High Speed Sealift Technology Workshop
Critical Interface (Load/Unload) Technologies Working Group Report

Introduction:

The High Speed Sealift Technology Workshop was held at Carderock Division Naval Surface Warfare Center (CDNSWC) on October 21 – 23, 1997. The key objectives of the workshop were to: identify and assess high speed sealift technology status and state of the art; identify high speed sealift technology issues which need to be overcome; generate support for the continued development and deployment of advanced high speed sealift concepts, technologies, and related rapid deployment initiatives; and to develop the foundation for a joint strategy, or roadmap, for the application of existing and emerging high speed sealift technologies to meet DOD's strategic mobility requirements. This report summarizes the work performed by the Critical Interface (Load/Unload) Technologies Working Group.

Objective:

The overall objective of the working group was to review the state of the art in the critical interface (load/unload) field, identify advanced concepts, and assess the technology's impact on future high speed sealift operations. The basic objective for loading and unloading is to move cargo on and off the transport ship and through the POE/POD effectively and efficiently. This requires getting the cargo onboard, restraining it, getting it off, keeping track of it, not breaking it, moving it through the ship and the yard quickly, doing it with least impact on the vessel, consolidating freight, accounting for special cases such as HAZMAT, providing information viability (C^4I), and operating anywhere in the world, regardless of port condition, at any time.

Participants:

The workgroup included representatives from commercial, academia, and government organizations. The attending participants are listed below:

Ed Dougherty (Cochair)	August Design
Art Rausch (Cochair)	CDNSWC
Bob Bouchard	Maritime Administration
David Byrne	Transmarine
Der-San Chen	University of Alabama
John Chen	J. J. McMullen & Assoc.
Jim Coffin	Designers and Planners
Dave Drenon	MacGregor Cranes & RO/RO
Marty Fink	Naval Sea Systems Command
Bjorn Hansen	TTS
Russ Hoffman	Bath Iron Works

Joe Mackes	CDNSWC
Jim McNamara	National Cargo Bureau
Ken Morisseau	EG&G
Richard Myers	Concurrent Technology Corporation
Dave Rudolf	Virginia International Terminals
Tom Schiller	M. Rosenblatt and Sons
Carl Seiberlich	VZM Transystems
Steve Sharp	American Bureau of Shipping
Lennart Svensson	Kvaerner Ships Equipment

Approach:

The workgroup's approach was to identify measures of effectiveness, review the state of the art and categorize the applicable systems and technologies. The critical interface (load/unload) area encompasses a wide array of systems and technologies including all shipboard and shoreside cargo handling, port operations and logistics technologies involved in moving material from fort to foxhole. A variety of cargo types were considered including containers, vehicles, pallets and cassettes. Impacts on the port of embarkation (POE) and port of debarkation (POD) were considered as were loading and unloading in an advanced port, an unimproved port and in those situations when a port is not available. In the latter two categories, Joint Logistics Over-The-Shore (JLOTS) operations are addressed as well as in-stream operations, a commercial variation of JLOTS.

After reviewing the state of the art, advanced/innovative load and unload concepts were developed in a brainstorming session and then subjectively assessed for their impact on high speed sealift ships. Both conventional and proposed high speed ship types were considered. Cargo handling related issues were identified. Predictions were made regarding cargo handling, load/unload related characteristics, and the features of the future high speed sealift ship. Finally, general conclusions were drawn from this initial review of the critical interface technology area.

Working Assumptions:

The following assumptions on the future high speed sealift ship were provided to the workgroup to help focus discussion:

- 5,000 to 10,000 nautical mile range
- 75,000 to 150,000 square feet of cargo load space
- 2,000 to 5,000 STON cargo load capacity. Note that this weight when compared to the cargo load space provides a low cargo density, less than half that of current sealift loadouts.
- 40 to 100 knot speed
- Shallow draft
- In-stream discharge capable

- It was also assumed that the JLOTS Master Plan would be implemented providing a JLOTS sea state 3 capability.

Measures of Effectiveness:

In assessing critical interface (load/unload) technologies, many measures of effectiveness apply to different areas of the operation. The following measures of effectiveness and related factors were identified:

Vessel/truck/train turn around time	surge is focus
Throughput (moves per hour)	departure on schedule
Throughput (per terminal acre)	transition from surge to sustainment is critical
Productive moves	automation in ship and port
Setup time	ports/offshore bases
Percent availability	ship/port interfaces
Commercial viability	port requirements
Cargo density	port design
Cost per lift	port clearances
Vessel port time	staging
POD efficiencies are critical	JLOTS
	C^4I

State of the Art and Advanced/Innovative Concepts:

The state of the art categorization focused on commercial operations which largely drive technology development in this field. The following areas were examined: port/yard operations, quay cranes, multiple container loading, tag technology, RO/RO ship systems, LO/LO ship systems and military state of the art.

Advanced/innovative load and unload concepts were examined in the following areas: LO/LO ship innovations, RO/RO ship innovations, cargo impact of conventional and proposed high speed ship types, ship and port automation, JLOTS improvements, staging and C^4I.

Given the large number of critical interface (load/unload) systems and concepts identified, the workgroup did not attempt to conduct a thorough review and assessment of the technology. In keeping with the level of discussion, the state of the art and advanced concepts sections are presented in outline form.

<u>State of the Art</u>

Port/Yard Operations SOA:

- Automated terminals provide high density and high productivity and near random access to cargo. Automated Guided Vehicles (AGVs) provide efficient maneuvering with minimum manpower. Overhead cranes provide access to

stacked containers. Pigeonhole is a system for warehousing containers in which the storage compartments are arranged in a multistory structure of rows and columns of compartments.
- Yard operations can be improved with intelligent software.
- “Onesies” container handling creates bottleneck, handling multiple loads at once is desirable.
- Yard maneuvering mostly controls port operations because the yard equipment feeding the quay cranes typically can not keep pace with the highly productive cranes.
- Container on chassis yard operations require a chassis for each container. It is the most flexible type of system, but is the least space efficient because it permits no stacking and requires large lanes for the chassis to maneuver.
- Straddle carrier is the next best yard system in regard to flexibility. A “strad” can pick off a 3 high container stack but can’t go over 3 high.
- Chassis/stack combo (rubber tired gantry) is inefficient in throughput, but very efficient in space.
- Sea-Land’s Hong Kong facility has approximately 24 rail mounted gantries that have demonstrated the ability to automatically pick and place containers within stacks.
- Ports can deny access due to cargo not arranged properly.
- DOT implemented the Safe Container Act due to improper documentation of container.

Quay Crane SOA:

- Semi-automated, high speed cranes are common in new purchases. Semi-automation provides “learned” paths for the spreader and improves productivity while reducing the skill level needed by the crane operator.
- On dock rail is newest trend (containerized).
- Anti-sway system - it has been reported that experienced operators can work faster without it, but the systems are valuable for less experienced operators.
- Dual hoist crane reduces cycle time by permitting parallel operations, but until the system is automated, it requires two operators. Main gantry crane moves container to a lower shuttle platform and a shuttle crane lowers the container to the ground. The dual hoist crane at VIT (Virginia International Terminals) typically operates at 28 to 30 containers per hour, maximum design rate is 54.
- VIT is developing a new type of crane using an elevating trolley gantry crane. This system is used for post-Panamax ships and has the crane operator close to the ship. It provides a short vertical pickup and a fast horizontal move (600 to 700 fpm) with a 2.5 second acceleration ramp.
- Standard ship to shore crane boom has one operator with a crane rate of 25 containers per hour. The maximum rate for a 4th generation crane is 42 to 45.
- Typically operators use 3 cranes to work a 4,000 to 5,000 TEU ship.
- The following provides the cost to move a container at VIT (includes operator, energy, amortization and maintenance): single hoist crane - $9.37; elevating

trolley gantry crane - $8.30; double hoist crane - $13.17 (higher due to labor cost of two operators).

- Chassis positioning is an issue as misalignment of a chassis wastes approximately 10% of the crane cycle time. Machine vision techniques have been demonstrated by Sea-Land and others that aid in chassis positioning and reduces cycle time.

Multiple Container Loading SOA:

- Experiments have been conducted in Japan with picking up multiple container empties in blocks of 4.
- Working both sides of the ship can reduce load/unload time. Mobile harbor cranes can provide up to 20 moves per hour with a proficient operator. Use floating cranes in Hong Kong for in stream operations, similar to JLOTS operations.
- RO/RO cassette can load up to 4 FEUs. Can handle all cargo types.
- High speed train RO/RO loading - Fastship Atlantic type system
- OSHA regulations could prohibit multiple lifts. All lifting devices must be certified. Container is not certified as a lifting device. Therefore, certain multiple container loading techniques may not be able to be certified as safe.

Tag Technology SOA:

- AEI (Automated Equipment Identification) tags are useful for checking yard inventory, and other operations, but are not universally accepted. For example VIT does not use tags, as it is not cost effective for their operation. They employ hand held recorders for inventory checks. Matson uses tags in more of a closed system. They are the only U.S. company that is automated (use a 4 high overhead crane). APL uses tags although is not a closed system (concentrating on chassis).
- Most commercial equipment is received via rail and tracked by manufacturer number..
- Major tag suppliers are Amtech, Hughes and Savi. Savi tags have been used primarily for military use.
- The cost factor of tags is significant.
- Need to agree on standards to provide a harmonized tagging system.
- GPS (Global Positioning System) is useful in tracking cargo handling equipment as well as cargo. Reportedly, APL is testing in Oakland terminal, estimated to save $400K per year.
- OCR (Optical Character Recognition) scanning is promising for cargo identification and inspection. Reportedly, Singapore has a 99% success rate using OCR, requires an advanced booking number. Reportedly, Mahar, NJ has a 90% success rate.
- TrAMS (Transportation Automated Measurement System) scans vehicles and cargo at their origin and at their point of shipment. Measures and transmits dimensional and weight data for tracking and load planning. Requires wheels or tracks and needs a unified tagging system.

RO/RO Ship Systems SOA:

- Even the fastest RO/RO ships still feed into poor infrastructures. It is a total system problem.
- RO/RO cargo is mixed.
- Statistics/productivity measures are not readily available because of variability of cargo.
- PCTCs (Pure Car and Truck Carrier) are loaded very quickly. Military rates are much slower. The PCTC is a fixed system designed for specific cargo that requires trained operators.
- Ferry operations for RO/RO usually drive cargo on the back and drive off front. This is ideal for ocean going RO/RO vessels. Typically the same ramp is used for load and unload. This minimizes ship design constraints but penalizes load and unload rates.
- Ramps are much faster than elevators. Elevators require maintenance and are less reliable than ramps. Elevators avoid turning radius problems and can help tanks and dozers with turning radius on PCTCs. Elevators eliminate space required for ramps.
- Spiraling ramps requires that the cargo/cargo handling units have a small turning radius. Spiraling keeps speeds low due to required turn arounds.
- Cascading ramps cost deck area.
- Stern ramps provide better maneuverability (turning radius) than side ramps. LMSR type side ramps are difficult to deploy.
- Military ramps are typically steeper than commercial ramps.
- Circus ramps are used to remove cargo from flatcar, otherwise the cargo is lifted off by devices such as mobile cranes.
- Vehicles are driven to the “first point of rest”.
- When the ship is in port, the cargo should be able to be driven directly to the ship.
- 500 pounds per square feet (psf) is the typical ramp load on a quay. New ramps can have a load sensing system so the ship can carry part of the ramp load.
- 500 psf is the nominal sealift uniform load for decks/ramps and is driven by the M1A1 tank.
- 110 psi is the nominal sealift wheel load for decks/ramps and is driven by the container handling forklift truck.
- 350 psf is the nominal sealift truck load for decks/ramps.

LO/LO Ship Systems SOA:

- Self sustaining ships are used where ports do not have modern handling equipment. In these cases all cargo handling equipment (cranes, ramps etc.) is onboard. These ships are useful in smaller ports commercially. The military pays a big penalty for self-sustaining ships, but they are useful in JLOTS and in damaged ports. Better methods are needed.

- Gantry/bridge cranes are used on some vessels. They are typically used on small feeder ships; Crowley uses in South American trade. The advantage is that large hatch covers can be handled.
- Pedestal/boom cranes are used on many self sustaining ships. In a port operation, these cranes reportedly produce 11 to 15 moves per hour. New cranes typically have a 50 lton capacity and can handle two full TEUs.

Military SOA:

- T-ACS (Auxiliary Crane Ship) offshore operation transfers containers from containerships to lighters alongside. Provides about two moves per hour per crane in the JLOTS environment. The entire ship to shore system limits the speed, not just the crane. Designed for four moves per hour per crane for four crane ship (300 containers per day per ship).
- Experimented with helicopters and airships, unproductive in past, must get cargo on deck first.
- Army CROP system, fits in container, use pallet loading truck to put in container, may be able to bypass containers.
- 30% of all military containers have HAZMAT (not ammunition); commercially HAZMAT is 10 to 15% of containers. HAZMAT separation rules complicate load planning and lift sequencing.
- Ammunition loaded on containerships in military TURBOCAD exercise.

<u>*Advanced/Innovative Concepts*</u>

LO/LO Ship Innovations:

- Multiload/unload multiple container packs
- Automated cranes - anti-sway, motion control technology
- New crane designs - elevator booms, dual hoist
- Lightweight containers - currently need to overall containers every 7 years; composite containers under development.
- Accurate chassis positioning
- Need to handle 40 and 45 foot containers for military. 45 foot containers can fit on deck in 40 foot container pick point locations. Military may use in contingency.
- Commercial road restrictions for containers over 40 feet

RO/RO Ship Innovations:

- Lightweight external/internal ramps - composites or LASCOR
- Lightweight chassis and cassettes
- Smart ventilation systems
- No cranes

- Eliminate labor intensive cargo restraint systems. Design ship so cargo restraints are not required. Provide movable bulkheads for cargo restraint and isolation of

HAZMAT.
- Move large quantities at once using modular loads/lego.
- Multi-lane access ramps, drive ‘em out
- Automated load/unload - cargo can drive itself on or off
- Get cargo off without turning it around. Maneuver cargo with minimum space. Options include drive through and automated cargo maneuvering devices. Turntables are inefficient. Better to have experienced drivers for unload, especially for tanks and truck trailers.
- Training simulators for vehicle drivers
- Interface with pier - Best to have a 90 degree interface (hard corner), can have a floating platform at port to lower ramp onto. Need to account for tidal variations. Ramps need to be able to change angle during load and unload. Better to have ramp downreach than upreach from ship to pier
- RO/RO cassettes are transportable platforms that hold multiple units of cargo. They can handle any payload, can be road worthy, and can be modified with wheels.
- Take cargo off ship and distribute it immediately, e.g. tractor/train with containers.
- Cargo arrives at POE as containers, is broken down and stowed on cassettes/pallets in automated systems.
- Provide means to prevent bottlenecks, e.g. accidents and vehicle breakdown.
- ITS (Intelligent Transportation Systems) - collision avoidance
- Don’t ship containers themselves. Use shrink wrap to weatherproof pallets. Use “air bags” to restrain cargo.
- Don’t ship vehicles empty - fill up vehicles with cargo and pass info to C^4I.
- Conduct RO/RO operations in greater than SS2. Use advanced causeway ferry and RO/RO discharge facility and motion controlled ramps.
- RO/RO barges
- Semi-submersible - tug w/ barge

Ship Types - Cargo Impact:

- Need easy and unobstructed loading and unloading.
- Wide, spacious cargo block preferred for RO/RO if turn around required.
- Catamaran
- SWATH (Small Waterplane Area Twin Hull) provides the best seakeeping so cargo securing is less of a problem. The deck area is wide open for cargo, propulsion and fuel can be below the water column, and is capable of ballasting easily. Could pick up floating/elevated cargo table/barge.
- Tri-maran and quad-maran can have a draft only about one meter.
- Catamaran, SWATH, tri-maran and quad-maran all have flat wide decks and are good for RO/RO. They typically have only one or two decks but are spacious; have a center ramp. They provide good maneuvering and easy loading and unloading.
- SWATH, tri-maran and quad-maran have high freeboards and high threshold levels making ramping difficult. Every meter height adds 10 meters of ramp length.
- Catamaran, tri-maran and quad-maran need to allow space for fuel and engines on decks.

- Surface Effect Ships (SES) have one long open cargo bay.
- Semi-planing hulls are similar to conventional ships. They are long and thin and have multiple decks requiring ramps, e.g. Fastship Atlantic, which has a rail driven internal loading system, and Bathmax 1500.
- Cargo needs to be secured in all cases.
- Modular motherships/lego ships carry large modular units such as lighters, barges, warehouses and causeways.
- Unmanned helicopters can capture modules off a ship's deck. They should be integrated with automated modular handling/stowage systems on ship. Can deliver directly to beach or units inland.

Automation - Ship and Port:

- Use infrastructure advantages at POE to take pressure off of POD, load at POE so unload is most efficient at POD.
- Just In Time (JIT) loading of vessel
- Eliminate staging at port, load trains at fort so they can be directly unloaded onto the ship.
- Expand U.S. infrastructure - more rails, more roads, more "capacity"
- Terminal and shiploading system for Fastship Atlantic involves the Container Terminal System in which CPTrains are pre-loaded with export cargo before Fastship arrival. There are 18 lanes that can load a ship in 4 hours. The Container Pallet Transfer System involves gantry cranes in the terminal that load containers onto platforms. Rail cars go under the platforms to pick the containers up. The design throughput is 750 TEU per hour.
- DART (Direct Acquisition Rail to Train) involves load and unloading a ship directly from rail. Includes side shift and video assist to train engineer.
- GRAIL (Grid Rail) system involves an overhead automated system with a shuttle on a monorail that goes anywhere in the terminal.
- Chassis positioning system has a computer, video camera on crane and message sign.
- Stereovision for Navy being developed to assist crane operators.
- ASPH (Automatic Seaborne Pallet Handling System) involves the PLS (Palletized Loading System) with stacker crane. This is an automated pallet/module handling and stowage system designed for reefer ships.
- AGV (Automated Guided Vehicles)
- Advanced mooring systems

JLOTS:

Logistics Over-The-Shore (LOTS) operations involve the loading and unloading of ships without the benefit of fixed port facilities in either friendly or undefended territory and, in time of war, during phases of theater development. LOTS operations are conducted over unimproved shorelines, through fixed ports not accessible to deep draft shipping, and through fixed ports that are not adequate without the use of LOTS capabilities. JLOTS are LOTS operations conducted jointly by forces of two or more service components or by a unified command.

Currently, LOTS operations cease in low sea state 3 conditions (Pierson-Moskowitz sea spectrum). The JLOTS Master Plan is currently addressing the critical issues required to provide a sea state 3 capability. The following reviews ideas and improvement concepts discussed related to JLOTS operations.

- Avoid it.
- CBR environment required.
- Third world ports are not useful, must be improved "instantly" using technology brought to the site.
- Addresses how to get container/cargo off ship 2 miles offshore in SS4 (future)
- Carry cargo in barges used for other purposes, improves efficiency.
- Can break down cargo to pallet sizes to ease distribution into the field.
- Transport preloaded self-propelled modules that are lighters that go to or onto shore. The module could be part of the hull. The hull is like a straddle carrier that can host modules.
- Need fast deployment of JLOTS delivery equipment/lighters. Require dedicated fast ship(s). Must be there first.
- May need more JLOTS prepositioning.
- Helicopters to transport containers or smaller loads. Had problems in past but has future possibilities, e.g. unmanned K-max variant.
- RO/FO (roll on/fly off) ship has well deck in RO/RO ship and can transport LCACs.
- Robotic cranes
    - Robocrane is based on the Stewart platform.
    - AACTS (Automated All-weather Cargo Transfer System) is an offshore container handling system with a rigid robotic crane that has a flexible end effector.
- Agile spreader bars such as the ISB (Intelligent Spreader Bar) being developed by CDNSWC. The spreader can move in six degrees of freedom to track and acquire/place cargo to/from the decks of moving vessels.
- Replace cranes - FLO/FLO (Float on float off), slide on/slide off, overhead conveyance to replace ELCAS and T-ACS.
- Large diameter flexible peristaltic hose to "inchworm" or "blow" dry cargo modules to beach, on or under the water.
- High speed barges used to carry cargo and "morph" into causeways.
- LSQ/C (Landing Ship Quay) is a causeway carrying tanker that grounds itself offshore and deploys the causeway.
- Overhead conveyance - SORDS (Sealift Overhead Rapid Delivery System) is similar to the LSQ/C, it eliminates surf issues and deploys the causeway to the beach.
- Rapidly Deployed Pier is similar to LSQ/C but the pierhead is floating.
- Relative motion control systems - anti-sway/pendulation, vertical motion compensation
- Fast lighters (with cargo) delivered by fast ship. ISO modular capable.
- Convoys of lighters - ROV or autonomous
- Quad hull could get close enough to shore to use ramp (no lighters needed).

- Variable draft handy-size Techship has deployable sponsons and employs a stowable inflatable causeway that is deployed with a rail system. Goal is two hours to deploy the causeway and unload cargo.
- Send in SEALS to blow channel to beach so vessels can get closer to shore.
- RIB (Rapidly Installable Breakwater) provides a lee for ship discharge and lighter operations.
- Artificial islands
- RTCC (Rough Terrain Container Carrier) is a straddle lifter that handles 20, 40, and 45 foot containers.
- Load at stern and offload at bow. Vessel with low draft can move near beach and deploy ramp (behind door).
- Store ramp under cargo train pedestals, e.g. the Fastship Atlantic loading system.
- Decision and planning tools to determine the best equipment required for a specific deployment, including the "best place to land".
- Personnel considered cargo - live in containers.

Staging:

- Pallet loading trucks - slide out cargo from containers; smaller loads, easier to move on small roads.
- Prestaging, planning, stow planning, resource planning, simulation
- Minimize retrograde - use disposable containers, once empty they vanish; figure out uses for empty containers.

C^4I:

- Intelligent Terminal Management Software - expert systems/automated planning tools to control tracking, parking, staging, stacking, loading, stowing, planning, managing, HAZMAT. Provide real time inventory and traffic management.
- System of systems - global information systems should control future flow of containers.
- Automatic/intelligent cargo location system - "active" tag sends a signal where it is. Find out where the cargo is located in real time; must work in stacks. Ned Lloyd tracked 500 reefers from Chicago with active tags and had a 60% increase in turnaround time
- Asset utilization
- Tightly coupled communications
- Contingency expert
- Electronic training/maintenance assistance

High Speed Ship Predictions:

The following provides guidance, from a cargo handling and load/unload perspective, on characteristics, features, and aspects of the future high speed sealift ship. Where numbers are presented, they are intended to be approximate characterizations and not requirements or specifications.

- Payload Density - 300 to 450 cubic feet per ton on a single deck; nominal sealift cargo density is about 130 pounds per square foot.
- Handling System - no cranes needed on high speed sealift ship; no hatch covers; need ramps.
- Weights
    - 100 to 150 tons per external ramp (steel)
    - 75 to 80 tons per internal ramp (steel)
    - 75 tons per external ramp (lightweight material, composite or LASCOR)
    - 40 tons per internal ramp (lightweight)
- Volume - 4000 cubic feet per stern ramp
- Power - 200 hp per external ramp
- Number of external ramps - 2 per deck (bow & stern)
- Number of internal ramps - 1 per deck
- Number of turntables - None
- Integration with hull - Pedestals, rails and tiedowns should be integrated with the deck. Keep vehicle decks as clear as possible (no stanchions, ducts, etc. interference).
- Throughput capability - 5,000 tons
    - POE - 2 to 4 hours load/unload
    - POD - 2 to 4 hours load/unload if ramp interface is available
    - JLOTS/degraded port operations
        - Fast speed RO/RO with ramp to shore: 8 hours in SS3 (assumes no preparation time)
        - Fly up on shore - 2 to 4 hours (once on beach)
        - Offshore - up to 3 miles
            - JMLS (Joint Modular Lighter System) - ½ to 1 day in SS3
            - Self contained lighters/modular ship - 12 hours in SS3
- Sea state limits - SS4 (far-term goal)
- Manning - none dedicated - assumes vehicle personnel available at POD and technicians needed for cargo equipment are provided by ship.
- Dependency on other shipboard resources - none
- Packaging flexibility - containers, pallets, vehicles, lighters, cassettes, other modules
- Infrastructure requirements - open, rectangular cargo space and ramp capable port
- Selective offload capability and cargo accessibility - Assume total offload therefore selective offload not needed. There is a high penalty for selective offload. The automatic pallet system is an example of random access.
- Seaway imparted loading - yes
- Ancillary system requirements - e.g. HVAC etc.
    - If drive on drive off high HVAC
    - If slide on slide off low HVAC (preferred)
    - Assume no reefers for military (likely needed commercially)
- Information requirements
    - Loadout plan/stow plan
    - POD/POE infrastructure

- Ship characteristics for cargo loading, HAZMAT, reefers and securing

Conclusions:

Cargo handling technology can meet the high speed sealift ship need. Cargo handling should be the foundation of the ship design, i.e. the ship needs to be designed around the cargo handling system. Cargo handling requirements must be fully integrated into the ship design.

An incredible array of applicable products, prototypes and concepts exist today in the field. But these are often isolated ideas not fully developed and deployed in industry. The whole system design team must work together to identify the most applicable technologies. Commercial logistics technology can handle the CONUS side. This technology must be applied to military needs. Advanced infrastructure at the POE should be used to reduce the burden on the POD which may be substandard, damaged or not there.

The preferred high speed sealift ship, in terms of load/unload considerations, should have: a low draft for direct beach RO/RO access; floating/flexible ramps for beach access; cargo loaded and unloaded in multiple units; and modular cargo (less than container sized) may be useful for ship automation, selective offload and in-theater distribution. A modular ship employing loaded lighters is an alternative. The first ship(s) at the site may need to carry POD port improvements and/or JLOTS equipment.

In summary, a high speed cargo transportation system, not just a high speed sealift ship, should be designed and implemented.