COMBAT & CASUALTY CARE

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STANDARDIZING SURGICAL CARE ACROSS ALL LEVELS

COMMANDER'S CORNER

LTG Mary K. Izaguirre
U.S. Army Surgeon General
Commanding General
U.S. Army Medical Command

CSM Timothy J. Sprunger
Command Sergeant Major
U.S. Army Medical Command
TSG Senior Enlisted Advisor

MAJ Angela Samosorn
Chief, Clinical Research Support
Defense Health Agency R&D-Medical Research and Development Command

- Clinical Decision Support System (CDSS)
- Augmented Reality Burn Assist Manager (ARBAM)
- Nerve Block Anesthetics for Pain Management
- Organ Support and Automation Technologies (CRT3)
- Probability of Survival Decision Aid (PSDA)
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AUGMENTING CARE TO REDUCE INJURY

The Defense Health Agency Research & Development-Medical Research and Development Command is exploring the use of augmented reality to provide decision-making support to help clinicians treat burn injuries in the field.

By Paul Lagasse

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LEADERSHIP PERSPECTIVE

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By Maddi Langweil

Cover: LTG Mary K. Izaguirre, U.S. Army Surgeon General, tours a combat casualty tent staffed by U.S. Army combat medics and medical officers with the 1st Armored Brigade Combat Team during the medical experimentation portion of Project Convergence Capstone 4 (PC-C4), Fort Irwin, Calif., March 16, 2024. Izaguirre led a contingent of leaders to tour a frontline medical facility to learn about the latest medical technologies and treatments under development by U.S. Department of Defense (DoD) medical experts. Medical developers from across the U.S. Army joined forces to test the latest DoD medical technology, concepts, and treatment programs as part of PC-C4 at the U.S. Army's National Training Center. Team members with the U.S. Army Medical Materiel Development Activity are assessing the progress of two programs during PC-C4: the Health Readiness and Performance System (HRAPS) and Medical Casualty Predictive Logistics Utilization System (MCPLUS). USAMMDA is the DoD's premier developer of world-class military medical capabilities. Located at Fort Detrick, Maryland, USAMMDA develops, delivers, and fields critical drugs, vaccines, biologics, devices, and medical support equipment to protect and preserve the lives of Warfighters across the globe. (U.S. Army Photo by T. T Parish/Released)

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INSIGHTS

With the dawn of another year, challenges of the previous are tools with which to build on the future. This certainly holds true for advancements in the field of combat surgery where what appear to be the most minute aspects of trauma care can make the largest of differences. Those differences depend on decisions made at the point of injury which act as the foundation for life-saving surgical intervention.

The final edition of 2024 *Combat & Casualty Care* takes us into 2025 with a focus on the critical work done in the triage and treatment facilities supporting military field surgery. Leading the U.S. Army's and much of the U.S. Defense Department's approach to quality, efficient field casualty care, U.S. Army Medical Command (MEDCOM), headed by Commanding General and U.S. Army Surgeon General LTG Mary K. Izzaguire, is invested in ensuring that the best skillsets meet the myriad needs of our nation's combat wounded. From the latest in resuscitative and vitals stabilization techniques to the evolution of casualty evacuation across a truly global battlespace, MEDCOM is at the tip of DoD's medical response spear.

This edition's features focus on ways burn and nerve related injuries are now being addressed to speed care during the critical golden hour. The Defense Health Agency Research and Development-Medical Research and Development Command (DHA R&D-MRDC) is exploring the use of augmented reality to provide decision support to help clinicians treat burn injuries in the field. With threat assessment trends suggesting an increasing potential for explosions capable of causing burn mass casualty incidents (BMCI) in combat scenarios as well as from attacks on civilian population centers, enhanced comms enabled by the clinical decision support system (CDSS), using Augmented Reality Burn Assist Manager (ARBAM) software, is poised to make a positive difference in burn casualty outcomes. On the neural side of trauma care, a new device targeting regional pain control in casualties while they are still at or near point of injury has arrived. The device uses advanced artificial intelligence (AI) technology to recognize and map the location of regional nerve bundles on the patient's body and automatically guide a needle to the correct location for delivery of pain control medications.

From casualty care to casualty rescue, we venture off shore with the U.S. Coast Guard (USCG) on its perpetual search and rescue operations (SAROPS) mission. In cooperation with the U.S. Army Institute of Environmental Medicine (USARIEM), the USCG is employing a new capability called the Probability of Survival Decision Aid (PSDA) to help organize conditions and time considerations in deciding the best manner and scope of maritime casualty response. To round things off, we get a profiled look at the U.S. Air Force's Ground Surgical Team (GST) mission set from training to real-time operations rounds of the edition. These multi-environment operators are difference makers when and where GST expertise is delivering combat ready care often a casualty's only hope of survival.

As always, we welcome comments and suggestions. Thank you for your continued readership!

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AUGMENTING CARE TO REDUCE INJURY

Defense Health Agency Research and Development-Medical Research and Development Command (DHA R&D-MRDC) is exploring the use of augmented reality to provide decision support to help clinicians treat burn injuries in the field.

By Paul Lagasse, USAMRDC

Members of the 51st Comptroller Squadron post-attack reconnaissance team assess a mock casualty's injuries as part of a mass casualty scenario outside Building 938 during Operational Readiness Exercise Beverly Midnight 14-02 at Osan Air Base, Republic of Korea, Feb. 11, 2014. Role players portrayed everything from lacerations and surface burns to hearing loss and an altered mental status. (U.S. Air Force photo/Airman 1st Class Ashley J. Thum)

In future large-scale combat operations (LSCO), mass casualty events involving burns could become a critical care bottleneck due to a lack of burn beds and insufficient numbers of adequately trained personnel. Researchers at the Defense Health Agency Research and Development-Medical Research and Development Command (DHA R&D-MRDC) Organ Support and Automation Technologies (CRT3), and Clinical Burn Center are investigating the use of mixed reality tools as a medical force multiplier to reduce morbidity and mortality on the battlefield.

MASS BURN POTENTIAL TRENDING UP

Threat assessment trends suggest an increasing potential for explosions capable of causing burn mass casualty incidents (BMCI) in combat scenarios as well as from attacks on civilian population centers. BMCIs can cause anywhere from tens to thousands of burn trauma casualties. Because burn care is among the most complex form of trauma, interventions require significant amounts of specially trained personnel and significant resources. Therefore, BMCIs would place significant stress on the military medical system both at the point of injury and at increasing echelons of care.

Sena Mike

The anticipated austere environments of LSCO have medical planners and providers examining the logistical challenges in transporting resources to the point of injury and the evacuation of injured personnel to advanced care. Communications are also likely to be disrupted, both due to surge usage and damage to in situ infrastructure, hampering the ability to provide remote mentoring support to clinicians responding to the event. In such cases, medics will need every advantage possible to intervene in the critical early hours post-injury.

ENTER CASUALTY CARE-ENABLING COMMS CAPABILITY

To help address this, the Virtual Health team within CRT3 led by Sena Mike, data scientist and principal investigator at DHA R&D-MRDC, is developing a clinical

decision support system (CDSS) that uses commercial off-the-shelf augmented reality headsets and custom software, collectively called the Augmented Reality Burn Assist Manager (ARBAM). This CDSS delivers essential medical knowledge to novice clinicians, enabling them to perform the critical tasks involved in burn patient management and surgical guidance, resulting in higher adherence to the latest clinical practice guidelines (CPGs) while also lowering the clinician's cognitive burden.

"Our task was to develop a tool that a medic could use to perform tasks that were out of the scope of their training and practice," said Mike. "Basically, we wanted to develop a device that we could hand off to someone who has at least some clinical background and have them perform an assessment or complete a procedure using pictures, videos, texts, and holographic overlays that take them through each step."

Mike's AR project is part of a new portfolio established by the Medical Research and Development Command's Combat Casualty Care Research Program (CCCRP) called Medical Assist Support Technologies (MAST)/Autonomous Care and Evacuation (ACE). MAST/ACE supports research into the use of intelligent data-driven, semiautonomous, and autonomous technologies to optimize medical care for Servicemembers. With funding from CCCRP, Mike, LTC (Ret.) Maria Serio-Melvin, and a team of researchers conducted a series of studies to determine whether ARBAM enhanced a clinician's ability to provide effective care to a simulated burn patient compared to current standard-of-care tools such as paper CPGs.

In the study, 11 participants were asked to perform four burn-related tasks, alternately using the Joint Trauma System CPGs with supplemental worksheets and the CRT3's ARBAM system:

- **Determine burn size**
- **Manage burn fluid resuscitation**
- **Calculate pain medication dosage**
- **Perform a simulated escharotomy**

Participants were provided with a scripted scenario to ensure consistency, and they were assessed on their completion time and performance accuracy. Mike and her team found that the average completion times for three of the four tasks were generally the same, with fluid resuscitation being faster with ARBAM than with paper guides (4.7 minutes compared to 6.9 minutes). The overall performance scores with ARBAM were higher for three of the four tasks (fluid resuscitation, medicine dosage calculation, and escharotomy), meeting the threshold of statistical significance.

Following the completion of the study, the Virtual Health researchers undertook two usability assessments to gauge user interaction and experience with the system – for the assessments, renamed the Augmented Reality Surgical Assist Manager (ARSAM) – while assisting surgeons with the performance of simulated cricothyrotomies and chest tube insertions. The overall positive feedback they received from the clinicians who tested the system was invaluable for identifying areas for improvement.

"The usability studies were important because no matter what device or application you give a clinician, if they do not accept it and don't want to use it, they will abandon that technology," said Mike. "Based off of the usability assessments, we were able to identify and prioritize gaps that the software needed to address prior to the final clinical performance study."

The clinical performance studies compared the accuracy and efficiency of the AR system in the completion of those key tasks compared to existing guidance methods, and determined whether the system can be developed and translated into a full-fledged clinical decision support system for providing remote patient care.

"When this technology first came out, we really didn't know if people would find it too foreign or cumbersome, but people found it fascinating," said Mike. "It has a coolness factor, like Iron Man – you can still see your environment, but yet you can manipulate all of these digital assets in front of you. I can see myself using this in the future."

LEVERAGING VALUABLE FUTURE TRAINING POTENTIAL

In addition to providing burn patient management and surgical guidance, ARBAM also offers the potential to offer fully immersive burn education and training scenarios. Mike said that several of the clinicians who participated in the research study and the usability assessments commented that they learned a lot while operating the device. Although the ARBAM/ARSAM device currently does not incorporate the "why" of a task, she says it could feasibly be incorporated.

"The level of fidelity of the software for providing decision support, and the way we've been able to take multiple CPGs and turn them into easily usable, digestible chunks with language that is accessible to non-expert users, means that the device could be used to augment a didactic training program right now with very little to no change to the software," said MAJ Angela Samosorn, Ph.D., ISR's chief of clinical research

support. "The system already incorporates many learning principles by design, as well as by virtue of how the team set up the research questions and the software and the studies."

Samosorn said that limitations of currently available hardware make the prototype system difficult to operate in a battlefield setting, but that will change as future iterations of AR devices come on the market. In the meantime, the prototype can be used to familiarize medics and surgeons with the principles and methodology so that they will be comfortable with them when the hardware catches up.

MAJ Angela Samosorn

FUTURE TESTING SLATED FOR PROJECT CONVERGENCE CAPSTONE 5

U.S. Army Futures Command has invited ISR to test the prototype ARBAM/ARSAM system at the Project Convergence Capstone 5 exercise to be held in the Spring of 2025. The U.S. Army Futures and Concepts Center, a subordinate organization under AFC, conducts annual Project Convergence exercises as a way to provide front-line Warfighters from the Army, Navy, Air Force, Marine Corps, Space Force, and militaries from partner and allied countries with opportunities to experiment with emerging capabilities, formations and doctrines in real-world conditions. The system will be one of four technologies from MRDC that will be tested during the event.

DHA R&D-MRDC has three learning objectives that it hopes to meet from the testing at PC-C5. One is to determine which point in the survival chain of the Department of Defense Joint Trauma System that mixed-reality technology can be integrated most effectively for patient care. Another objective is to determine whether the operator's performance and cognitive workload decreases when using the applications compared to standard tools when used in a high-fidelity simulation. Finally, the team seeks to identify software usability and issues that can be addressed in future software upgrades.

"We originally envisioned this project as a research effort, not necessarily to develop an advanced product," Mike said. "However, through the process and validation of our research studies, we have a much higher technology readiness level than a lot of other research products. So, we feel confident that we are ready to showcase this at PC-C5 and at other demos and experimentation events."

Mike also noted that, although the ARBAM/ARSAM project is still in the research phase, the Virtual Health team has its eye on eventual commercialization for fielding with military medical professionals.

"Virtual reality and AR are being used more and more widely in health care, and the FDA has already cleared several devices," said Mike. "How soon we can get this into the hands of Warfighters to start saving people's lives is yet to be determined, but in the meantime, even lower hanging fruit like transitioning this into a training application and getting it into other training labs would be a success in our eyes, for sure."

DELIVERING COMBAT READY CARE INTO THE FUTURE

Lieutenant General Mary K. Izaguirre serves as The 46th Surgeon General of the U.S. Army and Commanding General, U.S. Army Medical Command. Prior to this appointment, she served as the Commanding General, U.S. Army Medical Readiness Command, East.

LTG Izaguirre received her Bachelor of Science degree in Biology from Houghton College in 1991 and was commissioned through the Health Professions Scholarship Program as a second lieutenant in the U.S. Army. She received her Doctor of Osteopathic Medicine in 1995 from Philadelphia College of Osteopathic Medicine in Philadelphia, Pennsylvania, and completed residency training in Family Medicine in 1998, and a Faculty Development Fellowship in 2002, both at Madigan Army Medical Center, Fort Lewis, Washington.

LTG Izaguirre is board certified in Family Medicine and is a Fellow of the American Academy of Family Physicians. She received a Master of Public Health from the University of Washington in 2002, a Master of Military Arts and Science from the Command and General Staff College in 2008, and a Master in National Security and Resource Strategy at the Dwight D. Eisenhower School of National Security and Resource Strategy in 2015.

LTG Izaguirre's military education includes all Officer Professional Military Education, the Army Flight Surgeon Course, Division Surgeon Course, and Brigade Command Course. LTG Izaguirre's military assignments include Commander, Tripler Army Medical Center, from 2018-2020; Supervisory Assistant Deputy Health Affairs, Assistant Secretary of the Army for Manpower and Reserve Affairs, from 2015-2018; Commander, U.S. Army Health Clinic Schofield Barracks, from 2012-2014; Division Surgeon, 4th Infantry Division, Fort Carson, Colorado, and Tikrit, Iraq, in support of Operation Iraqi Freedom and Operation New Dawn from 2009-2012; Chief of Soldier Care, Evans Army Community Hospital, from 2008-2009; Director of Residency Training, Department of Family Medicine, from 2005-2007; Associate Program Director, Department of Family Medicine, from 2003-2005; Deputy Surgeon, Combined Joint Civil Military Operations Task Force, Bagram, Afghanistan in 2003; Director of Research, Family Medicine Residency Program, Dewitt Army Community Hospital; and Faculty Development Fellow and Family Medicine Residency Faculty, Madigan Army Medical Center, from 2000-2002 and 1998-2000 respectively. Prior to her current position, she served as the Commanding General for Medical Readiness Command, East from 2021-2023.

LTG Mary K. Izaguirre

U.S. Army Surgeon General

Commanding General
U.S. Army Medical Command

Combat & Casualty Care had the privilege of speaking with LTG Mary Izaguirre, The Army Surgeon General and Army MEDCOM Commanding General, regarding her outlook for 2025 and Army medical operational priorities in addressing the perpetual drive to deliver the best medical care at the point of injury and need across the global battlefield.

C&CC: You have stated that Army Medicine's purpose is to deliver Combat Ready Care. What does this look like for medical Soldiers assigned across the Army with diverse duties?

LTG Izaguirre: The Army Medical Regiment delivers *Combat Ready Care* to keep Soldiers in the fight, save lives, and clear the battlefield to enable warfighting. It is helpful to first think about this through the lens of what we are for. The Army Medical Regiment inspires confidence and builds trust with the Army and Joint Force to enable them to do their mission by providing expert medical care anywhere forces may be. As we approach the 250th birthday of the Army, it is important to note that Army Medicine has been there since the beginning, supporting the Army as it has fought and won our Nation's wars since 1775. Yesterday, today, and always, where you find the U.S. Army, the Army Medical Regiment is there.

A U.S. Soldier, assigned to the U.S. Army Medical Command, assists a Soldier with a simulated injury in response to a mass casualty situation during Installation Protection Exercise '24 at Tower Barracks, Grafenwoehr, Germany, Sept. 25, 2024. The exercise involved a simulated vehicle rollover that resulted in seven trauma casualties, who were treated and stabilized by Army ambulances, medical evacuation teams, and host-nation emergency medical services. Medical personnel performed triage, administered life-saving treatments, and evacuated the casualties via ground and air to host-nation hospitals. The exercise tested the clinic's ability to execute critical tasks in a high-stress environment and validated the readiness of Army medical personnel to respond to real-world emergencies. (U.S. Army photo by Sgt. Gianna Elle Sulger)

The Army Medical Regiment ensures Soldiers are medically prepared to deploy as the most lethal version of themselves (Soldier as a weapon system), provides combat casualty care at the point of need, and remains alongside them for rehabilitation should they become ill or injured. Developing combat ready medical forces prepared to accomplish this mission requires realistic, threat-informed training that develops tactical and technical proficiency. During competition, we sustain the lethality of the force through prevention, health promotion, and force health protection. Should deterrence fail, in combat we clear the battlefield, save lives, and return Soldiers to the fight. With an eye toward the future and an understanding of the volatility and uncertainty of today's environment, we adopt a culture of continuous transformation integrating modernization efforts across Doctrine, Organization, Training, materiel, Leadership and Education, Personnel, Facilities, and Policy (DOTmLPF-P). Finally, we invest in strengthening our combined professions of medicine and arms to develop medical leaders of character and competence that value service above self.

All of this requires a Total Army approach that leverages our joint, multinational, and interagency partnerships. This occurs across all Army components and commands, regardless of whether the command carries a medical guidon or otherwise. Our shared responsibility requires us to converge military medical expertise for effect in support of Warfighters and Families.

C&CC: The Military Health System (MHS) has undergone many changes over the last 5-10 years. As organizations and medical capabilities were reassigned to different Army Commands (ACOMs) and the Defense Health Agency (DHA), how does this change the approach to ensure Soldiers and formations are prepared to provide Combat Ready Care?

LTG Izaguirre: The MHS has changed significantly resulting in differences to task organization, funding, and authorities to name

A U.S. Soldier, assigned to the U.S. Army Medical Command, assists a Soldier with a simulated injury in response to a mass casualty situation during Installation Protection Exercise '24 at Tower Barracks, Grafenwoehr, Germany, Sept. 25, 2024. The exercise involved a simulated vehicle rollover that resulted in seven trauma casualties, who were treated and stabilized by Army ambulances, medical evacuation teams, and host-nation emergency medical services. Medical personnel performed triage, administered life-saving treatments, and evacuated the casualties via ground and air to host-nation hospitals. The exercise tested the clinic's ability to execute critical tasks in a high-stress environment and validated the readiness of Army medical personnel to respond to real-world emergencies. (U.S. Army photo by Sgt. Gianna Elle Sulger)

a few. I first want to acknowledge that this is hard. Our dedicated medical professionals have led change at echelon with excellence – thank you! Despite the myriad of changes, it is important to note that our purpose and what we are for has not changed. The Army Medical Regiment has an enduring and unified purpose across commands and agencies, supported by our shared culture. While your left shoulder patch and who you report to may have changed, we collectively remain committed to providing combat ready care to build trust, inspire confidence, and enable our Army and the Joint Force.

However, I do not want to oversimplify the restructuring. Since fewer Army Medical Regiment units are centrally organized benefitting from simple command and control relationships, we must integrate with intention at echelon. This starts with ownership. Medical leaders remain accountable and responsible for delivering expert medical care and advisement wherever the mission takes us. Through this, we have influence enabling medical leaders at echelon to integrate wherever they are assigned.

It is hard to talk about this without also mentioning one of my priorities and what undergirds everything we do – partnerships and trust. This includes key partnerships with organizations like the Defense Health Agency (DHA), ACOMs, and Combatant Commands as well as Allies and Partners. As we build trust, collaboration follows which begets integration and interoperability. Trust is the foundation of everything we do.

C&CC: One of the changes you discussed involves a shift from being responsible for the delivery of healthcare in Military Treatment Facilities (MTFs) to providing the people that staff MTFs. Can you describe this shift and explain what role, if any, you still play in the care of Soldiers and their Families?

LTG Izaguirre: This is a big shift with resultant confusion surrounding this topic. Each service provides people to staff MTFs. For the Army, under Army Medical Command, the Medical Readiness Commands (MRCs) are responsible for this task. DHA is now responsible for the authority, direction, and control of MTFs, which means they are responsible for the business of the delivery of healthcare for our Soldiers, their Families, and our retirees. As key members of the MHS, the Soldiers and Civilians of the Army Medical Regiment are often providing this healthcare. We partner closely with DHA to accomplish this mission as well as to train our people, develop future capabilities, and conduct critical research.

One reason Congress established the DHA was to enable the services to focus on their primary purpose – to provide expert medical care in operational environments. This clarity of purpose is helpful because it enables us to address those things that have not changed. We must generate medical forces to care for our Army and Joint Force partners. We must be prepared to project power if called upon to go to war. We must be prepared to receive casualties. Our MTFs, now operated by DHA and staffed by the services, understand this, and work diligently to provide the expert care all our patients deserve. This

is a critical component of maintaining trust with the services and our Families.

I also want to specifically address generating medical forces. This requires converging effects across the entire MHS, from concept development to graduate medical education programs to the schoolhouse at the Medical Center of Excellence (MEDCoE). Our MTFs are critical to this end – they are medical force generation platforms integral to ensuring we train our medical Soldiers' technical skills and maintain a force medically ready for combat.

C&CC: Any cursory review of the news makes clear that we live in volatile times. While no one desires war, we must be prepared. How is Army Medicine modernizing to ensure they are prepared should the military have to engage in Large Scale Combat Operations (LSCO)?

LTG Izaguirre: Today's environment is characterized by volatility, uncertainty, complexity, and ambiguity. Across Combatant Commands, threats loom driving a sense of urgency and underscoring the importance of transforming for lethality in warfighting. This reality informed one of the enduring priorities I established upon assuming my roles of Surgeon General and Medical Command Commander – a Culture of Continuous Transformation. It is further reinforced by one of the conclusions of my initial assessment – we must invest in preparing for the future fight.

There is no single initiative, nor command, that is working this critical effort. Instead, the entire Army Medical Regiment across

U.S. Army LTG Steven Watt, assigned to the 135th Forward Resuscitative & Surgical Detachment, prepares for a mock surgery during exercise Pacific Medic Focus 2024, at Watkins LTA, Republic of Korea, on March 6, 2024. The intent of Pacific Medic Focus was to maintain the highest level of medical readiness by exercising expeditionary deployment capabilities within the Korean Theater of Operation (KTO) to support 8th Army units with coordinated Health Service Support (HSS) and Force Health Protection (FHP). (U.S. Army Reserve photo by Spc. Jason Palacios)

MRCs, MEDCoE, Medical Research and Development Command, and our Theater Medical Commands are working in conjunction with Army Futures Command, Forces Command, Combat Capabilities Development Command, Training and Doctrine Command, Army Materiel Command, Assistant Secretary of the Army (Acquisition,

U.S. Army Soldiers from 2nd Squadron, 2nd Cavalry Regiment, depart the medical extraction point after delivering a simulated medical casualty to an HH-60 Blackhawk Helicopter during a medical evacuation rehearsal, Krivolak Training Area, North Macedonia, Dec. 4, 2023. Brave Partner is a U.S. Army Europe and Africa scheduled, directed, and led short notice action planning (SNAP) exercise, which includes live-fire training and is designed to demonstrate USAREUR-AF's operational reach, validate U.S. investments in the Republic of North Macedonia, and increase readiness. (U.S. Army Reserve Photo by Capt. Maria L. L. Salcido)

Logistics, and Technology), DHA, and our Joint partners toward this end. This is a deliberate, synchronized effort written into our Army Medicine Support Plan to the Army Campaign Plan and integrated into the Chief of Staff of the Army's Transformation in Contact plan. Importantly, this is all informed by what we are learning from the war in Ukraine and active hostilities in Central Command.

We are transforming across DOTmLPF-P in three time horizons simultaneously: Transformation in Contact (less than 24 months), Deliberate Transformation (3-5 years), and Concept-Driven Transformation (5-20 years). Some illustrative examples of ongoing work across time horizons include significant doctrine updates, fielding the Prolonged Care Augmentation Detachment, increased skills and scope for Combat Medics (Paramedic), Medical Trauma Sensors, Veterinary Anesthesia Machines, Field-Portable Ultrasound Scanners, Future Air Medical Evacuation Platform, Predictive Logistics, Protected Wheeled Ambulance, Augmented Decision-Making Tools, Freeze Dried Plasma, Casualty Tracking and Monitoring System, Integration into the Common Operating Picture, Automating Documentation, Cyclical Curriculum Updates, Virtual Health, Traumatic Brain Injury Assay, and AI-Assisted Medical Diagnostics.

Each transformation effort is grounded in the Army warfighting Concept and driven by Concept-Required Capabilities to overcome identified gaps. All these developments in support of enhanced medical capabilities make for an exciting time to be in Army Medicine. As the world changes, we are transforming to ensure we are ready to provide expert combat casualty care at the point of need.

C&CC: What is the biggest challenge you see Army Medicine needing to overcome during your time as TSG and MEDCOM Commander?

LTG Izaguirre: The Army's decisive capability and strategic advantage is its people; this is no different for the Army Medical Regiment. Our biggest challenge is ensuring the Army Medicine workforce, with the requisite skills, is ready at the time and place of need. Any shortage of or threat to our people presents a big challenge. As you survey our formations, we have gaps, not in the quality of our people, but in the numbers. This has resulted in phenomenal Army Medicine leaders currently serving carrying the weight of a workload that exceeds our on-hand strength. To all of the team, thank you for your selfless service and unswerving commitment to the mission!

Tackling this challenge requires addressing the multiple facets of the problem – retention, recruiting, reorganization, and identification of true requirements. While recruitment always requires the dedicated attention we will continue to provide, we are doing well on this front despite a global healthcare worker shortage. As the MHS has undergone significant reorganization, we have and will continue to invest in the alignment of form, function, and policy to ensure our people are best positioned to execute their mission.

Reorganization requires the identification of true requirements. We must ruthlessly prioritize, being willing to divest of legacy tasks which are no longer our requirement. This divestment will enable the force to focus on our required tasks – those that contribute to warfighting, lethality, and cohesion – having the biggest impact with the people we have.

I assess our greatest opportunity for growth is through retention. Our pipeline to develop trained medical professionals spans years, in some instances upwards of ten years. This underscores the importance of retaining quality people because the lead time to train is so long. To address this, we are modernizing our human capital strategy to ensure we afford people the opportunity to practice at the top of their game, provide them trust and autonomy, use data-informed processes to retain our talent, and remove nonsensical hardships such as arbitrary moves and unnecessary administrative burdens. We have much work to do on this front, but I am encouraged by the feedback we are receiving from the force.

While these challenges are significant, the capability of the professionals within the Army Medical Regiment to overcome them is greater. I am confident we have the talent to prevail and could not be prouder to lead this incredible team to perform our sacred mission.

Combat Ready Care…This We'll Defend!

EMBRACING THE FULL COMBAT MEDIC ETHOS

Command Sergeant Major Timothy J. Sprunger

21st Command Sergeant Major
United States Army Medical Command
Senior Enlisted Advisor to
The Army Surgeon General

Command Sergeant Major Timothy Sprunger enlisted in the United States Army as a 91A – Medical Specialist (now 68W) and attended Basic Combat Training at Fort Knox, Kentucky, and Advanced Individual Training at Fort Sam Houston, Texas.

CSM Sprunger's military career includes assignments as Aidman and Treatment NCO, 1st Battalion, 508th Airborne Infantry, 193rd Infantry Brigade, Fort Kobbe, Republic of Panama; Evacuation and Treatment NCO, 1st Battalion, 325th Airborne Infantry Regiment and Division Surgeon Noncommissioned Officer in Charge (NCOIC), 82nd Airborne Division, Fort Bragg, North Carolina; Drill Sergeant and Senior Drill Sergeant, 232nd Medical Battalion, Fort Sam Houston; Medical Platoon Sergeant, 3rd Battalion, 325th Airborne Infantry Regiment, 82nd Airborne Division, Fort Bragg, where he deployed in support of Operation Iraqi Freedom I; Medical Platoon Sergeant, 2nd Battalion, 87th Infantry and First Sergeant, 10th Sustainment Brigade Support Battalion, 10th Mountain Division, Fort Drum, New York, where he deployed in support of Operation Enduring Freedom VII; Chief Enlisted Instructor of the Physician Extender Branch and First Sergeant of B Company, 187th Medical Battalion, Fort Sam Houston; Senior Clinical NCO and Command Sergeant Major, U.S. Army Medical Department (USAMEDDAC) Activity, West Point, New York; Command Sergeant Major, USAMEDDAC, Fort Drum; Command Sergeant Major, Landstuhl Regional Medical Center, Landstuhl, Germany; Command Surgeon Sergeant Major, U.S. Army Forces Command, Fort Bragg; Deputy Chief of Staff G-3/5/7 Sergeant Major, Office of the Surgeon General and Army Medical Command, Falls Church, Virginia; Command Sergeant Major, U.S. Army Medical Research and Development Command, Fort Detrick, Maryland; Command Sergeant Major, U.S. Army Medical Readiness Command, West, JBSA-Fort Sam Houston.

Combat & Casualty Care had the pleasure of speaking with CSM Tim Sprunger, Senior Enlisted Advisor to the Army Surgeon General, U.S. Army Medical Command, regarding today's techniques in combat medic preparation and advice for medics and the doctors who save and stabilize lives on the battlefield.

C&CC: Did you always know that you wanted to be a senior leader in the Army? If not, when did you make that decision?

CSM Sprunger: When I joined the Army, my intent was to become a flight medic and serve for six or so years and return to my hometown and work on a Life Flight crew. That all changed when I started progressing as a leader and developed my interest in training Soldiers. I had fun coaching, teaching, and mentoring Jr Leaders. My 35 plus years went by so fast and I found myself as the Army's Senior Medic.

C&CC: Did you have role models or mentors that influenced you? If so, how did they help you?

CSM Sprunger: I have had several very good leaders that helped me along my career but the one that started it all was a PA I worked with in 1/508th Parachute Infantry Regiment in Panama. He focused on training his medics because he understood their role as physician extenders. He expanded our knowledge of anatomy and physiology as well as head to toe assessments and joint exams. This expanded our capabilities and developed our clinical decision-making ability. When we demonstrated proficiency, he trusted us to do complete SOAP notes and patient presentations so he could focus on the more complex patients. That set the stage for my passion for training medics.

C&CC: What are your thoughts on medic training?

CSM Sprunger: We need to focus more on how we are training our medics and then appropriately documenting the training being

U.S. Soldiers treat and evacuate simulated casualties during an exercise at the Combined Arms Collective Training Facility at Fort Indiantown Gap, May 17, 2024. This exercise included responding to the scene of a mass casualty event, providing first aid and evacuating the simulated casualties, all while being assessed by instructors with the Pennsylvania National Guard's 4th Battalion, 166th Regiment Regional Training Institute (Medical Battalion Training Site). These Soldiers, from the National Guard, Army Reserve and regular Army, are attending the 68W Healthcare Specialist Military Occupational Specialty Transition course, hoping to earn the 68W MOS after previously serving in other MOSs. (U.S. Army National Guard photo by Spc. Annie Riley)

conducted. We have all the tools to do so like our Medical Simulation Training Centers (MSTC), Medical Treatment Facilities (MTF), and unit level training, but the holistic application of that training varies too much to be truly effective. We do a very good job of training our medics at the Medical Center of Excellence. At times our units are not effectively planning, coordinating, and executing training at a high level to develop proficiency or maintain the skills our medics developed at MEDCoE. Some of that is due to OPTEMPO of our units, some of it is understanding what training can be done at our units, MSTCs, or other medical training platforms like our MTFs.

C&CC: What is your advice for doctors?

CSM Sprunger: Medics are physician extenders so you should train and trust them as such. Medics must be well trained and provided the opportunity to practice medicine on a routine basis to become proficient. No parent, brother, wife, etc., would want the person treating their loved one; a person who got "Just in Time Training." The medic's actions in the first minutes of injury set the stage for what the entirety of Army Medicine can bring to bare for that casualty. If medics are not proficient because we did not invest in their training and provide them opportunities to excel at their craft, casualties may not survive the trip to a surgeon and we would have failed as leaders.

C&CC: What is your advice for medics?

CSM Sprunger: Be relentless in the pursuit of excellence in your craft. It takes time and dedication to be good at medicine. It also takes self-investment so do not rely solely on others to provide you the tools to get there. It is your responsibility to advance your medical knowledge. There are several resources at your disposal: podcasts, Borden Institute publications, and webinars.

C&CC: What tactical or medical equipment do you think medics will need for the future?

CSM Sprunger: They must be equipped and trained with the same tactical equipment as their warfighter counterparts. Adding additional medical equipment becomes an issue when you consider weight and cube. There is only so much weight a medic can carry and there is only so much space in their pack. Our greatest impact is expanding their medical capability and clinical decision making. Then, they can identify a problem, apply the appropriate intervention, and know what to do next if they do not achieve the desired effect no matter the environment or conditions they find themselves in.

C&CC: What are one or two challenges, which you haven't previously mentioned, that you think our readers should consider prior to our next conflict?

CSM Sprunger: Using Large Scale Combat Operations (LSCO) as a template for the future fight, our force should consider how many people we will have to be evacuated. We usually fill our vehicles, aviation assets, and watercraft to maximize our chances for success on every mission. If you add one litter patient to a vehicle it takes up a lot of room. Not every form of transportation we possess is designed to transport and treat a combat casualty litter patient on the move. Post design or modification accessories to allow for a litter to be secured to an evacuation platform is not providing a U.S. Standard of Care for our service members. Our service members are innovative and resilient in their ability to improvise ways to secure a littler to vehicles, boats, aircraft, and special vehicles. However, starting with the "E" (emergency) in your PACE (primary, alternate, contingency, emergency) plan is where the majority of our fleet of transportation currently is. We don't want to leave our people behind on the battlefield and we don't want to cause further injury to our casualties during transport because we didn't have every transportation asset engineered while in the concept phase with CASEVAC in mind.

The second challenge to consider, in most combat arms units the ratio of medic to other MOS's and AOC's is about 1:20. What is the plan for when the medic becomes the casualty? Every service member deserves a U.S. Standard of Care to include the medic. Trying to instruct a non-medic on how to do pharmaceutical calculation or an advanced procedure while waiting for evacuation or returning to base does not give the casualty or casualties the best opportunity for survival. Step one of any procedure is to assemble your equipment, a non-medic even if he or she knows what the equipment looks like, they probably have no clue where it is in their medic's aid bag.

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SURGICAL AGILITY AT POINT OF INJURY

The U.S. Air Force Ground Surgical Team (GST), an austere resuscitative surgical team (ARSC), brings highly mobile, Role 2 surgical capability to casualty assessment amid environmental challenges.

By Christian Sheehy, C&CC Editor

U.S. Air Force Airmen assigned to an 86th Medical Group Ground Surgical Team assess and treat a simulated battle injury during a training in the simulation center at Landstuhl Regional Medical Center, Germany, Feb. 9, 2021. The team is designed to provide damage control resuscitation and surgery to those injured in combat. (U.S. Air Force photo by Senior Airman John R. Wright)

In 2017, the U.S. Department of Defense identified a lack of standardized austere resuscitative surgical care (ARSC) training standards with the rapid development and frequent deployment of ARSC capabilities. Based on a National Defense Authorization Act Forward Resuscitative Care in Support of Dispersed Operations Change Recommendation, the JTS chartered a formal curriculum development work group (WG), led by members of the Committee on Surgical Combat Casualty Care (CoSCCC) to develop a Joint ARSC curriculum to close this gap. This curriculum would then be supported by Clinical Practice Guidelines to enable small teams with limited resources and beyond traditional timelines of care to bridge gaps in roles of care to enable forward military operations while mitigating risk to the force.

As a Role 2 surgical care more agile and maneuverable than single unit doctrine Role 2 surgical teams, ARSC teams provide lifesaving resuscitation and surgical care in far forward, resourced-limited environments. This allows the team to provide care closer to the point of injury in austere, front-line, combat-active environments. Most commonly Role 2 surgical teams, ARSC teams bridge the gap between point of injury care and more definitive care performed by Role 3 military treatment facilities.

ARSC BY GROUND SURGICAL TEAM

Originally called Mobile Field Surgical Teams (MFSTs), today's U.S. Air Force Ground Surgical Teams, or GSTs, are spin off from MFSTs but in a smaller package of six personnel as opposed to ten. Filling a role held previously by the U.S. Army's Forward Surgical Team, or FST, what differentiates GSTs from FSTs is their size, autonomy and mobility. GSTs are smaller and because of this, more flexible. Additionally, they are not attached to another unit or battalion and are able to be tasked more readily. While FSTs still play a part in battlefield surgical response, GSTs act as a more transplantable and more quickly-accessible means of support.

Comprising a surgeon, ER physician, an anesthesiologist, a surgical technician, a medical service corps (MSC) representative,

U.S. Air Force Maj. Lindsey Marquez, 86th Medical Group nurse anesthetist, secures a chest tube placed in a simulated patient during a Ground Surgical Teams training in the simulation center at Landstuhl Regional Medical Center, Germany. GSTs provide damage control surgery, damage control resuscitation and emergency care of injured or critically ill patients in dynamic, austere environments outside of established support and patient movement capabilities. (U.S. Air Force photo by Senior Airman John R. Wright)

and a critical trauma nurse, a standard GST totes 14 equipment bags totally around 1.5 tons and the team is transportable by high mobility multi-wheeled vehicle (HMMWV), helicopter, cargo aircraft, or other types of troop transport. The GST's equipment bags are highly customizable according to response needed and each GST carries enough supply to potentially address ten surgical casualty scenarios without having to resupply. GST training occurs monthly with pairs of teams training simultaneously to achieve a common construct of operation, understanding standard terminology and equipment usage necessary for casualty response while maintaining modularity required by some response situations more than others.

The training pipeline for GSTs is divided into two phases. The initial phase occurs at U.S. Air Force School of Aerospace Medicine (USAFSAM), Wright-Patterson Air Force Base, Ohio. Trainees are introduced to the GST team concept, roles within the team, and team utilization within the larger combatant command mission set. Training is conducted with fully-interactive mannikin-based simulation on which actions such as fluids introduction and surgical techniques can be performed. Simulations immerse the trainees in the often-chaotic realities faced in combat with multiple patients in need of treatment at the same time. As part of the simulation training, live actors are infused into scenarios to increase incident fidelity and dynamism to reflect closer to real world environmental experience. In the second training phase, trainees from ASAFSAM move to Camp Bullis where they receive advanced surgical support education in conjunction the USAF Expeditionary Medical Support (EMEDS) facility which integrates candidates into larger team-oriented, battlefield simulations. Training continues amidst stress-induced, austere-like conditions which test trainee knowledge under pressure. From temperature to noise stressors, the feel of close to actual combat field stimuli challenges medic response times as fears for one's own safety rise.

All six members of the GST have extensive experience in or are practicing medical professionals in the civilian sector treating patients with injuries such as that of battlefield injuries. Short of bringing a hospital closer to the battlefield, highly-specialized, small GSTs mobilize care to hostile environmental need.

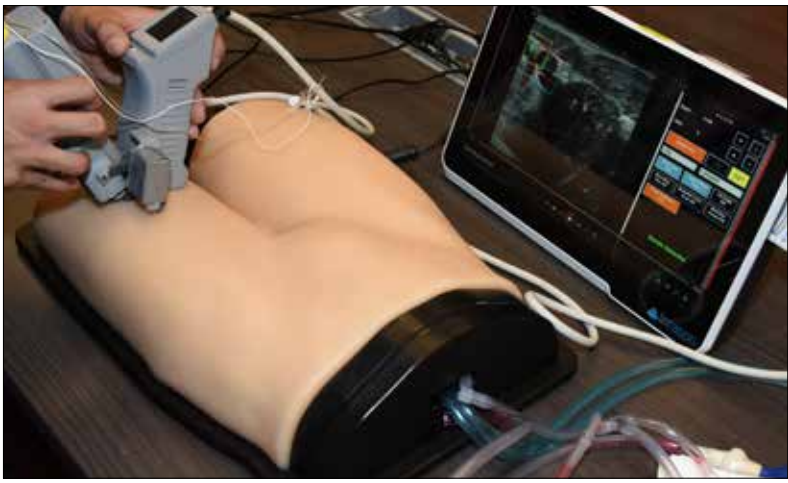
MEDICAL MACHINE LEARNING STRIKES A NERVE

Defense Health Agency Research and Development-Medical Research and Development Command and MIT Lincoln Laboratory are partnering on a tool that uses artificial intelligence to allow precision placement of nerve block anesthetics.

by Paul Lagasse, USAMRDC

The Defense Health Agency Research and Development-Medical Research and Development Command (DHA R&D-MRDC) Organ Support and Automation Technologies (CRT3) team is working with the Massachusetts Institute of Technology's Lincoln Laboratory to develop a new device for providing regional pain control in trauma patients while they are still at or near the point of injury. The device uses advanced artificial intelligence (AI) technology to recognize and map the location of regional nerve bundles on the patient's body and automatically guide a needle to the correct location for delivery of pain control medications. A safety mechanism prevents needle insertion until the appropriate anatomical target has been identified. These features will enable the device to be used by medics with little or no expertise in providing regional anesthesia, making it ideal for use in mass casualty events and other scenarios where such experts will likely be in short supply.

Clinical studies have shown that ultrasound guided femoral nerve blocks provide greater pain reduction than intravenous or intramuscular opioids. However, the technique requires a high level of dexterity to ensure accurate needle placement near the target nerve bundle in order to deliver the anesthetic. By utilizing a combination of AI and robotics, the device's creators hope to be able to overcome this limiting factor in providing effective and timely combat casualty care. Not only that, but the interdisciplinary collaboration between engineers and military clinicians that led to the development and testing of the device suggests a possible pathway for more streamlined implementations of clinical AI applications in the military.



The prototype of an AI-enhanced ultrasound nerve block device developed by the Institute of Surgical Research (USAISR) Organ Support and Automation Technologies (CRT3) in partnership with MIT Lincoln Laboratory is demonstrated on a manikin during a demonstration at the VelocityTX biotechnology incubator in San Antonio, Texas, in November 2024. (photo credit: USAISR Public Affairs Office)

ORIGINS OF NERVE BLOCK-BASED PAIN MANAGEMENT

While systemic pain control drugs such as morphine or ketamine are effective at treating pain, they also render the patient drowsy or unconscious, making them incapable of communicating effectively, continuing to fight, or leaving the battlefield under their own power. Systemic pain medications also potentially introduce physiological risks, such as a reduced respiratory rate that increases the susceptibility to cardiac arrest. Furthermore, patients treated by systemic pain control methods require constant monitoring by a medic, and should they require evacuation, will need to be transported by litter – all of which pulls additional personnel out of the fight.

LTC Brian Kirkwood, a comprehensive dentist and chief AI officer with CRT3, said the inspiration for the ultrasound nerve block device was a talk by Maj. Gen. Michael J. Talley, then the commanding general of MRDC, during a command-wide town hall meeting in October 2020. Talley, who mobilized MRDC's laboratories to respond to the coronavirus pandemic, encouraged attendees to think about the kinds of military medical technologies that would be needed on the battlefield of tomorrow. "Think Stalingrad meets Star Wars," Kirkwood recalls Talley saying.

LTC Brian Kirkwood

"After the town hall meeting, I was thinking about that question as I was walking back to the office with Dr. Jose Salinas, our science lead," recalled Kirkwood, the project's overall principal investigator. "I told him, 'I'm a dentist. I know how to administer anesthesia to manage pain. If you were to give me some type of technology that would enable me to jump in and help provide regional anesthesia in an area outside the mouth in a mass casualty event beyond just doing triage, I'd be more than willing to help get a soldier out of pain.' And that idea eventually evolved into this device."

To develop a prototype device that would be capable of allowing a non-expert to deliver a regional nerve block with pinpoint precision, ISR partnered with the Metis Foundation, a nonprofit research organization, and MIT's Lincoln Laboratory, which specializes in research, development, and rapid prototyping of advanced technologies for national security applications. The lab had developed a handheld ultrasound device called AI-GUIDE, which allows specialists to accurately place femoral vascular catheters and guide wires, that could serve as the basis for the new device. The team applied for and received support through a funding solicitation by the Medical Technology Enterprise Consortium, a nonprofit international affiliation of over 600 academic institutions, businesses, nonprofits and other organizations in the biomedical technology sector that operates through a contractual agreement with MRDC. The funding support for this research and development effort is supported by the Combat Casualty Care Research Program.

To learn how regional nerve blocks are administered in a clinical setting, Kirkwood observed several anesthesiologists as they worked and used that knowledge to help inform the design of the device and its operational technique. For example, he noted that, unlike AI-GUIDE, in which the needle is inserted out-of-plane – that is, perpendicular to the cross-sectional image produced by the ultrasound transducer – the prototype was developed with the needle inserted in-plane, parallel with the transducer, to mimic how the anesthesiologists he observed performed regional nerve blocks. Inserting the needle in-plane provides an opportunity to observe the needle during insertion to aid in development and adds to the safety

system designed into the software. This important distinction needed to be taken into account when designing both the hardware and software used in the new device.

The prototype device developed by CRT3 and Lincoln Laboratory consists of a 3D-printed handheld frame that holds an ultrasound transducer. The AI software utilizes both segmentation and object detection techniques were trained on nerve, artery, and vein landmarks from ultrasound scans of swine lower-body neurovascular bundles. In addition to detecting anatomy, the software also controls the device guidance system, which is a robotic arm that adjusts needle angulation and insertion. Once the target location has been identified by the AI software and safety checks are cleared, the operator is prompted to press the trigger button to deploy the needle. Once the needle is inserted at the proper location, the anesthetic can then be delivered.

TESTS VALIDATE CONCEPT, POINT TO AREAS OF IMPROVEMENT

Over the course of a year, Kirkwood's team conducted mulitple rounds of tests of the prototype. For the tests, at least ten different operators – including healthcare providers, engineers and technicians – attempted to use the device to place the needle for a femoral nerve block. On the ex-vivo model, each attempt began at the knee, scanning proximally toward the inguinal crease between the leg and groin until the AI recognized the target location. The device would prompt the operator's directional movements until the target location was identified, at which point the trigger button would be activated to allow for needle deployment. Insertion time and needle placement location were collected after each attempt to continuously improve the device.

Each round of tests identified areas requiring further work. The team at ISR communicated the necessary hardware and software improvements to the Lincoln Laboratory team after each round of testing so that it could update the prototype. Kirkwood and his team decided to reduce the number of operators to the two who were most proficient with the device, in order to focus on the device's performance.

"From the initial testing, we have shown that this type of technology can enable a minimally experienced person to place a needle for regional anesthesia in under 40 seconds," said Kirkwood. "During the pilot study, we were also able to show that the AI system works in both normal and hypotensive conditions, which is important because we can expect to see a wide range of damage to limbs on the battlefield. We still need to conduct larger preclinical studies in animal models to validate some of the systems that guide the device and needle placement. The ultimate goal is a device that is self-contained to improve portability for a frontline battlefield application."

Furthermore, as the prototype advances from the preclinical phase to clinical testing, the AI system will need to be thoroughly trained on human data, said Kirkwood. Eventually, usability testing is necessary to capture the insights and experience of clinical experts to refine the device for the end-user. Kirkwood is currently exploring funding options to support continued development and testing of the device in 2025 and beyond.

DEMONSTRATED VALUE IN INTERDISCIPLINARY COLLABORATION

Another important outcome of this project is its demonstration of the value of collaboration between clinicians and engineers in successfully developing and demonstrating an AI-based medical device for the future battlefield. This accomplishment spotlights one of CRT3's core competencies.

"One of the main missions of CRT3 is to use advanced engineering technologies to address documented capability gaps – in this case, the need to provide regional pain control on the battlefield," said Salinas. "To that end, we have put together heterogeneous and multidisciplinary teams that specialize in applying engineering technologies to develop medical solutions. It's not an easy solution, because there aren't any degrees out there that will teach you how to do this. An engineer isn't taught how to speak medical. Physicians aren't taught how to speak engineering. Creating these teams and getting them to speak the same language to the point where they can actually generate solutions is something that we have been very successful at doing."

Kirkwood – who is now pursuing a doctorate in translational science – and Salinas will be discussing the importance of interdisciplinary collaboration in developing AI systems to assist in clinical decision-making in military medicine at the 2025 AMSUS Annual Meeting in March 2025, in a breakout session titled "Bridging the Gap: Engineers and Clinicians Working Together to Advance Expeditionary Medical and Dental Applications of Artificial Intelligent Systems."

"It's important that we have good communication between clinicians and engineers to shape the development of AI systems so that the end user has trust and confidence in the systems that we're developing," said Kirkwood.

CLOSING THE CASUALTY TO RESCUE GAP

Developed by the U.S. Army Institute of Environmental Research (USARIEM), a new tool in maritime search and rescue is helping the U.S. Coast Guard save more lives.

By Maddi Langweil, USARIEM

CGC Washington (WPB 1331) RHI crewmembers BM1 Jeff Craig, MK2 David Rosetti and BM3 Jim recovers the three fishermen, Kurt Schweitzer, Brian Takafuji and Francis Stephenson, who were found adrift in their disabled vessel in eight feet seas south of Kauai, Hawaii. (USCG photo by PA3 Eric Hedaa)

In the early hours of March 26, 2024, Baltimore's Francis Scott Key Bridge collapsed after being struck by a cargo ship, plunging vehicles and six people into the frigid waters of the Chesapeake Bay. This catastrophic event not only disrupted a major transportation artery but also prompted an intensive search and the need for innovative rescue technologies.

"There were six unaccounted for persons and we had to act fast in this very emotional and stressful case," said U.S. Coast Guard Lt. Cmdr. Cory Pray, Search and Rescue Mission Coordinator for sector Maryland national capital region.

In the wake of this event, a disaster aid emerged as one of the critical resources to help rescue and recover those impacted by the collapse. The Probability of Survival Decision Aid, or PSDA, designed by the U.S. Army Research Institute of Environmental Medicine, was used in the U.S. Coast Guard's race to help find and save patrons.

"The Coast Guard was looking for a tool to help them organize search and rescue missions, so we created a system that can help with this purpose," said Xiaojiang Xu, Ph.D., Biophysical Mathematical Modeler with the Thermal and Mountain Medicine Division at USARIEM. "The goal is to save more lives because sometimes certain resources like helicopters can be too dangerous, so they needed a tool to assess situations and help with decision-making."

ENHANCING EXISTING HARDWARE WITH SOFTWARE ADVANCED PLUG AND PLAY

The PSDA is a compact software that seamlessly integrates into the USCG's primary rescue and rescue operations (SAROPS) system, a search and rescue optimal planning tool used to respond to catastrophic maritime environments. The team will use SAROPS to simulate how an object will drift in an area given certain conditions and see how well saturated the search area is. The PSDA focuses on the suspected person's survival time.

"During the collapse of the Key Bridge, it was determined that it was a very finite area that was well saturated," Pray said.

As SAROPS is used, the PSDA runs in the background to provide data for the primary system and ultimately help guide officials in how they approach various situations.

"Every situation is different, there may be a person that falls in the water off a cruise ship during the summer or a person driving that end up in the water during the winter," said U.S. Coast Guard official Matthew Brooks, D5 SAR Program Manager. "I've been in search and rescue for 20 years and I've been using the system for a while in every case."

The pop-up computer program is like a calculator that allows a user to insert various attributes about a missing person. From environmental parameters, including water and air temperature, to an individual's physical attributes such as height and weight, and clothing worn during the incident, allow the user to predict the individual's functional and survival time. The functional time, within the aid, is the measure of time when a missing person is conscious and can speak, move and even help themselves during a crisis. The survival time is when the at-risk person is unconscious, who can't help themselves but is still breathing.

"We have a number of boats that have capsized during the winter when we know it's cold and PSDA has helped put us in a time window where we need to seize our opportunity," Brooks said. "It has helped push us to get out there."

Traditional thermal models can be archaic looking and difficult to use. Taking this into account, the PSDA research team wanted something that was user friendly and "with relatively small inputs," said John Castellani, Ph.D., Research Physiologist in the Thermal and Mountain Medicine Division at USARIEM.

"Everything on the screen would be the most important factors to synthesize," he continued.

Petty Officer Third Class Amber Boguslawski, a boatswain's mate from U.S. Coast Guard Station Hatteras Inlet, North Carolina, looks out at the wreckage of the Key Bridge collapse in Baltimore, Maryland, April 10, 2024. The Key Bridge Response 2024 Unified Command priorities are to ensure the safety of the public and responders, account for missing persons, safely restore transportation. (Key Bridge Response 2024 Unified Command photo by Coast Guard Petty Officer First Class Lauren Steenson)

ENVIRONMENTAL CONDITIONS-DETERMINED CAPABILITY DEVELOPMENT

Challenging conditions—cold water, strong currents, size of area and poor visibility—can dictate how quickly and how long a person can survive. Brooks says that the PSDA is especially helpful during the colder season when these harsher conditions are present.

"If someone falls off their boat while fishing during high currents, we can put in these environmental factors into the aid like wind speed, water temperature and type of immersion to narrow the search," Castellani said. "The aid is continually updating as they work on search and rescue because sadly, there becomes a point when the Coast Guard will have to move from search and rescue to recovery options where the person isn't alive."

Whether an area size is small or large, the PSDA will help officials secure their resources and efforts to a location that would be the most promising to find an unaccounted-for person. "Bottom line is that they have to use it in all search and rescue missions where hypothermia is a risk," Castellani said.

Pray notes that the team took into account the timetables the PSDA model provided before they arrived at the difficult decision to suspend their search efforts. "While we don't fully rely on the aid, we use it for every case."

Over the course of a decade, the PSDA has gone through three versions that allow users to insert important factors about an event and provide a time span that is a more reliable search tool for the Coast Guard to follow.

"We want to continue to save more lives," Xu said. "That's our mission."

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FEB 5-7
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MAR 3 – 6
AMSUS
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AMSUS.org/events

MAR 18 – 19
Operational Medicine Symp & Tech
San Antonio, TX
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APR 28 – MAY 2
Military Health System Conference
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MAY 5 – 8
SOF WEEK
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