doctrinal options available to states when establishing command and control frameworks.[37]

My emphasis on conventional threats identifies a significant difference between regional nuclear powers and the Cold War superpowers. Whereas the U.S. and Soviet Union adopted "maximalist" nuclear postures to deter conventional and nuclear conflict, regional nuclear powers tailor their nuclear arsenal for more specific purposes.[38] Nuclear weapons provide strong

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[35] A widely cited rule of thumb that suggests offensive operations require numerical preponderance is the "3:1 rule," which argues that attackers require a threefold advantage in troop levels to conduct successful breakthrough operations. For a debate on the utility of the 3:1 rule, see: Joshua M. Epstein, "Dynamic Analysis and the Conventional Balance in Europe," *International Security*, Vol. 12, No. 4 (Spring 1988), pp. 154-165; John J. Mearsheimer, "Assessing the Conventional Balance: The 3:1 Rule and Its Critics," *International Security*, Vol. 13, No. 4 (Spring 1989), pp. 54-89. For additional insights into qualitative superiority, see Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, N.J.: Princeton University Press, 2004).

[36] On this point and a broader discussion of the requirements for deterring conventional attacks, see John J. Mearsheimer, *Conventional Deterrence* (Ithaca, N.Y.: Cornell University Press, 1983), pp. 23-66.

[37] In discussing strategic nuclear behavior, similar points are made by: Mark S. Bell, "Nuclear Opportunism: A Theory of How States Use Nuclear Weapons in International Politics," *Journal of Strategic Studies*, Vol. 42, No. 1 (January 2019), pp. 10-13; and Narang, *Nuclear Strategy in the Modern Era*, pp. 35-36.

[38] Narang, *Nuclear Strategy in the Modern Era*, p. 5. The U.S. literature on nuclear strategy in particular demonstrates the diverse range of thinking on the utility of nuclear weapons. For examples, see: Bernard Brodie, *Strategy in the Missile Age* (Princeton, N.J.: Princeton University Press, 1959); Lawrence Freedman, *The Evolution of Nuclear Strategy*, 3d ed. (New York, N.Y.: Palgrave Macmillan, 2003); Charles L. Glaser, *Analyzing Strategic Nuclear Policy* (Princeton, N.J.: Princeton University Press, 1990); Colin S. Gray, "Nuclear Strategy: The Case for a Theory of Victory," *International Security*, Vol. 4, No. 1 (Summer 1979), pp. 54-87; Robert Jervis, *The Illogic of American Nuclear Strategy* (Ithaca, N.Y.: Cornell University Press, 1984); Robert Jervis, *The Meaning of the Nuclear Revolution* (Ithaca, N.Y.: Cornell University Press, 1989); Paul Nitze, "Deterring our Deterrent," *Foreign*

deterrent credibility against nuclear use by other states, but the operational dispositions of nuclear forces unevenly shape the ability of a state to deter conventional aggression.[39] Depending on the nature of conventional threats confronting a state, therefore, my argument anticipates that political leaders will operationalize their nuclear arsenal differently.

Because a conventionally superior adversary can rapidly seize territory, destroy forces, or sever lines of communications, states facing such adversaries experience incentives to lower the nuclear threshold to deter conventional attacks. By lowering the threshold to nuclear use, a state can offset its conventionally inferiority and signal to its adversaries that no room exists underneath the nuclear umbrella for conventional conflict, as even limited conventional disputes will risk escalation to the nuclear level.

States facing a conventionally superior adversary adopt more delegative command and control systems that provide the operational means for states to manipulate the nuclear threshold and bolster arsenal reliability. The delegation of nuclear launch authority to lower-level military commanders increases the operational ability of military operators to respond to a conventional incursion with nuclear weapons and signals to an adversary that non-nuclear aggression may result in nuclear escalation. For example, France deployed tactical nuclear weapons under the command of the First Army during the Cold War to prevent the Soviet Union from winning even limited military objectives.[40] France's delegative command and control procedures purposefully

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*Policy*, No. 25 (Winter 1976/77), pp. 195-210; Scott D. Sagan, *Moving Targets: Nuclear Strategy and National Security* (Princeton, N.J.: Princeton University Press, 1989); Thomas C. Schelling, *Arms and Influence* (New Haven, C.T.: Yale University Press, 1966); and Thomas C. Schelling, *The Strategy of Conflict* (Cambridge, M.A.: Harvard University Press, 1960).

[39] Vipin Narang, "What Does It Take to Deter? Regional Power Nuclear Postures and International Conflict," *Journal of Conflict Resolution*, Vol. 57, No. 3 (June 2013), pp. 478-508.

[40] Robbin F. Laird, "French Nuclear Forces in the 1980s and 1990s," Professional Paper 400 (Alexandria, V.A.: Center for Naval Analyses, August 1983), pp. 22-23; Shaun R. Gregory, *Nuclear Command and Control in NATO: Nuclear Weapons Operations and the Strategy of Flexible Response* (New York, N.Y.: St. Martin's, 1996), p. 132. On France's Cold War nuclear strategy, see David S. Yost, *France's Deterrent Posture and Security in Europe, Part*

lowered the threshold to nuclear use to offset the Soviet Union's conventional military superiority, exemplifying the logic of threshold manipulation proposed in this theoretical framework.

The need for conventionally inferior states to manipulate the nuclear threshold demands that the presence of a conventionally superior adversary precludes states from adopting assertive command and control arrangements. A state's conventional threat environment, however, is not singularly determinative of its command and control frameworks. As the next section demonstrates, the effect of conventional threats on command and control systems is conditioned by the interaction of this variable with the severity of domestic threats to the political regime.

*Domestic Threats to Regime Survival*

The second node of the theoretical framework asks: does the state face domestic threats to regime survival? Civilian positions on military matters are simultaneously shaped by domestic and international considerations that force leaders to jointly consider internal and external challenges to their regime when developing military doctrine.[41] In addition to external threats to state security, domestic threats such as military coups, armed rebellion, and mass protests pose highly proximate threats to political regimes.[42] Because these domestic challenges also generate

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*I: Capabilities and Doctrine*, Adelphi Paper No. 194 (London: International Institute of Strategic Studies, Winter 1984/85); David S. Yost, "France's Nuclear Deterrence Strategy: Concepts and Operational Implementation," in Henry D. Sokolski, ed., *Getting MAD: Nuclear Mutual Assured Destruction, Its Origins and Practice* (Carlisle Barracks, P.A.: Strategic Studies Institute, U.S. Army War College, 2004), pp. 197-237.

[41] The argument that civilians are motivated by domestic balance of power considerations that interfere with foreign policy decision-making builds upon Elizabeth Kier, *Imagining War: French and British Military Doctrine Between the Wars* (Princeton, N.J.: Princeton University Press, 1997), pp. 14, 21-38. Steven David refers to the efforts of leaders to address both threats as "omnibalancing." Steven R. David, "Explaining Third World Alignment," *World Politics*, Vol. 43, No. 2 (January 1991), pp. 233-256.

[42] On the dual imperatives of internal and external threats to a regime's rule, see Sheena Chestnut Greitens, *Dictators and Their Secret Police: Coercive Institutions and State Violence* (Cambridge: Cambridge University

existential threats to the ruling elite, I argue that analysts must jointly consider the interaction of external and internal threats facing a state to explain command and control outcomes.

Studies that investigate the interaction between civil-military relations and national security policy often emphasize the distorting effects of military organizational interests and biases on foreign policy outputs, but typically overlook the potential for parochial civilian interests to shape national security decisions.[43] Instead, analysts commonly portray civilians as unencumbered by organizational pathologies and predisposed to generate optimal foreign policy.[44] For example, Michael Desch argues that "civilian leaders are less subject to organizational biases and have a more 'national' perspective on defense issues."[45]

In contrast, I argue that civilian elites also possess parochial interests that shape doctrinal preferences. Even in matters of national security where civilians are regarded as most likely to align military doctrine with structural cues, internal challenges to the political regime systematically produce similar command and control frameworks. Specifically, I show that concerns for regime survival makes civilians more likely to prefer defensive and deterrent

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Press, 2016), pp. 3-71. On the differences between threats to a regime and threats to a state, see Caitlin Talmadge, *The Dictator's Army: Battlefield Effectiveness in Authoritarian Regimes* (Ithaca, N.Y.: Cornell University Press, 2015), pp. 18-27.

[43] For examples, see: Barry R. Posen, *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars* (Ithaca, N.Y.: Cornell University Press, 1984); Scott D. Sagan, "The Perils of Proliferation: Organization Theory, Deterrence Theory, and the Spread of Nuclear Weapons," *International Security*, Vol. 18, No. 4 (Spring 1994), pp. 66-107; Jack Snyder, *The Ideology of the Offensive: Military Decision Making and the Disasters of 1914* (Ithaca, N.Y.: Cornell University Press, 1984)*;* Stephen Van Evera, "The Cult of the Offensive and the Origins of the First World War," *International Security*, Vol. 9, No. 1 (Summer 1984), pp. 58-107.

[44] Examples include: Bernard Brodie, *War and Politics* (New York, N.Y.: Macmillan, 1973), pp. 433-496; Stephen M. Walt, "The Search for a Science of Strategy: A Review Essay on *Makers of Modern Strategy*," *International Security*, Vol. 12, No. 1 (Summer 1987), pp. 140-165.

[45] Michael C. Desch, *Civilian Control of the Military: The Changing Security Environment* (Baltimore, M.D.: Johns Hopkins University Press, 1999), p. 6. Barry Posen also supports this perspective, suggesting that "civilians alone have the interest and the authority to reconcile political ends with military means and set priorities among military services according to some rational calculus." Posen, *The Sources of Military Doctrine*, p. 58.

doctrines that facilitate political influence over military affairs whenever the political regime faces significant internal threats.

Whereas external security threats impel leaders to adopt more delegative command and control systems, domestic threats to the political regime encourage more assertive command and control measures. Domestic threats incentivize assertive control for two reasons. First, centralizing authority over nuclear operations allows leaders to institutionally exclude and withhold resources and autonomy from domestic rivals. By excluding domestic rivals, nuclear authorities can better guarantee continued access to material resources and institutional privileges that allow actors to influence nuclear doctrine and foreign policy. For example, in countries where leaders fear deposal by a military coup, nuclear weapons allow states to keep military organizations weak and disorganized while relying on assertively managed nuclear forces to deter external aggression.[46]

Second, nuclear weapons can be used to consolidate domestic support.[47] In many countries, nuclear weapons have been viewed as a "symbol of governing authority" around which leaders have sought to coalesce domestic support.[48] For example, the control of nuclear devices embodied political power in France during the country's early stages of proliferation,[49] and Mao Zedong feared that allowing domestic competitors to take control of China's nuclear

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[46] Cameron S. Brown, Christopher J. Fariss, and R. Blake McMahon, "Recouping after Coup-Proofing: Compromised Military Effectiveness and Strategic Substitution," *International Interactions*, Vol. 42, No. 1 (January 2016), pp. 1-30. On the deleterious effects of coup-proofing on military effectiveness, see Talmadge, *The Dictator's Army*.

[47] On the use of nuclear weapons for domestic political gain, see Etel Solingen, *Nuclear Logics: Contrasting Paths in East Asia and the Middle East* (Princeton, N.J.: Princeton University Press, 2007), pp. 17-20.

[48] Peter D. Feaver, "Nuclear Command and Control in Crisis: Old Lessons from New History," in Henry D. Sokolski and Bruno Tertrais, eds., *Nuclear Weapons Security Crises: What Does History Teach?* (Carlisle, P.A.: Strategic Studies Institute and U.S. Army War College Press, 2013), p. 221.

[49] Bruno Tertrais, "A 'Nuclear Coup'? France, the Algerian War, and the April 1961 Test," in Sokolski and Tertrais, eds., *Nuclear Weapons Security Crises*, pp. 41-42, 48-50.

weapons would undermine his domestic political authority.[50] More recently, the Kim dynasty has used its nuclear program to build support among the military actors underpinning the continued survival of the Kim regime in North Korea.[51] For leaders facing domestic instability, control of nuclear weapons can clearly signal control of the government to potential rivals and challengers.[52]

Political leaders optimize their command and control frameworks in response to the full range of domestic and international threats. By jointly evaluating external and internal threats, my theoretical framework makes specific predictions and addresses the causal indeterminacy that plagues existing frameworks when multiple variables predict divergent outcomes.[53] Furthermore, by reframing the concept of command and control to account for the timing at which the delegation of nuclear use ability occurs, I offer a unique framework for describing the optimization strategies employed by states with nuclear weapons.

My theory makes three specific predictions for the interactive effects of the presence of a conventionally superior adversary and domestic threats to regime survival on command and control frameworks. First, states facing a conventionally superior adversary without a domestic threat to the political regime adopt delegative command and control systems. These states can focus nuclear planning solely on the external adversary and adopt delegative control patterns to lower the threshold to nuclear use and deter conventional aggression.

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[50] Mark A. Stokes, "Securing Nuclear Arsenals: A Chinese Case Study," in Sokolski and Tertrais, eds., *Nuclear Weapons Security Crises,* p. 74.
[51] Daniel Byman and Jennifer Lind, "Pyongyang's Survival Strategy: Tools of Authoritarian Control in North Korea," *International Security,* Vol. 35, No. 1 (Summer 2010), p. 63.
[52] Feaver, "Nuclear Command and Control in Crisis," pp. 210, 212 214, 217.
[53] Vipin Narang notes that existing theories of command and control are often indeterminate. Narang, *Nuclear Strategy in the Modern Era,* p. 26.

Second, states facing both a conventionally superior adversary and domestic threats to the political regime adopt conditional command and control frameworks. These states emphasize centralized control during peacetime to guarantee nuclear forces serve the regime's narrow political interests and to promote arsenal safety and security, but delegate launch ability early in a crisis to lower the nuclear threshold and deter conventional attacks.

Third, states that do not face a conventionally superior adversary but experience domestic threats to the political regime develop assertive command and control frameworks. For these states, external threats do not meaningfully shape the threat environment for political leaders. Instead, political elites become primarily concerned with internal threats and adopt assertive control measures to centralize their authority over nuclear decisions.

*Military Organizational Autonomy*

If a state's external security environment is benign and the political regime is domestically stable, the final node of my theoretical framework asks: how autonomous are the state's military organizations? In the absence of external threats to state security and domestic threats to regime survival, I argue that the level of military organizational autonomy serves as the dominant explanatory factor for command and control outcomes.

Military organizations hold a distinct set of interests that shape the military's strategic and doctrinal preferences.[54] These interests, however, are not necessarily commensurate with the

[54] Although this study follows the common approach of broadly discussing military organizational interests, it is important to note that most military organizations contain a heterogeneity of interests across their subunits. These competing interests often produce interservice rivalries, where different actors within a state's military organization advocate competing policies. For an elaboration on this point, see Jack S. Levy and William R. Thompson, *Causes of War* (Malden, M.A.: Wiley-Blackwell, 2010), pp. 168-174. For further information on distinctions between organizational interests and bureaucratic bargaining processes, see: Graham Allison and Philip Zelikow, *Essence of*

political dimensions of a state's grand strategy, and at times the two may be contradictory. Furthermore, rather than methodically reasoning through individual decisions, military organizations employ a series of simplifying mechanisms to address uncertainty during the decision-making process.[55] These simplifying mechanisms lead to a reliance upon organizational rules and an emphasis on operational matters that obscure broader strategic imperatives. Combined, the military's organizational interests and biases produce systematic challenges for integrating military doctrine with overarching political considerations.[56]

Military organizations possess three core interests which may pursued through political channels.[57] First, militaries desire greater access to material resources. With greater size and wealth, military organizations are more capable of developing and acquiring weapons systems necessary for conducting military operations.[58] Second, militaries seek autonomy over the management of internal military affairs, such as promotions and program management. Military leaders see such matters as purely internal affairs, and view attempts by civilians to interfere as efforts to politicize the military.[59] Third, military organizations pursue command of operational

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*Decision: Explaining the Cuban Missile Crisis*, 2d ed. (New York, N.Y.: Longman, 1999), pp. 5-7, 143-196, 255-324; Jonathan Bendor and Thomas H. Hammond, "Rethinking Allison's Models," *American Political Science Review*, Vol. 86, No. 2 (June 1992), pp. 301-322; David A. Welch, "The Organizational Process and Bureaucratic Politics Paradigms," *International Security*, Vol. 17, No. 2 (Fall 1992), pp. 112-146.

[55] For a summary of several simplifying mechanisms employed by military organizations, see Sagan, "The Perils of Proliferation," pp. 71-74.

[56] Posen, *The Sources of Military Doctrine*, pp. 51-54. For the initial and authoritative statement on the importance of integrating political goals and military means, see Carl von Clausewitz, *On War*, Michael Howard and Peter Paret, eds. and trans. (Princeton, N.J.: Princeton University Press, 1976), especially pp. 75-89.

[57] The interests identified in this section apply broadly to military organizations, without narrower attention to how the specific platforms and technologies desired by military leaders differ by service. For an evaluation of how armed services share the same general interests but may differ in their specific tactical and operational preferences, see Morton H. Halperin and Priscilla A. Clapp, *Bureaucratic Politics and Foreign Policy*, 2d ed. (Washington, D.C.: Brookings Institution Press, 2006), pp. 25-33, 38-61.

[58] On material resources as a core interest of military organizations, see: Eric A. Nordlinger, *Soldiers in Politics: Military Coups and Governments* (Englewood Cliffs, N.J.: Prentice-Hall, 1977), pp. 65-71; Posen, *The Sources of Military Doctrine*, p. 49.

[59] Betts highlights the importance of organizational autonomy, stating that "Military leaders prefer poverty with autonomy to wealth with dependency." Richard K. Betts, *Soldiers, Statesmen, and Cold War Crises* (New York, N.Y.: Columbia University Press, 1991), p. 8. Also see Nordlinger, *Soldiers in Politics*, pp. 71-75.

and tactical decisions regarding the use of force. Control over operational command and tactics represents the most central military organizational interest.[60] The ability to develop and employ operational and tactical doctrine lies at the core of a professional military,[61] and civilian interference in these affairs tends to estrange military leaders and produce civil-military tensions.[62]

Military organizations are further characterized by a series of procedural biases that shape military responses to the challenges of coordination and uncertainty.[63] Coordinating operations within a complex organization is immensely difficult,[64] and this difficulty is exacerbated by the pervasive uncertainty surrounding an organization's purpose, people, and environment.[65] Military organizations attempt to facilitate internal coordination and reduce operational uncertainty through two means.[66] First, militaries rely on organizational routines designed to

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[60] Betts notes, "An even more hallowed value than access or autonomy in management of programs for the military is control over operational command and tactics." Betts, *Soldiers, Statesmen, and Cold War Crises*, p. 9. This observation is largely inspired by James Wilson's research on the importance of "turf" to different organizations. See James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York, N.Y.: Basic Books, 1989), pp. 179-195.

[61] In the U.S. context, Richard Betts observes that military alienation resulted from "instances in which the soldiers believed civilians overstepped their bounds, usurped their authority, and transformed civilian control into civilian-command. Betts, *Soldiers, Statesmen, and Cold War Crises*, p. 12.

[62] The degree to which civilians should intervene in operational military matters is a subject of extensive debate in the civil-military relations literature. For competing arguments on the appropriate degree of civilian involvement in operations and tactics, see: Eliot A. Cohen, *Supreme Command: Soldiers, Statesmen, and Leadership in Wartime* (New York, N.Y.: Free, 2002); Desch, *Civilian Control of the Military*; Samuel P. Huntington, *The Soldier and the State: The Theory and Politics of Civil-Military Relations* (Cambridge, M.A.: Harvard University Press, 1957).

[63] This discussion of military organizations occurs within the broader framework of organization theory. Classic works and insightful overviews include: Bendor and Hammond, "Rethinking Allison's Models"; James G. March and Herbert A. Simon, *Organizations*, 2d ed. (Cambridge, M.A.: Blackwell, 1993); Charles Perrow, *Complex Organizations: A Critical Essay* (Brattleboro, V.T.: Echo Point, 2014); Herbert A. Simon, *Administrative Behavior*, 4th ed. (New York, N.Y.: Free Press, 1997).

[64] "Even when there is no serious conflict over goals, coordinating the actions of a large number of executive branch actors is no easy task." Bendor and Hammond, "Rethinking Allison's Models," p. 302.

[65] "Purpose" refers to the goals of an organization, "people" refers to the individuals operating within an organization, and "environment" refers to setting within which an organization operates. On these points and for an extensive discussion on the ways in which uncertainty shapes military organizational behavior, see Posen, *The Sources of Military Doctrine*, pp. 43-50, 54-55.

[66] This study primarily focuses on the procedural biases of organizational routines and goal displacement in military organizations. For a summary of additional biases, including satisficing, myopic searches for information, and the effects of organizational filters on individual beliefs and actions, see Sagan, "The Perils of Proliferation," pp. 71-72.

address specific tasks and issues.[67] Organizational routines and standard operating procedures structure the behavior of individuals within an organization by providing specific guidelines for a set of actions. By doing so, the use of organizational routines facilitates coordination among various actors within an organization. However, these routines deny individual reasoning of decisions and cause militaries to abide by protocol that may be poorly suited for a given decision.[68] Second, military organizations primarily conduct planning and analysis on operational-level issues. Emphasizing operational considerations allows militaries to better anticipate uncertainty during disputes. Problematically, this behavior also produces a form of "goal displacement," where the emphasis on operational means causes military organizations to lose sight of the broader strategic objectives and inhibits political-military integration.[69]

The military's efforts to reduce uncertainty and improve coordination produce a systematic proclivity for offensive military doctrines.[70] In contrast to defensive and deterrent doctrines—which aim to deny an adversary its political objectives and punish adversaries for aggression, respectively—offensive doctrines seek to preventively or preemptively disarm an adversary by destroying the opponent's armed forces.[71] Offensive doctrines allow the military to develop and execute elaborate war plans, which reduces the uncertainty facing military planners

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[67] Allison and Zelikow, *Essence of Decision*, pp. 147-153; Posen, *The Sources of Military Doctrine*, pp. 44-48.
[68] Sagan, "The Perils of Proliferation," p. 72.
[69] Charles Perrow emphasizes this point by noting the tendency for organizations to pursue "operative" goals at the expense of official goals. See Charles Perrow, "Goals in Complex Organizations," *American Sociological Review*, Vol. 26, No. 6 (December 1961), pp. 854-865.
[70] Proponents of this argument include: Posen, *The Sources of Military Doctrine*, pp. 41-59; Sagan, "The Perils of Proliferation," pp. 75-76; Snyder, *The Ideology of the Offensive*, pp. 26-30; Van Evera, "The Cult of the Offensive and the Origins of the First World War."
[71] Posen, *The Sources of Military Doctrine*, p. 14. Although prevention and preemption both represent offensive action, the concepts are substantively different. Preventive attacks initiate hostilities during peacetime, with the assumptions that conflict is eventually likely, and the adversary will be stronger at a later point in time. Preemptive attacks, in contrast, refer to attacks that occur when an actor believes that the adversary will imminently begin a conflict. Scott D. Sagan, "The Origins of Military Doctrine and Command and Control Systems," in Peter R. Lavoy, Scott D. Sagan, and James J. Wirtz, eds., *Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, and Chemical Weapons* (Ithaca, N.Y.: Cornell University Press, 2000), p. 19.

and facilitates operational coordination within the military.[72] Conversely, defensive and deterrent doctrines force a military to improvise in the face of significant uncertainty and allow the adversary to structure the conduct of battle.[73] This aversion to uncertainty also causes military organizations to prefer the quick and decisive uses of force embodied in offensive doctrines, rather than the gradual escalation of conflict aimed at persuading an adversary to change its ambitions inherent to defensive and deterrent doctrines.[74]

Offensive doctrines also serve the military's core interests in two significant ways. First, offensive doctrines increase the military's organizational size and wealth. Offensive operations are resource intensive,[75] typically requiring numerical superiority and extensive logistical support that demand greater financial support and manpower commitments. The potential for quick and decisive offensive action also offers hope for clear political gains, which incentivizes national investment in military action.[76] Second, offensive doctrines enhance military autonomy and control of military operations. Because offensive operations entail complicated military planning that requires extensive expertise, civilians face difficulties in understanding military affairs well enough to justify intervening in operational or tactical issues.[77] Furthermore, because offensive operations are typically conducted outside of a country's national borders, civilians are less motivated to participate in operational planning.[78] Combined, these points suggest that

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[72] Posen, *The Sources of Military Doctrine*, pp. 47-49; Sagan, "The Origins of Military Doctrine and Command and Control Systems," p. 18.
[73] Posen, *The Sources of Military Doctrine*, pp. 47-48.
[74] This argument is most clearly articulated and supported in Betts, *Soldiers, Statesmen, and Cold War Crises*.
[75] Posen, *The Sources of Military Doctrine*, p. 49; Sagan, "The Origins of Military Doctrine and Command and Control Systems," p. 18.
[76] Jack Snyder, "Civil-Military Relations and the Cult of the Offensive, 1914 and 1984," *International Security*, Vol. 9, No. 1 (Summer 1984), p. 121.
[77] Posen, *The Sources of Military Doctrine*, pp. 49-50.
[78] Ibid., p. 50.

military organizations can secure greater autonomy through offensive doctrines by simultaneously increasing the barriers to and reducing the incentives for civilian interference.

In nuclear states, the preference for offensive doctrines causes military organizations to prefer more delegative command and control along physical, technical, and administrative dimensions. This generates three specific predictions for command and control systems in nuclear states with politically influential military organizations.[79] First, military organizations pursue greater physical control of nuclear assets. Physical control increases military autonomy over the operational aspects of a state's nuclear arsenal and allows the military to develop organizational routines for mobilizing and deploying nuclear weapons. Second, military organizations prefer fewer technical controls on nuclear forces. Technical controls require greater coordination between military operators and senior leaders, which induces uncertainty in military planning for nuclear contingencies and creates an aversion to these measures. Finally, military organizations seek greater administrative control over nuclear weapons. The authority to mobilize or launch nuclear weapons allows the military to develop standard operating procedures that facilitate coordination within the military and reduces uncertainty in military operations by reducing dependence on senior leadership during crises.[80]

The military's ability to advance its preferences for more delegative command and control systems is dependent upon its level of organizational autonomy. In this study, autonomy

[79] For an applied analysis of how command and control systems may differ during moments of peace and crisis, see Khan, "Nuclear Command-and-Control in South Asia During Peace, Crisis, and War." Also see Blair, "Alerting in Crisis and Conventional War," pp. 75-120.

[80] During the Cold War, U.S. General Lyman L. Lemnitzer delivered a nuclear war plan briefing to President John F. Kennedy. This briefing, known as SIOP-62, included a clear statement on the importance and rigidity of SOPs in military planning. See Scott D. Sagan, "SIOP-62: The Nuclear War Plan Briefing to President Kennedy," *International Security*, Vol. 12, No. 1 (Summer 1987), pp. 37-39, 49-51.

refers to the decision-making authority of military organizations.[81] High military organizational autonomy indicates that military organizations have greater decision-making authority, whereas low autonomy indicates that political leadership is more directly involved in military decisions. By focusing on the level of autonomy experienced by military organizations, my theoretical framework identifies specific conditions under which the military is able to advance its interests into operational nuclear doctrine.

Three institutional factors indicate the level of military organizational autonomy. First, the process by which a state makes personnel decisions regarding senior military commanders reflects the military's level of decision-making authority. If the military directly appoints senior commanders or only requires executive approval for such appointments, then the military experiences greater autonomy. In contrast, if senior-level promotions require confirmation by additional civilian bodies such as a state's legislature, this indicates lower military autonomy as civilians become more directly involved in internal military decisions.[82]

A second indicator of autonomy is the amount of military discretion in operational military reform, including authority over weapons upgrades, troop deployments, and doctrinal formulation. When military organizations have more authority in these decisions, they enjoy greater autonomy. When civilians influence and determine military reforms, military organizations possess less autonomy.[83]

Third, the organization of defense policy institutions exemplify the level of military organizational autonomy. As the military obtains positions that provide policy recommendations

[81] This definition aligns with the definition used by David Pion-Berlin, "Military Autonomy and Emerging Democracies in South America," *Comparative Politics*, Vol. 25, No. 1 (October 1992), p. 84.
[82] Ibid., p. 87.
[83] Ibid., p. 88.

or directly control operations, military organizations obtain greater autonomy.[84] If the military is institutionally excluded from decision-making processes or hierarchically weak, then military autonomy is low.

My theory generates two predictions for command and control outcomes at this final node of the framework. First, states with high levels of military organizational autonomy adopt delegative command and control systems. Under these conditions, political leaders are willing to rely on the military's professionalism and obedience to protect against accidental and unauthorized use and allow military organizations to manage physical nuclear forces and include military leadership in the nuclear chain of command. Second, states with low levels of military organizational autonomy adopt assertive command and control frameworks. These states possess civil-military pathologies that purposefully exclude military organizations from conventional operational decision-making, and these patterns of civil-military relations travel to nuclear policy well. States with low military autonomy adopt assertive control measures to centralize nuclear authority and preclude military influence over nuclear doctrine.

**Alternative Explanations**

The academic literature provides four theories to explain command and control systems in emerging nuclear powers. Specifically, scholars have traditionally emphasized three potential explanations for nuclear command and control: the stability of civil-military relations, the

[84] This institutional structure reflects greater direct political influence of military organizations. Direct political influence refers to the formal processes by which the military provides policy recommendations or controls operations. At its apex, direct military influence refers to a military regime where the chief executive is a military officer. However, the level of institutional authority does not have to be so extreme for the military to exert direct influence on politics. On direct political influence, see Betts, *Soldiers, Statesmen, and Cold War Crises*, p. 5.

vulnerability of nuclear forces, and the strategic rationale of the nuclear arsenal. In this section, I establish the logic underpinning these alternative explanations and identify the observable implications of each theoretical perspective.

*Civil-Military Stability*

One influential explanation of regional nuclear power command and control systems emphasizes the explanatory power of civil-military stability. In countries where civil-military relations are more stable, military operators are expected to obey civilian political mandates, causing civilians to delegate greater launch authority and arsenal custody to military operators to promote arsenal survivability.[85] Conversely, unstable civil-military relations—observed in states with greater coup risks or extensively politicized militaries—are more likely to produce assertive control to prevent a domestic rival from leveraging the political utility of nuclear weapons.[86] This argument is similar to my theory in that it emphasizes the importance of civil-military relations for command and control outcomes; however, each argument proposes a distinct causal mechanism. Whereas I argue that the relative political power of civilian and military groups allows dominant groups to pursue their parochial interests, the civil-military stability perspective is built upon a principal-agent framework that evaluates the likelihood of agents enacting versus

[85] Peter Feaver clearly articulates this proposition in his landmark study on the origins of command and control in emerging nuclear nations, stating, "The more stable the civil-military relations, the more delegative the command and control system; the more volatile the civil-military relations, the more assertive the command and control system. Feaver, "Command and Control in Emerging Nuclear Nations," p. 178.
[86] Ibid., pp. 176-177.

shirking political mandates.[87] In this model, civilians unilaterally determine how much authority and autonomy to delegate to military actors in command and control arrangements.

If the civil-military stability argument is correct, then evidence should show that a fear of military intervention in politics causes civilians to assert greater control over nuclear decisions. This fear should be particularly pronounced in states with a history of military coups, causing command and control decisions to strongly favor assertive control. Civilians should be more willing to delegate authority to military commanders when civil-military relations are historically stable and the military is professional and subordinate to civilian mandates. Evidence should demonstrate that civilians determine when to delegate nuclear authority, and the perceived reliability of military actors should shape these decisions.

*Arsenal Vulnerability*

An influential security-based argument emphasizes the effects of arsenal vulnerability on command and control decisions.[88] From this perspective, states with nuclear arsenals that are vulnerable to preemption or decapitation face challenges to the survivability and responsiveness of their nuclear forces. States with greater arsenal vulnerability experience increased time-urgency—the degree to which a state believes its arsenal must be ready for rapid use—and adopt delegative control frameworks that bolster arsenal reliability.[89] Time-urgency is particularly pronounced in states with small arsenals and nuclear-armed adversaries, as these conditions

[87] For a helpful overview of principal-agent models, see Gary J. Miller, "The Political Evolution of Principal-Agent Models," *Annual Review of Political Science*, Vol. 8 (2005), pp. 203-225. For a theory of civil-military relations that explicitly employs the principal-agent framework, see Peter D. Feaver, *Armed Servants: Agency, Oversight, and Civil-Military Relations* (Cambridge: Harvard University Press, 2003).
[88] Sagan, "The Origins of Military Doctrine and Command and Control Systems," pp. 39-42.
[89] Feaver, "Command and Control in Emerging Nuclear Nations," p. 178.

generate "use them or lose them" pressures on states to safeguard against an adversary's preemptive strike.[90]

If the arsenal vulnerability hypothesis is correct, then two implications should follow. First, a state facing a nuclear adversary with a larger nuclear arsenal should adopt more delegative patterns of command and control to offset the state's nuclear inferiority.[91] This should be especially true for states whose nuclear weapons infrastructure is within range of large portions of an adversary's nuclear capabilities, as the adversary can bring a greater portion of its force to bear when targeting a state's nuclear arsenal. Second, states facing an adversary with tactical nuclear weapons should also adopt delegative control measures. Because tactical nuclear weapons are traditionally accompanied by first-use doctrines, states facing adversaries with tactical nuclear weapons should be more likely to delegate control to guarantee that its nuclear arsenal is prepared for use in case a localized nuclear conflict escalates to an interstate nuclear exchange.

*Strategic Rationale*

A final explanation of command and control assigns explanatory power to the strategic rationale underlying a state's nuclear weapons program.[92] Nuclear strategies can be grouped into two general categories: first-use and late-use strategies. Strategic rationale arguments posit that

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[90] Ibid.; Sagan, "The Origins of Military Doctrine and Command and Control Systems," pp. 39-40.

[91] Recent debates have evaluated the effects of nuclear superiority on crisis behavior. Although this study is more directly interested in operational nuclear behavior, the logic of the nuclear superiority debate nevertheless applies to the nuclear threat hypothesis. For competing perspectives on this debate, see: Matthew Kroenig, "Nuclear Superiority and the Balance of Resolve: Explaining Nuclear Crisis Outcomes," *International Organization*, Vol. 67, No. 1 (January 2013), pp. 141-171; Todd S. Sechser and Matthew Fuhrmann, "Crisis Bargaining and Nuclear Blackmail," *International Organization*, Vol. 67, No. 1 (January 2013), pp. 173-195.

[92] Vipin Narang's work on the sources of nuclear posture in regional nuclear powers offers the most explicit presentation of this argument. In his theory, command and control systems are treated as a descriptive component of nuclear posture. For a discussion of Narang's expected relationships between nuclear posture and command and control arrangements, see Narang, *Nuclear Strategy in the Modern Era*, p. 22.

these strategies require distinct nuclear command and control systems to support the overarching nuclear doctrine. First-use strategies anticipate using nuclear weapons first in a conflict, most likely in response to conventional attacks. Late-use strategies, in contrast, plan to withhold nuclear weapons until an adversary has conducted a nuclear strike or appears imminently likely to do so.

The strategic rationale hypothesis generates two observable implications. First, states that employ first-use doctrines will adopt delegative command and control systems. First-use doctrines require the delegation of launch capability to lower-level military commanders to guarantee that nuclear weapons are available for use before an adversary can preempt the state's nuclear launch. Second, late-use strategies employ a doctrine of nuclear retaliation that requires survivable second-strike forces and permits centralized political control of the arsenal. Late-use strategies therefore produce assertive command and control arrangements that allow for political oversight late into disputes.

**Empirical Strategy**

To evaluate my argument and the competing explanations, I conduct a series of within-case qualitative analyses. Specifically, I employ the method of process tracing to develop a causal narrative and test the mechanisms implied by each explanation. I use this method to analyze the creation and development of command and control systems in regional nuclear powers. For each case, I test the competing explanations with historical and archival data, as well as original interview data with civilian and military elites in each country's nuclear establishment.

Process tracing is a valuable method of analysis for explaining the origins of command and control for several reasons.[93] Because the population of regional nuclear powers only includes eight states, the number of state-level observations is severely limited and precludes large-N quantitative analysis. For quantitative work, an observation is commonly viewed as the measure of a single variable on single unit that provides leverage over a causal relationship.[94] In the context of within-case analysis, however, observations are better viewed as causal-process observations (CPOs).[95] Unlike the data-set observations (DSOs) used in quantitative research, CPOs typically do not provide scores on specific variables across a sample of cases. Instead, these observations provide insight into a variety of components of the hypothesized relationship between two variables, such as the causal pathways and mechanisms at play. Although these observations are "incomplete" by DSO standards, they may nevertheless aggregate together to support a unified causal inference at a deeper level than simply identifying correlations across DSOs. In practice, CPOs substantially improve causal inference by demonstrating that a particular independent variable is the cause of the dependent variable—reducing concerns of endogeneity—and creating an uninterrupted chain of events connecting the two variables to address omitted variable concerns.[96]

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[93] Scholars provide several competing perspectives on the best practices of process tracing. For examples, see: Andrew Bennett, "Process Tracing and Causal Inference," in Henry E. Brady and David Collier, eds., *Rethinking Social Inquiry: Diverse Tools, Shared Standards*, 2d ed. (Plymouth: Rowman & Littlefield, 2010), pp. 207-220; Tasha Fairfield and Andrew E. Charman, "Explicit Bayesian Analysis for Process Tracing: Guidelines, Opportunities, and Caveats," *Political Analysis*, Vol. 25, No. 3 (July 2017), pp. 363-380; Alexander L. George and Andrew Bennett, *Case Studies and Theory Development in the Social Sciences* (Cambridge, M.A.: MIT Press, 2005), pp. 205-232; Stephen Van Evera, *Guide to Methods for Students of Political Science* (Ithaca, N.Y.: Cornell University Press, 1997), pp. 49-88; David Waldner, "What Makes Process Tracing Good? Causal Mechanisms, Causal Inference, and the Completeness Standard in Comparative Politics," in Andrew Bennett and Jeffrey T. Checkel, eds., *Process Tracing: From Metaphor to Analytic Tool* (Cambridge: Cambridge University Press, 2015), pp. 126-152. Of these examples, my approach most closely aligns with the approach described by Andrew Bennett.
[94] For such an understanding of observations, see Gary King, Robert O. Keohane, and Sidney Verba, *Designing Social Inquiry: Scientific Inference in Qualitative Research* (Princeton, N. J.: Princeton University Press, 1994), p. 217.
[95] Henry E. Brady, David Collier, and Jason Seawright, "Refocusing the Discussion of Methodology," in Brady and Collier, eds., *Rethinking Social Inquiry*, p. 24.
[96] Bennett, "Process Tracing and Causal Inference," pp. 208-209.

The issue of limited state-level observations is further compounded by the tendency towards institutional persistence in command and control arrangements, which reduces the amount of observable variation over time. Process tracing offers a method for addressing these challenges by evaluating the causal processes that lead to the creation and evolution of command and control systems over time, rather than measuring a single variable on a single unit over time.[97] By focusing on complete causal processes, I am able to test a wide range of implications generated by my theory and the alternative explanations. These observations aggregate together to support a unified causal inference and provide evidence to evaluate the mechanisms underlying each explanation.[98]

I evaluate my theory using evidence from India, Pakistan, and apartheid-era South Africa. This case selection strategy allows me to test the explanatory power of my theoretical framework at each of the decisive nodes that generate empirical predictions. Figure 2.2 demonstrates the predictions of my theoretical framework in these cases and all other regional nuclear powers.

For each case, I test the competing explanations with a combination of historical, archival, and original interview data with military and political elites. These data establish general trends in each state's operational nuclear doctrine and provide primary source evidence

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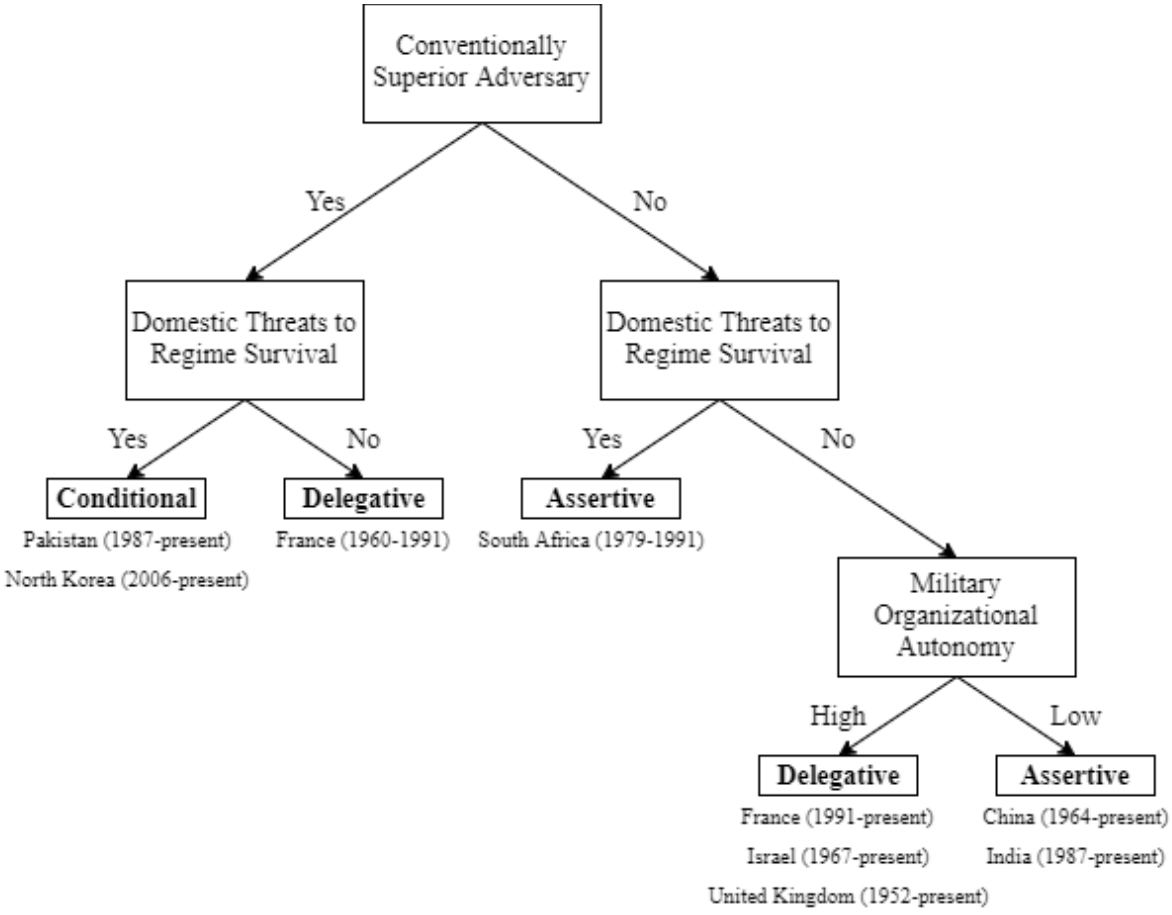
[97] In quantitative studies, an observation is commonly viewed as the measure of a single variable on single unit that provides leverage over a causal relationship. For such an understanding of observations, see King, Keohane, and Verba, *Designing Social Inquiry*, p. 217. In the context of within-case analysis, however, observations are better viewed as causal-process observations. Brady, Collier, and Seawright, "Refocusing the Discussion of Methodology," p. 24.

[98] For different understandings of causal mechanisms, see: Henry E. Brady, "Causation and Explanation in Social Science," in Janet M. Box-Steffensmeier, Henry E. Brady, and David Collier, eds., *The Oxford Handbook of Political Methodology* (New York, N.Y.: Oxford University Press, 2008), pp. 217-270; John Gerring, "Causal Mechanisms: Yes, But…", *Comparative Political Studies*, Vol. 43, No. 11 (November 2010), pp. 1499-1526; Kosuke Imai, Luke Keele, Dustin Tingley, and Teppei Yamamoto, "Unpacking the Black Box of Causality: Learning about Causal Mechanisms from Experimental and Observational Studies," *American Political Science Review*, Vol. 105, No. 4 (November 2011), pp. 765-789; Waldner, "What Makes Process Tracing Good?", pp. 126-152.

**Figure 2.2. Theory of Nuclear Command and Control: Empirical Predictions**




to directly evaluate the explanatory power of the competing arguments' causal mechanisms. Importantly, the use of these original data allows me to directly explore the observable implications of each argument in a manner unavailable to earlier studies of command and control in regional nuclear powers.

# CHAPTER 3

## INDIA

India was the first country to publicly demonstrate and acknowledge its nuclear weapons program since the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) established five legally recognized nuclear states in 1970.[1] India tested five nuclear weapons on May 11 and 13, 1998, formalizing a nuclear program that gained international attention with the 1974 test of a nuclear device. Numerous scholars have extensively analyzed the causes of India's decision to acquire nuclear weapons and its subsequent nuclear strategy.[2] I supplement the existing scholarship on India's nuclear weapons program by describing and explaining the sources of

[1] The NPT only recognizes states that tested nuclear weapons before January 1, 1967 as legal nuclear weapons states. This includes the United States, Russia, the United Kingdom, France, and China. Israel is widely believed to possess nuclear weapons but remains ambiguous regarding its nuclear capabilities. On Israel's program, see: Avner Cohen, *Israel and the Bomb* (New York, N.Y.: Columbia University Press, 1998); Avner Cohen, *The Worst Kept Secret: Israel's Bargain with the Bomb* (New York, N.Y.: Columbia University Press, 2010); Seymour Hersh, *The Samson Option: Israel's Nuclear Arsenal and American Foreign Policy* (New York, N.Y.: Random House, 1991); and Michael Karpin, *The Bomb in the Basement: How Israel Went Nuclear and What that Means for the World* (New York, N.Y.: Simon & Schuster, 2006). South Africa also developed and dismantled a nuclear weapons program during the 1970s and 1980s, but never overtly tested its nuclear weapons capabilities. On the South African program, see: Peter Liberman, "The Rise and Fall of the South African Bomb," *International Security*, Vol. 26, No. 2 (Fall 2001), pp. 45-86; Helen E. Purkitt and Stephen F. Burgess, *South Africa's Weapons of Mass Destruction* (Bloomington, I.N.: Indiana University Press, 2005); Hannes Steyn, Richardt Van Der Walt, and Jan Van Loggerenberg, *Armament and Disarmament: South Africa's Nuclear Experience*, 2d ed. (New York, N.Y.: iUniverse, 2005); and Nic von Wielligh and Lydia von Wielligh-Steyn, *The Bomb: South Africa's Nuclear Program* (Pretoria: Litera, 2015).

[2] A selection of major works includes: Raj Chengappa, *Weapons of Peace* (Delhi: Harper Collins, 2000); Sumit Ganguly, "India's Pathway to Pokhran II: The Prospects and Sources of New Delhi's Nuclear Weapons Program," *International Security*, Vol. 23, No. 4 (Spring 1999), pp. 148-177; Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, N.J.: Princeton University Press, 2014), pp. 94-120; George Perkovich, *India's Nuclear Bomb: The Impact on Global Proliferation* (Berkeley, C.A.: University of California Press, 1999); Ashley J. Tellis, *India's Emerging Nuclear Posture: Between Recessed Deterrent and Ready Arsenal* (Santa Monica, C.A.: RAND, 2001). On the process of nuclear proliferation in India, see: Gaurav Kampani, "New Delhi's Long Nuclear Journey: How Secrecy and Institutional Roadblocks Delayed India's Weaponization," *International Security*, Vol. 38, No. 4 (Spring 2014), pp. 79-114; Andrew B. Kennedy, "India's Nuclear Odyssey: Implicit Umbrellas, Diplomatic Disappointments, and the Bomb," *International Security*, Vol. 36, No. 2 (Fall 2011), pp. 120-153; Vipin Narang, "Strategies of Nuclear Proliferation: How States Pursue the Bomb," *International Security*, Vol. 41, No. 3 (Winter 2016/17), pp. 135-146.

India's nuclear command and control systems. I base my arguments on a combination of historical and original interview data with political and military elites in India.

In this chapter, I show that India has maintained assertive command and control systems throughout its nuclear history. Despite a range of conventional, subconventional, and nuclear threats to Indian security posed by China and Pakistan, the conventional balance of power offers India a high level of external security that allows civilian leaders to centralize political oversight of nuclear operations during peacetime and late into crises. Furthermore, despite inheriting a multiethnic state with religious cleavages, tribal identities, and an organized military capable of opposing civilian directives after British decolonization, India's efforts to politically include its diverse population and politically exclude the military have prevented significant domestic threats to the political regime. Given India's conventional security and domestic stability, civil-military relations play a decisive role in determining India's nuclear command and control arrangements. Specifically, the Indian military's low levels of organizational autonomy in the nuclear realm have resulted in strict civilian control of nuclear operations and the purposeful exclusion of military actors from nuclear debates. To maintain civilian control over nuclear forces and to exclude military influence, India's political elites have established assertive command and control systems along administrative, physical, and technical dimensions.

## India's Nuclear Weapons Program

India's nuclear program began near the end of British colonial rule and subsequent partition of the Indian subcontinent in 1947. The British had purposefully slowed the development of India's industrial and technological bases during their colonial reign, leading

early Indian leaders to view scientific advancements as a means for overcoming these colonial constraints and obtaining the status of a modern nation.[3] As George Perkovich notes in his authoritative history of India's nuclear program, "In this period, no field of science and technology appeared more promising and prestigious than atomic energy."[4]

Two individuals powerfully shaped India's nuclear program at this time: Prime Minister Jawaharlal Nehru and Indian physicist Homi Bhabha. India developed the Atomic Energy Research Committee in 1946, which was later replaced with the Atomic Energy Commission (AEC) in 1948 to guarantee the secrecy of India's nuclear program.[5] The AEC formally fell under the purview of the prime minister, but Bhabha exercised significant influence over AEC operations.[6] As chairman of the AEC, Bhabha fashioned India's nuclear policy to guarantee both civilian energy and nuclear weapons options.[7] Although Nehru publicly opposed nuclear weapons on moral grounds, he nevertheless understood the value of nuclear weapons for enhancing Indian status and security.[8] As a result, Nehru and Bhabha combined to develop a nuclear program in through the 1960s that maintained a restrained nuclear weapons capability.

India's nuclear program continued to develop in the 1960s without explicit authorization from political leadership.[9] Although India publicly asserted that its nuclear program was only intended for peaceful purposes, the AEC continued to produce and separate weapons-grade

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[3] For a broader discussion on the influence of India's postcolonial status on its nuclear weapons program, see Itty Abraham, *The Making of the Indian Atomic Bomb: Science, Secrecy and the Postcolonial State* (New York, N.Y.: St. Martin's, 1998).
[4] Perkovich, *India's Nuclear Bomb*, p. 17.
[5] Ibid., pp. 17-19.
[6] Ganguly, "India's Pathway to Pokhran II," p. 151.
[7] Several scholars note Bhabha's influence and drive to obtain nuclear weapons, including: Brahma Chellaney, *Nuclear Proliferation: The US-Indian Conflict* (New Delhi: Orient Longman, 1993), p. 9; and Ashok Kapur, *India's Nuclear Option* (New York, N.Y.: Praeger, 1976), p. 107.
[8] On the influence of Bhabha and Nehru during this period, see Perkovich, *India's Nuclear Bomb*, pp. 13-59. This account is especially important for identifying the duality of Nehru's perspectives on nuclear weapons.
[9] For an overview of India's nuclear research during this period, see ibid., pp. 125-160.

plutonium, develop explosive cores, and research the appropriate state of plutonium for nuclear weapons. When the NPT was finalized in June 1968, India declined to sign the treaty.[10] The AEC and Defense Research and Development Organization (DRDO) continued to study and design a nuclear design without political guidance. Ultimately, Prime Minister Indira Gandhi authorized the assembly of a nuclear device in 1972 and India conducted a "peaceful nuclear explosion" (PNE) in 1974, ushering in a new era of military competition in South Asia.

India's permanent representative to the United Nations at the time of the 1974 test strongly asserted that India's test was "conducted exclusively for peaceful purposes" and "had no military or political implications."[11] Despite this public facing, India had demonstrated the ability to retaliate against its adversaries with a nuclear attack. India thereafter maintained ambiguity regarding its ability to produce a nuclear weapon for nearly 25 years with the apparent effect that other states believed India was capable of producing and delivering a nuclear weapon.[12] This period of nuclear ambiguity ended when India's right-wing Bharatiya Janata Party (BJP) decided to test three nuclear weapons on May 11, 1998 and two additional weapons on May 13, 1998.[13] By conducting these nuclear tests, India removed any doubts regarding its nuclear capabilities and clearly signaled its status as a nuclear weapons state.

India has employed a strategy of assured retaliation since its 1974 nuclear test.[14] By employing an assured retaliation posture, India seeks to directly deter nuclear attacks and coercion by threatening nuclear retaliation against an adversary that targets India with nuclear

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[10] Ganguly, "India's Pathway to Pokhran II," p. 158.
[11] For the full statement, see Rikhi Jaipal, "The Indian Nuclear Explosion," *International Security*, Vol. 1, No. 4 (Spring 1977), pp. 44-51.
[12] Perkovich, *India's Nuclear Bomb*, pp. 267-268.
[13] For explanations of the decision to test nuclear weapons in May 1998, see: Ganguly, "India's Pathway to Pokhran II," pp. 171-175; Perkovich, *India's Nuclear Bomb*, pp. 404-443.
[14] Narang, *Nuclear Strategy in the Modern Era*, pp. 94-120. India's historical reliance on the assured retaliation posture is also discussed at length in Tellis, *India's Emerging Nuclear Posture*.

weapons.[15] Although the operational specifics have varied over time, the underlying logic of deterrence has remained constant in India's nuclear doctrine.

After the 1974 test, India relied on its nascent nuclear capabilities to deter its adversaries. India did not maintain a stockpile of deliverable nuclear weapons, but the PNE had demonstrated India's technological capacity to develop nuclear weapons if necessary. After the PNE, India "formalized what had been unofficial previously: the 'nuclear option' strategy."[16] Although it may have taken India weeks to assemble and deliver a nuclear weapon, the 1974 test showed that India would be able to respond to aggression with nuclear force. Additionally, this strategy represented India's historical aversion to nuclear weapons under Nehru and "satisfied twin objectives of retaining a moral high ground on disarmament while providing enough military potential to give adversaries pause."[17]

Following the May 1998 tests, India released two documents that encapsulated the country's assured retaliation posture. First, on August 17, 1999, India released a draft report of its nuclear doctrine. This doctrine identified three pillars of India's nuclear strategy: no first-use, credible minimum deterrence, and punitive retaliation.[18] The draft nuclear doctrine clearly articulates these points, stating, "India shall pursue a doctrine of credible minimum deterrence…India will not be the first to initiate a nuclear strike, but will respond with punitive retaliation should deterrence fail."[19]

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[15] Narang, *Nuclear Strategy in the Modern Era*, pp. 17-19.
[16] Perkovich, *India's Nuclear Bomb*, p. 189.
[17] Ibid.
[18] Government of India, "Draft Report of National Security Advisory Board on Indian Nuclear Doctrine," August 17, 1999. Available at: https://mea.gov.in/in-focus-article.htm?18916/Draft+Report+of+National+Security+Advisory+Board+on+Indian+Nuclear+Doctrine.
[19] On the modifications to the three pillars of India's nuclear doctrine over time, see Toby Dalton and George Perkovich, *India's Nuclear Options and Escalation Dominance* (Washington, D.C.: Carnegie Endowment for International Peace, 2016), pp. 7-8.

Second, in January 2003, India's Cabinet Committee on Security released a statement that largely formalized the draft nuclear doctrine, but with a pair of caveats. The no first-use criterion was loosened to state that "nuclear weapons will only be used in retaliation against a nuclear attack on Indian territory *or on Indian forces anywhere*."[20] Furthermore, the terminology of punitive retaliation was replaced with an emphasis on massive retaliation, promising that "Nuclear retaliation to a first strike will be *massive and designed to inflict unacceptable damage*."[21] As a result, since 2003 the three pillars of India's nuclear strategy have been: no first-use, credible minimum deterrence, and massive retaliation. Indeed, Arvind Gupta—India's deputy national security advisor from 2014-2017—maintains that these three aspects of India's nuclear doctrine remain the fundamental pillars of Indian nuclear strategy.[22] The essential logic of assured retaliation that has characterized India's nuclear strategy since 1974 remains intact in India's current nuclear doctrine.

**India's Nuclear Arsenal**

Identifying a date on which India weaponized its nuclear weapons program is made difficult by India's ambiguous nuclear intentions in the period after the 1974 test. Although India tested a nuclear device in 1974, its nuclear arsenal was not operationally viable until at least 1987. In March 1987, Prime Minister Rajiv Gandhi publicly stated that while India had not yet

[20] Prime Minister's Office, "Cabinet Committee on Security Reviews Progress in Operationalizing India's Nuclear Doctrine," press release, January 4, 2003. Available at: https://www.mea.gov.in/press-releases.htm?dtl/20131/The+Cabinet+Committee+on+Security+Reviews+perationalization+of+Indias+Nuclear+Doctrine. Emphasis added.
[21] Ibid. Emphasis added.
[22] Arvind Gupta, interview by author, February 5, 2019.

developed nuclear weapons, "if [India] decided to become a nuclear power, it would take a few weeks or a few months."[23]

Despite this statement, several scholars argue that the date of operationalization happened slightly later. George Perkovich suggests that weaponization more likely occurred between 1988 and 1990, during which time India "readied two dozen nuclear weapons for quick assembly and potential dispersal to air-bases for delivery by aircraft or retaliatory attacks against Pakistan."[24] Similarly, Sonali Singh and Christopher Way argue that India first possessed an operational nuclear capability in 1988,[25] a coding with which Dong-Joon Jo and Erik Gartzke agree.[26] By 1988, these studies argue that India had the necessary capabilities to assemble and deliver nuclear weapons within a matter of days, if required.[27] This delay was considered acceptable, as India believed its emphasis on a "force in being" provided robust deterrence and its nuclear arsenal would be prepared for use within 72 hours.[28]

Gaurav Kampani, however, provides an even later date, arguing that India's weapons only became fully operational in the mid-1990s.[29] Kampani notes the differences between several stages of a nuclear program, including the development of a nuclear device, the development of nuclear weapons, the process of weaponization, and the operationalization of the nuclear arsenal. Kampani states:

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[23] Rajiv Gandhi, quoted in Devin Hagerty, *The Consequences of Nuclear Proliferation: Lessons from South East Asia* (Cambridge, M.A.: MIT Press, 1998), p. 121.
[24] Perkovich, *India's Nuclear Bomb*, p. 293.
[25] Sonali Singh and Christopher R. Way, "The Correlates of Nuclear Proliferation: A Quantitative Test," *Journal of Conflict Resolution*, Vol. 48, No. 6 (December 2004), pp. 859-885.
[26] Dong-Joon Jo and Erik Gartzke, "Determinants of Nuclear Weapons Proliferation," *Journal of Conflict Resolution*, Vol. 51, No. 1 (February 2007), pp. 167-194.
[27] Alexander H. Montgomery and Scott D. Sagan, "The Perils of Predicting Proliferation," *Journal of Conflict Resolution*," Vol. 53, No. 2 (April 2009), pp. 307-310.
[28] Narang, *Nuclear Strategy in the Modern Era*, pp. 97-98.
[29] Kampani, "New Delhi's Long Nuclear Journey," pp. 79-114.

> A *device* is an apparatus that presents proof of scientific principle that a nuclear explosion will occur. The *weapon* is a rugged and miniaturized version of the device. It usually incorporates arming and safing mechanisms to prevent unauthorized or inadvertent use. *Weaponization* is the process of integrating the weapon with delivery systems. *Operationalization* entails the development of soft institutional and organizational routines. It refers to command and control mechanisms, coordination procedures between scientific and military agencies, and training protocols in the military to deploy and explode nuclear weapons.[30]

Kampani argues that although India possessed a nuclear device in 1974, India did not fully operationalize its arsenal until the mid-1990s—perhaps as late as 1996—at which point it acquired the ability to reliably and safely deliver nuclear weapons. Once India's nuclear arsenal became operational, nuclear weapons would likely have been delivered by India's Jaguar or Mirage 2000 fighter-bomber aircraft, which were modified for nuclear missions in the 1990s.[31]

India's 1999 draft nuclear doctrine clearly envisioned a nuclear triad of land-, air-, and sea-based delivery capabilities. Specifically, the doctrine calls for "a triad of aircraft, mobile land-based missiles and sea-based assets" to meet the requirements of its assured retaliation posture.[32] The various legs of India's envisioned triad, however, have progressed at markedly different rates.

India's first nuclear weapons would have been delivered by the Indian Air Force. Nuclear weapons could possibly have been air-deliverable in the late-1980s by a transport aircraft, although this delivery method would have been imprecise and unreliable.[33] Once the French-designed Mirage 2000 and French and British-designed Jaguar aircraft became nuclear-capable, these aircraft assumed primary responsibility for nuclear strike missions. The Mirage 2000 and Jaguar fighter-bombers remain the central delivery platforms of India's nuclear posture, with

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[30] Ibid., pp. 80-81. Emphasis added.
[31] Ibid., pp. 94-95.
[32] Government of India, "Draft Report of National Security Advisory Board on Indian Nuclear Doctrine."
[33] Narang, *Nuclear Strategy in the Modern Era*, p. 97.

three or four squadrons of aircraft assigned nuclear strike missions against Pakistan and China.[34] On September 23, 2016, India and France reached an agreement for the procurement of 36 Rafale aircraft to replace the aging Mirage 2000 and Jaguar platforms.[35] It is likely that India will convert some portion of the Rafale acquisition to assume the nuclear missions currently conducted by the Mirage 2000 and Jaguar aircraft.[36]

Land-based ballistic missiles have become an increasingly viable leg of India's nuclear arsenal. In 1983, Prime Minister Indira Gandhi renewed India's Integrated Guided Missile Development Program (IGDMP) to indigenously develop the Prithvi and Agni ballistic missile families, with Prime Minister Rajiv Gandhi later accelerating the program.[37] India began flight-testing ballistic missiles several years later with the short-range Prithvi I on February 25, 1988.[38] The short-range Prithvi-II was the first missile developed under the IGDMP and first deployed in 2003.[39] The Agni-I first became operational in 2007, three years after its introduction into the armed forces, making it the first operational member of the Agni missile family.[40] The solid-fuel Agni missiles have since become increasingly prominent in India's strategic nuclear forces,[41] with the Agni-IV possessing an approximate range of 3,500 kilometers and nearing

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[34] Hans M. Kristensen and Robert S. Norris, "Indian Nuclear Forces, 2017," *Bulletin of the Atomic Scientists*, Vol. 73, No. 4 (July 2017), pp. 205-206.
[35] Government of India, Ministry of Defense, "Annual Report 2017-18" (2018), p. 41. Available at: https://mod.gov.in/sites/default/files/Annualreport1718.pdf.
[36] Kristensen and Norris, "Indian Nuclear Forces, 2017," p. 207.
[37] Narang, *Nuclear Strategy in the Modern Era*, p. 97.
[38] For an excellent overview of the development of ballistic missiles in South Asia, see Vipin Narang, "Pride and Prejudice and Prithvis: Strategic Weapons Behavior in South Asia," in Scott D. Sagan, ed., *Inside Nuclear South Asia* (Stanford, C.A.: Stanford University Press, 2009), pp. 137-183.
[39] The Prithvi-II has an estimated range of approximately 250 kilometers. Kristensen and Norris, "Indian Nuclear Forces, 2017," pp. 206-207.
[40] Ibid., p. 207.
[41] Vice Admiral (ret.) Vijay Shankar, former commander of India's Strategic Forces Command from 2008-2009, states that "the Prithvi will go…the range makes no sense, especially with the solid-fuel Agni family in the arsenal." For this quotation and a discussion of the benefits of transitioning to the Agni missile family, see Narang, *Nuclear Strategy in the Modern Era*, pp. 98-99.

deployment.[42] The Agni-V will eventually provide India with its first intercontinental ballistic missile (ICBM) range of more than 5,000 kilometers.[43] Importantly, this improves the survivability of India's nuclear arsenal by allowing India to deploy its land-based missiles farther from the border with China, while still possessing the range to target high-value targets and major cities on China's east coast. India is also developing the Nirbhay, a ground-launched cruise missile that may also be intended for air- and sea-based deployment.[44]

The sea-based component of India's deterrent remains the least developed leg of India's nuclear triad, but India has recently made notable advancements with its nuclear-armed submarines.[45] After fifty years of research and development on nuclear propulsion, India commissioned the INS *Arihant*—India's first indigenously-built nuclear-powered and ballistic missile-capable submarine (SSBN)—in August 2016.[46] The *Arihant's* operational deployment was delayed in 2017 when it experienced major water damage to its propulsion system caused by an unsealed hatch while in port.[47] In November 2018, Prime Minister Narendra Modi announced that the *Arihant* had conducted its first deterrent patrol and completed the country's final and

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[42] Kristensen and Norris, "Indian Nuclear Forces, 2017," p. 207.
[43] Ibid., pp. 207-208.
[44] Hans M. Kristensen and Matt Korda, "Indian Nuclear Forces, 2018," *Bulletin of the Atomic Scientists*, Vol. 74, No. 6 (November 2018), p. 365.
[45] On the development of India's sea-based delivery vehicles, see: Yogesh Joshi and Frank O'Donnell, "India's Submarine Deterrent and Asian Nuclear Proliferation," *Survival*, Vol. 56, No. 4 (August/September 2014), pp. 157-174; Yogesh Joshi, Frank O'Donnell, and Harsh V. Pant, *India's Evolving Nuclear Force and Its Implications for U.S. Strategy in the Asia-Pacific* (Carlisle, P.A.: Strategic Studies Institute, 2016), pp. 8-11; Diana Wueger, "India's Nuclear-Armed Submarines: Deterrence or Danger?", *Washington Quarterly*, Vol. 39, No. 3 (Fall 2016), pp. 77-90.
[46] Zia Mian, M. V. Ramana, and A. H. Nayyar, "Nuclear Submarines in South Asia: New Risks and Dangers," *Journal for Peace and Nuclear Disarmament* (forthcoming).
[47] Dinakar Peri and Josy Joseph, "INS Arihant Left Crippled After 'Accident' 10 Months Ago," *Hindu*, January 8, 2018. Available at: https://www.thehindu.com/news/national/ins-arihant-left-crippled-after-accident-10-months-ago/article22392049.ece.

most survivable leg of the nuclear triad, although it is unclear whether nuclear weapons were carried on board during this patrol.[48]

India currently operates the Dhanush—a liquid-fueled, ship-based version of the Prithvi-II missile with a range of approximately 400 kilometers—on a pair of Sukanya-class surface vessels.[49] Once India's nuclear submarines become fully operational, however, the Dhanush will likely be retired and replaced with a pair of submarine-launched ballistic missiles (SLBMs). The K-15 SLBM was inducted into service in summer 2018, but with a limited range of only 700 kilometers, the K-15 is unable to target Islamabad and could only reach major Chinese cities from deep within the South China Sea. The K-4 SLBM has a range of 3,500 kilometers and is currently under development.[50] Once the K-4 is operational, it will likely supplant the K-15 on board India's SSBNs. The K-4 will enable India's nuclear-armed submarines to target major Pakistani and Chinese cities from safer locations in the Indian Ocean that bolster the survivability of India's sea-based nuclear platforms.

**Nuclear Command and Control in India**

India has employed highly assertive command and control measures over its arsenal for the duration of its nuclear weapons program. The operational specifics of how India maintains assertive control have evolved over time as India has developed new nuclear technologies and

[48] "INS Arihant Completes India's Nuclear Triad, PM Modi Felicitates Crew," *The Economic Times*, November 6, 2018. Available at: https://economictimes.indiatimes.com/news/defence/ins-arihant-completes-indias-nuclear-triad-pm-modi-felicitates-crew/articleshow/66509959.cms.
[49] Kristensen and Korda, "Indian Nuclear Forces, 2018," p. 365.
[50] Ibid.

modernized its arsenal, but the core principle of political control over nuclear operations remains inviolable.

Although command and control debates did not receive systematic consideration until India's overt weaponization in 1998, India's arsenal management practices from the late-1980s until the 1998 tests demonstrated a *de facto* reliance on assertive control procedures.[51] When India began developing nuclear weapons in the late-1980s, India's nuclear posture emphasized three features: limited in size, separated in disposition, and centralized in control.[52] These three features allowed political leaders to physically separate nuclear weapons across multiple governmental entities and administratively oversee all actions related to the access, movement, and potential use of nuclear weapons.

India's civilian leaders have demonstrated a consistent prioritization of negative controls over nuclear use at the expense of positive controls that would bolster arsenal readiness. As Vipin Narang notes, "Throughout much of its nuclear history, India has chosen to privilege assertive control at the expense of the ability to swiftly constitute the bulk of its nuclear weapons."[53] Because India has traditionally prioritized assertive control measures, a large portion of India's nuclear arsenal may take multiple hours or even a full day to prepare for use. Several scholars note that from the time at which India began stockpiling nuclear weapons in the late-1980s until at least the late-2000s, India would have required a significant time lag to

[51] The absence of direct discussions regarding nuclear command and control before the 1998 tests was corroborated by: Major General (ret.) Dipankar Banerjee, interview by author, January 29, 2019; Bharat Karnad, interview by author, February 4, 2019.
[52] Ashley Tellis discusses each of these features in detail in his landmark study of India's nuclear posture. Tellis, *India's Emerging Nuclear Posture*, pp. 374-466.
[53] Narang, *Nuclear Strategy in the Modern Era*, p. 103.

conduct a nuclear attack.[54] These measures increase the vulnerability of India's nuclear arsenal but allow political leaders to withhold nuclear launch authority late into crises and maintain centralized political oversight of nuclear operations under a wide range of circumstances.

Following the 1998 tests, India became the first country to publicly announce its nuclear doctrine. The 1999 draft nuclear doctrine includes a subsection that identifies six dimensions of India's nuclear command and control arrangements:

> 1. Nuclear weapons shall be tightly controlled and released for use at the highest political level. The authority to release nuclear weapons for use resides in the person of the Prime Minister of India, or the designated successor(s).
>
> 2. An effective and survivable command and control system with requisite flexibility and responsiveness shall be in place. An integrated operational plan, or a series of sequential plans, predicated on strategic objectives and a targeting policy shall form part of the system.
>
> 3. For effective employment the unity of command and control of nuclear forces including dual capable delivery systems shall be ensured.
>
> 4. The survivability of the nuclear arsenal and effective command, control, communications, computing, intelligence and information ($C_4I_2$) systems shall be assured.
>
> 5. The Indian defense forces shall be in a position to execute operations in [a nuclear/biological/chemical weapons] environment with minimal degradation.
>
> 6. Space-based and other assets shall be created to provide early warning, communications, damage/detonation assessment.[55]

These six dimensions highlight India's prioritization of assertive control. In addition to explicitly identifying the prime minister as the sole authority for nuclear use, the draft nuclear doctrine emphasizes the importance of developing survivable communications and procedures to guarantee that the prime minister's office maintains control of nuclear operations deep into

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[54] Bharat Karnad, *India's Nuclear Policy* (Westport, C.T.: Praeger, 2008), p. 99; Harsh V. Pant, "India's Nuclear Doctrine and Command Structure: Implications for India and the World," *Comparative Strategy*, Vol. 24, No. 3 (July 2005), pp. 285-286.

[55] Government of India, "Draft Report of National Security Advisory Board on Indian Nuclear Doctrine."

crises, including scenarios in which the operational environment has been degraded by nuclear, biological, or chemical weapons use.

In 2003, the Cabinet Committee on Security (CCS) revisited the 1999 nuclear draft doctrine and formally adopted many of the principles proposed in the draft doctrine.[56] The 2003 statement reinforces India's commitment to assertive command and control procedures at multiple points. For example, the statement reiterates that "Nuclear retaliatory attacks can only be authorized by the civilian political leadership through the Nuclear Command Authority."[57] Furthermore, the statement reads: "The CCS reviewed the existing command and control structures, the state of readiness, the targeting strategy for a retaliatory attack, and operating procedures for various stages of alert and launch. The committee expressed satisfaction with the overall preparedness."[58] After years of *de facto* adherence to assertive control procedures, India's 2003 declaratory doctrine provided a *de jure* basis for the continuation of assertive command and control practices.

Highly centralized administrative control has remained the central method of political control over nuclear forces in India since proliferation.[59] The 2003 CCS statement on India's nuclear doctrine led to the creation of the Nuclear Command Authority (NCA)—a formal administrative structure for the command and control of India's nuclear forces. After planning

[56] Government of India, "The Cabinet Committee on Security Reviews Operationalization of India's Nuclear Doctrine."
[57] Ibid.
[58] Ibid.
[59] For overviews of India's early commitment to assertive control, see: Gurmeet Kanwal, "Command and Control of Nuclear Weapons in India," *Strategic Analysis*, Vol. 23, No. 10 (January 2000), pp. 1707-1731; and Tellis, *India's Emerging Nuclear Posture*, pp. 251-475.

for nuclear operations through informal procedures for over 15 years, Indian policymakers deemed it necessary to manage its nuclear arsenal through more institutionalized means.[60]

The NCA entails two councils: first, a political council led by the prime minister; and second, an executive council led by the national security advisor.[61] Although the precise composition of these councils remains unclear, Harsh Pant observes that "the political council includes the members of the CCS and the national security advisor, while the executive council is composed of the chairman of the chiefs of staff committee (COSC) of the three services, the heads of intelligence agencies, and members of the scientific community associated with the nuclear program."[62]

The creation of the NCA also established an operational arm called the Strategic Forces Command (SFC). The SFC controls India's nuclear delivery platforms and is responsible for executing the orders of the prime minister and national security advisor. The development of the SFC was largely driven by the political realization that the military would ultimately be required to conduct nuclear attacks and the armed forces would need to train its personnel accordingly to improve India's retaliatory capability.[63] Although the NCA formally incorporates the military into India's command and control hierarchy, the SFC's presence in the executive council guarantees that the military remains firmly under the control of civilian leaders and can only execute nuclear orders from the appropriate political authorities.

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[60] On the informal administrative procedures during the initial phases of India's nuclear weapons program, see Perkovich, *India's Nuclear Bomb*, pp. 444-464.
[61] On the development of the NCA, see Harsh V. Pant, "India's Nuclear Doctrine and Command Structure: Implications for Civil-Military Relations in India," *Armed Forces & Society*, Vol. 33, No. 2 (January 2007), pp. 249-250.
[62] Ibid., p. 249. Also see John Cherian, "The Nuclear Button," *Frontline*, January 31, 2003.
[63] Rear Admiral (ret.) Raja Menon, interview by author, February 5, 2019.

This administrative control system guarantees that India's nuclear arsenal firmly remains under political control during peacetime and even in relatively intense crises.[64] The prime minister has the sole authority to issue orders for nuclear mobilization and use, including the assembly, movement, or release of nuclear assets.[65] The national security advisor is responsible for assisting the prime minister in the decision to use nuclear weapons and, once the decision to use nuclear weapons has been made, guaranteeing that the prime minister's orders are executed.[66] In the event of the prime minister's death, an alternate chain of command allows the prime minister's designated successor to authorize nuclear use.[67] The presence of an alternate chain of command ensures that civilian leaders can guarantee political oversight of nuclear use decisions deep into crises, even under conditions that have escalated to militarized conflict and incapacitated the prime minister and his or her immediate successors.

India's nuclear forces are organized around four levels of readiness, each of which requires direct authorization from the prime minister's office: first, arming of the weapons; second, dispersal of armed weapons to promote arsenal survivable; third, mating of nuclear weapons to delivery systems; and fourth, release of nuclear weapons to military control.[68] Each of these steps is subject to the two-man rule, requiring multiple individuals to access, move, or employ nuclear assets and strengthens administrative oversight of nuclear forces.[69] Military custodians of nuclear delivery systems operate within the SFC and execute orders as directed by the civilian-led NCA. By separating the military units responsible for conventional and nuclear

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[64] Narang, *Nuclear Strategy in the Modern Era*, p. 105.
[65] Pant, "India's Nuclear Doctrine and Command Structure: Implications for Civil-Military Relations in India," p. 249.
[66] Ibid.
[67] Ibid., pp. 250-253.
[68] For a discussion of these steps to nuclear use, see Verghese Koithara, *Managing India's Nuclear Forces* (Washington, D.C.: Brookings Institution Press, 2012), pp. 168-171.
[69] Narang, *Nuclear Strategy in the Modern Era*, p. 106.

operations, India reduces the likelihood of crossing the nuclear threshold without explicit political authorization.

Importantly, the chain of command for nuclear operations is completely separated from conventional military operations and subject to direct civilian oversight.[70] The SFC's presence in the NCA chain of command places the SFC entirely apart from conventional military units and under strict civilian supervision. This strict separation of nuclear and conventional operations creates a firewall against unauthorized nuclear use.[71] Conventional military units can only plan to retaliate against an adversary's attack with conventional forces, leaving the decision to use nuclear weapons firmly under civilian control. Furthermore, because India's regional adversaries deploy dual-use capable military platforms—platforms that can launch conventional or nuclear weapons—India is likely unable to quickly discriminate between a conventional and nuclear attack.[72] Instead, India will most likely absorb a nuclear first-strike before retaliating with nuclear force. Under these circumstances, civilian leaders would only provide the SFC control of complete nuclear platforms and the requisite targeting information after India had experienced a nuclear attack on its forces or homeland. These measures guarantee that highly centralized administrative control procedures remain in place at all times for India's nuclear arsenal.

The existing literature on command and control in India provides little information on the nature of technical controls over nuclear forces.[73] Although India does not appear to employ advanced PALs, nuclear forces are likely protected by an indigenously developed PAL

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[70] Multiple interviews corroborated the separation of conventional and nuclear chains of command, including: Major General (ret.) Dipankar Banerjee, interview by author, January 29, 2019; Manoj Joshi, interview by author, February 4, 2019; Rear Admiral (ret.) Raja Menon, interview by author, February 5, 2019.
[71] Major General (ret.) Dipankar Banerjee; Admiral (ret.) Arun Prakash, interview by author, January 29, 2019. For similar details on this arrangement, see Narang, *Nuclear Strategy in the Modern Era*, p. 107.
[72] Narang, *Nuclear Strategy in the Modern Era*, p. 107 n. 56.
[73] As Vipin Narang notes, "almost no public discussion or work exists on the state of Indian PALs." Vipin Narang, "Five Myths about India's Nuclear Posture," *Washington Quarterly*, Vol. 36, No. 3 (Summer 2013), pp. 154-155.

equivalent.[74] Multiple interviews with Indian political and military elites support this claim and offer references to the existence and importance of technical controls over nuclear assets, although details regarding the sophistication and technological specifics of these controls remain unclear.[75] In the event that India's political leaders authorize nuclear use, a code appears necessary at the final stages of deployment to arm and prepare the nuclear weapon for release across all platforms.[76]

Physical control has traditionally played an essential role in guaranteeing assertive control over nuclear forces in India.[77] To guarantee that nuclear forces only serve politically approved purposes, nuclear weapons have historically been disassembled and de-mated from delivery platforms. At least through the mid-2000s, the Department of Atomic Energy (DAE) maintained custody of the fissile pits and the DRDO managed non-fissile components, such as the nuclear triggers and detonators. Each of these civilian agencies geographically dispersed their subcomponents across multiple locations to facilitate survivability and inhibit unauthorized access to a complete nuclear device.[78] India's military forces would operate the country's delivery vehicles—such as land-based ballistic missiles and nuclear-capable aircraft—but had no direct access to nuclear weapons components. These measures of arsenal disassembly and geographic dispersion constituted a "super-PAL" that guaranteed nuclear weapons would only be used by order of the prime minister or the prime minister's designated political successor.[79]

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[74] Brigadier General (ret.) Gurmeet Kanwal, interview by author, August 4, 2016.
[75] Manoj Joshi, interview by author, February 4, 2019; Lieutenant General (ret.) Balraj Nagal, interview by author, January 17, 2019.
[76] On the "last screw" or "last code" approach to India's nuclear management operations, see Narang, *Nuclear Strategy in the Modern Era*, pp. 106-107.
[77] On India's early physical control arrangements, see Tellis, *India's Emerging Nuclear Posture*, pp. 401-428.
[78] Narang, *Nuclear Strategy in the Modern Era*, p. 101
[79] Tellis, *India's Emerging Nuclear Posture*, p. 433.

Despite the apparent continuity in India's nuclear doctrine over time, some analysts have recently suggested that India may be changing its strategic and operational nuclear doctrines.[80] Recent research by Christopher Clary and Vipin Narang provides the most pointed example of this argument. Clary and Narang argue that India is consciously seeking more flexible nuclear options that may indicate a shift from a strictly second-strike nuclear posture to a doctrine that incorporates counterforce capabilities that would allow India to target Pakistan's strategic nuclear assets in a nuclear first-strike.[81] In addition to observable changes in the composition of India's nuclear arsenal, several retired high-level Indian officials have made statements that appear to give credence to this strategic shift.[82] As a result, Clary and Narang find that India's command and control procedures are likely becoming more responsive and less assertively controlled.

Specifically, India's increasing reliance on canisterized systems undermines the physical separation and dispersal of nuclear components on which India has based its assertive control procedures for decades.[83] Canisterized systems pre-mate warheads to delivery platforms to protect solid fuel stores from external elements, increase the lifespan of the missile, allow for easier handling of the missile, and enable the missile to be launched from almost any location, rather than requiring a fixed launch site.[84] Furthermore, canisterization increases arsenal

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[80] For examples, see: Christopher Clary and Vipin Narang, "India's Counterforce Temptations: Strategic Dilemmas, Doctrine, and Capabilities," *International Security*, Vol. 43, No. 3 (Winter 2018/19), pp. 7-52; Narang, "Five Myths about India's Nuclear Posture," pp. 143-157; Kumar Sundaram and M. V. Ramana, "India and the Policy of No First Use of Nuclear Weapons," *Journal for Peace and Nuclear Disarmament*, Vol. 1, No. 1 (January 2018), pp. 152-168; Michael Tkacik, "India Nuclear Weapons: No First Use or No Full Disclosure?", *Defence Studies*, Vol. 17, No. 1 (January 2017), pp. 84-109. For an alternative perspective, see Gaurav Kampani, "Is the Indian Nuclear Tiger Changing Its Stripes?", *Nonproliferation Review*, Vol. 21, Nos. 3-4 (October 2014), pp. 383-398.

[81] Clary and Narang, "India's Counterforce Temptations."

[82] For examples, see: Balraj Nagal, "India's Nuclear Strategy to Deter: Massive Retaliation to Cause Unacceptable Damage," *Claws Journal* (Winter 2015), p. 13; Ajai Shukla, "After a Pakistani TNW Strike, India Can Go for Pakistan's Nuclear Arsenal: Former NSA Shivshankar Menon," *Business Standard*, March 18, 2017.

[83] Clary and Narang, "India's Counterforce Temptations," pp. 36-38.

[84] Sundaram and Ramana, "India and the Policy of No First Use of Nuclear Weapons," p. 162.

readiness and decreases the length of the launch process by eliminating numerous preparatory steps before launching a missile. As India continues to canisterize a larger portion of its nuclear arsenal, its reliance on extremely assertive physical controls is unlikely to persist.

These challenges to assertive control appear especially pronounced as India develops its SLBM capabilities. Space limitations onboard submarines force SLBMs to be canisterized, and because the core mission of nuclear submarines is to bolster survivability and strengthen a state's retaliatory capability under any conditions, submarine commanders often possess greater autonomy over nuclear use decisions than other platforms. India's recent progress in its SSBN program suggest that the pressures of at-sea deterrence will place additional pressure on India's historically assertive command and control procedures.

Clary and Narang correctly note an increasing reliance on canisterized systems that favor arsenal readiness, but India's command and control practices remain highly assertive and appear likely to endure as the arsenal develops.[85] Lieutenant General (ret.) Balraj Nagal, commander-in-chief of India's SFC from 2008-2010, referred to India's increased deployment of canisterized systems as a natural evolution of nuclear capabilities simply aimed at improving the quality of India's nuclear arsenal.[86] Arvind Gupta, India's deputy national security advisor from 2014-2017, provides further support for this perspective, noting that strict civilian oversight of nuclear operations will remain an unassailable "guiding principle" of India's command and control procedures in the future.[87]

[85] The likely expansion of canisterized platforms was corroborated by Rear Admiral (ret.) Raja Menon, interview by author, February 5, 2019.
[86] Lieutenant General (ret.) Balraj Nagal, interview by author, January 17, 2019.
[87] Arvind Gupta, interview by author, February 5, 2019.

As physical controls become less constraining on nuclear use, India is bolstering its technical and administrative control procedures. Fail-safe technologies are present on all of India's current nuclear weapons, and both civilian and military elites expect robust technical and administrative controls to manage India's emerging sea-based capabilities. For example, efforts are currently underway to improve communications with deployed submarines and administrative procedures to guarantee that civilians retain strict political control over nuclear use decisions.[88] Admiral (ret.) Arun Prakash—Chief of the Naval Staff and Chairman of the Chiefs of Staff Committee from 2004-2006—doubts that the Indian Navy exercises autonomous control of nuclear-capable submarines.[89] Although the underlying capabilities of India's nuclear arsenal are evolving, a commitment to strictly assertive control measures remains central to India's command and control practices.

**Explaining Assertive Control in India**

India's persistent employment of assertive command and control procedures aligns with the expected outcome of my theoretical framework, but does this outcome occur for the reasons predicted by my theory? I argue that the Indian case supports two major implications of my theory. First, despite a complex external threat environment that includes nuclear, conventional, and subconventional threats to India's security from two regional adversaries, India's conventional military security facilitates assertive control procedures. Indeed, multiple interviews with political and military elites indicate that India's decision-makers view the

[88] Ibid.; Rear Admiral (ret.) Raja Menon, interview by author, February 5, 2019; Lieutenant General (ret.) Balraj Nagal, interview by author, January 17, 2019.
[89] Admiral (ret.) Arun Prakash, interview by author, January 29, 2019.

conventional security environment as secure and permissive for assertive control. Second, India's conventional security and domestic political stability interact to produce a favorable threat environment that leads civil-military relations to influence command and control decisions. Specifically, the Indian military's low levels of organizational autonomy have translated into the nuclear realm and resulted in the purposeful exclusion of military influence in nuclear doctrine. As a result, civilian elites have instituted and maintained highly assertive command and control systems over India's nuclear arsenal.

*Threat Environment: Conventional Security and Domestic Stability*

India has experienced an array of external security challenges since achieving independence in 1947, ranging from subconventional militant incursions to adversarial relations with multiple nuclear powers. Despite the presence of numerous external threats to Indian security, however, I argue that India's conventional security has allowed domestic-level factors to determine command and control outcomes. Because India does not face a conventionally superior adversary with the capability and intent to achieve rapid and significant military gains, India's political leaders do not possess incentives to lower the threshold to nuclear use and instead maintain highly assertive patterns of command and control.

India has an extensive history of conventional military conflict with its neighbors. India faces an enduring border dispute with China dating back to the 1962 Sino-Indian War in which Chinese forces decisively defeated India's military in battle.[90] This border dispute remains

[90] For a historical overview of the 1962 Sino-Indian War and the resulting border disputes between India and China, see M. Taylor Fravel, *Strong Borders, Secure Nation: Cooperation and Conflict in China's Territorial Disputes* (Princeton, N.J.: Princeton University Press, 2008), chapter 4. On the domestic implications of this dispute in India,

unresolved, with both China and India continuing to deploy significant military forces to the region. Furthermore, India has engaged in numerous militarized crises and disputes with Pakistan. After two conflicts over control of Kashmir in 1947 and 1965, India intervened in support of East Pakistan's Bengali population with significant military force to decisively defeat Pakistani forces, severing Pakistan in two and resulting in the independent state of Bangladesh. In the years immediately following Indian independence, conventional military conflict became a central aspect of India's external security environment.

Despite a prolonged history of militarized conflict with China and Pakistan, however, India's political leaders have retained strictly assertive control over nuclear operations. The mountainous border with China limits the potential avenues for an offensive incursion and provides India with a defensively advantageous position that facilitates a defense-in-depth strategy, making a conventional Chinese attack on Indian territory unlikely to existentially threaten India's territorial sovereignty.[91] Interviews with senior military and civilian officials confirm that threat assessments by Indian elites reflect these circumstances, with leaders viewing the conventional threat from China as non-existential and unlikely to escalate into a broader conflict.[92] Nuclear weapons therefore provide an "insurance policy" against conventional attacks by China,[93] allowing civilian leaders to maintain centralized control over nuclear decisions.[94]

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see Srinath Raghavan, "Civil-Military Relations in India: The China Crisis and After," *Journal of Strategic Studies*, Vol. 32, No. 1 (February 2009), pp. 397-446.

[91] Narang, *Nuclear Strategy in the Modern Era*, pp. 111-112.

[92] Major General (ret.) Dipankar Banerjee, interview by author, January 29, 2019; Admiral (ret.) Arun Prakash, interview by author, January 29, 2019; Rear Admiral (ret.) Raja Menon, interview by author, February 5, 2019.

[93] Arvind Gupta, interview by author, February 5, 2019.

[94] Manoj Joshi, interview by author, February 4, 2019.

With respect to Pakistan, India enjoys clear numerical conventional superiority in land, air, and sea capabilities.[95] Bharat Karnad—a member of the first National Security Advisory Board (NSAB) which produced India's 1999 draft nuclear doctrine—suggests that Pakistan's conventional inferiority limited its influence on India's earliest command and control decisions and continues to be a low-priority threat.[96] Combined, the inability of China and Pakistan to pose an existential threat to Indian security with conventional military forces allows India's political leaders to maintain assertive command and control practices.

China and Pakistan also pose a range of nuclear threats to India's security. China has recently pursued a nuclear modernization program to bolster its second-strike capabilities,[97] resulting in a stockpile of nearly 300 nuclear warheads deliverable by land- and sea-based ballistic missiles and air-delivered gravity bombs.[98] Analysts further expect China to increase the number of land-based missiles with multiple independently targetable reentry vehicles (MIRVs),[99] which will improve China's offensive nuclear capabilities.[100] Pakistan's arsenal also continues to grow and diversify, with an arsenal of approximately 140-150 warheads deliverable by land- and air-based platforms.[101] Notably, Pakistan's arsenal includes the Nasr/Hatf-IX

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[95] Narang, *Nuclear Strategy in the Modern Era*, p. 111; Ashley J. Tellis, *Strategic Stability in South Asia*, Arroyo Center Document Briefing (Santa Monica, C.A.: RAND Corporation, 1997), pp. 12-33.
[96] Bharat Karnad, interview by author, February 4, 2019.
[97] On China's continuing modernization efforts to strengthen its assured retaliation capabilities, see Fiona S. Cunningham and M. Taylor Fravel, "Assuring Assured Retaliation: China's Nuclear Posture and U.S.-China Strategic Stability," *International Security*, Vol. 40, No. 2 (Fall 2015), pp. 7-50.
[98] Hans M. Kristensen and Robert S. Norris, "Chinese Nuclear Forces, 2018," *Bulletin of the Atomic Scientists*, Vol. 74, No. 4 (July 2018), pp. 289-295.
[99] Ibid., p. 289.
[100] Brendan R. Green and Austin Long, "The MAD Who Wasn't There: Soviet Reactions to the Late Cold War Nuclear Balance," *Security Studies*, Vol. 26, No. 4 (October 2017), p. 609.
[101] Hans M. Kristensen, Robert S. Norris, and Julia Diamond, "Pakistani Nuclear Forces, 2018," *Bulletin of the Atomic Scientists*, Vol. 74, No. 5 (September 2018), pp. 348-358.

missile system—a tactical nuclear platform with a maximum range of approximately 60-70 kilometers that presents a unique challenge to India's security.[102]

Although India shares borders with two nuclear states possessing a breadth of nuclear capabilities, India's command and control systems remain assertive. As predicted by my theoretical framework, given a relatively benign conventional threat environment, Indian policymakers view nuclear weapons as tools for deterring nuclear aggression by China and Pakistan. Indeed, Manoj Joshi—a former NSAB member within India's National Security Council—explicitly noted that the absence of existential conventional threats allows India to narrowly employ nuclear weapons as deterrents against other nuclear arsenals.[103] Whereas conventional threats to Indian security would incentivize the delegation of nuclear authority, the presence of two nuclear rivals does not similarly compel India's civilian elites to entrust the military with nuclear autonomy. Instead, India's political leaders maintain highly centralized control over nuclear use decisions.

In addition to large-scale conventional and nuclear threats, India also faces acts of state-sponsored terrorism by Pakistan.[104] Although Indian policymakers hoped that overtly testing nuclear weapons in 1998 might reduce Pakistan's support for subconventional attacks against India, the opposite result occurred. Instead, Pakistan used the seemingly greater threat of nuclear escalation to continue its support for terrorist groups, including the 1999 attacks that began the

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[102] On Pakistan's Nasr/Hatf-IX platform, see: Feroz Hassan Khan, "Going Tactical: Pakistan's Nuclear Posture and Implications for Stability," *Proliferation Papers*, No. 53 (September 2015); Jaganath Sankaran, "Pakistan's Battlefield Nuclear Policy: A Risky Solution to an Exaggerated Threat," *International Security,* Vol. 39, No. 3 (Winter 2014/15), pp. 118-151.
[103] Manoj Joshi, interview by author, February 4, 2019.
[104] On the role of militant proxies in Pakistan's foreign policy, see S. Paul Kapur, *Jihad as Grand Strategy: Islamist Militancy, National Security, and the Pakistani State* (Oxford: Oxford University Press, 2016).

Kargil War.[105] The challenges of countering Pakistan's sponsorship of subconventional attacks have become even greater since the deployment of the Nasr/Hatf-IX tactical weapon platform, which threatens the first-use of nuclear weapons in response to conventional aggression.[106] Nevertheless, these challenges have not caused India to contemplate more delegative command and control frameworks. Although India's policymakers view Pakistan's use of tactical nuclear weapons to create a shield behind which to support subconventional attacks as a severe foreign policy challenge, the delegation of nuclear authority is not considered to be a viable policy response.[107]

Instead, India's military forces have developed "proactive strategy operations"—commonly referred to as Cold Start—to deter Pakistan-sponsored terrorist attacks.[108] The goal of the Cold Start doctrine is to "establish the capacity to launch a retaliatory conventional strike against Pakistan that would inflict significant harm on the Pakistan Army before the international community could intercede, and at the same time, pursue narrow enough aims to deny Islamabad a justification to escalate the clash to the nuclear level."[109] This would entail India rapidly massing ground and airpower to make limited territorial gains—perhaps as shallow as 50 kilometers into Pakistani territory—and then use these territorial gains to extract concessions

[105] On Pakistan's use of the nuclear umbrella to conduct subconventional attacks against India, see S. Paul Kapur, "India and Pakistan's Unstable Peace: Why Nuclear South Asia Is Not Like Cold War Europe," *International Security*, Vol. 30, No. 2 (Fall 2005), pp. 127-152.
[106] On the evolution of Pakistan's doctrine to include first-use nuclear options, see Vipin Narang, "Posturing for Peace? Pakistan's Nuclear Postures and South Asian Stability," *International Security*, Vol. 34, No. 3 (Winter 2009/10), pp. 38-78.
[107] Major General (ret.) Dipankar Banerjee, interview by author, January 29, 2019; Arvind Gupta, interview by author, February 5, 2019.
[108] Walter C. Ladwig III, "A Cold Start for Hot Wars? The Indian Army's New Limited War Doctrine," *International Security*, Vol. 32, No. 3 (Winter 2007/08), pp. 158-190. The existence and continued study of "proactive strategy options" similar to the Cold Start doctrine was corroborated by Brigadier General (ret.) Gurmeet Kanwal, interview by author, August 4, 2016.
[109] Ladwig III, "A Cold Start for Hot Wars?", p. 164.

from Pakistan in post-conflict negotiations.[110] Although Cold Start faces numerous challenges and has failed to deter Pakistani support for subconventional attacks, the continued study of proactive strategy operations further demonstrates India's reliance on conventional military forces to address non-nuclear threats.[111] As a result, India's reliance on assertive command and control procedures remains unchallenged by external security threats.

In addition to its external security, India's political regime has remained insulated from domestic threats for the duration of its nuclear weapons program. To the extent that India has experienced domestic instability, this instability has come in the form of inter-caste conflicts and nationalist movements.[112] Since independence, the Congress Party—India's historically predominant political party—has provided a highly institutionalized democratic party with broad ethnic support that seeks to reduce social cleavages.[113] Although ethnic tensions remain prevalent, India's democratic system continues to function without significant threats to the established political order. Furthermore, India's military organizations have remained uninvolved in politics and do not pose a threat to civilian leaders. Despite occasional tensions between civilian leaders and military organizations—especially during the initial period after Indian independence—P. R. Chari notes: "at no time was the basic principle of civilian supremacy questioned or challenged."[114] Combined, India's external conventional security and

[110] Ibid., pp. 163-167.
[111] On the shortcomings and limitations of proactive strategy operations such as Cold Start, see: Shashank Joshi, "India's Military Instrument: A Doctrine Stillborn," *Journal of Strategic Studies*, Vol. 36, No. 4 (August 2013), pp. 512-540; Ladwig III, "A Cold Start for Hot Wars?"; Walter C. Ladwig III, "Indian Military Modernization and Conventional Deterrence in South Asia," *Journal of Strategic Studies*, Vol. 38, No. 5 (July 2015), pp. 729-772.
[112] For an overview of the presence of domestic tensions and conflict in India, see Paul R. Brass, *The Politics of India Since Independence*, 2d ed. (New York, N.Y.: Cambridge University Press, 1994).
[113] This argument is most clearly articulated by Steven I. Wilkinson, *Army and Nation: The Military and Indian Democracy Since Independence* (Cambridge, M.A.: Harvard University Press, 2015).
[114] P. R. Chari, "Civil-Military Relations in India," *Armed Forces & Society*, Vol. 4, No. 1 (November 1977), p. 3.

domestic political stability have generated a permissive threat environment that allows for India's civil-military relations to influence command and control decisions.

*Military Organizational Autonomy*

Strict civilian control of the military has a long legacy in India's civil-military relations. India's first prime minister Jawaharlal Nehru "thoroughly indoctrinated" the military with the principles of civilian control in the early years of independence.[115] Nehru's subjugation of military forces to strict civilian oversight reflected his disdain and distrust of the military. As Stephen Cohen observes in his influential study on India's strategic and military power, Nehru "brought to the office [of the prime minister] a strong distaste for armed forces and things military."[116] Additionally, Nehru viewed the Indian Army as an untrustworthy tool of the British Raj. P. R. Chari supports this view, stating that "The Indian political leadership had developed in circumstances which predisposed it to an antipathy for the civil administrators and armed forces, who had been utilized as the instruments of foreign domination."[117] As a result, Nehru prioritized economic development and state capacity over military power during the aftermath of decolonization.[118] India's civilian leaders only became increasingly wary of military influence in

[115] For this statement and details on institutional changes, see Stephen P. Cohen, *The Indian Army: Its Contribution to the Development of a Nation* (Berkeley, C.A.: University of California Press: 1971), pp. 170-177. Also see Stephen P. Rosen, *Societies and Military Power: India and its Armies* (Ithaca, N.Y.: Cornell University Press, 1996), especially pp. 197-256.
[116] Stephen P. Cohen, *India: Emerging Power* (Washington, D.C.: Brookings Institution Press, 2001), p. 128.
[117] Chari, "Civil-Military Relations in India," p. 10.
[118] Cohen, *India*, p. 128.

politics as they watched Pakistan's General Ayub Khan successfully lead the first military takeover of the Pakistani government in 1958.[119]

Over time, India's civilians have tightened control over all aspects of military affairs, including acquisitions, training, and recruitment.[120] Two critical changes occurred shortly after Indian independence in 1947 that institutionally cemented civilian control of the military.[121] First, civilian elites abolished the post of the military commander-in-chief, which had served as the primary military advisor to the civilian government. In her study of India's civil-military relations, Ayesha Ray notes that "The abolition of the post of Commander in Chief was felt necessary by India's political leadership to prevent the Indian armed forces from directly challenging civilian authority."[122] Second, Indian leaders established the Ministry of Defense to act as an intermediary between civilian and military leaders to minimize the threats to civilian control.[123] The institutionalized marginalization of the military has since remained a core tenet of Indian civil-military relations and in nearly every regard India's military experiences exceptionally low levels of organizational autonomy.

The institutionalized distrust of the military extends to the nuclear realm. India's nuclear weapons program developed exclusively under the supervision of political leaders and civilian scientists. During this period, scientists exercised particularly strong influence over the trajectory of the nuclear program, as they had direct access to the prime minister's office and control over

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[119] Stephen P. Cohen, "The Military and Indian Democracy," in Atul Kohli, ed., *India's Democracy: An Analysis of Changing State-Society Relations* (Princeton, N.J.: Princeton University Press, 1988), pp. 99-143. For more on civilian mistrust of the military, see Wilkinson, *Army and Nation*.
[120] Narang, *Nuclear Strategy in the Modern Era*, p. 114.
[121] Both of these points are noted in Pant, "India's Nuclear Doctrine and Command Structure: Implications for Civil-Military Relations in India," p. 243. Also see Cohen, *The Indian Army*, pp. 17-173.
[122] Ayesha Ray, *The Soldier and the State in India: Nuclear Weapons, Counterinsurgency, and the Transformation of Indian Civil-Military Relations* (Thousand Oaks, C.A.: SAGE, 2013) p. 37.
[123] Ibid., pp. 37-38.

many budgetary decisions.[124] Political leaders excluded the military from deliberations regarding the 1974 nuclear test and, although India's capacity to develop nuclear weapons became clear after the 1974 test, the military did not plan for the incorporation of nuclear weapons into its force structure.[125] The 1986 Brasstacks crisis between India and Pakistan demonstrates the lack of military knowledge regarding the nuclear program, as India's military leaders were uncertain about their ability to deliver nuclear warheads if the crisis escalated to a level that warranted nuclear use.[126] Gaurav Kampani's research suggests that civilian leaders purposefully sought to withhold autonomy from military organizations in the nuclear realm. As Kampani states: "Until 1998, the air force was the only military service with any knowledge of the weaponization program because of its role in delivering the weapons. But even as the user service tasked with delivery, until the early 1990s, it only participated in the weaponization program at the margins."[127]

From its inception, India's nuclear weapons program was political rather than military in purpose.[128] When civilian elites began to fashion an official nuclear doctrine after the 1998 tests, leaders prioritized the political objective of maintaining centralized control of nuclear decisions over the military applications and implications of an operational nuclear capability. Political leaders exhibited a preference for air-delivery platforms due to their safe and secure delivery methods that facilitate assertive control.[129] In practice, by the mid-1990s a nuclear response from

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[124] Rear Admiral (ret.) Raja Menon, interview by author, February 5, 2019. On the role of civilian scientists in the development of India's nuclear program, see Perkovich, *India's Nuclear Bomb*.
[125] Richard B. White, "Command and Control of India's Nuclear Forces," *Nonproliferation Review*, Vol. 21, Nos. 3-4 (2014), p. 263.
[126] Pant, "India's Nuclear Doctrine and Command Structure: Implications for Civil-Military Relations in India," p. 244. On the Brasstacks crisis, see P. R. Chari, Pervaiz Iqbal Cheema, and Stephen P. Cohen, *Four Crises and a Peace Process: American Engagement in South Asia* (Washington, D.C.: Brookings Institution Press, 2007), pp. 39-79.
[127] Kampani, "New Delhi's Long Nuclear Journey," p. 94.
[128] Perkovich, *India's Nuclear Bomb*, p. 178.
[129] Chengappa, *Weapons of Peace*, pp. 331-332; Kampani, "New Delhi's Long Nuclear Journey," p. 91.

India would require: first, the DAE would assess the political situation and, if the DAE deemed it appropriate, pass the fissile cores to the DRDO; second, the DRDO would fully assemble the nuclear weapons; and third, the DRDO would deliver the fully assembled weapons to the Indian Air Force.[130] Emergency drills were highly informal and unpracticed at this time and, as recounted by Gaurav Kampani, "Command and control essentially meant gathering all the members of the group (nuclear network) under one roof as quickly as possible."[131] These command and control procedures allowed India to maintain its nuclear deterrent "force in being" without requiring delegation to nuclear commanders.[132]

The group responsible for drafting India's nuclear doctrine had almost no experts on nuclear strategy and operations on the committee, resulting in very little attention to operationalizing the arsenal.[133] According to Admiral (ret.) Arun Prakash, a key driver of the emphasis on centralized control during this phase was the fear that providing the military access to nuclear weapons would grant the military an unacceptable lever of domestic power with which to challenge civilian authority.[134] Vice Admiral (ret.) Verghese Koithara supports this perspective, noting that civilians have systematically resisted incorporating the military into the nuclear chain of command. Koithara argues that "Keeping the military at arm's length and sidelining military competencies the way India has done has no parallel in global nuclear

[130] Kampani, "New Delhi's Long Nuclear Journey," p. 99.
[131] Ibid., pp. 100-101.
[132] Narang, *Nuclear Strategy in the Modern Era*, p. 98.
[133] Bharat Karnad, interview by author, February 4, 2019.
[134] Admiral (ret.) Arun Prakash, interview by author, January 29, 2019.

weapons development history."[135] Instead, India's political leaders have traditionally preferred to consult DAE and DRDO scientists on nuclear matters.[136]

The fear of a unified military body remains the primary reason for civilian opposition to the establishment of a chief of defense staff (CDS) post for the military.[137] The CDS would be functionally similar to the U.S. chairman of joint chiefs of staff, with a single military officer coordinating military affairs across services and providing a single point of counsel to the prime minister. Several senior officers have openly called for the establishment of a CDS to improve jointness between India's services and allow the military to inform policy debates.[138]

Multiple committees have also advocated for the creation of a CDS. For example, the Kargil Review Committee—organized in 1999 to review national security matters after India's slow and ineffective response to a group of Pakistan Army paramilitary and proxy fighters occupying a portion of territory in Kashmir—argued in favor of replacing the COSC with a CDS.[139] The report bluntly states: "The COSC has not been effective in fulfilling its mandate. It needs to be strengthened by the addition of a CDS and a Vice-Chief of Defense Staff (VCDS)."[140] Similarly, the 2011-2012 Naresh Chandra Committee reviewed India's defense management practices and advocated for the creation of a permanent chairman of the COSC.[141]

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[135] Koithara, *Managing India's Nuclear Forces*, p. 91. Also see Perkovich, *India's Nuclear Bomb*, p. 450; Tellis, *India's Emerging Nuclear Posture*, p. 282.
[136] This reliance on DAE and DRDO input was especially pronounce during the 1980s and 1990s as India continued to weaponize its arsenal. Kampani, "New Delhi's Long Nuclear Journey," p. 93.
[137] Although the evidence offered in this section discuss contemporary debates regarding the establishment of a CDS, the debate has much deeper roots. For example, see Chari, "Civil-Military Relations in India," pp. 23-24.
[138] Brigadier General (ret.) Gurmeet Kanwal, interview by author, August 4, 2016; Admiral (ret.) Arun Prakash, interview by author, January 29, 2019. Also see Arun Prakash, "India's Nuclear Deterrent: The More Things Change…," Policy Report (Singapore: S. Rajaratnam School of International Studies, March 2014).
[139] For a history of the Kargil Conflict, see Chari, Cheema, and Cohen, *Four Crises and a Peace Process*, pp. 118-148.
[140] Kargil Review Committee, "Report of the Group of Ministers on National Security," February 2000, p. 100.
[141] Manoj Joshi, interview by author, February 4, 2019.

The CDS position would allow the chairman of the COSC to relay information between the prime minister's office and SFC and focus entirely on strategic military debates, rather than also considering service-specific issues.[142] Nevertheless, the fear of military influence in political affairs continues to inhibit institutional change and the development of a unified military command.[143]

The same fears preventing the establishment of the CDS post have also reinforced the division between conventional and nuclear operational planning. Rear Admiral (ret.) Raja Menon—one of India's foremost strategic thinkers—suggests that the core motivation for maintaining this division is the concern that unifying both domains under a single military command would result in a loss of civilian oversight and empower the military to influence policy.[144] As a result, some analysts worry that inadvertent escalation during crises is more likely, as the military's lack of training on the connections between conventional and nuclear disputes precludes proper planning procedures.[145] For their part, senior civilians maintain that the military's official role in the NCA provides the military with a sufficient point of access for informing nuclear policy debates.[146]

The institutional structure of the SFC illustrates the lack of military influence in nuclear decision-making processes. Although the military's service chiefs can advise the NCA's political council if requested by civilian leaders during a crisis, the service chiefs do not regularly meet with the political council.[147] Furthermore, the SFC cannot interact with the DAE or DRDO

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[142] These benefits of a permanent chief of the COSC or CDS-equivalent were noted by Admiral (ret.) Arun Prakash, interview by author, January 29, 2019. Also see Prakash, "India's Nuclear Deterrent," p. 3.
[143] Manoj Joshi, interview by author, February 4, 2019.
[144] Rear Admiral (ret.) Raja Menon, interview by author, February 5, 2019.
[145] Major General (ret.) Dipankar Banerjee, interview by author, January 29, 2019; Manoj Joshi, interview by author, February 4, 2019.
[146] Arvind Gupta, interview by author, February 5, 2019.
[147] White, "Command and Control of India's Nuclear Forces," p. 267.

unless approved by the NCA.[148] On an institutional level, the military has been so thoroughly excluded from launch authority processes that this division has been referred to as "a policy of segregation."[149]

The SFC also experiences a pair of internal challenges that reduce the likelihood of the military challenging civilian leadership. First, the SFC is a tri-service command, meaning that general officers from the Indian Army, Navy, and Air Force take turns directing the SFC. This rotation of officers keeps the military disorganized and prevents any single service from dominating nuclear debates and posing a challenge to political authority.[150] Second, because many commander-in-chiefs of the SFC return to another role after their SFC posting, these officers cannot risk challenging their civilian superiors without simultaneously threatening their future career trajectory.[151] Ultimately, these conditions make it so that the military has enough structure to execute civilian mandates, but with minimal organizational autonomy and capacity to influence nuclear policy.

**Evaluating the Explanations**

The Indian case offers support for my theoretical framework. Throughout its nuclear experience, India has adopted highly assertive patterns of command and control. Despite a complex security environment that includes a range of nuclear, conventional, and subconventional threats, India's conventional security allows political leaders to maintain

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[148] Narang, *Nuclear Strategy in the Modern Era*, pp. 105-106.
[149] Arun Prakash, "9 Minutes to Midnight," *Force Magazine*, July 2012, p. 4, as cited in Narang, *Nuclear Strategy in the Modern Era*, p. 107.
[150] Manoj Joshi, interview by author, February 4, 2019; Admiral (ret.) Arun Prakash, interview by author, January 29, 2019.
[151] Rear Admiral (ret.) Raja Menon, interview by author, February 5, 2019.

centralized control over nuclear weapons decisions. The interaction of India's conventional security and domestic political stability produce a permissive threat environment that make civil-military relations essential for explaining India's nuclear management practices. Specifically, India's low levels of military organizational autonomy translate into the nuclear realm and result in civilian leaders exercising strictly assertive control over nuclear forces.

The three alternative explanations to my theoretical framework experience mixed results. First, the civil-military stability hypothesis fails to explain India's assertive nuclear command and control arrangements. The civil-military stability hypothesis predicts that India's history of stable civil-military relations would create a sense of trust between civilian authorities and military operators that produces delegative command and control arrangements. Given the unquestioned supremacy of civilian authority within India's military organizations and an absence of attempted military interventions in politics, India provides an easy test for this argument. Nevertheless, whereas the civil-military stability hypothesis predicts delegative control, India's assertive command and control systems demonstrate the opposite behavior as predicted by this hypothesis. My argument agrees that civil-military relations matter for command and control outcomes under certain conditions, but rather than the stability of civil-military relations, I demonstrate that it is the level of military organizational autonomy that explains assertive command and control systems in India.

Second, the arsenal vulnerability hypothesis poorly explains India's assertive command and control arrangements. This hypothesis predicts that an increased vulnerability of physical nuclear assets or the supporting command and control infrastructure should cause India to adopt more delegative command and control systems. Two problems emerge for this hypothesis. First, India's command and control decisions have not been responsive to shifts in the regional nuclear

balance of power. For example, despite possessing loosely planned and poorly institutionalized command and control procedures that made India vulnerable to nuclear decapitation before establishing the SFC in 2003, Indian leaders maintained highly centralized assertive control over nuclear weapons during this period. Furthermore, India's command and control systems have remained assertive while its regional adversaries expand their offensive nuclear capabilities, including China's nuclear modernization program. Second, interviews with political and military elites in India revealed an emphasis on conventional threats in command and control deliberations, rather than nuclear threats and vulnerabilities. Guaranteeing the survivability of command and control systems has been a priority in India since the release of the 1999 draft nuclear doctrine, but the vulnerability of India's nuclear arsenal has not led to delegative command and control systems. Instead, my theory demonstrates that India's conventional security reduces the incentives for India to delegate control and lower the nuclear threshold to deter conventional attacks, allowing civilian elites to maintain assertive control over India's nuclear arsenal.

Third, the strategic rationale hypothesis offers the most persuasive alternative explanation to explain assertive command and control in India. The strategic rationale hypothesis predicts that India's adherence to a late-use assured retaliation posture allows political leaders to centralize control over nuclear operations late into a crisis. Indeed, the evidence demonstrates a strong correlation between India's nuclear strategy and command and control arrangements and a declaratory commitment to the principle of no first-use.[152] However, differentiating the effects of the strategic rationale hypothesis from my theory is made difficult by the effects of the variables

[152] India's firm commitment to the principle of no first-use was corroborated by Major General (ret.) Dipankar Banerjee, interview by author, January 29, 2019; Arvind Gupta, interview by author, February 5, 2019; Manoj Joshi, interview by author, February 4, 2019; Rear Admiral (ret.) Raja Menon, interview by author, February 5, 2019.

within my theoretical framework on India's nuclear posture. For example, Vipin Narang notes that "India is in a relatively secure position but with highly assertive civil-military relations, driving it toward an assured retaliation posture."[153] One possibility, therefore, is that the factors that my theory identifies to explain command and control systems also influence India's strategic nuclear doctrine. Furthermore, although the strategic rationale hypothesis contributes to the explanation for India's command and control arrangements, my theory's emphasis on India's low levels of military organizational autonomy receives substantial support from interviews with Indian political and military elites. In sum, these observations suggest that the strategic rationale hypothesis supplements my theory, rather than competing with it.

[153] Narang, *Nuclear Strategy in the Modern Era*, p. 94.

# CHAPTER 4

## PAKISTAN

A substantial literature addresses the effects of nuclear weapons on conflict behavior and crisis stability in South Asia,[1] but the operational dimensions of nuclear doctrine typically receive less attention than these strategic considerations.[2] The primary motivation for analysts to study Pakistan's nuclear command and control systems has traditionally stemmed from persistent concerns regarding domestic terrorists and religious extremists within civilian bodies and military organizations.[3] My study of Pakistan's nuclear command and control arrangements advances current understandings of nuclear operations in Pakistan by emphasizing the political and strategic sources of command and control decisions, as well as providing a novel conceptual framework for classifying Pakistan's command and control systems.

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[1] Influential works include: Lowell Dittmer, "South Asia's Security Dilemma," *Asian Survey*, Vol. 41, No. 6 (November/December 2001), pp. 897-906; Sumit Ganguly, "Nuclear Stability in South Asia," *International Security*, Vol. 33, No. 2 (Fall 2008), pp. 45-70; Sumit Ganguly and S. Paul Kapur, *India, Pakistan, and the Bomb: Debating Nuclear Stability in South Asia* (New York, N.Y.: Columbia University Press, 2010); Devin T. Hagerty, "Nuclear Deterrence in South Asia: The 1990 Indo-Pakistani Crisis," *International Security*, Vol. 20, No. 3 (Winter 1995/96), pp. 79-114; S. Paul Kapur, *Dangerous Deterrent: Nuclear Weapons Proliferation and Conflict in South Asia* (Stanford, C.A.: Stanford University Press, 2007); S. Paul Kapur, "India and Pakistan's Unstable Peace: Why Nuclear South Asia Is Not Like Cold War Europe," *International Security*, Vol. 30, No. 2 (Fall 2005), pp. 127-152; S. Paul Kapur, "Ten Years of Instability in a Nuclear South Asia," *International Security*, Vol. 33, No. 2 (Fall 2008), pp. 71-94; and Scott D. Sagan, "The Perils of Proliferation in South Asia," *Asian Survey*, Vol. 41, No. 6 (November/December 2001), pp. 1064-1086.

[2] Several notable exceptions include: Feroz Hassan Khan, "Challenges to Nuclear Stability in South Asia," *Nonproliferation Review*, Vol. 10, No. 1 (Spring 2003), pp. 59-74; Feroz Hassan Khan, "Nuclear Command-and-Control in South Asia During Peace, Crisis, and War," *Contemporary South Asia*, Vol. 14, No. 2 (June 2005), pp. 163-174; Vipin Narang, "Posturing for Peace? Pakistan's Nuclear Postures and South Asian Stability," *International Security*, Vol. 34, No. 3 (Winter 2009/10), pp. 38-78.

[3] A volume from 2008 includes multiple contributions that address the range of potential threats to Pakistan's nuclear arsenal. For examples, see: Abdul Mannan, "Preventing Nuclear Terrorism in Pakistan: Sabotage of a Spent Fuel Cask or a Comercial Irradiation Source in Transport," Henry D. Sokolski, ed., *Pakistan's Nuclear Future: Worries Beyond War* (Carlisle, P.A.: Strategic Studies Institute, 2008), pp. 221-276; Chaim Braun, "Security Issues Related to Pakistan's Future Nuclear Power Program," in Sokolski, ed., *Pakistan's Nuclear Future*, pp. 277-346; Thomas Donnelly, "Bad Options: Or How I Stopped Worrying and Learned to Live with Loose Nukes," in Sokolski, ed., *Pakistan's Nuclear Future*, pp. 347-368.

In this chapter, I show that Pakistan employs conditional command and control systems that entail centralized oversight of nuclear operations during peacetime and the rapid delegation of nuclear use capability early in crises. These conditional control arrangements allow Pakistan to address the competing internal and external pressures on its nuclear command and control systems. Internally, conditional control enables safeguards against domestic instability during peacetime. Externally, conditional control facilitates the delegation of nuclear use capability early in a crisis to lower the nuclear threshold and credibly deter conventional aggression. In Pakistan, conditional command and control arrangements strengthen peacetime arsenal safety and security against the challenges of religious extremism, domestic terrorism, and political instability, while also preparing the arsenal for use early in a conventional crisis with India.

**Pakistan's Nuclear Weapons Program**

Pakistan's nuclear weapons program began in the aftermath of the 1971 India-Pakistan War.[4] The 1971 war divided Pakistan in two when India militarily intervened in support of Bengali dissidents and decisively defeated Pakistani forces, transforming East Pakistan into the sovereign state of Bangladesh. Brigadier General (ret.) Feroz Hassan Khan notes the importance of the 1971 war on Pakistan's strategic thinking, stating that "No other event in the history of Pakistan left as indelible a mark as the humiliating defeat of 1971, a key theme of Pakistani

[4] Several important works on the development of Pakistan's nuclear weapons program include: Hassan Abbas, *Pakistan's Nuclear Bomb: A Story of Defiance, Deterrence and Deviance* (New York, N.Y.: Oxford University Pres, 2018); Samina Ahmed, "Pakistan's Nuclear Weapons Program: Turning Points and Nuclear Choices," *International Security*, Vol. 23, No. 4 (Spring 1999), pp. 178-204; Feroz Hassan Khan, *Eating Grass: The Making of the Pakistani Bomb* (Stanford, C.A.: Stanford University Press, 2012); George Perkovich, "Could Anything Be Done to Stop Them? Lessons from Pakistan's Proliferating Past," in Sokolski, ed., *Pakistan's Nuclear Future*, pp. 59-84.

strategic culture today."[5] Indeed, almost immediately after Pakistan's defeat in December 1971, Prime Minister Zulfiqar Ali Bhutto initiated a formal nuclear weapons program in January 1972.[6]

The 1972 decision to develop nuclear weapons demonstrates that Pakistan's conventional defeat prompted Pakistan's pursuit of nuclear weapons, rather than India's 1974 nuclear tests. Instead, India's 1974 nuclear test strengthened Pakistan's determination to obtain nuclear weapons. As Samina Ahmed observes in her historical analysis of Pakistan's nuclear program, "Pakistan's resolve to establish a nuclear weapons infrastructure was reinforced when India detonated a nuclear device in May 1974, another turning point that set Pakistan irrevocably along the nuclear weapons path."[7]

Pakistan simultaneously developed parallel tracks of plutonium reprocessing and uranium enrichment in its efforts to produce weapons grade material. The Pakistan Atomic Energy Commission (PAEC) took charge of the pursuit of the plutonium reprocessing route.[8] Pakistan signed an agreement with France in 1976 to purchase a plutonium reprocessing plant, but the U.S. intervened to cancel the deal for fears of potential nuclear proliferation. Pakistan claimed that the reprocessing plant would serve the country's domestic energy needs, but the lack of technological and economic resources to develop such an expansive nuclear infrastructure indicated to the U.S. that the reprocessing plant would be used for military purposes.[9] The U.S. successfully pressured France to cancel its deal with Pakistan in 1977.[10] Nevertheless, Pakistan

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[5] Khan, *Eating Grass*, p. 70.
[6] Bhutto obtained domestic support for the nuclear weapons program at the Multan scientific conference in early-1972. For details, see ibid., pp. 84-88.
[7] Ahmed, "Pakistan's Nuclear Weapons Program," pp. 183-184.
[8] On the development of plutonium production in Pakistan, see Khan, *Eating Grass*, pp. 191-204.
[9] Ahmed, "Pakistan's Nuclear Weapons Program," p. 184.
[10] Ibid., p. 185.

remained persistent in its pursuit of fuel reprocessing facilities and the PAEC achieved reprocessing capability in 1987.[11]

Pakistan's pursuit of an indigenous uranium enrichment capability was made possible by Abdul Qadeer "A. Q." Khan, a Pakistani scientist who stole the necessary technology and blueprints for uranium enrichment from a Uranium Enrichment Consortium (URENCO) in Almelo, Netherlands.[12] As Vipin Narang notes, the uranium enrichment route provided numerous benefits to Pakistan: "the enrichment program was cheaper, more viable given the technology then available to Pakistan, and easier to obfuscate, thereby giving Pakistan plausible deniability that it was pursuing a nuclear weapons capability."[13] After ousting Prime Minister Bhutto in a 1977 coup, General Zia ul-Haq accelerated Pakistan's development of its uranium enrichment capabilities.[14] Khan Research Laboratories (KRL) enriched sufficient weapons-grade uranium for a nuclear device by the mid-1980s, with A. Q. Khan publicly stating in 1984 that Pakistan had achieved an indigenous uranium enrichment capacity.[15]

Much like India, Pakistan's nuclear weapons capabilities remained ambiguous throughout most of the 1980s and 1990s. When India tested five nuclear devices in May 1998, however, Pakistan promptly followed suit and tested six nuclear devices later that month.[16] As Pakistan's foreign minister Shamshad Ahmad stated the following year, "To restore strategic balance to South Asia, Pakistan was obliged to respond to India's May 1998 nuclear blasts…Pakistan's

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[11] Khan, *Eating Grass*, p. 200.
[12] Ahmed, "Pakistan's Nuclear Weapons Program," p. 184. For an overview of Pakistan's development of uranium enrichment capabilities, see Khan, *Eating Grass*, pp. 139-161.
[13] Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, N.J.: Princeton University Press, 2014), p. 58.
[14] Khan, *Eating Grass*, pp. 150-153.
[15] Ibid., p. 160.
[16] On Pakistan's decision to test nuclear weapons in response to India's May 1998 tests, see ibid., pp. 269-283.

nuclear tests were undertaken in self-defense."[17] Pakistan conducted these tests despite threats from the U.S. to impose sanctions if Pakistan tested a nuclear device.[18] On May 28, 1998, Pakistan officially became the world's ninth state to indigenously develop a nuclear weapons capability.[19]

Pakistan has adopted two distinct nuclear strategies since developing a deliverable nuclear weapons capability. First, Pakistan employed a "catalytic" nuclear strategy from the late-1980s until the end of the Cold War in 1991.[20] According to Vipin Narang, a catalytic nuclear posture:

> primarily envisions catalyzing third-party—often American—military or diplomatic assistance when a state's vital interests are threatened. It can do so by threatening to break out known nuclear capabilities or previously ambiguous or non-operational nuclear capabilities and escalate a conflict if assistance is not forthcoming…Because even a small risk of nuclear use may be sufficient to trigger third-party intercession, this posture can be executed with a limited arsenal that may not even be fully assembled or functional.[21]

Pakistan's catalytic nuclear strategy primarily aimed to mobilize the United States to intervene on its behalf in the event of a conventional conflict with India. This strategy sought to offset Pakistan's conventional inferiority by signaling to the U.S. that a conventional conflict in South Asia might escalate across the nuclear threshold. The catalytic strategic option was made possible by Pakistan's belief that it could rely upon the U.S. to intervene in such an event

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[17] Shamshad Ahmad, "The Nuclear Subcontinent: Bringing Stability to South Asia," *Foreign Affairs*, Vol. 78, No. 4 (July/August 1999), pp. 123-125.
[18] Ahmed, "Pakistan's Nuclear Weapons Program," p. 194.
[19] The eight countries to develop a nuclear weapons capability before Pakistan are the United States, the Soviet Union/Russia, the United Kingdom, France, China, Israel, South Africa, and India. Although Israel continues to employ a strategy of nuclear ambiguity, I follow the conventional wisdom and consider Israel a nuclear weapons state since 1967.
[20] Pakistan's catalytic nuclear posture is most coherently demonstrated in: Narang, *Nuclear Strategy in the Modern Era*, pp. 57-76; Narang, "Posturing for Peace?", 49-55.
[21] Narang, *Nuclear Strategy in the Modern Era*, pp. 15-16. The first use of the term "catalytic" was used to describe South Africa's nuclear strategy. See Avner Cohen and Terence McNamee, *Why Do States Want Nuclear Weapons?: The Cases of Israel and South Africa* (Oslo: Norwegian Institute for Defence Studies, 2005), p. 14.

because of Pakistan's importance to the U.S.'s covert war in Afghanistan against the Soviet Union during this time period.[22]

Two crises with India between 1986 and 1990 exemplify Pakistan's catalytic nuclear posture. First, Pakistan threatened to overtly weaponize its nuclear capabilities during the 1986-87 Brasstacks crisis.[23] The Brasstacks crisis began in late-1986 when India conducted a massive military exercise codenamed Brasstacks near the India-Pakistan border.[24] The Indian Army deployed approximately 250,000 troops and 1,300 tanks grouped into Reorganized Army Plains Infantry Division (RAPID) formations with support from the Indian Air Force, which conducted close air support sorties to practice combined arms operations. These operational concepts were "designed to be partly mobile but capable of holding territory, which was a uniquely Indian concept suitable for the India-Pakistan theater."[25]

The massive scale and close proximity of the Brasstacks exercise to Pakistan's borders caused alarm amongst Pakistan's ruling elites and led to the deployment of two Pakistani corps to the border.[26] At the crisis developed, U.S. leaders feared that Pakistan might weaponize its nuclear capabilities. This prospect troubled U.S. policymakers, as an overtly nuclear Pakistan would require the U.S. to enforce the 1985 Pressler Amendment to the Foreign Assistance Act of 1961, which would ban military and economic assistance to Pakistan unless the U.S. president

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[22] Narang, *Nuclear Strategy in the Modern Era*, p. 56.
[23] Ibid., pp. 62-65.
[24] For overviews of the Brasstacks crisis, see Kanti Bajpai, P. R. Chari, Pervaiz Iqbal Cheema, Stephen Cohen, and Sumit Ganguly, *Brasstacks and Beyond: Perception and Management of Crisis in South Asia* (Delhi: Manohar, 1995); P. R. Chari, Pervaiz Iqbal Cheema, and Stephen P. Cohen, *Four Crises and a Peace Process: American Engagement in South Asia* (Washington, D.C.: Brookings Institution Press, 2007), pp. 39-79; Sumit Ganguly and Devin T. Hagerty, *Fearful Symmetry: India-Pakistan Crises in the Shadow of Nuclear Weapons* (Seattle, W.A.: University of Washington Press, 2005), pp. 68-81.
[25] Chari, Cheema, and Cohen, *Four Crises and a Peace Process*, pp. 44-45. Each RAPID formation included two infantry brigades and one mechanized brigade.
[26] Ibid., pp. 51-56.

annually certified to Congress that Pakistan did not possess nuclear weapons.[27] Severing support at this time would have threatened the prospects for continued Pakistani assistance in the war effort in Afghanistan—the U.S.'s primary foreign policy interest in South Asia at the time.[28] Although the U.S. ultimately played a limited role in the Brasstacks crisis, Pakistan's repeated threats to weaponize its nuclear program demonstrated the viability of its catalytic nuclear posture by mobilizing the U.S. to open diplomatic conversations with Pakistan and India to ease tensions.[29]

The 1990 Kashmir Compound crisis provides a second example of Pakistan's catalytic nuclear posture.[30] This crisis began in early-1990 when Pakistan provided support and supplies for Kashmiri militants operating in Indian territory. India responded by deploying troops to Punjab and Kashmir, which resulted in Pakistan deploying I Corps and II Corps to the India-Pakistan border. The crisis continued to escalate and by March 1990, India had placed 200,000 troops in Kashmir, Pakistan deployed 100,000 troops to the region, and both countries positioned full corps-size units in Punjab and Rajasthan.[31]

As the crisis escalated, Pakistan signaled to the United States that it was willing to escalate across the nuclear threshold. In his well-known account of the 1990 Kashmir Compound crisis, Seymour Hersh states that "the Bush Administration became convinced that the world was on the edge of a nuclear exchange between Pakistan and India."[32] U.S. intelligence agencies

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[27] On the influence of the Pressler Amendment on Pakistan's threat assessment, see Tehmina Mahmood, "Pressler Amendment and Pakistan's Security Concerns," *Pakistan Horizon*, Vol. 47, No. 4 (October 1994), pp. 97-107.
[28] Chari, Cheema, and Cohen, *Four Crises and a Peace Process*, pp. 74-76.
[29] Ibid., pp. 74-75; Narang, *Nuclear Strategy in the Modern Era*, pp. 64-65.
[30] For overviews of the Kashmir Compound Crisis, see: Chari, Cheema, and Cohen, *Four Crises and a Peace Process*, pp. 80-117; Ganguly and Hagerty, *Fearful Symmetry*, pp. 82-115; Hagerty, "Nuclear Deterrence in South Asia," pp. 79-114; Narang, *Nuclear Strategy in the Modern Era*, pp. 65-69.
[31] Narang, *Nuclear Strategy in the Modern Era*, p. 66.
[32] Seymour Hersh, "On the Nuclear Edge," *New Yorker*, March 21, 1993.

estimated that Pakistan possessed between six and ten nuclear weapons by 1993.[33] As the crisis deepened, Pakistan moved its potentially nuclear-capable F-16s closer to the border and U.S. analysts obtained high-confidence intelligence that General Mirza Aslam Beg—Pakistan's Army chief—"had authorized the technicians at Kahuta to put together nuclear weapons."[34] Whether Pakistan actually readied nuclear weapons or merely feigned its willingness to cross the nuclear threshold, the U.S. ultimately organized a mission led by Deputy National Security Advisor Robert Gates to meet with Indian and Pakistani leaders. Shortly after the Gates mission, India withdrew its armored units from Rajasthan and the crisis ended within two weeks.[35] Pakistan's catalytic nuclear posture successfully mobilized U.S. support and guaranteed that the conventionally superior India would not attack Pakistan's homeland.[36]

As the Cold War ended, the U.S. no longer required Pakistani assistance to combat the Soviet Union in Afghanistan and Pakistan could no longer rely upon the U.S. to intervene on its behalf in disputes with India. Ambassador Robert Oakley—the U.S. ambassador to Pakistan from 1988-1991—recalls that "there was also a feeling…that once again, the United States was beginning to tilt toward India. And if there were a crunch, the United States would let Pakistan down once again."[37] President George H. W. Bush's refusal to certify that Pakistan did not possess nuclear weapons in September 1990 gave credence to this perspective and invoked the

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[33] Ibid.
[34] Ibid. Although questions remained regarding the ability of Pakistan's F-16s to deliver nuclear weapons at this time, analysts still worried that Pakistan could drop a nuclear device from the back of a C-130 cargo plane. Narang, "Posturing for Peace?", p. 54.
[35] Hagerty, "Nuclear Deterrence in South Asia," pp. 100-101.
[36] Devin Hagerty also notes the importance for Pakistan to obtain U.S. support, as "Washington had thoroughly war-gamed the Indo-Pakistani confrontation, and Pakistan was the loser in every scenario." Ibid., p. 101.
[37] Ambassador Robert Oakley, quoted in Michael Krepon and Mishi Faruqee, eds., *Conflict Prevention and Confidence-Building Measures in South Asia: The 1990 Crisis*, Occasional Paper No. 17 (Washington, D.C.: Henry L. Stimson Center, April 1994), p. 7.

Pressler Amendment,[38] resulting in the suspension of U.S. military assistance to Pakistan in October 1990.[39]

The loss of the United States as a third-party patron caused Pakistan to transition to a second nuclear posture. Since 1991, Pakistan has sought to develop and strengthen a posture of asymmetric escalation.[40] As defined by Vipin Narang, "an asymmetric escalation posture attempts to directly deter conventional conflict by another nuclear or non-nuclear state *in toto* by threatening the first use of nuclear weapons in either a tactical or strategic strike."[41] Whereas Pakistan's catalytic strategy sought to indirectly deter India by catalyzing U.S. support during a conventional crisis, Pakistan's asymmetric escalation posture seeks to directly deter a conventional or nuclear attack.

In his study of Pakistan's nuclear strategy, Michael Krepon identifies four pillars of Pakistan's nuclear doctrine that underpin its nuclear strategy:

> First, they assert that Pakistan's nuclear deterrent is India-specific. Second, Pakistan has embraced a doctrine of credible, minimum deterrence…Third, the requirements for credible, minimal deterrence are not fixed; instead, they are determined by a dynamic

[38] Mahmood, "Pressler Amendment and Pakistan's Security Concerns," p. 104.
[39] Although the U.S. formally suspended military assistance to Pakistan at this time, the CIA continued to cooperate with the Inter-Services Intelligence (ISI)—Pakistan's premier intelligence agency—without clear political oversight until the CIA's legal authority to conduct operations in Afghanistan ended on January 1, 1992. On this continued cooperation between the CIA and ISI even after the Pressler Amendment passed, see Narang, *Nuclear Strategy in the Modern Era*, pp. 73-74.
[40] On Pakistan's contemporary nuclear strategy, see: Zafar Iqbal Cheema, "Pakistan's Nuclear Use Doctrine and Command and Control," in Peter R. Lavoy, Scott D. Sagan, and James J. Wirtz, eds., *Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, and Chemical Weapons* (Ithaca, N.Y.: Cornell University Press, 2000), pp. 158-181; Timothy D. Hoyt, "Pakistani Nuclear Doctrine and the Dangers of Strategic Myopia," *Asian Survey*, Vol. 41, No. 6 (November/December 2001), pp. 956-977; Peter R. Lavoy, "Islamabad's Nuclear Posture: Its Premises and Implementation," in Sokolski, ed., *Pakistan's Nuclear Future*, pp. 129-165; Narang, *Nuclear Strategy in the Modern Era*, pp. 76-93; Narang, "Posturing for Peace?"; Scott D. Sagan, "The Evolution of Pakistani and Indian Nuclear Doctrine," in Scott D. Sagan, ed., *Inside Nuclear South Asia* (Stanford, C.A.: Stanford University Press, 2009), pp. 227-243.
[41] Narang, *Nuclear Strategy in the Modern Era*, p. 77.

> threat environment. And fourth, given India's conventional military advantages, Pakistan reserves the option to use nuclear weapons first *in extremis*.[42]

The definitive characteristic of Pakistan's nuclear strategy is its explicit willingness to use nuclear weapons first in a conflict. The other three pillars of Pakistan's nuclear doctrine, in contrast, are more flexible. For instance, although Pakistan's nuclear doctrine is primarily aimed at India, concerns regarding U.S. plans to seize or destroy Pakistan's nuclear arsenal have led to an alternative formulation of Pakistan's nuclear strategy in which nuclear weapons "deter all forms of aggression, *mainly* from India."[43] Furthermore, qualitative and quantitative improvements to Pakistan's nuclear arsenal are consistent with the formulation of credible minimum deterrence insofar as these improvements are considered necessary to guarantee the survivability and reliability of Pakistan's nuclear arsenal.[44]

Pakistan has publicly signaled its willingness to use nuclear weapons first in response to a range of threats. In 2002, Lieutenant General (ret.) Khalid Kidwai—Director General of SPD from 2000-2013—identified four conditions under which Pakistan would use nuclear weapons: first, India conquers a large part of Pakistan's territory (space threshold); second, India destroys a large part of Pakistan's land or air forces (military threshold); third, India economically strangles Pakistan (economic strangling threshold); or fourth, India destabilizes Pakistan via internal subversion (domestic destabilization threshold).[45] In the context of a conventional conflict, Kidwai's remarks clearly demonstrate that Pakistan is willing to use nuclear weapons in response

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[42] Michael Krepon, "Pakistan's Nuclear Strategy and Deterrence Stability," in Michael Krepon and Julia Thompson, eds., *Deterrence Stability and Escalation Control in South Asia* (Washington, D.C.: Stimson Center, 2013), p. 44.
[43] Adil Sultan, "Pakistan's Emerging Nuclear Posture: Impact of Drivers and Technology on Nuclear Doctrine," *Strategic Studies*, Institute of Strategic Studies, Islamabad, Vols. 31-32, Nos. 4-1 (Winter 2011/Spring 2012), p. 147. Emphasis added.
[44] For an extended discussion on the interpretive flexibility of these key pillars in Pakistan's nuclear doctrine, see Krepon, "Pakistan's Nuclear Strategy and Deterrence Stability," pp. 45-46.
[45] Paolo Cotta-Ramusino and Maurizio Martellini, "Nuclear Safety, Nuclear Stability, and Nuclear Strategy in Pakistan: A Concise Report of a Visit by Landau Network Centrol Volto," January 14, 2002.

to a serious degradation of its conventional forces, even before India is able to seize significant portions of Pakistani territory. As I describe in the next section, Pakistan's nuclear arsenal has evolved to provide the necessary capabilities to credibly threaten nuclear first-use under such conditions.

**Pakistan's Nuclear Arsenal**

Pakistan's intentional ambiguity regarding its nuclear capabilities in the 1980s and 1990s purposefully mimicked that of India. Although Pakistan's reliance on nuclear ambiguity during this period makes it difficult to identify the precise date on which Pakistan acquired nuclear weapons, it appears that Pakistan was capable of producing nuclear weapons by 1987.[46] This observation is supported by previous U.S. intelligence estimates and statements by Pakistani leaders. For instance, in 1993 former deputy director of the U.S. Central Intelligence Agency Richard Kerr went on record to state: "There is no question that we had an intelligence basis for not certifying [the absence of Pakistani nuclear weapons] from 1987 on."[47] Furthermore, Pakistan's President Zia ul-Haq announced in a March 1987 interview that "Pakistan has the capability of building the Bomb."[48] Pakistan's nuclear weapons status would nevertheless remain opaque from this time until late-May 1998 when the country tested six nuclear devices and overtly demonstrated its status as a nuclear weapons state.

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[46] For evaluations of when Pakistan acquired an operational nuclear weapons capability, see: Philipp C. Bleek, "When Did (and Didn't) States Proliferate? Chronicling the Spread of Nuclear Weapons," Discussion Paper (Cambridge, M.A.: Project on Managing the Atom, Belfer Center for Science and International Affairs, Harvard Kennedy School and the James Martin Center for Nonproliferation Studies, Middlebury Institute of International Studies, Monterey, C.A., June 2017), pp. 15-16; Narang, *Nuclear Strategy in the Modern Era*, pp. 59-60.
[47] Richard Kerr, quoted in Hersh, "On the Nuclear Edge."
[48] Zia ul-Haq, quoted in William Doerner and Ross Munro, "Pakistan Knocking at the Nuclear Door," *Time*, March 30, 1987.

Pakistan's first nuclear weapons would have been delivered by aircraft. Pakistan's PAEC and KRL successfully conducted "cold tests" in 1984 to demonstrate the viability of Pakistan's nuclear weapon design, but Pakistan's only nuclear weapon design "was still a large bomb that could be delivered only by a C-130 cargo aircraft with no assurance of delivery accuracy."[49] The U.S. began supplying F-16 multirole fighter aircraft to Pakistan between 1983 and 1987 and, although the U.S. did not transfer any aircraft capable of delivering nuclear weapons, Pakistan promptly modified these F-16s for nuclear missions. The F-16 appears to have been Pakistan's first nuclear-capable aircraft, but the French-designed Mirage V fighter-bombers quickly became nuclear-capable, as well.[50] The F-16 and Mirage V remain the core air-delivery platforms of Pakistan's nuclear arsenal, with the U.S. agreeing to provide a mid-life upgrade for Pakistan's existing F-16s in 2006.[51] Recent U.S. export sanctions have caused Pakistan to acquire Chinese-supplied JF-17 fighter aircraft that may also become nuclear-capable. JF-17s may provide a platform for Pakistan's dual-capable Ra'ad/Hatf-VIII air-launched cruise missile, but specific plans for the JF-17's nuclear role remain unclear.[52]

Land-based ballistic missiles constitute the core of Pakistan's nuclear deterrent.[53] Pakistan conducted its first successful test of its short-range Hatf-I ballistic missile on April 25, 1989 and has continued to increase its land-based ballistic missile capabilities until present.[54]

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[49] Khan, *Eating Grass*, p. 189.
[50] Hans M. Kristensen, Robert S. Norris, and Julia Diamond, "Pakistani Nuclear Forces, 2018," *Bulletin of the Atomic Scientists*, Vol. 74, No. 5 (2018), p. 352.
[51] Peter R. Lavoy, "Pakistan's Nuclear Posture: Security and Survivability," *Strategic Insights*, Vol. 8, No. 1 (February 2009), p. 8.
[52] Kristensen, Norris, and Diamond, "Pakistani Nuclear Forces 2018," p. 353.
[53] On the importance of ballistic missiles in South Asia, see Feroz Hassan Khan, "Nuclear Signaling, Missiles, and Escalation Control in South Asia," in Michael Krepon, Rodney Jones, and Ziad Haider, eds., *Escalation Control and the Nuclear Option in South Asia* (Washington, D.C.: Henry Stimson Center, 2004), pp. 75-100; Vipin Narang, "Pride and Prejudice and Prithvis: Strategic Weapons Behavior in South Asia," in Sagan, ed., *Inside Nuclear South Asia*, pp. 137-183.
[54] Cheema, "Pakistan's Nuclear Use Doctrine and Command and Control," p. 167.

Currently, Pakistan deploys four short-range ballistic missile systems: first, the Abdali/Hatf-II, with a range of 200 kilometers; second, the Ghaznavi/Hatf-III, with a range of 300 kilometers; third, the Shaheen-I/Hatf-IV, with a range of 750 kilometers; and fourth, the Nasr/Hatf-IX, with a range of 60-70 kilometers. Pakistan also deploys two medium-range ballistic missiles: first, the Ghauri/Hatf-V with a range of 1,250 kilometers; and second, the Shaheen-II/Hatf-VI, with a range of 1,500 kilometers. Each of these missiles is solid-fueled and delivered by a road-mobile transporter erector launcher (TEL), providing Pakistan with the ability to rapidly launch its missiles and greater mobility to increase survivability.[55]

Pakistan is currently developing two ground-launched missiles that will provide new capabilities for its nuclear arsenal. First, Pakistan is developing the medium-range Ababeel, a solid-fuel missile with an estimated range of approximately 2,200 kilometers. In addition to the Ababeel's increased range, the Pakistan government claims that the missile is capable of carrying multiple independently-targetable reentry vehicles (MIRVs).[56] MIRV technology would provide Pakistan with increased offensive capabilities and increase the number of warheads available per launcher if an adversary's first-strike failed to destroy all MIRV-capable missiles.[57] Second, Pakistan continues to develop the Babur/Hatf-VII ground-launched cruise missile (GLCM). The Babur's ability to fly at low altitudes and maneuver in flight provide Pakistan with improved offensive capabilities to defeat an adversary's air defenses. The Babur was last tested in 2014 and is probably currently deployed within the armed forces.[58] Pakistan is currently developing an

[55] Kristensen, Norris, and Diamond, "Pakistani Nuclear Forces 2018," pp. 349, 353-354.
[56] ISPR, Press Release No. PR-34/2017-ISPR, January 24, 2017. Available at: https://www.ispr.gov.pk/press-release-detail.php?id=3705.
[57] On the offensive utility of MIRVs, see Brendan R. Green and Austin Long, "The MAD Who Wasn't There: Soviet Reactions to the Late Cold War Nuclear Balance," *Security Studies*, Vol. 26, No. 4 (October 2017), p. 609.
[58] Kristensen, Norris, and Diamond, "Pakistani Nuclear Forces 2018," p. 355.

updated version of the Babur GLCM—the Babur-II—which will extend the missile's range from 350 kilometers to 700 kilometers.[59]

Perhaps the most noteworthy recent development in Pakistan's land-based ballistic missile inventory is the deployment of the Nasr/Hatf-IX in 2013.[60] The Nasr is a tactical nuclear weapon that—due to its limited range of 60-70 kilometers—cannot reach major Indian cities and appears uniquely intended for battlefield use against India's conventional forces.[61] The Nasr provides Pakistan with an operational capability to bolster its first-use nuclear doctrine and credibly threaten nuclear retaliation in response to conventional Indian aggression.

Pakistan does not yet deploy a sea-based nuclear platform, but significant developments are underway to provide Pakistan with an operational sea-based deterrent. Lieutenant General (ret.) Kidwai confirmed Pakistan's interest in a sea-based nuclear platform in 2015, stating that "The assured second-strike capability comes from being sea-based" and that "this capability will come into play in the next few years."[62] Pakistan is currently developing the Babur-III, a sea-launched cruise missile (SLCM) variant of the Babur-II GLCM. The Babur-III SLCM has been tested successfully twice, most recently on March 29, 2018 from "an underwater dynamic

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[59] Ibid.

[60] The U.S. government first identified the Nasr as operational in 2013. National Air and Space Intelligence Center, "Ballistic and Cruise Missile Threat," 2013.

[61] On Pakistan's Nasr/Hatf-IX platform, see: Feroz Hassan Khan, "Going Tactical: Pakistan's Nuclear Posture and Implications for Stability," *Proliferation Papers*, No. 53 (September 2015); Jaganath Sankaran, "Pakistan's Battlefield Nuclear Policy: A Risky Solution to an Exaggerated Threat," *International Security*, Vol. 39, No. 3 (Winter 2014/15), pp. 118-151. For technical details on the Nasr platform, see: Kristensen, Norris, and Diamond, "Pakistani Nuclear Forces 2018," pp. 353-354; Rajaram Nagappa, Arun Vishwanathan, and Aditi Malhotra, *Hatf-IX/NASR – Pakistan's Tactical Nuclear Weapon: Implications for Indo-Pak Deterrence* (Bangalore: National Institute of Advanced Studies, 2013); Arun Vishwanathan, "Pakistan's *Nasr*/Hatf-IX Missile: Challenges for Indo-Pak Deterrence," *Strategic Analysis*, Vol. 38, No. 4 (2014), pp. 444-448.

[62] "A Conversation with Gen. Khalid Kidwai," Carnegie International Nuclear Policy Conference 2015, transcript (Washington, D.C.: Carnegie Endowment for International Peace, 2015), pp. 15-16.

platform."[63] Once the Babur-III is ready for deployment, it will likely be deployed on Pakistan's diesel-electric Agosta class submarines.[64]

**Nuclear Command and Control in Pakistan**

Pakistan employs conditional command and control over its nuclear arsenal. Conditional control allows Pakistan to centralize political and military oversight of nuclear use decisions during peacetime, while also enabling the rapid delegation of nuclear use authority during crises to deter conventional aggression and bolster arsenal reliability. These conditional control arrangements reflect the competing imperatives of external security threats that require the early delegation of nuclear use capability and domestic political instability that compels actors to assert control over nuclear doctrine and operations.

Nuclear command and control systems were largely informal until Pakistan's overt nuclearization in May 1998.[65] Because Pakistan's first nuclear weapons were only air-deliverable in the late-1980s and early-1990s, physical separation of nuclear-capable bombs from delivery aircraft served as the primary means of arsenal safety and security during this period. According to Brigadier General (ret.) Feroz Hassan Khan—a retired brigadier general from the Pakistani Army and former director of arms control and disarmament affairs in the Strategic Plans Division—command and control procedures during this period were very "general" and

[63] ISPR, Press Release No. PR-125/2018-ISPR, March 28, 2018. Available at: https://www.ispr.gov.pk/press-release-detail.php?id=4660.
[64] Kristensen, Norris, and Diamond, "Pakistani Nuclear Forces 2018," p. 355.
[65] Naeem Salik, *Learning to Live with the Bomb: Pakistan: 1998-2016* (Karachi: Oxford University Press, 2017), p. 17.

administratively "under military control," but without clear operational procedures and routines in place.[66]

From 1993-1998, the Combat Development Directorate (CDD) supervised all nuclear matters. General Mirza Aslam Beg formed the CDD in 1985 as an organization for the "evaluation, analysis, and concepts of conventional weapons use and related doctrines."[67] The CDD became involved in nuclear matters in July 1993 when President Ghulam Ishaq Khan and Prime Minister Nawaz Sharif resigned from their positions. At this time, Chief of Army Staff (COAS) General Abdul Waheed received all nuclear documents and entrusted the CDD with oversight of all nuclear issues under the direction of Major General Ziauddin Butt, director general of the CDD.[68] The CDD's responsibilities were expansive, however, and included a significant emphasis on conventional arms development and acquisition that distracted some attention from the nuclear program. As a result, General Pervez Musharraf decided to develop a new organization that would focus exclusively on Pakistan's nuclear program upon assuming command as COAS in 1998.[69]

At the direction of General Musharraf, Pakistan's Evaluation and Research (E&R) Directorate began researching command and control models in mid-1998 for presentation to civilian and military leadership. In conjunction with the Military Operations Directorate, E&R created an outline of command and control systems by October 1998 that was approved within the military. This plan did not receive official civilian approval when the army first presented the plan in April 1999 and was placed on hold shortly thereafter when the Kargil conflict erupted in

[66] Brigadier General (ret.) Feroz Hassan Khan, interview by author, November 28, 2017.
[67] Khan, *Eating Grass*, p. 325.
[68] Ibid., pp. 325-326.
[69] Ibid., p. 328

May 1999.[70] Nevertheless, the military proceeded to merge the CDD and E&R during this time to form a new secretariat in charge of Pakistan's nuclear program.[71]

Since 2000, Pakistan has managed its nuclear weapons through the National Command Authority (NCA).[72] The prime minister officially chairs the NCA, which is responsible for policy formulation and the oversight of nuclear forces.[73] Within the NCA, the military-led Strategic Plans Division (SPD) is responsible for operational control of the arsenal. Over time, the SPD has developed "a firm hold of Pakistan's nuclear organization and policy,"[74] resulting in significant military influence over nuclear doctrine and operations.[75] Christopher Clary notes the centrality of the SPD to Pakistan's command and control infrastructure, writing: "In some ways the story of Pakistani nuclear command and control is the story of one organization—the Strategic Plans Division—and how it sought to operationalize the deterrent after 1998."[76] Although civilian leadership possesses *de jure* authority over nuclear operations, military commanders exercise *de facto* authority over nuclear use.[77] The SPD performs a wide range of functions that grant the organization significant influence over nuclear matters, including: preparing the agenda for NCA meetings, formulating policy recommendations for Pakistan's

[70] On the Kargil conflict, see: Mark S. Bell and Julia Macdonald, "How Dangerous Was Kargil? Nuclear Crises in Comparative Perspective," *Washington Quarterly*, Vol. 42, No. 2 (Summer 2019), pp. 135-148; and Chari, Cheema, and Cohen, *Four Crises and a Peace Process*, pp. 118-148.
[71] Khan, *Eating Grass*, pp. 329-330.
[72] Salik *Learning to Live with the Bomb*, p. 149.
[73] "Pakistan Announcement of Nuclear-Weapons Command-and-Control Mechanism," *Associated Press of Pakistan*, February 3, 2000.
[74] Khan, *Eating Grass*, p. 331.
[75] On the role of Pakistan's military in nuclear debates, see: Khan, *Eating Grass*, pp. 95-123; Salik, *Learning to Live with the Bomb*, pp. 133-176.
[76] Christopher Clary, *Thinking about Pakistan's Nuclear Security in Peacetime, Crisis and War* (New Delhi: Institute for Defense Studies and Analyses, 2010), p. 11.
[77] Narang, *Nuclear Strategy in the Modern Era*, p. 84.

nuclear strategy and doctrine, and operations, and creating operational plans for the movement, deployment, and employment of nuclear forces.[78]

Administratively, Pakistan's command and control systems are centralized during peacetime but allow for the rapid devolution of nuclear use capability to lower-level commanders during crises.[79] If communications are severed during a crisis and a field commander is unable to receive orders from higher-level authorities, the field commander appears capable of authorizing nuclear use.[80] Major General (ret.) Mahmud Durrani—Pakistan's national security advisor from 2008-2009—suggested in 2004 that authorization codes are held at military bases and can be assembled by lower-level officers. In the army, for example, the code to arm nuclear weapons is likely divided between the group and unit commanders.[81] This practice is representative of Pakistan's nuclear arsenal management practices, as the two- or three-man rule applies to all steps in the nuclear platforms.[82] These measures of administrative decentralization suggest that peripheral military commanders are capable of authorizing a nuclear attack as a crisis unfolds and the threat of high intensity conflict increases.

A defining feature of Pakistan's command and control infrastructure is its tight integration of conventional and nuclear operations.[83] Institutionally, the Joint Services Headquarters (JSHQ) has served as the coordination center for both conventional and nuclear operations since 2002. Brigadier General (ret.) Feroz Hassan Khan writes:

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[78] On the SPD's numerous functions, see Salik, *Learning to Live with the Bomb*, pp. 161-163.
[79] Feroz Khan notes that Chief Executive Pervez Musharaf was "determined" to centralize control within this group of elites and establish an institutional body to represent their perspectives. Khan, *Eating Grass*, p. 334.
[80] Khan, "Nuclear Command-and-Control in South Asia During Peace, Crisis, and War," p. 169.
[81] Mahmud Ali Durrani, "Pakistan's Strategic Thinking and the Role of Nuclear Weapons," Cooperative Monitoring Center Occasional Paper, No. 37 (Albuquerque, N.M.: Sandia National Laboratories, 2004) p. 33.
[82] Brigadier General (ret.) Feroz Hassan Khan, interview by author, November 28, 2017.
[83] Narang, *Nuclear Strategy in the Modern Era*, p. 84.

> By 2002, Pakistan had established its air and land nuclear forces and created ballistic missile units. The [Pakistan Air Force] squadrons under the Strategic Air Commands operated under a coherent command, control, communication, and intelligence ($C_3I$) system that was linked with Pakistan's national military operation centers at the JSHQ.[84]

The COAS therefore oversees both conventional and nuclear operations and has the ability to quickly authorize the escalation of conventional conflict across the nuclear threshold. This administrative arrangement is a critical enabler of Pakistan's first-use nuclear doctrine, as it provides operational-level evidence that Pakistan is capable of rapidly responding to conventional attacks with nuclear force.

Physically, Pakistan's warheads are partially disassembled during peacetime, with the fissile cores and detonators separated from one another and dispersed across an unknown distance.[85] These components are maintained in theft- and tamper-proof containers during storage and transport, and the facilities housing these components are surrounded by a three-tier security structure to protect nuclear assets.[86] These layers of security are organized concentrically: the SPD's security division is responsible for managing the inner perimeter; the second tier consists of fencing, electronic sensors, cameras, and additional security personnel; and third, counter-intelligence teams search for potential threats to nuclear facilities.[87]

To bolster arsenal safety and security during peacetime, nuclear warheads have traditionally been de-mated from delivery vehicles and separated by some distance.[88] Although some analysts doubt that nuclear warheads are truly disassembled during peacetime, most agree

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[84] Khan, *Eating Grass*, p. 354.
[85] Christopher Clary and Ankit Panda, "Safer at Sea? Pakistan's Sea-based Deterrent and Nuclear Weapons Security," *Washington Quarterly*, Vol. 40, No. 3 (Fall 2017), p. 153; Hans M. Kristensen and Robert S. Norris, "Pakistani Nuclear Forces, 2016," *Bulletin of the Atomic Scientists*, Vol. 72, No. 6 (November 2016), p. 370.
[86] David O. Smith, "The Management of Pakistan's Nuclear Arsenal," *Nonproliferation Review*, Vol. 21, Nos. 3-4 (October 2014), p. 282.
[87] Clary, *Thinking about Pakistan's Nuclear Security in Peacetime, Crisis and War*, p. 13
[88] Clary and Panda, "Safer at Sea?", p. 154; Clary, *Thinking about Pakistan's Nuclear Security in Peacetime, Crisis and War*, p. 10.

that—at a minimum—warheads are de-mated from delivery platforms to provide physical control during peacetime.[89] Brigadier General (ret.) Naeem Salik—former director of arms control and disarmament affairs in the Strategic Plans Division—notes that, for most platforms, "delivery systems are held by the services strategic force commands and though these are under the administrative control of their respective services, their operational control rests with the NCA while the warheads are under the direct control of the NCA."[90]

As crises escalate, however, Pakistan is likely to begin assembling weapons and mating those weapons to delivery platforms to increase the readiness of its nuclear forces. Analysts suggest that Pakistan disperses its nuclear components no more than ten kilometers apart during peacetime and may even collocate all components at a single location.[91] In the event of a crisis, Pakistan's military can quickly prepare nuclear weapons for deployment.[92] For instance, Hans Kristensen, Robert Norris, and Julia Diamond suggest that "In a crisis, [air-delivered] bombs could quickly be transferred to the base, or the F-16s could disperse to bases near underground storage facilities and receive the weapons there."[93] In a 2002 interview with Lieutenant General (ret.) Kidwai, reporters Paolo Cotta-Ramusino and Maurizio Martellini confirmed such arrangements, noting that "weapons can be assembled 'very quickly' and so also the reaction in a situation of crisis can be relatively 'very quick'."[94]

Pakistan's primary technical control over nuclear forces is a permissive action link (PAL)-like device that aims to prevent unauthorized use. Although these devices are not as

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[89] Salik, *Learning to Live with the Bomb*, p. 189.
[90] Ibid., p. 145.
[91] Kristensen and Norris, "Pakistani Nuclear Forces, 2016," pp. 370-372; Narang, *Nuclear Strategy in the Modern Era*, p. 85.
[92] Brigadier General (ret.) Feroz Hassan Khan, interview by author, November 28, 2017.
[93] Kristensen, Norris, and Diamond, "Pakistani Nuclear Forces 2018," p. 352.
[94] Cotta-Ramusino and Martellini, "Nuclear Safety, Nuclear Stability, and Nuclear Strategy in Pakistan."

sophisticated as the PALs employed by the United States, Brigadier General (ret.) Feroz Hassan Khan claims that Pakistan "has developed physical safety mechanisms and firewalls…in the weapon systems themselves."[95] Lieutenant General (ret.) Kidwai has stated that these "Pak-PALs" require twelve-digit alphanumeric codes to disable the technical control, although it remains unclear whether this entails a single twelve-digit lock or multiple locks with shorter codes.[96] Pak-PALs are likely simple code-lock devices that lock subcomponents of the weapon or blocks the fusing space to prevent a nuclear detonation.[97]

Importantly, Pak-PALs can be bypassed to allow for nuclear use in the absence of authorization codes from political authorities.[98] The military custodians of nuclear forces likely include technical teams on base with the capacity to bypass these locks and enable nuclear use.[99] Brigadier General (ret.) Feroz Hassan Khan offers support for this perspective, noting that the military custodians of Pakistan's nuclear weapons must be "technically self-sufficient and capable of launch even if orders from the NCA are not received."[100] Pak-PALs tighten political control during peacetime, but the ability of lower-level military commanders to bypass these technical controls in case of emergency allows Pakistan to rapidly transition its arsenal to a higher level of readiness.

Two emerging capabilities will place pressure on Pakistan's command and control systems in the immediate future. First, Pakistan's deployment of the Nasr tactical nuclear

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[95] Khan, *Eating Grass*, p. 331.
[96] Narang, *Nuclear Strategy in the Modern Era*, p. 88.
[97] For descriptions of Pak-PALs, see: Clary, *Thinking about Pakistan's Nuclear Security in Peacetime, Crisis and War*, p. 15; Clary and Panda, "Safer at Sea?", p. 154; and Durrani, "Pakistan's Strategic Thinking and the Role of Nuclear Weapons," p. 33.
[98] Clary, *Thinking about Pakistan's Nuclear Security in Peacetime, Crisis and War*, p. 16; Smith, "The Management of Pakistan's Nuclear Arsenal," p. 283.
[99] Narang, *Nuclear Strategy in the Modern Era*, p. 89.
[100] Khan, "Challenges to Nuclear Stability in South Asia," p. 68.

weapon platform poses challenges for nuclear management operations. Specifically, tactical nuclear weapons face a "deployment dilemma," which refers to the problems inherent to moving tactical nuclear weapons from their peacetime storage facilities into forward battlefield positions.[101] The deployment dilemma has geographic and temporal dimensions. Geographically, tactical nuclear weapons must be deployed close enough to the front line of battle to be effective, but not so far forward that the weapons are vulnerable to destruction and not so far in the rear that the weapons cannot reach their targets and become ineffective. Temporally, the authority to use tactical nuclear weapons must be withheld long enough to prevent unauthorized use, but also delegated early enough to guarantee that these weapons can be used before an adversary destroys the tactical nuclear platforms or severs communications between field commanders and higher authorities.[102]

Pakistan's first-use nuclear doctrine makes the deployment dilemma especially pronounced.[103] By lowering the nuclear threshold to deter conventional aggression from India, Pakistan faces significant pressures to delegate nuclear use capability to field commanders early in a crisis. In addition to the increased likelihood of unauthorized use, Pakistan's early delegation procedures could signal malign intentions to India during a conventional dispute. If India observed Nasr systems being forward deployed during a dispute, it would experience strong incentives to strike the Nasrs before Pakistan had a chance to use its tactical nuclear weapons.[104] Such strikes against Pakistan's nuclear arsenal could continue an escalatory cycle that would be

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[101] Khan, "Going Tactical," p. 31.
[102] These challenges of an operational doctrine for tactical nuclear forces are not unique to Pakistan. For an overview of the U.S. experience with similar challenges, see David O. Smith, "The US Experience With Tactical Nuclear Weapons: Lessons for South Asia," in Krepon and Thompson, eds., *Deterrence Stability and Escalation Control in South Asia*, pp. 65-92.
[103] The continuing difficulty of resolving this dilemma was emphasized by Brigadier General (ret.) Feroz Hassan Khan, interview by author, February 20, 2019.
[104] Khan, "Going Tactical," p. 32.

difficult to stop. Although Pakistan's 2013 deployment of the Nasr platform increases the credibility of its threat to use nuclear weapons in response to a conventional Indian attack, these weapons generate severe pressures on the safety and security of Pakistan's arsenal and provide additional avenues through which crises may escalate to the nuclear level.

Second, Pakistan's pursuit of nuclear-armed submarines also presents challenges for command and control systems. Pakistan's submarine-based nuclear forces will be managed by the Naval Strategic Forces Command headquarters, which officially began operations in 2012.[105] Although Pakistan views its forthcoming sea-based platforms as important for securing its second-strike capabilities, several vulnerabilities—especially to Pakistan's communications systems—create challenges for command and control operations. As Paul Bracken notes in his landmark work on nuclear command and control, these challenges are not unique to Pakistan. For all countries, Bracken observes, "Communications are intrinsically difficult for the submarines, and the command channels are inherently vulnerable to enemy attack."[106]

Pakistan's conditional command and control arrangements suggest that Pakistan will likely adopt a bastion model for its naval nuclear assets, in which submarines remain close to port during peacetime to provide for greater protection of submarines and facilitate centralized authority over nuclear use decisions.[107] This approach differs markedly from the continuous at-sea deterrent patrol model, in which nuclear weapons are placed on board submarines and continuously deployed at-sea to bolster arsenal survivability and reliability. Furthermore,

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[105] Kristensen, Norris, and Diamond, "Pakistani Nuclear Forces, 2018," p. 353.
[106] Paul Bracken, *The Command and Control of Nuclear Forces* (New Haven, C.T.: Yale University Press, 1983), p. 229.
[107] The bastion model served as a core pillar of Soviet naval strategy during the Cold War. For details on the concept and Soviet implementation, see Kristian Atland, "The Introduction, Adoption, and Implementation of Russia's 'Northern Strategic Bastion' Concept, 1992-1999," *Journal of Slavic Military Studies*, Vol. 20, No. 4 (December 2007), pp. 499-528.

Pakistan will likely keep its sea-launched nuclear weapons on shore during peacetime before mating these weapons to submarines during crises.[108] These measures would correspond to Pakistan's current conditional control practices by allowing leaders to maintain centralized control over sea-based nuclear weapons during peacetime and rapidly deploy nuclear-armed submarines to sea as crises emerge. If Pakistan elects to preplace nuclear weapons on board its submarines during peacetime, this would reflect a shift to more delegative command and control practices, even if the submarines are at port during peacetime.

The development of Pakistan's sea-based nuclear capabilities poses several issues for crisis stability and command and control practices.[109] For instance, if India attacks Pakistan's naval communications systems in a broader dispute, Pakistan may view these actions as an attempt to neutralize its sea-based deterrent and rapidly arm and deploy its submarines to bolster their survivability. In turn, the deployment of Pakistan's nuclear-armed submarines may appear as the preparatory phase of a nuclear attack, which would encourage India to destroy Pakistan's submarines before they can target Indian cities. Pakistan therefore faces a deployment dilemma at sea, as well—nuclear-armed submarines must be deployed early enough to ensure survivability, but not so early as to initiate an escalatory spiral.[110] The decision regarding when to flush out submarines is complicated by the reality that once Pakistan places nuclear weapons on board its submarines and deploys them to sea, physical and technical controls no longer inhibit the use of nuclear weapons. These considerations will powerfully shape Pakistan's

[108] These operational possibilities were identified by Brigadier General (ret.) Feroz Hassan Khan, interview by author, February 20, 2019. Brigadier Khan also identified an option in which the warhead is perpetually on board the submarine and both are deployed at sea. This option is only available for continuous at-sea deterrent patrols, however, and does not apply to bastion strategies.
[109] Similar concerns for inadvertent escalation are also noted by Zia Mian, M.V. Ramana, and A.H. Nayyar, "Nuclear Submarines in South Asia: New Risks and Dangers," *Journal for Peace and Nuclear Disarmament* (forthcoming).
[110] Brigadier General (ret.) Feroz Hassan Khan, interview by author, February 20, 2019.

doctrine as it continues to develop the sea-based leg of its nuclear triad and integrate its naval nuclear platforms into its conditional command and control framework.

## Explaining Conditional Control in Pakistan

In this section, I demonstrate that Pakistan's employment of conditional command and control arrangements aligns with the expected outcome of my theoretical framework and supports two fundamental implications of the theory. First, Pakistan's conventional military inferiority with respect to India creates a severe external threat environment that incentivizes the delegation of nuclear use capability to lower-level commanders. Although Pakistan also faces additional threats from India's growing and modernizing nuclear arsenal, the conventional balance of power proves to be the most influential external determinant of Pakistan's nuclear command and control decision-making. Second, Pakistan's long history of domestic political instability has led to centralized authority over nuclear operations during peacetime. Combined, Pakistan's conventional military insecurity and domestic instability create opposing pressures on command and control systems. To address these competing pressures, Pakistan employs conditional command and control arrangements that facilitate centralized control procedures during peacetime, while also enabling the rapid delegation of nuclear use capability early in crises to address Pakistan's conventional threat environment.

### *Conventional Threat Environment*

Pakistan's conventional inferiority with respect to India served as the core motivation for Pakistan's pursuit of nuclear weapons and has remained a defining characteristic of regional

security in South Asia throughout Pakistan's nuclear history. Pakistan and India have fought four conventional wars since partition in 1947 and, although the 1971 war was the only one in which Pakistan experienced a complete and decisive defeat, India has largely prevailed in each of these conflicts.[111] A future conflict between India and Pakistan would be characterized by different numerical, geographic, and technological factors than were relevant in previous wars, but Pakistan's history of conventional defeat continues to shape threat perceptions amongst political and military leaders in Pakistan. Pakistan's continuing conventional inferiority has produced command and control systems that delegate nuclear use capability early in a conflict to lower the threshold to nuclear use and deter conventional attacks by India.

India's large and growing economy have allowed it to spend a lower percentage of its gross domestic product (GDP) on defense expenditures than Pakistan, while also widening the absolute gap in military spending over time.[112] Since India and Pakistan overtly tested nuclear weapons in 1998, India has spent an average of 2.65% of its GDP per year on military expenditures. During this same period, Pakistan's military expenditures accounted for an average of 3.84% of GDP per year, representing a 45% relative premium on India's military investments. In absolute terms, however, India has massively outpaced Pakistan in terms of military expenditures. On average, India spent over $44.1 billion U.S. dollars (USD) per year on military expenditures during this period, while Pakistan averaged just over $7.9 billion USD per year.[113] This disparity became even more pronounced after the U.S. enforced nonproliferation sanctions in accordance with the Pressler Amendment in 1990. Pakistan responded to its worsening

[111] For an overview of the mixed outcomes of these four wars, see Christopher Clary, "Deterrence Stability and the Conventional Balance of Forces in South Asia," in Krepon and Thompson, eds., *Deterrence Stability and Escalation Control in South Asia*, pp. 136-138.
[112] Military spending data in this section are provided by the Stockholm International Peace Research Institute (SIPRI) Military Expenditure Database, available at: https://www.sipri.org/databases/milex.
[113] These values reflect constant 2017 U.S. dollars.

conventional environment during this time by increasing its emphasis on nuclear weapons. Brigadier General (ret.) Feroz Hassan Khan corroborates this point, stating: "Pakistan's conventional force balance with India, which had marginally improved in the 1980s, began to plummet, forcing it to seek more reliance on nuclear force goals."[114]

India's economic advantage underpins its ongoing military modernization efforts, which continue to exacerbate the disparity in conventional power between India and Pakistan.[115] India has recently increased its acquisitions of advanced precision-strike munitions, reconnaissance platforms, and command and control capabilities,[116] causing greater concern within Pakistan about its quantitative and qualitative disadvantages relative to India.[117] Pakistan has responded to these challenges by emphasizing high-quality materiel and developing internal lines of communication,[118] but major cities such as Lahore and Gujranwala are located near the India-Pakistan border and the primary lines of communication connecting Islamabad, Lahore, and other large cities are also close to the border and vulnerable to India's conventional forces.[119] India's conventional military preponderance in the region therefore remains the primary threat to Pakistan's territorial integrity and sovereignty.

Some recent research suggests that the conventional military balance in South Asia may not disadvantage Pakistan to the extent that scholars traditionally assume. Walter Ladwig, for

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[114] Khan, *Eating Grass*, p. 326.
[115] On India's military modernization efforts, see Gurmeet Kanwal, "India's Military Modernization: Plans and Strategic Underpinnings," (Washington, D.C.: National Bureau of Asian Research), September 24, 2012. Available at: https://www.nbr.org/publication/indias-military-modernization-plans-and-strategic-underpinnings/.
[116] Walter C. Ladwig III, "Indian Military Modernization and Conventional Deterrence in South Asia," *Journal of Strategic Studies*, Vol. 38, No. 5 (July 2015), p. 731.
[117] For example, see Malik Qasim Mustafa, "Pakistan's Military Security and Conventional Balance of Power," *Strategic Studies*, Vol. 29, No. 1 (Spring 2009), pp. 35-44.
[118] Narang, *Nuclear Strategy in the Modern Era*, p. 78.
[119] The vulnerability of Pakistan's primary lines of communication between its major cities was emphasized by Brigadier General (ret.) Feroz Hassan Khan, interview by author, November 28, 2017.

example, argues that rugged terrain and the deployment of Pakistan's conventional forces decrease the likelihood of India achieving rapid military success in areas of strategic value. Furthermore, Ladwig expects that India would be unable to achieve the necessary strategic surprised to enable even a limited offensive to achieve quick gains.[120] Christopher Clary offers further support for this perspective, arguing that India has "consistently 'punched below its weight' in the conventional force balance, underperforming compared to its impressive military spending advantage over Pakistan."[121] Furthermore, despite India's material advantages in land, air, and naval forces, Clary argues that the "integration of action across services still appears problematic and incomplete."[122] These observations support an insight offered by Stephen Cohen and Sunil Dasgupta, who document India's longstanding inability to efficiently convert its resources into military power.[123]

Although these analyses provide a valuable corrective to the study of the conventional military balance in South Asia, two factors highlight the continued importance of India's aggregate conventional military advantage. First, although India may be unable to suddenly seize strategically valuable territory near the disputed line of control separating India and Pakistan, India may still be able to achieve rapid success in other regions along the international border.[124] Furthermore, India still appears likely to prevail in a conventional conflict as the duration of the engagement prolongs.[125] Brigadier General (ret.) Feroz Hassan Khan offers support for this

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[120] Ladwig III, "Indian Military Modernization and Conventional Deterrence in South Asia."
[121] Clary, "Deterrence Stability and the Conventional Balance of Forces in South Asia," p. 136.
[122] Ibid., p. 147. For a full discussion of the challenges of integrating India's armed services to achieve battlefield success, see pp. 141-152.
[123] For this argument, see Stephen P. Cohen and Sunil Dasgupta, *Arming without Aiming: India's Military Modernization* (Washington, D.C.: Brookings Institution Press, 2010).
[124] Clary, "Deterrence Stability and the Conventional Balance of Forces in South Asia," p. 149.
[125] John H. Gill, "Brasstacks: Prudently Pessimistic," in Sumit Ganguly and S. Paul Kapur, eds., *Nuclear Proliferation in South Asia: Crisis Behavior and the Bomb* (New York, N.Y.: Routledge, 2009), pp. 44-45; Narang, *Nuclear Strategy in the Modern Era*, p. 78.

analysis, assuming that India's conventional preponderance would result in a decisive breakthrough within 1-2 weeks of combat.[126] Second, the historical trends promise to worsen Pakistan's relative conventional inferiority in the future. Christopher Clary aptly observes this reality, noting that "As long as India continues to grow faster than Pakistan and continues to spend at rates comparable to historical averages…there is no doubt that Pakistan will be unable to maintain even a patina of conventional parity over time."[127]

Statements by senior Pakistani officials provide evidence that Pakistan's conventional vulnerability has resulted in more responsive command and control arrangements that seek to lower the nuclear threshold. For example, in 2009 Pakistan's Foreign Office spokesman Abdul Basit stated:

> Pakistan cannot remain oblivious to increasing conventional asymmetries, unrelenting arms acquisitions as well as preferential treatment being accorded to certain countries in the region. Such developments disturb the strategic balance and Pakistan is constrained to adopt necessary safeguards as it deems fit…It is important that asymmetry between Pakistan and India in the context of conventional arms should not be widened too much. We have noticed that there are acquisitions of sophisticated weaponry by our neighbor which will disturb the conventional balance between our two countries and hence, lower the nuclear threshold.[128]

Basit's comments clearly indicate the importance of conventional threats to Pakistan's nuclear decision-making. Indeed, this pronouncement explicitly demonstrates Pakistan's willingness to lower the nuclear threshold in response to India's growing conventional military superiority.

Several years after Basit's statement, Pakistan began deployment of its Nasr tactical nuclear weapon platform. As Vipin Narang notes, Pakistan's deployment of the Nasr provides the operational means "to lower the nuclear threshold in response to Indian conventional

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[126] Interview by Brigadier General (ret.) Feroz Hassan Khan, interview by author, February 20, 2019.
[127] Clary, "Deterrence Stability and the Conventional Balance of Forces in South Asia," p. 136.
[128] Abdul Basit quoted in Baqir Sajjad Syed, "Minimum N-Deterrence Will Be Maintained: FO," *Dawn*, May 22, 2009.

power."[129] Lieutenant General (ret.) Kidwai offered strong support for this perspective in 2015 when discussing the purpose and contributions of the Nasr/Hatf-IX platform:

> Nasr, specifically, was born out of a compulsion of this thing that I mentioned about some people on the other side toying with the idea of finding space for conventional war, despite [Pakistan's] nuclear weapons…That there was some kind of gap in their realization at their tactical level, and therefore it was leading to this encouragement, or this idea of the concept on the other side that there was space for conventional war…So it was this particular gap that we felt needed to be plugged at the lowest rung. Because war was being brought down under the Cold Start Doctrine to the tactical level.[130]

As these examples demonstrate, Pakistan's conventional military inferiority with respect to India decisively compels Pakistan to lower the threshold to nuclear use. To strengthen its claims that nuclear weapons such as the Nasr will be used first in response to conventional military aggression, Pakistan employs conditional command and control systems that enable lower-level military commanders to quickly respond to a conventional attack with nuclear weapons. The decision to delegate nuclear use capability early in a crisis provides Pakistan with the necessary operational procedures to lower the nuclear threshold and strengthen deterrence against the conventionally superior India.

*Domestic Threats*

Pakistan's conventional military insecurity provides strong incentives for Pakistan to adopt more delegative command and control systems. In practice, however, Pakistan's conditional control arrangements stop short of delegating nuclear use capability during peacetime and instead rely upon highly centralized oversight of nuclear forces during peacetime. I argue that Pakistan's history of domestic political instability explains why Pakistan's severe

[129] Narang, *Nuclear Strategy in the Modern Era*, p. 83.
[130] "A Conversation with Gen. Khalid Kidwai," p. 8.

external threat environment does not result in purely delegative command and control systems. Pakistan's employment of conditional control arrangements represents an attempt to simultaneously address two competing pressures: first, conventional security threats that encourage more delegative control; and second, domestic threats that encourage more assertive control. In this section, I show that the competition for influence over Pakistan's nuclear weapons program over time has produced highly centralized institutions that grant politically dominant actors greater influence over nuclear doctrine and operations. Furthermore, persistent domestic instability and threats to Pakistan's physical arsenal provide strong incentives for Pakistan to maintain tight control over nuclear assets. Pakistan's external and internal threat environments interact to generate conditional command and control arrangements that facilitate centralized arsenal management during peacetime and the rapid devolution of nuclear use capability during crises to deter conventional attacks.

Poor civil-military relations have produced a longstanding source of instability in Pakistan's domestic politics.[131] Pakistan has experienced four successful military takeovers of government since independence in 1947. With each alternation between military and civilian government since the early-1970s, political leaders attempted to increase their control of the nuclear weapons program. Over time, however, Pakistan's military—especially the Pakistani Army—has gained nearly absolute control over nuclear doctrine and operations since the country's nuclear weapons tests in 1998.

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[131] For overviews of civil-military relations in Pakistan, see: Ishtiaq Ahmed, *Pakistan the Garrison State: Origins, Evolution, Consequences, 1947-2011* (Karachi: Oxford University Press, 2013); Stephen P. Cohen, *The Pakistan Army*, 2d ed. (Oxford: Oxford University Press, 1998); C. Christine Fair, *Fighting to the End: The Pakistan Army's Way of War* (Oxford: Oxford University Press, 2014); Shuja Nawaz, *Crossed Swords: Pakistan, its Army, and the Wars Within* (Oxford: Oxford University Press, 2008); T. V. Paul, *The Warrior State: Pakistan in the Contemporary World* (New York, N.Y.: 2014); Aqil Shah, *The Army and Democracy: Military Politics in Pakistan* (Cambridge, M.A.: Harvard University Press, 2014).

Prime Minister Zulfiqar Ali Bhutto sought to centralize his control of Pakistan's nuclear weapons program immediately after initiating the program in 1972. Within a month of taking power, Bhutto convened a meeting with the PAEC. In this meeting, Bhutto abruptly replaced the PAEC's chairman of twelve years—Ishrat Hussain Usmani—with Munir Ahmad Khan, a close friend of Prime Minister Bhutto. Bhutto ordered Khan to report directly to him, rather than the traditional practice of coordinating with the secretary of science and technology. From this moment on, the PAEC has remained strictly under presidential or prime ministerial control.[132]

General Zia ul-Haq deposed Prime Minister Zulfiqar Ali Bhutto through a military coup in 1977, resulting in the military's discovery of Pakistan's nuclear weapons program.[133] Bhutto had attempted to reduce the military's influence in politics after assuming office. For instance, Bhutto simultaneously promoted General Muhammad Sharif to Chairman of the Joint Chiefs of Staff Committee and General Zia ul-Haq to COAS to exploit the cleavages between the rival commanders.[134] This attempt failed, however, and Bhutto was removed from power only five years after becoming prime minister. Samina Ahmed notes that after this point, "The nuclear weapons program operated under the absolute control of the armed forces, while the civil bureaucracy played an active role through its subsidiary arm, the nuclear scientific establishment."[135] The military had seized a foothold in Pakistan's nuclear weapons program.

General Zia, who served as both COAS and president, died in a mysterious plane crash in August 1988. After his death, General Mirza Aslam Beg became COAS, Ghulam Ishaq Khan assumed the office of president, and Benazir Bhutto—daughter of the deposed Zulfiqar Ali

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[132] On Prime Minister Zulfiqar Ali Bhutto's efforts to centralize his control over the PAEC and its lasting impacts, see Khan, *Eating Grass*, pp. 87-88.
[133] Ibid., p. 137.
[134] Ibid., p. 125.
[135] Ahmed, "Pakistan's Nuclear Weapons Program," p. 186.

Bhutto—was elected as prime minister.[136] Although Bhutto's election signaled greater civilian influence in Pakistani politics, her ascension as prime minister was conditional on her acceptance of five conditions proposed by President Ghulam Ishaq Khan and brokered by General Beg:

> (1) Not to be vindictive toward the family of Zia-ul-Haq; (2) not to change defense policies or interfere in the affairs of the armed forces; (3) not to make sweeping bureaucratic/administrative changes; (4) not to alter the Afghan policy…and, most important, (5) not to alter nuclear policy, and to let the veteran President Ghulam Ishaq Khan guide and control the secret nuclear program.[137]

Bhutto's acceptance of these terms reflected the military's increasing control over nuclear matters. By her own agreement, Bhutto would avoid interfering in military affairs, allow political institutions to remain unaltered, and cede authority of the nuclear program to President Ghulam Ishaq Khan and General Beg.[138] Over the next year, Bhutto grew to resent the Pakistan Army's dominance in national security issues and became aware that she was excluded from many debates regarding foreign policy, especially the nuclear program.[139] Nevertheless, Bhutto remained sidelined in many high-level decisions regarding Pakistan's national security.

The military formally obtained control of Pakistan's nuclear weapons program in 1993 when COAS General Abdul Waheed forced President Ghulam Ishaq Khan and Prime Minister Nawaz Sharif to resign. President Ghulam Ishaq Khan refused to share nuclear information with a transitory government and instead chose to grant all nuclear responsibility to the Pakistan Army under General Waheed.[140] By the early-2000s, the army had institutionalized its control of the nuclear weapons program under the NCA and through the SPD. In 2007, President and COAS General Pervez Musharraf passed the NCA Ordinance to cement this institutional

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[136] Khan, *Eating Grass*, p. 227.
[137] Ibid., pp. 227-228.
[138] Ibid., p. 228.
[139] Chari, Cheema, and Cohen, *Four Crises and a Peace Process*, pp. 83-84.
[140] Khan, *Eating Grass*, pp. 257-258.

arrangement and prevent efforts by domestic competitors to undermine the army's oversight of nuclear weapons.[141] A nominally civilian government returned in 2008, but by this point Pakistan's nuclear program was soundly under the control of the COAS and SPD.[142] Christopher Clary observes the lasting influence of the army in this realm, noting: "The military seems quite able to resist…civilian pressure in an area that the military views as core to Pakistan national security, and the existing SPD policy to refuse political appointments seems likely to remain intact."[143]

Although the Pakistan Army has directly controlled the country's nuclear weapons program since 1993, domestic instability and security challenges continue to affect nuclear decision-making. A notable example of a domestic challenge to the security of Pakistan's arsenal management practices is the A. Q. Khan scandal, in which Pakistan's preeminent scientist A. Q. Khan illicitly transferred nuclear technology and knowledge to international actors such as Iran and held meetings with actors such as North Korea and Al Qaeda. The A. Q. Khan affair led Pakistan to restructure its command and control systems to emphasize the security of its nuclear arsenal. In addition to creating a security division within SPD, Pakistan instituted a stringent personnel reliability program (PRP) and human reliability program (HRP).[144] The PRP and HRP screen all military and civilian personnel involved in Pakistan's nuclear program and evaluates candidates on multiple dimensions every two years, including known associates, political affiliations, financial background, and physical and psychological health.[145]

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[141] Salik, *Learning to Live with the Bomb*, pp. 152-154.
[142] Narang, *Nuclear Strategy in the Modern Era*, p. 84.
[143] Clary, *Thinking about Pakistan's Nuclear Security in Peacetime, Crisis and War*, p. 17.
[144] For an overview of the A. Q. Khan affair, see Khan, *Eating Grass*, pp. 359-376.
[145] Clary, *Thinking about Pakistan's Nuclear Security in Peacetime, Crisis and War*, p. 14; Khan, *Eating Grass*, pp. 373-375.

Nevertheless, the A. Q. Khan affair seemed to confirm the fears of many outside observers of Pakistan's nuclear weapons program, who often worry about the potential effects of religious extremism and domestic terrorism on the safety and security of Pakistan's nuclear arsenal. U.S. President Barack Obama clearly articulated these fears in 2010, stating: "The single biggest threat to U.S. security, both short-term, medium-term, and long-term, would be the possibility of a terrorist organization obtaining a nuclear weapon."[146] In their study of U.S.-Pakistan relations, Jeffrey Goldberg and Marc Ambinder note that:

> Pakistan would be an obvious place for a jihadist organization to seek a nuclear weapon or fissile material: it is the only Muslim-majority state, out of the 50 or so in the world, to have successfully developed nuclear weapons; its central government is of limited competence and has serious trouble projecting its authority into many corners of its territory (on occasion it has difficulty maintaining order even in the country's largest city, Karachi); Pakistan's military and security services are infiltrated by an unknown number of jihadist sympathizers; and many jihadist organizations are headquartered there already.[147]

Although outsiders continue to worry about the physical safety and security of Pakistan's nuclear arsenal, Pakistan's leaders tend to emphasize the effectiveness of PRP and HRP protocol. Indeed, in 2015 Lieutenant General (ret.) Kidwai publicly stated:

> For the last 15 years Pakistan has taken its nuclear security obligations seriously. We understand the consequences of complacency; there is no complacency. We have invested heavily in terms of money, manpower, equipment, weapons, training, preparedness, and smart site security solutions. I say with full responsibility that nuclear security in Pakistan is a non-issue.[148]

Despite public statements by Pakistani officials that the country's nuclear arsenal is safe and secure, the threats of religious extremism, domestic terrorism, and political instability continue to shape command and control frameworks. To address these domestic threats, Pakistan

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[146] Barack Obama, quoted in Alex Spillius, "Nuclear Terrorism is Gravest Threat to Global Security, Barack Obama Warns," *Telegraph,* April 12, 2010.
[147] Jeffrey Goldberg and Marc Ambinder, "The Ally From Hell," *Atlantic,* December 2011.
[148] "A Conversation with Gen. Khalid Kidwai,", p. 5.

maintains an emphasis on its PRP and HRP requirements and de-mates and disperses nuclear weapon components to guarantee physical control over its nuclear arsenal. The interaction of Pakistan's domestic threats and conventional military inferiority with respect to India results in conditional command and control arrangements that allow leaders to centrally manage Pakistan's arsenal and nuclear use decisions during peacetime, while also enabling the delegation of nuclear use capability early in crises to lower the nuclear threshold and offset Pakistan's conventional military inferiority.

**Evaluating the Explanations**

The evidence from Pakistan's nuclear experience provides support for my theoretical framework. To resolve the competing pressures of conventional insecurity and domestic instability on command and control systems, Pakistan employs conditional control arrangements that facilitate centralized control during peacetime to strengthen arsenal safety and security, while also enabling the rapid delegation of nuclear use capability early in a crisis to deter India's conventional military forces. This case also demonstrates the utility of my conceptual framework, which provides a method for resolving the country's seemingly contradictory combination of assertive and delegative control measures by classifying Pakistan's command and control systems according to its emphasis on the early delegation of nuclear use capability in crises.

The three major alternative explanations, in contrast, are generally unpersuasive in explaining Pakistan's command and control systems. First, the civil-military stability hypothesis is unable to account for Pakistan's conditional control arrangements. The civil-military stability

hypothesis predicts that Pakistan's long history of military coups and attempts by civilians to restore civilian control of the government would generate assertive command and control systems. Indeed, Pakistan's prolonged civil-military instability provides an easy test for this hypothesis. Nevertheless, the civil-military stability argument is unable to explain conditional control in Pakistan. This argument correctly anticipates that actors attempt to seize control of nuclear decision-making institutions and exclude their political rivals, but these domestic threats only constitute half of the aggregate threat environment facing Pakistan's political and military elites. As my theory demonstrates, Pakistan also faces a conventionally superior adversary in India that compels leaders to create command and control procedures that allow for the delegation of nuclear use capability early in crises to deter conventional attacks. Furthermore, the civil-military stability hypothesis is unable to anticipate command and control outcomes in states where the military assumes control of the state, as has repeatedly occurred in Pakistan's history.

Second, the arsenal vulnerability hypothesis also fails to explain Pakistan's conditional command and control systems. This hypothesis predicts that increased arsenal or command vulnerability should cause Pakistan to adopt more delegative command and control systems. Two empirical observations challenge the explanatory value of this hypothesis, however. First, despite India's continuing nuclear force modernization and potential consideration of nuclear counterforce missions, Pakistan's command and control systems have remained conditional and emphasize centralized control during peacetime.[149] Second, the evidence provided in this section demonstrates that Pakistan's efforts to lower the nuclear threshold have occurred in response to conventional threats to Pakistan's territorial sovereignty, rather than threats to its nuclear arsenal.

[149] On India's potential development of counterforce options, see Christopher Clary and Vipin Narang, "India's Counterforce Temptations: Strategic Dilemmas, Doctrine, and Capabilities," *International Security,* Vol. 43, No. 3 (Winter 2018/19), pp. 7-52.

Although Pakistan experiences a notable degree of arsenal vulnerability, it has elected to address this vulnerability through nuclear platform diversification and redundancy rather than adopting more delegative command and control arrangements.

Third, the strategic rationale hypothesis only provides a partial explanation for conditional control arrangements in Pakistan. The strategic rationale hypothesis expects that Pakistan's clear emphasis on a first-use nuclear doctrine should produce more delegative command and control arrangements. Pakistani officials routinely emphasize that their arsenal is operationally prepared for the early use of nuclear weapons in response to conventional aggression by India, suggesting that the strategic logic of Pakistan's nuclear doctrine meaningfully influences its command and control systems. The strategic rationale argument, however, cannot explain why Pakistan employs conditional control frameworks rather than purely delegative control. Although the strategic rationale hypothesis provides a partial explanation for command and control in Pakistan, my theory's emphasis on the interactive effects of Pakistan's conventional military inferiority and domestic political instability provides a more complete explanation for why Pakistan's leaders choose to withhold nuclear use capability during peacetime and quickly delegate nuclear use capability early in crises.

# CHAPTER 5

## SOUTH AFRICA

South Africa's nuclear experience provides a unique case of nuclear proliferation and rollback.[1] In 1993, President F.W. de Klerk announced to the world that South Africa secretly developed and operated a nuclear arsenal since the mid-1970s and that the country had fully decommissioned its weapons program by 1991.[2] South Africa's decision to dismantle its nuclear weapons makes it the only state to ever decommission an indigenously developed arsenal.[3] Given such an unprecedented trajectory, scholars have extensively evaluated the causes of proliferation and disarmament in the South African context. In comparison, however, researchers have largely overlooked the strategic and operational behavior of nuclear South Africa. I address this shortcoming by explaining the origins of command and control in South Africa and theorizing the evolution and ultimate dismantlement of these institutions over time.

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[1] For detailed studies on South Africa's nuclear program, see: David Albright, "South Africa and the Affordable Bomb," *Bulletin of the Atomic Scientists*, Vol. 50, No. 4 (July 1994), pp. 37-47; Peter Liberman, "The Rise and Fall of the South African Bomb," *International Security*, Vol. 26, No. 2 (Fall 2001), pp. 45-86; Helen E. Purkitt and Stephen F. Burgess, *South Africa's Weapons of Mass Destruction* (Bloomington, I.N.: Indiana University Press, 2005); Hannes Steyn, Richardt Van Der Walt, and Jan Van Loggerenberg, *Armament and Disarmament: South Africa's Nuclear Experience*, 2d ed. (New York, N.Y.: iUniverse, 2005); Waldo Stumpf, "South Africa's Nuclear Weapons Program: From Deterrence to Dismantlement," *Arms Control Today*, Vol. 25, No. 10 (December 1995/January 1996), pp. 3-8; Nic von Wielligh and Lydia von Wielligh-Steyn, *The Bomb: South Africa's Nuclear Program* (Pretoria: Litera, 2015).

[2] von Wielligh and von Wielligh-Steyn, *The Bomb*, p. 259.

[3] For a complete explanation of the decision to decommission South Africa's arsenal and how this effort was undertaken, see ibid., pp. 209-282. Also see Mitchell Reiss, *Bridled Ambition: Why Countries Constrain Their Nuclear Capabilities* (Baltimore, M.D.: Johns Hopkins University Press, 1995), pp. 7-35. Importantly, South Africa's voluntary decommissioning of its self-developed nuclear arsenal differs from the experience of Belarus, Kazakhstan, and Ukraine, where these states inherited nuclear weapons from the Soviet Union and elected to relinquish the weapons to Russia. On the removal of nuclear weapons from post-Soviet states, see pp. 89-182. Additionally, South Africa's nuclear disarmament differs from the decisions in Brazil and Argentina to reverse the development of nuclear capabilities before developing an operational nuclear deterrent. See pp. 45-88 for an overview of the decisions to discontinue nuclear programs in Brazil and Argentina.

In this chapter, I show that South Africa adopted highly assertive patterns of command and control for the duration of its nuclear program. Although the country faced a variety of external threats to state security during the 1970s and 1980s, South Africa did not face a conventionally superior adversary that would compel the regime to delegate nuclear use authority. Instead, domestic threats to the survival of the apartheid regime served as the primary determinant of South African command and control systems. Political elites adopted assertive control measures to guarantee that nuclear weapons were only used for purely political purposes—namely, bolstering the survivability of the apartheid regime—and elected to dismantle the nuclear program with the impending collapse of the apartheid regime in the early-1990s. Furthermore, despite the high levels of organizational autonomy traditionally enjoyed by South Africa's military services, civilian elites tightly centralized control of all nuclear decision-making processes and intentionally excluded military influence in debates regarding nuclear doctrine and operations.

**Nuclear Command and Control in South Africa**

Although it is difficult to identify a precise date on which South Africa officially decided to pursue nuclear weapons, two events mark important points in the regime's decision to proliferate. First, in 1974, the Atomic Energy Board (AEB)—South Africa's primary civilian scientist organization for nuclear research—notified Prime Minister John Vorster that South Africa could develop a nuclear device.[4] Without explicitly approving the program, Vorster

[4] Ibid, p. 52. Some scholars suggest that 1974 was the year in which Vorster officially approved weaponization, although most accounts suggest a later date. See Purkitt and Burgess, *South Africa's Weapons of Mass Destruction*, pp. 41-45.

instructed the AEB to begin developing a potential nuclear test site at the Vastrap Air Force Base in the Kalahari Desert, ostensibly for further research on the peaceful nuclear explosives program.[5]

Second, by 1977, South Africa's primary uranium enrichment facility—the Y-Plant—was fully operational and the AEB completed an operational nuclear device. Although the Y-Plant had not yet produced enough highly-enriched uranium (HEU) for a complete nuclear test, Vorster ordered a cold test of the device to determine the viability of the weapon. Before the test was conducted, however, U.S. and Soviet intelligence identified the test site and requested an inspection of the facilities. The AEB hastily relocated and concealed its equipment and the device was never tested.[6] Although this episode temporarily delayed progress, the AEB successfully conducted a cold test of a nuclear device in 1978,[7] the Y-Plant began producing weapons-grade HEU by 1979, and the AEB produced an operational nuclear device in 1979.[8] AEB scientists later completed the first fully operational nuclear weapon in December 1982,[9] formalizing the completion of a "supremely efficient" nuclear weapons program.[10]

While scholars debate the explicitness of Vorster's support for nuclear weaponization, it is certain that by 1978 newly-elected Prime Minister P. W. Botha sought to weaponize South Africa's nuclear program.[11] Under Botha, South Africa adopted an explicitly catalytic nuclear posture aimed at mobilizing a third-party actor to intervene on South Africa's behalf through

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[5] Stumpf, "South Africa's Nuclear Weapons Program," p. 4.
[6] Ibid., p. 5. For a history of the Kalahari episode, see von Wielligh and von Wielligh-Steyn, *The Bomb*, pp. 136-149.
[7] von Wielligh and von Wielligh-Steyn, *The Bomb*, p. 149.
[8] Stumpf, "South Africa's Nuclear Weapons Program," p. 5.
[9] von Wielligh and von Wielligh-Steyn, *The Bomb*, p. 172.
[10] Jacques E. C. Hymans, *Achieving Nuclear Ambitions: Scientists, Politicians, and Proliferation* (New York, N.Y.: Cambridge University Press, 2012), p. 275.
[11] Steyn, Van Der Walt, and Van Loggerenberg, *Armament and Disarmament*, p. 42.

diplomatic or military means if its vital interests were threatened.[12] South Africa's nuclear doctrine epitomized the strategic logic of a catalytic posture. For the duration of the program, the core purpose of South Africa's nuclear strategy was to mobilize external support—primarily from the United States—in the event of a challenge to the core interests of South Africa's political regime.[13]

To accomplish this goal, Botha approved a three-stage nuclear strategy in 1978.[14] First, South Africa would maintain a policy of nuclear ambiguity that leveraged strategic uncertainty to deter aggression. Second, if this nuclear uncertainty failed to deter an adversary, South Africa would covertly disclose its nuclear capacity to a third-party to catalyze support. By revealing this nuclear capacity and indicating that conflict may escalate to the nuclear level, South African leaders hoped to mobilize the more powerful U.S. to intervene on their behalf. Third, if the U.S. declined to become involved on South Africa's behalf or failed to deter the adversary, then South Africa would overtly disclose its nuclear status by public announcement, or by conducting an underground or atmospheric test to demonstrate its nuclear capability and resolve.[15] If these three stages failed to deter an adversary and catalyze U.S. support, however, South African leaders planned to withhold nuclear weapons for fear of Soviet retaliation.[16]

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[12] On catalytic postures and South Africa's specific strategy, see Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, N.J.: Princeton University Press, 2014), pp. 15-17, 207-221.
[13] Albright, "South Africa and the Affordable Bomb," pp. 37-38.
[14] This strategy is well documented in studies of South Africa's nuclear program. See, for example: Liberman, "The Rise and Fall of the South African Bomb," pp. 54-58; Purkitt and Burgess, *South Africa's Weapons of Mass Destruction*, pp. 79-80. Corroborated by André Buys, interview by author, July 14, 2016. Buys served as an influential civilian-scientist in South Africa's nuclear weapons program, including positions such as general manager of Armament Corporation of South Africa (ARMSCOR) Circle nuclear weapons plant and chairman of the working group on nuclear strategy. Buys' role as a senior ARMSCOR official gave him direct insight into the strategic and operational development of South Africa's nuclear arsenal.
[15] If an underground test was not possible, an atmospheric test would be conducted by detonating a nuclear weapon over the ocean between South Africa and Antarctica. André Buys, interview by author, July 14, 2016.
[16] This point was emphasized by André Buys, interview by author, July 14, 2016, and Waldo Stumpf, interview by author, July 21, 2016. Stumpf directed a review of South Africa's nuclear program near the end of South Africa's

Whereas policymakers systematically evaluated and subsequently articulated a clear political purpose for South Africa's nuclear program by 1978, command and control decisions were largely overlooked at this time. Indeed, command and control systems only received systematic analysis once the nuclear arsenal became fully operational in 1982.[17] However, as soon as nuclear management operations became a key foreign policy issue, South Africa's political regime established assertive control along administrative, physical, and technical dimensions.

South Africa's civilian elites implemented assertive command and control through highly centralized administrative control procedures.[18] To access the components of a nuclear weapon, the president would issue orders to the minister of defense and minister of energy affairs. The defense minister would then relay the order to the chief of the South African Defense Force (SADF), while the energy minister would relay a separate order code to the chairman of the Atomic Energy Corporation (AEC)—the descendant organization of the AEB created in 1982.[19] The defense minister would also relay the order to an official from the Armaments Corporation of South Africa (ARMSCOR)—South Africa's state-run arms procurement and production agency and organizational custodian of nuclear assets—who would be responsible for unlocking the vault upon receipt of the codes from SADF and AEC representatives. These individuals would provide half of the code to a representative from their respective organizations and could

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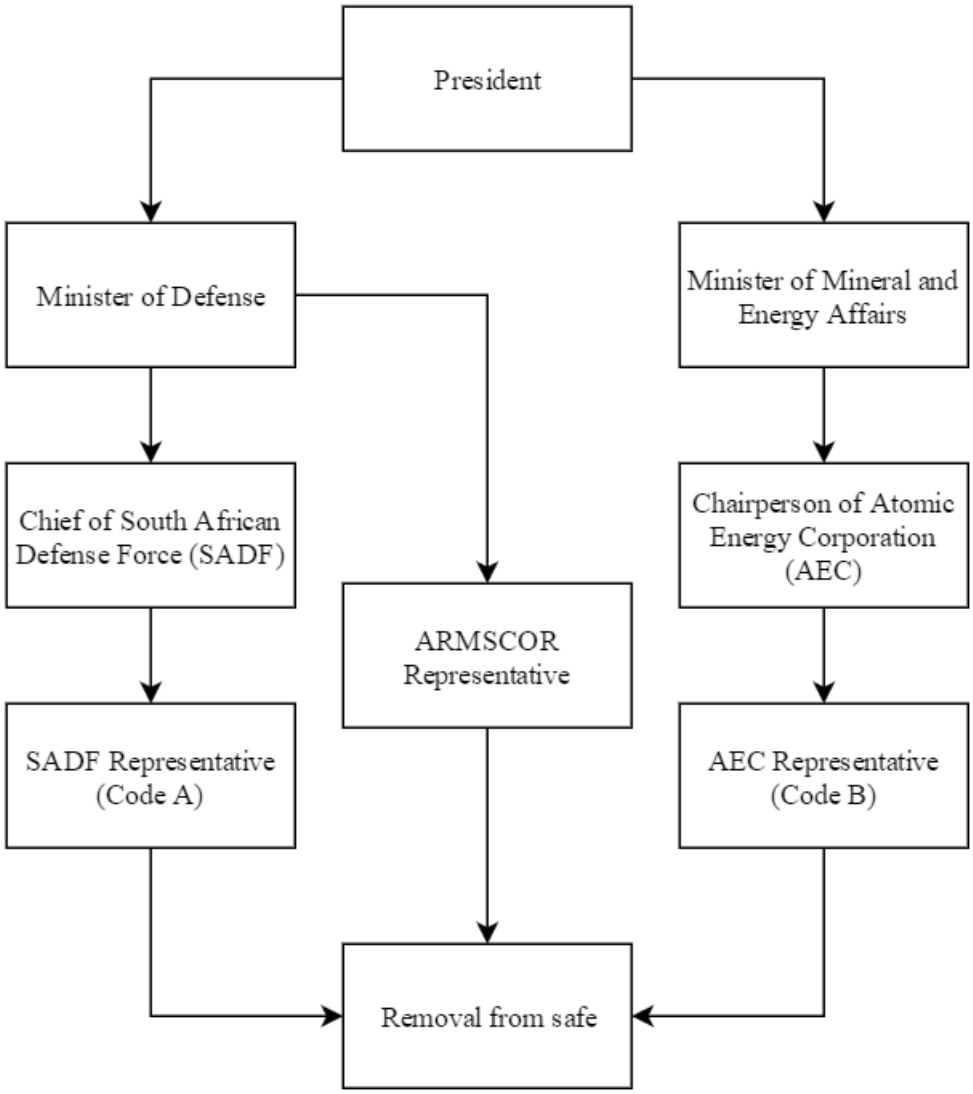
nuclear period and oversaw the dismantlement of South Africa's nuclear arsenal and accession to the Treaty on the Non-Proliferation of Nuclear Weapons and a safeguards agreement with the International Atomic Energy Agency.

[17] André Buys, interview by author, July 14, 2016.

[18] This discussion of administrative control is based upon a confidential 1990 memorandum from General Johannes Geldenhuys, Chief of the South African Defense Force, to General Magnus Malan, South Africa's Minister of Defense. The original memorandum is available in von Wielligh and von Wielligh-Steyn, *The Bomb*, pp. 504-505. The only notable change in the diagram presented in figure 3.1 is the presence of an ARMSCOR representative, who would have been responsible for unlocking the safe upon receipt of the codes from SADF and AEC representatives. This adjustment is made in light of a discussion with André Buys, interview by author, July 14, 2016.

[19] von Wielligh and von Wielligh-Steyn, *The Bomb*, p. 101.

**Figure 5.1. South African Administrative Control**




only then jointly remove the nuclear component from the vault. Because weapons were split into two halves, this process required duplication to completely assemble a nuclear weapon.

This multi-tiered chain of command centralized political control by precluding subordinate actors from acquiring nuclear assets without senior-level approval and inhibited potential collusion between these actors. Furthermore, after removing both components to

assemble a weapon, only senior political leaders could provide the codes to disable mechanical locks. Figure 5.1 provides a diagram of this administrative control structure.

Political leaders further exercised administrative control by institutionalizing centralized oversight of nuclear use procedures. The same administrative control methods constraining peacetime nuclear management operations also applied to the movement and potential use of nuclear weapons. South Africa only developed air-delivery platforms for its nuclear weapons, which allowed political elites to maintain control of nuclear weapons throughout mobilization and deployment processes. An assembled nuclear weapon would require transportation from an ARMSCOR facility to a South African Air Force (SAAF) base, where the device would be loaded onto an aircraft under the supervision of civilian authorities. Political leaders would provide SAAF operators with targeting instructions, and final authorization codes to arm the weapon would be transmitted from civilian leadership to the air delivery crew immediately before releasing the nuclear weapon.[20] These procedures guaranteed executive civilian oversight of nuclear use until the last possible moment, and ensured that military actors could not mobilize, deploy, or detonate nuclear weapons without authorization from senior political authorities.

Physically, nuclear weapons were disassembled into two parts: a front part containing the nuclear warhead, and a rear part containing the gun assembly and uranium missile to initiate the detonation process. This gun-type design was based upon the relatively simple and reliable technology used for the earliest U.S. nuclear weapons in the mid-1940s,[21] and by completely separating the atomic material from the gun device, guaranteed that the weapon could not

[20] The details in this section on the administrative control over tactical uses of nuclear force reference information provided by André Buys, interview by author, July 14, 2016.
[21] Johan Slabber, interview by author, July 21, 2016. Slabber was the scientist in charge of developing South Africa's first nuclear explosive device in the 1970s. As such, Slabber was directly involved in the design of nuclear components and physical and technical controls to secure nuclear devices.

detonate until both halves were conjoined. Furthermore, each component was secured in a separate vault.[22] If orders were given to assemble and deploy a nuclear weapon, each component would be transported in a separate vault to reduce the likelihood of accidental or unauthorized use. The two components would only be bolted together and ready for deployment once integrated with the delivery platform, such as a missile or glide bomb. These procedures also applied to underground tests, indicating that South Africa's physical control arrangements were highly assertive for peacetime and crisis scenarios alike.[23]

Even if the warhead and detonator were mated, the weapons were protected by technical controls to inhibit unauthorized use. Each nuclear weapon contained a mechanical lock that served as a safing mechanism by blocking the uranium missile from initiating a nuclear reaction unless the lock was removed.[24] Although this lock was somewhat rudimentary, it provided an effective layer of protection against unwanted nuclear use by preventing nuclear mobilization without proper authorization.[25] These locks remained in place while weapons were in storage, as well as when weapons components were transported during mobilization. The lock could only be opened and the physical barrier between the warhead and gun device removed after the weapon was fully assembled and mated to a delivery platform.[26] Combined, these indicators show that technical controls remained highly assertive for all potential operations.

As South Africa's command and control systems began to take shape in the early-1980s, however, the country's security environment progressively worsened. South Africa became

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[22] von Wielligh and von Wielligh-Steyn, *The Bomb*, p. 172. This storage arrangement was confirmed by André Buys, interview by author, July 14, 2016.
[23] Steyn, Van Der Walt, and Van Loggerenberg, *Armament and Disarmament*, p. 89.
[24] André Buys, interview by author, July 14, 2016; Johan Slabber, interview by author, July 21, 2016.
[25] Johan Slabber, interview by author, July 21, 2016.
[26] Steyn, Van Der Walt, and Van Loggerenberg, *Armament and Disarmament*, p. 89. Corroborated by André Buys, interview by author, July 14, 2016.

increasingly isolated from the international community, while the prolonged border war with Angola continued to escalate during this time with Cuban troops pouring into the region to support the Angolan military and the Soviet Union providing extensive material support for Cuban and Angolan forces.[27] Upon evaluating the viability and preparedness of South Africa's nuclear arsenal, defense planners worried that nuclear weapons would not be ready for use in the event of a crisis, which could undermine the credibility of the nuclear deterrent. South Africa's nuclear strategy and command and control arrangements were largely informal until this time, and policymakers questioned whether operators were prepared to conduct nuclear operations.

In response, South Africa's political elites conducted a review of nuclear strategy and operations in 1985. André Buys, a senior official at ARMSCOR, led the review committee. According to Buys, command and control matters were a central concern of the committee.[28] Political leaders sought to promote safety, security, and reliability at all stages of nuclear management and specifically aimed to eliminate the possibility of unauthorized use by military actors.[29]

The committee formalized two parallel chains of command as a means of centralizing administrative control over nuclear assets and reiterated the requirement of mechanical locks on disassembled nuclear devices to protect against accidental or unauthorized use.[30] The review committee ultimately formalized the three-stage strategy tacitly approved by Vorster and institutionalized assertive command and control procedures, guaranteeing that nuclear operations

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[27] On this dispute and other major events in South Africa's foreign policy during the time period, see James Barber and John Barratt, *South Africa's Foreign Policy: The Search for Status and Security, 1945-1988* (New York, N.Y.: Cambridge University Press, 1990), especially pp. 247-346.
[28] André Buys, interview by author, July 14, 2016.
[29] Purkitt and Burgess, *South Africa's Weapons of Mass Destruction*, p. 65. André Buys, interview by author, July 14, 2016.
[30] André Buys, interview by author, July 14, 2016.

would be managed through highly assertive control procedures under all potential scenarios. As a result, South African command and control systems demonstrated a high degree of assertive control along physical, technical, and administrative dimensions for the duration of the country's nuclear program.

South Africa's status as a nuclear weapons state proved short-lived. In 1989, only seven years after completing its first operational nuclear weapon, newly-elected president F.W. de Klerk immediately began the process of decommissioning South Africa's nuclear arsenal.[31] South Africa developed six deliverable nuclear weapons by this time and canceled the program with a seventh weapon in production. These weapons were never fully assembled, nor were they tested.[32] South Africa joined the Non-Proliferation Treaty in 1991 and the International Atomic Energy Agency (IAEA) completed verification of all nuclear materials and facilities by 1993.[33] By the time of the 1994 elections—the first elections to grant universal adult suffrage in South African history—both the nuclear weapons program and apartheid regime were dismantled.

**Explaining Assertive Control in South Africa**

Although South Africa's nuclear weapons program was short-lived, the case provides a clear example of highly assertive control and offers insight into the explanatory power of my

[31] Albright, "South Africa and the Affordable Bomb," p. 46.
[32] von Wielligh and von Wielligh-Steyn, *The Bomb*, p. 171. Although South Africa never tested a completed nuclear weapon, it used a relatively simple and proven gun-type design. Because previous proliferators had successfully tested gun-type weapons, South Africa was able to trust in the viability of its weapons without conducting a nuclear test that might be detected by international actors. Gun-type nuclear weapons have two key components: (1) the gun device; and (2) the nuclear warhead. These weapons work by shooting a projectile of nuclear material at an extremely high velocity from the gun device into nuclear material. At this point, the combination exceeds critical mass and results in a nuclear chain reaction. For details on gun-type versus implosion bombs, see ibid., pp. 33-34.
[33] On South Africa's accession to the Non-Proliferation Treaty and participation in the International Atomic Energy Agency verification process, see Stumpf, "South Africa's Nuclear Weapons Program," pp. 3-8.

theoretical framework. I argue that the South African case supports three broad implications of my theory. First, although South Africa's general security environment worsened throughout its nuclear tenure, the absence of a conventionally superior adversary led political leaders to prioritize domestic considerations when establishing command and control frameworks. Second, the presence of severe domestic threats to the survival of the apartheid regime served as the primary domestic determinant of command and control decision-making, causing political elites to centralize control over nuclear weapons to narrowly leverage South Africa's nuclear forces in support of the apartheid regime's continued survival. Third, South Africa adopted assertive control measures in spite of the military's traditionally high levels of organizational autonomy, demonstrating the political leaders' prioritization of regime survival over other considerations when developing nuclear doctrine. I elaborate on each of these points in the section below.

*Security Environment*

South Africa' nuclear program was originally intended for exclusively peaceful purposes. Initially, political elites prioritized the economic and industrial benefits of nuclear technology, while scientists and engineers involved in the early phases of South Africa's nuclear program valued the scientific advancement of nuclear research.[34] Nuclear technologies, however, are inherently dual-use, and the rapid transfer of technology and knowledge created a foundation for nuclear weapons research in South Africa.[35] Over time, an increasingly hostile regional and

[34] Albright, "South Africa and the Affordable Bomb," pp. 37-38; Liberman, "The Rise and Fall of the South African Bomb," p. 49. Corroborated by: Johan Slabber, interview by author, July 21, 2016; Waldo Stumpf, interview by author, July 21, 2016.

[35] Matthew Fuhrmann offers an extensive analysis of how nuclear cooperation—especially the Atoms for Peace program—facilitates nuclear proliferation in Matthew Fuhrmann, *Atomic Assistance: How "Atoms for Peace" Programs Cause Nuclear Insecurity* (Ithaca, N.Y.: Cornell University Press, 2012). For additional extensions of the

international threat environment caused policymakers to reconsider the purposes of the program in the early-1970s and political leadership ultimately supported a move towards weaponization by the late-1970s.[36]

Regionally, South Africa faced a variety of security threats. The collapse of Portuguese colonial rule in Angola and Mozambique fostered the rise of communist governments that were antipathetic to South Africa's white-minority rule and created instability on South Africa's borders. To its west, South Africa faced resistance by the Southwest African People's Organization (SWAPO), which challenged South Africa's territorial claims in Namibia through guerrilla military operations.[37] This dispute became a core component of South Africa's prolonged border war with Angola, which was made more severe by a large contingent of Cuban troops sent to support Angolan forces, as well as the Soviet Union's extensive provision of military supplies to Angolan and Cuban troops. To the east, Mozambique's porous borders offered sanctuary to South Africa's domestic adversaries, such as the African National Congress (ANC). The ANC exploited this opportunity by using positions in Mozambique to plan and conduct attacks within South African borders aimed at undermining the apartheid regime.[38] From the center to the periphery of South African territory, South Africa's political system was under attack.

Internationally, South Africa faced additional pressures from the international community and Western states with whom South Africa had historically amicable relations. In 1962, the

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argument, see Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution*, Vol. 53, No. 2 (April 2009), pp. 181-208.

[36] Liberman, "The Rise and Fall of the South African Bomb," pp. 50-51. The regional and international threats discussed in this section were also identified by André Buys, interview by author, July 14, 2016.

[37] On the South Africa's conflict with SWAPO in Namibia, see Christopher Coker, *South Africa's Security Dilemmas* (New York, N.Y.: Praeger, 1987), pp. 41-47.

[38] Barber and Barratt, *South Africa's Foreign Policy*, pp. 254, 269-274.

United Nations (UN) General Assembly voted in favor of a voluntary embargo on trade with South Africa.[39] In 1977, UN pressure escalated with UN Resolution 418, which established an embargo that formally precluded all member states from arms deals with South Africa and led to the cancellation of corvette and submarine sales by France, as well as the termination of U.S. fuel supplies for the SAFARI reactor.[40] As a result, South Africa quickly became diplomatically isolated in the international arena, primarily due to international opposition to South Africa's apartheid policies.[41]

Individual states further enacted policies that exacerbated South Africa's international concerns. For example, in the 1970s U.S. policymakers began forcefully advocating for an anti-apartheid position that would interrupt economic and technical cooperation between the two countries.[42] In 1975, after covertly supporting South African involvement in the Angolan civil war, the U.S. quickly distanced itself from South Africa when Nigeria and several other African states discovered and objected to U.S. involvement in the region, leaving South Africa alone in its fight against Angola.[43] The U.K. also canceled the longstanding Simonstown Agreement that guaranteed bilateral naval cooperation and protection in the South Atlantic Ocean.[44]

By the late-1970s, several previously friendly countries had effectively severed ties with South Africa and the UN had implemented a series of robust sanctions and embargoes. South Africa's connections to the West weakened at a time when the Soviet Union increased its

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[39] Ibid., p. 81.
[40] von Wielligh and von Wielligh, *The Bomb*, pp. 133, 164, 178.
[41] On the importance of isolation for South African foreign policy decisions, see Deon Geldenhuys, *The Diplomacy of Isolation: South African Foreign Policy Making* (Johannesburg: Macmillan, 1984).
[42] For a description of the U.S.'s domestic motivations for sanctions, see Liberman, "The Rise and Fall of the South African Bomb," pp. 68-71. For a more general discussion of why the U.S. adopted sanctions, see Audie Klotz, "Norms Reconstituting Interests: Global Racial Equality and U.S. Sanctions Against South Africa," International Organization, Vol. 49, No. 3 (Summer 1995), pp. 451-478.
[43] Barber and Barrett, *South Africa's Foreign Policy*, p. 195; von Wielligh and von Wielligh, *The Bomb*, p. 131.
[44] von Wielligh and von Wielligh, *The Bomb*, p. 131.

material support for several of South Africa's regional adversaries, such as Angola and Mozambique.[45] Concerningly for the ruling regime, South Africa's external security environment became more threatening precisely as its external support and international status began to dwindle.

The continuous worsening of South Africa's external security environment explains an important part of the country's decision to acquire nuclear weapons, but these trends did not prove decisive in the development of South Africa's command and control procedures. This outcome aligns with a core prediction of my theoretical framework: because South Africa did not face a conventionally superior adversary capable of posing an existential threat to South African existence, domestic considerations became primary for decision-makers. Although the large contingent of Cuban and Angolan troops posed a significant threat in the contested area of Namibia, for example, these forces were insufficient to decisively defeat South Africa in a conventional conflict. Additionally, Cuban commanders dispersed the units within their divisions to minimize the potential damage of a nuclear attack by South Africa.[46] With already insufficient numbers and capabilities to project conventional power across the entirety of South Africa, the dispersal of forces made South Africa's primary external adversary incapable of significant offensive action.[47] Instead, the primary threat to South Africa's political regime emanated from domestic sources.

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[45] For an overview of the Soviet Union's involvement in Southern Africa and how it affected South African security perceptions, see Robert Legvold, "The Soviet Threat to Southern Africa," in Robert I. Rotberg, Henry S. Bienen, Robert Legvold, and Gavin G. Maasdorp, eds., *South Africa and Its Neighbors: Regional Security and Self-Interest* (Lexington, M.A.: Lexington Books, 1985), pp. 27-53.

[46] Waldo Stumpf, interview by author, July 21, 2016.

[47] The concentration of military force is considered to be a necessary component of successful offensive conventional military operations. Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, N.J.: Princeton University Press, 2004).

*Domestic Threats to the Apartheid Regime*

Although South Africa's conventional threat environment did not produce an immediate threat to the survival of the apartheid regime, the intensifying combination of international, regional, and domestic challenges to South Africa's political order in the 1970s created the impression of a "total onslaught" among political elites.[48] South African leaders observed threats in political, economic, diplomatic, and military spheres and sought to develop an equally expansive range of responses to counter these challenges.[49] As General Magnus Malan, Chief of the South African Defense Force, stated:

> The total onslaught is an ideologically motivated struggle and the aim is the implacable and unconditional imposition of the aggressor's will on the target state. The aim is therefore also total, not only in terms of the ideology, but also as regards the political, social, economic and technological areas.[50]

For South Africa's ruling elites, the concept of total onslaught represented an existential threat to the future of the regime. Facing an array of threats to the future of South Africa's political system, civilian elites began to investigate the viability and requirements of developing a nuclear arsenal. By the mid-1970s, political elites perceived nuclear weapons as valuable for deterrence and prestige, and South Africa soon began moving towards an indigenous nuclear weapons capability.[51]

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[48] For an overview of "total onslaught" and the corresponding "total national strategy," see Philip H. Frankel, *Pretoria's Praetorians: Civil-Military Relations in South Africa* (Cambridge: Cambridge University Press, 1984), pp. 29-70.
[49] For an overview of different responses available to South Africa in response to "total onslaught," as well as how the state perceived these challenges, see Barber and Barratt, *South Africa's Foreign Policy*, pp. 253-266.
[50] Magnus Malan, quoted in Deon Geldenhuys, *Some Foreign Policy Implications of South Africa's "Total National Strategy", with Particular Reference to the "12-Point Plan"* (Johannesburg: South African Institute of International Affairs, 1981), p. 3.
[51] Liberman, "The Rise and Fall of the South African Bomb," pp. 49-53.

Prime Minister P. W. Botha embraced the concept of total onslaught to a much greater degree than his predecessors. Whereas earlier leaders prioritized external threats such as the arrival of Soviet-backed Cuban forces in Angola, international opprobrium, and a broader ideological struggle against communism,[52] Botha recognized the severity of internal security matters and became the first prime minister to publicly acknowledge the potential reality of a domestic revolution.[53] To counter the wide-ranging scope of threats posed by total onslaught, Botha adopted the doctrine of "total national strategy," which sought to jointly leverage South Africa's political, economic, social and psychological, and security bases of power.[54] A 1977 defense white paper demonstrates the expansive scope of total national strategy, stating that "A total national strategy is, therefore, not confined to a particular sphere, but is applicable at all levels and to all functions of the state structure."[55]

Through total national strategy, Botha tightly centralized his oversight over domestic and foreign policymaking in an effort to strengthen the ruling political regime. In the period immediately preceding South Africa's official pursuit of nuclear weapons, South African foreign policy was produced through a loose and decentralized system of management. This was especially true during the rule of Prime Minster John Vorster. The use of informal policy formulation generally achieved Vorster's aims and allowed Vorster to maintain control over the distribution of patronage and maintain support from key domestic actors.[56] Despite a general

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[52] For an overview of security challenges to South Africa leading into P. W. Botha's tenure as prime minister, see Deon Geldenhuys, *South Africa's Search for Security Since the Second World War* (Johannesburg: South African Institute of International Affairs, 1978).
[53] On P. W. Botha's perspective on total onslaught, see Robert I. Rotberg, "Decision Making and the Military in South Africa," in Rotberg, Bienen, Legvold, and Maasdorp, ed., *South Africa and Its Neighbors,* pp. 16-18.
[54] On the origins of South Africa's total national strategy, see Geldenhuys, *Some Foreign Policy Implications of South Africa's "Total National Strategy", with Particular Reference to the "12-Point Plan"*, pp. 8-10.
[55] South Africa, Department of Defense, *White Paper on Defense and Armaments Supply, 1977* (Cape Town, 1976), p. 5.
[56] Rotberg, "Decision Making and the Military in South Africa," p. 14.

reliance on an informal policymaking apparatus, in 1969 Vorster supported the development of a Bureau of State Security (BOSS). The creation of BOSS supported Vorster's goal of consolidating his domestic political power by reassigning security functions from the security police and military intelligence to BOSS, which reduced the political influence of the South African Police (SAP) and SADF. Vorster chose General Hendrik van den Bergh—a close friend and supporter of Vorster—to lead the new agency and doubled the size of BOSS within its first ten years.[57]

P. W. Botha's rise to prime minister produced a drastic shift in the balance of domestic political power. Before becoming prime minister, Botha served as minister of defense under Vorster for thirteen years. Despite his prolonged service under Vorster, however, Botha preferred an orderly and systematized decision-making process, much in contrast to Vorster's decentralized policy apparatus. In part, Botha blamed South Africa's humiliation in Angola on Vorster's informal foreign policy procedures, which allowed South Africa to stumble into a conflict unprepared. Upon assuming the office of prime minister, Botha swiftly moved to centralize and reorganize South Africa's foreign policy institutions. In addition to establishing a more competent policymaking process, Botha also needed to assert control over BOSS and other bureaucratic bodies that may have remained loyal to Vorster.[58]

The most notable institutional change enacted by Botha was the creation of the State Security Council (SSC). As part of Botha's administrative reforms, the SSC became the primary organization for producing foreign policy. SSC meetings were chaired by Botha and included senior cabinet members, the directors-general of foreign affairs and justice, the chief of the SAP,

[57] For an overview of Vorster's general reliance upon informal policymaking processes, and his support for the Bureau of State Security as a tool of power consolidation, see ibid., pp. 14-16.
[58] Ibid., p. 17.

and the chief of the SADF. The SSC met every Monday to discuss and produce policies on matters relating to South African security, and the committee made decisions by consensus. Most often, this consensus was led by the prime minister—or, after South Africa transitioned from a parliamentary to a presidential system in 1984, the president—which gave Botha a significant degree of influence over security-related policy issues.[59] Because South Africa's doctrine of total onslaught and total strategy meant that almost any political issue could be treated as a security matter, Botha was able to directly shape nearly all aspects of South African politics. Through the SSC, Botha achieved immediate control over all significant domestic and foreign policy decisions.

Importantly, these institutional changes altered the means through which policymakers made nuclear decisions. Nuclear weapons quickly became an important part of South Africa's total national strategy, and within one month of assuming office, Botha developed a committee to transform the AEB's peaceful nuclear devices into operational nuclear weapons.[60] Under Vorster, South African policymakers failed to articulate a clear nuclear strategy. In contrast, Botha quickly sought to formalize a nuclear doctrine and, shortly after becoming prime minister in 1978, Botha created the Witvlei Committee to formally develop nuclear weapons policy.[61] The Witvlei Committee represented the highest echelon of political power in South Africa, including: the prime minister; ministers of defense, foreign affairs, minerals and energy, and finance; director of ARMSCOR; minister of foreign affairs; AEB director; and chief of the

[59] For overviews of the State Security Council and its role in South African foreign policy, see: Kenneth W. Grundy, *The Militarization of South African Politics* (Bloomington, I.N.: Indiana University Press, 1986), pp. 49-57; Rotberg, "Decision Making and the Military in South Africa," pp. 18-26.
[60] von Wielligh and von Wielligh-steyn, *The Bomb*, p. 165.
[61] As an example of the importance of the Witvlei Committee for South Africa's nuclear doctrine, this committee produced the memorandum detailing South Africa's catalytic nuclear posture. See "KRAMAT Capability: Current Status and Further Development," declassified document, September 2, 1987. An English version of this memorandum is available in von-Wielligh and von-Wielligh-Steyn, *The Bomb*, pp. 487-496.

SADF.[62] By creating this committee, Botha was able to consolidate his authority over all aspects of South Africa's nuclear program, including the production, procurement, financing, and employment of nuclear weapons.

The core principle driving weaponization under P. W. Botha was that nuclear weapons were purely political devices that would not be used militarily.[63] Botha viewed nuclear weapons as tools for diplomatic leverage to promote regime survival, rather than military assets for achieving battlefield success. Botha's oversight of the Witvlei Committee allowed him to centralize and manage the debate on how to operationalize South Africa's arsenal and guarantee that nuclear weapons only served narrow political purposes. Indeed, Botha rejected a range of "exotic" recommendations by the working group that envisioned the military application of South Africa's nuclear forces, and over time Botha helped to formalize South Africa's catalytic nuclear posture.[64] Nuclear weapons would only be used as an opaque deterrent for supporting the political regime, and civilian elites would retain highly centralized control of nuclear assets to guarantee this.

South Africa's political elites viewed preventing the military application of South Africa's nuclear arsenal as a necessary condition for regime survival. An internal memorandum by the Department of Foreign Affairs (DFA) expected that "the immediate international response to the use of a nuclear device would overwhelm and remove/destroy that component of South African society/government, both the political and military, that had initiated the use of the

[62] Liberman, "The Rise and Fall of the South African Bomb," p. 53.
[63] von Wielligh and von Wielligh-Steyn, *The Bomb*, p. 169. Botha's commitment to nuclear weapons as a political, rather than military, tool was also confirmed by: André Buys, interview by author, July 14, 2016; Waldo Stumpf, interview by author, July 21, 2016.
[64] Waldo Stumpf, quoted in von-Wielligh and von-Wielligh-Steyn, *The Bomb*, p. 181.

device."[65] The military use of nuclear weapons, therefore, was a self-defeating option that amounted to "a no-win assurance of self-destruction for those whom the nuclear device [was] designed to ultimately protect."[66] This analysis suggests that apartheid leaders thought of regime survival separately from state security, and of the two considerations, regime survival took precedence. Strong assertive control guaranteed that the nuclear weapons designed to strengthen the ruling regime would not contribute to the detriment of the regime.

Ultimately, the end of the Cold War and impending collapse of the apartheid system combined to produce a structural shock to South Africa's political system that forced ruling elites to reconsider the political utility of nuclear weapons.[67] With the end of the Cold War, Cuban and Soviet support for Angola's war with South Africa dwindled. This ameliorated South Africa's threat environment and drastically reduced the likelihood that the U.S. would intervene on South Africa's behalf in future disputes.[68]

The end of the Cold War, however, cannot alone explain South Africa's decision to denuclearize. In response to the sudden removal of the Soviet threat, states such as Israel, France, and Pakistan simply reevaluated their nuclear strategies, while only South Africa dismantled its nuclear arsenal.[69] An important determinant of the decision to dismantle was the recognition by political elites in the early-1990s that the apartheid government would soon collapse. Nuclear

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[65] South African Department of Foreign Affairs, "A Balance Approach to the NPT: Armscor/AEC Concerns Viewed from a DFA Standpoint," September 1, 1988, Wilson Center History and Public Policy Program Digital Archive, South African Foreign Affairs Archives, NPT-IAEA Agreement/Negotiations on Full-Scope Safeguards." Declassified document, available at: https://digitalarchive.wilsoncenter.org/document/114185.
[66] Ibid.
[67] An institution that is "locked-in" may be vulnerable to exogenous shocks that undermine the institution. See Andrew Bennett and Colin Elman, "Complex Causal Relations and Case Study Methods: The Example of Path Dependence," *Political Analysis*, Vol. 14, No. 3 (Summer 2006), p. 257.
[68] Both of these points were noted by Waldo Stumpf, interview by author, July 21, 2016.
[69] On the strategic responses of these countries to the end of the Cold War, see Narang, *Nuclear Strategy in the Modern Era*, pp. 76-91, 169-178, 199-206.

weapons promoted regime survivability but could not suppress domestic unrest. Under pressure from the U.S.—who feared nuclear weapons falling into the hands of an ANC regime with connections to communist governments and extremist organizations—South Africa's political elites chose to decommission the arsenal, rather than relinquish command of nuclear weapons to its domestic rivals.[70] The end of the apartheid regime also meant the end of South Africa's nuclear weapons program.

*Military Organizational Autonomy*

South Africa's adoption of assertive command and control systems demonstrates the importance of sequencing the explanatory factors within my theoretical framework. South Africa's military forces traditionally enjoyed high levels of organizational autonomy and, in many aspects of foreign and domestic politics, exerted strong political influence. In the nuclear realm, however, civilian elites intentionally excluded the military from decision-making units. Nuclear weapons would not serve military purposes under any conditions and civilian elites designed command and control systems to guarantee that nuclear weapons would only be used in support of the regime's survival. As a result, military forces were unable to advance their preference for more delegative control measures within South Africa's command and control arrangements.

Civilians maintained dominance over strategic and operational decisions for the duration of South Africa's nuclear program, which allowed the civilian regime to leverage the political

[70] On these U.S. concerns and pressures, see Martha van Wyk, "Sunset over Atomic Apartheid: United States-South African Nuclear Relations, 1981-1993," *Cold War History*, Vol. 10, No. 1 (February 2010), pp. 66-67.

dimensions of nuclear weapons in support of regime survivability and guarantee political control of nuclear forces. South Africa's military services viewed nuclear weapons as a threat to budgets for conventional operations and ill-suited for military purposes, but a lack of political influence in doctrinal decision-making prevented military actors from shaping command and control decisions. Throughout the nuclear program, civilian authorities purposefully excluded military influence to guarantee the regime's control over nuclear weapons, and rather than relinquish control of nuclear forces to domestic opponents, elected to dismantle the nuclear program with the impending collapse of the apartheid regime.

South Africa's nuclear program operated almost exclusively under civilian control throughout its formative period. During these early stages of proliferation, only a select group of civilian leaders and scientists were aware of nuclear operations, and this pattern of civilian exclusion of the military persisted at length.[71] Because the program operated under secretive and peaceful auspices for decades before the decision to develop a nuclear arsenal, a narrow group of decision-makers were responsible for the creation of South Africa's nuclear doctrine. The AEB especially enjoyed dominance in internal debates regarding nuclear affairs and had direct access to the South African prime minister, which allowed South African scientists to develop the nuclear weapons program without significant external interference.[72]

Military forces, in contrast, were completely excluded from nuclear matters until Prime Minister Vorster's decision to test a nuclear device at Vastrap Air Force Base, and were only then approached by political leaders to assist by providing a site for the AEB to conduct a

[71] For an overview of the scientific origins of South Africa's nuclear program, see von Wielligh and von Wielligh-Steyn, pp. 97-123.
[72] Liberman, "The Rise and Fall of the South African Bomb," p. 49.

nuclear test.[73] The degree of secrecy and executive civilian authority over the program was so extreme that South Africa's Minister of Foreign Affairs Pik Botha only learned about the nuclear program after meeting with U.S. Ambassador William Bowdler in 1977. Prior to this meeting, Soviet satellites had detected South Africa's preparations for an underground test at the Vastrap location and passed intelligence to the U.S. with hopes that the Americans could dissuade South Africa from pursuing nuclear weapons.[74] Bowdler expressed direct concern over South Africa's nuclear intentions, and presented Botha with satellite photographs of the Vastrap test site.[75] Although he had no prior knowledge of the nuclear program, Botha quickly recognized the purpose of the Vastrap site and realized that South Africa was planning to test a nuclear device.[76] Despite Botha's senior position, he only learned of South Africa's nuclear program through Soviet and U.S. intelligence. Representatives from the military itself were equally unaware of the nuclear project, and only the Chief of the SADF would later become involved in the formal chain of command.[77] Instead, a narrow group of civilian elites held sway over nuclear decisions in South Africa and overwhelmingly excluded the military and defense establishment from the decision-making unit.

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[73] Ibid. The exclusion of military input during these initial stages was also corroborated by Johan Slabber, interview by author, July 21, 2016.

[74] Letter, Warren Christopher to William Hyland, "Response to Soviet Message on South Africa," August 10, 1977, Wilson Center History and Public Policy Program Digital Archive, National Archives, Record Group 59, Department of State Records, Records of Warren Christopher, Box 16, Memos to White House 1977. Declassified document, available at: https://digitalarchive.wilsoncenter.org/document/119249.

[75] Letter, William Bowdler to Pik Botha, "Message Conveyed to Minister of Foreign Affairs by U.S. Ambassador W. Bowdler," August 18, 1977, Wilson Center History and Public Policy Program Digital Archive, South African Foreign Affairs Archives, Brand Fourie, Atomic Energy, File 2/5/2/1, Vol. 1, Vol. 2. Declassified document, available at: https://digitalarchive.wilsoncenter.org/document/114150.

[76] von Wielligh and von Wielligh, *The Bomb*, p. 140.

[77] A declassified memorandum indicates that any form of disclosing or mobilizing South Africa's nuclear forces could be "authorized solely by the state president." "Meeting of Ad Hoc Cabinet Committee Under the Charimanship of the Honorable State President," September 3, 1985, Wilson Center History and Public Policy Program Digital Archive. Available at: https://digitalarchive.wilsoncenter.org/document/123058.

As peaceful nuclear research gave way to weaponization efforts, civilian control of the nuclear program tightened. In 1979, Botha transferred control of nuclear research from the AEB to ARMSCOR.[78] Upon assuming control of nuclear research, ARMSCOR's political mandate was very broad: elites directed the agency aimed to build a deterrent using nuclear weapons, but left the tactical-level details unspecified.[79] Although ARMSCOR brought in members of other organizations to assist with the production of nuclear weapons, the military's sole representative in the process was an operator from the SADF to provide details of technical requirements for military use.[80] Additionally, SADF representatives were only consulted for guidance on user requirement specifications, such as the necessary size and delivery platforms to make nuclear weapons viable.[81] All strategic and operational planning occurred under the direction of civilian authorities. During these critical moments of nuclear policy formulation, South Africa's military remained absent; instead, civilians and scientists controlled the development of nuclear doctrine and the trajectory of South Africa's nuclear weapons program.

The Witvlei Committee established the SADF's first institutional role in nuclear decision-making. The inclusion of a military representative in the Witvlei Committee reflected the broader trend of militarization in South African politics.[82] The South African government's emphasis on total onslaught and total national strategy required a strong and capable organization for policy implementation, and P. W. Botha's tenure as minister of defense led him to rely on the SADF as a political tool for addressing domestic and international threats.

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[78] For a description of this transition in control of the nuclear program, see Purkitt and Burgess, *South Africa's Weapons of Mass Destruction*, pp. 61-64.
[79] André Buys, interview by author, July 14, 2016.
[80] Purkitt and Burgess, *South Africa's Weapons of Mass Destruction*, p. 62.
[81] André Buys, interview by author, July 14, 2016.
[82] On the increasing role of South Africa's military in political affairs, see: Jacklyn Cock and Laurie Nathan, eds., *War and Society: The Militarization of South Africa* (New York, N.Y.: St. Martin's, 1989); Frankel, *Pretoria's Praetorians*; Grundy, *The Militarization of South African Politics*.

Furthermore, Botha worked closely with and trusted General Magnus Malan, who was serving as chief of the SADF when Botha created the Witvlei Committee.[83]

Nevertheless, two factors mitigated the ability of SADF leaders to influence nuclear decisions. First, internal secrecy remained a trademark of South Africa's nuclear program, even after the development of the Witvlei Committee, several cabinet members and military officials remained unaware of the nuclear program, including influential officers such as General Jannie Geldenhuys, the army chief of staff and later SADF chief.[84] Second, the military's representative in the committee was not responsible for creating policy, but rather for implementing the committee's decisions.[85] Strategic decisions regarding South Africa's nuclear program were made by Botha and a narrow group of civilian elites—such as the ARMSCOR working group that clarified South Africa's three-stage nuclear strategy—and military leaders were narrowly responsible for ensuring that the military could perform political mandates.

South Africa's military services viewed the utility of nuclear weapons differently from civilian leaders,[86] but the military's exclusion from nuclear decision-making prevented military actors from advancing their preferences and civilian interests prevailed.[87] Military leaders initially opposed the adoption of nuclear weapons due to fears that funding for the nuclear program would reduce conventional defense spending and because nuclear weapons served no

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[83] During crises, General Malan would quickly contact Prime Minister/President Botha to obtain orders. In some ways, this represented a similar ad hoc decision-making process to General van den Bergh's personal connection to Prime Minister Vorster. On these similarities and differences, see Rotberg, "Decision Making and the Military in South Africa," pp. 23-26.
[84] Liberman, "The Rise and Fall of the South African Bomb," p. 66.
[85] Ibid.
[86] For one example of differing opinions within the military, see Milton Hamann, *Days of the Generals: The Untold Story of South Africa's Apartheid-Era Military Generals* (Cape Town.: Zebra, 2001), pp. 164-170.
[87] The key group of political leaders aware of nuclear weapons included the president, minister of defense, minister of finance, minister of foreign affairs, and minister of energy. André Buys, interview by author, July 14, 2016.

operational combat purpose.[88] General Constand Viljoen, chief of the SADF from 1980-1985, clearly articulated this position, stating: "you don't win a revolutionary war with a nuclear bomb…let's rather buy tanks or guns."[89] Given threats to SADF budgets and the lack of an offensive military purpose, several of South Africa's senior military officials opposed the nuclear program, albeit without success.

To allay the military's concerns, South Africa's political elites promised continued funding for conventional operations and technical upgrades, ultimately persuading the armed services to facilitate nuclear operations by providing facilities and security.[90] However, facing a border war with Angola that rapidly escalated in the mid-1980s, South Africa's military sought additional resources for conventional combat operations and pushed for changes in nuclear doctrine.[91] Operationally, the military questioned the deterrent credibility of South Africa's three-tier strategy and advocated for a battlefield nuclear capability to strengthen deterrence against a conventional assault on South African territory.[92] Specifically, SADF leaders requested a long-range ballistic missile capability and miniaturized nuclear warheads capable of fitting on these missiles to serve offensive military purposes.[93] Furthermore, whereas political guidance earlier mandated the production of seven gun-type nuclear warheads,[94] SADF requests called for

[88] André Buys, interview by author, July 14, 2016; Waldo Stumpf, interview by author, July 21, 2016.
[89] General Constand Viljoen, quoted in Hamann, *Days of the Generals*, p. 168.
[90] André Buys, interview by author, July 14, 2016.
[91] On the increasing threat from Angola, see Coker, *South Africa's Security Dilemmas*, pp. 30-36.
[92] "Submission to the Witvlei Control Committee," September 3, 1987, Wilson Center History and Public Policy Program Digital Archive. Available at: https://digitalarchive.wilsoncenter.org/document/123066.
[93] Decision of Ad Hoc Cabinet Committee, "Program Dunhill: Development of a Nuclear Capability for the SADF," April 18, 1988, Wilson Center History and Public Policy Program Digital Archive. Available at: https://digitalarchive.wilsoncenter.org/document/123062.
[94] "Meeting of Ad Hoc Cabinet Committee Under the Charimanship of the Honorable State President," September 3, 1985, Wilson Center History and Public Policy Program Digital Archive. Available at: https://digitalarchive.wilsoncenter.org/document/123058.

fourteen gun-type warheads and called for increased efforts to develop plutonium-based implosion-type nuclear warheads.[95]

President P. W. Botha, however, rejected these proposals to develop advanced nuclear weapon designs due to budgetary constraints and the desire to maintain a purely deterrent capability.[96] Although South Africa's military preferred a more offensive nuclear doctrine that would more closely integrate nuclear weapons with conventional doctrine and increase SADF autonomy over nuclear operations, civilian elites controlled doctrinal debates and guaranteed that the nuclear arsenal would only be used for deterrent purposes.

**Evaluating the Explanations**

The empirical record from South Africa's nuclear history strongly supports the predictions made by my theoretical framework. In the absence of a conventionally superior adversary, South Africa's command and control systems were determined by domestic level factors. Specifically, the presence of a severe domestic threat to the ruling political regime led apartheid leaders to tightly centralize control over nuclear management operations to guarantee that nuclear weapons narrowly served the purpose of supporting regime survival. These patterns of assertive control emerged despite the South African military historically enjoying high levels of organizational autonomy, further demonstrating the primacy of domestic threats to the political regime for shaping nuclear command and control decisions.

[95] Decision of Ad Hoc Cabinet Committee, "Program Dunhill."
[96] Liberman, "The Rise and Fall of the South African Bomb," p. 73.

How do the alternative explanations fare against the evidence from South Africa? If the civil-military stability hypothesis is correct, then greater stability should cause civilians to trust military actors and adopt more delegative patterns of command and control. South Africa provides a relatively easy test of this argument, as political elites not only trusted the military, but also depended on the military for political survival during the tenure of P. W. Botha. Therefore, the civil-military stability explanation would expect apartheid leaders to delegate at least some degree of command and control authority to the SADF. Empirically, however, precisely the opposite relationship occurs. Despite the trust and strong ties between civilian and military elites—an amicable relationship largely supported by the common goal of maintaining minority white rule—South Africa's political leaders maintained highly assertive patterns of command and control for the duration of the program. Indeed, civilians explicitly rejected the SADF's requests for offensive capabilities that would require ceding authority to peripheral military commanders. These observations call into question the explanatory leveraged offered by the civil-military stability argument. Instead, evidence from South Africa suggests that civilian and military groups competed for influence over command and control systems, and because civilians dominated these debates, command and control systems were designed to represent the ruling elite's interest of protecting the political regime.

If the arsenal vulnerability hypothesis is correct, then the presence of a superior nuclear adversary or South African vulnerabilities should produce more delegative command and control frameworks. South Africa provides mixed results for this hypothesis. On the one hand, the arsenal vulnerability hypothesis correctly predicts that, in the absence of an immediate and overwhelming nuclear adversary, South Africa would not adopt delegative command and control frameworks. On the other hand, South African leaders were nevertheless attentive to the Soviet

Union's nuclear capabilities. Interviews with apartheid-era officials suggest that nuclear threats shaped South Africa's strategic nuclear decisions, rather than operational outcomes. For instance, multiple interviewees referred to the use of nuclear weapons against Soviet-supported troops as "suicide," which led to the creation of South Africa's catalytic nuclear posture.[97] To the extent that Soviet nuclear forces shaped South African nuclear policy, the effects were primarily strategic. Furthermore, although the arsenal vulnerability hypothesis explains why South Africa would not adopt delegative patterns of command and control, it does not offer a direct explanation for why South Africa would adopt highly assertive control arrangements. The benign nuclear threat environment facing South Africa therefore offers a partial explanation for South Africa's command and control decisions but requires augmentation to explain why civilian elites so tightly managed nuclear operations for the duration of South Africa's nuclear program.

If the strategic rationale argument is correct, then South Africa's catalytic nuclear posture and reliance upon the U.S. as a third-party nuclear patron should explain assertive command and control arrangements. The South African case appears to provide support for this position. As the strategic rationale hypothesis predicts, apartheid leaders centralized control over nuclear forces and refrained from integrating nuclear weapons into military doctrine.[98] The interview and archival data presented in this chapter, however, demonstrate that South Africa's command and control decisions were primarily driven by a concern for regime survival, rather than a byproduct of trusting in the U.S. to intervene on South Africa's behalf during a crisis. Indeed, fear for the survival of the apartheid political regime provides an explanation for both South Africa's strategic nuclear doctrine and command and control systems, suggesting that nuclear strategy

[97] André Buys, interview by author, July 14, 2016; Waldo Stumpf, interview by author, July 21, 2016.
[98] Narang, *Nuclear Strategy in the Modern Era*, p. 22.

and operations were largely determined by similar factors. Rather than serving as competing explanations, therefore, my theory and the strategic rationale argument explain different nuclear behaviors that are largely produced by the same causal factors. Although South Africa's catalytic posture correlates with the observed assertive control measures, the availability of the U.S. as a nuclear guarantor did not clearly shape nuclear management decisions. Instead, my theoretical framework is necessary to directly connect domestic threats to the political regime to South Africa's highly assertive command and control outcomes.

# CHAPTER 6

# CONCLUSION

This dissertation provides conceptual and theoretical frameworks for understanding and explaining command and control systems in regional nuclear powers. In doing so, this dissertation provides three significant contributions to the broader literature on nuclear strategy and operations. First, I develop a new conceptual typology of nuclear command and control systems. Traditional conceptualizations of command and control measure whether states assert political control over nuclear forces or delegate nuclear use capability to lower-level commanders. In practice, however, military operators are ultimately required to deliver nuclear weapons and all states must delegate control at some point to conduct a nuclear attack. I argue that the appropriate question when classifying command and control systems is therefore not *whether* a state delegates nuclear use capability to lower levels of command, but rather *when* such delegation occurs.

To account for the temporal aspects of nuclear command and control decisions, I identify three ideal types of command and control: first, *delegative* command and control systems that delegate nuclear use capability during peacetime; second, *conditional* command and control systems that centralize political oversight of nuclear forces during peacetime but rapidly delegate nuclear use capability early in a crisis; and third, *assertive* command and control systems that maintain centralized control over nuclear weapons until late in a crisis. I use three institutional indicators to classify command and control arrangements within this framework: administrative control, physical control, and technical control. These institutional aspects provide observable

indicators that allow me to descriptively classify a state's nuclear command and control systems and account for the timing of nuclear delegation.

Second, I provide a theoretical framework to explain variation in command and control arrangements across regional nuclear powers. My theory incorporates three variables: first, the presence of a conventionally superior adversary; second, the severity of domestic threats to the political regime; and third, the level of military organizational autonomy. I sequentially order these variables into a decision-theoretic framework to specify the conditions under which each factor influences command and control outcomes.

The structure of my theoretical framework reveals three findings that advance the existing literature on command and control in regional nuclear powers. First, command and control systems in these states are specifically responsive to conventional threats. Although most regional nuclear powers face threats from nuclear adversaries, the presence of a conventionally superior adversary provides the strongest incentives for a state to delegate nuclear use capability during peacetime or early in a crisis and lower the threshold to nuclear use. Second, political leaders in regional nuclear powers are also responsive to domestic threats to the political regime. My theoretical framework shows that political elites simultaneously evaluate their international and domestic threat environments and develop command and control systems that address the interactive combination of conventional security threats and domestic instability. Third, military organizational autonomy proves to be the decisive explanatory factor in states with a benign external and internal threat environment. Although a well-established body of literature notes the effects of military organizational interests and biases on military doctrine, my theory demonstrates that military organizations are only able to align nuclear doctrine in accordance with their interests and biases in states that are conventionally secure and domestically stable.

Third, I evaluate my argument and a series of alternative explanations with a combination of historical and primary source material. Specifically, I draw upon archival and original interview data with political and military elites from India, Pakistan, and apartheid-era South Africa to descriptively categorize and theoretically explain command and control systems in these states. By doing so, I update the literature on command and control—which is primarily built upon deductive extensions and generalizations from the U.S. experience—with the necessary data to empirically adjudicate between competing explanations of command and control in regional nuclear powers.

**Theoretical Implications**

In addition to these specific contributions to the nuclear command and control research program, my dissertation speaks to three broader debates in the literature on nuclear strategy and proliferation. First, my dissertation demonstrates the theoretical and practical importance of continued research on nuclear operations. Although nuclear proliferation and strategy remain important topics of academic study and policy relevance, the operational disposition of a state's nuclear forces yields significant implications for nuclear strategy and merits explicit attention. For instance, my dissertation demonstrates that some countries—such as India for many years after developing an operational nuclear capability and South Africa for the duration of its tenure as a nuclear weapons state—accept vulnerabilities to their command and control infrastructure in order to guarantee political control over nuclear decisions. This observation undermines the widespread assumption that states can easily acquire and maintain a secure second-strike capability and challenges a key underpinning of major theories on nuclear strategy.

Second, my dissertation illustrates the value of focusing on decision-making in regional nuclear powers. The Cold War experiences of the U.S. and Soviet Union provide foundational lessons for the study of nuclear weapons, but the majority of nuclear powers differ in significant ways that shape nuclear behavior. For example, none of the regional nuclear powers have pursued a maximalist nuclear posture that requires thousands of nuclear warheads and strains command and control systems by necessitating the involvement of more actors. Furthermore, regional powers do not employ strategies of extended deterrence that severely complicate command and control decisions. Regional nuclear powers are also less concerned about a sudden massive nuclear exchange that requires higher peacetime alert levels and preplanned procedures for rapid nuclear use. Instead, my dissertation shows that rather than nuclear threats, conventional threats provide more leverage for explaining command and control outcomes in regional nuclear powers. My focus on regional nuclear powers therefore provides a more comparable set of cases for projecting how new and emerging nuclear powers will manage their nuclear arsenals. Answering this question is inherently important, as any future proliferators will be regional nuclear powers.[1]

Third, my dissertation informs the longstanding debate between nuclear optimists and pessimists by identifying several potential avenues through which conventional crises may escalate across the nuclear threshold. Each command and control framework that I identify produces different challenges for escalation management. Delegative control persistently faces the risk of accidental and unauthorized use due to the peacetime delegation of nuclear use capability to lower-level operators. Delegative control also dramatically lowers the threshold to

[1] Vipin Narang, *Nuclear Strategy in the Modern Era: Regional Powers and International Conflict* (Princeton, N.J.: Princeton University Press, 2014), p. 299.

nuclear use when applied to land-based platforms that aim to deter conventional attacks. Conditional control provides relatively safe and secure arsenal management practices during peacetime, but the emphasis on early-crisis delegation opens avenues for undesired escalation. Once a state with conditional control systems removes barriers to nuclear use, the custodians of nuclear weapons become capable of unauthorized use. Furthermore, the rapid delegation of nuclear use capability during a crisis may signal malign intent to an adversary and provoke counterforce operations that initiate an escalatory spiral. Assertive control provides robust safeguards against accidental and unauthorized use and maintains a high threshold for nuclear use. Assertive control provides for greater crisis stability, but if a state's arsenal or command systems are vulnerable to preemption or decapitation, the slower mobilization time inherent to assertive control systems may increase the appeal of a decisive first-strike for an adversary.

**Empirical Results**

The three cases presented in this dissertation provide empirical support for my theory. By selecting one case from each decisive node in the decision tree, I demonstrate the importance of sequentially ordering the three key variables in my theoretical framework. Specifically, I find support for my theory in the cases of India, Pakistan, and apartheid-era South Africa.

First, India demonstrates the decisive role played by civil-military relations in states with a benign conventional security environment and domestic political security. Despite possessing a complex security environment that includes nuclear, conventional, and subconventional threats, India's conventional military security and domestic stability allow political leaders to centralize their authority over nuclear weapons. Given these conditions, the level of military organizational

autonomy becomes the dominant explanatory factor for assertive control in India. Specifically, India's historically low levels of military organizational autonomy translate into the nuclear realm and cause civilian elites to adopt highly assertive command and control systems. I support these arguments with extensive interviews with political and military elites in India.

Second, Pakistan shows the interactive effects of external security threats and domestic political instability on command and control outcomes. Pakistan has experienced a severe relative conventional military inferiority with respect to India throughout its nuclear history. Additionally, a prolonged history of military coups, tumultuous transitions to civilian power, and widely prevalent domestic terrorism and religious extremism generate high levels of domestic instability. Pakistan attempts to resolve these competing pressures by employing conditional command and control systems. These command and control arrangements entail centralized control during peacetime to strengthen arsenal safety and security, while also enabling the rapid delegation of nuclear use capability early in a crisis to deter India's conventional military forces. In addition to demonstrating the theoretical utility of my argument, Pakistan also illustrates the value of my descriptive framework. My conceptual category of conditional control allows analysts to reconcile Pakistan's seemingly contradictory combination of assertive and delegative control features by emphasizing Pakistan's reliance on early delegation when transitioning from peacetime to crisis arsenal management practices. I draw upon elite interviews and public statements by senior Pakistani officials to substantiate my claims regarding Pakistan's command and control decision-making.

Third, South Africa's nuclear history provides support for multiple implications of my theoretical framework. In the absence of a conventionally superior adversary, South Africa's command and control decisions were largely determined by the presence of domestic threats to

the apartheid regime. South Africa's domestic instability led apartheid leaders to adopt highly assertive command and control systems that guaranteed centralized control over nuclear doctrine and operations to guarantee that nuclear weapons exclusively supported regime survival. The South African case provides further support for the decision-theoretic structure of my theory, as concerns for domestic political survival superseded the organizational interests of the politically influential South African Defense Force. I support these arguments using archival and original interview data with apartheid-era South African political elites.

*Alternative Explanations*

I evaluate three alternative explanations for command and control outcomes in this dissertation. Specifically, I evaluate the explanatory power of civil-military stability, arsenal vulnerability, and strategic rationale on command and control systems in regional nuclear powers. The evidence presented in my dissertation suggests that my theoretical framework offers a more consistent and compelling theory of command and control in regional nuclear powers than the alternative explanations.

First, the civil-military stability hypothesis is empirically unpersuasive. The civil-military stability hypothesis expects stable civil-military relations to produce more delegative command and control systems, while unstable civil-military relations should result in more assertive command and control arrangements. This hypothesis inaccurately predicts all three cases in this dissertation. Despite historically stable civil-military relations in India and apartheid-era South Africa, both cases result in highly assertive command and control arrangements. Furthermore, despite Pakistan's prolonged history of civil-military instability, Pakistan employs conditional

control arrangements that delegate nuclear use capability to peripheral military commanders early in a crisis. My theory concurs that civil-military relations influence command and control outcomes, but the empirical challenges to the civil-military hypothesis show that the argument fails to specify the proper causal mechanism and does not identify the conditions under which civil-military relations become causally important.

Second, the arsenal vulnerability hypothesis provides a weak explanation for command and control in the cases discussed in this dissertation. This hypothesis expects states with vulnerable nuclear arsenals or command systems to adopt more delegative command and control arrangements to bolster arsenal reliability. The arsenal vulnerability hypothesis correctly correlates with South Africa's assertive command and control systems. For India and Pakistan, however, this argument fails to convince. Despite significant command vulnerability during the initial stages of India's nuclear weapons capability, India maintained highly assertive control procedures. India's adherence to assertive control has also persisted despite China's nuclear modernization efforts that increase China's offensive nuclear capabilities. Similarly, Pakistan continues to employ conditional command and control systems even though India's offensive nuclear capabilities continue to grow. Combined, these cases suggest that arsenal vulnerability was more important to the Cold War superpowers than it is to regional nuclear powers. Instead, my theory's emphasis on conventional military threats better captures the specific external threats that influence command and control decisions in regional nuclear powers.

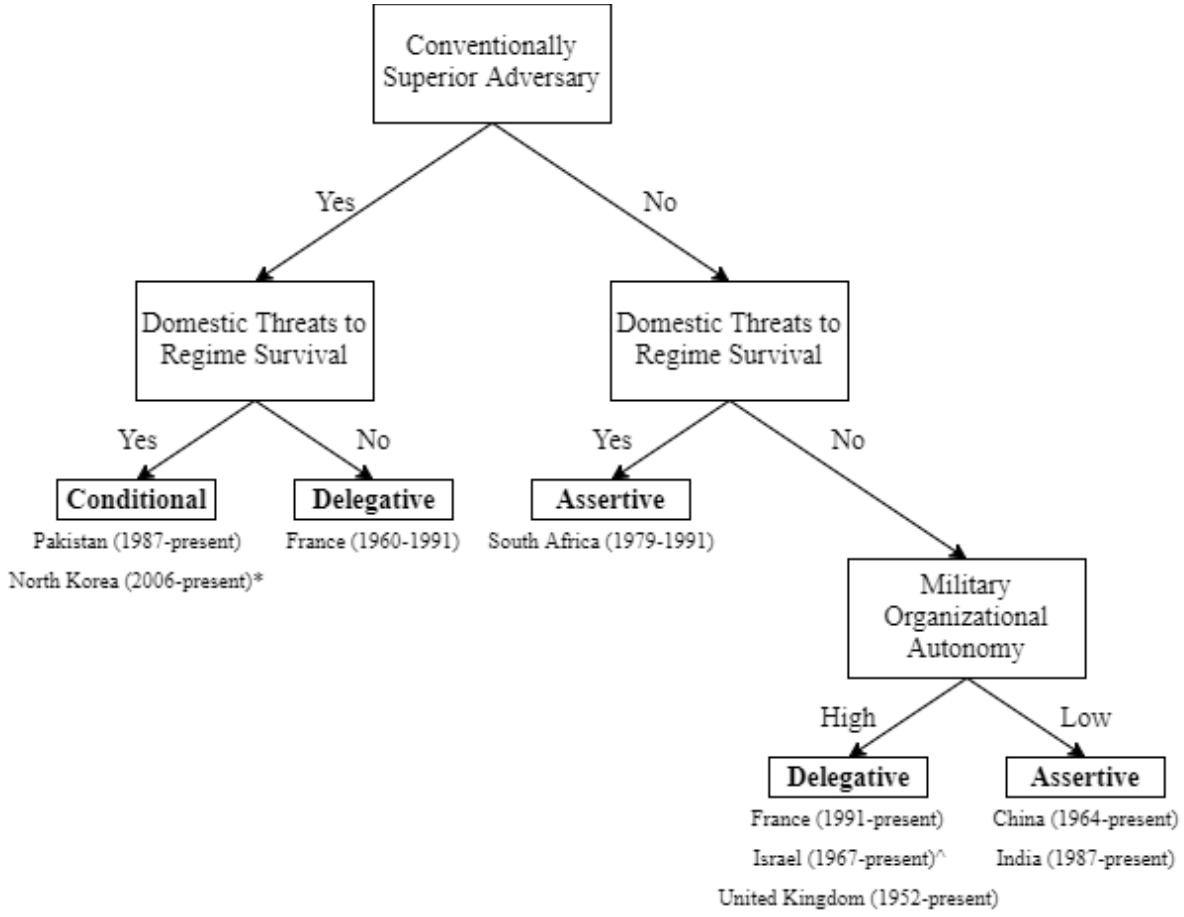
Third, the strategic rationale hypothesis provides the most compelling alternative explanation to my theoretical framework. The strategic rationale hypothesis expects states with early-use nuclear doctrines to favor more delegative control, while late-use doctrines should generate more assertive control. This hypothesis correctly predicts assertive control in India and

South Africa. Indeed, the evidence presented in the chapter on South Africa demonstrates that the reluctance of apartheid leaders to use nuclear weapons under any circumstances contributed to the country's assertive command and control frameworks. Two caveats, however, deserve attention. First, despite an explicitly first-use nuclear doctrine, Pakistan employs conditional control frameworks. The strategic rationale hypothesis is unable to explain why Pakistan emphasizes centralized launch authority during peacetime. My theory provides a more complete explanation of command and control in Pakistan that demonstrates how domestic instability interacts with its conventional threat environment to produce conditional command and control systems. Second, the factors that I argue explain command and control systems also influence a state's nuclear strategy. As a result, my theory and the strategic rationale hypothesis are likely complementary, rather than in competition with one another.

**Empirical Extensions**

I briefly analyze the command and control arrangements in each of the remaining regional nuclear powers to evaluate the generalizability of my findings. This analysis includes evidence from the United Kingdom, France, China, Israel, and North Korea. Although a full study of these cases is beyond the scope of this project, I evaluate whether these states employ the types of command and control systems predicted by my theory and whether the expected explanatory variables appear to be influential in these cases. As I demonstrate below, my theory appears to successfully predict seven of eight cases for a success rate of approximately 88%. Figure 6.1 illustrates the performance of my theoretical framework in predicting command and control systems in regional nuclear powers.

**Figure 6.1. Theory of Nuclear Command and Control: Empirical Results**[2]




*United Kingdom*

My theory predicts that the United Kingdom should employ delegative command and control systems from 1952 to present. The U.K. did not face a conventionally superior adversary during this time. Although the U.K. opposed the Soviet Union during the Cold War, the nature of the Soviet threat was not such that the U.K. feared an immediate conventional attack on its

[2] An asterisk (*) indicates insufficient data exist to evaluate the theoretical prediction. A caret symbol (^) denotes cases that are incorrectly predicted by the theoretical framework. The theory accurately predicts seven of eight cases for a success rate of approximately 88%. This calculation omits North Korea due to data limitations.

homeland. Indeed, Soviet forces would have to defeat forward-deployed NATO forces, advance through the Federal Republic of Germany and the Netherlands, Belgium, or France, risk nuclear escalation in doing so, and cross the English Channel to directly attack the U.K. with conventional forces. The U.K. has also been domestically stable throughout this period. My argument therefore predicts that the U.K.'s high levels of military organizational autonomy should produce delegative control throughout the U.K.'s nuclear weapons history.

Preliminary evidence suggests that my theory accurately predicts the U.K.'s delegative command and control arrangements.[3] The U.K. depended upon air-delivery for its nuclear arsenal from 1952-1967. During this time, the Royal Air Force (RAF) "became solely responsible for the custody and storage of all atomic bombs after production, including responsibility for the fissile cores and all component parts."[4] The military planned to have nuclear bombers airborne within one hour of receiving an order to mobilize. Although operational protocol required pilots to withhold nuclear weapons unless they explicitly received a "go code" from political leadership, the only barrier to nuclear use under such conditions was a reliance on the military's organizational professionalism.[5] No technical or physical barriers to use inhibited the RAF from using nuclear forces, even during peacetime. Indeed, Stephen Twigge and Len Scott observe that "the government implicitly granted *de facto* control of

[3] This section only discusses the U.K.'s national command and control systems. The U.K.'s nuclear doctrine was also extensively integrated into NATO command during the Cold War. I focus narrowly on the U.K.'s national command and control systems to maintain comparability between cases and emphasize the internal foreign policy decision-making of the country. On the U.K.'s nuclear roles in NATO, see: Shaun R. Gregory, *Nuclear Command and Control in NATO: Nuclear Weapons Operations and the Strategy of Flexible Response* (New York, N.Y.: St. Martin's, 1996), pp. 103-129; Beatrice Heuser, *NATO, Britain, France and the FRG: Nuclear Strategies and Forces for Europe, 1949-2000* (New York, N.Y.: St. Martin's, 1997), pp. 63-92.
[4] Stephen Twigge and Len Scott, "Learning to Love the Bomb: The Command and Control of British Nuclear Forces, 1953-1964," *Journal of Strategic Studies*, Vol. 22, No. 1 (March 1999), p. 33.
[5] Ibid., pp. 38-39.

nuclear weapons to the military" and "senior military officers possessed the ability to order a nuclear strike even without receiving direct instructions from the Prime Minister."[6]

Since 1969, the U.K.'s nuclear weapons have all been deployed on nuclear-powered ballistic missile submarines (SSBNs).[7] The U.K. conducts continuous at-sea deterrent patrols, keeping at least one submarine deployed and full-armed with nuclear weapons at all times.[8] The prime minister possesses the sole authority to authorize nuclear use. In practice, however, the U.K.'s SSBN crews are technically capable of launching nuclear weapons without higher approval. The "letter of last resort" protocol illustrates the military's autonomy in this sphere. As Niklas Granholm and John Rydqvist note, if an SSBN is unable to communicate with political leadership, the SSBN commander has four options:

1. Put yourself under US command.
2. Make your way to Australia, if it still exists.
3. Take out Moscow, or the capital of whichever country has initiated the attack.
4. Use your own judgment.[9]

These four options illustrate a high degree of military control over nuclear operations and delegative command and control arrangements. Although political leaders expect SSBNs to await explicit nuclear use authorization for as long as possible, the ability to use nuclear weapons is delegated to military commanders during peacetime. The U.K. case therefore aligns with the predicted outcome of my theoretical framework, adopting delegative command and control systems from 1952 to present.

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[6] Ibid., p. 45.
[7] Lawrence Freedman, "British Nuclear Targeting," *Defense Analysis,* Vol. 1, No. 2 (1985), p. 89.
[8] Niklas Granholm and John Rydqvist, "Nuclear Weapons in Europe: British and French Deterrence Forces," FOI-R--4587--SE (April 2018), p. 18. For more on the U.K.'s current SSBN program, see Nicola Butler and Mark Bromley, "Secrecy and Dependence: The UK Trident System in the 21st Century," BASIC Research Report, Number 2001.3 (November 2001).
[9] Granholm and Rydqvist, "Nuclear Weapons in Europe," p. 26.

*France*

My theory predicts that France should adopt delegative command and control systems from 1960 to present, but for two distinct reasons. From 1960-1991, France's immediate vulnerability to a conventional attack by the Soviet Union should cause leaders to delegate nuclear use capability to lower the threshold to nuclear use and deter a conventional Soviet onslaught. After the Cold War ended in 1991, my argument expects the French military's high levels of organizational autonomy to perpetuate delegative nuclear command and control arrangements.[10]

My argument appears to accurately predict France's command and control arrangements. During the Cold War, France placed its tactical nuclear weapons directly under military control.[11] Specifically, the First Army controlled France's land-based Pluton forces and the Force Aérienne Tactique controlled France's air-launched tactical weapons.[12] French political leaders envisioned tactical nuclear weapons as serving a "prestrategic" function, in which the use of tactical nuclear weapons in response to an oncoming conventional attack would serve as a final warning before the conflict escalated to a nuclear exchange.[13] Although all nuclear forces were nominally under political control, the military's operational control of nuclear weapons indicates that lower-level commanders could use nuclear weapons without explicit political approval.[14]

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[10] On the interaction of civil-military relations and nuclear doctrine in France, see Samy Cohen, "France, Civil-Military Relations, and Nuclear Weapons," *Security Studies,* Vol. 4, No. 1 (Autumn 1994), pp. 153-179.
[11] Gregory, *Nuclear Command and Control in NATO*, p. 137.
[12] Narang, *Nuclear Strategy in the Modern Era*, pp. 159-160.
[13] On the prestrategic function of France's nuclear weapons, see Shaun Gregory, "French Nuclear Command and Control," *Defense Analysis,* Vol. 6, No. 1 (1990), pp. 57-61.
[14] Robbin F. Laird, "French Nuclear Forces in the 1980s and 1990s," Professional Paper 400 (Alexandria, V.A.: Center for Naval Analyses, August 1983), pp. 22-23.

France's efforts to lower the nuclear threshold by delegating nuclear use capability during peacetime corresponds to the causal logic proposed by my theoretical framework.

Shortly after the end of the Cold War, France withdrew its forward-deployed Pluton forces from the Plateau d'Albion and canceled the Hadès program, which was intended to replace the aging Pluton forces.[15] France now relies upon a combination of M51 sea-launched ballistic missiles (SLBMs) and Air-Sol Moyenne Portée (ASMP) air-launched cruise missiles (ALCMs) for its nuclear deterrent.[16] The M51 SLBM family serves as the backbone of France's strategic deterrent and, like the U.S. and U.K., France conducts continuous at-sea deterrent patrols with its SSBN fleet. The ASMP-A variant currently deploys a TN81 nuclear warhead, which has dial-variable yields and allows the ASMP-A to serve strategic and tactical roles in France's nuclear doctrine.[17]

Although France withdrew its land-based tactical nuclear weapons after the Cold War, French nuclear behavior since 1991 offers two important pieces of support for my theory. First, France maintains delegative control over its SSBNs. To guarantee the reliability of France's secure-second strike capabilities, SSBN commanders conducting deterrent patrols appear capable of conducting a nuclear strike without political approval.[18] Indeed, France's military services still possess operational custody of fully mated and assembled nuclear weapons.[19] Second, France's removal of its land-based tactical nuclear weapons and greater reliance on SSBNs for strategic deterrence illustrate the changing logics of delegative control in my theory. Whereas the Pluton

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[15] David S. Yost, "France's Evolving Nuclear Strategy," *Survival*, Vol. 47, No. 3 (Autumn 2005), p. 122.
[16] Granholm and Rydqvist, "Nuclear Weapons in Europe," pp. 50-56.
[17] Narang, *Nuclear Strategy in the Modern Era*, p. 170.
[18] Gregory, "French Nuclear Command and Control," p. 59.
[19] Narang, *Nuclear Strategy in the Modern Era*, p. 171. For a contrary perspective that France employs more assertive command and control systems, see Bruno Tertrais, "France," in Hans Born, Bates Gill, and Heiner Hänggi, eds., *Governing the Bomb: Civilian Control and Democratic Accountability of Nuclear Weapons* (New York, N.Y.: Oxford University Press, 2010), pp. 103-127.

forces allowed France to lower the nuclear threshold and more credibly deter conventional aggression during the Cold War, the dissolution of the Soviet Union removed the need for France to manipulate the nuclear threshold. Command and control systems remained delegative after the Cold War, but rather than for reasons of deterring conventional attacks, France's high levels of military organizational autonomy facilitate the delegation of nuclear use capability to military commanders during peacetime. This change between rationales for delegative control corresponds to the predictions of my theoretical framework.

*China*

My theoretical framework predicts that China should adopt assertive command and control arrangements from when China developed nuclear weapons in 1964 to present. Although China experienced a pair of notable border conflicts with India in 1962 and the Soviet Union during 1969, neither adversary posed an existential threat to China's sovereignty with conventional military forces.[20] The Soviet Union posed the greatest conventional threat to Chinese security, but China's quantitative in-theater military advantage—often in excess of a 2:1 numerical advantage—and the Soviet Union's underdeveloped logistical chains precluded massive offensive conventional operations into Chinese territory.[21] China also experienced a degree of domestic turmoil in the 1960s and 1970s during the Cultural Revolution, but this domestic unrest did not pose a direct threat to the ruling political regime and resulted in the

[20] On the 1962 Sino-Indian border dispute, see Klaus H. Pringsheim, "China, India, and their Himalayan Border (1961-1963)," *Asian Survey*, Vol. 3, No. 10 (October 1963), pp. 474-495. On the 1969 Sino-Soviet border confrontation, see Yang Kuisong, "The Sino-Soviet Border Clash of 1969: From Zhenbao Island to Sino-American *Rapprochement*," *Cold War History*, Vol. 1, No. 1 (August 2000), pp. 31-41.
[21] On these points, see: M. Taylor Fravel, *Strong Borders, Secure Nation: Cooperation and Conflict in China's Territorial Disputes* (Princeton, N.J.: Princeton University Press, 2008), pp. 204-208; Narang, *Nuclear Strategy in the Modern Era*, pp. 140-142.

consolidation of the Communist Party of China's power under Mao Zedong.[22] My theory therefore predicts that China's historically low levels of military organizational autonomy should result in assertive nuclear command and control arrangements.

As predicted by my theory, China's command and control systems have remained highly assertive throughout the duration of the country's nuclear weapons program. Administratively, all nuclear operations occur under the authority of the chairman of the Central Military Commission (CMC).[23] Physically, nuclear warheads are de-mated from delivery platforms and geographically dispersed to guarantee that lower-level military actors cannot access, deploy, or use nuclear weapons without political approval.[24] John Lewis and Xue Litai note the fail-safe nature of China's command and control systems, stating: "A launch will automatically be aborted if any step violates the verification requirements, and several steps depend on the coordinated action of at least two authorized officers."[25]

China's highly assertive command and control arrangements reflect the military's low levels of organizational autonomy. Although China's party-army system somewhat blurs the lines between civilian and military roles, civilian leaders exert significant control over all matters of warfare.[26] In the nuclear realm, the CMC directly commands nuclear operations and civilian

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[22] For an overview of the Cultural Revolution, see Frank Dikötter, *The Cultural Revolution: A People's History, 1962-1976* (New York, N.Y.: Bloomsbury, 2016).
[23] Ta-chen Cheng, "China's Nuclear Command, Control and Operations," *International Relations of the Asia-Pacific*, Vol. 7, No. 2 (2007), pp. 156-158; Bates Gill and Evan S. Medeiros, "China," in Born, Gill, and Hänggi, eds., *Governing the Bomb*, p. 137.
[24] Mark A. Stokes, *China's Nuclear Warhead Storage and Handling System*, Project 2049 Institute Monograph, March 12, 2010.
[25] John Wilson Lewis and Xue Litai, *Imagined Enemies: China Prepares for Uncertain War* (Stanford, C.A." Stanford University Press, 2008), pp. 198-199.
[26] On Chinese civil-military relations, see: Dongmin Lee, "Chinese Civil-Military Relations: The Divestiture of People's Liberation Army Business Holdings," *Armed Forces & Society* Vol. 32, No. 3 (April 2006), pp. 437-453; Andrew Scobell, "China's Evolving Civil-Military Relations: Creeping Guojiahua," *Armed Forces & Society*, Vol. 31, No. 2 (Winter 2005), pp. 227-244. On the dominance of civilian oversight in military affairs, see James C. Mulvenon and Andrew N. D. Yang, *The People's Liberation Army as Organization* (Santa Monica, C.A.: RAND, 2002).

leadership—especially the president—dominates nuclear decision-making.[27] In short, an initial evaluation of the evidence suggests that my theory accurately predicts the descriptive nature and causal origins of China's nuclear command and control systems.

*Israel*

My theory predicts that Israel should have deployed delegative command and control arrangements from weaponization in 1967 to present. Israel's decisive military victory in the 1967 Six-Day War demonstrated the country's military superiority over its regional adversaries. The 1973 Yom Kippur War proved costly for Israel, but Israel nevertheless prevailed and established a peace with Egypt in the 1978 Camp David Accords, resulting in a generally benign conventional threat environment as Israel developed its nuclear arsenal.[28] Israel's political regime also remained stable throughout this period. Given its conventional military security and domestic political stability, my theory predicts that Israel's traditionally high levels of military organizational autonomy—with military organizations historically closely connected to political officials—should produce delegative command and control systems.[29]

Details on Israel's nuclear command and control systems are extremely limited. To the extent that data are available, however, Israel's command and control systems do not appear to align with my theory's predictions. Whereas my argument expects delegative command and

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[27] For a useful overview of centralized political control over China's nuclear forces, see Jeffrey G. Lewis and Bruno Tertrais, "The Finger on the Button: The Authority to Use Nuclear Weapons in Nuclear-Armed States," Occasional Paper No. 45 (Monterey, C.A.: James Martin Center for Nonproliferation Studies, February 2019), pp. 19-21.
[28] As Vipin Narang notes, "With Egypt neutralized and Iran and Iraq bleeding each other during the 1980s, Israeli conventional forces faced no serious challenges." Narang, *Nuclear Strategy in the Modern Era*, p. 191.
[29] On the connection between political and military bodies, see Eva Etzioni-Halevy, "Civil-Military Relations and Democracy: The Case of the Military-Political Elites' Connection in Israel," *Armed Forces & Society*, Vol. 22, No. 3 (Spring 1996), pp. 401-417.

control systems, the limited evidence on Israel's nuclear operations suggest that political elites employ assertive command and control measures.[30] My argument expects the traditionally high levels of organizational autonomy within the Israel Defense Forces (IDF) to translate into nuclear doctrine, but historical evidence suggests that civilian leaders have systematically excluded the military from nuclear decisions since the inception of Israel's nuclear program.[31] Avner Cohen observes that "Virtually nothing is publicly known about Israel's nuclear command and control structure," but indicates that civilians maintain control and custody of nuclear weapons and may employ permissive action links on nuclear weapons.[32] If Cohen's assessment is correct, then further research is necessary to explain why Israel's behavior deviates from the expectations of my theoretical framework.

*North Korea*

My theory expects North Korea to employ conditional command and control arrangements. The presence of U.S. forces in South Korea creates a potentially existential threat to Kim Jong Un's political regime. In addition to this severe conventional threat environment, leaders of the Kim dynasty have historically worried about domestic threats to their continued political rule.[33] To balance these competing pressures on North Korea's nuclear arsenal, my theory expects North Korea to adopt conditional control arrangements that allow the Kim regime

[30] See especially Avner Cohen, "Israel," in Born, Gill, and Hänggi, eds., *Governing the Bomb*, pp. 152-170.
[31] Ibid., pp. 154-156. On the decision-making procedures in Israel, see Lewis and Tertrais, "The Finger on the Button," pp. 22-23.
[32] Cohen, "Israel," in Born, Gill, and Hänggi, eds., *Governing the Bomb*, pp. 157-158.
[33] For examples of the domestic threats facing the Kim regimes over time, see: Daniel Byman and Jennifer Lind, "Pyongyang's Survival Strategy: Tools of Authoritarian Control in North Korea," *International Security*, Vol. 35, No. 1 (Summer 2010), pp. 44-74; Scott Snyder, "North Korea's Challenge of Regime Survival: Internal Problems and Implications for the Future," *Pacific Affairs*, Vol. 73, No. 4 (Winter 2000/01), pp. 517-533.

to centralize political oversight of nuclear operations during peacetime, while also enabling the rapid delegation of nuclear use capability early in a crisis.

The empirical data on North Korea's command and control arrangements are insufficient to determine the validity of my theoretical prediction. The limited information available on North Korea's nuclear weapons strategy, however, offers suggestive evidence in support of my theory. For instance, North Korea's state-run Korean Central News Agency reported that "nuclear weapons can be used only by a final order of the Supreme Commander of the Korean People's Army (KPA)," which indicates centralized management during peacetime.[34] Furthermore, North Korea's nuclear doctrine appears to emphasize preemptive strikes.[35] To make a preemptive doctrine operationally viable, North Korea would be required to quickly delegate nuclear use capability from political leaders to the KPA in the event of a crisis. These characteristics of North Korean nuclear strategy and operations appear to support my theoretical framework, but further empirical support is necessary to decisively demonstrate that North Korea adopts conditional control arrangements for the reasons predicted by my theory.

**Future Research**

This dissertation provides new conceptual and theoretical frameworks for describing and explaining command and control systems in regional nuclear powers. I employ extensive primary source data to support my findings and conclusions. My dissertation therefore provides a

[34] "Law on Consolidating Position of Nuclear Weapons State Adopted," Korean Central News Agency, April 1, 2013.

[35] Léonie Allard, Mathieu Duchâtel, and François Godement, "Pre-Empting Defeat: In Search of North Korea's Nuclear Doctrine," Policy Brief, European Council on Foreign Relations, 2017, p. 7. The authors of this report indicate that North Korea intends to delegate nuclear use capability at some point but do not specify when such delegation might occur.

framework for anticipating changes in the command and control arrangements of contemporary nuclear states and the likely command and control arrangements of future proliferators. This framework is also valuable for identifying the conditions under which conventional crises may escalate across the nuclear threshold.

Two further efforts are necessary to advance the nuclear command and control research program. First, the descriptive and theoretical frameworks proposed in this dissertation should be more fully evaluated with evidence from additional regional nuclear powers. Although my theoretical framework appears to accurately predict command and control outcomes in most cases, further research is necessary to evaluate whether these results obtain for the reasons postulated by my theory or whether these correlations are incidental. Second, future research should continue to incorporate new data into the study of nuclear command and control as these data become available. Details regarding nuclear operations remain scarce in many contexts, but as access to archives and affiliated personnel increases over time, existing theoretical frameworks should be reevaluated to identify their contributions and limitations.

My dissertation contributes to a large field of questions regarding nuclear operations that deserve serious academic inquiry. Within the study of nuclear command and control, questions remain regarding the effects of command and control systems on crisis stability and deterrence. Other issue areas such as the causes and consequences of nuclear platform diversification also merit continued attention as scholars continue to identify the dimensions of a nuclear arsenal that affect a state's deterrent and coercive capacity.[36]

[36] For a recent example of research on nuclear platform diversification, see Erik Gartzke, Jeffrey M. Kaplow, and Rupal N. Mehta, "The Determinants of Nuclear Force Structure," *Journal of Conflict Resolution*, Vol. 58, No. 3 (April 2014), pp. 481-508.

Nuclear nonproliferation has served as a cornerstone of U.S. grand strategy for decades and should remain so in the future.[37] So long as nuclear weapons remain a reality of international politics, however, scholars should continue to systematically explore theories of nuclear operations to promote the safe and secure management of nuclear weapons and to guarantee that nuclear weapons are not used under any circumstances.

[37] On the historical importance of nuclear nonproliferation in U.S. foreign policy, see: Francis J. Gavin, "Strategies of Inhibition: U.S. Grand Strategy, the Nuclear Revolution, and Nonproliferation," *International Security*, Vol. 40, No. 1 (Summer 2015), pp. 9-46; Nicholas L. Miller, "The Secret Success of Nonproliferation Sanctions," *International Organization*, Vol. 68, No. 4 (Fall 2014), pp. 913-944; and Nicholas L. Miller, *Stopping the Bomb: The Sources and Effectiveness of US Nonproliferation Policy* (Ithaca, N.Y.: Cornell University Press, 2018).

## APPENDIX A: ABBREVIATIONS

| | |
|---|---|
| AEB | Atomic Energy Board |
| AEC | Atomic Energy Commission (India) |
| AEC | Atomic Energy Corporation (South Africa) |
| ANC | African National Congress |
| ARMSCOR | Armaments Corporation of South Africa |
| BOSS | Bureau of State Security |
| BJP | Bharatiya Janata Party |
| $C_3I$ | Command, control, communications, and intelligence |
| $C_4I_2$ | Command, control, communications, computing, intelligence, and information |
| CCD | Combat Development Directorate |
| CCS | Cabinet Committee on Security |
| CDS | Chief of defense staff |
| COAS | Chief of army staff |
| COSC | Chiefs of Staff Committee |
| CPO | Causal-process observation |
| DAE | Department of Atomic Energy |
| DFA | Department of Foreign Affairs |
| DRDO | Defense Research and Development Organization |
| DSO | Data-set observation |
| E&R | Evaluation and Research Directorate |
| GDP | Gross domestic product |
| GLCM | Ground-launched cruise missile |
| HEU | Highly-enriched uranium |
| HRP | Human reliability program |
| IAEA | International Atomic Energy Agency |

| | |
|---|---|
| ICBM | Intercontinental ballistic missile |
| IGDMP | Integrated Guided Missile Development Program |
| JSHQ | Joint Services Headquarters |
| KRL | Khan Research Laboratories |
| MIRV | Multiple independently-targetable reentry vehicle |
| NCA | National Command Authority (Pakistan) |
| NCA | Nuclear Command Authority (India) |
| NPT | Treaty on the Non-Proliferation of Nuclear Weapons |
| NSAB | National Security Advisory Board |
| PAEC | Pakistan Atomic Energy Commission |
| PAL | Permissive action link |
| PEL | Permissive enable system |
| PNE | Peaceful Nuclear Explosion |
| PRP | Personnel reliability program |
| RAPID | Reorganized Army Plains Infantry Division |
| SAAF | South African Air Force |
| SADF | South African Defense Force |
| SAP | South African Police |
| SFC | Strategic Forces Command |
| SLBM | Submarine-launched ballistic missile |
| SLCM | Submarine-launched cruise missile |
| SOP | Standard operating procedure |
| SPD | Strategic Plans Division |
| SSBN | Nuclear-powered ballistic missile submarine |
| SSC | State Security Council |
| SWAPO | Southwest African People’s Organization |
| TEL | Transporter erector launcher |
| UN | United Nations |

| | |
|---|---|
| URENCO | Uranium Enrichment Consortium |
| USD | U.S. dollars |
| VCDS | Vice chief of defense staff |

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2018 – 2019 *Predoctoral Fellow*
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2017 – 2018 *Predoctoral Fellow*
Johns Hopkins University, School of Advanced International Studies, Henry A. Kissinger Center for Global Affairs, Carnegie International Politics Scholars Consortium and Network

## EDUCATION

2013 – 2019 SYRACUSE UNIVERSITY
*Ph.D.*, Political Science

2013 – 2014 SYRACUSE UNIVERSITY
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2010 – 2012 BUSH SCHOOL OF GOVERNMENT AND PUBLIC SERVICE AT TEXAS A&M UNIVERSITY
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2007 – 2009 SAM HOUSTON STATE UNIVERSITY
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## BOOK PROJECT

*Beyond the Rubicon: Command and Control in Regional Nuclear Powers*

What factors explain the origins of command and control in emerging nuclear powers? Using archival and original interview data with political and military elites from India, Pakistan, apartheid-era South Africa, and the United Kingdom, I show that three factors predict command and control systems in new nuclear states: first, the presence of a proximate and conventionally superior adversary; second, the severity of domestic threats to the political regime; and third, the degree of military organizational autonomy.

## WORKS IN PROGRESS

"Set to Fail? The Origins of Command and Control in Emerging Nuclear Powers"

"Civil-Military Stability and Nuclear Platform Diversification"

"The Adoption of Nuclear Arsenal Innovations" (with Kyungwon Suh)

"Command and Control in New Nuclear States" (with Peter D. Feaver)

## GRANTS AND FELLOWSHIPS

### EXTERNAL AWARDS

| | |
|---|---|
| 2018 | *Predoctoral Fellowship*<br>Massachusetts Institute of Technology, Security Studies Program, Stanton Nuclear Security Fellows Program |
| 2017 | *Predoctoral Fellowship*<br>Johns Hopkins University, School of Advanced International Studies, Henry A. Kissinger Center for Global Affairs, Carnegie International Politics Scholars Consortium and Network |
| 2017 | *Predoctoral Fellowship (declined)*<br>George Washington University, Elliott School of International Affairs, Institute for Security and Conflict Studies |
| 2016 | *Smith Richardson World Politics and Statecraft Fellowship ($7,500)*<br>Smith Richardson Foundation |
| 2016 | *Tobin Project Graduate Student Fellowship ($1,000)*<br>The Tobin Project |

### INTERNAL AWARDS

| | |
|---|---|
| 2019 | *GSO Travel Grant ($450)*<br>Graduate Student Organization, Syracuse University |
| 2018 | *Andrew Berlin Family National Security Research Fund ($4,797)*<br>Institute for National Security and Counter-Terrorism (INSCT), Syracuse University |
| 2018 | *Andersen Award*<br>Department of Political Science, Syracuse University |
| 2017 | *Roscoe-Martin Dissertation Grant ($750)*<br>Maxwell School of Citizenship and Public Affairs, Syracuse University |
| 2017 | *GSO Travel Grant ($300)*<br>Graduate Student Organization, Syracuse University |
| 2016 | *Meiklejohn Award ($5,200)*<br>Department of Political Science, Syracuse University |

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|---|---|
| 2016 | *Moynihan European Summer Research Grant ($1,500)*<br>Center for European Studies, Moynihan Institute of Global Affairs, Syracuse University |
| 2016 | *GSO Travel Grant ($417.21)*<br>Graduate Student Organization, Syracuse University |
| 2015 | *Roscoe-Martin Dissertation Grant ($1,000)*<br>Maxwell School of Citizenship and Public Affairs, Syracuse University |
| 2014 | *Andrew Berlin Family National Security Research Fund ($3,400)*<br>INSCT, Syracuse University |
| 2014 | *Bharati Memorial Grant ($500)*<br>South Asia Center, Moynihan Institute of Global Affairs, Syracuse University |
| 2011 – 2012 | *Ansary Fellowship ($10,000)*<br>Bush School of Government and Public Service at Texas A&M University |
| 2010 – 2011 | *Sydney Val-Smith Fellowship ($10,000)*<br>Bush School of Government and Public Service at Texas A&M University |

## CONFERENCES & PRESENTATIONS

| | |
|---|---|
| 2019 | American Political Science Association Annual Conference; *Presenter* |
| 2019 | International Studies Association Annual Conference; *Presenter* |
| 2018 | American Political Science Association Annual Conference; *Presenter* |
| 2017 | Midwest Political Science Association Annual Conference; *Discussant, Presenter* |
| 2017, 2016, 2015 | Political Science Research Workshop, Syracuse University |
| 2017 | Program for the Advancement of Research on Conflict and Collaboration, Syracuse University |
| 2016 | Midwest Political Science Association Annual Conference; *Presenter* |
| 2014 | ISSS-ISAC Joint Annual Conference; *Presenter* |
| 2014 | Institute for National Security and Counterterrorism, Syracuse University |

## TEACHING EXPERIENCE

### INSTRUCTOR

| | |
|---|---|
| 2017 | *Instructor*, Syracuse University<br>PSC 322: International Security |
| 2013 | *Instructor*, Lone Star College-Montgomery<br>GOVT 2305: American Government |

2013 — *Instructor*, Lone Star College-Montgomery
GOVT 2306: Texas Government

TEACHING ASSISTANT

2017, 2016 — *Teaching Assistant*, Professor James B. Steinberg, Syracuse University
PSC 600/IRP 400: From Republic to Superpower—America in the World

2016 — *Teaching Assistant*, Professor James B. Steinberg, Syracuse University
PAI 710: International Actors and Issues

2015, 2014, 2013 — *Teaching Assistant*, Professor Terrell Northrup, Syracuse University
IRP 124: Introduction to International Relations

AWARDS AND CERTIFICATIONS

2018 — *Certificate in University Teaching*
Syracuse University

2014 — *Outstanding Teaching Assistant Award*
Syracuse University

**ADDITIONAL EXPERIENCE**

2018 — *Graduate Assistant*, Dr. Matthew Cleary, Syracuse University
Department of International Relations, Undergraduate Capstone Advisor

2017 — *Research Assistant*, Dr. Seth Jolly, Syracuse University
Department of Political Science

2014 – 2015 — *Graduate Assistant*, Dr. Colin Elman, Syracuse University
Qualitative Data Repository (QDR)

**DEPARTMENTAL SERVICE**

2016 – 2017 — *President*, Political Science Graduate Student Association (PSGSA), Syracuse University

2017, 2014 — *Discussant*, Political Science Research Workshop, Syracuse University

2015 – 2016 — *Post-Comps Graduate Student Representative*, PSGSA, Syracuse University

2014 – 2015 — *Undergraduate Studies Committee Graduate Student Representative*, PSGSA, Syracuse University

**WORKSHOPS & TRAINING**

2019 — Bridging the Gap New Era Workshop

2018 — RAND Nuclear Deterrence, Emerging Technologies, and Strategic Stability Bootcamp

2018 — Institute for Qualitative and Multi-Method Research (IQMR)

| | |
|---|---|
| 2017 | Summer Workshop on the Analysis of Military Operations and Strategy (SWAMOS) |
| 2016 – 2018 | Carnegie International Politics Scholars Consortium and Network (IPSCON) |
| 2016 | Tobin Project Graduate Student Forum |
| 2014 – 2015 | Future Professoriate Project, Syracuse University |
| 2014 | Inter-University Consortium for Political and Social Research (ICPSR) |