

NOT FOR PUBLICATION  
UNTIL RELEASED BY  
HOUSE ARMED SERVICES COMMITTEE

**STATEMENT OF  
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BEFORE THE  
HOUSE ARMED SERVICES COMMITTEE  
SUBCOMMITTEE ON PROJECTION FORCES  
HEARING ON CONVENTIONAL LONG-RANGE STRIKE OPERATIONS  
MARCH 3, 2004**

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Mr. Chairman, distinguished members of the subcommittee, thank you for the opportunity to appear before you to discuss conventional long-range strike capabilities. As requested, my testimony will discuss potential oversight issues and investment options in connection with the conventional long-range strike capabilities of Navy surface combatants and attack submarines.

My testimony will focus on the following:

- the meaning of “long-range strike capabilities” when applied to surface combatants and attack submarines,
- the potential inherent advantages of Navy surface combatants and attack submarines as long-range strike platforms,
- the Tomahawk missile inventory,
- the Affordable Missile as a potential supplement to the Tomahawk,
- the concept of a long-range, high-speed strike missile for Navy surface combatants and submarines, and
- the relationship of long-range strike weapons to the Expeditionary Strike Group (ESG) and Surface Strike Group (SSG) concepts, the DD(X) destroyer program, and the Trident SSGN submarine program.

## **Meaning of “Long-Range Strike” for Navy ships**

There appears to be no single agreed-upon definition of “long-range strike capabilities,” but when the term is used in connection with Navy surface combatants and attack submarines, most discussions appear to focus on capabilities for attacking land targets that are 350 nautical miles (nm) to 1,200 nm from the ship. Attacks on land targets that are 200 nm or less from the ship, in contrast, tend to be discussed in connection with the alternative concept of naval surface fire support (NSFS), which aims at assisting friendly ground forces that are conducting combat operations ashore.

This testimony focuses on capabilities for attacking targets that are at least 350 nm from the ship, and consequently does not focus on weapons that have been proposed for attacking land targets at ranges of 200 nm or less. Examples of such weapons include NTACMS (a Navy version of the Army Tactical Missile System) and Land Attack Standard Missile (or LASM, a land-attack variant of the Navy’s Standard surface-to-air missile), which have maximum ranges between 100 nm and 200 nm. The exclusion of weapons like NTACMS and LASM from this testimony is based on range only and is not intended as a comment on the potential cost-effectiveness of such weapons as a means of attacking targets at ranges of 200 nm or less.

## Navy Ships As Long-Range Strike Platforms

Navy surface combatants and attack submarines offer at least three potential inherent advantages as long-range strike platforms:

- **Freedom from overseas land bases.** A key characteristic of naval forces, including surface combatants and submarines, is that they can operate in international waters, without need for access to in-theater land bases. In light of the committee's concerns regarding limited and uncertain access to such bases in the future, this advantage is potentially of fundamental significance.
- **Persistence on station at weapon-launch locations.** A second inherent characteristic of surface combatants and attack submarines is that they can remain on station at their weapon-launch locations, ready to fire large numbers of strike weapons immediately or almost immediately, persistently for weeks or months at a time. Aircraft, in contrast, usually can remain on station at their weapon-launch locations for a matter of hours before they need to return to base, making it potentially expensive to keep at least one aircraft persistently at a weapon-launch location for extended periods of time. The ability to remain on station at weapon-launch locations for extended periods of time can be particularly important in responding to situations of extended political tension that could suddenly evolve into crises or conflicts, or in attacking targets (such as terrorist forces) that are normally hidden but may expose themselves to detection on rare and unpredictable occasions.
- **Stealth and strikes without warning.** Navy attack submarines offer a third potential advantage in being inherently stealthy. Submarines can operate in an area of interest for extended periods of time without being detected by the enemy, giving them the ability to conduct no-warning strikes. This can be of particular value for attacking targets that can respond to warnings of impending strikes by relocating or taking defensive measures. Although the idea of operating undetected at sea is usually associated with submarines, supporters of surface combatants may argue that, for potential adversaries lacking access to ocean-surveillance assets, surface ships might effectively be just as stealthy as submarines. Some observers, for example, have suggested that in the case of the war in Afghanistan, the Taliban government may have had no way of detecting and tracking the activities of any kind of Navy ship operating in the Northern Arabian Sea.

In light of these potential inherent advantages, a policy issue whether current DoD plans make adequate use of Navy surface combatants and attack submarines as conventional long-range strike platforms.

## Tomahawk Inventory

In considering this issue, one potential oversight issue for Congress concerns the inventory of Tomahawk land attack cruise missiles (TLAMs). TLAMs can attack targets up to 900 nm away with

warheads weighing up to 1,000 pounds. A total of 802 TLAMs were used in the Iraq war,<sup>1</sup> or more than 40% of the reported pre-war inventory of 1,890 to 2,000 TLAMs,<sup>2</sup> which itself may have been much smaller than called for in DoD plans.<sup>3</sup> The relatively low TLAM inventory level raises a question of whether Navy surface combatants and attack submarines are currently being deployed with fewer TLAMs in their Vertical Launch System (VLS) tubes than operational planners might desire.

The version of the TLAM now being procured is the Block IV, more commonly called the Tactical Tomahawk (TacTom). The amended FY2004-FY2009 Future Years Defense Plan (FYDP) that was submitted to Congress last month calls for procuring 293 TacToms in FY2005 and more than 400 per year in the remaining years of the FYDP.

Given the large number of Tomahawks used in the Iraq war, and the currently rather low inventory of Tomahawks, some observers last year proposed increasing the number of TacToms to be procured in FY2004 and subsequent years to levels above those in the Navy's plan, so as to replenish the Tomahawk inventory more quickly. To support this plan, these observers proposed increasing the capacity of the Tomahawk production line from 38 missiles per month (456 missiles per year) to 50 missiles per month (600 per year) or 75 missiles per month (900 missiles per year).<sup>4</sup> The table below summarizes congressional action last year on the FY2004 funding request for procurement of TacToms and for additional TacTom production tooling and testing equipment.

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<sup>1</sup>U.S. Department of Defense. *Operation IRAQI FREEDOM – By The Numbers*. (Assessment and Analysis Division, USCENTAF, T. Michael Moseley, Lt Gen, USAF Commander, April 30, 2003, Unclassified) 16 p.

<sup>2</sup>Pae, Peter. Raytheon's Task: More Missiles, On The Double. *Los Angeles Times*, April 3, 2003; Squeo, Anne Marie. Navy's Tomahawk Arsenal Dwindles. *Wall Street Journal*, April 3, 2003; Infield, Tom. Tomahawks Used Heavily In War's First 12 Days. *Philadelphia Inquirer*, April 2, 2003.

<sup>3</sup>For an earlier discussion of reported desired and estimated Tomahawk inventory levels, see CRS Report RS20162, *Cruise Missile Inventories and NATO Attacks on Yugoslavia: Background Information*, by Ronald O'Rourke. Washington, 1999. (April 20, 1999) 6 p.

<sup>4</sup>See, for example, Brown, Malina. Raytheon Prepared To Accelerate Tactical Tomahawk Production. *Inside the Navy*, April 7, 2003; Pae, Peter. Raytheon's Task: More Missiles, On The Double. *Los Angeles Times*, April 3, 2003; Squeo, Anne Marie. Navy's Tomahawk Arsenal Dwindles. *Wall Street Journal*, April 3, 2003; Raytheon In Talks For Possible Production Increase. *Defense Daily*, April 3, 2003; Selinger, Marc. Navy Chief Looking At Ways To Remedy Tomahawk Shortage. *Aerospace Daily*, April 2, 2003; Keeter, Hunter. Clark Calls For Accelerating TLAM Production. *Defense Daily*, April 2, 2003; Brown, Malina. Navy Officials Warn Congress Of Urgent Tomahawk Shortfalls. *Inside the Navy*, March 31, 2003; Keeter, Hunter. Mullen Argues Against Remanufacturing Tomahawks, Prefers Block IV. *Defense Daily*, March 31, 2003.

**FY2004 Procurement of TacToms and  
TacTom Tooling and Testing Equipment**  
(dollars in millions)

	<b>Req.</b>	<b>HASC report</b>	<b>SASC report</b>	<b>Auth. conf. report</b>	<b>HAC report</b>	<b>SAC report</b>	<b>Approp. conf. report</b>
<b>Procurement quantity</b>	267	600	267		450	325	350
<b>Procurement funding</b>	\$277.6	\$613.6	\$277.6	\$460.6	\$460.6	\$272.3	\$355.3
<b>Add'l tooling, testing equip.</b>	\$0	\$40.0	\$0	\$25.0	\$25.0	\$0	\$0

In its report (H.Rept. 108-106 of May 16, 2003) on the FY2004 defense authorization bill (H.R. 1588), the House Armed Services Committee stated:

The committee notes that the Department of the Navy's programmed budget for Tomahawk missiles would result in an inventory that is significantly below the Navy's stated Tomahawk required inventory levels, and that recent Tomahawk missile expenditures, which have been in excess of 700 for Operation Iraqi Freedom, have exacerbated this shortfall. The committee also notes that the Emergency Wartime Supplemental Appropriations Act for Fiscal Year 2003 (Public Law 108-11) established a \$15.7 billion Iraqi Freedom Fund to provide for additional expenses associated with the ongoing military operations in Iraq including the replacement of munitions. Additionally, the statement of the managers accompanying the conference report on H.R. 1559 (H. Rept. 108-76) specifically identified TACTOM missiles among those precision guided munitions that should be procured from the funds provided. Since the committee believes that the Tomahawk missile shortage is severe and should be aggressively addressed in fiscal year 2003, it directs the Department of Defense to obligate at least \$24.0 million from funds provided in the Iraqi Freedom Fund by Public Law 108-11 to increase TACTOM production capacity to 600 missiles per year and to obligate at least \$336.0 million for an additional 300 TACTOMs. The committee understands that the additional TACTOMs can be delivered beginning in January 2005 with an associated production rate increase to 600 missiles per year beginning in November 2006.

To sustain TACTOM production at a rate of 600 missiles per year for fiscal year 2004, the committee recommends an increase of \$336.0 million for an additional 333 TACTOM missiles.

The committee also believes that future wartime expenditures may require inventory replenishment rates up to 900 missiles per year. Accordingly, the committee recommends an increase of \$40.0 million for further tooling and test equipment, and understands that a contract award in the second quarter of fiscal year 2004 would allow a 900-missile-per-year production capacity to be achieved by the second quarter of fiscal year 2006. (Pages 62-63)

In its report (H.Rept. 108-187 of July 2, 2003) on the FY2004 defense appropriations bill (H.R. 2568), the House Appropriations Committee stated:

In fiscal year 2005 the Navy should strive to achieve the highest annual production rate possible, with the goal of maintaining the 450 annual rate recommended by the Committee. This will no doubt require the Navy to adjust its fiscal year 2005 investment strategy because the current fiscal year 2005 plan is an annual production rate of 218 missiles. The Committee does not think it prudent to negate this 2004 recommended production rate with a large drop in future production rates and strongly recommends the Navy adjust its 2005 plan accordingly. (Page 139)

Although the conference report (H.Rept. 108-283 of September 24, 2003) on H.R. 2568 did not provide any funding for additional TacTom tooling and testing equipment, the conferees stated that they did so “understanding that this requirement will be accommodated from within funds previously made available to the Department of Defense as part of the Emergency Wartime Supplemental Appropriations Act (Public Law 108-11).” (Page 178)

Congress last year also approved multiyear procurement (MYP) authority for the TacTom program, beginning in FY2004. The authority was provided in section 122 of the FY2004 defense authorization bill, which states that “The total number of missiles procured through a multiyear contract under this section shall be determined by the Secretary of the Navy, based upon the funds available, but not to exceed 900 in any year,” and in section 8008 of the FY2004 defense appropriation bill.

The 293 TacToms requested by the Navy for FY2005 are less than the 350 that were funded in the conference report on H.R. 2568, but more than the 218 TacToms that were projected for FY2005 in the Navy’s FY2004 budget submission.

Potential oversight issues for Congress concerning the Tomahawk inventory and FY2005 TacTom procurement include the following:

- To what degree are surface combatants and attack submarines now being deployed with empty VLS tubes (or weapons that are less preferred than Tomahawks) because the Navy doesn't have enough Tomahawks to fill them?
- What are the potential near-term operational risks of the current shortfall in the Tomahawk inventory? What steps is the Navy taking to manage or mitigate these risks?
- Under the Navy's current procurement plans, how quickly will the shortfall in the Tomahawk inventory be eliminated? How much more quickly could it be eliminated if procurement of TacToms were increased to, for example, 350 or 450 missiles in FY2005, and 500 or 600 missiles per year in subsequent years?
- What effect, if any, would increasing the annual TacTom procurement rate in FY2005 and subsequent years have on TacTom unit procurement costs?

## **Affordable Weapon System (AWS)**

The Tomahawk, though capable, is relatively expensive. TacTom’s projected average unit procurement cost of less than \$600,000 is roughly one-half the unit procurement cost of earlier versions of the Tomahawk, but it is still roughly 30 times the cost of an air-delivered Joint Direct Attack Munition (JDAM).

The advent in recent years of relatively inexpensive, GPS-guided (and thus all-weather) air-delivered precision-guided weapons (PGMs) like the JDAM, combined with the ability of the U.S. military to achieve air supremacy against potential adversaries and thereby enhance the survivability of attacking U.S. aircraft, permits U.S. military planners to use land- or sea-based aircraft for conducting long-range precision attacks in all weather conditions at expected platform and weapon

costs that are much lower than those that would be incurred by using Tomahawks. As a result of this development, TLAM-armed surface combatants and attack submarines may now be viewed by U.S. military planners and DoD budget officials as less cost-effective platforms, relative to aircraft, for conducting long-range strikes than was once the case, particularly in situations where expected loss rates for attacking U.S. aircraft are zero or close to zero, as they have been in recent operations.

One option for restoring the relative cost effectiveness of Navy surface combatants as long-range strike platforms would be to develop a significantly less expensive supplement to the Tomahawk. The goal of such a program would be to acquire a weapon that would permit surface combatants and attack submarines to attack at least some targets that they can currently attack with Tomahawks, but which can be procured for a cost that is much closer to that of a JDAM.

One effort for developing such a weapon is the Affordable Weapon System (AWS), which the House Armed Services Committee describes as “a committee initiative to reduce the cost of PGMs through the development of more affordable military systems.”<sup>5</sup> The Affordable Weapon is a low-cost cruise missile now being developed by the Titan Corporation under contract with the Office of Naval Research (ONR). Its range (400 nm to 600 nm) and warhead size (200 pounds) make it potentially suitable for attacking some targets that currently might be attacked with Tomahawks. Supporters of the weapon believe that if procured in large quantities, the Affordable Weapon could be produced for a unit cost of \$60,000, excluding the cost of the warhead. This unit cost, if achieved, would be only a fraction of the cost of a TacTom, and about 3 times the cost of a JDAM.

In its report (H.Rept. 108-106 of May 16, 2003) on the FY2004 defense authorization bill (H.R. 1588), the House Armed Services Committee stated:

The Office of Naval Research (ONR) Affordable Weapon System (AWS) program is an advanced technology initiative to demonstrate the ability to design, develop, and build a capable and affordable precision guided weapon system at a cost that would be an order of magnitude cheaper than comparable weapon systems and in production would achieve a stable unit production cost very early in the production cycle.

The committee notes that the ONR program has been successful in all respects. In less than four years, the AWS program has demonstrated the use of commercial-off-the-shelf (COTS) components to construct a 400–600 mile range, subsonic (180–220 knot), “loitering, 200 pound payload, precision strike missile with global positioning system/inertial navigation system guidance and control and a data link.” The missile has both line of sight and satellite data links for interaction with ground stations and forward observers and is reprogrammable in flight. In operational use the missile would be launched from CONEX-type containers that hold between six and twenty missiles and could be carried on land, sea, or air platforms. The initiative has demonstrated that the COTS approach can reduce costs by an order of magnitude from traditional cruise missiles. The current missile cost in large scale production, exclusive of warhead, is estimated to be \$60,000. Within the last 16 months there have been ten successful flight tests that have demonstrated the missile’s range, accuracy and other capabilities.

The committee believes that the AWS has enormous potential both for continued development and procurement as a weapon system to fill the gap between cannons and multiple launch rockets and missile systems such as Tomahawk that have longer range and larger warheads and in developing a new paradigm for the rapid development, transition to production, and

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<sup>5</sup>H.Rept. 108-106, p. 12.

fielding of new and innovative weapons systems. The committee notes that there are still significant issues to be resolved in transitioning AWS through system development into production: selection and integration of warhead(s); launcher development; production engineering; logistics supportability; training development; and development and operational test. The committee understands that the program is under review by the Navy for transition in the fiscal year 2006 budget. The committee believes that the success demonstrated by the system to date and the operational contribution that the capability would provide to U.S. forces justify seeking new ways to accelerate transition from science and technology to fielded capability. (Pages 169-170)

Navy officials have expressed some interest in the Affordable Weapon, but Navy plans for procuring the weapon are unclear. At a February 12 hearing before the House Armed Services Committee on the Department of the Navy's proposed FY2005 budget, the Chief of Naval Operations (CNO) was asked about the Navy's plans for long-range missiles. The CNO responded:

Our long-range missile system is Tomahawk today and TACTOM for tomorrow.... We are also in this year's budget, again there is funding for the Affordable Weapons system, which has been in S&T [science and technology research] for the last two or three years and is making great progress in the testing area.<sup>6</sup>

Potential oversight issues for Congress concerning the Affordable Weapon include the following:

- What role does the Navy see the Affordable Weapon playing in its future planning for ship-launched, long-range strike weapons?
- What efforts, if any, is the Navy currently pursuing other than the Affordable Weapon for acquiring a ship-launched weapon that is significantly less expensive than the TacTom and capable of attacking targets at ranges of 400 nm or more?
- If Navy surface combatants and attack submarines continue to rely solely on Tomahawk as their long-range strike weapon, will this reduce their cost-effectiveness as long-range strike platforms, relative to aircraft armed with GPS-guided PGMs like JDAM, in the eyes of U.S. military commanders and DoD budget officials?
- Given current requested and programmed levels of funding for the Affordable Weapon, when might it be ready for procurement? Can this date be accelerated through increased funding, and how much additional funding would be required in FY2005 meet this accelerated date?

## High-Speed Strike Missile

**Current Weapons Are Subsonic.** The Tomahawk and the Affordable Weapon are subsonic weapons. The Tomahawk flies at a speed of about 550 miles per hour and consequently can require an hour or more to reach distant targets, while the Affordable Weapon flies at a speed of about 200 miles per hour and consequently can require 2 or 3 hours to reach distant targets. This

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<sup>6</sup>Transcript of hearing as reported by Federal Document Clearing House.



raises a third potential issue for Congress regarding the long-range strike capabilities of Navy surface combatants and attack submarines, which is whether to develop and acquire a conventional, long-range, high-speed strike weapon as a complement to the slower-flying Tomahawk and Affordable Weapon.

**Two Options for a High-Speed Weapon.** There are at least two basic options for such a weapon – a conventionally-armed ballistic missile or a high-speed cruise missile capable of flying at high-supersonic speeds (i.e., Mach 3.5 to Mach 5) or hypersonic speeds (i.e., above Mach 5).

**Three Potential Advantages of Such a Weapon.** A high-speed strike weapon would offer at least three potential operational advantages – an ability to attack time-sensitive targets, an ability to attack hardened or deeply buried targets, and enhanced weapon survivability against enemy defenses.

**Time-sensitive targets.** Notional examples of time-sensitive targets, also called time-urgent targets or short-dwell targets, include terrorists or high-value military forces that have temporarily exposed themselves to U.S. sensors but could move beyond the view of those sensors in a matter of a few minutes, or enemy missiles armed with nuclear, chemical, or biological weapons that appear to be in the final stages of being made ready for launch. Exactly how time-sensitive such targets might be is not clear, but U.S. officials have suggested that in some cases, the desired total time from target detection to target destruction might be on the order of “single-digit minutes.”<sup>7</sup>

Attacking targets within such a short time line using aircraft can be very difficult unless aircraft are continuously maintained aloft in locations that are relatively close to such targets, which may not always be possible, particularly if nearby land bases are not available. As mentioned earlier, however, Navy surface combatants and submarines can operate in international waters, free from reliance on in-theater land bases, for weeks or months at a time. Consequently, it might be easier for U.S. military planners to keep a Navy surface combatant or attack submarine constantly within range of potential time-sensitive targets. A ship-launched Mach 6 cruise missile could strike a target 500 nm away in 7 minutes, which is about one-ninth the time that a Tomahawk would require.<sup>8</sup>

**Hardened or deeply buried targets.** Hypersonic weapons, according to one report, can penetrate surfaces three times deeper than subsonic penetrating weapons.<sup>9</sup> Press reports on studies for high-speed cruise missiles suggest that such a weapon might be able to penetrate 30 feet to 50 feet of concrete.

**Weapon survivability.** High speed can reduce the chances of the weapon being detected and countered. An increase of 1.8 Mach points in speed, for example, is equivalent in terms of weapon

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<sup>7</sup>See, for example, Tuttle, Rich. Kill Chain Timeline Now Down To ‘Single Digit Minutes.’ *Aerospace Daily*, June 20, 2003; and Morris, Jefferson. Global Hawk Seen As Key In Defeating Iraqi Air Defenses. *Aerospace Daily*, July 16, 2003.

<sup>8</sup>Morris, Jefferson. Navy To Try Again For Hypersonic Missile ACTD In ‘04-05, Official Says. *Aerospace Daily*, October 15, 2003; Wall, Robert. Where Next? *Aviation Week & Space Technology*, October 20, 2003: 32.

<sup>9</sup>Ma, Jason. Hypersonic, Supersonic Weapons Becoming A DoD Research Priority. *Inside the Navy*, October 20, 2003.

survivability to an order-of-magnitude reduction in the weapon's radar cross section.<sup>10</sup>

**OSD Interest.** The Office of the Secretary of Defense (OSD) over the last year reportedly has developed a strong interest in high-speed weapons. An October 2003 press report stated:

There is "a lot of interest" within the Office of the Secretary of Defense (OSD) to get a hypersonic strike missile program off the ground, according to [Rear Admiral John] Chenevey [the Navy's program executive officer for strike weapons and unmanned aviation]. Among the strongest supporters is Ron Sega, the director of defense research and engineering (DDR&E), who is spearheading hypersonics development through the National Aerospace Initiative (NAI).

Studies on the advantages of hypersonic strike weapons have made their benefits apparent, according to Sue Payton, deputy undersecretary of defense for advanced systems and concepts....

"The value of speed [and] the need for speed is something that our current DDR&E [Sega] is very focused on and he's gathering lots of support, and we're hoping that this will be a real transformational capability," she said.

As surveillance methods improve, the speed of the weapon itself soon will become the longest link in the kill chain unless the military develops supersonic or hypersonic cruise missiles, according to John Wilcox, assistant deputy undersecretary of defense for advanced systems and concepts.

"If we had a supersonic cruise missile now, we would probably be able to hit anywhere within a 600-mile wide theater in 15 minutes," he said.<sup>11</sup>

A second report in October 2003 stated that DoD

wants to breathe new life into languishing efforts to develop faster long-range weapons. A high-speed Mach 5-6-class missile "would really change and transform warfighting," Payton argues....

The Pentagon is interested in not only hypersonic weapons--those operating above Mach 4 – but also Mach 3-class weapons. These could reach a target within 15 min., much faster than traditional cruise missiles. "That is a capability we really need," Wilcox said....

To make its point, the Pentagon will insert direction in its Fiscal 2006 Defense Planning Guidance – the policy directive underlying the budget process – in support of high-speed weapons. Although language to that effect existed before, this time it will be much more explicit to leave no doubt as to the interest of the civilian leadership.<sup>12</sup>

A third report from the same time period stated that

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<sup>10</sup>Ibid, and Wall, Robert. Where Next? *Aviation Week & Space Technology*, October 20, 2003: 32.

<sup>11</sup>Morris, Jefferson. Navy To Try Again For Hypersonic Missile ACTD In '04-05, Official Says. *Aerospace Daily*, October 15, 2003.

<sup>12</sup>Wall, Robert. Where Next? *Aviation Week & Space Technology*, October 20, 2003: 32.

Defense Department researchers increasingly see missile speed as an area for improvement in time-critical strikes and are interested in developing missiles that can fly several times the speed of sound....

A recent study from the Air Force and the Defense Advanced Research Projects Agency concluded that a primary shortfall in long-range precision engagement is the inability to strike heavily defended targets anywhere in the world on short notice, he said.

The Director of Defense Research and Engineering Ron Sega has been “hard charging” in the pursuit of hypersonic and supersonic weapons because high speed will “change the way we fight wars,” said Sue Payton, deputy under secretary of defense for advanced systems and concepts.

“The value of speed, the need for speed, is something that our current DDR&E is very focused on, and he is gathering lots of support and we’re hoping that this will be a real transformational capability of the future,” she said at the conference.<sup>13</sup>

**Past Navy Efforts.** Navy officials reportedly have been interested in developing a high-speed strike weapon as far back as 1994, if not earlier. Reported efforts include the following:

- **Cheap Shot (1995).** In 1995, it was reported that the Navy would soon begin development work on a weapon called the “Cheap Shot” missile, which was a strike missile with a notional speed of Mach 3, a range of 500 nm with a 1,000-pound warhead or 700 nm with a 700-pound warhead, and a unit production cost of \$180,000. The Cheap Shot program, according to this report, was scheduled to be a Navy Advanced Technology Demonstration (ATD) program starting in FY1997 and costing about \$15 million. The effort was reportedly based in part on a 1994 science and technology report prepared for the CNO which stated that high-speed standoff weapons would be “crucial” to the success of strike operations.<sup>14</sup>
- **Fast Hawk (1996-1998).** In 1996-1998, the Navy studied a proposal – apparently an outgrowth of the Cheap Shot effort – for a high-speed strike missile called Fast Hawk with a speed of about Mach 4 and a range of more than 700 nm with a 750-pound warhead. The weapon would also be able to attack targets buried as much as 40 feet deep. Fast Hawk was to use a booster rocket and ramjet and employ a wingless, bending body about the same diameter (21 inches) and length (21 feet) as a Tomahawk. The estimated unit production cost of Fast Hawk was \$400,000. Fast Hawk was proposed for a 3-year Low-Cost Missile System (LCMS) ATD starting in FY1997 and costing about \$15 million. The Fast Hawk effort was cancelled in late 1998, reportedly due to rising costs, lack of money, and lack of a firm requirement or acquisition plan.<sup>15</sup>

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<sup>13</sup>Ma, Jason. Hypersonic, Supersonic Weapons Becoming A DoD Research Priority. *Inside the Navy*, October 20, 2003.

<sup>14</sup>Duffy, Thomas. Navy Developing New Supersonic Strike Missile; Could Replace Tomahawk. *Inside the Navy*, March 27, 1995: 1, 6-7.

<sup>15</sup>USN Reveals Concept For Missile That Turns Corners. *Jane’s Defence Weekly*, July 31, 1996:5; Surface (continued...)

- **HiSSM (1997).** In 1997, the Navy and DARPA expressed interest in the concept of a hypersonic missile called the High-Speed Strike Missile (HiSSM) with a speed of Mach 4 to Mach 8 (and a mean speed of Mach 6), a range of 600 nm to more than 700 nm, a warhead of about 500 pounds, a unit procurement cost under \$500,000, and an initial operational capability (IOC) around 2010.<sup>16</sup>
- **ARRMD (1997).** Also in 1997, DARPA reportedly began an effort to develop a low-cost high-speed missile, called the Affordable Rapid Response Missile Demonstrator (ARRMD) with a speed of Mach 3.5 to Mach 4, a minimum range of 400 nm, a 250-pound warhead, and a unit procurement cost of about \$200,000.<sup>17</sup>
- **HyStrike (1998).** In 1998, the Navy invited industry participation in a 6-year Hypersonic Weapons Technology (HWT) program to develop technologies for a family of affordable high-speed strike weapons. The first contracts under the effort were scheduled for FY1999. HWT was described as a special focus within ONR's Air and Surface Weapons Technology (ASWT) program, and was viewed as supporting a projected Hypersonic Strike (HyStrike) program envisioned for FY2000. The HyStrike effort focused on developing a weapon with a speed of Mach 3.5 to Mach 7 and a range of up to 600 nm.<sup>18</sup>
- **JSCM (2001).** In 2001, it was reported that the Navy was considering developing a new high-speed strike missile called the Joint Supersonic Cruise Missile (JSCM) with a speed of Mach 3 to Mach 4, a range of 500 nm, a total development cost of

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<sup>15</sup>(...continued)

Warfare Boss Examines New Ways To Back Corps. *Navy News & Undersea Technology*, August 26, 1996: 5-6; Lok, Janssen. Fasthawk Aims To Overtake Tomahawk. *Jane's Defence Weekly*, April 16, 1997: 29; Fasthawk Missile Preliminary Design Review Set For May. *Inside the Navy*, April 28, 1997: 22; Cohen, Joshua T. Fasthawk Design Review Looks At Hydraulic And Heat Shield Issues. *Inside the Navy*, May 19, 1997: 15; Castelli, Christopher J. Confronting Rising Costs, Navy Cancels Fasthawk Technology Demo. *Inside the Navy*, November 30, 1998; Castelli, Christopher J. ONR Remains Mindful Of Need For Future High-Speed Strike Missile. *Inside the Navy*, December 28, 1998: 9. For more background on Fast Hawk, see

[<http://www.globalsecurity.org/military/systems/munitions/lcms.htm>]

<sup>16</sup>Navy Seeks Development Of High-Speed Missile. *Navy News & Undersea Technology*, August 18, 1997: 1, 8; Navy's Hypersonic Missile Could Change Strike Warfare. *Navy News & Undersea Technology*, September 1, 1997: 1, 8; Current Subsonic Missiles Lose To Future Needs. *Navy News & Undersea Technology*, September 22, 1997: 1, 8; Duffy, Thomas. Navy Eyeing Family Of Air-, Ship-Launched High-Speed Strike Missiles. *Inside the Navy*, September 22, 1997: 4-5.

<sup>17</sup>Berenson, Douglas. DARPA Looks To Develop Low-Cost Hypersonic Strike Missile. *Inside the Navy*, November 17, 1997: 4.

<sup>18</sup>US Navy Funds Technology For Hypersonic Strike Missile. *Jane's International Defense Review*, No. 5, 1998: 6. For more background on HyStrike, see

[<http://www.globalsecurity.org/military/systems/munitions/hystrike.htm>]

\$1 billion, and an IOC of 2012. The program at that point was not funded but was being considered for funding as an FY2002 Advanced Concept Technology Demonstration (ACTD).<sup>19</sup>

- **SHOC (2002).** In 2002, it was reported that the Navy and the Defense Threat Reduction Agency, potentially in combination with the United Kingdom, were planning an ACTD costing more than \$100 million to explore development of a high-speed strike missile called the Standoff High-speed Option for Counterproliferation (SHOC) with a speed of Mach 3.5 to 4.5, a range of at least 400 nm and preferably 600 nm, and a 200-pound warhead. The program was envisioned as commencing in 2004, with the goal of producing prototype test missiles plus 10 operational missiles by 2007, according to one report, or of starting system development and demonstration work in FY2008 and completing it in FY2012, according to another.<sup>20</sup>
- **Ballistic missile (2003).** In August 2003, the Navy issued a request for information (RFI) for exploring possibilities for a submarine-launched intermediate-range ballistic missile (SLIRBM) capable of carrying either a conventional or nuclear warhead with a diameter of up to 32.5 inches and a length of up to 36 feet. The RFI also requested information about potential IRBM capabilities for surface ships.<sup>21</sup> In October 2003, it was reported that a new Defense Science Board (DSB) report on the future of strategic strike recommends developing new weapons and payloads, including a conventionally armed medium- or intermediate-range ballistic missile for use by the Navy's Trident SSGN submarines and possibly Navy surface ships as well. The missile reportedly could have a payload of 2,000 pounds. According to the report, the DSB study began in March 2003 and was being briefed to DoD leaders in October 2003.<sup>22</sup>
- **Hypersonic strike missile (2003-2004).** In October 2003, it was reported that the Navy hoped to start developing a hypersonic strike missile starting in FY2004 as an ACTD after failing to secure funding for such an effort in FY2003. The missile would have a speed of Mach 4 to Mach 5 and a range of 350 to 600 miles. The effort reportedly could use technologies being developed by the Navy and DARPA under the Hypersonics Flight (HyFly) Demonstration Program, which was scheduled

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<sup>19</sup>Koch, Andrew. US Navy Could Field High-Speed Missile By 2012. *Jane's Defence Weekly*, June 6, 2001: 6. For more background on the JSCM (also abbreviated as JSSCM), see [http://www.globalsecurity.org/military/systems/munitions/jsscm.htm]

<sup>20</sup>Koch, Andrew. USA, UK To Consider Supersonic Cruise Missile. *Jane's Defence Weekly*, May 1, 2002; Brown, Malina. Navy Considers DTRA'S Supersonic Cruise Missile As ALAM Candidate. *Inside the Navy*, October 7, 2002. For more background on SHOC, see [http://www.globalsecurity.org/military/systems/munitions/shoc.htm]

<sup>21</sup>Navy Issues RFI For SLIRBM Concept, Plans Technical Exchange Next Month. *Defense Daily*, August 27, 2003.

<sup>22</sup>Ma, Jason. DSB Study Recommends Changes To Strategic Strike, SSGN Payloads. *Inside the Navy*, October 20, 2003.

to conduct a flight test of an experimental Mach 6 missile in FY2005.<sup>23</sup> According to the Navy Office of Legislative Affairs, the effort was not chosen as an FY2004 ACTD and is now a candidate for becoming an FY2005 ACTD.<sup>24</sup>

These efforts appear to have informed the Navy's understanding of design tradeoffs and potential operational concepts for high-speed strike missiles. They also, apparently, have provided opportunities to develop engine technology and other technology that would go into such a weapon. The history of past Navy efforts in this area also suggests, however, that the Navy and/or DoD has repeatedly shied away from moving beyond conceptual and exploratory efforts to a firm acquisition program for developing and procuring an operational weapon.

**Potential Oversight Issues for Congress.** Potential oversight questions for Congress regarding a high-speed strike weapon for use by Navy surface combatants and attack submarines include the following:

- What are the Navy's current plans for acquiring a conventional, long-range, high-speed missile that would permit Navy surface combatants and submarines to attack distant time-sensitive targets?
- What are the potential operational risks of not having a surface- or submarine-launched high-speed missile for attacking distant time-sensitive targets?
- Why has the Navy in recent years repeatedly begun efforts to explore options for a conventional, long-range, high-speed strike weapon, but never committed to a firm acquisition program?
- What has the Navy learned, in terms of technology, understanding of design tradeoffs, and potential concepts of operation, from its past efforts to explore options for a conventional, long-range, high-speed strike weapon?
- In 1997, weapon developers believed the HiSSM high-speed cruise missile could be developed and fielded by 2010 – that is, in about 13 years. Today, 7 years later, how much closer is the Navy to being able to field an operational high-speed cruise missile like HiSSM?
- If a firm commitment were made, starting in FY2005, to a program for developing and procuring a conventional, long-range, high-supersonic/hypersonic cruise missile for use by surface combatants and attack submarines, in what year could the first production models be procured for operational use? How sensitive would this date be to changes in annual funding levels for the development effort?

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<sup>23</sup>Morris, Jefferson. Navy To Try Again For Hypersonic Missile ACTD In '04-05, Official Says. *Aerospace Daily*, October 15, 2003. For more background on HyFly, see [<http://www.globalsecurity.org/military/systems/munitions/hyfly.htm>]

<sup>24</sup>Source: Telephone conversation with Navy Office of Legislative Affairs, February 24, 2004.

- What would be the potential total development cost and unit procurement cost for a conventional, long-range, high-supersonic/hypersonic cruise missile for use by surface combatants and attack submarines?
- Compared to a high-speed cruise missile, what are the relative advantages and disadvantages of a conventionally armed ballistic missile as a long-range, high-speed strike weapon?
- Are the efforts of various DoD departments and agencies – including the Navy, the Air Force, DARPA, and DTRA – to develop conventional, long-range, high-speed strike weapons sufficiently coordinated? Is there duplication of effort? Are departments or agencies competing against one another for funding that would be used to accomplish similar objectives? Is insufficient coordination between interested parties a reason why past efforts for such a weapon have not moved much beyond the preliminary development stage?

## **Relationship to ESG and SSG, DD(X) Destroyer, and Trident SSGN**

A final point to note is that the issue of long-range strike weapons may have particular significance for 3 new Navy initiatives – the Expeditionary Strike Group (ESG) and Surface Strike Group (SSG), the DD(X) destroyer, and the Trident SSGN submarine. Each of these is discussed below.

**ESG And SSG.** The ESG is a new kind of naval formation built around the traditional Amphibious Ready Group (ARG). The traditional ARG was a collection of 3 amphibious ships, including a “large-deck” (i.e., LHA/LHD-type) amphibious assault ship, that together could embark a Marine Expeditionary Unit of about 2,200 Marines. An ESG is essentially an expanded ARG that also includes 3 surface combatants, 1 attack submarine, and land-based P-3 maritime patrol aircraft.

The ESG is at the heart of a Navy initiative, called the Global Concept of Operations, to significantly increase the number of independently deployable, strike-capable formations in the fleet. In the past, the Navy had 12 aircraft carrier battle groups (CVBGs) plus 12 ARGs that would often steam in the company of CVBGs. Under this arrangement, the Navy had 12 primary independently deployable, strike-capable formations – the 12 CVBGs. Under the new initiative, the CVBGs have been renamed carrier strike groups (CSGs), and some of the surface combatants previously assigned to CVBGs will now be assigned to ESGs. Under this arrangement, the Navy is to have 24 primary, independently-deployable, strike-capable formations – 12 CSGs and 12 ESGs.

The number of independently deployable, strike-capable formations is to be further increased through the formation of surface strike groups (SSGs), which are formations of 3 surface combatants. (Such formations were previously referred to as surface action groups, or SAGs.)

The purpose in increasing the number of independently deployable, strike-capable formations is to increase the Navy’s modularity and consequently its flexibility for responding to contingencies

of different kinds in various locations. The logic behind the initiative is that some contingencies might not require the full striking power of a carrier air wing, but might nevertheless require the presence of a Navy formation with some amount of strike capability.<sup>25</sup>

Much of the CSG's strike potential is resident in the large air wing embarked on the carrier. This air wing can attack hundreds of targets per day with precision strike weapons, including all-weather, GPS-guided weapons such as the JDAM.

The ESG and SSG, in contrast, lack a large carrier air wing, so their long-range strike potential resides more heavily (in the case of the ESG) or exclusively (in the case of the SSG) on the weapons carried by their surface combatants and (in the case of the ESG) attack submarines. For this reason, the viability of the ESG and SSG as strike capable formations may be particularly influenced by whether they are armed with a full load of Tomahawks, or a low-cost supplement to the Tomahawk (such as the Affordable Weapon), or a conventional, long-range, high-speed strike missile for attacking time-sensitive targets, hardened targets, or deeply buried targets.

**DD(X) Destroyer.** A key mission for the proposed DD(X) destroyer is naval surface fire support (NSFS). This mission contributes substantially to the size and cost of the DD(X), particularly in terms of the ship being equipped with two large (155mm) naval guns.<sup>26</sup>

The fleet's requirement for additional NSFS capability has been reviewed and revalidated periodically in recent years. But the advent of relatively inexpensive GPS-guided bombs, the new concept of air-delivered loitering munitions, and evolving notions of land warfare may lead to a renewed debate about the priority of NSFS compared to other investments, or about the amount of NSFS capability that will be needed in the future. If so, the justification for the DD(X), or for building all 24 of the DD(X)s currently planned, may become subject to debate.

In addition to carrying two guns, however, the DD(X) will also be equipped with 80 vertical launch system (VLS) tubes for launching missiles. If the value of the ship's 2 guns comes into question, then the justification for the DD(X) program might turn more heavily on the ship's other capabilities. This could lead to a stronger focus on the question of whether the DD(X)s, if built, would be armed with a full load of Tomahawk missiles, or a low-cost supplement to the Tomahawk, or a conventional, long-range, high-speed strike missile for attacking time-sensitive targets, hardened targets, or deeply buried targets.

**Trident SSGN.** One of the principal advantages that Navy officials cite about the Trident SSGN submarine is the large volume of payload space resident in its 24 large-diameter missile tubes, which can accommodate, among other things, up to 154 Tomahawks (7 Tomahawks for each of 22

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<sup>25</sup>For more on the ESG and the Global Concept of Operations, see CRS Report RS21338, *Navy Ship Deployments: New Approaches -- Background and Issues for Congress*, by Ronald O'Rourke. Washington, 2003. (Updated periodically) 6 pp.

<sup>26</sup>For more on the DD(X) program, see CRS Report RS21059, *Navy DD(X) Future Surface Combatant Program: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 2003. (Updated periodically) 6 pp; and CRS Report RS32109, *Navy Surface Combatant Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O'Rourke. Washington, 2003. (Updated periodically) 93 pp.



tubes, with the remaining 2 tubes used for storing equipment).<sup>27</sup> The operational cost-effectiveness of the SSGNs will depend in part on getting maximum use out of their payload space. Ensuring that SSGNs deploy with a full load of Tomahawks, acquiring a low-cost supplement to the Tomahawk, or acquiring a conventional, long-range, high-speed strike missile for attacking time-sensitive targets, hardened targets, or deeply buried targets, may be viewed as consistent with the goal of making maximum use of the SSGNs' large payload space.

Mr. Chairman, distinguished members of the subcommittee, this concludes my testimony. Thank you again for the opportunity to appear before you to discuss these issues. I will be pleased to respond to any questions you might have.

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<sup>27</sup>For more on the SSGN, see CRS Report RS21007, *Navy Trident Submarine Conversion (SSGN) Program: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 2003. (Updated periodically) 6 pp.