XXV. RECOMMENDATIONS FOR FURTHER RESEARCH

A. INTRODUCTION

The Expeditionary Warfare Integrated Project was designed as a broad, system of systems examination of some basic questions concerning proposed new ways to conduct expeditionary warfare. The amount of time and the number of available students limited the scope of inquiry. As is often the case with preliminary results and analyses, the study raised as many questions as it resolved. The intent of this chapter, then, is to describe areas where further research may make a real contribution to the understanding of expeditionary warfare from a system of systems perspective. The areas of inquiry are grouped by academic curriculum.

B. SYSTEMS ENGINEERING AND ANALYSIS

The direction of the second year's Systems Engineering and Analysis Team is currently under discussion with N75. Possible candidates for further evaluation include:

--Model and generate requirements for platforms intended to provide fire support from the Sea Base to troops ashore.

--Incorporate the effects of multiple, widely spaced objectives and the scheme of maneuver into the ExWar EXTEND model.

--Perform a classified, and therefore more through analysis of the C4I requirements, perhaps in conjunction with the C4I capstone class, and balance those requirements against other mission areas.

--Perform a classified, and therefore more thorough, analysis of force protection requirements for the Sea Base, to include actual weapon system capabilities, future weapons technologies and realistic timelines for deployment, wargaming the force protection architectures, and trading off force protection requirements against other mission areas. For example, what are the trade-offs from a force protection standpoint, between using a large number of small, fast resupply craft or a smaller number of larger vessels?

--SEI-3 attempted to identify critical levels of Sea Base performance resulting from their excursion analysis. Conduct trade-off analysis among these critical factors influencing speed, the effectiveness of Sea Basing, and the effects of reducing footprint ashore in order to identify a "best fit" configuration. For example, how much does speed affect the Sea Base's force protection requirements and is there a means to trade-off between the two?

--SEI-3 analysis determined fuel consumption was one of the major logistical drags on the ability to perform STOM operations far from the Sea Base. Analyze the current MEB's fuel consumption and propose changes to reduce fuel consumption and dependence on resupply from the Sea Base.

--Attempt to define and analyze the impact of "Enhanced Networked" Sea Basing on the Expeditionary Warfare system of systems

--With a longer-range capability to move combat troops, equipment, and supplies ashore, a follow-on study needs to address the possibility of moving Joint Forces, as well as Allied Forces. The Sea Base provides a launching pad when a host nation does not want U.S. Forces stationed on their soil, so the capability to move not only the Navy and Marine Corps would give the Joint Task Force commander a robust power projection capability.

C. AERONAUTICAL ENGINEERING

--Design a small shipboard recoverable weapons-carrying UAV capable of providing precision fires in support of Marine operations ashore. Explore the viability of UAVs for providing volume fires.

--Design a harness rig for lifting large loads, such as 8' x 8' x 20' containers, when the precise load weight and center of gravity is unknown.

--Perform detailed design incorporating aircraft combat survivability enhancements required to mitigate the impact of the expected threat as discussed in Chapter XIV.

--Design a missile capable of providing precision and volume fire support from the Sea Base to Marines ashore.

D. TOTAL SHIP SYSTEMS ENGINEERING

--In order to support the transshipment of materials through the Sea Base, design a cargo handling system capable of handling the post transfer positioning and unloading of standard shipping containers, as well as the repackaging, respotting, and reloading of cargo for transfer ashore. Mechanisms for conducting the transfer of containers are already under review by a number of organizations and are not necessarily part of this research.

--Design a small organic patrol craft capable of providing force protection for both the Sea Base as well as surface craft on long transits between the Sea Base and landing zones ashore.

E. OTHER NPS CURRICULA

Formal, large-scale participation by departments other than Aero, TSSE, C4I, and Space Operations was hampered by lack of a scheduled "design class." Participation by the following curricula would therefore be limited to individual or small group efforts. The Directed Study approach used by the Aeronautical Engineering Department to work design concepts between scheduled design classes could provide a means for these curricula to participate if there is enough interest generated.

1. Combat Systems

--Design an artillery round, missile, or other weapon to allow sustained volume suppression and precision fire support for forces up to 200 NM inland to be shifted to the Sea Base. This is not a trivial problem. The designs can be performed in mock competition or cooperatively with the TDSI Weapon System Engineering curriculum. The widest possible range of solutions should be explored.

--Design sensor systems to support the delivery of precision and volume fire to targets ashore. The information would need to be pushed down to the lowest level possible to execute the mission quickly and efficiently. This could be done in cooperation with the Command and Control curriculum.

--Development of modular weapon systems that can be delivered in parts and then assembled ashore will drastically reduce the demand on the limited heavy lift capacity.

2. Information System Operations

--Generate stand-alone IO requirements for a MEB-sized forcible entry operation and design systems to achieve those requirements.

3. Information Systems Technology

--Generate requirements and designs for hardware and software to accommodate the new data flow needs (logistics, operational, fire, etc.) inherent in Sea Based operations.

4. MOVES

--Generate requirements and related designs for large-scale, high-fidelity training simulation aboard ship in order to minimize or eliminate dedicated physical rehearsal time prior to conducting an operation. The goal is to permit large-scale, in-stream virtual rehearsal while enroute to the operations area.

--Generate load/unload rehearsal and planning software for ad hoc loading and unloading of ships as materials arrive at the Sea Base.

5. NSA – Regional Intelligence

--Generate additional MEB-sized forcible entry scenarios in various regions of the world and assess their relative likelihoods of occurrence for incorporation into future studies.

--Conduct threat analysis for the ExWar scenarios for use in system analysis and design.

6. Operations Research/Operational Logisitcs

--Define and identify the impact of operational concepts like "Sense and Respond Logistics" on the Sea Base and expeditionary warfare supply chain.

--Model various Sea Based firepower operational concepts to determine effectiveness in support of the weapons designers, conduct in depth campaign analysis using several different future force structures, or analyze, in detail, the logistical throughput of the MEB.

--Perform detailed modeling (campaign level and high resolution) of proposed ExWar capabilities and platforms to determine how they contribute to overall mission effectiveness.

--Select measures of effectiveness, measures of performance, and design variables to optimize choices in a given trade-space such as Speed, Footprint, etc.

--Procurement of a heavy-lift aircraft would require a study to determine optimal loading plans for internal and external loads. Maximizing the aircraft's payload capability would reduce the number of aircraft required to delivered the daily sustainment requirements and allow for greater flexibility in scheduling the aircraft for other operational commitments.

F. TEMASEK DEFENSE SYSTEMS INSTITUTE

Under a joint program with NPS, approximately 30 Singaporean students will attend NPS in several technical curricula. As part of the agreement setting up the program between NPS and the Singapore Ministry of Defense, it is highly desirable that the students work on a large-scale project with their U.S. counterparts. Some possible areas of research by students in the TDSI program include:

1. Communication Systems Engineering

--Design a C4 system to accommodate the rapidly evolving C2 environment required by STOM and OMFTS. If, for example, the lead element shifts landing beaches during ingress, follow-on and logistics forces, some already enroute, have to adjust on the fly. This could be done in conjunction with the U.S. C4I curriculum project.

--Design a communication system that supports the ExWar CONOPS, including the alternate architectures developed by the C4I design group discussed in Chapter XVII.

2. OR, Modeling, and Simulation

--Model various Sea Based firepower operational concepts to determine effectiveness in support of the weapons designers, conduct in-depth campaign analysis using several different future force structures, or analyze, in detail, the logistical throughput of the MEB.

--Perform detailed modeling (campaign-level and high-resolution) of proposed ExWar capabilities and platforms to determine how they contribute to overall mission effectiveness.

-- Perform higher resolution analysis of logistical flows along the various paths needed to support a Sea Base and project power ashore, and attempt to find the next level of critical factors below those identified in the SEI-3 study.

--The current flow simulation (implemented in EXTEND™) has constant attrition factors for the blue forces and does not model attrition for the red forces. The logical extension would to add some simple, low-resolution, Lanchester-type attrition modeling. This would also change the metrics and enable the comparison between the times to attrit the red forces to the breaking points as a metric across architectures, and also look at blue losses. Intuitively, the architecture that allows for the most initial combat power deposited on the objective would be shown to be superior; this addition to the model would verify or refute that suspicion. Low initial force deposition might invite defeat in detail; this would help determine the minimal flow rate required to win, which would also be a very useful insight. The tie-in would be that the attrition coefficients would reflect whether sufficient materiel was on hand: no bullets and the kill coefficients go to zero, which gives insight into the interplay between the logistics and operations models.

3. Weapons Systems Engineering

--Design an artillery round, missile, or other weapon to allow sustained volume suppression and precision fire support for forces up to 200 NM inland to be shifted to the Sea Base. This is not a trivial problem. The designs can be performed in mock competition or cooperatively with the existing Combat Systems curriculum. The widest possible range of solutions should be explored.

--Development of modular weapon systems that can be delivered in parts and then assembled ashore will drastically reduce the demand on the limited heavy lift capacity.

4. Sensor Systems

--Examine concepts for components of the expeditionary warfare sensor grid. Possibilities include securing the Sea Base from ASW and cruise missile threats, detection of moving targets ashore, sensor coverage of the lines of communication from the Sea Base to the objective, tactical mine and obstruction detection and reporting during ingress, land attack cruise missile defense for the forces ashore, and the interfaces with manned and unmanned air and subsurface platforms. This effort needs to dovetail with the Communications Systems Engineering students' project.

5. Information Operations and Assurance

--Extend the design of the C4I system and sensor grid in conjunction with other tracks of the TDSI program. These contributions could improve network security over the extended distances of future expeditionary warfare, enhance the role of hard and soft IO in future operations, and generate well defined system requirements.

--Assess the role of psychological operations and deception in future expeditionary operations. Identify and design the necessary resources and systems.

G. ADDITIONAL RECOMMENDATIONS

--The future of the MV-22 in a state of uncertainty. Additionally this report has shown the MV-22 does not provide the logistical throughput for the CONOPS. The Marine Corps should investigate in the possibility of procuring a long-range heavy lift aircraft as well as the medium range MV-22. A long-range heavy lift aircraft would increase the throughput at longer ranges and enhance the USMC's airlift capability. Having the capability to deliver large quantities of fuel, water, and ammunition would help reduce the footprint ashore, giving the combat forces ashore more flexibility and maneuverability.

--The reduction of the footprint ashore requires a reduction in fuel consumption. This reduction would come primarily from the use of more fuel efficient generators and engines. Technologies for increasing the fuel efficiency of generators and engines have not advanced as rapidly as other technologies over the past half-century. If engines and generators operating ashore were to decrease their burn rate by 25% or even 50%, the reduction in fuel consumption, which comprises the Sea Base's largest logistic burden, would lessen re-supply requirements tremendously.

--Instead of a better and more efficient reverse osmosis plant, the Marine Corps should develop a miniaturized water purification kit that is modular and able to support a smaller component force. This would provide a more scalable and flexible water support or purification system to support the forces ashore.