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UNTIL RELEASED BY  
THE SENATE ARMED  
SERVICES COMMITTEE

STATEMENT OF  
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BEFORE THE  
SENATE ARMED SERVICES COMMITTEE  
EMERGING THREATS AND CAPABILITIES SUBCOMMITTEE  
ON  
TECHNOLOGY FOR COMBATING TERRORISM AND  
WEAPONS OF MASS DESTRUCTION  
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Mrs. Chairwoman, distinguished members of the Subcommittee, thank you for this opportunity to discuss the use of Naval Science and Technology for combating terrorism and weapons of mass destruction. You and the other members of the Senate Armed Services Subcommittee on Emerging Threats and Capabilities have been leaders in calling attention, both nationally and in the Department of Defense, to the changing nature of national security challenges facing our great nation.

I would like to discuss the Navy's science and technology efforts, especially programs developing new technologies to combat terrorism and weapons of mass destruction, as well as our fiscal year 2003 budget, our technology transition initiatives, and our plans to revitalize our labs and retain our top notch personnel.

You have challenged us, and we have challenged ourselves, to transform the Navy's ability to be even more responsive and more capable of meeting any current and future crisis. In the war against terrorism, S&T is the enabler which links innovative research to warfighter and homeland defense requirements. From discovery to deployment, innovation and experimentation facilitate the transition of successful concepts from lab to Fleet/Force.

#### Science & Technology in the War against Terrorism

The campaign in Afghanistan has already seen the use of new weapons rapidly developed in the laboratory. For example, PBXIH-135 thermobaric explosive developed at Naval Surface Warfare Center Indian Head (an explosive that produces extremely high temperatures and blast overpressures) was used to fill Air Force BLU-109 2000-pound bombs. The Defense Threat Reduction Agency tested the new weapon at Department of Energy ranges in Nevada, and it was ready in time to be used with devastating effect against al Qaeda caves in Afghanistan. This is just one example of how science and technology (S&T) organizations can swiftly collaborate to provide concrete deliverables in a wartime emergency. In addition, it shows how Naval science and technology interact effectively with other services, defense agencies, and federal departments.

The thermobaric weapon story is instructive in other ways. The labs delivered it in less than three months. The call for new warfighting capabilities was issued on September 19, 2001, and the weapon was sent to the Afghan theater in mid-December. Such speed was possible because the science was done before the need became urgent. This basic fact about how science transitions to operational capabilities explains why a relevant, balanced Navy and Marine Corps program plans to deliver across three phases: 1) Today's Navy and Marine Corps (dominated by emergent needs of the warfighter), 2) the Next Navy and Marine Corps (defined by requirements), and 3) the Navy and Marine Corps After Next (shaped by technological possibilities discovered through research in areas of Naval relevance).

Another example of the benefit of Naval basic research is Nuclear Quadrupole Resonance (NQR) Technology. NQR technology "sniffs out" explosives. The Naval Research Lab developed nuclear quadrupole resonance, a technology that has now been adapted to the detection of landmines, unexploded ordnance, and terrorist bombs. Because this technology gives us the means of detecting explosives directly (and not simply detecting metallic objects, as is the case in conventional detection systems) we are now able to see through clutter that presently obscures many mines and bombs from older sensors. The ability to detect widely used plastic explosives (RDX) was demonstrated in Bosnia; Naval Research Lab has more recently demonstrated the ability to detect TNT.

Another example highlighting the value of our long-term sustained research investment involves an ONR-sponsored scientist at the University of Wisconsin who was working on high-frequency (terahertz) radar phenomena in the Naval basic research program. The morning anthrax was detected in the mails, it occurred to his ONR program manager that this technology had potential utility for rapid detection of biological agents. At the program manager's suggestion, the scientist quickly determined that in fact his high-frequency radar could identify anthrax inside a sealed envelope in real-time. This technology gives a go/no-go readout and can be developed into a system for use by personnel with minimal training. The DoD Counter-Terrorism Task Force has selected this system for accelerated wartime development; we expect to deploy it by Fall 2002.

Naval funded research also identified a polymer produced by marine algae that, when used to dress wounds, can actually stop gushing arterial bleeding. Since the polymer does not contain any of the proteins normally associated with clot formation, it doesn't pose the disease-transmission or immune response risk of other hemostatic technologies. This lifesaving technology is the grail of combat trauma medicine, and provides an excellent example of a basic research result transitioning directly to the operational forces. The hemostatic dressing has passed initial FDA trials and is being accelerated into the military inventory under the DoD Counter-Terrorism Task Force.

In the aftermath of September 11<sup>th</sup>, when the DoD Counter-Terrorism Task Force solicited all military services and defense agencies for warfighter/homeland defense enhancements deliverable in thirty day/one year/one-to-five year timeframes, one third of the funded programs (validated by the Joint Staff) in each timeframe were Naval! This is a high return on Navy sustained S&T investment.

### Naval Science & Technology Investment Strategy

There is zero certainty that every research investment will pay the dividends we desire. What is certain: if we do not invest in promising research today, we guarantee that options and opportunities will be severely curtailed in future years.

So how do we choose the research in which to invest? We are guided by:

- 1) ***National Naval Responsibilities*** (fields in which Navy S&T is the only significant U.S. sponsor, such as Naval Engineering, Ocean Acoustics, and Underwater Weaponry),
- 2) ***S&T Grand Challenges*** (we encourage the nation's scientific community to achieve breakthroughs in difficult but achievable technical challenges involving issues such as: Naval Battlespace Awareness, Electric Power Sources, Naval Materials by Design, and Multifunctional Electronics for Intelligent Naval Sensors), and
- 3) ***Future Naval Capabilities (FNCs)***. (which complement our commitment to achieve mid-term/long-term breakthroughs, by squarely facing the immediate challenge of meeting today's warfighter requirements).

With the focus of this hearing on some of our more immediate requirements, I want to particularly emphasize S&T contributions to enabling Navy transformation through achieving goals outlined in the Future Naval Capabilities (FNCs). The key to achieving FNC goals is the strong business partnership between S&T, Industry, Requirements, Acquisition, and Fleet/Force stakeholders.

The FNC process delivers maturing technology to acquisition program managers for timely incorporation into platforms, weapons, sensors, and process improvements. With a total investment of \$577.6 million in FY02 and over \$600 million planned for FY03, FNC's support the Secretary of the Navy's goals to 1) increase combat capability, 2) enhance personnel performance, 3) introduce advanced technology, and 4) improve business practices.

ONR devotes approximately two-thirds of its 6.3 (advanced technology development) funds and about two-fifths of its 6.2 (applied research) funds to FNCs. As I have reported to you previously, the twelve currently approved FNCs (in no priority order) are:

- **Autonomous Operations** - focused on dramatically increasing performance and affordability of Naval air, sea, land, and underwater unmanned vehicles;
- **Capable Manpower** - focused on affordable human-centered hardware and systems matching human capabilities, limitations and needs, for use by individual Sailors and Marines in an information rich battlespace;
- **Electric Warships and Combat Vehicles** – focused on revolutionary power plants that will permit new hullforms and propulsors, reduce manning, streamline logistics, and enable future high energy/speed of light weapons and sensors;
- **Knowledge Superiority and Assurance** - focused on developing capability to distribute integrated information in a dynamic network with high connectivity and interoperability to ensure Naval forces have knowledge superiority, common situational understanding, and increased speed of command;
- **Littoral Antisubmarine Warfare** – focused on enhancing our capability to detect, track, classify, and engage enemy submarines in a near-the-shore environment before they are close enough to harm our Fleet/Force;

- **Littoral Combat and Power Projection** - focused on development of uniquely capable combat and logistics systems necessary to deploy and sustain the Fleet/Force without building up a large logistical infrastructure ashore;
- **Missile Defense** – focused on developing capability to detect, track, and engage ballistic, theater and cruise missiles, as well as enemy aircraft, through a single integrated air picture, composite combat identification, distributed weapons control, and overland intercept capability;
- **Organic Mine Countermeasures** – focused on developing an organic MCM capability to detect, characterize, and neutralize mines in operating environments at sea, on the shore, and inland;
- **Platform Protection** – focused on countering the worldwide proliferation of highly effective anti-platform weapons, as well as other asymmetric threats, through the development of effective organic means of protection: weapons, sensors, countermeasures, stealth and damage control;
- **Time Critical Strike** – focused on achieving a substantial reductions in the amount of time required to engage critical mobile targets, theater ballistic missiles, weapons of mass destruction, C4I centers and armored vehicles;
- **Total Ownership Cost Reduction** – focused on ways to use advanced design and manufacturing processes to significantly decrease costs associated with acquisition, operations, maintenance, manning, ensure environmental compliance, and give Naval forces reliable cost estimating tools; and
- **Warfighter Protection** – focused on protecting Warfighters in the emerging Expeditionary Maneuver Warfare battlespace through combat casualty prevention, care, and management.

### Technology Transition Initiatives

We are pursuing several initiatives to improve the transition from discovery to deployment within the Navy by strengthening the partnership between the Office of Naval Research (ONR) and the schools, universities, government laboratories and industry, as well as nonprofit and for-profit organizations. Despite the world-class S&T research conducted by the Naval Research Laboratory (NRL) and all of our other laboratories and warfare centers, we

intend to avoid the “Not Invented Here” syndrome. We are not the font of all knowledge and intend to take full advantage of the creative genius present in the schools and private sector to meet Navy and Marine Corps requirements.

The Commercial Technology Transition Officer (CTTO) is my senior Naval advocate for moving promising technology out of commercial research and into systems procured for the Navy/Marine Corps. For the last two years, we have sponsored an annual Naval-Industry Research and Development Partnership Conference, where we attempt to address regulatory, funding, and technology transition issues.

In addition, we have established a “Swamp Works” office, similar in concept to the Lockheed-Martin Skunk Works office, but dedicated to addressing critical blue/green Navy/Marine Corps problems with out-of-the-box solutions. Swamp Works has already begun to show its value; for example, in the initial deployment of its Sea Airborne Lead Line (Sea ALL) unmanned aerial vehicle (UAV) to the Fifth Fleet. The Navy’s Sea ALL UAV is derived from the Dragon Eye UAV, which was developed by ONR for the Marine Corps. Dragon Eye is a small, camera equipped, backpack-size UAV designed to provide Marines with a portable airborne reconnaissance capability. Sea ALL will similarly provide Navy ships with reconnaissance capability while in port, as well as the potential capability to employ remote sampling to detect chemical, biological and explosive threats.

Swamp Works is also looking at blast mitigation. This program is applying new materials and unique structural configurations to prevent blast from breaching a ship’s hull—as happened to *USS COLE*. Two concepts with advanced materials will be tested soon, and subsequent system design will offer near-, mid- and far-term applications. The near-term work will deliver a portable armor enhancement. The mid-term focus will be on permanent enhancements that can be back-fitted to existing ships. The far-term applications will be permanent enhancements to the next generation of ships.

We have also supported the Naval Fleet/Force Technology Office (NFFTIO) to strengthen communications between the Fleet/Force and the Naval S&T community by assigning

Naval Research Science Advisors to serve with Fleet/Force commands. We also established the Naval Research Science and Technology Action Team (NR-STAT) to provide technology solutions (from all sources: government, military, industry, academic, etc.) to problems identified by warfighters. Initially exercised in July 2001, since 11 September NR-STAT has been a principal conduit for technology proposals/solutions in the war against terrorism.

### S&T Labs and Personnel

Finally, let me describe some of our ongoing efforts to improve the quality of defense labs and test centers, and improve the quality of technical talent that can be attracted to these important facilities. The Congress has supported several legislative provisions that have helped the Service laboratories, especially Section 342 of the NDAA for FY 1995 and Section 1107 of the NDAA for FY 2000. Section 1107 eliminated controls on high-grade scientific and engineering positions, a move that has helped with retention of high-quality personnel scientific and technical personnel.

Section 245 has been used to allow participating Service laboratories and centers to implement, on a trial basis, a one-time clearing of the Priority Placement Program (PPP) registrants for professional science and engineering positions as soon as the recruitment action reaches the Human Resources Service Center. Preliminary indications are that this may be useful in reducing some of the time and effort needed to recruit new personnel. Implementation of Sec 1113 is in process.

There are systemic problems facing the Service laboratories. In light of this and the urgent need to address them, it appears that incremental approaches and piecemeal legislative efforts may no longer be sufficient and timely.

Since the end of World War II, Service laboratories, along with private sector counterparts, have played a crucial role in providing our military the technological superiority needed to counter potential adversaries. This role is even more critical in the post-9/11 world, where a wide range of new technologies are needed to fight terrorism, protect the homeland, and



enable defense transformation efforts. Therefore, it may now be time to consider establishing a new governance model within the Federal Government specifically tailored to the needs of a military research laboratory. Such a system could be designed to eliminate the need for piecemeal fixes, while retaining Federal status and competence in science and technology as it relates to National Defense.

Currently, a joint Naval Research Advisory Committee (NRAC) study, with panel representation from the Army Science Board and the Air Force Scientific Advisory Board, and sponsored by the Director Defense Research and Engineering, is examining the difficulty of the Service laboratories in recruiting and retaining top-quality scientists and engineers, as well as other issues related to their ability to remain world-class research institutions. The panel is currently examining recommendations from past studies of the laboratories, recent legislative reforms, including those mentioned above, and input from other experts, to develop a set of recommendations for improving the ability of these laboratories to attract and retain the best and brightest technical talent. The panel has just completed its visits to labs and is currently developing its findings and recommendations. It plans to submit a preliminary summary of its conclusions to the Services and OSD in May 2002. A formal report will probably not be completed until late summer 2002.

In conclusion, the pay off on S&T investment is clear. Naval transformation depends on a long-term, stable, and sustained investment in S&T/R&D, validated through on-going experimentation and transition to the Fleet/Force in a never-ending cycle.

Again, let me tell you how greatly I appreciate your inviting me to provide written testimony in your review of science technology to counter terrorism and weapons of mass destruction.