

# ANSWERING THE C\*A\*L\*L



## Military efforts set the pace for mobile medical imaging

by Dana Hinesly

**T**he primary objective of US military medical professionals is straightforward. “The standard of care we provide [deployed] soldiers must be the same as the care we would provide them in Washington, DC,” says Major General Lester Martinez-Lopez, Commanding General in the US Army Medical Research and Materiel Command (Fort Detrick, Md).

Long-distance image transmission technology for clinical consultations—more commonly known as teleradiology—helps put this objective well within reach. Credited with pioneering the first PACS in the early 1990s, the military is now focused on the development of faster and more efficient ways to care for its injured, whether they’re across a city or an ocean.

### An Evolving Battlefield

Historically, options available to field medics caring for troops injured in battle were limited. If the required medical expertise wasn’t immediately obtainable, evacuation was often the only choice.

Equipping battlefield hospitals to execute teleradiology transmissions provides an alternative. Digitally acquired X-rays, MRIs, and other medical images are sent electronically to radiologists who can promptly interpret and return results, helping the on-site medical personnel provide soldiers with appropriate treatment. This system will never replace field medics, but is in place to supplement their knowledge by giving access to those who have broader and more specific experience.

“You must have medical personnel on the ground, but you want to be able to tap into the knowledge in the medical center hubs in the United States. The technology is in place to project the same level of medical expertise you get in the United States without sending the humans to go with it,” says Robert de Treville, program manager and designated approving authority (DAA) at the Army PACS Program Management Office (APPMO of Fort Detrick, Md). “Every major medical center in the Army Medical Department is configured as a global teleradiology hub to support deployed troops around the world.”

### Not Enough to Go Around

The need to send images instead of people is not just a consequence of logistics. All branches of the service are contending with the high attrition rate of radiologists. By creating a system in which each specialist is available to interpret images from around the world, the Army is able to make the widest use of its limited resources.

And with almost 75% of its radiology systems being digital (with complete conversion slated for 2007), additional help can be called upon when needed. In addition to military resources, the Army has established relationships with civilian radiologists who perform image readings when military staff is overwhelmed with work.

“In order to maintain our standard of care and responsiveness, we have an increasing number of radiology groups that interpret exams [for the Army],” de Treville says. “It’s all done digitally, so it’s all very quick.”

### Connecting the World, One Image at a Time

The Army’s swift access to medical images is achieved with a teleradiology/PACS solution created by Medweb (San Francisco). By combining ease of use, portability, and secure transmissions, the Medweb All-In-One Server can digitally capture a variety of image types and transmit them to a remote location for reading. This technology makes it possible for the Army to provide exceptional, timely treatment for even the most remotely deployed troops.

“The Medweb PACS server combines the functions of a half-dozen different devices into a single lightweight server that is easily deployed and managed by a layperson,” says Medweb CEO Peter Killcommons, MD. “The distributed nature of its architecture [creates] a virtual reading room that allows military radiologists scattered across the planet to share workloads as if they were all in the same room.”

A single Medweb server has the potential to replace multiple devices, including a PACS archive and Web server, teleradiology server, DICOM routing device, and a fax/email report server. The system also includes an internal firewall that ensures secure transmissions.

“These images provide crucial information for specialists who are consulting with the medics and also for surgeons who are preparing for reparative surgery,” says Killcommons. “We are very proud of our contribution both to the health and welfare of our troops around the world, as well as people here at home.”

Equally satisfied is de Treville. “Medweb has done everything we’ve asked of them,” he says. “It is not just deployed in combat areas, but also is used at all remote Army hospitals and clinics in Europe that feed into Landstuhl.” The system also is used extensively in South Korea to support all of the Army’s remote clinics.

### Landstuhl Gears Up

In addition to serving area clinics, Landstuhl Regional Army Hospital, near Ramstein Air Base in Germany, acts as the primary receiving hospital for troops injured in combat. Prior to Operation Iraqi Freedom’s inception in 2003, the hospital sought to upgrade its radiology equipment in preparation for the possible increase of patients. Landstuhl needed a faster, more technologically advanced CT system.

“Representatives from the hospital approached us at a trade show in November 2002, and that’s where the dialogue started,” says Doug Larm, regional VP of the enterprise business group at Toshiba America Medical Systems (TAMS of Tustin, Calif). “They impressed upon us the urgency they had, and we made a commitment as a company [to meeting their need].”

That commitment came with the understanding that the government’s request could come without advance notice. “It was something we wanted to do as a company, and something I wanted to be personally involved with,” Larm explains. His team ensured success by putting the necessary procedures in place—then waiting for the order to come through.

When it was received in March 2003, the order for TAMS’ Aquilion 4 multislice CT system was fulfilled in record time—in less than a week, the unit was performing scans on the hospital’s regular patients. On March 20, the team at Landstuhl put TAMS’ technology to work scanning the first combat casualties.



Above: In Bagram, Afghanistan, Captain Eric Walker monitors the Deployable TeleRadiology System (DTRS), which gives the radiology personnel in a forward deployment area the ability to transfer/route images to other Department of Defense facilities in support of their wartime efforts. This situation happens in several scenarios: first, if the patient is to be evacuated to a fixed facility outside the operation theater due to injury; second, in difficult cases where consultation is needed; and third, at times when local radiological services are not readily available.



The Aquilion Super 4 from Toshiba America Medical Systems, which is used at the US Army base in Landstuhl, Germany, provides clear, high-resolution images and fast scan times—a must in field medicine.

Opposite page: Lieutenant Colonel Edward C. Callaway of the US Air Force Medical Corps, assistant chief of radiology and director of PACS and teleradiology at the Landstuhl Army Medical Center in Germany, reviews a head CT and chest CR from Bagram, Afghanistan, transferred using the Medweb All-In-One Server.

Since then, the system has been busy with both emergency and routine scans—all with great success. The primary benefit to the Aquilion system is its ability to perform exams more accurately and in shorter time. Studies like chest exams, which usually take 20–30 minutes to perform, now can be completed in about 20 seconds.

“It’s become a real workhorse for them, and it is meeting and exceeding expectations,” Larm says. “They’ve been able to significantly improve their throughput. It’s fit in well with their increased workload.”

Within the past 6 months, TAMS has supplied both the Naval Medical Center San Diego and the United States Army Institute of Surgical Research (Fort Sam Houston, Tex) with the Aquilion 16, a multislice CT system that can deliver as many as 16 0.5-mm slices within a 400-ms gantry rotation.

“Toshiba is committed to supporting all US government medical facilities. It’s part of our corporate strategy and has been a focus of ours for the last couple of years,” Larm says. TAMS represents all major imaging modalities, including ultrasound, vascular, and MRI imaging devices.

### Taking Technology to the Troops

The Army isn’t alone in its application of technology to care for the troops. As part of

Fleet Hospital 3 (FH-3), a combat-operations unit deployed last spring in support of Operation Iraqi Freedom, Captain Joe Davis was among the first to use field ultrasound in Naval medical operations.

FH-3 was a field hospital working in the southern Iraqi desert. Between April 1 and May 15, 2003, the unit treated about 1,100 patients and performed more than 670 surgical procedures. Handling these numbers was possible in part to the SonoSite 180Plus, a portable ultrasound device that assisted FH-3 with fast and accurate triage and preoperative diagnosis.

“The SonoSite kept us right up to the standards that are evolving in advanced trauma life support,” says Davis, a flight surgeon, family practitioner, and teacher for the Family Practice Residency Training program at Naval Hospital Pensacola (Fla). “It allowed us a very quick way to screen for the surgeons, and [they] really appreciated it. I know with the first handful of patients, they were hovering over us to see how well we performed and read it. After the first day, they just took our report.”

SonoSite Inc (Bothell, Wash) creates point-of-care ultrasound products. The systems are approximately the size and weight of a laptop computer, yet they’re capable of providing imaging performance equal to that of much larger systems.



In addition to FH-3, surgeons at the Forward Resuscitative Surgery System (FRSS) unit also put SonoSite’s system through its paces. Located near the front lines, the FRSS was assigned the critical task of stopping hemorrhaging in patients before they were transported to a hospital farther from battle. In both cases, the SonoSite performed exceptionally, meeting all military specifications, according to Davis.

“It was a very difficult environment for electronics and [the SonoSite] was absolutely flawless,” he says. “It made it in the sandstorms and working areas. It basically did not falter, even with the various changes in electrical charging systems. It was one of the few pieces of electronic equipment that didn’t choke at some time or another.”

The SonoSite 180Plus also plays a key

## ABSENT BANDWIDTH HAMPERS TECHNOLOGY

Technology makes it possible to give soldiers on the front lines the medical attention they need and deserve. However, even the most advanced equipment is useless when isolated from its network. With the military’s increased use of teleradiology comes a new hurdle: securing the necessary bandwidth.

“We now have the ability to deliver the same level of healthcare [to soldiers] in remote locations that they get in the United States, and we’ve purchased the medical technologies to support it,” says Robert de Treville of the Army PACS Program Management Office. “[But] you need bandwidth to link it back to the medical centers where the specialists and subspecialists, who can provide higher levels of expertise, are located.”

According to de Treville, the main stumbling block is not a lack of availability, but a lack of dedicated funding. “It’s an expense and a focus that hasn’t [been] ingrained in modern combat operations,” he says. “One of the best ways Congress can ensure all services have dedicated bandwidth is to establish a separate appropriation in support of military healthcare, [guaranteeing its availability] for the deployed troops, wherever they are located.”

Without the bandwidth to transmit images, field medics must resort to more traditional methods of care, which often means an emergency medical evacuation (medevac) of the patient. In addition to lost time, a medevac makes everyone involved more vulnerable, due to the inherent dangers associated with bringing additional personnel into a combat zone.

The Naval Hospital Pensacola (Fla) is developing medical record transportation options that don’t require bandwidth. Testing has been under way with a wristband medical record. This compact and portable digital technology allows the complete record and treatment history to stay with the patient. Upon discharge, the files can either be stored electronically or printed for filing.

“We have recommended [the wristband] for fuller development,” says Captain Joe Davis of the Naval Hospital Pensacola. “It’s just a reality that [bandwidth] is useful for the war-fighter and also for medicine, but there’s a finite amount of space [available].”

Though still in the developmental stages, Davis believes the wristband technology also could be beneficial to medics working on the front lines.

“It will greatly improve medical care, because it gives a continuously updated record,” Davis says. In the reality of busy field hospitals, medics often spend time trying to determine what medical procedures have been performed on patients already. “[In the field], the patient would come to us in extremis, and we’d have to figure out what was done to the patient, so the digital record will be a great advance.”

This prototype is one way to work around the lack of available bandwidth, without risking incomplete, inaccurate, or lost patient records. Progress is being made in the Army as well, as that military branch begins working to provide more bandwidth, according to de Treville. “The commanders and war fighters are beginning to understand the importance of getting the expertise [to where it’s needed most].”

“If we can provide that extra level of healthcare and communicate [with] medical centers, we owe it to our troops to do that,” he continues. “It won’t happen without an extraordinary focus [on getting it] done quickly.”

—DH



Left: In Afghanistan, Major Craig Manifold uses a SonoSite system to enable immediate, accurate diagnosis.

Opposite page: The compact and portable PcCR 1417 from Orex Computed Radiography is used in a mobile Army hospital in Iraq to read digital X-ray images.

role in many of the Army's mobile hospitals in Southeast Asia and been extensively used in Afghanistan, where the images are sent to Landstuhl for interpretation and archiving.

Because of its successful performance with FH-3, the SonoSite technology is being recommended for distribution throughout the Navy. "The timeline is being evolved at this point," Davis says. "But over the next few years, they will be in all the expeditionary medical units."

#### Putting Mobile Imaging to the Test

In 2002, the Department of Radiology at Brooke Army Medical Center (BAMC of Fort Sam Houston, Tex) began testing a CR system from Orex Computed Radiography (Auburndale, Mass) to determine if it was capable of satisfying the Army's portable medical imaging needs.

"The military chose Orex's PcCR 1417 because its high image quality, desktop size, and portability make it valuable in a range of settings where traditional X-ray capability is limited," says Hillel Bachrach, Orex president and CEO.

The system is low profile and light-weight, meaning one person can easily set up and use it without any assistance. The system enables front-line medical personnel to take X-rays on-site and burn the data to a CD, which then accompanies the patient to hospitals in safer locations.

In field use, the PcCR 1417 was able to consistently produce quality images, even in the harsh environment present in Iraq. In fact, the Department of Radiology at the BAMC conducted a recent performance assessment of Orex's system. "Without exception, reports regarding the performance and

reliability of the Orex PcCR 1417 received from US military medical units serving in the Middle East have been positive," according to the findings.

The BAMC concluded that the system's design effectively kept dust from entering the unit, and its compact size made it possible to carry the system in a protective bag when necessary, further shielding it from the elements.

"In hostile situations, time is of essence. The Orex CR units allow us to speed up the diagnosis process and serve as an efficient tool for Army medical personnel conducting field work in or near challenging and austere environments," says Fred Brown, who works with the US Army Medical Materiel Agency (Fort Detrick, Md) by providing DR equipment for deployed units. "This ultimately means faster diagnosis and improved care for troops that are injured in the line of duty."

#### Looking Toward the Future

"In the very near future, we'll see the lessons we learned put into better patient care, [such as] the recommendation to go completely to DR," Davis anticipates. "That is expected in the different sizes of level-three hospitals for the Navy in support of the Marine Corps."

With the majority of its radiology systems already digital, the Army is looking beyond teleradiology. "Regardless of the functional area—whether it's dermatology, pathology, cardiology, you name it—health-care can be improved through the use of electronic and other means," de Treville says. "They all have a place in the world of telemedicine." **MI**

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