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CONVENTIONAL PROMPT GLOBAL STRIKE: VALUABLE MILITARY OPTION OR THREAT TO GLOBAL STABILITY?

by

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This thesis examines the potential destabilizing implications of conventional prompt global strike capabilities that operate from or through space. Existing material on this subject is largely limited to debates over the merits of terrestrial verses space basing and arguments against deployment over perceived increases in the likelihood of inadvertent nuclear war. This thesis addresses these issues, but takes the next step and analyzes the root causes and proposes possible solutions to the "security dilemma" these weapons may create. The central finding is that in order to fully exploit the predicted advantages of conventional prompt global strike capabilities, significant changes to the enduring Cold War nuclear postures of the United States and Russia are necessary.

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LIST OF ACRONYMS AND ABBREVIATIONS

ABM	Anti-Ballistic Missile
ALCM	Air-Launched Cruise Missile
AOA	Analysis of Alternatives
CALCM	Conventional Air-Launched Cruise Missile
CAV	Common Aero Vehicle
CEP	Circular Error Probability
FALCON	Force Application and Launch from the Continental U.S.
FOC	Full Operational Capability
GPS	Global Positioning System
HTV	Hypersonic Technology Vehicle
ICBM	Intercontinental Ballistic Missile
IMU	Inertial Measurement Unit
IOC	Initial Operational Capability
KT	Kiloton
LBSD	Land-Based Strategic Deterrent
LNA	Launch Notification Agreement of 1988
MIRV	Multiple Independently Targetable Reentry Vehicle
NPR	Nuclear Posture Review
NRRC	Nuclear Risk Reduction Center
NSS	National Security Strategy
OST	Outer Space Treaty of 1967
PGM	Precision Guided Munition
PGS	Prompt Global Strike
QDR	Quadrennial Defense Review
SAC	Strategic Air Command
SIOP	Single Integrated Operations Plan
SLBM	Submarine-Launched Ballistic Missile
SLV	Small Launch Vehicle
SORT	Strategic Offensive Reductions Treaty of 2002
SRAM	Short-Range Attack Missile
SSB	Small Smart Bomb
SSBN	Nuclear-Powered Ballistic Missile Submarine
SSGN	Nuclear-Powered Guided Missile Submarine
START	Strategic Arms Reduction Treaty of 1991
TEL	Transporter Erector Launcher
UAV	Unmanned Aerial Vehicle
WAASM	Wide Area Autonomous Search Munition
WMD	Weapon of Mass Destruction

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I. INTRODUCTION

A. BACKGROUND

Throughout recorded history, military strategists have sought to increase the reach, responsiveness, and lethality of their military forces. In the earliest days of military confrontation and conquest, projecting forces abroad requires marching land armies great distances over potentially hostile terrain. To affect strategic centers of gravity, such as regime leadership, these land armies would have to first battle and defeat the adversary's fielded forces, which often involved lengthy and bloody struggles. Later, navies provided a faster method to project force to distant lands, at least those accessible by sea. Navies provided (and still provide) a means for direct attack via bombardment from off-shore. Their reach was extended by deploying troops ashore. Still, the journeys were long and dangerous.

In the twentieth century, the combination of modern ships with aircraft, in the form of aircraft carriers, greatly increased the reach and lethality of navies as instruments for force projection and warfighting. In addition to increases in reach and lethality, the Japanese attack on Pearl Harbor on 7 December 1941 demonstrated the ability to conduct major offensive operations against distant targets with little or no advance warning. Land-based aircraft also demonstrated the ability to strike directly at enemy leadership, industry, and populations without having to first battle and defeat enemy land and sea forces. However, the heavy bombers employed by the Allies in the Second World War relied on forward bases in Britain, North Africa, China, and the Pacific to strike the German and Japanese homelands. The strikes by lone B-29s against the Japanese cities of Hiroshima and Nagasaki with atomic weapons were a foreshadowing of methods for global force protection to come.

In the Cold War years following World War II, heavy bombers evolved to possess true global reach (enhanced by air-to-air refueling) and ever-increasing ability to penetrate enemy defenses. The emergence of the intercontinental ballistic missile (ICBM) revolutionized the ability to project power over global distances through its unprecedented speed and responsiveness. The time necessary to project military force, capable of achieving strategic effects, has shrunk from years to mere minutes. Today, there are those who seek to exploit the rapid power projection capabilities borne out of the Cold War, married with recent advances in precision guidance, to deliver conventional weapons over global ranges as a tool to meet the uncertain security environment of the post-Cold War and post-September 11th world.

The capability to strike targets at global ranges from bases within the continental United States with conventional weapons is generally known as "global strike." Currently deployed B-52, B-1B, and B-2A heavy bombers have demonstrated this capability, with the aid of in-air refueling, in numerous exercises and real-world contingencies. The ability to accomplish this same mission within hours (and ideally within 90 minutes) of a decision to do so is often referred to as "prompt" global strike (PGS). Currently, nuclear-armed ICBMs are the only weapons that possess this capability, but none are configured to deliver conventional weapons. Some would argue that submarine-launched ballistic missiles (SLBMs) provide a similar capability, however, due to their shorter range the submarine must first deploy to an operating location within range of the intended target. Due to the effects of time and distance and the limitations of technology expected to be available within the next ten years, PGS weapons must rely either on intercontinental missiles (modified ICBMs or space launch vehicles) or orbiting space platforms for delivery. Both of these options attract significant controversy.

B. A NIGHTMARE SCENARIO

Early in the next decade, on a typical Wednesday afternoon, U.S. defense analysts were reviewing recently collected imagery of one of the few remaining Russian Topol (SS-25) ICBM bases near Irkutsk, located in south-central Russia near the border with Kazakhstan. What the imagery reveled was unexpected and deeply disturbing. Three Topol road-mobile transporter-erector-launchers (TELs), presumably loaded with their ICBMs, and several support vehicles were seen leaving the site's garrison. This was highly unusual since Russian mobile ICBMs normally remained in garrison unless part of a pre-coordinated exercise. Also, the Irkutsk base, manned by the 51st Guards Missile Division, was in the final stages of deactivating the thirty-six Topol ICBMs originally deployed there.[1] Most disturbing was the fact that the imagery was almost a day old, and the Topols, assuming an average speed of 30 miles per hour, could be anywhere within a 500-mile radius of Irkutsk, a distance that was increasing with every passing moment. Other intelligence analysts began to take notice of increased Russian military activity and communications in the military districts in the vicinity of Irkutsk. Something was definitely up, but what? Available U.S. intelligence assets were immediately retasked to gain better situational awareness and hopefully track down the wayward ICBMs.

As the intelligence organizations worked to unravel the mystery, diplomatic inquiries on Thursday morning by the U.S. government received the typical Russian reply that "it was an internal matter, there was nothing to be concerned about, and no foreign assistance was needed or welcome." Later that day, CNN broadcast a taped message they had received from an anonymous source. A mid-level Russian military officer read a prepared statement that accused the United States of maintaining a threatening, offensive nuclear capability even in spite of the fact that Russian nuclear forces were being retired at a significantly faster rate than they were being replaced. He explained that he and his comrades made a decision to act before Russia's unilateral disarmament made it impossible. Unless the United States took immediate and verifiable action to remove its offensive nuclear forces from alert, he and his comrades would fire their missiles at targets in the United States.

Despite assurances from the Russian government that the conspirators would not be able to fire the missiles because of various safeguards designed to prevent such eventualities, the United States remained unconvinced. U.S. officials were concerned that since the missiles in question were mobile, it might be possible to gain access to the internal components of the missile. If given enough time, the rogues could, in theory, circumvent the safeguards and carryout their threat. Even if they proved incapable of actually launching the missiles, it was feared the warheads could eventually fall into the hands of terrorists. Three days into the crisis, tensions were rising between the United States and Russia. The United States accused Russia of not doing enough to resolve the situation and threatened to do what ever was necessary to prevent the missiles from being

[1] Unit, deployment location, and number of ICBMs referenced from: "Strategic Rocket Forces," Russian Strategic Forces Project, April 2005 [on-line] ; available from http://www.russianforces.org/eng/missiles; Internet; accessed May 2005.

fired. Russia claimed that it was doing everything possible to find the missiles, but would not grant U.S. intelligence, reconnaissance, and surveillance aircraft access to their airspace. Russia was also increasingly concerned about a U.S. preemptive strike against its territory if it was the first to discover the location of the missiles. Russia warned the United States that any strike against its territory would be regarded as an act of war, regardless of the reason.

On the fourth day of the developing crisis, U.S. intelligence assets detected the missiles outside Russian territory in Kazakhstan. This further complicated the situation because a fundamentalist Islamic regime had recently come to power and relations between Kazakhstan and both Russia and the United States had been under significant strain ever since. The vehicles were stationary for the moment, but there was no guarantee they would remain that way.

The nearest American forces in the region were in the Persian Gulf. These forces were ruled out because it would take several hours to plan the mission and several more to carry it out. Also, the aircraft (or cruise missiles) would have to penetrate the airspace of several countries – most not on friendly terms with the United States. A strike conducted with long-range bombers, such as B-2s, from bases in the United States was also not an option due to the time it would take to prepare for the mission and reach the target (nearly a day).[2] Over-flight of hostile third-party airspace would also be a consideration against long-range bombers.

The President of the United States would face the dilemma of having to choose among several unattractive options. First, he could give into the stated demands, but have no guarantee that the rogues would not fire the missiles anyway or hand them over to Islamic extremists. Second, he could take no immediate action in the hopes that Russian Special Forces could arrive before the missiles moved out again, fell into the hands of a third party, or were launched against the United States. If the missiles were launched, all hopes then rest with a limited and unproven missile defense system that was designed to defeat the relatively unsophisticated missiles that might be launched by rogue states or terrorists.

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[2] This estimate was derived from numbers presented for a notional strike against Iran in: Headquarters U.S. Air Force, "The Common Aero Vehicle: Addressing Congressional Concerns," (briefing presented to U.S. Congress, Washington D.C., December 2004), 12.

Third, the President could order a strike against the three TELs with nuclear-armed ICBMs or SLBMs. The Minuteman III possesses excellent responsiveness and a warhead with sufficient yield to destroy the Topols – assuming they do not move out again before the warheads arrive. If the Topols move, even just a few miles, after the Minutemen launch they could escape destruction. Attacks with Trident II (D-5) SLBMs would face similar constraints. Of course, this option also entails the use of nuclear weapons against a non-nuclear, third-party country and the potential for collateral damage from nuclear fallout down-wind of the target. Also, given the heightened tensions, the launch of U.S. nuclear-armed missiles, could result in a Russian decision to launch a retaliatory strike in the belief the missiles were headed their way.

Unfortunately for the President, efforts to develop and deploy conventional prompt global strike (PGS) capabilities languished due to Washington politics and had not progressed beyond the concept stage and a few limited demonstration flights. A conventional PGS system may offer the President a better option than those described above. With similar responsiveness to the Minuteman III, a conventional PGS system could deploy a Common Aero Vehicle (CAV) to strike the target within 45 minutes of launch.[3] However, unlike the Minuteman, the CAV can maneuver to adjust its trajectory if the target moves after launch.[4] Also, the CAV can carry six Wide Area Autonomous Search Munitions (WAASMs), basically miniature cruise missiles, with the capability to search out and destroy mobile targets.[5] One should note, however, conventional PGS capabilities are no panacea. Given the high tensions between Russia and the United States in this scenario, the launch of conventional PGS weapons could have been mistaken for a nuclear launch by the Russians with potentially devastating results.

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[3] Headquarters U.S. Air Force, Common Aero Vehicle, 25.

[4] Ibid., 5.

[5] Ibid.

Hopefully, the above scenario will remain a work of fiction, but the issues presented warrant further investigation.[6]

C. FRAMING THE DEBATE

This thesis examines and seeks to expand the debate regarding the development and deployment of conventional PGS that operate through or from space. In doing so, this thesis aims to influence the decisions of national-level policy makers and senior leaders in the Department of Defense by illuminating the positive role these weapons can play in America's national security posture while simultaneously highlighting the potential unanticipated consequences deployment of these weapons could have on the fundamental tenets of global stability.

Conventional PGS weapons capable of striking targets anywhere on Earth within minutes of a decision to do so represent a transformational capability and greatly expand the options available to the President for responding to imminent threats to the national security interests of the United States. Even though there is a strong basis for conventional PGS weapons in current national security policy, deployment of weapon systems that can accomplish this mission in minutes over global distances - without resorting to the use of nuclear weapons - have encountered controversy on several fronts. Uncharacteristically for a major modern weapons program, conventional PGS weapons suffer relatively little criticism over their potential cost or technical feasibility. While they will no doubt be expensive and will likely encounter technical challenges, the primary source of controversy revolves around their perceived effect on global stability. Currently, defense programs backed by national security policy appear to be on a collision course with core beliefs about the foundations of global stability and numerous elements of international and domestic public opinion.

A methodical review of current scholarly work on this subject or even a quick "Google" search on the topics of "prompt global strike," "conventional ICBM," or "space weapons" yields relatively accurate insights into the status of the debate over

[6] While I do not personally believe this type of scenario is likely, the events of 11 September 2001 should serve as a reminder that anything is possible. I constructed this scenario specifically to illustrate the various themes this thesis addresses in detail. For example, conventional PGS capabilities are responsive, enable access to denied areas, and provide a non-nuclear option. While these capabilities could provide the President with a better option in some future crisis, there are aspects of the enduring Cold War nuclear force postures of the United States and Russia that make the deployment and employment of conventional PGS weapons problematic at best, and at worst a prescription for disaster.

conventional PGS capabilities. As one might expect, there are numerous military planning documents and statements by military leaders that present the virtues of conventional PGS.[7] Military leaders, including General James Cartwright (Commander of United States Strategic Command) and General Lance Lord (Commander of Air Force Space Command), see these weapons as a potentially effective means to address the uncertain security environment of the post-Cold War world. Additional support for conventional PGS is found in current American policy documents, such as the *National Security Strategy*, that call for quick responses to aggression or even preemption in the face of significant threats by rouge states or terrorist organizations. These views are counterbalanced by those who, while not necessarily doubting the utility of conventional PGS, see these weapons as potentially destabilizing. The critics' primary concerns involve the potential weaponization of space and the "nuclear baggage" associated with intercontinental missiles. The "space sanctuary" advocates argue that placing strike weapons in orbit is unnecessary because there are adequate terrestrially-based alternatives (manned bombers, cruise missiles, conventional ballistic missiles, etc.) and that doing so will lead to a space arms race.[8] Others, including members of Congress who succeeded in "zeroing" funding for "weaponized" tests of conventional PGS technologies, fear that a nuclear-armed nation (the target or a third-party observer) could mistake the launch of a conventional PGS weapon for a nuclear attack with the potential consequence of inadvertent nuclear war.[9] This is, by far, the most commonly used argument against the case for conventional PGS weapons. A recent Congressional Research Service report again raises this issue, but fails to assess the true likelihood of this possibility or its root

[7] Please see: Headquarters U.S. Air Force, Future Concepts and Transformation Division, *The U.S. Air Force Transformation Flight Plan* (Washington D.C.: Government Printing Office, 2004), [on-line] ; available from http://www.af.mil/library/posture/AF_TRANS_FLIGHT_PLAN-2004.pdf; Internet; accessed August 2005, and Headquarters Air Force Space Command, Directorate of Plans and Programs, *Strategic Master Plan FY06 and Beyond* (October 2003).

[8] For examples please see: Bruce M. Deblois, Richard L. Garwin, R. Scott Kemp, and Jeremy C. Marwell, "Space Weapons: Crossing the U.S. Rubicon," *International Security* 29, no. 2 (Fall 2004) : 50-84; Michael Krepron, "Weapons in the Heavens: A Radical and Reckless Option," *Arms Control Today* 34, no. 9 (November 2004) : 11-18; and James Clay Moltz, "Reining In the Space Cowboys," *Bulletin of the Atomic Scientists* 59, no. 1 (January/February 2003) : 61-6.

[9] Congress, House, Committee of Conference, *Making Appropriations for the Department of Defense for the Fiscal Year Ending September 30, 2005, and for Other Purposes,* 108th Cong., 2d sess., 2004, Rpt 108-622, 240.

causes.[10] Also, though outside the scope of this thesis which focuses on the scholarly and political debate surrounding this issue, there is a body of public opinion that sees the potential deployment of conventional PGS weapons by the United States as a "Death Star" for global domination. They see conventional PGS as a dangerous tool that an increasingly unilateralist and aggressive United States will use to intimidate and coerce the "peace-loving" peoples of the world.[11]

This thesis seeks to widen the scholarly debate over conventional PGS capabilities. Weapons of this type *will* affect the global security environment *when* (not if) they are eventually deployed by the United States or others. As noted above, much of the existing debate has focused on deployment mediums (terrestrial or space) and delivery vehicles (missiles or spacecraft). Recommendations to terrestrially base conventional PGS weapons defuse one source of potential destabilization (weapons in space), but leaves the other issues of global stability largely unaddressed. It has become almost "conventional wisdom" that the difficulty in differentiating the launch of conventional PGS capabilities from a nuclear attack raises the risk of inadvertent nuclear war to unacceptably high levels. To remedy these concerns, the Air Force has proposed numerous technical and procedural methods to reduce the possibility for instances of mistaken identity.[12] These measures treat the symptoms resulting from attempting to introduce a capability designed to address twenty first century security concerns into a global security environment that remains locked in a twentieth century mindset. "Band-aid" fixes may suffice, but the ideal solution involves finally moving beyond Cold War force structures and nuclear postures that make it possible for inadvertent nuclear war to be launched on false or misinterpreted warning.

The definitive debate over conventional PGS capabilities has yet to occur. Will conventional PGS capabilities increase or decrease other nations' perceptions of vulnerability with regard to the United States? Will conventional PGS capabilities

[10] Please see: Amy F. Woolf, *Conventional Warheads for Long-Range Ballistic Missiles* (Washington D.C.: Congressional Research Service, 2005), 15-20, 24.

[11] For two of many examples please see: Environmentalists Against War at www. envirosagainstwar.org; and Neil McKay, "US Plan to Own Space," *Scotland Herald* (22 June 2003) ; [on-line] ; available from http://www.globalresearch.ca/articles/MCK306A.html; Internet; accessed September 2005.

[12] Headquarters U.S. Air Force, Common Aero Vehicle, 19-26.

increase or decrease nations' reliance on nuclear weapons? Are conventional PGS capabilities vital contributors to national security or threats to global stability? These are questions our national leaders have not yet answered but will have to address in the relatively near future. Momentum is increasing within the Department of Defense on several conventional PGS concepts as they near the transition from drawing board to development. The debate over conventional PGS weapons spans the spectrum from well reasoned analysis to emotionally charged disinformation. This debate will and must occur, but should be driven by thoughtful analysis rather than emotion and disinformation.

D. CHAPTER SUMMARY

The overarching research question addressed by this thesis is, "are conventional PGS capabilities militarily usable weapons or too destabilizing and disruptive to the international security environment to deploy?" This overarching question is broken into several parts, which in basic terms, amount to the "background, how, why, and so what" questions regarding conventional PGS.

1. Global Strike Then and Now

The second chapter provides the background or historical context for conventional PGS capabilities by examining their nuclear heritage and then surveys current global strike capabilities. The first section of this chapter chronicles the development of global strike technologies during the Cold War. Key technological milestones include the introduction of long-range bombers aided by aerial refueling and the advent of true PGS capabilities with the advent of the ICBM and space technology. The nuclear heritage of global strike technologies is a significant factor in the controversy conventional PGS capabilities generate today. The second section surveys current global strike capabilities. Many of these capabilities, including long-range bombers and cruise missiles that while originally designed to deliver nuclear weapons, have made the transition to dual-role or conventional-only delivery vehicles. These cases demonstrate that it is possible to shed "nuclear baggage" and utilize former (or current) nuclear delivery platforms for new roles.

2. Conventional PGS Concepts

Chapter three addresses the first part of "how" to accomplish conventional PGS. The chapter identifies several conventional PGS concepts that could come to fruition over the near or mid-terms (within the next fifteen years) and evaluates their associated operational strengths and limitations. At least one possible system, derived from the retired Peacekeeper ICBM, could become operational almost immediately. Current technology allows for two general alternatives for striking targets at global ranges within minutes of a decision to do so: 1) terrestrially-based (i.e., air, land, or sea) weapon systems that use modified intercontinental missile or space launch vehicles to transit space and strike distant targets, or 2) space-based weapon systems that are de-orbited to strike targets on the Earth's surface. This chapter splits discussion of conventional PGS concepts into two parts. First, the chapter surveys possible munitions for conventional PGS weapon systems including penetrating warheads, GPS-aided maneuverable reentry vehicles, and the Common Aero Vehicle (CAV). Second, the chapter presents several potential terrestrially-based and space-based conventional PGS delivery systems. Possible terrestrially-based systems include modified land or sea-based intercontinental missiles and small space launch vehicles. Potential space-based systems could place numerous individual weapons into various orbital planes to provide overlapping global coverage or employ satellites designed to carry and dispense multiple weapons.

3. Political, Regulatory, and Treaty Constraints on Conventional PGS

To address the second portion of "how" to accomplish conventional PGS, the fourth chapter examines the often intertwined political, regulatory, and treaty implications of the various conventional PGS concepts. The basic question addressed by this chapter is, "do political, regulatory, and treaty constraints erect insurmountable barriers to deploying or employing conventional PGS capabilities?"

There are two general areas of political constraints that act to constrain the development of conventional PGS capabilities. The first, and most significant political issue involves the "nuclear baggage" often associated with PGS capabilities that contributes to the perception that the operational employment of conventional PGS weapons could be mistaken for a nuclear strike and result in inadvertent nuclear war. Successful resolution of this issue is necessary in order for conventional PGS capabilities to win congressional support and be operationally relevant if deployed. The second general political constraint involves the perceived or actual weaponization of space which has significant political ramifications both domestically and internationally. There is a large and vocal following of the "space sanctuary" philosophy that oppose any increase in the military uses of space. The distinction between "transiting space" and "space-based" will likely be lost on many critics.

Current U.S. launch range safety rules and practices could significantly undermine the responsiveness of proposed conventional PGS capabilities. During peacetime, public safety (i.e., liability) concerns prohibit missile or space launch vehicle trajectories from passing over populated land masses during the early phases of powered flight.[13] Downrange airspace and ocean areas where spent booster stages and components are predicted to fall also must be cleared.[14] All safety rules may be waived in times of war or significant national need, but it is worth noting that conventional PGS weapons would likely be used prior to or in lieu of major combat operations. In order to retain the ability for rapid response, conventional PGS weapons require accepting calculated risks to public safety during launch operations.

Finally, conventional PGS weapons face significant constraints from treaties and agreements between the United States and Russia and other nations. Even though non-nuclear in nature, provisions of the *Strategic Arms Reduction Treaty* (START) could limit the number, type, and deployment locations of conventional PGS weapons.[15] The *Launch Notification Agreement* could also act to restrict the responsive launch capability of terrestrially-based PGS systems. Space-based alternatives, in particular, face potential legal challenges based on provisions of the *Multilateral Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies* (the Outer Space Treaty) and the *Convention on International Liability for Damage Caused by Space Objects of 1972* (the Liability Convention).

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[13] *Air Force Space Command Manual 97-710: Air Force Space Command Range Safety Policies and Procedures*, 1 July 2004, 52-73 and 105-12.

[14] Ibid.

[15] *Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms*, 31 July 1991 [on-line] ; Available from http://www.fas.org/nuke/control/start1/text/start1.htm#ArtI; Internet; Accessed July 2005.

Satisfactory resolution of these political, regulatory, and treaty issues should ideally occur before conventional PGS capabilities move from the drawing board to reality.

4. Rationale for Conventional PGS Capabilities

The fifth chapter examines the rationale behind U.S. efforts to develop and deploy conventional PGS capabilities. The rationale comes in two primary forms. First, current U.S. national security policy provides a strong foundation for developing and deploying conventional PGS capabilities. Second, conventional PGS systems enhance the warfighting abilities of the United States by increasing the responsiveness, access, and "economy of force" of the United States military. Both sources of rationale for conventional PGS capabilities are examined in detail.

The chapter begins with a look at relevant policy documents including *The National Security Strategy of the United States of America*, *The National Strategy to Combat Weapons of Mass Destruction*, and *The National Defense Strategy of the United States of America*. A consistent theme within all three documents is the recognition that in the post-Cold War world, deterrence may not be enough to ensure the safety of the American population against emerging threats from rogue states and non-state actors. Each of these documents provides a policy foundation for the prompt and potentially preemptive use of military force to address urgent threats to the national security interests of the United States.

The remainder of the chapter examines the military rationale behind the pursuit of conventional PGS systems by comparing their expected performance capabilities with existing global strike capabilities and forward deployed forces. In line with U.S. national security policy, the 2001 Quadrennial Defense Review (QDR) describes a world security environment where there is "increasing diversity in the sources and the unpredictability of the locations of conflict" that could result in requirements for U.S. military intervention or activities on "virtually every continent" against a "wide variety of adversaries" with "widely varying capabilities."[16] To meet the challenges presented by this environment, the Department of Defense, and in particular the United States Air Force, view conventional PGS systems as a transformational capability that could

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[16] Office of the Secretary of Defense, *The Quadrennial Defense Review* (Washington D.C.: Government Printing Office, 2001), 6; available from http://www.defenselink.mil/pubs/qdr2001.pdf; accessed August 2005.

increase the responsiveness, reach and economy of force of U.S. military response options available to back up desired national security policy objectives. In addition to providing access to denied areas, conventional PGS capabilities may reduce reliance on forward-deployed forces and reduce the need to send U.S. forces into harm's way.

5. Conventional PGS and Global Stability

The previous chapters of this thesis examined various aspects of conventional and nuclear global strike capabilities including: the development and evolution of global strike capabilities during the Cold War; current U.S. global strike capabilities; concepts for terrestrially-based and space-based PGS capabilities; potential constraints on conventional PGS deployment and employment; and the policy and military rationale for conventional PGS weapons. In sum, these chapters addressed the "how" and "why" questions regarding conventional PGS. This chapter addresses the "so what" aspect of a United States deployment of conventional PGS capabilities and serves as a counterpoint to the rationale for these capabilities presented in chapter five. While it is technically feasible to deploy conventional PGS capabilities in the near-term, and there is significant rationale to do so from both policy and military utility standpoints, there is a potential price to be paid. The presence of these weapons may produce unintended consequences for the stability of the global security environment, particularly among the existing nuclear powers. This chapter seeks to illuminate these risks and to characterize their severity.

This chapter opens with a general discussion of nuclear deterrence theory, which arguably remains a key pillar in support of global stability, even in this post-Cold War era. The contributions of several well-known deterrence theorists are presented to serve as a basis for the case studies and analysis that follow. The next section presents three case studies that examine the strategic thinking and nuclear strategy, doctrine, force structure, and posture of the United States, Russia, and China. The final section analyzes the potential impact of conventional PGS capabilities on the stability of the global security environment by drawing on the tenets of nuclear deterrence theory and the three case studies. Does the presence of responsive conventional global strike weapons capable of precision strikes anywhere on the global in less than 90 minutes create a "security dilemma" that undermines the perceived credibility or security of the Russian and Chinese nuclear deterrent forces? If so, will these weapons produce a "tipping point" that drives unintended consequences in the posture or size of their nuclear arsenals? Will the deployment or employment of U.S. conventional PGS weapons contribute to an increased likelihood of inadvertent nuclear war? Some fear that the inability of an adversary or third party country to differentiate the launch of a conventional PGS weapon from a nuclear-armed missile could instigate a nuclear retaliatory strike. How valid is this concern regarding Russia and China? The deployment of conventional PGS capabilities present a golden opportunity to de-emphasize nuclear weapons, but must be accompanied by significant changes to the nuclear force postures of the major nuclear powers, particularly the United States and Russia, to avoid detrimental effects to the stability of the global security environment.

E. SUMMARY OF FINDINGS AND RECOMMENDATIONS

This thesis was written with the intent to expand the debate over conventional PGS weapons and cut through the perceptions and propaganda to the true core issues affecting the future of this transformational capability. The ultimate aim of this thesis is to influence the decision calculus of senior Department of Defense and government policy makers on this important topic. Several key policy implications are highlighted:

1. Findings

The follow paragraphs highlight the key findings of this thesis:

a. Precedents for Nuclear-to-Conventional Conversion

All American global strike systems were originally developed and deployed to deliver nuclear weapons. The B-52, B-1, B-2, ALCM, and Ohio-class submarine have successfully transformed from dedicated instruments of Armageddon into dual-role or conventional-only platforms.

b. Conventional ICBMs?

Recent improvements in guidance technology make it feasible to consider intercontinental missiles armed with conventional munitions. But, the question remains – will intercontinental missiles ever be able to shed their "nuclear baggage" in the same fashion that strategic bombers, cruise missiles, and submarines have?

c. Near and Mid-Term Conventional PGS

Near-term conventional PGS options include modified Trident II or Peacekeeper intercontinental missiles. Mid-term alternatives could leverage small space launch vehicles like the SpaceX Falcon to boost CAVs carrying a variety of conventional munitions over intercontinental ranges or place CAVs into orbit for later use.

d. Launch Misidentification Safeguards

The comprehensive set of risk mitigation measures proposed by the Air Force should ensure adequate safeguards against launch identification mishaps for near-term, single sortie conventional PGS operations.

e. START Constraints

The constraints imposed by START will effectively delay conventional PGS deployment until after the Treaty expires in 2009. Treaty negotiators must look beyond the current situation to consider how treaty provisions might constrain future options if world security conditions change.

f. Policy Rationale

The policy objectives espoused in the National Security Strategy and supporting polices place a premium on rapid response, or in some cases preemptive action to defeat adversaries before they can inflict catastrophic damage against American territory or deployed forces.

g. Responsiveness

Conventional PGS capabilities promise to provide unmatched responsiveness. Conventional PGS capabilities enable global reach within 90 minutes from an "on-alert" posture.

h. Hard and Deeply Buried Targets

Conventional PGS weapons have the potential ability to hold additional hard and deeply buried facilities at risk without resorting to nuclear weapons.

i. Economy of Force

Conventional PGS capabilities offer significant "economy of force" improvements over existing capabilities. More importantly, conventional PGS capabilities offer the ultimate "economy of force" by the ability to strike highly-defended targets without risking the lives of friendly forces.

j. Defeat Anti-Access

Conventional PGS capabilities offer unsurpassed ability to defeat adversary anti-access strategies. Advanced air defenses, denial of forward basing, over-flight restrictions, and hardened and deeply buried facilities do not constrain the ability of conventional PGS weapons to hold vital enemy centers of gravity at risk.

k. Nuclear Deterrence Theory

Nuclear deterrence theory serves as an important predictor of potential "security dilemmas" created by conventional PGS capabilities. Of particular note is the potentially destabilizing interaction between deterrence theories designed to "inflict a cost" and those intended to "deny benefits."

l. Cold War Legacy

Russia's contracting nuclear force structure, high-alert posture, and deteriorating early warning system present a series of risk factors for inadvertent nuclear war that are exacerbated by the potential employment of conventional PGS capabilities. In contrast, China's low-alert level and policy of "no first use" present virtually no opportunity for an inadvertent nuclear exchange.

2. Recommendations

Based on the research and analysis conducted in the course of preparing this thesis, the following recommendations are made:

a. Conventional Peacekeeper

The Peacekeeper ICBM should be converted to a conventional role. The missiles are paid for, available, and provide an excellent opportunity to leverage sunk costs. The missile has sufficient range and payload capabilities to provide a militarily effective conventional capability.

b. GPS-Aided Reentry Vehicles

The Air Force should seek to capitalize on the technology developed in the currently unfunded Trident II Enhanced Effectiveness Program. The goal should be the development, testing, and eventual production of modified Mk 21 reentry vehicles to allow GPS-aided operation and precision maneuver during reentry. Project could provide a near-term, low-risk capability until such time that the Common Aero Vehicle becomes available.

c. CAV Development

The Air Force should continue to aggressively seek Congressional restoration of funding for "weaponized" CAV development. Resolution of the launch misidentification issue should be worked concurrently with weapon system development to provide an incentive for reaching resolution.

d. Launch Safety

Balancing launch responsiveness for conventional PGS systems with range safety requirements require a willingness to accept greater risk to the public (foreign and domestic) during launch operations. Unfortunately, a better solution will not be available until the far-term (or way-far-term) when a fully-reusable booster eliminates the danger posed by discarded booster stages.

e. Nuclear ICBM Divestiture

In the near future, the Air Force will face a decision on whether to proceed with the Land Based Strategic Deterrent (or Minuteman replacement). The Air Force should take this opportunity to pursue land-based conventional PGS capabilities in accordance with the New Triad. Funding for LBSD should be reprogrammed into providing a responsive space launch capability for that supports PGS and launch-on-demand.

f. De-Alerting

In order to fully exploit the potential of conventional PGS capabilities, the United States must pursue an end to the Cold war nuclear force postures maintained by itself and Russia. Force postures of both the United States and Russia must be altered so that the launch of nuclear weapons "on warning" is no longer possible or necessary.

3. Conclusion

The most significant finding of this thesis is that conventional PGS weapons are not in and of themselves destabilizing, but when they are combined with the enduring Cold War postures of American and Russian nuclear forces they become a valid cause for concern. The possible implications of conventional PGS capabilities simply highlight the danger we quietly face everyday. The continued presence of American and Russian nuclear forces on "hair trigger" alert poses a risk to our nations inconsistent with the other aspects of our relationship. To not deploy conventional PGS capabilities because of perceptions of a renewed nuclear arms race or inadvertent nuclear war, allows us to dodge the tough decision. We must finally clear away the last vestiges of the Cold War in order to be able to deploy capabilities necessary to protect American security interests in the post-Cold War world.

II. GLOBAL STRIKE THEN AND NOW

A. INTRODUCTION

This chapter examines the historical context and current state of U.S. global strike capabilities. I begin by chronicling the evolution of global strike capabilities during the Cold War. All current global strike platforms originally were developed as nuclear weapons delivery platforms. Many of these Cold War systems successfully dumped their "nuclear baggage" and made the transition from nuclear to dual-role, or conventional-only, delivery vehicles. These systems now form the backbone of the current U.S. global strike capabilities. However, the shadow of the Cold War still looms over the development of conventional PGS capabilities. Lessons learned through the transition of other nuclear delivery systems to new roles may provide insights helpful in breaking the paradigm that associates PGS capabilities exclusively with nuclear warfare.

B. EVOLUTION OF PGS CAPABILITIES DURING THE COLD WAR

American capabilities for striking targets at global ranges from bases in the continental United States developed quickly following the Second World War in response to the growing political, ideological, and military standoff with the Soviet Union. Building on U.S. experience gained from the strategic bombing campaigns against Germany and Japan, the long-range bomber became the global strike platform of choice. In March 1946, the Strategic Air Command (SAC) was established with the mission to "be prepared to conduct long-range offensive operations in any part of the world" and "to provide combat units capable of intense and sustained combat operations employing the latest and most advanced weapons."[17]

The United States had a small, but growing, nuclear arsenal in 1946 but lacked the means to deliver these weapons over the great distances necessary to reach possible targets in the Soviet Union. Initially, SAC's bomber force consisted of 148 B-29s, only about 30 of which were configured to carry nuclear weapons.[18] These bombers lacked a true global strike capability and would have relied upon forward basing in Europe or elsewhere to strike targets in the Soviet Union. By the late 1940s, SAC became truly

[17] Norman Polmar and Timothy M. Laur, eds., *Strategic Air Command: People, Aircraft, and Missiles*, 2d ed (Baltimore: Nautical and Aviation Publishing Company of America, 1990), 7.

[18] Ibid.

capable of conducting global strike operations with the introduction of the B-36, the B-50 (a modified B-29), and dedicated air refueling aircraft. In 1949, SAC demonstrated its global strike capabilities for the first time. In March a B-50 completed the first nonstop around-the-world flight in 94 hours with the aid of four in-flight refuelings.[19] Also in March, a B-36 flew a 43 hour and 37 minute mission that covered 9,600 miles nonstop without refueling.[20]

The Cold War intensified in the 1950s and with both superpowers now armed with nuclear weapons, some came to view the true enemy as war itself. In recognition of this new reality, the focus of SAC's bomber force shifted from offensive capabilities to deterring aggression. To be an effective deterrent, SAC would have to convincingly demonstrate the ability to inflict a devastating retaliatory attack upon the Soviet Union following a preemptive strike against the United States. In 1958 SAC adopted the motto "Peace is Our Profession" in recognition of the fact that if it were ever necessary to execute its nominal mission of striking targets in the Soviet Union with nuclear weapons, that it would have failed in its primary mission to prevent nuclear war from occurring in the first place.[21]

Introduction of more and faster jet aircraft, such as the B-47, B-52, and KC-135 greatly enhanced the speed and effectiveness of SAC's nuclear global strike capabilities. However, these gains were overshadowed by the October 1957 launch of Sputnik by the Soviet Union. The ability to launch an artificial satellite into earth orbit also provided an inherent capability for ICBMs, which represented a revolution in global strike capability. Even early ICBMs reduced the time necessary to strike targets at global ranges from several hours to around 30 minutes. The relative inaccuracy of early ICBMs was mitigated by the use of high-yield thermonuclear warheads. The threat posed by Soviet ICBMs, though later found to have been greatly overstated, shifted American ICBM development efforts into high gear and drove the United States to develop new early warning systems, capabilities for airborne command and control of strategic forces, and

19 Polmar and Laur, 18.

20 Ibid.

21 Ibid., 60.

alert procedures to ensure the survivability of at least a portion of the SAC bomber force in the event of a Soviet surprise attack.[22]

Throughout the 1960s, the United States continued to field incremental improvements to its nuclear global strike forces. Improvements were made to the bomber force in the form of new aircraft (B-52G/H models and the B-58), self-protection equipment (Quail decoy missiles), and standoff weapons (Hound Dog missiles).[23] Likewise, by 1965 new Minuteman and Titan ICBMs replaced the earlier Atlas and Titan I missiles deployed in the early 1960s and greatly improved the accuracy, responsiveness and survivability of American ICBMs.[24] From the mid-1960s forward the composition of the SAC alert force would increasingly favor ICBMs over bombers.[25] By the late-1960s the assured destruction capability of the ICBM was under threat by the growing capability of defensive systems. The potential introduction of large numbers of anti-ballistic missiles (ABMs) presented a possible (if unlikely) scenario where one of the superpowers could execute a preemptive strike that destroyed a large portion of the other's nuclear forces and then shoot-down the few remaining missiles launched in retaliation before they reach their targets.

Two developments, however, in the early-1970s would combine to assure the ICBM's status as the premier global strike weapon for the foreseeable future. In 1970 the United States fielded its first squadron of fifty Minuteman III missiles, each of which carried three Multiple Independently targetable Reentry Vehicles (MIRVs).[26] For the first time, individual ICBMs had the ability to hit multiple, geographically separated targets. The use of MIRVs alone undermined arguments for deploying ABM systems on a cost versus benefit basis since it could require multiple ABMs to defeat the warheads from a single ICBM. The second development was the *Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems* in 1972 that strictly limited the size and scope of allowable ABM system

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[22] Polmar and Laur, 73, 75-6.

[23] Ibid., 67-8, 75.

[24] Office of the Historian Headquarters Strategic Air Command, *Alert Operations and the Strategic Air Command 1957-1991* (Washington D.C.: U.S. Government Printing Office), 20.

[25] Ibid., 23.

[26] Polmar and Laur, 121.

deployment and development.[27] The net effect of MIRVs and the ABM Treaty was to ensure that as far as ICBMs were concerned "the only defense was a good offense" because, baring mechanical failure, the ICBM would almost certainly make it to its intended target(s).

For the remainder of the Cold War little changed in terms of global strike capabilities. Granted, new systems were introduced to replace obsolete systems, but these represented incremental improvements to existing capabilities. In the 1980s the United States undertook three initiatives to increase the survivability and effectiveness of the strategic bomber. First, Air Launched Cruise Missiles (ALCMs) were introduced to extend the utility of the B-52 by providing it the ability to strike targets from beyond the range of Soviet air-defenses.[28] Second, 100 B-1Bs were deployed and relied upon a reduced radar signature and near-supersonic speed at low-level to penetrate Soviet air-defenses.[29] Finally, development began on the B-2 stealth bomber to ensure the ability to penetrate the expected next generation of Soviet air-defenses.[30]

There were also measures taken to address the vulnerability of American silo-based ICBMs to a preemptive strike by Soviet heavy, multi-warhead SS-18s. Theoretically, it would only take about two-thirds of the Soviet SS-18 force (then over 300 strong with ten warheads each) to destroy all American ICBMs in their silos. As a stop-gap measure to increase the offensive punch of the American ICBM force, fifty Peacekeeper ICBMs with up to ten warheads each were deployed into existing Minuteman III silos and an additional fifty Peacekeepers were to have been deployed on rail-mobile launchers to enhance their survivability.[31] Additionally, a new small, road-mobile ICBM was developed to replace the Minuteman.[32] Due to budgetary factors and the end of the Cold War the rail-mobile Peacekeepers and the road-mobile small ICBMs

[27] "Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems," 26 May 1972 [on-line] ; available from http://www.fas.org/nuke/control/abmt/text/abm2.htm; Internet; accessed July 2005.

[28] Polmar and Laur, 169-70.

[29] Ibid., 169, 254.

[30] Ibid., 169.

[31] Ibid., 308.

[32] Ibid., 314.

were cancelled. The Soviet Union did, however, deploy rail-mobile SS-24 and road-mobile SS-25 ICBMs in significant quantities.

C. CURRENT GLOBAL STRIKE CAPABILITIES

The United States currently possesses unrivalled capabilities for conducting global strike operations. All of these capabilities are products of the Cold War and initially were developed to deliver thermonuclear weapons to targets in the Soviet Union. Thankfully, that was a mission that they never had to perform. Several platforms have made the switch from full-time instruments of Armageddon to dual-role or conventional only delivery vehicles including: B-52 bombers, ALCMs, B-1B bombers, B-2 bombers, and Ohio-class fleet ballistic missile submarines. So far, these transitions have not included ICBMs or SLBMs, the only existing systems capable of conducting prompt global strikes. The following paragraphs survey current American capabilities for conducting global strike operations. While not technically capable of global strike, the nuclear-powered ballistic missile submarine (SSBN) armed with SLBMs is included because of its potential for rapid response and its ability to project force into multiple theaters of operation simultaneously (depending on deployment location).

1. B-52H Stratofortress

The B-52 first flew in 1952 and a total of 744 were produced in eight different versions over an eleven-year period from 1952 to 1962.[33] While initially conceived and built exclusively to deliver nuclear weapons, the B-52's large payload and inherent flexibility were called upon as American involvement in the Vietnam conflict began to escalate.[34] The decision to deploy B-52s for combat duty in Vietnam in a conventional capacity was not without controversy. The United States began to increase the number of B-52s deployed to Guam in February of 1965, but the first combat mission was not flown until 18 June.[35] The delay was due to a combination of "political considerations" and questions over the utility of the B-52 against the planned targets.[36] However, there is no evidence to suggest that this deployment of B-52s was interpreted by the Soviets as signaling the intent or willingness of the United States to use nuclear weapons in

33 William G. Holder, *Boeing B-52 Stratofortress* (Fallbrook, CA: Aero Publishers, 1975), 13, 23.

34 Ibid., 41.

35 Lindsay T. Peacock, *Strategic Air Command* (London: Arms and Armour Press, 1988), 90.

36 Ibid.

Vietnam. Media commentators at the time were familiar with the B-52's primary function as a nuclear bomber and likened its use against the Viet Cong to "swatting flies with a sledge hammer."[37]

Pressed into service as a conventional bomber, the B-52Fs initially committed to combat in Vietnam packed a considerable punch, but they were limited to carrying just 51 bombs (27 internally and 24 on wing-mounted pylons).[38] In order to increase the B-52's conventional striking-power, the entire lot of B-52Ds underwent "big belly" modifications to increase the volume of the internal weapons bay to allow for carriage of 84 500 pound bombs.[39] The total bomb load of the B-52D was 108 500 pound bombs, which gave new meaning to phrase "carpet bombing."

During eight years of participation in such operations as "Arc Light," "Rolling Thunder," and "Linebacker II," with numbers of deployed aircraft reaching 200 by February 1972, B-52s flew 124,532 sorties and dropped 2.63 million tons of conventional bombs on Vietnam, Laos, and Cambodia.[40] A total of 29 B-52s were lost during operations in Southeast Asia including 17 as a direct result of enemy fire (15 of these in "Linebacker II").[41] Throughout the heavy involvement of B-52s in the Vietnam conflict, the majority of the force remained in the United States performing the nuclear deterrence mission with up to 40 percent on alert for immediate takeoff in response to a Soviet attack.[42]

Following the Vietnam War, the B-52 retained both conventional and nuclear capabilities. The losses incurred during the Linebacker II campaign contributed to growing concerns over the ability of the B-52 to penetrate modern Soviet air defenses. To increase the B-52's survivability, the G and H models were modified to carry up to 20 nuclear-armed short-range attack missiles (SRAMs) and tactics were changed from high-altitude flight to low-level penetration.[43] The B-52Ds, however, were limited to free-fall

37 Polmar and Laur, 96.

38 Peacock, 91.

39 Ibid.

40 Ibid., 92 and 96.

41 Ibid., 92 and 98.

42 Ibid., 100.

43 Ibid., 107.

weapons and were thus principally tasked with conventional warfighting until they were retired from service in 1984.[44] In the 1980s, the G and H model B-52s continued to demonstrate their potential for conventional global strike operations through participation in "Bright Star" exercises that involved flying 15,000 mile, 31 hour non-stop missions (with the aid of in-flight refueling) from the United States to bomb targets in Egypt and back.[45] The deployment of the AGM-86B ALCM in 1981 enhanced the survivability and nuclear striking-power of the B-52 by allowing the aircraft to strike targets from a 1,500 mile stand-off range, safely outside the range of Soviet air defenses.[46]

Just as its B-52 carrier aircraft had done in 1965, the ALCM also made the cross-over from nuclear to conventional capability. Beginning in 1986 under a "black program" code-named "Senior Surprise," several AGM-86B ALCMs were converted into AGM-86C conventional ALCMs (CALCMs) which carry a conventional high-explosive, blast-fragmentation warhead in place of the W-80 nuclear warhead.[47] To increase the payload weight (i.e., warhead size), the CALCM's range is reduced from 1,500 to 600 miles.[48] There are no obvious external distinguishing features between the two versions.

Unlike the initial B-52 operations in Vietnam, the first combat employment of the CALCM was conducted under a shroud of secrecy and was not revealed until well after the fact. At 6:36 A.M. local time on 16 January 1991, seven B-52s armed with CALCMs took off from Barksdale Air Force Base, Louisiana to strike communications, power generation, and power transmission targets in Iraq as part of the opening wave of the Operation DESERT STORM air campaign.[49] If the departure of the aircraft had aroused any media attention, a cover story stating that the aircraft were deploying to Loring Air Force Base, Maine as a staging location for possible deployment overseas was to be used

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44 Peacock., 107 and 110.

45 Polmar and Laur, 169.

46 Ibid., 169-70.

47 Michael R. Gordon and Bernard E. Trainor, *The General's War: The Inside Story of the Conflict in the Gulf* (Boston: Little, Brown and Company, 1995), 206, and *Report of the Defense Science Board Task Force on Future Strategic Strike Forces*, by Dennis Blair and Michael Carns, co-chairs (Washington D.C.: Government Printing Office, 2004), sec. 5, p. 3.

48 Defense Science Board, sec. 5, p. 3.

49 Walter J. Boyne, *Operation Iraqi Freedom: What Went Right, What Went Wrong, and Why* (New York: Tom Doherty Associates, LLC, 2003), 30.

in order to protect the secrecy of the operation.[50] The mission was flown as a non-stop 35-hour round trip returning to Barksdale because of concerns that if there were any "hangers" (unlaunched missiles) after the mission, the media at the recovery bases in Saudi Arabia might notice the ALCM-armed B-52s and draw attention to a capability the United States preferred to keep secret.[51] The desire to keep the existence of CALCMs secret was not simply due to operational security concerns, but was much more strategic in nature. The United States needed Soviet political support for the operations in the Gulf and so as not to offend Soviet sensitivities, the Bush administration chose not to "notify Moscow that air-launched cruise missiles, a system that the Soviets associated exclusively with nuclear weaponry, were going to make an operational debut."[52] The use of thirty-five CALCMs in DESERT STORM was a relatively insignificant portion of the overall air campaign but it provided the Air Force an opportunity to validate the operational capabilities of the ALCM in combat and to "show that the service could reach out globally to strike an enemy from bases in the United States."[53]

By the time the CALCM was employed in combat for the second time, its existence had been fully disclosed. However, unlike in 1991, it was employed relatively close to Russian territory with little consideration given to potential Russian sensitivity regarding its use.[54] The conflict between NATO and Serbia over ethnic cleansing in Kosovo and the on-going eastward expansion of NATO greatly increased tensions between NATO and Russia. Russian President Yeltsin and the Russian military engaged in a significant amount of saber rattling throughout the conflict.[55] From the U.S. and NATO perspective the conflict with Serbia was a limited war for limited objectives, however, the Russian perspective was significantly different. Former Russian Prime Minister Chernomyrdin, an envoy to negotiations with NATO over the Kosovo crisis stated on 28 May 1999, "The world has never in this decade been so close as now to the

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[50] Gordon and Trainor, 206.

[51] Gordon and Trainor, 206.

[52] Ibid.

[53] Ibid., 223.

[54] Peter Vincent Pry, *War Scare: Russia and America on the Nuclear Brink* (Westport, CT: Praeger Publishers, 1999), 285.

[55] Ibid., 284.

brink of nuclear war."[56] Statements such as this illustrate the fact that while NATO was tightly focused on events in Serbia, Russia was concerned that Operation ALLIED FORCE could easily shift into operations against Russia. One can surmise that the Russians were well aware that the B-52's CALCM launch points over the Mediterranean Sea were well within striking distance of targets in Russia.

Today, even though the newest B-52H is 43 years old, it is arguably a much more effective and versatile weapon system than when it was brand new. Current engineering estimates show the B-52 has a lot of life left in it and is predicted to remain structurally viable until at least 2040.[57] The published range of the B-52H is 8,800 miles, but with aerial refueling it is limited only by crew endurance.[58] The exceptional versatility of the B-52 has led to its certification to drop or launch the widest array of different weapon types of any aircraft in the U.S. arsenal.[59] In the conventional role, the B-52 can employ the CALCM for standoff strikes against heavily defended targets, and in relatively permissive environments, such as Afghanistan, it can employ the full range of unguided and precision guided direct attack munitions.[60] Even though no longer standing nuclear alert, the B-52 retains a significant nuclear warfighting capability. While no longer survivable against modern air defenses in a penetration role, the B-52 remains effective as a cruise missile "truck" for either the AGM-86B ALCM or the AGM-129 Advanced Cruise Missile, a low-observable design first deployed in 1992.[61] Both cruise missile types are undergoing service life extension programs to ensure operational viability until at least 2030.[62] The B-52 has been involved in nearly every major conflict the United States has fought in since it entered service and it is probably not a leap of faith to envision a role for the B-52 in any future conflict between now and 2040.

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56 Pry, 285.

57 Air Combat Command, "B-52 Stratofortress Fact Sheet," 2003 [on-line] ; available from http://www.af.mil/factsheets/factsheet_print.asp?fslID=83&page=1; Internet; accessed July 2005.

58 Ibid.

59 Ibid.

60 Ibid.

61 Defense Science Board, sec. 5, pp. 3-4.

62 Ibid.

2. B-1B Lancer

The B-1A was the second attempt to replace the B-52 as SAC's primary nuclear-armed strategic bomber following the cancellation of the XB-70 in the 1960s. The B-1A could virtually match the B-52's range and payload, but also had the option of high-altitude flight at Mach 2 or low-level penetration at near supersonic speeds. The B-1A first flew in December of 1974 and four prototypes participated in the development program, however, President Carter cancelled the program in June 1977.[63] Production was to have totaled 240 aircraft, but the administration chose to rely on ALCM equipped B-52s instead.[64]

As part of his strategic modernization program, President Regan resurrected the B-1 program with a decision to build 100 B-1B aircraft to supplement the ALCM-armed B-52s. The B-1B is very similar to the B-1A in range and payload, but modifications to the engine intakes to reduce their radar signature limit its top speed to Mach 1.25.[65] The B-1B has a radar signature approximately 85 percent less than the B-1A and 98 percent less than the B-52H.[66] The B-1B first flew in October of 1984 and entered service with SAC in July 1985, with initial operational capability declared in October of 1986.[67]

As with the B-52 before it, the B-1B's reason for being was to penetrate deep into enemy territory to deliver nuclear weapons to assigned targets as part of the Single Integrated Operations Plan (SIOP). Upon entry into service the B-1B was certified to carry B61 and B83 nuclear bombs and the nuclear-armed SRAM.[68] Also like the B-52, the B-1B later evolved into an effective conventional attack platform. The B-1B was certified to carry the unguided Mk 82 500 pound bomb in July of 1989, which remained the only conventional weapon available to the aircraft until 1995.[69] In 1991, the Air Force decided to restrict the B-1B fleet to the delivery of conventional weapons only.[70]

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63 Lou Drendel, *Bone: B-1 Lancer in Action* (Carrollton, TX: Squadron/Signal Publications, 2002), 8.

64 Ibid, 8.

65 Ibid., 12

66 Ibid.

67 Polmar and Laur, 186, 191, and 196.

68 Drendel, 27.

69 Ibid.

70 Ibid.

The Conventional Mission Upgrade Program permanently removed the ability for the B-1B to carry nuclear weapons and greatly expanded the variety of conventional weapons it could employ.[71] In 1995, Russian teams were allowed to inspect every B-1B to verify its nuclear capability had been removed in accordance with arms control treaty requirements.[72] Today, the B-1B can strike targets anywhere on earth (with the aid of in-flight refueling), in any weather, with a wide selection of unguided and precision guided conventional weapons, including up to eighty-four Mk 82 500 pound bombs or twenty-four GBU-31 GPS-aided 2000 pound Joint Direct Attack Munitions (JDAM).[73] The fact that the B-1B delivered nearly 40 percent of the total bomb tonnage and 67 percent of the JDAMs (nearly 3,900) during the first six months of Operation ENDURING FREEDOM is testament to the B-1B's superb payload and precision strike capabilities.[74]

The B-1B has been the subject of intense controversy, especially early in its operational career, over perceived operational shortcomings. The political battles that resulted in the program's initial cancellation and later resurrection likely helped to intensify (and certainly politicize) criticism of the B-1B. An example of politically motivated criticism involves the B-1B's non-participation in Operation DESERT STORM. Soon after the air campaign against Iraq began in January of 1991, the media (CNN in particular) and several Congressmen used the B-1B's absence from combat to further criticize the aircraft as an expensive "white elephant."[75] The B-1B remained home to perform its primary, and at the time only, mission of nuclear deterrence. What makes this criticism significant is that there appeared to be absolutely no concern over the potential "nuclear baggage" associated with introducing the country's front-line nuclear bomber into a conventional campaign in 1991.

While apparently lacking at the time of DESERT STORM in 1991, the B-1B seemed to acquire "nuclear baggage" at the time of its first potential combat employment in 1998. In a period of rising tensions between Iraq and the United States over Iraqi

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[71] Drendel, 27.

[72] Ibid.

[73] Air Combat Command, "B-1B Lancer Fact Sheet," 2005 [on-line] ; available from http://www.af.mil/factsheets/factsheet_print.asp?fslID=81&page=1; Internet; accessed July 2005.

[74] Ibid.

[75] Bert Kinzey, *The Fury of Desert Storm: The Air Campaign* (Blue Ridge Summit, PA: TAB Books, 1991), 103 and 105.

interference with United Nations weapons inspectors, the United States prepared to strike suspected weapons of mass destruction (WMD) targets in Iraq.[76] In addition to preparations for massive cruise missile strikes, the United States deployed a small number of B-1Bs to the Persian Gulf for their potential combat debut.[77] Moscow reacted quite strongly to this deployment, believing that the presence of B-1Bs in the region indicated that the United States was on the verge of launching a preemptive nuclear strike on Iraq.[78] Russian President Yeltsin even stated in televised remarks that “Clinton’s actions could lead to a world war.”[79] Yeltsin’s remarks were echoed by members of the Russian Duma and high-ranking members of the Russian military who also believed the presence of B-1Bs were meant to “blackmail Iraq” by threatening to use nuclear weapons.[80] Russian press reports claimed that the pending U.S. strike on Iraq was meant to “subvert Russian interests” and would be the first step in a “dash for the Caspian Sea” as part of a NATO conspiracy to capture the oil wealth of the region.[81] The passage of nearly a year between this initial controversy and the actual conduct of Operation DESERT FOX in December 1998 against suspected WMD sites in Iraq did little to alter Russian perceptions. Even though the strikes were carried out with conventional weapons and the B-1Bs played a relatively small role in the operation, it was reported in the Russian press and later confirmed by General Anatoliy Kornukov, then Commander-in-Chief of the Russian Air Force and Air Defense Forces, that Russian nuclear forces were placed on heightened alert.[82]

Two things make the general overreaction of the Russians to the deployment of B-1Bs significant. First, it demonstrates an extreme sensitivity regarding the use of American strategic systems near the periphery of Russian territory. Second, it demonstrates that the Russians still attached significant “nuclear baggage” to the B-1B, even though it had been declared a conventional-only delivery platform in 1991 and

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[76] Pry, 286.

[77] Ibid.

[78] Ibid.

[79] Pry, 286.

[80] Ibid.

[81] Ibid.

[82] Ibid., 289.

verified as such by the Russians themselves in 1995 – three years before the controversy in 1998. Whether justifiably so or not, the Russian reaction to B-1B deployments for Operations DESERT FOX demonstrate the potential difficulty of removing "nuclear baggage" from strategic systems, particularly in times of increased tensions. The lack of any apparent concern by the Russians over the extensive use of the B-1B in Operations ENDURING FREEDOM and IRAQI FREEDOM, however, seems to indicate that the "Bone" has finally been accepted as a dedicated conventional weapons platform. In Operation IRAQI FREEDOM, eleven B-1Bs delivered 2,250 tons of bombs in 432 sorties.[83] This total accounted for half of the overall bomb tonnage dropped during major combat operations and was nearly all precision guided munitions.[84] The recent appearance of the B-1B, for both static display and flying demonstrations, at the 2005 Moscow International Aviation and Space Salon held at Ramenskoye Airfield seems to indicate that the Russians have finally accepted the "Bone" as a conventional platform. Captain Steve Jones, one of the B-1 pilots, said "It's an honor to fly the first B-1s into Russia" and "I think it shows how much progress our two nations have made since the Cold War."[85] He continued to say that, "The fact the United States would bring one of its strategic bombers into this country and that the Russians will allow us to not only display the aircraft, but that we're able to fly it here…it shows how diffused the whole Cold War has really become.[86] The fact that it has taken ten years since the B-1 transitioned to a conventional-only role to get to this point effectively demonstrates that changes to a weapon system's role may be made quickly, but it may take time for perceptions to align with the new reality.

3. B-2A Spirit

The B-2A Spirit, commonly known as the stealth bomber, is another of several attempts to replace the B-52 with a nuclear-armed bomber capable of penetrating the Soviet Union's advanced air defenses. Whereas previous aircraft would have relied upon high-altitude flight, high-speed, or low-altitude penetration to reach assigned Soviet

[83] Boyne, 148.

[84] Boyne, 148.

[85] Master Sergeant Mona Ferrell, "America's B-1B Lancer Takes to Russian Sky," United States Air Forces Europe News Service, 19 August 2005 [on-line]; available from http://www.usafe.af.mil/news/news05/ uns05262.htm; accessed August 2005.

[86] Ibid.

targets, the B-2 was designed to be nearly invisible to radar through the use of radar absorbing and defeating "stealth" technology. SAC planners believed that a long-range bomber, capable of operating undetected by the world's largest and most sophisticated air defense system deep inside Soviet territory was the only way to hold Soviet mobile ICBMs, at risk.[87] In the event of nuclear war with the Soviet Union, the B-2 would be tasked to seek out, identify, and destroy the rail-mobile SS-24 and the road-mobile SS-25s that had dispersed from their garrisons.[88]

The initial contract for development and production of the Advanced Technology Bomber (late designated B-2) was awarded to Northrop in 1981.[89] The B-2 was developed under a shroud of secrecy and even the program's budget expenditures remained classified until late 1988.[90] The first artist's conception of the B-2 was released to the public in April 1988 and the first B-2 was unveiled 22 November 1988.[91] The B-2 first flew in July 1989 and following an extensive period of developmental testing, entered service with Air Combat Command in December 1993.[92] Original plans called for the production of 132 B-2s, but the aircraft's unprecedented high unit cost and the end of the Cold War conspired to limit production to just 21 airframes.[93]

The B-2 was designed as a nuclear bomber during the height of the Cold War, however, it did not enter service until after its "end" in 1993. Because of congressionally imposed production delays, the B-2 did not achieve initial operational capability (IOC) until April 1997 – over three and a half years after the first B-2 was delivered to the Air Force.[94] These two factors had an immediate effect on the weapons that the B-2 was initially certified to carry. Unlike the B-1B, there was no gap between IOC and the

[87] Bill Sweetman, *Stealth Bomber: Invisible Warplane, Black Budget* (Osceola, WI: Motorbooks International, 1989), 133.

[88] Ibid.

[89] Sweetman, 73.

[90] Ibid., 81.

[91] Ibid., 7.

[92] Air Combat Command, "B-2 Spirit Fact Sheet," 2005 [on-line] ; available from http://www.af.mil/factsheets/factsheet_print.asp?fslID=82&page=1; Internet; accessed July 2005.

[93] Sweetman, 73, and Bill Sweetman, "B-2 Stealth Bomber," *World Airpower Journal* 31 (Winter 1997) : 85-6.

[94] Sweetman, "B-2 Stealth Bomber," 88.

fielding of a conventional weapons capability for the B-2 and at IOC the B-2 was certified to deliver B83 nuclear weapons and various GPS-aided conventional munitions.[95] The conventional weapons carriage capability has gradually been expanded and now includes a wide variety of unguided and precision guided conventional weapons. The B-2's operational range, as with the B-52 and B-1B, is limited only by crew endurance with the aid of in-flight refueling. The B-2 reached full operational capability in December 1999.[96]

The B-2 made its combat debut as one of the lead elements of Operation ALLIED FORCE, the NATO campaign to halt Serbian "ethnic cleansing" of neighboring Kosovo. Several B-2s participated in the operation by flying nonstop missions from Whiteman Air Force Base, Mossuri to Serbia/Kosovo and back.[97] The B-2 is credited with destroying 33 percent of all Serbian targets during the first eight weeks of the campaign.[98] While no specific controversy regarding the B-2's primary role of nuclear warfighting was evident during ALLIED FORCE, its presence probably contributed to the overall unease the Russians demonstrated throughout the conflict. The operation of American strategic systems, ALCM-armed B-52s, B-1Bs, and in particular stealthy B-2s, in relatively close proximity to the periphery of Russian territory likely contributed to Russian fears that Operation ALLIED FORCE could easily shift its focus from Serbia to Russia.[99]

The B-2 has since participated in Operations ENDURING FREEDOM and IRAQI FREEDOM without any apparent concerns by the Russians. This is most likely attributable to a general lack of tensions between the United States and Russia and the growing level of cooperation between the two nations in the Global War on Terror. With its utility as a conventional weapons delivery platform demonstrated in three major combat operations, it now seems the United States can employ the B-2 as necessary without too much worry over "nuclear baggage." However, for a reminder of its continuing role as a nuclear bomber one needs to look no farther than the B-2's wing and squadron designations and lineage. The 509th Bomb Wing is the direct descendent of the

95 Sweetman, B-2 Stealth Bomber, 68, 89.

96 Air Combat Command, "B-2 Spirit Fact Sheet."

97 Ibid.

98 Ibid.

99 Pry, 284-5.

509th Composite Group that was activated in December 1944 to organize, equip, and train for atomic warfare against Japan.[100] Likewise, the 393rd Bomb Squadron is the descendent of the 393rd Heavy Bombardment Squadron, commanded by Colonel Paul Tibbets, which carried out the atomic bomb attacks against Hiroshima and Nagasaki with B-29 Superfortress bombers in August of 1945.[101]

4. Minuteman III ICBM

The Minuteman III is a derivative of the original Minuteman ICBM first deployed in the early 1960s. The Minuteman was the world's first ICBM with solid propellant and the Minuteman III was the first ICBM to carry MIRVs (up to three per missile) when initially deployed in 1970.[102] Between 1970 and 1975, the United States deployed 550 Minuteman IIIs into hardened silos scattered throughout large portions of Wyoming, Nebraska, Colorado, Montana, and North Dakota.[103] The Minuteman III originally carried up to three Mark 12 reentry vehicles containing the 170 kiloton (kt) W-62 thermonuclear warhead, and had a circular error probability (CEP) of 220 meters.[104] Beginning in 1979, 300 Minuteman IIIs were retrofitted with the Mark 12A reentry vehicle which reduced the CEP to 166 meters and carried the more powerful 335 kt W-78 thermonuclear warhead.[105] With its combat load of three warheads the Minuteman III has a range of 7,500 miles (6,750 nautical miles or 12,500 kilometers).[106] In the late 1980s, fifty Minuteman IIIs were removed from their silos in Wyoming to make way for the deployment of fifty Peacekeeper ICBMs.[107] This reduced the number of deployed Minuteman IIIs to 500, which remains the deployed total today.

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100 Robert F. Dorr, "B-2 Operators," *World Airpower Journal* 31 (Winter 1997) : 95.

101 Ibid.

102 Polmar and Laur, 305-6.

103 Polmar and Laur, 140, 305.

104 Max Walmer, *An Illustrated Guide to Strategic Weapons* (New York: Prentice Hall Press, 1988), 24.

105 Walmer, 24, and Polmar and Laur, 305.

106 Walmer, 24.

107 Polmar and Laur, 305.

Throughout its 35-year service life, the Minuteman III has averaged an incredible 99.5 percent missile alert rate.[108] To maintain this alert level, the weapon system has undergone several modification programs to extend its service life. The most recent modifications include replacement of the propellant and guidance sets to ensure the missiles will remain viable until 2020.[109] Additionally, the Minuteman IIIs are undergoing modification to reduce the umber of warheads carried from three to one. This modification was originally begun as a result of the second Strategic Arms Reduction Treaty (START II) which would have eliminated all multi-warhead land-based ICBMs.[110] Even though START II never entered into force, the downloading of Minuteman IIIs has continued in order to help meet the reduction targets specified by the Strategic Offensive Reductions Treaty of 2002 (SORT).[111] There are also plans as part of the Safety Enhanced Reentry Vehicle Program to equip 200 Minuteman IIIs with the Mark 21 reentry vehicles and W-87 thermonuclear warheads made available due to the deactivation of the Peacekeeper ICBMs.[112]

The Land-Based Strategic Deterrent (LBSD) program is underway to define and eventually develop a replacement for the Minuteman III by 2018.[113] In the mean time, however, the Air Force is proposing to enhance a few Minuteman IIIs to what the services terms a Minuteman III "Elite" configuration.[114] Air Force Space Command officials describe Minuteman III Elite as an interim step towards LBSD that would field some of the technologies desired for a future ICBM to upgrade a small portion of the existing Minuteman III force to make them more capable against "particularly complex targets."[115] While the exact system characteristics have not yet been determined,

108 Walter Pincus, "Commander Seeks Alternate Uses for ICBMs," Washington Post, 21 April 2005, A24 [on-line]; available from http://www.washingtonpost.com/ac2/wp-dyn/A6219-2005Apr20?Language =printer; Internet; Accessed July 2005.

109 Defense Science Board, sec. 5, pp. 1-2.

110 Amy F. Woolf, *U.S. Nuclear Weapons: Changes in Policy and Force Structure* (Washington D.C.: Congressional Research Service, 2005), 21 and 27, CRS, RL31623.

111 Ibid., 28

112 Wolf, 28.

113 Robert Wall, "Modernizing ICBMs: USAF Proposes Replacing Minuteman IIIs and Fielding an Enhanced Elite Version," *Aviation Week and Space Technology* (28 June 2004) : 32.

114 Ibid.

115 Ibid.

preliminary options include new reentry vehicles and a new guidance system, possibly using GPS, to improve the accuracy of the Minuteman III.[116] The proposed Elite modifications are still intended for use with a nuclear weapon, but the increased accuracy could allow the use of lower yield warheads than are currently deployed. If the accuracy improves enough, the Minuteman III Elite could employ a conventional warhead instead. Over the years there have been numerous proposals and studies regarding arming Minuteman IIIs with conventional warheads, however, recent studies such as the 2004 *Report of the Defense Science Board Task Force on Future Strategic Strike Forces* look towards retired Peacekeeper ICBMs as a better alternative for this role.[117] This is primarily due to the Peacekeeper's significantly larger payload capacity, which is four to five times greater that the Minuteman III.[118] Under current planning assumptions, the Minuteman III will continue in its current role as the land-based portion of the nuclear triad until it is eventually replaced in the 2020 timeframe after an operational career spanning 50 years.

5. Peacekeeper ICBM

The Peacekeeper ICBM, originally known by developmental name of "MX," was the United States' answer to the Soviet SS-18. The Peacekeeper carries up to ten Mark 21 reentry vehicles, which contain 300 kt W-87 thermonuclear warheads, and have a CEP of 100 meters.[119] With a full combat load of ten warheads, the Peacekeeper has a range of 6,600 miles (6,000 nautical miles or 11,000 kilometers).[120] Numerous basing modes for the missile were studied, including various mobile schemes that would reduce its vulnerability to a Soviet first strike, but the force of fifty missiles (reduced from the initially planned 200) ended up in modified Minuteman hardened silos in Wyoming.[121] The force of fifty Peacekeeper ICBMs attained full operational capability (FOC) in December 1988.[122] In early 1993, less than five years after having achieved FOC, the

116 Wall, 32.

117 Defense Science Board, sec. 5, pp. 2-3.

118 Ibid.

119 Walmer, 26.

120 Ibid.

121 Amy Butler, "Holstering Peacekeeper," *Aviation Week and Space Technology* (1 August 2005): 48.

122 Polmar and Laur, 310.

United States and Russia signed the START II agreement which called for the elimination of the Peacekeeper and all land-based multi-warhead ICBMs.[123] The treaty never entered into force, but the United States later chose to eliminate the Peacekeepers as part of the reductions necessary to meet the warhead totals agreed to under SORT in 2002. Peacekeeper deactivation began in October 2002 and will be completed in October 2005.[124]

Even though the Peacekeeper will have been removed from service by the time this thesis "goes to press," I include it as a "current global strike capability" because even though the missiles are being removed from deployed alert status, their associated flight hardware, reentry vehicles, warheads, and silos will not be destroyed. The rocket stages will be stored in environmentally controlled facilities under the purview of the Rocket System Launch Program and will be available for government projects.[125] The W-87 warheads will initially rejoin the Department of Energy's national stockpile, but there are plans to equip 200 Minuteman III ICBMs with these warheads and their associated Mark 21 reentry vehicles.[126] The missile silos will not be imploded as with previous ICBM deactivations to preserve them for possible future use and to save the expense of destroying them.[127] Unlike START, which counted missile silos against allowed ICBM totals (even if empty), SORT only counts operationally deployed systems against allowed warhead totals. It is technically possible, although highly unlikely that the Peacekeeper force could be reconstituted under conditions of sufficient national need. A more likely scenario would see Peacekeeper components employed as part of a conventional prompt global strike system.

6. Ohio-Class SSBN and Trident SLBM

While not technically a global strike system since the Trident SLBMs carried by the Ohio-class fleet ballistic missile submarines lack sufficient range to strike targets at global range from the continental United States, I include it because the nuclear-powered ballistic missile submarine (SSBN) does provide "global strike-like" capabilities. From

[123] Woolf, 21-2 and 27.

[124] Butler, 47.

[125] Defense Science Board, sec. 5, p. 3.

[126] Butler, 48-9.

[127] Butler, 49.

advantageous deployment locations, the SSBN can rapidly project power to numerous targets, including ones spread among several theaters of operation.

The Ohio-class SSBN was designed in the 1970s as a replacement for the Lafayette-class SSBNs built in the 1960s. The Ohio-class subs have twenty-four missile tubes capable of carrying the Trident I (C-4) missile or the larger Trident II (D-5) missile.[128] Original congressional opposition to the new submarines was overcome when the Soviets deployed the Delta-class ballistic missile submarine with 4,680 mile (4,137 nautical mile or 7,800 kilometer) range SS-N-8 SLBMs.[129] The USS Ohio, the first of an originally planned total of twenty-four Ohio-class SSBNs, entered service in November 1981.[130] The first eight Ohio-class submarines were armed with Trident I (C-4) SLBMs which have a range of 4,260 miles (3,870 nautical miles or 7,100 kilometers), a CEP of 450 meters, and carry up to eight Mark 4 reentry vehicles which contain 100 kt W-76 thermonuclear warheads.[131] Subsequent boats of the class were armed with Trident II (D-5) SLBMs which have a range of over 4,560 miles (4,000 nautical miles or 7,400 kilometers), a CEP of 122 meters, and carry up to ten Mark 5 reentry vehicles which contain 475 kt W-88 thermonuclear warheads.[132] Due to the end of the Cold War and constraints under START, only eighteen Ohio-class SSBNs were constructed and the final Ohio-class SSBN, the USS Louisiana, entered service in September 1997.[133]

Current plans call for retaining fourteen Ohio-class SSBNs in the nuclear deterrence role and converting the four oldest boats into cruise missile carriers and special operations platforms, designated SSGNs.[134] Under the current schedule, the first SSGN (the USS Ohio) is expected to enter service in 2007.[135] The refit of the entire fleet of fourteen SSBNs to carry the Trident II (D-5) SLBMs is scheduled for completion by

[128] Walmer, 50.

[129] Ibid.

[130] "SSBN-726 Ohio-Class FBM Submarines," 2000 [on-line] ; available from http://www.fas.org/nuke/usa/slbm/ssbn-726.htm; Internet; Accessed August 2005.

[131] Walmer, 50, 72.

[132] Walmer, 75, and Chuck Hansen, *U.S. Nuclear Weapons: The Secret History* (Arlington, TX: Aerofax, Inc., 1988), 206.

[133] "SSBN-726 Ohio-Class FBM Submarines," 2000 [on-line] ; available from http://www.fas.org/nuke/usa/slbm/ssbn-726.htm; Internet; Accessed August 2005.

[134] Woolf, 29.

[135] Defense Science Board, sec. 5, p. 5.

2007.[136] To meet allowed totals for deployed warheads under SORT, the Trident II (D-5) may be downloaded to carry as few as three warheads (from the current payload of eight).[137] The Ohio-class SSBNs are expected to remain in service for over twenty-five more years with the first one retiring in 2030, and the Trident II (D-5) will remain in production at a rate of twelve missiles per year until at least 2011 to ensure missile availability through the remainder of the submarines' service lives.[138]

Today, the Navy's emphasis for increased conventional striking power is placed on the SSGN conversion effort. There are no funded plans to arm the Trident II (D-5) with conventional warheads, but there was an effort to increase the missile's effectiveness in its nuclear role that could have implications for future conventional warhead efforts. The D-5 Enhanced Effectiveness (E2) Program was to have been a three-year effort culminating in a flight test of a more accurate reentry vehicle.[139] Unfortunately, the Navy's initial funding requests for this initiative were rejected by Congress in fiscal years 2003 and 2004 and it has not requested funds again since then.[140] The goal of the E2 program was to enhance the missile's ability to conduct prompt, highly accurate strikes and reduce collateral damage through the use of a lower- yield warhead.[141] The project combined the existing Mark 4 reentry vehicle and W-76 100 kt warhead from the Trident I (C-4) with a reentry vehicle body extension that integrates existing inertial measurement unit (IMU) and GPS technologies and a flap steering system.[142] The integrated assembly is similar in size and weight to the Mark 5 reentry vehicle/W-88 warhead combination that the Trident II (D-5) normally carries.[143] The E2 program sought increased accuracy through a three-step process: 1) the modified reentry vehicle's integrated IMU initializes with inputs from the D-5's missile guidance set, 2) the reentry vehicle receives and applies a GPS update to the IMU while in

136 Defense Science Board, sec. 5, p. 5.

137 Woolf, 29.

138 Defense Science Board, sec. 5, pp. 6 and 11.

139 Ibid., sec. 5, p. 6.

140 Amy F. Woolf, *Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress* (Washington D.C.: Congressional Research Service, 2005), 8, CRS, RL33067.

141 Defense Science Board, sec. 5, p. 6.

142 Ibid, sec. 5, p. 7.

143 Ibid.

exoatmospheric flight, and 3) during reentry the IMU provides steering inputs to the control flaps to steer the warhead to its target with GPS-like accuracy.[144] While the E2 Program is intended to upgrade the D-5's nuclear warfighting capability, the program's technology could be applied to a conventional PGS system. Despite the lack of official program funding, Lockheed Martin conducted E2-related reentry vehicle flight tests in conjunction with Trident launches in 2002 and 2005.[145] These tests demonstrated the modified reentry vehicle's ability to maneuver to the target with greater accuracy and decelerate to "control impact conditions."[146]

D. CONCLUSION

Current global strike capabilities are a product of the Cold War. Heavy bombers were developed with ever-increasing reach and survivability and ballistic missiles shortened the time necessary to strike targets at global ranges from hours to minutes. All American global strike systems were originally developed and deployed to deliver nuclear weapons. The paradigm that associates strategic (i.e., long-range, nuclear capable or formerly nuclear capable) systems exclusively with nuclear war has proven difficult, but not impossible to break. Many of the weapon systems described in this chapter have successfully transformed from dedicated instruments of Armageddon into dual-role or conventional-only platforms. The B-52, B-1, B-2, ALCM, and Ohio-class submarine serve as cases in point and demonstrate that it is possible to offload "nuclear baggage" and adapt existing weapon systems to address new national security needs that were not necessarily envisioned when the systems were originally built. These cases also point out, however, that it is advisable to approach the first combat employment of a newly transitioned weapon system with caution since it may take time for other nations to adjust to the change.

The glaring exception to the above nuclear-to-conventional success stories is the intercontinental missile. Historically, the primary reason for this has been technical. Until relatively recently it has not been possible for a missile to deliver a conventional warhead over intercontinental ranges with sufficient accuracy to be effective. A CEP of

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[144] Defense Science Board, sec. 5, p. 5.

[145] Woolf, Conventional Warheads, 8.

[146] Ibid.

100 meters is considered excellent for a 300 kt nuclear weapon, but it is useless for a 2,000 pound conventional weapon. Recent improvements in guidance technology make it feasible to consider intercontinental missiles armed with conventional munitions. The most significant remaining barrier to conventional PGS is the perception that intercontinental missiles are “inherently nuclear.” In actuality, intercontinental missiles are no more “inherently nuclear” than are long-range bombers, cruise missiles, and former SSBNs. But, the question remains – will intercontinental missiles ever be able to shed their “nuclear baggage” in the same fashion that strategic bombers, cruise missiles, and submarines have?

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III. CONVENTIONAL PGS CONCEPTS

A. INTRODUCTION

In October 2005, a formal Air Force Space Command-sponsored Prompt Global Strike Analysis of Alternatives (AOA) will begin.[147] It is well beyond the scope of this chapter (or even this thesis) to compete with the formal AOA, however, this chapter examines concepts for conventional PGS capabilities that could be made available within the next 15 years, including some that could be deployed almost immediately. Current technology allows for two general alternatives for striking targets at global ranges within minutes of a decision to do so: 1) the weapon system may be terrestrially-based (i.e., air, land, or sea) and use a modified intercontinental missile or space launch vehicle to transit space and strike distant targets, or 2) the weapon system is placed into space and de-orbited to strike targets on the Earth's surface when ordered. This chapter splits discussion of conventional PGS concepts into two parts. First, the chapter surveys possible munitions for conventional PGS weapon systems including penetrating warheads, GPS-aided maneuverable reentry vehicles, and the Common Aero Vehicle (CAV). Second, the chapter presents several potential terrestrially-based and space-based delivery systems.

B. CONVENTIONAL PGS MUNITIONS

Targets commonly envisioned for conventional PGS weapon systems include highly valued enemy surface and subsurface facilities, such as command centers and WMD production and storage facilities. In general, there are two types of munitions that a conventional PGS weapon system could employ: those intended to destroy the target through kinetic energy alone or those that use an explosive warhead to do the same. With sufficient accuracy, even inert warheads can impart significant destructive force against targets due to the extreme impact velocities possible with either terrestrially or space-based PGS systems. While conventional PGS systems could be used to effectively attack a wide variety of surface targets, the most challenging targets are those that are hardened or deeply buried. Conventional PGS systems have a theoretical advantage over other

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[147] Amy Butler, "Shopping for Deterrence: Air Force Planners are Seeking Better Accuracy, Reliability in Next Generation ICBM," *Aviation Week and Space Technology* (1 August 2005) : 49.

conventional weapons against this class of target. This section examines the theoretical possibilities and technical realities of strikes against hardened and deeply buried targets as well as two possible reentry systems conventional PGS systems may employ.

1. The Hard and Deeply Buried Target Problem

Attacks against hardened or deeply buried targets is the mission most commonly attributed to conventional PGS capabilities, but it is also the most technically challenging. To destroy this class of target requires very high impact velocities coupled with very strong and accurate penetrating warheads. Achieving the necessary impact velocities does not present a technical challenge. Space-based systems are theoretically capable of achieving impact velocities of up to 6.6 miles per second (from a 24,000 mile orbital altitude) and missile delivered weapons can achieve maximum impact velocities of about 3 miles per second (15,840 feet per second).[148] The two-part challenge resides in developing penetrating warheads able to survive these extreme impact velocities and providing the necessary accuracy.

There are two basic methods for penetrating hardened or deeply buried targets. The first method employs long metallic rods made of a dense material like depleted uranium, commonly referred to as "rods from God." The rods are theoretically capable of penetrating two to three times their length into the target.[149] The obvious weakness of this method is that to destroy very hardened or very deep targets requires very long rods. Rods in excess of about six feet in length could prove difficult to integrate with the delivery vehicle or platform based on payload space constraints. For example, the Mark 21 reentry vehicles carried by the Peacekeeper ICBM are 5.75 feet long (although there is additional unused "overhead" space) and the maximum height available with in the Trident II (D-5) SLBM nose fairing is a little over 6.5 feet.[150]

The second method uses an explosive warhead designed to survive penetration of the target and then explode. Presently this method is severely limited by existing materials technology. The extreme velocities necessary to penetrate very hard or very

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148 Major William L. Spacey II, *Does the United States Need Space-Based Weapons* (Maxwell Air Force Base, AL: Air University Press, 1999), 26-7 and 76.

149 Ibid., 27.

150 Chuck Hansen, *U.S. Nuclear Weapons: The Secret History* (Arlington, TX: Aerofax, Inc., 1988), 202, and "Trident II (D-5) Schematic" [on-line] ; available from http://www.fas.org/nuke/guide/usa/slbm/d5_04.gif; Internet; accessed on 7 Aug 2005.

deep targets exceed the ability of current materials to survive the impact. Current theoretical estimates envision materials that could survive impact velocities of 2.4 miles per second, but impact velocities up to only about 1 mile per second (5,280 feet per second) have been successfully demonstrated.[151] When the target is hardened concrete (rated to 5,000 pounds per square inch), the survivable impact velocity drops to approximately 4,000 feet per second.[152] Unfortunately, with current materials, there is a trade-off between penetration depth and impact velocity. When the impact velocity increases to above about 2,000 feet per second, penetration depth gradually decreases from about 50 feet to less than 10 feet.[153] While these limitations place much of the penetration potential of missile or space-delivered weapons beyond the reach of current technology, they still offer a significant improvement over the 1,500 foot per second impact velocities possible with standard aircraft-delivered free-fall weapons.[154]

Of equal importance to high impact velocities, weapons must also be sufficiently accurate to strike desired aim points with precision. The Peacekeeper is regarded as one of the most accurate ICBMs ever deployed. Using purely inertial guidance, the Peacekeeper can attain a CEP of approximately 300 feet.[155] This level of accuracy is clearly sufficient for a 300 kt nuclear warhead, but is of little use for warheads that rely on kinetic energy or conventional high-explosives kill mechanisms. The high velocities necessary to penetrate hard and deeply buried targets contribute to the difficulty of precisely guiding the weapon in two primary ways. First, the laws of physics dictate that the faster an object travels, the more difficult it becomes to maneuver that object. Second, at reentry velocities greater than about 2.75 miles per second, the reentry vehicle is surrounded by plasma which prevents reception of any guidance update signals.[156] For example, this would prevent a reentry vehicle traveling at these velocities from receiving GPS updates after release in the way that current GPS aided munitions like Joint Direct

151 Spacey, 27-8.

152 Headquarters U.S. Air Force, "The Common Aero Vehicle: Addressing Congressional Concerns," (briefing presented to U.S. Congress, Washington D.C., December 2004), 11.

153 Ibid.

154 Ibid.

155 Max Walmer, *An Illustrated Guide to Strategic Weapons* (New York: Prentice Hall Press, 1988), 26.

156 Spacey, 29.

Attack Munitions do. The combination of new "ultra precise" inertial navigation units and maneuverable reentry vehicles represent one potential solution that may eventually provide the necessary accuracy.[157]

2. GPS-Aided Maneuverable Reentry Vehicles

A near-term capability to deliver kinetic or explosive munitions against terrestrial targets could leverage technology intended for the Trident II (D-5) Enhanced Effectiveness (E2) program reentry vehicle. Test flights conducted in 2002 and 2005 demonstrated the potential of this technology for conventional applications. As mention in the earlier description of the Trident II (D-5), the D-5 E2 program sought to enhance the missile's ability to conduct prompt and highly accurate strikes.[158] Plans call for leveraging existing Mark 4 reentry vehicle technology combined with a GPS-aided IMU and a flap steering system.[159] The integrated assembly is similar in size and weight to the Mark 5 reentry vehicle normally carried by the D-5.[160] Increased accuracy is achieved by using GPS to provide a pre-reentry update to the vehicle's IMU which then provides steering inputs to the control flaps to steer the warhead during reentry to its target with GPS-like accuracy.[161]

Receiving a GPS update for the IMU prior to reentry circumvents the problem of reentry plasma blocking signals to the reentry vehicle. The initial tests appeared promising, but it remains to be seen if the E2 technology can produce increases in accuracy sufficient for conventional applications. If the accuracy proves adequate, explosive or kinetic warheads could be employed against a variety of terrestrial targets. The initial tests conducted by Lockheed Martin seem to indicate that the reentry vehicle design has the ability to decelerate a penetrating warhead to a survivable velocity of 1 mile per second or less for use against hard or deeply buried targets.[162]

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157 Spacey, 29

158 *Report of the Defense Science Board Task Force on Future Strategic Strike Forces,* by Dennis Blair and Michael Carns, co-chairs (Washington D.C.: Government Printing Office, 2004), sec. 5, p. 11.

159 Ibid., sec. 5, p. 7.

160 Ibid.

161 Ibid.

162 Amy F. Woolf, *Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress* (Washington D.C.: Congressional Research Service, 2005), 8, CRS, RL33067.

3. The Common Aero Vehicle

The Common Aero Vehicle (CAV) is another reentry system that is currently under development and could be available early next decade. According to the Defense Advanced Research Projects Agency (DARPA), the "CAV would be an unpowered, maneuverable, hypersonic glide vehicle capable of carrying 1,000 pounds in munitions or other payload."[163] As initially conceived, the 2,000 pound CAV would be boosted on a sub-orbital trajectory by a variety of vehicles including intercontinental missiles (ICBMs and SLBMs) and small space launch vehicles, or be deployed from an orbiting space platform. There are currently two planned versions of the CAV. The first version employs existing technology and has a modified cone shape that will allow it to glide for approximately 3,000 miles after atmospheric entry with a cross range of 800 miles.[164] The enhanced version of the CAV will use a lifting body shape to achieve glide ranges of up to 9,000 miles with a 3,000 mile cross range capability, but will require significant advances in thermal protection technologies.[165]

Once in the atmosphere, the CAV will glide at hypersonic speeds, maneuver as necessary, deploy its payload at the appropriate velocity for the type of munitions carried, and strike within ten feet (three meters) of the desired aim point.[166] Current plans envision the CAV with four basic payload configurations including: 1) a single 1,000 pound penetrating weapon for use against hard or deeply buried targets; 2) three or four Small Smart Bombs (SSBs) for use against surface facilities; 3) six small cruise missiles known as Wide Area Autonomous Search Munitions (WAASMs) for use against facilities or vehicles; and 4) six small unmanned aerial vehicles (UAVs) for intelligence gathering.[167]

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[163] DARPA, "FALCON Technology Demonstration Program Fact Sheet," November 2003 [on-line] ; available from http://www.ceasaroni.net/falcon_fs.pdf; Internet; accessed July 2005.

[164] Frank Colucci, "FALCON Aims at Global Striking Power," *Military Aerospace Technology* 3, no. 2 (25 June 2004) [on-line] ; available from http://www.military-aerospace-technology.com/print_article.cfm?DocID=518; Internet; accessed June 2005.

[165] "Bombing Anywhere On Earth In Less Than Two Hours," *Space Daily* [on-line] ; available from http://www.spacedaily.com/news/rocketscience-03zzr.html; Internet; accessed July 2005.

[166] Headquarters U.S. Air Force, "The Common Aero Vehicle: Addressing Congressional Concerns," (briefing presented to U.S. Congress, Washington D.C., December 2004), 5.

[167] Ibid.

The CAV is designed to enter the atmosphere at an angle of 3 degrees rather than the 28 degree reentry angle typical for ballistic missiles, and as a result the vehicle spends a significantly longer portion of the total mission time within the atmosphere.[168] This flight profile creates challenges from a thermal protection standpoint but it allows the CAV to make trades among altitude, speed and range to enable a variety of munitions deployment velocities ranging from 4,000 feet per second for a penetrating weapon to subsonic speed for the WAASMs or UAVs.[169] The CAV can fly slow enough to allow precision maneuver and reception of guidance updates, but at the same time match impact velocities with the survivability characteristics of current materials.

C. TERRESTRIALLY-BASED PGS CONCEPTS

Terrestrially-based vehicles transit space to reach and strike targets half a world away (i.e., up to 12,000 miles). Assuming a reentry angle of 30 degrees, it is possible to strike targets out to a distance of 9,000 miles within 90 minutes of launch.[170] There are two basic categories of terrestrially-based concepts. The first category employs modified ICBMs or SLBM to provide a near-term capability. This requires transitioning existing nuclear delivery systems into dual-role or conventional-only platforms. As noted in chapter two, this change of roles is not without precedent, but the associated "nuclear baggage" of these systems must be handled with the appropriate level of consideration for the sensitivities of other nations. The second category of terrestrially-based concepts make use of modified expendable or partially reusable space launch vehicles to boost conventional munitions to designated targets. While not likely to result in a significant operational capability within the next 10 years, these options tend to minimize the potential for "nuclear baggage" and may offer increases in operational flexibility over concepts using converted ballistic missiles.

1. Near-Term Terrestrially-Based Concepts

In order to have a chance of meeting near-term deployment timelines, options for conventional PGS capabilities must rely on modified intercontinental missiles (either ICBMs or SLBMs). Stephen Younger, Director of the Defense Threat Reduction Agency

168 Headquarters U.S. Air Force, "The Common Aero Vehicle, 25.

169 Ibid., 5.

170 Bob Preseton, Dana J. Johnson, Sean J.A. Edwards, Michael Miller, and Calvin Shipbaugh, *Space Weapons: Earth Wars* (Santa Monica, CA: RAND, 2002), 171.

said in 2004 that "[w]e are able to generate those weapons today" and indicated that it was possible to field an initial capability within 90 days.[171] General Cartwright, the Commander of United States Strategic Command, has expressed interest in such near-term capabilities if computer modeling and flight demonstrations prove sufficient accuracy is possible.[172] The Trident II (D-5) SLBM and the Peacekeeper ICBM are possible candidates to provide a near-term conventional PGS capability. A recent report by the Defense Science Board recommended use of these systems as an opportunity to provide near-term conventional PGS capabilities and leverage significant sunk costs in the process; however, there are no funded plans to do so at this time.[173]

a. Trident II (D-5) SLBM

Today, the Trident II (D-5) SLBM serves as the cornerstone of the U.S. nuclear deterrent. The missile has a range of over 4,560 miles (4,000 nautical miles or 7,400 kilometers), a CEP of 122 meters, and carries up to ten Mark 5 reentry vehicles which contain 475 kt W-88 thermonuclear warheads.[174] The missiles are expected to remain in operation aboard Ohio-class SSBNs beyond the year 2030.[175] To meet this service life requirement, Trident II missiles are committed to production until at least 2011.[176]

As mentioned before, there are currently no funded plans to arm the Trident II (D-5) with conventional warheads, but the technology to do so could be leveraged from the languishing Trident II (D-5) E2 initiative. Given the missile's throw-weight capability of 6,000 pounds, it should be possible to carry a militarily effective load of conventional munitions.[177] However, in order to carry a 1,000 pound-class high explosive or penetrating warhead within an E2 modified Mark 4 reentry vehicle, it may

[171] Amy Butler, "U.S. Could Easily Deploy Conventionally Armed ICBMs, Official Says," *Defense Daily* (26 January 2004) [on-line] ; available from http://www.nti.org/d_newswire/issues/2004_1_26.html#512350DD; Internet; accessed July 2005.

[172] General James Cartwright (speech at the Air Warfare Symposium, Orlando, Florida, 18 February 2005) [on-line] ; available from http://www.afa.org/Media/scripts/Cartwright_AWS05.html; Internet; accessed July 2005.

[173] Defense Science Board, sec. 1, pp. 8-9 and sec. 5, p. 11.

[174] Walmer, 75, and Chuck Hansen, *U.S. Nuclear Weapons: The Secret History* (Arlington, TX: Aerofax, Inc., 1988), 206.

[175] Defense Science Board, sec. 5, p. 6.

[176] Ibid., sec. 5, p. 11.

[177] Walmer, 75.

be necessary to reduce the number of reentry vehicles carried or sacrifice some amount of range. This is because the conventional warhead would weigh over twice as much as the 363 pound W-76 nuclear warhead it would replace.[178] Substitution of larger reentry vehicles may require removal of the Trident II's third stage rocket motor due to its location within the nosecone, but this would significantly degrade the missile's range.

In a conventional role, the Trident II offers significant potential for adaptation to a conventional PGS role. Given the ability to choose a desirable launch point, it may be possible to minimize the potential for over-flight of third party nations. Also, when launched from clandestine ocean operating locations, the Trident II has the ability to reach targets deep within enemy territory in as little as 15 minutes.[179] Finally, if the E2 technology demonstrations produce significant accuracy increases, it could allow conventionally armed Trident IIs to perform precision strikes with either high explosive or penetrating warheads. The most significant drawback to a conventionally armed Trident II is the "nuclear baggage" associated with its on-going nuclear deterrence role. Trident II missiles deployed in both conventional and nuclear versions could increase the possibility that a launch of a conventional PGS weapon could be misidentified as a nuclear-armed launch. However, the Defense Science Board still recommends examining the possibility of converting two additional Ohio-class SSBNs to perform conventional missions.[180]

b. Peacekeeper ICBM

In contrast to the increasing weight carried by the Trident II in the U.S. nuclear deterrent force, the Peacekeeper will find itself unemployed by October 2005. Originally deployed in the late 1980s as the U.S. answer to the Soviet SS-18, the Peacekeeper is being withdrawn from service as part of the U.S. plan to meet the reduced warhead totals called for under the 2002 Moscow Treaty.[181] In its nuclear role, the Peacekeeper carried up to ten Mark 21 reentry vehicles which have a CEP of 100

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178 Hansen, 206.

179 Defense Science Board, sec. 1, p. 9.

180 Ibid.

181 Amy F. Woolf, *U.S. Nuclear Weapons: Changes in Policy and Force Structure* (Washington D.C.: Congressional Research Service, 2005), 27, CRS, RL31623.

meters.[182] With a full combat load of ten warheads, the Peacekeeper has a range of 6,600 miles (6,000 nautical miles or 11,000 kilometers).[183]

As with the Trident II, the Peacekeeper has significant potential to serve as the basis for an affordable, near-term conventional PGS capability. Even though the majority of the missiles have been withdrawn from service, their components are stored in environmentally controlled facilities under the purview of the Rocket System Launch Program and will be available for government projects.[184] In fact, Orbital Sciences Corporation has announced that it will offer the Minotaur IV, which will use Peacekeeper components, for U.S. Government space launches under the Orbital/Suborbital Program 2 contract.[185] If reactivated as part of a conventional PGS weapon system, the existing missiles could serve in a conventional capacity until 2020 without a service life extension program.[186] The combination of the Peacekeeper's 8,000 pound throw-weight capability and technology leveraged from the Trident II E2 Program should allow it to deliver at least four reentry vehicles with conventional high-explosive or penetrating warheads over a 6,600 mile range.[187] Additional range could be achieved with a reduced payload.

The Defense Science Board views the conversion of the Peacekeeper into a conventional PGS system as too good of an opportunity to pass up. Its Task Force on Future Strategic Strike Forces made this recommendation:

> The Air Force should preserve 50 Peacekeeper ICBMs currently being deactivated, and redeploy them to Vandenberg and Cape Canaveral for use with conventional warheads. These weapons would give the United States a 30-minute response capability for strategic strike world wide. The cost of this recommendation is about $350 million for development, and $600 million for deployment, and the system could be ready by 2010.[188]

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182 Walmer, 26.

183 Ibid.

184 Defense Science Board, sec. 5, p. 3.

185 Orbital Sciences Corporation, "Minotaur IV Fact Sheet," 2003 [on-line] ; available from http://www.orbital.com/NewsInfo/Publications/OSP-2_SLV_fact.pdf; Internet; accessed August 2005.

186 Defense Science Board, sec. 5, p. 11.

187 Norman Polmar and Timothy M. Laur, eds., *Strategic Air Command: People, Aircraft, and Missiles*, 2d ed (Baltimore: The Nautical and Aviation Publishing Company of America, Inc., 1990), 310.

188 Defense Science Board, sec. 1, pp. 8-9.

Recent comments by North Dakota Senator Kent Conrad seem to indicate momentum is growing for a near-term conventional PGS capability using converted ICBMs. In a meeting of Task Force 21 members, Minot, North Dakota's base retention committee, he remarked that the current Quadrennial Defense Review would also be a Nuclear Posture Review, and his sources indicated that it would recommend converting fifty ICBMs to conventional roles.[189] However, the Strategic Arms Reduction Treaty (START) stands as the largest single barrier to a conventionally-armed Peacekeeper. Since the treaty does not distinguish between conventional and nuclear strategic systems, many of its provisions will limit the number of deployed conventional PGS systems and the locations to which they may be deployed. The Defense Science Board recognized these constraints and proposed a deployment date following the expiration of START in 2009.[190]

2. Mid-Term Terrestrially-Based PGS Concepts

Given the benefit of longer development times, mid-term conventional PGS solutions look beyond the use of modified intercontinental missiles and instead focus on small space launch vehicles to boost conventional munitions to distant targets. Small launch vehicles capable of placing 1,000 to 2,000 pounds of payload into low-earth orbit have been around for many years, but they have lacked the responsiveness and affordability to be considered as possible boost systems for conventional PGS weapon systems. Existing vehicles in this class, such as the Pegasus, normally measure responsiveness in months rather than hours and cost approximately $25 million per mission.[191] U.S. Military requirements for "operationally responsive spacelift" have resulted in several developmental space launch vehicle programs that have the potential to greatly improve responsiveness and reduce launch cost. These characteristics could make conventional PGS cost competitive with existing global strike platforms. This section focuses on one specific development program, the Force Application and Launch from the Continental United States (FALCON) Technology Demonstration Program,

189 Eloise Ogden, "Conrad: Review Poses Risk," *Minot Daily News*, online ed., 11 August 2005 [on-line] ; available from http://www.minotdailynews.com/news/story/0811202005_new11news2.asp; Internet; accessed August 2005.

190 Defense Science Board, sec. 5, p. 13.

191 Michael A. Dornheim, "Quick, Cheap Launch: Year-Long Study Aims for New Launchers by 2014," *Aviation Week and Space Technology* (7 April 2003) : 71.

which appears most likely to produce capabilities that could mature into an operational conventional PGS weapon system by the middle of the next decade.

The FALCON technology demonstration program is a joint Defense Advanced Research Projects Agency/U.S. Air Force effort to "develop and validate, in flight, hypersonic technologies that will enable prompt global reach missions and demonstrate affordable responsive space lift."[192] As this quote alludes, the program is divided into two tasks. In the near-term, one task seeks to develop the hypersonic technologies necessary for the CAV by flight testing three generations of Hypersonic Technology Vehicles (HTVs) with increasingly advanced aerodynamic configurations, thermal protection systems, and guidance, navigation, and control capabilities.[193] The eventual goal of the effort is to produce an autonomous, reusable hypersonic cruise vehicle that operates from conventional runways and can reach targets 9,000 miles away within two hours by the year 2025.[194] The other program task is to develop a Small Launch Vehicle (SLV) to launch the HTVs (i.e., CAVs) and demonstrate affordable, responsive space lift.[195] Total launch costs, excluding the payload, are not to exceed $5 million. Overall, FALCON is a three-phase program involving: system definition (completed), design and development (underway), and technology demonstrations. Phase II will conclude with the integrated flight test of a low-risk first-generation HTV atop the SLV. Phase three calls for the flight testing of an integrated second-generation HTV/SLV system and multiple flight tests of the reusable third-generation HTV.[196]

Space Exploration Technologies, known as SpaceX, is one of the remaining contenders competing to build the SLV. In what seems to represent a significant advantage over the other competitors, SpaceX and their appropriately named Falcon I launch vehicle currently hold contracts to launch two DOD research satellites in 2005 and for up to $100 million in launch options through 2010, not including the launches

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[192] DARPA, "Falcon Technology Demonstration Program Fact Sheet," September 2004 [on-line] ; available from http://www.darpa.mil/body/news/2004/falcon_fs_rev3.pdf; Internet; accessed August 2005.

[193] Ibid.

[194] Ibid.

[195] Ibid.

[196] Ibid.

planned as part of the FALCON program.[197] The target date for the Falcon I's maiden flight is 30 September 2005 from a SpaceX launch complex in the Kwajalein Islands.[198] The Falcon I is a 70 foot long, 5.5 foot diameter, two-stage liquid propellant (liquid oxygen and kerosene) rocket with a liftoff weight of 60,000 pounds that is designed to place approximately 1,100 to 1,500 pounds (depending on orbital inclination) into a 120 mile circular orbit.[199] The Falcon I was designed from the ground up to be both affordable and responsive.[200] In an effort to increase operational economy, the Falcon I first stage is designed for reuse. Following first stage shutdown and separation, parachutes lower it to a soft water landing for later recovery by ship.[201] SpaceX currently charges $5.9 million for a Falcon I launch, but indicates that discounts are available for multi-launch contracts.[202]

Published timelines for a typical Falcon I space launch call for horizontal integration of the payload and booster four days prior to launch and a 24-hour launch countdown.[203] These timelines are obviously inadequate for a PGS capability, but could likely be shortened significantly with a weaponized version of the Falcon I. One can easily envision a deployment scheme that places a small number of Falcons, perhaps a total of eight to ten, "on alert" at Vandenberg Air Force Base and Cape Canaveral Air Force Station. The vehicles, pre-integrated with CAVs, would reside in horizontal shelters reminiscent of the "coffin launchers" used by the early Atlas ICBMs. The shelters would not be hardened, but would protect the vehicles from the elements and "prying eyes." Each falcon would be armed with a single 2,000 pound CAV. The CAVs mated to the "on-alert" Falcons could be configured with a variety of payloads to provide rapid response options against various target types.

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197 SpaceX, "Falcon Overview" [on-line] ; available from http://www.spacex.com; Internet; accessed August 2005.

198 Ibid.

199 SpaceX, *Falcon Launch Vehicle Payload Users Guide*, Rev 2 (October 2004), 2-4 [on-line] ; available from http://www.spacex.com/payloaduserguide.pdf; Internet; accesses August 2005.

200 SpaceX, "Falcon Overview" [on-line] ; available from http://www.spacex.com; Internet; accessed on August 2005.

201 SpaceX, Payload Users Guide, 1.

202 Ibid., 2.

203 Ibid., 17.

A scenario for the launch of a Falcon PGS mission could unfold as follows. Upon receipt of a launch order, the operations crew selects the on-alert Falcon vehicle (or vehicles) with the appropriate armament and initiates the launch sequence. The roof of the chosen shelter(s) slides open and the Falcon immediately erects to a vertical position on its launch mount. Once in a vertical position, loading of the liquid oxygen and kerosene propellants begins. Simultaneously with propellant loading, the launch crew uploads the flight plan and target data into the Falcon and CAV guidance units. Within 15 minutes of receiving the launch order, the Falcon is fully fueled and targeted for launch.

An expectation for a response time of 15 minutes from order receipt to launch is well within the bounds of current technological capabilities. One can view the Atlas ICBMs of the early-1960s serves as a historical analog to the proposed Falcon basing scheme described above. The Atlas was deployed in horizontal "coffin launchers" and was only fueled when raised to the vertical position for launch. The Atlas was 75 feet long, 10 feet in diameter, and had a fueled weight of 265,000 pounds, which made it significantly larger than the Falcon.[204] Even though larger, the Atlas could reach launch readiness in between 8 and 15 minutes from first warning.[205] Clearly, techniques for rapid cryogenic tanking have existed for quite some time. Rapid targeting capabilities also exist today. A targeting system for a weaponized Falcon could leverage technologies developed to rapidly upload flight plan and initial intercept coordinates for the National Missile Defense system in addition to over 35 years of U.S. Air Force experience in remotely and rapidly conducting ICBM retargeting operations. It is technologically and operationally possible to produce a space launch vehicle-derived, liquid fueled PGS boost system with similar responsiveness to a Peacekeeper-derived system without the "nuclear baggage."

D. SPACE-BASED CONVENTIONAL PGS CONCEPTS

An alternative to terrestrial basing is to place conventional PGS weapons into space and de-orbit them to strike targets on the Earth's surface. Often referred to as "rods from God," space-based concepts offer the potential for unmatched responsiveness and

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[204] Chuck Walker, *Atlas: The Ultimate Weapon* (Burlington, Ontario: Apogee Books, 2005), 44.

[205] Ibid., 155.

impact velocities. A weapon launched from an orbital altitude of 500 miles, assuming an ideal orbital position at launch, could strike a target within 12 minutes at an impact velocity of 3 miles per second.[206] These potential advantages, however, come with many operational, technical, political, and treaty-related strings attached. While space-based concepts have been studied extensively in the past, they seem to have fallen out of favor in recent years and nearly all current planning is focused on terrestrial alternatives.[207] They are, however, addressed in this thesis for sake of completeness.

Recent studies of space-based alternatives have considered placing CAVs, either individually or attached to a satellite bus, into orbit for use against high-priority, fleeting targets. The CAVs could be launched into orbit in response to a crisis, similar to deploying an aircraft carrier to a trouble spot, or could be intended to maintain a continuous orbital presence for response against unanticipated contingencies. Unlike terrestrially-based systems that can hold any target within its range continually at risk, the realities of orbital mechanics result in a constantly changing position for the space-based systems that increases or decreases potential response times. Multiple space-based systems are required to maintain constant global coverage with response time equal to or better than terrestrially-based systems.

A recent study by the Schafer Corporation divides the space-based deployment possibilities into two generations of capabilities, which both rely on the same orbital deployment scheme to achieve the best compromise between constellation size and system responsiveness.[208] Both generations rely on deploying fifteen orbital weapons systems into a Walker Constellation with five equally space orbital rings with three vehicles equally spaced in each ring.[209] The orbital rings would be inclined 50 degrees to the equator, which would result in an orbital track that would cover between 50 degrees north and 50 degrees south latitude.[210] By assuming a 2,400 nautical mile cross-range for the CAV (the FALCON program hopes to achieve 3,000 nautical miles), the coverage

[206] Spacey, 27.

[207] Butler, "Shopping for Deterrence," 50.

[208] Terry Phillips and Bob O'Leary, "Common Aero Vehicle (CAV) on Orbit" (paper presented by the Schafer Corporation, 6 September 2003), 3-4 [on-line] ; available from http://www.dtic.mil/matris/sbir/sbir041/srch/af031d.doc; Internet; accessed on August 2005.

[209] Ibid.

[210] Ibid.

area is increased to cover virtually the entire globe from 90 degrees north and 90 degrees south latitude.[211] A weapon system of this type could offer response times from the reentry command to target impact of between 60 and 95 minutes. Smaller constellations are possible, but could result in significant gaps in attack opportunities while the vehicles orbit into the appropriate de-orbit locations.

Both space-based alternatives identified by the Schafer Corporation study rely on orbital versions of the CAV. The first generation system would use space launch vehicles to deploy individual CAVs into the constellation described above. The CAVs would be equipped with orbital support and de-orbit package that would provide battery power and propulsion for a maximum 30 to 90 day orbital stay.[212] Given the relatively short on-orbit life of this system, the vehicles would not be placed into orbit unless it was fairly certain that they would be used. Failure to operationally employ the systems would require the CAVs to be de-orbited into a predetermined disposal location (i.e., a live-fire weapons range) in a costly waste of limited resources. This disposal operation could provide valuable training for the crews operating the system, but at very high cost.

The second generation system would employ satellite buses that would provide power, communications, and propulsion for extended orbital operations and could carry between four and six CAVs with various munitions load outs.[213] This system alleviates the potentially wasteful deployment scenario mentioned above. The weapon system could remain on-orbit indefinitely (subject to the life span of the satellite bus) in a state of constant readiness. These orbital "Coke machines" would give ground commanders the opportunity to choose the most appropriate weapon for a specific target or call in multiple weapons simultaneously without having to wait until the next vehicle orbits into position.

Of course, this type of system presents the potential for disastrous consequences in the event of a satellite bus failure. Imagine a scenario where, due to failure of the on-board propulsion or communications systems, the satellite bus and its payload of four to six CAVs, armed with various kinetic and explosive weapons, suffers orbital decay and reenters into a populated area. Overall, terrestrially-based systems offer similar (or

[211] Phillips and O'Leary, 4.

[212] Ibid., 3,5.

[213] Ibid., 6.

better) responsiveness, continuous readiness against world-wide targets, and a much greater likelihood to “fail safe” rather than “fail deadly.” Space-based alternatives also face many political and treaty obstacles that will be discussed in the following sections.

E. CONCLUSION

This chapter examined how the United States could deploy conventional PGS capabilities in the near to mid-term. It examined the variety of possible munitions and reentry vehicle options available to provide militarily useful conventional PGS capabilities. Near-term options include modified Trident II or Peacekeeper intercontinental missiles armed with GPS-aided maneuverable reentry vehicles containing kinetic or high-explosive warheads. Mid-term alternatives could leverage small space launch vehicles like the SpaceX Falcon to boost CAVs carrying a variety of conventional munitions over intercontinental ranges. Finally, two mid-term concepts for space-basing of CAVs were examined. Technology does not present any “show stoppers” for deploying conventional PGS capabilities in the near or mid-term. The following chapter examines several intertwined political, regulatory, and treaty issues that could serve to significantly constrain the deployment or effectiveness of conventional PGS capabilities.

IV. POLITICAL, REGULATORY, AND TREATY CONSTRAINTS ON CONVENTIONAL PGS

A. INTRODUCTION

Unlike many other modern weapon systems concepts where cost and technical issues commonly form the predominant basis for debate, conventional PGS capabilities face a series of political, regulatory, and treaty constraints that supersede concerns over cost and technology. This chapter examines the often intertwined political, regulatory, and treaty implications of the proposed conventional PGS concepts discussed in the previous chapter. Each of these areas forms barriers that serve to inhibit progress towards development of conventional PGS capabilities that may be overcome with varying degrees of difficulty. Politically, conventional PGS systems suffer from lingering perceptions linked to their nuclear past. Regulations in the form of launch and range safety rules may inhibit the timeliness of conventional PGS employment. Finally, bilateral treaties between the United States and Russia may significantly limit the deployment locations and numbers of conventional PGS systems.

B. POLITICAL CONSTRAINTS

Political constraints on the development and deployment conventional PGS capabilities primarily involve concerns related to "nuclear baggage" or the weaponization of space. Both of these political concerns have some bearing on the various near and mid-term terrestrial and space-based conventional PGS concepts discussed earlier. This section examines the way existing political mindsets constrain conventional PGS development and seeks to identify which concepts have the best chance of successfully passing through the political barriers.

1. Nuclear Baggage

For terrestrially-based concepts, the single most significant political issue involves the perception among senior leaders that the employment of conventional PGS weapons could be mistaken for a nuclear strike and result in inadvertent nuclear war. This concern, rather than reflective of the inherent characteristics of conventional PGS capabilities, is actually an unfortunate byproduct of the continuing Cold War nuclear postures maintained by the United States and Russia where both remain ready to "launch-on-warning." For the inadvertent nuclear war scenario to play out, two things are required: 1) an early-warning capability and forces postured to respond in the time provided by the warning system and 2) a continuing paradigm that associates intercontinental missiles exclusively with nuclear weapons which provides the incentive to retaliate. There are two ways out of this trap. The first escape route requires the elimination of the launch-on-warning postures maintained by the United States and Russia. This topic is handled in detail in chapter six. The second way out requires breaking the "intercontinental missiles are always nuclear-armed" paradigm. This section examines ways conventional PGS capabilities may be made politically palatable, even in the presence of enduring launch-on-warning postures.

The examples of the B-52, B-1B, B-2, and ALCM detailed in a previous chapter demonstrated that it is possible to remove nuclear baggage from weapon systems that were initially designed to serve as nuclear delivery vehicles. While the majority of these examples maintain dual nuclear and conventional roles and have been used in numerous conventional conflicts and contingencies, this may not be the model to emulate for conventional PGS. Given the short flight times and greater sensitivities that seem to inherently accompany intercontinental missiles, it may be advisable to have a thicker firewall between nuclear and conventional capable PGS systems than currently exist with dual-use aircraft. The case of the B-1B may serve as a better role model, where the entire fleet was converted to an exclusively conventional role. Measures that may help assure other nations of the conventional-only nature of a conventional PGS weapon system may include: on-site inspections to verify destruction of nuclear-capable hardware; inspections to verify conventional weapons load-outs for deployed conventional PGS systems; and basing locations significantly distant from bases for nuclear-armed ICBMs. Of course, another option is to adopt a delivery system with no nuclear past.

The Trident II (D-5) has significant potential to perform well in a conventionally-armed capacity. However, its potential for launch misinterpretation is the highest of the terrestrially-based proposals presented earlier in this chapter. Even the best early-warning systems would find it extremely difficult (likely impossible) to distinguish a conventionally-armed Trident II from a nuclear-armed one, since they only differ in the payload carried. Even if conventional Tridents were deployed on separate submarines from nuclear ones, it would be of no use in trying to determine whether the launch originated from a submerged submarine designated for conventional operations or one designated for nuclear deterrence. Since the Ohio-class SSBN and their Trident II (D-5) SLBMs will form the backbone of U.S. nuclear deterrence in the years ahead, it is probably wise to leave this force completely dedicated to this important mission. Attempts to arm Tridents with conventional weapons could ultimately undermine their deterrence role by contributing to an increased likelihood of inadvertent nuclear conflict.

On the surface, one might expect the conversion of the Peacekeeper ICBMs to a conventional role to fall victim to the same problems that basically rule out such a transition for the Trident II. The Peacekeeper situation is actually quite different and provides an opportunity to carryout a "B-1B-like" transition to a conventional-only role. Foreign confidence in the conventional-only role of the Peacekeeper could be gained through a combination of program openness and executive-level communication.

As mentioned in the previous chapter, all of the Peacekeeper ICBMs will have been withdrawn from nuclear alert and their silos in Wyoming by October of 2005. This retired status should make the Peacekeeper available for new roles without the potential for confusion inherent in a dual-role system. Conventionally-armed Peacekeepers would be deployed Vandenberg Air Force Base and Cape Canaveral Air Force Station, a significant distance away from the nuclear ICBMs in the north central portion of the country. Due to the significant size difference between the Peacekeeper and the Minuteman III, the different infrared signatures produced during launch should serve as an additional means to differentiate a conventional PGS strike from a nuclear ICBM launch.

To solidify the Peacekeeper's conventional-only role, its nuclear-capable front-end sections (the reentry vehicle busses) should be destroyed and then, like with the B-1B, the Russians and possibly the Chinese should be allowed to inspect and verify completion of this action. Once the system is deployed, both nations should be granted periodic access to the deployment locations to verify the continued non-nuclear status of the system. If it should become necessary to employ a conventional PGS weapon, "Hot Line" notifications should be made just prior to launch to ensure the Russians and Chinese are not surprised and do not overreact. This assumes that neither country is the intended target, but one should easily recognize the inherent danger of employing this type of weapon against either Russia or China.

In theory, a terrestrially-based concept that does not use any components that were previously associated with nuclear weapons or existing ICBMs should have the least difficultly circumventing political concerns over launch misidentification. However, as an illustration of how deeply the "intercontinental missile equals nuclear" paradigm runs, Congress has zeroed all funding for weaponized testing of the CAV under the FALCON program until there are negotiated safeguards in place to ensure the launch of a conventional PGS weapon could not be misinterpreted as a nuclear missile launch.[214] These restrictions are in place regardless of the fact that the CAV and its potential Falcon launch vehicle have no association with current or planned nuclear weapons. The Air Force has proposed a tailored package of measures to mitigate the chances for launch misinterpretation including: a vow not to test or deploy the CAV on existing ICBMs, strategic dialog, cooperative inspections, confidence building measures, shared early warning , executive level notifications, and a host of basing and signature enhancements to make these vehicles clearly distinguishable from any others.[215] The congressionally mandated restrictions on the program appear to be overly cautious and the congressional language requiring negotiated safeguards with other nuclear powers effectively gives the Russians, Chinese, and may be even the French veto power over whether the United States ever develops or deploys conventional PGS capabilities.

Space-based alternatives could also be affected by some of the same misidentification concerns as missile or space launch vehicle derived concepts. While not subject to potential launch misidentification, a reentering space-based weapon could appear to be a missile in the later stages of its flight and generate a similar possibility for misidentification and overreaction. Employment of space-based systems would require pre-strike notifications similar to those contemplated for terrestrially-based alternatives. These concerns are but the tip of the iceberg for space-based concepts that take center stage in the debate over space weaponization, which is discussed in the next section.

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214 Congress, House, Committee of Conference, *Making Appropriations for the Department of Defense for the Fiscal Year Ending September 30, 2005, and for Other Purposes,* 108th Cong., 2d sess., 2004, Rpt 108-622, 240.

215 Headquarters U.S. Air Force, "The Common Aero Vehicle: Addressing Congressional Concerns," (briefing presented to U.S. Congress, Washington D.C., December 2004), 19-25.

2. Space Weaponization

Conventional PGS capabilities that simply transit space are controversial enough based on the previously discussed concerns over the potential for launch misidentification. The possibility of basing these weapons in orbit represents a "political hot potato" that few politicians are willing to get involved with at the current time. The perceived or actual weaponization of space has significant political ramifications both domestically and internationally. Unlike with the nuclear baggage issue discussed above, there are no mitigation measures that will allow one to maneuver successfully around the political obstacles to space weaponization in the near future. Benjamin Lambeth of RAND characterizes the issue of placing strike weapons into orbit as follows:

> The overarching problem connected with this mission area [space force application], however, is that – at least today – far greater political sensitivities attach to it than those associated with the less provocative notion of space control.[216]

The fact that he identifies space control, a typical lightening rod for controversy, as less controversial than space force application says quite a bit about the status of the debate over crossing the Rubicon of space weaponization.

There are two basic arguments regarding space weaponization. The first is known as the "sanctuary school" which seeks to keep space free of weapons of any kind and does not recognize any immediate threats to the U.S. ability to exercise freedom of operation in space.[217] Former Senator Tom Daschle of South Dakota represented the "sanctuary" viewpoint well when he stated in 2001 that, "It would be a disaster for us to put weapons in space of any kind under any circumstances. It only invites other countries to do the same thing."[218] The second argument is made by those who seek to weaponize space at the earliest opportunity because the eventual weaponization of space is inevitable and unilateral restraint by the United States will not stop others from doing so.[219] Proponents of this viewpoint often invoke the history of airpower as an analog for the

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[216] Benjamin S. Lambeth, *Mastering the Ultimate High Ground: Next Steps in the Military Uses of Space* (Santa Monica, CA: RAND, 2003), 114.

[217] Ibid., 116.

[218] John Hyten and Robert Uy, "Moral and Ethical Decisions Regarding Space Warfare," *Air and Space Power Journal* 18, no. 2 (Summer 2004) : 52.

[219] Ibid., 117.

future path of space power. General Howell Estes, former Commander of United States Space Command, pointed out that:

> The potential of the aircraft was not recognized immediately" and "their initial use was confined to observation…until one day the full advantage of applying force from the air was realized, and the rest is history. So too [will it be] with the space business.[220]

Another former commander of United States Space Command, General Joseph Ashy, did not cling to political correctness when he stated:

> It's politically sensitive, but it's going to happen. Some people don't want to hear this, and it sure isn't in vogue…but - absolutely – we're going to fight in space. We're going to fight from space, and we're going to fight into space when [U.S. and allied assets on orbit] become so precious that it is in our national interest.[221]

Advocates for both groups enthusiastically champion their cause and discussions on this subject often become emotionally charged, but

> …the fact remains that there is no more fundamental or more unresolved a military space issue in the United States today than the long-festering question of whether space should be kept free of weapons at every reasonable cost or actively exploited to the fullest extent of its ability to underwrite the nation's security.[222]

Given the unresolved nature of the debate, Benjamin Lambeth concludes that "[f]or the time being…there is no indication that the nation is anywhere near the threshold of deciding to weaponize space" and that such a decision would "involve a momentous political decision that the nation's leadership has not yet shown itself ready to make."[223] For the foreseeable future, barring a move by another power to weaponize space, space-based conventional PGS capabilities represent a political bridge too far and do not offer significant advantages over terrestrially-based alternatives to warrant expending the necessary political capital to deploy them.

It is also worth noting that terrestrially-based conventional PGS capabilities could also become ensnared in the space weaponization debate in a similar manner to the

[220] Lambeth, 118.

[221] Ibid., 117-8.

[222] Ibid., 115.

[223] Ibid., 119.

labeling of the National Missile Defense ground-based mid-course interceptors as part of "Star Wars." While weapons that only transit space are not technically space weapons, the distinction between "transiting space" and "space-based" will likely be lost on many critics. A factor that certainly must contribute to clouding this distinction is the fact that Air Force Space Command operates the ICBMs and designates its operational missile units as space wings.

C. REGULATORY CONSTRAINTS

Current U.S. missile launch and range safety rules could prove to be a significant impediment to responsive conventional PGS operations. Peacetime launch and range safety rules for space or missile launches prohibit launch trajectories over populated land masses and require clearing the airspace along the planned flight path and clearing ocean areas where booster stages and components are predicted to fall.[224] The time necessary to accomplish the required notifications to airmen and mariners and area clearance actions prior to launch would effectively eliminate the response-time advantage held by ballistic systems over other Global Strike alternatives (e.g., long-range bombers). The notification process is also likely to tip-off the intended target of the strike. All safety rules may be waived in times of war or significant national need, but it is worth noting that conventional PGS weapons would likely be used prior to or in lieu of major combat operations.

All of the terrestrially-based concepts available in the near and mid-term are affected by these rules since they dispose of two or more booster stages during operational flight. Strike missions with the CAV may allow greater flexibility in launch trajectory planning, due to its expected 3,000 nautical miles cross-range capability, which will allow booster drops in areas least likely to result in collateral damage. However, this trajectory flexibility may not always be possible, depending on the specific target. Unfortunately, ICBM or space launch vehicle derived boosters will require a compromise between operational responsiveness and accepting greater calculated risks to public safety during launch operations.

In order to retain a responsive launch capability with current or mid-term technology, one must be willing to accept increased reliance on the "big ocean" and "big

[224] *Air Force Space Command Manual 97-710: Air Force Space Command Range Safety Policies and Procedures,* 1 July 2004, 52-73 and 105-12.

sky" theories of collision avoidance. If the planned target is a high enough national priority, it may be decided that taking it out warrants the additional risk. It is worth noting that the only currently available PGS capabilities, nuclear-armed Minuteman III ICBMs based in the central United States, pose a much more certain threat to public safety if employed. Since their launch trajectories would pass over populated areas, there is a greater likelihood that spent booster stages will endanger the general public. The threat to public safety during launch, combined with the certainty of collateral damage from its nuclear warhead(s) make the use of the Minuteman virtually unthinkable in all but the most-dire of circumstances. The ultimate solution to ensuring public safety requires the use of fully-reusable boosters that return to land back at the launch site or recover at designated down-range locations. Unfortunately, this capability will not be available until the far-term.

Space-based capabilities, on the other hand, seem to offer a significant advantage over terrestrially-based systems in the context of range and launch safety. This is due to the fact that launches to deploy the CAV or satellite constellations could be accomplished in accordance with existing launch and range safety rules. Since the launch is simply to put the CAV/bus into orbit for future use, releasing appropriate noticves and conducting area clearance operations will not compromise mission responsiveness or security. Contingency launches for an emergency deployment or to replenish the constellation may require accepting similar risks of collateral damage as the terrestrially-based systems discussed above.

D. TREATY CONSTRAINTS

The United States is party to several bilateral and multilateral treaties and agreements that have the potential to significantly constrain its plans to field conventional PGS weapons. This section examines the implications of three treaties or agreements, two of which primarily affect terrestrially-based PGS concepts and another that may constrain space-based PGS concepts. The specific treaties and agreements are: the *Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms* (START), the *Agreement Between the United States of America and the Union of Soviet Socialist Republics on Notifications of Launches of Intercontinental Ballistic Missiles and*

Submarine-Launched Ballistic Missiles (Launch Notification Agreement), and the *Multilateral Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies* (Outer Space Treaty), and the *Convention on International Liability for Damage Caused by Space Objects of 1972* (Liability Convention).

1. START

While scheduled to expire at the end of 2009, provisions of START could limit the number, type, and deployment locations of conventional PGS weapons in the near-term because the Treaty does not distinguish between nuclear and non-nuclear strategic arms.[225] Of the possible conventional PGS concepts discussed in this chapter, the only ones that could realistically be deployed by 2009 are those based on the Trident II (D-5) and the Peacekeeper. Systems derived from space launch vehicles will likely not become available until beyond 2010. Since the only constraint on Trident would be that missiles converted to conventional roles would continue to count towards nuclear totals, this section will focus on the constraints START levies on a conventional Peacekeeper.

Notional plans call for deploying a force of conventionally-armed Peacekeeper ICBMs at Vandenberg and Cape Canaveral. Article IV of START could significantly limit or forbid conventional PGS deployments at Vandenberg or Cape Canaveral since both are considered to be "space launch facilities." Article IV, paragraphs 4b and 4c, states that each party shall limit the aggregate total of ICBMs present at space launch facilities to no more than the total number of ICBM launchers at that facility, not to exceed a total of 20 of which only 10 may be silos.[226] Article IV, paragraph 11, states that test ranges and space launch facilities must be located at least 100 kilometers from "any ICBM base for silo launchers of ICBMs."[227] This could be interpreted as barring the operational deployment of ICBM derived conventional PGS systems at Vandenberg or Cape Canaveral. However, it may be allowable to leverage a limited early operational capability during system research and development until START expires in 2009.

225 *Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms*, 31 July 1991 [on-line] ; available from http://www.fas.org/nuke/control/start1/text/start1.htm#ArtI; Internet; accessed July 2005.

226 Ibid.

227 Ibid.

2. Launch Notification Agreement

The Launch Notification Agreement, originally signed in 1988, could act to restrict the responsive launch capability of terrestrially-based PGS systems. Article I states that:

> Each Party shall provide the other Party notification, through the Nuclear Risk Reduction Centers of the United States of America and the Union of Soviet Socialist Republics, no less than twenty-four hours in advance, of the planned date, launch area, and area of impact for any launch of a strategic ballistic missile.[228]

While this agreement was certainly written with test and exercise missile launches in mind, since an operational launch at the time of its writing would have been part of a nuclear exchange, the agreement makes no distinction between test and operational launches. The notification requirements of this agreement are incompatible with the concept of conventional PGS. The whole purpose of having a conventional PGS capability is that we may not know 24 hours in advance that a strike will be necessary or the target will not likely remain in place for 24 additional hours. Since this agreement is of indefinite duration, it will be necessary to negotiate a separate protocol to handle conventional PGS launches. Perhaps the previously mentioned pre-launch "Hot Line" notifications would be acceptable.

3. Outer Space Treaty

Space-based alternatives, in particular, face potential legal challenges based on provisions of the Outer Space Treaty. Intercontinental missiles, while regarded by some as space weapons, are not restricted by the Outer Space Treaty since they pre-dated the treaty and were not subsequently banned when it entered into force. Space-based weapons or weapons platforms, on the other hand, may be banned by certain interpretations of the Treaty. Per Article IV of the Treaty, the only weapons explicitly banned from deployment in space are weapons of mass destruction (WMD).[229]

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[228] Agreement Between the United States of America and the Union of Soviet Socialist Republics on Notification of Launches of Intercontinental Ballistic Missiles and Submarine-Launched Ballistic Missiles, 31 May 1988 [on-line]; available from http://www.fas.org/nuke/control/start1/text/relatagre.htm#launchnotifagmt; Internet; accessed July 2005.

[229] Glenn H. Reynolds and Robert P. Merges, *Outer Space: Problems of Law and Policy* (Boulder, CO: Westview Press, 1989), 64.

Many in the military have chosen to interpret the lack of a specific ban against weapons other than WMD, as an implicit authorization for conventional weapons in outer space based on the inherent right to self-defense. This argument may hold some weight regarding weapons designed to defend satellites from attack or weapons tasked with defending the United States against ballistic missile attack. The self-defense argument holds less credibility regarding weapons based in space with the explicit purpose of offensive strike.

Several passages in the Treaty call into question the legality of placing offensive weapons into orbit including the following quotes from the preamble and Article I:

> The States Parties to this Treaty, …
> Recognizing the common interest of all mankind in the progress of the exploration and use of outer space for *peaceful purposes*,
> Believing that the exploration and use of outer space should be for the *benefit of all peoples …*,
> Desiring to contribute to broad international cooperation in the scientific as well as legal aspects of the exploration and use of outer space for *peaceful purposes*,
> Believing that such cooperation will contribute to the development of mutual understanding and to the *strengthening of friendly relations* between States and peoples…[emphasis mine][230]
>
> The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the *benefit and in the interests of all countries*, irrespective of their degree of economic or scientific development, and shall be the *province of all mankind* [emphasis mine].[231]

While not explicitly banning offensive weapons from space, these passages make it clear that any attempt to do so is clearly inconsistent with the intent of the Treaty. The fact that the United States and Soviet Union conducted numerous tests and studies for various types of offensive space weaponry during the Cold War does not change the negotiated intent of the Outer Space Treaty to ensure for the peaceful use of space for the benefit of all mankind.

Article VII of the Outer Space Treaty covers the liability of "launching nations" for damage their spacecraft cause to other parties to the treaty. The article states:

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[230] Reynolds and Merges, 63.

[231] Ibid., 64.

> Each State Party to the treaty that launches or processes the launching of an object into outer space…and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such an object or its component parts on the Earth, in air space or in outer space…[232]

The separate Liability Convention provides an expanded treatment of Article VII. This Convention is applicable to both civilian and military space activities and provides for absolute liability (unlimited liability for actual damages) for damages on the Earth's surface and on airplanes in-flight.[233]

The best-know application of this Convention was in response to the uncontrolled reentry of the Soviet Union's Cosmos 954 spacecraft, a nuclear-powered ocean surveillance satellite, in January 1978. The reentry spread radio-active debris over a large swath of Canadian territory including portions of the Northwest Territories, Alberta, and Saskatchewan.[234] The eventually paid Canada $3 million (Canadian) in April 1981, but the overall clean up costs totaled $14 million (Canadian).[235]

Article VII and the Convention were obviously intended to provide states legal protection against accidental harm caused by space activities, but could certainly be applied to purposeful acts. The provisions of this treaty would seem to give countries struck by U.S. space-based weapons a legal avenue to claim damages. Whether or not the United States would pay is open for debate, but the claimant would have legal grounds to claim damages, particularly if there is a spillover of collateral damage from the primary target. Presumably, since munitions delivered via sub-orbital trajectories are not "space objects." Use of terrestrially-based conventional PGS could strike the same target as a space-based system, but do not provide the basis for an international media circus over the target's liability claims.

E. CONCLUSION

This chapter evaluates the conventional PGS concepts presented in the previous

232 Reynolds and Merges, 65.

233 Ibid., 167,176.

234 Alexander Cohen, "Cosmos 954 and the International Law of Satellite accidents," in *Outer Space: Problems of Law and Policy*, eds. Glenn H. Reynolds and Robert P. Merges (Boulder, CO: Westview Press, 1989), 168-9.

235 Ibid., 169.

chapter against a series of interrelated political, regulatory, and treaty constraints. The following table summarizes the relative advantages and disadvantages of the various conventional PGS concepts and assigns them a value of low, medium, or high based on the likelihood that they will be affected, and to what degree, by the constraints.

	Political		Regulatory	Treaty		
	Nuclear Baggage	Space Weapon	Launch & Range Safety	START	LNA	OST/LC
Near-Term						
Trident II	**HIGH**	**LOW**	**HIGH**	**LOW**	**HIGH**	**LOW**
Peacekeeper	**MED**	**LOW**	**HIGH**	**HIGH**	**HIGH**	**LOW**
Mid-Term						
Falcon/CAV	**LOW**	**LOW**	**HIGH**	**N/A**	**MED**	**LOW**
Space-Based/ CAV	**LOW**	**HIGH**	**LOW**	**N/A**	**N/A**	**HIGH**
Far-Term						
Fully-Reusable/ CAV	**LOW**	**LOW**	**LOW**	**N/A**	**MED**	**LOW**

Table 1. Conventional PGS Capabilities vs. Constraints

As shown by the chart, the political, regulatory, and treaty constraints presented in this chapter are not insurmountable barriers, however, breaking through will require transforming the way we think and operate in order for conventional PGS capabilities to become reality. The following paragraphs summarize this chapter's four key findings and recommendations.

First, the congressionally-imposed limitations on the FALCON program effectively illustrate the magnitude of the perception management task that lies ahead to allow moving conventional PGS from the drawing board and into reality. The level of concern expressed over a weapon system so totally different from any of our current ICBMs demonstrates the consequences of basing major decisions on perceptions rather than fact-based analysis. The comprehensive set of risk mitigation proposals proposed by the Air Force go above and beyond what should be necessary to convince anyone who could detect the launch (and even those that cannot) that this vehicle is a conventional-only platform. The ultimate solution is not technical. Executive-level communication immediately prior to launch between the leaders of the United States and Russia (and maybe China) would effectively eliminate the possibility of surprise and misinterpretation. The current situation that gives other nuclear powers a veto over U.S. development and deployment decisions must not be allowed to continue.

Second, conversion of the Peacekeeper ICBM to a conventional role has the main advantage that most of the hardware is available today. The use of retired Peacekeeper ICBMs in a conventional role rather than converting Minuteman IIIs maintains a firewall between nuclear and conventional capabilities. The missiles are paid for which provides an excellent opportunity to deploy a relatively low-cost conventional PGS capability and recover some of the huge sunk costs previously invested in the weapon system. The missile also has sufficient range and payload capabilities to provide a militarily effective conventional capability. Unfortunately the mindset behind the restrictions imposed on the FALCON development program will probably result in squandering this opportunity.

Third, the constraints imposed by START provide a valuable lesson for future arms control negotiators. What was an effective solution to ensuring maximum accountability of ICBM totals and locations at the time the Treaty was written, now, in a changed world environment, unnecessarily levies constraints on seeking solutions to today's security concerns. Given the lengthy gestation periods of today's modern weapon systems, it is probable that it would take until at least 2010 to field an initial conventional PGS capability anyway, but the limitations imposed by START guarantee this eventuality.

Finally, maintaining launch responsiveness for conventional PGS systems will require a willingness to accept greater risk to the public (foreign and domestic) during launch operations. For this reason, conventional PGS weapons should only be used when the level of national need warrants the increased level of risk. Chances are though, if a conventional PGS weapon is believed to be necessary to achieve the desired effect, it is probably worth the risk, but this is a decision national leaders will need to make on a case-by-case basis. A better solution will not be available until the far-term when a fully-reusable booster eliminates the danger posed by discarded booster stages.

V. RATIONALE FOR CONVENTIONAL PGS CAPABILITIES

A. INTRODUCTION

Given the constraints on conventional PGS deployment presented in the previous chapter, why does the United States desire to develop these capabilities? In short, the driving force behind efforts to field conventional PGS capabilities is the result of a post-September 11th national security policy combined with efforts to transform the U.S. military. This chapter examines both the policy and military drivers for developing conventional PGS capabilities in detail.

The first section of this chapter examines relevant policy documents including *The National Security Strategy of the United States of America*, *The National Strategy to Combat Weapons of Mass Destruction*, and *The National Defense Strategy of the United States of America*. A consistent theme within all three documents is the recognition that in the post-Cold War world, deterrence may not be robust enough to ensure the safety of the American population against emerging threats from rogue states and non-state actors. These documents provide a policy foundation for the prompt and potentially preemptive use of military force to address urgent threats to the national security interests of the United States.

The remainder of the chapter examines the military rationale behind the pursuit of conventional PGS systems by comparing their expected performance capabilities with existing global strike capabilities and forward deployed forces. In line with U.S. national security policy, the 2001 Quadrennial Defense Review (QDR) describes a world security environment where there is "increasing diversity in the sources and the unpredictability of the locations of conflict" that could result in requirements for U.S. military intervention or activities on "virtually every continent" against a "wide variety of adversaries" with "widely varying capabilities."[236] To meet the challenges presented by this environment, the Department of Defense, and in particular the United States Air Force, view conventional PGS systems as a transformational capability that could increase the responsiveness, reach and economy of force of U.S. military response

[236] Office of the Secretary of Defense, *The Quadrennial Defense Review* (Washington D.C.: Government Printing Office, 2001), 6; [on-line] ; available from http://www.defenselink.mil/pubs/qdr2001.pdf; Internet; accessed August 2005.

options available to back up desired national security policy objectives. In addition to providing access to denied areas, conventional PGS capabilities may reduce reliance on forward-deployed forces and reduce the need to send U.S. forces into harm's way.

B. POLICY DRIVERS FOR CONVENTIONAL PGS CAPABILITIES

The basis and thinking behind American security strategy has changed significantly over the last 60 years, particularly with regard to the preemptive use of military force and the effectiveness of deterrence. Throughout the Cold War, the experience of Pearl Harbor shaped America's mindset and security strategy. The fear of a surprise attack intended to decapitate or disarm the nation led to development and deployment of a vast offensive nuclear arsenal. To increase force survivability, this arsenal consisted of a "triad" of delivery systems: manned bombers, land-based ICBMs, and nuclear-powered submarines armed with ballistic missiles. The thinking was that any potential attacker would be unable to guarantee the destruction of all American nuclear weapons in a first strike and would inevitably suffer a devastating retaliatory strike. The Soviet Union pursued a similar strategy to deter the United States from contemplating preemptive action against it. This balance of terror, often referred to as mutually assured destruction (MAD), provided the basis for deterrence and theoretically eliminated preemption as a viable strategy. For fifty years, mutual security relied on mutual vulnerability to offensively postured global strike systems armed with nuclear weapons.

The current *National Security Strategy* (NSS) *of the United States* was borne out of the post-Cold War environment and colored by the brutal terrorist attacks of 11 September 2001. The resulting NSS codifies the notion of "preemptive defense" or "the best defense is a good offense" into official policy. The events of 11 September 2001 serve as a poignant reminder that a threat of assured destruction is not sufficient to deter all of America's adversaries, especially in a world where rogue states and non-state actors are acquiring weapons of mass destruction (WMD).

The international community's desire to avoid aggressive, preemptive behavior among nations is evident in the norms embodied in the *United Nations Charter*, particularly *Article Two*:

> All Members shall settle their international disputes by peaceful means in such a manner that international peace and security, and justice, are not endangered.[237]

> All Members shall refrain…from the threat or use of force against the territorial integrity or political independence of any state…[238]

While the above wording forbids the types of action described in the NSS, the new, more aggressive nature of the American NSS is not without a legal foundation in international law. Later sections of the UN Charter describe the explicit right of states to act in self-defense and an implicit right to act preemptively against an imminent threat, as stated in *Article 51*:

> Nothing in the present Charter shall impair the inherent right of individual or collective self-defense if an armed attack occurs against a Member of the United Nations…Measures taken by Members in the exercise of this right of self-defense shall be immediately reported to the Security Council…[239]

International law, as interpreted by the UN Security Council, attempts to balance the inherent risk of instability from preventive wars with the need for timely defense through the right of anticipatory self-defense or preemption in response to an imminent attack.[240] In this context an attack is imminent if "a chain of events has been set in motion which will inexorably lead to the launching of an attack."[241]

The NSS departs from its firm basis in international law by adapting and expanding the concept of imminent threat to include activities by rogue states and terrorists aimed at acquiring WMD.[242] The United States makes its position and willingness to act in the interests of its national security quite clear.

> The United States has long maintained the option of preemptive actions to counter a sufficient threat to our national security. The greater the threat, the greater is the risk of inaction – and the more compelling the case for taking anticipatory action to defend our selves, even if uncertainty remains as to the time and place of the

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[237] *The Charter of the United Nations*. [on-line]; available from http://www.un.org/aboutun/ charter; Internet; accessed August 2005.

[238] Ibid.

[239] Ibid.

[240] Marc Weller, "The US, Iraq and the Use of Force in a Unipolar World," *Survival* 41, no. 4 (Winter 1999-2000): 93.

[241] Ibid.

[242] The White House. *The National Security Strategy of the United States of America* (Washington D.C., September 2002), 15. [on-line]; available from, http://www.whitehouse.gov/nsc/nss.pdf; Internet; accessed August 2005.

> enemy's attack. To forestall or prevent such hostile acts by our adversaries, the United States will, if necessary, act preemptively.…[I]n an age where the enemies of civilization openly and actively seek the world's most destructive technologies, the United States cannot remain idle while dangers gather.[243]

The *National Strategy to Combat Weapons of Mass Destruction* also contains preemptive elements. The strategy is built around three pillars: nonproliferation, counterproliferation, and consequence management. The counterproliferation pillar is further divided into three sub-pillars: interdiction, deterrence, and defense and mitigation. The third pillar of defense and mitigation contains the wording relevant to preventive or preemptive military action. In the context of this strategy, a good defense may also contain offensive elements as illustrated by this passage:

> U.S. military forces…must have the capability to defend against WMD-armed adversaries, including in appropriate cases through preemptive measures. This requires capabilities to detect and destroy an adversary's WMD assets before these weapons are used.[244]

As one would expect, *The National Defense Strategy of the United States of America* contains a similar emphasis on preemptive operations to deal with the possibility of catastrophic attack. This passage from the first of the strategy's three strategic objectives, to "Secure the United States from Direct Attack," clearly illustrates the proactive nature of the strategy:

> The danger of catastrophic violence dictates a new strategic imperative: we will actively confront – when possible, early and at safe distance – those who directly threaten us, employing all instruments of national power.[245]

The second portion of the strategy describes how the United States will accomplish its defense objectives. In the subsection titled "Deter Aggression and Counter Coercion," the strategy states that "In the current era there are many scenarios where we will not want to accept the huge consequences of an attack before responding" and that our deterrence policy now places greater emphasis on preventing and protecting against

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243 National Security Strategy, 15.

244 The White House. *The National Strategy to Combat Weapons of Mass Destruction* (Washington D.C., December 2002), 3. [on-line]; available from, http://www.whitehouse.gov/news/releases/2002/12/WMDStrategy.pdf; Internet; accessed August 2005.

245 *The National Defense Strategy of the United States of America* (Washington D.C., March 2005), 6. [on-line]; available from http://www.defenselink.mil/news/Mar2005/d20050318ndsl.pdf; Internet; accessed August 2005.

attacks.[246] The language favoring preemption is again found in the "Implementation Guidelines" as the following passage clearly shows:

> The United States will seize the strategic initiative in all areas of defense activity – assuring, dissuading, deterring, and defeating. Our first priority is the defeat of direct threats to the United States….Allowing opponents to strike first – particularly in an era of proliferation – is unacceptable. Therefore, the United States must defeat the most dangerous challenges early and at a safe distance, before they allowed to mature.…Under the most dangerous and compelling circumstances, prevention might require the use of force to disable of destroy WMD in the possession of terrorists or others or to strike targets (e.g., terrorists) that directly threaten the United States or U.S. friends or other interests.[247]

The policy objectives espoused in the NSS and supporting polices place a premium on rapid response, or in some cases preemptive action. An ability for the U.S. military to rapidly defeat adversaries before they can inflict catastrophic damage against American territory or deployed forces as called for in the NSS and the supporting strategies for combating WMD and national defense requires either an expansive global presences within quick striking distance of all conceivable threats or the ability to rapidly strike with precision over global distances. The next section examines attributes of conventional PGS capabilities that make them an attractive option for military leaders seeking the means to implement the more preemptive aspects of current national security strategy while minimizing the risk to U.S. forces.

C. MILITARY RATIONALE FOR CONVENTIONAL PGS

The Department of Defense and the Air Force, in particular, view conventional PGS capability as a transformational way to meet the policy demands for responsiveness to widely separated global threats in an era of a military shrinking force structure. The effectiveness of the traditional strategy of global presence is limited by three factors: 1) the size of the U.S. military, 2) access to basing in close proximity to threats, and 3) imperfect knowledge of all potential threats. While not intended to replace all forward presence, itself an important element of U.S. conventional deterrence, a conventional PGS system could mitigate many of the limiting factors of an expansive global presence. According to the 2004 Air Force Transformation Flight Plan, "Global Strike is the ability to rapidly plan and deliver limited-duration and extended range attacks to achieve

[246] National Defense Strategy, 7-8.

[247] Ibid., 9-10.

precision effects against highly valued adversary assets."[248] The plan also states that

> Global Strike capabilities must be capable of defeating anti-access strategies imposed by distance, physical hardening or active and passive defenses and…in order to meet potentially urgent timelines, Global Strike will primarily rely upon long-range, high-speed, kinetic (advanced conventional and nuclear) and non-kinetic aerospace delivery platforms …[249]

Currently deployed B-52, B-1B, and B-2A heavy bombers and nuclear-armed ICBMs and SLBMs possess many of the above characteristics but have significant shortcomings. This section examines the military rationale for conventional PGS capabilities. Proposed conventional PGS capabilities promise to deliver measurable advantages over existing military force projection capabilities in the areas of responsiveness, access, and economy of force.

1. Responsiveness

The primary selling point for conventional PGS capabilities is inherent in its name. The ability to hold targets at risk world-wide, and strike them if necessary within 90 minutes with conventional munitions, represents a capability many military planners covet. General Lance Lord, Commander of Air Force Space Command, identified providing a means for conventional PGS capability as one of the Command's top three priorities for addressing the effects and capabilities the nation and its warfighters need the most.[250] Air Force support of this priority is evident by its desire to attain the transformational capability of "rapid and precise attack of any target on the globe with persistent effects."[251] According to the Air Force Transformation Flight Plan:

> A non-nuclear, prompt, and persistent global attack capability will provide the United States with a range of options for deterrence and flexible

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248 Headquarters U.S. Air Force, Future Concepts and Transformation Division, *The U.S. Air Force Transformation Flight Plan* (Washington D.C.: Government Printing Office, 2004), D16. [on-line] ; available from http://www.af.mil/library/posture/AF_TRANS_FLIGHT_PLAN-2004.pdf; Internet; accessed August 2005.

249 Ibid., D17.

250 Congress, Senate, Armed Services Committee, Strategic Forces Subcommittee, Statement of General Lance W. Lord at Hearings on FY 2006 Defense Authorization Budget Request for Space Activities, 109th Congress, 1st sess., 16 March 2005 [on-line] ; available from http://armed-services.senate.gov/statemnt/2005/March/Lord%2003-16-05.pdf; Internet; accessed July 2005.

251 Transformation Flight Plan, 62-3.

> response when rapid response is absolutely critical, risks associated with other options are too high, or when no other courses of action are available.[252]

Past instances where this type of responsive capability would have been beneficial are probably few in number, but there is no way to know for sure. If the threat predictions found in the NSS and the 2001 QDR prove to accurately describe the world's future security environment, then the utility of conventional PGS capabilities may multiply significantly.

One can easily imagine a situation where a credible intelligence report identifies the location and timing of a meeting of key Al Qeada leaders or the location where final preparations are underway for a WMD attack, but the window of opportunity to act against the target is open for only a few hours. The options available to the President for acting on this intelligence are few. Forward-based forces may be an option, but much will depend on the location of the threat relative to those forces and their level of readiness. A global strike mission with strategic bombers from the continental United States would be ruled out in this scenario because of the time required to plan the mission, prepare the aircraft, and fly to the target. For example, a B-2 departing from Whiteman Air Force Base and flying to a notional target 7,000 nautical miles away will require at least 20 hours from a "go order" to strike the target.[253] This figure includes time required for mission planning and aircraft preparation, but does not factor in an allowance for negotiating necessary over-flight permissions. Certainly, nuclear-armed ICBMs or SLBMs possess the necessary responsiveness and ability to strike the target, but the "taboo" against nuclear first use and, more importantly, the inherent risk of significant collateral damage will "self-deter" the United States from choosing this option in all but the most-dire of circumstances. Today, the President could potentially be left with two unsatisfactory options: do nothing or resort to nuclear weapons. A conventional PGS capability could provide a more politically acceptable solution and put

[252] Transformation Flight Plan, 62.

[253] Headquarters U.S. Air Force, "The Common Aero Vehicle: Addressing Congressional Concerns," (briefing presented to U.S. Congress, Washington D.C., December 2004), 12.

"bombs on target" in a relatively brief 45 to 51 minutes, depending on the specific trajectory flown, from a launch base in the continental United States.[254]

With the possible exception of a future directed energy weapon, no existing or planned global strike platform can match the responsiveness of a PGS system that operates from or through space. While it may seem counterintuitive, there are many scenarios where a conventional PGS capability could provide a more responsive option against an imminent threat than would forward-deployed forces in the same theater of operation as the threat. For example, considering flight time alone, the Tomahawk cruise missiles launched as part of the opening wave of Operation ENDURING FREEDOM from naval vessels in the Indian Ocean took over two hours to reach their targets in Afghanistan.[255] A PGS weapon system could have struck the same targets in less than an hour form a launch point in the United States.

The opening strike of Operation IRAQI FREEDOM provides another example where conventional PGS weapons could have responded faster than theater forces. On 19 March 2003, George Tenet, then Director of Central Intelligence, presented intelligence information to the President indicating Saddam Hussein and other members of his government were located at Dora Farms, a southern Baghdad property owned by Saddam's wife.[256] Based on this intelligence and three hours of deliberation with key advisors, President Bush "made a decision to launch a limited precision air strike designed to kill Saddam Hussein and leading members of his government."[257]

General Franks, then Commander of United States Central Command, was asked if he could strike Dora Farms that night and in response his planners produced a proposal to use twenty-four Tomahawk cruise missiles.[258] Central Command planners completed "weaponeering" actions within an hour at which point Franks received another call from Washington that informed him of updated intelligence that indicated there was a reinforced concrete bunker at the site, against which the cruise missiles would be

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[254] Headquarters U.S. Air Force, Common Aero Vehicle, 25.

[255] Tommy Franks, *American Soldier* (New York: Harper-Collins Publishers, Inc., 2004), 286.

[256] Ibid., 451, and Walter J. Boyne, *Operation Iraqi Freedom: What Went Right, What Went Wrong, and Why* (New York: Tom Doherty Associates, LLC, 2003), 53.

[257] Boyne, 53.

[258] Franks, 452-3.

ineffective.[259] The only aircraft in-theater that possessed the ability to strike the bunker and survive Baghdad's air defenses was the F-117 Nighthawk.[260] In order to attain a near 100 percent probability of success, two F-117s were tasked to strike the suspected bunker location at Dora Farms with two EGBU-27 2,000 pound "bunker busters" each.[261] By 0259 on 20 March 2003, mission preparations were complete. Both F-117s were armed and their pilots were standing by in the cockpits in anticipation of the "go order."[262] The execute order was received from the White House at 0312 and both aircraft took off from their base in Qatar at 0338 followed later by the launch of the Tomahawks at 0439.[263] When the F-117s arrived over the target coordinates, a cloud deck obscured the target, but luckily both pilots found holes in the clouds which allowed them a mere six seconds to identify the target and drop their bombs.[264] At 0543, the F-117's four EGBU-27s and the twenty-four Tomahawks (launched from four ships and two submarines) struck the compound suspected of housing Saddam Hussein.[265]

As with the previous Afghanistan example, a conventional PGS weapon, if in a similar state of readiness as the F-117s (i.e., strip alert), could have struck the complex at Dora Farms within 45 minutes of the execute order, rather than the 2 hours and 31 minutes required by the F-117s and Tomahawks. This example illustrates the potential response time advantages of a notional conventional PGS system over forward deployed forces - even those at high states of readiness. However, it is worth pointing out that no amount of timeliness would have allowed this particular mission to succeed, since Saddam Hussein was later found to have not been at the target location.

A subsequent attempt to eliminate Saddam on 7 April 2003 demonstrated a significantly shorter "kill chain" where only 12 minutes elapsed between the strike tasking and "bombs on target."[266] This level of responsiveness was only possible as a

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259 Franks, 452-3.

260 Ibid., 453.

261 Ibid., 455.

262 Ibid., 457.

263 Ibid., 457-8.

264 Ibid., 459-60.

265 Boyne, 48.

266 Ibid., 148-9.

result of the permissive air environment established over Baghdad that allowed B-1Bs to orbit over the city awaiting orders to strike time-sensitive targets. Unfortunately, Saddam's survival cast doubt on the reliability of the pre-strike intelligence. He was either never at the targeted restaurant or somehow managed to escape in the 45 minutes between the intelligence tip and the air strike.

Both of the attempted strikes against Saddam Hussein demonstrate the pivotal importance of accurate and timely intelligence. A conventional PGS capability without accurate intelligence simply provides the capability to strike the wrong target faster. In addition to problems providing accurate targeting data, the relative lack of responsiveness of current global strike platforms places extreme strain on the intelligence system to provide intelligence or warning far enough in advance to allow a response. Providing attack options against highly valued or fleeting targets is the primary reason for conventional PGS capabilities. While still reliant on accurate and timely intelligence, conventional PGS capabilities may actually help to mitigate some of our intelligence shortfalls. While it may be very difficult or impossible to obtain intelligence on a meeting of terrorist leaders or final preparations for a WMD attack 48 hours in advance, it is more conceivable that warning could be received several hours in advance. Several hours notice would be of little use for launching a preventive or preemptive B-2 strike, but could be sufficient to allow action by a conventional PGS system.

The bottom line is that a conventional PGS capability would offer unmatched responsiveness against global threats and may even surpass the responsiveness of theater forces. The superior responsiveness of a PGS capability could also serve to maximize the utility of existing intelligence collection capabilities by providing a capability to act in response to previously unactionable intelligence.

2. Access

Global range, an inherent characteristic of a conventional PGS system, is only one aspect of "access." Other attributes include the ability to strike high-value adversary targets in spite of over-flight restriction by sympathetic or neutral third-parties and anti-access strategies that leverage active and passive defenses. The 2001 QDR's second goal of "projecting and sustaining U.S. forces in distant anti-access environments and defeating anti-access threats" and third goal of "denying enemies' sanctuary through persistent surveillance, tracking and rapid engagement with high-volume precision strikes" are particularly relevant to the concept of access as defined above.[267] In order to meet these objectives, the Air Force desires global strike capabilities able to defeat "anti-access strategies imposed by distance, physical hardening or active and passive defenses."[268] The 2001 QDR predicts

> Future adversaries could have the means to render ineffective much of our current ability to project military power overseas. Saturation attacks with ballistic and cruise missiles could deny or delay U.S. military access to overseas bases, airfields, and ports. Advanced air defense systems could deny access to hostile airspace to all but low-observable aircraft.[269]

This section examines how conventional PGS capabilities compare with current capabilities regarding the various aspects of "access" with emphasis is placed on the ability to penetrate sophisticated air defense systems, vulnerability to basing or airspace restrictions, and ability to attack hardened or deeply buried targets.

Modern air defenses pose a grave threat to most conventional strike aircraft and penetration to reach high value targets may require extensive defense suppression efforts. Stealthy aircraft, such as the F-117 and B-2, have the ability to penetrate most current threats but must rely on the cover of darkness to avoid detection by the "Mark 1 Eye-Ball." Stealth aircraft may have reduced radar signatures, but they remain easy to detect visually when silhouetted against a sunny blue sky.

The Air Force claims that conventional PGS capabilities, operating from or through space, hold a significant advantage over existing platforms in their ability to penetrate known and projected defenses.[270] This penetration capability could one day make PGS the weapon of choice to strike WMD storage and delivery systems, command and control nodes, and integrated air defenses.[271] Very few nations possess the capability to detect and fewer still have the ability to engage vehicles with the performance and flight characteristics of the CAV or other proposed PGS vehicles. Because of its speed and flight profile, defense against a PGS weapon system present a challenge similar to

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[267] 2001 QDR, 30.

[268] Transformation Flight Plan, D17.

[269] 2001 QDR, 31.

[270] Headquarters U.S. Air Force, "The Common Aero Vehicle," 5, 14.

[271] Ibid., 11.

defending against an ICBM, but is further complicated by the PGS reentry vehicle's maneuver capability. Given the difficulty the United States has experienced in its efforts to field a ballistic missile defense system designed to intercept relatively unsophisticated intercontinental missiles, one can safely assume that it will be some time before effective defenses against conventional PGS capabilities proliferate widely.

Advanced air defenses are not the only threat or obstacle that adversaries may employ to deny U.S. forces access. Adversaries may threaten the use or actually use WMD against potential U.S. forward bases, which could delay effective combat operations pending elimination of the WMD threat. The threat of WMD use may also serve to limit the willingness of third-party nations to allow U.S. forces to operate from their territories or through their airspace. Conventional PGS weapons and other global strike platforms circumvent the first part of this anti-access strategy by operating from bases outside the range of the adversary's offensive systems.

The refusal to grant over-flight permission can significantly impair the utility of aircraft and cruise missiles to access the enemy's territory. At best, these restrictions will only add distance to the mission. At worst, attacks against a land-locked country/target could be impossible without over-flight permission from the bordering nations. Operation EL DORADO CANYON against Libya on 14 to 15 April 1986 provides an example of the first possible outcome. A major portion of the U.S. attack plan relied on F-111F aircraft based in the United Kingdom. France and Spain denied the United States over-flight rights, so the strike aircraft had to fly a circuitous route over the Atlantic Ocean and then through the Straights of Gibraltar to gain access to the Mediterranean Sea and Libya.[272] The route flown was easily twice as far as would have been necessary with French or Spanish over-flight permissions that resulted in a 13-hour round trip for the F-111s.[273] It is easy to imagine a situation where the denial of over-flight rights by a third-party nation makes an attack impossible. For example, if the United States had been unable to gain over-flight rights from Pakistan in 2001, Operation ENDURING FREEDOM would have been significantly more difficult. Of course, if the national need is great enough, the United States could choose the diplomatically (and potentially

[272] Bill Gunston and Lindsay Peacock, *Fighter Missions: Modern Air Combat – the View from the Cockpit* (New York: Crown Publishers, Inc., 1989), 132.

[273] Ibid., 132-5.

militarily) risky option of penetrating the third-party's airspace against their wishes.

The flight of Sputnik I (the world's first artificial satellite) in October of 1957 established the precedent that objects in space do not require permission by countries to over-fly their sovereign territory. Conventional PGS capabilities projected to become available in the near to mid-term spend the vast majority of their flight path outside the atmosphere, and are thus virtually exempt from requiring over-flight permissions. The relatively steep reentry angle employed by systems derived from existing ICBMs or SLBMs makes it highly unlikely that atmospheric over-flight of third-party nations would be necessary, except in the case of strikes against a small, land-locked country.[274] The CAV, since it would rely on hypersonic cruise through the upper atmosphere to extend its range, faces the potential for greater restriction by over-flight concerns. However, the large cross-range capability of the CAV will allow mission planners to choose flight paths that minimize atmospheric over-flight of third-party countries.[275] This cross-range capability further allows planners to employ trajectories that minimize or eliminate orbital over-flight of countries like Russia that can detect and potentially overreact to the presence of a CAV overhead.[276]

A third way adversaries may seek to deny American forces access to key facilities or personnel is by placing them in hardened or deeply buried facilities. According to the 2002 Nuclear Posture Review, over 70 countries use underground facilities for military purposes and there are about 1,100 such facilities either suspected or known to have strategic functions (such as WMD, ballistic missile basing, leadership, and top echelon command and control).[277] Attacks against this class of target is the mission most commonly attributed to conventional PGS capabilities, but it is also the most technically challenging. A detailed discussion of the means to strike hard or deeply buried targets is provided in a previous chapter, so only an abbreviated discussion is provided here.

To destroy hard or deeply buried targets requires very high impact velocities coupled with very strong and accurate penetrating warheads. Space-based systems are

[274] Gunston and Peacock, 25.

[275] Ibid., 5, 26.

[276] Ibid., 26.

[277] Office of the Secretary of Defense, *Nuclear Posture Review* [Excerpts] (8 January 2002). [on-line]; available from http://www.globalsecurity.org/wmd/library/policy/dod/npr.htm; Internet; accessed July 2005.

theoretically capable of achieving impact velocities of up to 6.6 miles per second (from a 24,000 mile orbital altitude) and missile delivered weapons can achieve maximum impact velocities of about 3 miles per second (15,840 feet per second).[278] Current theoretical estimates envision materials that could survive impact velocities of 2.4 miles per second, but impact velocities up to only about 1 mile per second (5,280 feet per second) have been successfully demonstrated.[279] When the target is hardened concrete (rated to 5,000 pounds per square inch), the survivable impact velocity drops to approximately 4,000 feet per second.[280] While these limitations place much of the penetration potential of missile or space-delivered weapons beyond the reach of current technology, they still offer a significant improvement over the 1,500 foot per second impact velocities possible with standard aircraft-delivered free-fall weapons.[281]

3. Economy of Force

Air Force Basic Doctrine defines "economy of force" (one of the nine principles of war) as "the judicious employment and distribution of forces."[282] The true intent of this principle is to ensure that sufficient resources are available for use against primary objectives and the minimum essential amounts of resources are allocated to secondary efforts.[283] One can take this reasoning a step further and postulate that if the minimum essential amounts of resources are directed towards any one primary objective, it should be possible to strike more primary objectives simultaneously, or preserve scare resources for future contingencies. The principle of economy of force also serves as a warning against "overkill," since the excessive use of force may undermine gaining and maintaining legitimacy for military operations.[284]

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[278] Major William L. Spacey II, *Does the United States Need Space-Based Weapons* (Maxwell Air Force Base, AL: Air University Press, 1999), 26-7, 76.

[279] Ibid., 27-8.

[280] Headquarters U.S. Air Force, "The Common Aero Vehicle: Addressing Congressional Concerns," (briefing presented to U.S. Congress, Washington D.C., December 2004), 11.

[281] Ibid.

[282] Headquarters Air Force Doctrine Center, *Air Force Doctrine Document 1: Air Force Basic Doctrine* (Washington D.C.: Air Force E-Publishing, 2003), 24. [on-line]; available from http://www.e-publishing.af.mil/pubfiles/afdc/dd/afdd1/afdd1.pdf; Internet; accessed August 2005.

[283] Ibid.

[284] Ibid.

In the 1990s, the combat debut of stealth married up with precision guided munitions (PGMs) allowed dramatic reductions in the amount of resources necessary to destroy any given target and the number of people placed into harm's way to accomplish the mission. Two sets of air strikes conducted against Iraq's nuclear facilities at al Tuwaitha (the same site struck by Israel in 1981) during Operation DESERT STORM illustrate the significant economy of force enabled by the combination of stealth aircraft and PGMs.

Early in the campaign, several stealthy F-117s attacked the reactors and research facilities at al Tuwaitha with minimal support from EF-111 stand-off jamming aircraft and aerial refueling tankers.[285] Later in the conflict, and believing Iraq's air defenses had been sufficiently degraded, General Horner ordered a large strike package of over 70 F-16s (plus F-15s for escort, EF-111s for radar jamming, and F-4Gs for suppression of air defenses) to conduct a daylight attack on the al Tuwaitha complex and other targets in Baghdad.[286] Unlike the earlier F-117 strikes, this "strike package" met with significant resistance. Antiaircraft fire encountered while enroot to the target caused the formation to break up. About a quarter of the F-16s were unable to rejoin the group and were forced to return to base. As the strikers approached the target, 27 surface-to-air missiles were launched by the Iraqis. In addition to dense antiaircraft fire, the Iraqis used smoke pots to obscure visibility of the target. To avoid collateral damage, many of the F-16s did not drop their bombs. In spite of the air defense suppression efforts of the F-4Gs, the Iraqis shot down two F-16s and their pilots were captured.[287] The difference in economy of force between the two attacks is hard to ignore.

While stealth aircraft require very little support from other platforms to reach and penetrate to their assigned targets, they still require, at a minimum, aerial refueling tankers to achieve global reach without forward basing. Conventional PGS capabilities promise similar improvements in economy of force, but go the additional step of eliminating the need for any supporting forces. Conventional PGS capabilities also have the added advantage of not placing friendly forces at risk. Air Force planners have

[285] Michael R. Gordon and Bernard E. Trainor, *The General's War: The Inside Story of the Conflict in the Gulf* (Boston: Little, Brown and Company, 1995), 255-6.

[286] Ibid.

[287] Ibid.

prepared several case studies that compare the resources used in historical limited strikes to the expected economy of force advantages if conventional PGS platforms had been employed instead. Two of these examples are examined below.

The first case compares the resources necessary to execute Operation EL DORADO CANYON against Libya in April 1986 with the projected resources necessary if a CAV equipped PGS system was used instead. The actual mission required over 110 Air Force and Navy aircraft, of which only thirty-eight (twenty-four F-111Fs and fourteen A-6Es) were used to strike the operational objectives in and around Tripoli.[288] The remaining aircraft provided aerial refueling, airborne warning and control, defense suppression, and electronic warfare support. Air Force estimates place the cost of the operation at $99.1 million and the capital cost of the aircraft involved at $5.05 billion.[289] This operation also placed sixty-four aircrew members at risk from enemy fire, two of which were killed when their F-111 was shot down.[290] In contrast, if a PGS system armed with CAVs carrying four Small Smart Bombs (SSBs) each had been used instead, only four sorties would have been required to strike the primary objectives.[291] The Air Force estimated the total mission and capital cost would have been $32 million, assuming four launch vehicles would be necessary to deliver four CAVs. A Peacekeeper-derived system could potentially accomplish the same mission at even lower economic and material cost. The Peacekeeper's throw-weight capability could allow it to deliver four CAVs (assuming a weight of 2,000 pounds each) with a single sortie.[292] In summary, for a similar scenario in the future, a conventional PGS capability could reduce total mission cost by two-thirds, reduce the required number of sorties by over 100, and place no U.S. forces at risk.

Operation DESERT STRIKE, a retaliatory strike against Iraqi air defense targets in response to no-fly zone violations, is similar in scope to the type of operations

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288 Matt Bille and Major Rusty Lorenz, "Requirements for a Conventional Prompt Global Strike Capability" (briefing presented at the NDIA Missile and Rockets Symposium and Exhibition, May 2001), 12 [on-line]; available from http://www.dtic.mil/ndia/2001missiles/bille.pdf; Internet; accessed July 2005.

289 Ibid.

290 Ibid.

291 Ibid.

292 Max Walmer, *An Illustrated Guide to Strategic Weapons* (New York: Prentice Hall Press, 1988), 26.

projected for conventional PGS systems. This operation employed two B-52s launched from Guam in the Pacific Ocean, each armed with eight CALCMs, and thirty-one Tomahawk cruise missiles launched from naval vessels in the Persian Gulf.[293] The targets were eight surface-to-air missile sites and seven command and control nodes, of which eleven were damaged or destroyed.[294] In addition to the two B-52s and forty-seven missiles actually used in the strike, a significant amount of support from other aircraft was required to position the resources for the attack, provide aerial refueling, and attack escort. This support included: two spare B-52s held at Guam, fourteen KC-135 tankers, fifteen KC-10 tankers, one C-5 transport, and F-14s that escorted the B-52s while over the Persian Gulf.[295] Air Force calculations, based only on cost per flight hour, fuel off-loaded by tankers and the cost of the missiles, place the cost of this operation at $7.63 million per target hit ($114.45 overall).[296] If this same attack was conducted with a conventional PGS capability, it would have required fifteen CAVs, each armed with four SSBs or six WAASMs each, for an estimated cost of $2.04 million per target struck ($30.6 million overall).[297]

D. CONCLUSION

The policy objectives espoused in the NSS and supporting polices place a premium on rapid response, or in some cases preemptive action to defeat adversaries before they can inflict catastrophic damage against American territory or deployed forces. Conventional PGS capabilities provide an additional option for the President to respond to imminent threats to the national security of the United States that appear more likely in a post-Cold War, post-September 11th world.

In an era when a shrinking U.S. force structure threatens the future viability of the traditional strategy of global presence, the Department of Defense, and in particular the Air Force, views conventional PGS capabilities as a transformational answer to policy demands for a responsive military option to address widely separated global threats.

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[293] Headquarters U.S. Air Force, “The Common Aero Vehicle: Addressing Congressional Concerns,” 16.

[294] Ibid.

[295] Ibid.

[296] Ibid.

[297] Ibid.

Proposed conventional PGS capabilities promise to deliver measurable advantages over existing military force projection capabilities in the areas of responsiveness, access, and economy of force.

The primary military rationale for conventional PGS capabilities is their predicted ability to provide unmatched responsiveness. Historical cases have shown that even from an “on-alert” posture, forward-deployed forces have historically required at least two hours or more to reach targets within their theater of operations. Conventional PGS capabilities promise global reach within 90 minutes from a similar “on-alert” posture. This responsiveness also has the potential to increase the amount of actionable intelligence available by reducing the necessary lead-time. When a truly immediate response is necessary, there is no substitute for conventional PGS capabilities.

Perhaps even more significant than quick response, proposed conventional PGS capabilities offer unsurpassed access to an adversary’s highly valued targets. Advanced air defenses, denial of forward basing, over-flight restrictions, and hardened and deeply buried facilities do not constrain the ability of conventional PGS weapons to hold vital enemy centers of gravity at risk. The speed, flight path, and cross-range capability of proposed Conventional PGS weapons makes interception nearly impossible and drastically reduces the potential for over-flight considerations to limit access to vital targets. The ability to strike from well beyond the range of theater ballistic and cruise missiles could be a significant benefit to efforts to defeat adversary anti-access strategies. Finally, conventional PGS weapons have the potential to hold additional hard and deeply buried facilities at risk without resorting to nuclear weapons. While their penetration ability is still constrained by available materials, PGS weapons offer impact velocities 2,500 feet per second greater than contemporary aircraft-delivered weapons.

In addition to responsiveness and access, conventional PGS capabilities have the potential to offer significant “economy of force” improvements. While not likely to provide the least expensive method to strike a target on a cost-per-weapon basis, conventional PGS capabilities could remain cost-competitive when the overall operations costs of an operation are included in the analysis. More importantly, conventional PGS capabilities offer a means to strike highly-defended targets without risking the lives of friendly forces, which represents the ultimate “economy of force.”

VI. CONVENTIONAL PGS AND GLOBAL STABILITY

A. INTRODUCTION

The previous chapters of this thesis examined various aspects of conventional and nuclear global strike capabilities including: the development and evolution of global strike capabilities during the Cold War; current U.S. global strike capabilities; concepts for terrestrially-based and space-based PGS capabilities; potential constraints on conventional PGS deployment and employment; and the policy and military rationale for conventional PGS weapons. In sum, these chapters addressed the "how" and "why" questions regarding conventional PGS. This chapter addresses the "so what" aspect of a United States deployment of conventional PGS capabilities and serves as a counterpoint to the rationale for these capabilities presented in chapter five. While it is technically feasible to deploy conventional PGS capabilities in the near-term, and there is significant rationale to do so from both policy and military utility standpoints, there is a potential price to be paid. The presence of these weapons may produce unintended consequences for the stability of the global security environment, particularly among the existing nuclear powers. This chapter seeks to illuminate these risks and to characterize their severity.

This chapter opens with a general discussion of nuclear deterrence theory, which arguably remains a key pillar in support of global stability, even in this post-Cold War era. The contributions of several well-known deterrence theorists are presented to serve as a basis for the case studies and analysis that follow. The next section presents three case studies that examine the strategic thinking and nuclear strategy, doctrine, force structure, and posture of the United States, Russia, and China. The final section analyzes the potential impact of conventional PGS capabilities on the stability of the global security environment by drawing on the tenets of nuclear deterrence theory and the three case studies. Does the presence of responsive conventional global strike weapons capable of precision strikes anywhere on the global in less than 90 minutes create a "security dilemma" that undermines the perceived credibility or security of the Russian and Chinese nuclear deterrent forces? If so, will these weapons produce a "tipping point" that drives unintended consequences in the posture or size of their nuclear arsenals? Will the deployment or employment of U.S. conventional PGS weapons contribute to an increased likelihood of inadvertent nuclear war? Some fear that the inability of an adversary or third party country to differentiate the launch of a conventional PGS weapon from a nuclear-armed missile could instigate a nuclear retaliatory strike. How valid is this concern regarding Russia and China? The deployment of conventional PGS capabilities present a golden opportunity to de-emphasize nuclear weapons, but must be accompanied by significant changes to the nuclear force postures of the major nuclear powers, particularly the United States and Russia, to avoid detrimental effects to the stability of the global security environment.

B. DETERRENCE THEORY

The concept of deterrence, "the ability to dissuade someone from an action by frightening that person with the consequences of the action," predates the advent of nuclear weapons but gained new significance following the use of atomic weapons during the final stages of the Second World War.[298] The United States and other major powers have devoted sixty years of strategic thought, dominated by various concepts of nuclear deterrence, in an effort to define a global security architecture that accounted for the unprecedented destructive power of nuclear weapons. Even in today's post-Cold War environment, nuclear deterrence considerations remain important, if less publicized.

Soon after the Second World War, Bernard Brodie and several others began an academic discourse that eventually provided the enduring principles that are known today as nuclear deterrence. He believed the atomic weapon fundamentally changed the nature of warfare because of its unprecedented combination of tremendous destructive capability and relatively small size. In his words, "the atomic bomb seems so far to overshadow any military invention of the past as to render comparisons ridiculous."[299] To demonstrate the near pointlessness of relying on traditional air defenses in the face of a nuclear attack, he used the example of German V-1 "buzz-bomb" attacks against London.[300] On just one day, On 28 August 1944, Germany fired 101 V-1s at London of

[298] Kenneth N. Waltz, "Nuclear Myths and Political Realities," *The American Political Science Review* 84, no. 3 (September 1990) : 732.

[299] Bernard Brodie, ed., *The Absolute Weapon: Atomic Power and World Order* (New York: Harcourt, Brace and Co., 1946), 34.

[300] Brodie, 29.

which ninety-seven were shot down. London was able to "absorb" the four V-1s that leaked through the defenses, but he points out that the situation would have obviously been quite different had the V-1s been carrying nuclear weapons.[301] The difficulties of providing for a perfect defense led Brodie to conclude:

> Thus far the chief purpose of our military establishment has been to win wars. From now on its chief purpose must be to avert them. It can have almost no other useful purpose.[302]

Brodie went on to describe desirable characteristics of the military force structure necessary to avert, or deter, a future war with nuclear weapons. The first priority is to ensure the "possibility of retaliation in kind," which he points out "does not have to be 100 percent certain" as long as the adversary believes there is a "good chance" it will occur.[303] A nation must prepare to fight a war involving nuclear weapons with the forces available at the start of hostilities because most industrial capability will, in all likelihood, be destroyed at the outset, preventing the "grand mobilization" possible in the World Wars.[304] Brodie also recognized the necessity for survivable forces and command and control capabilities to ensure the ability to retaliate, and thus deter an attack in the first place. Brodie's proposed deployment concept for the retaliatory force bears a striking similarity to the methods employed by the major nuclear powers to this day. He called for the dispersal of atomic weapons and their delivery vehicles, underground storage, independent communications, and pre-delegation of authority for commanders to act while under attack.[305] Brodie's prescription for nuclear deterrence was to "reduce our vulnerability in order to reduce the chances of being hit at all" by making "the prospect of aggression much less attractive to the aggressor."[306]

Writing in the late-1950s following the Soviet launch of Sputnik, Albert Wohlsetter presents a view of nuclear deterrence that is very similar to Bernard Brodie's, but differs regarding the difficulty of maintaining stable deterrence. Wohlstetter also

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[301] Brodie, 29-30.

[302] Ibid., 76.

[303] Ibid., 74,76.

[304] Ibid., 89-90.

[305] Ibid., 91.

[306] Ibid., 104.

emphasizes the necessity to be able to "strike second" to deter a nuclear attack, but argues that the advent of intercontinental missiles and their inherent ability to attack with little warning makes this task increasingly difficult.[307] In order to remain survivable in the missile age, Wohlstetter wrote that a capability to "strike second" must be able to "hurdle" several "successive obstacles."[308]

> Such deterrent systems must have (a) a stable, "steady state" peacetime operation within feasible budgets…They must also have the ability (b) to survive enemy attacks, (c) to make and communicate the decision to retaliate, (d) to reach enemy territory with fuel enough to complete their mission, (e) to penetrate enemy active defenses…and (f) to destroy the target in spite of any "passive" civil defense in the form of dispersal or protective construction or evacuation of the target itself.[309]

Wohlstetter assessed that maintaining a deterrent force capable of overcoming the above obstacles "demands hard, continuing, intelligent work, but it can be achieved."[310] To further highlight the importance of survivable second strike capabilities, Wohlstetter likens the inherently destabilizing situation where two countries each possess the capability to destroy the other's retaliatory force and society to an "old-fashioned Western gun duel."[311] He wrote, "It would be extraordinarily risky for one side *not* to attempt to destroy the other, or to delay doing so, since it not only can emerge unscathed by striking first but this is the sole way it can reasonably expect to emerge at all.[312]

In addition to his ideas on force survivability, Wohlstetter presented several insights that could have easily been drawn from the pages of the 2001 Nuclear Posture Review. He acknowledges the inadequacies of deterrence as a stand alone strategy. Wohlstetter called for the development of advance conventional capabilities to meet cases of limited aggression and for greater emphasis on active and passive defenses to "limit the dimensions of the catastrophe in case deterrence should fail."[313] Finally, he

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307 Albert Wohlstetter, "The Delicate Balance of Terror," *Foreign Affairs* 37, no. 2 (January 1959): 213, 217.

308 Ibid., 216.

309 Ibid.

310 Ibid., 221.

311 Ibid., 230.

312 Ibid.

313 Ibid.

recognized that many of the measures necessary to ensure a survivable nuclear deterrent force, such as keeping missiles and bombers on alert, operating from dispersed locations, and mobile platforms, significantly "increase the risk of an irrational or unintentional act of war."[314]

Fast-forwarding to the end of the Cold War, Kenneth Waltz contends that nuclear deterrence is not as problematic or difficult as Wohlstetter predicted. Harkening back to the works of Bernard Brodie, Waltz presents a view of deterrence that requires only a "force that can survive a first strike and strike back hard enough to out-weigh any gain the aggressor had hoped to realize."[315] He also asserts that deterrence does not rely on destroying cities, but rather depends on "what one *can* do, not on what one *will* do."[316] According to Waltz, deterrence works because, given a survivable second strike force, the retaliator determines the level of damage to inflict upon the aggressor.[317] His belief that even small nuclear arsenals, if survivable, can effectively deter a numerically superior adversary may become increasingly relevant as Cold War nuclear arsenals continue to shrink and the number of nuclear states continues to rise.

Brodie, Wohlstetter, and Waltz wrote about the things that lead to successful nuclear deterrent relationships. Robert Jervis devoted significant effort to exploring the pitfalls of nuclear deterrence that could lead to nuclear confrontation even if both countries maintain survivable second strike capabilities. These threats to the viability of deterrence usually result from "security dilemmas." Jervis defines a security dilemma as: "the means by which states try to make themselves more secure often have the undesired and unintended consequence of making others less secure."[318] He writes specifically about several forms of crisis instability that generally result from a shared fear of surprise attack.[319] In general, crisis instability can drive a self-fulfilling prophecy in which the actions each side takes out of the fear that it may be the victim of surprise fuel the fears

314 Wohlstetter, 231.

315 Waltz, 732.

316 Ibid., 733.

317 Ibid.

318 Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, NY: Cornell University Press, 1989), 139.

319 Ibid, 138.

of the other side, producing a war neither side sought."[320] There are many factors that may aggravate crisis instability. A few examples of these factors include: states unaware of actions by their force that may send mixed signals or escalate the crisis; ignoring the security dilemma by failing to appreciate the extent to which their actions "menace" the other; and a tendency to attribute all of the adversary's observed activities to some overarching plan.[321]

Most deterrence concepts discussed above emphasize "imposing a cost" as the actual deterrence mechanism. For example, if Country A attacks Country B, Country B will retaliate against country A's industrial capacity and cities. The assumption is that the cost imposed by B will deter A from attacking B in the first place. The Department of Defense recently produced the Strategic Deterrence Joint Operating Concept which prescribes targeting multiple elements of an adversary's "decision calculus." This document defines strategic deterrence as "the prevention of adversary aggression or coercion threatening vital interests of the United States and/or our national survival."[322] According to the document, "strategic deterrence convinces adversaries not to take grievous courses of action by means of decisive influence over their decision making."[323]

The Strategic Deterrence Joint Operating Concept identifies three elements of an adversary's decision calculus regarding a possible course of action: 1) perception of benefits, 2) perception of costs, and 3) perception of the consequences of restraint (i.e., doing nothing).[324] Exploitation of this approach allows one to leverage all of the instruments of national power (diplomacy, information, military, and economic) to triple the number of "means" available to achieve the "end" of deterrence. Country B may now attempt to deter Country A by denying benefits, imposing costs, and inducing restraint.[325] For example, B may deny the benefit of A's attack by preemptively striking A's WMD capability or by relying on missile defenses to defeat an attack after launch. Country B

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[320] Jervis, 138.

[321] Ibid., 155, 158, 160.

[322] Department of Defense, *Strategic Deterrence Joint Operating Concept*, February 2004, 4 [on-line]; available from http://www.dtic.mil/jointvision; Internet; accessed July 2005.

[323] Ibid.

[324] Ibid., 6.

[325] Ibid.

may also employ diplomatic or economic incentives to induce A not to attack. This approach to deterrence provides expanded opportunities to deter actors (state or non-state) that are unconcerned about the possibility of nuclear retaliation.

The intended take-away from this discussion is that very little has changed since 1946 regarding the general requirements for successful nuclear deterrence. Even in today's post-Cold War world, nuclear deterrent relationships among the major nuclear powers remain an important ingredient in the global security framework. Unfortunately, Cold War alert postures remain, and with them the potential for security dilemmas and crisis instability. New, more proactive concepts of deterrence, as presented in the Strategic Deterrence Joint Operating Concept, seek to deter by affecting multiple elements of the adversary's decision calculus. Attempts to "deny benefits" through preemptive strikes, possibly with conventional PGS capabilities, or by deploying missile defenses have the potential to introduce instability by threatening other nations' ability to "impose costs."

C. CASE STUDIES

This section presents three case studies that examine relevant examples of security policy, nuclear strategy or doctrine, force structure, and force posture that serve as the basis for a later analysis of the policy and security implications of a U.S. decision to deploy conventional PGS capabilities. The differing threat perceptions and military capabilities of the United States, Russia and China result in different implications for each nation. Current U.S. thinking, as espoused in the 2001 Nuclear Posture Review, covets enhanced conventional strike capabilities, such as conventional PGS, as a means to reduce dependence on nuclear weapons and to reinforce the credibility of the nation's strategic deterrent against a wide variety of existing and emerging threats. Russia's reliance on a large, highly ready, and capable ICBM force, coupled with a crumbling early-warning system, and an overall perception of insecurity raise the risk of misunderstandings resulting from employment of conventional PGS capabilities by the United States. The potential Chinese reaction is a "wild card." Will the deployment of a U.S. conventional PGS capability finally push China to expand the size, mobility, and readiness of its nuclear forces? The following case studies examine these issues in detail.

1. United States

Throughout the Cold War, the United States relied on a "triad" of long-range bombers, ICBMs, and ballistic missile submarines as the cornerstone of its strategic deterrent. Following the end of the Cold War, U.S. nuclear strategy, posture, and force structure were slow to change. During the 2000 presidential election, then Governor George Bush criticized the Clinton Administration's slowness to adjust to the conditions of the post-Cold War security environment. Specifically, Bush accused the administration of remaining "locked in a Cold War mentality" and charged that the United States needed to "rethink the requirements for nuclear deterrence" in order to better "fend against the new threats of the 21st century."[326]

The Bush administration pursued a two-tier approach to adjusting the U.S. nuclear posture. First, the President set out to change the dynamics of the United States-Russia strategic relationship to better reflect the changed relationship between the two countries. President Bush publicly stated that "Russia is no longer our enemy" and vowed to align U.S. nuclear policy accordingly.[327] Administration officials professed that even though Russia retained a substantial nuclear arsenal, the growing level of cooperation allowed for a "new strategic framework" to replace reliance on mutually assured destruction.[328] The United States also claimed that it would "no longer plan, size or sustain its nuclear forces as though Russia presented merely a smaller version of the threat posed by the former Soviet Union."[329]

The second tier of adjustments aims to redress the credibility of U.S. strategic deterrence. The failure of the United States nuclear arsenal to deter the terrorist attacks of 11 September 2001 illustrates the limits of nuclear deterrence. Additionally, some believe the combination of international taboos against the use of nuclear weapons and their unprecedented destructiveness may convince potential adversaries, particularly terrorists and rogue states, that the United States will be self-deterred from retaliating

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[326] Amy F. Woolf, *U.S. Nuclear Weapons: Changes in Policy and Force Structure* (Washington D.C.: Congressional Research Service, 2005), 1, CRS, RL31623.

[327] Ibid., 2.

[328] Ibid., 5.

[329] Ibid.

with nuclear weapons unless its national survival is at stake.[330] The administration plans to address this perceived deterrence "credibility gap" through improved capabilities for conventional strike and defense.

a. The 2001 Nuclear Posture Review

In January 2002, the Department of Defense presented the classified Nuclear Posture Review (NPR) to Congress where it generated significant controversy and was eventually leaked to the press in March of that year.[331] The NPR does two primary things. First, it established a "New Triad" as the foundation for U.S. strategic deterrence. Second, the NPR establishes the baseline nuclear force structure and posture that was later codified in the 2002 Moscow Treaty.

The framework for U.S. strategic deterrence defined by the New Triad expands in scope of to include defenses and infrastructure in addition to the traditional strike forces. The first leg consolidates the former nuclear triad (bombers, ICBMs and ballistic missile submarines) into one and adds an expanded capability for precision conventional strike to form the "offensive strike forces."[332] The second leg of the New Triad consists of active and passive defenses, including national missile defense, and the third leg consists of a revitalized nuclear weapons infrastructure.[333] All three legs of the New Triad are "bound together" by enhanced command and control and intelligence capabilities. The Secretary of Defense, in his forward, acknowledges and justifies the resource implications of the New Triad as follows:

> Constructing the New Triad, reducing our deployed nuclear weapons, and increasing flexibility in our strategic posture has resource implications. It costs money to retire old weapons systems and create new capabilities. Restoring the defense infrastructure, developing and deploying strategic defenses, improving our command and control, intelligence, planning, and non-nuclear strike capabilities require new defense initiatives and investments. However, these investments can make the U.S. more secure while reducing our dependence on nuclear weapons.[334]

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[330] Woolf, U.S. Nuclear Weapons, 6.

[331] Ibid., 2.

[332] Department of Defense, *Nuclear Posture Review [Excerpts]* (Washington D.C., 2002) [on-line]; available from http://www.globalsecurity.org/wmd/library/policy/dod/npr.htm; Internet; accessed July 2005.

[333] Ibid.

[334] Nuclear Posture Review.

As stated above, the New Triad intends to reduce U.S. reliance on nuclear weapons and improve the ability to deter WMD attacks by greater emphasis on non-nuclear strike capabilities. The NPR asserts that "U.S. nuclear forces, alone are unsuited to most of the contingencies for which the United States prepares" and that a "new mix" of conventional and nuclear forces is necessary to address the "diverse set of potential adversaries and unexpected threats the United States may confront in the coming decades."[335] Non-nuclear strike forces are also advantageous for limiting "collateral damage and conflict escalation."[336] One particularly interesting passage in the NPR mentions that improvements in the accuracy and timeliness of targeting information may make it possible to substitute non-nuclear strike capabilities for nuclear weapons in some cases.[337] Industry analysts have determined that conventional PGS capabilities could cover between 10 and 30 percent of the targets now covered by nuclear weapons and United States Strategic Command wants to conduct a study to more definitively assess this possibility.[338] Finally, in line with the thinking of the Strategic Deterrence Joint Operating Concept, the NPR asserts that long-range precision strike capabilities that are able to strike "a wide range of targets throughout an adversary's territory may dissuade a potential adversary from pursuing threatening capabilities.[339]

From a force structure perspective, the NPR is less of a departure from the familiar. The NPR bases the size of the nuclear force off of the ability to address three types of contingencies. First, the force must be able to handle "immediate contingencies" in response to "well-recognized, current dangers," such as responding to a WMD attack.[340] The second type of contingency is what the NPR describes as a "potential contingency," which consist of "plausible, but not immediate dangers," such as the emergence of new hostile competitors or the re-emergence of a "hostile peer

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[335] Nuclear Posture Review, 7.

[336] Ibid., 13.

[337] Ibid., 15.

[338] Amy F. Woolf, *Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress* (Washington D.C.: Congressional Research Service, 2005), 3, CRS, RL33067.

[339] Nuclear Posture Review, 12.

[340] Woolf, U.S. Nuclear Weapons, 16.

competitor."[341] The final category consists of "unexpected contingencies" that present "sudden and unpredicted security challenges," such as could result from a regime change in an existing nuclear power that transfers control of its weapons to a hostile government.[342]

Te actual end-state totals of nuclear weapons represent a significant reduction below the levels negotiated under START, but do not go as low as many had hoped. The following table (Table 2) displays the projected 2012 end-state numbers, derived from Congressional Research Service Estimates, for warheads and delivery vehicles.[343] These warhead totals were codified in the 2002 Moscow Treaty.

Delivery Vehicle Type	Number	Accountable Warheads	Remarks
Minuteman III	**500**	**500**	All downloaded to single-warhead configuration
Trident II (D-5)	**336**	**864**	Assumes 12 deployed SSBNs with 24 D-5s each; 3 warheads per missile; excludes 2 subs in overhaul
B-52H	**76**	**500**	Can carry 20 ALCMs each; assumes only 25 B-52 dedicated to nuclear role
B-2	**21**	**336**	Can carry 16 nuclear weapons each
	933	**2,200**	

Table 2. United States Planned Nuclear Weapons Totals by 2012

One should note that the force structure totals (delivery vehicles) are the same as were agreed to for START II and the lower warhead totals required by the Moscow treaty are achieved by only counting "operationally deployed" warheads (those actually mated to missiles or stored near bombers) and downloading the number of warheads each delivery vehicle can carry.[344] The NPR specifically states that the warheads removed in this downloading process will be retained in storage "as a basis for reconstituting the responsive force."[345] The decision to keep the removed warheads in storage as a hedge against future contingencies is one of the more controversial aspects of the NPR. In a relatively short time period the number of deployed warheads could jump to nearly 3,500 (the START II levels) by simply increasing the number of warheads carried by each Trident II and by making more weapons available to the B-52 fleet.

341 Woolf, U.S. Nuclear Weapons, 16.

342 Ibid.

343 Ibid., 25-6.

344 Ibid.,

345 Nuclear Posture Review, 54.

b. U.S. Nuclear Posture

In addition to presenting the recommended strategic force structure, the NPR, somewhat surprisingly, recommended no changes to the alert status of U.S. nuclear forces. The bombers will remain off-alert (though capable of being generated to nuclear alert), the ballistic missile submarines will continue their deployments, and, most significantly, the ICBMs will remain on-alert. During the 2000 presidential campaign, candidate George W. Bush promised sweeping changes in the U.S. nuclear posture including a pledged to "remove as many weapons as possible from high-alert, hair-trigger status."[346] In that same speech he characterized weapons on hair-trigger alert as an "unnecessary vestige of Cold War confrontation."[347] The NPR's answer to this pledge is found in the following statement:

> U.S. forces are not on "hair trigger" alert and rigorous safeguards exist to ensure the highest levels of nuclear weapons safety, security, reliability, and command and control. Multiple, stringent procedural and technical safeguards are in place to guard against U.S. accidental and unauthorized launch.[348]

Unfortunately, this view is unlikely to be shared by Russia and, no doubt, contributes to maintenance of a similar posture of its ICBM force.

Several prominent public figures have spoken out against the continuance of high alert levels since the release of the NPR in 2002. For example, former Senator Sam Nunn cited a RAND report in a recent speech that pointed out that the risk of nuclear use between the United States and Russia is inconsistent with the other aspects of the relationship between the countries.[349] Senator Nunn summarizes the situation as one where by "keeping our nuclear weapons on hair trigger now increases the risk it was designed to reduce."[350] In a recent article, former Secretary of Defense Robert McNamara characterized current U.S. nuclear policy as "immoral, illegal, militarily

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[346] Sam Nunn, "A New Triumph of Sanity" (Speech presented at the Carnegie International Non-Proliferation Conference, 21 June 2004). [on-line] ; available from http://www.nti.org/c_press/statement_nunnceip_062104.pdf; Internet; accessed March 2005.

[347] Ibid.

[348] Nuclear Posture Review, 25.

[349] Nunn, 4.

[350] Ibid., 5.

unnecessary, and dreadfully dangerous."[351] He also argues that, "To launch [nuclear] weapons against a nuclear power would be suicide. To do so against a non-nuclear enemy would be militarily unnecessary, morally repugnant, and politically indefensible."[352]

It seems that the authors of the NPR recognized these concerns as evidenced by the new emphasis placed on non-nuclear strike and defense capabilities, but could not muster the bureaucratic courage to make any tough force structure choices. As noted above, almost all reductions will be made by downloading, rather than eliminating existing delivery vehicles. This could be the result of the lingering effects from the last time such "radical" steps were proposed. During the conduct of the previous NPR in 1994, Ashton Carter, President Clinton's assistant secretary of defense for nuclear security and counterproliferation, proposed and championed significant changes to the U.S. ICBM force. His attempts to introduce options for the significant reduction, the elimination, or at least the de-alerting of the Minuteman ICBM force "triggered a revolt" in the Pentagon.[353] Perhaps, now over three and a half years after the release of the NPR, it is time to reassess the alert levels of U.S. nuclear forces in light of the trade-offs that may be possible concerning conventional PGS capabilities. De-alerting or eliminating U.S. land-based nuclear-armed ICBMs could eliminate a significant source of concern over the employment of conventional PGS capabilities, namely the potential for a nuclear-armed nation to misinterpret the launch as a nuclear attack.

2. Russia

During the Cold War and most of the following decade, a realist theoretical perspective of international relations formed the central tenant of Soviet (and later Russian) foreign policy thinking. Mutual threat and rivalry kept the superpowers focused on nuclear issues. The Soviets thought in terms of a "geopolitical triad" based on zero-sum games, balances-of-power, and spheres of influence.[354] The concept of zero-sum games was a product of the bipolar Cold War environment where a gain for one

351 Robert S. McNamara, "Apocalypse Soon," *Foreign Policy* (May/June 2005) : 29.

352 Ibid., 32.

353 Janne E. Nolan, *An Elusive Consensus: Nuclear Weapons and American Security After the Cold War* (Washington D.C.: Brookings Institution Press, 1999), 54.

354 Bobo Lo, *Vladimir Putin and the Evolution of Russian Foreign Policy* (London: Blackwell Publishing, 2003), 72.

superpower automatically resulted in a loss for the other.[355] Regarding the concept of a balance-of-power, the Soviets regarded the nuclear balance, based on rough parity rather than numerical equality, as the most important balance with the West.[356] The concept of spheres of influence attained prominence during the Yeltsin years and was a source of increased Russian tensions over NATO expansion and the NATO campaign against Serbia.[357]

Concurrently with the greater sense of partnership between the United States and Russia, a "new Russian thinking" has emerged regarding their approach to foreign policy. Under President Putin, Russian foreign policy thinking has begun to alter all three areas of the traditional "geopolitical triad" through a "twofold" approach that: 1) avoids mention or suggestion of political-strategic competition with the West and 2) pursues a more "selfless" approach to strategic stability.[358] The zero-sum approach of the past is evolving into a "positive-sum" mindset.[359] Also, President Putin is pursuing an agenda of "cooperative balance" that emphasizes areas for cooperation or collective action (e.g., nonproliferation of nuclear weapons) rather than areas that highlight divisions.[360] Finally, he is adopting a "more sophisticated treatment" of spheres of influence that does not force Russia to fight battles it can not win (e.g., supporting, rather than resisting a United States presence in Central Asia after 9/11).[361]

Bobo Lo points out that Russia's transition to new foreign policy thinking is "evolutionary" rather than "revolutionary" in nature and that even though significant progress has been made, "regime attitudes towards security and geopolitics continue to bear the stamp of their Soviet (and Yeltsinite) past."[362] Despite their progress toward "new thinking," the Russians cling to two vestiges of their realist past. The first is their belief that Russia is a "great power," which places them one step above "regional power"

[355] Lo, 74.

[356] Ibid., 76 and 88.

[357] Ibid., 81.

[358] Ibid, 75.

[359] Ibid.

[360] Ibid., 79.

[361] Ibid., 82 and 95.

[362] Ibid, 95.

status but is one step below its former status as a "superpower."[363] The nuclear balance remains important to Russia since nuclear weapons remain its "most potent symbol of its identity as a great power."[364]

a. Russian Nuclear Doctrine

Following the collapse of the Soviet Union, the massive political and economic changes undertaken by the Russian government resulted in significant hardships for nearly all of Russian society. The military was particularly hard hit. The former Soviet military was divided among the 15 former Soviet Republics in a rather haphazard fashion, mostly depending on where particular units were stationed when the Soviet Union broke up. Funds for procurement, operations, maintenance, and personnel were drastically cut. The drawdown of Russian general purpose forces in the post-Soviet era may be viewed, without exaggeration, as a near catastrophe. The size and readiness levels of the Russian military forces fell off drastically and are only now beginning to stabilize. Given this situation, many in the Russian military and government believed that nuclear weapons would provide the "best bang for the buck" until the economy could gain strength and allow greater spending on conventional weapon systems.

In recognition of the relative strength of Russia's nuclear forces and the weakness of its general purpose forces, Russia's new military doctrine emphasizes the role of nuclear weapons in deterring aggression and warfighting. Under the new doctrine, Russia reserves the right to use nuclear weapons if attacked with nuclear weapons or other weapons of mass destruction, and more significantly, in response to "large-scale aggression using conventional weapons."[365] The new Russian doctrine is reminiscent of the "massive retaliation" strategy employed by the United States in the 1950s when it was believed that it would be too expensive to match the Soviet Union's conventional superiority. Ironically, Russia's current nuclear doctrine is the result of a reversal of roles where it now perceives an inability to match the growing conventional

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[363] Andrei Kokoshin, "What is Russia: a Superpower, a Great Power, or a Regional Power," *International Affairs – A Russian Journal* No. 6 (2002) : 14; [on-line] ; available from http://www.ciaonet.org/olj/iarj/iarj_02_06a.html; Internet; accessed March 2005.

[364] Lo, 88.

[365] Steven F. Main, "The Strategic Rocket Forces, 1991-2002," in *Russian Military Reform: 1992-2002*, ed. Anne C. Aldis and Roger McDermott (Portland, OR: Frank Cass, 2003), 113.

capabilities of the West, particularly in precision guided munitions and stealth technology.

The origins of this doctrine extend back to the mid-1980s and the final years of the Soviet Union. The deployment of U.S. land, sea, and air-launched cruise missiles capable of carrying both conventional and nuclear warheads caused concern among Soviet military leaders over the possibility of "strategic conventional attacks."[366] The inability to differentiate nuclear cruise missiles from conventional ones led the Soviets to claim they would have to respond as if the attack involved nuclear weapons.[367] The Soviets asserted that this type of response was consistent with their declared policy of "no first use" of nuclear weapons because they would be responding to "nuclear" warning.[368]

The display of American high-tech precision weapons and stealth aircraft during Operation DESERT STORM in early 1991 further contributed to Soviet (and later Russian) concerns over Western conventional superiority. The apparent ease with which the U.S.-led coalition destroyed Iraq's Soviet equipped and trained military was particularly alarming.[369] In May of 1991, General Igor Rodionov stated in an interview that the Soviet Union's hard-won parity with the West had been "destroyed" as a result of the huge disparity that existed between Soviet and American conventional weaponry.[370] These concerns did not dissipate with the fall of the Soviet Union. According to Peter Pry, numerous Russian military writings express the concern that "the United States could launch a surprise attack using advanced conventional weapons to destroy Russia's nuclear forces, and then blackmail Moscow into submission with the threat of nuclear annihilation."[371]

The expansion of NATO eastward and the air campaign conducted against Serbia in the late-1990s appears to have been the peak of Russian concerns about a

366 Rose Gottemoeller, "Nuclear Weapons in Current Russian Policy," in *The Russian Military: Power and Policy*, ed. Steven E. Miller and Dmitri Trenin (Cambridge, MA: MIT Press, 2004), 196.

367 Ibid.

368 Ibid.

369 Peter Vincent Pry, *War Scare: Russia and America on the Nuclear Brink* (Westport, CT: Praeger, 1999), 66.

370 Ibid., 67.

371 Ibid., 100.

possible NATO attack. Russian military analysts of the time chose to interpret Operation ALLIED FORCE as "an image of a possible future scenario with Russia on the receiving end of surgical strikes against industrial, infrastructure, and military targets," to selectively destroy Russia's nuclear forces and command and control without provoking a nuclear response.[372] This is exactly the type of scenario Russia's new nuclear doctrine, that disavows "no nuclear first use," is designed to deter. The use of nuclear weapons in response to a conventional attack was simulated in Russia's first post-Cold War major military exercise, known as Zapad-99, in June of 1999, coincidentally on the heels of NATO's campaign against Serbia.[373] In this exercise, the scenario involved aggression against Kaliningrad and Belarus to which "Russian forces responded to precision strikes on Russian and allied territory with limited nuclear strikes against the countries from whose territories the offensive was launched."[374] This exercise evaluated the concept of using nuclear weapons to "de-escalate" a conflict where conventional forces were not able "to mount a sustained defense of Russia's national interests."

b. Russian Nuclear Force Structure

As one would expect, given Russia's doctrinal emphasis on nuclear weapons, the nuclear forces have experienced a relatively gradual reduction in forces. Most of the reductions that have occurred to date are the result of arms control agreements negotiated before the fall of the Soviet Union. The following table (Table 3) presents Russian delivery vehicle and warhead totals current as of April 2005.[375]

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[372] Roy Allison, "Russia, Regional Conflict, and the Use of Military Power," in *The Russian Military: Power and Policy*, ed. Steven E. Miller and Dmitri Trenin (Cambridge, MA: MIT Press, 2004), 145.

[373] Jacob W. Kipp, "War Scare in the Caucasus: Redefining the Threat and the War on Terrorism," in *Russian Military Reform 1992-2002*, ed. Anne C. Aldis and Roger N. Mc Dermott (Portland, OR: Frank Cass Publishers, 2003), 248.

[374] Ibid.

[375] Robert S. Norris and Hans M. Kristensen, "Russian Nuclear Forces, 2005" *Bulletin of the Atomic Scientists* 61, no. 2 (March/April 2005) : 70-72. [on-line] ; available from http://www.thebulletin.org/print_nn.php?art_ofn=ma05norris; Internet; accessed July 2005.

Delivery Vehicle Type	Number	Warheads	Remarks
ICBMs			
SS-18	**100**	**1,000**	Approximately 50 will retire by 2009
SS-19	**130**	**780**	Most will retire by 2009; 30 new missiles in storage
SS-24	**15**	**150**	Will retire in 2005
SS-25	**300**	**300**	Will be withdrawn by early next decade
SS-27	**40**	**40**	In low-rate production
SLBMs			
SS-N-18	**96**	**288**	Assumes six Delta III subs; 3 warheads per missile
SS-N-23	**96**	**384**	Assumes six Delta IV subs; 4 warheads per missile; total includes 3 subs in overhaul
Bombers			
Tu-95 (MS6)	**32**	**192**	Can carry 6 ALCMs or bombs
Tu-95 (MS16)	**32**	**512**	Can carry 16 ALCMs or bombs
Tu-160	**14**	**168**	Can carry 12 ALCMs, SRAMs, or bombs
Total	**855**	**3814**	

Table 3. Russian Delivery Vehicle and Warhead Totals

While the above numbers would seem to indicate a rather robust nuclear force, they only tell half of the story. In spite of the fact that the Strategic Rocket Forces were receiving 80 to 90 percent of the Russian military procurement budget by 2000, the Russian nuclear forces will face significant attrition as 80 percent of the ICBMs and SLBMs will reach the end of their operational-lifespan by 2010.[376] Russia hopes to extend the service-lives of some of the SS-18s and SS-19s to 2016, but the prospects for success are highly uncertain.[377] Originally, Russia hoped to produce about 400 SS-27s between 1998 and 2010, but this number was revised downward to 150-170.[378] Even this lower number is unlikely, given the current production rate of only six missiles per year.[379] The sea-based portion of the Russian nuclear triad faces even greater obstacles to modernization. There are currently two new Borey-class ballistic missile submarines

376 Frank Umbach, "Nuclear Versus Conventional Forces: Implications for Russia's Future Military Reform," in *Russian Military Reform: 1992-2002*, ed. Anne C. Aldis and Roger McDermott (Portland, OR: Frank Cass, 2003), 78, 84.

377 Ibid., 91.

378 Ibid., 83.

379 Ibid.

under construction and a third one planned.[380] Each will be capable of carrying twelve SLBMs, however, the Bulava SLBM has not yet been flight tested.[381]

Without successful service-life extension programs or new procurement by the end of this decade, the Russian nuclear forces will consist of approximately 200 ICBMs, a largely obsolete bomber fleet, and potentially no SLBMs. The Russian nuclear forces may have received emphasis in doctrine and in the budget, but it has not been enough to ensure a sustainable force into the next decade. Russia finds this particularly distressing in light of a theoretical U.S. ability to "upload" 2,400 stored nuclear warheads, without prior warning, to existing missiles and bombers.[382] Russia will not have this option since its reductions to meet the 1,700 to 2,000 deployed warhead limit imposed by the Moscow Treaty are primarily being made by eliminating delivery systems.[383] By the beginning of the next decade, Russia could find itself close to nuclear parity with Britain, France, and possibly China.

c. Russian Missile Warning System and Nuclear Posture

In the late-1960s the Soviet Union began to deploy elements of a comprehensive missile attack warning system intended to provide timely detection of an incoming strike, assess its scale, determine its origin, and estimate possible damage in order to allow leadership to choose an appropriate course of action.[384] A warning system with these capabilities is an essential element of a launch-on-warning posture that enables leaders to launch a retaliatory strike while under attack. This strategy attempts to maximize the size of the retaliatory force by launching alert forces before they can be destroyed. However, the extremely grave consequences of a false alarm mandate that the warning system possess unquestioned reliability. According to analysis by Pavel Podvig, the Soviet Union never completed a comprehensive warning system capable of detecting

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380 Norris and Kristensen, 70-2.

381 Ibid.

382 Nikolai Sokov, "The Russian Nuclear Arms Control Agenda After SORT," *Arms Control Today* (April 2003) : 1. [on-line]; available from http://www.armscontrol.org/act/2003_04/sokov_apr03.asp?print; accessed September 2005.

383 Ibid.

384 Pavel Podvig, "History and the Current Status of the Russian Early-Warning System," *Science and Global Security* 10, no. 1 (2002) : 21-2.

all possible threats.[385] Technical difficulties and delays combined to lower the Soviet's (and later the Russian's) expectations for what the system could provide. Based on the reality of their system's limited capabilities, the Russians appear to have settled for a system that can provide warning of a massive attack, but not necessarily detect isolated launches from all possible threat locations.[386]

At its high point in the late-1980s, the Soviet warning system consisted of a network of missile warning radars and satellites. The radars provided coverage of all approaches to Soviet territory, except for a gap that was opened to the northeast towards possible SLBM launch locations in the northern Pacific Ocean when the radar at Krasnoyarsk was determined to violate the Anti-Ballistic Missile Treaty of 1972.[387] The space-based warning system consisted of eight to nine satellites in highly-elliptical orbits (HEO) augmented by a single satellite in geo-synchronous orbit that provided coverage of ICBM fields in the United States, but provided virtually no capability to detect SLBM launches.[388]

Following the breakup of the Soviet Union in 1991, Russia inherited a capable warning system that has since deteriorated for a variety of reasons. As a result of technical problems and funding issues, the space-based portion of the warning system has only two operational HEO satellites remaining, which each provide only six hours of coverage per day.[389] A significant gap in Russia's westward facing radar coverage opened when the government of Latvia demolished the warning radar at Skrunda in 1998, but a new radar site brought on-line in Belarus has since mostly closed the gap.[390] Overall, the space-based portion of the warning system remains fragile and the majority of the radar network is located in other countries (Ukraine, Belarus, Kazakhstan, and Azerbaijan) and could become a hostage to changing relations.

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385 Podvig, History of the Russian Early-Warning System, 22.

386 Ibid., 23.

387 Ibid., 30.

388 Ibid., 48.

389 Ibid., 50 and David Hughes, "Perilous Nuclear Shadow," *Aviation Week and Space Technology* (30 June 2003)

390 Podvig, History of the Russian Early-Warning System, 31-2.

The jury is still out on what level of danger the deteriorating state of Russia's missile warning systems represents. Does the imperfect vision of Russia's warning system make it more likely to launch missiles based on false or misinterpreted data, or does knowledge of the system's limitations induce caution and restraint? The following real-world event is often cited as "proof" for both of these arguments.

On 25 January 1995, NASA launched a Black Brant scientific rocket from Norway towards the North Pole that was initially misidentified by a Russian early-warning radar site as an American Trident II SLBM launched from the North Sea toward Russia.[391] President Yeltsin is reported to have accessed his equivalent of the "nuclear football" in preparation to initiate a possible nuclear retaliatory strike, but instead of ordering a launch, he and his advisors remained vigilant for signs of a broader attack.[392] In a classic demonstration of bureaucracy at work, Norway provided the necessary prior notification of the launch, but it was not forwarded to the Russian military.[393]

Pavel Podvig sees the deterioration of the Russian system as an opportunity for stability, not as a prescription for disaster. In his view,

> the Russian early-warning system…has virtually lost it importance as an integral component of the command and control system of nuclear forces. The quality of information about missile launches that the system can provide and its reliability seem to be so low that it is highly that this information will ever be used as a basis for a decision to initiate a launch-on-warning strike. The only marginal capability the system seems to provide is a detection of a massive missile attack.[394]

His philosophy is "if it is broken, don't fix it."[395] If the Russian early-warning system were to eventually fail completely as a result of gradual degradation, the potential for hasty, possibly erroneous retaliation decisions would fade away with it.

The other side of the debate, represented by a 2003 RAND study perceives danger, not stability as the natural result of continued degradation of Russia's early-

[391] Peter Vincent Pry, *War Scare: Russia and America on the Nuclear Brink* (Westport, CT: Praeger Publishers, 1999), 222.

[392] Ibid., 225-7.

[393] Ibid., 217-8.

[394] Podvig, 54.

[395] Pavel Podvig, "Reducing the Risk of Accidental Launch: Time for a New Approach?" PONARS Policy Memo 328, November 2004 [document on-line] ; available from http://www.csis.org/ruseura/ponars/policymemos/pm_0328.pdf; Internet; accessed 4 March 2005.

warning system coupled with alert nuclear forces. In the scenario above, the report author credits Russia's restraint and patience to its ability to receive confirmation from its early-warning satellites that U.S. ICBMs were still in their silos, a luxury that is now only available about 25 percent of the time.[396] In a statement by the report's author quoted in an Aviation Week article, he describes today's situation as follows:

> So the sum of all our fears in this is we have a blind, vulnerable Russia that might be compelled to launch very quickly in a crisis based on very little, if any, early warning information…and if there was a [nuclear] detonation on Russian soil, how could Russian leaders know if it came from the U.S., a terrorist, a ballistic missile from the South or detonation of an aging Russian weapon? Today the greatest threat from Russia comes not from its strength, but from its weakness.[397]

In addition to Russia's worsening blindness to surprise attack, The RAND report finds other aspects of Russia's nuclear posture potentially destabilizing. The vast majority of Russia's alert nuclear forces are ICBMs based in fixed silos or road-mobile SS-25s that are largely restricted to garrison. According to RAND analysts, Russia is only able to keep one or two ballistic missile submarines on patrol with sixty-four warheads each and between nine and eighteen single-warhead SS-25 "on the road" at a time.[398] The "survivable" fraction of Russian strategic forces (assuming there is a threat) amounts to between 2 and 4 percent of its total available warheads.

3. China

Throughout the Cold War, the United States and Russian thinking was dominated by the bi-polar balance between the superpowers. China's focus, even after becoming a nuclear power itself, was and remains distinctive. Chinese grand strategy relies on a two-part concept to evaluate and maintain the proper balance between economic development and a security environment conducive to the former.[399] The first part is the concept of "comprehensive national power" (CNP) that Chinese planners use to "evaluate and measure" China's national standing relative to other nations based on "qualitative and

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[396] Hughes, 66-7.

[397] Hughes, 67.

[398] Ibid., 66.

[399] Office of the Secretary of Defense, *Annual Report to Congress: The Military Power of the People's Republic of China* (Washington D.C., 2005), 9. [on-line]; available from http://www.defenselink.mil/news/Jul2005/d20050719china.pdf; Internet; accessed July 2005.

quantitative measures of territory, natural resources, economic power, diplomatic influence, domestic government, military capability, and cultural influence."[400] The second portion of the concept is the "strategic configuration of power," or "shi," which translates roughly as "alignment of forces."[401]

More recently, another strategy, known as the "24 Character Strategy," has been employed by China's security and diplomatic services as a way to "downplay China's ambitions" in the short-term and "build up China's power to maximize options for the future" over the long-term.[402] Specifically, the guidance first issued by Premier Deng Xiaoping in the early 1990s directed the following: "observe calmly; secure our position; cope with affairs calmly; hide our capacities and bide our time; be good at maintaining a low profile; never claim leadership; and make some contributions." Taken together, the concepts of CNP and "shi" and the "24 Character Strategy" provide a useful basis for understanding Chinese nuclear policy and strategy, as well as, possible Chinese reactions to future U.S. conventional PGS capabilities.

a. Chinese Nuclear Strategy

Assessing the true nature of Chinese nuclear strategy has seemed to present a difficult challenge for Western observers and analysts. This may be largely due to the fact that China's approach to nuclear possession and use differs so drastically from the deterrence concepts familiar to observers of the United States and Soviet Union. This "square peg" does not fit into the "round hole" we have constructed for it. In a recent article, Sun Xiangli, Deputy Director of the Arms Control Research Division at the Beijing Institute of Applied Physics and Computational Mathematics, attributes three characteristics to Chinese nuclear strategy: 1) the policy of "no first use," 2) retaining only a limited nuclear deterrent force, and 3) support for complete world-wide nuclear disarmament.[403] This framework is used to provide insight into Chinese nuclear thinking and strategy with particular regard to the likely effect of growing conventional superiority by the United States.

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[400] Military Power of the PRC, 9.

[401] Ibid.

[402] Ibid., 11.

[403] Sun Xiangli, "Analysis of China's Nuclear Strategy," *China Security*, no.1 (Autumn 2005) : 25-6. [on-line] ; available from http://www.wsichina.org/attach/china_security.pdf; Internet; accessed August 2005.

The Chinese policy of "no first use" of nuclear weapons dates back to China's first nuclear test explosion on 16 October 1964.[404] From the very beginning of its status as a nuclear weapons state, China pledged to never be the first to use nuclear weapons under any circumstances and to never use nuclear weapons against non-nuclear weapons states.[405] This pledge was deeply rooted in Mao Zedong's personal belief that nuclear weapons could serve only the single purpose of retaliating against a nuclear attack.[406] The policy was also a carefully crafted attempt to present a non-confrontational nuclear doctrine that would not invite preemptive nuclear strikes by the United States or Soviet Union.[407] China is the only declared nuclear weapons state to have consistently adhered to an unconditional "no first use" policy.

In recent years, some analysts believe the growing conventional superiority of the United States could force China to move away from its "no first use" policy. Pan Zhenqiang, a retired Major General of the People's Liberation Army, contends that "unlike all the other nuclear weapons states…China has never intended to use its nuclear capability to make up for the inefficiency of conventional capabilities vis-à-vis other world powers."[408] Such a policy change could have several detrimental effects for China including: instigating confrontational bi-lateral relations with the United States; increasing crisis management risk; undermining international arms control efforts; damaging China's international reputation; and complicating regional relations.[409]

The second fundamental aspect of Chinese nuclear strategy involves maintaining a small, defensively oriented nuclear force. Mao believed even small nuclear arsenals represented overkill and a danger to humanity, and thus chose to avoid a costly

404 Shen Dingli, "Nuclear Deterrence in the 21st Century," *China Security*, no. 1 (Autumn 2005) : 10. [on-line] ; available from http://www.wsichina.org/attach/china_security.pdf; Internet; accessed August 2005.

405 Pan Zhenqiang, "China Insistence on No-First-Use of Nuclear Weapons," *China Security*, no. 1 (Autumn 2005) : 5. [on-line] ; available from http://www.wsichina.org/attach/china_security.pdf; Internet; accessed August 2005.

406 Ibid.

407 Dingli, 11-12.

408 Zhenqiang, 5-6.

409 Ibid., 6-7.

arms race with the United States and/or the Soviet Union.[410] Based on this belief, Moa chose to build a small nuclear arsenal based on the principle of "minimum deterrence" where even a small number of nuclear weapons, if they could be reliably delivered to their targets, would be enough to inflict "unacceptable damage" on any would be attacker.[411] The level of destruction China believed necessary to achieve "unacceptable damage" was significantly less than called for by contemporary Western estimates, such as those by Robert McNamara that called for a minimum of 400 nuclear weapons to deter the Soviet Union.[412] Continued adherence to "no first use" allows China to keep its nuclear totals low by only requiring a number of weapons sufficient for what the Chinese call a "minimum retaliating strike."[413] The relatively small size of China's nuclear force today provides evidence that it remains committed to minimum deterrence.

The third aspect of China's nuclear strategy is a commitment to global nuclear disarmament. Maintaining a very small nuclear force and policy of "no first use" should serve to deemphasize the importance of nuclear weapons and contribute to China's credibility as an advocate for disarmament. China has called for all nuclear weapon states to sign a treaty that renounces the "first use" of nuclear weapons under any circumstances as a further step toward fulfilling the obligations of Article VI of the Non-Proliferation Treaty.[414]

b. Chinese Nuclear Force Structure and Posture

In accordance with China's policy of "no first use" and strategy of minimum deterrence, its deployed force of nuclear delivery systems and warheads remains the smallest, by far, of the three nuclear powers covered in this chapter. China's "triad" of strategic forces consists primarily of land-based missiles, but it does have approximately 100 obsolete medium-range bombers (based on the Soviet's 1950s era Tu-

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410 Bruce G. Blair, "General Zhu and Chinese Nuclear Preemption," *China Security*, no. 1 (Autumn 2005) : 15. [on-line] ; available from http://www.wsichina.org/attach/china_security.pdf; Internet; accessed August 2005.

411 Xiangli, 23-26.

412 Ibid., 26.

413 Ibid.

414 Zhenqiang, 6.

16) and a single ballistic missile submarine.[415] Currently, China has only about twenty nuclear delivery vehicles capable of reaching the continental United States and another twenty that could threaten Alaska and Hawaii.[416] The following table (Table 4) provides a summary of China's current strategic nuclear forces based on estimates from the Department of Defense and the *Bulletin of the Atomic Scientists*.[417]

Delivery Vehicle	**Number**	**Range (kilometers)**	**Remarks**
Land-Based Missiles			
DF-3A (CSS-2)	**14-18**	**2,790-2,900**	6-10 Launchers
DF-4 (CSS-3)	**20-24**	**5,470-5,500**	10-14 Launchers
DF-5/5A (CSS-4)	**20**	**8,460-13,000**	Silo-based; Upgrading to Mod 2
DF-21A (CSS-5)	**19-23**	**1,770-1,800**	34-38 Launchers
DF-31 (CSS-X-10)	**0**	**7,250-8,000**	Developmental; road-mobile; initial deployment in 2005-2006
DF-31A	**0**	**11,270-12,000**	Developmental; road-mobile; initial deployment in 2007-2009
SLBMs			
JL-1 (CSS-NX-3)	**12**	**1,770+**	One Xia-class sub; 12 missiles
JL-2 (CSS-NX-4)	**0**	**8,000**	Developmental; based on DF-31
Bombers			
Hong-6 (B-6)	**100**	**3,100**	Estimated number nuclear capable
Total	**185**		All missiles and bombers are assumed to carry single warheads/bombs

Table 4. Chinese Nuclear Forces

In addition to its relatively small size, when compared to the rival forces fielded by the United States and Russia, China's nuclear force maintains a very low state of readiness. For example, the DF-5A (CSS-4) silo-based ICBMs must be elevated to the surface for launch and reports indicate that the missiles are stored unfueled and without

415 Robert S. Norris and Hans M. Kristensen, "Chinese Nuclear Forces, 2003," *Bulletin of the Atomic Scientists* 59, no. 6 (November/December 2003) : 77-80. [on-line] ; available from http://www.thebulletin.org/print_nn.php?art_ofn=nd03norris; Internet; accessed July 2005.

416 Ibid.

417 Please see: Norris and Kristensen, Chinese Nuclear Forces, and Military Power of the PRC, 45.

warheads on a day-to-day basis.[418] The Chinese effort to develop a more survivable nuclear force has progressed slowly. The road-mobile DF-31 ICBM was successfully tested in 1999, but has not yet entered service.[419] A longer range version, the DF-31A, capable of reaching targets in the continental United States is expected to enter service by the end of the decade.[420] Development of a ballistic missile submarine, traditionally viewed as a prerequisite for a survivable second strike capability, has been a lengthy development process for China. The Xia, China's lone ballistic missile submarine, was launched in 1981, but did not successfully launch a JL-1 missile until 1988.[421] As of 2003, the Xia's missile system was still not fully operational, and the submarine had yet to sail beyond Chinese territorial waters.[422] The Xia is stationed at the Jianggeshuang submarine base, which is believed to be the storage location for its JL-1 missile warheads.[423] Work has begun on a new ballistic missile submarine program, Project 094, designed to carry an SLBM derived from the DF-31, but estimates place deployment of this capability well into the future.[424]

Bernard Brodie theorized nearly sixty years ago that for a nuclear deterrent force to be effective, it only needed to provide a credible threat of retaliation in kind.[425] The relatively small size of China's nuclear force, combined with fixed-site basing and low readiness levels would seem to leave it vulnerable to preemptive elimination by the superior nuclear forces of the United States and Russia, or even the advance conventional precision munitions available to the United States. However, this situation represents nothing new for China. One possible explanation for China's apparent lack of concern could be an assessment that the United States and Russia are not very motivated (if motivated at all) to attack, so very little is necessary to deter them. China's gradual move towards mobile forces should be viewed as a positive change that

[418] Norris and Kristensen, Chinese Nuclear Forces, and Brad Roberts, Robert A. Manning, and Ronald N. Montaperto, "China: The Forgotten Nuclear Power," *Foreign Affairs* 79, no. 4 (July/August 2000) : 55.

[419] Roberts, Manning, and Montaperto, 56, and Military Power of the PRC, 28.

[420] Military Power of the PRC, 28.

[421] Norris and Kristensen, 77-80.

[422] Ibid.

[423] Ibid.

[424] Ibid.

[425] Brodie, 74.

could enhance crisis stability by offering better survivability and not require any changes to its day-to-day nuclear alert levels. The world would be a much safer place if the United States and Russia were willing to adopt a similar nuclear posture.

D. ANALYSIS OF POLICY IMPLICATIONS FOR CONVENTIONAL PGS

This section evaluates the impact and severity of potential disruptions to the stability of the global security environment that may result from the introduction of U.S. conventional PGS capabilities. Two specific questions are addressed. First, to what extent could U.S. conventional PGS capabilities create a "security dilemma" by increasing Russian and Chinese perceptions of vulnerability? If vulnerability is increased, what possible actions will Russia and China take to restore a perception of balance? Also, if the United States were to anticipate increased perceptions of vulnerability by Russia and China, what measures could it take to defuse the situation ahead of time? Second, to what extent could the deployment or employment of U.S. conventional PGS capabilities contribute to the risk of an inadvertent nuclear exchange between the United States and Russia or China? How valid is this concern based on the nuclear postures of Russia and China? What measures can the United States implement to mitigate or eliminate this possibility? The answers to these questions will ultimately determine whether U.S. conventional PGS capabilities become valuable military options or a threat to global stability.

1. Will Conventional PGS Create a "Security Dilemma?"

According to the 2001 NPR, the United States desires expanded non-nuclear strike capabilities as a way to reduce its dependence on nuclear weapons and enhance the credibility of its deterrent posture. Conventional PGS capabilities could fill this need by providing a rapid response, precision strike capability that can defeat a variety of target types. Will the deployment of conventional PGS capabilities by the United States cause Russia and China to develop increased perceptions of vulnerability?

In short, the answer is yes. The inherent characteristics that allow conventional PGS capabilities to deny a rogue state or terrorist organization the benefit of its hard and deeply buried facilities, WMD storage areas, and missiles through a preemptive strike, could also be turned against strategic targets, such as missile silos, in Russia and China. Both nations have exhibited concerns over the dominance of existing U.S. conventional forces as demonstrated in DESERT STORM, ALLIED FORCE, ENDURING FREEDOM, and IRAQI FREEDOM. Technically, conventional PGS capabilities do not expand the threat already posed by existing U.S. conventional and nuclear capabilities. However, the greater speed of PGS verses other conventional capabilities and the greater usability verses nuclear capabilities will likely combine to produce a greater overall sense of vulnerability. Even assuming Russia and China do not feel threatened directly, conventional PGS capabilities could be destabilizing if for no other reason than they may make the United States more likely to resort to force instead of diplomacy. Assuming Russia and China perceive greater vulnerability, what, if anything, will they do to reestablish balance with the United States?

As discussed in the case study above, Russia already feels threatened by the conventional warfighting capabilities of the United States. This perceived vulnerability contributed to Russia's decision to renounce the former Soviet Union's "no first use" pledge and adopt a nuclear doctrine that allows for nuclear retaliation in response to attacks with conventional weapons. Other procedural remedies to reduce the vulnerability of Russian strategic forces have also been implemented previously. For example, to reduce their vulnerability to preemptive strike, Russian ICBMs are on alert and are reportedly able to be launched within twelve minutes.[426] The relatively low percentage of "survivable" forces (deployed ballistic missiles submarines and mobile ICBMs outside of garrison) amounts to only 2 to 4 percent of Russia's entire force. While fiscally impractical, increasing the percentage of warheads deployed on ballistic missile submarines or increasing the number of mobile ICBMs deployed outside of garrison could reduce Russia's perceived level of vulnerability. Any reduction in Russia's perception of vulnerability will likely need to come in the form of measures taken by the United States to reduce the threat it projects.

As with Russia, it is fairly certain that U.S. conventional PGS capabilities would contribute to an enhanced sense of Chinese vulnerability vis-à-vis the United States. While having been vulnerable to American conventional and nuclear capabilities for quite some time, China's commitment to "no first use" and minimum deterrence have significantly limited the scope of China's response by preventing increasing the size and

[426] Hughes, 66.

readiness of its strategic forces. China's on-going programs to field mobile ICBMs and improved SLBMs should work to reduce the level of potential crisis instability by increasing the survivability of Chinese strategic forces.

Recently, there have been rumblings from inside China that the time may have come to renounce it policy of "no first use" and minimum deterrence. Major General Zhu Chenghu, Dean of China's National Defense University, presented this case recently in remarks he characterized as his own personal view rather than that of the government.[427] Even though he claimed to be speaking on his own behalf, his remarks generated great controversy in the United States and China.

Bruce Blair, the President of the World Security Institute, recently wrote an article refuting the logic of Zhu's proposal. He argues that China's nuclear program has "remained virtually etched in stone for many decades" in spite of the fact that the superpowers built up huge nuclear arsenals and placed them on "hair-trigger" alert.[428] China's current policy has also endured the more recent provocations of being officially added back to U.S. nuclear war plans as a target in January 1998 and being identified as an "immediate threat" by the 2001 NPR.[429] Blair reasons that if China's nuclear policy has lasted this long in the face of significant nuclear threats, why would it be renounced now in the face of U.S. conventional superiority?[430] Blair also points out that Zhu's proposal to shift to a "first use" policy is suicidal unless China can achieve "a meaningful level of escalation dominance" over the adversary, which given the wide disparity in nuclear capabilities between the United States and China is extremely unlikely to occur without a significant Chinese nuclear buildup.[431] In order to accomplish this buildup, China would need to restart its fissile materials production facility (closed since 1990), design new nuclear warheads, and resume underground nuclear testing, but all of this would involve an "implausibly radical departure from China's current course."[432]

[427] Blair, 15.

[428] Ibid., 16.

[429] Ibid.

[430] Ibid.

[431] Ibid., 18.

[432] Ibid., 18-9.

In summary, both China and Russia would likely perceive a deployed U.S. conventional PGS capability as an additional source of vulnerability. However, neither country will be able to take significant action to restore the balance due to fiscal or policy constraints. Any reduction to the overall level of vulnerability perceived by Russia and China will likely have to come in the form of measures taken by the United States to reduce the level of threat it projects. Possible avenues available to the United States are to limit the deployment of conventional PGS system to a "silver bullet" force sized to not threaten major portions of the Russian and Chinese nuclear deterrent forces. However, restricting the conventional PGS deployment to this size will significantly reduce its ability to provide meaningful support to the Combatant Commanders in support of regional contingencies.

2. Will Conventional PGS Increase the Risk of Inadvertent War?

One of the most common arguments against the deployment or employment of conventional PGS capabilities that operate from or through space is potential that a PGS launch could easily be mistaken for the launch of a nuclear-armed missile. This possibility was again asserted in a recent Congressional Research Service Report on the subject of conventionally-armed ICBMs.[433] This section evaluates the severity of the threat posed by conventional PGS employment for an inadvertent nuclear exchange and then examines the utility of various potential technical, procedural, and policy solutions to this problem.

The scenario is simple but frightening. For example, the United States launches a conventional PGS strike against a target near the periphery of Russian territory. Because of the poor condition of Russia's space-based early-warning system, it does not detect the initial launch at all. As the PGS weapon nears its target it is picked up by part of the Russian ballistic missile warning radar network. Since the PGS weapon has made several maneuvers during reentry. The radar is unable to accurately determine the object's launch location or predicted impact locations. The radar operator believes the object originated from the vicinity of an ICBM field in North Dakota and is headed towards the early-warning radar site in Azerbaijan. In actuality the PGS weapon was launched from Vandenberg Air Force Base on the coast of California and is headed towards a target in

[433] Woolf, Conventional Warheads, 13.

Iran. However, the erroneous report that goes forward to senior Russian leaders warns that a missile warning site is under attack from an American ICBM. Believing this to be part of the first wave of a massive attack that is underway but not yet detected (or that the radars have been "spoofed" somehow), the Russian leadership orders a retaliatory launch against counterforce and command and control targets in the United States. The belief that they were already under nuclear attack lessened the normal inhibitions against launching a nuclear strike, since the only remaining goal available was damage limitation in a nightmare scenario.

How likely is this to occur? In order for this scenario to be possible at all, there are two prerequisites. First, the country in question must be able to detect an attack while it is in progress. Basically, it must possess some type of early-warning system. Second, the country must have the ability to "launch on warning." Its nuclear forces must be generated to a level of alert that allows a retaliatory launch before the attacking warheads strike their targets. In today's world, only the United States and Russia meet both of these requirements.

As presented in the Russian case study above, the Russian nuclear force structure, force posture, and the state of its early-warning system combine to produce several risk factors for the above scenario. Heavy reliance on vulnerable, silo-based ICBMs tends to result in a "use them or lose them" mentality. Also, the relatively few "survivable" forces (deployed SLBMs and mobile ICBMs outside of garrison) available could detract from a willingness to "wait and see" what is really happening. A deteriorating early-warning system leaves the leadership uncertain as to whether what has been reported by the system is all there is. The amount of danger represented by Russia's current status depends on which view of reality one holds. If one subscribes to Pavel Podvig's view, they will be less concerned since Russia's leadership is aware of the limitations of their system and they will not trust it enough to make irrevocable decisions, like launching ICBMs.[434] The position taken by the 2003 RAND study is more pessimistic in tone. The message there is that Russia is blind and vulnerable and may make poor decision based on poor-quality information.[435] A third view is presented by Mickhail Tsypkin. Upon

434 Podvig, History of the Russian Early Warning System, 22-3.

435 Hughes, 67.

initial detection there will be concern as the warning crews attempt to determine whether there is only one object or a mass attack, but within five to seven minutes the Russians will have determined the trajectory and know that it is not headed for Moscow.[436] However, the entire system will have suffered "a very bad shock."[437]

There are many things that may be done to reduce or eliminate the risk of an inadvertent nuclear exchange resulting from the employment of a conventional PGS weapon. The Air Force has proposed a variety of technical and procedural mitigation measures that include: strategic dialog (signals U.S. intentions, plans, and shapes expectations); basing of conventional PGS on coasts away from nuclear ICBMs; conventional/nuclear firewall (readily detectable signature differences); on-site inspections to build confidence (similar to those for START); implement the previously agreed to shared early-warning system (also have direct executive-level communication); cooperative signature enhancement (easily distinguishable trajectory); and careful mission planning to minimize chance that conventional PGS will approach Russia and appear threatening.[438] These measures may be adequate and prevent the worst from happening, but all have their limitations. Each of these measures requires either a level of technological sophistication (which the Russian warning system does not have) or a fundamental level of cooperation and trust. In today's environment these characteristics may be easily obtained, but imagine a scenario where United States-Russian relations sour as they did during the NATO air campaign against Serbia. These measures treat the symptoms, but do not cure the underlying problem.

One way to reduce the danger would be to follow China's example. Its nuclear posture, while posing concerns for its survivability against two preemptively postured nuclear superpowers, presents no possibility of an unintentional nuclear exchange. In the long-run, if the United States wishes to deploy a conventional PGS capability that can provide significant warfighting support to the Regional Combatant Commanders, instead of a limited "silver bullet" force, something must be done to address the Cold War-legacy

[436] Mikhail Tsypkin, interview by author, from notes, Monterey, Ca., 23 August 2005.

[437] Ibid.

[438] Headquarters U.S. Air Force, "The Common Aero Vehicle: Addressing Congressional Concerns," (briefing presented to U.S. Congress, Washington D.C., December 2004), 20-26.

force postures that make an inadvertent nuclear exchange possible (if not likely). Given the Russian's current reliance on nuclear weapons for national security, it is unlikely that they will unilaterally volunteer to remove their ICBMs from alert status. However, if the United States initiates the de-escalation of nuclear postures by taking its nuclear ICBMs off-alert, the Russians may be convinced to do the same once their vulnerabilities are addressed. Because of the Trident II's short flight-time and counterforce capability, the Russians may also require that the Ohio-class submarines patrol outside the range of targets in Russia. The exact de-alerting scheme adopted is not important. What is important is beginning the process to eliminate the possibility of prompt nuclear annihilation as a result of false or misinterpreted warning. The Cold War has been over for fifteen years, it is time for the two nuclear superpowers to catch up.

The time has come for the United States to make a choice. It can keep the nuclear-armed ICBM, which will remain, vulnerable and unusable in all but the most nightmarish scenarios, or it can leave it behind in exchange for a robust conventional PGS capability that operates from or through space. A decision in the near future would allow the opportunity to forgo replacement of the Minuteman III, and instead channel scare procurement dollars into an operationally responsive spacelift capability that can also be leveraged to serve as the means for boosting conventional PGS weapons. Combining these programs provides the Air Force with the capability that it really wants to operate for the twenty first century.

E. CONCLUSION

This chapter covered a significant breadth of material relevant to the interaction of conventional PGS with the stability of the global security environment. It began with a survey of leading principles of nuclear deterrence, some of which were first presented nearly sixty- years ago. However, their age has not diminished their value. Of particular note is the potentially destabilizing interaction between deterrence theories designed to "inflict a cost" and those intended to "deny benefits." The former tend to emphasize survivable second strike capabilities, while the latter exploit preemption.

The second section presents three case studies that examine the current and future direction of the United States, Russian and Chinese nuclear strategy, force structure, and force posture. Each of these areas has implications for conventional PGS capabilities.

The United States is moving to deploy advance conventional capabilities to reduce its emphasis on nuclear weapons while maintaining a large, ready nuclear force. Russia faces continued dependence on nuclear weapons due to its crumbling general purpose forces. However, Russia's high alert posture combined with a degraded early-warning system serves as a source of risk for inadvertent nuclear war. The Chinese case presents a completely different philosophy about nuclear posture and the size of force necessary to successfully deter. China's "no first use" and minimum deterrent policies should serve as a model for other nuclear nations to follow in the twenty first century.

The third section analyzes the risks of introducing conventional PGS into the security environment described in section two. Because of the speed and precision of conventional PGS capabilities, they create a security dilemma for both Russia and China. Both countries' nuclear retaliatory forces could be vulnerable to attack with conventional PGS weapons. Since both nations have exhausted the means available to reduce their vulnerability, it falls upon the United State to take action to reduce the threat it projects toward Russia and China. Finally, this section analyzed the contribution of conventional PGS to the risk of an inadvertent nuclear exchange between the United States and China or Russia. Russia's force structure, high-alert posture, and deteriorating early warning system are all risk factors that could lead to grave danger. China's low-alert level and policy of "no first use" present virtually no opportunity for an inadvertent nuclear exchange.

The United States faces a key choice in the near future. It can cling to land-based nuclear ICBMs or it can instead move towards conventional PGS capabilities. A reduction in the rapid retaliatory postures of the United States and Russia are necessary to allow for their safe operation. Conventional PGS capabilities provide the opportunity to forgo replacement of the Minuteman III. The program savings could be channeled into operationally responsive spacelift capabilities that may be leveraged to also boost conventional PGS capabilities.

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VII. FINDINGS, RECOMMENDATIONS, AND CONCLUSION

A. INTRODUCTION

This thesis was written with the intent to expand the debate over conventional PGS weapons and cut through the perceptions and propaganda to the true core issues affecting the future of this transformational capability. The ultimate aim of this thesis is to influence the decision calculus of senior Department of Defense and government policy makers on this important topic. Several key policy implications are highlighted:

B. FINDINGS

The follow paragraphs highlight the key findings of this thesis:

1. Precedents for Nuclear-to-Conventional Conversion

All American global strike systems were originally developed and deployed to deliver nuclear weapons. The paradigm that associates strategic systems exclusively with nuclear war has proven difficult, but not impossible to break. The B-52, B-1, B-2, ALCM, and Ohio-class submarine have successfully transformed from dedicated instruments of Armageddon into dual-role or conventional-only platforms. These systems serve as cases in point and demonstrate that it is possible to offload "nuclear baggage" and adapt existing weapon systems to address new national security needs that were not necessarily envisioned when the systems were originally built.

2. Conventional ICBMs?

The glaring exception to the above nuclear-to-conventional success stories is the intercontinental missile. A CEP of 100 meters is considered excellent for a 300 kt nuclear weapon, but it is useless for a 2,000 pound conventional weapon. Recent improvements in guidance technology make it feasible to consider intercontinental missiles armed with conventional munitions. But, the question remains – will intercontinental missiles ever be able to shed their "nuclear baggage" in the same fashion that strategic bombers, cruise missiles, and submarines have?

3. Near and Mid-Term Conventional PGS

Near-term conventional PGS options include modified Trident II or Peacekeeper intercontinental missiles armed with GPS-aided maneuverable reentry vehicles containing kinetic or high-explosive warheads. Mid-term alternatives could leverage small space launch vehicles like the SpaceX Falcon to boost CAVs carrying a variety of conventional munitions over intercontinental ranges or place CAVs for into orbit for later use. Technology does not present any “show stoppers” for deploying conventional PGS capabilities in the near or mid-term.

4. Launch Misidentification Safeguards

The comprehensive set of risk mitigation measures proposed by the Air Force should ensure adequate safeguards against launch identification mishaps for near-term, single sortie conventional PGS operations. These measures go above and beyond what should be necessary to convince any country capable of detecting a conventional PGS launch (and even those that cannot) that this vehicle is a conventional-only platform. As a minimum, executive-level communication immediately prior to launch between the leaders of the United States and Russia would effectively eliminate the possibility of surprise and misinterpretation.

5. START Constraints

The constraints imposed by START will effectively delay conventional PGS deployment until after the Treaty expires in 2009. Treaty negotiators must look beyond the current situation to consider how treaty provisions might constrain future options if world security conditions change. It is probable that it would take until at least 2010 to field an initial conventional PGS capability without START constraints, but the limitations imposed by START guarantee this eventuality.

6. Policy Rationale

The policy objectives espoused in the National Security Strategy and supporting polices place a premium on rapid response, or in some cases preemptive action to defeat adversaries before they can inflict catastrophic damage against American territory or deployed forces. Conventional PGS capabilities provide an additional option for the President to respond to imminent threats to the national security of the United States that appear more likely in a post-Cold War, post-September 11th world.

7. Responsiveness

Conventional PGS capabilities promise to provide unmatched responsiveness. Historical cases have shown that even from an “on-alert” posture, forward-deployed forces have typically required several hours to reach targets within the theater of operations. Conventional PGS capabilities enable global reach within 90 minutes from a similar "on-alert" posture.

8. Hard and Deeply Buried Targets

Conventional PGS weapons have the potential ability to hold additional hard and deeply buried facilities at risk without resorting to nuclear weapons. While their penetration ability is still constrained by available materials, PGS weapons offer impact velocities 2,500 feet per second greater than contemporary aircraft-delivered weapons.

9. Economy of Force

Conventional PGS capabilities offer significant "economy of force" improvements over existing capabilities. While not likely to be the least expensive on a cost-per-weapon basis, conventional PGS capabilities could remain cost-competitive when the overall operations costs of a mission are included in the analysis. More importantly, conventional PGS capabilities offer the ultimate "economy of force" by the ability to strike highly-defended targets without risking the lives of friendly forces.

10. Defeat Anti-Access

Conventional PGS capabilities offer unsurpassed ability to defeat adversary anti-access strategies. Advanced air defenses, denial of forward basing, over-flight restrictions, and hardened and deeply buried facilities do not constrain the ability of conventional PGS weapons to hold vital enemy centers of gravity at risk.

11. Nuclear Deterrence Theory

Nuclear deterrence theory remains important today as a predictor of potential "security dilemmas" created by conventional PGS capabilities. Of particular note is the potentially destabilizing interaction between deterrence theories designed to "inflict a cost" and those intended to "deny benefits." The former tend to emphasize survivable second strike capabilities, while the latter exploit preemption.

12. Cold War Legacy

Russia's contracting nuclear force structure, high-alert posture, and deteriorating early warning system present a series of risk factors for inadvertent nuclear war that are exacerbated by the potential employment of conventional PGS capabilities. In contrast, China's low-alert level and policy of "no first use" present virtually no opportunity for an inadvertent nuclear exchange.

C. RECOMMENDATIONS

Based on the research and analysis conducted in the course of preparing this thesis, the following recommendations are made:

1. Conventional Peacekeeper

The Peacekeeper ICBM should be converted to a conventional role. The missiles are paid for and the hardware is available today. This provides an excellent opportunity to leverage sunk costs to deploy a relatively low-cost near-term conventional PGS capability. The missile has sufficient range and payload capabilities to provide a militarily effective conventional capability. The use of retired Peacekeeper ICBMs in a conventional role rather than converting Minuteman IIIs or Trident IIs also maintains a firewall between nuclear and conventional capabilities.

2. GPS-Aided Reentry Vehicles

The Air Force should seek to capitalize on the technology developed in the currently unfunded Trident II Enhanced Effectiveness Program. The goal should be the development, testing, and eventual production of modified Mk 21 reentry vehicles to allow GPS-aided operation and precision maneuver during reentry. The Project could provide a near-term, low-risk capability until such time that the Common Aero Vehicle becomes available.

3. CAV Development

The Air Force should continue to aggressively seek Congressional restoration of funding for "weaponized" CAV development. Launch misidentification is not a valid issue during since all launches will be conducted in accordance with standard notification procedures. Resolution of the launch misidentification issue should be worked concurrently with weapon system to provide an incentive for reaching resolution. The current situation that gives other nuclear powers a veto over U.S. development and deployment decisions must not be allowed to continue.

4. Launch Safety

Balancing launch responsiveness for conventional PGS systems with range safety requirements require a willingness to accept greater risk to the public (foreign and domestic) during launch operations. For this reason, conventional PGS weapons should only be used when the level of national need warrants the increased level of risk. This is a decision national leaders will need to make on a case-by-case basis. Unfortunately, a better solution will not be available until the far-term (or way-far-term) when a fully-reusable booster eliminates the danger posed by discarded booster stages.

5. Nuclear ICBM Divestiture

An opportunity was missed in 1994 for the Air Force to divest itself from land-based nuclear ICBMs which resulted in the estimated $5.5 billion programs to refurbish various components of the Minuteman III.[439] In the near future, the Air Force will be face a similar decision, this time on whether to proceed with the Land Based Strategic Deterrent (LBSD). The Air Force should take this opportunity to pursue land-based conventional PGS capabilities in accordance with the New Triad. Funding for LBSD should be reprogrammed into providing a responsive space launch capability for that supports PGS and launch-on-demand. Nuclear deterrence is best performed by the virtually invulnerable ballistic missile submarine and the Trident II (D-5). It has the survivability and the accuracy to strike any desired target. The Air Force can then focus on providing responsive conventional deterrence and strike against the new threats of the twenty first century instead of perpetuating the shadows of the twentieth century.

6. De-Alerting

In order to fully exploit the potential of conventional PGS capabilities, the United States must pursue an end to the Cold war nuclear force postures maintained by itself and Russia. Procedural and technical mitigation measures may work adequately against the threat of an inadvertent nuclear exchange for a small, "silver bullet" conventional PGS system, but in order to provide meaningful support to major theater contingency operations, a more reliable solution is required. Force postures of both the United States and Russia must be altered so that the launch of nuclear weapons "on warning" is no longer possible or necessary.

D. CONCLUSION

The most significant finding of this thesis is that conventional PGS weapons are not in and of themselves destabilizing, but when they are combined with the enduring Cold War postures of American and Russian nuclear forces they become a valid cause for

[439] Amy F. Woolf, *U.S. Nuclear Weapons: Changes in Policy and Force Structure* (Washington D.C.: Congressional Research Service, 2005), 28, CRS, RL31623.

concern. The possible implications of conventional PGS capabilities simply highlight the danger we quietly face everyday. The continued presence of American and Russian nuclear forces on "hair trigger" alert poses a risk to our nations inconsistent with the other aspects of our relationship. To not deploy conventional PGS capabilities because of perceptions of a renewed nuclear arms race or inadvertent nuclear war, allows us to dodge the tough decision. We must finally clear away the last vestiges of the Cold War in order to be able to deploy capabilities necessary to protect American security interests in the post-Cold War world.

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