

Section 2

S&T COLLABORATION AND ENGAGEMENT

S&T investment is one of the earliest steps in the process of properly equipping the future force. Applied correctly, it can result in a balanced Marine Corps that is postured for the future with new state-of-the-art equipment that has been developed through rigorous analysis, targeted investment, aggressive experimentation, and, most importantly, through the active collaboration and engagement of all stakeholders.

S&T Objectives

The most important objective of S&T development is to ensure the United States Marine Corps (USMC) always has an overmatching technological advantage. Preserving technological superiority, which continues to be a cornerstone of our National Military Strategy, is critically important as high-technology weapons become less expensive and more readily available to non-traditional adversaries. Additionally, USMC 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; and

- ▶ Transition mature technology to Acquisition PORs.

The Executive Agent for USMC S&T

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 to provide 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, encompasses the earliest forms of Research, Development, and Test and Evaluation (RDT&E) funding in the Federal Budget. S&T is comprised of three categories: Basic Research, Applied Research, and Advanced Technology Development. It is the path by which new ideas are investigated (Basic Research-Phenomenology), and, if further research shows a military applicability (Applied Research-Connectivity), the process continues until the technology is demonstrated (Advanced Technology Development) at a level where it is transferred to a program office (utility)

to finalize the research and development (R&D) process. USMC 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.

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 (requirements) and that the technologies being developed are aligned with a PORs resources and schedule.

Collaboration

Each circle has a unique and pivotal role in the S&T process within the 3 Circle S&T Community. Although they have overlapping interests and influences regarding the likelihood of the transition, the collaboration and engagement of these communities is critical for successful transitions (see Figure 2-1).

The S&T Community Stakeholders

The USMC 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 it also involves the Futures Directorate, MCWL, ONR, MCSC, PEO LS, and the EA (CG MCWL) for S&T. This 3 Circle relationship is depicted in Figure 2-2.

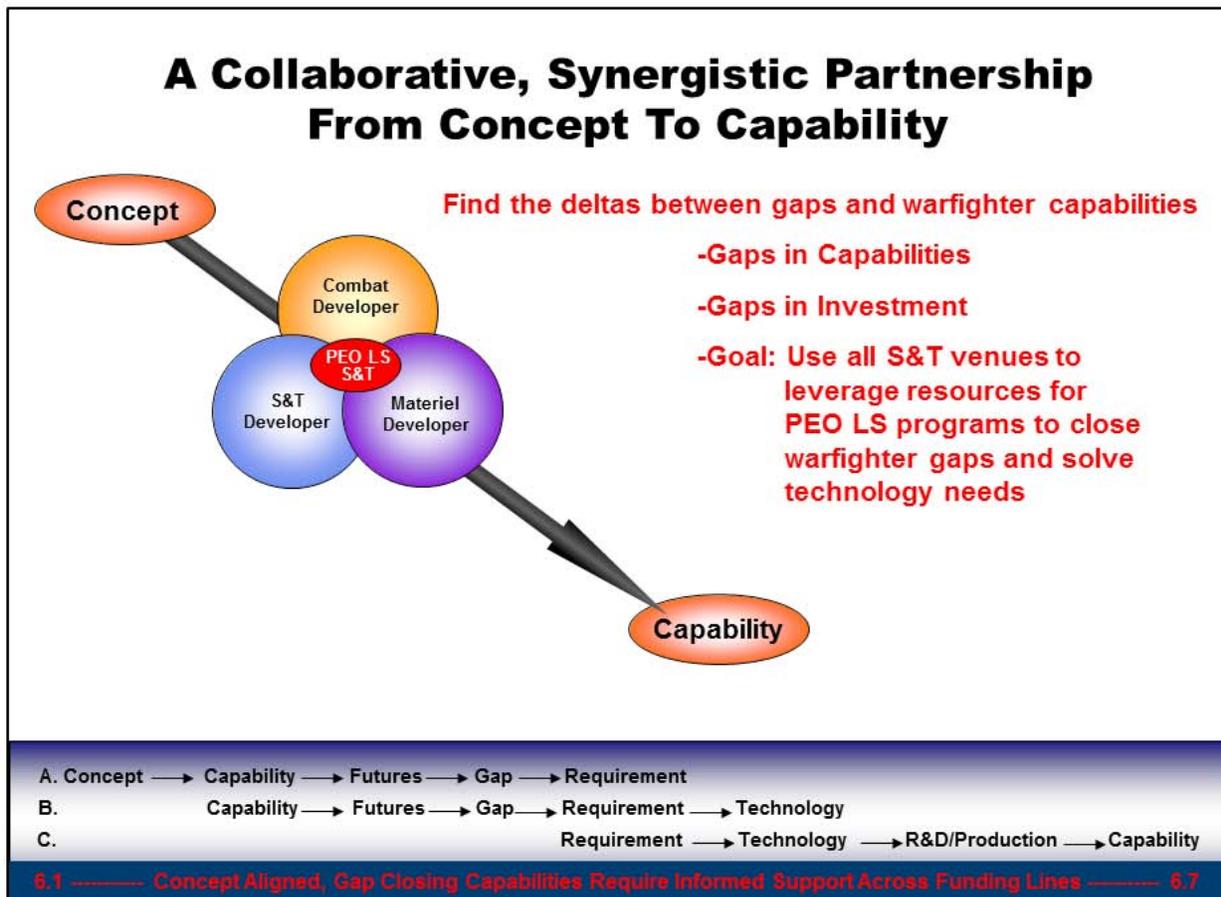


Figure 2-1. The Collaborative, Synergistic Partnership From Concept to Capability

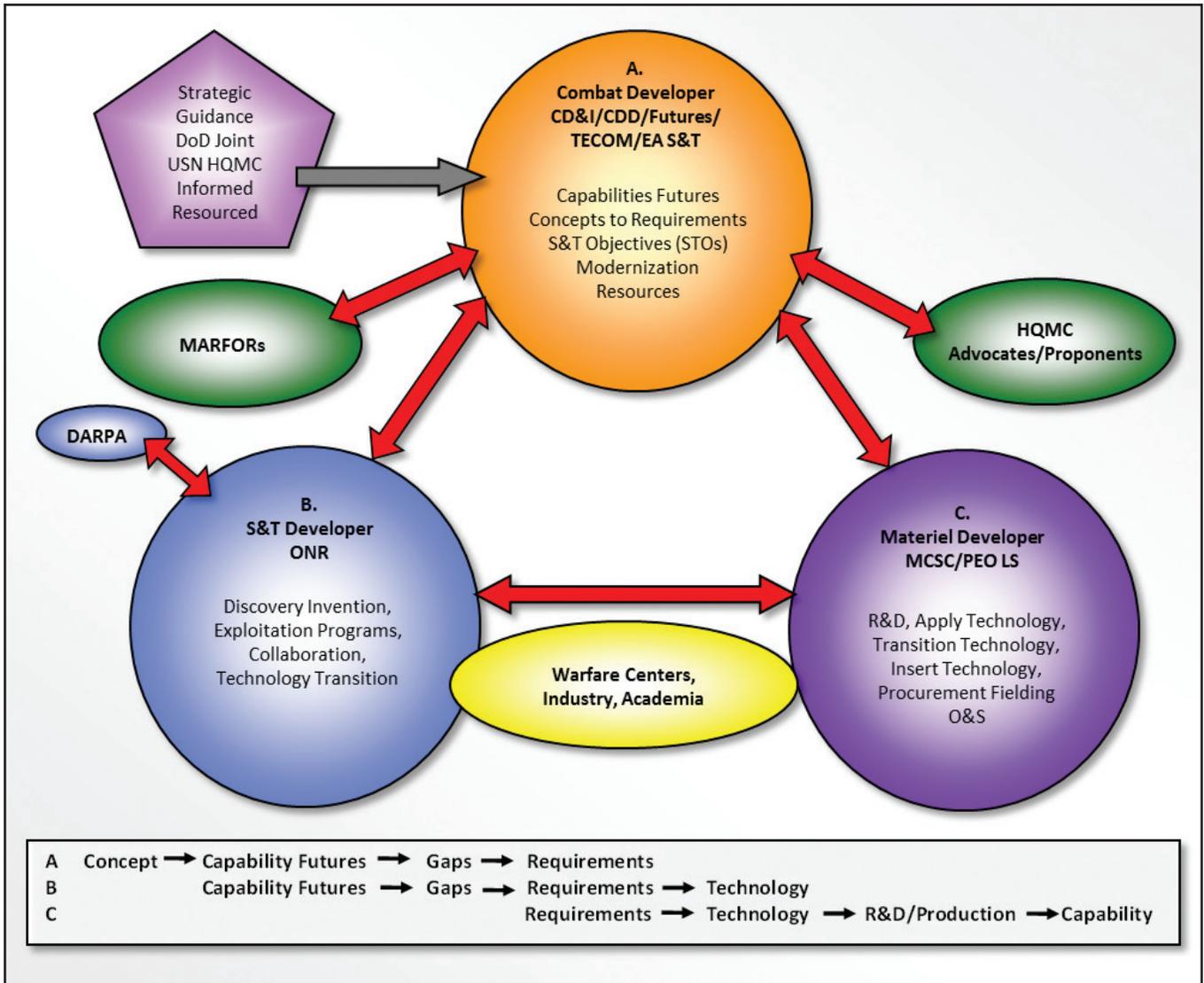


Figure 2-2. The 3 Circle S&T Community

DC, CD&I

DC, CD&I is the principal agent in the Combat Developer circle. The Combat Developer represents the warfighters who will deploy, operate, and maintain the systems needed for military operations. Combat Developers write the requirements that the Materiel Developers must have in order 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 field combat-ready and relevant forces.

- ▶ **Director, Capabilities Development Directorate** develops warfighting capabilities and requirements through the MCFDS. The Director, Capabilities Development Directorate accomplishes this activity through a Capability Based Assessment (CBA) by refining and validating the Marine Corps Capabilities List (MCCL), analyzing and identifying the Marine Corps Gap List (MCGL), and developing the Marine Corps Solutions Planning Directive (MCSPD) to identify possible materiel and non-materiel solutions. This process culminates

in creation of the Marine Corps Enterprise Integration Plan (MCEIP), which serves as the long-range plan to integrate capability investments. The S&T Objectives (STO) articulated in the *U.S. Marine Corps S&T Strategic Plan* are products of the MCFDS Process and are developed in coordination within the Marine Corps S&T enterprise.

- ▶ 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 Science and Technology Integration** is tasked with executing the Director, Futures Directorate/CG, MCWL S&T responsibility as the USMC Commandant's EA for S&T. OSTI functions to coordinate S&T within the combat development life cycle from "requirement to transition." Through coordination with the 3 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 OSD and 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.

MCSC and PEO LS

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 development 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 Marine Air-Ground Task Force (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 Command Technology Office develops an S&T Portfolio for MCSC that responds to capability needs with innovative technology solutions.
- ▶ MCSC and PEO LS conduct a monthly **S&T Working Group (S&T WG)** that was established to enhance MCSC's role in S&T and to expand technology into PORs. The S&T WG assists in developing S&T processes and S&T transitions, establishing roadmaps, discussing timelines, and enhancing internal and external S&T project awareness.
- ▶ The **PEO LS S&T Director** serves as 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, and ensures the timely delivery of technology solutions to the warfighter. The Director accomplishes this activity by working 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.

ONR

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 (VCNR).

- ▶ **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 (MARSOC), Naval Special Warfare Command (NSWC), and Navy Expeditionary Combat Command (NECC).

Other S&T Stakeholders

- ▶ The **DARPA** relies on diverse performers to apply multidisciplinary approaches both to advance knowledge through basic research and to create innovative technologies that address current practical problems through applied research. DARPA's scientific investigations range from laboratory efforts to creation of full-scale technology demonstrations in the fields of biology, medicine, computer science, chemistry, physics, engineering, mathematics, materiel sciences, social sciences, neurosciences, and more. As the DoD's primary innovation engine, DARPA undertakes projects that are finite in duration but that create lasting, revolutionary change. 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).
- ▶ **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 provide superior capabilities for the Future Force. It is the Nation's laboratory for developing advanced military ground vehicle technologies, for process integration expertise, and for system-of-systems (SoS) engineering solutions for Force Projection Technology, Ground Vehicle Power and Mobility, Ground Vehicle Robotics, Ground Systems Survivability, and Vehicle Electronics and Architecture.

- 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.
- ▶ **Industry.** Independent Research and Development (IRaD) is a program designed to enable superior performance of future United States weapon systems and components by reducing the acquisition and life cycle costs of military systems; strengthening the defense industrial base and the technology base of the United States; enhancing the industrial competitiveness of the United States; 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 between academia and 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 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, thereby expanding 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 and sustain critical scientific/technical capabilities to which the Government requires assured access.

- ▶ 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 and build confidence in the effectiveness of emerging technology solutions.

Concept to Capability Process

The Concept to Capability process, depicted in Figure 2-3, used by PEO LS is a focused, repeatable process that has proven essential for facilitating effective interaction with S&T stakeholders within the S&T Community.

The PEO LS Concept to Capability process begins with an in-depth understanding and alignment to the overarching concepts identified in *Expeditionary Force 21* and to the capstone concepts for the future Marine Corps. The next step in the 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, Rehoning the Expeditionary Edge, Reducing the Sustainment Footprint, Fuel

Saving across the MAGTF, 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 MCCL and MCGL, as well as in the Marine Corps Solutions Planning Directive and the Capability Investment Plan.

The STOs are matched to the technology issue identified by the program office and capability gap. This step is performed to ensure the traceability of S&T investments and to enable stronger support within the 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 along with the resource sponsor and the S&T Developer collaborate to ensure a successful transition. This 'shared commitment' is usually documented in a Technology Transition Agreement (TTA) signed by all parties. After the TTA is signed by the appropriate level of 3 Circle leadership, the S&T representative continues to work closely with the PM to ensure funding support is available (in the POM). POM funding is essential in order to integrate and transition the technology to the appropriate POR and close the associated

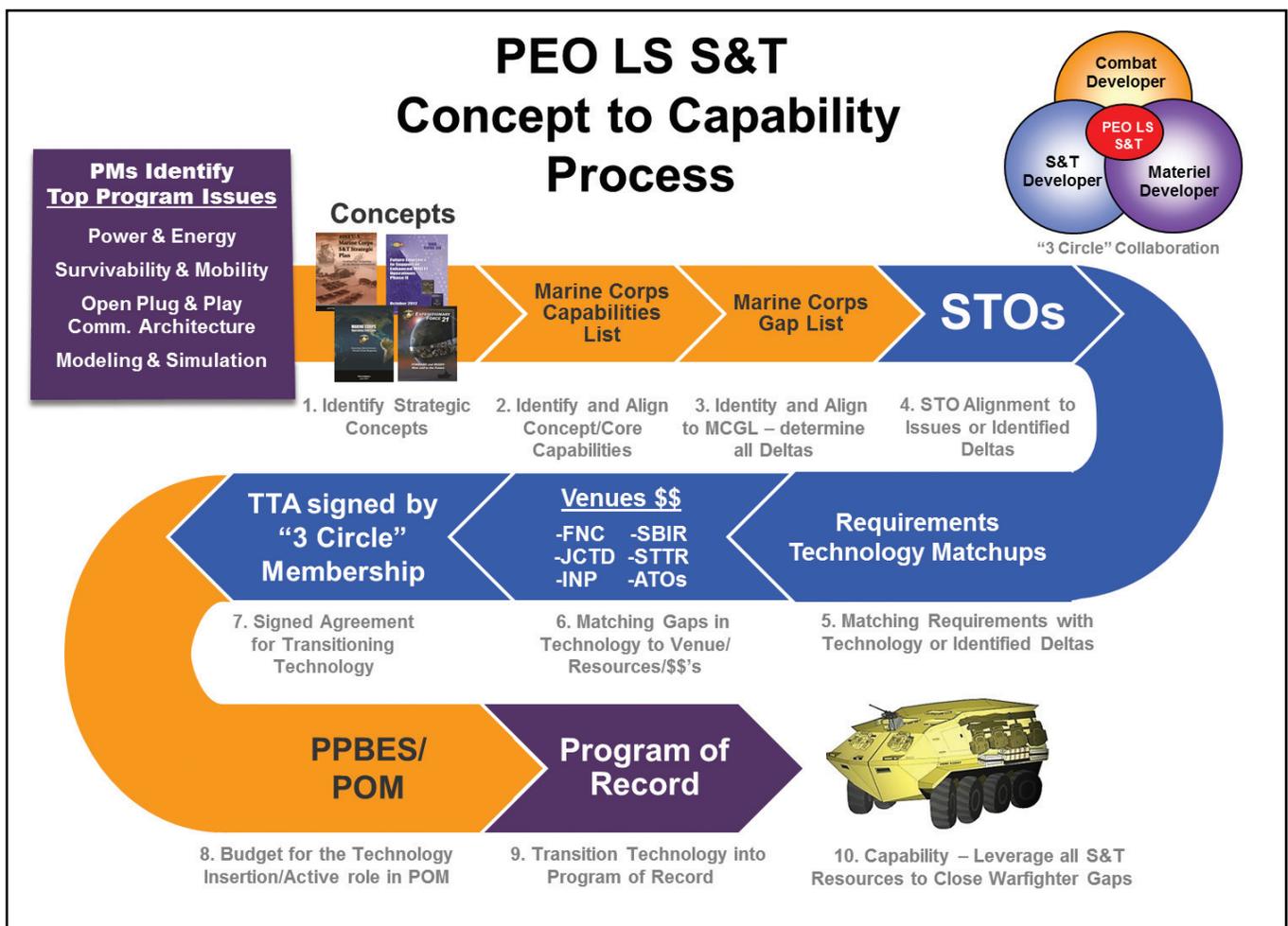


Figure 2-3. PEO LS S&T Concept to Capability Process

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.

How to Get Involved in the Process

The PEO LS S&T community fosters the cooperative development of requirements, informs, and influences S&T budgeting resources, and advances the state of the art for the PEO LS portfolio.

The first step for a business, college department, or independent researcher to become involved is a period of investigation and preparation. Having a thorough understanding of the S&T challenges facing PEO LS programs and how your proposed solution can meet those challenges is vital to participating in S&T projects. The subsequent chapters of the 2014 ATIP provide an outline of technical challenges facing the PEO LS portfolio. After you have reviewed the challenges and opportunities for the PEO LS S&T enterprise, the following sections in *this* chapter address the methods and venues and provide a jumping off point for your involvement.

In an environment of fiscal austerity, changing requirements, and rapid technical innovation, being engaged and knowing with whom to discuss new ideas is vital to fostering opportunities across the S&T Enterprise. With your participation, we can maximize ingenuity in a constrained environment and “Focus the Future Faster” for our warfighters.

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 is the central resource for DoD investment priorities and capability needs. Government and DoD agencies provide updated strategic documents, congressional testimony, and a list of opportunities for researchers. As a hub of resources, the DIM is a critical resource to enable interested organization to become involved in the R&D enterprise.

Venues

S&T Venues provide resource opportunities by which industry/academia can officially partner with Government agencies. These venues provide a multitude of methods and different funding sources to engage with the DoD S&T Enterprise. The Appendix provides a comprehensive list of S&T Venues available for technology development along with the points of contact and information regarding the venue. A small sampling of some of the more common venues are described below. The most recent information regarding these venues can be found on the DIM website.

Manufacturing Technology (ManTech) is designed to improve the affordability of platforms critical to the future force.

Quick Reaction Funds (QRF) focus on responding to emergent needs during the execution years that take advantage of breakthroughs in rapidly evolving technologies.

Rapid Innovation Fund (RIF) is designed to transition innovative technologies, primarily from small businesses that resolve operational challenges.

Rapid Reaction Fund (RRF) focuses primarily on a 6-18 month time frame for development to stimulate interagency coordination, anticipate adversary capabilities, identify technology developed outside of DoD, and accelerate fielding.

Small Business Innovative Research (SBIR)/Small Business Technology Transfer (STTR) are designed to stimulate technological innovation, increase private sector commercialization of Federal R&D, increase small business participation in Federally-funded R&D, and foster participation by minority and disadvantaged firms in technological innovation.

Although the Navy's SBIR and STTR programs are a component of the overall DoD SBIR/STTR program, the Navy's program is targeted at addressing the needs and areas of interest to the Navy and its System Commands (SYSCOM).

On a schedule coordinated by DoD, the Navy issues SBIR solicitations, usually three per year, that contain a series of "Technical Topics" that describe the areas of interest and needs of the Navy and its SYSCOMs. Small businesses are invited to submit proposals that are targeted at one or more of the technical topics listed in the solicitation. The STTR program works in the same manner, but has only two solicitations per year.

SwampWorks explores innovative, high-risk, and disruptive technologies and concepts. SwampWorks leverages short exploratory studies to examine the maturation of a proposed technology before making substantial investments. Efforts are smaller in scope and are intended to produce results in less than three years.

Technology Insertion Program for Savings (TIPS) is a technology transition initiative designed to increase the rate at which new technologies are inserted into Department of Navy (DoN) Acquisition programs in order to reduce operations and maintenance support costs. The \$2M TIPS

program is structured to rapidly transition applicable commercial off-the-shelf solutions and late-stage development technologies from any source to meet an immediate need. TIPS provide execution year funding for a rapid start, bridging the gap until the program of record can fund the completion of the technology insertion.

University Research Initiative (URI) seeks to improve the quality of defense research conducted by universities and supports the education of engineers and scientists in disciplines critical to national defense needs. URIs bring together multiple researchers and teams from various specialties and universities to respond to one of the DoD's research areas of interest. URIs tend to include more funding and have longer development timelines than individual research initiatives.