

NOT FOR PUBLICATION UNTIL RELEASED BY THE  
HOUSE ARMED SERVICES COMMITTEE  
INTELLIGENCE AND EMERGING THREATS AND CAPABILITIES SUBCOMMITTEE

STATEMENT OF

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BEFORE THE

INTELLIGENCE, EMERGING THREATS AND CAPABILITIES SUBCOMMITTEE

OF THE

HOUSE ARMED SERVICES COMMITTEE

ON

THE DEPARTMENT OF THE NAVY FISCAL YEAR 2020 BUDGET REQUEST FOR  
SCIENCE AND TECHNOLOGY PROGRAMS

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## **Introduction**

Chairman Langevin, Ranking Member Stefanik and distinguished members of the Subcommittee, I appreciate the opportunity to appear before you today to discuss the Department of the Navy (DON) Science and Technology (S&T) efforts and how they support our Sailors and Marines. Science and Technology is the critical building block in the National Defense Strategy for the future Fleet and Force. The Fiscal Year (FY) 2020 S&T Budget requests \$2.3 billion for our Navy and Marine Corps team and represents a key enabler to ensure the Department of the Navy maintains and expands its comparative overmatch against our competitors.

The DON S&T portfolio ensures the Navy maintains technological superiority, avoids technological surprise, fosters knowledge expansion, and spurs innovative technological breakthroughs. The Naval Research Enterprise is uniquely positioned to develop and accelerate priority-driven technology and rapidly deliver revolutionary advantages for the current force and the future force to preserve naval superiority.

## **The Naval Research and Development Establishment (NR&DE)**

The Naval Research and Development Establishment (NR&DE) includes 20 commands from the Naval Air Warfare Centers, Naval Surface Warfare Centers, Naval Undersea Warfare Centers, Space and Naval Warfare Systems Centers, Office of Naval Research (ONR) and the Naval Research Laboratory (NRL). It is comprised of diverse and highly educated scientists, engineers and technicians (including more than 2,000 PhDs).

The NR&DE works closely with talented individuals from industry, academia and across the government. We successfully partner with these individuals and institutions to ensure our Sailors and Marines have the most advanced capabilities now and in the future. During FY 2018, ONR awarded more than 900 new grants. The caliber of the research can be exemplified by the 2018 Nobel Prize winner in Chemistry, Dr. Frances Arnold from the California Institute of Technology, where she became only the fifth woman—and the first American woman—to take home the chemistry award. Through her career, the Department supported Dr. Arnold with various grants, and her research has led to discoveries and breakthroughs with important implications for both the Navy and society at large. Since 1952, more than 60 Nobel laureates

have been sponsored by the DON for their work in everything from laser technology to graphene.

Effective naval power requires a combination of capacity, capability, and lethality. Improvements in each of those elements requires cutting-edge science, technology, research and development. For Naval forces, much of this work is performed by our corporate laboratory, the Naval Research Laboratory, and at the warfare centers. Over half the work performed by NRL is in fundamental S&T research – in partnership or collaboration with academia and researchers in other government laboratories and activities. The Warfare Centers focus more on technology and engineering, often in partnership with industry and government program offices.

NRL and the warfare centers conduct research, translate the results into technologies, and facilitate transfer of these technologies to other Navy, Defense Department (DoD), federal, and industrial organizations for incorporation into more effective operational military systems. NRL and the warfare centers also conduct highly-innovative, competitively funded, basic and applied research. While this early phase work represents a modest portion of NRL and the warfare center’s working capital fund budget, history has shown that it often proves vital to improving warfighting capabilities, developing cost-cutting processes, preventing technological surprise by potential adversaries, and occasionally introducing revolutionary new capabilities.

### **Science and Technology Alignment to the National Defense Strategy**

The National Defense Strategy emphasizes the particular importance of naval power in an emerging great power competition era. The Department cannot expect success fighting tomorrow’s conflicts with yesterday’s weapons or equipment. S&T investments are focused on establishing an unparalleled 21st century National Security Innovation Base that effectively addresses the scope and pace of our competitors’ and adversaries’ ambitions and potential capabilities. These investments support the modernization of key capabilities outlined in the 2018 National Defense Strategy in order to meet tomorrow’s capability and capacity needs.

The Department’s S&T priorities for this budget include development of the next generation of directed energy and electric weapons; swarming mission-focused autonomous systems; artificial intelligence and machine learning; advanced manufacturing; high performance

materials and energetics; networked sensors and weapons; cyber security; quantum science and computing; and development of hypersonic boosters.

## **Fundamental Research**

Many technologies we now take for granted might not have existed without our predecessors' investments in long-term government scientific exploration. The development of high-power shipboard lasers, like SSL-TM, necessitated basic theory and experiments on laser beam combination that began over two decades ago at NRL. Another illustrative example is the emergence of Gallium Nitride (GaN) as the critical wide-bandgap semiconductor technology; enabling multiple Navy major defense acquisition programs including Next Generation Jammer and Air and Missile Defense Radar. Anticipating future military requirements, NRL researchers initiated R&D for this material in the 1990s, leading to multiple breakthroughs and GaN technology maturation that enabled its successful use today. The FY 2020 budget continues to push the frontiers of knowledge. Researchers in the NR&DE continue this legacy through full-spectrum basic and applied research on cutting-edge problems, such as quantum sensing and neuromorphic computing with memristive systems. These explorations include the successors of those who discovered GaN. The present generation of NRL researchers is hard at work, searching for tomorrow's ultra-wide-bandgap semiconductor materials that will outperform anything seen to date.

The Department's FY 2020 investment in naval relevant, high risk basic research and early applied research increases in the following areas: artificial intelligence in autonomy and decision making; ocean sciences and ocean acoustics. Another key initiative in fundamental research is Task Force Ocean. The Chief of Naval Operations established Task Force Ocean, directing the naval research community to reinvigorate their partnership with the academic oceanographic research community. This partnership is being strengthened through research grants, sponsorship of graduate students and post-doctoral researchers, a dedicated "Scientist-to-Sea" program, and a Tactical Oceanography Symposium series, in order to ensure the U.S. Navy's advantage in tactical exploitation of the environment for maritime superiority is maintained.

## **Future Naval Capabilities (FNC)**

The Future Naval Capabilities program is designed to develop and transition cutting-edge technologies to acquisition programs of record. The program delivers these technologies for integration into platforms, weapons, sensors or specifications to improve Navy and Marine Corps warfighting and support capabilities. FNCs are now streamlined to a three-year process from concept to delivery of technology to a program of record. The FNC process provides a strong linkage between the S&T community, the resource sponsors and the Fleet and Force. The previous process could take up to five years.

In 2018, nineteen FNC products transitioned to acquisition programs of record across the DON. Also in 2018, eight FNC products were deployed to the Fleet and Force from programs of record in areas including rocket imaging seekers, avionics training displays, logistic support tools, and detection and classification algorithms. For FY 2020, the Department has selected 19 Future Naval Capabilities. These efforts will incrementally improve sonar systems, radar systems, electromagnetic maneuver warfare, Fleet training technologies, diver safety, unmanned systems and others.

## **Innovative Naval Prototypes (INPs)**

Innovative Naval Prototypes are disruptive technologies for which a formal requirement does not yet exist. These are higher risk, but also have a higher payoff when they succeed. These technologies, such as the Solid State Laser and the Sea Hunter, will deliver capability to the warfighter faster than traditionally developed programs. They are or will soon be deployed, providing opportunities for our S&T community to learn directly from the warfighter and improve the delivered capabilities of these programs, as well as existing programs of record. The Sea Hunter transit with a battle group will provide insights into teaming of autonomous platforms with deployed warships and the value these combined capabilities can provide to the battle group commander. INPs are matured using traditional S&T dollars and then demonstrated using Advanced Component Development and Prototypes funding to transition the INP to the Fleet. Your continued support for these efforts will ensure our superiority on the battlefield.

## **Doing Business Better**

The Navy is taking advantage of authorities granted by Congress to invest in our unique workforce – comprised of the brightest and most creative people in the world. Innovation and agility cannot be centralized in the DON, and must span across our organizations.

In order to achieve this, the Department has established the Naval Expeditions (NavalX) Agility office. NavalX Agility is designed to further develop our workforce by lowering the barrier towards using agility-enhancing methods in organizations as well as provide a storefront to industry for new innovation technologies and content. The Department has identified over 50 non-traditional methods, tools, and technologies currently in use across the DON, but often only in isolated offices. These methods span from discovery to engineering to deployment, and include items such as Prize Challenges, Rapid Prototyping, Warfighter-Driven Experimentation, Other Transaction Agreements, Mid-Tier Acquisition, and Agile Acquisition Management. NavalX will codify these methods into playbooks which will be developed and shared across the DON, allowing the workforce to better understand which methods are fit to which purpose. Over time, these methods will become a routine part of doing business within the DON, enabling us to deliver capability with the at-scale agility necessary to achieve our National Defense Strategy.

To increase agility and better align the naval research enterprise with the naval strategy, the Department is prototyping industry standard data storage, retrieval and analysis tools and also partnering with the Air Force Research Laboratory to bring robust data analytics to the naval science and technology portfolio.

To reduce cost, improve performance, and increase responsiveness we have implemented a Manufacturing Technology Program investing in new processes to advance manufacturing technology. One example is the development of optimized manufacturing processes for cost reduction and production rate improvements for F-35 canopy transparencies, which include automation of thermoforming, polishing, repair, and inspection / acceptance processes. Small Manufacturing Technology investments continue to provide return on investment for our major programs of record.

## **Small Business Innovation Research**

The DON Small Business Innovation Research (SBIR) Program continues to stimulate technical innovation and increase small business participation in federally funded research and development by providing competitive awards to enterprising companies that would otherwise be on the sideline of our service priorities. Many SBIRs have transitioned to our Fleet and Force including Progeny Systems MK 54 MOD 1 Lightweight Torpedo and Infrascan's Infrascanner Portable Medical Diagnostic Device. Progeny's Lightweight Torpedo Sonar Assembly enhances the torpedo's ability to detect slow moving targets in shallow water and contested environments. The MK 54 MOD 1 provides increased weapon effectiveness against all submarine targets. It does this without increasing system volume, weight or power, which minimizes the changes required to launch from fixed and rotary wing platforms. Infrascanner is a hand-held device used on the battlefield for fast, accurate diagnosis of brain injuries. This contributes to readiness of the Force, and helps minimize long-term brain damage resulting from improperly diagnosed injuries. Infrascanners – are now part of the Marine Hospital Corpsman diagnostic toolkits for operational use.

## **Transitioning Technology to the Fleet**

The Navy continues to advance the latest technology to the Fleet and Force. Sea Hunter, the largest unmanned surface vehicle, completed the first ever autonomous surface vessel open ocean transit from San Diego to Pearl Harbor in concert with a major battle group exercise in the Fall of 2018. Sea Hunter is just one part of providing autonomous technology to the Fleet in all domains. The DON recently installed a next generation network hardware and software demonstrator on one ARLEIGH BURKE Class destroyer, with plans for a second by the end of the year. This at-sea network architecture is the first step to enabling a more agile, lethal force with distributed and coordinated hard kill and soft kill capabilities. This summer the Department will install SSL-TM aboard USS *Portland* (LPD 27). Already tested at over 100 kilowatts, it will be the most powerful laser ever demonstrated on a Navy ship. The SSL-TM deployment will provide warfighter feedback which will inform the HELIOS program planned for installation on board our destroyers and integrated with AEGIS combat system. Moving technology rapidly from the lab and industry to the warfighter provides us with the needed

feedback to enhance the technology development. As the Department looks for avenues to accelerate the technology development process, the feedback from these technology demonstrations will ensure continued improvements to the warfighter.

## **Partnerships**

To solidify our Joint competitive advantage, the Navy partners across the DoD to discover and develop disruptive technologies with multi-domain applications. This fall, the Department will establish a DoD Railgun facility at White Sands Missile Range to demonstrate Hyper Velocity Projectiles at full energy and multiple repetition firing rate. Using the DARPA-developed Sea Hunter, we are conducting early operational testing and evaluation. Finally, to address systems that operate at hypersonic speeds, we are working a joint DARPA/Air Force effort that enables future air-launched, tactical-range hypersonic boost glide systems.

## **Congressional Authorities**

The DON continues to make good use of congressional authorities like 10 USC § 2363 (aka Section 219). The Department has implemented this authority for Naval Innovative Science and Engineering (NISE) investments that provide the NR&DE with mechanisms to fund four crucial efforts. These include innovative basic and applied research in support of military missions, development of programs that support the transition of technologies developed by the defense laboratories into operational use, workforce development activities to recruit and retain personnel with needed scientific and engineering expertise and supporting efforts to revitalize and recapitalize the laboratories. NISE funding has allowed the DON to maintain its lead over all other US Government agencies in the number of patents it receives annually. Last year we received over 330 utility patents for new inventions.

As a result of this year's NISE-funded projects, the Department was able to demonstrate new technology at the Advanced Naval Technology Exercise (ANTX) Coastal Trident program at the Naval Surface Warfare Center Port Hueneme Division. Successful ANTX demonstrations resulted in a number of new partnership arrangements, including three Cooperative Research and Development Agreements, one Partnership Intermediary Agreement, and one strategic Educational Partnership Agreement. These partnerships will speed transition of technology to

the Fleet and optimize resources. In addition, numerous NISE-funded projects were able to further the testing and experimentation, and one project will transition into a Combat Systems demonstration next year. Another technology success is the new capability to 3D print custom molded earplugs at Navy sites. This effort, grew out of several years of basic and applied research, addresses the need to provide more effective and easier to use hearing protection to warfighters in extreme noise environments.

Our ability to recruit, compensate and retain the nation's best minds is due in large part to long-standing congressional advocacy for the laboratory personnel demonstration program, first established through the FY 1995 National Defense Authorization Act (NDAA). Successive improvements to the lab demo's contribution-based compensation system have established, and then greatly extended, direct-hire authorities, providing laboratory directors with extremely effective manpower management tools. Our laboratory leaders greatly appreciated the many FY 2016 NDAA enhancements that brought additional flexibilities through student direct-hire conversions, flexible term appointments, reemployed annuitants, Voluntary Early Retirement Authority and Voluntary Separation Incentive Payments.

Furthermore, congressional authorities, originally granted via Section 233 of the FY 2017 NDAA, have expanded NR&DE activity flexibilities in many areas including contracting, purchasing, IT procurement, facilities management, and laboratory revitalization. In FY 2018 the DON implemented twelve management initiatives using this authority, that, in a short time, have led to great improvements in project delivery, support, experimentation and prototyping; strengthening the workforce at the labs and warfare centers to meet technical capability demands of the Navy. The second phase of implementation will focus on business operations, personnel management policies and practices and facilities management construction and repair. This will allow us to address important issues such as the age and condition of the unique RDT&E facilities and test ranges that are essential to ensure the technological superiority of our forces against potential threats. I look forward to continued collaboration with this Committee to refine and expand upon these authorities to ensure continued vitality, effectiveness and competitiveness across the NR&DE ecosystem.

## **Conclusion**

Thank you for the opportunity to testify on the naval science and technology program for FY 2020. The Department of the Navy maintains its commitment to science and technology to further our advantages to the Fleet and Force. The naval research enterprise continues to search for new technology around the world, to search for new ways to partner with non-traditional innovators, and to search for new ways to buy research smarter and faster. This enterprise cannot succeed without the strong congressional support you continue to provide.