USAMRIID Diagnostic Testing

Commander's Corner

COL. (Dr.) Michael A. Weber
Commander
Dwight David Eisenhower Army Medical Center
Ft. Gordon, GA

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Cover: The litter team from Expeditionary Medical Force Great Lakes One performs triage on a casualty delivered by a U.S. Army HH-60 Black Hawk helicopter on Forward Operating Base Liberty during Operation Northern Lights. The aircraft is a vital part of battlefield medicine, as it is used to transport casualties to field medical centers. Operation Northern Lights is an annual Navy Reserve medical training exercise hosted here by the Expeditionary Medical Facility Great Lakes One based out of Great Lakes, Ill. The purpose of the exercise is to provide practical medical experience in an expeditionary environment. (U.S. Navy photo by Ensign Christopher Hanson/Released)
While the nation’s eyes remain firmly fixed on the presidential race, the men and women in the medical military community continue their critical duties as servicemember doctors and caregivers. With medical technology, and the means to deliver it quickly, innovation is a constant in regards to battlefield medicine. And the future only holds more promise for speedy, highly-advanced additions to the military’s medical wing.

In the Spring 2016 issue of Combat & Casualty Care, we take a broad look into the worlds of preparation and execution from enhancements to medical simulation bringing the chaos of battlefield response into virtual reality to advances in hemorrhage control, perhaps more critical than any single element of tactical combat casualty care. In an exclusive interview with COL Michael Weber, Commander, Eisenhower Army Medical Center, readers get insight into efforts in surgical and anesthesia training, transfusion ratios, hemostatic bandages, and the role of tranexamic acid in military and civilian trauma, including objectives in sustaining lessons learned through simulation training for 68W combat medics.

In the light of technology enabling high-fidelity simulation, combat medics are today better prepared for the realities of casualty response in terms of environmental condition and wound presentation. At the Val G. Hemming Simulation Center, School of Medicine at the Uniformed Services University of the Health Sciences (USU), Bethesda, Maryland, a visual virtual environment is created with physical, audio and smell elements completing the true combat experience, such as simulated ammunition bursts and associated sounds, burning materials, and even weather-related conditions such as heat and light variation.

Looking into the world of unmanned system assets for medical response, we examine some surface and aerial capabilities that may soon change the landscape of emergency medical evacuation during combat action, keeping medics out of harm’s way so they can attend to harm that’s already been done.

From a tourniquet evolutionary perspective, the National Center for Medical Readiness (NCMR) and Wright State University are working to ensure that quality in newly-introduced tourniquet technologies is maintained while counterfeit capabilities are weeded out.

As always we look forward to your comments and thanks for the continued readership, enjoy!

Sincerely,

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CoTCCC guidelines recommend: “...use Combat Gauze as the CoTCCC hemostatic dressing of choice.”

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Medical diagnosis is the process by which clinicians attempt to determine the cause of a particular disease or disorder in a sick individual. The goal of diagnosis is to assist in making correct medical decisions about the treatment and prognosis of the patient. For infectious diseases, laboratory tests represent one piece of the diagnostic puzzle, which also includes physical and clinical findings and the patient’s medical history. All of these pieces are critical to accurate diagnosis, and getting the right answer must always take priority over getting a quick answer.

As defined by the U.S. Food and Drug Administration (FDA), in vitro diagnostics are “those reagents, instruments, and systems intended for use in diagnosis of disease or other conditions…in order to cure, mitigate, treat, or prevent disease or its sequela. Such products are intended for use in the collection, preparation, and examination of specimens taken from the human body.” As such, the FDA has oversight and regulatory authority to clear in vitro diagnostic tests (medical devices) for commercial sale and use. Diagnostic assays for infectious diseases, therefore, are subject to regulatory compliance in order to be used for patient care. The quality of the clinical laboratory doing the testing is regulated by the Clinical Laboratory Improvement Amendments (CLIA), which were passed in 1988, while in vitro diagnostic tests are regulated by section 210(h) of the Federal Food, Drug, and Cosmetic Act.

For laboratory assays, two critical elements must meet minimal standards to be considered regulatory compliant: the laboratory performing the test must be qualified and the test being performed must be validated. The combination of a CLIA-accredited laboratory performing regulatory compliant test results in a diagnostic result that can be used for treatment and prognosis of the patient. For the Department of Defense (DoD), maintaining regulatory compliance in performing in vitro diagnostic tests in a deployed environment is a requirement that poses significant challenges.

The U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Fort Detrick, Md., is the agency charged with developing regulatory compliant diagnostics for biological threats. USAMRIID’s diagnostic expertise spans the pathway from assay development through FDA clearance. While this expertise was exemplified during the recent Ebola virus disease outbreak in Western Africa, USAMRIID’s diagnostic capability provides the DoD and the nation a critical resource that can be leveraged for any infectious disease should the need arise.
The division is unique in that it has both a research and development mission and an operational mission. The research portfolio includes diagnostic approaches that employ next-generation sequencing as well as identification and verification of host biomarkers that could be used for diagnostic applications. Operationally, USAMRIID’s Special Pathogens Laboratory (SPL) is one of three National Laboratories within the Centers for Disease Control and Prevention (CDC) Laboratory Response Network (LRN), as well as a member of the Defense Laboratory Network. The SPL is accredited under the Department of Defense Clinical Laboratory Improvement Program (CLIP) to perform regulatory-compliant diagnostic testing for patient care.

These capabilities—spanning research and development, support of FDA clearance, and operational diagnostic testing—position USAMRIID as a unique military asset that can be utilized to support the entire pathway associated with performing regulatory-compliant diagnostic testing for patient care. The Ebola virus disease outbreak is an excellent example of how USAMRIID contributed to the U.S. response to the crisis by providing assay development and validation, regulatory authorization and operational testing to support Ebola diagnosis worldwide.

**Ebola Virus Outbreak Support**

Surprisingly, USAMRIID had very few hurdles to overcome when responding to the Ebola virus disease outbreak with a regulatory-compliant diagnostic capability. In fact, the Institute had already established positive relationships with FDA and CDC before that outbreak to enable a swift response to just such an emergency. Preparations began with a briefing to FDA in December 2009 on the work of USAMRIID and the DoD to standardize assay development processes and performance.

From these discussions came a new initiative to improve readiness for biological contingencies. USAMRIID would pre-position its data on diagnostic assay performance with the FDA so that, in the event of an outbreak, an Emergency Use Authorization (EUA) could be initiated in order for those assays to be used in humans. By July 2010, FDA and DoD had agreed on the pre-EUA study protocols and 73 assays were submitted by USAMRIID and logged into the FDA database. In July 2011, USAMRIID completed the first data set that was accepted by the FDA, which was for the Ebola Zaire assay. By March 2013, all of USAMRIID’s filovirus (Ebola and Marburg virus) pre-EUAs, eight in all, had been completed and accepted by the FDA.

On July 9, 2014, in light of the escalating situation in Western Africa, FDA and DoD began discussions regarding an EUA for the Ebola Zaire assay that USAMRIID had developed. Thanks to forethought, careful planning and pre-positioned data, it took less than 30 days for the EUA to be authorized. On August 5, 2014, the U.S. Army Office of The Surgeon General (OTSG) was notified that
Tactical Defense Media

FDA had granted the DoD’s request for an EUA of the USAMRIID assay, dubbed EZ1. That assay was deployed to 16 DoD diagnostic laboratories (10 CONUS, 6 OCONUS) and 56 state public health laboratories within the United States. USAMRIID’s status as a CDC National Laboratory within the LRN provided a critical interface to the CDC, and that partnership led to the rapid deployment of diagnostic capability throughout the United States.

Training and Education

USAMRIID also plays a critical role in training personnel who perform diagnostic assays in field laboratory settings. It all began prior to the Persian Gulf War in 1991, when military planners realized there was a significant need for battlefield detection of biological warfare agents. As environmental detectors were developed and deployed, the ability to confirm what the detectors were “seeing” was crucial to add confidence for battlefield, medical, and National Command Authority decisions. The requirement for a deployable biological agent laboratory was born. With development and deployment of biological agent detection assays, the need for transition to field deployment and subsequent training of personnel was necessary.

USAMRIID’s Diagnostic Systems Division developed a course to train individuals in both molecular and immunological assays. Currently, the Field Identification of Biological Warfare Agents (FIBWA) course offers the most advanced fieldable technologies for confirming biological agents. Students are trained to set up, maintain, and operate a deployable laboratory under field conditions. The deployed laboratory capability supports combatant commanders and theater surgeons as a resource for biological agent testing. Since the FIBWA course was first offered in 1999, nearly 1,000 students, including members of three services, DoD civilians, and foreign national scientists have attended.

In 2005, the National Guard Bureau began using the FIBWA training program as the foundation for the advanced biological component of their Civil Support Teams (CST). These teams, assigned to each state and territory, form the basis of a highly specialized weapons of mass destruction (WMD) response element. The training capability that supports FIBWA also has been utilized and adapted for special training needs when required. For example, when USAMRIID and the NIAID-IRF helped the Liberian government to establish a diagnostic laboratory during the Ebola virus disease outbreak in 2014, the FIBWA program developed a three-day training program for all personnel traveling to Liberia to support the laboratory testing effort. This specialized support is still ongoing.

Looking Ahead

The Ebola virus diagnostic response within the U.S. was a good example of how interagency cooperation and collaboration can work. While the magnitude of the Ebola outbreak cannot be overstated, the fact that DoD and USAMRIID were prepared for such an event and responded quickly and effectively with a regulatory-compliant diagnostic capability must not be forgotten.

USAMRIID’s science and technology base serves not only to address current threats to our armed forces, but is an essential element in preparing for any future biological threats that may confront our nation.

USAMRIID EBOLA VIRUS DIAGNOSTIC RESPONSE TIMELINE

20 April 2014: USAMRIID establishes laboratory capability, in collaboration with NIH National Institute of Allergy and Infectious Diseases-Integrated Research Facility (NIAID-IRF) at the Liberian Institute for Biomedical Research (LIBR)
   a. USAMRIID trains local staff at the National Reference Laboratory (NRL) on how to safely and accurately test clinical samples for Ebola virus
   b. April - August 2014: LIBR is the only Ebola testing facility in the country of Liberia
   c. August 2014 – present: USAMRIID and NIAID-IRF continue to provide constant “on the ground” support for Ebola diagnostics at LIBR. To date, over 17,000 samples have been processed.

19 June 2014: CDC suspends routine operations and LRN support (safety stand-down)
   a. 28 July 2014: CDC Emergency Operations Center asks for USAMRIID support for domestic Ebola diagnostics during CDC shutdown
   b. 29 July 2014: Hospital in Houston, Texas sends patient samples to USAMRIID for testing (negative)
   c. 1 August 2014: Hospital in Mississippi sends patient samples to USAMRIID for testing (negative)

29 September 2014: USAMRIID begins supporting the National Institutes of Health (NIH) Special Clinical Studies Unit in Bethesda, Md., with diagnostic testing in support of patient care at the facility

21 October 2014: Texas Animal Health Commission requests testing support for domestic canine of Houston nurse who was exposed to Ebola virus
   a. USAMRIID had validated EZ1 assay for canine blood for use in military working dogs
   b. Assay is used on dog of Dallas nurse; she is eventually reunited with her pet

Sample extraction laboratory at the Liberia National Public Health Reference Laboratory.
(Photo by Dr. Randal Schoepp, USAMRIID)
We have to seize every opportunity we can,” said U.S. Rep. Bill Pascrell, D-NJ, during his opening remarks at a brain injury-themed panel discussion on March 17 in Washington, D.C. “Because the type of research we’re funding here, it’s absolutely essential.”

Pascrell’s comments came during the annual “Brain Injury Awareness Day on Capitol Hill” event, which is designed to educate Members of Congress, their staffs, and the general public on the full range of effects of brain injury, as well as the support systems available to brain injury survivors. The event, now in its fifteenth year, also typically serves as a means to announce groundbreaking research and promote key technological developments in the field.

““This is where we get the chance to shine,” said Dr. Alicia Crowder, Neurotrauma Portfolio Manager with the U.S. Army Medical Research and Materiel Command (USAMRMC) Combat Casualty Care Research Program, while giving a guided tour of new brain injury detection tools during the exhibitor portion of the event. Devices like the iSTAT and the Ahead 100 – the latter of which uses a headband-shaped device to measure a brain injury patient’s EEG signals – were developed using MRMC funding and expertise.

““An event like this is where we get to show lawmakers our playbook – our plan for both right now and for the future of brain injury diagnosis and treatment.”

More than two dozen other agencies and organizations lined the halls of the Cannon House Office Building to promote their latest research efforts as well, including the NIH and the Defense and Veteran’s Brain Injury Center. Outside of developmental technology, chief themes of the day included a specific focus on head injuries in women, and how exactly to translate military medical solutions to the civilian arena.

“This is exactly what I needed,” said Matt Taylor, an event attendee and head injury patient who suffered a TBI in a car accident at age ten. “Seeing all the tools available now as opposed to what we had when I was younger, it gives me hope for the future, for everyone else who’s gone through the same thing.”

U.S. Representative Bill Pascrell (D-N.J.) speaks to a brain injury survivor during the 15th annual “Brain Injury Awareness Day on Capitol Hill” event on March 17 in the Cannon House Office Bldg. (Photo by Ramin A. Khalili, Knowledge Manager, Combat Casualty Care Research Program)
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COL (Dr.) Michael A. Weber earned his commission through ROTC and his undergraduate degree in biochemistry from the University of Wisconsin in 1987. He was branched in the chemical corps and was assigned as a platoon leader in the 13th Chemical Company, Baumholder, Germany, in 1988. After two years, he was assigned as the assistant S-3 of 6-29 Field Artillery at Idar Oberstein, Germany. Next, he completed the Chemical Officer Advance Course in June 1992 and was re-branched in the Medical Service Corps in July 1992 before attending the Uniformed Services University of the Health Sciences.

After graduating medical school in 1996, he was assigned to Walter Reed Army Medical Center, where he completed his general surgery internship and residency. After residency graduation in 2002, he was assigned to Fort Hood, taking command of the 555 Forward Surgical Team. In February 2003, he deployed his unit to Kuwait and Iraq in direct support of the 2nd Brigade of the 3rd Infantry Division.

COL Weber returned to Walter Reed Army Medical Center in 2004 for fellowship training in vascular surgery. In 2006, he was assigned to William Beaumont Army Medical Center as the chief of vascular surgery. He was deployed to Iraq in 2008 as the OIF-OEF Theater Vascular Consultant at Ibn-Sina Hospital with the 86th Combat Surgical Hospital (CSH) and the 10th CSH. COL Weber was again assigned to Walter Reed Army Medical Center in 2009 and became the integrated chief of vascular surgery and vascular surgery fellowship program director. He led the planning and execution of the vascular surgery BRAC transformation establishing the fellowship training program at Walter Reed National Military Medical Center-Bethesda and the first vascular surgery service at Fort Belvoir Community Hospital. In July 2012, COL Weber took command of the U.S. Army Institute of Surgical Research, which includes the DOD's only Burn Center, Combat Casualty Care Research, and the Joint Trauma System.

COL Weber is double board-certified in General Surgery and Vascular Surgery. He is a Fellow of the American College of Surgery, a Certified Physician Executive, and a Registered Physician in Vascular Interpretation. He completed the Officer Basic Course, Officer Advanced Course, and the Command and General Staff College. His military awards and decorations include the Bronze Star Medal with Oak Leaf Cluster, the Meritorious Service Medal, and the Combat Medical Badge.

COL Weber was interviewed by C&CC Editor Kevin Hunter.

COL (Dr.) Michael A. Weber
Commander
Eisenhower Army Medical Center (EAMC)
Ft. Gordon, GA

C&CC: Please talk about your role and mission as Commander, EAMC.

COL Weber: My role as the EAMC commander is to drive the operations process to lead a system for health for the relatively known contemporary environment and develop a system for health for the future environment that is unknown, unknowable, and constantly changing. Understanding the contemporary healthcare environment requires knowledge of the science of medicine and knowledge of the business of medicine. I received my medical training through the Uniformed Services University (USU) and Walter Reed Army Medical Center. My business of medicine training came from U.S. Army Medical Command (MEDCOM) and an MBA from the University of Massachusetts. Preparing EAMC for the future healthcare environment requires me to understand the visions of The Joint Surgeon and The Surgeon General. One of the most important competencies for future healthcare at EAMC is our ability to innovate in all aspects of Telehealth. I also have a special role and responsibility for developing providers and leaders for the current and future environments. My family receives their care in the Military Health System and I want to ensure that all military families are confident and delighted with their care at EAMC.
C&CC: From a mission-focus perspective, speak to EAMC objectives heading into 2016 and lessons learned from more than a decade of tactical combat casualty care.

COL Weber: Our main, mission-focused objectives for 2016 are leveraging our competencies with Telehealth and Behavioral Health. EAMC is serving the Regional Health Command-Atlantic RHC-A as the Telehealth hub and center of excellence. EAMC Telehealth has routine operational reach to Rodriguez Army Health Clinic in Puerto Rico and the SOUTHCOM Clinic in Miami. EAMC serves as the treatment hub in a demonstration project for low acuity patients presenting at the Fort Campbell emergency department. Telehealth and Tele-behavioral health are enabling competencies that will become increasingly important in both garrison and deployed care. There are many lessons learned from the past 15 years of tactical combat casualty care. The majority of doctors, nurses, and medics at EAMC have deployed to the CENTCOM Theater. The lessons learned are a combination of “what to do” and “how to communicate.” The principles of damage control and surgical resuscitation are routine elements of surgical and anesthesia training at EAMC. Transfusion ratios, hemostatic bandages, and the role of tranexamic acid in military and civilian trauma are common questions during teaching and ward rounds. One of our objectives is to sustain the lessons learned through simulation training that includes 68W combat medics. I am committed to 68W sustainment training and job rotation through clinical environments. Our communication objectives expand upon lessons learned from Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) principles. EAMC leveraged AMEDD programs like the Patient Caring Touch System and Unit Practice Councils that adopt best clinical and communication practices.

C&CC: From a joint global healthcare perspective, how is EAMC addressing the need for comprehensive streamlining of critical day-to-day and long-term patient/member care?

COL Weber: Fort Gordon is not a Joint Base, but it is a triservice and interagency installation that serves as one of the Nation’s power projection platforms for global cyber warfare. The cyber workforce is engaged 24/7 and their unique demands require flexibility from their supporting activities. EAMC uses the Patient Centered Medical Home (PCMH) model for enrolling Tricare Prime beneficiaries and PCMH clinics have a combination of acute and non-acute appointments to provide for urgent and routine care that are focused on returning health and maintaining wellness. Urgent care needs are backed-up by the ‘Today’ Clinic that handles acute same-day appointments and the Emergency Department. Access for uniformed members is streamlined by the Troop Medical Clinic and Connelly Health Clinic. EAMC’s wellness efforts are supported by the Army Wellness Center that provides state of the art fitness testing, training, and education for the military and civilian workforce and their dependents. The dental clinics offer the “Go First Class” program where the exam, cleaning, and restoration are done at one visit instead of three separate appointments.

C&CC: Speak to ways EAMC is working to partner with civilian facilities to broaden and strengthen its reach and care network.

COL Weber: EAMC partnered with the local civilian facility Trinity Hospital for delivering babies. The decision to partner with Trinity Hospital allows the doctors from EAMC to deliver babies
at Trinity Hospital to better match the demand for obstetrical care with the costs of an obstetrics department. EAMC provides numerous clerkships for Medical College of Georgia—Regent University (GRU) medical students. EAMC shares Emergency Medicine residents with GRU and EAMC surgery residents rotate on the Burn Unit at Doctors Hospital.

C&CC: What are some of the key accomplishments/challenges EAMC has achieved/is addressing moving forward in 2016?

COL Weber: There are many achievements, but I will highlight two. EAMC participates in the American College of Surgeons National Surgical Quality Improvement Project (NSQIP) and was recognized as a Meritorious Hospital performing in the top ten percent of all hospitals worldwide. NSQIP ranked EAMC in the top ten percent for patient safety and surgical outcomes with institutions like John Hopkins, Boston University, and the University of Pittsburg. Patient safety is a central focus of how we care for our patients at EAMC.

The second achievement is serving as a Telehealth center of excellence and innovation platform to demonstrate what is possible in emergency medicine, internal medicine, and behavioral health. EAMC is focused on being a benefit to the healthcare facilities in our region and is looking for ways to be a true regional hub through telehealth. We are focused on improving patients’ access to care and telehealth will improve access to medical specialties while avoiding the inconvenience and costs of traveling to a referral clinic. We are shaping the future of telehealth at home and for future use in the combat environment. EAMC’s biggest challenge moving into 2016 is retaining the great team of providers, leaders, and innovators that make EAMC the First Choice for 5-Star.

C&CC: Do you see EAMC at the fore of tactical combat casualty care over the next quarter-century? If so, in what areas specifically?

COL Weber: Over the next quarter-century, I see EAMC as a leader in the telemedicine aspects of tactical combat casualty care. The Army Operating Concept describes the Army’s challenge as “Win in a Complex World.” The “complex world” is unknown and unknowable, but medical assets will form a key portion of the sustainment warfighting function during simultaneous offensive, defensive, and stability operations in future environments. As combat power transforms from mechanized to “informatized” to virtualized, convergence of information dominance becomes increasingly important. The meaning of tactical combat casualty care will have to expand beyond just care under fire to include sustaining cyber warriors. Military medical units must be able to detect, respond and innovate faster than the enemy and emerging medical threats. Telemedicine will play a major role in the agility of sustaining the fighting strength. The current expertise developed by EAMC with telebehavioral health, teleprimary care, telespecialty care and telepharmacy are leading to competency in telepresence. As a telemedicine hub, EAMC will be able to extend its operational depth from points of injury all the way through rehabilitation and reintegration with units, families, and society.
The United States Army Institute of Surgical Research (USAISR) reports that 30 to 40 percent of civilian deaths by traumatic injury are the result of hemorrhaging; of those deaths, 33 to 56 percent occur before the patient reaches an emergency care facility.

By Will Fox, M.B.A., Vice President, Sales & Marketing, RevMedx and Pamela Jackson, COO & Co-Founder, Panakeia

The Department of Homeland Security (DHS) is working to educate the general public on how to be prepared to address severe bleeding from traumatic injury. Through its “Stop the Bleed” campaign (www.dhs.gov/stopthebleed) they are helping to raise awareness of the importance for early control of severe bleeding to help prevent shock and save lives.

RevMedx, a Portland-based medical device company has dedicated itself to saving lives by creating groundbreaking medical products. They’ve developed an entire line of devices designed specifically for combat medics and civilian first responders to revolutionize the treatment of traumatic bleeding.

Their partner, Panakeia, LLC is also focused on this goal by providing medical solutions that transform patient care and save lives. They distribute innovative medical products to the global medical community, including the military, pre-hospital care and EMS, law enforcement, fire/rescue, Veteran’s Administration and hospital critical care. Panakeia was also recently awarded a General Services Administration (GSA) Federal Supply Schedule (FSS) to add the full line of RevMedx products for the next five years. This allows the military medical community another contract vehicle to purchase RevMedx products through Panakeia. Additional products now available include the Parabelt, a daily-wear belt with integrated ratcheting tourniquet, the Sharkbite Trauma Kit for the treatment of large blast injuries, and XGauze, a z-folded dressing embedded with expanding sponges. The FSS contract number is: V797D40152.

RevMedx Vice President John Steinbaugh served in the U.S. Army for 25 years—20 of which he spent as a Special Forces medic with multiple tours of duty in Iraq and Afghanistan. Steinbaugh worked with medics returning from the battlefield that were not happy with the results of traditional hemostatic treatments. Medics wanted a quicker solution to severe junctional bleeding of the axilla and groin. Steinbaugh and his team set out to invent a portable, quick solution to allow the medic to inject material into the wound that would immediately stop bleeding without direct pressure. With feedback from medics along the entire design process the XSTAT hemorrhage control device was created.

New Solution for Critical Wound Care

Recently cleared by the FDA for civilian use, the XSTAT is a first-in-kind hemostatic device for the treatment of severe bleeding in the axilla or groin area where tourniquets or other methods are inadequate.

It consists of a 30mm diameter syringe filled with 92 compressed mini-sponges, treated with a hemostatic agent – chitosan, as well as a radiopaque marker for visibility under imaging. These sponges, when in contact with blood or fluid, expand up to 10x their size and create a temporary barrier to blood flow. The compact syringe features a telescoping handle to quickly inject the sponges to the injury site. The rapid expansion of the sponges provides for internal compressive forces in the wound area to control bleeding until the patient can receive surgical care. Additionally, no manual compression is required after deployment, although a cover bandage is recommended.

Wound packing time based on testing results show that XSTAT took medics 25% of the time required to pack the wound and to reach hemostasis versus traditional methods using gauze. Because these sponges directly apply pressure from the inside, medics no longer need to spend three to five minutes applying pressure to the wound, waiting for the bleeding to stop. Or even worse, if the bleeding does not stop after the first attempt, the medic will have to remove used...
XSTAT – For the control of severe, life threatening bleeding from junctional wounds in the groin or axilla:

- Stops bleeding in seconds with rapidly expanding sponges
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XSTAT-30 Product #: 30-305
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gauze and repeat the process until the bleeding ceases.

**Innovation as a Success Driver**

In order to ensure that XSTAT was immediately and efficiently made available to the military population, RevMedx partnered with Panakeia LLC, a worldwide distributor of innovative medical solutions. Since the first shipment of XSTAT to the U.S. military back in November 2014, the partners have realized significant success with XSTAT, including FDA Clearance for both the military and civilian markets; use by the U.S. Army Special Forces; and most recently, the addition of XSTAT to the Tactical Combat Casualty Care Guidelines as a treatment for hemorrhage not amenable to limb tourniquet use.

"As a leading provider of lifesaving medical innovations that are helping to change the face of trauma care on the battlefield, we are honored to represent XSTAT for the military community. XSTAT is a real game-changer and platform for a series of new products," added Panakeia co-founder, Pamela Jackson. “We’re excited to be at the forefront with our partner RevMedx.”

According to Andrew Barofsky, CEO and President of RevMedx Inc, “We designed the XSTAT with direct input from military medics and first responders to provide a unique solution to the issue of junctional hemorrhage. This technology will save lives for years to come.”

More info: panakeiausa.com

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**CLEARING THE EYES OF COMBAT**

The leading supplier of cutting edge eye irrigation technology enables hands free care so combatants can focus in the fog of war.

By Steve Bixby, Director, MorTan, Inc.

From a hospital in Vietnam during the late 1960s, use of the Morgan Lens has spread to where it’s now found in nearly 95% of emergency departments across the U.S. It’s not surprising, since it provides the only hands-free method for quickly and easily treating ocular chemical burns or for removing non-embedded foreign bodies. Acids, bases, solvents, cleaning agents, biological or radiological agents, and small particulates are among the many contaminants that are effectively removed.

During World War II, Dr. Loran Morgan was a paratrooper battalion surgeon with the 466th PFA (17th Airborne) where he was awarded many accolades including the Bronze Star. After the war, and a dozen years in general practice, he became an ophthalmologist. Returning to the battlefield in Vietnam on four occasions as a volunteer physician, he was troubled by the many treatable eye injuries that developed into permanent disabilities due to a lack of medical personnel or because of infection. During his third tour, he invented the Morgan Lens, a simple yet effective medical device that solved these problems and allowed the treatment of life-threatening injuries while not ignoring the eyes.

As the only “hands-free” method of eye irrigation available,
the Morgan Lens allows medical personnel to treat other injuries or patients while the irrigating fluid is effectively flushing all regions of the eye, cul-de-sac, and inner eyelid. Since minimal attention is required, the patient may be transported without interrupting irrigation, and one medic may treat multiple victims in mass casualty situations. Instead of fighting the body's natural blinking reflex, the eyes are closed during irrigation, making the process more comfortable. This means irrigation may be continued for the hours, or even days, that may be necessary for proper treatment.

The Morgan Lens requires minimal training and may easily be used in the hospital or in the field. After attaching the lens to an IV set and bag of irrigating solution, it's slipped under the eyelids, and in less than 20 seconds, the most efficient treatment possible is underway. Fast, effective, and easy to use means the Morgan Lens is the ideal option for treating injured eyes in all situations.

More info: morganlens.com
Military field surgeons are preparing for combat surgery through the use of “Hands-in-the-Body” high fidelity simulation technology.

By D. Michael Navin, CEO and Robert F. Buckman III, VP, Operative Experience Inc.

All deployed military physicians, regardless of specialty, are expected to provide combat casualty care. Many of these physicians, even some trained general surgeons, have received little training in trauma surgery during their medical education and residency. What would be most beneficial would be a training system that could rapidly bring general and subspecialist surgeons already lacking solid trauma experience to the point of competency in the performance of open, major, surgery.

TATRC

The Medical Modeling & Simulation (MM&S) team at the Telemedicine and Advanced Technology Research Center (TATRC), U.S. Army Medical Research and Materiel Command (USAMRMC), recognized this need. Seeking to improve trauma training effectiveness, the MM&S team proposed a number of forward-looking research topics, one of which was entitled “Rapid Trauma Skills Training”, to the Small Business Innovative Research (SBIR) program. The SBIR topic was approved, the government solicited research proposals; many were submitted.

Operative Experience Inc (OEI) was one of the two companies selected. TATRC provided government oversight during Phases 1 and 2. Based on successful performance, a second Phase 2 award was made. Management oversight has been transferred to the Congressionally Directed Medical Research Program (CDMRP), in response to a reorganization directed by the USAMRMC.

OEI stated they have undertaken a long-term project to develop training systems that can meet these needs. OEI has produced unique, high-fidelity physical models of a variety of combat injuries as well as multimedia training modules to rapidly teach more than 20 critical trauma procedures and skills. The training systems developed by the company have been suitable for the education of trauma providers at various roles of care. These include a suite of five combat casualty simulators with wounds consistent with an IED detonation, high velocity gunshot wounds, trans-facial gunshot wounds, traumatic amputations, burns, blasts, and fractures. The point-of-injury simulators are currently used by the USMC at Camp Pendleton as well as the U.S. Department of State. Surgical training simulators include a craniootomy simulator for training in the relief of a subdural hematoma, a two-incision four-compartment fasciotomy of the lower extremity, above and below knee amputations, and proximal control, extensile exposure, and shunting of the femoral artery.

The company’s approach has been to create physical models of relevant surgical anatomy, including the derangements caused by combat-relevant wounds. The models are made of materials that can be subjected to all the maneuvers of major surgical operations using standard instruments such as those in deployed instrument sets. Within these models, artificial organs, muscles, skin, bones, fascia, blood vessels and other tissues are accurately represented. The all-important dissection planes, which allow the safe surgical approach to deep structures, are incorporated. OEI stated the resulting physical simulators are the first in the world that permit the demonstration and practice of major, “hands-in-the-body” surgical operations for combat wounds without the need for live tissue or cadavers. The artificial tissues of the simulators can be cut, retracted, stapled and sutured using standard surgical instruments, but unlike real tissues, the artificial tissues are stable and are not subject to dehydration or decay. Each simulator serves as the basis for a curriculum-based multimedia educational module consisting of a systematic demonstration of surgical anatomy as well as trauma operative management tactics and techniques. “The idea of using real surgical instruments, both to learn and rehearse surgical procedure(s) on a manikin with synthetic tissues is intriguing, but it is extremely important to validate how well this approach actually improves training effectiveness,” said Harvey Magee, Lab Manager, TATRC’s Medical Modeling & Simulation Innovation Center.

Medical Procedure Training

OEI’s most recent project enables the teaching of emergency resuscitative thoracotomy and other combat-relevant thoracic surgery techniques. These low-frequency, high-stakes procedures represent extreme resources of the surgeon facing a casualty with imminent or actual cardiac arrest due to blood loss. The simulator enables
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repetitive training in the technical steps to manage severe injuries of the heart, lungs and mediastinal blood vessels. It includes a complete integrated anatomy of the chest wall and the thoracic viscera and vessels, and a heart that simulates cardiac contractions and that pumps blood. The heart produces pulsatile spurts of hemorrhage when wounded and can be repaired repeatedly with staples or sutures. It also includes lungs that can mimic important combat-relevant injuries with both hemorrhage and air leakage. The lungs can be subjected to major operations, including pneumonectomy.

The physical simulator is supported by a standardized, multimedia curriculum for emergency combat surgical operations within the chest cavity, including: thoracic incisions; control of pulmonary hemorrhage; lung resections; pulmonary tractotomy; exposure and control of aortic arch vessels; pericardiotomy and repair of cardiac wounds. This includes assessments to test the cognitive and psychomotor proficiency of trainees in the actual performance of the major procedures listed.

OEI’s simulators have been demonstrated at the Uniformed Services University of Health Sciences’ Simulation Center and in some of its field exercises. Trainees will have the opportunity to learn standardized approaches to severe traumatic injuries, to practice these approaches and be tested for proficiency. Upon the completion of a training course, trainees will be able to take away the instructional modules for refresher or just-in-time training. Several OEI simulators have either been independently validated or are currently undergoing validation studies. Upon validation, OEI anticipates that curriculum-driven, simulation-based training of surgical procedures will supersede current training. Emergency Medicine physicians and others who require knowledge of emergency surgical operations would also be candidates for training.

Editor’s Note: This research and development project is being conducted by Operative Experience and was made possible by a contract vehicle which was awarded and administered by the U.S. Army Medical Research & Materiel Command at Fort Detrick, MD under Contract Number: W81XWH-15-C-0078. The views, opinions and/or findings contained in this publication/video are those of the authors and do not necessarily reflect the views of the Department of Defense and should not be construed as an official DoD/Army position, policy or decision unless so designated by other documentation. No official endorsement should be made.
In the future, rescue and medevac at sea will be conducted by unmanned surface vessels.

By Edward Lundquist, C&CC Correspondent

Search and rescue (SAR) at sea is often time consuming and dangerous. Once missing or injured people are located and rescued, they have to be delivered to a care facility.

Singapore-based Zycraft is developing its 56-foot Vigilant-class Independent Unmanned Surface Vessel (IUSV) to respond to SAR cases and serve as a medical evacuation sea-ambulance. Because Vigilant carries modular payloads, it can be configured with the unmanned search and rescue mission package, which includes special radar and electro-optic day and night camera systems to conduct wide area searches.

James Soon, president of Zycraft, says it isn’t necessary to always have people on rescue vessels when unmanned craft can accomplish the task without putting rescuers’ lives at risk. “Technology has advanced to a point where the option of using unmanned vessels for SAR is real.”

Target Track and Double Back

The drone can be assigned a systematic search pattern that follows pre-planned tracks to completely cover the area. The search data can be recorded and reviewed later to assist in any investigation.

After a casualty is spotted, the SAR payload is capable of remote recovery of either ambulatory or unconscious casualties. The IUSV is equipped with a robotic arm that is controlled from the shore base by a manned operator. “Once placed in the stretcher, cameras and biomedical sensors will provide status of the casualty’s pulse, temperature and health condition so that the base can then plan accordingly for further medical treatment and resources,” says Soon.

The craft will be able to recover up to eight casualties lying in a special litter rack. If there are conscious casualties, an additional 15 persons can be seated in other areas within the IUSV.

“The robotic arm is also designed to tag bodies in the water for future recovery so that space on-board the IUSV is reserved for survivors, leaving body recovery as a last act once survivors are accounted for,” according to Soon.

According to Soon, the IUSV could carry a medic or rescue swimmer, even though the boat would be controlled from ashore. Therefore the rescue team doesn’t have to operate the boat and can rest or treat patients. It has active gyro stabilization, providing a steady platform and comfortable ride for patients and passengers. It’s stable enough to permit a helicopter to airlift recovered casualties to receive urgent treatment.

Endurance Now and Evolving

The IUSV is controlled using a satellite data and communications link, so long-distance searches are possible. “For prolonged searches, a change of an operator at an observation desk in a communications room at the shore base replaces the need to change a fatigued crew,” Soon says. “We take the limitations of the human being out of the SAR operation, which leads to longer endurance missions and the ability to deploy more frequently.”

Don’t expect to find an IUSV SAR boat conducting a rescue at sea just yet, however; there are still some technology and policy issues to address. “We don’t have all the answers yet, as SAR is a new area of development for our company. We know the technology is there. The IUSV part is proven. Getting SAR authorities to exploit the new technologies is the work ahead.”
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The Russell PneumoFix™ is a sterile chest decompression device designed for the management of tension pneumothorax, simple pneumothorax and pleural effusion. Unlike the intravenous cannula, used historically in an improvised way for the management of tension pneumothorax, the Russell PneumoFix™ is designed specifically for this purpose.

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- Convenient **visual indicator** clearly demonstrates that the needle tip has entered the pleural space
Demonstration in unmanned air systems shows integrated coordination from single controller in enabling medical casualty response.

By Edward Lundquist, C&CC Correspondent

A flight demonstration using a hand-held tablet has shown how unmanned air and ground vehicles can be supervised together by a single operator, and how big and small businesses can work together. The demonstration was conducted recently at Kaman Aerospace in Bloomfield, CT, involving a Lockheed / Kaman CQ-24A K-MAX autonomous helicopter, Neya Systems’ UxInterceptor Unmanned Ground Vehicle (UGV), all coordinated through Neya’s Mission Management platform.

During the medical casualty response and resupply scenario, a distress call from a ground unit reporting a casualty led ground operators to send an unmanned ground vehicle to assess the area and injured party. The ground operators, who were using controls stations that communicated with each other using the Unmanned Aircraft System (UAS) Control Segment (UCS) architecture, requested airlift by unmanned K-MAX of one individual who was injured—simulated in the scenario by a mannequin. UCS provides a common basis for acquiring, integrating, and extending the situational awareness and capabilities of the control systems for unmanned systems.

From the ground, the K-MAX operators used a tablet to determine the precise location and a safe landing area to provide assistance to the team. When the UAS arrived at the scene, the two unmanned vehicles were given instructions by a single operator using a Vertical Takeoff and Landing (VTOL) Evacuation and Resupply Tactical Interface (VERTI) Medic Interface and UxFleet / Collaborative Mission Planning system from Neya Systems. The injured team member was then strapped into a seat on the side of the unmanned K-MAX, which was then able to fly the casualty to a safe area for treatment.

Today, virtually all unmanned systems have their own unique and proprietary control system, communications and data links. The UCS architecture decomposes capabilities provided by these control systems and data links, independent of the platform. With UCS, legacy systems can be adapted for use with common control stations by opening up their capabilities, and integrating them with open UCS interfaces, making existing systems not only interoperable but readily upgradable. The flight test showed how the UCS Architecture can integrate a handheld GCS with the aircraft and ground vehicle and enable collaborative activities between multiple autonomous platforms.

Neya Systems, a small business located in Wexford, Pa., near Pittsburg, was the prime on the effort, and developed the rapid prototype and demonstration effort leveraging several different
small business innovation research (SBIR) grants and follow-on Department of Defense (DoD) funding. The company partnered with the Lockheed Martin and Kaman team to deliver the innovative technology to existing systems.

Neya provided UCS-compliant software, developed through their open and freely available UCS software development kit (SDK), to Lockheed Martin for integration within their K-MAX GCS. This same software was integrated with Neya’s VERTI Android tablet. VERTI supports UCS and Joint Architecture for Unmanned Systems (JAUS) interfaces, allowing for simultaneous control of with UCS-compliant UASs and JAUS-compliant UGVs.

Under a variety of SBIR, Navy, and Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD (AT&L) funding, “Neya has been developing interoperable technologies for mission planning, human-robot interface, and UGV and UAS control,” said Parag Batavia, PhD, president of Neya Systems, “Our VERTI Android-based handheld controller, which uses the UCS Architecture, makes interfacing with a broad range of platforms and capabilities straightforward.”

Batavia says Neya’s notion of modularity is all about using open architectures and open interfaces, and not considering those interfaces proprietary.

“Integrating open architecture services within the UxInterceptor and K-MAX control stations meant that there was no redesign of

the UAS or UGV platform required,” says Batavia. “This allowed for rapid integration and testing.”

The operator conducting the demo had no previous experience controlling the K-MAX and was able to control both the UAS and UGV at the same time after just one hour of familiarization training.

“This collaborative demonstration signifies how using multiple unmanned systems can address critical needs such as medical casualty response and resupply without endangering additional lives,” said Kevin Westfall, director of Unmanned Solutions for Lockheed Martin Mission Systems and Training. “As technology and autonomy mature, there is significant potential for these systems to be used for humanitarian aid, first response and military applications.”

**Optionally-Piloted Helicopter**

Lockheed Martin’s K-MAX is an optionally manned helicopter—with both Local Control (LOCO) and unmanned or Non-Local control (NOLO) modes—for its unmanned logistics delivery system. Test flights can be operated in controlled airspace, such as around the Kaman facilities in Bloomfield, close to Bradley Hartford-Springfield International Airport in Windsor Locks, by having a safety pilot onboard when in the NOLO mode.

The aircraft has mechanical controls for the rudder and the servo flaps that control the angle of the rotor blades. There are no
hydraulics, and no power boost for the controls. The disadvantage to the design is that the aircraft is relatively slow, with a top speed of 100 knots, but most loads are flown between 40 and 80 knots.

K-MAX has counter-rotating rotors, so all the power goes to lift. With a conventional main rotor / tail rotor configuration, up to a third of the engine’s power can go to the tail rotor, necessary to counter torque and maintain the heading of the aircraft, but since there are no tail rotors, all the power goes to the lifting blades. It can lift its own weight. “It’s a 6,000 lb. aircraft that can lift 6,000 lbs.,” says Jon McMillen, Lockheed Martin’s program manager for the unmanned K-Max aircraft.

The aircraft burns about 85 gallons an hour, which gives it a mission duration of just under three hours.

It can travel at about 100 knots without a load. A typical load for the unmanned mission is 4,500 lbs.

While deployed with the U.S. Marine Corps from 2011 to 2014, the unmanned K-MAX successfully conducted resupply operations in Afghanistan. “We delivered more than 4.5 million pounds of cargo during more than 1,900 missions in two and a half years,” says McMillen.

The aircraft was designed for the vertical lift mission and is barely wide enough for the single pilot’s seat. Typically, the pilot is looking down at the cargo hook and places the hook into the ground crewman’s hands, thereby necessitating the narrow fuselage. There is limited space inside for cargo and personal gear, and there are FAA-approved side-mounted jump seats for a crewmember to sit on, such as a logger or a firefighter.

**Bullish on K-MAX**

The unmanned K-MAX was employed successfully in Afghanistan to provide logistics support to remote operating bases. The missions had been conducted by convoys or by larger manned helicopters. “The unmanned K-MAX took a lot of Marines and soldiers off the roads,” Terrance P. Fogarty, director of business development for K-MAX helicopter programs.

Fogarty says the technology and aircraft are an ideal system for firefighting. Presently aircraft are limited by weather or visibility from smoke, and can fight fires only during limited daylight hours. And it’s a grueling job. Lockheed Martin and Kaman are demonstrating how K-MAX can be used to make multiple lifts to drop water or fire retardant on fires around the clock.

The system can be deployed rapidly to provide humanitarian assistance to remote, inaccessible or contaminated areas, especially if roads or airfield have been damaged, and has a relatively small footprint. “It depends on how long we stay, but when we deployed with the U.S. Marine Corps, the entire operation consisting of a Lockheed Martin field team of about a dozen people with aircraft, support equipment and spares were transported with three C-17 lifts,” Fogarty says.

Radio, satellite or Iridium communications can be used as a datalink with the aircraft. The satellite antenna is mounted on top of the aircraft and is able to receive a virtually uninterrupted signal even with the blades rotating above.

It’s a stable helicopter, designed by pilots and maintainers, Fogarty says, and it’s the only aircraft designed, built, tested and certified for repetitive external lift, instead of a passenger carrying aircraft converted to full time repetitive lifts.”

The K-MAX prototype first flew in 1991—35 production model K-MAX helicopters were built, and 22 are still flying, mostly in the forest products and firefighting industries, around the world. Fogarty says although K-MAX is currently not in production, Kaman is recently announced that it will reopen the production line, and has begun accepting deposits. Fogarty says the new aircraft will retain the same proven design. “We’re bullish on the future of K-MAX,” he says.

### On the Ground

According to Brian Stancil, director of robotic systems at Neya Systems, the company has a long involvement with medical robotics.

“We’ve looked at a lot of small unmanned ground vehicles for locating and getting to the casualty. Assessment and triage are very difficult to do with unmanned systems, so a lot of the work that we’ve done has been to put remote sensors and gain access to casualties in and perform remote telemedicine approaches,” Stancil says. “Once you have located the casualty, the soldier has to be protected. For treatment, we’ve been looking at high-degree-of-freedom manipulators attached to our unmanned ground vehicles to provide some initial and early treatment for problems,” Stancil says.

“With extraction, you’re starting to get to the last 80% of the problem. There are good places and bad places to grab a guy on the ground. If he’s in the line of fire, you want to get him into a safe position quickly. In other situations, you would want to be a little bit more careful.”

According to Stancil, most control systems have a static functionally laid out user interface (UI). “There are different tabs and sections for the various functional components of the system. With VERTI, we’re creating specific UI views for any task that the soldier needs to do at that time.”

“The testing we did with Lockheed and Kaman has been invaluable. We’ve integrated a lot of UCS services. We’ve tested out a lot of the issues with networking and wireless bandwidth. We’re going to be looking for transition opportunities to do further demonstrations and to share this with to other groups that are working in similar spaces,” Stancil says.

The UCS architecture helps small businesses and directly supports DoD’s Better Buying Power (BBP) initiatives, because it gives smaller, innovative companies the flexibility and ease of inserting technology into existing systems, while reducing costs.

### UCS Architecture

“Open architecture allows us the,” says Rich Ernst, who was the lead for UCS with DoD and is now with the Department of the Navy.

The mission planning and management system provided by Neya not only fits on the K-MAX, but can work with other systems, opening up a much larger market. “It provides that far-reaching innovation for the system, but also lowers the cost of the system going forward,” Ernst says.

While the demo showing the collaboration between autonomous air and ground systems was remarkable, and so is the collaboration between big and small business, Ernst says.

“We standardized the [contract] language so you can procure things in a certain set of ways that is advantageous for however you have invested money into that system,” says Ernst. “Vendors can own everything – but at minimum, the government owns the interfaces (and) the behavior models to that application.”

Even with squeezed budgets, Ernst says the open architecture approach reduces redundancies and inefficiencies, and thus procure
more systems for warfighters while at the same time driving up margins for vendors.

**Software Development Kit**

“We took what we developed through an Army Phase I SBIR, which was a relatively low-dollar effort, and we integrated that into UCS because we had this SDK, and because we were able to generate this code quickly. It immediately opened up the suite of things that we could integrate our software with,” Ernst says. “The whole point is not to have to re-architect and rewrite all of your code.”

Stancil says the implementation of the interfaces using the UCS software development kit (SDK) was relatively simple. “We opened up the tool kit, picked the interfaces that we want to implement, we auto-generated that code and the interfaces, and rapidly integrated our application logic.”

He says most of the work involved generating the services on the GCS. For the purposes on the demonstration, a lot of the core components of the autonomous services were already available via Lockheed Martin. “All they needed to do was integrate them into our UCS interfaces.”

“Lockheed Martin basically took our UCS interfaces and incorporated the services into their hardware-in-the-loop system integration bench. That’s where we tested for the last month using the exact hardware running on the K-MAX. Then we actually flew this code for the first time,” Stancil says. “I’ve been involved in a lot of robotic integration efforts, and I have never waited until two days before the demonstration to integrate on the hardware that we were to use. So, I would credit Lockheed Martin’s collaborative hardware in the loop simulation laboratory (CHIL SIM) for that. They’ve got a fantastic bench dock set up, and that really helps reduce integration time.”

When a man on the ground wants to supervise the UAS there is a positive hand-off. The tablet requests control from the GCS, and the GCS can grant or veto that request.

The on-scene user can update the UAS with instructions as to specifically where it should land, no fly zones, a specific desired approach direction or angle. “The ground control station takes those constraints and generates a detailed flight that is passed back to the tablet so the operator can see what the action might be.”

“This application of the unmanned K-MAX enables day or night transport of wounded personnel to safety without endangering additional lives,” said Jay McConville, Lockheed Martin director of business development for Unmanned Solutions. “Since the K-MAX returned from a nearly three-year deployment with the U.S. Marine Corps, we’ve seen benefits of and extended our open system design incorporating the UCS architecture which allows rapid integration of new applications across industry to increase the safety of operations, such as casualty evacuation, where lives are at stake.”
Emergency Responder Training Center
Skedco, Inc. offers equipment training and rescue training resources for confined space rescue, water rescue, Hazmat rescue, emergency and casualty evacuations.

Skedco recently launched the Skedco Learning Center (SLC) where you can acquire comprehensive training on many of their products. With the formation of SLC, users can register for open enrollment courses at SLC headquarters in Tualatin, OR. One and two day courses are offered focusing on intensive hands-on Sked Stretcher instruction, the Oregon Spine Splint II and a Skedco Bleeding Simulation System program called the HydraSim. The second day of a two-day course focuses on the TerrAdaptor, a portable anchor system that can be used in rescue, industrial and wilderness environments. It comes in standard tripod and quadpod configurations.

More info: skedco.com

Robotics Marries Medical and Military Technology
Wearable and implanted devices are the next frontier of military technology and medicine. These machines could be anything from a personal cooling system to an exo-skeleton suit, replacement limbs or even a jet pack. Speakers at the conference said those advances are just a few years away from reality.

Geoffrey Ling, former director of the U.S. military’s Defense Advanced Research Projects Agency’s Biological Technologies Office, said technology and medical research have advanced enough to begin considering wearable robotics. “I believe that we are on a threshold of man’s next transformation,” Ling said. “And that is where man and machine become symbiotic.”

Much of that technology is still in the testing phase, but enough is available to provide a glimpse of the future.

Eduardo Fernandez, a graduate student at Arizona State University, is part of a team developing personal machines for military use. Those projects include a system for reducing the sway of military backpacks and shirts that keep soldiers cool on hot days. But perhaps the one that garnered the most interest from attendees was a jetpack designed to allow anyone to run a four-minute mile. Fernandez said they haven’t perfected the system, but the current version does improve running times, although not to the extent of enabling the average person to run a four-minute mile.

The concept of wearable systems goes beyond increasing strength or stamina. Some researchers are developing technology to combat diseases or find a workaround for spinal injuries.

David Armstrong, a professor of surgery at the University of Arizona College of Medicine, said wearable robotics could help address foot decay among diabetes patients.

“We don’t think of a hearing aid, we don’t think of bifocals, as some sort of cybernetic device, but in fact they are – they augment what we do,” Armstrong said. “In the future, this is not going to be so exotic and crazy. This is just going to be another part of our life.”

Ling said the best way to address potential ethical issues is to be aware of them while maintaining a commitment to advancing the technology.

More info: azcentral.com

Military Hospitals are Key to Keeping Medical Staff Combat-Ready
Military hospitals and clinics allowing doctors to practice a variety of specialties are critical to keeping medical staff combat-ready, they say.

“To ensure the readiness of the entire medical team for a broad range of missions we must maintain and sustain our hospitals and clinics as our readiness and training platforms. This system ensures our force is trained, ready and relevant,” Brig. Gen. Robert Tenhet, the Army deputy surgeon general, testified Feb. 26 before a House subcommittee.

Lawmakers said they’re looking for ways to balance that combat readiness with reforming the military health care system.

“The purpose for this hearing is that as we undertake the reformation of the military healthcare system, we want to make sure that we keep readiness first and foremost in our minds, and we don’t impede, one, the readiness of our military medical providers --- but certainly that we don’t hinder the medical readiness of our troops,” said Rep. Joe Heck, a Republican from Nevada and chairman of the House Armed Services Personnel Subcommittee.

Lawmakers have said they plan to propose a series of health care reforms as part of the 2017 National Defense Authorization Act process, but want to strike a balance between keeping training options available for military healthcare providers, lowering taxpayer military healthcare costs and providing excellent care to military member, families and retirees.

One common criticism of military healthcare among lawmakers is that many of the system’s providers focus on military family care instead of combat readiness. But military officials at the hearing said that those services do play a readiness role both from a stateside perspective as well as during deployment.

“We need to maintain readiness not only of our active duty members but of our families also, and the OB/GYN and pediatric care that we provide help us to maintain that family readiness so when that active duty member is deployed they have confidence that their family will be taken care of,” said Maj. Gen. Dorothy Hogg, the Air Force’s deputy surgeon general.

Tenhet, the Army deputy surgeon general, said women today represent a high percentage of troops on the battlefield.

“In any given [forward operating base] we may have upwards of 30 percent females, so a ‘gynecologist in theater’ is not a misnomer,” he said. “Eighty percent of our evacuations are disease non-battle injuries as well. So sustaining just within the trauma system itself, we have to look across the entire system of medicine.”

More info: military.com

Joint Staff Surgeon General Testifies on Future Medical Readiness
Military medicine must be better aligned to continue demonstrating its readiness posture to Defense Department senior leaders, the joint staff surgeon general recently told a House Armed Services Committee panel.

Army Maj. Gen. (Dr.) Joseph Caravalho Jr. testified before the HASC
Military medicine has one mission: to support the joint force with globally integrated operations. "Military medical centers, hospitals and clinics [are] our home stations’ front lines of care,” he emphasized. “They provide ready warfighters and medical forces alike, while delivering quality health care to our valued beneficiaries [and] ... during and following deployments, they offer continued high-quality care for those in need.”

Caravalho noted such an alignment coordinates with the chairman of the Joint Chiefs of Staff’s “vision of future security environments.”

The chairman’s recently published Joint Concept for Health Services describes his vision for what the future force will need for military medicine to support globally integrated operations, Caravalho noted.

“It is my observation that [the] joint force expects military medicine to be more than interoperable and at times more than joint,” he told the panel.

“Whenever and wherever feasible, while remaining cognizant of service responsibilities to best support the joint force, the services’ medical forces must be interchangeably aligned,” Caravalho said.

The services are working on putting into place “core medical specialty requirements” to help create a more interchangeable joint medical force, he added.

“Readiness metrics will then reflect each medical specialty’s ability to function across the full spectrum of military operations,” the general said.

Caravalho said he’s seen an increasing number of requests for medical support to smaller and more widely dispersed ground forces, adding that he expects this trend to continue.

The medical community must also adapt to new paradigms of health service support, he said.

“To meet this challenge, we have already begun work toward a formalized and disciplined review to develop new organizations, training, policies and doctrine,” Caravalho said.

“Military medical centers, hospitals and clinics [are] our home stations’ front lines of care,” he emphasized. “They provide ready warfighters and medical forces alike, while delivering quality health care to our valued beneficiaries [and] ... during and following deployments, they offer continued high-quality care for those in need.”

Military medicine has one mission: to support the joint force with globally integrated health services, Caravalho noted.

“We will not lose focus on the world-class health care our service members and families deserve,” he said, “but it will be performed in support of our primary mission of medical readiness.”

From home stations to operational deployments to evacuation to post-deployment settings, Caravalho said, “I feel strongly the military medical team across all the services will remain relevant, adaptive and highly valued members of the joint force.”

More info: defense.gov

Phokus Research Group Receives Patent for Low Profile Medical Kit

Battle tested in Iraq and Afghanistan, the Phokus Trauma Kit’s lightweight packaging allows for quick deployment in the field. The innovative pressure sealed, flat design allows operators to comfortably wear medical gear that is concealable and instantly accessible, eliminating the need for bulky external medical pouches.

Designed as a system to fit behind the ballistic plates of a protective vest, the kit is protected from shrapnel and tearing, is easily locatable and removable and does not affect the user's freedom of movement. When the kit is removed from its protected location, it presents the medical trauma supplies in a logical and easily viewable manner.

Phokus Trauma Kits feature high quality, combat proven components that follow all Tactical Combat Casualty Care (TCCC) guidelines. The contents are packed for priority of care and are sealed within heavy-duty medical grade vinyl that provides weatherproof protection of critical medical supplies. Radio Frequency (RF) welded seams provide superior loss protection of valuable equipment. Available in four sizes, Phokus Trauma Kits are designed to suit every operator’s needs.

"Being able to provide life saving medical gear that can be worn by an operator has always been our goal and we continue to innovate products for this life saving system,” said Steve Friedlander, VP Sales and Marketing of Phokus Research Group.

More info: phokusresearch.com

Poison Ivy & Insect Bite Treatment

Zanfel Poison Ivy, Oak and Sumac Wash, is the only evidence based product available that removes the poison ivy plants’ toxin from the skin, anytime after outbreak of the rash. After application, the affected individual can immediately return to duty in an itch free and healing state.

Use of Zanfel has been reducing military occupational health costs associated with this very common allergic skin reaction. During visits with personnel from Fort Benning and USSOCOM, Zanfel’s Vice President, Steve Sisler learned about the huge cost savings Zanfel has been providing (versus a clinic visit, prescription medications, and lost duty/training time). "The cost associated with standard therapy was $500 - $1000 per day, with the average length of treatment being three days. The cost of treatment at the battalion aid station with Zanfel is less than $28, with an immediate return to duty”, said Sisler.

Each year about 50 million Americans experience a case of poison ivy, oak, or sumac. The incidence of this allergic skin reaction is significantly higher for those who work and train outdoors.

Healthcare providers recommend Zanfel to help patients heal quicker and avoid the side effects associated with steroids and sedating antihistamines.

In addition to poison ivy related dermatitis, Zanfel has been found to be extremely effective in reducing the itching and pain associated with ant bites, and other insect bites and stings.

More info: zanfel.com

More info: phokusresearch.com
The Val G. Hemming Simulation Center was established within the School of Medicine at the Uniformed Services University of the Health Sciences (USU), Bethesda, Maryland, in 1999. Initially, the center used simulated patients (SPs) to act as patients for medical and nursing students to interview and examine in order to practice and get feedback on their skills in history taking, physical examination and communications skills. SPs assessed student performance and gave feedback to USU medical and nursing students.

Over time, other capabilities were added, specifically the use of anatomic manikins and task trainers to allow students to practice procedures such as IV insertion, lumbar puncture and inserting chest tubes in trauma patients. At the same time, the center introduced the use of high complexity human patient simulators that allowed students to respond and get feedback on emergencies such as cardiac arrest, seizures and intubation – procedures that cannot be performed on SPs. These methodologies filled a gap between cognitive knowledge of understanding what to do and being able to actually demonstrate skills in specific high-risk tasks.

**Mixed Methods Trauma Simulation**

In 2003, the Center began working to create an immersive virtual environment in which computers create the setting while trainees attend to casualties. The center has continued to develop this groundbreaking technology and in the past few years has moved it from concept to reality. The Wide Area Virtual Environment, or WAVE, is the largest virtual reality theater in health care. In this environment, computer-generated graphics create the surrounding reality while teams of learners work on SPs or mannequins. WAVE, which is the size of a basketball court, uses 24 screens to project 3D images of various environments, many of which involve combat-oriented scenarios. Casualties in the form of humans or manikins are inserted within the real-time training scenario to enable medical students to practice building combat-related skills for actions such as hemorrhage control, airway obstruction, IV insertion, and evacuation of the wounded by ground or by air. In accompaniment with the visual virtual combat environment are physical, audio and smell elements that complete the true combat experience, such as simulated ammunition bursts and associated sounds, burning materials, and even weather-related conditions such as heat and light variation. From virtual field to virtual facility, trainees also gain experience treating patients in role 3 facility settings such combat support, fleet surgical, or Air Force EMEDS hospitals. For each scenario offered, all that needs to be swapped out are the live or manikin casualties. This immersive environment can recreate the chaos of war for teams of four-to-six learners at a time, and allows the training and evaluation of both technical skills and teamwork.

The Simcenter also employs the use of a hybrid technology where a human dons a wearable ensemble allowing treatment of certain types of combat-related injuries. Treatment may include placement of a tourniquet, a chest tube, or even a surgical airway. Trainees get the added benefit of working on a live individual while performing the procedures, bringing the training level that much closer to real-time combat casualty situations.

The hardest part of simulation is not the technology, but in developing reliable and valid tools that measure the performance of individuals and teams in simulation that translate to the real world. It is not as simple as it appears. Clinical skills and decision making are complex human tasks, and the current assessment tools we have are not very precise. We need better performance measures to get the best value out of simulation. The second challenge is proving simulation creates better outcomes for actual patients outside the simulation lab. Drawing a direct line between simulation practice and clinical practice is challenging and a source of ongoing research to tease out how much of the patient improvement was due to simulation training.

By Col. (Dr.) Shad Deering, Professor and Chair of OBG and Dr. Joe Lopreiato, Medical Director, Val G. Hemming Simulation Center, Uniformed Services University of the Health Sciences

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**BRINGING REAL WORLD TO VIRTUAL CARE**

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Mixed Methods Trauma Simulation

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Real Training for Real Scenarios

Simulation allows teams to practice and get feedback on their skills in a safe environment. Previously, students honed their skills on patients in the hospital where disease is variable and feedback not always timely. In simulation, learners can practice and receive feedback in a controlled environment to be competent when seeing patients in the real world. Say we want to provide a group of combat medics, Navy corpsman, or Air Force technicians with tactical combat casualty care (TCCC) training. Using the cut suit or manikin, and immersing the trainees in the chaos of combat at the point of injury, a WAVE scenario might involve using a few folks as casualties wearing appropriate makeup to simulate injuries of the nature we want to replicate such as burns, abrasions, limbs blown off, etc. Along with the replication of injuries, WAVE also provides a realistic backdrop of combat action such as explosions, small arms fire, vehicles moving through the battle, sights and smells normally associated with combat, whether urban or austere. In this fluid environment, the trainees are given the opportunity to practice tourniquet application, intubating a casualty, bandaging a wound, morphine injection, etc. before moving the casualty to the next echelon of care, such as a waiting ambulance or helicopter. The entire training scenario is live video recorded and archived so that the trainees can be debriefed using the actual footage of the scenario they were actively involved in.

In situations where trainees are not actually able to train at the Sim Center with the full application of WAVE, the Center is currently experimenting with WAVE-lets or smaller versions of the WAVE experience that can be set up using a couple of screens at a warehouse or other non-medical facility like a temporary shelter. Presently, there are three WAVE-lets in operation; at Camp Bullis in San Antonio, at the Surface Warfare Medical Institute in San Diego, and at the Medical Research Center of Chemical Defense in Aberdeen, MD. In essence, these are applications of WAVE in a scaled down version of virtual reality through the same software, delivered locally, to create a combat training environment in a space the size of a small office. In the future, WAVE scenarios may be distributed from the master WAVE in Bethesda, streaming out some of the software so small little WAVE-lets can be set up wherever there is a projector and the screen capability.

We are currently performing research and training teams using this new methodology with a variety of medical and nursing teams from the DoD.
The National Center for Medical Readiness (NCMR) has played an integral role in tactical combat casualty care, with a keen focus on the use of tourniquets for battlefield use.

By COL (Ret.) Douglas “Boots” Hodge, Associate Director, Operational and Disaster Medicine, NCMR, Wright State Research Institute (WSRI)

As Associate Director of Operational and Disaster Medicine, my job is to continually perform research and keep up-to-date information on trauma and disaster medicine which the National Center for Medical Readiness (NCMR) uses to perform: education and training; modeling and simulation; consulting and management; and research, testing and evaluation. My primary focus is research and training in trauma care in the field medicine, pre-hospital care and en route care. I have has several areas of interest in medicine: How do we determine medical competency and how do we measure skill degradation in a perishable skill areas? I continue to work issues for counterfeit medical devices.

NCMR is part of Wright State Research Institute (WSRI). It offers a realistic research and training environment set on over 50 acres in Fairborn, Ohio that uses unique props and realistic settings to duplicate the full range of hazardous materials, confined spaces, and civilian and military transportation-oriented wreckage for any potential emergency response personnel – from community groups and healthcare providers to law enforcement agencies and combat medics. NCMR also serves an applied research platform as well as a test bed for industry development and commercialization of disaster preparedness-related equipment and materials. NCMR provides a unique capability of curriculum development and delivery across the spectrum of adult learning. Distinct efforts are made to provide highest quality models and simulations.

Tourniquet Evolution
Prior to Sept 11th, military and civilian tourniquets were very limited and remained unchanged for about 40 years. They were generally not recommended except in last ditch efforts. While tourniquets have been around for centuries, the greatest breakthrough has been in the last 10 years with the introduction of the CAT and SOFT-T tourniquets. These revolutionary changes were the result of recognition that U.S. casualties and death during combat where tied to extremity hemorrhage. The end customers, Special Forces, developed their own designs, which eventually were supported by DoD R&D for improvements. They continued to evolve, making improvements in the windlass, widening the actual tourniquet material, sewing and catches. However, they are not foolproof. We continue to see failures when overtightened, or not applied as recommended.

The biggest problem today with quality is the continued introduction of counterfeit tourniquets that are intended to look exactly like the original ones. They were developed for the Air Soft Market, but rapidly were adopted by medics because they look identical to the original devices. Side by side most people can’t tell the difference except for an expert and even then some can’t tell them apart. The problem is counterfeit tourniquets break during actual use.

There have been multiple reports in
the civilian EMS and law enforcement communities. I’m absolutely positive they were bought with the right intentions. The price is often two-thirds less than the retail price of the “approved” devices. The biggest area of concern is the windlass breaks when tightened. Purchasing from a recommended source is the only guarantee you’re getting the real deal.

**NCMR and Industry**

WSRI - NCMR provides industry and the military with a wide variety of test, evaluation and research partnerships in areas of: medical equipment, Human Performance Manikins, rescue equipment, Unmanned Air Vehicles (UAV), communications equipment, sensors research for the military and civilian markets. We do make recommendations to various programs on tourniquet issues, especially regarding the counterfeits at this time.

Wright State Research Institute and NCMR maintain a high level of participation with various groups in our Miami Valley, throughout Ohio, and at the national level. We participate with the Greater Dayton Area Hospital Association (GDAHA), Greater Miami Valley EMS Council (GMVEMSC), and Air Force Research Laboratory (AFRL), and work closely with local and regional colleges and universities such as Wright State University, University of Cincinnati, University of Toledo, Case Western Reserve University, the Ohio State University, and Sinclair Community College.

**Med Future**

I believe that current day tourniquets have been perfected to the point where they won’t change much in the future. The next technological jump in hemorrhage control will come in the form of injectable hemostatic, local vasoconstrictor agents, and tamponade with pneumatic devices, and biomaterials – glues from bio-synthetic polymers and ceramics.

Rather than dressing and wound-packing, we will start seeing instant void filling liquids and foams that will effectively stop bleeding. Finally “Star Trek,” the immediate super cooling or freezing of traumatized tissue for surgical correction later on, will become prominent in wound care. It’s actually really exciting to see these developments. Applying lessons learned from current tourniquet usage, and the continuing study and research of future methods, will contribute to life saving in the military and more importantly, in civilian EMS and law enforcement contexts.

While on active duty, we had the great fortune to work with the Armed Forces Medical Examiners (AFME) at Dover where lessons learned named Feedback to the Field (FBTF) originated. They continue to be released today as new items come up. FBTF lessons learned on medical equipment issues, training issues, and potential tactics, techniques and procedures (TTP) issues are reviewed with recommendations available at Defense Health Agency, Medical Logistics Division, under Joint Medical Test & Evaluation (JMT&E) helpful links, under links and FBTF resources.
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Meeting Contact: Kimberly Williams, kwilliams@ndia.org

DI2E Plugfest & Mashup (AFEI)
June 1-2, 2016 ► Fairfax, VA
Exhibit & Meeting Contact: Tammy Kicker, tkicker@ndia.org

Medical RDA in Support of the Warfighter ► 6310
April 19-20, 2016 ► Ellicott City, MD
Exhibit Contact: Luellen Hoffman, lhoffman@ndia.org
Meeting Contact: Tiffany Wilson, twilson@ndia.org

2016 Global EOD Symposium & Exhibition ► 6950
August 2-3, 2016 ► Bethesda, MD
Exhibit Contact: Luellen Hoffman, lhoffman@ndia.org
Meeting Contact: Leah Oleszewski, loleszewski@ndia.org

Armament Systems Forum ► 6610
April 25-28, 2016 ► Fredericksburg, VA
Exhibit Contact: Allison H. Carpenter, ahcarpenter@ndia.org
Meeting Contact: Britt Sullivan, bsullivan@ndia.org

2016 CBRN Defense Conference
August 3-5, 2016 ► Aberdeen Proving Ground, MD
Exhibit Contact: Allison H. Carpenter, ahcarpenter@ndia.org
Meeting Contact: Adrienne White, awhite@ndia.org

2016 Special Operations Forces Industry Conference – SOFIC ► 6890
May 23-26, 2016 ► Tampa, FL
Exhibit Contact: Luellen Hoffman, lhoffman@ndia.org
Meeting Contact: Christy Mason, cmason@ndia.org

DLA Land & Maritime/DSCC Supplier Conference & Expo
Aug 29 - Sept 1, 2016 ► Columbus, OH
Exhibit Contact: Allison H. Carpenter, ahcarpenter@ndia.org
Meeting Contact: Kimberly Williams, kwilliams@ndia.org

I/ITSEC 2016 (NTSA)
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Exhibit Contact: Debbie Langelier, dlangelier@ndia.org 703-247-9480

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CALENDAR OF EVENTS

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| APR 11 – 13 | Drone Dealer Expo  
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Dronedealerexpo.com |                                               |
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Bordersecurityexpo.com |                                               |
| APR 17 – 21 | SPIE  
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| JUN 27 – 30 | Bio Defense World Summit  
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| JUL 14 – 15 | Warrior Expo East  
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Warrior-expo.com |                                               |

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