

Humanitarian Assistance and Disaster Relief Aboard the USNS *Mercy* (TAH-19)

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The USNS Mercy, one of the two hospital ships in the United States Navy, has provided disaster relief and humanitarian assistance for multiple natural disasters around the world. As a self-sustaining 1000-bed hospital, the USNS Mercy provides a full complement of surgical and medical capabilities to care for the sick and injured in a mobile platform environment. This article describes the recent missions of the USNS Mercy, highlighting the capabilities and humanitarian mission goals. (Journal of Surgical Orthopaedic Advances 20(1):38–43, 2011)

Key words: disaster relief, hospital ship, humanitarian assistance, navy, USNS *Mercy*

In May 2010, USNS *Mercy* (TAH-19) left its homeport in San Diego, California, to begin Pacific Partnership 2010 (PP10), the fifth in a series of annual humanitarian and civic assistance endeavors by the U.S. Pacific Fleet. During its deployment, the USNS *Mercy* provided humanitarian and disaster relief training alongside eight partner nations (PNs) and 17 nongovernmental organizations (NGOs). In this capacity, Pacific Partnership 2010 utilized the USNS *Mercy* as the cornerstone to provide a broad range of medical, civic, and humanitarian assistance to the countries of Vietnam, Cambodia, Indonesia, Timor Leste, Papua New Guinea, and Palau (1). As one of the core strategic maritime strategy components of the United States, the USNS *Mercy* serves as a vital foundation for disaster relief and humanitarian operations in the Asia-Pacific region.

Mission and Ship Capabilities

The USNS *Mercy* (TAH-19) is one of two hospital ships operated by the U.S. Navy's Military Sealift Command (Fig. 1). *Mercy* is a converted San Clemente class super-tanker retrofitted by the National Steel and Shipbuilding Company and delivered to the U.S. Navy on December 19, 1986. Its two GE turbines and two boilers produce

24,500 hp (18.3 MW) and can move the 44,648-ton, 894-ft (272-m) vessel at 17.5 knots (20.1 mph). The ship can carry enough fuel to travel 13,420 nautical miles (2, 3).

Mercy's primary mission centers on providing "an afloat, mobile, acute surgical and medical facility to the U.S. military" in support of expeditionary warfare. Its secondary mission is to provide "full hospital services to support U.S. disaster relief and humanitarian operations worldwide" (1). The USNS *Mercy* may be described as a floating level I trauma center and is one of the largest trauma facilities in the United States. It houses a 1000-bed hospital (80 ICU beds, 20 PACU beds, 400 intermediate care beds, and 500 minimal care beds) along with 12 operating rooms (Fig. 2). Additional services offered aboard *Mercy* include dental, optometry (including a lens laboratory), audiology, and physical therapy. *Mercy* houses four rooms equipped for full diagnostic x-ray and ultrasound, one CT scanner, and an interventional radiology suite. Supporting these services are laboratory, pathology, sterilization, and biomedical repair facilities. *Mercy* has two oxygen-producing plants and a blood bank able to maintain up to 5000 units of blood. It is also home to a small helipad platform capable of landing a SH-60 to facilitate the reception or evacuation of patients (1–3). Its sister ship, the USNS *Comfort*, is based in Portsmouth, Virginia, and has nearly identical capabilities; however, its sphere of operation is in the Caribbean, South America, and Europe.

The ship is staffed by a crew of approximately 65 Civil Service Mariners who oversee the day-to-day operations of the ship and a medical staff of approximately 1215 Navy personnel who are tasked with providing and managing the hospital component of the ship (3). The staff is housed aboard *Mercy* with facilities for sleeping, showering, and laundry. *Mercy* is home to a full galley and cafeteria and also contains three gyms and a number of

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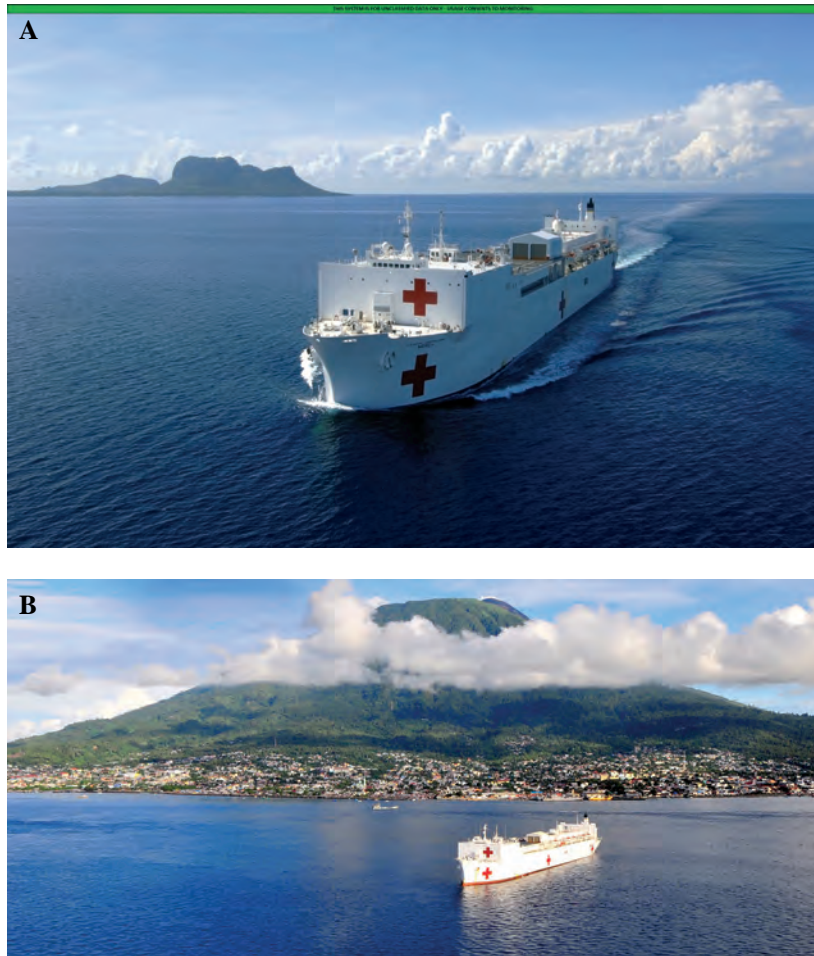


FIGURE 1 (A) USNS *Mercy* (TAH-19) steaming toward southeast Asia for Pacific Partnership 2010. (B) The USNS *Mercy* is anchored in August 2010 in Ternate, Indonesia, providing humanitarian disaster relief and civic assistance.



FIGURE 2 Surgical suite onboard USNS *Mercy*. There are 11 surgical suites (and one additional interventional radiology unit), with capabilities similar to that of a typical operating room.

lounges. The staff has access to the satellite Internet and telephones.

Background

Humanitarian civic assistance (HCA) missions are a relatively recent addition to the U.S. Navy's repertoire and were born from the disaster relief efforts after the Banda Aceh tsunami in 2004. Both USNS *Mercy* and *Comfort* now regularly participate in HCA missions, and these endeavors have proven so successful that they have been incorporated as one of six core competencies in the Navy's Comprehensive Maritime Strategy.

After providing exceptional support to the people of Indonesia and the surrounding Indian Ocean basin after the 2004 tsunami, utilization of USNS *Mercy* and *Comfort* was examined in a new light. Successful Pacific Partnership missions throughout Southeast Asia and Oceania have now been conducted by USNS *Mercy* in 2006, 2008, and 2010 (Table 1). USNS *Comfort* has deployed to the Caribbean, Central, and South America on alternate years and been involved in HCA missions in 2007 and 2009 (4, 5). In addition, USNS *Comfort* provided a

TABLE 1 Recent missions of the USNS *Mercy* (3)

Pacific Partnership 2010	Humanitarian and civic assistance to Vietnam, Cambodia, Indonesia, Timor Leste, Papua New Guinea, and Palau. Supported by 8 PNs and 17 NGOs. 100,000+ patients treated.
Pacific Partnership 2008	Humanitarian and civic assistance to the Republic of the Philippines, Vietnam, Timor Leste, Papua New Guinea, and the Federated States of Micronesia. Supported by 10 PNs and several NGOs. <ul style="list-style-type: none"> • 90,000+ patients treated
2006 Humanitarian Assistance Mission	Humanitarian assistance to the Republic of the Philippines, Bangladesh, Indonesia, and Timor Leste. <ul style="list-style-type: none"> • 60,000+ patients treated • 19,375 immunizations administered • 1141 pairs of eyeglasses distributed • 1083 surgeries conducted
Operation Unified Assistance	Humanitarian and civic assistance provided to Indonesia, Timor Leste, and Papua New Guinea in response to the tsunami in 2004. <ul style="list-style-type: none"> • 107,000+ patients treated • 11,555 pairs of eyeglasses distributed • 6900 dental procedures performed • 466 surgeries conducted • Assisted in the repair of infrastructure and biomedical equipment
Operation Desert Shield/Storm	Deployed to the Middle East in support of Operations Desert Shield and Desert Storm. <ul style="list-style-type: none"> • 690 patients treated • 300 surgeries conducted
Spring 1987 Humanitarian Assistance/ Training Deployment	Humanitarian assistance to the Republic of the Philippines and other South Pacific islands. <ul style="list-style-type: none"> • 73,000+ patients treated

critical disaster relief platform for the Haiti earthquake in 2010 (6).

The Mission

The core mission for the current generation of hospital ships remains unchanged, that is, to provide rapid, flexible, and mobile level I trauma care to littoral regions in support of air and ground combat operations conducted by the Marine Corps, Army, and Air Force. As a mobile primary casualty and treatment facility with capabilities on par with major trauma hospitals, the ability to support extended combat operations is the foundation on which the HCA and disaster relief missions are built. Since the patient demographics and endemic diseases vary between the geographic regions served by each ship, the standard supply load is augmented based on these factors to allow maximal flexibility and adaptability.

Pacific Partnership (*Mercy*) and Continuing Promise (*Comfort*) are annual training and readiness missions that work with host and partner nations, NGOs, and other U.S. government agencies to execute a variety of humanitarian and civic assistance activities. The combined team works in concert to conduct various surgical, medical, dental, optometry, veterinary, and engineering civic action programs providing focused efforts toward goals that have been identified by the host nation. The HCA programs are designed to assist regional and local communities with a wide range of services to support and enhance local health care capacity.

As part of ongoing disaster relief preparations, cooperation between the U.S. Navy, multiple PNs, and civilian volunteers from NGOs allows for a great deal of cross-training and platform familiarization that facilitates the ability to rapidly deploy a multinational force that can practice a common standard of care. It is through these 5-month missions that military, civilian, and PN medical

professionals ensure that safe, compassionate, and culturally sensitive care can be delivered regardless of whether the services provided are part of a scheduled deployment or are in response to a natural disaster.

Host nations for mission sites are carefully chosen at the highest military and governmental levels, taking almost a year of planning to identify and prioritize. The current model of HCA missions provides humanitarian assistance in medically underserved regions of the world where infrastructure capacity building also serves to improve peace and stability.

The Platform

The PP10 crew onboard the USNS *Mercy* was comprised of U.S. military personnel, military from 10 PNs, volunteers from 17 NGOs, the United States Public Health Service, and other U.S. Government agencies. During the mission, the USNS *Mercy* medical staff provided care to over 100,000 host nation residents and performed 856 surgical procedures. In addition, medical services were provided to host nations in the form of biomedical repair technicians repairing medical equipment and devices. While in each country, the USNS *Mercy* medical personnel were also invited to participate in a subject matter expert exchange with host nation personnel to function as an intellectual exchange covering a comprehensive range of medical and surgical topics.

In each country, approximately 50 local translators with medical backgrounds volunteered their services and lived on the USNS *Mercy* and also participated in MEDCAP and SURGCAP activities. The translators provided important medical communication and document translation services (i.e., postoperative instructions).

Surgery Onboard USNS *Mercy*

Surgical treatment represents one of the core components of the overall medical mission within the broad scope of Pacific Partnership (PP) and provides a rare opportunity to provide definitive care to patients in underserved regions of the host nation. The prevailing objective is to provide a single-stage surgical intervention which requires limited or no aftercare and which provides tangible benefit to the patient while incurring limited risk. In the context of the mission's goals, limitations, and with the eyes of the world upon us, the principle of "primum non nocere" takes on even greater relevance.

The initial on-the-ground, large-scale planning for the medical operations of PP begins 6 to 9 months in advance of the ship's arrival. The arrival of *Mercy* at a mission site is preceded by that of an advance party 1 to 2 weeks earlier, including a surgeon (variable specialty) who is

designated to engage local host nation health authorities and providers regarding potential surgical candidates. Anticipated surgical need at any given mission site is communicated back to the approaching surgical team onboard. A preliminary schedule is accordingly designed to provide anticipated block time per specialty, and a screening team is detached to the site(s), typically on the morning of the ship's arrival and the weighing of anchor (the "SURGCAP"). This 40- to 60-member team consists of one surgeon and a technician from each specialty including anesthesia, an internal medicine consultant for preoperative screening, administrative staff for processing patients and coordinating transport to the ship, and security personnel.

The surgical screening site is typically a public facility that may range in character from a large common room with tables and chairs to a sparsely equipped but dedicated clinic space with independent rooms for each specialty. The advance party surgeon selects or designs the space to provide controlled access to care, with a single entry and exit point for crowd control, security, and patient tracking purposes. The team is self-equipped to conduct many necessary preoperative evaluations in the field and brings a variety of diagnostic equipment, including portable ultrasound units, a flexible laryngoscope, and an electrocardiography unit. Once the team arrives at the site, security personnel establish a safety perimeter with the assistance of local law enforcement officials. They begin to sort through what are often several hundred preselected, friendly but anxious potential patients who typically have been waiting since the early morning hours for the screening team's arrival (Fig. 3). Once registered, vital signs are taken, and the patients are taken to relevant specialty stations based on prescreening presenting symptom or physical finding or both.

Each surgeon then evaluates the candidates and selects them for surgery based on their indications, with the following special considerations: 1) absence of significant comorbid conditions, which are potentially unmanageable in the limited perioperative period and which may increase the risk of either a surgical or anesthetic complication (e.g., hypertension, coagulopathy); 2) appropriate equipment and consumables available; 3) adequate time to recover the patient to an ambulatory status; 4) available local postoperative care if necessary (both near and long-term considerations); 5) eligibility for single-stage surgery; and 6) the ability to handle any potential short-term complication within the mission's postoperative treatment window. If the patient is a candidate and renders informed consent, he or she is evaluated by anesthesia and medicine consultants as necessary. Patients are selectively scheduled to allow for an adequate window for recovery



FIGURE 3 Patients in Indonesia in line for a surgical screening day to determine suitability for surgical intervention.

and for an observation period beyond the point of a near-term complication. More complex surgeries are necessarily scheduled early in the mission, tapering to minor procedures over the mission's final days (Figs. 4 and 5).

Once through this process, arrangements are made for transport back to the ship via boat or helicopter. Patients typically arrive for transport from a designated site the day before their surgery and are required to bring one escort. All undergo tuberculosis screening by chest x-ray;

a positive study results in denial for surgery and referral to local health officials for further testing and treatment of tuberculosis.

Postoperative follow-up requirements are minimized through the careful selection of cases and use of absorbable wound closure materials. When necessary, postoperative care is arranged via a variety of mechanisms: local surgeons and/or primary care physicians via local health authorities or through regionally operating NGOs. Although no patient required an extended hospital stay over the course of PP10 (beyond those who were transferred to *Mercy* from local hospital as inpatients and subsequently transferred back for continued postoperative care), continued care onboard *Mercy* following departure remains a potential option.

During PP10, the surgical team completed 856 surgical cases, including 84 orthopaedic-specific cases (Fig. 6). The predominance of orthopaedic cases in the humanitarian assistance and disaster relief (HA/DR) mission during PP10 were fracture care or revision fracture care (53%), irrigation/debridement (22%), elective syndactyly or polydactyly (10%), and miscellaneous. From these data, one can clearly see that the majority of care, even on HA/DR missions, is for fracture or fracture-related injuries. The orthopaedic surgical capabilities of the USNS



FIGURE 4 Orthopaedic surgery performed for correction of tibial malunion. A 22-year-old male sustained a tibia fracture 2 years previously, with inability to work and difficulty with ambulation (A) secondary to angulation in the coronal and sagittal planes of approximately 30° (B, C). After an open approach and osteotomy, an intramedullary nail was utilized to stabilize the tibia (D, E).

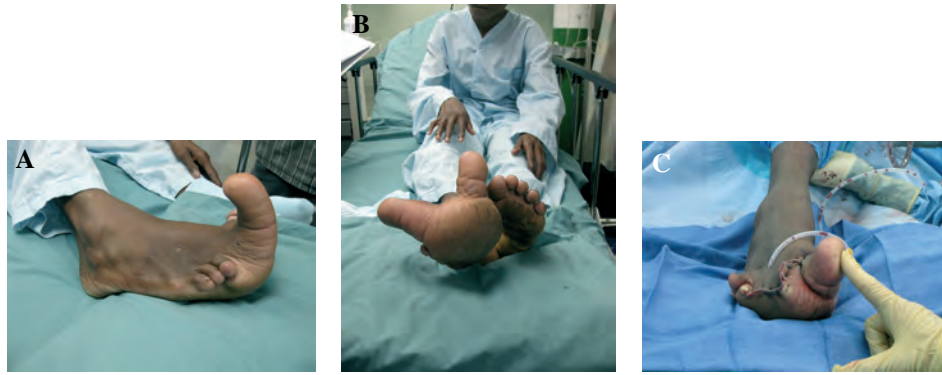


FIGURE 5 A unique case of lipohemochromatosis with macrodactyly of the right (unilateral) foot (**A, B**). An excision of the second ray, shortening osteotomy, and debulking were performed to nearly match the opposite normal extremity (**C**).



FIGURE 6 The surgical team for one of the four phases of Pacific Partnership 2010.

Mercy allow for comprehensive care in both the humanitarian and disaster relief realm, with excellent supplies for the treatment of the most complex of orthopaedic injuries.

Pacific Partnership is the quintessential example of cooperation between the U.S. Navy, host nations, civilian NGOs, and PNs during humanitarian missions and allows the entities involved to gain experience in working as a collective unit. This invaluable experience provides an increased ability to rapidly respond in the case of natural disasters or other emergencies requiring a rapid deployment of humanitarian aid.

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