TATRC TIMES

VOLUME 7 | QUARTER 2

JULY 2021

A QUARTERLY PUBLICATION OF THE
TELEMEDICINE & ADVANCED TECHNOLOGY RESEARCH CENTER

FEATURED

The NEXUS

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From the Desk of the Director

COL Jeremy C. Pamplin,
Director TATRC

Our new Mission statement:

To fuse data, humans, and machines into solutions that optimize warfighter performance and casualty care

The times, they are a changing! And overall, for the better! This issue of the TATRC Times represents the official launch of TATRC 2.0, our campaign to educate our partners, sponsors, and stakeholder community about TATRC's new mission, organization, and future.

I am often surprised to learn than many across the Military Health System, research community, and industry do not know that TATRC is currently a staff element under the Headquarters of the U.S. Army Medical Research and Development Command (USAMRDC). As part of our journey to become a full-fledged research command, we have worked very hard to better understand our place and our purpose in military medical research and development.

Our new Mission statement, ***"To fuse data, humans, and machines into solutions that optimize warfighter performance and casualty care"*** embodies the essence of what makes TATRC unique and valuable to the Military Health System. While other research labs are focused on creating new therapeutics – the what of patient care - we are laser focused on improving how we deliver that care on the future battlefield. We can only optimize performance and casualty care by understanding how medical professionals perform their art and, in so doing, developing new solutions that enhance how we train and equip them. What technologies help us deliver patient care? What technologies get in our way? Can we understand how the humans and machines team up to produce optimal outcomes?

In this issue, we also proudly introduce our new lab capability, the first operational medicine performance lab, that we call 'NEXUS.' It is a place where scientists, engineers, program managers, clinicians – and most importantly medics, come together to observe, discuss, and measure casualty care in realistic contexts so that we can gather data – A LOT of data – about their performance and what right looks like. This new research capability will: 1) develop standardized simulation models of casualty care from the point of injury through definitive surgery and standardized methods for evaluating (testing) caregiver casualty care performance in these contexts; 2) measure baseline performance of various operational caregivers; 3) study the influence of technology, specifically human-machine teams, on caregiver performance in these contexts; 4) improve training across the enterprise using these standard models and performance measures to define best training methods and platforms (like gaming); 5) inform new operational medicine technology requirements; and 6) test new technologies in relevant operational medicine contexts.

The NEXUS is open for business! We are excited and look forward to partnering with others to do research in this lab and beyond to develop best solutions that help close the survival chain – a parallel of the "kill chain" that can assess patients, decide what to do for them, intervene with best treatments, and synchronize their care in the context of resources available in order to achieve best outcomes. The digital transformation that must occur in order to achieve this vision is paramount for TATRC, and indeed the Military Health System. TATRC continues to push the envelope, moving forward, delivering knowledge and material products that will enable military medicine to successfully deliver optimal care on the battlefield of tomorrow. Forge the Future!

TATRC 2.0: Remissioned, Reimagined, and Ready to Forge the Future

In 2019, the Department of the Army saw significant changes at the highest levels. The creation of the Army Futures Command (AFC), along with the reflagging of the U.S. Army Medical Research and Materiel Command to the U.S. Army Medical Research and Development Command (MRDC), provided the perfect opportunity for TATRC to embrace change as well. New Army capability areas such as Army Robotic and Autonomous Systems and Multi-Domain Operations pivoted the Army toward a new vision of war. Last March, BG Michael Talley, MRDC Commanding General, identified the unique resources and capabilities at TATRC and designated the organization a provisional command (USATATRC (P)) to better reflect TATRC's functions, portfolio of work and ultimately, it's potential for future impact on operational medicine.

TATRC's previous mission was carefully reevaluated as part of the vision-setting process of the organization and to see if this mission reflected the new realities within the Army. Several meetings with TATRC's command team and division leadership determined that a new mission was needed to meet the changes afoot in the Army as well as MRDC. A new TATRC mission statement was born, "*Fusing data, humans, and machines into solutions that optimize warfighter performance and casualty care,*" and the organization embarked on a comprehensive rebranding strategy to show its key stakeholders and collaborators the new focus of TATRC.

One of the most significant changes within the organization beyond its new mission, was the reorganization and establishment of four key Divisions and one core program. TATRC's four main Divisions consist of the Biotechnology High Performance Computing Software Applications Institute (BHSAI), the Digital Health Innovation Center (DHIC), the Medical Modeling Simulation, Informatics, and Visualization Division (MMSIV), and the Medical Robotics and Autonomous Systems Division (MedRAS). TATRC's program, the Advanced Medical Technology Initiative (AMTI), continues to be an important part of the organization and provides a funding mechanism for not just Army Innovators, but our sister services as well.

We've been hard at work designing and developing new knowledge products to share "TATRC 2.0." Some of these exciting tools include: a newly rebranded and reorganized website, a new layout (as you can see here) to our TATRC Times Quarterly Newsletter, a high-tech organizational overview video to give you a teaser into the focus of TATRC, and updates to all of our Social Media Platforms. These products showcase all of our important initiatives and provide users the opportunity to learn more about our new mission and research efforts that demonstrate our commitment to the Warfighter. TATRC continues to evolve and will never waiver in providing capabilities to Soldiers to save lives on the battlefield. Together, let's Forge the Future!

TATRC's New Mission:

Fusing data, humans, and machines into solutions that optimize warfighter performance & casualty care.

The Wondrous Working Women of TATRC

During the month of March, in recognition of Women's History Month, Team TATRC rolled out a special social media campaign to acknowledge and honor all of the incredible women who work in support of the TATRC mission day in and day out! The 'Women of TATRC' series shined a light on the distinctive divisions and working groups, and provided the opportunity to spotlight and show appreciation for the various women we are privileged to have as part of the TATRC family!

With almost 30 women working here at TATRC, we are lucky to have almost half our workforce comprised of a diverse, skilled, and extremely dedicated set of individuals who each bring their own unique and valuable perspectives to their various areas! From leadership, senior Program Managers and Division Chiefs, to Project Officers, Administrators, Budget Analysts, and Engineers, TATRC's team of women perform a plethora of key duties that make the organization what it is today.

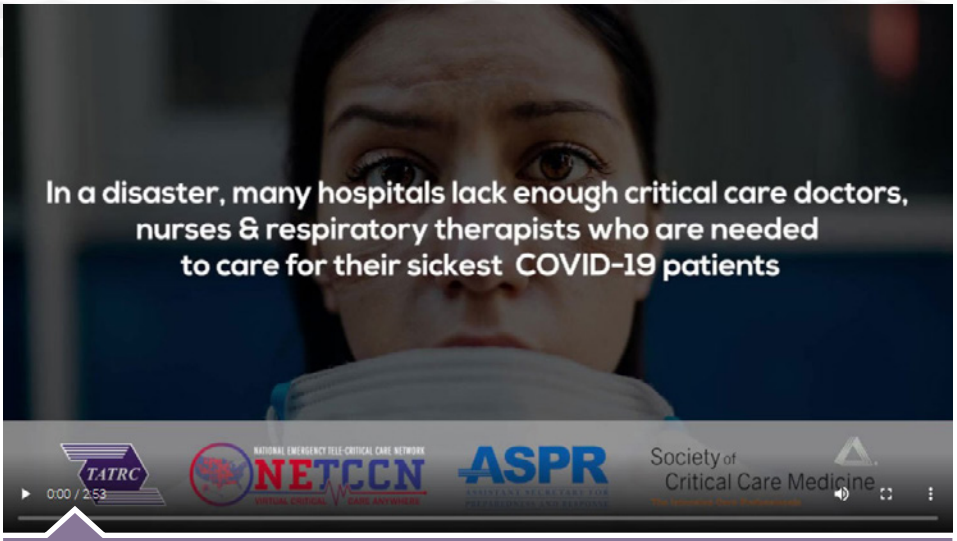
Women's History Month had its origins as a national celebration in 1981 when Congress passed Pub. L. 97-28 which authorized and requested the President to proclaim the week beginning March 7, 1982 as "Women's History Week." In 1987 after being petitioned by the National Women's History Project, Congress passed Pub. L. 100-9 which designated the entire month of March 1987 as "Women's History Month" to celebrate the contributions women have made to the United States and recognize the specific achievements women have made over the course of American history in a variety of fields.

By highlighting the women of TATRC who have made a difference in our organization, it opens up that world of possibilities to other women and young girls interested in the field of technology. We here at TATRC salute the countless working women making an impact in their communities, their nation, and the world.

To each of our wonderful Women of TATRC, while March is the official month for honoring Women's History, know that your TATRC family is grateful to be able to call you coworkers, colleagues, and friends! Thank you all for your hard work and tireless efforts supporting the mission of fusing data, humans, and machines into solutions that optimize Warfighter performance and combat casualty care!

TATRC Director Warms Things up at Winter Town Hall

In late February, our whole team gathered again virtually for the latest installment in our series of Director's Town Hall events. Led by TATRC Director, COL Jeremy Pamplin, this quarter's Town Hall touched on numerous topics and points of interest around the organization, including our highly dynamic and ever-evolving NETCCN project! After providing the latest updates and milestones on the project and the various sites we are currently working with, the team was treated to a debut of our brand new, informational NETCCN promotional video (you can find it on TATRC's website: https://www.tatrc.org/netccn/videos.html).



A brand new, informational NETCCN promotional video was featured during the Director's Town Hall.

Additional topics on the agenda included updates on the COVID-19 pandemic, the vaccination effort currently underway, upcoming events and personnel changes, as well as our announcement of the Employee of the Quarter, Mr. Ethan Quist, who earned this well-deserved title for Quarter 1!

As a Robotics Engineer for our Medical Robotics and Autonomous Systems (MedRAS) division, Ethan has been key in the execution of several MedRAS intramural research projects in the past year. Reflecting on the award, Ethan said, "I just want to say thank you so much for that recognition, it really does mean a lot to me! None of this would have been accomplished without the guidance I've gotten from Nate Fisher and the rest of my MedRas teammates; Oliver, Marne, and Zack, and everyone that I've been working with so far. It's definitely a team effort!"

Summing up the state of our organization at the moment, COL Pamplin said, "We are at an important time for TATRC. We must continue to give thought to how we can accelerate the historical work that's already in place with our various projects and portfolios. I continue to believe that we have immense potential to continue to scale our efforts and grow into an even more valuable role within the USAMRDC. Keep up the great work everyone!"

As always, the Town Hall was a great opportunity for the team to come together and stay in touch, especially at a time when the majority of our staff continues to work remotely. Thanks to all who tuned in and we'll see you next quarter!

TATRC TRIVIA

Question:

In honor and recognition of Women's History Month, can you name TATRC's first and only female Chief of Staff?

Answer from Previous TATRC Times Issue:

Question: TATRC can be found in two geographic locations in the United States. What are they?
Answer: TATRC's Headquarters can be found within MRDC at Fort Detrick, MD, and TATRC's Digital Health Innovation Center (DHIC) can be found in Augusta, GA at Fort Gordon.

TATRC Hosts One-Day Tactical Combat Casualty Care Training Session

Mr. Eric Briggs, a combat medic, and Mr. Rob Shotto, a Simulations Technologist, both from TATRC's Medical Modeling Simulation, Informatics, and Visualization (MMSIV) team, conducted an all-day Tactical Combat Casualty Care (TCCC) training session for the MMSIV staff. Some may wonder, what is TCCC? It is the standard of care for all DoD combatant personnel in operational environments. TCCC is not only for military environments, but is also practiced in the civilian pre-hospital sector and in other countries as well. TCCC sets the priorities and standards for administering care in an operational environment. TCCC is made up of 4 phases; Care Under Fire, Tactical Field Care, Tactical Evacuation Care and Prolonged Casualty Care. The training provides detailed information on tactical decision making while providing emergency medical care, detailed emergency trauma treatments used to treat casualties, medications and tactical doctrine. The MMSIV team took the Medical Provider course, which is taught to DoD medical providers such as combat medics and licensed professionals such as physicians in order to expand, refresh, and familiarize their knowledge.

TATRC's diverse MMSIV team works collaboratively on many different projects and programs and the team consists of both medical and non-medical members. Mr. Rob Shotto stated, "Because the nature of our research is primarily focused on military medical environments, it is important to understand how treatments are administered, where they are administered, why or why not they are administered or when they are done. The MMSIV division serves as a tangible research tool for TATRC programs. We provide the physical data. We provide human factors testing data, device performance data in a real time environment and provide Service Member feedback for the studies. We capture the "Real Life" data."

This training is valuable for everyone on the MMSIV team to become familiarized with TCCC. This base knowledge helps communications within the team, understanding terminology and understanding the reasons why, or purpose of why tactical medicine does what it does and when it does it.

The entire MMSIV team, which is comprised of statisticians, human factors engineers, IT network experts, artificial intelligence experts, and MMSIV leadership, all participated in this one day training event that took place in our lab here at TATRC.

Human Factors Engineer, Mr. Jimmy Gaudean stated, "As a large proponent of the user centered design process, it is imperative that you understand the target user group. Just about all the projects that I am a part of have implications towards Service Members who are TCCC trained. This training was able to give me a better understanding of the thought process that goes behind some of the decisions that a medic would have to make."

Dr. Amy Lingley-Papadopoulos, MMSIV's AI / Machine Learning Research Scientist, added, "This training provided a better understanding of both the TCCC guidelines and the environment in which they are used. One of the projects I am currently working on is both a medical and technical challenge. I have the technical background, but this training helped provide some of the necessary medical and military information that will allow me to see the product from more than just the engineering perspective."

The goal of this training is to provide an understanding of the medical and operational environment, in which the MMSIV team does research. It provides a context for team members to draw from as they conduct their research in their specific area of expertise. It also allows the staff to consider the unique characteristics of operational medicine and creatively think about solutions.

Completion of this training provided the MMSIV team a deeper knowledge and understanding of how our combat medics perform their jobs, act as force multipliers, and conserve the fighting strength.

For more information on the TCCC Training and other initiatives within the MMSIV division, please contact Mr. Geoff Miller at geoffrey.t.miller4.civ@mail.mil.

MedRAS Engineers Introduce its Newest Research Asset, the M4

TATRC's Medical Robotics and Autonomous Systems (MedRAS) Division has a new resource and asset in its lab. In mid-March, the MedRAS team successfully took receipt of the prototype known as the Mobile Multiple Mission Module or 'M4,' at its location in Ft. Detrick. The M4, developed by our partners at Piasecki Aircraft Corporation, is a detachable transport module designed as a payload for the Aerial Reconfigurable Embedded System (ARES) Unmanned Aerial System (UAS). The ARES UAS is designed to support a variety of mission specific payloads. The M4 payload is multi-purpose, providing troop transport, cargo resupply, and patient evacuation.

An up close look at the inside configuration of the M4.

The "Mighty Men" of MedRAS pictured from left to right: Mr. Nathan Fisher, Mr. Ethan Quist, Mr. Oliver Allen, and Mr. Zachary Buono after taking delivery of the M4.

The sleek, 12 ft. x 6 ft. aluminum housing may look a bit like an Airstream Travel Trailer, but TATRC is planning to use this prototype transportation pod for something much more critical than trips to the lake. While awaiting future flight tests onboard the ARES UAS, the M4 will be used as a transport simulator to support research for the next generation of advanced emergency casualty evacuation (CASEVAC) technologies.

The M4 will support an ongoing research effort that the MedRAS Lab is leading: the UAS Medical Research Platform (UMRP) project. This project's goal is to design a testbed for early test and evaluation of concepts and technologies to support emergency CASEVAC operations, to expedite evacuation when traditional Medical Evacuation (MEDEVAC) assets are unavailable while retaining critical enroute care capabilities during transport. The M4 will be integral to this research testbed, which will be used to support research in physiologically-controlled closed-loop care systems, remotely-controllable medical devices, and next generation communications capabilities. This research ultimately will be used to design a remotely managed enroute care system onboard future vehicles of opportunity, such as future UAS. This system will support flight medics by decreasing manual workload and providing them telemedicine assistance during flight. As technology advances, this system may be able to replace the need for an onboard medic altogether in some cases.

Here, the M4 is attached to the ARES craft. While we only have the M4 at TATRC, this helps visualize how it fits together into the larger aircraft in planned future applications.

Mr. Nate Fisher, Chief of the MedRAS Division, stated, "Having the M4 here on-site is a great asset to our MedRAS lab for our research efforts related to patient transport. The M4 will support early performance testing while it remains in our lab until it is needed next year for flight testing with the ARES UAS."

The interior of the M4 is currently setup to support two medical litters for patient handling, as well as a bench seat for an onboard medic. However, the internal setup of the M4 can also be reconfigured to account for different operational needs. In addition, the pod is equipped with adjustable internal lighting and electronic connections for onboard medical and communications devices.

First year engineer Mr. Zachary Buono, who is working hands-on in support of the UMRP project, discussed some of the initial testing plans for the M4. "We are going to start by exploring how communications systems and remote controllability of our medical systems are impacted by being onboard the craft. We will also begin to determine how to develop these systems with the onboard user in mind. How can we effectively load the patient? How can we connect all necessary sensors and therapies? Those are the types of questions we hope to address. While this is a basic simulation, it will give us vital feedback before we begin airborne testing."

For more information on this new and exciting resource, please contact Mr. Nate Fisher at nathan.t.fisher3.civ@mail.mil.

TATRC Establishes New Science Cell – Specialized Expertise to Support TATRC's "Fusion" Mission

TATRC's mission is to forge the future by fusing data, humans and machines into solutions that optimize Warfighter performance and casualty care. Achieving this mission requires that TATRC's labs and teams work together seamlessly and in an integrated fashion. In addition, it will require that TATRC's labs have ready access to the administrative, regulatory and scientific skills that they need.

To support TATRC's mission and to streamline access to needed resources across the organization, TATRC has recently established a Science Cell under the Office of the Science Director. The Science Cell consists of key personnel with specific capabilities and technical expertise to provide valuable support to all of TATRC.

Longstanding TATRC staff member Ms. Ollie Gray will help lead the Science Cell and will provide extensive project management expertise. Ollie's wealth of knowledge and experience will be instrumental in helping TATRC's labs more easily assess the cost, schedule and performance of their projects, to identify and prioritize funding opportunities, and to digitize key processes.

Ms. Debbie Locke will continue to serve as TATRC's Office of Research and Technology Applications (ORTA) Project Officer. Debbie will work across TATRC to streamline the processes and management of the many partnerships and agreements between TATRC and other organizations.

As the Science Cell grows, additional members will be added to include a human factors engineer, a data scientist, a regulatory compliance specialist; and a scientific strategic advisor.

In addition, TATRC is in the process of onboarding two ORISE Fellows. ORISE stands for Oak Ridge Institute for Science and Education and creates short-term opportunities for post-doctoral fellows to collaborate, gain mentorship, and contribute to the work of federal entities like TATRC.

TATRC's Science Director Mr. Matt Quinn stated, "I am excited to lead the newly created Science Cell here at TATRC. Our mission to fuse data, humans, and machines will push the organization to work collaboratively like never before and the purpose of this group is to ensure that our labs have the assistance that they need in order to make this happen."

2B-Healthy: BHSAI's AI System for Early Warning of Adverse Conditions in Humans

Because early detection of exposure to pathogens from biological weapons or emerging infectious diseases is critical for maintaining Force Health Protection, Dr. Jaques Reifman, Director, of the Biotechnology High Performance Computing Software Applications Institute (BHSAI) here at TATRC, led a team to develop the *2B-Healthy* app for automated, real-time detection of abnormal vital signs. Consisting of commercial-off-the-shelf (COTS) hardware and customized software, the *2B-Healthy* app pairs a non-invasive wearable device that continuously collects vital-sign data with a proprietary algorithm that identifies physiological changes associated with abnormal events, including infection. To this end, this exciting new Army technology serves as a self-sufficient, early-warning, bio-threat detection system that allows for rapid situational awareness and time-sensitive deployment of countermeasures, such as evacuation, quarantine, and treatment of infected Service Members.

Figure 1. 2B-Healthy combines non-invasive commercial-off-the-shelf hardware and a customized AI algorithm for real-time detection of abnormal events, including infection.

2B-Healthy was a collaborative effort between the U.S. Army, CPT Sidhartha Chaudhury who now serves at the Walter Reed Army Institute of Research, staff at BHSAI, and the U.S. Naval Medical Research Center (NMRC). The *2B-Healthy* project was sponsored by the U.S. Defense Threat Reduction Agency.

Elements of traditional physiological modeling combined with hardware suitable for field environments allowed for real-time monitoring of subjects under every-day ambulatory conditions. With the use of non-invasive wearable devices and mobile computing technologies to collect and analyze continuous vital-sign data from subjects in controlled human infection studies, the research team used computational methods, including a machine-learning algorithm, to detect vital-sign deviations indicative of infection. This enabled the development of a model for predicting the likelihood of infection directly from continuous vital-sign data, and its implementation as an app capable of real-time infection detection.

This project piggybacked on a controlled human malaria infection (CHMI) study performed at the NMRC. A malaria infection challenge was chosen because it is an established clinical model with a well-defined time course and symptoms of infection, has direct clinical and military relevance, a known time of exposure and infection, a long incubation period that allows time to make predictions, and early- and late-stage diagnostic tests approved by the FDA. The study used wearable technology in the form of a Samsung Gear S3 smartwatch to collect continuous vital-sign data from volunteers, and then wirelessly transmitted it to a Samsung Galaxy S8 smartphone where the machine-learning algorithm resides (see Figure 1).

Subjects in the CHMI study received wearable devices and collected vital-sign data for at least 12 hours per day, with the first 2 weeks collected during normal activity. Subjects were then deliberately exposed to malaria-carrying mosquitos in a controlled setting (Day 0) and resumed their daily activities (for example, lived at home, went to work, exercised) while being regularly monitored for symptoms by clinical investigators. On Day 9 after the malaria challenge, the subjects checked into a hotel at night for daily monitoring by the clinical team, including blood-smear tests, the clinical gold standard diagnostic for detection of blood-stage parasitemia. At the first sign of infection, subjects received an FDA-approved antimalarial drug to clear the infection.

In the CHMI study, heart rate, skin temperature, and 3-axis accelerometer data were collected from subjects for 6 weeks. The vital-sign data collected 2 weeks before infection defined an individualized baseline for each subject so that predictions of infection could be made. Subjects were challenged with malaria at the end of week 2, and monitoring continued for 4 additional weeks so that data could be collected during the incubation (pre-symptomatic) and symptomatic infection periods. In addition to the CHMI study, a second baseline-data collection study was conducted and used as a control for developing the algorithm. The same vital signs of heart rate, skin temperature, and activity data were continuously monitored using the smartwatch/smartphone hardware for 4 weeks in healthy, non-infected adult volunteers.

With the use of the vital-sign data from both studies, the *2B-Healthy* infection-prediction algorithm was developed. It consists of two steps: 1) detection of abnormal heart rate patterns while accounting for circadian rhythm and physical activity and 2) estimation of the probability of infection using a model that accumulated evidence of abnormal heart rates over time. In over two-thirds of the CHMI subjects, the model correctly predicted infection and allowed for early detection, on average 6 days before parasitemia (a very early test of infection). The study results correspond to an overall sensitivity of 78% for infection detection and 67% sensitivity for early infection detection (before parasitemia), validating the algorithm as a screening tool. Dr. Reifman noted that "control studies, such as the CHMI, are the perfect mechanism to assess the potential benefits of wearables and the Army's infection-detection algorithm, because in this type of study we know exactly when the infection occurred and have very sensitive assays to detect infection as early as possible. These allowed us to obtain a very accurate assessment of the algorithm's performance, which is supported by accurate and timely clinical data."

The U.S. Army Medical Research and Development Command has filed multiple U.S. and international patent applications for the *2B-Healthy* system.

The successful development of the *2B-Healthy* app provides the U.S. military with the capability to carry out automated, rapid detection of Service Member infection, including SARS-CoV-2-infected individuals, before they are able to infect others around them. This will be essential to restoring and maintaining Force Readiness during the current COVID-19 pandemic as well as future ones. As Dr. Reifman stated, "we now know that by integrating COTS wearables, as imperfect as they may be, with customized AI algorithms tuned to an individual, we are able to provide early indication of an abnormal event, including human infection."

For more information on this project, please contact Dr. Jaques Reifman, jaques.reifman.civ@mail.mil.

MMSIV Division Chief Named to SSiH Board of Directors

Mr. Geoffrey T. Miller, Senior Research Scientist and Division Chief of the Medical Modeling, Simulation, Informatics and Visualization (MMSIV) team, has been appointed to the Board of Directors for the Society for Simulation in Healthcare (SSiH). Geoff will serve a three-year appointment as a Board Member. During his appointment, Dr. Juli Maxworthy, President of the Society noted "thanks to the leadership of individuals like you, the Society for Simulation in Healthcare continues to grow and evolve in pursuit of our mission and vision for healthcare simulation. We believe that your achievements, together with your unique perspective, interests and skills, will bring valuable breadth and depth to SSiH leadership."

The SSiH is the largest body representing medical modeling and simulation nationally and internationally. In this role, Geoff will have the opportunity to advocate for, and encourage collaborations, as well as represent Military Health Systems medical modeling and simulation efforts to the community of interest.

TATRC's MMSIV Introduces its New, State-of-the-Art NEXUS

The new NEXUS laboratory combines a range of state-of-the-art technologies (motion/volume capture, with synchronized psychophysiological monitoring) to record military medical professionals performing medical tasks and procedures to better understand clinical procedural performance, use and impacts of medical devices and technologies, and data and visualization tools with current and future technologies in combat casualty care by individuals and teams.

The NEXUS laboratory also incorporates the ability to record other physiological responses such as heart rate, blood pressure, respiratory response, and electrodermal activity (sweat production).

TATRC has recently developed a new research environment, the NEXUS laboratory. The NEXUS is a high-technology medical performance measurement laboratory, designed to explore, analyze and understand the intersection of humans, data and technology within and across the Military Health System (MHS). This new lab combines a range of state-of-the-art technologies (motion/volume capture, with synchronized psychophysiological monitoring) to record military medical professionals performing medical tasks and procedures to better understand clinical procedural performance, use and impacts of medical devices and technologies, and data and visualization tools with current and future technologies in combat casualty care by individuals and teams. Data derived from the NEXUS laboratory enables research into how current or new procedures, medical devices, robotics, autonomous, and digital health technologies impact caregiver performance in military operational medicine contexts. By establishing baseline medical performance of medics, physician assistants, nurses, doctors, and even infantrymen who provide care to simulated casualties in a laboratory setting that can replicate the spectrum of casualties and illnesses across a range of austere and operational environments (AOEs), we can study how technologies augment or degrade performance and what perspectives caregivers, and someday patients, have about replacing aspects of human care with machine care. By studying technology in this unique laboratory setting first, we can more

rapidly identify products likely to help caregivers complete their mission instead of hindering it like many medical technologies currently do today, especially when faced with the constraints of the AOE.

The NEXUS laboratory combines motion capture technology along with physiological monitoring to create accurate models of expert performers. The NEXUS laboratory utilizes both optical motion tracking for gross motor movements and electromagnetic motion tracking for the finer movements, like finger articulation inside a chest cavity. In talking about the creation of the NEXUS laboratory, Geoffrey Miller, Division Chief of Medical Modeling, Simulation, Informatics, and Visualization (MMSIV) said, "while there are plenty of experts who can teach the guidelines for specific medical procedures, there are no objective models showing 'what right looks like.'"

Along with tracking physical movement, participants can be monitored by a myriad of different physiological monitors. The NEXUS laboratory will utilize an Electroencephalogram (EEG) to measure the electrical activity of the brain. By averaging these electrical responses to stimuli presented to the participant, an objective measure of cognitive load and event related potentials can be measured. This will allow the researcher to know when a participant is experiencing stress or a heavier workload and the ability to pinpoint specific tasks in a procedure that consistently cause the highest cognitive load.

In addition to EEG monitoring, the NEXUS laboratory will use eye tracking technologies. By understanding where the eye fixates when performing a task, researchers can understand what expert performers view as critical information to focus on during specific tasks. Using the eye tracking system, researchers can determine what the experts need to focus on when performing these difficult tasks. Are these experts actually focusing on something that current training methods overlook?

The NEXUS laboratory also incorporates the ability to record other physiological responses such as heart rate, blood pressure, respiratory response, and electrodermal activity (sweat production). By monitoring these responses, the researchers will be able to quantify and describe actions that expert performers involuntarily do that novices would not know to do. Capturing and synchronizing these measures to the motion capture data, researchers can also find specific biophysiological strategies that experts employ, and which are not easily taught.

In creating models of expert performance of a procedure or assessing the impact of new procedures, tools and technologies, military and civilian medical professionals will come into the lab and don all the sensors and equipment. With the motion capture system, researchers can start to find answers to specific ways that medical professionals must position their body to do the procedure. Alternatively, researchers would also be able to see if specific body positions, which are currently taught to be important, are not actually as important to the success of a procedure.

> ***While there are plenty of experts who can teach the guidelines for specific medical procedures, there are no objective models showing 'what right looks like.'***
>
> Geoffrey Miller, Division Chief of Medical Modeling, Simulation, Informatics, and Visualization (MMSIV)

Not only does the NEXUS laboratory aim to accurately model what current procedures look like, there is also a need to understand how changes to the status quo alter the model. The NEXUS laboratory provides the ability to insert new technologies, clinical practice guidelines, or other novel technologies and performance adjuncts and see how they directly affect military medical professionals and, ultimately, the casualties they care for. By getting a better understanding of both the current and potential future states of combat casualty care, the NEXUS laboratory aims to refine both current practices, as well as investigate new innovations aimed at improving military medical care.

For more information on this project, please contact Mr. Geoffrey Miller, geoffrey.t.miller4.civ@mail.mil.

Training to Train: MMSIV Team 'Suits' Up!

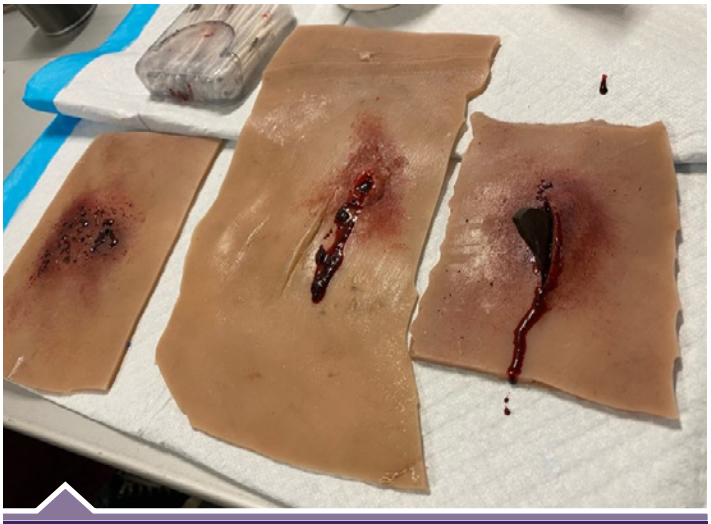
Instructor from Strategic Ops teaches our sim staff how to repair, moulage, & set up casualty simulations utilizing cut suits for more realistic casualty care scenarios. From left to right: Mr. Oliver Allen, Mr. Zachary Buono, and Mr. James "Jimmy" Gaudaen get trained by the STOP instructor on the art of moulage.

Mr. Zach Buono wearing the Surgical CutSuit vest as MMSIV's Rob Shotto assists in the background.

MMSIV Human Factors Engineer, Mr. James "Jimmy" Gaudean puts on the TCCC CutSuit vest and skin.

TATRC's Medical Modeling, Simulation, Informatics, and Visualization (MMSIV) Division welcomed the new year in January by hosting three days of intensive hands-on training on their newly acquired Strategic Operations (STOPS) Total Combat Casualty Care (TCCC) and Surgical CutSuits. This interdisciplinary training brought staff together from multiple TATRC labs for the opportunity to become familiarized with the CutSuits capabilities. Participants also got a taste of what special effects and moulage capabilities MMSIV has to offer as they gained first-hand experience with the STOPS Hyper-Realistic Moulage Kit (HRMK).

The CutSuits are task trainers designed to be worn by role-playing actors called Standardized Patients (SP), which enable the efforts of the MMSIV lab to create environmental realism of battlefield injuries as needed in the research and development process. Realism in the research domain is important as it contributes to participant's suspension of disbelief allowing for more accurate data collection. Both the Surgical and TCCC CutSuits provide the ability to perform the following medical procedures on a SP: extremity hemorrhage control with tourniquets application or arterial ligation/clamping; cricothyroidotomy; bilateral anterior and axillary chest needle thoracentesis; bilateral surgical chest tube thoracotomy; suturing and stapling of skin in all locations; peripheral IV access; and iliac arterial hemorrhage control. The Surgical CutSuit offers additional medical procedures such as: foley catherization; external bladder tap; thoracotomy and intra-thoracic exploratory surgery with hemorrhage control of gross organ structures; laparotomy and intra-abdominal exploration with hemorrhage control of gross organ structures; and suturing of gross organ structures. Team TATRC was able to get up close and personal with the CutSuits to gain a full understanding of what the SP will experience while wearing these task trainers. The SP wears a large 25-35lb simulated rib-cage (think of wearing



Various simulated wounds created on synthetic skin during moulage training.

a heavy vest) with a synthetic skin bodysuit pulled over, thus giving the ability to perform invasive procedures on a real person without causing any harm. The CutSuits are equipped with hard protective shields throughout to prevent injury to the SP and require the supervision of a safety SME during use at all times. The safety SME is always embedded into scenarios to ensure the physical and psychological safety of the SP at all times. The following nine TATRC team members are officially certified as TCCC & Surgical CutSuit SME's: Ms. Christen Phillips, Ms. Holly Ortman, Mr. Carl Manemeit, Mr. Oliver Allen, Mr. James "Jimmy" Gaudaen, Mr. Robert Shotto, Mr. Zachary Buono, Mr. Mike Jenkins, and Ms. Lynn Difato.

In addition to the three-day CutSuit training, the team was introduced to the art of moulage, a type of special effects makeup used to simulate everything from disease to traumatic injury. The main focus for this training was battlefield-type injuries using the Hyper-Realistic Moulage Kit (HRMK). The kit includes standard moulage tools and products like alcohol activated paint, makeup brushes, and tools. It also includes prosthetics with different caliber gunshot wounds, blast injury sleeves for the extremities, ocular evulsions, and more.

MMSIV personnel put their newly honed skills from this training into practice by utilizing the HRMK and components of the CutSuit with Human Patient Simulators (HPS) during the annual Cyber Quest 21 demonstration that took place at Fort Gordon this past March.

For more information on this MMSIV initiative, and the CutSuit training, please contact Mr. Geoff Miller at geoffrey.t.miller4.civ@mail.mil.

International Meeting for Simulation in Healthcare (IMSH) 2021 Virtual Conference

On 19 March, Mr. Geoffrey T. Miller, Senior Research Scientist and Division Chief of the Medical Modeling, Simulation, Informatics and Visualization (MMSIV) team presented a virtual interactive session entitled "Joint Medical Simulation Instructional / Operational Methods (JMedSIM)" at the 2021 International Meeting for Simulation in Healthcare (IMSH). Geoff co-presented this session with Dr. Joseph Lopreiato, Uniform Services University (USU) Director, Val G. Hemming Simulation Center, Mr. Ruben Garza, Defense Health Agency (DHA) J-7/Chief, Defense Medical Modeling and Simulation Office (DMMSO), Ms. Daphne McGill, DHA J-7/DMMSO Program Analyst, Mr. Joseph Ruisi, Deputy Chief, Air Force Medical Modeling and Simulation Training (AFMMAST), and Mr. Thomas Soto, Army Central Simulation Committee (CSC) Executive Council Representative.

While the IMSH Conference was held virtually this year, there was no shortage of active participation and robust collaborations amongst its partners. This particular session focused on discussing the background of the JMedSIM effort and MHS simulation programs, the JMedSIM project development goals and current plan of action, along with development efforts to create a joint services, standardized medical modeling and simulation curriculum for all military medical simulation specialists, educators and operators.

Team TATRC was grateful to take part in this important annual simulation event and looks forward to reconnecting at IMSH in person in 2022!

Team TATRC Hits the Road in Support of Cyber Quest 21

TATRC deployed seven representatives from multiple divisions within our organization to participate in this year's Cyber Quest 21 (CQ21) at Fort Gordon in March. TATRC personnel coordinated with the CQ21 planners to synchronize the simulated casualty scenario within the CQ21 exercise One Semi-Automated Forces (OneSAF) computer simulation program, which was being conducted on-site at Fort Gordon in Augusta, GA. Mr. Carl Manemeit, Deputy Division Chief for the Medical Modeling Simulation, Informatics, and Visualization (MMSIV) team; Mr. James Beach, Project Manager; Mr. Larry Markins, Network Engineer, MMSIV; Ms. Christen Phillips, SIM Engineer, MMSIV; Mr. Edward Kensinger, Senior Project Manager, Digital Health Innovation Center (DHIC); Mr. Marvin Cole, DHIC; and Mr. John Small, DHIC were all on hand to support this annual event.

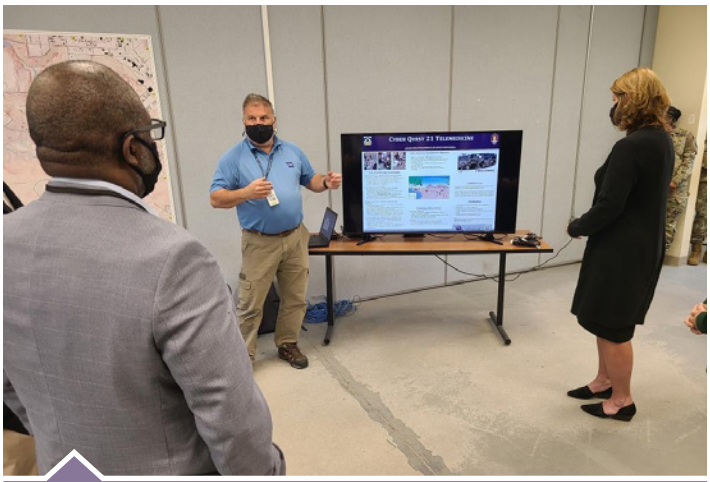
TATRC personnel staged simulation mannequins with combat wounds for medics at Fort Gordon to treat and assess.

CQ21 was hosted by the Army Futures Command and the Cyber Center of Excellence to showcase and demonstrate emerging cyber, electronic warfare, intelligence and networking technologies. The Cyber Battle Lab was tasked to identify technology solutions to accelerate modernization and align with capability gaps of addressing the Army Multi-Domain Operation in Cyber, Signal and Electronic Warfare. This year's event linked operational units conducting operational maneuver exercises under the Army Expeditionary Warrior Experiments (AEWE) held at Fort Benning. AEWE is a live-prototype assessment for Soldier and small-unit modernization that included live-fire and force-on-force experiments on the latest technologies at the squad and platoon level. CQ21 and AEWE were linked through the OneSAF which is a computer-generated forces simulation that provides entity-level models and behaviors through the tactical network.

As the OneSAF computer simulation initiated the battle from Fort Gordon under CQ21, the Army units at AEWE conducted their maneuvers for the reconnaissance, defense, and counter attack missions. When the simulated casualties occurred, TATRC personnel would stage simulation mannequins (MedSIM and Trauma FX) with combat wounds for medics at Fort Gordon to treat and assess. TATRC's objective was to characterize bandwidth and network security bi-directional impacts of virtual health capabilities operating on a Brigade Tactical Radio Network and obtain human factors feedback from test participations utilizing virtual health capabilities during the command post exercise in minimally compressed prolonged field care scenarios.

TATRC's objective for CQ21 was to conceptually demonstrate the use of telemedicine systems on tactical networks from simulated medical casualties in an operational environment at the point of injury, as well as collect data on the

Mr. Larry Markins was on-hand to help successfully connect front line personnel with remote surgeons.



MMSIV Deputy Director, Mr. Carl Manemeit, briefs Cyber Quest 21 attendees.

functionality, feasibility, and usability of the systems; and provide usable data to advanced developers and transition program managers on further development of the systems being researched.

Additionally, TATRC evaluated capabilities to provide the front line medic the ability to reach out and touch a specialized physician through telemedicine. TATRC conducted simulated casualty scenarios with a variety of medical personnel, to provide user feedback and recommendations on the point of care patient monitoring capabilities that can provide knowledge based telemedicine data through a tactical cloud to a medical provider in the rear. The new technologies identified to conceptually demonstrate tele-mentoring, and to close the capability gaps in cyberspace operations, were the U.S. Air Force Research Laboratory's Battlefield Assisted Trauma Distributed Observation Kit (BATDOK), Remote Diagnostic Technologies' Tempus Pro and Corsium Suite, and Aviation and Missile Center S3I's Micro-Medical Data Cloud (MMDC) dashboard. The basic OV-1 concept, point of care patient monitoring devices; BATDOK and Tempus Pro, would make a call and transmit medical data, imagery, VOIP over tactical radios to a mobile PacStar server with the MMDC installed. Then a medical provider would receive the call and use the web browser over the internet to view the medical data and imagery, and have a VOIP conversation with the front line medic.

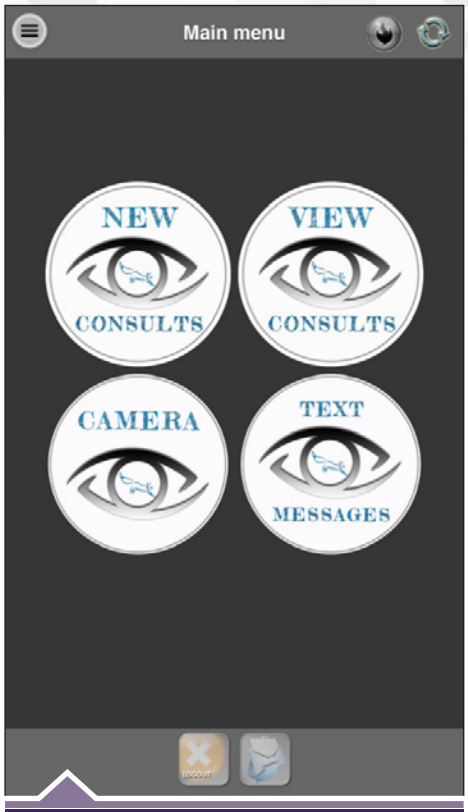
TATRC successfully connected the front line medical personnel at Fort Gordon, GA with surgeons at the Brigade HQ. The assessment and overall feedback from front line medics and medical providers was that the concept demonstration of these technologies was a complete success and highly recommend this for further advanced development and transition to a program of record.

This tactical telemedicine capability is a potential solution to provide front line medics with a valuable method to reach back and request assistance on patients that may be above their skill level in emergent or prolonged field care. The key success is increasing survivability rates and reducing non-urgent evacuations during Multi-Domain Operations with peer adversaries or in possible austere environments. It also fills critical operational medicine gaps identified by the Surgeons of the 75th Ranger Regiment and 160th SOAR and SOCOM in air-to-ground / ground-to-air medical information exchange during CASEVAC missions.

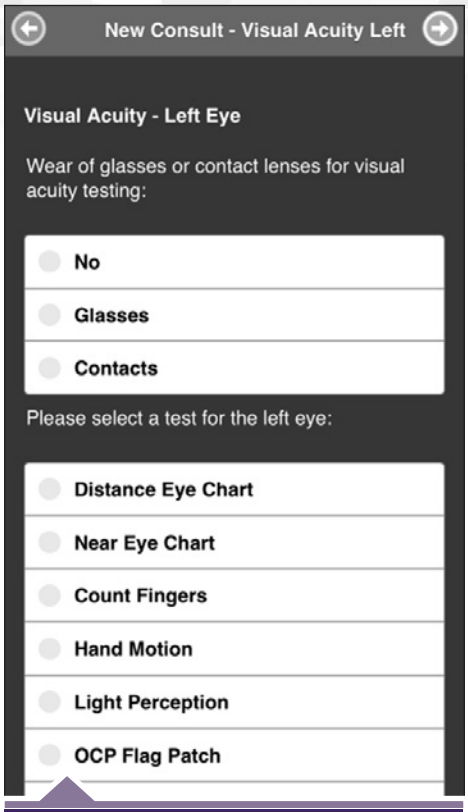
This three week event included setting up a local network that integrated with the CQ21 network, testing and validating telemedicine devices communicated through the network from the point of care to the Brigade Surgeon at the Tactical Operations Command, training the medical personnel on the medical devices and capabilities, execution of simulated combat casualty scenarios, and then a demonstration and presentation for Distinguished Visitors. The Distinguished Visitors included: Major General Neil Hersey, Commanding General, Cyber Center of Excellence and Brigadier General Miles Brown, Deputy Director, Futures and Concept Center.

TATRC's MMSIV and DHIC staff were pleased to be involved in this exercise as it proved extremely beneficial for further testing and evaluation opportunities.

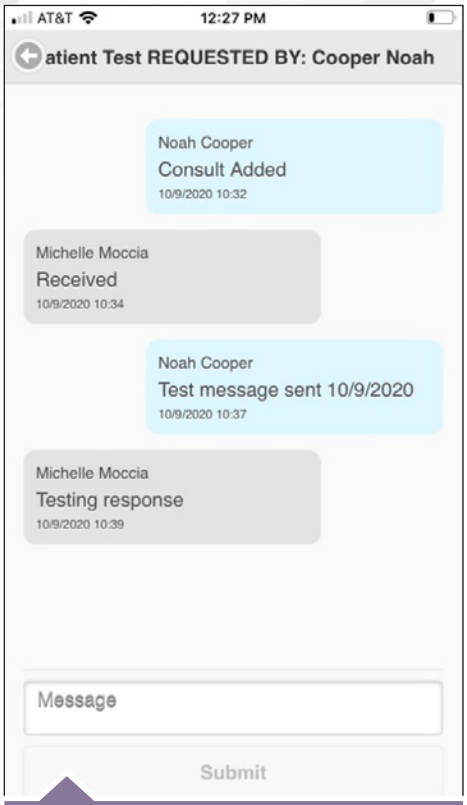
Project BOOM – A Cumulative Positive Impulse



This is an image of the home screen



Visual Acuity Testing



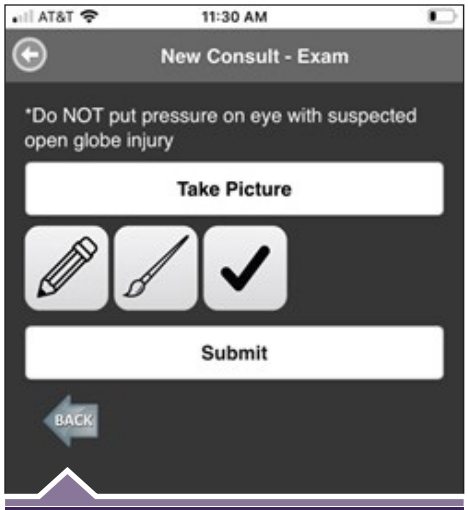
Sample Secure message interaction between a specialist and a provider at the point of injury or in this case the Emergency Department.

TATRC's Digital Health Innovation Center (DHIC), through its Project BOOM, supporting the Joint Health Risk Management Enhanced Capability Demonstration (JHRM ECD), continued agile software development to add to the suite of prototype capabilities for Blast Exposure Monitoring (BEMO) hosted in the Mobile Health Care Environment (MHCE).

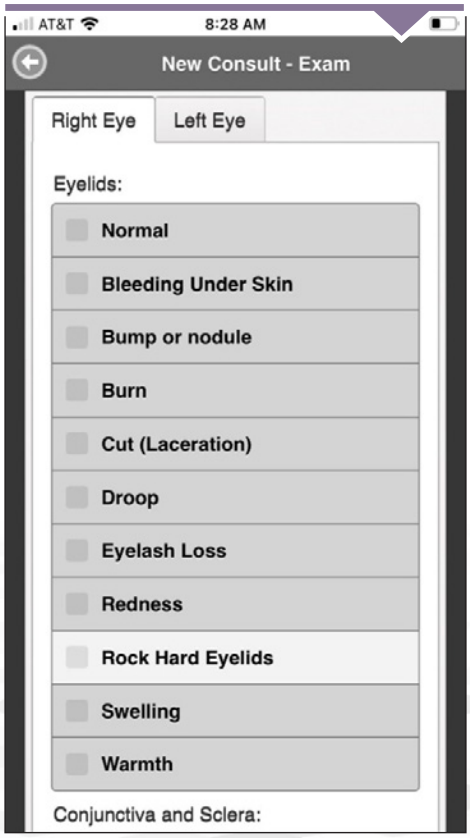
The newest features and capabilities under development are the Environmental Health Sensor Issuance Tool and the BEMO Training Feedback Report Generator (TFRG). The Sensor Issuance Tool enables wearable sensor data (from blast overpressure gauges in this case) to be associated with personally identifiable information (PII) for longitudinal exposure recording regardless of where sensor data is downloaded relative to the point of issue and without loading PII on the sensor itself. The TFRG aggregates individually-associated blast overpressure gauge and weapon firing log data into unit-level summary exposure reports to provide Commanders, instructors and Force Health Protection personnel with analytical information needed to manage health risks and identify trends.

TATRC's Project Manager for this initiative, Ms. Tabitha Waldrop, stated, "As Project BOOM morphs, the mCare / MHCE system implements new features and capabilities. The team continues its 'cumulative positive impulse' across many other projects, by implementing innovative ways to design and develop modularly and incrementally, continuously improving and building upon lessons learned. I'm incredibly proud of all the work that the DHIC development team has accomplished on this project."

TATRC will be supporting several upcoming demonstrations with the U.S. Special Operations Command and Marine Corps later this year for the previously developed BEMO Weapon Firing Log. Demonstrations of a fully integrated suite of BEMO tools, including the Sensor Issuance tool and the TFRG prototypes, is planned for the 4th Qtr of this fiscal year in support of the OSD Health Affairs 734 Working Group



The exam menu allows users to add freetext notes regarding an exam, draw and image or take a picture, and to note the findings of an exam using the detailed exam menu. See below for the menu that appears when you click the check box.

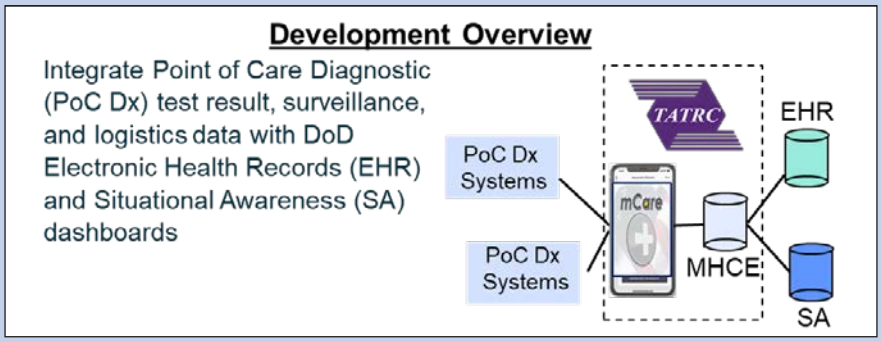


Blast Overpressure Studies.

For more information on this project, please contact Ms. Jeanette Little, jeanette.r.little.civ@mail.mil.

DHIC Developing COVID-19 Mobile Test Kit Integration Capability for the DoD

TATRC's Digital Health Innovation Center (DHIC) has begun work on a fast turnaround project to capture COVID-19 diagnostic test data and transfer this information into the DoD Electronic Health Record (EHR) and COVID-19 surveillance dashboards. The effort, called 'Project Impulse,' is funded through the CARES Act and developed in partnership with the DoD COVID Diagnostics and Testing Task Force, the Defense Health Agency (DHA) and the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND). The JPEO CBRND supports both DHA and U.S. Department Health and Human Services in COVID-19 response efforts including the test, integration and procurement of several simple to use and portable Point of Care (PoC) Diagnostic (Dx) test systems able to be employed in non-traditional testing settings.



The initial capability under development will enable DoD PoC Dx test operators to securely report patient COVID diagnostic test results using the TATRC mCare mobile application and transfer that data to the Mobile Health Care Environment (MHCE) web portal. The mCare Impulse application will be vendor agnostic, enabling the results of many types of COVID tests to be reported without the need for repeated integration efforts with each. Additional features support PoC Dx test asset supply chain and inventory visibility for using units and DoD decision makers and aggregation of daily test data to support COVID surveillance reporting. The second phase will ensure test results are automatically transferred to the DoD EHR via the Military Health System (MHS) Defense Exchange Service (DES).

This is the second major effort that the TATRC DHIC team is developing for JPEO-CBRND. The other initiative is Project Boom; the development of mobile device and desktop software applications to collect, visualize, and longitudinally record individual blast overpressure exposure data in training and combat environments. Ms. Tabitha Waldrop, TATRC's lead for both Project Impulse and Project Boom, stated, "I'm excited to work with the JPEO CBRND office on another high energy, incredibly relevant project, especially in such an important effort for our Service Members during this pandemic and the fight against the spread of COVID-19."

For more information on this project, please contact Ms. Jeanette Little, jeanette.r.little.civ@mail.mil.

Bringing NETCCN to Life in Phase 2 – From R&D to Operations

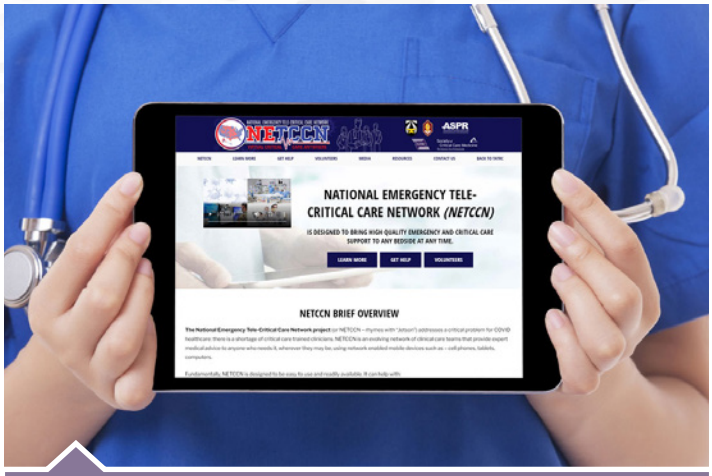
The COVID-19 pandemic has pushed all of us to accelerate our efforts to bring research and development activities into the fight against the disease. And TATRC's National Emergency Tele-Critical Care Network (NETCCN) project is no different. In the first phase of the NETCCN project, clinical and technical teams delivered tele-critical care to seriously ill COVID-19 patients in concert with hospital staff in places like Guam, Puerto Rico, the Dakotas and Minnesota. Phase 2 of the project will demand that TATRC works closely with hospitals and clinicians to make them aware of NETCCN and rapidly work to integrate this new capability into the clinical workflows of healthcare organizations in need.

In anticipation of the need to recruit and manage additional clinical sites for Phase 2 of NETCCN, TATRC has established a new Operations cell for this initiative. Led by Mr. James Beach, the cell consists of Mr. Cleveland Cook, Ms. Tabitha Waldrop and Ms. Ollie Gray. TATRC is in the process of recruiting an LNO or liaison officer for the team.

The Operations Cell has three main functions:

- **To keep TATRC and the Department of Health & Human Services (HHS) / Office of the Assistant Secretary for Preparedness and Response (ASPR) leadership informed with regard to the status of NETCCN, its current and prospective NETCCN missions, and applicable policies (like cross-state licensure);**
- **To collaborate with NETCCN partners in the U.S. healthcare system, as well as federal and state governments; and**
- **To manage outbound communications and inbound requests for NETCCN support & clinical volunteers.**

In support of NETCCN, the TATRC Operations team has established a variety of channels through which to communicate with key NETCCN "customers" like hospitals, hospital associations, critical care clinicians, and HHS/ASPR Regional Emergency Coordinators. For example, the Operations Team has conducted a series of live and recorded demonstrations of NETCCN platforms. In addition, TATRC's Public Affairs Office designed and launched a new website (www.tatrc.org/netccn) to allow healthcare organizations in the U.S. healthcare system to request support or to volunteer to assist others.



TATRC launched a new website (www.tatrc.org/netccn) to allow healthcare organizations in the U.S. healthcare system to request support or to volunteer to assist others.

As time goes on, TATRC will transition more and more of the operational capabilities for running NETCCN to HHS/ASPR. HHS/ASPR intends to make the NETCCN platforms and the approach of "anywhere to anywhere" tele-critical care, part of the future of national disaster response capabilities for hurricanes, floods, wildfires and other disaster events that require the rapid extension of specialized clinical expertise to places where it does not currently exist. In the meantime, the hard work of the TATRC Operations team is filling the gap and making a difference in the fight against COVID-19.

For more information on this project, please contact Ms. Jeanette Little, jeanette.r.little.civ@mail.mil.

FOXTROT Changes Consult Requests for Ophthalmology

Operational view of Project 'FOXTROT' (Forward Operating Base EXpert Telemedicine Resource Utilizing MObile Application for Trauma).

TATRC continues its growing partnership with fellow collaborator's at the U.S. Air Force's 59th Medical Wing, furthering the secure mobile application known as 'FOXTROT' and its accompanying web portal. The Forward Operating Base Expert Telemedicine Resource Utilizing Mobile Application for Trauma (FOXTROT) application provides a secure, HIPPA-compliant tool that connects the providers at the point of injury in deployed locations to an ophthalmologic specialist at a higher level of care. The FOXTROT application leverages TATRC's Mobile Health Care Environment - Research (MHCE-R) and its accompanying mobile app, mCare, as a solution to treat ocular trauma. As previously reported, FOXTROT was deployed to Afghanistan in 2019, and in August 2020, the findings of that project were published in JAMA Ophthalmology. During the Afghanistan performance improvement project, 18 different FOXTROT users directed a total of 28 consults to one expeditionary ophthalmologist over a six week period. The teleophthalmology services provided via the FOXTROT application helped prevent the need for aeromedical evacuation in four of the 28 consults placed, and downgraded the category of aeromedical evacuation in four more. Moreover, users really liked utilizing the app. Application users' median rating was a 5 on a 5 point satisfaction survey scale.

Since October of 2020, FOXTROT is revolutionizing virtual consults for two ophthalmology specialists at Joint Base Andrews and their Emergent Care Center (ECC), replacing traditional consult methods. On average, the specialists receive 3-5 consults per week, with a maximum of three consults received in one day. To date, providers at the Joint Base Andrews ECC have requested a total of 33 consults. Ophthalmology specialists receive a complete picture of the patients in question using FOXTROT, and can respond to consults with a thorough treatment plan at all hours of the day.

The FOXTROT application transmits patient demographic data, historical information as well as injury information and assessment. Additionally, providers at the ECC can send numerous images and directly communicate using FOXTROT's secure messaging function.

According to the FOXTROT research coordinator Michelle Moccia," the FOXTROT application saves the ophthalmologists from being pulled from an exam room to answer an urgent consult. It allows them to provide better care for consult patients and scheduled exam patients as well."

The immediate future plans for FOXTROT include bringing the additional approved sites at Brooke Army Medical Center in San Antonio, TX and Portsmouth Naval Hospital in Portsmouth, Virginia online. Providers at these two sites completed training on the platform in January 2021. Furthermore, efforts are underway to expand FOXTROT to include a secure video web-conferencing feature using Web RTC as part of a push for a global "ocular suite" of a la cart ophthalmological assessment options. The development and project management staff at TATRC's Digital Health Innovation Center continue to work hand in hand with the FOXTROT team to make this project a success. This technology has the potential to change the way specialty consults are communicated in a deployed setting and here at home as well.

For more information on this project, please contact Ms. Jeanette Little, jeanette.r.little.civ@mail.mil.

DHIC Team Member Leaves TATRC After Five Years of Dedicated Service: A Fond Farewell to Amanda Schmeltz

TATRC's Digital Health Innovation Center (DHIC) said goodbye to one of their key Project Managers, Ms. Amanda Schmeltz, earlier last month. Amanda, who joined TATRC in 2016, quickly became an integral part of the digital and mobile health team at Fort Gordon. The DHIC team has relied on Amanda to assist with all concept developing, proposal writing, grants and clinical protocols for the last five years. During her tenure with TATRC, not only did she expand her family with the birth of an additional child, she also attained her Master's degree. As her experience has grown, a new prospect for professional development has presented itself to Ms. Schmeltz, and she has decided to pursue this new opportunity. However, lucky for us, she has graciously agreed to provide consulting services to TATRC on a part time basis until her position can be backfilled.

"The TATRC team, particularly at DHIC, are very sad to see Amanda leave us on a personal level, but we are all thrilled for the new opportunities this new position will offer her for the future. We can fill the open positions, but we can't replace the friendship and role she plays in our hearts. So we send her off with our best and warmest wishes for the future," said Ms. Jeanette Little, DHIC's Division Chief.

TATRC Director, COL Jeremy Pamplin (left) along with DHIC Division Chief, Ms Jeanette Little (right), presented Ms. Schmeltz (center) with a Cerftificate of Appreciation & Excellence during a recent site visit to the Fort Gordon office. The certificate was presented in recognition of her five years of contributions to the TATRC Mission.

In her new position, Amanda will be assuming the role of a Digital Science Senior Project Manager for a remote clinical trials organization that works to accelerate medical treatment and cures in the private sector.

Amanda leaves us with this parting thought, "It's absolutely bitter sweet to leave what I consider to be the most amazing group of people I could ever have asked for. My TATRC co-workers remain a second family to me and I will hold them firmly to the promise of staying in touch. I am, on the other hand, excited to meet new challenges head on. Much of my last five years of experience will be applied to my new role with end to end clinical study and team management. Thank you my beloved TATRC family, I will be watching the ever growing incredible things you all continue to do as we push onward!"

Adapting in the Year of a Pandemic:

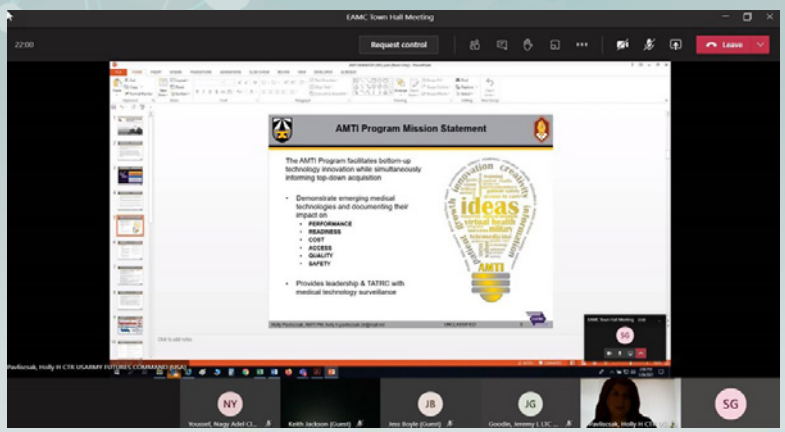
AMTI Town Halls Go Virtual

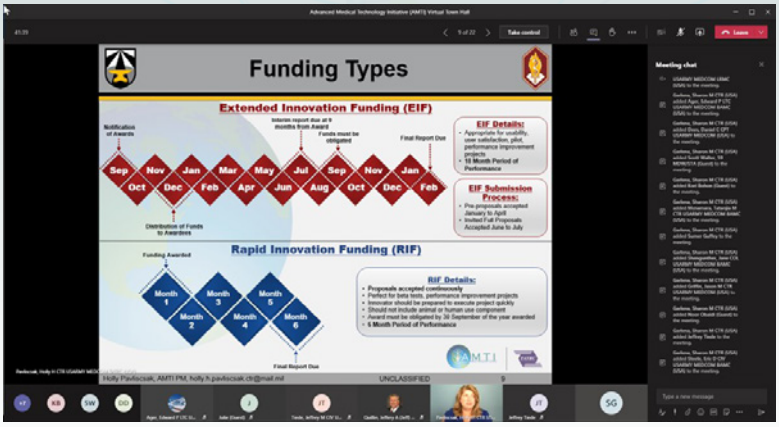
In a typical year, Ms. Holly Pavliscsak, the Advanced Medical Technology Initiative (AMTI) Program Manager (PM) visits two to three military treatment facilities (MTF) on-site and in person where AMTI has active projects to check in with Innovators directly. While she is there, she also briefs any interested staff on the AMTI Program. Unfortunately, 2020-2021 has been anything but a typical year and with DoD government travel restricted, she decided to conduct virtual town halls in order to provide an overview of AMTI in the absence of the ability to travel.

Throughout January and February of this year, Ms. Pavliscsak hosted four virtual town halls for clinical staff at the Eisenhower Army Medical Center (EAMC), Brooke Army Medical Center (BAMC), Tripler Army Medical Center (TAMC), and Madigan Army Medical Center (MAMC). Participants from each of these sites had to preregister in order to be included in the virtual town halls that were held via Microsoft Teams. Each of these events offered an overview of the AMTI, as well as an opportunity for direct dialogue and open question and answer from participants. The virtual town halls provided a unique opportunity that many times in person gatherings in an auditorium do not, which is the increased availability for participation from busy professionals and clinicians. After registering, participants could work seamlessly from their desk instead of having to leave their work area to come down to a centralized event.

One thing Ms. Pavliscsak did miss was the face-to-face interaction with AMTI Innovators and support staff, which allows her to see firsthand the work that is being completed at each of the sites and determine areas where AMTI can improve on support for these worthwhile projects. She looks forward to a hybrid model in the future when travel can resume and she can continue to conduct town halls while visiting the awarded MTFs and connecting directly with the staff on site.

Below are some screen captures from the events.





If your center or MTF location is interested and would like to setup a virtual town hall to learn more about AMTI, please contact Ms. Pavliscsak at usarmy.detrick.usamrdc.list.aamti-team@mail.mil.

AMTI
ADVANCED MEDICAL TECHNOLOGY INITIATIVE

Important Upcoming FY22 AMTI Submission Deadlines:

Dates to Remember:

15 JAN — 15 APRIL, 2021 EIF Pre-Proposal Submissions Accepted
21 JUN — 30 JUL, 2021 Opening Date for EIF Full Proposal Submissions *(Invitation Only)*

TATRC has opened the Advanced Medical Technology Initiative (AMTI), formally AMEDD Advanced Medical Technology Initiative (AAMTI) proposal submission process for FY22.

The Advanced Medical Technology Initiative (AMTI) Program facilitates bottom-up technology innovation while simultaneously informing top-down acquisition. The main goals of the program are to:

- **Demonstrate emerging medical technologies and documenting their impact on PERFORMANCE (Lethality), READINESS, COST, ACCESS, QUALITY, and SAFETY through a bottom-up (provider/ MTF level) approach; and**
- **Provide leadership with medical tech-surveillance capability.**

The purpose of the AMTI Program is to focus on identifying, exploring, and demonstrating key technologies and enabling biomedical principles required to overcome technological barriers that are medically and militarily unique. This initiative and Call for Proposals plays a vital role in the fulfillment of these objectives to include advanced technology development, demonstration and validation of important new technologies and procedures.

Submissions to the AMTI Call for Proposals should be innovative, non-duplicative, acquisition sensitive, collaborative and implementable within AMTI funding timeframes. AMTI is an intramural program and only military or civilians assigned to a Military Treatment Facility or Operational Unit may apply.

Each submission will be evaluated based upon the following criteria: military relevance, innovative concept, metrics for success and potential return on investment. Those Innovators whose pre-proposals are evaluated to be of greatest interest will be invited to submit a full proposal, which will be evaluated by the AMTI Full Proposal Review Panel. Funding is made available on a year by year basis and follow-on funding is not authorized.

Questions concerning the preparation of submissions can be emailed to usarmy.detrick.medcom-usamrmc.list.aamti-pm@mail.mil. Instructions on how to submit a Pre-Proposal can be found on the TATRC website, https://tatrc.amedd.army.mil/AMTI/Default.aspx. We know you all are very busy working on many new initiatives and we look forward to receiving your great ideas!

AMTI
ADVANCED MEDICAL TECHNOLOGY INITIATIVE

PROJECT SPOTLIGHT

Optimizing REBOA for the Austere Combat Environment Using the COMPASS® Portable Pressure Monitor

Although there have been great advances in the care of Service Members wounded in combat and other operational environments, bleeding remains a common cause of death. Among deaths that have been determined to be "potentially preventable," hemorrhage has been identified as the primary cause in 80-90% of cases. Of these, approximately half are due to bleeding within the chest or abdominal body cavities. Until recently, there have been no available options to treat and stabilize patients with this type of bleeding outside of a fully staffed hospital operating room. A relatively new technique called the Resuscitative Endovascular Balloon Occlusion of the Aorta, or REBOA, has been developed and can be used to slow or stop hemorrhage and stabilize a wounded Service Member until they can get to a facility with surgeons and an operating room. This procedure involves inserting a catheter with a balloon tip through the groin and into the aorta, and then inflation of the balloon to stop all blood flow to the injured area.

However, one of the limitations of REBOA is that it requires the availability of an advanced patient monitoring device and equipment that is connected to the REBOA catheter to continuously monitor the patient's blood pressure and other vital signs. This makes it difficult or impractical to utilize in many austere battlefield settings. The research team sought to evaluate and validate the utility of a new minitiarized and handheld digital blood pressure device called a COMPASS® (Mirador Biomedical, Seattle, WA) for guiding REBOA therapy and potentially eliminating the need for the usual advanced (and non-portable) pressure monitoring equipment. This project involved a series of validation exercises utilizing a realistic animal model of severe abdominal injury with massive bleeding, and direct comparison of the COMPASS device to the standard bulkier monitoring systems. Of note, this project also represented a new and highly productive and collaborative inter-service effort between investigators from the U.S. Army at Madigan Army Medical Center and the U.S. Navy at Naval Medical Center San Diego.

Results from the initial series of validation tests of the COMPASS device in uninjured healthy animals demonstrated that the device is highly accurate and reliable compared to standard blood pressure monitoring systems. Subsequent validation tests then examined the accuracy and reliability of the device under a number of "real-world" conditions including animals with massive hemorrhage, and with monitoring the response to treatment with REBOA. In these series of tests, the COMPASS device again demonstrated a high degree of accuracy and reliability in comparison to use of the larger and more expensive monitoring systems. In a final set of validation tests, the ability of a lone medical provider to treat animals with massive hemorrhage using only the COMPASS device to initiate and then adjust treatment with a REBOA catheter was evaluated. These tests confirmed that a medical provider could successfully initiate and then adjust REBOA therapy

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Figure 1: COMPASS® Centurion (Mirador Biomedical, Seattle, WA) device being tested during REBOA therapy in a large animal model of massive bleeding

using only the minitiarized COMPASS device and without the need for the larger and bulkier blood pressure monitoring systems.

This project and the resulting data speak directly to multiple pillars of the Advanced Medical Technology Initiative (AMTI)'s Program. The most obvious pillar is readiness and preparedness of the medical forces for forward deployment and providing high quality and effective care to patients with massive bleeding. Use of these devices in combination have the potential to greatly improve the ability of austere forward surgical or resuscitative medical units to immediately intervene and stabilize severely wounded Service Members. The project also speaks to the pillars of reducing cost. The use of the studied devices could greatly simplify the required equipment that is needed to implement a REBOA program in the forward deployed environment, including eliminating the need for the bulky and expensive patient monitoring systems that are currently required. The effective use of REBOA, and utilization of the COMPASS device to accurately guide therapy, may also result in decreased costs through reducing the need for multiple blood transfusions or other interventions that are required when there is no ability for early control of massive bleeding. This work could also greatly impact the pillar of quality, by providing what would currently be the only effective forward capability for control of torso hemorrhage outside of the operating room environment.

The work from this project has already had significant impact on the Military Health System, and will continue to have impact as additional data analyses and reports are completed. The most tangible impact is in the protocols and guidelines for forward deployed REBOA utilization. The COMPASS device has now been added to the Joint Trauma System Clinical Practice Guideline on REBOA utilization in the operational

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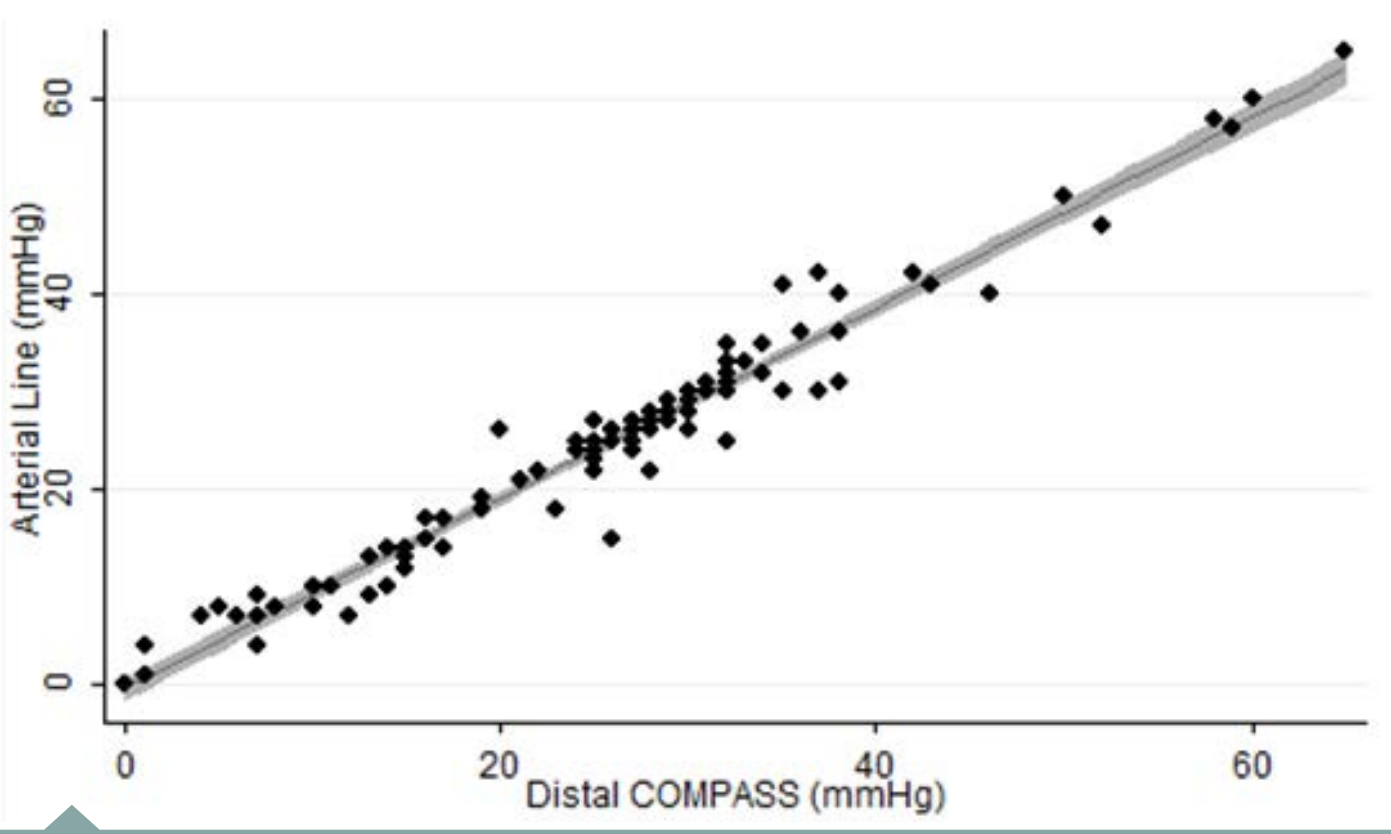

Figure 2: Scatterplot of blood pressure measured with the handheld COMPASS device (x-axis) versus a standard invasive blood pressure monitoring system (y-axis) shows near perfect correlation and agreement between the two methods.

environment. In addition, the device is being fielded and utilized by a number of forward deployed medical/surgical units, including small austere surgical teams that otherwise would not be able to safely perform REBOA.

Dr. Matthew Martin, AMTI Innovator for this initiative stated, "This work would not have been possible or practical without the generous funding support of AMTI. Validation tests of this nature in large animal models are prohibitively expensive without a dedicated line of funding and other administrative support. The AMTI funding was also critical to the ability to do a complete and thorough series of validation tests starting from uninjured animals and proceeding through to a realistic model of major hemorrhage being managed under austere battlefield conditions."

This work has supplied adequate data to support clinical use of the COMPASS device in the deployed or operational environment by trained providers. Future iterations plan to evaluate the use of the COMPASS device by less experienced personnel such as basic combat medics/corpsman, the use of the device to accurately guide and perform fine titrations of REBOA with only partial balloon inflation, and to assess any updated/improved versions of this or similar devices.

Dr. Martin added that, "This work represents how immediately impactful and clinically relevant data can be obtained with adequate funding support (via AMTI) and utilizing the great pool of expertise available at our military medical centers. In addition, this was a fantastic example of close collaboration between U.S. Army and U.S. Navy innovators who are guided by the prime mission of improving combat care and survivability for our Service Members."

For additional information on this AMTI funded project, please contact Ms. Holly Pavliscsak at holly.h.pavliscsak.ctr@mail.mil.

EMPLOYEE SPOTLIGHT

Congratulations to TATRC's Q2 Employee of the Quarter!

Mr. Kirit Raja, Software Developer for Medical Modeling, Simulation, Informatics, and Visualization Division.

A big congratulations are in order for Mr. Kirit Raja, one of TATRC's Software Developers, for being named TATRC's Employee of the Quarter for Q2. In the past 3 months, TATRC's Digital Health Innovation Center (DHIC) located off-site in Fort Gordon, GA, experienced an exceptionally large volume of software development tasks for both mobile devices and web portals for a number of their active projects. Ms. Jeanette Little, Division Chief for DHIC stated, "It was literally a perfect storm of critical projects all needing to be done at the same time. As the Division Chief, I was working on some permanent expansion plans for the development team, but the time to bring someone new on board, train them, and have them help manage the workload was not possible to achieve in the past quarter."

As a short term solution, Kirit Raja, who works in TATRC's Medical Modeling Simulation, Informatics, and Visualization Division, offered to manage his existing workload and also provide surge support for the DHIC development team. To the delight of the DHIC staff, Kirit was very knowledgable with the tools and techniques already being employed, and jumped right into the work with a can do, positive attitude almost immediately. He quickly migrated from a "backup" support position, to being directly in charge of very specific technical DHIC tasks for the Project Boom effort, while other team members were focused on the COVID funded Project Impulse efforts and ARCS project. Kirit personally led efforts to resolve technical challenges to access the MHCE system from Fort Detrick permanently. He provided outstanding work products and met all requirements and deadlines to complete the BEMO Sensor Issuance Tool in support of Project Boom. Kirit conducted numerous successful sprint reviews with our JPEO CBRND sponsor and worked closely with DHIC Project Manager, Scott Kotz, and DHIC's lead developer, Zaheir Razak to deliver code that worked seamlessly within the MHCE system, despite having no prior experience with that platform.

Ms. Little added, "As a Division Chief trying to manage a very robust portfolio of work, along with CAM duties and high visibility, special COVID related projects, knowing that there are TATRC team members like Kirit who will jump in and help ensure we meet our customers' very high expectations and not fall behind in our scheduled deadlines, despite having all of the odds against us, is incredibly reassuring. I am exceedingly grateful for Kirit's contributions and can't think of anyone more deserving for this quarter's recognition."

Congratulations Kirit and thanks for being an outstanding team member!

TATRC Hires New Budget Analyst

Malwina Derr, who goes by "Molly", is the newest member of TATRC's Resource Management Group. As the new Budget Analyst who joins the team of four, Molly's primary focus will be supporting the Biotechnology HPC Software Applications Institute (BHSAI). She comes to us from MRDC's Joint Program Committee - 1 (JPC-1) Group, where she also focused on budgets, spreadsheets and all things financial for the Army funded MSISRP/MAST Portfolio. Before her federal positions, Molly successfully supported a Gaithersburg based Interior Design firm as their Business Analyst for 5 years.

Although Molly has called the Frederick area home for over sixteen years, she has lived in numerous places throughout her life. As a proud Polish immigrant and Naturalized U.S. citizen, Molly found the Chicago area as her first "home" in the states at age 7. As her family moved in search of "the American Dream," Molly also resided in the greater Atlanta area and later Nashville, better known as "Music City." There, Molly attended Vanderbilt University where she earned her Bachelor's Degree in Economics.

Currently, Molly lives in the beautiful Middletown Valley with her family. She is a proud and active mother of four children, with her oldest son having just graduated from Salisbury University. In addition to her family, Molly is passionate about the Washington Capitals hockey team and is an avid fan of 'Da Bears. Continuing her childhood family's aspiration for traveling to foreign places, Molly hopes to endeavor on many more international trips, with her last adventure to South Africa being her favorite thus far.

Ms, Malwina "Molly" Derr, Budget Analyst

Molly is proud to join the TATRC Team and is eager to make meaningful contributions to the many various missions within our Command.

Team TATRC warmly welcomes Ms. Molly to our growing organization!

DHIC Expands its Pool of Developers

Mr. Tyler Wright, Developer for Digital Health Innovation Center.

TATRC's Digital Health Innovation Center (DHIC) in Fort Gordon, GA is pleased to announce that their core developer cell is expanding due to the high volume of workload. Mr. Tyler Wright joined the TATRC DHIC team last month as a developer to assist the rest of the dynamic developers. Tyler is a 2016 graduate of the University of South Carolina – Aiken with degrees in both Mathematics and Computer Science. He has seven years of professional experience, and his most recent position was as a government contractor for JANUS corporation, specifically doing front and backend web features for the ArCADIE system. Mr. Wright will be working on both web and mobile development projects for TATRC, including but not limited to projects leveraging the Mobile Health Care Environment (MHCE) system.

Tyler is happily married and the proud father of two young children. He is a worship leader in his church and an avid musician who plays a variety of instruments that include: piano, acoustic guitar, electric guitar, bass, keyboards, and drums. We are very much looking forward to having Mr. Wright as an active part of the TATRC development team!

Welcome to the team Tyler!

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