Executive Summary
Ship to Warfighter Logistics
Logistics for Small Unit Operations

Purpose of the Study

Logistics support of the warfighter takes on an increasingly important role and major new challenges for rapid response expeditionary operations in the littorals. Recognizing the changing operational concepts and attendant logistics support challenges embodied in Naval doctrine such as "From the Sea" and "Operational Maneuvers from the Sea"; the Assistant Secretary of the Navy for Research, Development and Acquisition asked the Naval Research Advisory Committee (NRAC) to convene a panel to study Ship-to-Warfighter Logistics for Small Unit Operations (SUO). The Panel focused its attention on developing a framework for the study, identifying associated resupply requirements for different natural and combat environments, information processing, delivery systems, power and energy use, health services and chemical biological warfare (CBW). It assessed the current state of technology, including that applicable to operational concepts exemplified in the Navy Extended Littoral Battlefield ACTD and USMC "Sea Dragon". The Panel identified those technologies which should both provide for significantly reduced logistics footprint and exposure time, and increase the efficacy of small unit operations. The Panel feels that this report can serve as the basis for an affordable DoN technology investment strategy to provide effective and efficient Ship-to-Warfighter Logistics for Small Unit Operations.

Framework and Approach

The operational nature of the topic required significant background knowledge. Accordingly, subject matter experts were invited to join the Panel. Conceptual and Operational Frameworks were established, drawing upon Joint Vision 2010 for "Focused Logistics" and upon a mix of operational concepts to establish unit size, dispersal, footprint and deployment times for a variety of missions. The panel drew upon products of the Hunter Warrior Advanced Warfighting Experiment (AWE), with some members having the benefit of previous exposure to "Sea Dragon", observing a portion of the Hunter Warrior AWE, and observing operations aboard the USS LaSalle (Joint Task Force Command Ship) during the Albanian American Citizen Non-combatant Evacuation Operations (NEO). The panel drew heavily upon briefings and meetings focused on the conduct of SUO, logistics management and resupply techniques, AWE after-action reports, and specifically applicable technology elements. The Panel identified the main logistics elements as focused by the operational framework and filtered through a technology assessment process to identify Technology Windows of Opportunity. Specific actions were recommended for immediate and longer term implementation to provide reduced foot print asset management for Ship-to-Warfighter Logistics for SUO.

Overarching Issues

Three issues emerged that appeared in virtually all aspects of the study. They are: Training; Energy Conversion; and, Transition from Advanced Warfighting Experiments to the Acquisition Process.

Training needs to reflect the background and skills of today's recruits (e.g., computer literate); who are much more amenable to and capable for cross-training than in the past. The Military Occupation Specialty (MOS) Structure and Individual Training Standards (ITS) should be upgraded to reflect this. In addition, combat specific training must account (and prepare) for systems limitations, uncertainties, or lack of availability; incorporating alternatives. Finally, due to an increasing dependence in electronics and communications technology, the training should be conducted within an appropriate Electronic/Information Warfare Environment.

The panel observed that, with a greater dependence upon information flow and communication, there is greater use of radios...hence power supplies. For SUO this is typically thought to be "batteries". Radios and batteries are significant drivers for the individual marine's equipment load and for resupply of SUO. However, significant savings in energy requirements can be attained through radio and signal processing design focused upon energy reduction. The potential exists to provide as much as a 30 to 1 increase in battery life. This issue goes hand in hand with training to reduce the number of transmissions necessary, streamline transmission protocols, and provide essential communications discipline.

The AWEs make excellent use of surrogates, based upon commercial technology in many cases, to evaluate and even establish new operational concepts and their merits. The AWEs are properly designed to exploit the available technology and are success oriented. The Panel discussed two specific issues in the context of transition to Acquisition which may produce unintended results. First, the Panel believes that the AWEs need to be subjected to additional threats in an operational assessment to evaluate limited degradation or denial, training inadequacies for the new concepts, and environmental extremes. Second, the Panel notes that technology, specifically commercial information technology and processes, are moving faster than the acquisition cycles. It is clear that commercial technology must be leveraged to the maximum extent; which includes both a need to remove traditional impediments on protection of emerging commercial intellectual property (relating to technology advances) and a need to dramatically reduce acquisition/deployment time.

Technology Windows of Opportunity

The study provided insight into wide ranging groups of technologies. The Panel categorized these into seven technology product areas relevant to the support and resupply of SUO. They are Information Systems, Delivery Systems, Power/Energy, Communications/Navigation, Consumables, Health Services (including combat casualty care), and Chem/Bio (CBW) Detection.

Deployed USMC logistics Information Systems were assessed against the support requirements and compared to the "Combat Support Services - Enterprise" (CSS-E) experiment conducted as an adjunct to the Hunter Warrior AWE. CSS-E after action reports indicate that the assembled hardware and software provides a potentially low risk, low cost, "80-90%" solution to requirements for situation awareness, asset visibility, customer confidence, logistics command and control, inventory and footprint, effective asset allocation and logistics anticipation. The Panel believes that CSS-E should be deployed; with proper consideration of any military communication and information systems safeguards. At the same time, the Panel recommends development of logistics systems applications to "open systems" standards for the future.

A number of delivery systems were assessed to support precision remote resupply of small units. Requirements were assessed and a number of manned and unmanned systems offer promise. Clearly, the introduction of jungle or urban environments necessitate the consideration of vertical aspects for Unmanned Air Vehicles (UAV) and introduction of Unmanned Ground Vehicles (UGV) while riverine or littoral operations suggest use of Unmanned Surface Vehicles (USV). The Panel noted that introduction of unmanned vehicles could satisfy a variety of needs and should be considered for multi-role applications. There are a number of existing prototype vehicles that could be used as surrogates in the upcoming AWEs. Integration of beacon or GPS/INS capabilities enhances delivery accuracy. Cache security also may be enhanced via location beacons and integrated command and control. UGVs could be used to monitor cache integrity.

Power and energy demands for SUO were considered from both man-portable (communications) and general purpose perspectives. Intense communication needs for dispersed units provides a challenge for support and resupply of traditional radio/battery systems, taxing the individual load. A more suitable alternative to battery development is energy efficient radio and signal process design, communication protocols and training. In the future, micro-machined power modules (engine/generators) offer the potential for high density power supply. There appears to be no near term alternatives for general purpose applications, other than to continue the development of fuel cells with emphasis on low signature power generation, solar and wind sources, and hybrid systems for generation, storage, and use.

The Panel believes a central issue for SUO to be communications and navigation. The challenge is to provide assured, low-latency, sufficient bandwidth communications and GPS navigation which is interoperable with legacy systems. All radio transmissions made by small units should have low probabilities of detection and intercept. Similarly, GPS transmissions should be properly encrypted to prevent interception or alteration. The Panel found that the vulnerability of GPS signals to low power jamming, particularly for the ground force and aerial resupply techniques was not widely appreciated. Solutions, although in development, can be very costly and may require the introduction of "psuedolites" as airborne high power GPS repeaters in an integrated expeditionary communications/navigation infrastructure. The Panel recommends specific attention to these issues, along with the immediate introduction of training in a realistic comm/nav threat environment.

Consumables were found to dominate the equipment load for the individual Marine; and, for missions longer than four days and SUO size greater than 10 Marines, drove SUO replenishment requirements. Ammunition, water, repair parts, and rations were addressed. There are promising developments to reduce the individual load, or re-tailor it to address the Marine and his equipment load as an integrated weapon system.

Health services were addressed in the context of expeditionary medicine requirements, viewed both with and without the availability of medevac. A revised trauma model is required, which supports emerging operational concepts (rather than one dependent upon the civilian EMS model). Improved casualty stabilization and intervention (treatment) on the battlefield should include new hemorrhage control techniques, tele-medicine and remote protocols development. Stealthy unmanned evacuation systems should be assessed. Improved medical readiness both pre- and post-deployment via vaccines, chemoprophyllactics and repellents demands continued microbial and chemical research to recognize and combat new threats.

Improved CBW detection, prevention and decontamination is needed. This breaks down into the need for: portable sensors for early, sub-lethal detection; portable, waterless chemical decontamination approaches; and, improved protective clothing. The Panel was impressed with the array of sensor technology in development for CBW detection; improving markedly upon fielded systems. Most importantly, the Panel recommends that DoN ensures that joint requirements support emerging operational concepts.

Take Aways

The Panel developed three main issues and recommendations as "take aways" for senior leadership. These three issues reflect a total of 29 recommendations developed across the broad span of logistics elements and technology opportunities contained in the report.

- The CSS-Enterprise experiment should be grown into a logistics test-bed with the 15th Marine Expeditionary Unit (MEU).
- Battery technology is relatively mature, with no high order improvements in the offing. On the other hand, significant gains can be made via design of low energy radios and signal processors, and by introducing efficient communications protocols.
- Training and technology discipline are needed across the board, including testing in operational environments. Elements include disciplined communications use in a degraded environment, wider use of surrogates to test operational concepts and establish operational requirements, and treatment of the Marine and his equipment load as an integrated weapons system with a focus on reducing the load. Finally, modern commercial technology needs to be tried in a realistic military environment to explore the effectiveness of alternative operational concepts.