COMBAT & CASUALTY CARE

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ALIGNING INTEROPERABILITY ACROSS POINT-OF-INJURY CARE

COMMAND SURGEON'S CORNER

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PLATELET CRYOPRESERVATION MOVES CLOSER TO PRACTICALITY

The U.S. Army Institute of Surgical Research (USAISR) and Vitrafy are teaming up to evaluate an innovative method for preserving blood cells that control clotting.

By Paul Lagasse

Featured Interviews

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LEADERSHIP PERSPECTIVE

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Cover: Students in the Special Operations Combat Medic (SOCM) Course at the U.S. Army John F. Kennedy Special Warfare Center and School (USAJFKSWCS) simulate casualty care with Servicemember volunteers and high fidelity manikins and using hyper realistic special effects makeup called moulage during training at Fort Bragg, NC in February 2023. Naval Special Operations Medical Institute (NSOMI), a detachment of Naval Medicine Operational Training Command (NMOTC), specializes in training the enlisted Servicemembers and medical providers who support U.S. Special Operations. Enlisted Servicemembers who completed the courses will specialize in trauma management, infectious diseases, cardiac life support and surgical procedures, with a basic understanding of veterinary medicine and dental medicine. NMOTC) is comprised of six nationwide detachments that offer specialized medical training in the fields of aviation, aviation survival, surface and undersea warfare, expeditionary and special operations medicine. (U.S. Navy Photo Illustration by Mass Communication Specialist 2nd Class Russell Lindsey)

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INSIGHTS

As seasonal temperature change brings clandestine viral attack on the body, so U.S. and coalition silent professionals likewise bring covert targeted assault on the networks of those who would do us harm. Supporting these special operators are the medics and surgeons who work just as silently to treat those wounded in defense of national interests.

The Volume II 2025 edition of *Combat & Casualty Care* brings readers into a world of military servicemen and women, mostly unseen but certainly not unfelt by conventional forces whose enemies they thwart. At the fore of U.S. Army Special Operations Forces (SOF) medical operations, 75th Ranger Regiment Command Surgeon LTC Andy Oh speaks to ways that SOF medicine is advancing the likelihood that prehospital battlefield death in future combat scenarios will be a more infrequent occurrence. From mass crisis response amid medically austere conditions within large scale combat operations (LSCO) to damage control resuscitation in tactical combat casualty care (TCCC), filling the critical gaps in SOF and non-SOF care delivery is a training priority for all current and future combat medics.

With the focus of all first combat medical response either resuscitation, hemorrhage control, or both, recent advances in blood and blood product preservation are increasing the lifesaving liquid's potency at point of injury. The U.S. Army Institute of Surgical Research (USAISR) is partnering with industry to develop techniques in cryopreservation that target blood clotting capability, a factor unique to blood platelets. The introduction of viable platelet-rich blood cells will correspond to a reduction in blood loss as the body's natural ability to stop bleeding will be boosted, leading to fewer bleed outs.

From a state of Special Forces medicine modernization, we get word from Major Donald "DJ" Hamilton, Chief Knowledge Officer, HQ, Battalion U.S. Army, on the use of artificial intelligence (AI) to bolster prolonged field care (PFC) application. With increased positive casualty outcomes will come enhanced global force resiliency critical to mission success across an LSCO-defined battlespace. Much of what U.S. military minds are putting to the test is also being mirrored on the international scene as we hear from Sergeant Major Sandro "Rabbit" Heinrich, Senior Enlisted Advisor, Bundeswehr Joint Forces Operational Command on ways Special Operations medicine is coordinating with North Atlantic Treaty Organization (NATO) medical units to better streamline SOF and non-SOF combat medic interoperability.

Be sure not to miss this edition's Command Spotlight with the Walter Reed Army Institute of Research (WRAIR) or Industry Perspective with KeriCure biotechnology firm and the latest in spray-on wound care.

As always, please feel free to send us your comments and suggestions. Thanks for the continued readership!

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INTEROPERABILITY: OUR CHALLENGE TO SUPPORT FUTURE UNCERTAIN ENVIRONMENTS

By Sean Keenan, MD, COL (U.S. Army Ret.), President, Special Operations Medical Association

The Special Operations Medical Association (SOMA) serves as the genesis of Combat Casualty Care Advances and provides unparalleled opportunities for forging strong relationships that build inherent interoperability of Service, Joint and international expeditionary medical systems.

Sean Keenan

Three decades ago, SOMA hosted a presentation on a paradigm shift of point of care first responder military medicine. The introduction of Tactical Combat Casualty Care (TCCC) by Dr. Frank Butler was met with skepticism and tepid responses from the Old Guard of medical practitioners who had formed their medical habits through the Vietnam conflict and participated in civilian education such as Advanced Trauma Life Support. This new concept of TCCC was a revolutionary approach to medicine that incorporated the operational reality of modern combat and formed the basis of lifesaving point of injury care for the next 3 decades. This innovation, bred in the necessity of special operations medicine, became the foundation for care still used today in modern conflicts.

Later, SOMA's membership hosted the Prolonged Field Care working group, the Austere Resuscitative Surgical Care efforts, and, most recently, formed the Medical Support to Irregular Warfare Committee to conceptualize and form a think tank to support emerging medical threats. The PFC WG and the ARSC team were eventually adopted by the Joint Trauma System and formalized through the Defense Committee on Trauma, ensuring incorporation into doctrine and clinical practice guidelines. These efforts by operational medicine leaders, fostered in the SOMA experience, provided the true grassroots innovation the drives substantive change in both military and civilian medicine. SOMA is the ultimate incubator that turns lessons observed into medical practice for the entire military.

MORE THAN A MEETING

The annual SOMA education, training and scientific assembly is more than medical meeting. For over 35 years of annual gatherings (with the notable exception of 2020 during the COVID pandemic), it has become the national and international nexus of operational medicine thought leaders and practitioners. Through the robust, relevant presentations, squarely featuring and focused on far forward medic experiences, as well as the daily lab offerings, large industry and academic participation, and research track, the gathering seeks to truly develop the art and science of medicine. This incredibly robust program, accelerating content and reach over the past 15 years, has attracted both national and international attendees, so much so that the NATO Special Operations Command will, for the first time in the US this year, host its semi-annual Medical Expert Panel (SOFMEP), and the National Tactical Officer's Association (NTOA) has designated SOMA as it's Tactical Emergency Medical Service (TEMS) yearly academic meeting. This opportunity has become THE place to build alliances among like national and international colleagues.

BUILDING INTEROPERABILITY: A NECESSITY FOR TOMORROW'S UNCERTAIN ENVIRONMENTS

For any of us that deployed during the Global War on Terrorism, we found ourselves working with other Special Operations and conventional medical units and systems. Additionally, many of us worked alongside other nations' combatants and support personnel. I distinctly remember assisting New Zealand's SOF medical team with medical logistics, planning combined operations with Netherlands SOF forces and conventional surgical teams, and serving alongside Canadian colleagues in southern Afghanistan. We supported Romanian special operations detachments and flew in Spanish evacuation helicopters (and planned and operated, and enjoyed dinner and espresso, with Italian SOF teams!). The common mission of medical support, coupled with small expeditionary ground forces, brought together by necessity a unified network to literally save each other's lives. Many of these bonds formed in wartime, persist today, though our opportunities to work together are presently shrinking.

When our nations call for the collective defense, SOF will be sent even before overt action occurs. We will find ourselves falling in on whatever medical support system is in place, and unlikely to be composed of robust national medical systems. The relationships built ahead of time shall serve as the infrastructure that leads to success. Through prior planning, exercising and meeting, at venues such as SOMA, we can form the necessary relationships that will ensure interoperability when medical care systems are needed most. By sharing best practices, adopting guidelines and practices based on solid fundamentals, and training together at common venues, we hope to ensure natural interoperability through common focus and sustained friendships. SOMA is where relationships are made and renewed each year, and emerging trends are presented, debated and refined. It is truly a unique venue and we, the SOMA Board of Directors, Committee members and support staff invite you to this experience. Join us in Raleigh, North Carolina, May 5-9, 2025 – we hope to see you there!

PLATELET CRYOPRESERVATION MOVES CLOSER TO PRACTICALITY

U.S. Army Institute of Surgical Research and Vitrafy are teaming up to evaluate an innovative method for preserving blood cells that control clotting.

By Paul Lagasse, DHA R&D-MRDC

Will Hoskin, left, team leader of Vitrafy Life Sciences Limited's biomedical laboratory, explains the function of Vitrafy's cryopreservation system to U.S. Army Institute of Surgical Research Blood & Shock Resuscitation Combat Casualty Research Team (CRT1) research scientist Dr. Kristin Cardenas and science lead Dr. Adam Meledeo. (USAISR)

Hemorrhage is by far the leading cause of preventable death in combat; by some estimates, blood loss is responsible for up to 90% of injury fatalities. Shrinking this number – especially in future large-scale combat operations (LSCO) where contested logistics will impede timely medical reachback – will require extensive forward deployment of whole blood and blood products such as plasma, platelets, and red blood cells. And effective forward deployment, in turn, depends on the ability to adequately preserve them for long-term storage.

Platelets – mammalian cytoplasm fragments formed from bone marrow cells – are particularly important blood products to have on hand because their natural clotting ability slows blood loss. However, even with the use of preservative solutions, platelets have the shortest shelf life of all blood products at just 14 days. Cryopreserved platelets can be stored for up to two years, allowing for stockpiling in advance of LSCO or mass casualty events, but the current methods of freezing come with some significant disadvantages.

Dr. Kristin Cardenas

"Most cryopreserved products available now tend to have a reduced platelet function, especially post-thaw, and have a short shelf life after thawing," explains Dr. Kristin Cardenas, a research scientist with the U.S. Army Institute of Surgical Research Blood & Shock Resuscitation Combat Casualty Research Team, known as CRT1. "Most cryopreservation techniques require very specialized equipment and training. There's also a high risk of cell damage that occurs during the freezing and thawing process since the freezing induces ice crystal formation. Additionally, patients may experience immune reactions to the cryoprotectants, specifically DMSO [dimethyl sulfoxide]. And lastly, the technique isn't widely standardized among labs and blood centers."

Until those shortcomings can be sufficiently

addressed, widespread use of cryopreserved platelets will continue to be limited. That is why Cardenas and her CRT1 team are investigating a new cryopreservation technology developed by Australian biotechnology company Vitrafy Life Sciences Limited, which aims to significantly increase platelet survival times and clotting effectiveness.

COOPERATIVE AGREEMENT SPEEDS COLLABORATION

CRT1 can conduct the evaluation of Vitrafy's system thanks to a cooperative research and development agreement (CRADA) that it signed with the company. CRADAs are an effective tool for allowing federal government organizations to enter collaborative partnerships with private companies to conduct research into promising new technologies.

In a CRADA, both parties agree to contribute resources, including personnel, laboratory facilities and equipment, and intellectual property. In exchange, the CRADA enables participants to maintain confidentiality, and in some cases grant exclusive rights, which are important concerns for companies that are interested in licensing and commercially developing new medical products.

"Having partnerships with industry and universities is absolutely vital for research institutes like ISR," explains Cardenas. "We can develop our own novel technologies and also provide evaluation of externally created products, but getting life-saving interventions to the battlefield and into the hands of our end users absolutely requires those military-civilian partnerships. The CRADA mechanism enables me, as a researcher, to have opportunities to evaluate promising novel technologies that could potentially be developed for use by our Warfighters. It's a mechanism that has proven successful for our department over the past decade that I've been here at ISR."

EVALUATION SHOWS PROMISING RESULTS

Vitrafy's proprietary technology comprises a portable, liquid nitrogen free cryopreservation device, a thawing device, and secure software to tailor the freezing and thawing processes. Unlike other cryopreservation technologies that require up to four hours to freeze biological samples, Vitrafy's system freezes in less than five minutes and has protocols to use alternative cryoprotectants that may help to reduce toxicity and immune reactions in recipients.

The first phase of CRT1's evaluation under the CRADA was to refine and evaluate a process for retaining viability and functionality of cryopreserved platelets with the assistance of Vitrafy scientists William Hoskin and Ani Mebalds. This first phase of CRT1's evaluation was an important feasibility study and a gating item of whether to progress with more detailed evaluations.

Dr. Cardenas began by obtaining platelet units from healthy donors at a local blood center and cryopreserving them at -80°C in cryopreservation bags using Vitrafy's technology. Prior to freezing, the platelets were divided into three groups: one group treated with a common freezing media; one treated with trehalose, a cell stabilizing sugar; and one neat – that is, with no added preservation media. The three cryopreserved platelet groups were then thawed and sampled for evaluation using complete blood count, blood gas analysis, and visual inspection against backlight, called swirl. The team assessed hemostatic function using thromboelastography and thrombin generation capacity. Finally, the team used flow cytometry to determine platelet phenotype.

The CRT1 team found that the recovery rate of platelets in all three sample groups was around 89%, with the freezing media samples showing better clot strength compared to the trehalose and neat samples. In all samples, thrombin was generated at a faster rate post-thaw compared to pre-freezing, peaking at 2.5-fold, and all samples exhibited comparable endogenous thrombin potential. They also noted that platelet swirl was not present in the neat samples but was present in the other two formulations. In all cases, the researchers found that the platelet samples' constitutive markers were preserved, and their activation was increased, by the cryopreservation process.

WHAT'S NEXT FOR CRYOPRESERVED PLATELETS?

"Phase one's results will enable ISR and Vitrafy to collaboratively optimize the preparation steps, cryopreservation procedures, and analytical methods to ensure that the process is in the best position to proceed to a larger scale data acquisition and analysis of the products," says Cardenas.

"Despite the limited sample size of our initial phase 1 study, our results suggest that cryopreserved platelets have the potential to be a game changer for Warfighters, especially in LSCO and resource-constrained environments," says Cardenas. "Cryopreserved platelets have a very long shelf life over existing platelet products, offering more logistical flexibility and the ability to stockpile inventory to meet those intense demands of mass casualty events and to ensure that lifesaving care is being delivered to our Warfighters, which will ultimately enhance combat readiness and survivability of casualties."

Another aim within the CRADA agreement involves refining a process for preserving the viability and functionality of cryopreserved whole blood, not just platelets. This will include the optimization and scalability of outcomes, beginning with small volumes of product that can be tested to determine the impact of the cryopreservation and thawing process on the health of red cells, leukocytes, and platelets – including detailed measurements of clot formation, oxygen capacity, platelet aggregation, cell surface markers, cell mitochondrial respiration, cellular destruction products, and overall cell count.

According to Cardenas, "By the end of phase two, we're expecting that we will have generated enough data using Vitrafy's technology to address critical capability gaps in military applications."

ANSWERING THE NEED TO COUNTER THE BLEED

The Defense Health Agency's Operational Medicine (OPMED) Program Management Office is advancing blood products to increase the likelihood of positive post-hemorrhage event outcomes.

By T. T. Parish, OPMED Strategic Communications

Trauma surgeons and nurses attached to the 8th Forward Resuscitation Surgical Team, 18th Medical Command (Deployment Support), perform surgery on a simulated casualty during a field training exercise on Schofield Barracks, Hawaii. The Defense Health Agency's Operational Medical Systems Program Management Office has a robust blood products portfolio focused on far-forward, austere environments. OPMED PMO's Cryopreserved Platelet program commercial partner recently received U.S. Food and Drug Administration "Fast Track" designation for its CPP treatment protocol, which is being developed for use when conventional platelets are not available or are in short supply. (U.S. Army photo by Sgt. 1st Class Thomas Duval/Caption by OPMED Strategic Communications)

Blood loss due to battlefield wounds and injuries is a serious concern for U.S. Servicemembers preparing for potential conflicts across the globe. The seconds, minutes, and hours after a casualty is wounded are critical to preventing combat trauma-related death.

U.S. casualty survival rates increased dramatically between the Second World War and Operations Enduring Freedom and Iraqi Freedom, in large part due to improved protection and treatment, better equipment and training, more robust medical logistics capabilities, and quicker medical evacuation times. However, hemorrhage control and treatment – and the ability of medical providers at and near the front lines to arrange for casualty transportation to higher echelons of care – remain vitally important.

LTC Stephen Crimmins

To address these challenges, the Defense Health Agency (DHA) is focused on preparing the U.S. Joint Force for the operations of today and the battlefields of tomorrow. DHA's Operational Medical Systems team, Fort Detrick, MD, works to develop solutions for the nation's Servicemembers, including hemorrhage control and blood replacement therapy programs to equip frontline providers with the lifesaving and life-prolonging treatments they require.

MANAGING SEVERE BLEEDING IN THEATER

"The OPMED blood program seeks to prevent deaths due to hemorrhage, the leading cause of preventable death on the battlefield," said U.S. Army LTC Stephen Crimmins, a product manager with OPMED's Warfighter Protection and Acute Care Project Management Office. "Cryopreserved platelets are one part of a larger blood program that also includes cold stored platelets and freeze-dried plasma."

All three components of the program are critical in supporting hemorrhage control from the point of injury through the Role 3 level of trauma care, according to Crimmins. This broad-based development approach will give military medical providers more options for treatment – and provide refined control over blood product use and inventory management.

Platelet transfusions are essential in managing severe bleeding, but product shelf life and limited availability can pose logistical challenges in a far-forward environment. Cryopreserved platelets, or CPP, can be stored frozen for up to 5 years – providing a long-lasting alternative that can be deployed in both military and civilian healthcare settings.

Recently, OPMED's commercial partner, Cellphire Therapeutics, Inc., received U.S. Food and Drug Administration "Fast Track" designation for its CPP treatment protocol, which is being developed for use when conventional platelets are not available or are in short supply. The designation, granted under the federal Food, Drug, and Cosmetic Act, is designed to expedite the development and review of drugs that address serious conditions and have the potential to fill an unmet medical need.

LTC Andrea Mountney

In this case, it means CPP is one step closer to potential approval for use in future combat trauma treatment.

"The Fast Track designation provides several benefits, including more frequent communication with the FDA, rolling review of completed sections of a submission, and eligibility for accelerated approval and priority review," said Crimmins. "We feel that these benefits will help to quickly resolve problems as they come up and allow for an expedited review of the CPP submission – which could result in a faster delivery time of CPP to Warfighters."

EXPANDING TREATMENT OPTIONS

A common issue with combat trauma hemorrhaging is coagulopathy, or the inability of blood to form clots, sometimes caused by platelet deficiency due to blood loss. During combat trauma treatment, medical providers can transfuse platelets to help stabilize patients – but traditional platelet treatments may be in short supply or impractical to administer at and near the front lines. Having an alternative, like the cryopreserved platelets that are currently in development, may give future providers another treatment option to decrease the likelihood of mortality in wounded Servicemembers.

In addition, having a wide selection of hemorrhage control products will help to fill the blood capability gap at distinct roles of care – providing more opportunities for lifesaving intervention. This combined approach with conventional platelets, cryopreserved platelets, and other blood replacement therapies will aid in improving survivability and reducing the impact of logistical lines crossing hundreds or thousands of miles, according to U.S. Army LTC Andrea Mountney, WPAC's deputy program manager.

"There is no one-size-fits-all approach to hemorrhage control or blood replacement therapies, especially in the critical moments after a catastrophic wound or injury," said Mountney. "In resource-limited environments and potential conflict areas with contested and congested logistics, it is imperative to have a multi-

Cryopreserved platelets are one part of a comprehensive blood strategy that also includes cold stored platelets and freeze-dried plasma. The program, managed by the DHA's OPMED Systems, seeks to prevent service member deaths due to hemorrhage, the leading cause of preventable death on the battlefield. (Photo by T.T. Parish, OPMED Strategic Communications)

tiered approach for blood replacement therapies."

Because of the large geographic distances in places like the Indo-Pacific – which comprises roughly 52% of the Earth's surface – medevac capabilities for frontline providers may be more limited than during previous conflicts. The evolving nature of U.S. defense strategy places a premium on light logistical footprints, small-unit independence, and mission-specific force structures to maximize lethality while increasing maneuverability in littoral regions.

POISED TO MAKE A DIFFERENCE

Developing lifesaving and life-prolonging blood products will go a long way toward meeting the mission needs of combatant commanders preparing for future large-scale combat operations in austere environments across the globe, according to Mountney.

"The cryopreserved platelets we are developing help to directly equip frontline medics, corpsmen, and health care providers with another tool to prolong life while awaiting medevac and mitigate the effects of severe bleeding when traditional options are exhausted," she said. "Blood and blood products continue to be one of the most valuable resources in combat medicine – it is critical to have as many treatment options as possible."

MITIGATING PREHOSPITAL BATTLEFIELD DEATH IN THE FUTURE FIGHT

Lieutenant Colonel Andrew S. Oh is a board-certified Emergency Medicine Physician and currently serves as the Command Surgeon for the 75th Ranger Regiment. Lieutenant Colonel Andrew S. Oh was born and raised in the Washington DC area, where he served as an Infantryman in the Virginia Army National Guard and then on active duty at Fort Carson, Colorado and Ar Ramadi, Iraq. It was his combat deployment, as a Rifle Platoon Leader, that ultimately led Lieutenant Colonel Oh to pursue a career in Army Medicine.

After completing his active-duty service obligation, Lieutenant Colonel Oh completed his pre-medical course work, while serving as an Army ROTC Instructor at the University of Massachusetts - Amherst. Starting in 2009, Lieutenant Colonel Oh attended the Uniformed Services University of Health Sciences, graduating with a Doctor of Medicine degree, and then completed an Emergency Medicine Residency at San Antonio Military Medical Center, Fort Sam Houston, Texas. Lieutenant Colonel Oh subsequent assignments included the Battalion Surgeon at 1st Battalion, 1st Special Forces Group (Airborne), Torii Station, Okinawa, Japan, and the Commander of the 135th Forward Resuscitative and Surgical Team, Camp Humphreys, South Korea. Having spent five years in Asia, Lieutenant Colonel Oh implemented a rapidly deployable, mobile damage control resuscitation package that was sent to eight different countries, in support of POTUS, VPOTUS, and Secretary of State, and a forward surgical team for "Transition to Hostilities" wartime contingency for the Republic of Korea.

Prior to arriving to the 75th Ranger Regiment, Lieutenant Colonel Oh completed his Pediatric Emergency Medicine Fellowship at the Children's Hospital Colorado and has served as the Special Operations Medical Association Scientific Assembly Program Co chair for the last three years.

LTC Andrew S. Oh
Command Surgeon
75th Ranger Regiment
Ft. Benning, GA

Combat & Casualty Care had the privilege of speaking with LTC Andy Oh, Command Surgeon, 75th Ranger Regiment, regarding current day challenges to mitigating prehospital battlefield deaths as a future featuring mass casualties across large-scale combat operational environments moves closer to reality.

C&CC: How do medical leaders within the 75th Ranger Regiment see the future fight?

LTC Oh: The future fight is unknown, unclear, and uncomfortable. Current strategic and operational leaders may have implicit bias from the twenty years of Global War on Terrorism (GWOT) and associated tactics. The National Defense Strategy charters protection of vital U.S. interests by preparation for, and integrated deterrence against, China and Russia, while remaining vigilant of threats posed by North Korea, Iran, and violent extremist organizations. This strategic preparation outlines considerations for future large scale combat operations (LSCO) and the near-peer fight, and becomes challenging as our military trends toward less iterative combat operational deployments.

The field of Ranger medicine has maintained a zero percent prehospital preventable battlefield death rate during the past 20 years of GWOT. This accomplishment is a result of relentless leader-ownership of medical training as part of the Ranger "Big 5," which includes the absolute mastery of TACTICAL COMBAT CASUALTY CARE (TCCC) fundamentals, immediate availability of battlefield cold-stored whole blood, and the implementation of Ranger O-low titer (ROLO) whole blood battlefield transfusion With 2009 Department of Defense implementation of policy dictating "Golden Hour" access to damage control surgery (DCS), improvements in the availability of surgery drastically reduced casualty fatality rate as compared to early GWOT. This mandate resulted in 359 lives saved during subsequent 5-year period and DCS operative management remains the standard for all trauma care.

The future fight will provide significant challenges to accessing surgery, a prelude seen in the Ukraine-Russian fight and other large-scale throughout history. The operational environment will

A Ranger medic administers fresh whole blood, while his Advanced Ranger First Responder continues to assess the casualty during TCCC tactical lane. (75th Ranger Regiment)

not likely have air superiority and as a result, immediate medical evacuation (MEDEVAC) or casualty evacuation (CASEVAC) may not be an option. Casualties will outpace medical capabilities. Furthermore, hypersonic munitions and one-way unmanned aircraft systems, which dictate a decentralized defense in depth system, will eliminate a well delineated line of troops. DCS capability will likely be unavailable or delayed beyond the previous Golden Hour mandate.

C&CC: How does the 75th Ranger Regiment expect to mitigate future prehospital battlefield death?

LTC Oh: We submit a model for saving the greatest number of potentially survivable lives in future combat operations, specifically in LSCO and given current mission requirements in medically austere crisis response locations.

Leader-ownership of the casualty response system was integral in maintaining a zero preventable battlefield death rate during GWOT. A leader-owned system is deliberate and inclusive of not only Commanders, but all leadership down to the team leader and accountability amongst their Ranger buddies. Relentless ownership of realistic, tough, and repetitive medical training, fully integrated into all tactical training builds medical fluency to their operations and saves lives. Leader-emphasized training focuses on TCCC medicine, and the operational effects of taking casualties: accountability, task organization, logistics, risk to the force versus casualties, and non-traditional CASEVAC to name a few.

TCCC is the foundation of all prehospital combat medical care and must be sustained through tough, realistic, and repetitive training. The Ranger First Responder (RFR) and Advanced Ranger First Responder (ARFR) programs are the tools that the 75RR leaders utilize to build the TCCC fundamentals in every Ranger. The programs remains the single most impactful medical training that will mitigate preventable Ranger deaths in LSCO, particularly in environments where casualties will overwhelm operational or medical resources. Numerous Ranger combat vignettes demonstrate that the first medical responder is the injured Ranger casualty themself or their Ranger buddy, as opposed to the medic. RFR and ARFR are executed every nine to 12 months for the battalions. Along with the medical training, Rangers must demonstrate proficiency in critical life-saving interventions through tactical scenarios and more importantly, act as medic extenders until the medic can intervene.

To ensure Ranger medics are prepared and sustain their competency, the 75RR executes the Ranger Medic Assessment and Validation (RMAV) prior to every short notice alert cycle. Although all Rangers are selected through a rigorous assessment and selection, the key to Ranger medic's expertise is through frequent repetitive training and validation. Battalion medical directors (Battalion Surgeons and Physician Assistants) and Battalion senior medics themselves lead by example and maintain their own competency through the TCCC trauma lanes. Along with lessons learned from the Ukraine-Russia and Israeli-Hamas wars, emerging evidence-based standards are integrated into every evolution of RMAV's trauma lanes to ensure proficiency is attained through repetition.

Genuine hands-on trauma patient care is never more important given the decrease on iterative combat deployments. All Special Operations Combat Medics, including Ranger medics, are required to regularly rotate at a high-volume civilian hospital for trauma sustainment. These formal military – civilian partnerships (MCP) provide realistic trauma and allow for critical wartime skill sustainment. Although these relationships take time to develop, the investment in the training is achievable, established, and consistently reproducible. Recent analysis of the MCP demonstrates that the existing programs are a highly effective model for high fidelity trauma, critical care, and a large volume of emergency medicine encounters. This sustainment model is capitalizes on the strengths of the appropriate MCPs that best meet the unique requirements of Ranger medicine.

Lastly, while staying true to the mastery of the TCCC fundamentals, the 75RR is finalizing standards for their damage control resuscitation teams (DCRTs), the gap between TCCC and DCS. The casualties from Ukraine- Russia war illustrate long evacuation times, with mean of 36 hours, up to 3 days. With evidence of targeting of medical vehicles, evacuation of casualties have proven difficult and non-standard, thus they remain on or near the point-of-injury for prolonged periods of time. Damage control resuscitation principles largely draw from hospital-based critical care and combat-based prolonged care: limited resources, casualties with physiologic changes outside of one hour in a 12 to 24-hour patient-driven exercise, and end-of-life care decisions to allocate the medical resources (including providers) to save the

A Ranger medic carefully monitors whole blood consumption for a casualty during a night time extended casualty care training iteration. (75th Ranger Regiment)

highest number of preventable deaths on the battlefield and return Rangers to the fight.

C&CC: Your unit is known for starting prehospital O-low titer whole blood during the GWOT. What other blood innovations are the Rangers considering?

LTC Oh: Whole blood is the best resuscitation tool in hemorrhagic shock. Since the birth of Ranger O-low titer (ROLO) in 2016, the 75RR consistently incorporates prehospital fresh low titer O whole blood transfusion training into battle drills. Ranger medical direction supports ROLO use when deployed and tactical leaders integrate ROLO into the combat operational plan. In 2019, the use of ROLO, after exhausting the supply of cold-stored whole blood, saved a Ranger's life. Acknowledging that future research and innovation examining unmanned aerial vehicle delivery of medical resupply and artificial/manufactured blood products may ultimately influence the way the 75RR prioritizes blood resuscitation in the future, we currently see fresh whole blood as the gold standard to traumatic resuscitation.

The current TCCC algorithm states relieving physiologic tension pneumothoraces with early needle/finger thoracostomy ("R" in MARCH), before completely addressing a casualty's circulation status ("C"). Although tachypnea can be an indicator of respiratory distress present in tension pneumothoraces, hemorrhagic shock is responsible for more than 90% of GWOT potentially survivable prehospital deaths. The evidence suggests that the development of prehospital tension pneumothoraxes develop over time and is a very small portion of potentially survivable prehospital battlefield death that is only seen in specific injury patterns. Additional data from the current Israeli – Hamas war has given cause for the Israeli Defense Forces to remove all needle decompression devices from their individual first aid kits. Ultimately, respiratory decompensation can result from hemorrhagic shock because of acidosis and associated hypoxemia. Thus, 75RR emphasizes redundant early vascular access and early blood administration to mitigate the risk of delaying treatment for hemorrhagic shock.

The low titer O whole blood donor, the current standard for prehospital fresh whole blood, only accounts for approximately 45-55% of available blood supply. Blood is further limited when accounting for the availability of O low titer leaders during an active combat engagement and the potential for the casualties themselves as the previously identified O low titer donors. To increase the supply, the 75RR is exploring additional screening for low titer A whole blood screening increasing total availability to 70%, and currently executes prehospital type-to-type specific (i.e. B-type donor to B-type recipient) fresh whole blood transfusions protocols in our 10-12 person teams. In fact, whole blood type-to-type prehospital transfusions simplifies the cognitive effort, as only confirmatory type and screen matching and standard bloodborne pathogen testing are required. To improve the safety

Capitalizing on real world lessons learned and tactical medicine protocols, Ranger medics evaluate casualties in a confined-space trench environment. (75th Ranger Regiment)

During their annual Ranger Medic Assessment and Validation, a Ranger medic performs a life-saving battlefield cricothyrotomy on a live casualty role player. (75th Ranger Regiment)

of transfusions, the 75RR plans to incorporate these new methods of transfusions into repetitive training/battle drills as part of the command ownership of the casualty response system.

As humans are the best containers for prehospital fresh whole blood, we suggest that whole blood antibody titer testing, bloodborne pathogen screening, and type and screen matching must be quick, accurate, widely available, and as far forward as possible. Current blood testing is often restrained to bench laboratory and not widely available. "Point-of-care" card results are subject to interpretation or inconclusive. The goal is a rapidly deployable, hand-held device, with the capability of confirmatory blood type and screen, antibody titer levels (<1:256 as the current standard), and common bloodborne pathogen testing (HIV, hepatitis, etc). Once this capability gap is met, type-to-type blood exchange battle drills must be incorporated into the Commander's rehearsals, such as current ROLO protocols that are repetitively rehearsed.

Commanders must have risk-based options when increasing the blood supply, through the number and availability of potential donors. The current FDA waiting period after donating 1 unit of whole blood is 56 days. This number is based on hemoglobin levels returning to baseline for most adults between 20-59 days. Hemoglobin levels are indicative of oxygen-carrying capability to vital organs; hence why fresh whole blood is the fluid of choice for hemorrhagic resuscitation. The process of stem cell hemopoietic differentiation, to fully matured hematocyte carrying hemoglobin requires elemental iron, a precursor to the production of oxygen carrying capability. With partnerships at local universities and medical schools, the 75RR is studying the feasibility of reducing the minimum blood donor window for subsequent donations from 56 days to 35 days with appropriate iron supplementation. Another current initiative examines the resultant bacterial load present in blood after 24 hours outside the donor's body and mechanisms for safe autologous blood transfusions if not utilized during missions. Risk mitigation protocols must be further studied to determine their efficacy to provide Commanders with additional options during situations that result in large numbers of casualties.

Thank you to the following contributors: Patricio Vasquez, Adam Sahlberg, Robert McQueen, Christopher McNamara, Sean Collins, Charles McAdams, Russ Kotwal, Charles Moore, David Hardin

TARGETED WOUND CARE AT POINT OF INJURY

KeriCure Medical, a biotechnology firm based in Tampa, FL, has announced their innovative spray-on wound care products Field Shield Wound Dressing and KeriCleanz Antiseptic Spray have been awarded national stock numbers (NSNs).

By Dr. Kerriann Greenhalgh, PhD, Founder, CEO, CSO KeriCure Medical

KeriCure Medical is a woman owned small business that specializes in skin and wound care products for both military and civilian customers. Keeping both major and minor wounds from infection and promoting early healing is a priority for KeriCure, and their products are designed to do just that. "We know that a minor cut or itchy, wet feet, can quickly develop into cellulitis and serious infections if not addressed early on. So KeriCure is here to make sure that doesn't happen," says Dr. Greenhalgh.

Field Shield Wound Dressing is a simple to use spray-on dressing designed with KeriCure's nanopolymer technology for advanced burn and wound care. This first-in-class protective barrier combines antimicrobial silver with pain relieving lidocaine, for an all-in-one solution. Field Shield is a required carry item for the 2025 Best Ranger Competition, and KeriCure is a sponsor of the Army's Best Medic Competition.

KeriCleanz antiseptic spray cleans and disinfects skin and wounds through a unique combination of silver and hydrogen peroxide, where a small amount of peroxide (1%) is able to provide as much antimicrobial power as a 10x solution, killing germs within 10 seconds of application.

"Our unique wound care products are care multipliers for combat medics, where a small 1oz bottle can manage 10 to 30 wounds," says Dr. Greenhalgh. "This latest achievement of securing NSNs supports our mission of providing advanced wound care in austere environments that is quick, ruggedized, and easy to use in Role 1 and up."

IMPROVING HEALING OUTCOMES FOR LARGE BURNS

Field Shield is currently being investigated in a clinical trial enrolling 40 patients suffering 5-30% total body surface area burns. The study sites include U.S. Army Institute of Research (Dr. Leopoldo Cancio) and Valleywise Health Burn Center (Dr. Kevin Foster). The study focuses on improving healing outcomes, evaluating healing time, pain management, and surgical interventions required for healing.

Stop by Booth #411 at SOMA2025 and see firsthand how KeriCure is setting new standards in military wound care.

For further information on the KeriCure products, please visit www.KeriCureMedical.com/faq

MODERNIZING SOF MEDICINE FOR TOMORROW'S CONFLICT

Major Donald "DJ" Hamilton is a senior military medical officer with extensive experience in combat casualty care, medical force modernization, and operational medicine across both conventional and special operations forces. Over his career, he has deployed eleven times in support of U.S. combat operations worldwide, holding leadership, instructional, and medical innovation roles to enhance battlefield trauma care and integrate emerging technologies into military medicine.

MAJ Hamilton enlisted in the U.S. Army as a combat medic in 2002 and was selected to serve in the 75th Ranger Regiment, completing follow-on medical training at Fort Bragg, North Carolina. He served as a platoon medic and later as a company senior medic within the regiment. His expertise in combat trauma care led to an assignment on the 75th Ranger Regimental staff, where he served as an Instructor/Writer at the Joint Special Operations Medical Training Center (JSOMTC) and later as the Medical Force Modernization Non-Commissioned Officer (NCO).

MAJ Hamilton commissioned as a Physician Assistant (PA) in 2016 after earning a Master of Science in Physician Assistant Studies from the Interservice Physician Assistant Program (IPAP) in San Antonio, Texas. He was first assigned as a Battalion PA in the 6th Battalion, 52nd Air Defense Artillery Regiment at Suwon Air Base, South Korea. Selected for the Joint Medical Unit, Joint Special Operations Command (JSOC), he served as a Physician Assistant Team Leader, Troop Commander, and later Deputy Director of Force Innovation and Modernization, leading advancements in medical technologies and prolonged field care. During this time, he also earned a Doctorate in Emergency Management and Global Health.

MAJ Donald "DJ" Hamilton
Chief Knowledge Officer
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Arlington, VA

Combat & Casualty Care had the pleasure of speaking with MAJ Donald "DJ" Hamilton regarding the state of modern Special Operations Forces (SOF) medicine and trends that are dictating the prioritization of prolonged field care (PFC) and the use of artificial intelligence (AI) to enhance the training necessary to bolster future global battlefield force resiliency.

C&CC: From your perspective on focal shifts in modern SOF medic evolution, can you tell us about these shifts and any promising current and emerging technologies that could significantly enhance casualty care and triage in austere environments? How might these advancements shape the future of SOF medicine?

MAJ Hamilton: Over the past two decades, SOF medicine has evolved significantly from the rapid, highly resourced care model developed during the Global War on Terror to a more adaptable, prolonged field care-centric approach. We now operate in an era where contested logistics, denied communications, and prolonged casualty care are no longer outliers—they are baseline assumptions for future conflicts.

One of the most critical shifts is the increasing reliance on technology to extend operational reach of SOF medics in austere environments. For example, unmanned systems are proving their worth in casualty evacuation and medical resupply. UAVs capable of autonomously delivering whole blood or essential medications to isolated teams are already in operational testing, while early iterations of unmanned CASEVAC platforms have been successfully demonstrated. The ability to move casualties without exposing additional personnel to enemy fire will be a force multiplier in future conflicts.

Simultaneously, we're seeing significant advancements in telemedicine and remote medical guidance. Augmented reality (AR) telementoring now allows a forward-deployed medic to receive step-by-step transcontinental procedural guidance from a surgeon. This technology can revolutionize battlefield medicine by providing real-time decision support, enhancing patient monitoring, and improving outcomes during delayed evacuation when paired with wearable biosensors and AI-driven triage algorithms.

The future of SOF medicine will depend on making our capabilities more mobile, modular, and self-sustaining than ever before. The challenge isn't in adopting new technology—it's ensuring that these tools integrate seamlessly into operational context without adding

MAJ Hamilton leads a dynamic TCCC lane in Suwon, South Korea, integrating small unit tactics, care under fire, 9-line MEDEVACs, and casualty evacuation—all while exchanging paintball fire under combat-like conditions. (U.S. Army)

unnecessary complexity or logistical burdens. Integrating these technologies successful requires a fundamental shift in how SOF medics are trained, ensuring they seamlessly employ AI, robotics, and autonomous tools in extreme conditions.

C&CC: Advances in medical simulation, virtual reality, and AI-driven training tools have the potential to revolutionize SOF medical training. Which of these technologies do you think could have the biggest impact, and how might they be best utilized to enhance medical readiness?

MAJ Hamilton: SOF medics must train as they fight—in high-stress, unpredictable environments. Traditional training is effective, but AI, VR, and haptic feedback systems are unlocking a new frontier of realism and scalability.

A very impactful advancement is AI-driven adaptive training. AI can dynamically adjust training scenarios using real-time performance analytics, reinforcing strengths and identifying inherent weaknesses. VR combat casualty simulators will immerse medics in hyper-realistic combat environments, where AI-generated casualties react dynamically to treatment—bleeding, going into shock, and showing real-time physiological changes.

Emerging haptic feedback simulators will enhance procedural realism. Medics will feel tissue resistance when performing cricothyrotomy, chest tube insertion, or wound packing—creating a more lifelike experience than traditional training models.

Looking ahead, fully immersive, AI-driven combat scenarios will push SOF medics beyond technical proficiency, forcing them to integrate decision-making under pressure, mass casualty triage, and logistical constraints—ensuring they are medically competent and operationally prepared for the chaos of combat medicine.

C&CC: Prolonged Field Care remains a critical challenge in SOF medicine. If you had full control over future strategy development, what innovations or approaches would you prioritize to optimize limited medical resources in these settings?

MAJ Hamilton: Prolonged Field Care (PFC) is not just an extension of Tactical Combat Casualty Care—it is a fundamentally different problem set. It requires a shift from short-term stabilization to sustained management of critically ill patients with minimal resources.

Given complete control over future strategy development, I would prioritize the following:

Portable, Modular Medical Kits: We require lightweight, scalable kits tailored for PFC scenarios. These kits should include shelf-stable blood products, compact patient monitoring devices, ruggedized diagnostics, and preconfigured resupply modules that allow medics to customize their load-outs based on mission duration and expected casualty loads.

Unmanned Resupply & CASEVAC: Autonomous UAVs and ground vehicles must become a standard element of SOF medical resupply, ensuring that essential medications, blood, and equipment can reach isolated teams without reliance on conventional logistics. Moving casualties out of hostile areas will be a game-changer in denied environments.

Predictive Analytics for Patient Management: While AI-driven triage and decision support tools will play a significant role in PFC, their value extends beyond initial stabilization. Predictive analytics can analyze trends in a casualty's vitals over time, allowing medics to anticipate impending medical catastrophes and intervening hours before sepsis, worsening hemorrhage, or respiratory failure hours develop; using limited resources more effectively.

Advanced Telemedicine & Remote Consultation: Secure, low-bandwidth telemedicine platforms must enable medics to receive remote guidance from surgical specialists, even in communications-denied environments. Pre-loaded AI-generated treatment algorithms could supplement this when external connectivity is lost.

Training for Austere Medicine: PFC training must go beyond trauma care and incorporate advanced critical care skills, infection management, resource improvisation, and field-expedient surgical techniques to match the realities of prolonged, independent operations.

PFC is a challenge that will define the next era of SOF medicine. The key to success hinges on developing medics who can think critically, adapt rapidly, and sustain life under extreme constraints, while leveraging technology as an enabler, not a replacement, for human expertise.

MAJ Hamilton and a teammate conduct surgical first assist training—enhancing cross-functional capability on small surgical teams, a critical skillset for future conflict. (U.S. Army)

C&CC: Transitioning cutting-edge medical tech from research to operational use can be slow, yet collaborations among military, private industry, and academia are often crucial for innovation. What changes would you make to revamp this process, and which partnerships or initiatives do you see as most beneficial for SOF medicine?

MAJ Hamilton: The biggest challenge isn't a lack of innovation—it's bureaucratic inertia, funding gaps, and misalignment between developers and end-users. Often, promising medical technologies stall in transition from successful prototyping to battlefield deployment. To accelerate this process, SOF must embed medics and operational end-users earlier in research cycles, ensuring that emerging technologies align with real-world constraints before full-scale development begins.

A very effective way to bridge this gap is through Cooperative Research and Development Agreements (CRADAs), where SOF medical personnel directly collaborate with military research labs, private biotech firms, and academic institutions. This approach has already successfully shaped AI-driven diagnostics, wearable biosensors, and battlefield trauma solutions through partnerships with DARPA, the Defense Health Agency (DHA), and the U.S. Army Medical Research and Development Command (USAMRDC).

Future research must emphasize automated medical logistics, AI-driven resupply, and unmanned CASEVAC. Air Force Research Laboratory (AFRL) 711th Human Performance Wing and the Naval Medical Research Center (NMRC) programs are pioneering autonomous medical resupply systems and predictive medical logistics platforms. The Biomedical Advanced Research and Development Authority (BARDA) and NIH are developing synthetic blood substitutes, bioprinting techniques for regenerative medicine, and advanced trauma management solutions—capabilities that could reshape prolonged field care and combat casualty sustainment.

On the academic side, institutions like Johns Hopkins Applied Physics Laboratory (APL) and MIT's Institute for Soldier Nanotechnologies are creating next-generation wound care solutions, lightweight diagnostic tools, and smart medical materials. The University of Pittsburgh's McGowan Institute for Regenerative Medicine is pioneering tissue engineering and bio-printing, which could allow 3D-printed skin grafts or even on-demand surgical implants in austere environments.

Industry collaboration remains vital. Programs like SOFWERX and AFWERX are streamlining transition of emerging medical technologies into operational use, notwithstanding early-phase operational testing must increase. Technologies should not reach deployment only to be discovered as combat-infeasible—they need agile prototyping, early user feedback, and real-world battlefield testing before large-scale adoption.

For SOF medicine to be effective at scale, it must seamlessly integrate across conventional forces, allied partners, NATO, and civilian medical systems. If SOF medics use equipment unfamiliar to flight medics, conventional providers, or NATO partners, patient handover becomes a liability instead of a lifeline. Standardization ensures seamless transition of care, common biomedical maintenance programs, and reliable resupply chains, reinforcing SOF Truth #5: "Most Special Operations require non-SOF support to execute successfully."

The future of SOF medicine depends on early engagement in research, multinational alignment on medical technologies, and rigorous operational testing. Collapsing the gap between concept and battlefield deployment, prevents lifesaving innovations from being buried in bureaucracy. Widespread adoption ensures that every provider—SOF, conventional, allied, or civilian—operates with the same lifesaving capabilities, creating a battlefield where medicine is an advantage, not a limitation.

C&CC: With the growing focus on great power competition and near-peer conflicts, SOF medical providers may need to adapt to new battlefield conditions. In your opinion, what are the most pressing medical challenges that could arise in such conflicts, and how might SOF medicine evolve to meet them?

MAJ Hamilton: In a near-peer fight, every assumption from the past two decades is up for revision. The permissive airspace and rapid evacuations we relied on in Iraq and Afghanistan may no longer be viable. SOF medics will likely operate in contested, degraded, and denied environments, where prolonged field care isn't just an occasional contingency—it's the expectation.

A significant challenge will be austere logistics. Class VIII medical resupply will compete with munitions and fuel for transport priority, meaning medics must become more self-sufficient than ever. Technologies like freeze-dried plasma, 3D-printed surgical tools, and on-demand biomanufacturing of critical drugs could mitigate resupply delays. Research in synthetic blood substitutes could provide an alternative to whole blood when donor supply lines are cut off.

Triage and casualty management may also shift. In high-intensity, near-peer conflict, the strategic value of certain personnel may override purely medical triage principles. Suppose the unit is critically short on drone pilots or cyber warfare specialists. In that case, commanders may prioritize those casualties over others who might otherwise receive more immediate care under traditional triage models. Similarly, force preservation concerns may drive a focus on treating the "walking wounded" first to keep as many rifles in the fight as possible. These decisions will place a moral burden on SOF medics, requiring balance of clinical ethics with the operational realities of the fight.

Another key challenge will be communications and data transfer in a cyber-contested environment. AI-enabled decision support is promising, but if those tools rely on continuous network connectivity, they will not survive first contact with a near-peer adversary. SOF medics will need offline-capable AI systems, low-bandwidth data transfer methods, and quick-burst communications protocols to ensure medical situational awareness even under electronic warfare (EW) threats.

At the end of the day, near-peer conflicts demand that SOF medicine becomes skilled in prolonged field care and improvisational logistics, combat casualty decision-making, and navigating EW and cyber threats. The future battlefield will be ruthlessly contested, and our ability to adapt quickly will define survivability for individual casualties and entire mission sets.

C&CC: Any final thoughts on how to prepare SOF medicine for the future?

MAJ Hamilton: The future of SOF medicine cannot be left to chance—it must be proactively shaped before the next war exposes preventable gaps. The battlefield of tomorrow will demand a new approach that fuses technological innovation with an absolute mastery of the basics.

Technology is a critical enabler, but no AI-driven triage system or robotic surgical platform will replace the need for a highly trained medic who can sustain life with limited resources. The foundation of SOF medicine will always be human expertise. Anatomy, physiology, trauma resuscitation, and prolonged field care must remain at the core of training, ensuring that medics can function autonomously in contested environments. Advanced simulation programs, high-stress casualty exercises, and exposure to decision-making under uncertainty will be key to preparing the next generation of SOF medical providers.

At the same time, SOF medicine must relentlessly pursue technological advancements that enhance survivability. AI-assisted triage, synthetic blood, 3D-printed medical devices, and autonomous resupply systems will redefine battlefield sustainment. Integrating artillery-based blood delivery and CASEVAC drones will ensure that traditional logistics constraints do not limit medical support. Predictive analytics will transform medical logistics from a reactive process to a proactive one, ensuring that lifesaving supplies arrive before they are critically needed.

Rapid acquisition and fielding of these technologies must be a priority. Too often, innovations are trapped in research pipelines while outdated methods persist on the battlefield. The key is early operational testing, iterative development, and a willingness to integrate new capabilities before they are perfected in a lab. The pace of technological advancement will not slow down, nor should SOF medicine.

The way forward is clear: master the fundamentals, integrate cutting-edge technology, and drive agile acquisition processes that keep SOF medicine ahead of the fight. If we succeed, we won't just be prepared for the next war—we will define the future of battlefield medicine on our terms.

ADVANCING FORCE HEALTH ON A GLOBAL SCALE

From its establishment in 1893 as an anti-malaria research institute to today's pioneering deployment of artificial intelligence in novel drug manufacture and vector surveillance, Walter Reed Army Institute of Research (WRAIR) continues to deliver military relevant research in collaboration with strategic international partnerships to prevent, detect, and respond to emerging diseases that threaten the nation's warfighters and nation itself.

By COL Eli Lozano, Commander, Walter Reed Army Institute of Research

Col. Gerald Kellar, Maj. John Eads, and Maj. Luis Pow Sang collect waste water from sewers at the Counter Insurgency, Terrorism, and Stability Operations Center during Exercise Justified Accord. (WRAIR)

The Walter Reed Army Institute of Research (WRAIR) is the DoD's largest biomedical research organization, with a mission to discover, design, develop, and deliver globally impactful solutions for military relevant infectious diseases, brain health, and performance optimization through innovative research. As the preeminent medical research institute for the U.S. Army, and now, the Defense Health Agency (DHA), WRAIR's scientific enterprises around the globe have distinguished it as a true enabler of DHA's combat support agency (CSA) role for the DoD's military services. WRAIR's unique research capabilities have served to enhance the global health engagement, tactical presence, and strategic influence of the DoD's Geographic Combatant Commands, particularly in the role of optimizing the readiness, force health protection (FHP) and health service support (HSS) of our warfighters. At our WRAIR Headquarters, we say, "WRAIR puts the CSA in DHA!"

WRAIR accomplishes CSA-focused mission sets through an extensive global network sustained by its forward-positioned institutes: WRAIR-Africa, WRAIR- Armed Forces Research Institute of Medical Sciences (AFRIMS), WRAIR-Europe Middle East (EME), and WRAIR-West. These forward locations strategically enable us to conduct infectious disease surveillance, deliver real-time health threat assessments, and strengthen interoperability and global health security with our international partners. These laboratories are embedded in critical regions, aligned with Combatant Command priorities, and are built on decades of trust with host nation partners.

ENHANCING GLOBAL DISEASE RESPONSE AND SUSTAINING HEALTH

WRAIR's overseas institutes are truly the crown gems of our joint CSA-oriented mission sets. In the Military Review article "To Conserve Fighting Strength in Large-Scale Combat Operations," the U.S. Army Surgeon General and senior Army Medicine leaders emphasize that "an increased understanding of the impact of specific infectious diseases on servicemember performance is needed." They warn that as conflicts unfold, the collapse of local and regional systems for sanitation, vector control, and public health "often lead to resurgence of endemic diseases or the introduction of new ones brought in by foreign military forces." To counter these threats, they recommend incorporating "critical information about disease prevalence and impact" into medical-requirements models, insuring Commanders can accurately assess risks and protect force readiness. WRAIR's institutes conduct relevant medical research on disease threats to our operational forces, while executing critical global disease efforts like the President's Emergency Plan for AIDS Relief (PEPFAR). We established our overseas institutes at the request of host nations, some dating back 66 years, and we remain deeply embedded in their public health ecosystems.

In Thailand, WRAIR-AFRIMS supports U.S. Indo-Pacific Command (USINDOPACOM) by conducting infectious disease research, biosurveillance, and health security engagements across a broad geography that includes the Philippines, Nepal, Cambodia, Australia, and Papua New Guinea. At the beginning of the year, WRAIR-AFRIMS conducted comprehensive disease surveillance throughout multiple domains in support of the multinational joint exercise, Cobra Gold. Researchers screened vectors for high-risk infectious threats such as malaria, dengue, Japanese encephalitis, and Chikungunya; analyzed medical wastewater for antimicrobial-resistant organisms; and collected nasal swabs from symptomatic service members—delivering FHP recommendations not only for real-time mitigation of DNBIs at Cobra Gold, but also informing future FHP for upcoming events like USINDOPACOM's Hanuman Guardian and Balikatan 2025.

Dr. Stephen Ferrara, Acting Assistant Secretary of Defense for Health Affairs, explained it clearly: During OIF and OEF, we had fixed hospitals, air superiority, and the golden hour—conditions that enabled high-quality care at critical moments. But the Indo-Pacific is a different story altogether. With 36 countries spanning 16 time zones, hosting three of the world's biggest economies and seven of the largest militaries, and encompassing two-thirds of the world's population, the region's scale and complexity redefine everything—from patient movement to combat readiness.

We are applying the same model with U.S. Africa Command (USAFRICOM), where WRAIR-Africa supported Justified Accord 2025, USAFRICOM's largest annual exercise on the continent, by identifying

The Brazilian Military East Training Center team demonstrates the utility of the Military Combat Track for evaluating operational performance under stress. Participants assess threats, engage targets, and make medical decisions as part of a simulated combat exercise. (WRAIR)

dangerous infectious agents present in the training AO and directly coordinating with medical personnel to implement appropriate FHP measures. The team conducted daily vector surveillance by collecting mosquitoes, sandflies, and ticks for pathogen testing and analyzed wastewater samples for infectious disease threats. WRAIR-Africa scientists detected viral agents (Jingmen tick virus and norovirus), Q fever and epidemic typhus causing bacteria, and five other biological threats to military exercise participants. The team shared these significant findings directly with Role 1 medical leaders and other HSS personnel for immediate evidence-based FHP advancement.

Supporting U.S. European Command and U.S. Central Command, WRAIR-EME plays a key role in conducting vector and disease surveillance in support of U.S. and allied troops while executing long-term biosurveillance work in partnership with the Richard Lugar Center for Public Health in Tbilisi, Republic of Georgia. As conflict dynamics evolve in Ukraine and beyond, our partnerships with Eastern European and Middle Eastern health entities afford our scientists, and the DoD at large, early visibility of emerging infectious threats that have the potential to greatly impact warfighter readiness and lethality. Most recently, the remarkable research efforts of WRAIR-EME scientists have raised DoD Senior Leader awareness on the increased presence and spread of multidrug-resistant organisms throughout Europe and Western nations, highlighting the urgency of optimizing FHP by bolstering surveillance processes at our military health system facilities.

WRAIR-AFRIMS nurse collects a nasal swab sample from a symptomatic service member so the team can monitor and identify pathogens causing respiratory and diarrheal symptoms in CG25 participants. (Edited by Ramiro Chavez)

PARTNERING TO MEET EMERGING THREATS HEAD ON

Located at Joint Base Lewis-McChord, WRAIR-West researchers target warfighter performance through several collaborations in USINDOPACOM and U.S. Southern Command. Through WRAIR-West's collaborations with joint, operational forces like the Navy Experimental Dive Unit and a newly formalized project agreement with the Brazilian Armed Forces, we are advancing research on cognitive endurance, recovery, and fatigue mitigation so that our warfighters remain mentally resilient in the LSCO landscape.

Our forward institutes' enduring presence abroad facilitates exceptional access and trust building, and reduces the space for near-peer competitors to influence vulnerable key regions. Through global health engagements, joint exercises, and sustained health research collaborations at our strategic locations, we extend the DoD's reach and influence into areas where partnerships are just as vital as preparedness.

Conducting such a complex mission on a global scale necessitates having a highly skilled team of subject matter experts. Retaining our incredibly talented researchers, clinicians, logisticians, and other highly sought-after scientific leaders is absolutely essential. Recruiting and reorganizing to meet new and emerging threats requires sustained investment, the result of which is highlighted in the decades of bilateral and multilateral relationship building and state-of-the-art science emerging from the WRAIR global enterprise. Regardless of today's challenges, WRAIR's Walter Medics continue a 132-year legacy of delivering innovative medical research solutions for the battlefield of tomorrow, and beyond.

SHAPING THE FUTURE OF NATO SPECIAL OPERATIONS MEDICINE

SGM Sandro "Rabbit" Heinrich is the Senior Enlisted Medical Advisor German Bundeswehr Joint Forces Operational Command Special Operations; a Special Operations Forces Combat Medic and serves currently as the Secretary/Treasurer of the Special Operations Medical Association (SOMA). His military assignments included, Senior Enlisted Medical Advisor Kommando Spezialkräfte (KSK- German T1 Unit), Senior Enlisted Medical Advisor Allied Special Operations Forces Command (former known as NSHQ). "Rabbit" has conducted Humanitarian / Disaster Relief, Direct Action, Special Reconnaissance and medical operations around the world. His experience spans from the point of injury through extended care in austere locations.

During his military career, SGM Heinrich has deployed multiple times around the world to support Engagement Forces to understand and influence the human component of the land domain to advance NATO SOF global priorities. His military training includes the KSK Operator training, KSK mountain training, HAHO / HALO training and Survival Escape Resistance and Evasion (SERE) Level C.

SGM Sandro "Rabbit" Heinrich

Senior Enlisted Medical Advisor
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Combat & Casualty Care had the pleasure of speaking with Sergeant Major Sandro "Rabbit" Heinrich, Bundeswehr Joint Operations Command, regarding efforts to better integrate care interoperability across North Atlantic Treaty Organization Special Operations and Conventional medical forces, each a critical component of Europe's combat medicine community.

C&CC: Please speak to your role and mission within the SOF medical community.

Heinrich: My role is an elected volunteer role. I initially started my SOF career as SOF Operator in the German "KSK". I decided to pursue being a SOF Medic 3 years into my career. I felt it was important to be a SOF medic because on my first SOF mission (2000) we had 5 casualties and I saw how important it is to do good medicine in bad places. I attended my first SOMA in 2005 and then volunteered to co-chair SOMA's International Track. In 2022, I was asked to run for one of the At-Large Board positions and two years later I ran for the Secretary / Treasurer Position, which I am currently serving. I feel it is critical that the NATO Alliance is integrated in order to increase survivability in future conflicts. Therefore, I listen to every medical provider in the alliance, regardless of whether they are junior or senior, SOF or non-SOF. My goal is to connect people, helping them build their own networks and friendships. This is approach is what we do at SOMA, where we bring together medical personnel of all levels. In 2024, we had more than 1,700 participants from 29 different countries taking part in SOMA. Most nations face the same challenges, and by working together, we have more resources to find solutions.

I have fought alongside SOF operators from different NATO countries all over the world, and during these missions, we suffered casualties. This experience made me aware of the varying training levels of SOF medics across the Alliance. In the future, we will work even closer together, and I want to ensure each SOF Operator, service member, and MEDIC (yes medics get hurt too) receives the best possible medical care and opportunity for survival. My personal mission is to standardize the education of SOF medics, SOF doctors, and SOST members — so that we can seamlessly integrate with each other in the future. As a first step, this effort will focus on SOF medical training, followed by general-purpose forces, as we did with TCCC.

C&CC: How is SOF medicine essential to NATO's silent operators and how does it support the General-Purpose forces (speak to collaboration and resources)?

Heinrich: NATO Special Operations Forces (SOF) operate worldwide in various combat environments, often with limited medical support. Frequently, these missions are covert or clandestine. To meet these challenges, SOF medical personnel have developed ways to maximize

A German Navy Special Operations Medical Support Team (SOMST) provides medical care to a patient on a ship. (Bundeswehr)

medical care without compromising mission success.

This necessity drives SOF medical teams to continuously refine their techniques, tactics, and procedures (TTPs) to enhance patient care. SOF operators rely on highly qualified medical personnel, which significantly impact their confidence and focus, it boosts their morale and willingness to take risks to accomplish missions.

As SOF depends on non-SOF support, in line with SOF Truth Number 5 – Most Special Operations require Non-SOF Support, medical lessons identified and learned are shared with the General-Purpose Force. Soldiers across all branches and nations face similar challenges, and medicine itself is not classified. The 1st SOF Truth — Humans Are More Important Than Hardware—applies universally across the military.

The experience gained in SOF medicine has influenced the medical training and education of all soldiers. Consider the origins of Tactical Combat Casualty Care (TCCC) — a concept familiar to many through the movie Black Hawk Down. That mission was a SOF operation. Harold "Monty" Montgomery, a former Ranger Medic, and Frank Butler, a former Navy SEAL, analyzed the lessons from that mission and founded the Committee on Tactical Combat Casualty Care (CoTCCC). Today, their work sets the medical standard across the NATO Alliance for both conventional and SOF units.

C&CC: To increase SOF and general-purpose medical capabilities, what are the driving elements needed to integrate and synergize communication to increase the survivability of our patients.

Heinrich: In Iraq and Afghanistan, SOF was fully supported by non-SOF units. Today, SOF is supporting non-SOF units—marking a significant shift. To improve patient survivability, joint and realistic scenario-based training that integrates SOF medical personnel, general medical personnel, and evacuation teams are essential. Sharing experience, knowledge (as we do at SOMA), and protocols during training and exercises is key.

In the Ukraine, it can take 6 to 8 hours for a patient to be seen by a medical professional and another 6 to 8 hours to reach surgical care. SOF personnel are highly trained in Prolonged Field Care, and some NATO SOF units are preparing their medics for patient evacuation without standardized medical vehicles, incorporating unmanned casualty evacuation platforms. This knowledge must be shared with non-SOF medical personnel.

Real-time telemedicine plays a crucial role. Secure, low-latency telemedicine platforms enable real-time consultations with higher medical echelons, ensuring quality medical care in challenging environments. DARPA is already developing AI and decision-support tools to assist medical personnel on the front lines and behind enemy lines in diagnostics and decision-making.

A cross-domain communication system is needed to integrate SOF, general-purpose forces, and civilian assets—such as non-governmental organizations—into mass casualty or disaster response scenarios. The challenge lies in establishing a secure communication system that allows direct interaction and patient tracking, when necessary, without requiring escalation through higher echelons.

At the different NATO levels, real-time battlefield awareness of casualties, evacuation status, and treatment capacity across all Areas of Operations and rear areas are essential. Most importantly, tactical medics must be empowered to make real-time decisions with strategic-level support. During my deployments, I witnessed non-SOF medics having their life-saving decisions questioned by higher command under fire. I personally experienced this once during my career. By integrating these elements, SOF and general-purpose medical teams can enhance communication, increase patient survivability, and operate effectively in dynamic and contested environments.

C&CC: You have a vast range of experience, not only with German forces, but the entirety of the NATO alliance from your expertise. What are some key characteristics and attributes and determining the right

people to fill specific medical jobs within SOF? From an expertise collection perspective, what are some factors considered in determining who and where new SOF medical talent is acquired?

Heinrich: A key characteristic is to always move forward, take the next step, and carry the burden of SOF. Medical personnel who apply to join SOF have already selected themselves. I like the term a friend of mine -his callsign is PAC- once used "SOF self selected" when referring to those who do it for the right reasons.

Think about the doctors and nurses who willingly take on this burden and choose to serve in SOF. They studied for years and could have had an easy life in a clinic, yet they chose to go back into the mud to support SOF—despite all the personal sacrifices and hardships that come with it.

If a medical professional fails selection because they do not yet fully meet the physical fitness standards, they may need to try again in the future. However, if they have the right mindset, a willingness to learn new medical advancements, procedures, and technologies, and the ability to integrate medical training with new operational requirements, alternative roles should be considered. These could include positions such as a J3 Med Planner (since most nations do not have a designated Med Planner career like the U.S. 70H), instructor, researcher, or similar roles.

If you already have a role, just keep an open mind toward all services. I was deployed with my squadron to Afghanistan in 2005. We spent weeks in the field and returned to our base only for a few days at a time during this tour. The mechanic on base was a great guy—he fixed our vehicles as quickly as possible. So, we encouraged him to go through selection because he had the right mindset. He did it, passed, and went on to complete the Special Forces Medical Sergeant Program, better known as 18D. SOF personnel, with or without a badge, must act as SOF diplomats—both within the military and on a global scale. That's the best way to recruit new personnel for SOF.

C&CC: Medicine, especially battlefield medicine, is constantly evolving to keep pace with the vast amounts of weapon systems that are currently being employed and our future development, what is your team's role in professionally developing current enlisted officer medical providers ensuring they connect at the University level and beyond.

Heinrich: SOMA brings medical personnel together to present the latest lessons identified from various battlefields. For example, Ukrainian SOF medics have been presenting over the past three years, sharing how they addressed specific challenges and engaging in discussions with the audience to explore additional solutions. The audience comprises not only SOF members but also university representatives, providing diverse perspectives and ideas on current battlefield challenges.

Some presentations are accredited with university credits, allowing medical professionals to demonstrate that they are up to date. Additionally, certain universities have initiated programs to support SOF medical personnel in attaining university degrees. Since 2015, Allied SOF Command has collaborated with University College Cork (UCC) to offer medical courses that are university-accredited and lead to a Master of Science degree.

Alan O'Brien, a retired Irish SOF medic working for UCC, recognized that SOF medics, despite their extensive experience, were not acknowledged in the civilian sector. He dedicated five years to developing this program so that the experience and knowledge of SOF medics would be recognized by a university. Through this program, SOF medics learn how to formalize their experience and knowledge, as well as initiate their own research.

C&CC: Each nation in the alliance and globally has individualistic cultures and ethics that evolve at the pace of technology. This has a significant impact on decision-making. How does SOF NATO medicine in particular set and maintain such a high standard for others to follow?

Heinrich: The Euro-Atlantic Partnership Council brings together NATO members and partners—currently a total of 46 countries. The goal for all nations is to achieve the best outcomes for their patients.

In 2011, NATO SOF Allied Command established the NATO SOF Medical Expert Panel (SOFMEP), primarily for NATO SOF MedAds and SEMAs. In 2013, the NATO SOF Tactical Medicine Panel (SOFTMP) was created to bring together senior enlisted SOF medical personnel to discuss standards within SOF. The results of these panels are published as NATO doctrines, such as AJP 4.13, or as NATO publications, including the SOF Medical Leaders Handbook and SOF Allied Training Directives for SOF Medicine. A direct outcome is the NATO Special Operations Combat Medic (NSOCM) and the NATO Special Operations Medical Technician (NSOMT), which set the standard for NATO SOF Medicine. At the moment, a panel is working on the standard for NATO Special Operations Surgical Teams (NSOST).

All of this leads to better outcomes for our patients, especially when we fight together, shoulder to shoulder.

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MAY 28 – 29
DoD/VA & Gov Health IT Summit
Washington DC
Healthhit.dsigroup.org

JUN 4 - 5
AFCEA Technet Mid-America
Collinsville, IL
Technetmidamerica.com

JUN 16 – 17
AIM Health R&D Summit
San Antonio, TX
Aimsatx.com

JUL 3 - 4
Combat Medical Care Conference
Ulm/Blaubeuren, Germany
Cmc-conference.de

AUG 4 – 7
MHSRS
Kissimmee, FL
Mhsrs.health.mil

AUG 12 – 14
GVSETS and Modernization Update
Novi, MI
NDIA.mich.org

OCT 13 – 15
AUSA Annual Meeting
Washington, DC
Ausa.org/annual

OCT 22 – 23
DOD/VA & GOV Health IT Summit
Washington, DC
Healthit.dsigroup.org

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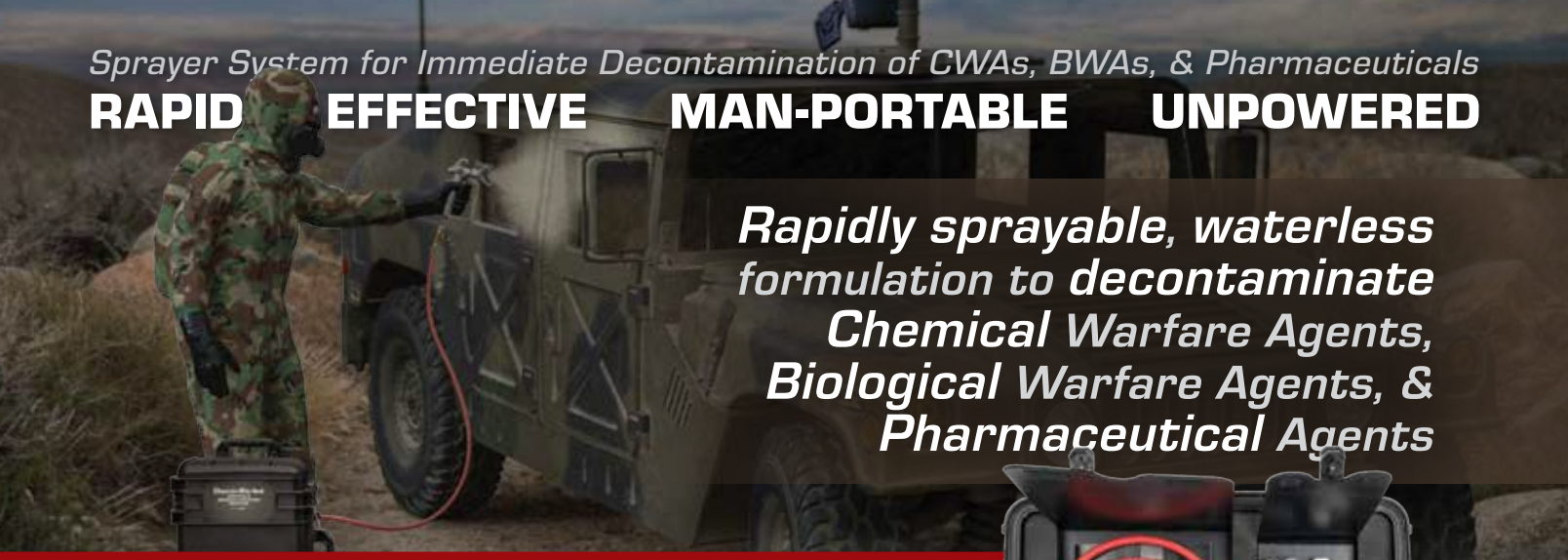

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