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Research Report

Developing Navy Capability to Recover Forces in Chemical, Biological, and Radiological Hazard Environments

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Prepared for the Office of the Secretary of Defense

NATIONAL DEFENSE RESEARCH INSTITUTE

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Summary

The mission to recover amphibious forces can be complicated if ashore forces come under attack from enemy weapons, particularly chemical, biological, or radiological (CBR) weapons. If ashore forces are attacked with CBR weapons, they may become contaminated and pose a cross-contamination risk to other forces with whom they come in contact. If contaminants spread to equipment and vehicles, creating persistent hazards, these items may pose an additional cross-contamination risk. Among the potential agents that may be used in CBR weapons, persistent liquid and solid chemical agents present the greatest challenge for physical decontamination.

Navy military capability will be compromised as ships' resources are dedicated to recover contaminated ashore forces. The personnel dedicated to the recovery mission will be directed away from their other responsibilities. Areas of ships used in the recovery mission will be unusable for other activities during the recovery process, and for the duration until they are determined to be free of any potential contaminants. Navy capability will be further degraded as personnel who are injured by CBR agents become casualties, and as conventional casualties become contaminated with CBR agents that exacerbate their underlying medical conditions.

In 2010, a series of tabletop exercises[1] conducted by the Navy revealed specific issues in Navy doctrine and capabilities related to transporting contaminated forces from land to the sea base and decontaminating contaminated forces aboard ships. Although the preference is to decontaminate ashore forces in the operating environment or in a clean area elsewhere on land, this is not always feasible. Thus, it is necessary for the Navy to have effective capabilities to recover and decontaminate affected forces aboard ships. Participants in the exercise expressed concern that the Navy lacked clearly defined capabilities to recover contaminated forces. Issues of concern included the following:

1. Which amphibious assault ship should receive contaminated forces?
2. Which connector is best to go ashore and bring forces back to the sea base?
3. What procedures should be used to decontaminate the forces when they arrive aboard the ships?
4. What is the prognosis for connectors and ships returning to full military capability in support of the mission?
5. Will the ships be required to return to port for reconstitution?

To address the capabilities identified in these exercises, researchers from RAND National Defense Research Institute (NDRI) were contracted by OPNAV N81 to assess current policies and capabilities pertaining to the recovery and decontamination of ashore forces and to identify

[1] Naval Surface Warfare Center Dahlgren Division (NSWCDD), Navy Craft CBRN Survivability TTX Status Report May 2010.

policy options the Navy could pursue to better perform this mission. RAND designed a study addressing the Navy capabilities required to perform the following amphibious mission functions:

- Transport contaminated and injured forces from shore to ship
- Decontaminate and treat litter-bound casualties at the sea base
- Decontaminate ambulatory and uninjured forces
- Return ships and transports to full mission capability.

Current Navy processes and measures of capability were documented on the basis of current military guidance and interviews with service members. Some aspects of Navy capability, such as the time necessary to transport contaminated forces from shore to ship using each of the connectors in the study, were calculated using basic spreadsheet models populated with numerical data derived from current guidance, Navy damage control crew interviews, and basic assumptions. No operational tests of capability were performed in this study.

The ashore force used in this analysis was a Marine Expeditionary Unit, which consists of approximately 3,000 Marines—all of whom were assumed to be ashore during the mission. Of this group, the study assumed that 10 percent of the force was contaminated during operations, requiring recovery to a sea base for decontamination.[2] In addition, 100 of those contaminated were also wounded in action with conventional injuries. The recovery operation involved 300 total contaminated service members, including 24 contaminated litter casualties and 75 contaminated ambulatory casualties. This is a robust but realistic scenario against which to measure the Navy's capabilities.

The study design considered alternatives for both the receiving ship and transport vehicles. It evaluated recovery to an amphibious assault group composed of Landing Helicopter Dock (LHD), Landing Platform Dock (LPD), and Landing Ship Dock (LSD) ships. Connectors analyzed for the recovery mission to transport forces from land to the sea base included the CH-46 Sea Knight, CH-53E Sea Stallion, MV-22 Osprey, Landing Craft Air Cushion (LCAC), and Landing Craft Utility (LCU).

The study began with an assessment of current Navy decontamination processes and capabilities. Then, using the assumptions outlined above, it evaluated steps that could be taken to increase capabilities.

Methods to Increase Navy Capability

The assessment of current Navy capability was structured around four amphibious mission functions—transporting forces, receiving casualties, decontaminating forces, and returning ships to full mission capability. After evaluating existing capabilities it was determined that the Navy

[2] U.S. Army Medical Department Center and School (USAMEDDC&S), *Multiservice Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment*, FM4-02.7/MCRP 4-11.1F/NTTP 4-02.7/AFTTP 3-42.3, July 2009.

could develop procedures to increase its throughput to recover contaminated forces by staging expedient decontamination stations and showers.

In addition, it appears that the Navy lacks a decision process for responding to a recovery mission involving CBR contamination. Once it is known that forces must be recovered, the operational commander must immediately determine what amphibious assault ship should receive contaminated forces, what connector should be used to transport forces, what procedures are required to decontaminate the forces when they arrive aboard their ship, and what decontamination processes are needed for the connectors and ships themselves.

Which amphibious assault ship should receive contaminated forces?

To minimize the opportunity cost to the battle group, forces should be recovered to one amphibious assault ship if possible. Of the amphibious assault ships in this study, the LHD has the most medical department resources[3] and should be considered to receive contaminated forces when necessary.

Which connector is best to go ashore and bring forces back to the sea base?

The selection of a connector depends on the number of forces to be recovered and how many require medical care. In cases where casualties require urgent medical attention, it is recommended that aircraft be used to recover forces—because the difference in transport time could well affect the lives of those injured. When the number of contaminated forces exceeds the passenger capacity of a single craft performing a single sortie, it is recommended that the next-largest connector be used. This policy will generally enable all forces to leave the shore as quickly as possible in a single sortie, and will minimize contamination to craft. However, operational factors may support using multiple sorties. In cases where casualties require urgent medical care and the number of forces to recover exceeds aircraft capacity, an aircraft is recommended to recover casualties and a landing craft to recover the balance of forces.

What procedures should be used to decontaminate the forces when they arrive aboard the ships?

Developing capability to increase throughput to decontaminate forces represents the greatest opportunity for the Navy to increase its capability to recover contaminated forces. *RAND recommends that the Navy increase its ability to decontaminate litter patients by staging expedient deck decontamination station*s *and expedient decontamination showers*. Doing so increases the throughput rate for patient decontamination and keeps contaminants toward the downwind aft section of amphibious assault ships, expediting the process to decontaminate ships and return them to full military capability. This process also keeps liquid and vapor hazards away from the fore sections of the ship, so that a vapor hazard buffer may be established and flight

[3] Department of the Navy, *Contingency Fact Book*, Washington D.C., Bureau of Medicine and Surgery, 2006a.

crews and other ship's crew may operate without Joint Service Lightweight Integrated Suit Technology (JSLIST) gear.

Patient Decontamination Station

Staff on amphibious assault ships should construct expedient deck patient decontamination stations. Using tables and tarps, ships' crew members can construct a three-stage process in which litter bearers or other crew members cut patients out of their protective gear and decontaminate patients while medical department representatives inspect patients to ensure that they are decontaminated.

If conditions permit, staging these expedient deck patient decontamination stations on the aft of the flight deck, in close proximity to where casualties have been recovered by aircraft, is preferred. On the aft section of the flight deck, liquid hazards carried with contaminated forces will remain on the surface of the flight deck and can easily be washed with the ship's Countermeasures Washdown System (CMWDS) after patients have been decontaminated and the aft flight deck is cleared.

Keeping contaminants aft of the superstructure on LHDs will allow continued operations on the fore sections of the ship, including flight operations. As such, flight operations can continue without requiring service members to wear protective gear. Additionally, if no hazards are detected, crew may enter and exit the interior of the ship without using decontamination stations.

Ambulatory and Uninjured Personnel Decontamination

Damage control staff are currently trained to perform personnel decontamination by setting up a contamination control area in close proximity to where forces enter the ship. After removing recovered forces' outer gear and outer garments, damage control crew escort them along a marked path toward the existing personnel decontamination stations and use the stations to process the contaminated forces. By establishing expedient showers near the area where forces board an amphibious assault ship, the Navy can gain capability by keeping liquid and vapor contaminants from permeating throughout the ship, and can perform personnel decontamination much more quickly.

In the case where ambulatory and uninjured forces arrive on the aft section of the flight deck, fire hoses outfitted with fog nozzles that reduce pressure to around 60 pounds per square inch can be used as showers.[4] Showers should be directed so that contaminated runoff drains off the ship. After showering, service members can walk upwind toward the fore section of the flight deck and the superstructure, into an area free of hazards. With this procedure, all liquid and vapor hazards remain on the aft section of the flight deck and do not interrupt operations in other areas of the ship.

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[4] U.S. Army Soldier and Biological Chemical Command (SBCCOM), *Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Agent Incident*, ECBC-TR-125, January 2000.

In the case where forces are recovered and arrive via landing craft in the well deck, damage control crew can stage expedient showers using either the well deck sprinkler systems or fire hoses and fog nozzles to create mass showers, as recommended in Army guidelines for civilian emergency response.

If wind generated through the well deck exits from the aft section of the ship, the area forward of the well deck—which includes the lower vehicle area and the balance of the ship—is beyond the vapor hazard area. Medical department staff should meet recovered forces beyond the vapor hazard area to monitor their health and ensure that they are free of contaminants. Here, ships' crew can work free of protective gear, including gas masks, as long as there is no detectable vapor hazard present.

The Army guidelines recommend that approximately 100 persons per hour can process through an expedient shower area ten feet in width. By extension, a shower area three times that width that is established in the well deck of an amphibious assault ship can be conservatively estimated to process 300 service members in an hour.

Implementing expedient deck patient decontamination stations and expedient showers can increase ships' decontamination throughput from twelve litter patients per hour to 36 litter patients per hour, and from 60 ambulatory personnel per hour to 300 ambulatory personnel per hour.

What is the prognosis for connectors and ships returning to full military capability in support of the mission?

If contaminated patients are brought to existing patient decontamination stations, contaminants will be brought within the skin of the ship. When litter-bound casualties are decontaminated in expedient deck patient decontamination stations staged on the flight deck, contaminants are kept out of interior spaces. Ships' crews must be assured that CMWDS will effectively remove contaminates as quickly as they are capable.

Landing craft can generally be decontaminated more easily than aircraft. Selecting landing craft to recover contaminated forces can ease connector decontamination.

Will the ships be required to return to port for reconstitution?

Using CMWDS to remove contaminants from ships' exterior surfaces, and decontaminating interior spaces with high-test hypochlorite solution, ships' damage control crew can thoroughly decontaminate ships so that they can continue their mission without returning to port for decontamination. However, ships face a persistent threat of cross-contamination when recovered forces have been infected with biological agents. In order to remain at sea without returning to port to offload contagious passengers, ships must plan to isolate them from the uninfected crew. The Navy is able to manage biological hazards requiring standard and contact precautions using current medical department capabilities aboard amphibious ships. The precautions necessary to prevent cross-contamination for hazards requiring airborne precautions pose a challenge for

Navy ships. Options exist to prevent airborne biological hazard cross-contamination, which are discussed in further detail in the body of the report.

Conclusions

The Navy's capability to recover contaminated and injured forces to the sea base during amphibious missions is limited by two primary factors. The first is lack of an efficient process to evaluate the operational environment and identify connectors and ships based on transportation requirements for the recovery operation. The second is a limitation in the capacity and throughput to recover contaminated personnel onboard ships. To improve Navy capability, this study makes the following recommendations:

1. Develop a decision process for recovery operations. Once it is determined that contaminated forces will be recovered to the sea base, the operational commander must quickly decide which ship(s) will receive the contaminated forces and how the forces will be transported to the ship. These decisions are based largely on the number of forces to be recovered and the extent and nature of casualties. In addition, the requirements for and location of decontamination operations must be determined, with the primary goal of reducing the spread of contaminants.

2. Employ expedient deck decontamination processes aboard amphibious assault ships to increase personnel decontamination throughput per hour. Set up expedient patient decontamination stations on the flight deck and expedient showers in the well deck. Such a configuration will speed decontamination, minimize the areas where JSLIST gear must be worn, and decrease the time required to thoroughly decontaminate and return the ship to full military capability.

Implementing these recommendations will require some change in DOTMLPF (doctrine, organization, training, materiel, leadership and education, personnel, and facilities). Primarily, the Navy needs to amend doctrine to strengthen guidance in these areas, and train its forces to be familiar with and proficient at performing recovery operations. Minor changes are also needed to organization, materiel, and personnel. But overall, implementing these recommendations is well within the Navy's reach, as additional costs in terms of needed materiel and personnel are nominal.

The Navy has included operations to recover amphibious forces in CBR environments in recent tabletop exercises and in studies sponsored by RAND and CNA to address this mission (see McGrady, 2010). Isolating contagious service members has been studied at even greater length.[5] If the Navy incorporates such scenarios in its planning requirements, it could address its gaps in capability by implementing recommendations from this study.

[5] Joint Requirements Office for CBRN Defense, *Shipboard Isolation and Quarantine Concept Experiment Final Report*, May 2011, not available to the general public.