TATRC TIMES

TATRC Welcomes COL Gina E. Adam, as its 9th Director

COL Gina E. Adam, Director, TATRC

With great excitement, the staff at TATRC warmly welcomed COL Gina E. Adam, former Commander of the Cold Regions Test Center in Fort Greely, Alaska, to lead the team. COL Adam assumed Directorship from Acting Director, Mr. Tim McCarthy on 30 July.

COL Adam stated that she was honored by the appointment and has great respect for the work being done at TATRC. "TATRC has long served as MEDCOM's innovative heartbeat, always pushing the medical envelope for our Warfighters. It's been exciting watching TATRC evolve from its early days as a congressional special interest research clearing house to now having its own voice with its carefully curated portfolio of advanced technology solutions."

In an introductory meet and greet with TATRC staff, COL Adam provided some of her background and insight into her leadership philosophies, adding that she firmly believes in authenticity, transparency, and teamwork. Regarding her plans for the organization, COL Adam said, "I aim to do the best I can to help push TATRC forward. My leadership arrives at a time of great change within the Army and military medicine. But, I firmly believe that change brings opportunities and I am excited to develop those opportunities for TATRC."

Self-described as having a passion for the vital work that the MRMC does, COL Adam is excited about becoming "the voice of TATRC," which she described as a unique organization with its seven labs and programs operating in different areas of military medicine and technology, but always working together in an

New Director

4th Annual Open House Adds New, Live Simulated Medical Scenarios to its Lineup

Medics relay patient data and receive feedback remotely from a doctor in real time.

Soldiers demonstrate loading a casualty onto the unmanned Squad Multi-Purpose Equipment Transport (SMET).

By: Leticia Hopkins, USAMRMC

The U.S. Army Medical Research and Materiel Command's Telemedicine and Advanced Technology Research Center (TATRC) hosted its fourth annual open house and technology demonstration at Fort Detrick 12 September.

Lt. Col. Jeremy Pamplin, deputy director, TATRC, said the open house is a relationship-building event and it's those relationships that TATRC builds with others, both here and beyond, that are important.

Pamplin added that relationships are a key aspect of TATRC's collaborative innovation to develop medical technology designed to improve future combat casualty outcomes.

From 10 a.m. to 3 p.m., the event gave more than 350 guests, from academia, industry and government, the opportunity to see and interact with TATRC's technology and engage in fruitful discussions with the research leads.

Pamplin said TATRC's open house was designed to demonstrate and share with the community at large, TATRC's ability to develop innovative solutions for military medicine now and in the future, as well as showcase some of the knowledge and materiel products that have been or are in the process of being developed with collaborators.

At this year's open house, attendees had the opportunity to view more than 50 projects that were on display and set up over three main field tents, the Prototyping, Integration and Testing Lab and outdoor scenario area. The event also included six live simulated medical demonstrations showing many of these interactive technologies in use in a real-world situation.

Pamplin said the demonstrations were part of the story TATRC wanted to share with its guests about its abilities to develop solutions from the point of injury through the analytics that will eventually enable semi-autonomous and autonomous casualty care solutions.

"We did a demonstration today," Pamplin added, "a scenario-based storyline which showed the ability to integrate these solutions across the operational medical battlespace and in particular the imagined multi-domain battlespace of our future."

With all of the available activities, participants found the scientific posters extremely helpful while navigating the open house.

"Those technical posters were really quite helpful, so if I didn't have a lot of time to spend talking with one of the subject matter experts (SMEs), I could still get the key information that I needed right off the posters. It enabled me to say: 'this is the booth I want to be at,' and ask questions, [and say:] 'this is the technology I'm interested in," said Joni Fernbaugh,

BdExec Consulting, LLC., whose job is to help companies that want to work with the military, find partnership opportunities.

For guests, the engagement with TATRC staff, demonstrators and the hands-on technologies, along with the addition of the simulated medical scenarios, made the open house extremely successful and worth attending again in the future.

Kim Bahrami, from Medweb, said she has attended all three previous TATRC open houses, but this year by far, was one of the best and has been the most meaningful to her.

In reference to the engagement between exhibitors and guests, Bahrami added, "it was a good example of what the dialogue should be between industry and government."

A statement that Fernbaugh agreed with and added that it was due to the informal environment, staffed by proper SMEs that, allowed attendees to be able to ask tough and detailed questions. Which, according to Fernbaugh, is what industry is looking for.

Fernbaugh also said she is going to encourage her clients to attend future TATRC open houses.

Feedback like Bahrami's and Fernbaugh's, add to the reasons why the TATRC staff believes the event was successful.

Open House

Open House continued from page 2

Col. Junker, Air Force Surgeon Generals Office participates in a surgical telestration demo in the Medical Modeling, Simulation, and Visualization Environment (MMSVE).

BG Shan Bagby, Deputy Chief of Staff for Support, MEDCOM G-1/4/6 (3rd from left) gets briefed on autonomous casualty evacuation.

"In terms of goal achievement, we absolutely developed some more key contacts," Pamplin said in response to the positive feedback TATRC received. "We gave insight to some senior leaders about the work that is done here, not just at TATRC central, but across our network of connections."

Pamplin, who encourages people to continue attending the open houses in the future, said there is a lot to see and do including the opportunity to interact with SMEs, investigators, and partners from industry and academia. It's those demonstrations and displays that are the heart of the open house.

"It's developing a relationship that will hopefully bear fruit in the future for improving combat casualty care," Pamplin said.

Pamplin also commented that research is an innovative process, and that it takes creativity, adding, "Evidence suggests that the more interaction you have with other creative beings, the more likely you are to find and create solutions that ultimately transition to capabilities that improve combat casualty care." ◢◢◢

New Director

effort to provide state-of-the-art solutions for the Warfighter.

No stranger to the MRMC, COL Adam has been actively involved with the Command in her past appointments. COL Adam's Directorship adds to a long list of career achievements, including Research Psychologist at the U.S. Army Aeromedical Research Laboratory and Deputy Director at MPD at the U.S. Army Research Institute of Environmental Medicine (USARIEM), XO at USARIEM, Deputy Project Manager at U.S. Army Medical Materiel Development Activity, a faculty member at the National Defense University, and, most recently, Commander of the Cold Regions Test Center for 2 years.

COL Adam holds a PhD in Cognitive Neuroscience, an MBA from the University of Maryland, and is most recently an honors graduate from the Army War College (AWC) with a Master of Strategic Studies degree. Upon graduating from the AWC, she was presented with an AWC Foundation Award for Outstanding Strategy Research Paper for her research paper, entitled, "The Arctic: A New Security Dilemma?"

"It's as if my entire career was preparing me for this assignment. With what I bring to the table, and how TATRC is so strategically aligned to key Warfighter research portfolios, I couldn't imagine being anywhere else. The time is right for TATRC to find its voice in the new research landscape, and I'm glad to be here to lead in that direction." ◢◢◢

TATRC Holds Telesurgical Consultation Test During MISL Evaluation Event

The U.S. Army Medical Research & Materiel Command's Telemedicine and Advanced Technology Research Center (TATRC), held a telesurgical consultation test and evaluation event at TATRC, 4-7 September 2018. TATRC conducted a proof-of-concept capabilities study to meet research objectives on multiple systems to perform tactical telemedicine & communications integration testing, as well as operational and technical proof-of-concept research objectives for Prolonged Care.

The overall research objective is the potential of conceptually demonstrating a variety of medical sensors to provide actionable, "time sensitive" medical information to a medic's End User Device (EUD) using close range wireless communications technologies with low electronic signatures. The operational medical information systems evaluation event tested virtual health systems designed to be used in the operational environment by medical personnel. The research team designed medical scenarios simulating tactical combat casualty care and prolonged care.

The tools tested were telemedicine capabilities that enable a physician located at a distance to provide medical direction and guidance to a medic in the field. The research will be used to analyze future concepts and emergent technologies to inform senior DoD medical leadership of potential capability improvements that decrease gaps in future military medical care.

The simulated casualty environment allowed field medics to test the equipment in a lifelike, real-world scenario. The field medic was presented with a patient that possibly needed an escharotomy—a surgical procedure used to treat third-degree circumferential burns. In the scenario, the field medic

Field medics use telemedicine technology capabilities to connect to the doctor for specialized assistance with an escharotomy at TATRC, Fort Detrick, 7 September.

needed to perform an emergency escharotomy with coaching from a doctor.

The technology allowed the field medics to have real-time support from a doctor at a distance, as well as send photos, have face-to-face video conversations, and more.

These teleconsultation capabilities included Remote Health Solution's Virtual Exam Room, and Remote Diagnostic Technologies' Tempus Pro with i2i software solution.

Video Telestration Capabilities included ATC-NY's TELTAN. High Bandwidth Communications Capabilities included Cornet Technologies' 4G LTE Manpack Radio with a video teleconferencing application. This result and connections with industry are supported by several TPCI, CRADAs, and SBIRs.

The research event focused on a proof-of-concept evaluation on how

these systems performed and communicated over a secure tactical network. Each of the different Teleconsultation systems were evaluated and tested on each of the different wireless radio connections. The Tactical network consisted of a mobile 4G base station, a tactical wireless Wi-Fi, and MPU-5 radios with the dismounted medic. For the long range back haul, TATRC used the Persistent Systems' Wave Relay Mobile Ad-Hoc Network to connect to the medical provider at the simulated Brigade Medical Company.

The testing of the tool is only one piece of the project. The other half of the project consists of evolution of data flows involving packets and bandwidth requirements.

"If you can't tell, we are all very excited about this," said Mr. James Beach, Operational Telemedicine Project Manager. "We want to put research findings into the hands of Warfighters."

Telesurgical Consultation

TATRC *TIMES*

Telesurgical Consultation

Field medics perform a simulated escharotomy using the Remote Diagnostic Technologies i2i Solution (Tempus Pro) at TATRC, Fort Detrick, 7 September.


Dr. Raymond Fang assists medics in the field with an escharotomy using telemedicine teleconsultation capabilities at TATRC, Fort Detrick on 7 September. After testing, feedback was provided to vendors.

The final day of research and testing was Friday, 7 September.

Feedback from this event will be provided to the vendors so that they can adjust and improve the product as needed. Phase 2 will involve validating research, collecting additional feedback, and more testing.

Mr. Carl Manemeit, Deputy Lab Manager of TATRC's Medical Intelligent Systems Laboratory stated, "Hosting this year's research event for the first time ever right here in our own backyard at TATRC, demonstrated our capability to successfully establish a secure tactical network to conduct proof-of-concept tests on the network without ever having to leave Fort Detrick." ◼◢◢

TATRC Kicks Off MHCE Project with Army National Guard
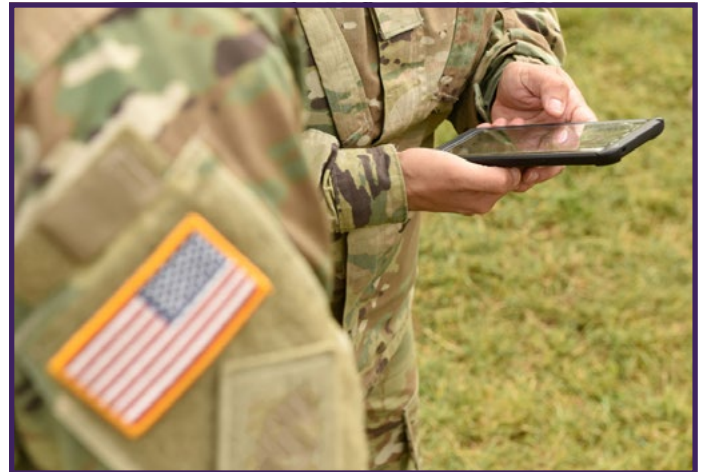
On 9 August, TATRC's Mobile Health Innovation Center (mHIC) held its first official kick-off meeting with the Army National Guard (ARNG) for a partnership pilot project to connect National Guard Bureau members with their assigned units to assess their readiness levels. This assessment will be done using mHIC's increasingly popular Mobile Health Care Environment (MHCE) system and its secure mobile app, mCare; but in a fashion that is customized specifically for the ARNG use case in terms of both appearance and functionality.

While this project is in its infancy, it represents a means to securely and confidentially provide bi-directional communications with Service Members through their personal mobile devices to assist unit leaders in planning and resourcing their troops appropriately. TATRC is very excited about the potential that this landmark partnership represents. Mr. Ron Yeaw, Deputy Lab Manager for mHIC is eager to be working with the ARNG. "Working with customers outside of the MEDCOM is great for mCare. It really shows our reach into the enterprise, and mHIC's ability to support clinicians across the Military Health System," stated Yeaw.

The ability for mCare to be loaded on a Service Member's personal phone, and the part-time schedule of many Guard Soldier's duty assignments, make this app an ideal communication form factor. ◼◢◢

TATRC Shines at Annual MHSRS

The 2018 Military Health System Research Symposium (MHSRS) offered a great opportunity for members of the TATRC team to present their current research efforts. The annual MHSRS took place 20 – 23 August in Kissimmee, FL and provided a unique atmosphere for TATRC to showcase some of its latest work, and to introduce our new Director to our key industry partners and stakeholders.

The Annual MHSRS is the Department of Defense's premier scientific meeting that focuses on Combat Casualty Care (CCC). It combines three previous conferences, including the former Advanced Technology Applications for Combat Casualty Care Conference (ATACCC); the Air Force Medical Service Medical Research Symposium; and the Navy Medicine Research Conference under its umbrella. It's a jam-packed, four day meeting where DoD partners can come together to share valuable insights and gain knowledge from various research areas in each of the Services.

For TATRC, this was extremely beneficial as we were selected to deliver a total of five oral presentations including three from our Biotechnology High Performance Computing Software Applications Institute (BHSAI) team, one from our Mobile Health Innovation Center (mHIC) and one from our Medical Intelligent Systems Lab (MISL).

Dr. Sridhar Ramakrishnan of BHSAI gave a presentation entitled: "2B-Alert App: A Validated Tool to Predict Individual Warfighter Alertness in Real Time," which was a well-attended session on Management of Sleep & Fatigue for Maximization of Soldier Operational Readiness. BHSAI's Dr. Srinivas Laxminarayan

TATRC's new Director, COL Gina Adam (left) was introduced to research partners and key stakeholders within the MHS during the event.

gave a presentation entitled: "An Artificial Intelligence System for Real-Time Individualized Core Temperature Estimation" during an Enhancing Human Performance & Survivability in Extreme Environments session and Dr. Jose Rubio, also of BHSAI, presented: "Is There a Need for a High-Fidelity Computational Model to Characterize Brain Responses to Primary Blast Exposure?" during the session on Blast-Related Trauma. Ms. Amanda Schmeltz, Project Manager for TATRC's mHIC, gave a talk entitled: "Development of Mobile Web-Based Application for Pre and Post-Operative Patient Education of the Military Surgery Patient" during the popular Telehealth / Virtual Health / Remote Monitoring in the Military Health System (MHS) session. Finally, Dr. Gary Gilbert, Lead for TATRC's MISL, spoke during the session on Clinical Decision Support, Robotic & Autonomous Systems with a talk entitled: "The Virtual Lab: New Medical

Science & Technology Research Task Areas in Medical Intelligent Systems Require Paradigm Shift."

Additionally, TATRC's Medical Modeling, Simulation and Visualization Lab Manager, Mr. Geoff Miller, was on hand to moderate an engaging panel discussion on The Future of Medical Simulation in the Continuum of Care.

TATRC also had a presence during the Scientific Poster Session with three new posters on display.

MHSRS is also a forum where TATRC's AMEDD Advanced Medical Technology Initiative (AAMTI) gets to shine each year through the various oral and poster presentations from its recipients. There were seven oral presentations and four posters from Investigators that were funded by the AAMTI Program, with one of the projects nominated in the Young Investigator Competition.

Notably, this AAMTI Rapid Innovation Funding awardee, CPT

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Dr. Gary Gilbert, Program Manager for Medical Intelligent Systems giving his presentation entitled "The Virtual Lab: New Medical Science & Technology Research Task Areas in Medical Intelligent Systems Require Paradigm Shift," coauthored by TATRC's Mr. Nathan Fisher!

Ms. Amanda Schmeltz, from TATRC's mHIC lab, presented "Development of Mobile Web-Based Application for Pre- and Post-Operative Patient Education of the Military Surgery Patient," at this year's MHSRS.

Michael Derickson, a resident in the general surgery program at Madigan Army Medical Center (MAMC), took the 2nd place award in the Young Investigator Competition and was selected from 356 entries. In his research, CPT Derickson evaluated the effectiveness of night vision goggles to conduct lifesaving surgical procedures under light and noise discipline. The results are extremely relevant to the doctrine and deployment of Focused Assessment with Sonography in Trauma team-based trauma care in the disaggregated future operating environment. CPT Sheldon Rowan accepted the MHSRS award on behalf the entire team.

In addition to these presentations and posters, the TATRC team had abundant opportunities to meet with current and potential future research partners, including, to the Uniformed Services University (USUHS) Vice President for Research, Dr. Yvonne Maddox and her staff.

Even with all the excitement and insightful discussions that MHSRS brings, TATRC had the distinct pleasure to introduce and announce the arrival of our new Director, COL Gina E. Adam. During the conference, TATRC leadership held an informal meet and greet session for COL Adam to be introduced to a number of our existing research partners and key stakeholders throughout the MHS. The conference was one of the most opportune and all-inclusive ways for COL Adam to not only get to introduce herself, but also for our partners to learn more about the direction that TATRC is headed in the future.

TATRC's Science Director and Lead for the Virtual Health Support Office, Dr. Francis McVeigh, stated, "The

TATRC's own Dr. Sridhar Ramakrishnan, of the BHSAI giving his presentation on the widely reported "2B-Alert App: A Validated Tool to Predict Individual Warfighter Alertness in Real Time."

TATRC Team was once again fully engaged in this thought-provoking conference and was able to meet with key members across the MHS to discuss further collaborations that can take our ongoing research to the next level in order to ultimately help our Warfighters." TATRC is looking forward to what the 2019 MHSRS Conference will bring. ◼◼◼

A New Tool for Sleep-Deprived Soldiers to Optimize and Restore Alertness When It Matters Most

A screenshot of 2B-Alert Web, which is accessible here[1].This tool uses a validated mathematical model to predict the effects of sleep loss and caffeine intake on alertness and an algorithm to find optimal caffeine schedules that maximize alertness at the desired time for the desired duration.

Sleep deprivation is common among military personnel. Roughly 40% sleep less than 5 hours a night, even though they need 7 to 8 hours to recover mental acuity. Yet, Warfighters often need to be vigilant while deprived of sleep. For example, in combat operations, they may face demanding schedules, ranging from a few days without sleep to many days of less than 5 hours a night. Inevitably, this hinders their cognitive performance and increases the risk of accidents.

Not surprisingly, caffeine is widely used in the military. (Around 85% of U.S. adults consume a daily amount equal to that in two cups of coffee.) As overdosing has negative consequences, individualized guidelines on when and how much caffeine to consume would be valuable. However, despite the boom in health-monitoring gadgets, no evidence-based tool has been developed to provide caffeine intake schedules that restore alertness in a timely and safe manner. Until now.

A team of scientists from TATRC's Biotechnology High Performance Computing Software Applications Institute (BHSAI), led by Dr. Jaques Reifman, recently tackled this problem with collaborators at the Walter Reed Army Institute of Research. They asked whether an algorithm could be developed to estimate when to consume caffeine, and how much, to restore alertness at the desired time for the desired duration in sleep-deprived subjects without overdosing.

The team built upon a comprehensive model of sleep, previously developed and validated extensively by Dr. Sridhar Ramakrishnan, a BHSAI staff scientist and co-author of the paper. The model predicts alertness, as measured by the gold-standard psychomotor vigilance test, based on a history of sleep schedules and caffeine intake events. Using this model, the BHSAI team first derived a mathematical function, which when minimized by optimizing its parameters, was expected to yield safe caffeine schedules that restored alertness in a temporally specific way.

One major roadblock stood in the way: conventional optimization algorithms took way too much time. Dr. Francisco Vital-Lopez, a BHSAI staff

2B-Alert *continued on page 9*

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2B-Alert *continued from page 8*

scientist and lead author of the study, ultimately came up with a workable solution. Drawing upon an earlier algorithm that could solve the well-known "traveling salesman problem," and placing reasonable constraints on the allowable doses and time points, he found a way to simplify the process of searching for caffeine schedules that maximized alertness at a specified time, so that it required only a few seconds.

This breakthrough[2], together with *2B-Alert Web*[3] and *2B-Alert App*[4]—tools that BHSAI scientists have developed to predict the effects of sleep loss and caffeine at the group and individual levels, respectively—now sets the stage for finalizing an app that individual Warfighters can use to personally manage their caffeine and sleep schedules. Such an app, connected to a network, may also help commanders plan missions more effectively by quantitatively assessing Force status in real time and providing customized alerts and countermeasure recommendations.

Clearly, sleep deprivation is a concern for individuals worldwide. This is evident from the public interest in this new work. So, the day we can download an app—one that tells us how much coffee to drink, and when, to stay alert when we need to—may come around sooner than we think.

"This deals directly with Soldier readiness," said Dr. Reifman. "If you could come to work, drink caffeine and have your mental acuity improved by 40% for four hours, wouldn't you like that? That's what we're trying to do here." ▰▰▰

Links: 1. https://2b-alert-web.bhsai.org/2b-alert-web/login.xhtml
2. https://onlinelibrary.wiley.com/doi/abs/10.1111/jsr.12711
3. https://academic.oup.com/sleep/article/39/12/2157/2706363
4. https://onlinelibrary.wiley.com/doi/abs/10.1111/jsr.12725

On the Horizon...

Upcoming Events:

17 - 19 October: PCHA Conference, Boston, MA

23 - 25 October: Defense Innovation Challenges, Tampa, FL

11 November: (Recognized 12 November) Veterans Day

22 November: Thanksgiving

26 - 30 November: I/ITSEC Conference, Orlando, FL

26 - 30 November: AMSUS Conference, National Harbor, MD

14 December: TATRC Annual Holiday Party

25 December: Christmas Day

31 December: New Year's Eve

This Quarter'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) 172   B) 250   C) 326   D) 414

Answer to Last Issue's TATRC TRIVIA...

!

Question: Who was TATRC's First female Deputy Director?

A: LTC Deydre S. Teyhen (Who also served as Acting Director during her tenure at TATRC from 2012 - 2013). Teyhen is now COL Teyhen and proudly serves as the Commander at Walter Reed Army Institute of Research (WRAIR).

DHITS 2018 Conference: The Calm Before the Storm

Team TATRC at DHITS 2018 in the MHS booth.

DHITS, the Defense Health Agency's (DHA) annual IT Symposium took place 23 – 26 July this year in Orlando, Florida. Returning to the Caribe Royale Resort and Convention center for the 5th consecutive time, DHA Director, Vice Admiral Raquel Bono opened the conference this year with a message aimed at both rallying confidence and calming nerves across the enterprise.

While the official purpose of DHITS is to provide the venue for critical information management and the sharing of innovative information technology ideas, most of the focus this year was about affording leadership an opportunity to speak to the turbulent period of change that the Military Health System (MHS) is experiencing. With Military Treatment Facilities realigning with DHA and significant delays and concerns in the deployment of the MHS Genesis, the DoD's electronic health record, this year's DHITS came at a critical time for military medicine.

At the time, executive approval of the NDAA was pending and signalled big changes. Per VADM Bono's keynote, "We will reduce or eliminate duplicative organizations and systems for managing human resources, finance, health services, travel, and supplies. We will build an Integrated System of Readiness and Health…to enhance lethality and affordability for the Department."

Bringing business reforms to DoD is sorely needed across military medicine. The Commander of the U.S. Army Medical Department Center and School, Maj. Gen. Patrick D. Sargent, also spoke during the opening keynote stating, "…MHS should look at the requirement to re-forge our way ahead as a powerful opportunity. We are connecting and enabling things that were never connected or enabled before, making things 'smarter,' more 'cognitive' and more 'intelligent.' Remember, what you make has the potential to save, touch and improve the lives of not a few, but billions of people. That's the kind of opportunity we have before us… this is our time."

This call to arms opened the three day annual conference, pulling together over 2,000 military medicine providers and IT professionals under the unifying message of "One Team, One Mission - Creating Our Future Together." TATRC was at DHITS in full force with an active presence in every aspect of the conference: from providing assistance in crafting messaging for senior leadership keynote remarks, to hosting multiple booths within the exhibit hall, to moderating panel discussions in the auditoriums.

This year TATRC operated three kiosks within the main DHA Exhibit Booth focusing on 1) AMEDD Advanced Medical Technology Initiative, 2) Direct & Beneficiary Care Research, and 3) Virtual Health. TATRC Lead Project Officer, Mr. Robert Chewning, loves the ability to have such a presence at DHITS. "DHITS continues to provide tremendous value by providing key face-to-face interactions with our partners, but this year particularly provided some exciting new opportunities to collaborate on next generation telemedicine solutions for our Warfighters. Time introducing our staff and engaging key stakeholders at the TATRC booth provided immediate takeaways that we are actively moving forward with for FY19 and beyond."

Mr. Ron Yeaw, Deputy Lab Manager for TATRC's Mobile Health Innovation Center, ensured TATRC also had the opportunity to provide strategic guidance for the MHS in the area of Virtual Health by facilitating a Q&A panel of senior operational medicine leaders. "We wanted to provide the ability for DHITS attendees to talk directly with those virtual health subject matter experts with knowledge from the battlefield. Our goal was to have representation from every aspect of operational medicine: from physicians, to cyber battle-lab engineers, to MHS Virtual MedCen policy makers, to recently deployed Soldiers. This allowed us to talk about virtual health from every facet, and do a deep dive into virtual medicine conversations that had never really been done before in a public forum."

For Virtual Health Capability Area Manager, Ms. Jeanette Little, conferences like DHITS are a perfect opportunity to get customer feedback on the direction of our technology. "Getting all of your stakeholders in one room to talk about future capability gaps, long range missions, and Warfighter medical needs is so important to what we do, and DHITS is perfect for that. We are setting up portfolios that will not be fully realized for five to ten years, so it is mission-critical that we ensure that every use case and to-be scenario is vetted by the boots on the ground assets that we are designing them for."

The annual DHITS conference will be back in Orlando from 27 July – 3 August 2019 and Team TATRC looks forward to playing a vital role again. ◢◢◢

Summer Launch of the Peri-Operative Surgical Patient Education AAMTI Initiative

This summer the lab team at TATRC's Mobile Health Innovation Center (mHIC) launched phase one of the "Development of a Mobile Web-Based Application for Pre and Post-Operative Patient Education of the Military Surgery Patient" pilot project. This effort is an AMEDD Advanced Medical Technology Initiative (AAMTI) funded demonstration insertion project designed to communicate perioperative instructional information to patients, via SMS text messaging.

In lieu of handing pre-op patients a bunch of hard copy hand outs and paperwork regarding their upcoming surgeries, how to prepare the days leading up to their surgery and what to expect regarding post-operative care, these preparatory materials would be sent directly to patients' cell phone via text messaging. This project was developed in partnership with LTC Matthew Eckert, MD, Chief Surgeon and Trauma Center Director at Madigan Army Medical Center (MAMC) to help eliminate the need for these hard copy handouts, especially when all of the information provided can get easily lost in translation depending on how complex of a prep is required and under what conditions patients are receiving these instructions.

The existing backend provider portal was leveraged for this demonstration, and managed the pre-approved messaging content that is generic enough to be distributed through direct SMS messaging and avoids any HIPPA violations. Perioperative nurses and care providers can login to the portal at any time to view the upcoming messages, as well as those that have already been delivered. If appointments need to be rescheduled, the provider may login at any time to readjust message timing, based on the next appointment.

Currently, patients receive a high level overview and welcome message, with next appointment time, date and location, as well as clinic contact information. This is followed with a hyperlink to an online-hosted pdf handout of what the procedure will encompass, preparatory steps and recovery overview.

Leading up to the pre-op, surgical visit and post-op appointments, are reminder messages as well as "just in time" content indicating when to wash/launder bed sheets, when cut off time for eating and drinking the

Step 1: Provider enters profile/appointment information for patients' future surgical visits

Step 2: Provider is taken to brief summary screen of booking

Clicking SUMMARY (here) takes the provider to the following screen, which details all future messaging patient will receive via SMS

Care managers have access to all messages sent and future which patient will receive, for their documentation records

What the patient sees on their mobile device:

Clicking the link in the text message brings the patient to the following screen (browser opens up on their smart phone)

night before is, shaving requirements, location of appointments etc.

As of August 2018, a phase one portion of the project has been launched to 10 providers at MAMC to assess any requests for refinement and overall acceptability. These refinement requests were completed by the end of August, allowing mHIC personnel to begin deployment of phase two. The second phase examines usability and acceptability

for up to 100 surgical patients at MAMC, which started this October 2018.

According to mHIC Project Manager, Amanda Schmeltz, "Alpha testing has been completed for over 30 care providers at MAMC with very positive and enthusiastic results, and we have begun going live in the last few days. We are very much looking forward to the usability and acceptability results coming out of this trial." ∎∎∎

TATRC Deputy Director Sails Off Into the Sunset while New Deputy Takes the Helm

After 2 years of serving as both Deputy Director and Acting Director of TATRC, along with a dedicated life of work in the federal sector, Mr. Timothy McCarthy has retired from Civilian Service. The TATRC Times sat down with Mr. McCarthy and new incoming Deputy Director, LTC (P) Jeremy Pamplin for a collegial chat about where TATRC has been and where it is headed.

TATRC's new incoming Deputy Director, LTC (P) Jeremy Pamplin *(left)* and TATRC's outgoing Deputy Director, Mr. Timothy McCarthy *(right) sit down to chat about the organization and to pass the baton.*

TATRC Times: Mr. McCarthy, how would you describe your tenure here at TATRC, and specifically these last few months?

Tim McCarthy: Full...to say the least. [Laughter] And it's been good, but I have to tell you too, that it's a period of great growth for me. It's been… I can't tell you how long it's been since I've felt so completely absorbed by what's going on. Learning the business of TATRC and understanding where the organization had been before 2014 and where it is now, along with the transformation that it went through, I think were really significant and enlightening.

TATRC Times: How so?

Tim McCarthy: The transformation from being essentially an extra-mural management activity (in 2014) to intramural research was a huge change and adjustment for TATRC. I think that the organization has evolved tremendously even from that during the last two and a half years that I have been here, because we now have two capability area managers designated with POM funding to do much earlier research than ever before; and so we're now in the position of actually steering the research and looking for venues to explore some of the areas that we think we need for the future. Some of this stuff is not born yet and I think that's a very, very exciting place to be.

TATRC Times: So you touched on that in 2014, TATRC nearly ceased to exist. Funding down to zero, losing the congressional special interest grants. What good do you think came out of that 2014 transition through all the pain, through all the re-structuring?

Tim McCarthy: I think we had to learn to be a very responsive and agile organization and I think even now, as we take a look at TATRC, the way the labs were designated back in 2014, is becoming a little bit obsolete. It's become a great deal more of a matrixed organization than it was before. I see for example, medical modeling, simulation and visualization underpinning a great deal of what both capability area managers for virtual health and robotic and autonomous systems are doing. I think that the future model may end up being more about putting together tiger teams, as the work progresses. We don't know yet. That concept has been tossed around and we don't know how it's going to end up because we continue to evolve as the tasks and technology continues to evolve.

TATRC Times: As the new Deputy Director, do you feel that those changes have positioned TATRC favorably for the future?

LTC (P) Jeremy Pamplin: I don't think I could really answer that question any better than Tim already has in a lot of ways. TATRC is, I don't know if I can say uniquely positioned, but very well positioned to take advantage of not only its past history, I think -- I mean it's not just coming into its own now. It's come into its own at least three or four, maybe five other times in its past, and when I have tried to look at how that has occurred, it's largely the resetting of technology innovations. You know, so when technologies advance to a certain tipping point, they tend to become adopted and TATRC seems to kind of re-organize at that point because it's no longer needed to take advantage and research and develop the thing that's now being used by everybody. So in a lot of ways, we're at that point in time now, especially with the virtual health revolution that's going on across the military health system. The challenge is how do we

take advantage of the current status of technology and apply that to gaining future ground. That requires vision.

TATRC Times: This is interesting … So TATRC must evolve beyond our own branding?

LTC (P) Jeremy Pamplin: I think the telemedicine component is exceedingly key. It's an infrastructure piece that we need to move to the next level, because without the adoption of telemedicine and in particular the data transfer, we cannot make the next evolution of medical care which is autonomous systems.

TATRC Times: Mr. McCarthy, where would you like to see TATRC in five years?

Tim McCarthy: First of all, I think that with the entire DoD medical community in re-organization mode that I see TATRC being recognized as the DoD's innovation center for technology, tri-service recognition formally as a lab, as its own entity, the aggregation of responsibility for all of DoD operational and institutional technology advancement, the sorts of things that LTC (P) Pamplin has been talking about in terms of decision support systems, autonomy and certainly serving the sort of battlefield that we ourselves are being challenged to support in the future.

TATRC Times: Thank you very much for your guidance and leadership, both as Deputy Director for TATRC and for stepping in and serving as the Acting Director. So what now, sir? What sunset are you sailing off in?

LTC (P) Jeremy Pamplin: [Laughter] I heard something about a boat!

Tim McCarthy: Yeah, well my bucket list is huge. [Laughter] There are a lot

of things that I haven't done yet in this young life of mine, that have been neglected and one of them has to do with the fact that I am of an age where my parents are in need of my support, and are depending on me a bit more than they have in the past. I'm looking forward to spending time on my boat. My sailboat is certainly neglected. And I have lots of projects at home that have been put off for years and some exciting travel that has been put on the back burner. So I am looking forward to having more time than anything else. It's time that's important to me.

TATRC Times: Well, just from a professional career perspective, Mr. McCarthy your time is coming to an end. Dr. Pamplin, yours is just starting. What are you going to do? Where do you want to get started first? What are your plans?

LTC (P) Jeremy Pamplin: Well I think the first step is to express my appreciation and say thank you more than anything else. I'm appreciative of Mr. McCarthy who has helped lay down the foundation of the success that TATRC has today. Sir, Thank you so much for your leadership and helping me get started here. Everybody in the organization is exceedingly grateful to you. For me, the first thing that I really need to do is spend time with our Director, COL Adam. I need to get together with everybody and talk with people and understand what their concerns and issues are; because the position that I had before was a collaborative effort, but now I'm in a servant role. One I'm very much looking forward to stepping into.

TATRC Times: Thank you both for your time, and Mr. McCarthy… Fair winds and following seas, sir! ▰▰▰

The ABCs of DBS-C (Defense Business Systems Certification): How is Innovative Research Being Affected?

By: Dr. Francis McVeigh, Science Director and Lead for Virtual Health Support Office

Just as President Ronald Reagan stated on 12 June 1987, "Mr. Gorbachev Tear down this wall (Berlin Wall)," I say to those who can affect Defense Business Systems Certification (DBS-C) threshold ceilings, **"Tear down the Fourth Estate Organizations' low DBS-C Threshold Ceiling."**

While the FY 2016 National Defense Authorization Act (NDAA), Title 10 U.S. Code section 2222 raised the threshold for Military Departments defense business system investments to $250 Million over the period of the current Future Years Defense Program, it maintained that the DoD's Office of the Chief Management Officer, OCMO, formerly known as the Deputy Chief Management Officer, (DCMO), had the authority to review and certify defense business system (DBS) investments of $1 Million over the FYDP for the Fourth Estate organizations.

The DoD Fourth Estate is comprised of organizational entities which are not in the Military Departments or the Combatant Commands. These include the OSD, the Chairman of the Joint Chiefs of Staff, the Office of the Inspector General, the Defense Agencies, and Field Activities (Department of Defense, 2015a). The Fourth Estate business environment includes large, diverse organizations performing a complex set of functions. OCMO monitors baseline certification data from the Fourth Estate to pursue consolidation and business process improvement opportunities.

The Defense Health Agency (DHA) is a fourth estate organization and as such, any Defense Health Program (DHP) funding initiatives (both RDTE and O&M) that may exceed one million dollars over their life expectancy must complete the DBS-C process which is complex, time consuming, and extensive. By not raising the DBS-C threshold for the fourth estate organizations, it makes it administratively, and legally difficult to start and rapidly execute efforts that could put new capabilities into the hands of our Warfighters.

For the past seven years, all of the DHP Joint Program Committee-1's (JPC-1) Health IT funds have been certified by DHA's J-6. There are different rules for the Services than DHA as they are not fourth estate organizations. Since the JPC-1 money is DHP money, the approval process goes through DHA to the OCMO, as the requirement remains that any initiative involving material products that is funded with DHP dollars must be certified. If any DHP money is put on an effort funded with Service funds, then the money needs to be certified. JPC-1 is writing an information paper to address the low ceiling concerns.

Not all research goes through JPC-1. Therefore all other non JPC-1 information technology research initiatives are required to follow the current DBS-C threshold of the $1 million ceiling. This low ceiling discourages individuals to engage in research and requires others who have approved DBS-C packets to severely limit new related initiatives for fear of exceeding the low $1 Million threshold.

I am not saying that having DBS-C guidelines is wrong, what I am saying is by keeping DHA's DBS-C thresholds low, it hampers Military Health System personnel from conducting research that could make a difference for our Warfighters today—which is what our Secretary of Defense and our Service Chiefs are demanding.

Our DoD leaders are telling us to knock down administrative hurdles that negatively affect our abilities to increase our Warfighters' lethality and readiness. Raising the Fourth Estate Organizations' DBS Certification ceilings would help us accomplish these stated goals. Raising the ceilings to the same levels of the non-Fourth Estate DoD Organizations will greatly reduce the complex, time consuming, administrative requirements needed to gain research approval starts, and thus result in more research being conducted that could enhance our Warfighters' capabilities.

Just as I was confident in 1987 that the Berlin Wall would eventually come down, I am equally confident today that the low DBS-C Ceilings will be raised—as it is the right thing to do. ◢◢◢

TATRC Hosts Virtual Medical Centers to Discuss Remote Health Monitoring for Diabetic Patients
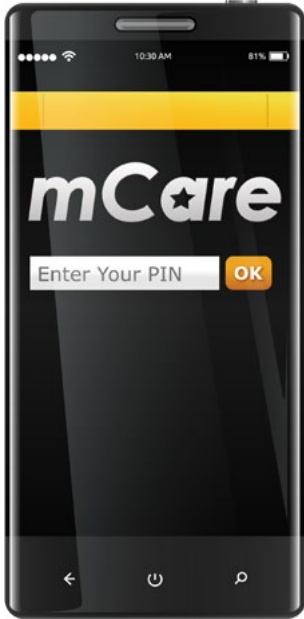
In early August, TATRC's Mobile Health Innovation Center (mHIC) in Fort Gordon, GA, hosted representatives from both of the Virtual Medical Centers (VMEDCEN)s located at Brooke Army Medical Center (BAMC) and Walter Reed National Military Medical Center, to discuss leveraging mHIC's Mobile Health Care Environment (MHCE) system and its secure mobile app, mCare, as an interim solution for remote health monitoring (RHM) of diabetic patients.

During the visit, LTC Jennifer Stowe from the BAMC VMEDCEN and CDR Vinh Mai from the National Capital Region MEDCEN were on hand to learn more about the existing RHM capabilities and the differences between the existing research pilots at Nellis Air Force Base and Madigan Army Medical Center and the Dwight D. Eisenhower Army Medical Center (DDEAMC) Endocrinology pilot efforts to date.

The meeting was highly collaborative and addressed many of the logistical questions and software features of the existing system. The discussion also included an in-depth, hands on demonstration, and more detailed reviews of the current MHCE system features.

Existing workflows for enrollment and sustained use of the system and lessons learned to date from the 3 pilot efforts were also explored.

Finally, the specific metrics and how to collect them from inside the MHCE system and other enterprise sources were discussed, with the TATRC and DDEAMC team providing the VMEDCEN POCs with input for consideration.

Ms. Jeanette Little, the Lab Manager for TATRC's mHIC stated, "The overall meeting was quite productive, and set a positive tone for future collaboration and partnership in achieving an FY19 implementation at both sites." ■■▮▮

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AAMTI Project Spotlight: The use of Real-Time Instrumented Feedback to Train Physical Therapists

Osteoarthritis (OA) of the knee is a common and debilitating condition for many active duty and retired Service Members and beneficiaries. Traditional medical approaches include medications and injections providing modest symptom benefit with associated risks. Lower risk yet cost-effective interventions to provide both symptomatic relief and improve function for patients with knee OA are greatly needed. Current clinical practice guidelines for the treatment of knee OA advocate for greater utilization of non-operative management strategies as the treatment of choice. There is high level evidence for the use of select physical therapy strategies utilizing primarily exercise strategies with little associated risk. Including joint mobilization, in conjunction with specific movement enhancing exercise as part of a comprehensive physical therapy approach to treat knee OA provides particularly important levels of benefit. Multiple clinical trials in a variety of clinical settings have determined this approach for knee OA reduces pain and stiffness with exercise and daily activity, improves function, and reduces the need for medication, injections, and surgery.

Major Danielle Anderson is demonstrating a knee extension mobilization on a training partner. The loadpad® provides an unobtrusive interface that allows the treating physical therapist to feel the joint movement while providing real time feedback via a tablet device.

While manual physical therapy, including joint mobilization, is a commonly used skill set within most physical therapy clinics in the MHS, there is room to improve manual skills to deliver better care for patients with knee OA. By leveraging technology to provide precise feedback during manual skill practice, physical therapists may be able to more quickly replicate the precision of joint mobilization forces utilized by expert clinicians in published manual physical therapy clinical trials.

To this aim, faculty and students from the Army-Baylor University Doctoral Fellowship in Orthopedic Manual Physical Therapy at Brooke Army Medical Center used the AMEDD Advanced Medical Technology Initiative (AAMTI)
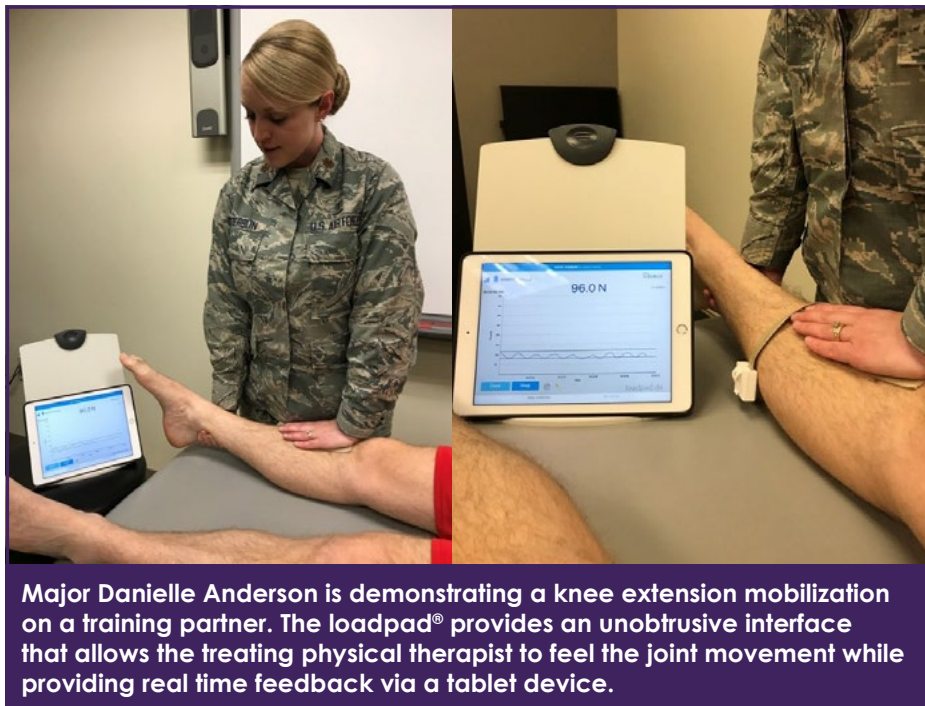
funding to partner with novel Electronics Inc. to develop the loadpad® device and software. This technology has been used in previous studies to measure joint mobilization forces, but was modified to provide real-time feedback to assist with manual skill training. The loadpad® measures force using a thin, flexible sensor making it ideal to assess the forces used during manual physical therapy applications. The loadpad® sensor communicates via Bluetooth with a smartphone or tablet to display force values in real-time.

The purposes of this AAMTI funded project were to 1) determine the feasibility and acceptability of using real-time instrumented feedback to teach physical therapists joint mobilizations and 2) determine if the use of real-time instrumented feedback during practice enables physical therapists to apply joint mobilization forces to the knee with the same consistency and accuracy of students practicing the techniques under direct expert manual physical therapist instruction.

To assess the loadpad® devices we developed a hands-on continuing education course that was delivered in 2-hour blocks over the course of four weeks. Sixteen physical therapists from Brooke Army Medical Center participated in the training. Half of the participants completed their training using the loadpad® to receive real-time feedback as they practiced their joint mobilization skills and half trained with traditional feedback from an expert instructor and their training partner. Training focused on commonly used joint mobilization techniques and integration of exercise for the treatment of patients with knee OA.

All participants took part in baseline assessment with the loadpad® to determine pre-training force and consistency of treatment as compared to forces utilized by a fellowship trained manual physical therapy expert. At baseline, both

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Grade III results for M1M013: from: 00:00:29:962 to: 00:00:39:960

Average peak force: 59.1 N +/- 0.8 N
Mean force: 45.6 N
Oscillation Frequency: 1.70 Hz (17 peaks)
Average PTP Amplitude: 25.1 N +/- 2.0 N
FTI (dosage): 456.3 Ns

lower limit: 100 N   upper limit: 100 N
  below 100.00 %   between 0.00 %   above 0.00 %
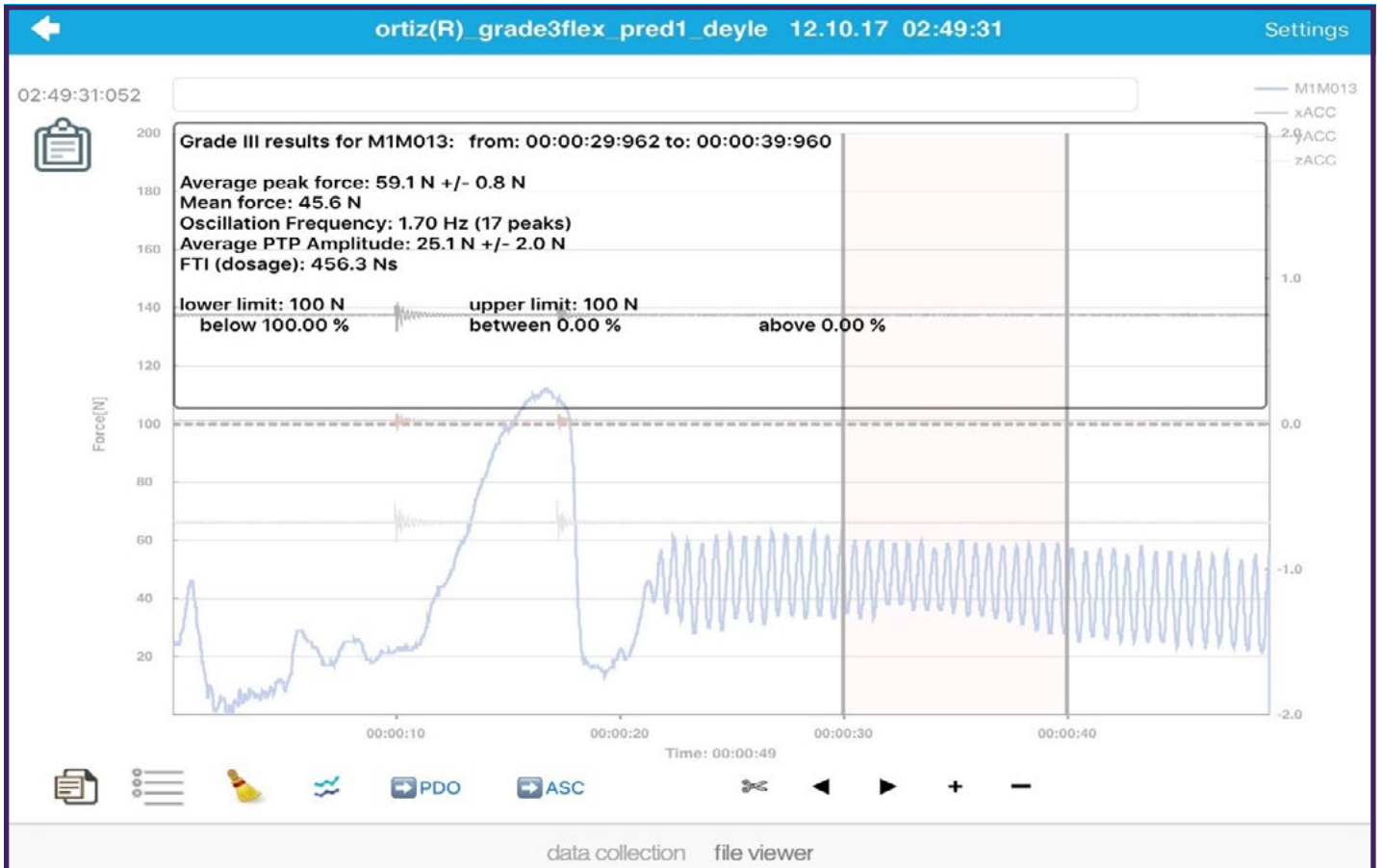
Tablet display of mobilization forces, amplitude, frequency, dosage, and percentage of time within a set range. This range is predetermined and the upper and lower bars are set as the reference for the learner to perform joint mobilizations within.

groups displayed considerable variability in their accuracy and consistency of force application as compared to the reference forces. By the end of the course, both groups demonstrated statistically significant improvements in their ability to replicate the reference standard mobilization forces. Survey feedback from participants who received the instrumented feedback via the loadpad® device indicated that the training using the loadpad® improved their training experience. Specifically, the ability to visualize the forces used with real-time feedback helped to improve confidence and produced a "better experience than any past hands-on training."

The findings of this project suggest that practice with such a device can provide the learner targeted feedback and enhance the learning effect to that of an intensive practice session with an expert instructor. Physical therapists and PT students typically learn joint mobilizations through continuing education courses where an instructor, identified as an expert in the field, provides a demonstration followed by a period of practice with verbal feedback from the individual being mobilized. This training paradigm may suffer from a dilution of training effects with larger classes and may not be possible at all for physical

therapists in some clinical settings. Devices providing force feedback may provide tools to assist an instructor with larger classes and potentially to provide force feedback in the absence of an instructor. We plan on continuing to investigate the use of this technology with physical therapists using varying training schedules and also with physical therapists of varying manual physical therapy skill abilities.

Major Danielle Anderson, Co-Innovator for this AAMTI funded project stated, "The loadpad® device was helpful in our training and I can envision this being a useful tool to train physical therapists in joint mobilization techniques. With our traditional training, the availability of a clinical instructor to give hands-on feedback has been a rate limiting step. The loadpad® is potentially a force multiplier that will allow physical therapists to train a complex task with less reliance on an instructor."

This project would not have been possible without the support of TATRC through the FY 2016 AAMTI funds. The data collection is completed now and is in the process of being submitted for publication. ◢◢◢

AAMTI Project Spotlight: Dual-Task Stability Assessment Utilizing a Wearable Motion Analysis System: Diagnosis and Management of mTBI

Despite the proliferation of state of the art traumatic brain injury (TBI) centers throughout the Department of Defense (DoD), the diagnosis and management of most mTBI cases occurs at the small unit level. Combat medics relying on the Military Acute Concussion Assessment (MACE) are often the first medical providers to assess injured Soldiers. While readily available and easy to implement, the MACE has limitations in diagnostic accuracy which further diminishes if not implemented within 12 hours of injury. Furthermore, it provides little value for tracking recovery and informing return to duty (RTD) decision making. As such, current RTD criteria are generally based on time (24 hours rest for first injury, 7 day rest for second injury in a single year) or subjective symptom resolution which normalize within 3-10 days.

Increasingly the current best evidence suggests these criteria are insufficient as acutely injured individuals demonstrate deficits in dynamic balance control that persist as long as 2-months post-injury. Furthermore, recovery of balance control actually regresses immediately following rapid return to activity. Improper management of mTBI may result in increased risk for adverse sequela such as re-injury, musculoskeletal injuries, occupational mishaps, and depressive and substance abuse comorbidities. Coupled with long-term consequences such as chronic symptom and degenerative neurologic disease development, these adverse sequela may severely affect operational readiness and strain DoD and Veterans Affairs health and disability systems.

Persistent gait balance control impairments have been exposed using a dual-task gait assessment paradigm (functional task with concurrent cognitive task), which more accurately depicts the demands of everyday activity. Unfortunately, these laboratory studies utilized sophisticated camera-based motion analysis systems to record highly sensitive biomechanical markers, limiting their clinical utility. Therefore, the purposes of this AMEDD Advanced Technology Initiative (AAMTI) funded project are to 1) develop a clinical dual-task gait balance control assessment for use by first line medical providers in clinical and forward environments, 2) assess its reliability and clinical feasibility, and 3) provide the foundation for translation into a universally accessible smart phone based application.

Twenty (10F) healthy adults participated in this repeated-measures study. A portable clinical instrument was designed consisting of a wearable sensor system (one sensor over the low back as a center of mass proxy and one on each ankle to record gait events), a single laptop, and Superlab software which automated the protocol and administered cognitive tasks through a wireless headset (Fig. 1). All subjects performed
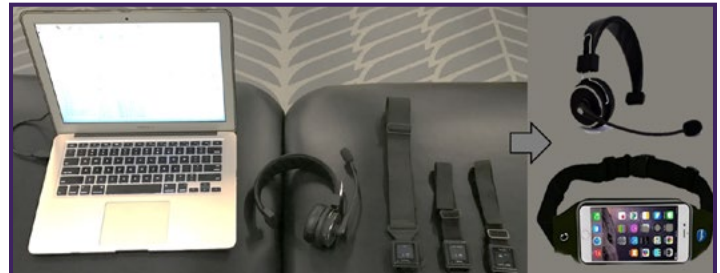

Figure 1: The assessment tool consists of a wearable IMU system, wireless headset and automated Dual-Task protocol. The desired end state is to package the assessment into universally available smart phone based application.

a simple walking task consisting of an 8m level walk, a 180 degree turn, and returning 8m walk in each of three walking conditions (walking only, walking while performing a Stroop task, walking while responding to spelling and arithmetic questions). Cognitive tasks were selected for their ability to challenge different aspects of executive function. The concurrent performance of a gait and cognitive task results in decrements in balance control and/or cognitive task function due to limitations in processing resources which is exacerbated by the diffuse axonal injury associated with mTBI.

To assess reliability, the assessment was repeated in both laboratory and non-laboratory environments, by two different raters, and on two separate days. Eight gait event-specific peak accelerations along three orthogonal axes (Fig. 2) were collected and analyzed using an eight item Cronbach's α and Intrarater Correlation Coefficient. Cronbach's α values of .881 to .980 for the eight metrics and ICC values of .868 to .987 indicate excellent internal consistency and inter-rater reliability.

The assessment was then implemented in a collegiate sports medicine clinic with 26 Division One athletes. The assessment, performed by an athletic trainer, took 8:30 minutes ± 35 seconds on average. As the ImPACT assessment and SCAT5 (currently accepted standard in athletics) take 25 and 10-15 minutes respectively, our assessment time of less than 10 minutes establishes its clinical feasibility. In an additional pilot study, a single injured female Division One athlete who sustained an acute mTBI was assessed longitudinally over a 2-month post-injury period. Multiple peak accelerations along the medial-lateral axis demonstrated a dramatic reduction immediately post-injury and gradually improved over the assessment period, demonstrating the sensitivity of the assessment metrics to both immediate changes in balance control and subtle changes
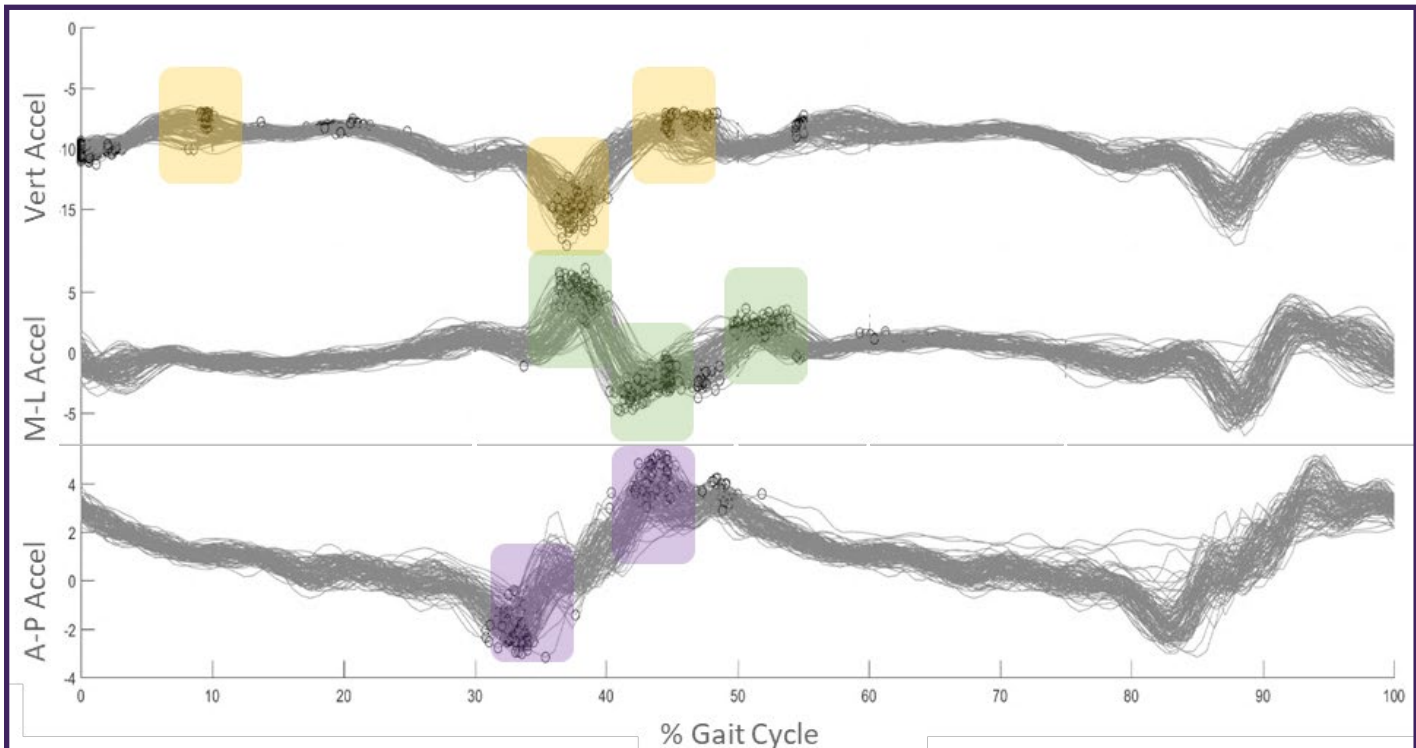
Figure 2: Three axis acceleration profiles during a single gait cycle for each trial. Gait event specific peak accelerations are highlighted.
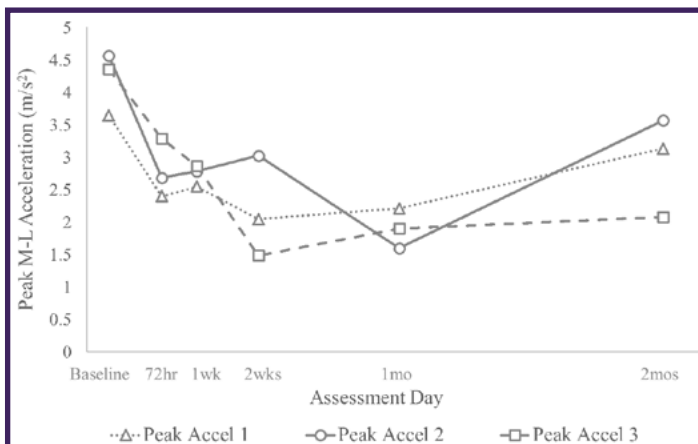

Figure 3: Three M-L peak accelerations for an injured Division One athlete including a pre-injury baseline and five post-injury assessments. Note the acute decline in peak accelerations continuing through 2 weeks, then improving gradually out to 2 months.

associated with recovery (Fig. 3).

At this time, we have developed a feasible clinical instrument that is both reliable and sensitive to subtle changes in dynamic balance control for use in mTBI diagnosis and management. We recently began a longitudinal study to more fully describe recovery profiles for these balance control metrics and establish normative databases. We are also collaborating with the Joint Base Lewis McChord Intrepid Spirits Traumatic Brain Injury Center of Excellence to perform a longitudinal study employing our clinical instrument with mTBI injured Service Members. Data from these investigations will be used to develop a machine-learning algorithm to automate assessment grading, providing clinicians with a real-time objective measure of dynamic balance control. The automated algorithm will then be packaged into a smart phone based application, leveraging the device's internal sensors to produce a highly compact, readily available, objective clinical mTBI assessment instrument (Fig. 1).

"Development of an objective, smart phone based, clinical dynamic balance control assessment has the potential to radically alter diagnosis and management of mTBI throughout the DoD and at all levels of athletic competition," stated MAJ William Pitt, the AAMTI Innovator for this study.

Successful completion of this project will result in a powerful tool able to be implemented at the lowest levels of medical care, improving diagnosis and management of mTBI injury. The effects will be improved Service Member quality of life, increased operational readiness, and reduced military health system burden through more rapid recovery, reduced re-injury and musculoskeletal injury, and reduced incidence of long-term post-concussive symptom development. ■■■

The Future of Telestration in Combat Casualty Care

We've all seen it. We're watching a sporting event on T.V. and after a key play we see a video replay. A commentator describes the play and augments it by drawing arrows, circles, and other freehand additions on the screen. That ability to do freehand markup over a video is called telestration. Telestration is currently used mostly for televised sporting events and weather forecasts. However, it also has great potential in telemedicine and surgical telementoring, where it can be used to provide guidance from a surgeon in a remote location from the patient and the patient's on-the-ground caregivers. This capability is crucial in providing critical care in austere environments where trauma or combat surgeons are not available.

Research into the use of telestration and telementoring in remote casualty care is growing, and a number of capability studies are underway. One of those is the Augmented Reality Forward Surgical Care (ARFSC) demonstration project funded by the AMEDD Advanced Medical Technology Initiative (AAMTI) program, managed at TATRC. The project aims to show that telestration and telementoring using an augmented reality (AR) system is effective in remotely training and guiding non-surgical personnel through surgical procedures.

Earlier this year, the project initiated a proof-of-concept demonstration. The key players were a U.S. Army orthopedic surgeon and a U.S. Navy Physician Assistant (PA). The surgeon was in a separate location from the PA and communicated by computer. The PA wore Osterhout Design Group (ODG) R-7HL smartglasses and used them to interact with the surgeon. The objective of the demonstration was to remotely guide the PA in exposing and clamping an artery in a surgical manikin.

The demonstration was a clear success. Using the telestration capabilities of the ODG smartglasses, the surgeon remotely guided the PA through the procedure. Without prior surgical skill, the PA was able to expose and clamp the proximal common femoral artery in the manikin.

TATRC played an important role leading up to the demonstration. Prior to the demo, the ARFSC "Telestration Team" gathered at TATRC to conduct functional testing of the telestration capabilities in AR devices to deliver full-frame video, audio, still pictures, and data from one connection point to another.

The team involved in the test were comprised of subject matter experts (SMEs) from The U.S. Army Special Operations Command, (MAJ Bill Vasios, SFC Chris Perry), Womack Army Medical Center (COL Tyler Harris; TATRC (Geoff Miller, Harvey Magee, Ollie Gray), BioMojo LLC, Librestream Inc, NuEyes Inc. The Principal Investigator (PI) is COL Tyler Harris, orthopaedic hand and combat surgeon and TATRC's Medical Modeling,

LTC(P) Harris briefs Telestration team before conducting bandwidth testing.

SFC Perry to place 1 fingerbreadth above the fibula during a "dry run" of the Telestration Test & Demonstration.

Simulation & Visualization team serves as the Co-PIs led by Geoff Miller, and Project Managers Harvey Magee and Ollie Gray.

With its initial success, the ARFSC project is gearing up for its next phase, which will evaluate the clinical benefits of telestration and telementoring in supporting remote surgical interventions. In addition, the next phase will assess the educational benefits of training programs for telestration and telementoring. And lastly, the quality of telestration and telementoring will be evaluated as well as user satisfaction with the pertinent technologies and their human-computer aspects.

A mixed methods study has been designed for the next phase of the project. The study will evaluate the following aspects of providing surgical support in remote environments using telestration and telementoring:

- **Technology requirements.** What are the minimum requirements for telestration and telementoring between a surgical specialist in a medical treatment facility and a remote non-surgeon in a far-forward environment using existing telecommunication systems within the U.S. Army?

- **Training requirements.** What training is required to prepare surgeons and non-surgeons to control lower extremity junctional hemorrhage, and to use associated telestration hardware, software, and communication systems?

- **Transferability.** Can the training approach and technologies used in the initial phase of the project be transferred to a wider range of medical care and clinical skills in anticipation of future medical needs and environments?

This second phase of the project is part of the rigorous investigation needed to ensure that forward surgical support using AR and telestration technologies are being provided in a safe and effective way, as well as to inform the development and improvement of new and future technologies to support this capability.

COL Tyler Harris has pointed to the potential this technology has for life saving procedures on the battle field. Along with Geoff Miller, Dr. Harris is beginning to plan for the next round of procedures that need to be studied. ◼◢◢

Enhancing Access to Clinical Records for DOD and VA Users

Many active duty service members transition to the Department of Veteran Affairs (VA) for ongoing care, especially those with disabilities when they separate from active duty. Many people, including reservists, continue to receive care in both the DoD and VA systems. Clinicians from DoD and VA need a total picture of the care rendered in both facilities for these cases. In response to the mandates of the National Defense Authorization Act (NDAA) of 2014, the Joint Legacy Viewer (JLV) was selected as a secured, standard-based, integrated read-only view of electronic health record (EHR) data from DoD's CHCS and AHLTA, and VA's VistA Electronic Health Record systems. This eliminated the need for VA or DoD clinicians to access separate viewers to obtain patient information from the other facility.

A sample screenshot of the Linked Problem List lab results page.

The Problem List is one of many widgets in the JLV application. It provides a listing of all the active diagnoses, or problems, associated with a given patient. When hovering with a mouse over a problem in the list, a user can view the SNOMED and ICD-10 codes associated with each problem. If a JLV user clicks on the problem, a more detailed description of the problem is shown including a listing of notes, encounters, orders, procedures, or consults related to that problem. However, links to those artifacts are not readily available from within the Problem List widget. In other words, JLV displays all the problems in its Problem List widget, but its users cannot simply click on a problem and easily see all associated notes, encounters, orders, procedures, or consults.

In AHLTA, linking the associated artifacts with the problems in the Problem List is a standard feature. In a presentation to the Health Information Exchange Work Group earlier this year, COL John Scott, Director for Informatics Policy, Office of the Assistant Secretary of Defense for Health Affairs, clarified the feature this way, "[The] AHLTA Problem List Module creates a powerful navigation aid for record review. Associated encounters, medications, orders, and artifacts are displayed. One click navigation makes it easy to navigate to associated notes and artifacts." To view the associated artifacts in JLV, a user must switch to each respective domain widget and must remember the identifying information about that artifact in order to retrieve the original note, encounter, order, procedure, or consult. This requires several mouse clicks and when a clinician is busy, this often does not get done. As Dr. Reese Omizo of the Defense Health Agency's Innovation and Advanced Technology Development Division and the VA Office of Informatics & Analytics explains, "users need to be able to make associations between some of the AHLTA associations that are automatically brought in to the Linked Problem List and keep those associations for future use and for shared use." He also believes that "the Linked Problem List feature in the JLV could change the way users interact with the EHR in a way that allows clinicians to be clinicians again." This function would be a step toward focusing on clinical workflow while addressing the needs of other users that require access to this information such as Veterans Benefits Administration staff. "If we build this, there will be a lot of very happy providers out there and patients will get better care," says Dr. Omizo.

To support this goal, TATRC's Health Technology Innovation Center (HTIC) is prototyping a Linked Problem List to enhance the JLV widgets. The project produced a working prototype of enhancements to include a display of existing associations of data elements and artifacts to Problem List items in AHLTA. Current work, which is ready for deployment, will allow providers to create links to data and artifacts, "on-the-fly", and store and share links to these artifacts among clinicians and other authorized personnel using JLV. In addition, the new prototype allows a detailed graphical display of the number of artifacts associated with a specific problem to show the problem with the most artifacts.

Ms. Ollie Gray, the Principal Investigator and Lab Manager for the HTIC, is happy to announce that the outputs from Phase 1 of the project are already being incorporated into JLV, and looks forward to Phase 2 outputs being incorporated in the near future. ◼︎◼︎◼︎

TATRC Demonstrates Op-T-med Capabilities at Army Science Conference

Summer sizzled this past August with TATRC heating things up in the District! On 22 – 23 August, two members from the Medical Intelligent Systems Laboratory (MISL) represented TATRC at the 2018 National Defense Industrial Association's Army Science & Technology Symposium and Showcase. Project Managers Mr. James Beach and Ms. Rebecca Lee highlighted two key capabilities within MISL. The symposium, which focused on the Army's six modernization priorities: Long-Range Precision Fires, Next Generation Combat Vehicle, Future Vertical Lift Platforms, An Army Network with hardware, software, and infrastructure, Air and Missile Defense, and Soldier Lethality, was well attended by senior DoD researchers and VIPs including the Assistant Secretary of the Army (Acquisition, Logistics and Technology), the Honorable Dr. Bruce D. Jette, Deputy Assistant Secretary of the Army (Research and Technology), Dr. Thomas P. Russell, Army Vice Chief of Staff, General James C. McConville, and Commanding General, U.S. Army Medical Research and Materiel Command (MRMC), Major General Barbara R. Holcomb.

TATRC joined six other MRMC labs to exhibit and demonstrate technological capabilities at the symposium. Other labs included the U.S. Army Institute of Surgical Research, U.S. Army Medical Research Institute of Chemical Defense, U.S. Army Center for Environmental Health Research, U.S. Army Medical Research Institute of Infectious Diseases, the U.S. Army Research Institute of Environmental Medicine, and Walter Reed Army Institute of Research.

TATRC demonstrated two capabilities related to patient care and evacuation of the future. The first was

Ms. Rebecca Lee (left) and Mr. James Beach (right) showcasing MISL's key operational capabilities.

its new Environmental Factors Data Acquisition System (EFDAS), to characterize and study the flight profiles of various manned and unmanned aircraft and their effects on patient transport. The EFDAS represents a portion of the MISL's ongoing and future research in unmanned patient transport and autonomous patient care systems. The second demonstration was the lab's air-to-ground medical information exchange and patient telemonitoring research, which is a collaboration with PEO Aviation at Network Integration Exercises and Advance Warfighting Exercises. The MISL team displayed, various tactical radios, routers and other comms equipment, as well as end user

monitoring and medical information exchange platforms that have been developed and integrated.

The wide range of topics and representative organizations offered the ability to gain visibility into research being conducted by other Army organizations. Mr. James Beach stated that "this symposium offers the potential to form multi-functional collaborative research efforts that impact multiple modernization priorities. The medical research community should participate in future research symposiums sponsored at the Service level to identify high-impact research efforts across the Army enterprise." ◼◤◤

Employee Spotlight

TATRC Congratulates Mr. Tom Bigott, Q4 Employee of the Quarter

Mr. Tom Bigott, Project Manager supporting TATRC's Medical Intelligent Systems Lab (MISL) has been named TATRC's Employee of the Quarter for Q4 for his continued excellent work and untiring efforts supporting three significant MISL Projects: 1) Joint Program Committee – 1 (JPC-1) funded Medical Communications for Combat Casualty Care, 2) MRMC funded P6.7 electronic Tactical Combat Casualty Care (TCCC) Card / DD1380 implementation for site of injury and pre-hospital enroute care in Army and Marine Corps tactical ground formations, and 3) the Virginia Tech Medic's Ruggedized SMART Phone GUI project. These unique projects are intricate and particularly difficult to manage since they involve significant weekly coordination in the form of telecons, frequent face-to-face meetings with a host of stakeholders, as well as periodic briefings, preparation and submission of reports to JPC-1, the JPC-1 Steering Committee, Congressionally Directed Medical Research Program, Defense Health Agency Technology Executive Committee, and the AMEDD Center & School HR CoE DCDD.

While managing these projects, Tom has overcome huge obstacles to bring successful completion to these projects by devising, developing, and coordinating statements of work, as well as budgeting and supporting other required contractual documents. In addition to these projects, Tom manages several other SBIR research awards aimed at medical image data compression on top of his day to day project

Mr. Tom Bigott, R & D IT Project Manager for Medical Intelligent Systems Laboratory is Employee of Quarter for Quarter 4.

management responsibilities.

At the annual Special Operations Medical Scientific Assembly (SOMSA) conference in May, Tom provided the cloud background infrastructure that supported all of the TATRC telemedicine technologies demonstrated by LTC(P) Jeremy Pamplin during the Prolonged Field Care Medic orientation and training session.

It is certainly clear to all at TATRC that Tom continuously sets the example and models the qualities of a stellar employee through his patience, thorough attention to detail, positive, professional attitude, respect of institutional policies, assistance and support to his co-workers, all while he exhibits outstanding customer service and courteous people skills.

Congratulations Tom on this well-deserved recognition! ■■■

TATRC Welcomes New IT Support Specialist to the mHIC Team

Mr. Michael White, Information Technology Specialist

Mr. Michael "Mike" D. White joined the TATRC team in this summer as an Information Technology (IT) Support Specialist. He is working out of the Fort Gordon branch office of TATRC, supporting the Mobile Health Innovation Center's (mHIC) intramural lab activities.

Mike is a true Southerner, originally from Charleston, South Carolina. As prior military, he has spent time serving in both the Army and Air Force Reserves. In 2005, he was deployed to Kuwait to support Operation Iraqi Freedom, where he ran transportation missions all through Iraq. He has worked as a military contractor oversees from 2010 to 2012.

A graduate of DeVry University, he has over 16 years of experience in Network and IT system support. He has numerous IT certifications and is constantly striving to expand his technical expertise.

Mr. White is the proud father of 3 children, and is an avid traveler. One highlight of his travels to date was visiting Addis Abba, Ethiopia; and he is looking forward to planning a future trip to the Maldives. His hobbies include the aforementioned traveling, being a great father, cooking, spending time with family and working on a nonprofit effort to donate wigs, and bundles to homeless women, burn victims, and cancer patients.

Welcome aboard Mr. Michael White! ◢◢◢

TATRC Welcomes New Human Factors Project Officer

Mr. James "Jimmy" Gaudaen joins the TATRC team as a new Project Officer. His expertise is in Human Factors and will be primarily supporting and assisting the Medical Modeling, Simulation and Visualization lab, as well as the other labs at TATRC headquarters in Fort Detrick, MD. With this background, he will assist in developing designs for systems and products that follow proper human factors standards. Jimmy will also use his experience to provide recommendations on how to improve the overall usability of products and practices.

Jimmy recently graduated with his MA in Human Factors and Applied Cognition from George Mason University, where he also received a BS in Psychology with a minor in Data Analysis. While this is his first job, during his master's program he researched topics such as trust repair in automation, and how physical

Mr. James Gaudaen, Human Factors Project Officer

stressors can affect skill acquisition.

Jimmy grew up in the Northern Virginia area, where he currently lives with his fiancée, Amy. Jimmy and Amy met on a study abroad trip in Rome, Italy. After four years of being together, the couple decided they needed to get married in Disneyworld on their favorite day of the year, Pi day (3/14). In his spare time, they enjoy going to escape rooms, wineries, binge watching shows like Doctor Who, and hanging out with their animals - a rabbit named Goob, and a puppy named Alfie.

TATRC Welcomes Jimmy to the team! ◢◢◢

MISL Travels the Globe in Search of Unmanned Systems Partnerships

Dr. Gary Gilbert, Mr. Nathan Fisher and Ms. Rebecca Lee of TATRC's Medical Intelligent Systems Lab, along with several other representatives from the U.S. Army Medical Research & Materiel Command (MRMC), the Office of Naval Research (ONR), and Air Force 59th MDW, traveled to Israel in early September. The purpose of the trip was to better understand Israel's capabilities and requirements in military medicine, especially in the area of autonomous medical evacuation.

The first day of the trip included a tour of Israel's Aerospace Industries' Lahav Division, which develops several types of manned and unmanned aircraft followed by a visit to Tel Nof Airbase. At the airbase, the U.S. delegation met with representatives of the Airborne Rescue and Evacuation Unit, (Unit 669), which consists of highly trained special operators who undergo years of additional specialized training. The operators, alongside paramedics, nurses, and civilian doctors perform rescue missions for both military and civilian populations.

On the next day, the delegation toured the facilities of Urban Aeronautics Ltd., developer of the Cormorant Unmanned Aerial System (formerly known as the Airmule). The platform is an unmanned aircraft, propelled by tandem ducted fans and designed to meet the requirements of NATO STO TR-HFM-184 "Safe Ride Standards for Casualty Evacuation Using Unmanned Aerial Vehicles." This meeting was followed by a trip to Simbionix Ltd., which develops

U.S. Delegation touring Galilee Medical Center in Haifa, Israel, which treats both military personnel and war refugees.

Cormorant Unmanned Aerial System at the Urban Aeronautics facility.

medical simulation systems for training, including the Virtual Reality training module for the Intuitive Surgical da Vinci system.

The following day was spent in the northern part of Israel, starting with a visit to the Galilee Medical Center. At the hospital, the team was given a presentation on the care that the medical center provides to Syrian civilian casualties, followed by a tour of their underground emergency department which was built after being directly hit during the 2006 Lebanon War. Afterwards, the team went to the 91st "Galilee" Division, a territorial division of the Israeli Defense Force (IDF) Northern Command near the border of Lebanon.

The highly productive trip resulted in several potential collaborative projects between the U.S. delegation and LTC Ariel Furer, Chief Medical Innovation Officer of the IDF

Medical Corp. There were many synergies and shared ideas when it came to enabling the concept of unmanned patient evacuation that were briefed to the Armed Services Biomedical Research Evaluation and Management, Community of Interest, Senior Leader Advisory Group. As a result of that meeting, a working group including the attendees of the trip plus additional stakeholders will be established to better understand the proposed effort. "To me, the most valuable parts of the trip, were firstly, to share our ongoing and planned research with our Israeli counterparts and to have them share theirs with us in order to facilitate future collaboration; and secondly, to discuss the lessons learned among the other MRMC and ONR travelers in order to better shape the way forward," Dr. Gary Gilbert concluded. ◢◢◢

TATRC *TIMES*

TATRC Chair & ASBREM Convene Autonomous Medical Evac Workshop

Graphical rendition of Autonomous Reconfigurable Embedded System (ARES) Combat Evacuation Misson Module.

In preparing to address the medical needs of future conflict, Dr. Gary Gilbert, TATRC Chair of the Joint Medical Unmanned Systems Working Group (JMUSWG), worked in concert with the Executive Secretary of the Armed Services Biomedical Research and Evaluation and Management (ASBREM) to plan, organize, convene, and execute an Autonomous Medical Evacuation (AME) State of the Science Workshop. Hosted by MITRE Inc. in Tysons Corner, VA in July, the workshop was well attended by key stakeholders including medical operational users, combat developers and researchers from all the Services, the United States Special Operations Command (USSOCOM), United States Transportation Command (USTRANSCOM) and the Department of Defense Communities of Interest (CoIs). The DoD COIs represent 17 technical areas that span cross-cutting science and technology such as platforms, energy and power, and human systems to name a few. These military medical and scientific experts came together to explore the feasibility, potential development and use of AME in future combat operations.

The workshop started with high-level briefings from the Joint Staff Surgeon, the USTRANSCOM Surgeon, and the Defense Health Agency Research and Development Director who provided strategic guidance and operational context for the future operating environment. State of the Science briefs by experts from multiple CoIs provided relevant technical overviews. Attendees and presenters participated in scenario-based work groups highlighting technological gaps and challenges associated with AME capability development.

The workshop focused participants on four scenarios to enable brainstorming with facilitators guiding the discussion. The four scenarios were (1) urban ground combat, (2) combat search and rescue (CSAR), (3) littoral combat, and (4) maritime combat.

Attendees explored these cases for AME, considered the risks and benefits, proposed possible solutions and identified the related technological and policy requirements. The work groups then presented the highlights of their discussions and initial findings, including recommendations for next steps during an out brief session at the end of the workshop.

By the end of the workshop, the attendees generally agreed that developing the AME capability will involve a phased approach dependent on evolving doctrine and policy, formulation of operational CONOPS, development of technology maturity roadmaps, documentation of capability needs and attention to regulatory approval requirement. They noted that the largest barriers to full autonomous care and evacuation (ACE) capability development and implementation, is decisive cross-Component leadership, support and championship. This support is needed to develop a clear plan to address policy and system of systems integration considerations required to achieve ACE.

Dr. Gary Gilbert, who chairs the JMUSWG and serves as USAMRMC's Capabilities Area Manager for the Army Science & Technology task area of Medical Robotics and Autonomous Systems (MED-RAS) and other lead scientists, acknowledged that developing fully autonomous capabilities for casualty care and patient evacuation is complex and includes a broad spectrum of technical and non-technical challenges and considerations. Probably more than any other Army S&T task involving application of emerging technologies to future DoD operational missions, MED-RAS will require significant and continuous cross functional coordination among almost all DoD COIs. ◣◢◢

TATRC's MISL Team Takes to the Podium at 2018 AUSA Medical Symposium & Exposition

The 2018 Association of the United States Army's Institute of Land Warfare Army Medical Symposium and Exposition was held at the Henry B. Gonzalez Center in San Antonio, TX from 27-28 June. The goal of the symposium was to educate and inform the attendees on a wide-array of challenges and opportunities for Army medicine in an increasingly complex world. This event provided education and collaborative discussion on leading practices and innovations from Joint, Interagency, Intergovernmental, and Multinational organizations, as well as from industry and academic partners. It also provided an opportunity to connect those who dedicated their professional lives to finding improvements in the delivery of medical care. The meeting was enlightening, thought-provoking, expansive, and very productive. There were approximately 160 seminar participants which included diverse representation from the Army, Air Force, Navy, and Marines, in addition to international participants from the United Kingdom and Australia, with over 50 presenters within the two day period. Mr. Tom Bigott and Mr. James Beach, two Project Managers from TATRC's Medical Intelligent Systems Laboratory (MISL) were on hand to present and provide insight into Virtual Health related topics.

Virtual Health was an area of great interest at the Symposium, with five Virtual Health Presentations on the schedule. TATRC delivered two of these presentations, as well as provided information on Virtual Health research as part of a panel. Lieutenant Colonel Sean Hipp and Major Dan Yourk of the Virtual Medical Center also gave individual presentations on the Virtual Medical Center and on the Mobile Medic program. Additionally, SFC Todd Hall from the European Regional Medical Command (ERMC) provided a briefing on the ERMC Telehealth initiatives supporting United States Central Command.

Mr. James Beach represented TATRC

MISL Project Managers, Mr. James Beach (left) and Mr. Tom Bigott (right) presented and provided insight into Virtual Health related topics.

Mr. James Beach (left) and Mr. Tom Bigott (right) evaluating a telemedicine system for use in operational environments.

during the five-member panel discussion, *"Modernizing Army Medicine Capabilities in Support of Lethality."* Mr. Beach said, "Having a seat at the table to discuss and collaborate with other senior Army Medicine leaders, as well as hear valuable feedback from the audience, helps to refine and validate our focused research areas."

Mr. Thomas provided an hour long presentation entitled: *"Operational Telemedicine Research at the Tactical Edge."* Mr. Bigott discussed the current DD 1380, the Tactical Combat Casualty Care Card and several problems with the paper copy not getting into the casualty's medical record. Mr. Bigott also discussed efforts to date on creating an electronic version of the DD 1380, additional support capabilities within the DD 1380 that make the Medic's

job easier to document the casualty's clinical condition and care provided, cross domain solutions to transmit the DD 1380 from classified to unclassified networks, and several Cloud based initiatives to support the electronic health record in Theater.

Mr. Beach provided a second presentation specific to MISL's mission entitled: *"Joint Medical Exchange & Documentation Information for Combat Casualty Care."* Mr. Beach discussed his support to the Special Operations Command (SOCOM) in transitioning Virtual Health capabilities from research and design to advanced development activities, with highlights on specific virtual health technologies that will assist SOCOM Medics in the near future. ◣◣◣