

Section 2

PEO LS S&T COLLABORATION AND ENGAGEMENT

Concept to Capability Process

The Concept to Capability process used by Program Executive Officer Land Systems (PEO LS), depicted in Figure 2-1, is a focused, repeatable process that has proven essential for facilitating effective interaction with Science and Technology (S&T) stakeholders within the S&T Community.

The PEO LS Concept to Capability process begins with an in-depth understanding of and alignment to the overarching concepts identified in The Commandant’s Planning Guidance, Expeditionary

Force 21, Marine Corps Service Campaign Plan, and Force Development Strategic Plan. The next step in this process entails developing an understanding of warfighter concepts and the core capabilities required to enable those concepts. It is also critical to develop an understanding of the top-level strategic and operational service issues that rely on materiel solutions for resolution, such as: Holistic Modularity, Re-honing the Expeditionary Edge, Reducing the Sustainment Footprint, Fuel Saving across the Marine Air-Ground Task Force (MAGTF),

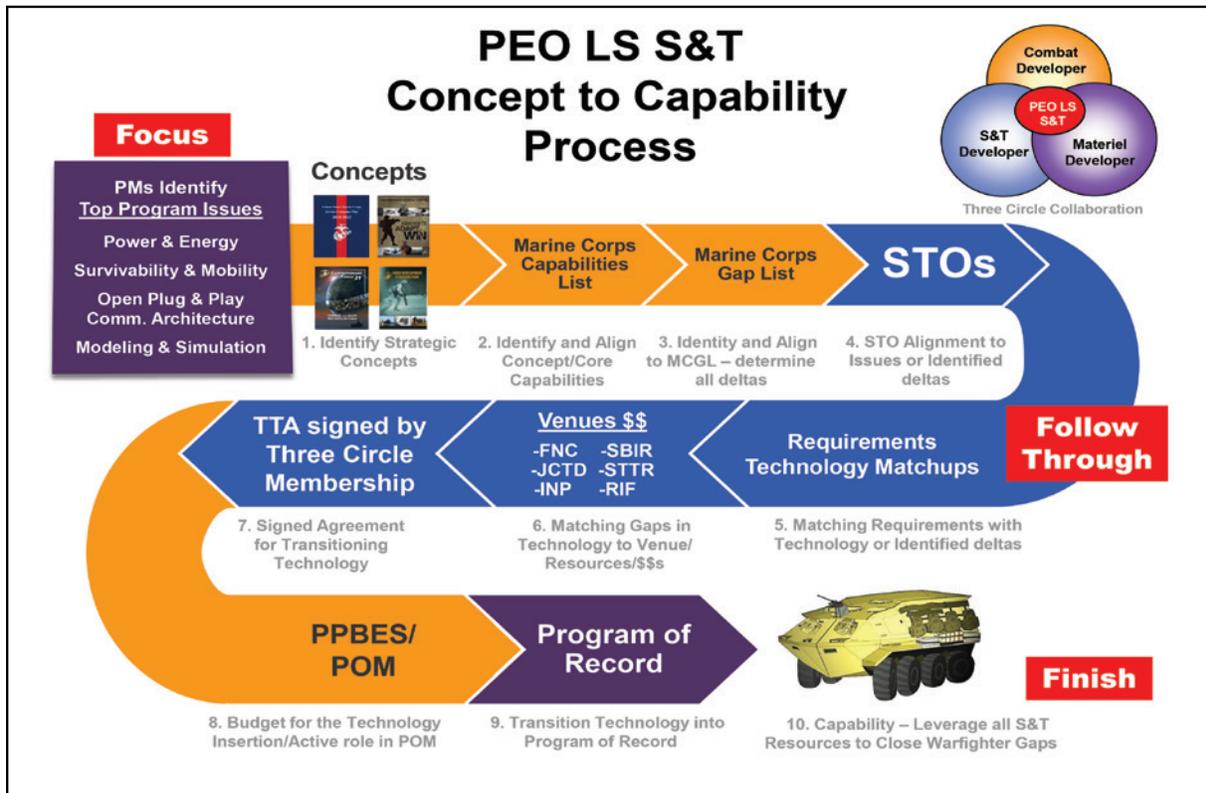


Figure 2-1. PEO LS Concept to Capability Process

“Today’s ideas are tomorrow’s solutions, both industry and government need to do a better job getting the two together.”

—Mr. Bill Taylor, PEO LS

Lightening the MAGTF Load, and Reducing the MAGTF Footprint.

Once the operational concepts and capabilities are understood, an analysis is performed to identify the Marine Corps’ capabilities and technology gaps. These capabilities and gaps are categorized in the Marine Corps Capabilities List (MCCL) and Marine Corps Gap List (MCGL), all incorporated into the Marine Corps Enterprise Integration Plan (MCEIP).

The S&T Objectives (STOs) are matched to the technology issue the program office and capability gap identifies. This step ensures the traceability of S&T investments and enables stronger support within the Program Objective Memorandum (POM)/Planning, Programming, Budgeting and Execution (PPBE) process.

After identifying that there is a matching requirement for the S&T initiative and that it can close a gap, applicable S&T venues are examined to fund the maturation of the technology.

Before resources are applied, a transition path must be identified. The PM collaborates with the resource sponsor and the S&T Developer to ensure a successful transition. This ‘shared commitment’ is usually documented in a Technology Transition Agreement (TTA) that all parties sign. After the TTA is signed by the appropriate level of Three Circle leadership (as depicted in the top right of Figure 2-1), the S&T representative continues to work closely with the PM to ensure funding support is available (in the POM). POM funding is essential to integrate and transition the technology to the appropriate Program of Record (POR) and to close the associated warfighter gap. Currently, TTAs are only required

for a specific venue, Future Naval Capability (FNC). All other venues and core funding initiatives do not require a TTA, but should have a transition path and a requirement.

By working through the Concept to Capability process, potential S&T opportunities and solutions are identified, enabling S&T representatives to better inform requirements and to provide “best value” S&T investing and transition gap-closing technologies to a POR.

S&T investment is one of the earliest steps in the process of properly equipping the future force and, when applied correctly, will result in a well-balanced Marine Corps, postured for the future with state-of-the-art equipment. This is developed through rigorous analysis, targeted investment, aggressive experimentation, and most importantly, through the active collaboration and engagement of all stakeholders. As shown in Figure 2-1, the process requires Focus on the technical issue that needs to be addressed; Follow-Through with the S&T Developer to get S&T to develop a solution; and then Finish to get the solution funded and incorporated into a Program of Record.

S&T Objectives

The most important objective of S&T development is to ensure the Marine Corps always has an overmatching technological advantage. Preserving technological superiority continues to be at the cornerstone of our national military strategy. It is critically important as high-technology weapons become less expensive and more readily available to non-traditional adversaries. Additionally, the Marine Corps S&T has the following specific goals:

- ▶ Inform the Marine Corps Combat Development Process
- ▶ Encourage, promote, plan, initiate, execute, and coordinate research and technology development
- ▶ Identify and assess technologies
- ▶ Develop and demonstrate technologies
- ▶ Reduce technical risks
- ▶ Protect against technology surprise
- ▶ Conduct warfighting experimentation
- ▶ Transition mature technology to Acquisition PORs

The Executive Agent for USMC S&T

The Commanding General (CG), Marine Corps Combat Development Command (MCCDC) tasked the Director Futures Directorate/CG, Marine Corps Warfighting Laboratory (MCWL) to act as the Executive Agent (EA) for S&T, thereby consolidating responsibility for coordinating all aspects of Marine Corps S&T requirement generation and coordination to the EA. Inherent in this transfer of responsibility was the transfer of staff cognizance to the Office of Science and Technology Integration (OSTI) from MCCDC Headquarters to the Warfighting Lab. OSTI is responsible for providing policy, guidance, and strategy in the areas of scientific innovation, to include co-sponsoring annual roundtables to identify Marine Corps S&T requirements.

Science and Technology

Science and Technology, within the Defense Department, includes the earliest forms of Research, Development, and Test and Evaluation (RDT&E) funding in the federal budget. S&T is composed of three categories: Basic Research, Applied Research, and Advanced Technology Development. It is the path by which new ideas are investigated (Basic Research-Phenomenology), developed, if further

research shows military applicability (Applied Research-Connectivity), and matured until the technology is demonstrated (Advanced Technology Development Utility) at a level where it is transferred to a program office to finalize the Research and Development (R&D) process. Marine Corps S&T efforts are assisted by close coordination with the S&T community, other services, academia, and industry leaders to bring together and fund relevant S&T efforts. The ultimate goal is to investigate, develop, demonstrate, and deliver affordable state-of-the-art technologies to the Warfighter.

Collaboration

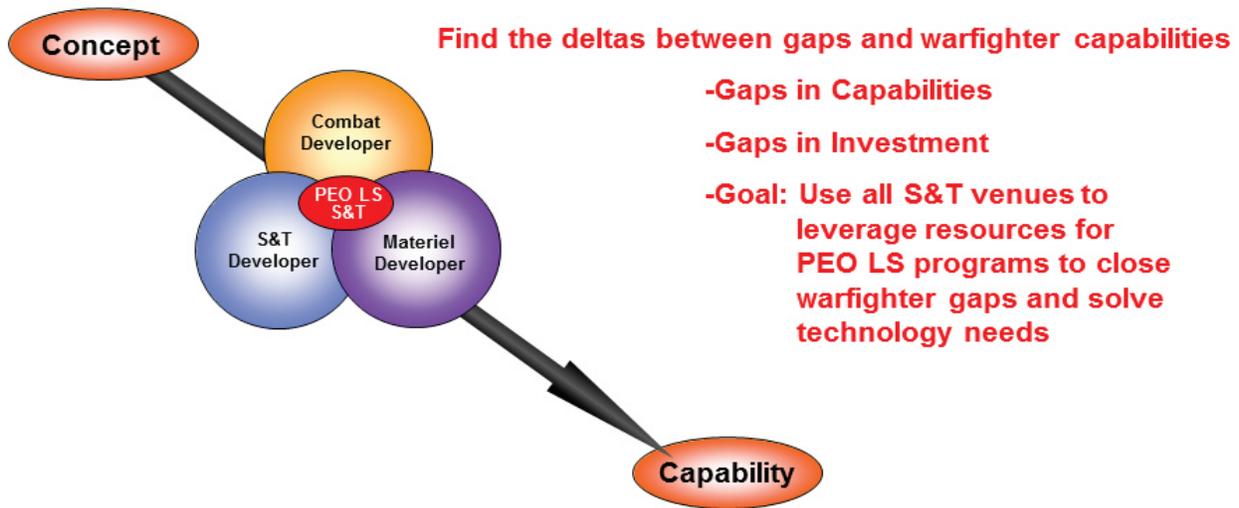
As depicted in Figure 2-2 on the following page, each circle (within the Three Circle S&T Community) has a unique and pivotal role in the S&T process. Although they have overlapping interests and influences regarding the likelihood of the transition, the collaboration and engagement of these communities are critical for successful transitions.

S&T developers transition their technology to the Materiel Developers, but the Materiel Developers must first have a requirement from the Combat Developer. Therefore, stakeholder involvement is critical to ensure warfighter priorities are adequately addressed through requirements and that the technologies being developed are aligned with the POR's resources and schedule.

The S&T Community Stakeholders

The Marine Corps S&T enterprise, which is an integral part of the larger Naval Research Enterprise (NRE), is a collaborative effort led by the Deputy Commandant (DC), Combat Development & Integration (CD&I), but also involves the Futures Directorate, MCWL, ONR, Marine Corps Systems Command (MCSC), PEO LS, and the EA (CG MCWL) for S&T. This Three Circle relationship is depicted in Figure 2-3 on the following page.

A Collaborative, Synergistic Partnership From Concept To Capability



6.1 Concept Aligned, Gap Closing Capabilities Require Informed Support Across Funding Lines 6.7

Figure 2-2. The Collaborative, Synergistic Partnership From Concept to Capability

Deputy Commandant, Combat Development & Integration

DC, CD&I is the principal agent in the Combat Developer circle. The Combat Developer represents those warfighters who will deploy, operate, and maintain the systems needed for military operations. Combat Developers write the requirements that the Materiel Developers must have to develop and procure materiel. Combat Developers also generate new operational concepts, define future capability needs, identify new capability gaps/shortfalls, and state capability requirements. CD&I receives the Commandant’s guidance, develops Marine Corps warfighting concepts, and determines required capabilities to enable the Marine Corps to innovate, adapt and win.

- ▶ **Director, Capabilities Development Directorate (CDD)** develops warfighting capabilities and requirements. The Director, CDD accomplishes this through the Marine Corps Capability Based Assessment (MC CBA) resulting in the Marine Corps Enterprise Integration Plan (MCEIP). The MCEIP is produced annually, approved by the Marine Requirements Oversight Council (MROC), and signed by the Assistant Commandant of the Marine Corps (ACMC). It translates strategic guidance into capability development activities, and provides investment recommendations to achieve required capabilities within a fiscally constrained environment. This is done by refining and validating the Marine Corps Capabilities List (MCCL), which are prioritized and measured against MROC-approved scenarios, guidance and event task,

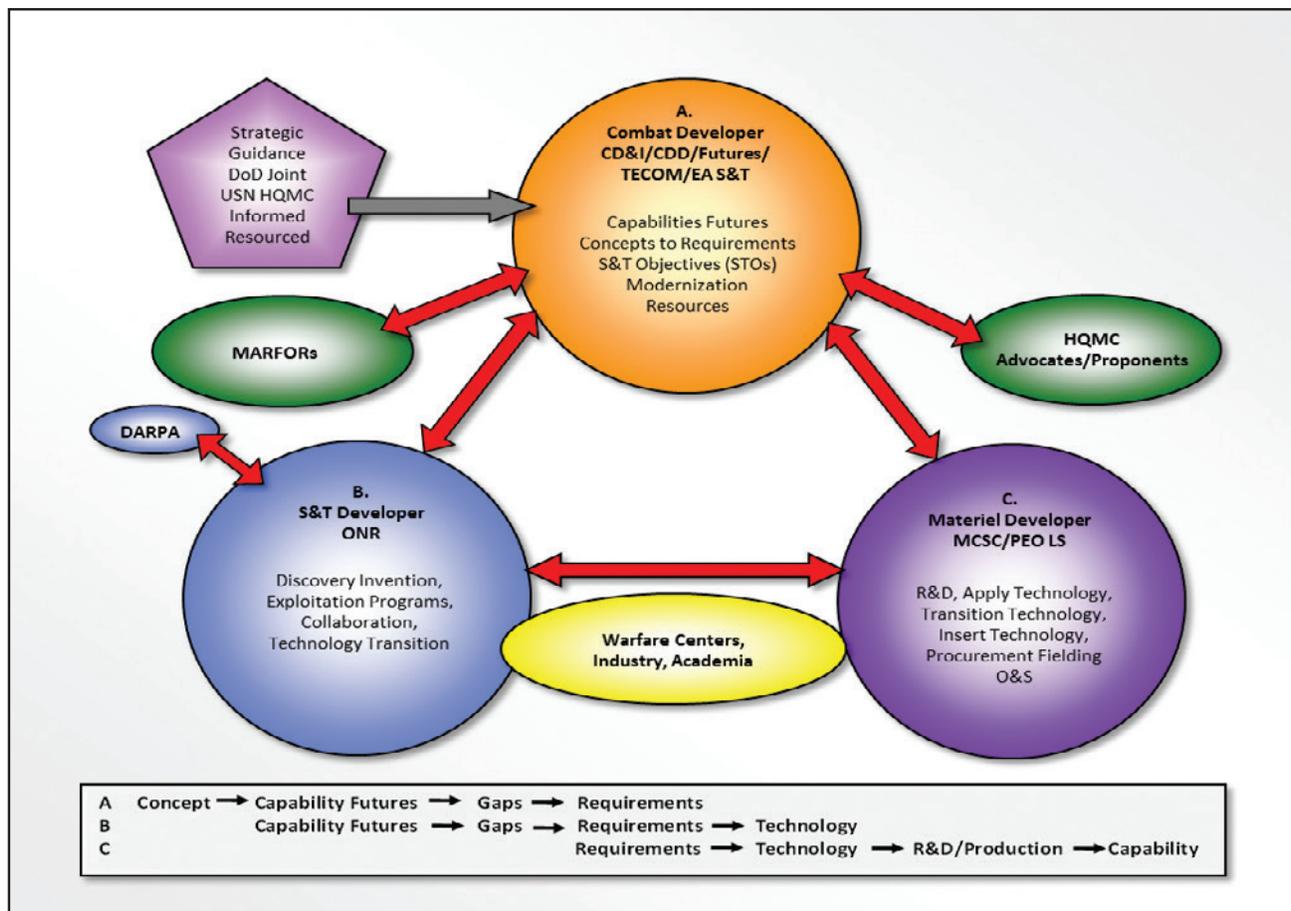


Figure 2-3. The Three-Circles S&T Community

condition and standards. The gaps in the MCCL are identified and further prioritized to create the MCGL. This feeds in to the Marine Corps Solutions Development Directive (MC SDD). MC SDD provides a solutions analysis, which in turn, yields solutions that span the Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities and Policy (DOTMLPF-P) pillars with identified actions, to include initiatives that implement the solutions. Formulation of the Enterprise Capabilities Management Plan (ECMP), which consolidates CBA analytical results and provides a capability investment strategy, will guide future Marine Corps capabilities development.

- ▶ The **Director, Futures Directorate/CG, MCWL** determines the future Marine Corps strategic landscape by assessing emerging

security environments and by developing and evaluating Marine Corps operating concepts by integrating these concepts into Naval and Joint concepts. The Futures Directorate helps to identify potential gaps and opportunities, which inform the force development process.

- ▶ The **Office of S&T Integration** is tasked with implementing the Director, Futures Directorate/CG, MCWL S&T responsibility as the USMC Commandant's EA for S&T. OSTI coordinates S&T within the combat development life cycle from "requirement to transition." Through coordination with the Three Circle S&T Community, OSTI develops the vision, policies, and strategies needed to exploit scientific research and technical development. A Defense Advanced Research Projects Agency (DARPA) Transition Officer is assigned to OSTI to stay

abreast of DARPA's ongoing efforts and to ensure MCWL's ability to incorporate relevant technologies into future experimentation. OSTI provides technical oversight of proposals submitted to Office of the Secretary of Defense (OSD) and Department of Defense (DoD) and manages/monitors the daily operations of the S&T programs under the OSTI portfolio. Additionally, OSTI develops and coordinates the prioritization of S&T requirements for OSD and the Department of the Navy. OSTI is also tasked with the development of the U.S. Marine Corps S&T Strategic Plan. Within the Marine Corps S&T Strategic Plan are S&T Objectives (STO), which are products of the MC CBA process and are developed in coordination within the Marine Corps S&T enterprise.

Marine Corps Systems Command and PEO Land Systems

MCSC and PEO LS are principal agents in the Materiel Developer circle. The Materiel Developer administers and manages the activities of the workforce to meet the modernization requirements and enhanced capabilities efficiently and effectively. The Materiel Developer community includes the Acquisition Executives, Program Executive Officers, Program Managers, Project Officers, and support staffs. In response to a validated operational requirement from the Combat Developer, the Materiel Developer is responsible for assessing alternatives, conducting cost/benefit analysis, establishing R&D requirements, defining S&T performance and maturity thresholds, and procuring and fielding the required operational capability.

- ▶ **Systems Engineering, Interoperability, Architectures & Technology (SIAT)** is responsible for leading MAGTF systems engineering and integration efforts, ensuring Marine Corps systems interoperability with coalition and Joint forces, and identifying and pursuing S&T transition opportunities

for Marine Corps systems. Deputy Commander, SIAT Technology Transition Office (TTO) develops an S&T portfolio for MCSC that responds to capability needs with innovative technology solutions.

- ▶ The **PEO LS S&T Director** serves as both the primary advisor for all S&T policy/process issues and as a conduit for the flow of critical S&T information between all applicable S&T forums and PEO LS. The Director also ensures the timely delivery of technology solutions to the Warfighter. The Director works closely with PEO LS PMs (and S&T stakeholders) to resolve program technical issues, reduce program risk, and deliver state-of-the-art technology via PORs. He also publishes annually the Advanced Technology Investment Plan.

Office of Naval Research

The Office of Naval Research is the principal agent in the S&T Developer circle. The S&T Developer delivers technologies that enable future warfighters to maintain their technical edge over our adversaries. The community consists of scientists, engineers, and academics who understand the technological frontier and what developments are possible for future systems. This group examines technical possibilities, identifies scientific gaps, develops S&T requirements, and executes scientific efforts. The S&T Developer is also responsible for exploring the phenomenology, feasibility, and utility of S&T as it pertains to the improvement of legacy systems, the realization of future capabilities under development, and the advancement of discovery in areas yet to be exploited.

ONR identifies S&T solutions to address Navy and Marine Corps plans and scientific research as it relates to the maintenance of future naval power. ONR also manages the Navy's S&T funds to foster transition from S&T to higher levels of RDT&E. The Director, Futures Directorate/CG, MCWL



also serves as the Vice Chief Naval Research. Key stakeholders in this effort are ONR Global Science Advisors and Expeditionary Maneuver Warfare & Combating Terrorism Department, also known as ONR Code 30.

- ▶ **ONR Global Science Advisors** are civilian scientists, engineers, and technologists selected to participate in a one-to-three-year career development tour. Science advisors serve as a command's senior liaison with S&T organizations in government, academia, and industry. They communicate needs and requirements to the ONR and NRE to help shape S&T investments. They are worldwide in Joint, Navy, and Marine Corps Commands. Specifically, each Marine Expeditionary Force (MEF) has a Science Advisor on staff to assist in providing operational ground truth for the S&T community.
- ▶ **Expeditionary Maneuver Warfare & Combating Terrorism Department (Code 30)**, one of ONR's S&T departments, develops and transitions technologies to enable the Navy-Marine Corps team to win and survive on the battlefield both today and tomorrow. Its primary focus is on the Marine Corps, but it also supports the Marine Corps Special Operations Command, Naval Special Warfare Command, and Navy Expeditionary Combat Command.

Other S&T Stakeholders

- ▶ **DARPA** for more than 50 years, has held to a singular and enduring mission: to make pivotal investments in breakthrough technologies for national security. Working with innovators

inside and outside of government-including academic, corporate and military Service partners-DARPA has repeatedly delivered on that mission, transforming revolutionary concepts and even seeming impossibilities into practical capabilities. Outcomes have included not only game-changing military capabilities such as precision weapons and stealth technology, which together have enabled new strategic opportunities and novel tactical options, but also such icons of modern civilian society as the Internet, automated voice recognition and language translation, and Global Positioning System (GPS) receivers small enough to embed in consumer devices.

- ▶ Increasingly, DARPA has focused its efforts on human-machine collaboration, manned and unmanned systems-of-systems, and scaled autonomy. Ground combat is but one of many military domains-from undersea to space, from cybersecurity to neurotechnology-that have benefited from DARPA's investments in these areas. The Marine Corps maintains awareness of DARPA's initiatives by assigning a Marine Corps Operational Liaison to DARPA and assigning a DARPA Transition Officer to MCWL (OSTI).
- ▶ **U.S. Army's Tank and Automotive Research, Development and Engineering Center (TARDEC)** develops, integrates, and sustains the right technology solutions for all manned and unmanned DoD ground systems and combat support systems to improve current force effectiveness and to provide superior capabilities for the future force. TARDEC leads research in ground systems survivability, power and mobility, intelligent ground systems, force

protection and vehicle electronics architecture. TARDEC is a partner with industry, academia and other government agencies to harness new technologies for emerging systems, integrate new energy and propulsion alternatives, reduce operating and maintenance costs of fielded systems, and ensure that our Soldiers have the best performing, most reliable and easiest to maintain ground vehicles in the world.

- The **Joint Center for Ground Vehicles (JCGV)** focuses on collaboration and synchronization of portfolios for ground vehicles across the services, leveraging industry and academia to better use resources. This effort provides a key resource for Marine Corps and Army collaboration in vehicle development.

- ▶ **Ground & Sea Platforms (G&SP) Community of Interest (COI)** is the technical area of most relevance within the COI to PEO LS. The G&SP COI provides a forum for discussion of topics associated with a broad range of platform technologies for both ground and sea systems. The portfolio examines concepts in modularity, survivability, mobility, maintainability/sustainability and unmanned ground/sea vehicles as the primary emphasis areas.
 - **Maintainability/Sustainability:** S&T that reduces life-cycle cost, reduces logistics burden, increases reliability, and provides timely support of ground and sea platforms. Areas of research include structural health monitoring, sustainment analysis tools, networked sustainment command and control, and high-reliability structures and components.
 - **Modularity:** S&T that standardizes and designs interfaces, subsystems, and components that allow functional elements to be used across or within platforms. Areas of research include flexible designs for

- multi-mission adaptability, interoperable components and payloads, and platform infrastructure.
 - **Mobility:** S&T focused on improving the mobility/maneuverability of ground and sea platform systems across all operational environments. Areas of research include sea stability during intense maneuvering, land stability in aggressive terrain, high-efficiency powertrain components, fuel economy, technologies enabling increased power generation, and amphibious maneuvering.
 - **Survivability:** S&T that provides protection to ground and sea platforms and their occupants, while maintaining and enhancing ability to accomplish the mission through development, evaluation, integration, maturation and testing of technologies integrated into the platforms. Areas of research include platform-centric approaches to threat defeat, including active protection (hard and soft kill), ballistic protection, and hazard protection that includes blast, shock, and fragmentation hazards and directed energy weapons.
 - **Unmanned Ground and Sea Vehicles:** S&T for maturation and integration of optionally manned competencies into ground and sea platforms to enhance force structure operational capabilities. Areas of research include conversion technologies for manned/unmanned operation and advanced unmanned vehicle development and integration concepts.

- ▶ **Industry's** participation in the Independent Research and Development (IRaD) program enables superior performance of future U.S. weapon systems and components by reducing the acquisition and life-cycle costs of military systems; strengthening the U.S. defense industrial base and the technology base;

enhancing U.S. industrial competitiveness; promoting development of technologies identified as critical; and increasing the development and promotion of efficient and effective applications of dual-use technologies. IRaD is a contractor's own investment in basic and applied research and development that DoD may reimburse the company for making.

- ▶ **Academia.** Educational partnerships with the S&T community provide a means for organizations to assist universities in extending their research capabilities in areas relevant to the needs of the Navy/Marine Corps, and they also provide an opportunity for students to work on degrees in programs of interest to these organizations. The benefits are two-fold: First, the university develops scientific and engineering expertise applicable to future needs. Second, students working on Navy/Marine Corps sponsored research receive an early exposure to those organizations, which expands the possible talent pool for future recruitment.
- ▶ **Government Laboratories** execute long-term government scientific and technological missions, often with complex security, safety, project management, or other operational challenges. Government labs develop unique, often multidisciplinary, scientific capabilities beyond the scope of academic and industrial institutions to benefit the Nation's researchers and national strategic priorities. The labs also sustain critical scientific/technical capabilities to which the Government requires assured access.
- ▶ **Naval Service Warfare Centers (NSWCs)** supply the technical operations, people, technology, engineering services and products needed to equip and support the fleet and to meet the warfighters' needs. The Warfare Centers are the Navy's principal Research, Development, Test and Evaluation (RDT&E) assessment activity for surface ship systems and

subsystems. In addition, the Warfare Centers provide depot maintenance and in-service engineering support to ensure the systems fielded today perform consistently and reliably in the future. The mission of the NSWCs are to cohesively and seamlessly operate the Navy's full-spectrum research, development, test and evaluation, engineering, and fleet support centers for offensive and defensive systems, which are associated with surface warfare and related areas of Joint, homeland and national defense systems from the sea

- ▶ **The Joint Non-Lethal Weapons Directorate (JNLWD)** was established in 1996 with the Commandant of the Marine Corps (CMC) as the DoD Non-Lethal Weapon (NLW) Executive Agent. JNLWD receives ONR funding for developing and advancing the suite of NLW available to U.S. forces. The military services (Army, Air Force, Navy, and Marine Corps) are responsible for NLW procurement and sustainment. Non-lethal weapons provide warfighters with additional escalation-of-force options while minimizing casualties and collateral damage. The JNLWD stimulates innovative solutions to the toughest non-lethal technology challenges and conducts scientific research necessary to understand the risk of injury, as well as build confidence in the effectiveness of emerging technology solutions.

Defense Innovation Marketplace

The Defense Innovation Marketplace (DIM) [defenseinnovationmarketplace.mil] is a web-based forum that brings together the entire Defense R&D Enterprise to enable successful technology development and transition. Organized and managed by the Assistant Secretary of Defense for Research and Engineering, it provides industry with improved insight into the Research and Engineering (R&E) investment priorities of the DoD. Government and DoD agencies provide updated R&E strategic



Figure 2-4. The Defense Innovation Marketplace Home Page (As of 1/08/2016)

documents, solicitations, congressional testimony, and a list of opportunities for researchers, along with news/events to better inform IR&D planning. The IR&D Secure Portal houses project summaries that provide DoD with visibility into the IR&D efforts submitted. As a hub of resources, the DIM (depicted in Figure 2-4) enables interested organizations to become involved in the R&D enterprise.