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Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress

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Summary

The United States has deployed long-range ballistic missiles in its strategic offensive nuclear forces for more than 40 years. In recent years, some have proposed that the United States deploy conventional warheads on these missiles. This would provide the United States with the ability to strike promptly anywhere in the world, regardless of the presence of overseas bases or nearby naval forces.

The Air Force and Navy have both studied the possible deployment of conventional warheads on their long-range ballistic missiles. The Air Force has been pursuing, with DARPA, research into a number of technologies that might enhance the U.S. long-range strike capability. These include a hypersonic glide vehicle, known as the Common Aero Vehicle (CAV), that could carry conventional munitions on modified Minuteman II or Peacekeeper missiles, or it could deploy these missiles with more familiar conventional warheads. This effort is now known as the Conventional Strike Missile (CSM) and could be deployed as a mid-term option for the Prompt Global Strike mission. The FY2007 Defense Budget requested $127 million to pursue the deployment of conventional warheads on Trident missiles, which might be deployed in 2-4 years, but the 109th Congress rejected most of this request. The FY2008 budget requested $175.4 million, but the 110th Congress did not approve this funding, either, instead transferring $100 million to a combined fund to conduct research into a broad range of "prompt global strike" technologies. In the FY2009 budget, the Administration requested $117.6 million for the prompt global strike program element.

Many have expressed concerns about the possibility that other nations, such as Russia or China might misinterpret the launch of a conventionally-armed ballistic missile and conclude that they are under attack with nuclear weapons. The Air Force outlined a number of measures that might reduce this risk with its CSM concept. For example, it could base these missiles along the U.S. coast, far from bases with nuclear-armed ballistic missiles. The United States could also use consultations, notifications, and inspections to inform others of the difference between conventional and nuclear ballistic missiles. But, although these measures could address some of the concerns, they are not likely to eliminate the risks of misunderstandings, particularly if the United States used these missiles on short notice in a crisis. The Navy would not segregate its conventional missiles, but would deploy them on submarines that also carry nuclear warheads, but it could still notify Russia or other nations to mitigate the possibility of misunderstandings.

Long-range ballistic missiles can bring unique capabilities to the PGS mission. But these missiles are only uniquely capable if the United States must attack promptly, or within hours, of the start of an unanticipated conflict. In any other circumstance, the United States is likely to have the time to move its forces into the region. Hence, Congress may review whether the benefits brought by these systems outweigh the risks of misunderstandings arising from their use. This report will be updated as needed.

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Introduction

The United States began to deploy long-range ballistic missiles in the late 1950s and early 1960s. These missiles—land-based intercontinental ballistic missiles (ICBMs) and sea-based submarine-launched ballistic missiles (SLBMs)—have served as the backbone of the U.S. strategic nuclear deterrent for more than 40 years. They provided the United States with the ability to threaten targets throughout the Soviet Union, and, if necessary, in other nations, from the United States or from submarines patrolling at sea. When the Cold War ended in the early 1990s, these missiles carried more than 8,000 nuclear warheads. The United States has reduced its strategic forces during the past 15 years, but it still has approximately 4,816 warheads deployed on 982 ICBMs and SLBMs.[1] All the missiles still carry nuclear warheads.

In recent years, analysts both inside and outside the government have suggested that the United States consider deploying conventional warheads on its long-range ballistic missiles. The Bush Administration, in the 2001 Nuclear Posture Review, called for the integration of precision conventional weapons with strategic nuclear forces in a new category of "offensive strike" weapons.[2] Ballistic missiles armed with conventional warheads are one possible option for a new type of precision conventional weapon. In addition, the Pentagon identified a new mission—prompt global strike (PGS)—that would allow the United States to strike targets anywhere on earth in a matter of hours, without relying on forward based forces. Many analysts believe that long-range ballistic missiles armed with conventional warheads would also be an ideal weapon for this mission.

Both the Navy and Air Force have studied concepts and technologies that might allow the deployment of conventional warheads on long-range ballistic missiles. The Administration has requested funding for these initiatives in recent years. These requests have thus far received a mixed reception in Congress. In FY2007 and FY2008, the Administration requested funding for both the Air Force and the Navy. In FY2008, Congress did not approve the requested funding for the separate services, but combined the funding in a new category that would explore a wider range of options for the prompt global strike mission. This funding—$100 million in FY2008—fell well short of total of the separate amounts requested by the Administration. As a result, Congress and the Bush Administration have continued to debate the alternative programs and to discuss the best way for the United States to proceed, if at all, with the deployment of conventional warheads on long-range ballistic missiles.

This report provides an overview of the Administration's rationale for the possible deployment of conventional warheads on long-range ballistic missiles. It then reviews the Air Force and Navy efforts to develop these systems. It summarizes congressional reaction to these proposals, then provides a more detailed account of the issues raised by these concepts and programs.

[1] U.S. Department of State, *START Aggregate Numbers of Strategic Offensive Arms*. Fact Sheet. Bureau of Arms Control, October 1, 2007. These numbers reflect the counting rules outlined in the 1991 START Treaty, and include the warheads that could be carried on the deactivated Peacekeeper missiles. Hence, it overstates the actual number of deployed forces by about 50 missiles and 500 warheads.

[2] U.S. Congress, Senate Committee on Armed Services. Hearing on the Nuclear Posture Review. Statement of the Honorable Douglas J. Feith. Under Secretary of Defense for Policy. February 14, 2002. p. 4.

Background

Conventional Ballistic Missiles and Offensive Strike Forces

The Bush Administration's Nuclear Posture Review (NPR), released in early January 2002, calls for the deployment of a "new triad" of capabilities that would contribute to deterrence and U.S. national security in the coming years.[3] During the Cold War, the United States deployed a "triad" of forces comprised of the three types of delivery vehicles for strategic nuclear weapons—land-based intercontinental ballistic missiles (ICBMs), submarine launched ballistic missiles (SLBMs), and long-range bombers. In the "new triad," these nuclear-armed delivery vehicles would combine with precision-guided conventional weapons and become known as "offensive strike" forces.[4]

In the Administration's view, offensive strike weapons with conventional warheads could address some missions now assigned to long-range nuclear forces. While some critics claim that this concept would blur the distinction between conventional and nuclear weapons and increase the likelihood of a U.S. use of nuclear weapons, the Administration has argued that the availability of precision conventional weapons would, possibly, provide the President with more options in a crisis, and, therefore, reduce the likelihood of the use of nuclear weapons. In testimony before the Senate Armed Services Committee in April 2005, General James Cartwright, then the commander of STRATCOM, noted that "the New Triad concept will enable more precisely tailored global strike operations."[5] Furthermore, some have argued that, by replacing some nuclear weapons with conventional weapons in the U.S. strategic war plan[6] the United States might be able to further reduce its number of deployed strategic nuclear weapons.[7]

General Cartwright and others have asserted that the substitution of conventional warheads for nuclear warheads in the U.S. war plan would require significant improvements in the accuracy of U.S. long-range ballistic missiles. If missiles can deliver their payloads more precisely to their targets, then, for some categories of targets, they may not need the explosive yield of a nuclear weapon to destroy the target. General Cartwright has sought a study that will allow him to determine what proportion of the targets in the U.S. war plan could be attacked with conventional weapons. An industry analyst has estimated that his proportion could be between10% and 30% of

[3] U.S. Department of Defense. "Special Briefing on the Nuclear Posture Review," News Transcript. January 9, 2002.

[4] The other two legs of the new triad are missile defenses, which the Administration has stated will contribute to deterrence by complicating an adversary's attack planning and undermining his confidence; and a "responsive infrastructure" which would allow the United States to maintain and, if necessary, expand its nuclear arsenal in response to emerging threats. These three legs are joined together by "command and control, intelligence, and planning capabilities," which, according to the Administration, will provide the United States the ability to identify targets and plan nuclear or conventional attacks on short notice, in response to unexpected threats. See U.S. Congress, Senate Committee on Armed Services. Statement of the Honorable Douglas J. Feith, Under Secretary of Defense For Policy. February 14, 2002.

[5] U.S. Congress, Senate Committee on Armed Services. Subcommittee on Strategic. Testimony of Admiral James E. Cartwright, Commander, U.S. Strategic Command. Hearing, April 4, 2005.

[6] The war plan that outlines options for the use of nuclear weapons was known as the SIOP (Single Integrated Operational Plan) throughout the Cold War. It is now known as OPLAN 8044 and it reflects changes in U.S. targeting plans and priorities that resulted from the Bush Administration's nuclear posture Review.

[7] Grossman, Elaine M. "U.S. General: Precise Long-Range Missiles may Enable Big Nuclear Cuts," *Inside the Pentagon*, April 28, 2005.

the existing targets.[8] Both the Navy and the Air Force are exploring advanced guidance and targeting technologies, such as the use of GPS guidance, that might provide their missiles with these improvements in accuracy. This effort has been underway for more than a decade.

Conventional Ballistic Missiles and Prompt Global Strike

The Prompt Global Strike Mission (PGS)

Throughout the Cold War, the United States maintained military bases overseas so that it could position its troops to deter, and if necessary, respond promptly to an attack from the Soviet Union or its allies. These forward bases were located, for the most part, in Europe and Asia—regions where conflict seemed most likely to occur. These overseas bases and forces were believed not only to increase preparedness, but also to deter conflict by their very presence in unstable regions. However, with the demise of the Soviet Union and the end of the Cold War, analysts argue that the United States must now be prepared to fight a wider range of potential adversaries in unexpected areas who may possess a great variety of military capabilities. And, although the United States continues to deploy its military forces at bases around the world, it can no longer be certain that these bases will be located close to the theater of operations if a conflict occurs. As a result, the United States not only plans to restructure, and, in some cases, reduce, its forces based overseas, it has also sought to improve its ability to move military forces into a region quickly when and if a conflict occurs.

At the same time, many analysts and military officials have argued that the United States must maintain and enhance its *long-range* strike capability so that it can strike anywhere in the world with forces that are based in or near the United States,[9] or with forces that have the range to reach targets across the globe from wherever they are deployed. This would not only allow the United States to pursue an adversary without relying on forward bases, it would also allow the United States to reach targets deep inside an enemy's territory. Further, some argue that the United States must be able to attack targets, across the globe, in a matter of hours, or less, either at the start of a conflict or during ongoing operations. This is because, as some have argued, U.S. adversaries could to adapt to the U.S. precision-strike capability by withholding targeting information with concealment techniques or mobility, leaving the United States with little time to attack after it identified relevant targets. Finally, many have noted that adversaries could seek to protect their assets by deploying them in buried or hardened facilities, leading to a requirement for improvements in the U.S. ability to defeat hardened and deeply buried targets.

The need for prompt long-range, or global, strike capabilities has been addressed both in more general defense policy studies, such as the 2001 Quadrennial Defense Review (QDR), which noted that the U.S. defense strategy "rests on the assumption that U.S. forces have the ability to project power worldwide," and also in more specific service reports on Air Force doctrine, which have noted that "rapid power projection based in the continental United States has become the predominant military strategy." In May 2003, the Air Force issued a formal Mission Need Statement for the Prompt Global Strike (PGS) Mission. This document was written by Air Force

[8] Grossman, Elaine M. "U.S. General: Precise Long-Range Missiles May Enable Big Nuclear Cuts," *Inside the Pentagon*, April 28, 2005.

[9] See, for example, Watts, Barry D. *Long-Range Strike: Imperatives, Urgency, and Options*. Center for Strategic and Budgetary Assessments. April 2005.

Space command, coordinated with officials in the Joint Staff and the Office of the Secretary of Defense, and validated by the Joint Requirements Oversight Council (JROC). This statement indicated that the United States should be able to strike globally and rapidly with joint conventional forces against high-payoff targets. The United States should be able to plan and execute these attacks in a matter of minutes or hours, as opposed to the days or weeks needed for planning and execution with existing forces, and it should be able to execute these attacks even when it had no permanent military presence in the region where the conflict would occur.[10] The 2006 Quadrennial Defense Review also highlighted a growing need for global strike capabilities.

PGS and the New U.S. Strategic Command

In October 2002, the U.S. Strategic Command (STRATCOM), which was in charge of plans and operations for U.S. strategic nuclear weapons, merged with U.S. Space Command (SpaceCom), which commanded military space operations, information operations, computer network operations, and space campaign planning.[11] This merger gave the new STRATCOM the "ability to project power around the globe through space and information warfare." Further, in late 2002 and early 2003, the Pentagon restructured the new STRATCOM so that it could take on new missions, including the planning and execution of the prompt global strike mission.[12] This change in the command structure highlighted the growing emphasis on long-range, strategic missions in conventional warfighting doctrine.

Admiral James O. Ellis, the first Commander of the new STRATCOM, stated that the new mission "extends our long-standing and globally-focused deterrent capabilities to the broader spectrum of conflict." He further indicated that "the incorporation of conventional, non-kinetic,[13] and special operations capabilities into a full-spectrum contingency arsenal will enable the command to *deliberately and adaptively plan for and deliver rapid, limited-duration, extended-range combat power anywhere in the world (emphasis added)*." This will "provide a wider range of options to the President in responding to time-critical global challenges." He also stated that STRATCOM's capabilities would "provide the nation an immediate ability to engage a select set of targets by moving rapidly from actionable intelligence, through adaptive planning, to national-level decision-making and the delivery of effects across thousands of miles."[14] He stated that data-gathering, decision-making, and execution must occur in minutes to support the PGS mission, a standard that is not yet possible with existing technology.

General James Cartwright, the second commander of STRATCOM, defined the global strike mission area by stating that "it provides to the nation the ability to rapidly plan and rapidly deliver effect any place on the globe ... " The capability would not necessarily be nuclear, and a

[10] Jumper, John, General, U.S. Air Force. Final Mission Need Statement. "Prompt Global Strike," May 2, 2003.

[11] U.S. Department of Defense. "DOD Announces Merger of U.S. Space and Strategic Commands," June 26, 2002.

[12] According to Admiral James O. Ellis, the Commander of STRATCOM, these missions included global strike planning and execution; information operations; global missile defense integrations; and oversight of command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) in support of strategic and global operations. See Statement of Admiral James O. Ellis. Commander United States Strategic Command. Before the House Armed Services Committee. March 13, 2003. p. 4.

[13] Kinetic energy weapons are those that destroy their targets with blast or impact; non-kinetic weapons, such as lasers, destroy their targets through electromagnetic or other forms of energy.

[14] Statement of Admiral James O. Ellis, Commander, U.S. Strategic Command, House Armed Services Committee, March 13, 2003.

regional combatant commander could "tailor it for his target and deliver it very quickly, with very short time lines on the planning and delivery, any place on the face of the Earth." General Cartwright also emphasized that the global strike capability involved much more than just the delivery of a weapon to a target, stating that "it encompasses both the ability to plan rapidly, to apply the precision to the intelligence and gather that intelligence in a very rapid manner, and then to apply that intelligence to the target and understand the effect we want to create."[15] The U.S. military is seeking to acquire the capabilities needed to meet this standard.

The intelligence requirements for the PGS mission are often overlooked, and may prove to be so demanding as to affect the likelihood for success. As General Michael Hayden, the CIA director, noted in mid-2007, the PGS mission will require "very convincing intelligence" before any attacks occur.[16] He further stated that "if you are going to strike suddenly ... it has to be based on very powerful, very convincing intelligence." Further, the intelligence may need to be released to the public, to demonstrate both the military need and time restraints that made the attack necessary.

Potential Targets and Weapons for the PGS Mission

The United States might need to strike several categories of targets promptly, throughout the spectrum of conflict. For example, if an adversary deployed air defense or anti-satellite weapons that could disrupt the U.S. ability to sustain an attack, the United States might choose to strike promptly at the start of a conflict with weapons that could penetrate and destroy the defenses. A prompt strike against an adversary's ballistic missiles or caches of weapons of mass destruction (WMD) might allow the United States to destroy these weapons early before an adversary could use them. Some targets could also appear quickly and remain vulnerable for short periods of time during a conflict. These might include leadership cells that could move during a conflict or mobile military systems that the adversary had chosen to keep hidden prior too their use.

The United States might use a number of different weapons systems, in the near term, in the PGS mission.[17] These could include medium- or long-range aircraft, cruise missiles launched from bombers or submarines, and ballistic missiles based at sea or on land in the United States.[18] But conventional aircraft, even if they are based near the theater of operations, could take several hours, or more, to reach their targets. Aircraft may also be vulnerable to enemy air defenses, particularly if they tried to attack targets deep inside enemy territory. Similarly, aircraft or cruise

[15] U.S. Congress, Senate Committee on Armed Services. Subcommittee on Strategic. Testimony of Admiral James E. Cartwright, Commander, U.S. Strategic Command. Hearing, April 4, 2005.

[16] Grossman, Elaine, M. Hayden: "Prompt Global Strike" Raises Bar for Intel Community. Inside The Air Force. June 22, 2007.

[17] In the longer term, the Air Force and Navy are both exploring the use of ramjets, or scramjets, for long-range attack term. These hypersonic aircraft, which could fly at speeds of Mach 2-Mach 5, are still in the early stages of development. The are envisioned to launch from air bases, like aircraft, but to travel at speeds that far exceed those of U.S. aircraft and may approach the speeds of missiles. See, for example, Pincus, Walter. "Pentagon Has Far-reaching Defense Spacecraft in Works," *Washington Post*, March 16, 2005. p. 3.

[18] In his testimony in 2003, Admiral Ellis specifically mentioned two systems that could contribute to this mission, Trident submarines reconfigured to carry Tomahawk cruise missiles with conventional warheads and the proposed Common Aero Vehicle, which could be used to deploy conventional munitions on long-range ballistic missiles. See the statement of Admiral James O. Ellis, Commander, U.S. Strategic Command, House Armed Services Committee, March 13, 2003.

missiles based at sea may be too far from the theater of operations to strike critical targets in a timely manner.

Officials in the Air Force, at the Pentagon, and at STRATCOM, along with some analysts outside government, believe that the United States could achieve the prompt global strike mission with its long-range ballistic missiles (ICBMs and SLBMs).[19] The Pentagon's Defense Science Board (DSB), in a study published in early 2004, asserted that land-based long-range ballistic missiles have "unique, time-critical characteristics" that include "responsiveness, range, speed, precision, lethality, and freedom of maneuver."[20] With these capabilities, they could attack targets anywhere in the world within an hour of their launch, without relying on forward bases or supporting military capabilities, such as the tanker aircraft needed to support long-range flights by bombers. They would not be at risk from air defenses, and there would be no risk to flight crews. Further, if the warheads could maneuver to slow their reentry and increase their angle of attack, they might be effective against some types of hardened and deeply buried targets. The DSB study asserted that these weapons could provide "a reliable, low-cost force on continuous alert with a high readiness rate and the capability to immediately react under strict control of the National Command Authority." In other words, the high levels of reliability, readiness, and command and control that were needed as a part of the U.S. strategic nuclear deterrent during the Cold War are also valuable characteristics for a long-range conventional strike system in the post-Cold War era.

However, because U.S. long-range ballistic missiles have always carried nuclear warheads, many analysts believe that potential adversaries might misunderstand U.S. intentions if the United States employed ballistic missiles armed with conventional warheads, possibly deciding, if and when they detect a launch, that they are under nuclear attack from the United States. This possibility has been at the core of congressional concerns with the deployment of conventional warheads on long-range missiles. Accordingly, several studies, including the National Academy of Sciences Study on U.S. Conventional Prompt Global Strike, have sought to evaluate the validity of the concern and to propose steps that the United States might take to mitigate the risks.[21]

Plans and Programs

Both the Navy and the Air Force have studied the possible deployment of conventional warheads on their long-range ballistic missiles in the past. The Air Force briefly studied the penetration capabilities of conventional ICBMs in the mid-1990s. In August 1995 it launched an ICBM armed with a "pointy" front end (and no explosive warhead) against a granite slab that had characteristics similar to reinforced concrete. Press reports indicate that the warhead entered the target at a 90 degree angle and penetrated to a depth of 30 feet, which is greater than the depth of

[19] See, for example, U.S. Department of Defense, Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. *Report of the Defense Science Board Task Force on Future Strategic Strike Forces*. February 2004. See, also, Eric A. Miller and Willis A. Stanley. *The Future of Ballistic Missiles*. National Institute for Public Policy, October 2003.

[20] U.S. Department of Defense, Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. Report of the Defense Science Board Task Force on Future Strategic Strike Forces. February 2004. p. 5-1.

[21] Committee on Conventional Prompt Global Strike Capability, *U.S. Conventional Prompt Global Strike: Issues for 2008 and Beyond*, National Research Council of the National Academies, Washington, D.C., August 2008, http://www.nap.edu.catalog/12061.html.

penetration of any existing U.S. weapon.[22] The Navy also sponsored studies in the 1990s that sought to develop a non-nuclear penetrating warhead for the Trident SLBM. These studies also focused on questions about whether a reentry vehicle from a ballistic missile could penetrate a hardened target, using only its speed and angle of reentry, without a nuclear explosion. Both the Navy and the Air Force recognized that, without a nuclear explosion, the reentry vehicle from a ballistic missile would have to be far more accurate than those deployed in the 1990s (and still deployed today) to attack and destroy a buried target.

Navy Programs

Reentry Vehicle Research

In FY2003, the Navy requested funding for research on a new type of reentry vehicle that could significantly improve the accuracy of the Trident II (D-5) missiles. This program, known as the Enhanced Effectiveness (E2) Initiative, included an initial funding request of $30 million, a three-year study, and a full-scale flight test in early 2007.[23] Congress rejected the initial funding request in FY2003 and FY2004, but Lockheed Martin Corporation, the contractor pursuing the study, continued with a low level of research into this system.

The E2 reentry vehicle would integrate the existing inertial measurement unit (IMU) guidance system (the system currently used to guide long-range ballistic missiles) with global positioning system (GPS) technologies so that the reentry vehicle could receive guidance updates during its flight.[24] A standard MK4 reentry vehicle, which is the reentry vehicle deployed on many Trident SLBMs, would be modified with flap-based steering system, allowing it to maneuver when approaching its target to improve its accuracy and increase its angle of penetration. This steering system, which the Navy has referred to as a "backpack extension," would increase the size of the reentry vehicle, making it comparable in size to the MK5 reentry vehicle that is also deployed on Trident missiles. The E2 warhead could possibly provide Trident missiles with the accuracy to strike within 10 meters of their intended, stationary, targets. This accuracy would not only improve the lethality of the nuclear warheads but it would also permit the missiles to destroy some types of targets with conventional warheads.[25]

[22] Grossman, Elaine M. "Pentagon Eyes Bunker-Busting Conventional Ballistic Missile for Subs." *Inside the Pentagon*. June 27, 2002. p. 1.

[23] Norris, Robert S. and Hans M. Kristensen. "U.S. Nuclear Forces 2005," *Bulletin of the Atomic Scientists*. January/February 2005. pp. 73-75.

[24] According to the Defense Science Board Task Force on Future Strategic Strike Forces, the IMU would guide the missile in its early phases, but the reentry body would receive a GPS update during its exoatmospheric flight; it would then use the IMU and control flaps to steer the warhead with GPS-like accuracy during atmospheric reentry. See U.S. Department of Defense. *Report of the Defense Science Board Task Force on Future Strategic Strike Forces*. February 2004. pp. 5-7.

[25] Grossman, Elaine M. "Pentagon Eyes Bunker-Busting Conventional Ballistic Missile for Subs," *Inside the Pentagon*, June 27, 2002. p. 1. See also, Robert S. Norris and Hans M. Kristensen. "U.S. Nuclear Forces 2005," *Bulletin of the Atomic Scientists*, January/February 2005, pp. 73-75.

Lockheed Martin, flew these reentry vehicles in test flights of Trident missiles.[26] In a test conducted in 2002, it demonstrated that the new reentry vehicle could steer towards a target and strike with improved accuracy. In a test conducted in early 2005, a modified version of its reentry vehicle demonstrated that it could not only steer towards a target with improved accuracy, but also slow down and "control the impact conditions," capabilities that would be needed for the delivery of some types of conventional warheads to their targets. Lockheed estimated that, if the program received funding from Congress beginning in FY2006, its reentry vehicle could enter production in FY2010 and achieve an initial operational capability in 2011. The Navy, however, did not seek funding for this program in FY2004, 2005, or 2006.

The Lockheed reentry vehicle became a part of the plan to deploy conventional warheads on Trident submarine-launched ballistic missiles, and was been included in the Navy's budget request for FY2007 and FY2008. The budget request for FY2008 indicated that most of the work needed to design and develop the reentry vehicle for the conventional Trident could have been completed in FY2008, with an additional $20 million request planned for FY2009.[27] The FY2008 funding would support, among other things, efforts to finalize the guidance and flap system on the maneuvering body extension of the reentry body, design an interface between the new guidance system and the missile system flight controls, begin development of a conventional payload that could fit within the reentry body, and initiate efforts to modify existing facilities so that they can test the CTM designs. Congress, however, rejected these funding requests.

If it had received the requested funding in FY2008, and proceeded with the expected work plan, the Navy would have conducted system development and demonstration activities in FY2008 and FY2009, and could have planned to begin production and deployment in FY2010. With this timeline, the system would have reached its full operational capability by the end of 2012. However, as is noted below, Congress rejected its funding request in for FY2008 and restructured the PGS program.

Nevertheless, reports indicate that the Navy sought to continue pursuing this concept with its portion of the combined funding for the PGS mission. In documents submitted with its FY2009 budget request, the Navy sought funding for a 2009 flight experiment "using a Life Extension Rest Bed (LETB-2) reentry body on a currently planned Trident D-5 missile test."[28] The LETB-2 is essentially the new name of the maneuvering reentry body, described above, that evolved from the E2 reentry vehicle program. Congress had prohibited the use of any of the PGS funds for the CTM modification. Even thought the test bed would fly on a Trident missile test, the Navy contends that the technology would be applicable to any conventional ballistic missile, and, therefore, is not prohibited by the FY2008 legislation.

The Navy has also requested, in its FY2009 budget, funding for a reentry body for a conventional ballistic missiles. This program, known as the Medium Lift Reentry Body, would be too large to fit on a Trident missile, but carry the warhead on the intermediate range submarine-launched

[26] Krivich, David. Director, SMP Advanced Programs and Business Development. Lockheed Martin Space Systems Company. *Update on Precision Conventional Ballistic Missile Global Strike Capabilities*. Briefing to the Defense Science Board Task Force on Nuclear Capabilities. July 22, 2005.

[27] Department of the Navy. Fiscal Year 2008/2009 Budget Estimates. Justification of Estimates. February 2007. Research, Development, Test, and Evaluation, Navy Budget Activity 4.

[28] Elaine M. Grossman, "Controversial Missile Idea Lingers," *Global Security Newswire.*, March 20, 2008.

ballistic missile described below. It would carry a flechette warhead, which would be designed to destroy area targets such as airfields and military bases.

Conventional Trident Modification

The Navy began to speak publicly about its plans for the Conventional Trident modification (CTM) in early March 2006, in anticipation of congressional testimony by General Cartwright. The budget prepared for FY2007 included a total of $503 million over five years, with $127 million for FY2007, $225 million for FY2008, $118 million for FY2009, and $33 million for FY2010.[29] As is noted below, Congress denied the funding request in FY2007. The Pentagon requested a total of $175.4 million for FY2008, but Congress did not approve the specific funding again. Instead, as is noted in more detail below, it provided research and development funding for a more general category of "prompt global strike" initiatives.

With the Conventional Trident Modification (CTM) concept, the Navy planned to deploy each of its 12 Trident submarines on patrol (2 would be in overhaul at any given time) with 2 missiles equipped to carry 4 conventional warheads each. The remaining 22 missiles on each submarine would continue to carry nuclear warheads, and the submarines would continue to patrol in areas that would allow them to reach targets specified in the nuclear war plan, although the patrol areas could be adjusted to accommodate targeting requirements for the CTM. Only four submarines would be within range of their targets, with two in the Pacific Ocean and two in the Atlantic ocean. Consequently, only eight conventional missiles would be available for use at any time, and only one or two of the submarines would likely be within range of the targets specified for attack with conventional ballistic missiles.[30]

The Navy considered two types of warheads for the CTM program in the near-term. One warhead would be designed to destroy or disable soft, area targets, using a reentry vehicle loaded with tungsten rods—known as flechettes—that would rain down on the target and destroy everything within an area of up to 3,000 square feet. The other might be able to destroy hardened targets if it were accurate enough to strike very close to the target. Each would be deployed within the reentry body developed and tested under the E2 program. The Navy is also exploring, for possible future deployment, technologies that might be able to penetrate to destroy hardened, buried targets.

If Congress approved the program and the funding, these warheads would provide the Navy with the ability to contribute to the prompt global strike mission in the near term, a goal that was identified in the 2006 QDR. The report indicated that the Navy would seek to deploy an "initial capability to deliver precision-guided conventional warheads using long-range Trident" missiles within two years,[31] although many expect it to take four years to field the full complement of 96 warheads. The capability, even when fully deployed, would be limited by the small number of available warheads. Hence, it seems likely that the Pentagon would only plan to use these missiles in limited circumstances to meet specific goals.

[29] Grossman, Elaine. Pentagon Wants Early Start on Conventional Missiles for Subs. InsideDefense.Com, January 20, 2006. See also, Grossman, Facing Doubts, Pentagon Readies Pitch for New Sub-launched Missile. *Inside the Pentagon*. March 9, 2006.

[30] Ibid.

[31] U.S. Department of Defense. Quadrennial Defense Review Report. February 6, 2006 p. 50.

Submarine-Launched Intermediate-Range Ballistic Missile (SLIRBM)

The Navy is also studying the possible development and deployment of an intermediate-range missile that could be launched from its ballistic missile submarines. It requested industry participation in the study in mid-2003, and planned to conduct two static test-firings of a prototype rocket engine in 2005.[32] According to the Defense Science Board Task Force, this missile might deliver a 2,000 pound payload over a 1,500 mile range,[33] with an accuracy of less than 5 meters. This would allow the missile to reach its target in less than 15 minutes.[34] Reports of the initial studies into this concept indicated that this proposed missile could carry either nuclear or conventional warheads, allowing it to contribute to the missions requiring prompt, long-range strike capabilities.[35] These missiles could also be deployed on the modified Trident submarines, with two or three missiles each in up to 22 of the submarine's launch tubes, for a total of 66 missiles per submarine. However, as the concept has emerged, it has become evident that the missiles would be deployed, with perhaps two per launch tube, in the four Trident submarines that have already been converted to carry conventional cruise missiles and other non-nuclear weaponry.

The proposed submarine-launched intermediate range ballistic missile would achieve many of the objectives necessary for the PGS mission. It could attack targets quickly, both at the start of a conflict if the submarines were within range, and during the conflict if new targets emerged. Its speed and angle of attack might also make it capable of attacking some types of hardened or buried targets. It would also be able to penetrate an adversary's defenses without putting aircraft or crews at risk. Further, by launching from submarines based close to the theater of conflict, these missiles might avoid some of the overflight problems that would occur if a ballistic missile launched from the continental United States. It would not eliminate all possibilities of misunderstanding, however, because nations observing the launch might not be able to tell whether the missiles carried nuclear or conventional warheads, and, with the short time-of-flight, they might decide to assume the worst. Nevertheless, Navy officials have stated that there would be "immediate observable differences at launch" between this missile and a Trident missile because this missile would use two, rather than three, stages and would deliver a single reentry body and warhead, while the Trident missiles can carry up to eight warheads.[36] Further, the warhead under development for this missile would be too tall to fit on a Trident missile.[37]

Congress earmarked $10 million for the SLIRBM in FY2005 and $7.2 million in FY2006. In the House, the Defense Appropriations subcommittee has added $2 million for this effort in FY2007, but the Conference Committee provided only $1.3 million. The Pentagon did not request any additional funding for this program for FY2008, but it did indicate that prior-years funding would be used to continue funding efforts that will demonstrate the affordability and feasibility of this concept.

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[32] Norris, Robert S. and Hans M. Kristensen. "U.S. Nuclear Forces 2005," Bulletin of the Atomic Scientists, January/February 2005. pp. 73-75.

[33] A Trident II (D-5) missile can deliver its warheads over a range of 4,000 miles.

[34] *Report of the Defense Science Board Task Force on Future Strategic Strike Forces*. February 2004. p. 5-12.

[35] Koch, Andrew. "U.S. Considers Major Changes to Strategic Weapons," *Jane's Defence Weekly*, September 27, 2003

[36] Grossman, Elaine M. "Navy Eyes New Weapon for Global Strike, Missile Defense," *Global Security Newswire*, July 17, 2008.

[37] Dan Taylor, "Official: No Conventional Trident, But a Smaller Missile is Possible," *Inside Defense*, July 21, 2008.

Recent reports indicate, however, that the Pentagon has shown renewed interest in this concept and may allocate $120 million in FY2008 and $140 million in FY2009 to pursue a medium-range "Submarine-launched Global Strike Missile" with a range of 2,000-3000 nautical miles.[38] This missile would carry a conventional warhead, and would not have a nuclear variant. Funding could come from the new account established in the FY2008 Defense Appropriations Bills. This missile, however, would not provide a near-term alternative to the CTM. Reports indicate that, with test launches beginning around 2012, the missile might become operational between 2015 and 2018.

Air Force Programs

The Air Force began an Analysis of Alternatives (AOA) study in 2006 to review technologies and programs that could meet the requirements of the prompt global strike mission. Reports indicate that the Navy and Air Force are collaborating on the study. Personnel reportedly have been exchanging information on "service-specific" platforms, and are thinking broadly, across service lines, to consider a range of alternative platforms for the long-term PGS option.[39] These include a long-range land-based option, a shorter-range forward deployed land-based missile, a sea-based option, and an air-breathing option. The Air Force expected to complete the study by the summer of 2008, and to send it forward to the Joint Requirements Oversight Council, but, as of late 2008, the results were not yet available.[40]

In addition, the Air Force is pursuing the development of the Conventional Strike Missile (CSM). It initially expected this missile to serve as a mid-term follow-on to the Conventional Trident Modification (CTM) Program,[41] but, after Congress refused to fund development of the CTM, the Air Force alternative may become the earlier option for the PGS mission. Reports indicate that the Commander in Chief of STARTCOM, General Kevin Chilton, assigned the Air Force the lead role in developing the long-range missile capability for PGS in mid-2008.[42] The CSM would draw on existing missile technologies and reentry technologies developed under the FALCON (Force Application and Launch From Conus [Continental United States]) program, a joint Air Force/DARPA demonstration that is developing, among other things, both near-term and far-term capabilities for the prompt global strike missions.[43]

The Air Force has outlined a notional architecture and concept of operations for the CSM. Unlike the Trident plan, which would deploy nuclear and conventional warheads on the same submarines, the Air Force plan would segregate the missiles armed with conventional warheads and deploy them far from bases with nuclear warheads. The missiles could be deployed "on

[38] Grossman, Elaine, M. Midrange Missile May be Backup to Modified Trident. Global Security Newswire. September 21, 2007.

[39] Munez, Carlos. Services Collaborate on Long-Term Prompt Global Strike Study. Inside the Navy. September 10, 2007.

[40] Emelie Rutherford, "AoA for Prompt Global Strike to go to JROC this Summer, Chilton Says," *Defense Daily*, March 5, 2008.

[41] Grossman, Elaine M. "Conventional Strike Missile" Proposed as Midterm Global Option. *Inside Defense*. April 6, 2006.

[42] Elaine Grossman, "Chilton Shifts Prompt Strike Priority to the Air Force," *Global Security Newswire*, September 3, 2008.

[43] DARPA, "FALCON (Force Application and Launch from CONUS) Technology Demonstration Program," Fact Sheet. November 2003.

mobile launchers or in semi-buried silos or berms on each coast, ready to launch on short notice."[44] The two potential bases include Vandenberg Air Force Base on the West Coast and Cape Canaveral on the East Coast. As is discussed in more detail below, some experts believe that this missile, and the Air Force Concept of Operations for it, would make it easier to distinguish from a nuclear missile and less likely to be open to misinterpretation than a CTM launch.

Missile Options

Although it could build a new missile in the future, the Air Force has indicated that it could modify both Minuteman II missiles and Peacekeeper (MX) missiles to carry conventional warheads in the near term. The Minuteman II missile was first deployed in 1965 and was retired in the early 1990s. The Air Force deployed 450 of these missiles. Each carried a single nuclear warhead and had a range of over 7,000 miles. The Air Force has already modified some of these missiles, using five as target vehicles in tests of missile defense technologies and a few in a space-launch configuration. The Peacekeeper missile was first deployed in 1986; the Air Force began to deactivate these missiles in October 2002 and is to complete the process by the end of FY2005. The Air Force deployed 50 of these missiles; each carried 10 warheads and had a range greater than 6,000 miles.

The Air Force has designated these modified missiles as the Minotaur II and Minotaur III missiles. It has stated that the modifications can be made at a relatively low cost and low level of technical risk. They would use the missiles' existing rocket motors. The avionics and guidance systems could rely, primarily, on existing technologies, with some modifications to allow the upper stages of the missiles and their reentry vehicles to maneuver for improved accuracy. The Air Force has noted that it could deploy its ballistic missiles with conventional warheads as a "mid-term" solution, between 2013 and 2015, for the PGS mission. The Air Force has indicated that this option, using a modified Peacekeeper missile, would be able to carry much larger payloads than the Trident missile. [45]

Warhead Options

The modified Minuteman II missiles might each be able to carry a single warhead that weighed between 500 and 1,000 pounds; a modified Peacekeeper could possibly carry between 6,000 and 8,000 pounds of payload, which would allow for multiple warheads or reentry vehicles.[46] According to some estimates, these missiles could even destroy some targets without an explosive warhead, using the "sheer force of impact of a reentry vehicle moving at 14,000 feet per second."[47] They could also carry a single conventional warhead with a reentry body that had been modified to improve accuracy by allowing for the maneuverability of the warhead, like the maneuvering warhead the Navy has considered for the Trident modification. Reports indicate that the Air Force is also considering deploying some of these missiles with specialized warheads that could be designed to destroy selected categories of targets.

[44] Air Force Space Command. *Common Aero Vehicle White Paper*.

[45] Sirak, Michael. Air Force Envisions Mid-Term, Prompt Global Strike Missile. *Defense Daily*, July 7, 2006.

[46] Report of the Defense Science Board Task Force on Future Strategic Strike Forces. February 2004. p. 5-3.

[47] Schmitt, Eric. "U.S. Considers Conventional Warheads on Nuclear Missiles," *New York Times*, February 24, 2003.

One of the leading options for a reentry package, and a central focus of the FALCON study noted above, is the proposed Common Aero Vehicle (CAV). The CAV would be an unpowered, maneuverable hypersonic glide vehicle capable of carrying approximately 1,000 pounds in munitions or other payload. According to the Air Force, these payloads might include a "fuzed penetrator" warhead that would hit its targets with impact speeds of approximately 4,000 feet per second. With this high impact speed, the CAV should be able to attack and destroy some types of hardened or buried targets. The CAV could also carry several small smart bombs to destroy facilities and infrastructure above ground, wide area autonomous search munitions (WAASM) to destroy dispersed targets, and unmanned aerial vehicles (UAVs) that could gather intelligence in the target area.

The Air Force, which now refers to the CAV as the hypersonic test vehicle, plans to conduct two flight tests of the experimental vehicle in FY2009. A third test, which might explore the vehicle's ability to delivery weapons to a target, might occur in FY2010.[48] The Army is also developing a hypersonic payload vehicle; this might also serve as the front end of the Air Force CSM in the future.

System Characteristics

The FALCON study indicated that the proposed CAV, based on a modified ICBM or other launch vehicle, should be able to travel at 5 times the speed of sound (Mach 5) so that it can deliver a substantial payload from the continental United States to anywhere in on Earth in less than two hours.[49] The study has identified a number of objectives for the CAV system, in addition to the possible range of munitions loadings, that would allow it to achieve these goals. For example, to meet the "prompt" needs of the mission, the CAV and its delivery vehicle should achieve alert status, which would make it ready to launch, in under 24 hours. Further, it should then be able to launch from this alert status in less than 2 hours, once it has received an execution order. It should then be able to reach its target within one hour of its launch.[50] These characteristics would provide it with the capabilities needed to attack time-sensitive targets.[51]

To meet the "global" portion of the PGS mission, the CAV should not only have the range to "strike throughout the depth of an adversary's territory," it should also have a cross-range capability of 3,000 nautical miles. The cross range measures the ability of the CAV to maneuver and vary from a standard ballistic trajectory after its release from its launch vehicle. This ability to maneuver would allow the CAV to adjust to new information so that it could attack mobile targets, if timely and accurate information became available and were communicated to the CAV during its flight. Further, it would provide the CAV with a high degree of accuracy, allowing it to

[48] Elaine M. Grossman, "Chilton Shifts Prompt Strike Priority to Air Force," *Global Security Newswire*, September 3, 2008. See, also, Caitlin Harrington. "USAF Plans Hypersonic Weapon Test in 2010." *Jane's Defense Weekly*. August, 2008.

[49] DARPA, "FALCON (Force Application and Launch from CONUS Technology Demonstration Program," Fact Sheet. November 2003. See, also, Pincus, Walter. "Pentagon has Far-Reaching Defense Spacecraft in the works. Bush Administration Looking to Space to Fight Threats," *Washington Post*, March 16, 2005, p. 3.

[50] Report to Congress on the "Concept of Operations" for the Common Aero Vehicle. Submitted in response to Congressional Reporting Requirements, by Peter B. Teets, Under Secretary of the Air Force. February 24, 2004. p. 2.

[51] This implies that the U.S. command and control system would have the capability to identify potential targets, plan the mission, and prepare to launch the CAV within this time frame. These capabilities would be needed for the PGS mission, regardless of the munitions package on the ballistic missile.

deliver its weapons within a planned 3 meters of the intended target. The CAV would also have to be linked to "complete, timely intelligence, surveillance, and reconnaissance information."

Consequently, the ability of a missile armed with a CAV, or one armed with a single conventional warhead, to deliver its weapons to targets across the globe within hours of a decision to launch an attack presumes several interrelated capabilities. The United States would need the intelligence, surveillance, and reconnaissance (ISR) capability that would allow it to identify a target precisely and quickly. It would also need the command and control capability to review the targets, plan the attack, target the CAV vehicles, and order the launch within a short amount of time. Finally, it would need the continuing reconnaissance capability to verify that the intended target remained available and that the CAV reached and destroyed that target. The requirements would exist for both land-based and sea-based missiles.

Legislative Activity

Congress first considered the Administration's plans to develop conventional warheads for possible deployment on long-range ballistic missiles in FY2003. Since then, it has demonstrated some support, and some skepticism, about the plans.

FY2003 and FY2004

As was noted above, the Navy requested $30 million for its E2 program in FY2003 and FY2004. In each case, this was to be the initial year of funding in a three-year study. Congress refused the Navy's request in both years; the Navy has not requested additional funds for research and development on conventional warheads for SLBMs in subsequent years.

The Bush Administration requested $12.2 million in research and development funding for the CAV program in FY2004. The House, in its version of H.R. 1588, the FY2004 National Defense Authorization Bill, nearly doubled the authorized funding to $24.2 million. The Senate provided the requested amount, and the Conference Committee split the difference, authorizing $17.025 million. Although Congress supported the Administration's request for funding, the House had shown concerns about the possibility that U.S. launches of ballistic missiles armed with conventional warheads could be misinterpreted as non-conventional launches by nations who might monitor U.S. military activity, a concern, particularly, to Russia and China. Hence, the House required that the Air Force submit a report on the concept of operations for the CAV that would address questions about the potential for misinterpretation of the launches. This reporting requirement remained in the final version of the National Defense Authorization Act for Fiscal Year 2004 (P.L. 108-136).

The National Defense Authorization Act for Fiscal Year 2004, (P.L. 108-136, Sec. 1032) also contains a requirement for an annual report describing "an integrated plan for developing, deploying, and sustaining a prompt global strike capability." Congress mandated that the plan should include information on, among other things, the types of targets for long-range strike assets, the capabilities desired for these assets, an assessment of the command and control, intelligence, and surveillance capabilities necessary to support the PGS mission, integration with tactical missions, and cost and schedule for achieving the mission. In the Conference report (H.Rept. 108-354), Congress noted that its interest in these issues derived from the Nuclear Posture Review and its focus on integrating nuclear and conventional strike capabilities to reduce reliance on nuclear weapons. It indicated that it saw a need for further analysis of future system

requirements, along with a comprehensive effort to link planning and programs in a PGS roadmap to achieve a coherent force structure. Hence, although the Air Force considers the NPR objective of integrating nuclear and conventional strike forces as a separate mission and separate concept from PGS, Congress, initially at least, blended both into the request for a new report.

The Air Force submitted its report on the CAV concept of operations to Congress in February 2004. This report offered several suggestions for measures the United States could take to reduce the possibility of misinterpretation if the United States were to deploy, and employ, ballistic missiles with conventional warheads. Many of the measures discussed in this report are reviewed below, under "Issues for Congress."

FY2005

The Bush Administration requested $16.4 million for research and development on the CAV in FY2005. Congress again increased this funding level, appropriating $21.6 million for the development of the CAV. However, in July 2004, with passage of the FY2005 Defense Appropriations Act (H.R. 4613, P.L. 108-287), Congress repeated its concerns about the potential for misinterpretation. In the report on the Defense Appropriations Bill, Congress questioned whether there were safeguards in place to guarantee that other nuclear weapons states did not misinterpret the intent or use of ballistic missiles armed with CAV. In response to these concerns, the report states that funds provided for CAV could only be used for non-weapons related research on hypersonic technologies, including studies into microsatellites or other satellite launch requirements. Congress specified that the funds could not be used to "develop, integrate, or test a CAV variant that includes any nuclear or conventional weapons." Congress also indicated that the funds could not be used to "develop, integrate, or test a CAV for launch on any ICBM or SLBM." Congress would consider expanding the scope of this program in future years if safeguards negotiated among international partners were put into place.[52]

FY2006 and FY2007

The Bush Administration requested $27.2 million for CAV in FY2006. In response to the restrictions in the FY2005 Defense Appropriations Act, it restructured the program, and redesignated the CAV as the Hypersonic Technology Vehicle. This new program excludes any development of weapons capabilities for the CAV. Congress approved the requested funding in the FY2006 Defense Appropriations Act and did not impose any new restrictions. The Bush Administration requested, and Congress appropriated, an additional $33.4 million for CAV in its FY2007 budget. Congress also appropriated $12 million for the Air Force to Conventional Ballistic Missile (CBM) program, which is exploring the possible use of a modified Minuteman missile as a mid-term option for the PGS mission.

The budget projections in the FY2006 budget request demonstrate how costs could increase if the Air Force continues to pursue the CAV program. The budget requests were projected to be between $31 and $39 million each year for the next three years, but they were then projected to rise to $92 million in FY2010 and $94 million in FY2011. This sharp increase reflects an expected change in the program from research and development to production and deployment at

[52] U.S. Congress, House. *Making Appropriations for the Department of Defense for the Fiscal Year Ending September 30, 2005, and For Other Purposes*. Conference Report to Accompany H.R. 4613, H.Rept. 108-622. p. 240.

the end of the decade. This change would require that the Air Force address and resolve congressional concerns about the potential for misunderstandings with the launch of ballistic missiles armed with conventional warheads. But it also indicates that the CAV would not provide a near-term solution to the PGS mission needs, as might the Navy's CTM program.

As was noted above, the Navy's FY2007 budget included $127 million for the conventional Trident modification. The request separated into three categories. The budget included $38 million for the CTM within the much larger ($957.6m) budget for Trident II missile modifications; $12 million for strategic missile systems equipment to support the CTM; and $77 million for the development of an advanced strike capability that would demonstrate the feasibility of the CTM concept.

Neither the House nor the Senate Armed Services committees authorized the Administration's request in their versions of the FY2007 Defense Authorization Bills (S. 2766 and S.Rept. 109-254; H.R. 5122 and H.Rept. 109-452). Both Committees noted their concerns about the possibility that nations, such as Russia, might misunderstand the launch of a conventional Trident missile and determine that it was under attack from U.S. nuclear weapons. Both committees requested reports from the Administration that would address a range of issues raised by this prospective program. The Senate Armed Services Committee withheld $95 million of the Administration's request, pending completion of the report. It authorized the use of $20 million for the preparation of the report and $32 million for research and development on technologies that would support the Trident modification. It specified that the money could not be used on the CTM program itself. The full Senate accepted the Committee's position. The House Armed Services Committee eliminated the $38 million for CTM in the Trident II modification budget and the $12 million for strategic missile systems equipment. It also reduced by $47 million the Navy's request for funding for the CTM program, leaving $30 million for this effort.

The Conference Committee, in its report (H.Rept. 109-702, Sec. 219) adopted the reporting requirements included in the Senate Bill, but, instead of fencing the funding pending completion of the report, accepted the House's reduction in CTM funding. Therefore, as was the case in the House bill, the Conference Report includes only $30 million for research and development into an advanced strike capability that would support the CTM concept.

The House and Senate Appropriations Bills also rejected the Administration's request for funding for the CTM program. Following the HASC, the Defense Appropriations subcommittee in the House eliminated all but $30 million in research and development funding. It also raised questions about the feasibility of the proposed schedule for the program and questioned whether the decision to move forward immediately would pre-judge the outcome of the PGS AOA study. In the Senate, the Defense Appropriations Subcommittee eliminated all funding for the CTM program, and provided $5 million for the National Academy of Sciences to analyze the mission requirement and recommend alternatives. The Conference Report on the Defense Appropriations Act (H.Rept. 109-676) retained the Senate provision that funded $5 million for a report from the National Academy of Sciences. It also included $20 million in Research, Development, Test and Evaluation funds for research that would focus on those "developmental items which are common to all the global strike alternatives."

FY2008

The President's budget request for FY2008 included continued funding of $32.8 million for the CAV. Congress did not approve this request, but in both the Authorization and Appropriations

Bills, transferred this funding to a new, integrated account for Prompt Global Strike Research. Congress also eliminated separate funding of $50 million for other elements of the FALCON program, rolling them into the new account as well. As is discussed in more detail below, the total funding for this new account was set at $100 million for FY2008, less than half of the requested funding for all the programs that were combined in the new account. The Pentagon has objected to this transfer, noting that the elimination of the specific line items and the overall reduction in funding would lead to the termination of the FALCON program and the cancellation of several planned flight test for the CAV. Although the Pentagon eventually accepted the idea of a combined program for PGS research, it suggested that the total budget be set at $208 million, an amount equal to the total proposed for the combined programs, so that each could continue to receive the required level of investment.[53] Congress did not accept this appeal, and the conference reports on both the Authorization (H.R. 1585, H.Rept. 110-477) and Appropriations (P.L. 110-116, H.Rept. 110-134) bills limited the funding to $100 million.

The President's budget for FY2008 also included a total of $175.4 million for the CTM program. This request included $36 million, within the much larger budget of just over $1 billion for Trident II modifications, to begin modifying the Trident II missiles to carry conventional warheads. Congress had denied all funding for this purpose in FY2007. It also included $13 million in strategic systems missile equipment, which would be used to begin modifying Trident submarines to carry the conventional missile. Congress had also denied this funding in FY2007. Finally, the budget included $126.4 million to develop advanced strike capabilities under the "Hard and Deeply Buried Target Defeat System Program" area. This funding is allocated to continue research and development into reentry vehicle technologies for the conventional Trident modification. Congress had appropriated only $20 million for this effort in FY2007, even though the budget had requested $77 million.

The House Armed Services Committee, in its version of the FY2008 Defense Authorization Bill (H.R. 1585, H.Rept. 110-146), supported continued research, development, testing, and evaluation of the conventional Trident concept, but prevented funds from being obligated or expended for the operational deployment of the system. Specifically, it approved the request for $126.4 million for continued research and development on the reentry vehicle, and authorized $16 million for procurement, but reduced the budget request by $33 million, withholding all funds for long-lead procurement. The Strategic Forces Subcommittee noted that it supported, in general, the pursuit of technologies for the Prompt Global Strike Mission, but also noted that questions remained about the concept of operations and the possibility for misunderstandings. Hence, it sought to slow the program until the National Academy of Sciences completed its report.

The Senate Armed Services Committee, in its version of the FY2008 Defense Authorization Bill (S. 1547, S.Rept. 110-77), recommended that no funding be provided specifically for the CTM program, and that all $208 million in PGS funding be transferred to PE 65104D8Z, to support common prompt global strike concepts. The committee specifically indicated that this program element should support a "coordinated look at a variety of kinetic non-nuclear concepts is necessary to address the feasibility of a prompt global strike." In its report, it noted that the services are exploring several potential options for the PGS mission, and that research funded through this program element could support, "in a coordinated fashion," technologies that could

[53] Department of Defense Budget Appeal, FY2008 Defense Appropriations Bill. October 15, 2007.

be common to several of these concepts. The committee also indicated that it believed any resulting PGS capability should be clearly, and unambiguously, non-nuclear.

The Conference Committee adopted the Senate's approach to combining the funding in a single account, but, as the Appropriations Committee had done, limited the funding to $100 million (H.Rept. 110-477). The Conference Report also required that the Under Secretary of Defense for Acquisition, Technology, and Logistics submit a plan describing how DOD would obligate the FY2008 funds (H.Rept. 110-477, sec. 243). This funding profile indicates that Congress has not rejected the Prompt Global Strike concept completely, even though it has not accepted the Administration's sense of urgency or its certainty in the need for the CTM program in the near-term.

The House and Senate Appropriations Committees followed the "combined funding" model established by the SASC. The House Appropriations Committee eliminated the specific funding for the CTM, directed DOD to create a "prompt global strike program element within the Research, Development, Test, and Evaluation, Defense-Wide appropriation," and moved $100 million into this new account to "further the Department's prompt global strike initiative" without "limiting the Nation to a single option" at this point in time. Some of these funds could be used to support research and development on the CTM concept. The committee also mandated that DOD submit a report "that discusses the technology thrusts and investment objectives and outlines the allocation of funding towards achieving these objectives." The Senate Appropriations Committee, in its version of the Bill (H.R. 3222, S.Rept. 110-155) provided $125,000,000 for the Research, Development, Test and Evaluation, Defense-Wide account for prompt global strike mission. It noted that these funds should be used "for engineering and development of alternatives to the conventional TRIDENT missile program." The final version of the FY2008 Appropriations Bill limited the funding to $100 million (P.L. 110-181, H.Rept. 110-477).

FY2009

The Pentagon requested $117.6 million for the prompt global strike program element established in the FY2008 Defense Authorization and Appropriations processes. It also submitted a report to Congress, as required by the FY2008 Defense Authorization Bill (P.L. 110-181, H.Rept. 110-477, Sec. 243), that outlined its plans for dividing up the FY2008 and FY2009 funding under the PGS program element. In this report, DOD planned to spend $58 million in FY2008 and $70 million in FY2009 on tests of hypersonic glide vehicle. It also allotted $30 million in FY2008 and $40 million in FY2009 for alternative re-entry systems development, a reference to the Medium-Lift Reentry Body that could be deployed on a new sea-based ballistic missile. Further, the report indicated that DOD would spend $6 million in FY2008 and $3 million in FY2009 on the LETB-2 demonstration described above (see "Reentry Vehicle Research").

The House Armed Services Committee, following the lead of the Strategic Forces Subcommittee, approved this request. The Senate Armed Services Committee, however, added $30 million to this amount, for a total of $147.6, in its version of the FY2009 Defense Authorization Bill (S. 3001). It indicated that these added funds, plus an additional $15 million in the budget request, were to be allocated to R&D on an advanced hypersonic-glide vehicle—the CAV program described earlier in this report. However, in the final version of the FY2009 Defense Authorization Bill, Congress provided the requested amount of $117.6 million for the PGS account.

The Defense Subcommittee of the Senate Appropriations Committee, however, deleted $43 million from the PGS account, leaving only 74.6 million. It removed the $40 million planned for

work on the Medium Lift Re-entry Body and the $3 million allocated to the LETB-2 test bed program. In other words, it rejected DOD's plans to continue developing reentry technologies that could be deployed on either the Trident missile or a new sea-based conventional ballistic missile. The final version of the Defense Appropriations Bill, which was included in a larger consolidated appropriations bill, included this reduction in funding. Further, the legislation specified that "not less than one-fourth" of the funds provided, or $19 million, must be "available" for the Advanced Hypersonic Weapon under development by the Army.[54]

Issues for Congress

During the past few years, when reviewing Administration's request for funding for these programs, Congress has focused, primarily, on questions about the potential that misunderstandings might arise if the United States were to launch long-range missiles during crises or conflicts. Stepping back from the specific programs, however, Congress has also reviewed the rationales offered by the NPR and PGS mission to determine whether the threats and capabilities faced by the United States justify the pursuit of these programs. It has also begun to question whether other military programs and capabilities can satisfy the emerging requirements, without raising many of the questions about the potential for misunderstandings associated with the deployment of conventional warheads on ballistic missiles. Further, Congress could review the Air Force proposals for addressing the issues raised by the deployment of CAV or other conventional warheads on ICBMs and the more recent proposals to meet the PGS mission need with the near-term deployment of conventional warheads on Trident missiles. Finally, U.S. obligations under the 1991 Strategic Arms Reduction Treaty (START) could impinge plans for the deployment of long-range ballistic missiles with conventional warheads.

Assessing the Rationale

The Nuclear Posture Review

Those who believe that conventional ICBMs might contribute to this mission argue that, with improvements in accuracy, conventional warheads could substitute for nuclear warheads in attacking some sites now targeted by nuclear weapons. The Bush Administration and some analysts have argued that this would provide the President with a wider range of options during a crisis and, therefore, reduce the likelihood that he would have to use a nuclear weapon. Some have questioned, however, whether the President needs more options or flexibility. Nuclear weapons have always been reserved for the most extreme circumstances, serving particularly as a deterrent against nuclear attack from other nations with nuclear weapons. In less extreme circumstances, the President has never lacked for conventional options, they say, as is evidenced by the fact that the United States has not used nuclear weapons since 1945.

Many analysts have also argued that the Bush Administration's formula for integrating conventional and nuclear capabilities into an "offensive strike" force could actually increase the likelihood of nuclear war by blurring the distinction between nuclear and conventional weapons. This new capability could allow the President to respond with conventional strikes against some

[54] Elaine M. Grossman, "Strategic Arms Funds Tilt Conventional in 2009," *Global Security Newswire*. November 7, 2008.

types of targets, but it is not clear that the adversary would know that the incoming weapons carried conventional warheads. It is also not clear that the United States would be able to control the adversary's reaction or the escalation of the conflict, particularly if the adversary possessed nuclear weapons. Hence, by making the start of the war "easier" the deployment of conventional warheads on ballistic missiles might, in this view, actually make the eventual use of nuclear weapons more likely.

PGS

The PGS mission's requirements are based on the assumption that a future conflict would take place far from existing U.S. bases overseas, and possibly far from ocean areas where the U.S. has deployed most of its sea-based forces. They also assume that a future conflict could develop quickly, allowing too little time for the United States to move its forces into the region, either by acquiring basing rights on land or by moving sea-based forces closer to the theater of conflict. Further, the concern about hidden or relocatable targets reflects an assumption that targets could appear with little notice and remain vulnerable for a short period of time, factors that place a premium on the ability to launch quickly and arrive on target quickly. The requirements also assume that U.S. forces are likely to face an "anti-access" threat, or air defense capabilities that would impede operations by U.S. aircraft.

Many of these characteristics were present in Afghanistan in 2001, when the United States attacked al Qaeda training camps and the Taliban government after the September 11 terrorist attacks. The attacks on the United States came without warning, and, although the United States took several weeks to plan its response and acquire the needed intelligence information on target areas, speed was of the essence if the United States hoped to trap and destroy leaders at the training camps in Afghanistan. The United States had no military bases in the region, and had to take the time to acquire basing rights in nearby nations and to move U.S. naval forces into the region. Further, the mountainous terrain offered the enemy areas, deep within the country, where it could conceal its leadership and hope to evade attack.

These characteristics, with the premium they place on prompt, long-range attacks, support the view that the United States should deploy long-range ballistic missiles with conventional warheads for the PGS Mission. In this view, other weapons systems cannot address all the characteristics at the same time; bombers may be too slow to arrive and too vulnerable to air defense systems, sea-based or air-launched cruise missiles may also be too slow too arrive and of too short a range to reach remote targets, and sea-based systems, with the exception of long-range ballistic missiles, may also be too far away to reach high priority targets promptly at the sudden start of a conflict.

However, the presence of many of these characteristics in one recent conflict does not necessarily mean that they will all be present in most, or even many, future conflicts. While each is certainly possible, taken together, these characteristics describe a worst-case scenario that may occur rarely, or not at all, in its entirety. This observation highlights several questions that Congress could consider when reviewing the rationale for the PGS mission. How likely is it that the United States would face a sudden, unanticipated conflict, with no time to build up its forces in the region *and* with the requirement to strike some targets within hours of the start of the conflict? Would a delay of several hours or even days undermine the value of attacking these targets at the start of a conflict? Could other weapons systems provide the United States with the ability to

"loiter" near the theater of operations, allowing a prompt attack during the conflict if hidden or concealed targets are revealed?[55] A comparison of the likelihood of those scenarios that may provide the most stressing environments with the likelihood of less stressful scenarios may lead to the conclusion that other weapons systems can respond to many of these requirements in most circumstances.

Reviewing the Alternatives

Land-Based Ballistic Missiles

Long-range land-based ballistic missiles armed with conventional warheads would likely possess many of the operational strengths associated with nuclear-armed ballistic missiles. They would have extremely high rates of readiness and reliability, allowing military planners to expect more than 90% of the missiles to be available for use at any given time; they could to respond promptly after a decision to launch; and they have high degree of accuracy allowing for attacks across a wide range of targets. Consequently, these systems would "free the U.S. military from reliance on forward basing and enable it to react promptly and decisively to destabilizing or threatening actions by hostile countries and terrorist organizations."[56] They would allow the United States to "hold adversary vital interests at risk at all times, counter anti-access threats, serve as a halt phase shock force, and conduct suppression of enemy air defense and lethal strike missions." Further, they address the need to "defeat time-critical, high value, and hardened and deeply buried targets."[57] In other words, these weapons would address all the potential circumstances cited in requirements for the PGS mission.

But the resemblance to nuclear-armed ballistic missiles would also raise questions and create concerns. If the United States were to launch them during a conflict, nations with minimal launch notification systems (such as China) or degraded launch notification systems (such as Russia) could conclude that they were under attack with nuclear missiles.[58] Further, because many possible targets lie south of Russia and China, and the United States has historically planned to launch its ballistic missiles over the North Pole, a conventionally-armed long-range ballistic missile would likely fly over these to nations to strike its targets. For many minutes during their flight patterns, these missiles might appear to be headed towards targets in these nations. The potential for misunderstanding is compounded by the short time of flight of these missiles, giving these nations little time to evaluate the event, assess the threat, and respond with their own forces.

[55] Barry Watts, an analyst expert in this subject has stated that, "for those rare occasions when it really is imperative to be able to strike anywhere on the globe from the United States as quickly as possible, a long-range ballistic missile solution is the most sensible near-term option in light of cost and technological risk." But he has also asserted that it may be "far more important to be able to dwell or loiter to await information and take advantage of opportunities" to attack hidden or mobile targets during a conflict. Watts, Barry D. *Long-Range Strike: Imperatives, Urgency and Options*. Center for Strategic and Budgetary Assessments. April 2005.

[56] DARPA, "FALCON (Force Application and Launch from CONUS Technology Demonstration Program," Fact Sheet. November 2003.

[57] Ibid.

[58] For a description of ongoing problems with Russia's early warning system for ballistic missile attack, see Mosher, David E., et al. *Beyond the Nuclear Shadow: A Phased Approach for Improving Nuclear Safety and U.S.-Russian Relations*. RAND Corporation, 2003. p. 5.

There is precedent for the United States to deploy some types of delivery vehicles with both nuclear and conventional warheads. For example, U.S. long-range bombers have always been able to carry conventional weapons and all three of the current types of nuclear-capable bombers—B-1, B-2, and B-52—have delivered conventional weapons during recent conflicts. In addition, the conventional cruise missiles carried by the B-52 bomber were initially deployed as nuclear air-launched cruise missiles and were later (during the early 1990s) converted to carry conventional weapons. Unlike ballistic missiles however, bombers can change their course and return to base if necessary. Further, the Tomahawk sea-launched cruise missiles (SLCMs) have always been deployed in both nuclear and conventional versions. The United States has often launched the conventional SLCMs during conflicts and has never experienced misunderstandings about whether these missiles carried nuclear or conventional warheads.[59] But these have never flown over Russia in pursuit of their targets.

Long-range ballistic missiles with conventional warheads could be viewed with far more concern than these other dual-capable systems because they were developed and deployed solely as a part of the U.S. strategic nuclear deterrent force. Even if the United States were to convince other nations that we had deployed some of these missiles with conventional warheads, they could still question whether the missiles launched during a conflict carried conventional warheads or whether the United States had converted them back to carry nuclear warheads.

The launch of land-based long-range ballistic missiles armed with conventional warheads could present another type of problem for the United States and Canada. If these missiles were launched from existing ICBM bases in the northern and central United States, they could drop their rocket motor stages over populated areas of the United States or Canada. This may have been considered a small price to pay during a global nuclear war with the Soviet Union, but it may be far less acceptable within civilian populations under less trying and catastrophic circumstances.

As was noted above, the Air Force has said it would rename the retired Minuteman and Peacekeeper missiles as the Minotaur II and Minotaur III missiles if it deploys them with the conventional warheads or the proposed CAV system. This would allow the United States to differentiate between the conventional and nuclear-armed versions of its ballistic missiles in its operational plans, and possibly help provide other nations with a means to distinguish between the two. The Air Force has also identified a concept of operation for the Minotaur missiles that includes a number of "mitigating measures" that might ease concerns about the potential for misunderstandings and damage arising from their launch. These factors fall into three general categories: basing measures; cooperative measures; and operational measures.

Basing Measures

The Air Force has stated that it would deploy ballistic missiles armed with CAVs or other conventional warheads for PGS mission at bases far from missiles armed with nuclear warheads and far from bases with storage facilities for nuclear warheads.[60] The two potential sites include Vandenberg Air Force base in California and Cape Canaveral in Florida. According to the Air

[59] On the other hand, the Soviet Union, and Russia, have sought to contain U.S. cruise missile capabilities by suggesting arms control limits on nuclear SLCMs that could also capture SLCMs armed with conventional warheads. Soviet and Russian analysts have viewed these weapons as threatening to Soviet nuclear facilities, regardless of their warhead, because of their high accuracy and relatively short time of flight.

[60] U.S. Air Force. Common Aero Vehicle White Paper. p. 7.

Force, "the new coastal basing sites would have no nuclear capability or association"[61] as they would lack the facilities and equipment needed to handle or store nuclear weapons. The coastal basing plan would also address concerns about debris from missile launches falling on populated areas in the United States or Canada. If the missiles were launched from the U.S. coast, rather than from bases in northern, central states, then the debris would likely fall over the oceans rather than over land.

The Air Force has also stated that it could deploy Minotaur missiles on mobile launchers, horizontally in earthen berms, or above ground, rather than in the hardened, vertical silos used at nuclear ICBM bases. The United States could then declare, to Russia or other nations, that these new, modified launchers were equipped with conventional-only delivery vehicles. This declaration would further demonstrate that the missiles at the two coastal bases were different from nuclear ICBMs, even though it would not preclude the possible covert deployment of nuclear warheads on the missiles.[62] Further, their deployment with a CAV reentry vehicle, rather than a standard post-boost vehicle and warhead present on a nuclear-armed missile, would reinforce this designation.[63]

Cooperative Measures

The Air Force has proposed that the United States institute a number of cooperative measures with other nations to add confidence to the U.S. declaration that the Minotaur missiles deployed at coastal bases would carry conventional warheads. These measures could include military-to-military contacts, high level political consultations, and ongoing discussions to keep Russia and other nations informed about U.S. plans for these missiles and to make them aware of the observable differences between conventional and nuclear ballistic missiles. The Air Force has referred to this process as a "strategic dialogue" that might, over time, answer questions and ease concerns about the plans for and capabilities of long-range ballistic missiles armed with conventional warheads.[64]

The United States could also invite other nations to observe test launches of these missiles or to participate in exercises that include simulations with these missiles. This might allow nations such as Russia to become familiar with the operational procedures associated with ballistic missiles armed with conventional warheads and to distinguish between these procedures and those associated with nuclear-armed missiles. Further, the United States could allow Russia to conduct short-notice inspections at the Minotaur bases, similar to, or even more intrusive than, the inspections permitted at nuclear missile bases under the START Treaty, to confirm the absence of nuclear weapons either on the missiles or in the storage facilities.[65] Over time, these measures would not only provide information about the missiles and their missions, but might

[61] Report to Congress on the "Concept of Operations" for the Common Aero Vehicle. Submitted in response to Congressional Reporting Requirements, by Peter B. Teets, Under Secretary of the Air Force. February 24, 2004. p. 4.

[62] The United States uses a similar formula with its B-1 bombers. Although they were originally equipped to carry nuclear weapons, they have been deployed at bases that do not house nuclear weapons and redesignated as conventional bombers. Hence, their weapons delivery status is determined by basing and declaration, rather than by their original nuclear capabilities.

[63] Air Force Space Command. Common Aero Vehicle White Paper. p. 8.

[64] Ibid. p. 7.

[65] Report to Congress on the "Concept of Operations" for the Common Aero Vehicle. Submitted in response to Congressional Reporting Requirements, by Peter B. Teets, Under Secretary of the Air Force. February 24, 2004. p. 4.

also build confidence and understanding between the parties. The increased level of cooperation, and possibly decreased level of suspicion, might then reduce the likelihood of misinterpretation if the United States were to launch ballistic missiles with conventional warheads.

The United States could also provide Russia with prior notification of planned launches of ballistic missiles with conventional warheads, or the two nations could set up a dedicated "hot line" for use after a launch, so the United States could inform Russia of the launch and assure it that the missile did not carry a nuclear warhead and was not headed for targets in Russia. Further, as has been discussed on many occasions over the years, the United States and Russia could share early-warning data at a joint facility so that Russia would have the information it needed to distinguish between the launch of a nuclear-armed ballistic missile from a northern base and the launch of a conventional-armed ballistic missile from a coastal base.

Mission Planning and Operational Measures

The Air Force has also indicated that it could alter the trajectory of ballistic missiles armed with conventional warheads so that they would not resemble the trajectories that would be followed by nuclear-armed ballistic missiles on course for targets in Russia or China.[66] As was noted above, CAV is have the capability to travel 3,000 miles downrange and 3,000 miles cross-range, after release from its ballistic missile delivery system. Hence, according to the Air Force, the missile could travel on a "shaped trajectory" or, if launched from the East Coast towards the Middle East, a southern trajectory, so that it would not fly over Russia or China, and make up for the added distance by using the flight range of the CAV. The missile could also launch with a "depressed trajectory," then use the aerodynamic lift of the CAV to achieve the range it would need to reach around the globe without flying over Russia.

Taken together, these three types of measures might help reduce the risks of misunderstandings. But the accumulation of information during peacetime and frequent communications during crises may not be sufficient address problems that could come up in an atmosphere of confusion and incomplete information during a conflict. Specifically, the argument in favor of using long-range ballistic missiles for the PGS mission assumes that the United States might have little warning before the start a conflict and might need to launch its missiles promptly at that time. This scenario would allow little time for the United States to consult with, or even inform, other nations about its intentions. If other nations are caught by surprise and fear they might be under nuclear attack, they might also decide to respond promptly, before the United States had the opportunity to convince them that the missiles carried conventional warheads.

Further, routine data exchanges and on-site inspections can provide confidence in the absence of nuclear warheads on the missiles on a day-to-day basis in peacetime, but they cannot provide assurances that the warheads could not be changed in a relatively short period of time or that the warheads were not actually changed in the days or weeks since the last inspection. In addition, changing the basing patterns or launch patterns of missiles to draw a sharper distinction between conventional and nuclear-armed missiles assumes both that other nations can observe the differences and that they believe the different appearances indicate different warheads. Finally, these measures would do nothing to alleviate concerns among nations that did not participate in the cooperative programs. As a result, while the measures described above can reduce the possibility of misunderstandings, they probably cannot eliminate them.

[66] Air Force Space Command. Common Aero Vehicle White Paper. p. 11.

Submarine-Launched Ballistic Missiles

As was noted above, DOD had hoped to deploy conventional warheads on Trident long-range ballistic missiles. Although they would be based at sea, these missiles would share many characteristics of land-based ballistic missiles that make them suited to the PGS mission. As nuclear delivery vehicles, they have been deployed with the command and control systems needed to allow for prompt decision making and prompt launch during a crisis. They have the range to reach targets around the world and they would have the accuracy, particularly if the reentry vehicles can receive GPS updates, to attack a wide range of targets on short notice. Congress has offered modest support for this effort in the past, providing an additional $10 million in the FY2005 Defense Appropriations Act for "Advanced Conventional Strike Capability Assessment." And, as was noted above, the Navy requested $127 million for this effort in the FY2007 budget, with funding to total $503 million in the next six years, but Congress rejected this funding request, providing only $30 million for research on the reentry vehicle. It has requested $162.4 million in FY2008.

SLBMs armed with conventional warheads could raise many of the same questions about misunderstandings as land-based ballistic missiles, particularly if these warheads are deployed on the same submarines that currently carry nuclear warheads. The Navy could not employ many of the techniques identified by the Air Force to convince potential adversaries that the missiles carried conventional warheads. Even if the United States did deploy SLBMs with conventional warheads on submarines that did not carry nuclear warheads, it would be extremely difficult to demonstrate these differences and assure other nations of the segregated deployments in a submarine that is intended to be hidden and invulnerable when at sea. Further, according to some reports, Russia's ability to monitor U.S. SLBM launches is even more degraded than its ability to monitor ICBM launches, so it might conclude that it is under nuclear attack if it observed an SLBM launch from a U.S. ballistic missile submarine.

On the other hand, because the submarines are mobile and the missiles are long-range, the United States could alter the patrol areas for Trident submarines so that, if they were to launch their conventional missiles, they could use trajectories that did not require them to fly over these nations on their way to their intended targets. Alternatively, the submarines could move prior to launching their missiles, to avoid overflight of Russia or China, but this presumes that the United States had the time to move its submarines to these new launch points prior to the start of the conflict, a possibility that is inconsistent with the PGS mission's assumption that the United States could need to launch its missiles promptly at the start of an unexpected conflict.

The plan to deploy Trident missiles with conventional warheads on the same submarines as missiles with nuclear warheads could also raise questions about the command and control of those missiles. At the present time, submarine commanders can not launch their missiles until they receive authorization from the National Command Authority (essentially, the President). It is unclear whether the missiles with conventional warheads would be subject to the same stringent command and control processes, or whether someone within the military chain of command would be able to authorize their use without Presidential approval.

Long-Range Bombers

U.S. bombers—B-52s, B-2s, and B-1s—have the range and payload needed to deliver weapons to targets across the globe. But they may not be suited to the PGS mission because they could take hours or days to reach targets in remote areas, and they would require tanker support to refuel

during their missions. The long flight time could contribute to crew fatigue and air defenses could deny the bombers access to some critical target areas. Conventional cruise missiles delivered by B-52 bombers would allow the aircraft to stay out of the range of some air-defense systems, but they could still take too long to reach their targets meet the objectives of the PGS mission. On the other hand, the long time of flight could give the United States time to review and resolve the situation without resort to military attacks.

Tomahawk Cruise Missiles

At the present time, the Navy has the capability to attack targets at ranges of around 1,500 nautical miles with sea-based cruise missiles. These Tomahawk missiles have been employed often in the conflicts in the past 15 years, providing the United States with the ability to reach targets without risking aircraft or their crews. The Navy is currently modifying four of its Trident ballistic missile submarines so that they can carry cruise missiles. These submarines are to be equipped to carry up to 7 Tomahawk missiles each in up to 22 (out of 24) of their Trident launch tubes, for a total of 154 cruise missiles per submarine. But these missiles may be limited in their ability to contribute to the PGS mission. With a maximum speed of about 550 miles per hour and a range of 1,500 nautical miles they can take 2-3 hours to reach their targets. Further, their reach is limited, even if the ships or submarines carrying the missiles are deployed in the region of the conflict. Consequently, the Navy has also explored alternatives that would allow it to reach its potential targets more quickly.

Hypersonic Cruise Missiles

Since the mid-1990s, the Navy has explored several options for the development and deployment of an attack missile that could travel at speeds of Mach 3-Mach 5.[67] These hypersonic missiles would allow the Navy to attack targets within 15 minutes from ships or submarines based within 500-600 nautical miles of their targets. Hence, they would provide the capability for prompt strikes within the theater of operations, but they would not have the range sought for the PGS mission. The United States would either need to keep its vessels on station near potential areas of conflict, which it already does in certain areas, or it would need days or weeks to move its ships or submarines into place.

Forward-Based Global Strike (FBGS)

Analysts have also explored the option of deploying long-range land-based ballistic missiles at bases outside the continental United States. For example, it might be deployed in Guam, Diego Garcia, or Alaska. This system would use a two-stage rocket motor, with a payload of up to 1,000 pounds, a flight time to target of less than 25 minutes, and an accuracy of less than 5 meters. It could employ many of the same reentry vehicle and warhead options as the CTM and CSM systems. Because it would rely on existing rocket technologies, it might be available for deployment by 2012, in roughly the same time frame as the CSM system. However, because it would be launched from outside the continental United States, its trajectory would not resemble that of a land-based ICBM. Hence, some analysts argue that it would solve many of the questions

[67] For a summary of these programs see Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, before the House Armed Services Committee, Subcommittee on Projection Forces. Hearing on Long-Range Strike Options. March 3, 2004. pp. 10-11.

about misunderstandings and misperceptions that plague the CTM and CSM systems. The Defense Subcommittee of the House Appropriations Committee included $4 million for this effort in the FY2007 defense appropriations bill, but the Conference Committee reduced this amount to $1.8 million.

Arms Control Issues

Air Force Plans

The Air Force has acknowledged that "depending on system design" long-range ballistic missiles armed with conventional warheads could be covered by the provisions in the 1991 START Treaty.[68] This assessment, however, assumes that the START Treaty remains in force when the missiles are deployed. START expires at the end of 2009, and, at this time, it seems possible that the bulk of the Treaty will lapse, even though the United States and Russia may retain some of the monitoring and verification provisions.

START limits the United States to a total of 4,900 "attributed" warheads on its land-based and sea-based long-range ballistic missiles (ICBMs and SLBMs). The number of warheads attributed to each type of missile is outlined in a memorandum of understanding that accompanies the treaty. The Minuteman II missile, which would serve as the base for the Minotaur II missile, is counted as carrying one warhead; the Peacekeeper, which could become the Minotaur III missile, is counted as carrying 10 warheads.

The treaty specifies that all ICBM launchers and submarine launch tubes that can hold ballistic missiles covered by the treaty will count against the treaty limits. This would presumably include launchers for Minotaur missiles. However, even if the Minotaur missiles count against the START limits as if they were still Minuteman II or Peacekeeper missiles, it is unlikely that the United States would exceed the START limit of 4,900 warheads. This is because the United States plans to reduce its warheads to between 1,700 and 2,200 "operationally deployed warheads," as it is required to do under the 2002 Moscow Treaty between the United States and Russia. These deeper reductions warheads on nuclear-armed ballistic missiles will mean that the United States has the "room" to deploy missiles with conventional warheads without exceeding START limits. The United States would not have to count missiles with conventional warheads against the limits in the 2003 Moscow Treaty if it excludes these systems from its definition of "operationally deployed warheads."[69]

The START Treaty could, nonetheless, impinge on the Air Force plan to deploy ballistic missiles with conventional warheads at coastal bases. The treaty indicates that new types of ICBMs, or modified versions of existing ICBMs, must be deployed at ICBM bases in rail-mobile, road-mobile, or silo launchers.[70] The United States could declare Vandenberg to be a new ICBM base,

[68] Report to Congress on the "Concept of Operations" for the Common Aero Vehicle. Submitted in response to Congressional Reporting Requirements, by Peter B. Teets, Under Secretary of the Air Force. February 24, 2004. p. 4.

[69] The Moscow Treaty does not define "operationally deployed warheads." Each nation can do so on its own, and declare which systems it will count under the limit of 2,200 operationally deployed warheads.

[70] Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms (START Treaty). Article V, para 3. Russia, Ukraine, Kazakhstan and Belarus succeeded the Soviet Union as parties to the Treaty.

but it would have to build new silos, or use mobile launchers for the missiles. The treaty does allow the parties to locate "soft-site" launchers for ICBMs at test ranges or space launch facilities, which would include Vandenberg and Cape Canaveral.[71] But the treaty states that the parties cannot flight test ICBMs equipped with reentry vehicles from space-launch facilities, which would seem to preclude deployment at Cape Canaveral.[72] The treaty further limits the aggregate number of ICBMs and SLBMs located at test facilities (which would include Vandenberg) to 25 and the aggregate number of test launchers to 20.[73] The United States has already declared that it has 15 test launchers at Vandenberg, leaving little room for the deployment of additional launchers for ballistic missiles armed with conventional warheads.

The START Treaty also allows on-site inspections at bases housing delivery vehicles limited by the treaty, notifications prior to the launch of missiles limited by the treaty, and the provision of telemetry generated during test flights of missiles limited by the treaty. These provisions could all apply to the new Minotaur missiles, even if they are deployed with conventional warheads far from bases that house nuclear warheads or nuclear delivery vehicles. These provisions, particularly those calling for prior notification of missile launches, could help the United States inform Russia or other nations of its intentions when it decides to use a Minotaur missile in a conflict. On the other hand, these provisions could also complicate U.S. efforts to launch these missiles promptly at the start of a sudden, unexpected conflict.

The United States could claim that, because the Minotaur missiles were deployed with conventional warheads, they should not count under START or be subject to the deployment restrictions and data exchange provisions in the Treaty. However, it is likely that the United States would have to meet with Russia, Ukraine, Belarus, and Kazakhstan, the four former Soviet states that are parties to the Treaty to work out how the provisions of the Treaty are to apply to these missiles. Regardless, the relationship between these missiles and U.S. arms control obligations, along with Russia's possible reaction to U.S. proposals to either apply or avoid these obligations for the new Minotaur missiles, deserves further analysis.

Navy Plans

The Navy has not yet addressed, publicly, arms control questions that might arise from the deployment of conventional warheads on its Trident missiles. Many of the issues discussed above for the Air Force stem from the plan to segregate missiles with conventional warheads from those with nuclear warheads, and to have those with conventional warheads recognized as different missiles. Because the Navy would deploy the missiles with conventional and nuclear warheads on the same submarines, the Navy would not have similar concerns. It would, in all likelihood, simply accept that the conventional warheads on Trident missiles count under the START Treaty. The warheads would count against the Treaty limit of 4,900 ballistic missile warheads, and the missiles carrying the warheads would be subject to short-notice inspections to confirm that they did not carry more than the agreed number of 8 warheads (or 6 warheads if the missiles were declared to be "downloaded.") Because the DOD plan appears to call for the missiles to be deployed with only 4 warheads each, and because the Navy would be under no obligation to

[71] START Treaty, Article V, para 9.

[72] START Treaty, Article V, para 14.

[73] START Treaty, Article IV, para 1(D).

display the exact configuration of the missiles, but only to demonstrate that they carried fewer than 8 warheads, these requirements apparently would not impinge on the CTM program.

The Moscow Treaty provisions also probably would not constrain the CTM program. That Treaty limits the United States to 2,200 "operationally deployed" nuclear warheads. It does not define this term and it does not outline any counting rules that the nations must use when determining which warheads count under the limits. The United States likely would not count the warheads on the CTM missiles under the limits and it would be under no obligation to reveal this to Russia; it would simply have to inform Russia of the total number of warheads it was counting under the Treaty. Further, the United States could deploy more warheads on its ICBMs, or on other SLBMs, to make up for the 96 conventional warheads on the conventional Trident missiles. An arithmetic method, multiplying deployed missiles by the number of warheads carried by those missiles, like the one used in START Treaty, might then put the United States over the 2,200 warhead limit, but the Moscow Treaty does not use such a method to count deployed warheads.

Russia may object to the CTM plan on arms control grounds, insisting that the warheads on the conventional Trident missiles should count against the Treaty limits and that the United States should have to reduce the number of warheads on other systems to accommodate these missiles. However, this view is not consistent with the provisions or requirements of the Moscow Treaty. Consequently, even if the missiles raised issues for bilateral discussions about arms control implementation, it is unlikely that the United States would have to alter its plans to accommodate the Moscow Treaty.

Weighing the Benefits and Risks

The Air Force, and many analysts outside government, have argued that long-range land-based ballistic missiles armed with conventional warheads can provide a low-cost, near-term solution to the meet the demands of the prompt global strike mission. They have demonstrated, during their many years on alert during the Cold War, that they have high levels of reliability and readiness, along with a robust and responsive command and control structure. They were also designed to perform with and a great degree of accuracy, which may improve in the future if they are deployed with new guidance technologies. Many experts argue that these characteristics are invaluable for a long-range conventional strike system in the post-Cold War era.

But these weapons might provide the United States with more capability than it needs under most circumstances, while, at the same time, raising the possibility that their use might be misinterpreted as the launch of nuclear weapons. For example, as would be true for any weapon seeking to achieve this mission, the ability to attack targets across the globe on short notice depends on the U.S. ability to acquire precise information about the locations of potential targets and to translate that information into useful targeting data. If it takes longer for the United States to acquire and use that information than it would take for it to launch and deliver a ballistic missile, or, as has often been the case, if such precise information is unavailable, then the United States may not be able to benefit from the unique characteristics of long-range ballistic missiles. Bombers would take longer to reach their targets, but this added time might provide the United States with the opportunity to acquire the needed intelligence. A recent report by the Government Accountability Office (GAO) identified this particular problem, noting that many of the ongoing

studies into global strike and prompt global strike have not addressed the need for critical enabling capabilities along with the weapons systems that would be used in the attacks.[74]

In addition, long-range ballistic missiles would have an advantage over sea-based systems if the United States did not have naval forces near the conflict region, or did not have time to move these forces to the area, or if the target area were out of range for the sea-based systems. But the U.S. Navy deploys its force around the world and maintains capabilities near likely areas of conflict. A few targets may be out of range for these weapons, but bombers armed with cruise missiles might be able to reach them. Land-based long-range ballistic missiles would only be needed in the rare circumstance where the United States had no warning, needed a prompt attack, and had to reach too far inland for sea-based systems. But even in these circumstances, the benefits of the use of long-range ballistic missiles might not outweigh the risks.

Most analysts recognized, during the Cold War, that long-range land-based ballistic missiles could prove destabilizing in a crisis, when nations might have incomplete information about the nature of an attack, and too little time to gather more information and plan an appropriate response. Faced with these circumstances, a nation who was not an intended target, such as Russia, might choose to respond quickly, rather than to wait for more information. The same could be true for the adversaries who are the intended targets of U.S. ballistic missiles. If the United States hoped to destroy a nation's military forces or weapons of mass destruction at the start of a conflict, before they could be used against U.S. troops, the other nation might choose to use these weapons even more quickly during a crisis, before it lost them to the U.S. attack.

Some have argued that the possible crisis instabilities associated with long-range ballistic missiles should not eliminate them from consideration for the PGS mission because the United States can work with Russia, China, and other nations to reduce the risks and because no other weapons, at least in the short term, provide the United States with the ability to attack promptly anywhere on the globe, at the start of an unexpected conflict. Yet the question of whether the United States should accept the risks associated with the potential for misunderstandings and crisis instabilities can be viewed with a broader perspective. How likely is the United States to face the need to attack quickly at great distances at the start of an unexpected conflict? How much would the United States lose if it had to wait a few hours or days to move its forces into the region (or to await the intelligence reports and precise targeting data needed for an attack)?

If the risks of waiting for bombers or sea-based weapons to arrive in the theater are high, then long-range ballistic missiles may be the preferred response, even with the risk that other nations might misunderstand U.S. intentions. On the other hand, if the risks of waiting for other forces to arrive in theater are deemed to be manageable, and the risks of potential misunderstandings and crisis instabilities associated with the launch of long-range ballistic missiles are thought to be high, then the United States can consider a broader range of alternative weapons systems to meet the needs of the PGS mission.

[74] U.S. Government Accountability Office. Military Transformation. DOD Needs to Strengthen Implementation of its Global Strike Concept and Provide a Comprehensive Investment Approach for acquiring Needed Capabilities. GAO-08-325. April 2008. p. 5.

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