Casualty Treatment in Tomorrow's War

Insights into the future of medical logistics and mobile surgical capabilities in the Indo-Pacific region in a post-OEF/OIF environment

by LCDR Trevor Tompane

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While plotting a U.S. military invasion of Bougainville Island in 1943, medical planner LtCol Ashley Oughterson devised a novel plan to drastically reduce battlefield fatalities. He imagined a system that would deliver surgical care very close to the front lines in the early stages of the Pacific Island Campaign against Japan. According to Dr. Thomas Helling's detailed anecdotes in *Desperate Surgery in the Pacific War; Doctors and Damage Control for American Wounded, 1941–1945*, LtCol Oughterson envisioned surgical teams leap-frogging one another, keeping up with the front and operating on the move.[1] Surgery in the portable hospitals would be performed under tents at best, under palm trees more likely, and amidst the buzzing sounds of mortars and live rounds. The forward surgical teams would fill in behind the advancing front, saving lives and limbs. The plan was perfect, like all best-laid plans, until it was not.

Five days after D-Day in November 1943, the medical planner found that his teams still lacked surgical, blood transfusion, and laboratory equipment. LtCol Oughterson lamented the sight of his surgical teams struggling without supplies in the conditions on Bougainville, a dense jungle that would have been a miserable place to keep patients alive, even without the threat of artillery and enemy infiltration on all sides. The forward surgical teams attempted to compensate for logistical shortcomings. Still, the Bougainville Campaign would be marked by one of the more tragic figures in the South Pacific within two short months. Forty percent of all Marine Corps casualties died. For reference, the percentage of casualties resulting in death on Iwo Jima was estimated at 25, and the whole of World War II averaged a fatality rate of 33 percent.

None of this story should detract from the valiant warfighting and lifesaving efforts of Marines hopping between islands in the Pacific to change the course of World War II. It should, however, paint a clear picture of the complexities in medical logistics and the impending catastrophic losses if they are not planned precisely. Sending skilled practitioners forward means little if they deploy without their tools and supplies.

In the decades following World War II, the nature of conflicts fought by the U.S. military changed. Casualties in Iraq and Afghanistan sustained more injuries from explosive mechanisms than gunfire and artillery. A paradigm of ready access to air and ground evacuation developed as Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) progressed. The traditional Role 2 military treatment facility rose in prominence during OIF and OEF to provide readily accessible trauma resuscitation for casualties incurred during the maneuver phases of the war. In the waning years of war in the Middle East, the Marine Corps began preparing for modern warfare against a peer or near-peer enemy. The CMC embraced the idea of planning for such a future in *Force Design 2030*, emphasizing the need for maneuverability of medical equipment and personnel within the weapons engagement zone. In the following pages, the leaders of Combat Logistics Battalion-5 and the Role 2 medical platoon offer a summary of lessons learned during the Marine Rotational Force–Darwin (MRF-D) 22.2 deployment. This article seeks to disprove the words of LtCol George C. Thorpe in 1917 that "history repeats itself, war after war, giving the world story after story of muddled preparation of the means of fighting."

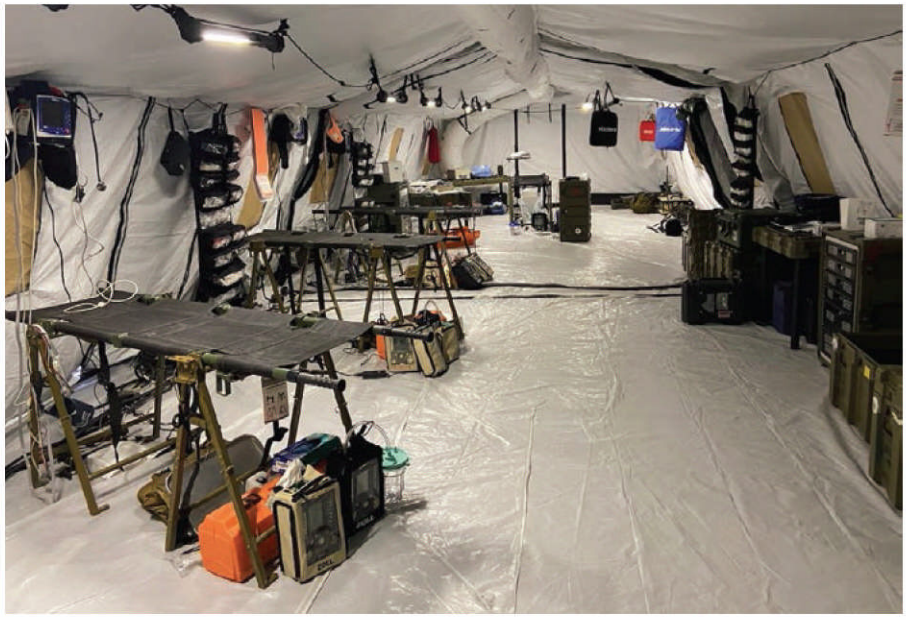
MRF-D 22.2 Initiatives and Role 2 Integration

From April through October 2022 in Darwin, Australia, MRF-D 22.2 served as a forward-postured, partnered MAGTF. The objective was to rapidly respond to crises and contingencies, increase combined warfighting capability, and strengthen shared alliances and partnerships. The 2022 iteration of MRF-D aimed to employ the full complement of forward medical and

surgical capabilities throughout joint exercises with the Australian Defense Force. Historically, MRF-D training exercises utilized a component of the Role 2 hospital to augment joint training exercises for a period of time during the deployment. The previous rotations, belonging to III MEF, were tasked as a Deployed for Training force. The 2022 iteration evolved into a forward force with a posture of readiness. The new mindset and mission of MRF-D and the Marine Corps drove a reworking of the concepts for damage control resuscitation and damage control surgery.

The MRF-D 22.2 Logistics Combat Element tasked the Role 2 medical platoon with creating Role 2 Light Package (R2LP) and Role 2 Medium Package (R2MP) to test the mobility and scalability of each footprint during joint training exercises. These packages were devised with respect to equipment and personnel to improve mobility inside the weapons engagement zone as a tactical advantage. The packages were also designed with consideration for the mission, supplies on hand, and local health and infrastructure requirements.

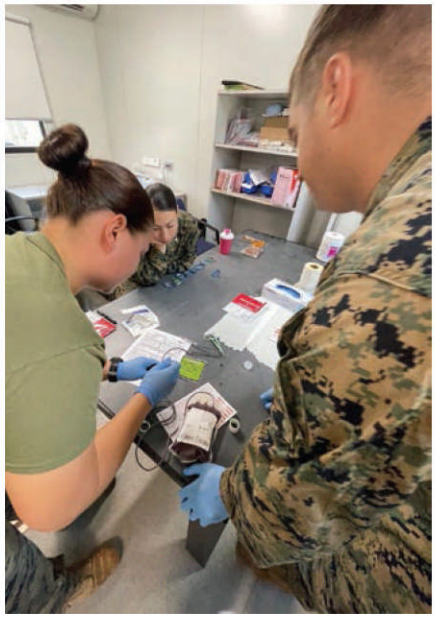
At baseline, the traditional Role 2 hospital structure is transported in 22 Quadcons, housed under 9 305 tents, and occupied by 66 personnel. The R2MP was designed to fit within 8 Quadcons, under 4 tents, with 38 personnel, and supported by an ambulance. Those personnel include (at least) a shock trauma platoon with four beds and two emergency physicians, a Forward Resuscitative Surgical System (FRSS) with two surgeons and one anesthesiologist, a holding/enroute care bay with two nurses, and a command suite. The R2LP was designed to fit within four Quadcons, under two tents, and staffed by nineteen personnel. The structure was intended to house a combined STP and holding area with an emergency physician and an FRSS with a general surgeon and an anesthesiologist. As one might expect, scalable hospitals offer differing capabilities. The R2LP is thought to be capable of treating up to four patients simultaneously and up to seven surgical patients before resupply is required. The R2MP is theorized to offer care to seven patients at a time and ten surgical patients before resupply.



Configuration of a shock trauma platoon and adjoining Forward Resuscitative Surgical System, which formed half of a Role 2 Medium Package or the entirety of a Role 2 Light Package as tested during MRF-D 22.2. *(Photo provided by author.)*

Logistics Support Challenges Encountered at MRF-D 22.2

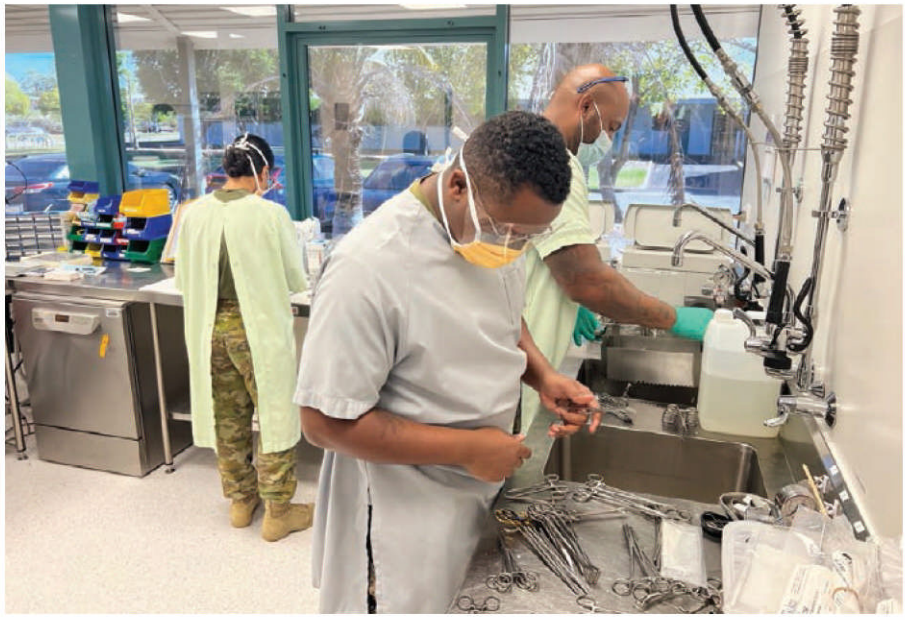
Although the training exercises of MRF-D 22.2 were designed with a somewhat notional nature, the R2LP and R2MP were deployed with the intent to provide real-world care in the event of a mass casualty event. That intent quickly illuminated barriers to providing even the lowest standard for safe and effective health care. Principal among these barriers was the acquisition and storage of whole blood, the most effective resuscitation measure for a hemorrhaging casualty. Whole blood must be obtained from donors in bags containing a preservative that allows it to be stored for 21 days in a refrigerated unit before it expires. While a theater-level asset does exist within INDOPACOM for distribution, the logistics of ordering and receiving Low-Titer O Whole Blood (LTOWB) proved grossly inadequate. As a result, LTOWB was either available far too early for the planned exercise, causing it to expire before exercises even began, or far too late. To compensate for this shortcoming, Role 2 leadership activated the Walking Blood Bank, ordinarily the last resort, to obtain an initial supply of whole blood. It was a temporizing measure for a problem that demands a more sustainable solution, especially if the Marines face casualties on the scale expected for a peer or near-peer conflict.



Role 2 personnel HM2 Lass and HM2 Bard facilitate the collection of whole blood via the Walking Blood Bank initiative, in preparation for joint training exercises with the Australian Defence Force during MRF-D 22.2. *(Photo provided by author.)*

Appropriate storage of LTOWB is an energy-intensive necessity to avoid loss of efficacy, but adequate storage and expiration concerns only begin with whole blood. All medications utilized in a trauma resuscitation scenario must be stored below a temperature that typically tops out at 77°F, or else it becomes as good as expired, if not worse when high temperatures alter the chemical compounds irreparably. Some critical medications and laboratory reagents harbor more stringent requirements for cold chain support, a theater-level asset currently underdeveloped within INDOPACOM. While storage temperatures may seem trivial in warfare, the problem would be quite difficult to ignore if anesthetic agents no longer put patients to sleep before surgery or antibiotics ceased to prevent infections, leading troops with battlefield wounds to undergo amputations for ordinarily reconstructable open fractures. Lest the logisticians forget, the transport and storage of critical tools for trauma resuscitation is not just an energy-intensive problem with current resources; it may become a near impossibility in a paradigm of electronic warfare.

Traditional forward surgical hospitals rely on ready transport of fuel and class VIII supplies to sustain their responsiveness to mass casualty events. For example, Role 2 FRSS teams in Afghanistan were accustomed to using surgical instruments sterilized on-site or shipped back and forth from the sterilization units at Role 3 Combat Surgical Hospitals. In a forward environment without that resource, surgical teams rely on a chemical product that only allows fourteen days of maximal repeated uses to achieve semi-sterile conditions. The chemical proves exceedingly difficult to acquire in Australia, and a resupply has not yet been obtained due to onerous hazardous material shipping restrictions. Admittedly, such barriers are likely to be trivial or nonexistent in a wartime scenario, but they mimic the inaccessibility to resources that expand the maximum throughput of a field hospital. The MRF-D 22.2 FRSS personnel established an agreement with the Australian dental clinic to utilize their sterilization facilities, a training environment solution that would hardly be useful in an active conflict. These are only a few things that threaten to revert a 21st-century forward surgical hospital to a 20th-century one. Of course, surgeons, doctors, nurses, and corpsmen will operate and resuscitate as long as they remain awake and breathing. However, no amount of effort can ford the rivers of unpreparedness if they flood.



Role 2 personnel HM3 Grant and HM1 Dorsainvil sterilize surgical instruments in collaboration with the Australian Defence Force at the Dental Hub, prior to joint training exercises at MRF-D 22.2. *(Photo provided by author.)*

Management of Logistics Support in OIF and OEF

World War II, OIF, and OEF taught us that the battlefield's maturity determines the logistics involved with patient movement and class VIIIA/B resupply. Schrager, Branson, and Johannigman discussed how combat operations differed in the transition from Iraq to Afghanistan.[2] A lack of roadways prevented ground evacuation for critical casualties. As a result, transport time from the point of injury to Role 2 or Role 3 military treatment facilities steadily increased to a span of hours. While "Golden Hour" is largely misunderstood and probably an inaccurate reflection of survival time for the most common cause of battlefield death, it conveys the importance of delivering expeditious medical care with maximal resources allowable. In OIF and OEF, serious efforts were made after 2009 to restore the speed of medical evacuation through the air. As the battlespace matured, ground transport became a valuable asset in supply delivery to forward medical units and evacuating critically injured casualties to higher levels of care. This begs the question: how did the U.S. military manage medical logistics throughout OIF and OEF? What might be learned from the most recent wars?

During the early planning stages of OIF, a conference was held between the Army, Air Force, Navy, and CENTCOM surgeon's medical logistics planner. At the conference, the Army was named the Single Integrated Medical Logistics Manager and declared responsible for providing medical supplies to all services in the area of responsibility. The decision was intuitive: the Army possessed the largest medical logistics structure in the DOD and would establish a class VIIIA distribution center in Kuwait and a warehouse in Qatar that would be stocked for a war with Iraq. I MEF used two medical logistics companies within the 1st Force Service Support Group (now 1st Marine Logistics Group) to pull supplies from the Army's 424th Medical Logistics Battalion at the distribution center in Kuwait and

issue those supplies to their respective medical units. All level I and II class VIIIA supplies were distributed to battalion aid stations via ground convoys from Kuwait. Beyond that, the level III supplies for deployable hospitals were delivered from the warehouse in Qatar via air assets. It seemed, from a medical planning perspective, to be straightforward.

However, during the earliest maneuver phases of OIF, units were deploying with significantly fewer supplies than they required. As a result, army warehouses in the United States lacked the surplus of supplies they needed to support the volume of units moving forward simultaneously. The distribution center in Kuwait thus found itself struggling to make up for the difference when units arrived in-country. To be fair, predicting casualty counts and expected casualty severity is a notoriously difficult task. And by proxy, stocking sufficient medical material for unpredictable demand would puzzle some of the more robust corporations in the world. In World War II, demand for supplies fluctuated in different geographic zones at different phases of offensive action. Rapid increases in the number and types of units deploying, coupled with the relative immaturity of the warehouse and distribution centers, created a near supply crisis.

Logisticians struggled to keep up as the Army War Reserve Automated Process ordered supplies for the warehouse in Qatar; because the supplies were ordered through a third-party vendor, the warehouse had difficulty tracking what was due in and what they received.[3] The hectic environment was also challenged by the warehouse location in Qatar. Had it been in Kuwait, coupled with an adjoining distribution center, much of the supply accounting and distribution would have been streamlined to the forces who landed on the ground before their incursion across the Iraqi border. Perhaps it would be best to consider the supply chain for OIF a near-miss. Mercifully, transportation was the most straightforward part of a medical logistician's work. A more pessimistic scenario would be one in which the U.S. military lacks transport avenues on the ground and through the air while casualties pile up at an unprecedented rate as in, say, a near-peer conflict.

A Way Forward

The opening act of every war the U.S. military entered over the last 80 years was plagued by a phenomenon known as the "Peacetime Effect," an unfortunate finding that case fatality rate (the number of fatalities divided by the total number of injured soldiers) exceeds the low point of the previous war.[4] Something happens in the periods of relative peace between wars that allows more soldiers to die than expected. While no one quite knows the cause of this phenomenon, it is fair to wonder if disorganized supply chains contribute to the slow start.

Medical logistics are complicated, whether the subject is patient care, patient movement, or delivery of class VII-IA and B supplies. The nature of medications, consumables, and equipment mandate transportation in accordance with temperature and storage requirements. Preserving the safety of highly technical and sensitive equipment involves planning that may differ from the delivery specifications for a particular medication or a unit of LTOWB. To our knowledge, the Marine Corps does not possess robust predictive models for operating theaters where medical supply chains are strained, and consumption rates are unknown. Perhaps analytical models can be developed to incorporate active warehouse stock, casualty generation rates, and supply expiration rates for wargaming purposes. Perhaps technological investment can streamline the delivery of supplies and their subsequent storage at medical facilities. Dedicating resources to solving these problems will undoubtedly pay real dividends in warfighter survival.

Although it may not seem accurate at first glance, MRF-D 22.2 represents a genuine accomplishment for medical logistics in the Marine Corps. Like a fighter sparring in the ring, joint training exercises in the confines of Northern Australia exposed our weaknesses so that they might be turned into strengths. As Maj Galuszka noted in a 2006 review of medical planning during OIF, "logistics must be the same in peace as in war. If the military does not "practice like they play," units will not understand proper procedures when they deploy; garrison practices must strive to replicate field practices."[4] And so they have.

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Notes

1. Thomas Helling, *Desperate Surgery in the Pacific War; Doctors and Damage Control for American Wounded, 1941–1945* (Jefferson: McFarland & Co, Inc., 2017).

2. Jason J. Schrager, Richard D. Branson, and Jay A Johannigman, "Lessons from the Tip of the Spear: Medical Advancements from Iraq and Afghanistan," *Respiratory Care* 57, No. 8 (2012).

3. Douglas H. Galuszka, *Medical Logistics in a New Theater of Operations: An Operation Iraqi Freedom Case Study*, (Fort Leavenworth: School of Advanced Military Studies, United States Army Command, and General Staff College, 2006).

4. J.W. Cannon, D.N. Holena, Z. Geng, I.J. Stewart, et al., "Comprehensive Analysis of Combat Casualty Outcomes in US Service Members from the Beginning of World War II to the end of Operation Enduring Freedom," *J Trauma Acute Care Surg* 89 (2020).