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14. ABSTRACT

Sea-based operations have been called a critical future capability for the United States military. Sea-based operations will greatly diminish the logistical footprint of combat service support elements, including health services support (HSS). In order to provide combat casualty care from a seabase, Navy Medicine has developed or is developing Forward Resuscitative Surgical Systems (FRSS), En Route Care Systems (ERCS), and Level III medical treatment facilities (MTFs) aboard future Maritime Prepositioning Force [MPF(F)] ships. This paper examines the strengths and weaknesses of these developments and their impact on combat casualty care. The author concludes that in reducing its footprint to become more sea based, Navy Medicine may inadvertently over-reduce its casualty holding capacity. This will make HSS more dependent on aeromedical evacuations, which have heretofore been provided to Navy Medicine by lifts of opportunity. The author recommends that a modest casualty holding capacity be retained ashore and that dedicated air ambulances be assigned to provide aeromedical evacuations from naval MTFs. In addition, a sea-based heavy lift aircraft will have to be developed to clear the seabase of combat casualties during armed conflicts with high casualty rates.

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HEALTH SERVICE SUPPORT FROM THE SEABASE

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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14 May 2004

Abstract

Sea-based operations have been called a critical future capability for the United States military. Sea-based operations will greatly diminish the logistical footprint of combat service support elements, including health services support (HSS). In order to provide combat casualty care from a seabase, Navy Medicine has developed or is developing Forward Resuscitative Surgical Systems (FRSS), En Route Care Systems (ERCS), and Level III medical treatment facilities (MTFs) aboard future Maritime Prepositioning Force [MPF(F)] ships. This paper examines the strengths and weaknesses of these developments and their impact on combat casualty care. The author concludes that in reducing its footprint to become more sea based, Navy Medicine may inadvertently over-reduce its casualty holding capacity. This will make HSS more dependent on aeromedical evacuations, which heretofore have been provided to Navy Medicine by lifts of opportunity. The author recommends that a modest casualty holding capacity be retained ashore and that dedicated air ambulances be assigned to provide aeromedical evacuations from naval MTFs. In addition, a sea-based heavy lift aircraft must be developed to clear the seabase of combat casualties during armed conflicts with high casualty rates.

ACKNOWLEDGEMENTS

This paper is the result of my independent research, but it would not have come to fruition without the invaluable assistance of others.

First and foremost I thank Arthur M. Smith, MD, an active professor of surgery (urology) and a retired Navy medical corps captain, for encouraging me to investigate Navy Medicine's casualty care plans in support of future sea-based operations, and for sharing personal correspondence and outcome data from surgical colleagues who served in Operation *Iraqi Freedom*. In addition, I thank Captain Tim Thompson, MSC, USN, and Commander Sara Marks, NC, USN, Doctrine Department of the Navy Warfare Development Command, for helping me formulate my initial understanding of future concepts of health service support from the seabase, and for inviting me to observe medical war games and workshops designed to test these concepts. I also appreciate the information and references provided by Commander Corley Puckett, MSC, USN, from the Marine Corps Combat Development Command, especially as they pertain to medical care ashore and en route care to and from future seabases. I also thank Rear Admiral Don Arthur, who has been nominated to be the 35th Surgeon General of the Navy, for sharing his strategic vision of Navy Medicine's answer to the challenges in providing health service support from the seabase. Finally, I thank Professor Paul Romanski, Joint Military Operations Department at the Naval War College, for sharing his primer on sustainment logistics and for his editorial review of the manuscript.

The paper is a better product because of their expert input. I take responsibility, however, for any factual errors that may appear due to my misunderstanding or misinterpretation of any information they may have shared with me. *DAL*

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Introduction

Sea basing has been called a "critical future joint military capability for the United States" because it offers a mobile, reliable and secure environment from which to operate when suitable fixed bases are not available.[1] While sea-based operations may "…use revolutionary information superiority and dispersed, networked force capabilities to deliver unprecedented offensive power, defensive assurance, and operational independence to Joint Force Commanders,"[2] by their very nature seabases present significant obstacles to health services support (HSS), particularly in providing combat casualty care in support of operational maneuver from the sea (OMFTS). Accordingly, this paper argues that these obstacles could preclude Navy Medicine from providing combatant commanders (COCOMs) with adequate combat casualty care in the field and at the seabase during expeditionary operations with high casualty rates.

Sea Basing Basics

The 2001 Quadrennial Defense Review directs the Department of Defense to develop sea basing capabilities as a means to project and sustain forces. The Chairman of the Joint Chiefs of Staff's *Joint Vision 2020*, the Navy's *Sea Power 21 Series*, and *Marine Corps Strategy 21* provide the collective vision to achieve this capability. A seabase is intended to be a sovereign, maneuverable "system of systems," designed to allow direct seaborne assault on inland objectives across the entire range of military functions, including offensive and defensive fires, maneuver, command and control, and logistics. In other words, the seabase will be a launch pad from which expeditionary forces enter areas of operations, and then will

[1] Defense Science Board, Final Report of the Defense Science Board Task Force on Sea Basing, (Washington, DC: August 2003), vii-viii.

serve as the principal source of support and sustainment for those forces until ports and airheads have been secured and adequately defended.[3] The main conceptual difference between sea basing and current amphibious doctrine is that the seabase will provide for rapid movement directly from the seabase to the objective (e.g. ship-to-objective-maneuvers [STOM]) without the need for a buildup of combat power, materiel, and reinforcements ashore.[4] This will reduce the vulnerability and increase the maneuverability of U.S. forces by minimizing the reliance on a diminishing number of overseas bases and by reducing the need for a large, cumbersome logistic footprint ashore. Health Services Support—commonly referred to as "medical"—has heretofore been considered a part of the shore-based logistic footprint.

Health Services Support (HSS) Primer

Joint doctrine provides that battlefield casualties flow through five phases of treatment: first responder, forward resuscitative surgery, theater hospitalization, en route care, and care outside the theater.[5] The HSS infrastructure, therefore, is structured with five echelons or levels of care to support this continuum.[6] The five levels include:

I. Self-aid, buddy aid, and emergency lifesaving skills
II. Physician-directed resuscitation, stabilization, emergency procedures, and forward resuscitative surgery
III. Advanced resuscitative care requiring hospitalization including surgery, postoperative management, and initial restorative procedures
IV. Rehabilitative and recovery therapies

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[2] Vern Clark, "Sea Power 21 Series—Part I: Projecting Decisive Joint Capabilities," U.S. Naval Institute Proceedings (October 2002): <http://usni.org/Proceedings/Articles/PROcno10.htm>, [25 March 2004].
[3] Defense Science Board, 16-21.
[4] Ibid, 22.
[5] Joint Chiefs of Staff, Doctrine for Health Services Support in Joint Operations, Joint Publication 4-02, (Washington, DC: 30 July 2001), I-4.
[6] Some references refer to echelons of care while others refer to levels of care. In this paper the terms will be used interchangeably.

V. Definitive care, including the full range of acute, convalescent, restorative, and rehabilitative services[7,8]

From an operational commander's perspective it is important to realize that mobility decreases substantially as HSS capability increases from Level I to Level V. Level I care, for example, is provided at mobile battalion aid stations ashore and in sickbays aboard ship. Transportable medical/surgical companies have Level II capabilities, as do aircraft carriers and other designated primary and secondary casualty receiving and treatment ships (CRTSs)[9]. Modular fleet hospitals in the combat zone (CBTZ) and deep draft, T-AH class hospital ships have Level III capabilities, which are also found at fixed-base hospitals and deployable fleet hospitals in the communications zone (COMMZ). These latter assets can also be equipped and staffed to provide Level IV care. By doctrine and practice, Level V capabilities are normally only available at military and civilian medical centers in the continental United States (CONUS).

In contrast to decreased mobility, the patient holding capacity and logistical footprint of HSS increases as casualties advance through the levels of care. A battalion aid station, at one end of the spectrum, is an integral part of the unit it supports, and is staffed with a medical officer and a small team of hospital corpsmen. It can be set up in moments and is immediately capable of providing emergency care for a few casualties at a time. But because it has no holding capacity, patients must be either immediately returned to duty or evacuated to a higher echelon of care. A surgical company, on the other hand, takes about a day to set up, can perform initial resuscitative surgeries and administer blood products,[10] and has a

[7] Chief of Naval Operations, Operational Health Services Support, NWP 4-02 [formerly NWP 6], (Washington, DC: August 1995), 1-5, 1-8.
[8] Joint Pub 4-02, II-1-II-5.
[9] Primary CRTSs include the big-deck amphibious assault ships of the LHA- and LHD-classes. Secondary CRTSs include the LPD-, LSD-, and LCC-class warships. (NWP 4-02, Chapter 5).
[10] Blood products are specifically mentioned as a metric of logistical complexity. They must be kept continuously refrigerated, in which case they have a limited shelf life, or kept frozen in which case they require

limited holding capacity of 50-60 patients. At the other end of the spectrum is the deployable fleet hospital. It takes a week or more to construct the 250-bed variant, which has a staff of more than 550 medical and support personnel and is capable of providing major surgeries, post-operative care, and intensive/critical care for a large numbers of casualties. [11]

Although the practice of medicine has kept pace with "state of the art" technology at all levels of operational HSS, the current continuum that takes a patient from the point of wounding to a final medical disposition (i.e., return to duty or not) via echelons of increasing medical complexity has its roots in the medical-surgical practices and the methods of evacuation of the World War II era. And while the intra-theater Level II and III facilities have the specified holding capacities, a casualty's length of stay at a given level is determined more by COCOM-established theater evacuation policies and the availability of evacuation resources than by clinical factors. During Operation *Iraqi Freedom* (OIF), for example, the evacuation policy was one week, even though there was ample bed capacity to care for patients longer, with roughly 1,000 hospital beds at fixed and deployed MTFs in both the Central Command and European Command theaters (not including the 1000-bed hospital ship, *USNS Comfort (T-AH 20)*, which was operating in the Persian Gulf). Casualties were light in OIF and the HSS system had considerable excess capacity. More than 90 percent of patients evacuated to Level II/III MTFs in the COMMZ were further evacuated to CONUS on the next available evacuation flight, with no apparent direction from

special handling during reconstitution and thawing. Blood and blood products are a critical component of Level II HSS and are rapidly consumed when caring for battlefield casualties.

[11] Depending on their configuration fleet hospitals have the capacity to hold 116, 250, or 500 patients. The 116-bed version is more correctly called an expeditionary medical facility (EMF).

the COCOM to return any to the CBTZ.[12] The aeromedical evacuation system was the rate limiting step.[13]

Health Services Support Concepts for Sea Basing and OMFTS

By concept and definition, sea-based operations and OMFTS will require a smaller, more mobile logistical footprint ashore. In turn, expeditionary HSS assets will have to be smaller, more agile, and "be able to operate from austere sites at sea or on shore and to smoothly transition between the two."[14] In response to these requirements, for example, it is envisioned that HSS forces will provide only *essential care* in theater using specially trained non-physician medical personnel (i.e. hospital corpsmen and medics) at the site of injury or wounding, followed by forward resuscitative surgery as close as practical to the battlefield, followed by rapid evacuation out of the theater for more definitive care.

Until recently *essential care* has been defined as "the care received within a theater that is dependent on the mission, enemy, terrain, troops, time available, and other civilian considerations."[15] Forward-deployed MTFs have often used this definition as the rationale for providing all medical/surgical care that was clinically indicated, that they were capable of providing, and that was consistent with the tactical situation. In future sea-based operations where casualty holding capacity will be substantially reduced, *essential care* will mean "resuscitative care and en route care as well as care to either return the patient to duty (within the theater evacuation policy) or begin initial treatment required for optimization of outcome,

[12] David J. Smith (CAPT, MC, USN) and Patrick J. Kelly (CAPT, MSC, USN), "Casualty Care in the Communications Zone," Lecture, TRICARE Europe Medical Conference, Naples, Italy: 27 May 2003.
[13] Ibid. (Note: Fleet Hospital Eight was a 250-bed MTF deployed to Rota, Spain during the major combat operations phase of OIF. It reached a peak patient census of 127 only once, and its average census was 51 patients.)
[14] Navy Warfare Development Command and Marine Corps Combat Development Command, Concept of Naval Force Health Protection for the 21st Century, (Newport, RI: In Press, draft dated 6 November 2003), 2.
[15] Joint Pub 4-02, GL-5.

and/or stabilization to ensure the patient can tolerate evacuation to the next level of care."[16] This brand of essential care will necessarily lead to "stabilized—*but not necessarily stable*—patients being evacuated"[17] outside the theater for definitive treatment [emphasis added]. In other words, the excess capacity of the current system will be traded for more rapid stabilization and evacuation.

To implement this change in HSS doctrine will require casualty care innovations—including some that are, at best, under development. They will need to be implemented along the entire casualty care continuum, from the point of wounding to military medical treatment facilities (MTFs) in CONUS. Thus, the remainder of this paper critically examines several of these innovations that, I believe, will serve as vital operational nodes in the delivery of HSS: forward resuscitative surgery, evacuation of casualties to and from the seabase, and in-theater care.

Forward Resuscitative Surgery

For reporting purposes casualties are categorized according to type and status. The major headings include: killed in action (KIA), died of wound(s) received in action (DOW), wounded in action (WIA), and disease and nonbattle injury (DNBI).[18] Casualties are considered KIA if they are "killed outright" or die "as a result of wounds… before reaching a medical treatment facility."[19] Since 90 percent of battlefield deaths are classified as KIA, most due to uncontrolled hemorrhage, minimizing the time to treatment for these patients is critical, and a delay of a few minutes in receiving care can mean the difference between life

[16] Joint Chiefs of Staff, Force Health Protection in the 21st Century Capstone (Washington, DC: In Press, draft dated 03 July 2003) 42.
[17] Ibid, 28-32.
[18] Joint Pub 4-02, GL-4.
[19] Ibid, GL-8.

and death. First responders and aid stations providing Level I care lack the capabilities to provide adequate care for most wounded patients with active bleeding. They need surgery STAT! (This statement may be more controversial than it appears. One published report, for example, in an internationally respected peer-reviewed medical journal by a physician with the International Committee of the Red Cross, reviewed survival data from more than 10,000 casualties from recent wars and concluded that many patients "…even with severe injuries do not necessarily require surgery" for many days or even weeks to survive.[20])

Until recently, surgical companies (elements of a medical battalion) were the only source of organic Marine Corps medical support above the battalion aid station level, and the most forward-deployed source of Level II surgical capabilities. Because they have limited capacity[21] and are vital links in the medical evacuation chain, Marine Corps doctrine states they "should be located, whenever possible, in close proximity to an airfield capable of casualty evacuation by fixed-wing aircraft."[22] While this doctrinal policy may be necessary to prevent saturation of a unit's bed capacity and ensure adequate force protection, it is counter to both optimal medical management, as noted above, and to the emerging doctrine of health service support for sea basing and STOM.

The Forward Resuscitative Surgery System (FRSS) was recently developed to take *essential* Level II surgical care as close to the forward edge of the battle area (FEBA) as possible, and keep it close despite the rapid tactical advances of expeditionary maneuver warfare elements. Six FRSS teams were fielded during the major combat operations phase of

[20] R. M. Coupland, "Epidemiologic approach to surgical management of the casualties of war," British Medical Journal (June 25, 1994): 1693-1697.
[21] A medical battalion has up to 260 holding beds. It includes eight shock-trauma platoons with 10 triage beds each, and three surgical companies. Each surgical company has 3 operating rooms and 60 beds.
[22] Chief of Naval Operations, Marine Corps Health Service Support Operations, NWP 4-02.5/MCWP 4-11.1, (Washington, DC: 10 March 1998) 3-5.

OIF, but outcome data from their clinical experience is statistically inconclusive compared with the pre-FRSS casualty care provided in Mogadishu in October 1993, and older, more robust data from Vietnam. In both Somalia and Iraq, the KIA rate was 18 percent[23] suggesting that a FRSS team's proximity to the FEBA (often within five kilometers) and rapid evacuation from the point of wounding to the FRSS (typically 30 minutes) were not enough to prevent the death of many severely wounded casualties.[24] In fact, the very presence of the FRSS teams near the front lines probably has a significant positive impact on warfighter morale—an effect that should not be overlooked—even if the clinical impact is marginal, except for a very few number patients, and the casualty numbers to date too small to be extrapolated to future conflicts.

The FRSS is not a panacea for the COCOM or subordinate commanders, even if the FRSS concept eventually proves to be medically efficacious. If these small mobile teams replace the surgical company as the forward Level II surgical asset, they will need support from dedicated air and ground ambulances because they lack a significant patient holding capacity of their own. Unlike the U.S. Army, the Marines have never opted to use dedicated air ambulances like the H-60 Blackhawk the Army presently uses. They have relied instead on airlifts of opportunity. This method has been sufficient, arguably, because the surgical companies and fleet hospitals have had excess bed capacity that could accommodate delays in onward evacuation of their patients. In the absence of dedicated air ambulances, the joint force air component commander (JFACC) or Marine aviation combat element (ACE)

[23] Harold R. Bohman MD (CAPT, MC, USN) <hrbohman@cpen.med.navy.mil> "Iraq Surgery," [Email to Arthur M. Smith MD (CAPT, MC, USNR, Ret.)< asmith@mail.mcg.edu>] 20 September 2003, forwarded to the author 15 April 2004. (Note: CAPT Bohman was the senior surgeon assigned to the FRSS program during OIF, and oversaw the training of all personnel.)

[24] In Vietnam 75-80% of KIAs died within five minutes of wounding. To make a significant intervention within this narrow timeframe would require first responders to have the capability to intervene with high volume fluid and blood product replacement or with surgery.

commander will need to decide if and when to divert already scarce aviation resources for medical evacuation missions or have a substantial number of the "stabilized—*but not necessarily stable*—patients" die of their wounds. On the other hand, medical's logistical footprint could actually increase above today's HSS package if the FRSS program is fully implemented and the large organic Level II holding capacity is retained in its present form.

En Route Care

Expeditionary forces employing ship-to-objective tactics can be operating hundreds of miles from the seabase, making en route care from the FRSS to the seabase an area of concern for the COCOM. In this regard much has already been learned from Operation *Enduring Freedom* (OEF), which approximated the HSS and logistical considerations of sea basing. In his post-OEF testimony to the Senate Armed Services Committee, the Central Command Surgeon cited the life-saving value of enhanced en route critical care capabilities during OEF and predicted it would serve as a template for future operations.[25]

The Marine Corps Combat Development Command (MCCDC) recognized the lack of adequate en route care support systems as a significant shortcoming in HSS to sea basing and OMFTS. Taking advantage of existing commercial mobile life support systems, MCCDC has recently acquired "a modular system that includes medical equipment, medical treatment protocols, and consumable supplies necessary for the medical management of two critically injured/ill, but stabilized, casualties during transport onboard Marine Corps aircraft from elements ashore…"[26] to the seabase. The concept of operations (CONOPS) for the en route

[25] Ronald A. Maul, "Statement of Command Surgeon, U.S. Central Command," Senate Armed Services Committee Subcommittee on Personnel, Hearings on Medical Support of Forces Participating in Operation Enduring Freedom, 107th Cong, 2d sess., 13 March 2002, p. 2.
[26] K. J. Glueck, Jr. to Chief of Naval Operations (N931D) "Training for the En Route Care System," Marine Corps Combat Development Command letter 1500/C39, 8 October 2002, Quantico, VA

care system (ERCS) is that it will be assigned to the Aviation Combat Element (ACE), and staged at forward operating bases or the seabase. When needed, aircrew and a team of medical personnel (flight surgeon, flight nurse, and hospital corpsman) will install the ERCS in an available aircraft within 10 minutes and transit to the site of the casualty needing urgent transport, presumably at an FRSS. The ERCS and medical personnel are then expected to provide medical care for two stabilized casualties for up to a two-hour transit to the appropriate receiving MTF, most likely aboard the seabase."[27] Despite the system's name, the en route care system medical team will not be trained or equipped to provide en route care and will only perform "clinical interventions per pre-approved protocols…necessary to prevent clinical degradation while in transit."[28] Full operational capability (FOC) is in 2005 for 60 ERCS sets, including specialized training for 48 medical teams. (Each Marine Expeditionary Force (MEF) will receive approximately 16 units, with the remainder distributed between the reserve component and the maritime prepositioning ships.[29])

A similar system was employed during OIF to evacuate patients from forward FRSS units, and 34 casualties (28 Iraqis and 6 Marines) were evacuated in this manner.[30] Two severely wounded patients, in particular, at least partially validated the CONOPS for the ERCS. The two were intubated, mechanically ventilated, medically paralyzed, and chemically sedated during 350-mile transport from Baghdad to Kuwait City using a combination of rotary wing and fixed wing aircraft and ground ambulances.[31]

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[27] Marine Corps Combat Development Command, "Draft Operational Requirements Document for the En Route Care System," 17 March 2003, Quantico, VA
[28] Ibid.
[29] Ibid.
[30] Corley E. Puckett, "USMC En Route Care System," Brief preceding En Route Care War Game, Navy Warfare Development Command, Newport, RI: 9 March 2004.
[31] Bohman.

While anecdotes from OIF are real-life success stories, with only two critical patients and 34 total casualties from a major combat operation that lasted just over a month, significant data remain lacking about the robustness of the ERCS concept in future sustained expeditionary operations from a seabase. The issue of just how stable a stabilized patient really is has not been adequately tested. Nor has the need arisen to deny or substantially delay responding to a request for aeromedical evacuation due to a lack of airlifts of opportunity. In this latter regard, Bohman noted in his post-OIF report on FRSS unit activities that the mean delay for an airlift from a FRSS was eight hours.[32]

Sea-Based Hospital Care

After battlefield casualties have been stabilized for transport and a system put in place to transport them, their survival will depend on having a ready, capable platform to receive them. As described in the HSS Primer section, that platform has traditionally been a deployed fleet hospital with its Level III capabilities, followed by onward evacuation to Level IV/V MTFs in CONUS. To support sea-based operations, however, emphasis will shift from fleet hospitals ashore to a Level III capability organic to the seabase itself, as depicted in Figure 1. Even though Navy Medicine excels in the delivery of health services at sea, this will present, perhaps, the biggest operational challenge for the COCOM with regard to sea-based health service support.

The CONOPS of sea basing revolves around the Future Maritime Prepositioning Force [MPF(F)], which will support, sustain, reconstitute, and redeploy the seabase from an advanced logistics base located 2,000 nautical miles away (for planning purposes).

[32] Ibid.

Figure 1

Concept of Health Services Support from the Seabase

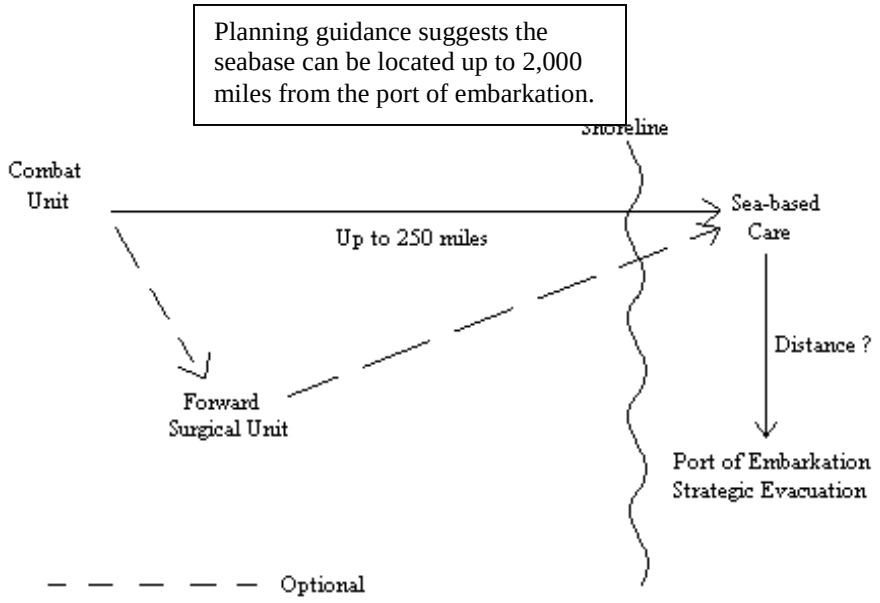

Figure 1 shows the basic of concept of health service support from the seabase in support of Operational Maneuver from the Sea (OMFTS). A casualty is taken from the point of wounding to either a forward surgical unit or, if clinically stable, directly to the sea-based medical treatment facility.[33]

The primary mission of the MPF(F) will be to support the Maritime Prepositioning Group (MPG), with its Maritime Prepositioning Squadron (MPSRON), Marine Expeditionary Brigade (MEB), and supporting naval forces. The MPSRON—six to eight of a new class of deep draft, high capacity ships—will be forward deployed to a theater and specifically preloaded to support the full spectrum of sea-based operations. (Some scenarios

[33] Marine Corps Combat Development Command, "A Concept of Casualty-care for Operational Maneuver from the Sea (Working Draft)," Marine Corps Combat Development Command, Quantico, VA and Naval Doctrine Command, Norfolk, VA, November 1997; viewed online at <http://books.nap.edu/html/naval/chap5.html> [02 May 2004].

presuppose the use of multiple MPSRONs.) Each MPSRON will include two ships equipped and staffed to serve as Level III CRTSs.[34]

The medical treatment facility in each ship will have six operating rooms and 121 hospital beds, including 38 intensive care unit beds and 83 hospital ward beds. In addition to Level III hospital care, the ships will also provide laboratory, pharmacy, radiology, blood banking, telemedicine, medical logistics, and mortuary services in support of what is notionally being called the Sustained Operations Ashore Echelon (SOAE)—in other words, the expeditionary land forces.[35] In addition, the deployed expeditionary strike group (ESG) will retain Level II capabilities in its LHD- and LHA-class ships. In a worst-case scenario, however, in which logistical footprint constraints preclude a substantial HSS presence ashore, these sea-based hospital beds in the MPSRON and ESG (~300) could be the only inpatient casualty holding capacity available to the COCOM for up to 2,000 nautical miles.

Three hundred hospital beds afloat may sound adequate given the low numbers of casualties experienced in recent operations, but this may not always be the case, especially when an acceptable platform, proposal, or concept does not yet exist for the onward evacuation of patients from the seabase to the notional advanced logistical base. The shore-based system was stressed during OIF, even with the low numbers of casualties seen. Fleet Hospital Eight had a peak census of just 127, as previously noted, but maintained a throughput of 200-250 patients per week.[36] To clear the seabase adequately will require,

[34] Navy Warfare Development Command and Marine Corps Combat Development Command, "Draft MPF(F) Concept of Operations," Newport, RI: 8 March 2004.
[35] Corley E. Puckett, "Maritime Pre-positioned Force—Future," Brief preceding En Route Care War Game, Naval Warfare Development Command and Marine Corps Combat Development Command, Newport, RI: 9 March 2004.
[36] Smith and Kelly.

recent war gaming suggests, a long-range, medium- or heavy lift, sea-based aircraft,[37] and lack thereof has been identified as a critical obstacle to seabase success by the Defense Science Board, along with inadequate at-sea cargo (read "casualty" in the case of HSS) handling capabilities under realistic sea conditions.[38] The difficulties with maintaining throughput will be greatly compounded when caring for chemical, biological, or nuclear casualties, or when, as in recent wars, large numbers of enemy casualties are cared for in U.S. MTFs.

Counterpoints

The three health service support nodes discussed in this paper—forward resuscitative surgery, en route care, and sea-based hospital care—have the potential to enhance the health service support Navy Medicine provides combatant commanders by substantially improving combat casualty care.

Although the FRSS teams did not provide dramatically greater outcomes, their concept of operations has face validity—put advanced life-saving care as close to the point of wounding as possible. In OIF the FRSS teams were new to U.S. commanders, and their governing doctrine and tactical employment in their infancies. Consequently their clinical impact may not have been as significant as envisioned. Clinical outcomes achieved may improve, however, as warfighters, logisticians, and health care providers all gain experience with the concept and apply their lessons learned. In addition, the statistical power of analysis will increase as the number of casualties treated by FRSS units increase and their impact on

[37] Navy Warfare Development Command, "Preliminary conclusions from Medical Seabasing Phase II Workshop and War Game," Newport, RI: 27-29 April 2004.
[38] Defense Science Board, 91-94.

KIA and DOW rates becomes more fully understood at the clinical, tactical, and operational levels.

While Navy Medicine has demonstrated the ability to put advanced medical capabilities just about anywhere needed and in the harshest environments, providing adequate en route care has always been difficult. But forward medical units cannot function in a vacuum and eventually severely injured/ill patients must to be moved to MTFs with adequate and/or specialized resources to care for them. The ERCS appears to be a step in the right direction toward state-of-the-art care during en route phases of casualty management. Issues need to be addressed such as the limited availability of ERCS equipment, the lack of dedicated aeromedical evacuation platforms, and inadequate numbers of trained personnel for theater-wide transport in order for this to become a truly effective initiative. The fact that the ERCS concept is being driven by warfighters who recognize this as a critical unmet need for conducting STOM bodes well for the future of this program.

As mentioned, sea-based operations have been labeled a critical future military capability, and Navy Medicine considers itself a subject matter expert on providing hospital care at sea, including Level III care afloat. Maintaining "throughput" to clear the seabase and sustain the combat force is one of the biggest challenges to the sea basing model, including sea-based HSS. The outlook is favorable in overcoming this obstacle, however, because it is common to all potential users of future seabases. Navy Medicine will benefit in this regard from the concerted effort the Department of Defense is putting into finding a solution to this logistics quagmire. Several platforms are already being studied to help clear the seabase MTF, for example, including evacuation connector ships and high speed vessels. Moreover, much attention is being directed toward developing a heavy lift, sea-based

aircraft, because the success or failure of other logistical sustainment innovations relies on this development.

Conclusions

Joint Pub 4-02, *Doctrine for Health Service Support in Joint Operations* outlines the following guiding principles for the HSS system: conformity, proximity, flexibility, mobility, continuity, and coordination vis-à-vis operational requirements, the commander's plan, and the tactical situation.[39] Along with the U.S. Naval Service, in general, Navy Medicine is transforming to meet the strategic vision and operational requirements outlined in *Joint Vision 2020*, *Sea Power 21*, and *Marine Corps Strategy 21*. This paper has presented three areas where the evolving HSS doctrine, the available technology, or both could preclude Navy Medicine from fulfilling one or more HSS guiding principle.

The first area is in forward resuscitative surgery capabilities. Recent experience with forward resuscitative surgery system (FRSS) teams brought essential Level II surgical capabilities to within five kilometers of the FEBA, demonstrating flexibility, mobility, and proximity. Nonetheless, the time from wounding to receiving care at an FRSS was seldom less than 30 minutes, and the KIA rate was similar to that sustained in previous conflicts, including Vietnam and Somalia. Additionally, because FRSS units have little or no casualty holding capacity, they could quickly become overwhelmed by patients needing care when casualty rates are high unless sufficient air and/or ground ambulances are immediately available to maintain throughput.

In this regard, an en route care system (ERCS) is being fielded to maintain mobility and continuity between the FRSS units and the seabase. Early results with a handful of

[39] Joint Pub 4-02, II-1 – II-3.

"cooperatively stable" patients are encouraging, but the system has not been adequately stressed with greater numbers of stabilized patients who become unstable en route. During sustained combat operations at extended ranges from the seabase, for example, the ERCS will no doubt compete with the warfighter's need for airlift support, and ERCS personnel will be under-trained and under-equipped to manage casualties whose clinical course does not follow prescribed protocols.

It is at the seabase itself that evolving doctrine and available technology combine to create the biggest challenges for Navy Medicine. Heretofore the sizeable medical footprint ashore has provided a buffer to weather peaks and valleys in logistical support such as delays in resupply or the onward evacuation of patients. The footprint and its inherent capacity will be greatly diminished during full sea-based operations in support of extended range ship-to-objective-maneuvers, and the seabase will become the combatant commander's most capable—while at the same time the most potentially vulnerable—medical resource. Casualty "throughput" is likely to be a rate limiting step; and while the ERCS may prove to be effective at bringing patients to the seabase, no one has figured out how to get them off in sufficient numbers for what could be a 2,000 mile evacuation to the nearest advanced logistics base.

Recommendations

The joint vision for sea basing and OMFTS is clear, and Navy Medicine is working on innovative strategies to meet its mission of providing health service support and casualty care to joint forces operating from a seabase. FRSS units, ERCS equipment sets and personnel, and Level III hospital care aboard MPSRON ships are examples of these strategies. To best exploit the opportunities they offer while mitigating their risks, Navy

Medicine will need to maintain capability ashore to provide Level II inpatient casualty care and holding. In other words, some facsimile of the present day medical/surgical battalion must be adapted for future use, even in the era of sea-based operations, because our inability to evacuate the wounded when and where needed is the Achilles heel of all three innovations on the horizon. The medical battalion of the future will need to be smaller, lighter, and more modularized for more rapid set-up and re-deployment, of course, but this should be readily achievable using the same commercial technology and evaluation/procurement process that was used for the ERCS.

Additional HSS footprint reductions could be achieved by assigning a rotary wing aviation detachment to each future medical battalion to provide dedicated aeromedical evacuation support, because in a sense, having a large number of hospital beds ashore during sea-based operations is a reflection of inadequate patient movement capacity.[40]

The appropriate reengineering of the medical battalion, to judiciously reduce its capacity while greatly reducing its weight, cube, and footprint, coupled with dedicated airlift support will by itself enhance casualty care for those wounded on the battlefield. It will have synergistic effects with the innovations planned for and described in this paper, and in addition will provide a critical buffer or "capacity safety valve" until newer technologies come on line. This adaptation of present plans for sea-based operations will keep Navy Medicine the expeditionary maneuver element's medical force in readiness.

[40] The author independently arrived at this conclusion. A similar view was expressed by Donald C Arthur (RADM, MC, USN) during his telephone conversation with the author on 21 April 2004. Admiral Arthur was nominated to be the 35th Surgeon General of the Navy on 5 May 2004.

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