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Commander’s Corner

COL Harlan M. Walker II
U.S. Army Medical Corps
Command Surgeon
U.S. Special Operations Command
MacDill AFB, FL

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Cover: Soldiers from various nations participate in the International Special Training Center Advanced Medical First Responder Course in Pfullendorf, Germany in October 2014. The multinational students receive the training to enhance their medical skills to support NATO soldiers, sailors, and airmen and treat and stabilize combat trauma casualties using SOF-oriented medical procedures and skills. (Visual Information Specialist Jason Johnston)

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As 2014 draws to a close, the past 12 months have been marked by upheaval from the Middle East to Ukraine and West Africa—places most Americans will never know personally, but locations ever more familiar to the U.S. military. Amidst the turmoil of history’s worst Ebola outbreak, representatives of the 1st Area Medical Laboratory, 20th Support Command-CBRNE, U.S. Army, have been tasked to perform analytical testing and health hazard assessments, employing modern technology to combat the spread of a disease as potentially deadly as a rifleman’s bullet.

In the final issue of the year, we focus on the world of Special Operations Forces (SOF) medicine, and how it is pushing the technology envelope across the multifaceted spectrum of combat medical care. In an exclusive interview with Command Surgeon Colonel Harlan Walker II of Special Operations Command (SOCOM), readers gain insight into how SOF medics are being trained and equipped amidst a mutating battlespace. Moving from command-level instruction to training-level education, this issue illuminates the integrated classroom and real-time simulated scenario preparation offered at the Joint Special Operations Medical Training Center (JSOMTC), Fort Bragg, N.C.

From the Air Force, we delve into how live one-on-one communications are keeping patients and providers connected no matter the distance or locale of deployment. Advances in physical medicine often overshadow attention that is and must continue to be paid to therapies addressing cranial trauma such as mild traumatic brain injury (mTBI) and post-traumatic stress disorder (PTSD). Once positive diagnoses have been made on patient condition, difficulty often exists in completing in-person follow-on treatment. To address this, an evolving form of care called telemedicine is taking root across DoD, one based on phone and video streamed patient-to-doctor and doctor-to-doctor consultation.

Other coverage in this issue includes a profile of the Naval Medical Research Unit-San Antonio, TX, one of DoD’s premier centers for R&D in the arena of expeditionary trauma care. We also look into the potential future of squad support robots as casualty evacuation platforms.

As always, thank you for your comments and continued readership.

Happy holidays!

Sincerely,

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In the past, the Special Operations Medical Association (SOMA) was the organization associated with a scientific assembly held every December in Tampa, FL. This meeting typically brought together medical providers serving in Special Operations Forces (SOF) of the U.S. and allied nations. But, if you think about it, SOMA really is a medical society comprised of medics, physicians, and others who practice a unique blend of medicine that combines trauma, tactical, environmental, human performance, disaster, wilderness, and primary care disciplines. We are, I believe, the most interesting medical society in the world. No other organization does what we do. With this in mind, we are shaping our organization to function more like a professional medical society.

**New Media**
The SOMA website has been re-built and is now operational. The site can still be found at specialoperationsmedicine.org, but it is now more than just a place to register for the meeting. Members can exchange professional ideas in forums and find the latest best practices and clinical guidelines for Tactical Combat Casualty Care (TCCC) and SOF medicine.

One thing that hasn’t changed is SOMA’s dedication to its mission of supporting SOF medical operators and paving the way for their success. Ultimately, our goal is to improve the survival rate and reduce the suffering of SOF warriors in harm’s way.

**Current Endeavors**
The 2014 Special Operations Medical Scientific Assembly (SOMSA) is one the most ambitious and cutting edge that we’ve offered. Pre-conference meetings and lab sessions will kick off on 8 December. Highlights include the usual robust line up of labs with some new additions: Dr. Cord Cunningham is hosting a half-day medical informatics session. As you may know, collecting patient care data from the field is a challenge, yet this data is key to improving combat casualty care. This session will include military and civilian experts in pre-hospital care and will highlight some evolving technologies to capture patient care data. After all, we can’t improve what we can’t measure.

Colonel Sean Keenan’s prolonged field care group is holding a “train the trainer” session as a pre-conference course. During this, we will have three separate units simultaneously run casualty scenarios with robust discussion and AAR’s particularly directed at the how-to portions of education and training. Dr. Keenan would like to invite representatives from units to see what we (you) think are viable options for training.

During the main session we have made a commitment to significantly increase the number of medic presentations. We will have six SOF medics presenting in the main session with a SOF medic roundtable discussion at the end. I anticipate the SOF medic roundtable discussions being the highlight of this year’s plenary session.

We are very pleased to have Dr. Art Kellerman, dean, Uniformed Services University of the Health Sciences (USUHS), at our Second-Half Initiative lunch session. SOMA’s Second-Half Committee exists to inform and mentor medics interested in higher medical education. Dr. Kellerman will discuss the new Medic to MD program at USUHS. This will be a key session for medics interested in attending the medical school. Finally, we have a great Mess Night program in the works. A small donation allows you access to Mess Night where we have a great speaker and a great program lined up. All proceeds go to the SOF Medic Scholarship Fund, which sends SOF medics to become doctors, PA’s, nurses, or to other higher-level medical education.

**New Location, Greater Reach**
As many of you may have heard by now, we are moving the date and location of our annual Scientific Assembly to the spring of 2016 in Charlotte, N.C. This is a big move for us, but one that was requested by the uniformed SOF medical leadership, and one that in the end will help us get more enlisted medics to SOMSA. In addition to being a great town to have a meeting, Charlotte is within a day’s drive of the majority of SOF medics, allowing more to attend. We’ve also moved the meeting to the spring, a time that is more budget friendly to most SOF units.

We think this move will significantly improve our ability to reach enlisted medics and the SOF medical force in general as it will allow for substantially more uniformed SOF medical operators to attend. See you in Tampa!

Sincerely,
LTC Bob Mabry, MD
SOMA President
Student medics at the Joint Special Operations Medical Training Center are immersed in a combination of state-of-the-art medical simulation and real-world training.

By Mr. Daniel A. Doerr, JSOMTC
Special Operations combat medics frequently find themselves hundreds of miles from the nearest hospital and licensed physicians. Their teams count on them to know how to handle every medical emergency that arises from the routine cut to the life-threatening bullet wound and everything in between. For these medics, the training at the Joint Special Operations Medical Training Center (JSOMTC), operated by the U.S. Army John F. Kennedy Special Warfare Center and School’s Special Warfare Medical Group (Airborne), is the key to their success.

Located at Fort Bragg, N.C., medical training at the JSOMTC is among the most advanced training offered to combat medics. Students spend countless hours pouring over medical texts and practicing medical procedures on not only themselves but also their classmates, but that only gets them so far. To reach the level of professionalism necessary to perform in the complex environments of today’s battlefields, training must be lifelike. That’s where realistic simulation of human anatomy and the multitude of physiologic responses associated with illness and injury come into play. To that end, training at the JSOMTC utilizes a complex mix of medical simulators, from partial task trainers and manikins (high-fidelity patient simulators) to computer simulators.

It is imperative that both trainers and students understand the role and necessity of medical simulation in training, while understanding that even the best simulation cannot take the place of hands-on experience in the practice of medicine.

Finding the Right Balance
Training at the JSOMTC is taught in relatively rapid progression from very basic life-saving skills through advanced combat trauma skills and prolonged casualty care. The models and simulators applied to each successive block of instruction are selected accordingly. For example, in order for a student to begin casualty care, he must first learn anatomy and physiology as well as various basic medical skills. For this portion of the course, the students themselves act as role models for not only physical examination techniques, but also for many minimally invasive procedural interventions (after first practicing these skills on partial task trainers).

Partial task/skills trainers are also utilized for more invasive treatment techniques during all phases of training. For instance, airway trainers are used to teach and assess the medic’s ability to perform both basic and advanced airway procedures, but there are drawbacks. One of the biggest challenges with all airway trainers is the lack of flexibility in the neck area, which can lead to bad habits during intubation, such as prying with the laryngoscope. Instructors have to be cognizant of this issue while their students use this equipment. Similarly, there are also issues with realism when performing a cricothyrotomy on any type of skills trainer, as the simulated anatomy is not completely correct. Moreover, simulators take time to reset, and do not provide realistic bleeding at the incision site. These concerns create challenges for the manufacturer in creating a realistic product, balancing realism with cost.

There are many other examples of this trade off when using simulators. For instance, a pneumothorax trainer is used to train and assess the student’s ability to perform a needle decompression. At the JSOMTC, students utilize a full-sized chest model so the landmarks for decompression can be reinforced, with the ability for air to escape the catheter when the procedure is performed properly. However, the ability to recognize abnormal breath sounds, percussion, or breathing in order to identify the need or location of the procedure is not provided by the simulator.

Simulators show imperfections in other ways as well. For intraosseous training, the devices used allow the procedure to be performed including locating proper landmarks, but they give no feedback with regard to blood flow. An interchangeable urinary catheter trainer is used to train and assess the student’s ability to perform urinary catheterization. This
allows the student to practice maintaining sterility during the procedure, but still lacks the realism at the point of insertion because of the rigidity of the material used to make the anatomy.

While there are some drawbacks to medical simulators, certain simulators offer unique ways to train medics. An example of this is the ultrasound trainer, which is utilized to train and assess the student’s ability to not only perform, but interpret the exams with simulated modalities that cannot be performed when practicing on a healthy human. The main challenge with all medical simulation is realism; instructors must clearly identify the objectives of the training and select the most appropriate simulator in order to achieve those objectives, whether a complex computerized device or a simple plastic mock-up.

Role Playing, Not Fantasy
As students’ progress through their medical training, however, a complete human casualty is required in order to fully train and assess their ability to put all of their skills together as they assess and treat a trauma casualty. The most common form of simulation utilized during this type of training is role playing, which utilizes students as casualties with simulated wounds called moulage. This form of simulation is used for most of the casualty treatment scenarios in the JSOMTC, as it allows ease of movement throughout the training area and the speed in which multiple casualties can be set up at one time with minimal instruction and oversight.

As with other simulations, realism with moulage has an effect on cost. Most of the moulage utilized is commercially manufactured and provides the real look and feel of traumatic injuries, such as bone protruding from open fractures. An abdominal evisceration can be re-introduced, which provides wounds that can be packed with gauze.

However, there are significant limitations to some of these moulage kits. An example of moulage limitation is finding a realistic imitation chest wound that is not damaged or degraded after application of the occlusive dressing is virtually impossible. In these cases, inexpensive, homemade yet unrealistic looking wounds are often used. Another challenge with moulage is creating realistic bleeding and then stopping bleeding when wounds are treated properly, such as with the application of a tourniquet; one of the systems used has a plastic tourniquet shield, which allows a tourniquet to be emplaced and tightened as tight as necessary to stop the bleeding. Another has a key fob control that allows the evaluator to start and stop the bleeding wirelessly based on actions taken by the student. Still, one of the most convenient ways to provide bleeding feedback is the use of a squirt bottle that does not have tubes to kink or cut and can be carried anywhere.

An additional challenge with role playing is the acting itself. As the students learn more about medicine, they are also able to improve their role-playing ability, thereby resulting in
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improved training. In this regard, it is critical that instructors thoroughly brief role-playing students on their required actions based on the scenario. Instructors also have to be prepared for mistakes that the casualty role player might make and adjust as needed. As long as the instructor identifies the objective of the scenario, proper moulage and acting can be utilized to enhance training and make it as realistic as possible.

**Computer-enabled Simulation**

Computerized simulators are absolutely critical to medical training. They provide aspects of realism that are impossible to simulate in any other way, such as with Advanced Cardiac Life Support instruction and testing. These simulators provide a complete range of physiologic responses to both injuries and treatments and also allow students to be evaluated on their interpretation of the findings and responses.

Computerized simulators force students to make assessments and treatment decisions independent of feedback from the instructor, which is the most critically important skill students must learn in order to be able to operate independently. However, computerized simulators have one major disadvantage: They lack realism when performing procedures such as airway and intravenous/intraosseous interventions. Once in place, though, the instructor can then input oxygen or give fluid therapy and the “casualty” will respond accordingly.

There are logistical impediments as well. Computerized simulators also do not allow for easy movement without risking damage to the simulator, computer, or fluid lines. Untethering the computerized simulators may allow more freedom during movement and realism during exposure, but removes the realism of colored fluid excretions allowing blood to be red, sweat to be clear, and urine to be yellow or tea colored in accordance with the given scenario. For these reasons, as well as due to the increased cost of maintenance of these advanced simulators, the JSOMTC only uses them for static training scenarios.

**Moving Forward**

Medical training, particularly for Special Operations Forces, must remain challenging and present the most realistic models available for combat medics to become proficient in the evaluation, stabilization, and treatment of casualties in the most demanding and austere environments. In order to meet this daunting task, every conceivable simulator and training model available must be utilized and tailored to the necessary training objectives. Medical simulators are not a panacea. The cost of the simulator is typically tied to its level of realism, which puts them out-of-reach for many training institutions or at the very least, limits their use among the number of students enrolled in training.

Students enrolled in the Special Operations Combat Medic Course at the Joint Special Operations Medical Training Center utilize computer simulators. Computerized simulators force students to make assessments and treatment decisions independent of feedback from the instructor, which is the most critically important skill students must learn in order to be able to operate independently. (Staff Sgt. Shelman Spencer)

Lead art: Students enrolled in the Special Operations Combat Medic Course at the Joint Special Operations Medical Training Center at Fort Bragg, N.C., practice intubating a patient on an airway trainer. (Staff Sgt. Shelman Spencer)
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By Ricardo Flores, Military Programs – Field Sales Manager
Z-Medica, LLC

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The CoTCCC guidelines are derived from evidence-based medicine and continuous evaluation of the latest research. The CoTCCC guidelines are used by all U.S. military forces and are currently influencing and impacting domestic tactical medicine. These guidelines are also being incorporated internationally by many U.S.-allied foreign military services.

QuikClot Combat Gauze is designed to be applied on the battlefield, which requires a durable package that is simple to open. Additionally, the military needs products that are designed to work effectively both while our warriors are under extreme stress and in a wide array of environmental conditions. As the military’s primary hemostatic dressing, QuikClot Combat Gauze has a long history of utilization under the tense battle conditions in which medics operate.

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Colonel Harlan M. (Hal) Walker II became the Command Surgeon for U.S. Special Operations Command (SOCOM) in March 2013. Previous key medical assignments include Special Operations Command Europe Command Surgeon, SOCOM Clinic Commander, U.S. Military Academy Cadet Health Clinic Commander, and 12th Aviation Brigade Flight Surgeon, which included multiple deployments. Prior to becoming a physician, he was an Army Aviator for 16 years as a UH-1 Instructor Pilot and CH-47 Pilot-In-Command.

Interview by C&CC Editor Kevin Hunter

C&CC: What is the focus of the Special Operations Command (SOCOM) Command Surgeon’s Office? How does it accomplish these missions?

COL Walker: The Command Surgeon’s Office focus is Special Operations Forces (SOF) medicine in remote and austere combat environs. We ensure SOF warriors get the best possible medical care for injuries and illnesses while performing their duties in the most difficult environmental and combat circumstances. We concentrate our efforts to improve all SOF medical personnel skills/systems/equipment, from pre-mission biosurveillance to point of injury and prolonged patient care SOF medic skills, through readily accessible Role 2 Damage Control Resuscitation assets and CASEVAC [or] MEDEVAC to definitive care.

The lynchpin of the SOF medical enterprise is the autonomous SOF medic. While our Surgeon’s Office may appear distant from individual medics on an organizational chart, we overcome this gap by having positive impacts on SOF medics through SOCOM Directive 350-29–mandated medic certifications, refresher courses, advisory groups, and other mechanisms that link us directly with individual medics and their needs.

Our office’s sphere of influence includes working with the SOF service components, Theater Special Operations Commands (TSOCs), SOCOM HQ assets, Tactical Combat Casualty Care (TCCC) Committee, Joint Staff, Defense Health Agency (DHA), Assistant Secretary of Defense for Health Affairs (ASDHA), and other key DoD and non-DoD agencies to maximize mission-appropriate SOF medical manning, funding, training, equipment, medical intelligence, Role 2 surgical access, and MEDEVAC assets. With the large number of stakeholders involved and blurred lines of responsibility, efforts can be complex and time consuming; an example is our current global MEDEVAC plan initiative, which has required two-plus years of U.S. government-wide staffing and will be implemented incrementally in FYs 15-26.

C&CC: Will the global MEDEVAC plan replicate the one-hour MEDEVAC standards of recent operations?

COL Walker: SOF missions are moving from the mature and robust medical and MEDEVAC asset arenas of Operations Enduring Freedom and Iraqi Freedom into more remote and austere environs that have no indigenous or U.S. military medical infrastructures. In some current areas of operations, it can take one to three days to obtain MEDEVAC [or] CASEVAC support. While a one-hour MEDEVAC standard may not always be attainable, we must reduce the presently unacceptable response gap to hours. To accomplish this, we are re-emphasizing prolonged patient care training for SOF medics so they can maintain casualties in the field until definitive surgical resuscitation and/or MEDEVAC assets can be accessed. We are also working with the joint staff and the rest of the DoD medical enterprise to improve the joint theater patient evacuation system. Lastly, to support TSOCs and Geographic Combatant Commands (GCCs), we are increasing the number, mobility, and capability of damage control surgical assets and pushing them as far forward as
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possible, preferably within one hour’s transit from likely points of injury, thereby reducing the need for immediate evacuation.

C&CC: Please discuss the force health protection initiatives currently being pursued.

COL Walker: We are developing the Global Biosurveillance Web-based Portal (GBSP) with the joint staff and many other agencies. GBSP will be a consolidated, single-source reference for planners and operators at all levels that will provide near real-time geo-tagged biosurveillance, force health protection, and CBRN data and analyses. GBSP will greatly improve, simplify, and expedite the process of obtaining enhanced medical situational awareness prior to deployments.

C&CC: Please describe the missions of the three SOCOM HQ agencies. How do they compare?

COL Walker: These three independent but synchronized SOCOM HQ agencies all maximize the health and well-being of SOF forces and their dependents. Our missions overlap, but a simplistic differentiation is:

- [Command Surgeon’s] Office focuses on combat/remote/ austere medicine efforts (pre- and intra-deployment biosurveillance, point of injury and prolonged field care, Role 2 resuscitation, and surgical asset access, CASEVAC/MEDEVAC availability).
- Preservation of the force and families (POTFF) enhances warrior and dependent pre-/intra-/post-deployment resiliency and rehabilitation (physical, psychological, social, and spiritual).
- Care coalition (CC) coordinates specialized rehabilitation for wounded, injured, or ill servicemembers to return warriors to the fight. If an individual’s disabilities are too extensive to remain in the military, CC facilitates their and their families’ transitions to productive civilian roles and lifelong medical care alternatives.

All three SOCOM HQ agencies work in concert to provide SOF warriors and their families the best care, resilience, rehabilitation, and post-military quality of life assistance available.

C&CC: What can you tell us about SOCOM’s lines of operation and how SOF medicine supports them?

COL Walker: The last few years SOCOM has focused on four lines of operation: (1) Win the current fight; (2) expand the global SOF network (GSN); (3) POTFF; and (4) responsive resourcing.

SOF medicine has key roles in every line of operation. We support winning the current fight by advancing, employing, and integrating TCCC principles and directives. POTFF improves human performance, behavioral/mental/spiritual health, injury prevention, and rehabilitation programs. SOF medics remain well-trained and resourced through constant modifications of Joint Special Operations Medical Training Center courses and updated CASEVAC sets. SOF medics have always been a GSN beacon for our partners and allies by setting high standards of battlefield medical care. Special Forces and Civil Affairs medics have provided, shared, and coordinated every form of health care with indigenous forces and local populations. SEAL Corpsmen, USAF Pararescuemen (PJs), flight paramedics, and Ranger medics have provided invaluable tactical medical support to our ground commanders and [allies].

C&CC: Can you give us more detail regarding how the Surgeon’s Office supports SOCOM’s GSN?

COL Walker: We maintain and expand the GSN via four distinct programs. First, we support TSOC medical sections’ integration of SOF medical operations into their respective GCCs by working with SOCOM HQ Force Management and Resources and Requirements Directorates to tailor, validate, and push resources to the TSOCs. We also leverage services to fill TSOC requirements, often before finalizing permanent billet authorizations, to ensure TSOCs have optimal support. Second, we engage partner nations directly via participation in NATO SOF HQ and other multi-national training events. Third, with the Special Operations Medical Association we co-sponsored the annual Special Operations Medical Scientific Assembly (SOMSA) in 2013 and are doing so again this year. This exceptional Global SOF Medical Network training event brings together U.S. and partner nation SOF, other DoD, and civilian allied agencies’ medical personnel to learn the latest advances in SOF medicine, and to share new ideas and perspectives. Lastly, we maintain habitual communications with the SOF medical enterprise via a number of different mechanisms. SOCOM Directive 350-29 ensures SOF interoperable medical training standards. We distribute a monthly SITREP to the entire enterprise, have a monthly secure video teleconference with the service component and TSOC surgeon generals (SGs) and their staffs, and perform periodic assistance visits to the components’ and TSOCs’ [areas of operations].

C&CC: What are the main components of the SOF internal medical network infrastructure?

COL Walker: SOF medics, corpsmen, and PJs are the core of SOF medicine. Everything we do at all levels must provide SOF medics with the resources needed to execute their missions. To facilitate that goal, the SOCOM internal medical network consists of the Joint Medical Enlisted Advisory Council (JMEAC), Curriculum & Examination Board (CEB), Board of Command Surgeons (BOCS), and Biomedical Research, Development, Testing, and Evaluation Advisory Group (BRAG). The seminal component of the SOF medical network infrastructure is the JMEAC, which provides direct representation for unit-level SOF medics, PJs, and corpsmen. The JMEAC identifies and resolves training, equipment, operations, and medic career development problems. JMEAC’s synchronized efforts at the unit level legitimize tactical relationships with our international SOF partner forces, interagency medic equivalents, and civilian counterparts.

The CEB provides schoolhouse examinations, tactical medical emergency protocols (TMEPs), and specialty consultations, and connects SOF with national and international medical education and certification programs.

The BOCS provides oversight and guidance at the policy level for SOF health care; it is comprised of SOF component and TSOC surgeons. The networking function of the BOCS provides persistent connections to the GCC surgeons, service surgeon generals, DHA, joint staff, and ASDHA.
Finally, the BRAG is a new infrastructural organization comprised of SOF SMEs in medical RDT&E, force modernization, and combat development roles. BRAG members represent SOF medicine within DoD-level panels and activities, and ensure we habitually synchronize and communicate SOF medical requirements to medical research communities and health care industries.

These four network infrastructural groups are systemic conduits for SOF medic requirements to be resourced throughout the SOF medical enterprise. The network’s efforts may result in a new protocol, policy, training method, or SOF medicine-unique tool. Regardless of the outcome, the network’s focus is always how to best meet the needs of medics in harm’s way.

C&CC: How is the SOCOM SG Office shaping the future of SOF medicine through research and development?

COL Walker: We continually foster existing relationships and build new partnerships with defense research agencies, industries, and academia to shape SOF medicine’s future through R&D. We have vastly improved linking the SOF medical enterprise with service component and DHA R&D organizations. These relationships ensure open lines of communication to synchronize research efforts, avoid unnecessary duplication, and allow us to focus on SOF-unique requirements and capabilities. Current research areas of SOF medicine interest include hemorrhage control, damage control resuscitation, far-forward blood distribution and blood-product alternatives, portable lab diagnostics, force health protection, environmental medicine, medical simulation and training, canine medicine, maximizing human performance, and development of the Tactical Assault Light Operator Suit (TALOS).

Many of these research efforts are shared with conventional forces, but SOCOM specifically seeks technologies that are small, lightweight, ruggedized, modular, multi-use, and designed for operation in remote/austere/extreme climate environs where evacuation and surgical resources are not readily accessible. We also leverage the DoD Small Business Innovation Research and Rapid Innovation Fund programs in parallel efforts to design integrated medical monitoring devices capable of remotely tracking multiple casualties from a tablet-based interface.

We continue to expand freeze dried plasma (FDP) use within SOCOM. Partnering with the Army Medical Research and Material Command, Army Medical Materiel Development Activity, USASOC, and Army Blood Program, we are tripling FDP availability and use in FY 15 by providing U.S.-sourced plasma to the French organization that currently is our sole FDP provider. We are working to extend FDP IND protocols into all SOF components to increase life-saving opportunities until the FDA approves a U.S. FDP manufacturer.

The above illustrations highlight just a few of the many R&D efforts within the SOF medical enterprise.

C&CC: What new developments exist in SOF medic training and capabilities?

COL Walker: We constantly review how our medics have been employed in the past, but more importantly, how they should be employed in the future. For the last 13 years our medics have been perfecting the employment of TCCC principles and procedures that began in SOF almost 20 years ago. Our force is well-trained and has extensive TCCC experience [in Operations Enduring and Iraqi Freedom]; however, SOF’s future will probably look more like it did prior to 2001, with small teams deployed globally in remote locales lacking medical infrastructure. We cannot have a SOF medic in every possible incident location, so we are changing how we train medics and operators to provide tiered levels of medical response and capability within all teams and units.

The first and critical tier is comprised of every operator; they are kept up-to-date with current TCCC guidelines and provided tailored pre-deployment medical training. The next tier is the Special Operations Tactical Responder (SO-TR). SO-TR training and certification gives selected operators the ability to provide trauma care normally expected of medics. The SO-TR provides additional TCCC trauma management capability for remotely located teams, and is currently employed mostly within Naval Special Warfare. The Special Operations Tactical Paramedic (SO-TP) provides an increased medical capability by attaining additional paramedic and tactical trauma skills beyond basic TCCC proficiency. SO-TP training was designed to supplement USAF PJ skill sets, but is being considered by other SOF components. The Special Operations Advanced Tactical Paramedic (SO-ATP) is the highest SOF medic capability, able to independently manage complex traumatic and medical problems in isolated locales for prolonged periods.

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Preventing Dehydration During Ebola Outbreaks

Almost 17 tons of CeraLyte rice-based oral rehydration solution (ORS) has been donated by Cera Products, Inc. of Hilton Head, S.C., to humanitarian organization Direct Relief to send to Liberia and Sierra Leone to help keep Ebola patients from dehydration and shock, enabling them to have a better chance to fight the disease. CeraLyte ORS helps reduce fluid losses as it hydrates and provides needed calories for the people affected by the virus. The value of these gifts, which arrived “ready-to-drink,” was approximately $72,000.

Ebola hemorrhagic fever is a severe, often fatal disease. An outbreak of this deadly virus—considered to be the worst one in history—is now centered in the West African countries of Liberia, Sierra Leone, and Guinea, and has also spread to Senegal and Nigeria. Direct Relief has been mobilizing and shipping medical goods, such as CeraLyte ORS, and personal protective equipment to help government agencies, private charitable organizations and facilities, and on-the-ground health workers combat this public health emergency. Eleven emergency shipments valued at over $6 million (wholesale value) have already gone to the frontlines to treat people exhibiting the virus and to protect the local healthcare workers on the frontlines. This includes the largest shipment in Direct Relief’s history—more than 100 tons of aid—airlifted from New York on 20 September to Sierra Leone and Liberia.

Direct Relief is accepting approved donations at its Santa Barbara, CA, Headquarters and/or financial support via its website, directrelief.org.

More info: ceraproductsinc.com

ONR Awards Hypoxia Research Contract

Athena GTX has won a $2.98 million development contract with the Office of Naval Research to assist in the development of the Hypoxia Monitoring, Alert, and Mitigation System (HAMS) for Navy and Marine Corps personnel. The team of Athena GTX in Des Moines, IA, won the Phase 2 award competitively after completing the initial HAMS software development program in Phase 1.

The objective of this project is to provide optimal protection of military personnel through intelligent monitoring and adaptive modeling that accounts for individual differences in tolerance and to provide timely notification/warning to both ground forces and casualty evacuation personnel. The program seeks to develop a sensing system to be worn by soldiers under equipment. Multiple operators will be monitored simultaneously and provide mission leaders the opportunity to track team performance and individualized issues wirelessly and while highly mobile.

The focus of the program revolves around Athena’s continued expertise on micro-controller–based electronics in miniature wearable platforms. The HAMS system is configured as a miniature armband technology measuring multiple vital signs and tracks workload and fatigue as well as hypoxia (low oxygen levels in the blood). Athena has been successful moving the novel technology from the laboratory into actual underwater and high altitude environments in both military and civilian operations.

Key commercial applications include civil aviation, mountain climbing, diving, and mountain search and rescue.

More info: athenagtx.com

Pocket Ultrasound Tool Unveiled

GE Healthcare has introduced the Vscan with Dual Probe to give healthcare providers more uses for pocket ultrasound. This pocket-sized ultrasound tool uses two transducers in a single probe, allowing clinicians to see both shallow and deep views of the body without changing probes. GE said that this innovation enables efficient triage and fast workflow, which may lead to time and cost savings in many point-of-care settings.

“We’re excited to unveil Vscan with Dual Probe—a first-in-market dual probe ultrasound device,” said Ajay Parkhe, GM of Primary Care Ultrasound for GE Healthcare.

“It builds on our experience in the global pocket ultrasound market to solve our customers’ biggest clinical and economic challenges … In addition, the Dual Probe version combines the sector probe with a linear probe in one device to conduct most of the standard ultrasound scans within minutes.”

GE said Vscan with Dual Probe adds clinical value in a wide variety of resource-constrained environments with a pocket-sized device that covers many point-of-care ultrasound procedures as identified by the American College of Emergency Physicians. For emergency care, this includes inserting central or peripheral lines (IV line inserted into a large vein) or completing focused heart and lung assessment exams. For hospital environments, this includes bedside cardiac evaluations on rounds and efficient assessment at admission and discharge.

More info: vscan.gehealthcare.com

Thermal Scanner Introduced

Thermoteknix, a leading thermal imaging technology manufacturer, has introduced its FevIR Scan Fever Screening System, a miniature, discreet, and ultra-portable skin temperature measurement system for mass screening of high-volume pedestrian transit areas such as airports, train stations, ports, factories, shopping malls, and other public places.

According to Thermoteknix, the FevIR Scan system is easily installed, operated, and relocated with the very minimum of setup time and operator training. On-screen alerts identify one or more individuals in a large crowd situation, aiding rapid detection, and maintaining passenger flow. The system is password protected to prevent unauthorised changes and is based on a Thermoteknix thermal imaging camera working in conjunction with a blackbody calibration unit for high accuracy temperature measurement.

More info: thermoteknix.com
Brain Health Evolution

Amarantus BioScience is working on technologies that may change both detection and treatment in traumatic brain injury (TBI) and chronic traumatic encephalopathy (CTE) as well as provide new therapies in post-traumatic stress disorder (PTSD).

Amarantus’ LymPro Test uses a patient’s blood to identify signs of neurodegenerative diseases or conditions. The company says the device works on the theory—backed up by peer-reviewed studies—that certain disease-related processes going on in the neurons of affected brains are reflected in blood chemistry as well. LymPro is initially being developed to look for early signs of Alzheimer’s disease, but Amarantus is also working with the Boston University School of Medicine to explore the use of LymPro in TBI, where accurate onsite diagnosis is critical to proper treatment and long-term outcomes. LymPro could also have applicability in detecting CTE, a neurodegenerative disease, with an outcome similar to Alzheimer’s, which is related to repeated head trauma, possibly even at sub-concussive levels. CTE-related deaths are on the rise in occupations that expose individuals to head trauma, such as sports or the military. Amarantus is also developing a medical technology that could treat these brain conditions. MANF (Mesencephalic-Astrocyte-derived Neurotrophic Factor) is a protein produced in the body that stops cells from initiating a “suicide” process (apoptosis) that leads to their deaths.

Amarantus is also working on a drug called eltoprazine that may be effective in treating PTSD. The company plans to evaluate eltoprazine in PTSD with clinical trials.

More info: amarantus.com

New Sterilizer Cleared in U.S.

Sterilucent, Inc. has announced that it has received clearance to market its flagship technology in the U.S. The Sterilucent PSD-85 Hydrogen Peroxide Sterilizer is a low-temperature vaporized hydrogen peroxide system designed for use in healthcare facilities that may be operating in austere environments, such as combat support hospitals and disaster response sites.

The sterilizer’s specialized features include: a ruggedized design to limit damage due to transportation; low energy requirements, lumen and non-lumen cycles to broaden the types of devices that can be processed; and the capability to process moisture and heat-sensitive devices. Its related consumable products are designed to have a long shelf life, while a line of sterility assurance consumables and processing accessories is available directly from Sterilucent to assure all the necessary elements for consistent, productive low-temperature sterilization.

Sterilucent products deliver safe and effective surgical instrument sterilization with reduced operating and logistical costs,” said Stephen Loes, COO of Sterilucent.

More info: sterilucent.com

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The U.S. Air Force Telehealth Office, under the funding and requirement of the Air Force Medical Operations Agency (AFMOA) Behavioral Health consultant, launched the Tele-Behaviorial Health Encounters via Video TeleConferencing program in 2013, the culmination of a two-year deployment effort to outfit all 75 mental health clinics across the service’s medical system with portable video teleconferencing (VTC) carts to conduct telehealth encounters between patients and providers. The key capability is live person-to-person VTC interaction with high-quality video links over DISA ISDN network in lieu of a traditional face-to-face encounter.

The objective of the project is to provide adequate access to care and continuity of treatment for wounded warriors returning from battlefields of Iraq and Afghanistan with traumatic brain injury (TBI), post-traumatic stress disorder (PTSD), chronic pain and addiction. A cadre of mental health providers have been embedded and dedicated to providing these telehealth encounters in a regional hub and spoke format at 6 selected continental U.S. sites to service the enterprise. This enhances current operations by avoiding travel costs for patients or providers to remote sites without sufficient provider manning or expertise, improves patient access, decreases wait times, facilitates supervision and mentoring of junior providers, and enables distance referral evaluations.

“Perhaps the most significant aspect of telehealth is that it enhances patient access both in garrison and in theater,” said Lieutenant Colonel Antonio Eppolito MD, chief of USAF Telehealth, Air Force Medical Support Agency. “With the global deployment of U.S. forces often in active combat zones, today’s evolving field of telemedicine practices enables the combat medic to have real-time access to specialty consultations and diagnostic imagery synchronously with other health care personnel from anywhere on the planet. This real-time relations capability can often make the difference between reactive and proactive patient assessments, the latter being critical to the implementation of treatments for positive long-term outcomes down the road.”

While the Air Force has recently adopted these telebehavioral health capabilities within the past year, the Army has been leading
the DoD with a very mature and robust program of telehealth-based patient-doctor encounters for several years now.

“Facilitating field-level healthcare delivery is central to the purpose of telemedicine from a military perspective,” noted Eppolito. “In the case of psychological reviews in theater where licensed psychologists [or] psychiatrists may be in short supply, patients can engage service providers in live, real-time telehealth consultation, hence promoting early intervention for a greater likelihood of positive long-term outcomes.”

The next phase of the project to be engaged in 2015 is to web enable the VTCs for desktop application and to cross pollinate with our network of civilian TRICARE providers, sister service DoD providers, and VA providers to further fill gaps in care.

### Tele-imagery

Other advances in telemedicine include improved transfer and management of information. The Air Force’s Telehealth Office and School of Aerospace Medicine (USAFSAM) at Wright Patterson AFB, OH, have finished deployment of a project called Electrocardiographic Library Archive, which provides the capability to electronically submit all cardiac studies from any of the 238 Air Force flight medicine clinics (FMCs), in original raw digital data format, to a central archive at USAFSAM’s Aeromedicine Consultation Service (ACS) at Wright-Patterson.

“In the past, this has been a manual process requiring providers at the flight medicine clinics to submit requests for aeromedical consultation by mail, resulting in costly delays in getting aviators back to flight status,” said Eppolito. “All ECGs were scanned and saved in PDF format or stored on microfiche. Other cardiac studies including echocardiograms, cardiac catheterizations, and nuclear studies were sent by CD, DVD, or VHS tape. Now the ACS has a new cardiology image management picture archiving system in place.”

Having established the world’s largest database of cardiac studies on 283,157 aviators covering 1.2 million studies going back to 1957, the resulting capability will be an automated web-based system enabling the FMCs to transmit cardiac studies on Air Force-rated aviators to the ACS central repository containing all past, current, and future cardiology studies in one database. The system will support legacy ECG systems and new systems capable of sending cardiac studies in the original digital format, greatly enhancing the ability to query, review, and analyze data in ways that were impossible until now. This facilitates more expeditious aviator cardiovascular evaluations, vastly improve the capacity to conduct ground-breaking research needed to support changes to Air Force policy/waivers, significantly improve the ability of the service to monitor pilot health, and markedly improve provider productivity.

“This form of telehealth, the transmission and archiving of diagnostic images, in this case telecardiology … involves the use of diagnostic imagery by which specialty care doctors offer review and interpretation of such imagery,” said Eppolito. “The Air Force is presently the lead in tele-Imaging category with the VA having fielded a similar program. The Army and Navy are working to ramp up programs of their own.”

### Project ECHO

A Tri-Service effort for which the Air Force Telehealth Office is an integral part, Project ECHO, builds specialty care capacity into the primary care clinic at the local level. It is an ongoing series of one hour weekly or monthly live webinars (i.e. virtual grand rounds), consisting of 15 minutes of didactics (i.e. a lesson of the week) followed by 45 minutes of fielding case presentations, and a proven model originated at University of New Mexico. We launched in January 2012 with one specialty (complicated diabetes management) serving three Air Force pilot sites. Now, after 30 months we have expanded to include...
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chronic pain management, traumatic brain injury, behavioral health, acupuncture, addiction, ears nose throat, dermatology, and neurology for a total of nine live ECHO specialty series.

“We have expanded participation to include all three DoD services and the Veterans Administration. Continuing Medical Education (CME) has been accredited for eight of the nine ECHO,” noted Eppolito. “Participating provider response, surveyed after every session, has been overwhelmingly positive with a 17 percent increase in provider knowledge and confidence level in their management of these complicated patients and an overall 95 percent approval rating in the ECHO’s value to their practice. The key impact is that it results in more efficient primary care provider management of complicated patients with chronic disease.”

AFMOA officials have noted that ECHO fits seamlessly into the patient-centered medical home model of healthcare delivery, saying it emboldens primary care providers with professional gravitas, free CME, and links to an academic milieu, improving clinical practice guideline (CPG) outcome metrics. This year saw the technological move from the traditional VTC suite to the providers’ desktop web-based video platform. “In effect we are using ‘new’ technology to bring back the ‘old’ fashioned curbside consult,” Eppolito indicated. “Based on the University of New Mexico model, it is projected to reduce referrals to the Tricare network by 10 percent when fully matured across 21 specialties over a seven-year expansion plan.”

“The basis of Project Echo is to provide a resource through which primary care doctors can tap targeted information from highly qualified specialists regarding certain patient needs,” noted Eppolito. “Launched in 2012 by the USAF, the program is expanding enterprise-wide to include Army, Navy and VA healthcare systems. The Army in particular has a Chronic Pain specialty ECHO that reaches to every Army military treatment facility (MTF).”

**Tele-radiology**

The AFMS has been pursuing an enterprise wide digital imagery (DI) capability since the 1990s, having developed a DI business plan, dated September 2001, that suggested the creation of a “virtual” radiology department that supports tele-radiology and the ability to dynamically shift workload from remote sites with no radiologist to facilities where clinical expertise is available. This capability, executed by AFMOA/SGALE, (the Clinical Engineering Branch at Fort Detrick, MD) includes the systems for acquiring, managing, interpreting, reviewing, and storing medical images and their related text information (e.g., patient demographics, diagnostic reports, and image attributes/metadata).

“So much in terms of long-term positive outcomes depends on accurate, timely information transfer and decision making based on that information,” Eppolito noted. “Advances in telemedicine are ensuring that diagnostic imagery such as an EKG or CATSCAN procedures done in theater without the presence of a specialist can be shared with a specialist in real-time via Web-enabled applications, making information more readily available when patients arrive back in European or CONUS facilities, optimizing the likelihood of proper treatment application and long-term care through the creation of seamless electronic records keeping.”

The tele-radiology project includes the deployment of disaster recovery system consisting of five regional archives interlinked globally which comprise the largest digital repository of radiological studies in the world. The dawn of 2015 ushers in the next phase of the project—the active deployment of the web based dynamic workload allocation system of transmitted digital images, whereby 109 Air Force radiologists across 75 MTFs will be able to read “any image anywhere at any time” while operating in a global virtual radiology group. This is the solution to the impending manning shortage and the escalating cost for downtown services without tele-radiology in place.

Lead art: Senior Airman Casey Burch looks at a patient’s X-ray at Scott Air Force Base, IL, on 3 June 2014. Information such as ECGs are becoming available electronically, reducing delays. (Staff Sgt. Maria Bowman)
Readiness Through Research

Commander Forest R. Sheppard, U.S. Navy trauma surgeon, currently heads the Expeditionary and Trauma Medicine Department, Combat Casualty Care and Operational Medicine Directorate at the Naval Medical Research Unit San Antonio. CDR Sheppard is a principal investigator leading a dynamic team in trauma medicine research and also serves as Chair of the Navy Medical Research and Development Combat Casualty Care Working Group. He is a member of the DoD Joint Program Committee for Combat Casualty Care (JPC 6), Forward Surgical Steering Committee, and the Hemorrhage and Resuscitation Steering Committee. CDR Sheppard received his medical degree from the University Of Virginia School of Medicine and is board certified in Surgery and Surgical Critical Care. His awards include the Joint Service Commendation Medal, Navy and Marine Corps Commendation Medal (two awards), Navy and Marine Corps Achievement Medal, NATO Medal with Clasp ISAF, and over 20 combined campaign medals and service medals.

Navy Medicine and the Evolution of Combat Casualty Care

Located on the San Antonio Military complex, the U.S. Navy Medical Research Unit San Antonio (NAMRU-SA) is one of eight subordinate research commands in the global network of laboratories operating under the Naval Medical Research Center. NAMRU-SA’s role in Navy medicine research is to improve readiness and enhance future capabilities through vital work in combat casualty care and military operational research.

Combat & Casualty Care Editor
Kevin Hunter spoke recently with Commander Forest R. Sheppard, head of the Expeditionary and Trauma Medicine Department, Combat Casualty Care and Operational Medicine Directorate at NAMRU-SA, about how the unit works to enhance the health, safety, performance, and operational readiness of Navy and Marine Corps personnel, and address their emergent medical problems in both routine and combat operations.

C&CC: Please discuss NAMRU-SA’s research and development capabilities.

CDR Sheppard: At NAMRU-SA, basic and advanced development research is being conducted in the arenas of combat casualty care and operational medicine (CCC&OM) and craniofacial health and restorative medicine (CH&RM). Our core capabilities include: expeditionary trauma medicine, which encompasses hemorrhage, shock, resuscitation, and test and evaluation of field medical devices; molecular biology and immunology-based bioassay development; testing and evaluation of biomaterials; research and development of micro and nanomaterials for drug delivery and tissue engineering; epidemiology; and dental materials-related environmental surveillance. Every NAMRU-SA project is directed toward the development of life-saving or health-improving technologies that will result in better outcomes for warfighters.

CDR Sheppard: Overall, our group focuses on traumatic hemorrhagic shock and resuscitation. The evaluation of interventions to stem hemorrhage, control hemorrhage, and provide subsequent resuscitation are quite complex and include metabolic, immunologic, and coagulation effects, not only of the original injury, hemorrhage, or shock state, but also in response to the resuscitative intervention(s). Our scientists test and evaluate hemorrhage control devices such as tourniquets, which are our first line of defense, using synthetic cadavers (SynDavers) and HapMed mannequins. NAMRU-SA’s goal is to get the most effective products that are approved and available for medic use into the field or appropriate medical setting.

We also look at shock and resuscitation. Innovative research is underway to develop and test in-laboratory assays to help us understand the molecular aspects of the immune response to shock and the long-term effects of shock in warfighters. Our lab is focusing on the underlying mechanisms responsible for the observed clinical outcomes from shock, which will aid us in understanding why certain therapies work
A similar approach is taken with resuscitation fluids and blood replacement products. The effectiveness of the product is tested along with the effect on immune systems to determine human compatibility and appropriateness for adoption by the military. A more thorough knowledge of cellular responses and activity will permit us to refine and improve our approach to treating trauma and will, in the end, increase translatability to combat casualties with the goal of saving lives.

C&CC: Is NAMRU-SA studying how to best treat post-event shock?

CDR Sheppard: Yes. Platelet-derived hemostatic agents (PDHAs)—human platelets that are either lyophilized or spray dried to permit long-term storage and immediate use following reconstitution in sterile water—are being researched. This is important because platelets as currently stored have a shelf life of only five days. These new storage methods will extend that time from days to years and greatly increase the availability of platelet-directed therapy to forward deployed troops as well as expand availability within the continental U.S. within the civilian sector. From a hemostatic perspective, these agents are very interesting. Because of their partially activated state, they are designed to actively seek outbreaks in the endothelium (where a hemorrhage would be occurring) and bind to create a “platelet plug,” which is the first step in clot formation.

Multifunctional resuscitation fluid (MRF) is also of interest to us. This agent encompasses all of the attributes of whole blood—oxygen carrying capacity, platelet function, and plasma. However, these products do not require the logistical considerations of, nor are they hindered by, normal blood’s limited life expectancy. MRF’s are free from the requirements of freezers for storage and require only sterile water for reconstitution and use. Additionally, many of these powdered plasma products provide a more consistent coagulation protein profile as compared to traditional fresh frozen plasma and offer the potential for reduced immune responses compared to traditional plasma products. Oxygen carriers would eliminate the requirement for traditionally stored red blood cells to provide oxygen carrying capacity as a part of resuscitation.

Basically, we investigate each product individually to be able to compare each to its currently available human blood component counterpart. We also study each product in combination with MRF, for comparison to whole blood resuscitation. Taken together, these effects could result in improved blood component availability for the military...
understand the implications of not only the injury but also the therapy. I am greatly concerned that many scientific models fail to take into consideration brain preservation, and this EEG capability will make such evaluation and assessment a routine part of every study we do.

Additionally, we have developed collaborations with the Air Force 59th Medical Group and the U.S. Army Institute of Surgical Research to leverage their focus areas in hematology, blood banking, trauma-induced coagulopathy, and ischemia-reperfusion injury, all of which feedback into our own work and improve the research we do with regard to global-body combat casualty care. Furthermore, NAMRU-SA has the distinct privilege of being located with the Brooke Army Medical Center, the only DoD Level 1 trauma center. My collaborators at the bench-top are my clinical colleagues in the trauma room and emergency department. This close working relationship facilitates the movement of medical issues from the bedside to the bench and then back to bedside. This may be the only location in the DoD with the ability to deliver pertinent, translational “bench to bedside and back” research that fills these types of military medical gaps.

C&CC: You often say “No one else is doing what we do.” Talk about NAMRU-SA’s unique capabilities and facilities.

CDR Sheppard: We are in the unique position to have the Air Force and Army as day-to-day collaborators and “office-mates.” This, in and of itself, is unique because it mirrors the camaraderie that occurs in operational situations. By working together, the best of the three services are able to focus on improving the translatability of what we do for the warfighter.

A very distinctive capability to San Antonio is the Tri-Service Laboratory. The 181,000-square-foot facility supports a full range of combat casualty care research using small and large animal models. The facility houses a 45,000-square-foot vivarium that provides full service animal husbandry, five state-of-the-art surgical suites, seven procedure rooms, fluoroscopy and digital X-ray capabilities, and a highly trained histology/pathology team. NAMRU-SA has the best veterinary sciences team in the area, and probably across the country, ready to support any research protocol utilizing any combat casualty care model. This team supports all investigators, and it is all available under one roof.

The command is [also] fortunate to have a number of biomedical engineers to lend their expertise to the more technical aspects of our studies. The bioengineers design, build, and operate a wide range of equipment to facilitate unique experiments. In addition, we have a post-doctoral program that has recruited some of the best young researchers in the country to bring their state-of-the-art science expertise to bear on our combat casualty care projects. These hard-working researchers have brought new perspectives to some of our most challenging research questions and have become an invaluable part of our team.

Lastly, the NAMRU-SA research staff was brought together with the aim of building a multi-disciplinary approach to research. Scientists, research associates, and laboratory technicians come from varying degree fields and specific areas of study to ensure the approach to solving combat-related medical issues is well-rounded and complete. This process is unique, and it greatly benefits the researcher and research.

Moving wounded soldiers out of harm's way and en route to improved treatment is an important goal for U.S. servicemembers. Indeed, one might consider it a foundational part of the military’s ethos—taking risks to help a fellow soldier, Marine, airman, or sailor in need of medical attention. Retired Army Sergeant Kyle White, for example, was recently awarded the Medal of Honor in part for repeatedly attempting to save a wounded Marine laying on open ground in 2007 while under heavy enemy fire.

Though his heroism was remarkable, the nature of the engagement White participated in was not unique in the Afghanistan War: A small contingent of U.S. forces, along with Afghan counterparts, were attacked in a place they called “ambush alley” after leaving a meeting with villagers. In the event that a soldier is badly wounded, he may need to be carried off the battlefield by up to four of his comrades, who often have little regard for their own safety. If helicopters are not able to land in the area, the injured servicemember must be carried as long as necessary. With only 10 men in a squad, transporting a wounded comrade can degrade movement and firepower.

Robotics might represent a partial solution to this problem. In Iraq and Afghanistan, well-armed insurgents aimed to minimize American technological advantages, such as precision weapons, through surprise attacks on isolated units. The Army’s response has been to focus considerable energy into developing “squad overmatch,” an attempt to make U.S. forces as dominant in small engagements as they are in large tank battles. To do this, however, soldiers must carry more equipment—better communications gear, more batteries, weapons, and armor—thereby inhibiting movement and speed.

One possible way around this dilemma is fielding a squad support robot designed to carry gear. Such systems also have potential to serve as casualty evacuation (CASEVAC) platforms, freeing up soldiers and further enhancing the squad’s combat power.

Good Idea or Fanciful Selling Point?
Though no official requirement yet exists, and the Army still technically prohibits CASEVAC by unmanned systems, manufacturers in the U.S. and abroad are preparing systems able to fulfill this role should the need arise. Squad support unmanned ground vehicles (UGVs), many manufacturers claim, may prevent other soldiers from getting in harm’s way by moving to the casualty by remote control (or autonomously) and serve as protection for rescuers extracting casualties.

“You don’t have to spend time in the field to understand that the ability to get a wounded person to safety is absolutely critical,” said Paul Scharre, a former Army Ranger who served in Iraq and Afghanistan and now a fellow and director of the 20YY Warfare Initiative at the Center for a New American Security.

Scharre explained that a UGV is not a substitute for soldiers. “Combat troops have a bond that they will be willing to risk their lives to rescue one another if wounded, and you want to make sure
that robots help them keep that promise, not replace them," he told C&CC.

However, Scharre noted that there are situations where a UGV would be useful. "Having a vehicle able to carry a 180-pound soldier with 100 pounds of gear over difficult terrain would be absolutely critical," he said. "The technology challenges are not trivial, by any means, but the need is certainly there."

**Extraction and Evacuation by Robot**

The kind of UGV envisioned for this role is still unknown, but a general outline seems clear: small, rugged, somewhat autonomous, fairly quiet, and capable of lifting weight off of combatants' shoulders. Famously, DARPA tested the Legged Squad Support System (which resembled a robotic mule) in 2012, but a number of options that roll rather than trot seem closer to fielding.

"[An infantryman's] way of evacuating a casualty is fundamentally a fireman's carry," Don Kotchman, vice president of Tracked Combat Systems at General Dynamics (GD), said. GD's Multi-Utility Tactical Transport (MUTT) is a quiet, electric-powered vehicle that is led, as its name implies, by a leash-like tether that can attach to the leader's belt. Simple to operate and capable of carrying over 600 pounds, the MUTT is being tested by the Marine Corps.

"This gives something far more stable and less burdensome for the soldier to evacuate the casualty, and far quicker, because the soldier could go at his normal pace rather than being slowed down by additional weight," Kotchman said. "If a situation arose where you had a casualty, you could easily prioritize to evacuate the casualty, offload the supplies, put the casualty on, and evacuate him." The MUTT can carry one litter.

HDT Global makes the Protector, a diesel-powered system that Kent Massey, director of Advanced Programs at HDT, said can carry 1,000 pounds for 16 miles as well as two stretchers extended from the body of the vehicle, which means users would not need to off-load equipment in order to transport wounded. By generating two kilowatts of power, the Protector can also run temperature-controlled storage for IV fluids and a refrigerator for blood.

"It's not about trying to get them all the way back to wherever the aid station is; it's about exfiltration a mile or two to a safe landing zone for a helicopter," said Massey. "The whole squad is moving with them … It's just a way of carrying wounded soldiers so you can get more quickly to a place where helicopters can pick them up." When under fire and trying to move wounded personnel to MEDEVAC helicopters, soldiers "need people who can shoot
and provide a combat effort to cover [the squad]” that carrying a litter does not allow, Massey added.

A joint U.S.-Israel project by the Israeli company Roboteam, the Probot is notably smaller than other UGVs (easily lifted by two people) and uses standard batteries for propulsion, though the system can carry up to 550 pounds and one stretcher. The first batch of Probots will be released in 2014, and the company has tested prototypes in the casualty extraction/evacuation mission.

“The platform was designed with [CASEVAC] in mind,” said Shahar Abuhazira, CEO of Roboteam North America. He told C&CC that the first batch of systems will be released by the end of 2014, “so this will be the first time an operational system will go for one year of evaluation with [the Israel Defense Forces and U.S. Army].”

Another Israeli company, Amstaf, produces two vehicles applicable to squad support with six and eight wheels, run by electric engines and a lithium battery (supplemented by a diesel generator to recharge the battery and provide greater range).

The company’s CEO, Amos Goren, claimed that Israeli soldiers were killed in the 2014 Gaza campaign trying to extract their wounded. “To send [a robot] to pull someone out or give some cover to other soldiers, would make the mission less dangerous,” Goren said. Amstaf’s UGVs were deployed to Israeli towns near the Gaza border in perimeter security roles earlier this year.

Ready for the Challenge?
The Army’s prohibition on the use of robots for CASEVAC and lack of official requirement for a squad support robot hasn’t dissuaded industry from pursuing these technologies. Should the U.S. military decide that it needs a squad support robot, it appears the Pentagon will have plenty of options from which to choose.

Lead art: Israeli soldiers demonstrate Roboteam’s Probot in a casualty evacuation role. (Roboteam)
Sensors Target Brain Structure and Function

DARPA has created a proof-of-concept tool that demonstrates much smaller, transparent contacts that can measure and stimulate neural tissue using electrical and optical methods at the same time. Researchers at the University of Wisconsin at Madison developed the new technology with support from DARPA’s Reliable Neural-Interface Technology (RE-NET) program. It is described in detail in a paper in Nature Communications.

“This technology demonstrates potentially breakthrough capabilities for visualizing and quantifying neural network activity in the brain,” said Doug Weber, DARPA program manager. “The ability to simultaneously measure electrical activity on a large and fast scale with direct visualization and modulation of neuronal network anatomy could provide unprecedented insight into relationships between brain structure and function—and importantly, how these relationships evolve over time or are perturbed by injury or disease.”

The new device uses graphene, a recently discovered form of carbon, on a flexible plastic backing that conforms to the shape of tissue. The graphene sensors are electrically conductive but only 4 atoms thick—less than 1 nanometer and hundreds of times thinner than current contacts. Its extreme thinness enables nearly all light to pass through across a wide range of wavelengths. Moreover, graphene is nontoxic to biological systems, an improvement over previous research into transparent electrical contacts that are much thicker, rigid, difficult to manufacture and reliant on potentially toxic metal alloys.

“Artificial Spleen” Technology

DARPA’s Dialysis-Like Therapeutics (DLT) program seeks to develop integrated, portable and ruggedized technology that would enable widespread deployment of dialysis treatment to fight sepsis. The DLT program recently tested a novel prototype that could greatly advance sepsis treatment and lead to increased survival of future sepsis patients. The program successfully demonstrated one of the first technologies for pathogen removal via blood filtration. With a design inspired by the human spleen, the shoebox-sized prototype removes many of the microbes and toxins that can trigger sepsis.

Sepsis—a life-threatening over-reaction by the immune system to infection—poses a significant threat to warfighters who suffer combat injuries that predispose them to infection. Antibiotics can kill sepsis-inducing microbes but their overuse is contributing to the threat of drug-resistant microbes and they don’t neutralize the toxins that some pathogens leave behind.

“Sepsis is a massive problem for both civilian and military healthcare, which is why DARPA set out to develop more effective and portable technologies for sepsis treatment,” said U.S. Army Col. Matt Hepburn, DARPA program manager. “Our ‘artificial spleen’ prototype shows a promising new way to fight sepsis more quickly and thoroughly. The technology is also small and light, and usable either on its own or with commercial dialysis equipment.”

The DLT prototype is designed to work outside the body like a traditional dialysis machine. Blood is funneled from a patient’s veins into the device, where it is cleaned before returning to the body. The approach is similar to that used by the human spleen, which removes pathogens and dead cells from the blood by filtering it through a series of tiny interwoven blood channels.

The DLT team first tested its blood-cleaning system in the laboratory using human blood spiked with pathogens. A single device bound and removed more than 90 percent of key sepsis pathogens. The team next tested the device using rats infected with two pathogens (E. coli and S. aureus) along with bacterial toxins—a microbial cocktail mimicking those seen in the bloodstream of human sepsis patients. The prototype removed about 90 percent of the bacteria and toxins from the rats’ bloodstream within five hours.

Going forward, DARPA plans to continue development of component technologies to mitigate sepsis and then combine those component technologies into an integrated system. Subsequent trials would then seek to demonstrate the safety and efficacy of the integrated DLT device and provide crucial evidence to support an eventual application to the U.S. Food
Exosuit for Musculoskeletal Injury Prevention

Harvard University’s Wyss Institute for Biologically Inspired Engineering is continuing development of a lightweight, soft exosuit for DARPA’s Warrior Web program, which is aimed at creating technologies that mitigate musculoskeletal injuries among warfighters while improving performance. The Wyss team is seeking to integrate component technologies developed in separate Warrior Web efforts into a prototype suit that offers expanded capabilities. DARPA plans to test the final suit in appropriate mission profiles under realistic loads to evaluate performance.

The equipment and gear carried by today’s dismounted warfighter can exceed 100 pounds. This added weight—especially while bending, running, squatting, jumping, and crawling in a tactical environment—increases the risk of musculoskeletal injury, particularly in such areas as ankles, knees, and lumbar spine. This load weight also causes increase in physical fatigue, which further decreases the body’s ability to perform and protect against both acute and chronic injury.

The Warrior Web program’s ultimate goal is a lightweight, conformal under-suit that is functionally transparent to the user—similar to a diver’s wetsuit. As envisioned, the suit will ultimately employ a system of closed-loop controlled actuation, transmission, and functional structures that protect injury prone areas, focusing on the soft tissues that connect and interface with the skeletal system.

The current Wyss Institute suit is made of soft, functional textiles woven into a piece of smart clothing that is pulled on like a pair of pants and intended to be worn under a soldier’s regular gear. Through a biologically inspired design, the suit mimics the action of the leg muscles and tendons when a person walks, and provides small but carefully timed assistance at the joints of the leg without restricting the wearer’s movement.

More info: darpa.mil
CRITICAL CASUALTY Carrier

Air ambulances have a deep-rooted history in transporting wounded warriors.

By Angel MedFlight Contributor

The earliest recorded use of airborne medical transport dates back to 1870. During the Siege of Paris, hot air balloons evacuated 160 wounded soldiers from the battlefield. Later, the British military outfitted De Havilland DH-9 aircraft as air ambulances during the First World War and Middle Eastern colonial wars of the 1920s. In World War II and the Korean War, wounded soldiers were transported by helicopters such as the Bell 47. The casualty rate during the Korean War dropped almost in half from World War II, largely attributable to the use of air medical transports.

The Vietnam War saw further evolution of airborne medical transport. Medical personnel and helicopters were dispatched to the battlefield, allowing lifesaving measures to be performed while in-flight. This significantly reduced the mortality rate. The knowledge, equipment, and techniques learned from the use of air ambulances during these wars led to the creation of civilian flight paramedics and air ambulances.

Fully Integrated Capability

Air ambulance technology has advanced far beyond the first balloon air ambulance. Angel MedFlight is a leading global air ambulance company, maximizing safety and patient care with innovations in technology.

Their fleet of Learjet 35s and 60s are equipped with state-of-the-art systems that exceed FAA standards. The Terrain Awareness Warning System alerts pilots to potentially hazardous proximity to the ground or other obstacles. The jets also run the Traffic Alert and Collision Avoidance System, an enhanced safety system the relays air traffic information while giving navigational instructions to the pilots. Each jet is also equipped with AirCell Satcom and satellite phones, which are vital for in-flight communications between the flight crew in the air and the flight coordinators on the ground. Flight management systems are installed on each aircraft in place of the traditional Global Positioning System, providing more detailed data to pilots.

The same high standards in safety apply to patient care. Advanced medical equipment—equivalent to what one would find in an intensive care unit—is available in each jet. Customized stretchers and base life port systems house advanced life support components to care for patients during extended flights. The Propaq MD by Zoll, for example, is an advanced heart monitor and the only FDA-cleared airworthy defibrillator to provide monitoring of three invasive pressures during long-range transports. It was specifically designed for
the military and has 25 years of use on the battlefield.

Flying Ahead
With the combination of Angel Medflight’s medically-configured Learjets, highly-trained medical crews and pilots, advanced medical equipment, and avionics, the company is well-equipped to transport not only critically injured or ill military personnel but civilians as well. Whether it’s a member of the Armed Forces who has been injured overseas and needs to come home for rehabilitation or a veteran who has fallen ill and needs a higher level of care, our specialized team ensures a safe transfer.

Flying Ahead

Angel MedFlight’s Learjet 260AJ. (Angel MedFlight)
The 1st Area Medical Laboratory recently deployed to Liberia in support of Operation United Assistance, the U.S.-led combined effort to contain the most deadly Ebola outbreak in history.

By Walter T. Ham IV, 20th CBRNE Command

Part of the 20th CBRNE Command (Chemical, Biological, Radiological, Nuclear, Explosives), soldiers from the Aberdeen Proving Ground, Maryland-based 1st Area Medical Laboratory, or AML, will set up laboratories to support operations there. In support of Army, joint and combined operations, 1st AML deploys worldwide to perform analytical laboratory testing and health hazard assessments of environmental, occupational, endemic, and CBRNE hazards.

Headed by the U.S. Agency for International Development, known as USAID, and supported by U.S. Army Africa and U.S. Africa Command, Operation United Assistance is helping affected countries in Africa to contain the most devastating Ebola outbreak in history.

American troops are supporting the effort with command and control, logistics support, training, and engineering support.

“The 1st AML will establish an initial infectious disease laboratory in order to support the Ebola screening in West Africa,” said 1st Area Medical Laboratory Commander Colonel Patrick M. Garman.

“The 1st AML will bring state-of-the-art analyzers and experienced personnel, who will be able to enhance the identification of Ebola and other endemic diseases in an expeditious manner,” said Garman.

According to Garman, 1st AML soldiers have partnered with the 20th CBRNE Command surgeon and the Fort Detrick, Maryland-based U.S. Army Medical Research Institute of Infectious Diseases to train for the deployment.

Teaming for Success

General David M. Rodriguez, commander of U.S. Africa Command, said, “U.S. Africa Command consulted with USAID, the Centers for Disease Control, the World Health Organization and Doctors Without Borders, to develop protocols based on known risks and prudent planning.”

“Preventing the spread of Ebola is the core task of this effort,” said Rodriguez. “This is a key requirement in everything that we do in this operation, and this applies both to our support efforts and the protection of our own people.”

“The 1st AML is trained, equipped, and ready for this mission,” said Brigadier General JB Burton, the commanding general of the 20th CBRNE Command.

In Liberia, 1st AML will serve as a part of the 101st Air Assault Division (Air Assault) Joint Task Force Headquarters, and will set up laboratories for testing samples.

“They will join a team of soldiers, doctors and scientists who have come together to support the U.S. Agency for International Development. They will deploy state-of-the-art analyzers and highly-trained soldiers to enhance the identification of the disease using the most advanced protocols,” said Burton.
Heroes Shouldn’t Have to Wait For Test Results.

By Douglas W. Gavin
Senior Product Manager
Abbott Point of Care

Abbott Point of Care, manufacturer of the i-STAT System® and exclusive distributor of the Piccolo Xpress®, is dedicated to advancing patient point-of-care testing and diagnostic technology. The company’s mission is to improve patient care and system efficiency by fundamentally changing the way health care professionals manage the patient-testing process across a variety of settings.

Our goal is to take healthcare to patients, wherever they are located. To support this goal, we manufacture the i-STAT System, an advanced, handheld diagnostic tool that provides real-time, lab-quality results for patient point-of-care testing within minutes to accelerate the patient care decision-making process. The i-STAT is lightweight and portable, and offers the most comprehensive testing menu in a single patient-side platform. Its broad menu of CLIA Waived and Non-Waived tests include chemistries, electrolytes, blood gases, cardiac markers, coagulation, lactate, and hematology.

The advanced biosensor technology of the i-STAT System enables health care professionals to be able to access real-time, lab-quality results within minutes, rather than hours, in decentralized clinical and field environments where sample logistics, patient transportation, and result-reporting problems have a direct impact on the quality of patient care. By accelerating the availability of diagnostic test results, this system provides health care professionals with the information they need to make treatment decisions sooner, which may lead to enhanced quality of care and improved system efficiency when every minute matters.

Abbott Point of Care is also the exclusive distributor of the Piccolo Xpress chemistry analyzer, which offers the most CLIA waived lab-quality blood chemistry tests on a single platform. The Piccolo Xpress is a fully automated system with an intuitive user interface and full color touch screen. Its broad menu of tests includes the only CLIA waived Comprehensive Metabolic Panel on the market, and CLIA waived lipid and liver function testing. The Piccolo Xpress is portable, rugged and designed for easy transport and setup with built-in intelligent quality control (IQC) and self-calibration with every test that is run. The Piccolo analyzers provide lab-accurate results quickly and easily to accelerate patient care decision making on land, sea, or in the air.

Abbott Point of Care maintains both GSA & FSS schedules and has over 20 years of experience providing point-of-care testing to all types of government healthcare systems.

Field Proven

Since the development of the i-STAT System in 1992 and the Piccolo Xpress in 1995, both point-of-care lab devices have been used extensively by first responders, Veterans Affairs, public health, and the Department of Defense. Both systems have been deployed in a multitude of settings, to include domestic emergencies such as the Boston Marathon bombing, and in field operations in Iraq, Afghanistan, and Kuwait during Operations Iraqi Freedom and Enduring Freedom.

The i-STAT and Piccolo Xpress provide the fast, lab-accurate test results our military, veterans, and first responders need when every minute matters. Both systems require only three easy steps for rapid, clinical decision making: insert blood into the cartridge or rotor, insert cartridge or rotor into the analyzer, and view the lab-quality results in minutes.

Proven Provider

As part of Abbott Laboratories, a global, diversified health care innovator with a legacy of pioneering work in medical diagnostics, Abbott Point of Care is uniquely positioned to bring innovative point-of-care testing to our nation’s heroes. Abbott Point of Care is headquartered in Princeton, N.J., with more than 1,500 global employees and a presence in 84 countries. We understand the need for fast, accurate, and reliable test results that give health care professionals across health care settings the confidence they need to make patient care decisions.
### Calendar of Events

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- Portable platforms for field use
- Simple, intuitive operation for a wide range of tests

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