The Naval Research Laboratory 2018

Naval Research Advisory Committee, November 2018

Executive Summary

World class laboratories come in many forms, and to a large degree are judged through the lens of history. NRL is recognized for scientists and engineers who are eminent in their field of study. It has a history of transformational discovery in diverse fields of research. In this sense, NRL is indeed a world class laboratory. However, these measures largely quantify past performance. Indicators of future success can be found in characteristics such as a clear sense of identity and mission, movement of people, availability of state-of the-art facilities, and stable research funding. These measures are interrelated. For example, a world class laboratory attracts the best and the brightest in its fields of endeavor in part because it has outstanding facilities. In these forward-looking metrics NRL remains strong, however, as described below, we see warning signs for NRL's future.

Increasingly, in the 21st century, a world class laboratory is characterized by mobility – of ideas, of people, and of activities. Innovation is more distributed today than it once was – the creative enterprise is spread across diverse organizations. The ability to assemble teams quickly from small, highly capable pockets of expertise is key to agility and effectiveness. Researchers thus contribute more than brainpower, they also bring their network of experts. Movement manifests in other ways as well, for example with researchers transitioning from the laboratory to industry and then back again, moving ideas from the laboratory to application and returning new insights and ways of working. The relevance to the DoN is twofold. First, this mobility of people and ideas is key to connecting more effectively with the warfighter. Second, existing government processes greatly impede the desired mobility.

The NRAC recommends the Navy develop a long range S&T strategic plan, and even in the absence of such a plan NRL should develop its own S&T strategic plan. Funding must be provided soon to correct the many serious infrastructure deficiencies that exist at NRL Washington DC. New approaches to personnel management are required for the NRL to compete in the increasingly competitive market for outstanding scientists who are the essential ingredient for developing the cutting edge advances in knowledge that can be applied to naval warfare.

Senior leadership of the Navy needs to be more interested and involved in science and technology which may be more important today than it has ever been. One of the challenges facing NRL is the fragmented nature of the Naval Research Enterprise writ large, which inhibits senior leadership from managing it, and therefore requires "leadership from below." Currently there is not a four star admiral or general that has responsibility of S&T.

This study was undertaken as a fast, high-level review. It did not include a deep dive into the broad range of NRL research areas, or visits to the diverse NRL sites such as those in Monterey, California and the Stennis Space Center, Mississippi.

NRL and the Naval Research Enterprise

The role of the Naval Research Lab is primarily to develop scientific knowledge that positions the Navy to respond to future needs of national defense. It is the element of the DoN research ecosystem with a particular focus on fundamental science and advanced technologies that enable future capabilities. This contrasts with the Warfare Centers, which largely work on technology and engineering relevant to their particular mission areas. In some sense this makes NRL similar to universities, where much of the nation's basic research activities are carried out, and where young researchers are molded. However, universities struggle with classified research, and the high turnover of students and postdocs limits the size and complexity of projects. In contrast, NRL, which does not have an educational mission, conducts research at the classified level and has the expertise to take a systems' approach to science and technology issues.

NRL has played a key role in breakthroughs in nuclear power, radar, meteorology, materials, electronic warfare, space science – including GPS – and others. NRL provides in-house expertise to inform Naval leadership on S&T issues. Its researchers originate and investigate technology and knowledge in domains where there is little commercial interest. NRL's staff serves as the "SWAT team" when the larger DoN Research Enterprise encounters challenges that cannot be solved with existing technology. Thus NRL's deep expertise enables rapid response in periods of crisis.

The cornerstone of the NRL's basic research activities is the "base funding" from the Office of Naval Research. Base funding is presently $200M/year, primarily drawn from the 6.1 and 6.2 budget lines (i.e., the most fundamental research funding). Base funding is directed by NRL leadership, and thus allows NRL the ability to invest in its vision for the future. The emphasis on fundamental research causes NRL, together with ONR, to play central roles in discovery-driven transformative innovation within the DoN. NRL accomplishes this through the interactive processes of scientific discovery and technology creation, enabling capabilities which can transform naval warfare.

The bulk of NRL's budget is awarded competitively and comes from a variety of sources, including the other military services, NASA, DARPA, DoE, and others. These activities are mostly applied research. This is not incompatible with the research orientation of the laboratory. In order to ensure impact, the Lab must show how scientific knowledge can be applied through prototyping and through working with the warfighter. However, the ratio of laboratory funding that is funded competitively is rising – in the past base funding was as high as 25% of the NRL budget, today it is 15%. This is largely due to the increase in competitively won projects, as the $200M in base funding has been limited to inflation adjustment.

Setting the Strategy

What is the right balance between investing in the creation of new technologies versus leveraging existing technology for immediate needs? The current Naval Research and Development Framework states that, "Maritime superiority for America's Navy and Marine Corps is enabled by technological superiority". While this reflects a critical need, it is equally important that the Navy build the scientific foundation for the next 20-30 years. In the parlance of today, we

should resist the temptation to starve investment in the "Navy after next" to direct resources to enhance the current Navy.

The Navy does not have a long term naval S&T strategic plan, and therefore NRL must plan its research areas without any top-level DoN guidance. There is an opportunity for NRL to play a key role in framing and executing an advanced science and technology strategy for the Department of the Navy with an NRL-developed strategic plan. The bedrock of any organization is its strategy as captured in a formal strategic plan. In the case of the Navy, the strategy framing documents stem from the National Security Strategy. The DoN strategy for Naval S&T should include the Chief of Naval Research (CNR), the Warfare Centers' laboratories, and the Marine Corps Warfighting Lab.

At the present time, there is a Framework for Navy R&D that emphasizes speed of capability and informs areas of interest. While this is NOT a strategy it could set the technical agenda for NRL and the Warfare Centers. Using this guidance, NRL should create and adopt a strategic plan pursuant to these goals that aligns with the core competencies of the NRL and metrics to assess progress toward goals. It should be noted that the Marine Corps benefits from its *Science and Technology Strategic Plan*. An NRL strategic plan should be updated annually and will enable:

1. Alignment of staff and establishment of hiring priorities
2. Prioritization of base-funded R&D projects
3. Balancing the portfolio to ensure appropriate investments in basic and applied research
4. Determination of capital investments/equipment
5. Selection and recruitment of talent
6. Identification of needed facilities

We further recommend that NRL develop an annual long-range technology outlook focusing on how science and technology, pertinent to the Navy, will evolve over the long-term. This long-range outlook will drive the subsequent NRL strategic plan. The long-range technology outlook will:

- Serve as catalyst for strategy development
- Provide visibility as a leading national R&D laboratory
- Lead the development of a coordinated Naval R&D ecosystem
- Create a detailed assessment of the current state-of-the-art
- Provide basis for portfolio management at NRL and across the Naval Research Enterprise
- Provide a working and personal basis to drive cooperation and coordination between NRL Divisions

NRL should hold an annual workshop that includes NRL leadership, and external resources (e.g., ONR, Naval Warfare Development Command, Marine Corps Combat Development Command, Center for Naval Analysis, Naval War College, Office of Naval Intelligence, and others from beyond government) to gather input for the long-range outlook. The output of this process should be briefed to senior Naval leadership to provide the context for their review of various strategies and plans.

Currently NRL is organized into divisions that operate independently, many of which have different policies, procedures, rates, and business models. The incentives are strong for divisions to pursue funding to maintain the team, rather than identify those areas that are most important for the overall lab. This inhibits collaboration, sharing and mobility across the divisions, and this in turn can limit the innovation that comes from interactions across disciplines and teams. It is inefficient, and results in pockets of R&D that are effectively stranded in one team and not available for reprogramming to emerging needs.

There should be several actions to improve tools and processes:

- Establish a common set of standardized rates and common policies across divisions to reduce barriers to cross-division staffing on programs
- Invest in contemporary accounting, project management, and other business process tools
- Evaluate the expansion of a program management matrix-like model (similar to the NRL Space Systems Program), in which
    - program managers are responsible for funding and managing research portfolios, and maintaining the vast majority of program budgets
    - technical teams are aligned by disciplines, led by technology leaders who are responsible for technical excellence, career growth, and resource deployment

Once the resources to operate the laboratory are defined, decisions can be made on how aggressively to pursue any given area of science or technology consistent with the strategic plan. In some cases, the laboratory must clearly be best in class. In other areas, the wisest investment will to be a smart buyer and adapter. Finally, there may be some areas where any investment would be deemed irrelevant. In the areas of research and technology the laboratory does pursue, it must determine whether the laboratory is in catch-up mode with an international competitor, or actually at the global forefront. As it engages with other institutions, both domestically and internationally, it must carefully balance across all areas of science and engineering security – versus the openness of the exchange.

The creation of a strategic plan and the execution thereof will require strong leadership from senior executives. This is a task that will not be successfully accomplished by administrators who are busy dealing with day-to-day laboratory decisions.

Accordingly, NRAC recommends that:

- The Navy develop a long range S&T strategic plan
- NRL develop its own Strategic Plan
- NRL develop an annual long-range Technology Outlook Workshop and final report.

How does/should NRL interact with the Warfighter to maximize impact?

The “warfighter” element that offers the highest strategic impact for NRL is senior naval leadership. NRL represents a unique crucible where science and technology is forged with the mission of the Navy. The strategic value proposition here is direct. If NRL’s relationship and visibility with senior leaders increases, the understanding of NRL’s needs will improve and will

lead to senior leaders' revaluation of the Navy's science program. This new interface will naturally foster relationships with less senior naval leaders who are direct recipients of the solution.

Senior naval leaders (i.e., SECNAV, CNO, CMC, ASNs, VCNO, 4-star Admirals, major N-codes and HQMC codes) get routine briefings on many key topics. They are vocal that the U.S. is losing ground to potential adversaries in the area of science and technology. They emphasize the criticality of S&T in national defense strategies; but NRL, the Navy's corporate scientific laboratory, is not present at these briefings. Senior naval leaders are not connected directly with NRL nor do they participate in any routine meetings to keep them informed of specific areas of scientific import. The interaction must be regular and persistent. It should include briefings, visits, assignments, and reports – all focused on improving the bond between the operational naval leaders and DoN's science leaders. Secondly, such dialogue should clarify and reinforce how science underpins and supports the broader naval mission.

The needed interaction should be focused on senior naval leadership, but also should reach to other critical naval elements. These include junior officers and the organizations that essentially help clarify strategic needs and technological utility. The latter includes: the Center for Naval Analysis, Naval War College, the Naval Warfare Development Command, and the Warfighting Development Centers. Regarding junior officers, as weapons systems get more technically complex, it is increasingly important that they develop a working understanding of science and technology, and the Navy's efforts in particular. This means more junior officers need to be assigned for tours at NRL and the Warfare Centers and seek advanced technical degrees at the Postgraduate School and U.S. universities. Naval ROTC scholarships need to strongly emphasize science and engineering. And, lastly the Navy's scientists need to be more routinely seen at sea; instructing, informing, and creating awareness of the Navy's shore-based science and technology capabilities.

NRAC recommends:

- Incorporating a regular and persistent S&T discussion with senior naval leadership, to include briefings, visits, assignments, and reports
- Improving junior officers' understanding of science and technology by increasing junior officer assignments at NRL and the Warfare Centers and encourage more to seek advanced technical degrees
- Increasing the naval scientist interface with sailors at sea: instructing, informing, and creating awareness of the Navy's shore-based science and technology capabilities and opportunities

Management:

In our short discussions with some of the NRL research staff members, we detected their strong identity with naval research, but some were confused by the ambiguity of the role of NRL vis-a-vis Warfare Centers. This may arise from the lack of an articulated and regularly re-enforced strategy. There was weak understanding of how basic research fits within the scope of the entire research enterprise.

There appear to be rigid silos between the directorates and the divisions – in terms of their business practices – which can make teaming across the laboratory cumbersome and difficult. This in turn limits one of NRL's strongest benefits: unique cross-disciplinary mission focused research. Some of the young staff report having issues with work/life balance, especially with respect to family leave. Some indicated that mentoring is inconsistent across the laboratory divisions. More broadly, the laboratory lacks a rigorous lab-wide professional development program. There is some variation in division overhead rates, which is manageable, but clever staff may attempt to home projects where they get the best rates – leading to inefficient project management.

There are also a variety of issues around funding. One critical issue, which certainly reduces the laboratory's responsiveness and ability to be at the forefront of science and technology, is the long lead time to fund base projects. In fact, they often require an 18-month lead time just to start an internally-funded project. Furthermore, the fact that staff often must obtain their own funding creates great angst amongst new, less-experienced researchers, and drives internal competition that is not optimal for a laboratory.

In our discussion with staff, we found that administrative support in some areas is minimal and the extent of this support varies across the laboratory. Also, most of the administrative processes appear to be paper-based and obsolete. Similarly, it was reported that the procurement process can be sluggish, slowing research progress. We found issues that are common to business, academia, and government. For example, career development is not formalized, the dual ladder is more heavily populated with management, rather than technical leaders, and there is not a formal management and leadership development program. New staff feel that it is difficult to learn the ways of the laboratory. Perhaps the creation of a new course, let's call it "NRL 101", would introduce new employees to business and other processes at the lab. Attempts should also be made to improve opportunities for staff to have short orientation tours at sea.

NRAC recommends that NRL:

- Eliminate management barriers to collaborative, cross-discipline research
- Work to reduce the processing time to get new funding for NRL base projects
- Improve administrative tools and processes
- Consolidate leave and other personnel policies

Facilities

More than 100 external studies of the laboratory have been conducted over the past 45 years. Ageing, substandard facilities and equipment continue to deteriorate. Unless significant improvements are made, NRL will no longer be able to recruit, retain, and support the high-quality scientists and engineers required for naval research of the future.

Failing infrastructure is not a new problem; every report for more than 20 years has highlighted the need to upgrade and repair the physical plant at NRL. The Naval Audit Service reported in January 2018 that:

"NRL continues to operate in deteriorating facilities, thus diminishing the Navy's ability to perform critical research and testing and maintain a competitive advantage over adversaries. Additionally, the facility conditions have contributed to loss of research contracts and customers, an unsafe working environment for personnel, equipment loss, and may create challenges in recruiting and retaining highly skilled scientists and research personnel."

Various NRL facilities and laboratories are experiencing leaks, heating and air conditioning problems, and other infrastructure failures. Many of the facilities were built in the 1960s (in fact, some date as far back as the 1920s…) and require not only repair, but also capacity increases to mechanical and electrical systems to support modern research equipment.

We found that most of the facilities are in incredibly poor condition. Poor facilities lead to inefficient research, safety issues, and negative motivation for potential researchers. In addition, the "quality of life" facilities such as the cafeteria, fitness facilities, daycare and lactation rooms are absent or in poor condition.

The DoN should explore all options to fund the upgrading of NRL facilities. Although MILCON funding is an option, it has not yielded much benefit to date. There is no reason not to consider multi-year direct funding of new construction and facility upgrades. Another possibility is third-party funding of buildings on-site, adjacent to the site, or fully off-site.

There is a need for a regularly updated facilities' master plan that aligns with the NRL strategic plan recommended in this document. This master plan would include an overview of the strategy that was used to build the current facilities, an assessment of the use and adequacy of each NRL building and facilities within those buildings, and a short and long-term plan to renovate, or construct new buildings.

NRAC strongly recommends that DoN leadership:

- Provide the funding needed to correct the many well documented deficiencies that exist at NRL Washington DC

Talent

World class research institutions in the 21st century must be able to attract, retain and refresh top diverse talent. This requires the availability of space and resources to undertake specialized research, a vibrant culture that encourages curiosity and collaboration, and a supportive administrative infrastructure that allows the scientists to focus on research.

The need for a superior technical staff is first and foremost, because NRL will only remain "world-class" by hiring and retaining productive, high-quality people. The panel believes that NRL is currently competitive at recruiting top entry-level bench scientists and engineers in most research areas. But, some leading-edge disciplines are extremely competitive (e.g., computer & software scientists/engineers, data scientists, and roboticists), and a close watch should be kept for manning challenges encountered in those disciplines. Deviation from the routine hiring paygrade

salary may be required. Particularly with Amazon moving into the region, new challenges will emerge in recruiting top technical talent.

NRL leadership reported some difficulty retaining mid-level/senior, highly accomplished research staff. When researchers receive prestigious recognition, as in admission to the National Academies, there is a current trend to leave NRL for an academic institution for significantly greater compensation, in some cases nearly double the maximum currently allowed for federal employees. Consideration should be given to a pilot program for compensating "highly recognized experts" at levels competitive with academia and industry. Also, as a designated Science and Technology Reinvention Laboratory (STRL), NRL should be more aggressive in the utilization of the hiring authority for super-grade GS compensation for scientists and engineers.

In addition, the program management matrix model previously mentioned, could serve to define a specific set of leaders responsible for career development and technical excellence within their research area.

The panel also noted that the public/private collaborative nature of research institutions has changed over the last 30 years. Researchers now routinely transition to and from the private sector and academia. The standard federal employment rules make this practice at NRL difficult, but the panel believes some consideration should be given to pursuing an approach that provides opportunities for sabbaticals (in both directions).

Finally, the panel encourages the leadership of NRL to deliberately pursue a leadership role in enhancing diversity, equity, and inclusion of its technical workforce. Demographic data presented indicate that the distribution of scientists, engineers, and leaders is not diverse and in fact declines with seniority. A strong effort is needed to recruit and retain a diverse scientific and engineering workforce. Attention must be paid to equity and inclusion.

NRAC recommends that NRL:

- Provide resources to recruit, retain, and develop top scientific and engineering talent
- Provide mentoring and career development programs that are tailored to onboard researchers (e.g., NRL 101) and better connect them to the Naval Research Enterprise and its mission
- Have a NRL-wide plan to enhance diversity, equity, and inclusion – with sustained investment and leadership
- Provide opportunities for an optimal work/life balance

Conclusion

NRL has a proud history of accomplishment. However, there are clear threats for its future. NRL is fighting at a growing disadvantage in the war for talent - the essential ingredient of a world class laboratory. The recent announcement of the opening of an Amazon HQ across the river from NRL brings the problem into stark relief. Further, outstanding research institutions are increasingly characterized by a high degree of mobility as creative individuals leave to other enterprises – often startups – and then return with new insights and experience. In contrast, NRL is embedded in a

highly inflexible personnel system that does not have the incentives for intellectual renewal and refresh that you find at universities. Facilities and infrastructure represent another weakness of the Laboratory. While the laboratory leadership has been effective in creating new research capabilities, such as the Laboratory for Autonomous Systems Research, the overall NRL physical plant is obsolete and in poor repair, especially compared to the new research facilities in China. The laboratory needs a strategic plan to guide its future in the fast changing and disruptive S&T environment. Finally, connection to the broader Navy is hampered by the fragmented connection of the research enterprise to the Department of the Navy leadership. Does leadership have a mechanism for tracking not just the output, but also the health of the research and development enterprise in a prognostic sense? How are we doing in the war for talent? Are we connecting effectively to the innovation community? How are we doing relative to our competitors? To make most effective use organizations like NRL, the entire R&D ecosystem must be understood and managed.

In summary, the major NRAC recommendations are:

- DoN leadership needs to more closely track their research enterprise giving visibility and support to this critical national capability – and create a DoN S&T strategic plan.
- NRL should develop and maintain a strategic plan
- NRL, with help from DoN leadership, needs to implement new policies that will enable the retention of very highly qualified technologists before they are lured away

DoN leadership needs to solve the NRL infrastructure problem by providing the needed funding to correct the many facility problems that have been identified

APPENDIX 1:TOR

Naval Research Laboratory – The Next 100 Years
Naval Research Advisory Council

TERMS OF REFERENCE

These terms of reference establish the Secretary of the Navy (SECNAV) objectives for the Naval Research Advisory Committee (NRAC), a permanent subcommittee of the SECNAV Advisory Panel (SNAP), to conduct a study of the current effectiveness and future role of the Naval Research Laboratory (NRL) to help ensure the technological superiority of the Navy and Marine Corps.

Issue Statement: NRL provides a stable cadre of scientists, engineers and technologists dedicated to making science discoveries and creating new technologies to advance US Naval Power. By developing research strengths important to naval warfare, NRL has built a distinguished history of innovation and invention that produced advances in naval capabilities for nearly 100 years.

NRL is an element of the Naval Research and Development Establishment (NR&DE), which includes the Navy's warfare centers, systems centers. Each of these entities conducts Research and development (R&D) to improve the effectiveness of our naval warfighting capabilities. Furthermore, the NR&DE interacts extensively with University Affiliated Research Centers (UARCs), Federally Funded Research and Development Centers (FFRDCs), and other organizations spanning academia, government and industry.

Maintaining military advantage is becoming increasingly difficult. Our near-peer adversaries' are rapidly accelerating their investment, capacity and capability. The balance between government and industry funding of R&D has changed, with industry investment outstripping government spending in areas key to defense, such as information technology and autonomy. A variety of new models for innovation have evolved in regions like Silicon Valley. They often mesh poorly with DON practices and organizational culture. Accordingly, the characteristics of NRL may require significant changes to achieve similar successes in the course of its next 100 years.

Mission Statement: The NRAC shall conduct a review which identifies the characteristics of a world-class laboratory that will enable rapid advances in technology, and equally rapid transition to capability.

Objectives and Scope: Questions will include:

a. What are the characteristics of a world class advanced research laboratory, and how well does NRL meet the desired characteristics? How does it compare to other research laboratories, and what should be improved?

b. How should NRL interact with the warfighter to maximize impact? This topic should consider interactions with the rest of DoN and especially NRL's role among the contributing NR&DE organizations.

c. What are short and long term strategies for achieving desired changes, including recommendations to enhance the organizational structure, funding mechanisms and talent management? This should include strategies for blending long-term S&T needs with nearer-term leadership priorities and warfighter requirements.

Methodology: This study will be conducted in compliance with the Federal Advisory Committee Act (FACA) and all pertinent Federal and Department of Defense regulations.

Deliverables: The NRAC shall provide an interim report by mid-October 2018 and a final report by mid-December 2018. NRAC will deliver periodic progress updates to the Under Secretary of the Navy.

Membership: The members will address the task as delineated below:

a. In conducting the study, NRAC members will consult nationally recognized individuals, representing a broad spectrum of experience, including leaders from business and research institutions, and include military, government and private sector representatives.

b. NRAC members participating in the study: Dr. Bellingham; VADM Bowes (Ret.); Dr. Padilla; and Dr. Walsh.

c. Per the SNAP Charter, non-voting subject matter experts (SMEs) may be appointed to assist SNAP or its subcommittees on an ad hoc basis to address specific issues under consideration. These SMEs are not members of SNAP or its subcommittees and will not engage or participate in any deliberations

Support: The Department of Defense through the Office of the Secretary of the Navy, shall provide support, as necessary, for the performance of the committee's functions, and shall ensure compliance with requirements of the FACA and established DoD policies and procedures.

Approved by: _____ 09 JUL 2018
Under Secretary of the Navy

APPENDIX 2

RECENT EXTERNAL REVIEWS CITING "WORLD-CLASS" DISTINCTION

DATE OF REPORT	S&T AREA REVIEWED	REVIEW PANEL CHAIR
August 2014	Space & Space Technology Research	Dr. Robert Merlino, University of Iowa, "The Space Focus Area is clearly functioning at the level of a world-class laboratory as envisioned by Thomas Edison to support Navy and Marine Corps needs."
July 2015	Marine Biology	Dr. Richard Anthes, University Corporation for Atmospheric Research, "The quality and relevance of the research has increased over the already high quality present in 2012 and is comparable to the research produced by the best centers in the world."
July 2016	Information Technology	Dr. David Kortenkamp, TRACLabs, Inc., "Performers: Several world-class researchers who are very active in their field with high visibility; thought leadership is encouraged. NRL has several in the IT area."
August 2016	Optical Sciences	Dr. Paul McManamon, University of Dayton, "NRL's Optical Sciences Division is a world class laboratory in the area of photonics and optics."
September 2016	Radar	Dr. Andrew Gerber, Georgia Institute of Technology, "The investment in the Multi-Phase-Center Synthetic Aperture Radar airborne testbed and the NexGenHF Surface Wave Radar clearly give NRL a significant boost in being able to achieve world-class research results in these areas."
June 2018	Functional Materials	Dr. Joseph Heremans, Ohio State University, "The work funded as 6.1 was generally of world-class quality."
June 2018	Structural Materials	Dr. Gary Shiflet, University of Virginia, "The Naval Research Lab is a world class laboratory … The laboratory has excellent researchers with state of the art computational and testing facilities."

APPENDIX 3

STUDY MEMBERS

NRAC Members:

Chairman: Dr. James Bellingham, Director, Center for Marine Robotics, Woods Hole Oceanographic Institution

Vice Chair: VADM William Bowes (ret.), former Commander Naval Air Systems Command and acting Assistant Secretary of the Navy (Research, Development, and Acquisition)

Dr. Ingrid Padilla, Director, Environmental Engineering Laboratory, University of Puerto Rico

Dr. Jay Walsh, Vice President for Research, Northwestern University

Subject Matter Experts:

Dr. Susan K. Avery, President Emerita, Woods Hole Oceanographic Institution

Dr. Mark F. Bregman, General Partner, Quidnet Ventures LLC

Dr. Timothy Coffey, former Director of Research, Naval Research Laboratory

Dr. Kevin R. Fall, former Chief Technology Officer and Deputy Director of the Software Engineering Institute, Carnegie Mellon University

Mr. Jay Hill, Chief Technology Officer & Chief Operating Officer, GE Healthcare Imaging

Mr. Scott O'Neil, former Executive Director and Director for Research and Engineering, Naval Air Warfare Center Weapons Division, China Lake

Dr. Alton D. Romig, Jr. Executive Officer, National Academy of Engineering

Mr. Scott Seaton, President, Advanced Technologies and Systems Division, SRI International

VADM Paul Sullivan (ret.) Executive Director, Pennsylvania State University Applied Research Laboratory

Executive Secretary: Mr. Brad Buswell, Special Assistant to the Chief of Naval Research