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PRECISION GLOBAL STRIKE: IS THERE A ROLE FOR THE NAVY CONVENTIONAL TRIDENT MODIFICATION OR THE AIR FORCE CONVENTIONAL STRIKE MISSILE?

by

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Biography

Colonel Owens was previously assigned to the Future Operations Division in the J3 Directorate at United States Pacific Command (PACOM) where he served as Chief of PACOM Targeting and Global Strike. He was commissioned through the Reserve Officer Training Corps (ROTC) in 1985. Colonel Owens earned a Bachelor of Science degree in Physics and Mathematics from the University of Kentucky and a Master of Aeronautical Science degree from Embry-Riddle Aeronautical University in 1996. Colonel Owens has also served as an F-16 Operations Officer, a Commander of an Operations Support Squadron, and a Deputy Operations Group Commander.

"We are strengthening our deterrence by developing a New Triad composed of offensive strike systems (both nuclear and improved conventional capabilities)…When the consequences of an attack with WMD are potentially so devastating, we cannot afford to stand by as grave dangers materialize."[1]

President George W. Bush

"The media and expert circles are already discussing plans to use intercontinental ballistic missiles to carry nonnuclear warheads. The launch of such a missile could…provoke a full-scale counterattack using strategic nuclear forces."[2]

Russian President Vladimir Putin

Introduction

In 2006, the Navy requested $503 million to fund the Conventional Trident II (D) Modification (CTM) program which would utilize existing Navy Trident II (D5) missiles retrofitted with conventional warheads.[3] The CTM program would be a near-term solution to enhance the United States (US) range of options available for dealing with emerging threats and take advantage of the high readiness levels and short duration flight times inherent in a Submarine Launched Ballistic Missiles (SLBM). The same year, the Air Force requested $27 million to fund a similar Conventional Strike Missile (CSM) as part of a larger Conventional Ballistic Missile (CBM) program which would retrofit retired Minuteman II and Peacekeeper Intercontinental Ballistic Missiles (ICBMs) and provide a mid-term solution.[4] Both plans were born out of the 2006 Quadrennial Defense Review (QDR) request for the fielding of a rapid, precision strike weapons capability within two years of funding.[5] In 2007, the strategic and operational concerns of fielding the CTM and CSM were called into question by the Government Accounting Office (GAO) and various members of Congress. Funding for both programs was

[1]Bush, George W., President of the United States, *National Security Strategy of the United States of America,*Washington, DC: The White House, March 2006, 28.

[2] Rosenberg, Eric, "Experts Warn of an Accidental Atomic War: Nuclear Missile Modified for Conventional Attack on Iran Could Set Off Alarm in Russia," *San Francisco Chronicle*, 6 October 2006, 1.

[3] US Congress, Senate Armed Services Committee, Subcommittee on Strategic Forces, *Fiscal Year 2007 Global Strike*, Testimony of RADM Charles Young, Director for Strategic Systems Program, Hearing, 29 March 2006, 2-3.

[4] US Congress, Congressional Research Service Report for Congress, Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress, 19 June 2007, 14.

[5] US Department of Defense, *Quadrennial Defense Review Report*, Washington, DC, 6 February 2006, 50.

cut; a total of $100 million was appropriated for "defense-wide research and development funding…propulsion and guidance systems, mission planning, re-entry vehicle design, modeling and simulation efforts, and launch system infrastructure."[6] Congress mandated future funding would be contingent upon further review and Congressionally-funded studies of the concepts.

Citing a capability gap in dealing with potential long-range, "high-regret-type" threats, the Department of Defense (DoD) is continuing to pursue its quest for the fielding of a short-term alternative.[7] In its FY 2008 budget, the DoD is requesting an additional $175 million to continue with development of the Navy CTM program as well as $32.8 million in funding for the Air Force Common Aero Vehicle (CAV) re-entry vehicle.[8] The requirement for the US to rapidly engage and defeat potential threats posed by the use of Weapons of Mass Destruction (WMD) by state and non-state actors is highlighted in joint doctrine as one of the greatest challenges faced by the US.[9] Likewise, US Air Force doctrine addresses the WMD counterproliferation efforts through, among other things, the use of counterforce. "Counterforce refers to offensive operations to strike adversary Chemical, Biological, Radiological, and Nuclear (CBRN) weapons and associated production, transportation, and storage facilities prior to use."[10] One key aspect of the Air Force counterforce operations is the pre-emptive nature of its targeting process. Counterforce targeting may be executed pre-emptively assuming the effort is well coordinated with allied partners and relies heavily on accurate intelligence and exact target location.[11] From a tactical perspective, US intelligence suspecting the future use of WMD

[6] Sharp, Travis, Arms Control and Non-Proliferation Highlights from House Appropriations Committee Action on the FY2008 Defense Appropriations Bill (H.R. 3222). Center for Arms Control and Non-Proliferation, 2 August 2007, 1.

[7] Boese, Wade, "Global Strike Still on Pentagon Wish List." *Arms Control Association*. April 2007, 1.

[8] US Congress, Congressional Research Service Report for Congress, Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress, 19 June 2007, 16.

[9] Joint Publication (JP) 3-40, *Combating Weapons of Mass Destruction*, 8 July 2004, 11.

[10] US Air Force Doctrine Document 2-1.8, Counter-Chemical, Biological, Radiological, and Nuclear Operations, 26 January 2007, 9.

[11] Ibid, 9-10.

by terrorist groups or rogue nations all but drives senior decision makers into this pre-emptive strategy. As has been witnessed in North Korea, Iran, and perhaps Iraq, the US containment strategy does not ensure rogue states and terrorist groups will not be able to acquire and ultimately use WMD.[12]

The 2002 US National Security Strategy (NSS) set an historical precedent in the way policy makers and the military would deal with these potential threats. After 9/11, US focus shifted from a reliance on deterrence as an effective means of defense to the need to find and deal with would-be attackers before they had a chance to do harm to the US again. The 2002 NSS stated the US reserved the right to react pre-emptively when faced with evidence of an imminent threat posed by rogue states and terrorists groups.[13] This US proclamation laid the foundation for the initiation of hostile actions during OPERATION Enduring Freedom and OPERATION Iraqi Freedom.

This paper will analyze and address the developmental, operational, and political concerns associated with the use of the Navy CTM and Air Force CSM for Prompt Global Strike (PGS) missions and establish why the US should fully fund the near-term CTM program. It will examine the Navy justification for the Trident II (D) modification as well as the Air Force justification for a land-based alternative and discuss the proposed Concept of Operations (CONOPS) for each of their use. The paper will then provide analysis of likely scenarios involving the use of either a conventional ICBM or SLBM and discuss the applicability and potential concerns of employment. Finally, the paper will conclude with some recommendations

[12] US Congress, Congressional Research Service Report for Congress, *North Korea's Nuclear Weapons Development and Diplomacy*, 2 July 2007.

[13] Bush, George W., President of the United States, *National Security Strategy of the United States of America,*Washington, DC: The White House, September 2002, 15.

on how the DoD might mitigate the current concerns associated with the development, employment, and funding of the Navy CTM.

The Prompt Global Strike Construct

The ongoing debate over pre-emptive actions against hostile forces has led to a wide range of ideas and changes in how the US must best posture itself to face its future challenges. In order to support the US pre-emptive option, the 2002 NSS highlights three areas of emphasis, "build better, more integrated intelligence capabilities to provide timely, accurate information on threats wherever they may emerge; coordinate closely with allies to form a common assessment of the most dangerous threats; and continue to transform our military forces to ensure our ability to conduct rapid and precise operations to achieve decisive results."[14] In essence, the Director of National Intelligence (DNI), the Department of State (DOS), and the DoD were tasked to plan for and improve the US capability to find, fix, track, and target terrorist groups and/or rogue states sponsoring or providing safe-havens to terrorist activities.

Prior to the 2002 NSS, the DoD published its 2001 Quadrennial Defense Review (QDR) and similarly recognized the threat posed by WMD and the importance US offensive deterrence capability (both nuclear and non-nuclear) would have on damage limitations and escalation control. The increased chance of a US offensive attack would place an aggressor's key nodes of operation at risk and question their ability to successfully launch an attack.[15] The following year, the US Air Force issued a Mission Needs Statement requesting the Air Force establish the PGS mission set. "This statement indicated the US needs to be able to strike globally and rapidly with joint conventional forces against high payoff targets. The US should be able to plan and execute these attacks in a matter of minutes or hours, as opposed to days or weeks needed for

[14] Ibid,16.

[15] US Department of Defense, Quadrennial Defense Review: Strategy-Driven Choices for America's Security, Washington, DC, April 2001, 327.

planning…it should be able to execute these attacks even when it had no permanent military presence in the region."[16]

With the new Secretary of Defense Donald Rumsfeld in charge, the DoD set about "transforming" itself into a more technology focused fighting force, leveraging gains in lethality and speed against reductions in force structure and funding.[17] The recent emergence of modern weapon systems in addition to advances in the integration of net-centric data management systems has undeniably produced a unique military advantage for US forces. Enhanced intelligence, surveillance, and reconnaissance and improved command and control (C2) have greatly improved the commander's decision-making cycle. The ability of commanders to rapidly position forces, anticipate enemy movements, and react with sufficient lethality stems from these various advances in modern technology. Technology has in large part driven military leaders to pursue the perfect "ready, aim, fire" solution cycle. A long-range precision strike weapon such as the CTM or CSM would allow the US to "attack targets thousands of miles away with precision-guided, conventional high explosives in minutes…Because of the missiles speed, [it] would be able to pierce enemy air defense and avoid putting American pilots at risk."[18] As part of the new US Nuclear Triad, CTM or CSM launch timelines and authorities will look very similar to the requirements for other US nuclear ballistic missile launches except they will carry a non-nuclear weapon payload.

The "New" Nuclear Triad

In 2001, Congress directed the DoD conduct a thorough review of its nuclear posture to ensure the US was prepared for the type of future wars it anticipated to fight. The old strategy of

[16] US Congress, Congressional Research Service Report for Congress, Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress, 19 June 2007, 4.
[17] Jaffe, Greg, "Rumsfeld's Push for Speed Fuels Pentagon Dissent," *The Wall Street Journal*,16 May 2005, 1.
[18] Schmitt, Eric, "Threats and Responses: US Considers Conventional Warheads on Nuclear Missiles," *The New York Times*, 24 February 2003, 1.

Soviet containment during the Cold War would not be as applicable to the threats posed by terrorist groups or rouge states today. Terrorist groups can operate with impunity, attacking US interests without fear of reprisal short of an improbable nuclear attack. As such, WMD in the hands of hostile states and terrorist groups poses one of our gravest threats to US national security.[19] Building on the published 2001 QDR, the DoD began redesigning the nation's nuclear posture in terms of a capabilities-based versus threat-based requirements approach.[20] Although the idea of nuclear deterrence has not gone away, the transformed nuclear triad would be capable of handling a much wider range of potential threats. Historically called upon for strictly offensive operations, advances in missile defense technologies make it possible for the first time to develop unique defensive measures to thwart an enemy attack. The previous Cold War Nuclear Triad referred "to the three legs of the US strategic nuclear force: submarine-launched ballistic missiles (SLBMs), land based intercontinental ballistic missiles (ICBMs), and long-range bombers." [21] The new 2001 Nuclear Posture Review (NPR), submitted by DoD, relied upon a triad of three distinct capabilities: Offensive Strike Operations (both nuclear and non-nuclear), Defensive (both active and passive) Systems, and a more responsive Defensive Infrastructure [22] (Figure 1).

Offensive Strike Operations

The first leg of the new US Nuclear Triad consists of offensive strike operations to include nuclear and non-nuclear weapons such as the CTM or CSM. The US plan set out to complement the nuclear force with non-nuclear conventional weapons capabilities in addition to the traditional nuclear platforms such as ICBMs, SLBMs, and long-range bombers like the B-1,

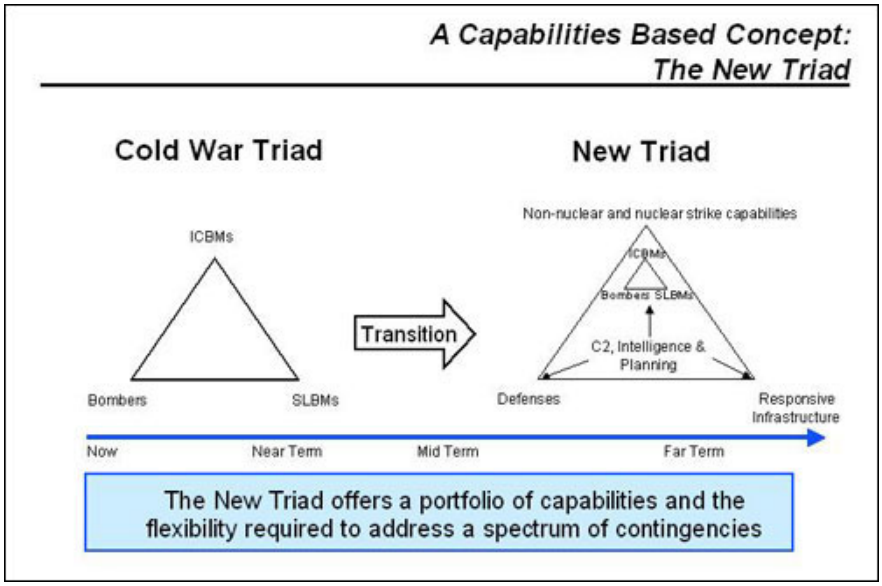
[19]Bush, George W., President of the United States, *National Strategy to Combat Weapons of Mass Destruction*, Washington, DC: The White House, December 2002.

[20] US Department of Defense, *Quadrennial Defense Review Report*, Washington, DC, 6 February 2006, 273.

[21] Russell, James and James Wirtz, "A Quiet Revolution: The New Nuclear Triad," *Strategic Insights*, Volume I, Issue 3, May 2002, 1.

[22] US Department of Defense, "Nuclear Posture Review [Excerpts]," *Global Security*, 8 January 2002, 1.

B-2, and B-52.[23] Given reductions in force structure and the challenges associated with deploying forces forward to respond to a remote threat, a long-range conventional option would provide the ability for the US to respond globally within a short time. The first leg of the new triad provides senior decision makers with a wider range of nuclear and non-nuclear courses of action to deal with the wide range of threats of tomorrow.[24]



[25]

Figure 1.

Defensive Systems

The second leg of the new US Nuclear Triad relies on the use of defensive systems to deter and counter the threat of a ballistic missile launch. The US Ballistic Missile Defense (BMD) program relies on a layered defense of short, medium, and long-range engagement capabilities.[26] The BMD program, noted in the NPR, is intended to provide coverage over "all

[23]Bush, George W., President of the United States, *National Security Strategy of the United States of America,*Washington, DC: The White House, March 2006, 28.
[24] US Department of Defense, "Nuclear Posture Review [Excerpts]," *Global Security*, 8 January 2002, 2.
[25] Weinstein, Daniel, "US Military Transition Necessary But Path Not Smooth," *The Jewish Institute for National Security Affairs*, 9 July 2004, 4.
[26] US Department of Defense, The National Defense Strategy of the United States of America, Washington, DC, March 2005, 12.

50 states, our deployed forces, and our friends and allies against ballistic missile attacks."[27] Although not the panacea for all launch possibilities, it offers a first line of defense for short-notice launch scenarios. Current parts of the BMD program include both short and long-range interceptors, C2 systems, as well as early warning acquisition and tracking radars.

Defensive Infrastructure

The third leg of the new US Nuclear Triad consists of the defensive infrastructure to include the timely development, maintenance, and utilization of the triad. Consolidation of weapons systems and a more responsive development and fielding process for new technologies will ensure a viable deterrence option for US threats. "[M]aintaining our ability to respond to large strategic changes can permit us to reduce our nuclear arsenal and, at the same time, dissuade adversaries from starting a competition in nuclear armaments."[28] The ability to respond quickly to emerging threats relies heavily on the effective use of intelligence, C2, and planning capabilities. As an enabler to C2 and planning efforts, the most vital part of managing the new Nuclear Triad is the ability of the US to provide relevant and accurate intelligence in a timely manner.

In 2004, the Congress enacted the Intelligence Reform and Terrorism Prevention Act which consolidated all the functions of the Intelligence community under one single office. As stated in the legislation, the DNI will provide, "timely, objective, independent of political considerations, and based upon all sources available to the intelligence community and other appropriate entities."[29] The goal of establishing a single focal point for intelligence activities was to ensure the sharing of intelligence information across multiple intelligence bodies to

[27] Ibid, 6.
[28] Ibid, 2.
[29] US Congress, Intelligence Reform and Terrorism Prevention Act of 2004, Public Law 108-458, 17 December 2004, 8.

enable consistency and timeliness of analysis and reporting. Additionally, improvements in US C2 and planning include upgrading the current C2 architecture which was previously reliant upon the geographical deployment of the E-4B National Airborne Operations Center (NAOC) aircraft. The new system will utilize a network-based approach to information sharing and collaboration.[30] As such, recent US Strategic Command (USSTRATCOM) initiatives include the development of the Global Operations Center-Collaborative Environment (GOC-CE) for real time planning and coordination among disjointed participants and operational regional combatant commands (RCCs). GOC-CE was developed to support the real time, net-centric, collaborative planning required for a global strike scenario.[31]

Nuclear Offensive Strike: ICBMs and SLBMs

As the backbone of nuclear offensive strike operations, ICBMs and SLBMS have been a part of the US triad of nuclear deterrence for over 40 years.[32] Land-based ICBMs constitute a range of variants such as the Minuteman II, Minuteman III and the Peacekeeper missiles. Currently, the US has no remaining Minuteman II or Peacekeeper missiles on nuclear alert. As of 1 October 2007, according to the current Strategic Arms Reduction Treaty (START) Aggregate numbers, the US possessed 500 Minuteman III, 120 Trident I, and 312 Trident II missiles.[33] Additionally, the US has approximately 1,200 ICBM and 3,216 SLBM warheads for a total of 4,416 nuclear warheads spread among land and naval forces (excluding the bomber force). In the NPR, the US stated a goal of "an operationally deployed force [will] optimally consist of between 1,700-2,200 strategic nuclear warheads by 2012…[and will] support US

[30] Kucera, Joshua, "US Upgrades its Nuclear C2 Structure," *Jane's Defence Weekly*. 13 March 2006.
[31] Bille, Matt and Rusty Lorenz, "Requirement for a Conventional Prompt Global Strike Capability," NDIA Missile and Rockets Symposium and Exhibition, May 2001, 4.
[32] US Strategic Command, "Global Operations Center-Collaborative Environment Case Study and Status," Presentation to the USSTRACOM C2 Technology Symposium, 25 October 2006, 4.
[33] US Department of State, START Aggregate Numbers of Strategic Offensive Arms, 1 July 2007.

deterrence policy to hold at risk what opponents value, including their instruments of political control and military power, and to deny opponents their war aims."[34]

US ICBM Inventory

As part of the nation's arsenal of nuclear weapons, the Air Force maintains approximately 500 ICBMs at various locations in the US. In the past, the main variants of the missile included the Peacekeeper and Minuteman II and III. Following the June 2002 US/Soviet START II agreement, the US began a slow draw down in its nuclear inventory and decommissioned its remaining Peacekeeper and Minuteman II missiles leaving the Minutemen III for current operational use. Both Peacemaker and Minuteman II and II variants have a range of 6,000 miles but the Peacekeeper missile is a larger missile with increased carriage capacity. The newest of the US ICBMs, the Peacekeeper missile entered the inventory in 1986 at a cost of $70 million per missile. The Peacekeeper is a four-stage ICBM and can carry up to 10 independently-targetable vehicles allowing for multi-targeting capability. The oldest of the two variants, the Minuteman II missile entered service in 1965 followed by the upgraded Minuteman III version in 1970. Both versions are three-stage, solid propellant ICBMs. The newer Minuteman III model provides additional thrust and carriage capacity at a cost of approximately $7 million each.[35]

US SLBM Inventory

The Navy first deployed the Trident II (D5) missile aboard Ohio-class submarines in 1990, and the missile is planned to remain in the Navy's arsenal until past 2020.[36] The Trident missile is an inertial guided, three-stage, solid-propellant ballistic missile and is currently deployed on Ohio-class Trident submarines. The two variants of the Trident SLBM are the

[34] US Department of Defense, "Nuclear Posture Review [Excerpts]," *Global Security*, 8 January 2002, 5.
[35] Federation of American Scientists, Intercontinental Ballistic and Cruise Missiles.
[36] US Navy, Fact Sheet: Trident Fleet Ballistic Missile, 3 April 2005, 1.

Trident I (C4) and the Trident II (D5). Each Trident-class submarine is capable of carrying 24 Trident (D5) missiles within its hull. The Trident (D5) was first deployed in 1990 at a cost of approximately $30M per missile. Both the Trident I and II are capable of target ranges up to 4,000-6,000 miles. However, the older versions of the Trident I (C4) missile are somewhat smaller than the more advanced Trident II (D5) version. In addition to size differences, the Trident II (D) has a much larger payload capacity and more accurate targeting capabilities. The payload on a Trident (D5) consists of a Multiple Independently Targetable Re-entry Vehicle (MIRV). As opposed to a unitary warhead, the MIRV consists of several nuclear warheads capable of independently selecting multiple target locations.[37]

Conventional Offensive Strike: The CSM

In 2006, the Air Force proposed the use of its decommissioned Peacekeeper and Minuteman II missiles as a potential platform for a long-range, conventional strike scenario. The Air Force advocated a mid-term solution which could be fielded in the 2013-2015 timeframe.[38] The CSM program would include the retrofitting of the Minuteman II and Peacekeeper missiles and designating them as Minotaur II and Minotaur III missiles. Proponents of the program have also recommended the use of the Air Force's CAV as a hypersonic glide re-entry vehicle modified to fit into the nose section of the CSM and capable of carrying approximately 1,000 pounds of munitions. The CAV was the result of a joint program between the Air Force's joint Force Application and Launch from Continental United States (FALCON) and Defense Advanced Research Projects Agency (DARPA) programs to develop a hypersonic vehicle capable of taking satellites into space or acting as re-entry vehicle for deploying weapons.[39] The

[37] Ibid, 2.
[38] US Congress, Congressional Research Service Report for Congress, Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress, 19 June 2007, 11.
[39] Tirpak, John, "In Search of Spaceplanes," *Air Force Magazine Online*, Vol 86, No. 12, December 2003, 2-3.

CAV would aerodynamically "glide" to the target making course correction with the use of flaperons. The CAV would be capable of ranges of upwards of 3,000 miles once released, greatly improving the overall range capability of the payload. The Air Force has proposed numerous types of warheads for the CAV based on the type of target requiring servicing. One option calls for a "fuzed penetrator" for hard, deeply buried targets or smart bombs for targeting facilities and structures.[40]

The flight profile of the CSM would not differ substantially from that of any land-based nuclear launch. Similar to a Minuteman II launch, the Peacekeeper missile fires its three stages of solid propellant to guide it along its flight path. The first three stages of the rocket propel the missile up to 700,000 feet. The fourth stage, which is a liquid propellant rocket, provides speed and course corrections while maneuvering the missile into the correct position for the re-entry vehicle to deploy.[41]

Conventional Offensive Strike: The CTM

In order to achieve the conventional offensive strike capability as envisioned in the 2001 NPR, the Navy has proposed the modification of the Trident II (D) platform. As a workhorse for the Navy nuclear fleet, the Trident II (D) missile was selected as the best candidate for the CTM program. As part of the US Nuclear deterrent force, Ohio-class submarines carrying Trident (D5) missiles provide stealth and rapid reaction capability for any global scenario. The CTM program would replace the current Trident II (D) MIRV payload with a new re-entry vehicle and payload package. The Navy E2 re-entry vehicle is proposed as the best candidate for the CTM payload body. The E2 re-entry vehicle would be equipped with Global Positioning System (GPS) capability and a new guidance control which promises to provide increased accuracy of

[40] US Congress, Congressional Research Service Report for Congress, Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress, 19 June 2007, 12.
[41] Federation of American Scientists, Intercontinental Ballistic and Cruise Missiles.

the warhead.[42] The E2 would contain a strap-on flap system capable of steering the vehicle to its desired location. The conventional warhead would be designed as either a series of rods or cluster-type munition, and fit within the new re-entry vehicle. Accuracy of the weapon will approximate the accuracy of a precision guided weapon, about 10 meters.[43] When retrofitted with the E2, the new Trident II (D) CTM would be capable of the long-range, precision strike capability desired by DoD.

Like the nuclear Trident version, the CTM follows an identical flight profile as its nuclear cousin. "The launch from the submarine occurs below the ocean surface. The missiles are ejected from their tubes by gas pressure created by a 'gas generator,' a solid-fuel rocket motor attached to the bottom of the missile tube which heats a pool of water creating steam. After the missile leaves the tube and rises through the water over the submarine, the first stage of motor ignites, the aero-spike extends, and the boost stage begins. Ideally, the missile is 'sheathed' in gas bubbles for its entire time in the water, so liquid never touches its fuselage. Within about two minutes, after the third stage motor fires, the missile is traveling faster that 20,000ft/s."[44]

CSM Employment CONOPS

The CSM could be placed in an existing nuclear missile silo or on a mobile rail launcher until launch time. In order to achieve the rapid time response desired of a long-range strike weapon, the CAV and the modified ICBM would have to be placed on a continual alert status. This alert status would allow the CSM to launch and arrive at the target within the desired one-hour time limit.[45] One unique aspect of the CAV would be its ability to maneuver after rocket separation. This would affectively allow the CAV to obtain mid-course corrections off of

[42] Butler, Amy, "Hardly Conventional," *Aviation Week & Space Technology*, Vol. 167 Issue 1, 2 July 2007, 2.
[43] US Congress, Congressional Research Service Report for Congress, Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress, 19 June 2007, 8.
[44] "Trident Submarine Missile System," *SolarNavigator.net*, 28 June 2006, 2.
[45] Grossman, Elaine M., "Air Force Proposes New Strike Missile," *Inside Defense*, 8 April 2006, 1.

inertial and GPS updates. The CAV would glide at approximately five times the speed of sound or approximately 4,000 ft/s. Due to its ability to maneuver in flight, the CAV would additionally have the ability to track a moving target. Projected accuracy of the CAV would be approximately three meters.[46] The range of the CSM would be in excess of 6,000 miles given the added ability of the CAV to glide un-aided to the target. The Air Force plan for employment of the CSM would be along the coast of the US to preclude confusion over a possible nuclear launch at historically nuclear launch facilities.

CTM Employment CONOPS

The launch of a CTM would be similar to the launch of other Navy conventional strike missiles. Like the submarine launch of a land attack version of Tomahawk Land Attack Missile (TLAM-C), the CTM would have the capability to be launched from any of the 14 Ohio-class submarines. The CTM would use a combination of inertial, GPS, and spacial navigation to fly to and acquire the target. Each Ohio-class submarine would be fitted with two CTMs which would replace two of its onboard nuclear equivalents.[47] Once launched, the missile would receive midcourse guidance and corrections while proceeding to the target. The estimated range of the weapon would be from 4,000 - 6,000 miles, and with a strap-on kit under consideration by lead contractor, the weapon could achieve "near-GPS" accuracy.[48] Ohio-class submarines containing the CTM would be placed in both the Pacific and Atlantic oceans providing flexible targeting options to either hemisphere. The Trident submarines would be on constant patrol and extremely difficult for an adversary to detect.[49]

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[46] US Congress, Congressional Research Service Report for Congress, Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress, 19 June 2007, 12-13.

[47] Polmar, Norman, "Conventional Trident on Hold," *US Naval Institute Proceedings*, Vol. 132 Issue 11, November 2006, 1.

[48] Butler, Amy, "Hardly Conventional," *Aviation Week & Space Technology*, Vol. 167 Issue 1, 2 July 2007, 2.

[49] Benedict, Terry, "A New Role for the Trident," *US Naval Institute Proceedings*; Vol. 132 Issue 6, June 2006, 5.

Conventional Targeting Scenarios

A wide range of benefits can be assumed from the ability of the US to attack global targets quickly, precisely, and with the right amount of force without committing high-value assets or forces to a region. The US will increasingly be asked to respond to a wide variety of regional conflicts stretching our forces thin and forcing a prioritization of time and resources. The ability of the US to hold a target at risk without the requirement to be deployed forward in the region would strengthen the nation's deterrence capabilities and hold hostile nations or non-state actors accountable for their actions. The current US nuclear strategy requires a threshold to be crossed before the US would respond in kind. The ability to conventionally target lowers the response threshold and permits a reasonable alternative to nuclear conflict. This lower US response threshold highlights the current dilemma the US has in regards to the proliferation and potential use of WMD. Given a future nuclear conflict with a near-peer competitor is unlikely,[50] two possible causes remain for the US to use a conventional long-range strike option: a time-critical attack against a known or suspected terrorist group planning to harm US interests or the use of a long-range strike at the start of a larger combat operation.[51]

Time-Critical Strike

Events in Iraq highlight a likely target requiring a rapid, long-range strike capability. The kickoff to the Iraq War was in part due to the suspected known whereabouts of Saddam Hussein. The US assembled its response forces and attempted unsuccessfully to target his location. One reason for the failure has been blamed on the four hours it took for US forces to respond to the

[50] Russell, James and James Wirtz, "A Quiet Revolution: The New Nuclear Triad," *Strategic Insights*, Volume I, Issue 3, May 2002, 2.

[51] US Congress, Senate Committee on Appropriations, Subcommittee on Defense, *Conventional Prompt Global Strike Capability: Letter Report (2007),* The National Academies Press, 11 May 2007, 2-3.

request, perhaps sufficient time for a fleeting target to move.[52] An additional example was witnessed in 1998 when the US located the whereabouts of Ayman al-Zawahiri, Bin Laden's number two man. Following a phone call to a Pakistani reporter, the US launched a cruise missile attack at the location. Launch authority to bomb on target took one hour. By that time, al-Zawahiri was gone.[53] The same year, the US attempted another TLAM attack on an Al Qaeda training camp in eastern Afghanistan where Bin Laden was suspected to be located. In the time it took the missile to travel the two hours to his location, Bin Laden was gone.[54] A US capability to launch within 30 minutes and have effects on targets worldwide would increase the US range of options when dealing with time-critical, high-value targets.

An additional scenario could involve the transport of a nuclear weapon by a known terrorist group. Through intelligence and overhead imagery, the location of the weapon is determined to be inside a warehouse in a remote region of the Middle East. The weapon is expected to be at the location for less than an hour. Launching an aircraft to attack the target may not be an option due to time, distance, and political concerns. In addition, a TLAM may not be an option due to its slower speed (550 knots) and limited range (1,500 miles).

Finally, one possible scenario might involve a rogue state preparing to launch a long-range missile with a nuclear device on it. Once overhead imagery correlates missile type, payload, and subsequent liquid-refueling, the time available to attack could be too late. Targeting the missile while it is still on the launch platform would render the missile and launch platform ineffective in addition to deterring the aggressor from contemplating another attack.[55]

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[52] US Senate, 2007 Department of Defense Appropriations Act, Conventional Trident Missile Modification Program Amendment, Senate Floor Statement of Senator Sessions, 3 August 2006, 2.

[53] Boettcher, Mike, "Authorities Target Bin Laden's Second-in Command," CNN, 28 September 2001, 2.

[54] Shachtman, Noah, "Hypersonic Cruise Missile: America's New Global Strike Weapon," *Popular Mechanics,* January 2007, 1.

[55] US Congress, Senate Committee on Appropriations, Subcommittee on Defense, *Conventional Prompt Global Strike Capability: Letter Report (2007),*The National Academies Press, 11 May 2007, 3-4.

Pre-Planned Strike

One potential pre-planned scenario involving the use of a long-range, conventional strike munitions might be as part of the kick-off to a theater operational plan.[56] Targets which cannot be attacked by conventional forces due to forward basing, distance or over-flight issues could be taken out as a precursor to the beginning of hostilities. This first wave of attacks could attack deep interior targets and soften up defenses for follow on forces to attack. For certain theaters where area denial is of particular concern, a long-range standoff option would preclude the need to deploy the full complement of combat forces and would render ineffective an adversary's Integrated Air Defense System (IADS). [57]

Similarly, the US could choose to launch a retaliatory strike against an adversary who was linked to an attack on US interests. Such an attack may be planned for a time and location of our choosing permitting intelligence to confirm culpability and an appropriate retaliatory target. Although unlikely, unless the target was incapable of being serviced by a TLAM or other theater asset, this targeting option does provide senior leaders with more options from which to choose from.

Given the political, strategic, and financial costs associated with utilizing a long-range strike missile, the US would most likely chose to use the weapon only for time-critical, high-value targets. Reserving the missiles for potential time-critical scenarios would require fewer missiles to be procured and maintained versus using them as a first-wave strike weapon prior to the beginning of major hostilities.[58]

[56]Bille, Matt and Rusty Lorenz, "Requirement for a Conventional Prompt Global Strike Capability," NDIA Missile and Rockets Symposium and Exhibition, May 2001.
[57] Ibid, 3-5.
[58] Ibid, 5.

CTM and CSM Comparative Analysis

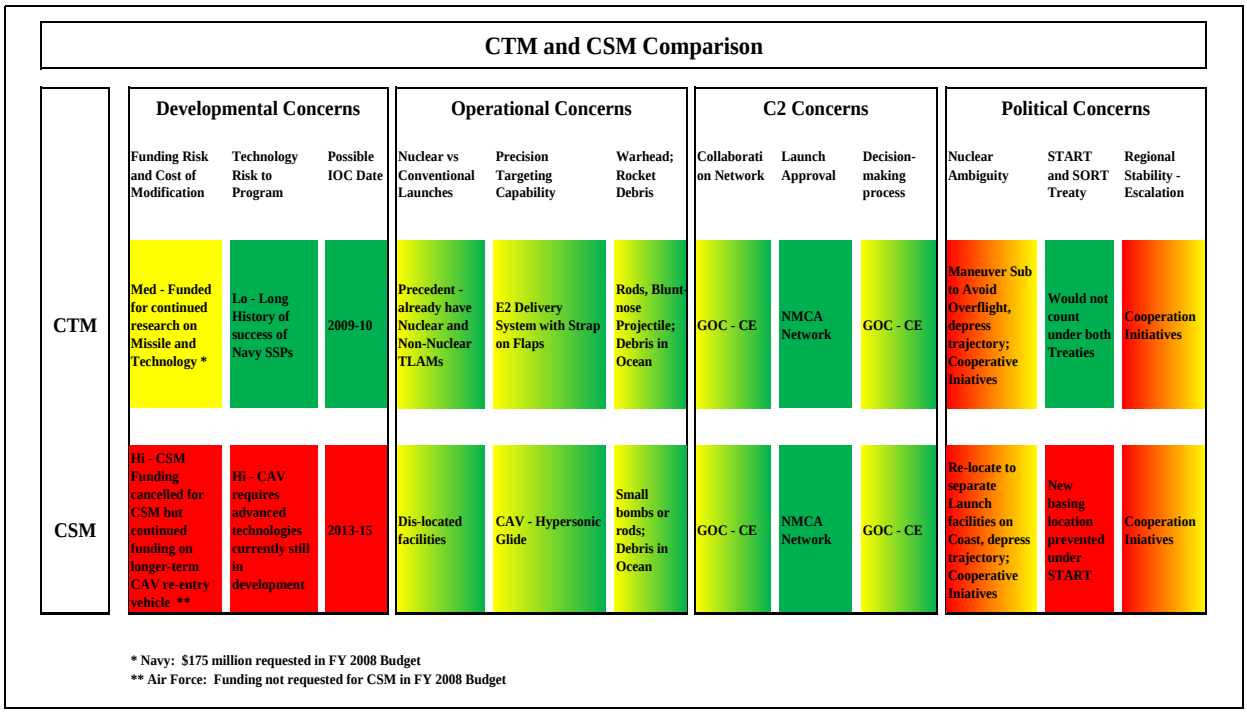


Figure 2.

Developmental Concerns

Funding

Both the CTM and CSM program are competing with each other for Congressional spending for a new PGS weapon. In 2007, the Navy's ambitious $127 million request for the CTM program was cut in the 2007 Defense Appropriations bill pending further study into the operational requirements of the missile.[59] The Navy received $30 million for continuation of the CTM program. The Air Force failed to receive funding for its CSM program and, instead, received $33.4 million in funding for continued research on the CAV. However, with the Congressional appropriations came the caveat the CAV would not be used in weapons carriage capacity. In the FY 2008 budget, the Navy requested an additional $175 million to keep the

[59] US House of Representatives, Department of Defense Appropriations Bill, 2007: Report of the Appropriations Committee, *Conventional Trident Modification*, 109th Congress, 2d Session. 16 June 2006, 247.

CTM program on track.[60] However, concerns in Congress have yet to convince the electorate to fully support the program. Pending further Congressionally-mandated reports on the CTM, approval for FY 2008 has so far been withheld.

The Air Force, in its FY 2008 budget request did not request further funding of the CSM program and, instead, is focusing on its CAV program. The Air Force requested $32.8 million for CAV to continue research and development of the technology.[61] Lack of Congressional and funding support for the Air Force's mid-term CSM program has put the program in jeopardy. It appears Congress has placed more support behind the Navy CTM program, given its earlier projected delivery date and, therefore, given the Air Force the lead for continued research and development of its hypersonic glide technology. With no other near-term PGS competitor, the Navy has the only PGS weapon that can be fielded in the 2009 timeframe.

Technology Risk

The Navy CTM program will utilize current technology to modify its current Trident II (D5) missiles. Although several technical challenges in regards to its E2 delivery vehicle must be resolved, the Navy's Strategic Systems Program (SSP) has a long track record of delivering weapons systems to the Navy on time.[62] The Air Force CSM would require significant risk given the immature hypersonic glide technology of the CAV. In addition, the CSM must continue to develop its range of proposed warheads for hard and soft targets. Given the technological risk of the Air Force program, the Navy CTM program provides the best chance of achieving a capable weapon without incurring significant technical and developmental risks.

[60] Boese, Wade, "Panel Endorses US Global Strike Initiative," *Arms Control Today,* June 2007, 1.

[61] US Congress, Congressional Research Service Report for Congress, Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress, 19 June 2007, 16.

[62] US Congress, Senate Committee on Appropriations, Subcommittee on Defense, *Conventional Prompt Global Strike Capability: Letter Report (2007),*The National Academies Press, 11 May 2007, 6.

Initial Operating Capability (IOC) Dates

Only the Navy CTM program is capable of meeting the 2006 QDR goal of two years from funding, to development, to employment of a viable PGS weapon system. With continued funding of the CTM program in the FY 2008 Defense Appropriations Bill, the Navy would be able to field the weapon within the designated timeframe. In contrast, the cancelling of the Air Force CSM program and lack of a funding request by the Air Force in its FY 2008 submission makes it unlikely the CSM program would be able to meet the QDR request. However, the $12 million CAV funding in the FY 2007 Defense Appropriations and additional funding for the Air Force CBM program could provide the Air Force with a possible mid-term solution in terms of a launch platform and delivery vehicle.

Operational Concerns

Nuclear versus Conventional Launch

The operational distinction between the launch of a nuclear missile and the launch of a conventional variant of the same missile requires discipline and a clear and distinct set of operating procedures. The Navy and Air Force routinely operate and train in an environment containing both nuclear and conventional weapons. The Navy has traditionally operated with both nuclear and conventional variants of the TLAM. During combat operations, the Navy may be called upon to respond to either a nuclear or non-nuclear crisis. To date, an operational misunderstanding over the launch of a nuclear weapon versus a conventional weapon has never occurred. Likewise, the Air Force continues to operate its bomber fleet with nuclear and conventional versions of the same weapon. Routinely, Air Force ground and air crews are called upon to exercise and train for the potential launch of a nuclear weapon. The accidental launching of an ICBM has never occurred. Given the Navy and Air Force's long track record of

carrying and managing launch decisions of nuclear and conventional weapons, both are well postured to maintain confidence building measures and procedures against an accidental nuclear launch.

Precision Targeting Capability

Both the Navy E2 and Air Force CAV re-entry vehicles promise GPS-level accuracy with the ability to make mid-course corrections in flight prior to weapon release. The proposed Navy E2 delivery system on the CTM would utilize a simple strap-on flap system to guide the re-entry vehicle near to the target whereas the CAV would utilize a combination of ailerons and flaperons to guide to the target. The enhanced ability of the CAV to maneuver provides an extended range advantage of approximately 3,000 miles after re-entry vehicle release. However, given the 4,000 - 6,000 mile range of the Trident II, Minuteman II, and Peacekeeper missiles, achieving the desired range to the target would probably not be necessary. The unique advantage of the CAV would be its ability to target moving targets after missile launch. Mid-course updates could be provided to the vehicle if the target had moved after launch. It should be pointed out, however, Air Force development of this capability is still a long way out and most likely will not occur before the preferred fielding of a near-term CTM weapon.

Warhead and Rocket Debris

In addition to the launch and precision targeting issues, the type of warhead and associated rocket debris are also of concern. The various types of warheads proposed for the CTM and CSM fall into two basic categories: rod/unitary and multiple bomb/sub-munitions. The rod-type warhead would enable the penetration of hardened targets while the unitary warhead would allow for hard and deeply buried targets. The small bombs or sub-munitions would primarily be used for the targeting an area of soft targets above the ground. The high rate

of velocity of the projectiles at impact (20,000 ft/s for the E2 or 4,000 m/s for the CAV) would provide for sufficient penetration capability and target destruction assuming the accuracy of the guidance package. Both the CTM and CSM propose a similar set of weapons capabilities based on target selection.

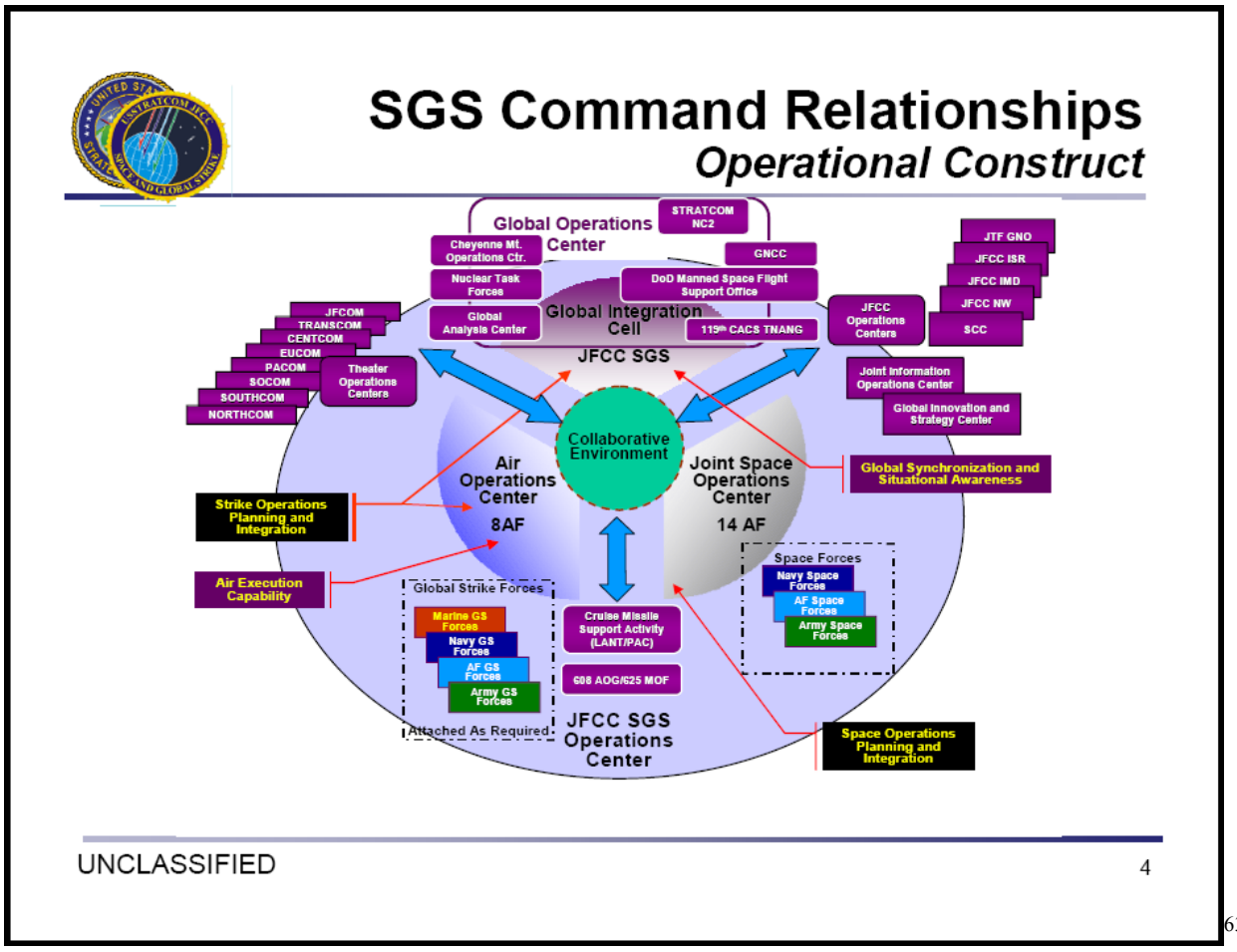
Another major factor which should be considered is the debris field caused by the launch of an ICBM. After booster separation, the third and fourth stage of the rocket motor will continue to travel to the Earth ballistically. In order to alleviate concerns of non-combatant casualties, the CTM has a distinct advantage in its ability to alter its loitering location to ensure the debris field falls within the surrounding waters. In the deployment CONOPS for CSM, the launch locations would be on both the east and west coasts of the US. Launch debris in this case would similarly remain well clear of any inhabited areas.

C2 Concerns

Collaboration Networks

In 2006, USSTRATCOM began the development and funding of the GOC-CE program. As a tool for its Global Strike mission area set, GOC-CE provides federated members with the ability to collaborate in a net-centric environment. GOC-CE permits real-time planning and coordination on PGS mission scenarios. Keeping with the PGS construct of a one-hour decision making cycle, crisis action/time-sensitive planning is conducted across Theater Air Operations Centers (AOCs) and Combatant Command (COCOM) planners via the GOC-CE collaborative environment. The GOC-CE tool allows USSTRATCOM Joint Functional Component Command (JFCC) planners in conjunction with supported commander staff's to produce a Mission Analysis and Course of Action (COA) proposal to senior leaders in a time compressed manner (Figure 3). One shortfall of the GOC-CE program is its inability to provide Voice over

Internet Protocol (VoIP) capability. In addition to its ability to provide shared data and mission planning capability, GOC-CE should contain a secure, real-time exchange of information and ideas from participating COCOM Joint Operations Centers (JOCs) and Component Headquarter AOCs.



[63]

Figure 3.

Launch Approval

Similar to the approval authority given by the National Military Command Authority for nuclear launches, the approval for PGS missions would rest with the President or his designated representative. Launch authority occurs at the conclusion of the STRATCOM-led collaborative

[63] US Strategic Command, JFCC Space and Global Strike, Presentation on "JFCC Integration," 15 March 2006.

planning process. Once a long-range conventional strike missile has been selected for use as the preferred COA, an alert order is issued to whichever COCOM has been assigned primary responsibility for the asset. Following verbal guidance, the joint staff would issue an execute order for the supported COCOM involved. The process would remain the same regardless of it being a Navy or Air Force asset.

Decision Making Process

With a US desire for a rapid PGS capability comes the requirement for a rapid decision-making process. The ability of senior-level decision makers to provide launch authority within one hour is not unprecedented. As previously pointed out, compelling intelligence and target information can lead to a rapid decision to launch an attack. The continued, future funding and development of the USSTRATCOM GOC-CE provides senior decision makers with the necessary tools to achieve coordinated planning and decision making within minutes instead of hours or days. The ability to place planners, senior COCOM commanders, subordinate commanders, and senior Pentagon and White House officials in the same collaborative environment can prevent needless delays and ensure all sides of the argument (pros and cons) are voiced.

Political Concerns

Nuclear Ambiguity

Undoubtedly, the most significant stigma to overcome with the use of an ICBM for PGS is the issue of nuclear ambiguity. After all, the idea of using an ICBM in a role traditionally reserved for nuclear warfare is new. However, it seems unreasonable to think the type of missile platform used for delivering a conventional weapon onto a WMD target or at a terrorist group aiming to cause harm to the US should be dictated by public perceptions. The PGS mission need

statement categorizes the need to be able to quickly defeat targets considered to be time-critical, high-value, fleeting targets of opportunity. In the event a known or suspected threat is plotting to do harm to the US and its people, the nation's leaders have a solemn obligation to do whatever it takes to save American lives and protect our vital interest. As such, the use of a longer-range, globally-capable weapon offers the next step in the evolution of warfare. The US must ensure this progression is well understood and implements all measures necessary to pacify concerned nations, but this must not be allowed to prevent the US from being prepared.

The first measure the US must address is the issue of launch visibility. The only nation capable of recognizing, tracking, and determining the trajectory of an ICBM launched from the US or from a Trident submarine is Russia. In all likely cases, the intended target of a PGS missile would not be located in Russia nor would the flight profile continue in a manner consistent with a launch profile directed at Russian territory. However, the US must be prepared on short notice to notify Russian authorities of an imminent US launch of a PGS missile, the location of the intended target, and the launch point of the weapon. One could argue the US could further mitigate Russian concerns by avoiding the launch of an ICBM from the US mainland. A US mainland ICBM launch would look more provocative to the Soviets than a submarine-launched missile somewhere in the south Pacific or Atlantic Ocean. This makes the case for a Navy CTM version of the PGS missile even more appealing.

Likewise, the US could take measures to alter the location and flight trajectory of a launched PGS missile to ensure it does not overfly a particular country or region. A depressed trajectory could be accomplished short of achieving the desired range and azimuth to the target. The repositioning of a CSM is problematic given US treaty concerns discussed later, but the repositioning of a Trident submarine is an option. With multiple submarines on either coast, the

US could maneuver its submarines to achieve the proper flight profile and minimize potential over-flight issues. The ability of submarines to maneuver undetected, in order to achieve the reaction time and flight profile necessary, makes the CTM particularly attractive.

Finally, the US could take steps to renegotiate agreements with Russia and willing nations upon notification of a PGS launch. Current agreements and procedures for the timely distribution of information and data regarding a missile launch already exist between the US and Russia on issues of ICBM and SLBM launches.[64] Further agreements could be reached to include weapon inspections and open disclosure of number and types of non-conventional, long-range strike weapons as well as their intended locations of employment. This open and frank dialogue between US and Russian counterparts would greatly assist in smoothly transitioning the US to this new weapon system.

START and SORT

The US has taken extensive measures over the last twenty years to reduce its nuclear stockpile and reduce the threat posed by nuclear weapons. Two such treaties, the START and the Strategic Offensive Reduction Treaty (SORT) are of particular interest. START I and START II laid the foundation for US and Russian disarmament. In March 1997, the US and Russia agreed to a framework for a START III which laid out the framework for a US reduction to 2,000 - 2,500 warheads by 31 December 2007. However, negotiations on START III never continued, so the treaty never was agreed upon by either side. In 2003, the US and Russia signed the SORT which laid out the current goal of 1,700 - 2,200 warheads. The SORT did not specify exact counting rules for the active warheads and launch vehicles, but the current administration

[64] US Department of State, Agreement Between the United States of America and the Union of Soviet Socialist Republics on Notification of Launches of Intercontinental Ballistic Missiles and Submarine-Launched Ballistic Missiles, 31 May 1988, 1.

considers only those warheads on operationally-active, strategic delivery vehicles.[65] Under the agreements, the additional deployment of the CSM using mobile launchers at alternate coastal locations would count toward the total aggregate and not be permitted.[66] However, due to the SORT's failure to define the term "operationally deployed" missiles and given the US interpretation of the definition, the US would most likely not count the CTM toward its treaty limits.[67]

Regional Stability and Escalation

The use of a CSM or CTM in a theater of operations would require a cooperative approach to ease tensions and prevent an escalation of military activity by regional states. Specific measures to alleviate concern would include education and open dialogue. However, regional leaders will most likely not know of an attack until after the fact. As a preventive measure, the US could train and exercise with alliance and coalition partners in the region, including scenario building requiring the use of a PGS weapon. Of prime concern for the US would be its ability to acclimate the civilian and military leadership on the differences and unique circumstances required for a launch. This in turn would provide a better foundation to judge the appropriate regional reaction to such an event.

The potential for an arms race or the development of defensive measures to counter the US use of a PGS weapon would likely involve current US near-peer competitors. However, the financial cost in the development of such a program would be high. The only nations capable of such an escalation would involve China and Russia. Current Chinese development and procurement of such a system is beyond reach at this time. Likewise, the chances of a missile

[65] "US-Soviet/Russian Nuclear Arms Control," *Arms Control Today*, June 2002, 2.
[66] Department of State, START Aggregate Numbers of Strategic Offensive Arms, 1 July 2007, 1.
[67] US Congress, Congressional Research Service Report for Congress, Conventional Warheads for Long-Range Ballistic Missiles: Background and Issues for Congress, 19 June 2007, 28.

launch against Russia seem remote given its weapons arsenal and retaliatory capability. Even without the introduction of a PGS weapon to a region, increasingly the US will be faced with the further proliferation of missile technology. As such, the US must take the lead in developing technology which will thwart attempts of rogue states or terrorist factions to achieve first-strike capability.

Recommendations

As directed in Rumsfeld's NPR review, the US must take steps to implement its new Nuclear Triad.[68] However, the US currently lacks a credible offensive weapons deterrent capability which can rapidly target and destroy individual, group, and state threats plotting to do harm against us. Without the ability to always forward deploy conventional forces and high-value assets to all regions of the globe, the US must rely on its diplomatic, informational, and economic elements of national power to deter the possession and spread of WMD. However, the US must also have a credible military option short of nuclear war to rapidly target and destroy aggressors in the event the previous deterrence options fail to work. A US long-range PGS weapons capability provides senior decision makers with a credible conventional weapon option. Concerns over the development, deployment, and use of a PGS weapon can be mitigated by instituting several measures meant to ensure the smooth transition and fielding of the weapon.

Developmental Actions

The US Congress must fully fund, in the FY 2008 US Defense Budget, the Navy's request for $175 million for the CTM program and $32.8 million for the Air Force CAV program. The Navy CTM program has distinct advantages over the Air Force CSM program. Of the two programs, the CTM program is the only near-term PGS weapon system with low

[68] England, Gordon, "DoD Transformation Priorities," Lecture handout at Air War College, Montgomery AL, 1 Nov 2007, 1.

technology risk and high probability of fielding within two years of funding approval. The CTM fulfills the requirements in the US NPR, QDR, NSS, National Defense Strategy (NDS), and the National Strategy to Combat WMD. The CTM utilizes existing Trident II (D5) weapon systems and a proven Navy nuclear and conventional C2 architecture. The CTM is also more versatile given its capability to alter its launch location and trajectory to avoid over-flight and debris issues. Likewise, the CTM avoids many of the nuclear armament restrictions directed in US/Russia START I/II and the SORT. In addition to the Navy CTM program, the future Air Force hypersonic glide technology provides promise for a range of defense applications to include its use as a space and weapons delivery platform. The Air Force should continue to invest in hypersonic technology and migrate the technology to its range of delivery platforms. As part of the effort, the Air Force should continue to request developmental funding for its CBM program to develop a potential mid-term follow-on solution to the CTM.

Operational Actions

The Navy must begin the development and training of processes and procedures necessary for the dual use of Trident II (D5) missile on Ohio-class submarines. The Navy must continue development of a distinct fire-control computer for use in the targeting and employment of the CTM. Confidence-building measures should be developed to ensure the ability of the Navy to ascertain a nuclear launch from a conventional launch. The Navy must also publish its version of the STRATCOM CTM CONOPS. The Navy CTM CONOPS should include Standard Operating Procedures (SOPs) and Tactics, Techniques, and Procedures (TTPs) for employment of the CTM. In conjunction with STRATCOM, the Navy should also develop an exercise training program highlighting the use of the CTM during contingency operations.

Lessons Learned from the PGS exercises should be applied to operational procedures to ensure the Navy is prepared by IOC date.

The Navy must continue with its operational testing and development of the CTM, E2, and warheads. An aggressive operational testing plan should be implemented by the Navy to ensure CTM, E2, and rod/unitary warhead milestones are met and IOC date is achieved. Flight test profiles should include the demonstrated capability of the CTM to alter (depress) its flight trajectory profile to address over-flight and debris issues. In addition, operational testing should include the demonstrated capability of the E2 re-entry vehicle to receive GPS signaling en route to the target with a required near-precision Circular Error Probable (CEP). Warhead selections must include the ability to target soft and hard, deeply buried targets. The proposed combination of rod, blunt nose, and area munitions should be tested against a variety of simulated WMD launch, storage, and underground communications networks.

In addition, the Air Force must continue development of its CAV program and address the technological risks to the program. The CAV has unique capabilities over the CTM E2 re-entry vehicle in terms of maneuverability and additional payload capacity. Assuming current technology issues are overcome, the CAV re-entry vehicle could provide a mid-term solution for a follow-on PGS weapon delivery system in the 2013-2015 timeframe. Hypersonic technology could be used for long-term, space-based alternatives to current PGS weapon system alternatives.

C2 Actions

The DoD must continue with its investment in the USSTRATCOM GOC-CE program. GOC-CE provides the venue for policy makers to achieve the decision cycle requirements of the PGS construct. USSTRATCOM and RCCs should continue to exercise joint operations with the inclusion of likely time-critical, PGS scenarios. Multi-COCOM issues in regards to supported

and supporting commanders should be exercised and trained to on a wide range of scenarios. As part of GOC-CE, USSTRATCOM must seek funding for and develop technology for a secure VoIP capability. A VoIP capability distinct to GOC-CE will enhance collaborative planning and discussions. In the short term, training should continue to focus on a condensed timeline of less than one hour for planning and decisions making with the ultimate goal of less than 30 minutes from decision to launch. Likewise, senior leaders must be actively involved in the planning and decision-making cycle. During crisis situation, combatant commanders and senior leaders must become comfortable with a net-centric method of receiving and presenting mission analysis data and COCOM COAs. Decisions will need to be in a matter of minutes for emerging targets, not days or weeks. Achieving the desired timelines require leadership awareness of the time-sensitive nature of likely scenarios involving WMD.

Political Actions

The US must take the lead in establishing an open dialogue with partner nations on the use of the CTM. A cooperative approach with other nations on the use of CTM will alleviate some fears and misperception about the use of previous nuclear warfare technology for conventional purposes. Likewise, the US should incorporate partner nations in the planning and execution of simulated PGS training exercises. Open disclosure of the CONOPS for the use of CTM as well as the associated SOPs and TTPs would provide transparency to the PGS process and dispel fears the US is launching a possible nuclear attack.

In addition, the US must also develop mutual agreements between Russia and the US on a notification process for the imminent launch of a CTM. Based on previous agreements, the US would provide Russia with launch location, anticipated target, and flight trajectory of the missile. Similarly, in anticipation of China's future capability to track a US launch of a CTM, the US

could extend current agreements between China and Russia on launch warning.[69] Such agreements could lay the foundation for mutual security and understanding of the weapon system. Open transparency over the process would dispel concerns over US intentions and help stabilize regional reactions to a CTM launch.

Conclusion

The US should fully fund the Navy CTM program over consideration of the Air Force CSM program. The Navy CTM program provides the only near-term solution for a current gap in the US long-range PGS capabilities. The Navy CTM program provides the best chance of achieving a capable weapon without incurring significant developmental, operational, command and control, and political risk. Associated concerns regarding the use of the Navy CTM can be sufficiently mitigated by various diplomatic and military assurance measures. The US must act now in order to prepare itself for the full range of likely future contingency operations including defense against the further proliferation of WMD and anti-western ideology and the eventual use of WMD on US personnel and forces.

[69] Cody, Edward, "China and US to Establish Hotline," Washington Post, 6 November 2007.

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