Navy Programs

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.[21] Congress rejected the initial funding request in FY2003 and FY2004, but Lockheed Martin Corporation, the contractor pursuing the study, has 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.[22] A standard MK4 reentry vehicle, which is the reentry vehicle deployed on many Trident SLBMs, would be modified with 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.[23]

Lockheed Martin, has flown two reentry vehicles in test flights of Trident missiles.[24] 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

---

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

[22] 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.

[23] 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.

[24] 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.

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 Navy has, however, included funding for a conventional warhead for Trident in its budget request for FY2007. 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. Press reports indicate that the request includes a total of $503 million over 5 years, with $127 million for FY2007, $225 million for FY2008, $118 million for FY2009 and $33 million for FY2010.[25] The same report indicates that the Navy may seek to reprogram $100 million in the FY2006 budget to get and "early start" on the effort to equip Trident missiles with conventional warheads.

Press reports indicate that the Navy could 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. In addition, 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 are likely to be within range of the targets specified for attack with conventional ballistic missiles.[26]

In the near term, the Navy is considering two types of warheads for the CTM program. One warhead would be designed to destroy or disable soft, area targets. 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.

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,[27] 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

---

[25] 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.

[26] Ibid.

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

Pentagon would only plan to use these missiles in limited circumstances to meet specific goals.

Air Force Programs

The Air Force is pursuing two initiatives related to the deployment of conventional warheads on long-range ballistic missiles. The first of these is known as FALCON (Force Application and Launch From Conus [Continental United States]), 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.[28] The second is an Air Force Analysis of Alternatives (AOA) study that is to review technologies and programs that could meet the requirements of the prompt global strike mission.

The Air Force has outlined a notional architecture for a force of ballistic missiles armed with conventional warheads. 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 mobile launchers or in semi-buried silos or berms on each coast, ready to launch on short notice."[29] The two potential bases include Vandenberg Air Force Base on the West Coast and Cape Canaveral on the East Coast.

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. Although the estimates are preliminary, the Air Force believes that it could deploy a small number of these missiles in under two years, at a total cost, for the development, integration, and testing needed to modify the missiles, of around $31 million. This does not include

---

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

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

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.[34] These characteristics would provide it with the capabilities needed to attack time-sensitive targets.[35]

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 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.

---

[34] 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.

[35] 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.

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.[48] 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.

Submarine-Launched Ballistic Missiles. As was noted above, DOD has announced plans to deploy conventional warheads on Trident long-range ballistic

---

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

missiles in the next 2-4 years. 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 has requested additional funds for this effort in the FY2007 budget, with funding to total $503 million in the next six years.

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