ZOLL continues its commitment to broadening its portfolio for the military. With the addition of new products via recent acquisitions, ZOLL has the most comprehensive solutions for military critical care. From monitoring and airway management to enhanced perfusion, ZOLL is focused on providing you with lifesaving technologies that are portable and effective throughout all echelons of care.

ZOLL continues its commitment to broadening its portfolio for the military. With the addition of new products via recent acquisitions, ZOLL has the most comprehensive solutions for military critical care. From monitoring and airway management to enhanced perfusion, ZOLL is focused on providing you with lifesaving technologies that are portable and effective throughout all echelons of care.

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Streamlining Care Readiness from Trauma to Treatment
The Army is developing technologies to quickly and efficiently capture and move patient data.
By Christian Sheehy

Maximizing Expeditionary Trauma Care
Naval Medical Research Unit San Antonio (NAMRU-SA), Joint Base San Antonio, Ft. Sam Houston, TX, serves as one of Navy Medicine’s leading biomedical research and development laboratories under the Naval Medical Research Center (NMRC).
By NAMRU-SA Public Affairs

Optimizing Single Suite Functionality
RDT, creator and manufacturer of the Tempus Pro vital signs monitor, enabling medical providers to carry less and do more.
By Barnie G. Howell

Improving Health Through Advanced Simulation
The Joint Program Committee-1 (JPC-1) Medical Simulation and Information Sciences Research program, U.S. Army Medical Research and Materiel Command, coordinates emerging medical simulation and health information research.
By David Thompson

Modernizing the Rescue Litter
U.S. Army Medical Materiel Development Activity (USAMMDA) Medical Support System Project Management Office, Ft. Detrick, is overseeing adoption of a next-gen litter system.
By Barbara Romiti

ZOLL continues its commitment to broadening its portfolio for the military. With the addition of new products via recent acquisitions, ZOLL has the most comprehensive solutions for military critical care. From monitoring and airway management to enhanced perfusion, ZOLL is focused on providing you with lifesaving technologies that are portable and effective throughout all echelons of care.

Cover: Explosive Ordnance Disposal Airmen perform Tactical Combat Casualty Care techniques during an exercise at Holloman Air Force Base, N.M. The training focuses on individual trauma, tools, techniques, and treatment procedures through the use of moulage, non-lethal training munitions, trained role-players, and a multitude of other artificial stressors. (U.S. Air Force photo by Senior Airman Chase Cannon/Released)
At the core of good medicine is the material that enables proper treatment to occur. In this vein, no medical pun intended, the Summer issue of Combat & Casualty Care (C&CC) offers a look at critical asset procurement, management, and sustainment being done by U.S. Army Medical Materiel Agency (USAMMA), a subordinate unit of U.S. Army Medical Research and Materiel Command (USAMRMC), Ft. Detrick, MD. With an emphasis being put on point-of-trauma care, we explore some of the latest capabilities being brought to bear in today’s complex world of advanced tactical combat casualty care (TCCC).

The Summer 2017 C&CC Medical Health System Research Symposium (MHSRS) issue headlines with an exclusive interview from the office of USAMMA Commander COL Lynn Marm, who addresses current and ongoing efforts in research, advanced development, and materiel readiness for Army Medical and overall Military Health System.

Perhaps the biggest single advancer of military medical science is feedback in the form of lessons learned in combat and daily operations. Armed with this knowledge, USAMRMC’s Combat Casualty Care Research Program (CCCRP), Ft. Detrick, directed by Col. Mike Davis, is continually collaborating with wounded servicemembers, through the Army Institute of Surgical Research (USAISR) and civil medical or academic organizations, to better understand best practices when dealing with today’s myriad combat injuries.

On the combat injury theme, much of what has produced results in enhancing point of trauma care has come from improvements in sharing critical information on the moment to moment status of casualties. A developing application called Medical Hands-free Ultra-Wideband Broadcast or MEDHUB, can automatically capture, store and forward data from medical devices to prepare receiving treatment facilities on the immediate status of incoming casualties.

Rounding out this issue is a look at how today’s operational medical environment is being streamlined to address health issues both immediate and long term. C&CC takes a look at the work being done daily at the Naval Medical Research Unit- San Antonio (NAMRU-SA) in advancing expeditionary medicine, advancements in medical simulation by the Joint Program Committee-1 (JPC-1) Medical Simulation and Information Sciences Research Program, as well as efforts to improve patient data interoperability in veteran’s healthcare being addressed by Dr. Lauren Thompson, Director of the Dept. of Veteran’s Affairs Interagency Program Office (VA/IPO).

As always, we look forward to your comments and appreciate for your continued readership!
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When we treat servicemembers, we know that they’re making the ultimate sacrifice. I consider myself lucky that I’m taking care of these heroes; that I’m taking care of the servicemembers who deserve to be credited with those kinds of things. To have that kind of relationship and that kind of point of view creates a very unique physician-patient relationship. Whether we’re taking care of patients directly or engaging in combat casualty care research, we’re really in it for a very unique cause. We’re taking care of these servicemembers that are defending our nation and way of life. To be honest with you, it can be hard to put into words sometimes because it is such a unique relationship from other clinical work.

We’ve developed a relationship through treating casualties at the point of injury all the way through definitive reconstruction. That’s what I really try to get across to the other military and civilian investigators to develop the products and technologies required to aid wounded servicemembers. In his new role as CCCRP Director, Col. Michael Davis speaks to the program’s mission and vision.

By Col. Michael Davis, Director, Combat Casualty Care Research Program

The U.S. Army Medical Research and Materiel Command’s (USAMRMC) Combat Casualty Care Research Program (CCCRP), located at Ft. Detrick, MD, works with both military and civilian investigators to develop the products and technologies required to aid wounded servicemembers. In his new role as CCCRP Director, Col. Michael Davis speaks to the program’s mission and vision.
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data. These numbers, coupled with the rising cultural visibility of head servicemembers have been diagnosed with a TBI according to federal morbidity and mortality from TBI. Since 2000, more than 360,000 brain injuries; with a specific goal of finding a solution for increased effort towards the early detection and combatting of traumatic injuries, which are not dependent on large logistic bases and air superiority.

From a research and development standpoint, the CCCRP is currently focused on the “Multi-Domain Battle,” a concept which encompasses focus on the “Multi-Domain Battle,” a concept which encompasses both the mid-term and the long-term plan for developing materiel and knowledge products designed to close capability gaps in military trauma care. Indeed, while trauma is the leading cause of death for U.S. civilians under the age of 46 years old, there is very little federal investment in trauma research outside the DoD; so I will also serve, in essence, as the de-facto director of the overall U.S. investment in trauma research. On the military side, the primary focus of the CCCRP is the care delivered to warfighters on the battlefield; from the point-of-injury to the use of field hospitals and combat support hospitals.

One of the leading technologies in the portfolio is the I-Portal PAS tool developed by Pennsylvania-based Neuro-Kinetics, Inc. The device, which is designed to diagnose concussions both early and accurately, uses a virtual-reality headset to assess possible brain injury by measuring a specific series of oculo-motor pathways. The I-Portal PAS has received financial support from both the DoD and the National Football League, and is currently being tested at a number of military medical facilities.

"We're excited about it," says Crowder, “but in many ways it’s just one part of the whole.”

To that end, Crowder says the CCCRP will look to a more of “Frankenstein’s monster” approach to early detection of possible brain injury; meaning that while she’s confident an oculo-motor assessment device may be able to diagnose a concussion in a large majority of people, the possibility exists that similar injuries to the brain may manifest themselves in different people in different ways. As such, the program is currently in the midst of launching a search for a technologically-mature device that will allow first responders to measure brain function that’s associated with morbidity and mortality at the point-of-injury.

"We’re hoping that one of these devices will enable first responders to better adhere to the clinical practice guidelines, which we know are better associated with reduced morbidity and mortality, “ Crowder noted.

As severe bleeding remains the number one cause of death on the battlefield, the topic of hemorrhage continues to play a key role in the CCCRP’s investment efforts as well. While the main thrust of the program’s Hemorrhage and Resuscitation Portfolio is to provide improved methods and technologies to control bleeding, more specific and long-term goals are baked into the portfolio’s day-to-day efforts.

“We’re looking for ways to reduce mortality by at least 25 percent,” says Hemorrhage and Resuscitation Portfolio Manager Crystal Hill-Pryor. “At the same time we’re also trying to develop blood products that can be used wherever needed on the battlefield, instead of only where freezers and specialized laboratories are available – all of which will make the earlier use of blood products possible.”

Here too we see the incremental shift towards the battlefield of the future –as envisioned in the “Multi-Domain Battle” concept– with the use of a number of established technologies augmented by the development of a number of emerging products. For instance, while the use of abdominal tourniquets, junctional tourniquets, and the REBOA tool are now commonplace in the military medical world, there continue to be a number of other avenues to explore.

Broad Spectrum of Care

The Combat Casualty Care Research Program spreads its interests across four distinct portfolios: Neurotrauma and Traumatic Brain Injury, Hemorrhage Control and Resuscitation, Forward Surgical-En Route Care, and Photonics and Light-Based Innovation for Severe Injury. As program director, my prime responsibility will be to create both the mid-term and the long-term plan for developing materiel and knowledge products designed to close capability gaps in military trauma care. Indeed, while trauma is the leading cause of death for U.S. civilians under the age of 46 years old, there is very little federal investment in trauma research outside the DoD; so I will also serve, in essence, as the de-facto director of the overall U.S. investment in trauma research. On the military side, the primary focus of the CCCRP is the care delivered to warfighters on the battlefield; from the point-of-injury to the use of field hospitals and combat support hospitals. From a research and development standpoint, the CCCRP is currently focused on improving care on future battlefields, including a specific focus on the “Multi-Domain Battle,” a concept which encompasses early-entry operations, near-peer battle situations, and operations which are not dependent on large logistic bases and air superiority.

Current Key Efforts at the CCCRP

Naturally, the CCCRP lends a substantial amount of its overall effort towards the early detection and combatting of traumatic brain injuries; with a specific goal of finding a solution for increased morbidity and mortality from TBI. Since 2000, more than 360,000 servicemembers have been diagnosed with a TBI according to federal data. These numbers, coupled with the rising cultural visibility of head injuries, means a tightly-focused, continuous effort from CCCRP officials.

“One of the things we have to balance is walking the line between moving the program forward and also letting our senior leaders and the public know what we’re doing with the money they’ve entrusted us,” says Dr. Tammy Crowder, manager of the CCCRP’s Neurotrauma and Traumatic Brain Injury Portfolio. “Regardless, the end result is always the same – to do what we can to make sure that potentially survivable injuries are not limited by lack of knowledge, capabilities, or technology.”

According to Crowder, one of the leading technologies in the portfolio is the I-Portal PAS tool developed by Pennsylvania-based Neuro-Kinetics, Inc. The device, which is designed to diagnose concussions both early and accurately, uses a virtual-reality headset to assess possible brain injury by measuring a specific series of oculo-motor pathways. The I-Portal PAS has received financial support from both the DoD and the National Football League, and is currently being tested at a number of military medical facilities.

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“Developing an FDA approved dried plasma product is a top priority for us,” says Hill-Pryor. “Future products will need to aim to enable survivability for six-to-twelve hours and also as far out as 72 hours in prolonged field care scenarios. To achieve these goals, there is a need for significant and sustained investment to understand the challenges.”

The CCCRP’s collective dedication to understanding future battlefield scenarios also manifests itself within the Forward Surgical-En Route Care portfolio, where a commitment to reliable communication flow is key to prolonged sustainability.

“We constantly have an ear to the ground to hear what the current needs are,” says FSERC Portfolio Manager Col. Antoinette Shinn, “and the feedback we get in return helps us shape research priorities and clinical practice guidelines, as well as helping us to know where the priorities remain.”

Chief among those priorities is the advancement of telemedicine capabilities in far forward areas in the most efficient ways possible. Says Shinn, “We’re looking for ways to maximize tele-mentoring and tele-monitoring in ways that will assist a medic, a combat medic, or even no medic in a far-forward environment to provide life-sustaining care in situations for up to 72 hours.”

The use of autonomous systems for transport of medical equipment and supplies is similarly gaining traction in the portfolio as well. But for Shinn and her team, palpable excitement lies in the burgeoning world of non-invasive hemorrhage detection, an obvious need on the battlefield of the future.

“We need to be able to identify when someone has, say, a blunt injury with internal injuries but they’re not overtly bleeding and they’re not symptomatic yet,” says Shinn. “If we can identify those people, that’s going to help with planning and logistical support, with determining who needs blood, who needs to be transported first.”

Says Shinn of the availability of such a device, “I think we’re closer to getting there – and when we do, it will help save lives.”

Continuing the Mission

In the end, all those separate strands of research ultimately intersect at the very core of the CCCRP’s overall goal to deliver medical innovation to the warfighter. The all-encompassing nature of such care is the most exciting aspect of my new position.

Ultimately, I just want to make sure that we get the best outcomes that truly translate to the battlefield and to the servicemembers back home. We don’t do research for research sake here, we have a very clear target, and that’s to make a difference to servicemembers.
**COL Lynn Marm**

Graduated from Duquesne University in Pittsburgh, Pennsylvania, with a degree in International Business. COL Marm received her commission through the Reserve Officer Training Corps in May 1994, and was the distinguished military graduate. She later completed a Master’s Degree in Business and Organizational Security from Webster University and the Army’s post-graduate medical logistics course.

Upon entering active duty, COL Marm was assigned as an ambulance platoon leader in the 724th Main Support Battalion, 24th Infantry Division at Fort Stewart, Georgia. She moved to Fort Bragg, North Carolina in 1996 and attended the Medical Logistics course, specializing as a medical logistician. While stationed at the home of the Airborne community, she served as the Chief of Materiel Distribution at Womack Army Medical Center and was selected to serve as the battalion Logistics Officer for the 56th Medical Evacuation Battalion in the 44th Medical Brigade. She served on staff for two years before assuming command in 1999 of the only airborne medical logistics depot company in the United States Army – Alpha Company, 32d Medical Logistics Battalion. Following command, in 2002, COL Marm was assigned to the 62d Medical Brigade Headquarters at Joint Base Lewis-McChord, Washington, as the Deputy Brigade Logistics Officer. She deployed in spring 2003 in support of Operation Iraqi Freedom as part of the medical brigade headquarters responsible for combat health support in Northern Iraq. Upon return, she was assigned as a medical plans officer at the I Corps Surgeon’s office, responsible for developing war plans in support of contingencies in the Pacific Region. She was selected to attend the U.S. Army Command & General Staff College (CGSC) at Fort Leavenworth, KS in 2005. Following completion of CGSC, COL Marm served as the Chief of Operations focused on CENTCOM medical logistics at the Office of the Army Surgeon General (OTSG). Afterwards, she was selected to serve as the Executive Assistant to the Deputy Surgeon General.

Following these assignments, COL Marm served as a fellow in the office of Senator Scott Brown (Massachusetts) and represented Army Medicine to Congress as a legislative liaison. After, she served as the Chief of Congressional Affairs for the Army Surgeon General. In 2014, she was selected to command the 1st Medical Recruiting Battalion at Fort Meade, Maryland, a unit responsible for recruiting the future medical force. Most recently, COL Marm was assigned as the Director of Medical Programs at the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology.

**COL Lynn E. Marm**

Commander
U.S. Army Medical Materiel Agency (USAMMA)
Ft. Detrick, MD

C&CC: Tell us about USAMMA and the role your organization serves in Army Medicine.

**COL Marm:** USAMMA is one of more than a dozen subordinate organizations that compose the U.S. Army Medical Research and Materiel Command (USAMRMC), which is the Army’s main materiel developer. USAMRMC provides research, advanced development and materiel readiness for Army Medicine and the Military Health System.

USAMMA’s mission is to develop, tailor, deliver, and sustain materiel capabilities and data in order to build and enable health readiness. Our core competencies are focused on equipping and sustaining the medical force. We do this by:

- Forecasting, planning and executing a variety of medical materiel readiness missions by providing a full-range of medical materiel solutions and support.
- Developing and procuring medical technologies and materiel, performing medical set assembly functions and materiel delivery or fielding for the operating and generating forces worldwide.
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C&CC: Describe the USAMMA team. How many people serve at USAMMA, what do they do and where do they serve?

COL Marm: The USAMMA team is amazing. We have logisticians, engineers, biomedical maintenance technicians, project managers and a variety of other experts and support personnel. They are all experienced professionals who are dedicated to the work we do and laser-focused on serving the Warfighter.

Currently, USAMMA has about 430 employees, including about 200 civil service personnel, 150 contractors, 60 military personnel and 20 foreign nationals. Some of these personnel are located at USAMMA's headquarters at Fort Detrick, Maryland. Other team members serve at stateside medical maintenance depots or overseas locations where we have prepositioned medical stock.

USAMMA operations are worldwide. On any given day USAMMA has staff members deployed to provide expertise down range. One example of this is the Forward Response Activity-Medical (FRA-M) teams. Each FRA-M team includes one member focused on pulmonary, anesthesia and oxygen generation; one skilled in laboratory and patient monitoring; and one specializing in medical imaging systems. The FRA-M augments unit-based biomedical equipment specialists, known as “68 Alphas,” to provide specialty-certified expertise that would be nearly impossible for every medical maintainer to retain. In the past five years, FRA-M personnel have deployed on 45 missions, providing critical medical maintenance support and services to medical units in operations worldwide.

C&CC: You took command of USAMMA in 2016 and have completed almost a year in this position. What are some of the challenges have you faced?

COL Marm: We remain focused on the Army’s challenges: a growing complexity of global security threats and the Army’s capacity to support a myriad of missions.

The Army’s strength is the Soldier. Unlike other services, the Army equips Soldiers to fight and win across all domains. Currently, the Army has more than 186,000 Soldiers committed in 140 countries.

As a part of Army Medicine, the challenge for us is finding innovative ways to improve combat casualty care on the battlefield – without overburdening operational forces with medical materiel that is too large, too heavy, or too difficult to use and maintain. Cyber-security is also a growing challenge. As such, many of our modernization efforts focus on delivering solutions that shrink the logistical footprint of our medical capabilities, while increasing information security.

One recent example is the new Portable Digital Radiography System (NSN 6525-01-651-1758) – a lightweight X-ray unit that we have begun fielding. This device replaces two aging devices, including an X-ray generator and an accompanying computerized reader system. This single modernization will save the Army about $55,000 per system and will reduce shipping weight by about 60 pounds per system and reduce the number of shipping containers from three to one.

The PDRS is also the first Army medical device to receive its Authority to Operate (ATO) under the new Risk Management Framework (RMF). The RMF integrates security and risk management activities into the system development life cycle. Cyber security is a growing concern both overseas in a multi-domain battlefield space, as well as in the homeland of the United States. Coordination between military service is essential. The entire Military Health System must work together.

In the case of the PDRS, this same system is being used by the Navy and Marine Corps. Achieving an ATO under the RMF assures the Army, Navy and Marine Corps that this device complies with all of the current cybersecurity requirements.

C&CC: Along those same lines, let’s talk about the Army’s number one priority: readiness. How does USAMMA support Army readiness?
COL Marm: We support the readiness of both the generating and operating forces. On any given day, USAMMA is balancing the requirements of deploying units, medical equipment modernization and fielding, forward positioned theater contingency stocks and current operational in-theater demands.

In the past year, we supported readiness through operations in Iraq/Syria, Afghanistan, and Kuwait with materiel sourcing solutions and medical maintenance. We also fielded $25 million in medical materiel to tactical units worldwide in support of Army Contingency Operations to include unit activations, conversions, resets (e.g., replenishment) and modernizations. USAMMA also conducted 400 direct ship materiel delivery actions and executed materiel fielding visits.

Another way we support readiness is through our vaccine distribution efforts. In the past year, the USAMMA Distribution Operations Center (DOC) tracked and distributed more than 2.8 million toll free 1.866.839.3455 email: info@tommanikin.com

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doses of Force Health Protection vaccines (e.g., Adenovirus, Anthrax, Smallpox and Influenza) valued at over $70.9 million. These vaccines were shipped to Army, including active and reserve components, Navy, Air Forces, Marine, and the U.S. Coast Guard units.

USAMMA also supports readiness by strengthening our allied forces. USAMMA’s Foreign Military Sales team worked in conjunction with U.S. Army Security Assistance Command’s Foreign Military Sales program to coordinate with more than 20 countries to deliver medical equipment, supplies, and services that totaled more than $165 million.

Additionally, USAMMA assesses all capital investment medical equipment, infrastructure, associated information assurance requirements, and clinical operations within Army Medicine’s medical treatment facilities. Teams from USAMMA perform site visits at MTFs around the U.S. in order to provide a five-year strategic replacement plan for required medical equipment, as well as recommend improvements in operations, facilities, staffing and workflow. In its 22 years of existence, this function of USAMMA has realized a cost savings to Army Medicine in excess of $262 million -- including $9.9 million in just this past year.

C&CC: As you enter into the second half of your command tour, what are your goals for USAMMA?

COL Marm: My primary goal at USAMMA is to continue to grow our resource capacity so that we can support all of our current operations, as well as have flexibility to grow, if needed, for future missions.

We have several major muscle movements happening over the next year. One big effort is the conversion of all Combat Support Hospitals (CSHs) into the Field Hospital Force Design Update (FH FDU). The FH FDU an Army Medicine initiative designed to increase flexibility for the combatant commanders and provide maximum responsiveness for those injured on the battlefield. USAMMA will support the fielding requirements for this initiative. The FH FDU changes the structure and capabilities of existing CSHs to increase surgical and emergency medicine specialties and capabilities. This update is also expected to improve essential clinical capabilities without growing personnel requirements; expand early entry trauma capabilities; increase intensive care capabilities; and add computed tomography (CT) scanners and microbiology lab capabilities.

Additionally, USAMMA continues to support several Army Medicine’s centralized management programs and war reserves. These programs rely greatly on support from the defense industrial base to set and open operational theaters. Since 2007,
we have been providing centralized management for the Army Surgeon General’s Medical Materiel Readiness Program (MMRP), which consists of four CSHs worth of Class VIII (i.e., medical materiel) and Class VII (i.e., major end items to support setup and patient care areas of the hospital such as tents, power and environmental controls). The MMRP is stored and maintained out of Sierra Army Depot in Herlong, California. On a quarterly basis, USAMMA biomedical maintenance engineers perform technical inspections and calibration on biomedical maintenance-significant equipment. USAMMA also funds Sierra Army Depot to perform care of supplies in storage and repairs on the non-medical associated support items of equipment. To reduce costs where possible, the MMRP focuses on efficiently managing maintenance, inventory, spare parts and storage. When compared with the costs of having to field and sustain all previous active components and reserve CSHs, the MMRP reaps an annual cost avoidance for the Army of $12.3 million in reduced care of supplies in storage and approximately $500,000 in sustainment costs.

Recently, under the direction of the Army Surgeon General, we leveraged the MMRP to reset (i.e., replenish medical equipment) the 28th CSH, upon its return from a nine-month deployment to Baghdad, Iraq. The unit needed new equipment and supplies because they left their equipment behind for follow-on units. Leveraging the MMRP in this way ensures continuity of care (for theater operations) and readiness (for the returning unit).

As we move forward, Army Medicine is also exploring new opportunities for centralized management. One example is the Centralized Medical Materiel Management (C-M3) program, which is designed to create an efficient, streamlined medical supply chain functioning under a single catalog. If done correctly, C-M3 has the potential to further increase unit readiness by standardizing support provided to all operating force units either in garrison or deployed to a Theater of Operations. Over the next year or so, USAMMA will further explore this concept and work through a variety of factors such as master data, cataloging and sourcing requirements that are necessary for CM-3 to succeed.

I am excited for the future of USAMMA. We are continuing to challenge our already remarkable record of providing Readiness. We are testing and exercising our go-to-war programs and rethinking our acquisition strategies to deliver better solutions, more rapidly, to the Warfighter. With industry becoming more just-in-time in nature, we must leverage our depots and forward sites to provide just in case stocks. The opportunity for us now is balancing efficiency and effectiveness; managing limited resources and future unknowns to support the Army’s number one priority -- Readiness.

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Battlefield logistics are a challenge regardless of the mission. Adversaries, terrain, and the environment can all serve to complicate the process of delivering supplies to warfighters. The current Department of Defense (DoD) approach to medical supply logistics is limited in its reach to far-forward emergency settings, response to emergent in-theater threats, and utility for bio-preparedness stockpiling. It can often take weeks to months to manufacture and airlift organic pharmaceuticals and protein therapeutics to battlefield frontlines, meaning that critical medical supplies often do not arrive in time where they are needed most. Furthermore, the need to prepare medical supplies in advance based on an anticipated, specific threat can result in wasted materials, labor, and money when that threat is not realized. The DoD needs a new approach to manufacturing and delivering pharmaceuticals to enhance disaster responsiveness and enable timely response to emergent threats.

The U.S. Defense Advanced Research Projects Agency (DARPA) Battlefield Medicine program seeks to address this capability gap through two integrated research thrusts: the Pharmacy on Demand (PoD) and Biologically-derived Medicines on Demand (Bio-MOD) initiatives. The combined efforts seek to develop miniaturized device platforms and techniques that can produce multiple small-molecule active pharmaceutical ingredients (APIs) and therapeutic proteins in response to specific battlefield threats and medical needs as they arise. The PoD research is aimed at developing and demonstrating the capability to manufacture multiple APIs of varying chemical complexity using shelf-stable precursors, while the Bio-MOD research is focused on developing novel, flexible methodologies for genetic engineering and modification of microbial strains, mammalian cell lines, and cell-free systems to synthesize multiple protein-based therapeutics. As a proof of concept, both PoD and Bio-MOD efforts will seek to develop platforms for manufacturing single-dose levels of FDA-approved APIs and biologics and demonstrate high purity, efficacy, and potency in short timeframes.

In developing a flexible, miniaturized synthesis and manufacturing platform, Battlefield Medicine will leverage continuous flow approaches that will, if successful, pave the path forward for enabling distributed, on-demand medicine manufacturing capabilities in battlefield and other austere environments. Additionally, the platform would have built-in flexibility to produce multiple types of therapeutics through its modular reaction design. The ultimate vision for Battlefield Medicine is to enable effective small-batch pharmaceutical production that obviates the need for individual drug stockpiling, cold storage, and complex logistics.
The U.S. Defense Advanced Research Projects Agency (DARPA) is working with seven U.S. universities and elements of the Air Force and Army on research that seeks to stimulate the brain in a non-invasive way to speed up learning. This Targeted Neuroplasticity Training (TNT) will explore using peripheral nerve stimulation to enhance learning processes in the brain.

Announced in March, the Targeted Neuroplasticity Training, or TNT, program has begun to explore the safest and most effective ways to activate a natural process called “synaptic plasticity.”

Plasticity is the brain’s ability to strengthen or weaken its neural connections to adapt to changes in the environment. For TNT Program Manager Dr. Doug Weber, such plasticity is about learning.

“We’re talking about neural plasticity, or how the neurons, which are the working units in the brain, how their function changes over time as we train on new skills,” he said.

Targeted Neuroplasticity Training

TNT research focuses on a specific kind of learning called cognitive skills training. People use cognitive skills to do things like pay attention, process information, do several things at once, detect and understand patterns, remember instructions, organize information and much more.

TNT researchers will try to identify physiological mechanisms that might allow them to enhance natural learning by electrically stimulating peripheral nerves -- those that connect neurons in the brain and spinal cord to organs, skin and muscles -- to make the brain more adaptive during key points in the learning process, according to a DARPA announcement about TNT.

“The mechanisms underlying this enhancement are not well understood,” Weber said, “but we believe that neurostimulation boosts the release of neurotransmitters such as acetylcholine, norepinephrine and others that play a role in modulating cognitive processes related to learning.”

There's probably no single “silver bullet,” he added, “but rather there are multiple processes involved. Thus, a primary goal of TNT is to tease apart the various mechanisms to understand the links between neurostimulation, neurotransmitter release, and resulting changes in plasticity.”

To activate the peripheral nerves, researchers will compare non-invasive electrical stimulation through the skin with an invasive form of stimulation -- using an implanted device -- to see which is more effective.

But Weber envisions a device that can promote plasticity by using electricity to stimulate peripheral nerves through the skin, DARPA says.

The program is starting with the basic science of brain plasticity and will conclude, if the research is successful, with human trials in healthy volunteers.
Imagine being a battlefield medic providing lifesaving care to up to six critically injured Warfighters. The medic’s battlefield stress is increased when they know their battle-buddy’s lives are dependent on the care they provide. This is both, physically and emotionally challenging to even the trained medic. The Army has designed a solution to reduce the medic’s burden. The technology is called Medical Hands-free Ultra-wideband Broadcast (MEDHUB) and is currently being developed at the U.S. Army Medical Materiel Agency (USAMMA), a subordinate organization of the U.S. Army Medical Research and Materiel Command (USAMRMC). MEDHUB’s distinction is its patient-care focus and operational situational awareness capability. The goal is to keep the medic or flight paramedic focused for performing life-saving tasks for multiple patients and remain unencumbered from documentation. Therefore, MEDHUB is designed to automatically capture, store, and forward data from medical devices, without adding any burden to the medic and to provide situational awareness to prepare the receiving hospitals. The key components are individual wearable vital sign monitors that record vitals and provide littered or ambulatory status through accelerometers; peripherals to capture patient weight; and an end-user device, such as a tablet or phone, that captures and stores the data. Low band-width intensive data will be automatically sent ahead of the evacuation vehicle or aircraft on existing long-range DoD communication systems.

"MEDHUB will provide the medics a powerful companion to help them capture, store and forward medical data that will improve patient safety, care, and outcomes in all pre-hospital settings for both theater operations and consequence management response force operations," explained Jay Wang, Product Manager for Transport Telemedicine Systems, USAMMA.

Data is Key

Hospital teams in the field often have limited information on the number of patients they are receiving and their conditions. A Medical
The SAM® Junctional Tourniquet for hemorrhage control is designed to control bleeding in areas where standard tourniquets would not be effective, such as with IED/Blast injuries or high level amputations. With these types of injuries, time is of the essence. The SAM® Junctional Tourniquet is compact and designed for quick application. The patented Autostop buckle provides the optimum range of force required to safely and effectively close an unstable pelvic fracture, as documented by almost 100 peer reviewed journals since 2002.
Evacuation (MEDEVAC) aircraft may return with more patients than they were called out for in the initial mission request which makes it difficult to plan for MEDEVAC patient arrival. Forwarding the accurate patient count, nature of injuries and vitals well ahead of arrival allow the gaining medical unit to alert and form the reception litter teams, anticipate the triage, and assemble the right providers. The hospital staff can take appropriate action when several MEDEVACs are inbound and non-Personally Identifiable Information (PII) information is displayed on a big screen where all can see.

“Currently, a limited voice message is passed with line-of-sight tactical radios,” said Wang. "With improved technology, we can provide better patient outcomes. A faster flow of data will help the field hospitals better prepare immediate treatment plans,” said Wang. "By shortening the time it takes for an injured service member to receive critical care, we may be able to increase that patient’s chance of survival.”

Faster transitioning of patients may also allow MEDEVAC ground and air teams to quickly return to mission and continue the evacuation of wounded warriors from the battlefield.

**Onboard Gateway to Additional Smart Tools for the Medic**

Wang explained, “MEDHUB will automatically measure the patient’s weight, perform the calculations, and provide the medic the exact dosage seamlessly. The tool could also support Food and Drug Administration (FDA) approved medical decision support tools such as Compensatory Reserve Index (CRI), which assist clinicians in quickly identifying and appropriately managing the most severely ill and injured patients.

Wang offered, however, that it is also important to understand what MEDHUB is not designed to do. MEDHUB is not being designed to replace the medic or to direct clinical decisions. Rather, it is about data and time. More time for the medic to spend on the patient vice calculating or documenting care. More time for the hospital to treat the patient because it is already prepared for the patient.

**The Evolution of Transport Telemedicine**

The Transport Telemedicine Program, under which the MEDHUB project is being developed, began in 2012. Earlier projects, such as the Transport Telemedicine System Rotary-Wing (T2RW) project, validated the capability of pre-hospital documentation and transmission during a medical evacuation (MEDEVAC). This was demonstrated in a formal proof of military utility held in Reno Nevada. T2RW provided a medical data transport infrastructure that collects data from Combat Medics and existing medical devices. This information was transmitted through the existing military single-channel satellite communications network from one evacuation platform to one gaining medical facility.

A related follow-on project focused on the development of enabling technologies to support and enhance the functionality of T2RW. The Nett Warrior Electronic Life-Saving Line Equipment (NOELLE) and Close Area Medical Integration Technology (CAMIT) prototypes, the program changed focus to automating medic tasks, patient-care focus, and providing critical situational awareness to the receiving medical facility. The medics are task saturated with up to six patients aboard a medical evacuation aircraft and reported handheld devices with voice and data entry were distractions that hindered patient care. It was determined the combat medics needed an automatic system to capture, store and forward data in order for them to perform lifesaving treatment.

The MEDHUB concept was developed from user feedback from Flight Paramedics of all Army Components, including flight paramedics stationed at the U.S. Army School of Aviation Medicine (USASAM). MEDHUB leveraged the networking and software components of NOELLE and CAMIT to provide the medic with a device to autonomously capture, store, and forward data from onboard medical devices, without adding any administrative burden to the medic. The MEDHUB concept more adequately meets the requirement of pre-hospital documentation, while providing needed situational awareness to improve patient outcomes, according to Wang.

**Integrating Technologies**

According to LTC Christian Cook, USAMMA’s MEDEVAC Mission Equipment Project Manager, there are more than 5,000 Army medical ground ambulances and 585 Army air ambulances that could provide timely medical data to field hospital to prepare for better care and outcomes for the patient. The medic needs to hand-off patient data but does not need to be burdened during the evacuation creating the documentation.

MEDHUB is uniquely positioned to integrate with legacy and future medical devices. In addition, the MEDHUB development team is partnering with Program Executive Offices (PEOs) to fully integrate with existing systems where possible. For example, the team is working to leverage the PEO Soldier NETT WARRIOR program for handheld technology and the Joint Battle Command Platform (JBC-P) Joint Variable Messaging Format (JVMF) for data transfer to facilitate simultaneous MEDEVAC mission communications. In later phases of the project MEDHUB could work seamlessly with Medical Communications for Combat Casualty Care (MC4) and Joint Operational Medicine Information System (JOMIS), providing direct data upload to the Electronic Health Record.

Cook added, “By providing state of the art medical and Information Technology (IT) equipment and leveraging existing and planned Army communication infrastructure, we can improve the timeliness and quality of care.

**MEDHUB’s Next Steps**

The MEDHUB team at USAMMA is continuing to move forward with its accelerated development of MEDHUB with the goal of fielding a system by 2020.
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C&CC: Will you speak to the evolution of the Army’s need / requirement for a Portable Digital Radiography System (PDRS)?

Gomez-Morales: In the beginning, field radiography was accomplished by the use of film processing that required the use of chemicals to develop the latent image obtained from a X-ray system. There were a lot of challenges trying to keep the chemicals and film within the correct temperature and lighting requirements. Also, there were environmental concerns regarding the handling and disposal of the chemical agents used in the development of the films.

The early X-ray generators were bulky and far from being truly portable. By the late 90’s, the introduction of the Computed Radiography (CR) Reader eliminated the need for chemical processing of film. The first portable X-ray system fielded to the Army medical units spent much of its time in the medical maintenance. I want to make it clear that film processing and X-ray generation were always considered two separate capabilities. Previously, you would have needed an X-ray Generator and some type of image processor to view the images. The PDRS combines these two capabilities into one system solution. Additionally, the first portable X-ray systems did not use state of the art miniaturized electronic components. These systems were maintenance heavy and very unreliable. The introduction of high frequency X-ray generator technology allowed for the X-ray production to become more reliable and maintainable and considerably reduce its size.

By the late 90’s portable radiography was becoming lighter and radiation exposure to the patient was drastically reduced with the use of new (solid state) ionization energy detector technology. However, the processing of the images still required a scanner to read the image and send it to the application software for interpretation.

Migrating from CR to Digital Radiography (DR) technology resulted in the elimination of the image scanner/processor (CR Reader) which added electromechanical variables that have proven to be a challenge to sustain and maintain in an austere environment. The Army capability developers identified the technology gap and provided a capability requirement for the USAMMA to develop a medical materiel solution that would transition our current CR systems to the commercially available portable DR technology. The result was the current Portable Digital Radiography System (PDRS) manufactured by Virtual Imaging/Canon.

In short, the chemical film processing and X-ray generator capability were replaced with the CR reader and X-ray generator capability, which were then replaced with a detector plate integrated with X-ray generator technology.

C&CC: As PDRS has been noted to be smaller, lighter, less expensive and more cyber secure than previously fielded systems, will you please speak to the specifics on these aspects in comparison with previous fielded capabilities, and how they are expected to benefit users directly/indirectly?

Gomez-Morales: Eliminating the CR Scanner component was the biggest factor in reducing the overall weight and cubic footage in comparison to the previous system by 15% (less weight) and reducing the number of transport cases from 4 to 1. Not to mention, the additional work flow steps required initially for the installation and normal operation of the previous system were reduced.

Another reduction that is not normally captured is the administrative time requirements for the Line Item Numbers (LIN) management. The current system reduces the LIN administration by 50% (from 2 to 1 LIN). The total cost of the PDRS is about 63% less than the previous CR Reader and X-Ray Generator systems. Moving away from the Computed Radiography (CR) technology eliminated the need of the CR Reader/Scanner.

Another aspect that has always been a sore topic for discussion is the maintainability and reliability of the CR Scanners in the field. Unfortunately, these older systems were affected by the environmental factors surrounding military operations. Additionally, the design, application software management-registration and product support of the systems was challenged by the normal operation and maintenance of the systems by military personnel. After many modifications made by the manufacturer, the CR Scanners never gained back the confidence from the military operators and maintainers.
C&CC: With intended users expected to be deployed medical, special operations, and mortuary affairs units, speak to any system modularity that will enable greater unit compatibility depending on need for use depending on the circumstances.

Gomez-Morales: The PDRS is intended to be operational out of the transport case within 15 minutes and intended for Role of Care 2 and 3 type units. The system requires minimal installation, but it is accompanied by an extensive level of training resources in the form of written literature (Operator and Maintainer Manuals) and videos that take the least experienced operator and maintainer step by step through the installation, operation and maintenance required for the system. Additionally, there will be support available from the USAMMA Medical Maintenance Depot in Tracy, CA and the manufacturer (if required). It is also worth mentioning that the parts and accessories will be available for purchase via the Defense Logistics Agency’s Electronic Catalog resource. The manufacturer is also responsible for creating a website portal via their website to support the PDRS sold to the DoD. In summary, support for this system is integrated in the acquisition strategy and is only a phone call away. Obviously, we want our customers to always try to make an attempt to solve their PDRS problems by reading the manuals first and contacting their local medical maintenance support.

I do have to mention that some may find that having the PDRS in only one transport case makes the system difficult to transport (using the correct number military personnel to avoid injury), but we feel that the system can be easily taken out of the transport case and wheeled to the location that it will be used. The PDRS has off-terrain wheels that allow for it to be pushed, or pull around unimproved terrain found around deployed military installations.

C&CC: What are some primary challenges to integration and potential system upgrades down the line?

Gomez-Morales: The Risk Management Framework (RMF) process is relatively new to medical devices and it is still evolving. One of the biggest challenges is going to be the migration from Windows 7 to Windows 10 for the PDRS because it will require for the PDRS with a Windows 10 operating system to go through the RMF process again. Currently, most if not all medical devices utilize a Windows 7 operating system. So, it is taking a lot work with the manufacturer to help them understand that the DoD has mandated that all systems have a capability to connect to the network, all devices must utilize a Windows operating system, and must have a Windows 10 operating system by late 2017. The current plan is to continue working with the OEM on a “Windows 10 Migration Plan”. Fortunately, the manufacturer has become acquainted with the RMF process and that is half the battle.
Naval Medical Research Unit San Antonio (NAMRU-SA) Combat Casualty Care and Operational Medicine (CCC&OM) conducts basic and advanced development research focused on expeditionary trauma medicine which encompasses hemorrhage, shock, resuscitation, and stabilization.

"Therapies for controlling bleeding as well as investigation of novel resuscitation adjuncts are at the forefront of the directorate's research," said Capt. Montcalm-Smith, NAMRU-SA's commanding officer. The development of advanced en route hypotensive therapeutic resuscitation strategies to stabilize casualties and improve survival is a vital priority.

Other capabilities include development of stem cell and immune based therapeutics; and biomedical systems engineering, to design, test and evaluate field medical devices. To accomplish this NAMRU-SA researchers collaborate with the Navy, Army, Air Force and Marine Corps, along with industry and universities. "These collaborations identify the best and most promising treatments and technologies to improve combat casualty outcomes," said Amber Mallory, Director of NAMRU-SA's CCC&OM Directorate.

"For example, our collaboration with the University of Maryland’s Shock Trauma Center lends an understanding to the utility of spray dried plasma products for treatment of trauma-associated sepsis," said Mallory.

NAMRU-SA has also collaborated with the U.S. Air Force 59th Medical Wing and the U.S. Army Institute of Surgical Research in the areas of hematology, blood
banking, trauma-induced coagulopathy, and ischemia-reperfusion injury, all of which leverages our work to improve the research we conduct.

NAMRU-SA serves as the Navy Medicine lead for the Joint Operational Evaluation of Field Tourniquets, providing feedback from military users regarding application feasibility and ease of use. These data are used to determine which tourniquets are best suited for field situations.

**Expeditionary and Trauma Medicine**

In combat environments, hospital surgery assets are not readily available, so it is critical to be able to preserve life by providing prolonged field care. “NAMRU-SA’s Expeditionary and Trauma Medicine Department focuses on the protection, resuscitation, and stabilization of combat casualties at frontline points of care in combat environments,” said Mallory. The Trauma Medicine group conducts primary and pre-clinical research for the development and optimization of drug products and advanced therapies for the treatment of hemorrhagic shock. The Expeditionary Medicine Group works to identify and effectively mitigate stressors and improve survivability through the evaluation of products and agents that deliver capabilities to meet rapidly evolving expeditionary warfare requirements.

“In the field, time is of the essence and reducing the time it takes to provide definitive care improves survival,” said Cmdr. Jacob Glaser, Department Head of the Expeditionary and Trauma Medicine Department.

NAMRU-SA researchers are investigating novel, low-volume, permissively hypotensive resuscitation strategies to pharmacologically target aspects of cardiovascular function and metabolic stabilization. “Studies are also under way to explore coagulation and immune system functions to improve casualty stabilization, decrease resuscitation fluid volume requirements, and improve pre-hospital survival and long-term outcomes,” said Mallory.

NAMRU-SA researchers are at the forefront in testing combinations of FDA-approved therapeutics to stabilize patients, pre-hospital and during transport. Therapeutics that are recognized as having great potential for battlefield use are tested by Glaser and his team in a unique poly-trauma pressure-targeted hemorrhagic shock model system, developed and validated by NAMRU-SA scientists. It is essential new investigational therapies are stringently tested in an appropriate and relevant preclinical model. “The model system simulates multiple injury patterns that include hemorrhagic shock, soft tissue injury, and musculoskeletal injury and that permits acute and long-term assessments of outcomes,” said Glaser. It is anticipated that these studies will lead to higher survival rates once implemented into clinical practice guidelines.

**Cellular and Immune Based Adjuncts for Casualty Care**

The Cellular and Immune-based Adjuncts for Casualty Care Department investigate stem cell and immune-based therapeutics intended to improve warfighter outcomes and survival. Led by Alexander Burdette, head of the department, the division of stem cell therapeutics studies the comparison and assessment of stem cells from different tissue sources. Investigations include the assessment of protein secretomes or exosomes for preventing and reducing injury from trauma/hemorrhagic shock, and the targeted treatment of severe tissue defects in order to promote tissue repair.

“Our current efforts include testing different types of scaffolding that are customized to release therapeutics for the treatment of critical size bone defects as well as long bone defects,” said Burdette.

The immune system of a warfighter in the combat environment can be severely dysregulated in the event of trauma and hemorrhage. The division of immune based therapeutics focuses on immunomodulation to prevent and reduce tissue and organ damage resulting from trauma and hemorrhagic shock.

Burdette’s department also houses a unique initiative that is investigating a bacteriophage-based therapy for treatment of snake bites. “This project shows great promise as snake venom is extremely toxic and the current standard of care relies on an antibody based antiserum, which is difficult to store in the combat environment,” said

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Burdette. “It is anticipated, a phage-based therapeutic approach will allow for field deployment and ease of use, and can also be designed as a universal anti-venom with application against other poisonous species such as spiders, scorpions, and jellyfish,” said Mallory.

Biomedical Systems Engineering and Evaluation

The Biomedical Systems Engineering and Evaluation Department applies engineering principles and design concepts to develop and evaluate medical devices, treatments, and diagnostic tools used in military medicine. Roy Dory, Head of the Biomedical Systems Engineering and Evaluation Department has established capabilities in advanced trauma mannequin testing systems. Dory delivers expertise in the design of human subject research studies to evaluate the safety, efficacy, and human factors aspects of medical devices deployed in prehospital medicine.

The department also provides broad engineering expertise for a diverse portfolio of projects within the laboratory, including prototype development, computational modeling, custom machining/fabrication, and software development/ automation. Recent development efforts include a field-portable sterilization system and an automated electrospinning system used to generate nanofiber scaffolds for wound care.

“Our design team works to help address some of the fundamental challenges associated with Role 1 care both at the point of care in the field and during patient transport,” said Dory. “We developed the field-portable sterilizer to be a truly self-sufficient, portable system that can be operational from battery power” Dory said.

“The department has also expanded to include research and development of imaging tools to detect oxygenation in discrete tissue including the brain, teeth, and bone,” said Mallory.

NAMRU-SA’s CCC&OM research goals span across many disciplines from trauma surgery, immunology and cell based-biological therapies to medical device development and test and evaluation. The commonality across this interdisciplinary effort is the vision to give our warfighters the best chance for survival in combat environments. This includes exploring novel ways to effectively improve outcomes in prolonged field care scenarios, as well as continuing exceptional point of care treatment, whether it is at the site of injury, en route, or at the medical treatment facility.

More info: [https://go.usa.gov/xRQHc](https://go.usa.gov/xRQHc)
For over 20 years, RDT has provided innovative, rugged, durable, and reliable products for the military environment. We understand your specialized environment and develop products with that in mind. Coupled with an IP (Ingress Protection) rating of 66, the physical attributes of the Tempus Pro vital signs monitor make it the most suited to cope with the demands of military usage. Highly compact and durable it has the longest battery life on the market. Ground breaking in weight and size, at just 6 pounds it is ideal for use in the most austere environments. In operation, its touch driven display and intuitive interface make the monitor extremely easy to use – no need for repetitive touching of buttons or keys to enter patient data or interact with the monitor. An electronic version of the DD1380 is built into the Tempus and automatically populated with patient vital signs. Drugs, interventions, and extraneous notes can be easily entered into the Summary Record of Care and sent wired or wirelessly to any computer and ultimately into an EMR and GENESIS. In addition to being designed and built to military specification, it is a monitoring platform that can advance as the military’s requirements change and evolve over the life of the product.

Facilitating Ease of Diagnoses

Military medics oftentimes must operate in very hostile environments with limited access to medical or consultative assistance for extended periods of time, making a difficult diagnosis very challenging. Also, adapting to multi-domain and cross-functional operations require medics to perform independently until patient transport can be made available. The Tempus Pro has the unique ability to transmit patient data directly from the Tempus to a FST, CSH, or MTF anywhere around the world without the need for additional equipment. It also provides the medic the ability to establish voice communication with the care provider and receive consultative assistance in remote locations. The integral camera allows the medic to effectively convey the condition of the patient, wound location, and provide critical situational awareness.

Unique to the Tempus Pro is the optional integrated secure real-time ReachBak capability. Tempus Pro can transmit all vital signs data including photographs and video, ultrasound and intubation images, 12 Lead ECG recordings, waveforms and the full patient record. It can also establish full duplex voice communications over standard military headsets. Data can be transmitted over civilian communications networks and military IP radios and all patient identifiers are AES256 encrypted (level of encryption for inter-governmental data transfer). ReachBak is augmented by the built-in GPS positioning which allows the patient record to be geo-tagged to identify the patient’s location and record where drugs and therapies were given.

Open Architecture Modifiable

The Tempus Pro has an extremely powerful processor that enables the monitor to provide additional capabilities over the life of the device. RDT’s philosophy is that as customer’s requirements and budgets can change over time, the Tempus Pro will evolve to meet those needs. Rather than becoming obsolete, the Tempus Pro will incorporate new technologies, algorithms, and additional capabilities as they become available. Examples of these are Abdominal and Vascular Ultrasound, Video Laryngoscopy, Summary Record of Care, and ultimately CRI, Compensatory Reserve Index; all incorporated in the same small lightweight form factor.

Evolving to Meet Advancing Need

One of the reasons that many NATO militaries and U.S. agencies have selected the Tempus Pro is due to its ability to evolve over the life of the product as requirements and budgets change. Over the next several years there will be many new advancements to the Tempus Pro including Cloud Based telemedicine capability, and most exciting, electrotherapy capability. The Tempus ALS defibrillation capability is available OCONUS this year, and pending FDA clearance available CONUS late 2018.
The USAMRMC’s JPC-1 is responsible for programming research in two distinct portfolio domains: Medical Simulation and Health Information Technology/Informatics. The JPC-1 works with all the services and joint agencies to address gaps, threats and requirements. The JPC-1 is tasked with planning, coordinating and overseeing a tri-service science and technology program to improve strategic planning and process development related to research in two portfolio areas:

Improving military medical capabilities through live, virtual, constructive and serious gaming methods (LVCG) of medical simulation.

Improving health information sciences through increased interoperability and better health information technology applications

The establishment of JPC-1 has enabled a collaborative process to identify and validate the research initiatives pertaining to the military, thereby allowing the USAMRMC to better align its research and development efforts. This program assists in the identification of relevant emerging technologies, the assessment of technologies through a structured process and the transition of technologies that are of value to the MHS.

The MSIS seeks to improve patient safety and quality of care through strategic over-the-horizon research by transitioning more capable healthcare information and medical simulation technologies and systems; by addressing stakeholder driven priorities to bridge existing and future capability gaps in the MHS; and through proactive integration and implementation of emerging technologies into military healthcare relevant applications.

Evolution of Medical Simulation Technology

Seeking to develop, hone or improve their medical skills and capabilities, medical simulation began when medical professionals...
Registration is now open for the 2017 Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury Summit, “Advances in the State of the Science and Best Practices.”

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practiced on something other than a patient. While modern medical simulation is relatively new compared to other areas of simulation, such as flight simulation, the future of modern medical simulation has the potential to be revolutionary.

Early medical simulation was typically seen as a sub-standard detractor from medical training provided by practicing on patients and human cadavers. Medical simulation tools were typically purchased by individuals or medical offices that did not have a long-term training strategy. Investment by the public sector was limited, as very few companies saw these tools as profitable. This sentiment changed as simulation matured and became a more accepted method of training basic medical procedures.

A universally recognized example of modern medical simulation is the Cardio Pulmonary Resuscitation mannequin that was developed in the 1960s, commonly referred to as the “Resuscitation Annie.”

Simulation capabilities have evolved tremendously from their early beginnings and their use is now widespread. Today, medical simulation is most often utilized by the military services for first responder training, along with general medical education and medical team training. Although use has grown and is more widely accepted, it has yet to be fully embraced. This is likely due to known technical limitations. Tremendous efforts have been made to develop simulation that more fully meets the needs of even the most complex medical procedures. This creates a demand for synthetic patients, which replicate real patients more closely in tissue, organs and internal systems, including accurate physiological and pharmacological responses.

One of the largest changes is the way the military services manage medical simulation. In 2009 the United States Army established the first formal program of record known as the Medical Simulation Training Center, along with a dedicated program office to develop, field, sustain and maintain medical simulation across the Army. The Army program was the first of its kind and determined that strategic planning and execution of simulation was highly necessary.

Closing the Gap Between Virtual and Real-World Combat Casualty Care

In the past few years, industry has identified opportunities within the medical community for simulation and has dedicated resources to future development of capabilities. With this added industry engagement, competition has had positive effects on the simulation community including lower prices, more choices and increased capabilities.

Cost savings are expected as standardized capabilities are provided to the military services through bulk purchases of training capabilities and pre-planned lifecycle management. The Medical Simulation Enterprise also directly addresses the public concern of live tissue training using animals for the very first time, with programs within the MSE defining requirements to reduce and eventually replace live tissue training with human-like synthetic patients.

Challenges and Expected Improvements

Despite these advances, the medical simulation community faces several challenges. There continues to be a perception that medical simulation is only relevant in the training sector and that there is a gap between integration and interoperability across commercial products. The lack of a Department of Defense-wide strategic vision for medical simulation often leads to a disjointed purchasing of simulation tools by individual offices across the military services. Finally, there is a concern that medical simulation is not as effective as using animals for skills training, as well as the level of fidelity of the products.

What needs to change with regard to medical simulation? The organization of medical simulation within the DoD is at the early stages of changing with the advent of the Defense Health Agency. Just as the military services worked to find out what simulation was already being utilized, what was needed and how it is best managed across the organization, the DHA is beginning to wrestle with the same questions. The addition of the rate at which new technology is being matured and put into operation, along with the ability for any office to purchase the tools which that office wants to use, further complicates the answers to those questions. Part of the answer has been the development by the DHA J-7, of the DHA Medical Simulation Enterprise, that identifies a strategic vision of programs to replicate the military Continuum of Care, and to address medical simulation needs of not only the training sector, but of the medical operational and clinical sectors also, thereby enabling the old adage of training as you fight.

Moving Forward

New obstacles will be confronted as medical simulation matures. As the world becomes more electronically connected, so does military medical simulation. Therefore, the security of life-long training information could enable an adversary to identify DoD weaknesses or expected areas of future operations. Another challenge involves the use of holographic simulation in the medical operations and clinical sectors. Holographic simulation has the potential to guide a non-medical Warfighter or a medical provider through an unknown procedure when the correct medical care is not readily available in a disbursed operation or a degraded communications environment.

Although it has taken a long time for simulation to be accepted by the medical community, and while it still is not widely embraced, it is becoming a more integrated and integral part of the military medical capability. Medical simulation is moving from being strictly part of the medical training sector toward utilization across medical operations and clinical sectors, which will result in all three sectors being more closely linked. Furthermore, a strategic DoD path forward will result in overall cost savings for the DoD while at the same time delivering more applicable and useful simulation products.

The U.S. Army Medical Research and Materiel Command (USAMRMC) is the Army's medical materiel developer, with responsibility for medical research, development, and acquisition and medical logistics management.
MODERNIZING THE RESCUE LITTER

Current rescue litter applications have been used in Army Medical Department (AMEDD) medical equipment sets for over 30 years and need updating to meet new requirements. The U.S. Army Medical Materiel Development Activity (USAMMDA) Medical Support System Project Management Office, Ft. Detrick, MD, has been tasked with accomplishing this objective.

By Barbara Romiti, USAMMDA

Since the beginning of time, man has needed a way to move wounded Warriors off the battlefield. The earliest version of transport was a stretcher comprised of some sort of cloth stretched over a frame made of two poles. This simple mode of carrying a patient works well if rescuers and patient are located on relatively flat ground. But history has not lent itself to battles fought on conveniently located open territory.

“What do you do when you get wounded out in the middle of the jungle and can’t get to a hospital or a forward surgical team or you can’t be evacuated? The rescue litter allows medical personnel to package the patient up in a supine [flat] position and carry the person over rough terrain,” said Jaime Lee, MSS product manager.

To meet the need to evacuate a patient over difficult ground conditions or out of tight situations, such as mountainous areas, collapsed buildings, water rescue, etc., USAMMDA’s MSS PMO worked with Skedco in Tualatin, Oregon to come up with a new kind of litter.

According to Lee, the rescue litter was only developed in the last thirty years, because only then had the technology become available. Skedco began to develop products to be able to rescue people and hoist them by helicopter in situations where you could not land to load a patient normally. The resulting and currently used Sked is a basket type litter which secures the patient for horizontal and vertical carrying, thus allowing for evacuation over all kinds of terrain.

Patients are strapped on to the litter using a series of buckled straps. If air evacuation is needed, after the patient is secure, four additional straps meet in the center and are fastened with a carabiner closure, which then secures to a helicopter line for hoisting. If needed, a flotation kit can be used, which allows the litter to float vertically. For patients needing more support, a spine splint is also available for use with the litter.

The litter can be pulled along the ground using a one-person harness. For more rocky terrain, it can be carried by four medical personnel, two on each side, using nylon handles.

Requirements Update

Because the Skedco rescue litter has been in the field for decades, servicemembers have been able to provide valuable feedback on how to improve it. They have expressed the need for it to be lighter and smaller, to move away from the strap system of securing the patient, and to allow for better patient access.

The Operational System Development funded project, which supports the continued improvement and upgrading of products already in production, will consist of a two-fold approach. First, the current litter will be revised. Second, a lighter advanced-design rolled rescue litter will be developed using new polymer materials. Both litters will have the advantage of a new five-point harness system, which improves patient support, provides better patient access and reduces the number of steps needed to secure the patient allowing for faster mobility.

“The new litter will use an updated geometric design, which allows for a more foldable product, with seams on both sides allowing for improved unrolling of the product. It will have a smaller footprint, will be easier to pull over rough terrain and will offer more patient security,” said Lee.

The improved rescue litter, the Mission Sked, is carried rolled up in a nylon backpack which measures nine inches in diameter. When it is laid out flat it is 28.25 inches by 88.25 inches. When packaged, the complete Sked system weighs 17 pounds. The litter itself is made out of a durable medium density E-Z glide polyethylene plastic.

The newly designed Flexsked will also be 28.25 inches by 88.25 inches. The final weight is still to be determined based on the results of the final testing.

Projections for an updated version of the Mission Sked that meets the new requirements show that the cost would stay approximately the same as the current version. Costs for the Flexsked will be determined once the design is finalized.

Recent Product Testing

Ground testing was recently conducted June 19-20, 2017 at Camp Bullis, San Antonio, Texas. For two days, Soldiers on behalf of the AMEDD, put both the modified Mission Sked and the new Flexsked to the test. They practiced evacuating a test mannequin from a building. During timed maneuvers, they had to unpack the litter from its carrying case, attach a splint to the patient, secure him to the litter and carry him down a set of steps. They then carried and dragged the patient over an obstacle course which consisted of a series of different terrains, including asphalt, gravel, grass and rocks.

The Soldiers practiced rigging up the litter for air evacuation, which was then “cancelled” for practical purposes of the exercise. They then placed the patient onto a regular litter and loaded him into a Mine Resistant Ambush Protected MaxPro Plus Ambulance and then into a M997 Ambulance for ground evacuation. This scenario was repeated many times in order to get a good idea of the ease of use and durability of the litters.

Air and water testing will take place in the future at Fort Bragg, North Carolina.

Once the test results are in, either modifications will be made to the current Mission Sked or a new Flexsked will be developed. Regardless, the need for a rescue litter in the medical equipment sets will remain a constant.
The mission of the DoD/VA IPO is to lead and coordinate the adoption of and contribution to national health data standards to ensure interoperability—the ability of two or more systems or components to exchange information and to use the information that has been exchanged—among the DoD, VA, and private sector providers worldwide. The IPO serves as the single point of accountability for identifying, monitoring, and approving the clinical and technical standards and profiles necessary to ensure the seamless integration of health data. The IPO also collaborates closely with the Office of the National Coordinator for Health Information Technology (ONC) within the Department of Health and Human Services (HHS), Standards Development Organizations (SDOs), and other public and private sector partners to support national health data sharing efforts.

DoD and VA Healthcare Landscape

The DoD and VA represent two of our nation’s largest healthcare systems, sharing more data than any other two major health systems. With more than 1,200 DoD care locations, including Military Treatment Facilities at home and abroad, and more than 1,400 VA care locations throughout the country, our commitment to provide world-class healthcare remains unchanged. Together, the DoD and VA represent more than 15 million beneficiaries with over 60 percent receiving healthcare from private sector providers.

The Value of Interoperability

A key component of serving the unique needs of our beneficiaries, regardless of their status, location, or provider, is ensuring their health data is secure, accurate, easily accessible, and ultimately interoperable. With that goal in mind, the DoD, VA, and IPO work to establish the seamless integration of health data between the Departments and their private sector partners. This integration further reduces medical errors and streamlines administrative functions to improve clinical decisions.

The former National Coordinator of Health Information Technology highlighted the importance of health data exchange in ONC’s Connecting...
Health and Care for the Nation: A Shared Nationwide Interoperability Roadmap, which states "...exchange of information between health systems is flowing faster than ever before, and new technology innovations are bringing more usable digital health information to the bedside and beyond. We must build upon this success to create an open, person-centered health IT infrastructure." The DoD and VA achieved a significant milestone in April 2016 by certifying interoperability to Congress required by the Fiscal Year 2014 National Defense Authorization Act. While this certification marked a major accomplishment for both Departments, the DoD, VA, and IPO recognize the health IT landscape is constantly evolving and their efforts must remain ongoing to ensure our beneficiaries receive the best care available.

Interoperability and the IPO Today

The Departments work alongside ONC, and various SDOs, to identify, implement, and map the appropriate national standards associated with both Departments’ EHR systems. Today, the IPO serves as the single point of accountability to enhance health data standards to improve data sharing between the DoD, VA, and their private sector partners. As a result of our collaborative efforts, the DoD and VA currently share more than a million data elements daily.

The DoD and VA currently use several tools to support health data sharing. For example, since 2006, the DoD and VA have shared medication and allergy data through the Clinical Data Repository/Health Data Repository (CHDR) interface, an initiative that exchanges medication and allergy data between the Clinical Data Repository and VA’s Health Data Repository. The DoD also utilizes the Health Artifact and Image Management Solution (HAIMS) tool, an enterprise-wide data sharing capability that allows the DoD and VA healthcare providers to access artifacts and images generated during the healthcare delivery process.

The Joint Legacy Viewer (JLV) provides care teams with an integrated, read-only display of health data from the DoD, VA, and private sector partners in a common data viewer. Through JLV, more than 320,000 DoD and VA clinicians can view in real-time records of more than 15 million patients receiving care from both Departments. For example, this allows care teams to immediately view their patient’s medical history for recorded events that may affect the outcome of the surgery. JLV also reduces the need for patients to carry hard copies of their health records when they visit different facilities. Additionally, complete access to a patient’s medical history leads to more informed decisions about patient care. This increase in user activity has garnered tremendous support from care teams, proving JLV as an invaluable resource to our patients and providers.

Currently, the DoD shares electronic health data with private sector partners through eHealth Exchange, while the VA uses both eHealth Exchange and Direct Messaging. eHealth Exchange is the nation’s largest health data sharing network comprised of federal agencies and private sector partners who share information under a common trusted framework to improve patient care and advance public health reporting through a secure, trusted, and interoperable health information exchange (HIE). Direct Messaging, a provider-to-provider messaging, allows health information to be shared between authorized VA clinical staff and trusted community healthcare partners. The DoD and VA developed external partnerships with many private sector HIEs and continue to add new partners each year. Together, the DoD and VA maintain access to over 120 private sector partners with additional HIEs being tested and on-boarded concurrently.

Modernization and the Way Forward

In July 2015, the DoD awarded a $4.3 billion contract to Leidos, Inc. to deliver a modern, interoperable EHR. Leidos is the Prime Contractor who, in contract execution, utilizes its Leidos Partnership for Defense Health (LPDH) team that includes Cerner Corporation, Accenture, and Henry Schein Inc. MHS GENESIS is a state of the market commercial off-the-shelf solution consisting of Cerner Millennium, an industry-leading EHR, and Henry Schein’s Dentrix, a best of breed dental module.

On February 7, 2017, the DoD achieved a major milestone, deploying MHS GENESIS at its first patient care facility, Fairchild Air Force Base in Spokane, Washington. The second deployment occurred on July 15, 2017, at Naval Hospital (NH) Oak Harbor, the first inpatient facility to receive MHS GENESIS. Additional deployments will continue across the Pacific Northwest at the remaining initial fielding sites which include NH Bremerton and Madigan Army Medical Center. The DoD plans to deploy MHS GENESIS to more than 9.4 million beneficiaries and 205,000 medical personnel and staff by the end of 2022.

On June 5, 2017, Dr. David Shulkin, Secretary of the VA, announced his decision to adopt the same EHR as the DoD. This decision ultimately results in a single software baseline and enables seamless care between the Agencies without the manual and electronic exchange and reconciliation of data between two separate systems. This decision will, over time, fundamentally solve the problem of transitioning patient health record data between the DoD and VA by eliminating the need for moving data between the two Agencies—there will be one clinical system.

With this announcement and the DoD’s ongoing deployment efforts, the need to enhance health data sharing is more vital than ever before. As the DoD and VA continue with their modernization strategies, the IPO facilitates collaboration with health IT leaders to ensure the DoD and VA are at the forefront of emerging standards and trends in health data sharing. Specifically, the IPO is working alongside the ONC, Health Level Seven International, the Advanced Technology Academic Research Center, the Institute of Electrical and Electronics Engineers, and other public and private sector partners. Advancements to health data interoperability are the future, and will ultimately lead to better health outcomes for our servicemembers, veterans, and their families. As the DoD and VA continue to build on their successes, the IPO continues to expand these collaborative relationships to advance the interoperability capabilities of today and address the technological challenges of tomorrow.
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