New Technologies Join to Revolutionize Medical Shipping and Field Hospitals

From wireless tracking tags that "talk" to each other to a system that automatically inventories medical supplies down to the last syringe, warehouse technology moves from the retail world to saving lives in the field.

Knowing that having the right supplies and equipment at hand can mean the difference between life and death, several logistics technology developers have joined forces to improve the odds for our warfighters.

These developers began working together within the past year to make their technologies compatible for improved ordering, shipping, tracking and organizing of medical supplies needed for field operations. The U.S. Army Medical Research and Materiel Command's Telemedicine and Advanced Technology Research Center (TATRC) brought them together in the summer to explore further how they could meet emergency needs, whether in a war zone or in the aftermath of a natural disaster.

The lynchpin of these efforts has been TATRC Medical Logistics Portfolio Manager John DePasquale. Envisioning a modification here and a tweak there, he has seen the potential synergies. And his excitement about the projects is palpable.

"The value of these projects together is far more than the sum of the parts," he says. "What we're doing here could make logistics more efficient and revolutionize it worldwide."

According to DePasquale, these new products could be in widespread use within a year.

In a new future for medical logistics, military medical specialists will have rugged, standardized containers that fit together in modules to organize supplies—"just grab the pieces you want without unpacking everything." All items will be tagged using smart technology so containers and the equipment inside them can be accounted for and tracked to ensure they have made the journey safely. Modules that have everything for each mission—say, pediatric supplies for civilians, IVs for critically wounded warriors, or the portable logistics system to set up a hospital—will be tagged, packed and ready to be deployed where needed.

Standardizing Medical Shipping

While 20-foot ISO shipping containers are standard worldwide, what is packed into those containers is often a random assortment of all shapes and sizes of heavy boxes. The Department of Defense is leading the way in moving to modular logistics, with the first standard shipping and storage container designed to fit neatly into modular, stackable groups.

All service branches are adopting the standardized JMIC container developed by the Navy for munitions shipping. The JMIC is rugged, stackable, collapsible and designed so that 16 of the boxes fit perfectly into a 20-foot container with no wasted space.

The JMIC UltraLight™ shipping and storage container collapses to one third of its original size for easy return shipping. Photos courtesy of Triton Systems.

Another variation, Triton Systems' JMIC UltraLight™, was originally created for biochemical defense use through an Army Research Office (ARO) Small Business Innovation Research (SBIR) grant. The UltraLight is made of a composite material much lighter yet more durable than the original aluminum and offers the added advantage of significant fuel savings. It is being adapted for medical field use at TATRC's request.

Says DePasquale, "We saw that the container would make for safer, more efficient shipping of medical supplies. This is a great leap forward from the wooden and cardboard boxes that we used to use."

Triton Systems is also working with VerdaSee Solutions through ARO and TATRC to create a smart version of the JMIC UltraLight. The container's panels are wired to monitor location and whether the container has been tampered with, exposed to extreme environmental conditions or simply had its contents emptied, thus indicating the need for replacement shipments.

The U.S. Marine Corps is engaged in operations testing of the basic JMIC UltraLight, and TATRC is currently helping Triton find a partner to test the smart JMIC for medical logistics.

An Improved Medical Chest

Within the standardized JMICs will soon be standardized medical chests. The military has been converting from aluminum to Pelican-Hardigg's more rugged plastic chest over the last several years. When TATRC asked Pelican to resize their chests to fit six exactly in the JMIC container, the company made the modifications at its own expense

With the needs of the Soldier in mind, the chests have been designed with grooves and anchors so they can be cross-stacked and used as printer stands or desks in the field. They include recessed areas for securely attaching smart tags. DePasquale notes that the company is working with VerdaSee to develop a smart chest with sense and respond capability to automatically monitor and report when a medic has removed items.

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Six of the rugged plastic medical chests the military currently uses will fit in the JMIC UltraLight™. Photos courtesy of Triton Systems.

Disposable Smart Tags for Tracking

TATRC-managed Army SBIR grants have supported the development of two types of RFID, or radio-frequency identification, "smart tags." These meet military requirements for a secure, low-cost method to track and monitor the condition of medical supply items.

The Eigent Technologies RFID sensor tag transmits temperature, humidity and shock information along with shipment ID information to the 900-MHz EPG global-compatible readers currently used by the

Army. An operator on location or at a command center can determine if the supplies are damaged and replacements need to be shipped.

Eigent's sensor tags are smaller, lower cost and can track smaller quantities than the 433-MHz pallet RFID sensor tags currently in use. The new RFID tags, about the size of a bike taillight, can provide critical information for shipments of medical supplies, pharmaceuticals, food, chemicals, sensitive instruments and munitions.

The InfinID Technologies V-Tag™ is a similar RFID tag that adds the ability for the tags to "talk" to each other rather than having to communicate directly with a central gateway. One tag could warn that its supplies are getting too hot, for instance, no matter how far from the server or scanner it is, or whether radio waves are blocked. The tag-to-tag networking creates an ad hoc wireless

The Eigent Technologies Intelligent Sensor RFID System

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network that is robust, reliable and reduces the amount of infrastructure needed for deployment; the hop distance between tags can be up to 300 feet. At approximately $20 per tag, the business card-sized tags are also a significant cost savings.

The InfinID Technologies V-Tag™ System

## Medical Logistics in a Box

VerdaSee Solutions' mobile logistics system includes everything needed to communicate accurate supply information from far-forward locations.

Shipping medical supplies safely in standard containers, and tracking them using smart tags and GPS, will soon be the final piece in ensuring supplies are available anytime, anywhere. VerdaSee Solutions' mobile logistics system for austere environments addresses the need to communicate supply information accurately back and forth from command centers to far-forward locations throughout the globe.

VerdaSee President and CEO Reuben Vasquez says, "With our system, Senior Command will know immediately whether a medic tent has received supplies—a capability it hasn't had before. And the forward tent will know what they're going to get in advance—they'll understand they're not out there alone."

In a black box the size of a toolbox are two handheld scanners that can read everything from barcodes to the latest RFID tags; a mesh network that allows the scanners to communicate wirelessly; a laptop server with programs that enable multiple users to keep track of incoming and outgoing supplies; and an optional satellite receiver and solar panel for operations in any environment. Set up the Intelli-Flex™ shelves that read smart tags and the collapsible aluminum doorframe that reads all tagged items entering the medic tent, and there it is—a medical supply system in a box.

According to Vasquez, the system can manage 3 million boxes spread among medic tents worldwide. He explains that the system is designed for ease of use and interoperability with technology from a variety of suppliers. "A few medics in a tent could use the system today to quickly track, inventory and reorder everything the unit needs."
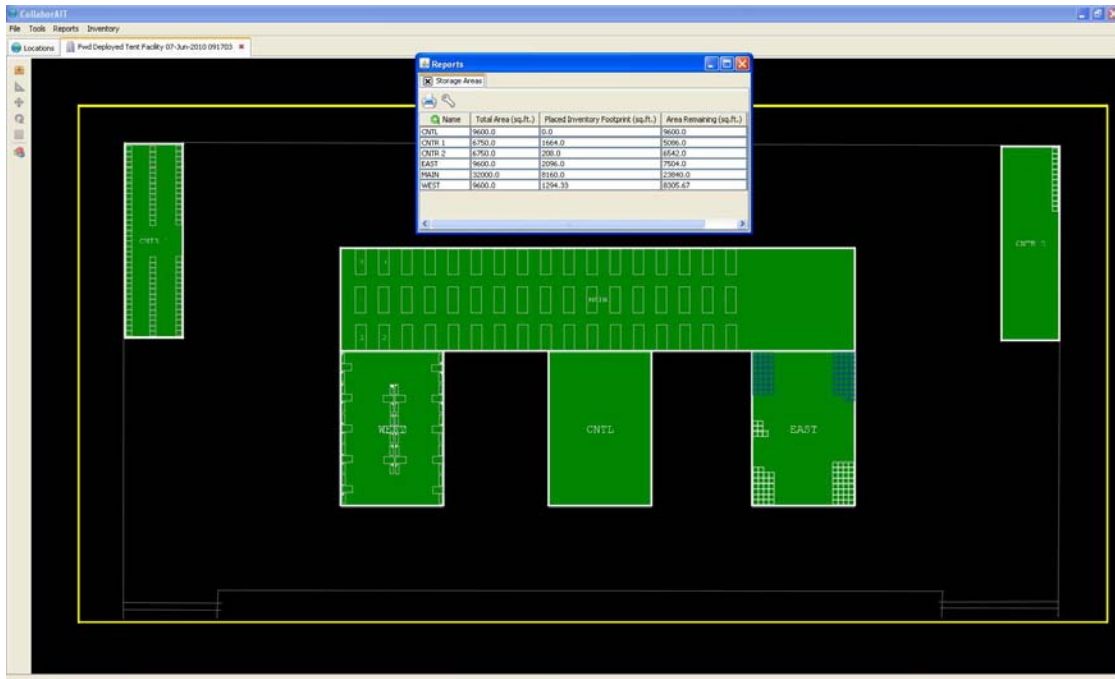
Shown is an Inventory Report and Zone Utilization map from the VerdaSee system.

The system's scanner is a standards-based, cost-effective reader that can read a wide variety of input, taking the place of what would usually take three or four different scanners. The shelves can be a roll of film, Styrofoam or hard plastic, wired to sense what is put on and taken off.

The server software can create a floor plan of a tent or an airfield, linked to a spreadsheet that shows the inventory on each shelf or zone of the area, from the number of JMICs down to individual syringes. The operator can see exactly how much space is left for additional shipments, and can color code the inventory, by expiration date, for example, to know which supplies to use first.

During a large influx of inventory, service members can simply scan incoming items and an "as positioned" map will be available immediately without the need for time-consuming cataloging or location surveys. Command centers can see exactly where everything is in real time to keep far-forward positions efficiently supplied.

Notes Vasquez, "The bottom line is that if operating rooms in the field get the exact medical supplies they need more quickly, it will save lives."

Army SBIR grants managed by TATRC have supported VerdaSee efforts. In August, TATRC sponsored a Beta test of the system that the company ran with a humanitarian relief organization in Haiti. The organization handles 200,000 items a month in Port au Prince—tents, cots, cooking kits, water purifying tablets, mosquito netting—and military observers were on hand to watch the new system in action.

Notes TATRC Chief Scientist Dr. Charles Peterson, "'Smart logistics' are critical in providing the best and most efficient care to the warfighter. TATRC is proud to bring forward new approaches and technologies that have such an important practical impact in this time of difficult and distant delivery systems and supplies."

For more on these projects, please contact Mr. DePasquale at depasquale@tatrc.org.