



A Message from the Director



COL Gina E Adam, Director, TATRC

“Change is the only constant in life.”

– Heraclitus of Ephesus, circa 500 BC

I suppose the Greeks figured it out a long time ago, so it should not surprise us how much change we are faced with on a daily basis. TATRC has certainly experienced a vast amount of change over the past year: in its leadership, its focus, and even its command! Still, the men and women who make up TATRC have accepted, adapted to, and continue to overcome the challenges that change presents to us. It's been my honor

to become a part of this fine organization over the past eight months. I'm humbled by the experience that exists here, the novelty and creativity of the projects that we undertake, and the dedication and professionalism of our staff. I learn something new about TATRC and our research space every day! To highlight, I'd like to review a few of our changes, and accomplishments, over the past year:

- We experienced tremendous turnover in our leadership team: COL Kral's departure in the spring, Mr. McCarthy's tenure as acting director through the summer, new Director and Deputy Director in the past eight months.
- We've had new research portfolios develop following alignment with the Medical Assist Support Technologies (MAST) Portfolio which created the two new capability areas of Medical Robotic and Autonomous Systems (MedRAS) and Virtual Health (VH).
- We completed the Linked Problem List and successfully transitioned it to DMIX.
- We completed the Team Fitness Tracker protocol, which continues to generate interest in this technology.
- We developed five new mathematical models that help minimize the risk of stress-fracture injury, understand blood-clot formation during the lethal triad of trauma, identify genetic factors that impact psychiatric illness and increase our ability to identify those susceptible to such disorders, and enhance the efficacy of vaccine regimens.
- We developed and validated an optimization algorithm that determines when and how much caffeine to consume to maximize Soldier alertness at the desired time of day, for the desired duration.

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Director's Message *from page 1*

- In the midst of re-vamping the AAMTI Proposal Submission System, the program supported projects that produced 4 pending patents and one investigator that won 2nd place in the Young Investigator's Award at MHSRS. An e-book for our successful AAMTI portfolio is now available at <https://tatrc.amedd.army.mil/AAMTI/>.
- The RIF program has taken off! It is now funding \$2 million worth of ground breaking efforts such as using a mobile application with thermal scanning to identify adequacy of tourniquet placement, an alternative treatment for tension pneumothorax, and the feasibility of utilizing night vision goggles in black-out conditions to complete surgical procedures!
- We launched the Telehealth 2.0 research pilot, allowing BH providers from their MTF desktop computer to have a secure VTC connection to their established patients using the patient's personal mobile device.
- And, we've published 27 manuscripts in peer reviewed literature, presented work at 14 conferences, and participated in over 18 wargames and 2 strategic mapping exercises.

Whew! That's a lot and it does not account for even a fraction of all the "quiet" work being done behind the scenes to overcome our challenges and support these amazing accomplishments! Thank you for accepting me and our new Deputy Director, LTC(P) Pamplin, and for supporting us as we continue TATRC's long-standing tradition of excellence.

Gina E. Adam
COL, MS

TATRC Says Farewell to Mr. Harvey Magee After 19 Years of Shaping Medical Simulation

After 19 +, exciting, fun and creatively productive years at TATRC, Mr. J. Harvey Magee, affectionately known as "Happy Harve," has moved on to a brand new chapter in the world of nonprofit!

For those of you who haven't heard the news, Harvey has officially accepted a position with the Henry M. Jackson Foundation for The Advancement of Military Medicine. He will be serving as the Program Manager in the Department of Surgery at the Uniformed Services University (USU), under Dr. Mark Bowyer, Program Director. Harvey will be responsible for coordinating work between the American College of Surgeons Military Health System, & Strategic Partnership, USU, sub-awardees, current and future collaborative military and civilian sites. This program is a multi-year, ongoing effort supporting a new military health system and strategic partnerships with the American College of Surgeons. His last day with TATRC was Friday, 2 November.

For 19 years and 5 months, Harvey was a key member of the TATRC staff and played a pivotal role in shaping and serving the Medical Modeling & Simulation community at large, by focusing on ways to improve safety and quality of care through enhanced training.

Before leaving, Harvey left us with these words, "Being part of this tight-knit community of professionals has been



COL Adam, presenting parting gifts in appreciation of Mr. Harvey Magee's contributions to TATRC.

the highlight of my entire career, and one of my greatest honors. To those of you wearing the uniform, I stand at attention and render a military salute as a gesture of respect and continued support."

Thank you for 19 years of dedication, commitment, and passion to advancing and shaping the world of Medical Simulation. Your TATRC colleagues wish you all the best! ■■■

'Tis the Season for Celebrating Innovation

Another joyful and fitting end to a highly productive year as Team TATRC celebrated their 23rd Annual Holiday Party! The TATRC staff, along with family, friends, and alumni came together over great food, great games, teambuilding activities, and the perennial favorite ... TATRC's Infamous Year in Review Holiday Slideshow!

TATRC's new Command Team was on hand to motivate and rally the staff and to encourage everyone to continue their dedicated efforts to improving military medicine.

The team was able to celebrate all of the many noteworthy accomplishments, accolades and recognitions for this past year and look forward to raising the bar in the coming year.

Best wishes from everyone here at TATRC, and here's to an even better 2019! ■■■



LTC (P) Pamplin (left) and COL Adam (right) showed their Holiday Spirit at TATRC's 23rd Holiday Party.

TATRC Participates in NASA's SPACECOM Conference



TATRC's mHIC Lab Manager, Ms. Jeanette Little participated in a panel discussion with NASA researchers at SpaceCom 2018!

The NASA Human Research Program (HRP) team at the Johnson Space Center in Houston, TX extended an invitation to TATRC to participate in a panel presentation on 27 November 2018 during the Space Commerce Conference and Exposition (SPACECOM). The theme

of this conference was: Where NASA, Aerospace, and Commercial Industries Come Together.

TATRC's own Ms. Jeanette Little, Lab Manager of the Mobile Health Innovation Center, delivered a presentation on, "Autonomous Medicine: An Overview of

the New U.S. Army Science & Technology Medical Research Foci." This panel presentation was part of the opening day of SPACECOM which was held at the George R. Brown Convention Center and the goal of the panel was to help conference participants recognize the common interests between the U.S. Army and NASA with respect to future tools, techniques and methods for Autonomous Medicine. Because many of the challenges that NASA will experience in manned missions to Mars overlap with the challenges of Virtual Health and Autonomous systems for the military, this invitation to co-present was a welcome sign of the potential for future collaboration and discussions going forward.

Following the conference, Ms. Little was given an opportunity to tour the HRP Research Labs at the Johnson Space Center and directly engage with researchers that have common interests with the Army S&T research objectives for the future. She stated, "This is an exciting first step in what we hope will be a growing collaborative exchange between our two agencies." ■■■



A 5 Year Lookback at AAMTI

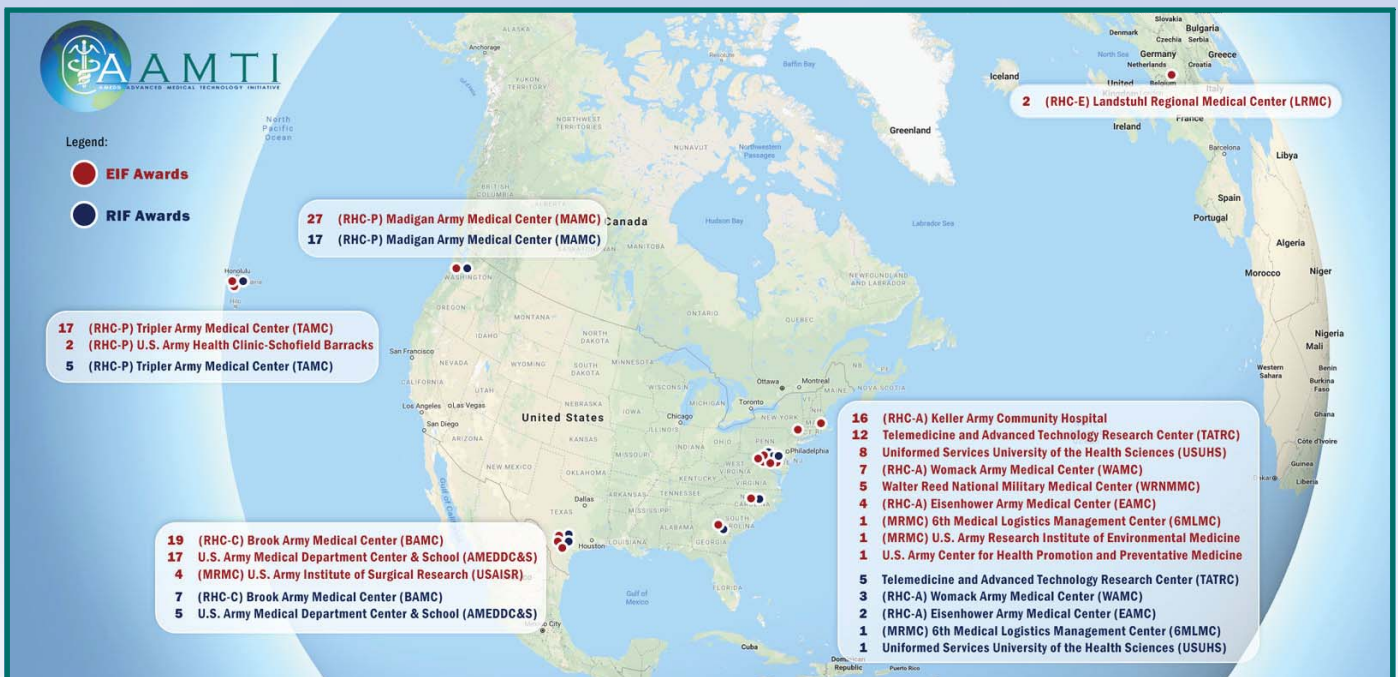
During the last five years at TATRC, the AMEDD Advanced Medical Technology Initiative (AAMTI) program has transformed into an ‘innovation incubator’ for enthusiastic clinicians across the AMEDD. The introduction of the Rapid Innovation Fund (RIF), as part of the AAMTI portfolio of funding mechanisms, placed innovation and rapid fielding within AMEDD military treatment facilities at the forefront of the AAMTI program. By focusing on technology innovation, the AAMTI program made technology scouts out of all AAMTI awardees. In the last 5 years, over 214 AAMTI Innovators have been awarded, supporting 124 Extended Innovation Fund (EIF) projects and 49 RIF projects at over thirty-eight sites across the AMEDD.

The program not only supports awardees on the front end, but also markets their successes in a variety of formats to showcase and reward their hard work. The best projects of the year were highlighted at TATRC’s Annual Open House, held last year on 12 September 2018 at Fort Detrick, MD. At this forum, over thirty AAMTI projects have been showcased to senior decision makers

and thought leaders across military medical research. Additionally, over thirty AAMTI projects have been featured in the TATRC Times quarterly Newsletter, which has a distribution to approximately 2,000 subscribers. Information on AAMTI success projects can also be found on the www.tatrc.org website.

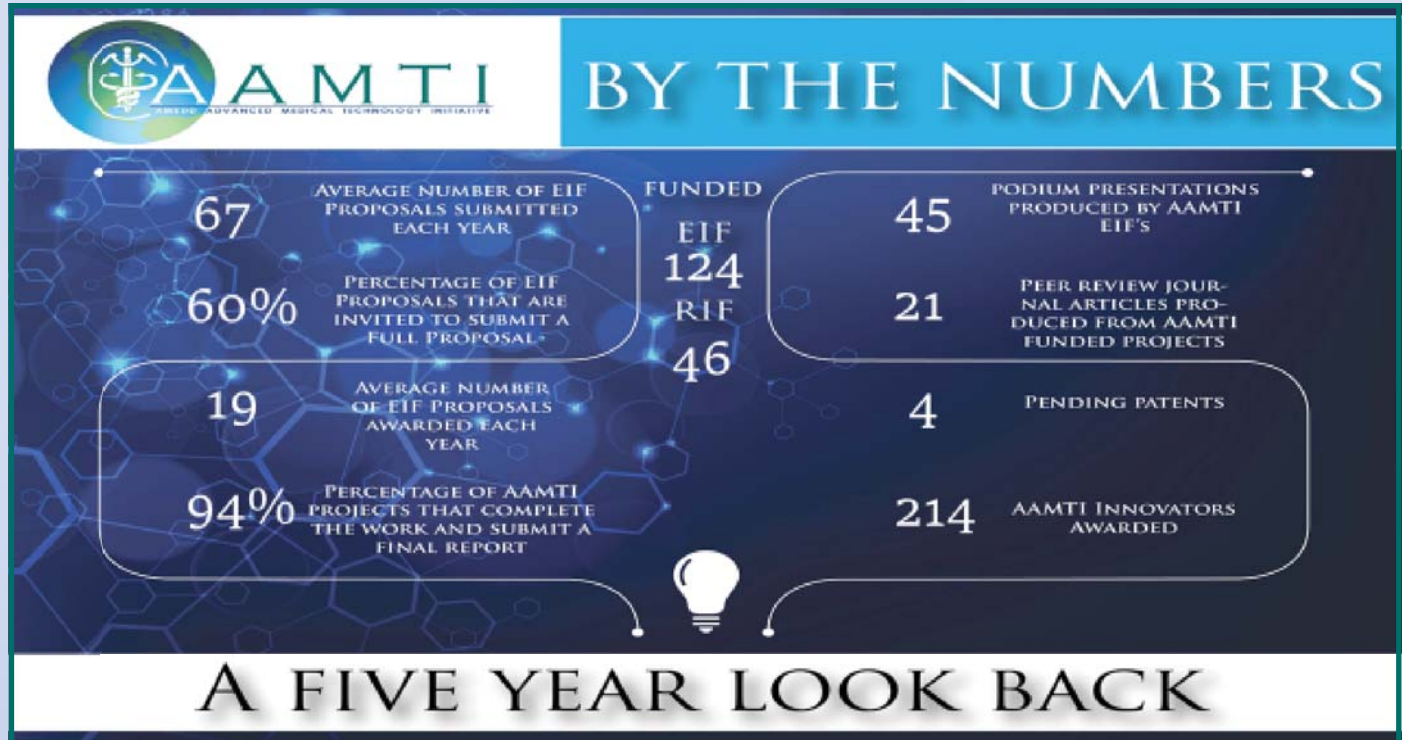
In the last five years, over forty-five podium presentations and technical posters have been presented by AAMTI awardees on AAMTI projects. Additionally, there have been over twenty-one peer-reviewed journal articles produced from AAMTI funded projects, which is extremely impressive considering AAMTI projects are the step before research projects. Finally, there are currently four patents pending for AAMTI awarded projects signaling the impact that the AAMTI program has had by funding AAMTI projects at the forefront of science and innovation.

In addition to sharing knowledge through publications and presentations, Ms. Holly Pavlisca, AAMTI Program Manager, has brought a renewed focus on transitioning successful proofs of concepts to product development teams.



This image shows the location and number of projects the AAMTI program has funded through the Extended Innovation Fund (EIF) in the last five years.

5 Year Lookback continued on page 5

5 Year Lookback *continued from page 4*

COL Donald Goss, Associate Professor and Program Director at Keller Army Community Hospital and the United States Military Academy at West Point, NY stated, "Overall, as a result of AAMTI funding, the Keller Army Community Hospital team has had the opportunity to complete and present their research through 1 invited presentation, 5 platform presentations and 17 poster presentations at nationally recognized conferences. Additionally, they have had 3 abstracts and 3 manuscripts

published in peer-reviewed journals with many more to come. None of this work would have been possible without the AAMTI funding received. The research conducted has informed providers and benefited over 2000 patients in the past 4 years alone. The team is sincerely appreciative of the AAMTI program that has been a true force multiplier for the research team at Baylor University-Keller Army Community Hospital Division 1 Sports Physical Therapy Fellowship." ■■■

**REMINDER****AAMTI FY19****Extended Innovation Funding (EIF) Timeline***

Date(s)	Milestone
11 JAN - 15 APR 2019	EIF Pre-Proposal Submissions are Accepted
1 JUL - 9 AUG 2019	Opening Date for EIF Full Proposal Submissions (By Invitation Only)
30 SEP 2019	EIF Award Notifications

* Subject to change

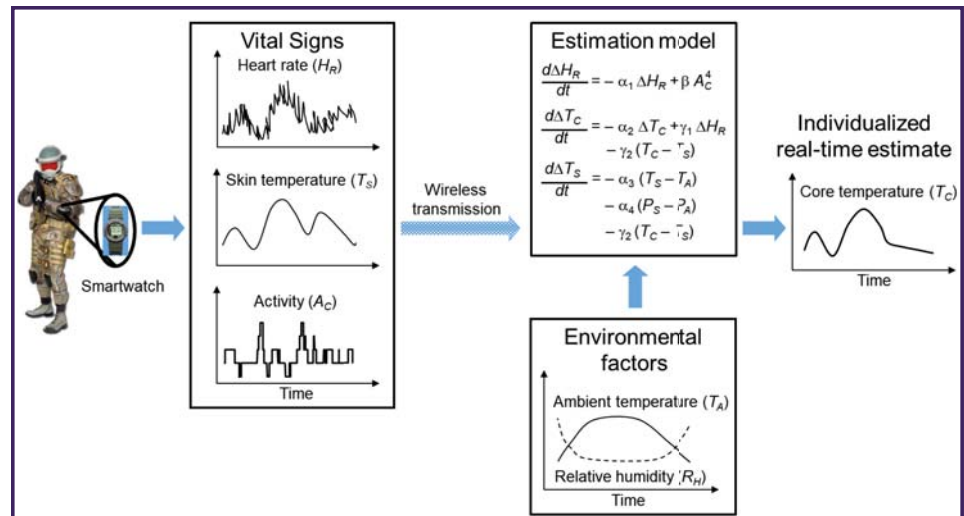
BHSAI's New Algorithm Could Help Reduce the Risk of Heat Injuries

We often overestimate our ability to stay active in scorching weather—hence, our surprise when we hear of people dying of heat stroke during a summer heat wave. Warfighters who take part in military training or combat missions under such conditions face a similar threat, as their risk of incurring heat injury increases (~2000 Service members/year for the past several years).

A marked increase in core body temperature heightens the risk of heat injury. In principle, we could mitigate the risks posed by intense physical activity in hot and humid weather by developing a wearable system that accurately measures core body temperature and alerts the wearer before it increases to dangerous levels. However, such a system has been difficult to implement in practice.

One reason is that core body temperature is difficult to measure accurately. The rectal temperature probe has long been the gold standard. Measurements obtained at other sites (mouth, armpit, etc.) do not accurately reflect the time course of changes in core body temperature; hence, probes placed at such sites are inadequate for alerting the individual in a timely fashion. A major problem of rectal probes, however, is that they are invasive, uncomfortable, and impractical for long-term monitoring in the field.

Fortunately, the increasing power of commercial devices, such as smartwatches, for monitoring physiological measurements, has raised the prospects of developing a non-invasive system that uses



Schematic of BHSAI's AI algorithm to provide individualized estimates of core body temperature in real time, using non-invasive physiological and environmental data.

multiple physiological measurements to estimate core body temperature in real time. What has remained lacking, however, is a mathematical model—simple enough to be computationally efficient, but also powerful enough to account for the large individual differences in sensitivity to heat stress.

In the June issue of the *Journal of Applied Physiology*, a team of scientists from TATRC's Biotechnology High Performance Computing Software Applications Institute (BHSAI), led by Dr. Jaques Reifman and supported by the Military Operational Medicine Research Area Directorate of the U.S. Army Medical Research and Materiel Command, described a model that meets these requirements. The model incorporates a newly developed artificial intelligence (AI) algorithm that uses vital signs from a smartwatch and adjusts the model parameters to estimate an individual's core body temperature. In doing so, the algorithm automatically “learns” how each

individual responds to heat stress.

With multiple collaborators at the Uniformed Services University of the Health Sciences, Sheba Medical Center, Israel Defense Forces Institute of Military Physiology, Tel Aviv University, University of Otago, and University of Pimorska, the BHSAI team used the model to retrospectively analyze core body temperature data for 166 subjects trained under different environmental and exertional heat-stress conditions in three separate studies. They showed that the algorithm could automatically learn how each of the subjects responded under the different conditions. Dr. Srinivas Laxminarayan, a BHSAI staff scientist and lead author of the study, added that, “the new AI system clears the path to develop a practical non-invasive system that will help reduce the risk of heat injury among Service Members.” ■■■

TATRC Deputy Director Speaks at AMSUS on Virtual & Mobile ICUs



LTC(P) Pamplin discussed Virtual ICUs/Mobile ICUs at AMSUS.

LTC(P) Jeremy Pamplin, a critical care medicine physician and TATRC's newest Deputy Director, was a featured speaker at the 2018 Association of Military Surgeons of the United States (AMSUS) Annual Meeting. This yearly, tri-service event was held from 26 – 30 November at the Gaylord National Resort & Convention Center in National Harbor, MD.

LTC Pamplin participated in a discussion entitled "Telemedicine to Reduce Medical Risk in Austere Environments" and focused specifically on Virtual Intensive Care Unit (ICU)s / Mobile ICUs.

The AMSUS Annual Meeting is the only conference where federal health leadership and professionals from the Department of Defense, Veterans Affairs, Health and Human Services, Department of Homeland Security, industry and international partners come together to share results of collaborative efforts and exchange valuable information. Participants are able to learn about innovative medical advances and superior practices in patient care and health administration and connect with others in federal healthcare. ■■■

TATRC Provides Research Transition Support to USSOCOM

On 24 October 2018, Mr. James Beach, Project Manager for TATRC's Medical Intelligent Systems Lab, traveled to U.S. Special Operations Command (USSOCOM) Headquarters in Tampa, FL, to support Mr. Jeff Luciano, the Assistant Program Manager for the Tactical Combat Casualty Care (TCCC) Casualty Evacuation (CASEVAC) program. Mr. Beach assisted in briefing the Joint Medical Exchange of Documentation and Information for Combat Casualty Care (J-MEDIC3) effort to the new Command Surgeon and worked through several other J-MEDIC3 programmatic issues. J-MEDIC3 is a USSOCOM Advanced Development effort, under PM TCCC (CASEVAC), to fulfill requirements identified in the approved USSOCOM J-MEDIC3 Capabilities Development Document, approved on 4 April 2018. This effort is a Defense Health Agency (DHA) funded initiative falling

under the DHA Milestone Decision Authority, Dr. Barclay Butler.

While there, Mr. Beach also demonstrated the Tempus Pro Physiological Status Monitor as a segue to discuss the transition roadmap for USSOCOM virtual health capability from the current capability to the future J-MEDIC3 capability with the Corsium Suite (TATRC's J-MEDIC3 Virtual Medical Portal), and the Battlefield Assisted Trauma Distribution Kit (BATDOK) capability integrated with TATRC's Medical Data Cloud Research project. This demonstration was repeated for USSOCOM J-6 staff that will be assisting with the Risk Management Framework process with significant discussion on the accreditation process that is the most significant barrier to delivery of initial capability.

J-MEDIC3 offers collaborative potential to transition research from DoD

Labs, ranging from TATRC's J-MEDIC3 Virtual Medical Portal, Medical Data Cloud Research, and Augmented Reality Forward Surgical Care, to the Air Force Research Laboratory's BATDOK. Mr. Jeff Luciano highlights "high levels of collaboration within USSOCOM and with the Services is absolutely critical to ensuring fielding of a J-MEDIC3 capability that meets USSOCOM requirements that is also ready for transition to the other Services and the DHA."

Mr. Beach stated, "The J-MEDIC3 is a perfect example of how program managers can leverage research organizations and research investments to deliver military capabilities that are acceptable by end users because of the high-level of engagement with the end user community." ■■■



AAMTI PROJECT SPOTLIGHT

Assessing the Feasibility of a Novel Non-Invasive Sensor for Guiding Wounded Warrior Rehabilitation

As a result of recent combat operations in Iraq and Afghanistan, the Military has been entrusted to care for over 1,700 Service Members and Veterans who have experienced traumatic limb loss, 82.7% of which have been of the lower limb. Beyond the physical and psychological difficulties of adapting to life after limb loss, individuals with amputations are at a higher risk for developing secondary complications, such as joint pain, osteoarthritis, chronic back pain, cardiovascular disease, and phantom limb pain. Optimizing rehabilitation strategies in caring for Service Members with

amputation may not only improve their functional performance, but will also likely mitigate many of these long-term risks. While the Department of Defense has established three Advanced Rehabilitation Centers (ARCs) that specialize in state-of-the-art interdisciplinary rehabilitative care utilizing the latest technology in prosthetics and assistive devices,

further research is needed to help optimize those rehabilitation interventions, particularly as it relates to establishing individualized guidelines for prescribed intensity, duration, and frequency of exercise regimen.

With an AMEDD Advanced Medical Technology Initiative (AAMTI) funded project, a research team within the Center for Rehabilitation Sciences Research located at Walter Reed National Military Medical Center (WRNMMC)

investigated the feasibility of using Near Infrared Spectroscopy (NIRS) sensors to measure real-time muscle oxygenation in a rehabilitation setting. NIRS technology continuously monitors muscle tissue oxygenation via the absorption of the near-infrared light by hemoglobin and myoglobin in the tissue as the light is projected through the muscle. NIRS has been previously validated for use in both laboratory and applied sports settings, and portable NIRS sensors have shown promise as a reliable, non-invasive local measure of oxygen delivery and consumption. Researchers have found that differences in

deoxygenation and reoxygenation times provided by NIRS monitoring can serve as an indication of the training state of an individual and a potential tool to examine the differences in physical fitness of individuals over time as well as the adaptations of skeletal muscle to training. If shown to be feasible and a reliable measure in a rehabilitation setting, it is possible that NIRS devices may be used by clinicians to help monitor and



NIRS Sensor (provided by BSX insight)

guide the scope of rehabilitation for those with lower limb loss during both the acute phases of their rehabilitation and longitudinally.

As part of the current study seeking to identify the feasibility of using NIRS in a rehabilitation setting, twenty

Non-Invasive Sensor

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AAMTI Innovator Recognized at National Competition

Congratulations to an outstanding AAMTI Innovator, CPT Rowan Sheldon MD, Madigan Army Medical Center General Surgery resident, who was the winner of the 2019 American College of Surgeons (ACS) Committee on Trauma (COT) Resident Paper Competition for the all-DoD/VA/Canadian Military for Region 13.

CPT Sheldon's paper was further selected to compete for National COT Resident Trauma Research Paper. His paper is entitled, "An evaluation of a novel medical device versus standard interventions in the treatment of tension pneumothorax in a swine model (*sus scrofa*)" and has also been recognized and presented at the COL Pat C. Kelly Madigan Research Day in Tacoma, WA on 4 May 2018, where it received the Best Preclinical Podium Presentation, and the Society of American Gastrointestinal and Endoscopic Surgeons

/ Society of Military Surgeons symposium in Seattle, WA on 11 April 2018 where it won the Army ACS Committee on Trauma Resident Paper Competition.

This AAMTI funded project was also selected to be presented at TATRC's Annual Open House this past fall.

The impact of this technology is that the intervention with the Reactor Thoracostomy device combines the benefits of the needle thoracostomy while maintaining the efficacy of gold-standard hospital management. As a fast and effective alternative treatment for tension pneumothorax, it presents an opportunity to allow for more complete care of injured soldiers in a far-forward setting.

Congratulations to this exceptional officer and his team of dedicated researchers for their notable contributions! ■■■

Non-Invasive Sensor

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NIRS sensor placement on subject with transtibial amputation.



Clinician collecting data during Single Stage Treadmill Test.

Service Members and Veterans with unilateral limb loss (19 subjects with a transtibial amputation and 1 with a transfemoral amputation) were recruited from WRNMMC between September 2016 and October 2017 for participation. For the one-time clinical session, subjects wore a NIRS sensor on each extremity (secured over the biceps and quadriceps) while they performed two functional outcome measures, the Single Stage Treadmill Test and the Six-Minute Walk Test. Information was obtained from each subject regarding age, gender, height, weight, body mass index, resting heart rate and blood pressure, mechanism and date of injury and amputation, length and

circumference of residual limb, Fitzpatrick Skin Score and Type, and information about current activity level and time spent wearing a prosthesis daily.

Clinicians observed that the NIRS sensor recordings were generally accepted by all subjects and were unaffected by perspiration during physical exertion. Prosthetic fit was unaffected by sensor positioning on the thigh in participants with transtibial amputation; however, there were suspension issues experienced by those with transfemoral sockets. Sensor slippage and loss of skin contact occurred in 40% of participants, however, the majority (95%) of subjects stated that the sensors did not impede their ability to exercise, with 70% of subjects reporting that they would welcome the use of the sensors to track their progress during exercise and rehabilitation. Further, a limitation noted in the technology was the lack of ability to monitor multiple sensors simultaneously because each sensor required the use of an independent mobile device. Therefore, further development is needed to make this technology more readily available for clinical deployment in a busy military rehabilitation unit where therapists are providing group therapy. It is recommended that modifications be made to the system to provide a single dashboard to allow a clinician to monitor multiple sensors simultaneously.

MAJ Matthew Miller, Principal Investigator for this project stated, "NIRS sensors were well accepted among participants and successfully collected continuous SmO₂ data in our patient population with traumatic limb loss. Improvements in the software interface to better allow patients and providers to acquire and track data would further improve feasibility. Future research is warranted to evaluate the changes that occur in SmO₂ longitudinally in patients with traumatic limb loss and subsequently the ability of this data to optimize rehabilitation." ■■■

TATRC Hosts Officers from the Korean Armed Forces Nursing Academy



COL Adam, TATRC's Director, welcomes BG Myoung Ok Kwon to TATRC for an interactive tour and demonstration of our top technologies in Simulation, Unmanned Systems and Robotics, and Operational Medicine.

On Tuesday, 13 November, TATRC had the distinct honor of hosting three senior military leaders from the Korean Armed Forces Nursing Academy for a morning of briefings on our key initiatives and focus areas, followed by an interactive tour and demonstration of our top technologies in the areas of Simulation, Unmanned Systems and Robotics, and Operational Telemedicine.

Upon arriving at the TATRC campus, BG Myoung Ok Kwon, COL Kyoung-hwa Jung, and LTC Yoomi Jung were greeted and briefed by TATRC Director, COL Gina E. Adam, before receiving demonstrations on TATRC

initiatives that included the Medical Intelligent Systems Lab Ms. Rebecca Lee, who spoke on Unmanned Systems & Medical Robotics, and Mr. James Beach, on JMEDIC / Virtual Medical Portal, as well as the Medical Modeling, Simulation & Visualization Lab Manager Mr. Geoff Miller, who gave a hands-on demonstration of Augmented Reality and Medical Modeling & Simulation Applications.

This visit provided a unique forum for the Korean Officers to learn more about the technological innovations being researched at TATRC and to introduce new topics and discuss potential joint efforts.

Team TATRC appreciated the opportunity to exchange ideas and share common interests in the field



Ms. Rebecca Lee, Project Manager for TATRC's MISL, demonstrates research in Unmanned Systems and Robotics.



Mr. Geoff Miller, TATRC's MMSV Lab Manager, provides a hands on look at current research being done in Simulation.



Mr. James Beach, Program Manager within TATRC's MISL, discusses capabilities in Operational Medicine.

of military medicine and technology with our Korean colleagues. ■■■

FY19 Virtual Health Research Task Area Awards

This fiscal year is the first year that the newly established Virtual Health (VH) Research Task Area is able to support research proposals with Army S&T funding. Because this is the flagship year for this opportunity, only intramural projects from 3 research labs: TATRC, the U.S. Army Institute of Surgical Research (USAISR) and the Walter Reed Army Institute of Research (WRAIR) were awarded. Future funding will also have opportunities for extramural participation.

4 distinct research projects have been funded and have already commenced, or will be starting by 1 January 2019. They are:

- Use of Augmented Reality Concepts to Deliver Critical Care in a Prolonged Field Care Environment is a research project that will be led by USAISR.
- Emerging Cybersecurity and Communication Solutions to Achieve Remote, Semi-Autonomous Patient Monitoring (PMS) in the Future Battlespace is a research partnership between TATRC and the United States Army Cyber Battle Lab.
- Collaborative, Multi-Domain Medical Modeling, Simulation and Visualization Environment (MSVE) for future Virtual Health solutions in Multi Domain Battle (MDB) is a research partnership between TATRC and WRAIR.
- Research Roadmap: (VH) Establishing Virtual Health Foundational Concepts in a Future Multi Domain Battle (MDB) via Systematic Analysis is another research partnership between TATRC and WRAIR.

Ms. Jeanette Little, who serves as the Capability Area Manager for the new Virtual Health Research Task Area is excited about the foundational work these intramural efforts will provide to the research portfolio. "These four proposals were vetted by an external peer review team and an internal Virtual Health Steering committee prior to being selected for funding. They focus on identifying common ground with other government, academic and industrial research efforts, modeling and visualizing the future multi-domain needs, ensuring that semi-autonomous patient monitoring considers the consequences of cyber vulnerabilities and electronic warfare and how virtual reality can augment care."

All of these research projects will provide key foundations and knowledge products that will help direct the future of virtual health tools, techniques and best practices. ■■■

FOBOTS3S: A New Air Force Research Partnership in 2019



FOBOTS3S to utilize tele-ophthalmology to improve and extend ophthalmic trauma in remote deployed environments. (U.S. Army Reserve Photo by Sgt. Stephanie Ramirez)

In FY18, TATRC was invited to partner with the United States Air Force Ophthalmology Element Leader at the Warfighter Eye Center in Joint Base Andrews. Key senior staff from TATRC's Mobile Health Innovation Center (mHIC) worked with Maj William G. Gensheimer, MD to develop a successful proposal entitled, "Forward Operating Base Ocular Trauma Triage and Stabilization (FOBOTS3S)." This exciting application was approved for funding by the 59 MDW Chief Scientist's office on 1 October.

The research project addresses a gap in virtual health; during Operation Iraqi Freedom and Operation Enduring Freedom, 10-15% of combat-related trauma injuries involved the eye. There is currently limited access to ophthalmic care at forward operating bases. Currently in the military, there are three primary methods for obtaining tele-ophthalmology support. In ocular emergencies or time-sensitive cases, first responders and point-of-care providers at Role 1 or 2 call and speak directly with physicians at Role 3, which may include an ophthalmologist.

The research project hypothesis is that tele-ophthalmology will greatly improve and extend ophthalmic trauma care in remote deployed environments.

The goals and objectives of this research project are to:

1. Evaluate and test image acquisition and communication devices for use in military tele-ophthalmology
2. Develop a secure mobile tele-ophthalmology application
3. Develop a standardized and reproducible protocol for utilizing tele-ophthalmology
4. Assess the cyber and data security of tele-ophthalmology acquisition devices and communications devices
5. Create a tele-ophthalmology training program for military ophthalmologists

The project funding is expected to be awarded in early Spring this year, and the TATRC mHIC team is looking forward to establishing closer research ties with the Air Force through this effort. ■■■

MISL Says “Aloha!” from Hawaii during Island Marauder Exercise

This past Fall, team members from TATRC’s Medical Intelligent Systems Lab (MISL) traveled to Oahu, Hawaii, where they performed training, network integration, and testing of telemedicine systems in support of the *Island Marauder* exercise. This exercise was a continuation of initial testing that was done at the *Bold Quest* Exercise at Fort Stewart, GA in October of 2017, where the lessons learned proved to be invaluable for the success of the Island Marauder Exercise. At both of these events, TATRC personnel participated in transport telemedicine final integration, flight electromagnetic interference (EMI) validation, and flight testing through sponsorship of the Program Manager, Aviation Systems (PM AS). The research objective was to characterize and evaluate the telemedicine capabilities supported by the Iridium Satellite Radio system and Cellular Radio Systems. During the evaluation periods, TATRC staff assisted with conducting teleconsultations and tele-mentoring sessions using these systems to connect flight medics in a UH-60 helicopter with telemedicine evaluation personnel on the ground at Wheeler Army Airfield and Emergency Room personnel at Tripler Army Medical Center (TAMC). Evaluation of PM AS’s AeroMednet network, which supports medical communications and off-boarding of patient medical information from the MEDEVAC aircraft, was also conducted.

Mr. Larry Markins, Field Support Engineer, Ms. Tee Dockery,



An exercise during the Island Marauder testing where personnel on the ground tested telemedicine capabilities between their teams and the flight medics aboard UH-60 helicopters to support medical communications and off-boarding of patient medical data.

Software Engineer, and Ms. Teresa Guthrie, Project Officer represented TATRC’s MISL at the exercise. While there, each had a unique and specific role which was to assist with training and integration, and support flight operations for the TEMPUS-Pro patient monitor and tele-mentoring telemedicine system and the AeroMednet Ground-to-Air-to-Ground tactical network. They also provided training to the flight medics for filling out the electronic Tactical Combat Casualty Care (TC3) card on the Army NETT Warrior End User Device (EUD), using the BATDOK application developed by the U.S. Air Force Research Lab (AFRL) and the SensoTOUCH platform from VitalTech Affiliates LLC, with whom TATRC has a Cooperative Research and Development Agreement. This EUD was not evaluated in flight because it does not currently support real-time transmissions of patient data, but feedback was collected to

aid future design and programming decisions for both technologies.

During the exercise, the AeroMednet and inflight communications systems performed very well with the TEMPUS-Pro system and had no loss of communications during flights that covered the entire island of Oahu. Breathtaking aerial photographs of the north shore of the island were able to be transmitted with no problems to the MISL personnel sitting indoors in the hangar. Using the 3G cellular network, transmission of vital signs and estimated time of arrival from the MEDEVAC aircraft and telemedicine consultations from Wheeler and TAMC were achieved successfully.

Ms. Tee Dockery, MISL Software Engineer stated, "It was very helpful to get direct feedback from the flight medics. Their specific and invaluable insights will assist us greatly in the future developments for this technology." ■■■

TATRC Partners with PEO Aviation to Test AeroMednet at Network Integration Exercise 18.2

TATRC's Medical Intelligent Systems Lab (MISL) sent a team of four personnel to participate in the Army's Network Integration Exercise (NIE) 18.2 in partnership with Program Executive Office (PEO) Aviation at Fort Bliss in El Paso, TX this past Fall. TATRC's purpose at the exercise was to perform research data collection of the ability of PEO Aviation's AeroMednet to support off-boarding of medical telemetry. The TATRC team consisted of Mr. Larry Markins, Mr. James Beach, Ms. Teresa Guthrie, and Ms. Tee Dockery. TATRC was able to leverage the AeroMednet capabilities to inform ongoing characterization of tactical radio system's ability to support exchange of medical telemetry, patient documentation, medical imagery, audio, and video. In addition, TATRC performed data collection efforts on the SensoTOUCH mobile medical sensor platforms with combat medics located at the C Company, 82nd Brigade Support Battalion and K Company, 508th Parachute Infantry Regiment.

TATRC personnel provided technical support for the integration of research capabilities into the network, performed Soldier training, and collected research data. Several other systems, such as BATDOK from the U.S. Air Force Research Lab, the Tempus Pro Physiological Status Monitor, and the U.S. Army Medical Materiel Development Activity's MEDHUB program were all integrated into the AeroMednet to conduct network analysis and capability testing of Trellis Ware's TSM Radio Waveform to support bi-directional medical exchanges. TATRC personnel also provided support to the MEDHUB program by providing networking and technical support at the medical company's ground station. These capabilities allowed for the medical personnel to prepare an appropriate response for the incoming casualties with informed medical situational awareness that included treatment performed and medications provided at Role I and during the helicopter flight.

At the medical company's ground station, the C Company, 82nd Brigade



C Company medics offloading a patient from a UH-60 MEDEVAC aircraft at Fort Bliss during NIE 18.2.

Support Battalion's Physician Assistant and senior medics were able to monitor and prepare for incoming casualties with the medical information sent from the helicopter through the AeroMednet. They reviewed the Tactical Combat Casualty Care Cards captured at the Point of Injury on the BATDOK system and sent them through the AeroMednet to an MC4 AHLTA-T laptop. They also monitored the casualties' physiological status sent from the Tempus Pro physiological status monitor. In addition, medical personnel used the MEDHUB's big board casualty notification information to obtain data on the patients' vital signs and ambulatory status.

While performing data collection efforts during the scenario, both Ms. Tee Dockery and Ms. Teresa Guthrie had the opportunity to observe K Company's operations to defend a village from enemy capture attempts. The air and ground operations also involved AH-64 Attack Helicopters and UH-60 Utility Helicopters. During the operations, Ms. Dockery and Ms. Guthrie were able to observe the medics performing simulated tactical combat casualty care and evacuation of the patients. The K Company medics used BATDOK during the operations to perform

patient care documentation and exchanged this information with the MEDEVAC flight medics using BATDOK's Near Field Communications and QR (Quick Response) code capabilities. Mr. James Beach, MISL Project Manager, added that "exposure of our personnel without military experience to operations at the tip of the spear is vital to ensuring our personnel understand the pre-hospital environment, which is the major focus of the operational telemedicine research."

Ongoing TATRC participation in military exercises provides unique opportunities to capture information about military utility of various capabilities and to evaluate different capabilities in operational environments that include tactical radio networks. This information is used to help inform and shape research and development efforts with direct input from personnel that will ultimately use the capabilities arising from these efforts. This bottom-up design approach ensures that potential transition and advanced development and program offices have the necessary information (knowledge products) to develop capabilities acceptable to the end-user. ■■■

Employee Spotlight

TATRC Welcomes New Senior Health IT Administrator

Godwin Odia, PhD is a retired Captain in the Commissioned Corps of the U.S. Public Health Service (USPHS). Prior to transferring to the USPHS, he served in the United States Army Reserve and the United States Army. His past professional experience includes several Health Information Management positions with the U.S. Army across the United States and in the Middle East, such as Director of Health Information Management, Electronic Health Record Implementation Specialist, Privacy Officer and Health Record Consultant with the Indian Health Service, both at its Maryland headquarters and across the country, HIPAA Implementation Specialist, Office for Civil Rights, U.S. Department of Health & Human Services, Washington, DC, HIPAA Compliance Officer, TRICARE, Washington, DC and Program Analyst for the Health Resources and Services Administration in Rockville, Maryland.

Most recently, he served as the Technical Director for the Centers for Medicare & Medicaid Services, in the Center for Medicaid and Children's Health Insurance Program, Data and Systems Group where he led the implementation of ICD-10, which is the 10th revision of the International Statistical Classification of Diseases and

Related Health Problems, a medical classification list by the World Health Organization, across the States Medicaid Agencies.

He received his initial health record and health administration training at the U.S. Army Academy of Health Sciences, Fort Sam Houston, Texas after graduating with a Bachelor of Science degree from Southern University, New Orleans. Other academic trainings include a Post Baccalaureate Certificate in Health Information Administration Northeastern University, Boston, a Masters in Public Administration (MPA) and a Masters of Business Administration (MBA) with a concentration in Health Care Management from Western New England University, Springfield, Massachusetts and a Doctor of Philosophy (PhD) degree in Health Science from Trident University (formerly Touro University International), Cypress, California. He is a Registered Health Information Administrator with the American Health Information Management Association and a licensed Nursing Home Administrator in the State of Massachusetts. He is a fellow of the 2015 National Institutes of Health Fellowship in Health Informatics, National Library of Medicine.

Dr. Odia is an Associate Professor in Health Informatics at the University of Maryland University College, and a contributing faculty member in



Dr. Godwin Odia, Senior Health IT Administrator

Health Informatics at Walden and American Military Universities. He is a recipient of numerous Uniformed Services and civilian agency awards and a 2008 graduate of the Federal Interagency Institute for Healthcare Executives.

Dr. Godwin Odia will serve as the new Health IT Administrator / Researcher for TATRC's Health Technology Innovation Center and will be supporting TATRC research in the areas of telemedicine, medical informatics, health information management, electronic health records, and health information technology.

He is excited to be here and looks forward to making his own contributions to the mission of TATRC in the months, and years ahead.

Welcome to the team, Dr. Odia. We're thrilled to have you here at TATRC. ■■■

TATRC Welcomes new IT Support Specialist at the Fort Gordon Office

Mr. John “Eric” Smalls joined TATRC’s Mobile Health Innovation Center (mHIC) at Fort Gordon as an IT Support Specialist with specific duties in Network and System Administration with the Geneva Foundation. Immediately prior to joining TATRC, Eric worked as the Lead Training Manager and Training Instructor for the U.S. Army Special Operations Command at Fort Bragg, North Carolina.

Mr. Smalls is a retired Army veteran with over 21 years of active duty service. His military positions include the Operational SGM for the U.S. Army Signal School (Fort Gordon), Senior Leaders Course Branch Chief for Cyber Center of Excellence Non-Commissioned Officer Academy (Fort

Gordon), Information Services Branch Chief G6/XVII Airborne Corps (Fort Bragg) and Brigade Information Technology Chief BDE S6/U.S. Army Special Operations Command (Fort Bragg). He has had multiple combat tours worldwide including support of Operation Joint Guard / Joint Endeavor and Operation Enduring Freedom / Iraqi Freedom.

Eric holds a Bachelor’s Degree in Technology Management from Excelsior College and is currently pursuing a Master’s of Science degree in Cyber Security.

Mr. Smalls is a native of Augusta, Georgia. He and his wife Latonya have 4 children ranging in age from 4 to 20, keeping them both very busy. Eric has a passion for college football and enjoys



Mr. John “Eric” Smalls, IT Support Specialist

expanding his personal knowledge of finances in his free time. He is also a proud member of Iota Phi Theta Fraternity.

He comes to work with a smile and an enthusiastic, “can do” attitude each and every day and is a ray of sunshine in the TATRC mHIC office.

A warm and sunny welcome to Mr. Eric Smalls! ■■■

New TeleHealth Manager Joins TATRC’s Virtual Health Support Office

TATRC is pleased to announce the arrival of Ms. Mary Bechtel, who joins the team as a Telehealth Manager, and will be supporting various initiatives and activities within the Virtual Health area under the direction of Dr. Francis McVeigh.

Mary was born in Washington, DC and raised in Southern, MD. She enlisted in the United States Air Force after high school and also spent time in the Air National Guard at Andrews AFB.

Mary earned a BS degree in computer science from the University of Maryland and continued her studies to earn a MS in Telecommunications from



Ms. Mary Bechtel, TeleHealth Manager

John Hopkins School of Business.

Mary spent much of her career working in the corporate sector for General Electric Information Services, Hughes Network Systems, and various government consulting companies.

In the past few years she worked as a Project Manager with SRA, for the

Congressionally Directed Medical Research Programs, and learned more about Combat Casualty Care research, as well as other research programs such as spinal cord injury, and Alzheimer’s Disease.

Mary was fortunate to also spend time in her most recent position working with the Defense Health Agency as a contractor gathering requirements for the Medical Logistics Community.

She is very excited to be joining TATRC to work on virtual health initiatives. As a Veteran, Ms. Bechtel feels that getting the chance to work with technology combined with military medicine, is an ideal position.

Her personal interests involve spending time with her 16 year old son, hiking, camping, and going on adventures together. She also is a member of CrossFit Frederick and enjoys the challenge of their structured workouts.

The TATRC Team Welcomes Ms. Mary Bechtel! ■■■

Employee Spotlight

Congratulations to Ms. Lori DeBernardis, TATRC's Q1 Employee of the Quarter

TATRC's Director of Marketing and Public Affairs, Ms. Lori DeBernardis has been named TATRC's Q1 Employee of the Quarter for her stellar support to the entire TATRC organization. Ms. DeBernardis manages all of TATRC's strategic messaging, supporting our scientific presentations, coordinating VIP tours, crafting thematic video messages, managing the TATRC Times quarterly newsletter, or the organizational web site and all of our social media platforms. Ms. DeBernardis has an active role in all of it.

One of TATRC's largest events of the year is the TATRC Technology Open House, which is coordinated and managed by Ms. DeBernardis. Shaping and organizing this intensive event

that includes over 55 scientific displays and demonstrations, is a herculean effort. Ms. DeBernardis manages and has overall oversight of the entire event to include the initial marketing communications all the way through transforming the TATRC PITLAB to an operational field environment that showcases the organization's unique and critical role in helping our Warfighters on and off the battlefield. She is a master planner with exceptional organizational skills and is able to consistently coordinate all of this each year, to pull off the event seamlessly. It's an event that is lauded by all of our distinguished participants.

Lori always has a positive, professional attitude, exhibiting impeccable customer service and people skills. She is an exemplary



Ms. Lori DeBernardis, Director of Marketing & Public Affairs is the Employee of the Quarter for Quarter 1.

employee and leader to her team and she is highly deserving of this recognition.

Congratulations Lori De! ■■■

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or call 301.619.7927

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To Subscribe and be added to our mailing list, please e-mail Lori DeBernardis at: lori.a.debernardis.ctr@mail.mil

TATRC Revisits Tracking Battlefield Casualty Care through Joint mHIC/MISL SBIR

TATRC is excited to announce the launch of two new Small Business Innovation Research (SBIR) projects to address tracking combat casualty care in the pre-hospital setting. TATRC's "Patient Transportable Tactical Combat Casualty Care Capability" SBIR is aimed to finally solve a decades old problem... tracking casualty care documentation on the battlefield.

The Military Health System requires a persistent, durable, non-paper patient transportable tactical combat casualty care documentation capability for transport and transfer of medical care information into the currently fielded Department of Defense electronic health record in the absence of a reliable communications link. This technology would enable the facilitation of medical information exchange, thereby improving clinical outcomes.

Studies show that the loss of medical information in the pre-hospital environment is significant and trauma patients' outcomes are directly impacted by failures in communications. Dr. Frank Butler, Chairman, DoD Committee on Tactical Combat Casualty Care, highlighted in the Tactical Combat Casualty Care Update 2009, that less than 10% of the 30,000 casualties in Iraq and Afghanistan had any form of documentation in their records. He also further stated that only 1% of the patients have sufficient pre-hospital documentation.

During the early 2000s, with the first deployment during Operation Iraqi Freedom, the Army put significant effort into an electronic medical documentation storage capability called the Electronic Information Carrier (EIC). This electronic storage capability in SD-card format, was meant to be worn with a Soldier's dog tag, as a component of the then Theater Medical Information Program. Although the EIC concept was innovative in many ways, and won the Army's Greatest Invention Award in 2004, several problems doomed it to failure. Problems arose such as issues with the then, emerging Bluetooth technology not connecting quickly, austere environmental factors that significantly degraded the capability (e.g. corrosion of the EIC contacts), and significant cybersecurity issues with Soldiers constantly having sensitive data on them in a deployed environment, were deemed insurmountable and the "digital dog tag" program was discontinued.

With the new "Patient Transportable Tactical Combat Casualty Care Capability" SBIR, TATRC is seeking to develop a capability that will allow for the transfer of

patient information through a persistent and durable mechanism that can be easily maintained with the patient. This mechanism will feature a minimal risk of loss of the information or the medium on which it is conveyed.

Two companies were awarded contracts under this SBIR. Vivonics Incorporated, of Bedford, MA was awarded for their NFC-based Persistent Access to Tactical Casualty Health (PATCH) solution. Per Senior Engineer, Dr. Ryan Myers, "Through prior involvement in combat casualty care technologies, Vivonics appreciates the need for more effective communication of casualty health information from point-of-injury through the subsequent Roles of Care. We are eager to be contributing to the solution with our PATCH system, which builds upon and complements our family of wearable point-of-injury medical systems and digital health solutions for military and civilian applications."

Additionally, Cambridge Research & Development, Inc. of Nashua, NH was awarded a contract for their point-of-care temporary tattoo printer, "Patient Transportable Tactical Combat Casualty Care Documentation Capability" concept. "We are always engaged and proud to work with TATRC on research that has the potential for positively impacting the lives of our Warfighters. Solving the TC3 problem is a perfect example of how public and private entities can work together to make immediate and direct impact," Ken Steinberg, CEO of Cambridge R&D stated. Both of the firms presented profoundly innovative and diverse approaches to getting after this problem set.

This SBIR presents the first official cross-lab intramural SBIR effort for TATRC's Mobile Health Innovation Center (mHIC) and Medical Intelligent Systems Lab. Mr. Ron Yeaw, who is the SBIR COR and the Deputy Lab Manager for the mHIC Lab, is excited about the potential these projects offer. "A definitive way to solve the tracking of combat casualty triage documentation across the continuum of care has been a holy grail of military medicine since the inception of war itself. The problem space, technology, and solution sets being offered are perfectly aligned within TATRC's wheelhouse."

All SBIR Phase 1 efforts are 6 month, \$150,000 efforts. Those Phase 1 efforts that show true promise may submit for a supplemental Phase 2, two year grant worth \$1,000,000. For more information about the U.S. Army SBIR program, please visit <https://www.armysbir.army.mil/>. ■■■

Science Director's Corner

How do TATRC's Science Efforts relate to Defense Secretary's frequently asked question, 'What does your line of effort contribute to Warfighting?'

by Dr. Francis L. McVeigh

We at TATRC take the Secretary of Defense's question very seriously and have internalized the Secretary's question in all that we do. Before proposing new efforts and/or evaluating ongoing work, we dive deeper and ask ourselves a more specific question, "How do TATRC's knowledge and materiel products increase the Warfighters' lethality, will, and readiness?"

Before giving examples of TATRC's efforts, I want to cite a few definitions that will help explain the type of work that TATRC does.

'Science' can be defined in many ways, but I have chosen the following definitions of Science: a branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws. A methodology for increasing understanding.

'Research' - The Department of Education and Training defines research as follows: the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes.

'Evaluation' - 1) focuses on programs vs. populations, 2) improves vs. proves, 3) determines value vs. stays value-free and 4) happens in real time. In light of these 4 points, evaluations, when carried out properly, have great potential to be very relevant and useful for program-related decision-making.

'Integration' - bringing together the component sub-systems into one system (an aggregation of sub-systems cooperating so that the system is able to deliver the overarching functionality) and ensuring that the sub-systems function together as a system, and in information.

'Test and Evaluation' - Test & Evaluation (T&E) is the process by which a system or components are compared against requirements and specifications through testing. The results are evaluated to assess progress of design, performance, supportability, etc.

IAW T. Beney (2011), Research and evaluation are characterized by similar features that center on the shared objective of answering a question. However, it is important to distinguish between the two disciplines by explaining that the purpose of evaluation is essentially to improve the existing program for the target population, while research is intended to prove a theory or hypothesis. Although both use similar data collection and analysis methods, the two disciplines diverge again during use and dissemination. Research is intended to increase the body of knowledge on a particular issue; any subjective opinion limits the researcher's credibility. On the other hand, evaluators must balance the need to remain objective and the expectation to make recommendations for stakeholders. Evaluators must determine what information is valuable, what method is best for data collection, how to analyze the data, and how to relay findings to stakeholders. This requires interpretation and a certain level of judgment by the evaluator that is absent from the role of the traditional researcher.

Daniel L. Stufflebeam, Ph.D., a noted evaluator, captured it succinctly: "The purpose of evaluation is to improve, not prove³." In other words, research strives to establish that a particular factor caused a particular effect. For example, smoking causes lung cancer. The requirements to establish causation are very high. The goal of evaluation, however, is to help improve a particular program. In order to improve a program, program evaluations get down-to-earth. They examine all the pieces required for successful program outcomes, including the practical inner workings of the program such as program activities.

TATRC as a hybrid organization, uses various scientific approaches to address the Secretary of Defense's question, such as, research, evaluation, and integration. This

TATRC's Science Efforts

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TATRC's Science Efforts

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combination and merging of approaches brings strength and value to the Warfighters by analyzing the same and different challenges in a myriad of ways. This approach enhances the likelihood that the end products will be meaningful and most importantly, put into the Warfighters' hands sooner.

Some of the completed, ongoing and future targeted TATRC outcomes that are aimed at increasing lethality and readiness are as follows:

- Offsetting low level medical decision making and monitoring to enable Soldier-medics to focus more on other Soldier duties.
- Enable evacuation of casualties increasing OPTEMPO of unit, thus clearing the battlefield for maneuver elements through the use of unmanned systems and other modalities.
- Rapid return to duty, by treating Soldiers with more knowledgeable medics and not evacuating unnecessarily thus keeping more Soldiers in the fight, (one way to accomplish this is by providing clinical decision support tools throughout the battlefields).

- Enhance medics' ability to treat multiple patients faster, keeping other medical assets in the fight (an example how to do this would be by using sensors and capabilities that allow you to simultaneously monitor multiple patients' vital signs).
- Developing models and simulate medical training in an effort to standardize the training and evaluate its effectiveness. Developing simulation models for individual and teams' tasks in complex environments, like multiple domain operations, and integrating into their work domain artificial intelligence (AI) driven clinical decision support, machine learning, robotic assistance and unmanned systems.
- Development of models and AI algorithms for preventing non-battle injuries, optimizing and enhancing Soldier performance and optimizing casualty care.

TATRC uses many different scientific approaches to tackle the myriad of multi-domain operations' complex challenges. Make no mistake -- TATRC's intent is to produce knowledge and materiel products that contribute to making the Warfighters more lethal and ready. ■■■

This Quarter's TATRC TRIVIA...



Question: *This mobile app won the 2010 Army Greatest Inventions Award for its HIPAA-compliant design that allowed for secure communication between our Warfighters, doctors and third parties. What is the application called? HINT: Our Mobile Health lab continues to make strides using this fantastic technology.*

Answer to Last Issue's TATRC TRIVIA...



Question: *This year's 4th Annual Open House had record breaking numbers and surpassed all previous years. Can you guess how many participants signed up and registered for this year's event?*

A: *TATRC's 4th Annual Open House drew in a record breaking 414 Registered Guests!*

Research, Development, & Evaluation of a Simulated Theater Cloud-based Architecture Supporting Multiple EHR Systems

At the end of FY18, TATRC's Medical Intelligent Systems Lab (MISL) successfully completed its research of a JPC-1-funded three-year Medical Cloud Connectivity for Combat Casualty Care (MC5). MC5 supported a number of related projects all aimed at enhancing the support to the Combat Medic generating and making available to deployed medical treatment facilities an electronic DD 1380 /Tactical Combat Casualty Care (TCCC), which facilitates tele-consultation between the Combat Medic and the Advanced Medical Provider. These projects included:

Phase I

- Support for the Air Force Research Laboratory's BATDOK (Battlefield Assisted Trauma Distribution Kit)
- Support for the Medic Smartphone Project
- Support for the Cross Domain Project
- Distribution Observation Kit) medic casualty tracking and trending application
- Research, development, and evaluation of an Enterprise & a Tactical Cloud environment
- Research and evaluation of the Health Assessment Light Operations (HALO) application
- Research, development, and evaluation of electronic DD 1380 compression algorithm
- Research and evaluation of transmitting electronic DD 1380 across Iridium satellite phones
- Research and evaluation of Tempus Pro in a large scale USMC RIMPAC Exercise
- Research and evaluation of BATDOK in USMC International Bold Alligator Exercise
- Research and evaluation of 4G LTE for Point of Injury and Role 1 support
- Research and evaluation of Secure Wi-Fi for Role 2 and Role 3 facilities

Phase II

- Research and evaluation of the Combat Medic Data Cloud (CMDC)

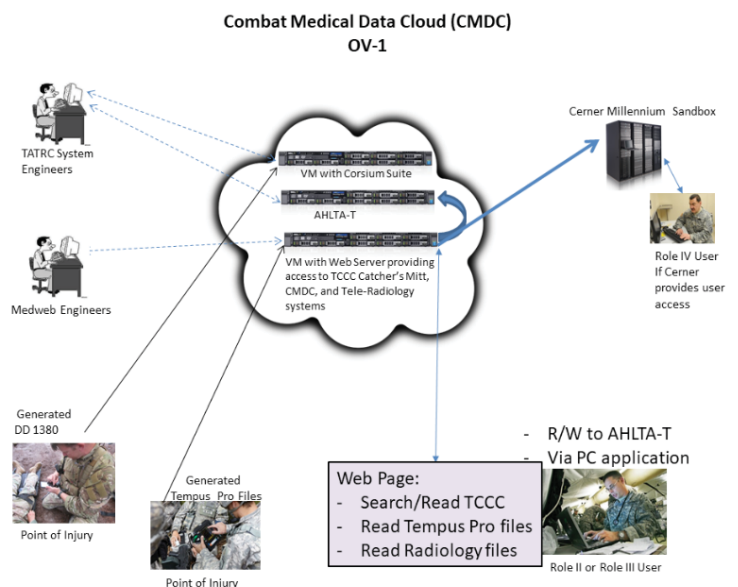
Phase two of the MC5 project was initially planned to develop a prototype simulated Theater cloud-enabled MHS Genesis architecture using tactical communications and to conduct a field evaluation to see how well MHS Genesis would work in the tactical field environment. Unfortunately, TATRC was unable

to acquire a copy of the MHS Genesis system and had to seek to an alternative solution which led to the research, development, and evaluation of a prototype cloud-based architecture that would support multiple Theater-based electronic health record systems (EHRs).

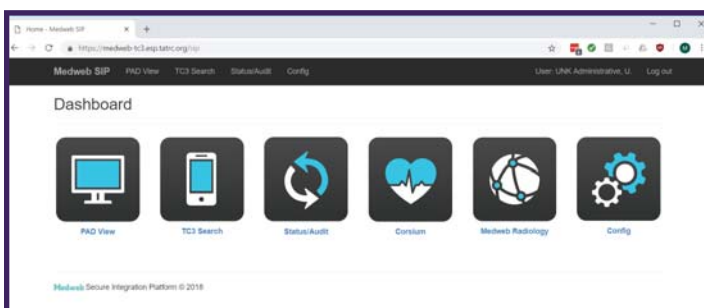
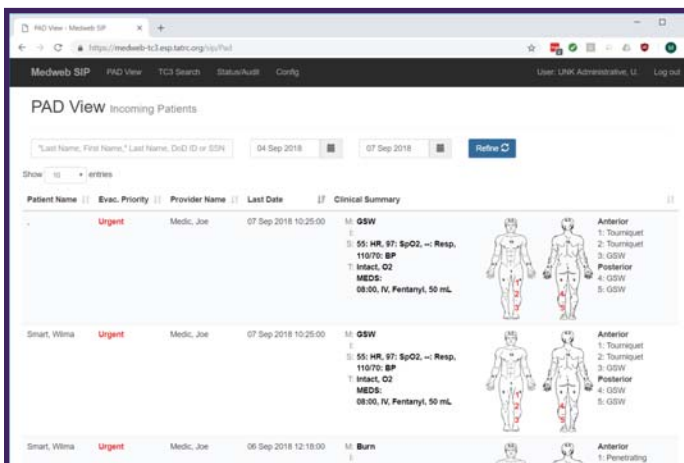
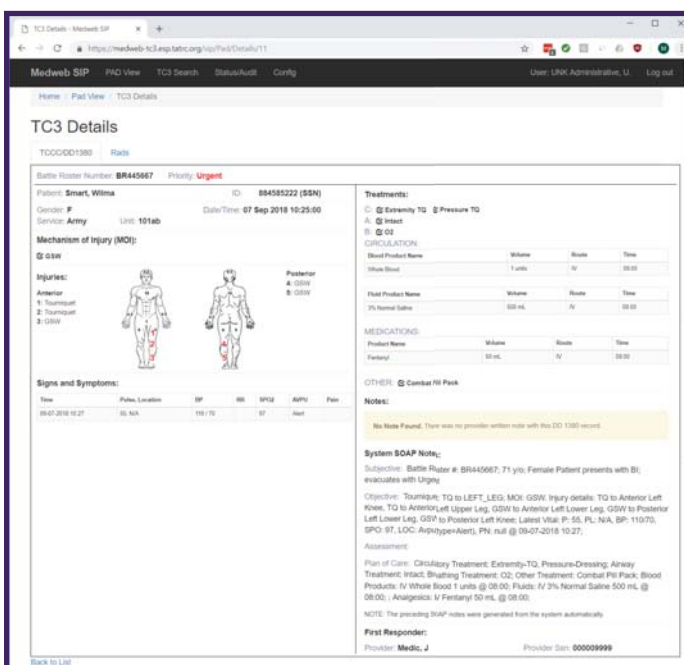
TATRC, working with Nexsys Electronics, Inc., researched, designed, developed, and field-evaluated a solution which addressed the gaps for a multi-EHR cloud architecture which supported various TATRC EHR related projects called the Combat Medical Data Cloud (CMDC). The CMDC was built on the existing core infrastructure of the contractor's Tele-Radiology system in order to have the system "accreditation ready" when complete. The CMDC supports a variety of functions to include:

A central web page where users can access any of the cloud-based applications.

Design and develop a digital DD 1380 /TCCC Card Catcher's Mitt to receive digital TCCC cards from the three DD 1380 / TCCC application developer's TATRC is working with: TATRC/MC4, Joint Operational Medicine Information Systems (JOMIS), and Air Force Research Lab.



Once the electronic DD 1380 is passed to the Catcher's Mitt application, the application places the data into its database where it is later parsed so that it is in a digestible format for the AHLTA-T and the Cerner Millennium Sandbox to ingest. Additionally, if a casualty has radiology images in the Tele-Radiology system, those images are accessible from the Catcher's Mitt through a tab that is displayed.

**Tempus Pro device****Home page that a user sees when logging in to the CMDC user interface at a deployed MTF.****Patient Administrator (PAD) view, which includes summary data and an injury location diagram for all incoming casualties. This view would give administrators and clinicians at deployed MTFs a quick but comprehensive view of incoming casualties, with the ability to drill into more details as needed.****The detailed view displays is a concise "side by side" view of the TCCC card so the entire card can be seen on screen without scrolling or clicking through tabs.**

In order to use the Tele-Radiology system as the basis for the CMDC, the Tele-Radiology system needed to be converted to a cloud-based architecture.

The third cloud-based application is the Remote Diagnostic Technology (RDT) Ltd, Corsium Suite, which enables advanced medical providers access to view any of the Tempus Pro devices that are in use at the time where the Tempus Pro device is transmitting to the Corsium Suite. Providers can view multiple devices at a time, or multiple providers can access the same Tempus Pro device for a group consultation.

The CMDC infrastructure not only supports these cloud-based systems, but it is easy to add additional web applications to the cloud and have them accessible as well.

Lastly, the CMDC has a variety of specialized utilities that provide detailed tracking of the data being pushed into the AHLTA-T or Cerner Millennium Sandbox, as well as user access management.

Mr. Tom Bigott, Project Manager from MISL stated, "The overall Combat Medical Data Cloud provides an easy to use interface simplifying the end user's requirements for accessing numerous web based applications in the cloud. Based on the

success of this project, an additional project was funded by JPC-1 to develop a secure tactical medical data cloud."

TATRC's MISL is currently in the process of transitioning this project to the JOMIS program office. ■■■

USAARL Trains TATRC on Using an Environmental Factors Data Acquisition System



Ms. Rebecca Lee (left), MISL Project Manager aboard the UH-60 during EFDAS training in Fort Rucker, AL.

Can Unmanned Vehicles be made safe for evacuating combat casualties from hostile environments? That is the question which prompted ongoing collaboration between TATRC and the U.S. Army Aeromedical Research Laboratory (USAARL) in research aimed at developing methods for measuring environmental factors that could affect patient safety onboard unmanned ground and air systems. Last Fall, Mr. Nathan Fisher and Ms. Rebecca Lee of the Medical Intelligent Systems Lab traveled to Fort Rucker, Alabama to receive training on the Environmental Factors Data Acquisition System (EFDAS). This system was developed under a JPC-6 funded research collaboration with TATRC entitled: “Emergency Medical Resupply and Enroute Care Unmanned Air System (UAS) Research Platform.”

This project seeks to investigate the use of emerging UAS platforms to augment traditional means of providing emergency medical resupply and casualty evacuation (CASEVAC) in austere environments. Safe patient transport onboard UAS is critical to this concept, and requires systematic analysis of in-flight conditions relevant to patient safety. The EFDAS is a research payload that would enable data acquisition of in-flight conditions of the interior cargo area of the aircraft pertinent to future medical missions focused on utilizing unmanned systems, to include environmental effects important during patient transport (e.g. peak acceleration,

temperature, barometric pressure, shock and vibration).

In addition to the training, the EFDAS was flown on a manned UH-60 to validate the performance of the EFDAS and to collect baseline data from the UH-60 for future comparison studies on UAS platforms. After the system is validated, TATRC will lead the integration, testing, and demonstration of the DAS-equipped DP-14 in the Spring of 2019 to characterize the in-flight conditions of the multi-purpose UAS platform.

“The EFDAS provides a key capability to characterize the safety of emerging unmanned transport vehicles for CASEVAC missions, both on the ground and in the air,” as stated by Mr. Nathan Fisher, Principal Investigator for this effort. “The utility of the EFDAS system will extend beyond the objectives of this project and will act as an enabler to future R&D efforts supporting the Medical Robotics and Autonomous Systems S&T Task Area.” For example, data collected from the EFDAS can inform the design of systems that will dynamically alter the flight profile of unmanned vehicles to ensure the patient safety when performing CASEVAC.

Addressing these important patient safety concerns early on will ensure that when sufficiently large UAS platforms are called into service for CASEVAC in future operations, they will do so under the safest possible conditions. ■■■