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MRDC Commander Makes a Double Visit to TATRC

Mr. Geoff Miller (right) briefs and presents to Brigadier General Michael Talley (center) the plans for TATRC's new Technology Comparative Effectiveness Lab, as COL Jeremy Pamplin and Dr. Robert Walker look on.

TATRC had the opportunity to welcome our newest Commanding General of USAMRDC, Brigadier General Michael Talley to two back-to-back visits last Fall for a site visit, portfolio review, and a deep-dive discussion on the potential timeline for enabling the Army's transition to Autonomous Combat Casualty Care (ACCC). BG Talley is making his way around the command and learning about all of the different units and components that fall under MRDC. Team TATRC was pleased to host BG Talley for his incoming orientation brief of the organization.

TATRC Director, COL Jeremy Pamplin, kicked off the 2 day visit and briefing with a TATRC Overview and introductions of TATRC's respective Lab Leads. mHIC Deputy Lab Lead, Mr. Ron Yeaw, joined by Dr. Robert Walker of the Surgeon General's Office of Innovation, followed with a deep-dive presentation and explanation on the "Capability and Timeline for Enabling the Transition to Autonomous Combat Casualty Care."

Dr. Robert Walker stated, "TATRC's far forward views of what it will take to bring true autonomous medicine to the battlefield resonated very strongly about both this year's Defense Health IT Symposium (DHITS) and the Special Operations Medical Association (SOMA) conference. I'm glad BG Talley had the opportunity to hear them as well." BG Talley echoed this feeling, inviting COL Pamplin to provide the same brief

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TEAM TATRC Gathers for Strategic Planning Offsite – Big Ideas Yield Big Results for Organization

Team TATRC gathers for rare cross-lab photo op during the Strategic Planning.

As an organization, we do not get the opportunity for the entirety of our team to gather in-person nearly enough! Luckily, we were able to do just that last November when the team came together for our inaugural all-hands strategic planning meeting to discuss the state of our current affairs, our organizational mission, strategic messaging, restructuring and reorganizing, as well as important aspects regarding the future of TATRC.

Held offsite at the Morningside Inn in Frederick, MD, the interactive all day event provided an excellent opportunity for the entire team to come together and brainstorm on all things TATRC, including our focus, our vision, and how best to spread the message of who we are and what we do. Additionally, the event provided the perfect opportunity to debut our newly updated Mission statement – "Forging the future by fusing data, humans, and machines into solutions that optimize Warfighter performance and casualty care."

TATRC's Leadership team, including Director, COL Jeremy Pamplin, and Deputy Director, LTC (P) Justin Stewart, presided and got things started with kickoff presentations on organizational business and an introduction to the overall purpose of the meeting, which was to begin the process of developing the TATRC brand and determining how best to position ourselves as an organization to support and advance Military Medicine.

COL Jeremy Pamplin set the stage for the team by stating, "The world as we know it is changing. Specifically, the world related to military medicine. One of the issues facing us is distance. Prolonged field care is something we must grow our capabilities for. How do we go from the space where we have a lot of stuff, capability, and resources, to the space where we don't have those things? Where our Warfighters don't have those things. It's us. It's technology. It's TATRC."

The team then broke out into individual work groups and worked together to solve interactive, hands-on tasks to develop key aspects of the TATRC mission, including the nature of the relationship between TATRC, the Warfighter, and medical providers, as well as ways to optimize performance within the organization by addressing things like management structure and the dynamics between our various labs and programs. These work groups proved to be highly productive, with each team creating unique components that will ultimately be combined and help to build and refine the new mission of TATRC.

Following the work group sessions, the team was treated to a comprehensive, informative presentation on the various types of management structures by our very own Ms. Tabitha Waldrop, MS, PMP, PMI-ACP and Telehealth / Virtual Health Project Manager from our mHIC office at Ft. Gordon! Ms. Waldrop expertly guided the team through the various styles of management and the pros and cons of each, following up with tasking the groups to determine which style they thought best suited TATRC. This resulted in thoughtful, productive discussions

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to the MRDC Leadership Conference being held the following month with the entire command.

TATRC's Lab Lead for Medical Modeling, Simulation, and Visualization, Mr. Geoff Miller, provided Dr. Walker and BG Talley a walkthrough of TATRC's developing SIM Environment, the Battlefield Emergent Stabilization Skills Lab, as well as future plans for TATRC's Technology Comparative Effectiveness Lab. Mr. Miller was eager and pleased to explain what these unique features and new future capabilities will allow. "TATRC's ability to develop a true Human Performance Capability Lab will truly redefine what the field of human performance means to many people, and I was glad to see BG Talley's interest in this new area," said TATRC Director, COL Jeremy Pamplin.

Discussions with BG Talley also included viewing TATRC's capabilities related to Virtual Health, Vertical Lift, and Artificial Intelligence-based Medical Assist tools. BG Talley was very pleased with all he saw, telling the TATRC Team to "Keep doing what you are doing, I love the work, and we need your partnership more than ever." BG Talley specifically appreciated the vast cross-lab, academia, and industry partnerships and relationships that TATRC has fostered to help ensure our portfolios continue to keep up with the pulse of technology across both the military and commercial spaces.

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TEAM TATRC Thanks BG Talley for spending some of his valuable time gaining a deeper understanding of the important work we do!

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across the spectrum of team members, including Leadership, Lab Leads, as well as support staff, which could only have been possible at an event such as this.

Staff member Mr. Ray Samonte, Graphic Designer and Webmaster who works on the Public Affairs team stated, "It really is empowering for someone who is not a scientist, like me, to have a voice and be a part of an organization where the leadership team is bringing all of us together to have a voice in forging a future vision together. It allows those of us even in support roles to truly feel like we're a part of the incredible mission TATRC has moving forward."

Ms. Dawn Petruzzello who serves as the service contract manager on the Resource Management team was able to get a deeper look into what goes on in each individual lab on the day to day. Ms. Petruzzello said, "To be out of my comfort zone, in workgroups that included scientists, technology experts, and program managers that I don't normally work with, really allowed me to have a better understanding of the organization as a whole. It opened up a whole other perspective for me and enhanced my understanding and appreciation of everybody's role here, and how each person has a vital role to play."

At the end of the day, the event had proved to be a resounding success! Perhaps most importantly, with the exception of a dearly missed few, the meeting allowed for all of the team's voices to be heard in person and in a meaningful way – something that is not always easily achieved due to personnel locations and day-to-day tasks.

LTC (P) Justin Stewart concluded the off-site meeting with the following sentiments, "The future fight requires different ways of thinking. We need to understand what threats our Warfighters are facing and how to address them. This is the beginning of rebranding and defining our role in that fight. There is a lot of hard work ahead, but I think we're up for the challenge."

A big thank you to all our staff for your dedicated efforts in helping to refine and improve the TATRC brand! We are excited to see what TATRC's future holds.

Senior OUSD SES Member Visits TATRC for 'Tech Talk

TATRC Leadership. COL Jeremy Pamplin (left) and LTC(P) Justin Stewart (right) welcomed Dr. James "Ben" Petro (center), Director of Human Systems, within the Office of the Under Secretary of Defense for Research and Engineering.

Dr. Petro provided TATRC a valuable, high-level awareness briefing of programs and priorities at the senior-most areas of DoD, and how they see TATRC's role in it.

On 17 December, TATRC was fortunate enough to host a visit and spend the morning with Dr. James "Ben" Petro, Director of Human Systems, within the Office of the Under Secretary of Defense for Research and Engineering, where he oversees, coordinates, integrates and synchronizes a $3.2 B / yr research portfolio targeted to optimize Warfighter effectiveness and lethality.

His management of the Human Systems portfolio includes the technology areas of biology (to include medical, warfighter performance, and nonmedical research), human-machine teaming, training, environmental sciences, and DoD compliance with statutes, regulations, and policies for protection of human and animal research subjects, so visiting TATRC was a logical fit.

TATRC's Director, COL Jeremy Pamplin kicked things off with a comprehensive overview of TATRC's new mission, our approach to research, and an inside look at the future of our Medical Robotics, Autonomous Systems, Virtual Health, and Medical Simulation portfolios. COL Pamplin was followed by several key staff from the Medical Intelligent Systems Lab, the Mobile Health Innovation Center, and the Medical Modeling, Simulation and Visualization Lab.

Dr. Petro provided TATRC a valuable, high-level awareness briefing of programs and priorities at the senior-most areas of DoD, and how they see TATRC's role in it. Dr. Petro stated that he was "pleased with how well TATRC's portfolio aligned with future military medicine research priorities and Army Future Command initiatives."

A member of the Senior Executive Service, Dr. Petro has a Ph.D. in Microbiology and Immunology from Vanderbilt University, a Master of Science in Strategic Intelligence from the National Defense Intelligence College, a Bachelor of Science in Biotechnology from Worcester Polytechnic Institute, and is a graduate of the Federal Executive Institute's Leadership for a Democratic Society and the Massachusetts Institute of Technology's Seminar XXI programs.

TATRC appreciated hosting this visit from such a champion of innovation. Thank you, Dr. Petro for your time!

BHSAI Licenses the 2B-Alert Fatigue-Management AI Tool for Commercial Development

If you've been reading the TATRC Times for some time now, chances are you have heard of Dr. Jaques Reifman, Director of the Biotechnology High Performance Computing Software Applications Institute (BHSAI) here at TATRC. Dr. Reifman is once again making big waves with the licensing of his 2B-Alert fatigue-management AI tool.

Sleep deprivation is a universal challenge faced by nearly all Service Members, especially during military operations. It can lead to accidents and catastrophic mission failures. The ability to predict future alertness levels and recommend effective measures to improve cognitive performance can reduce or prevent accidents and injury.

Over the past 10 years, Dr. Reifman and his team of BHSAI researchers synthesized data from decades of sleep research collected by collaborators at the Walter Reed Army Institute of Research (WRAIR) and developed a biomathematical model that predicts how various sleep-deprivation conditions affect alertness. Recently, they integrated the model with an AI algorithm that learns how each individual responds to sleep deprivation and generates customized alertness predictions, as well as an algorithm that quickly discovers the best countermeasures to reduce alertness impairments at the desired times and durations.

In collaboration with WRAIR scientists, the BHSAI team has implemented the model and algorithms in two decision tools. The first, 2B-Alert Web, is a PC-based application that allows users, especially mission planners and work schedulers, to predict how sleep-wake schedules and alertness-improving measures affect cognitive performance for a group of individuals. The second, 2B-Alert App, is a smartphone AI application that allows individual users to monitor their own alertness levels and generate personalized alertness-enhancing recommendations based on their prior sleep-wake schedules.

Having established a mature 2B-Alert technology, the next step was to license it. To do so, the BHSAI team worked directly with the Medical Technology Transfer (MTT) office, which is USAMRDC's enterprise-wide Technology Transfer Office led by Dr. Paul Michaels. MTT identifies intellectual property that has the potential for licensing to industry, performs outreach to potential licensees and Research & Development (R&D) collaborators, and negotiates the licenses for USAMRDC's patents and other intellectual property.

C. Blake Sajonia, the MTT agent assigned to license the 2B-Alert tool, worked directly with Dr. Reifman and Mr. Quinton King, a licensing professional from TechLink (a DoD Technology Transfer Partnership Intermediary), to develop and execute a licensing strategy. His challenge was to ensure that USAMRDC remained the holder of the model and algorithms while retaining the benefit of one or more companies commercializing a software product.

An example of 2B-Ready's clear and focused Dashboard.

Working through several iterations of the Patent License Agreement (PLA) and the Cooperative Research and Development Agreement (CRADA) to address business, legal, and technical issues, Mr. Sajonia achieved a mutually acceptable pair of agreements by linking the PLA with the CRADA, through which the company would have access to software upgrades and subject matter expertise. The resulting non-exclusive PLA and CRADA were executed with Integrated Safety Support, a company focused on fatigue training, analysis, and management, as well as solutions that enhance future workforces.

These developments place the 2B-Alert tool at the stage of technology transfer (T2)–a step that helps realize the full benefits of our nation's R&D investment in funding federal laboratories and is thus vital to our economy and national security. "T2 for the Army is important because it encourages and enables companies to produce commercial products that can benefit both the public in civilian applications and be purchased by the military for use. Such products often result in significant cost savings to the military because of the broader customer base that dual-use (civilian and military) products have over purely military products," said Dr. Paul Michaels, Director of the MTT office.

"It is gratifying to see the research efforts of numerous individuals across many years culminate in a product that will be useful for both the military and the general public, and which promises to increase Warfighter Readiness on a wide scale," said Dr. Reifman, at the prospect of working with Dr. Adam Fletcher, CEO and Principal Consultant of Integrated Safety Support. Given the potential of commercial partners to add improvements and features to new technologies to create value-added products, the possibilities for a new generation of scientifically validated fatigue-management devices seem limitless.

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No Pilot, No Problem: Unmanned "Flying" Laboratory Lifts Off in a TATRC First

Representatives from DPI, TATRC, USAARL, Joint Program Committee-6, Medical Evacuation Proponency Division, Joint Program Committee-1, and the logistics community participated in DP-14's first test flight.

Team TATRC does it again! On 29 October, the first flight and demonstration of the DP-14 Unmanned Aerial System (UAS) was successfully held at the Warren Grove Gunnery Range in New Jersey. The project originated from TATRC's Medical Intelligent Systems Lab and concluded the first phase of a research collaboration between TATRC, the U.S. Army Aeromedical Research Lab (USAARL), and DPI UAV Systems (DPI). This study was developed under a Joint Program Committee-6 (JPC-6) funded research project entitled, "Emergency Medical Resupply and En-route Care UAS Research Platform."

This project seeks to provide a "flying laboratory" designed to enable research of emerging UAS and autonomous en-route care systems as a means to augment traditional medical resupply and casualty evacuation (CASEVAC) efforts in austere environments. During Phase 1, the DP-14 aircraft was designed, built, and tested, culminating in this successful "maiden-flight" event performed without the exterior skins of the aircraft to prove out mechanical performance and system stability during a manually controlled flight.

DP-14's "maiden-flight" event performed without the exterior skins of the aircraft to prove out mechanical performance and system stability during a manually controlled flight.

During Phase 1, an Environmental Factors Data Acquisition System (EFDAS) system was designed and built by USAARL and used to collect data during the event, measuring conditions that affect

Flying Laboratory

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TATRC visits IBM's Thomas J. Watson Research Center

Thomas J. Watson, an American Businessman, and for whom the IBM Thomas J. Watson Research Center is named after, once said, "To be successful, you have to have your heart in your business, and your business in your heart."

On 26 September, TATRC Director, COL Jeremy Pamplin and Ms. Jeanette Little, Lab Lead for TATRC's Mobile Health Innovation Center, had an opportunity to visit the Thomas J. Watson Research Center. The Thomas J. Watson Research Center is the headquarters for IBM Research and the center is comprised of two sites, with its main laboratory in Yorktown Heights, New York, and the second with offices in Cambridge, Massachusetts. It is part of one of the largest research organizations in the world tackling a variety of issues across different sectors.

While on campus, they met with Dr. Jeff Rogers, who leads IBM's global research efforts in using artificial intelligence and internet-of-things or devices for healthcare. The work of Dr. Rogers and his team focuses on creating systems of integrated sensors, models, and closed-loop controllers to support personalized health. He has overseen the deployment of these systems to homes, cars, and medical facilities to address applications ranging from managing chronic disease to wellness.

One of the things that Dr. Rogers and his team of researchers are focused on is leveraging quantum computing to identify potential clinical conditions based on biosensor data. This approach could potentially enhance the efforts already in progress by TATRC in the operational environment. COL Pamplin and Ms. Little were able to tour the 'Smart House' on the research campus, and talk to numerous individual researchers about their work in the early detection of Parkinson's disease using sensor technologies within the home. They were also introduced to the work being done at IBM about sensor data that can be collected from all areas of life including vehicles and social media, among other sources. These expanded technologies could potentially also impact the research TATRC has already done. There was also an opportunity to tour the quantum computer configuration lab and discuss possible options for a future IBM / TATRC collaborative research project leveraging artificial intelligence and quantum computing. "This visit demonstrates the importance of the work TATRC is already undertaking, but it also helps to build partnerships with respected industry leaders in the civilian sector which might help broaden the horizons of our future work," COL Pamplin stated.

During their visit, Ms. Jeanette Little (left) and COL Jeremy Pamplin (right) teamed up against IBM Watson in a friendly game of 'Jeopardy!'.

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patient safety during flight. During the next phase, DPI will complete the build and flight testing of the DP-14 UAS, adding the required vehicle autonomy and network capabilities, resulting in a UAS testbed for autonomous medical transport and evacuation research. The final flight demonstration is planned for late next spring. Attendees included representatives from DPI, TATRC, USAARL, Joint Program Committee-6, Medical Evacuation Proponency Division, Joint Program Committee-1, and the logistics community.

Dr. Gary Gilbert of TATRC's MISL Lab stated, "By leveraging emerging technology to develop faster, more efficient methods of medical resupply and CASEVAC, TATRC is ensuring Warfighter resiliency and maintaining the Army's competitive advantage over potential adversaries." A big shout out to all involved who made the first flight of this one-of-a-kind aircraft such a success! Dr. Gary Gilbert and Mr. Nathan Fisher, of TATRC's MISL Team look forward to continued collaborations with this esteemed group of partners.

TATRC HQ Heads South to Fort Gordon

In late October, TATRC's Senior Leadership and Command team conducted a site visit to TATRC's mHIC office, located in Fort Gordon, Georgia. This was the first occasion for TATRC's new Deputy Director, LTC (P) Justin Stewart to meet mHIC's team members first hand and see the unique work being done on site at Fort Gordon. The 2 day series of meetings allowed team members, individually and as small functional teams, to have quality time with our leadership to further introduce themselves, their work, and to familiarize our leaders with the unique capabilities our mHIC team contributes to TATRC as a whole. Team mHIC provided project status reports and conducted focused discussions on specific research projects for FY20, allowing for valuable input and feedback from our Senior Leadership for future direction and notional guidance as we plan for projects beyond FY20. In addition to the packed and productive meeting agenda, the GA crew showed off their typical southern culinary hospitality, with a signature potluck luncheon that everyone enjoyed.

TATRC Fort Gordon Team with TATRC Leadership.

"Having Leadership here and on the ground first hand really made a big difference. While we're all connected and virtual, having the opportunity to interact in person to discuss such key things like mHIC's specific accomplishments and challenges, as well as future plans at both the research end of the spectrum, and the internal organizational capabilities as a whole, was invaluable," stated Ms. Jeanette Little, mHIC Lab director.

Team mHIC looks forward to hosting our Senior Leadership's next visit!

Team mHIC Takes to the Links for Charity

On Friday, 11 October, mHIC staff members from our office at Fort Gordon in Augusta, Georgia took to the links in the name of charity. Mr. Marvin Cole, Mr. TJ Brown, Ms. Tabitha Waldrop and Mr. Nate Montgomery took time away from the office to volunteer and participate in the Blake Hadden Memorial Golf Tournament. This local tournament was established in 2018, in memory of a young native Augusta golfer whose life ended too soon. Proceeds from the Blake Hadden Memorial Golf Tournament provide scholarships for athletes who excel academically and athletically.

Held on a Friday in conjunction with the Southeastern Junior Golf Tour, a junior golfer was paired with each team of adults, and the event was considered that junior golfer's practice round for their tournament which occurred that weekend. Our team's junior golfer was nine-year old Turner Stevenson, who has already won 49 trophies over the past two years! It was a great day for fun with an up and coming potential future golf champion. We're keeping an eye on his young career!

"It was a great day. An experience I will never forget! And young Turner is amazing! I can't wait to see how he's doing in about ten years. He's probably going to be famous!" said Marvin Cole, one of mHIC's Systems Integrators.

Our golf team for the day, left to right: TJ Brown, Turner Stevenson, Nate Montgomery and Marvin Cole.

For more information about the tournament, please visit www.cricketfoundationbh.com.

mHIC Announces its Employee of the Quarter for the Ft. Gordon Team

Mr. Ronnie "Dean" Parrish, is mHIC's Q1 Employee of the Quarter.

Congratulations are in order for Mr. Ronnie "Dean" Parrish of TATRC's Mobile Health Innovation Center located at Fort Gordon in Augusta, GA. Mr. Parrish is dual hatted and serves as a mobile application and web portal developer for the MHCE system, and was specifically recognized this quarter for his efforts to develop and field the beta version of an ocular trauma mobile telemedicine application known as FOXTROT.

Thanks to Dean's commitment to excellence, the deployment of FOXTROT was immensely successful, as this capability enabled role 1 - 3 medic-users to place teleophthalmology consults in the FOXTROT mobile app for trauma or disease non-battle injury (DNBI). An expeditionary ophthalmologist stationed in Bagram, Afghanistan was alerted via email and responded using a secure computer portal directly linked to the mobile app end users. Our partner and PI on the project, Maj William G. Gensheimer, MD, reported very high user satisfaction and exceptional response time following the analysis of this beta testing.

Notably, during initial planning and development of FOXTROT, Dean fielded countless capability requests which often included developing off hours as our PI's imminent deployment and demanding requirements required full time attention. Ultimately, the FOXTROT application and portal received accolades from numerous users and remains a capability with growing enhancements being evaluated to serve our medic warriors.

Dean is an incredibly dedicated, hard worker, and loves to solve complicated problems that meet the needs of our military heath care teams and their specific problem set. We have yet to send him a challenge he has not met and remains well worthy of this nomination! Congratulations Dean and please keep up the amazing work!

TATRC's mHIC Team Collaborates at Clemson University

Clemson University

On 10 October 2019, Ms. Jeanette Little and Ms. Amanda Schmeltz from TATRC's Mobile Health Innovation Center (mHIC) in Fort Gordon spent the day at the Clemson University School of Public Health, in an extensive working session where they collaborated with Dr. Ron Gimbel and his team of researchers to discuss key findings and results from their latest research study, and finalize details for some upcoming peer reviewed publications. Dr. Gimbel serves as the chair of the Department of Public Health Sciences within the College of Behavioral, Social and Health Sciences. He came to Clemson in 2014 from the Uniformed Services University of the Health Sciences with extensive experience in operations, health administration and health policy. His research interests focus on improving health care delivery and health outcomes through clinical research on physician decision-making, clinical documentation, and enhanced communication. Ms. Amanda Schmeltz stated that, "being on-site and in this immersive environment with our colleagues at Clemson allowed us to discuss the implications of this critical research and vital next steps from the lessons learned."

In addition, the TATRC team members were able to visit with Dr. Kuang-Ching "KC" Wang from Clemson's Holcombe Department of Electrical and Computer Engineering Department and discussed his research efforts on supporting communications in the DIL (denied, intermittent, or low/no comms) environment expected in the MDO. Dr. Wang is currently engaged in research in wireless networks and mobile computing, ad hoc and sensor networks, distributed protocols, and pervasive applications and embedded systems, which made this a natural fit for the mHIC team.

The day proved fruitful and productive as the two teams finalized planning for an article that was submitted into the Journal of Medical Internet Research following the joint TATRC / Clemson / Madigan Army Medical Center / Nellis Air Force Base Diabetic home monitoring project analysis, being finalized as of this writing. Dr. Wang briefed the team on his progress as Principal Investigator on the "Complete and Resilient Documentation (CARD) for Operational Medical Environments" project, as well as capabilities being integrated to further support Warfighter communications in the anticipated diverse range of challenging networking requirements.

TATRC Visits UK's Ministry of Defense to Establish a Collaborative Research Partnership

Group Photo from the HMS President on the Thames River with the Tower Bridge in the background. Personnel from left to right are: 2LT Matt Dickinson, Mr. James Beach, Lt Col Bartels, Dr. Gregory Burnett, Mr. Jeff Luciano, and 2LT Corey Mack.

Last fall, TATRC personnel packed up and headed off to visit the United Kingdom's Ministry of Defense (MOD) Surgeon's Office to collaborate with the United Kingdom's military telemedicine lead, Lt Col Oliver Bartels. Mr. James Beach, Project Manager from TATRC's Medical Intelligent Systems Lab traveled as part of a multi-Service delegation, along with Dr. Greg Burnett from the U.S. Air Force Research Laboratory (AFRL) and Mr. Jeff Luciano from the Program Management Office, Special Operations Forces Support Survival Equipment Systems. Over the course of four days hosted at the MOD's main building and the HMS President in London, the group met with 46 MOD personnel to conduct capability demonstrations with the Battlefield Assisted Trauma Distributed Observation Kit (BATDOK™), and to discuss TATRC's research roadmap for Virtual Health. The British participants were medics, physicians, regimental surgeons, military exercise planners, capability developers, and acquisition personnel from across the three single Services (British Army, Royal Navy and Royal Air Force) and Joint Forces Command.

Lt Col Bartels conducted various briefings about the United Kingdom's telemedicine development activity (Project LARA) that he leads as a military anesthesiologist with extensive operational experience. His team is already integrating several capabilities including the Tempus Pro Physiological Status monitor that is commonly found in the Tactical Combat Casualty Care kits provided to U.S. Special Forces Organizations. Through Project LARA, Lt Col Bartels has demonstrated telemedicine capabilities and is actively pursuing research efforts that are similar to the USAMRDC research efforts led by TATRC. These briefings served as an introduction to each group for MOD telemedicine research and development efforts for both UK and U.S. personnel.

Dr. Burnett, along with 2LT Corey Mack and 2LT Matt Dickinson, conducted multiple BATDOK demonstrations that included hands-on practicums to allow for the MOD personnel to evaluate the BATDOK capability for potential use within the United Kingdom's Armed Services. The UK personnel were able to become extremely familiar with the BATDOK capabilities for local patient monitoring and documentation for pre-hospital care. Dr. Burnett also discussed how the capability could easily be adapted to address specific UK pre-hospital medical documentation requirements.

Mr. James Beach briefed on current TATRC Virtual Health research and the Virtual Health Roadmap and discussed potential collaborative research opportunities for telemedicine interoperability between the United Kingdom and United States at each session involving key United Kingdom capability development and acquisition personnel. This TATRC briefing discussed the transformation of BATDOK into a fully-fledged pre-hospital telemedicine system in partnership with Dr. Burnett and Mr. Jonnie Johnson at the Combat Capability Development Center Aviation Missile Center through the Joint Program Committee-One funded Medical Data Cloud research. The linkage of this research and resultant data collection capabilities for the Clinical Decision Support Systems (CDSS) and Artificial Intelligence (AI) development was also discussed to introduce U.S. Military concepts for CDSS and AI Virtual Health Systems. The mechanisms to collect sufficient proper clinical data to inform the development of CDSS and AI systems do not currently exist. Mr. James Beach also provided information

TATRC in UK

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Director's Town Hall Focuses on New Lab Space and 'Rallies the Troops' for the Year Ahead!

Last December, Team TATRC had the opportunity to assemble in what is soon to become TATRC's *NEW* Technology Comparative Effectiveness Lab for the latest Quarterly Director's Town Hall meeting! A lot of hard work has been done and progress is being made for the future of our organization, and with progress comes change! The Town Hall provided an excellent opportunity for TATRC's Director, COL Jeremy Pamplin, to bring the team up to speed on the latest organizational happenings and to highlight the recent achievements.

The meeting opened with a special addition to the agenda, as COL Pamplin presented Dr. Loretta Schlachta-Fairchild, who served as Coordinator of Medical Simulation and Information Sciences (MSIS) at Joint Program Committee-1 (JPC-1), and who retired at the end of 2019, with a special Director's Coin for all the dedicated work and remarkable achievements she's accomplished throughout her career in support of advancing Military Medicine in support of the Warfighter!

The focus then shifted back to TATRC-related business, where we were able to cover quite a lot of ground, including a look back at what has been a very dynamic and metamorphic year for the organization, to include our new mission, our organizational restructuring, rebranding and strategic messaging, as well as an optimistic look at the road ahead and our goals for 2020!

Director, COL Jeremy Pamplin, congratulates Dr. Loretta Schlachta-Fairchild on a long and successful career in support of Military Medicine and presents her with the Director's Coin.

COL Pamplin addresses the Team in the new Technology Comparative Effectiveness Lab during the organization Town Hall this past December.

As COL Pamplin stated, "We are in a good position, not only to exist, but to start to expand."

Thanks to the hard work being put in across the board, by our entire staff and leadership, as we are poised to grow and become more effective and impactful than ever in this new age of military medical technology!

TATRC in UK *continued from page 10*

on how this research will further progress into robotic and autonomous systems to augment medics on the ground to reduce the reliance of communications.

Lt Col Bartels stated, "It was a pleasure to host this visit to the United Kingdom by five colleagues from across the U.S. Armed Forces. The opportunity to meet and discuss virtual health and digital pre-hospital patient management systems, with a view to future collaboration was incredibly useful. The visit allowed the teams from AFRL, TATRC and SOCOM to brief 46 UK MOD personnel over three days on their programmes of work to help shape the UK's understanding of which telemedicine and virtual health technologies we will need going forward to achieve interoperability. A great visit in all respects and we are looking forward to building on these relationships formed."

As a result of this visit, the UK telemedicine lead and TATRC are staffing a draft Cooperative Research and Development Agreement (CRADA) focusing on how information systems and virtual health can support interoperability. Research opportunities will focus on more than technology integration. For telemedicine interoperability, larger issues revolve around differences in partner nation clinical practices, combat medic scope of practice, human-to-human communications, and medical record legislation for provisioning of care in a multi-national environment. The CRADA will focus on using current prototypes in research and in advanced development to demonstrate technology interoperability. In addition, the cooperative research relationships established offer enhanced technology surveillance capability for Virtual Health technologies that covers both sides of the Atlantic Ocean. Through proper coordination and collaboration, the United Kingdom and United States will be able to demonstrate options to clinically support each other in multi-national operations, even in cases where there is no appetite to put boots on the ground for mutual support.

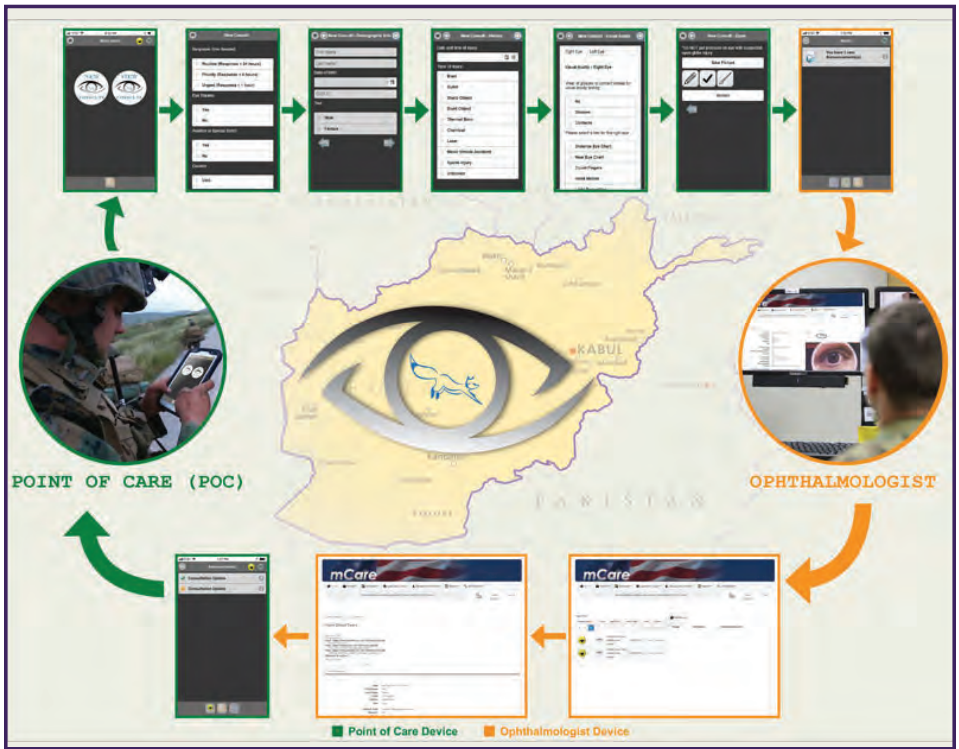
TATRC's Mobile Health Project 'FOXTROT' Trots into the Spotlight

Ocular Expert Visits TATRC Fort Gordon Campus

The last week of September brought a welcome visit to the Mobile Health Innovation Center's (mHIC) Ft. Gordon team as LTC Jennifer Stowe visited for two full days of collaboration and further project planning for the highly acclaimed Forward Operating Base EXpert Telemedicine Resource Utilizing MObile Application for Trauma (FOXTROT) project.

Project FOXTROT is a secure tele-ophthalmology mobile app for treatment of ocular trauma utilizing the Mobile Health Care Environment (MHCE) system, and this solution provides a novel approach for creating a training platform for medical providers, specifically with regard to ocular trauma care.

LTC Stowe, Deputy Director of Injury Protection and Biodynamics, as well as Science Program Administrator from the U.S. Army Aeromedical Research Laboratory (USAARL), served as the Co-PI on Project FOXTROT and worked directly with the mHIC Developers to discuss enhancements of the existing FOXTROT platform capabilities, including the integration of a tonography tool, which records intraocular pressure, within FOXTROT. LTC Stowe briefed the team on the clinical utility of downrange tonography in that it is the more drastic changes in intra ocular pressure, rather than a steady, high pressure which are more damaging to the optic nerve. Further explaining that a large percentage of TBI and or blast patients go on to develop glaucoma and other IOP diseases. Enhanced downrange retinal imaging camera capabilities were also discussed for FOXTROT integration, allowing greater remote diagnostic capabilities which still meet the rigorous security and privacy requirements of medical data exchange which the MHCE provides.



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

MAJ William Gensheimer, Air Force Ophthalmologist who deployed FOXTROT in Bagram Airfield, Afghanistan stated,"FOXTROT introduces a powerful new tool for decision support in operational environments to diagnose military-relevant eye disease, illness, or injury; prescribe mitigation and treatment strategies; and determine risk of Warfighter's return to duty. The ability to provide virtual and remote eye care and clinical decision support has never been possible in battlefield medicine, and represents a unique, specialized-care capability gap that is capable of affecting all service members."

The visit concluded with finalizing the storyboarding for integrating the Apple Watch capability with the mCare app, as an option for users who are recording their activity on projects such as DREAM and future readiness use cases for mCare/MHCE. LTC Stowe was recently assigned a new research role at Ft. Rucker, AL, and suggested there are many collaboration opportunities for TATRC and the USAARL, and recommended TATRC send representatives to tour and visit her new stomping grounds soon.

FOXTROT into Spotlight

continued to page 13

National Guard Announces Proof-of-Concept Pilot of TATRC Readiness App

Over the past 2 years, the Army National Guard (ARNG) and TATRC's Mobile Health Innovation Center (mHIC) have been working collaboratively on a medical readiness app called 'PR2ME' (Portal for Ready and Resilient Individuals Using Mobile Enterprise). PR2ME, a component of the Mobile Health Care Environment (MHCE) system, is a novel and secure mobile application that ARNG citizen-soldiers can use on their personal devices to complete the DoD Periodic Health Assessment (PHA), Part A. On Saturday, November 16th during a quarterly ARNG Medical Advisory Group (MedAG), mHIC Deputy, Ron Yeaw, performed a capabilities brief and live, interactive demonstration of PR2ME. The MedAG had State Surgeon representation from all 54 ARNG states and territories. In attendance was, among others, BG Stewart Reece, the Deputy Commander 35th Infantry Division, and BG Jill Ferris, the National Guard Deputy Surgeon General. The goal was to get consensus to transition PR2ME research to a limited field testing trial with the Maryland Army National Guard (MD-ARNG).

Following the live demonstration, LTC Tim Cho, Chief of Preventive Medicine, ARNG, gave his support for the product to begin live patient field testing. The ARNG MedAG was excited with the demonstration and collectively approved the March 2020 proof-of-concept pilot of PR2ME. Per LTC Cho, "The initial operating capability (IOC) is ready to be tested and I am glad that the MD-ARNG will be able to conduct a proof of concept starting next year."

MD-ARNG Deputy State Surgeon, LTC Bill Fox stated, "MD-ARNG is very excited, and pleased to have been selected as the IOC site for PR2ME and is ready to start as soon as possible. The MD-ARNG is patiently awaiting the opportunity to field the PHA Mobile Application. All indicators suggest the Mobile PHA will be a great resource for Soldiers and Commanders, enhancing nationwide medical readiness and overcoming some existing barriers to completing Part A of the PHA by Reserve Component Soldiers outside of the armory."

TATRC mHIC Deputy, Ron Yeaw, pictured with LTC Tim Cho, Chief of Preventive Medicine, ARNG on the right and MD-ARNG Deputy State Surgeon, LTC Bill Fox on the left, among others, at a PR2ME kick off with the Maryland National Guard Medical Office.

Three additional proof-of-concept field tests will be performed in FY20, with the goal of an enterprise release in the 1st quarter of FY21. With ARNG 350,000 citizen soldiers, the PR2ME product has the potential to be TATRC's largest ever software fielding to date.

FOXTROT into Spotlight *continued from page 12*

FOXTROT Awarded 2019 AMSO 'Project of the Year'

In the fall, the Army Modeling and Simulation (AMSO) Office released their call for Fiscal Year 2019 nominations for their annual Army Modeling and Simulation (M&S) awards. The theme for FY19 was "Enabling Army Readiness and Modernization" and there were 7 specific categories under which M&S awards could be submitted.

LTC Jennifer Stowe, Co-Principal investigator on the Project FOXTROT teleophthalmology mApp submitted a team nomination on behalf of the entire group of clinicians and the TATRC Mobile Health Innovation Center Staff.

On December 17th, the AMSO notified the mHIC staff that they were the recipients of the 2019 AMSO Project of the Year. The TATRC team members that were specifically named for their contributions on this award are as follows: Jeanette Little, Mabel Cooper, Ronnie "Dean" Parrish, Amanda Schmeltz, Yukia Green-Matkins and Tabitha Waldrop.

Employee Spotlight

Congratulations to MISL's Rebecca Lee on Employee of the Quarter!

Ms. Rebecca Lee, Project Manager/Biomedical Engineer for Medical Intelligent Systems Lab.

Ms. Rebecca Lee of TATRC's Medical Intelligent Systems Lab is the Q1 Employee of the Quarter at TATRC HQ for continuing her outstanding work and untiring efforts as a Medical Robotic & Autonomous Systems (MED-RAS) Research Projects Biomedical Engineer. Ms. Lee represents the future of Army medical technology research and engineering. She aggressively and enthusiastically takes on and promptly completes any program management task, whether it involves science and engineering or administrative, managerial or training tasks.

During Q1, while serving as a PI for a challenging two-phase Combat Medic Decision Support System research project, she planned, proposed, and initiated research under both DHP and Army S&T funding programs, both of which required her to coordinate development of Transition Agreements with separate Program Managers within both the Army and the Joint community. For one of those which was accepted for funding, the TRUMAN Data Commons project, she volunteered to serve as the Contracting Officers Representative (COR). In this capacity, she organized and oversaw contractor conducted interviews and the collection of end user data requirements during the MHSRS meeting in Florida. This was highly successful with over 30 participants from both conventional and special operations military research, and operational communities having been interviewed.

Additionally, she has become a key participant in another MHSRS research collaboration meeting lead by the U.S. Army Institute of Surgical Research, for a project aimed at data collection and analysis for SEPSIS assessment and treatment in the field. She submitted and participated in four new major research proposals involving biomedical engineering and/or medical intelligent systems and authored an MHSRS poster, as well as and an oral presentation and a conference proceedings paper for Association for Unmanned Vehicle Systems International.

To support and extend her own research and to help close unfunded technical gaps, she authored and continues to serve as COR for seven SBIR projects which leverage and further develop emergent enabling technologies from outside DoD. In most cases, her research efforts involve significant coordination and collaboration with numerous military labs, academic institutions, and private industry partners. In every case, she meets reporting requirements and maintains project performance, budget and schedule on track. Additionally, she took on numerous taskers in support of the MED-RAS Capability Area Manager for POM development and strategic planning, and promptly produced detailed model results.

An aspiring future technology leader, she served as a liaison for developing relationships with the Joint AI Center and completed the didactic portion of her Master's degree program in Systems Engineering.

Congratulations, Ms. Lee on this high honor!

New Project Officer to Join TATRC's Medical Modeling and Simulation Team

Ms. Deborah Locke, Project Officer for Medical Modeling, Simulation and Visualization Lab.

Ms. Deborah "Debbie" Locke is the newest addition to join the TATRC team. She will be supporting and assisting the Medical Modeling, Simulation and Visualization lab at TATRC headquarters at Ft. Detrick. In the role of Project Officer, she will provide assistance to the PI on various research projects as well as update project records, track deliverables, compile data and information useful for medical research proposal documents and other areas of project planning.

A graduate of Virginia Commonwealth University, Ms. Locke has six years of project management expertise working exclusively on government contracts. In her previous roles, she was responsible for monitoring compliance, project scope, timelines, financial forecasts, and resource management from project initiation to contract closeout. She managed performance on contracts that provided support for clinical trial research in the therapeutic areas of infectious disease, TBI, experimental therapeutics, sleep, human subject's protection, medical devices, clinical monitoring, and regulatory affairs. She was the primary contact for military and government customers at Walter Reed Army Institute of Research as well as Ft. Detrick.

Prior to government contracting Ms. Locke spent several years serving as a Payroll Tax Manager for a local Defense organization and also large Hospitality company. She wrote policies and procedures for continuity of payroll tax practices and to improve efficiencies.

Ms. Locke, a native of Baltimore, currently resides in Frederick, MD with her husband Mike. Both car enthusiasts, they belong to the Golden Gears Car Club of Frederick County. The club is dedicated to the preservation, use and enjoyment of classic, muscle and special interest vehicles. The club hosts benefit events for charitable organizations in the community. They recently finished collecting two trailer loads of items for the local Toys for Tots Campaign. In addition to the car shows and cruise-ins, Ms. Locke spends a lot of time and energy training their brand new Yorkie puppy named Kasey.

TATRC is so happy to have this wonderful asset here to assist this up and coming lab!

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TATRC

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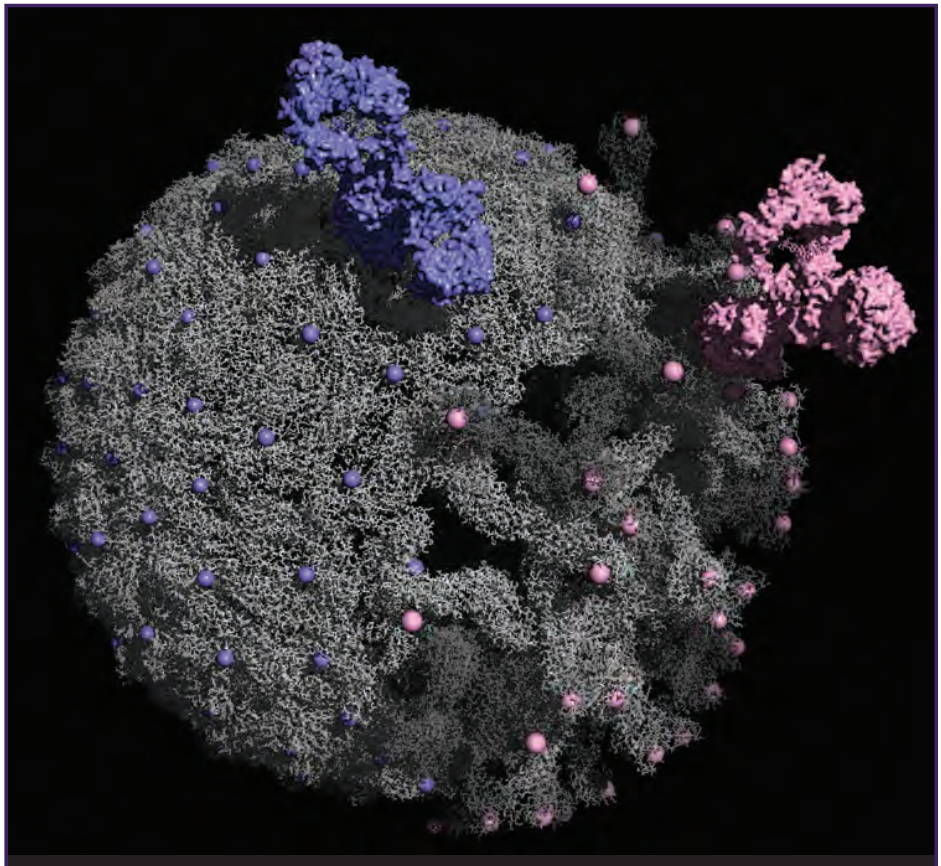
BHSAI Uses Simulations to Identify the Molecular Basis of Antibody Neutralization in Dengue Virus

Dengue fever is a mosquito-borne illness that is endemic to large parts of South America, Africa, and Asia, and is continuing to spread, along with related viruses such as yellow fever and Zika virus, due to climate change. Localized outbreaks of dengue fever can have a crippling impact on Force Readiness, and the U.S. Army has long prioritized the development of vaccines or therapeutics that can protect Service Members stationed in regions of the world where dengue is endemic.

Dengue virus exists as one of four types, or serotypes, that co-circulate in the same geographical region. A defining feature of the virus is that while exposure to one serotype induces lifelong immunity to that serotype, that same immunity actually increases the likelihood of severe dengue disease following subsequent exposure to one of the other three serotypes. In a process known as antibody-dependent enhancement of infection, or ADE, antibodies induced by the earlier dengue infection enhance the severity of a subsequent infection. Researchers have investigated ADE for years in experimental settings, and more recently in clinical studies on dengue pathogenesis. However, the relevance of ADE to dengue vaccine research was unknown until the stunning finding in a recent Phase 4 study of Dengvaxia, a dengue vaccine produced by Sanofi-Pasteur Inc., where some vaccine recipients showed higher rates of severe dengue disease following vaccination than subjects who had not received the vaccine, suggesting that the vaccine may be triggering the ADE process.



Atomic model of a partially mature dengue virus particle interacting with a type-specific (blue) and a cross-reactive (pink) antibody shown using a surface representation. The mature (smooth) regions of the virus are shown at left, whereas the immature (rough) portion is located towards the lower right. The small, blue and pink spheres indicate the location of epitopes targeted by the type-specific and cross-reactive antibodies.

Why do some antibodies neutralize dengue virus whereas others enhance infection? To answer this question, researchers at TATRC's Biotechnology High Performance Computing Software Applications Institute (BHSAI) turned to molecular simulations guided by in vitro data to provide insight into virus neutralization and enhancement. By modeling antibodies that are well characterized in vitro, Dr. Daniel Ripoll, a research scientist at the BHSAI, was able to show how some mixtures of antibodies neutralize dengue virus with varying efficacy while others enhance infection. "Our simulations show that ADE is dependent on the epitope specificity of the antibody response," explained Dr. Ripoll. "Some antibody mixtures target predominantly cross-reactive, poorly neutralizing epitopes and lead to ADE under a wide range of conditions." The simulations reveal that antibodies typically found following secondary infections have a much higher propensity for ADE than those produced in response to the initial infection, providing a molecular basis for enhanced risk of severe dengue disease. Dr. Ripoll's

Dengue Virus

continued to page 17

MAST Virtual Health FY20 Update

This fiscal year is the second year that the newly established Virtual Health (VH) Research Task Area is able to support research proposals with Army S&T funding. The focus of this research is to support the medical needs of the far-forward Multi-Domain Battlefield. Considerations for virtual health to support in prolonged field care scenarios and limited and/or non-existent communications due to electronic warfare, are key aspects of this research funding.

This exciting new research area falls under the Army Medical Simulation and Information Sciences (MSIS) Research Program portfolio. The nature of this research is Army 6.2 funding, that is applied research, which is defined as "systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met." Ms. Jeanette Little, who is Lab Director of TATRC's Mobile Health Innovation Center, also serves as the Capability Area Manager (CAM) for the new Virtual Health Research Task Area and is excited about the foundational work these intramural / extramural efforts will provide to the research portfolio. "The second year of Virtual Health research projects were vetted by an external peer review team and an internal Virtual Health Steering committee prior to being selected for funding. All of the projects focus on identifying common ground with other government, academic and industrial research efforts, modeling and visualizing the future multi-domain needs, ensuring that semi-autonomous patient monitoring considers the consequences of cyber vulnerabilities and electronic warfare, and how virtual reality can augment care," said Ms. Jeanette Little.

In FY20, the MSIS Medical Assisted Support Technology (MAST) Virtual Health Research Area will support both intramural and extramural research efforts. Two of the key intramural efforts that will be funded under the Virtual Health research portfolio are continuations of projects that commenced in FY19. The first project is, the "Use of Augmented Reality Concepts to Deliver Critical Care in a Prolonged Field Care Environment." The Principal Investigator is Maria Serio-Melvin, MSN, RN from the U.S. Army Institute of Surgical Research. The second project entitled: "Emerging Cybersecurity and Communication Solutions to Achieve Remote, Semi-Autonomous Patient Monitoring Systems (PMS) in the Future Battlespace" is led by Principal Investigator, Mr. Ron Yeaw, from TATRC, and the Co-Investigator Eddie Eidson from Army Futures Command's Cyber Battle Lab.

Use of Augmented Reality Concepts to Deliver Critical Care in Prolonged Field Care Environment is one of the key intramural effort that will be funded unde the Virtual Health research portfolio.

In addition to these ongoing research efforts, there will be two new intramural projects starting up in FY20. They are "Optimization and Automation of Virtual Health Data Capture, Prioritization and Communication to Improve Casualty Care" with Mr. Geoff Miller from TATRC serving as the Principal Investigator and "Vocal Behavioral Markers of Stress Response: Developing an Empirical Framework for Non-invasive Machine-Learning-Based Health Risk Indicator" with Principal Investigator Phillip J. Quartana, Ph.D. from Walter Reed Army Institute of Research.

Finally, it is anticipated that there will be 2 extramural research awards in FY20, however, these efforts have not yet been awarded, and therefore cannot yet be announced. Please stay tuned as there is much more to follow in this exciting new research area!

Dengue Virus *continued from page 16*

findings were recently published in the journal, Frontiers in Cellular Infection Microbiology.

BHSAI's research efforts into dengue vaccines continues in FY20, in the form of collaboration with Dr. Adam Waickman and Dr. Heather Friberg-Robertson at the Walter Reed Army Institute of Research. There, BHSAI scientists will apply sequencing, modeling, and simulation methods to analyze immune responses from two Army dengue vaccine candidates: the Purified Inactivated Virus and the Live-Attenuated Virus. Dr. Sid Chaudhury from the BHSAI stated, "By combining extensive profiling of the immune responses from clinical studies with computational modeling, we aim to understand exactly what immune responses are being elicited by these vaccines and how they contribute to protection."

MMSIV's New Joint Medical Simulation Instructional Methods (JMedSIM) portal

The team from U.S. Air Force School of Aerospace Medicine at Wright Patterson Air Force Base in Dayton, Ohio simulated C-17 loading and unloading procedures as Team TATRC captures and documents the demonstration.

TATRC's Medical Modeling Simulation, Informatics and Visualization (MMSIV) team recently completed the development of the new Joint Medical Simulation Instructional Methods (JMedSIM) portal. The portal, developed in consultation with the Defense Health Agency (DHA) J7, will provide knowledge, skills and confidence while using simulators for simulation training scenarios. Sites identified that they needed a way to consistently and continuously train new personnel on a variety of simulators and training practices, because in this environment of cost constraints, a means of training without the cost of TDY has become essential. TATRC has initiated and developed a solution.

Over the past 12 months, TATRC staff worked with key medical simulation leaders from centers across all 3 services to develop a robust and comprehensive repository of content and training tools to identify the foundations of a simulation training curriculum as well as a wealth of materials to train simulation operators. This supported the objectives identified at the beginning of this initiative which were twofold:

First was to improve simulation-based medical education and assessment across the Military Health Service (MHS) through the development of a standardized, blended learning JMedSIM curriculum.

And second, was to develop a common standard JMedSIM Portal to collect, describe, catalogue, curate and distribute instructor and operator resources and simulation materials.

The repository has been populated with thousands of various images and videos that were collected over the course of this initiative from multiple simulation centers throughout CONUS. Not only have the images and videos been cataloged for use within the courses developed, but the materials have also been tagged with metadata, to make them readily available for inclusion in training materials.

Ruben Garza, Director, Modeling and Simulation Office, J7, is excited to make this tool available soon to all simulation centers throughout the DHA.

Mr. Geoff Miller, Lab Lead for the MMSIV stated, "The main goal of any training program is to prepare trainees to perform effectively on post-training tasks in a real-world setting. This goal equally applies to medical and healthcare educators and simulation specialists. The efficacy of healthcare simulation activities for learners depends on the knowledge and skill of the instructor and the simulation operations specialist. Most instructors / operators have on the job training and a few have attended civilian course in healthcare simulation. This project will produce a series of simulation instructor / operator

JMedSIM *continued to page 19*

JMedSIM continued from page 18

TATRC's Public Affairs and Multimedia team were key and instrumental in traveling to the numerous sites to collect and capture all the content from across multiple simulation labs in the country.

professional development courses that can be delivered to military personnel who are responsible for the conduct of simulation based medical / healthcare education."

Team TATRC wishes to gratefully acknowledge and thank the following Sim Centers for their unwavering support, gracious hospitality and unlimited access to their facilities. Without their support, none of this would be possible.

A Shout out to: The Uniformed Services University of the Health Sciences & the Val G. Henning Simulation Center in Bethesda, MD, The Medical Readiness Training Center at Camp Bullis, The Defense Medical Readiness Training Institute at Camp Bullis, Wilford Hall Ambulatory Services Center Sim Center at JBSA, Lackland, METC Department of Combat Medic Training, and the team at JBSA running the Tactical Combat Medical Care Course, The 711 Human Performance Wing - US Air Force School of Aerospace Medicine at Wright Patterson Air Force Base in Dayton, Ohio, and The Naval Medical Center in Portsmouth, VA.

Another Year of Holiday Cheer

Director and "Holiday Head Honcho," COL Jeremy Pamplin, spreads good tidings to the team.

As always, this year's event enjoyed a great turnout.

Team TATRC keeps the holiday spirit going strong! Last December marked the 24th year for our Annual Holiday Party! More than 60+ staff, alumni, and family all gathered to enjoy this festive annual event which featured some fun, holiday-spirited games and team-building exercises, as well as the ever so popular and infamous Year in Review slideshow that always captures the true spirit of the TATRC family and highlights the fun and accomplishments from the past year! This year also debuted a new tradition in the form of an opening poem from TATRC's newest Deputy Director and "Dabbler in Doggerel," LTC (P) Justin Stewart, that Shakespeare himself would've been proud of. Director and "Commander in Cheer," COL Jeremy Pamplin closed the event with a rousing, heartfelt look back at this past year, and an enthusiastic look at what lies ahead for our organization! A very special thank you to all who attended and made the event a success yet again, and here's to next year!

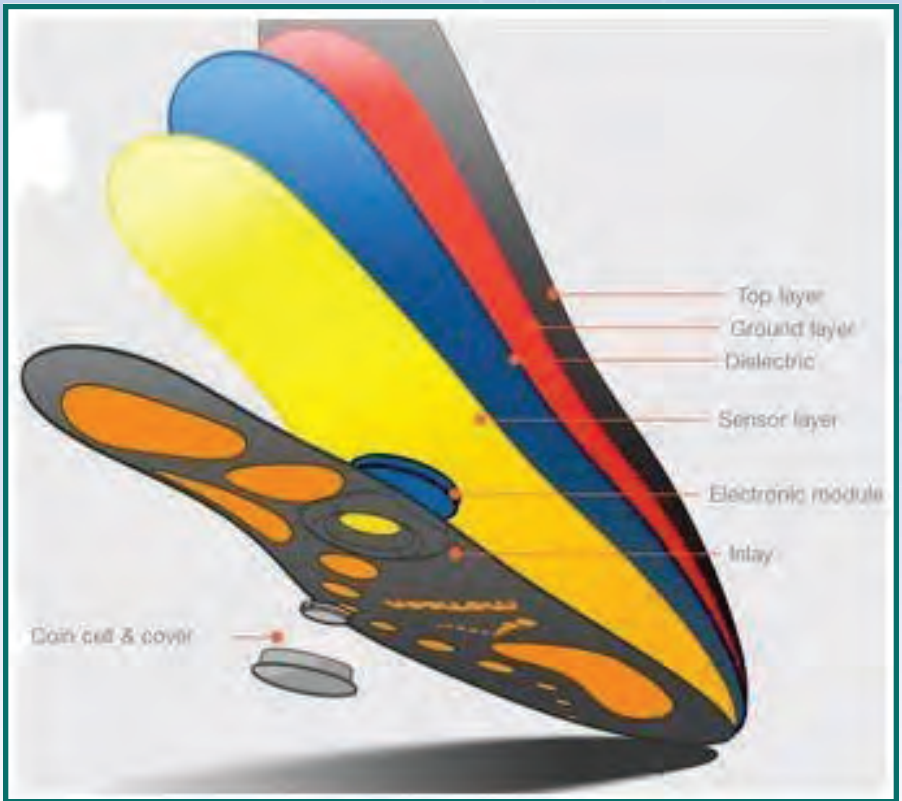
AMTI
ADVANCED MEDICAL TECHNOLOGY INITIATIVE

PROJECT SPOTLIGHT

AMTI Shines A Spotlight on Warfighter Performance

Health care costs for running related musculoskeletal injury in the AMEDD exceed $560 million annually. The majority of these injuries are overuse in nature. TATRC's AMTI program funded a project to further research these injuries called the "Feasibility of Wearable Devices to Measure and Monitor Changes in Gait Characteristics during Running". Ms. Holly Pavliscsak, AMTI's Program Manager stated, "This project highlights the AMTI programs' continued support of projects that reinforce TATRC's overall mission to fuse data, humans, and machines into solutions that optimize warfighter performance and casualty care."

Seventy-five to ninety percent of all runners demonstrate a rear foot striking (RFS) gait pattern, which produces increased average vertical loading rate (AVLR), impulse, peak impact forces, and vertical ground reaction forces (vGRF). These same kinetic forces are implicated in overuse running injuries. A non-rear foot striking (NRFS) gait pattern has consistently been shown to reduce AVLR, impulse, and vGRF as well as completely eliminate the impact peak seen in RFS runners. Logically, this suggests that transitioning from a RFS gait pattern to a NRFS gait pattern would reduce injury and injury risk in runners. Unfortunately, the current standard of practice is symptomatic treatment with little attention to underlying biomechanical and motor control abnormalities. This occurs largely because of clinical time constraints and the cost of specialized equipment needed to perform these types of analysis. Transitioning patients to a new foot strike pattern who have already sustained an injury associated with a RFS pattern would provide a modest cost savings to the military health care system in preventing recurrent injury. However, transitioning individuals with an RFS pattern to a NRFS pattern across the enterprise to prevent injuries could result in cost savings of tens of millions of dollars annually. To realize this vision with respect to running patterns, appropriate monitoring and guidance needs to be applied as a new motor pattern is learned in order to prevent secondary injury. Coupling the power of wearable technologies with evolving analysis strategies may provide clinicians with a user-friendly platform to develop meaningful re-education

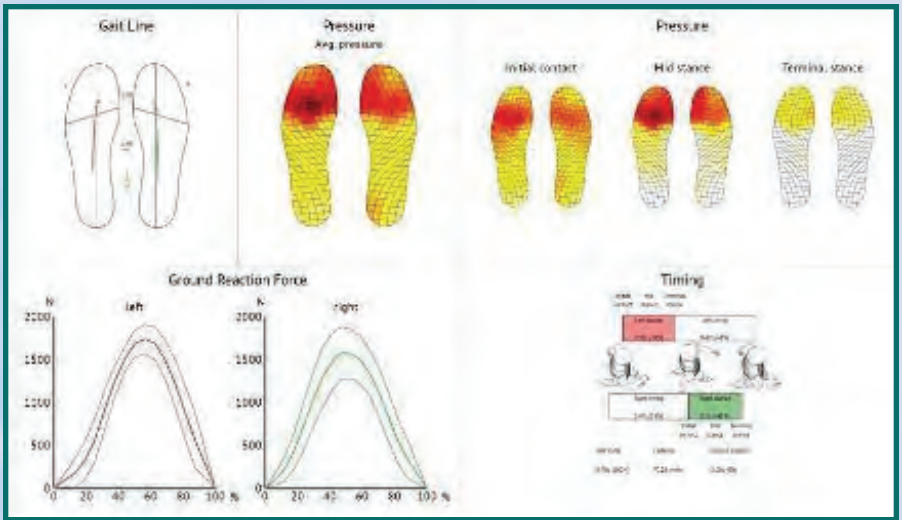


Cross-sectional view of how strike pattern data was captured in the study.

programs to drive motor learning that can be implemented as a preventative health measure across a larger cross-section of an at risk population (e.g. Soldiers who run) with a modest investment of clinical resources. Recent advances in pressure sensing insoles and body worn sensors (accelerometers and gyroscopes) are an appealing option to provide this level of monitoring and have the potential to influence both immediate user (runner) feedback and clinician-based program development. This technology demonstration evaluated the effectiveness of a program designed to transition runners with a RFS pattern to a NRFS pattern in both a laboratory setting and during over-ground running.

Findings from the initial project yielded several promising results. The AMTI awardees found that by using a short term, group-based training program, AVLR was successfully reduced in habitual RFS runners to NRFS runner levels and maintained over 3 months without structured follow up. Therefore, group-based training programs with minimal instrumentation can produce robust changes in running parameters known to be associated with higher injury risk. Given the operational tempo of units and the frequency of military deployments and personnel turnover, it is important that programs targeting motor control changes be robust and efficient. The three week training program designed in this technology demonstration appear to have promise in implementing such changes. Such interventions may be effective components of injury reduction strategies in military settings. Future investigations will need to assess how these types of training programs can be adapted to optimize change across participants.

The team further demonstrated that wearable technologies demonstrate good to excellent correlation with robust laboratory measurement systems in characterizing specific temporal and spatial running gait parameters. These results would suggest that such technologies may serve as acceptable surrogates to laboratory-based assessments, which is a necessary step to implementing unit-level injury prevention initiatives. Future projects need to determine what spatio-temporal parameters have the best predictive injury risk reduction capacity and whether these parameters can be optimally measured and assessed for changes associated with training programs.



Collated strike pattern data results extracted using the AVLR device.

Unfortunately, none of the evaluated wearable technologies provided a turnkey solution to reduction and processing of a comprehensive running gait assessment. "It is obvious from this investigation that there is a need for a wearable sensor suite, supported by a robust and comprehensive software platform, that can provide the average clinician with the means to accurately and reliably measure meaningful gait data that will facilitate the clinician's ability to assess impairments and develop personalized training programs to reduce injury risk, optimize recovery and prevent re-injury," stated LTC Angela Diebal-Lee, PI for this project and Director, Physical Performance Service Line General Leonard Wood Army Community Hospital. Future efforts need to be undertaken to realize this objective in order to optimize care of Warfighters and other DoD beneficiaries.

MAJ Mark Lester, Director Center for Rehabilitation Science, Associate Professor Army-Baylor University Doctoral Program in Physical Therapy said, "Running injuries are a major burden on the military healthcare system and currently there is a lack of evidence regarding running training programs that may reduce injury susceptibility in military settings. This work is encouraging as it demonstrates the potential to offer an effective group based running instruction program which could be effective at reducing musculoskeletal injuries and increasing the readiness of the force. Injuries are extremely costly and this initiative is an effort to promote a system of health in an extremely active population."

AMTI
ADVANCED MEDICAL TECHNOLOGY INITIATIVE

PROJECT SPOTLIGHT

Virtual Reality Trauma Simulation: An Immersive Method to Enhance Military Medical Personal Training and Readiness

Two years ago, Madigan Army Medical Center's (MAMC) Emergency Medicine Research Department initiated a project to create a realistic trauma simulator in immersive virtual reality (IVR). Similar to a pilot's flight simulator, the Trauma Simulator is a free-play virtual reality training platform capable of training military medical personnel through dynamic physiologic responsive simulations that allow decision-training without an instructor. The primary focus was on decision training (i.e., cueing) when to initiate a blood transfusion, place a chest tube, or complete a cricothyrotomy. IVR can be highly effective as a medical simulation training platform. Recent advancements have rendered this technology increasingly portable and visually realistic. The system leverages a highly-responsive, validated physiology simulation (Biogears/Pulse Engine) funded by over $7 million in prior DoD based research. Tying interventions and visual output to the physiology engine results in realistic alterations in levels of consciousness and vital signs. It also allows injuries to present and respond to treatment in real-time without instructor input. This highly-responsive simulation, combined with an environment containing 100+ 3D objects to treat the patient (replicated from the Madigan trauma bay), creates a highly interactive and realistic experience. The system tracks when a learner identifies an injury and their time to critical interventions. Therefore, the user can practice and receive feedback on advanced trauma life support (ATLS) and tactical combat casualty care (TCCC) repeatedly without an instructor being present. This IVR system was designed as a scalable solution to allow a wide variety of future case combinations and incorporation into multiple treatment environments.

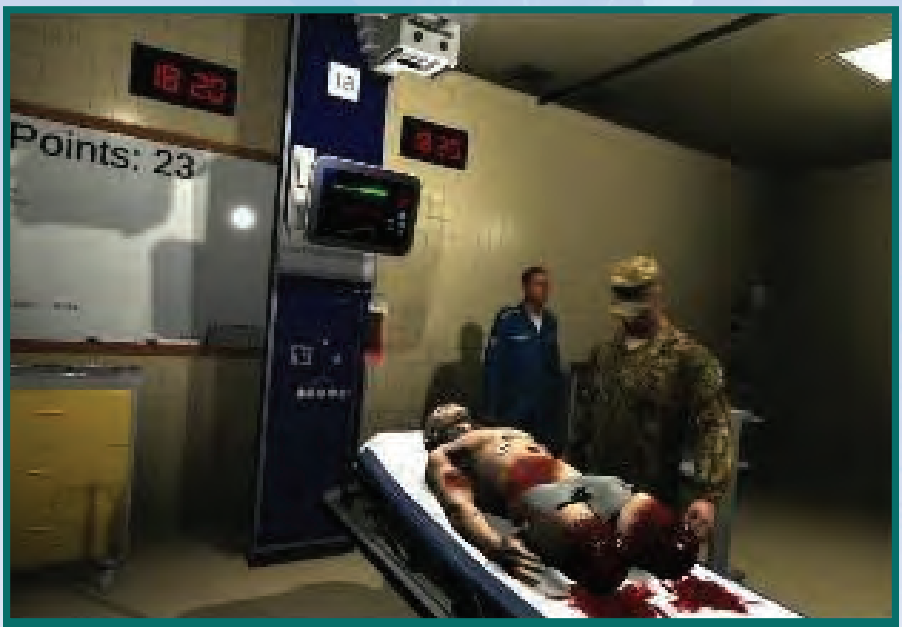
Figure 1: Army Medic looks at vital signs monitor in current simulator at a role 3 in Iraq (Feb, 2019).

VR Trauma Simulation

continued to page 23

VR Trauma Simulation continued from page 22

3D scan of Madigan trauma bay for VR build.



View inside simulator during active resuscitation.

The final software version was completed in March 2019, and preliminary data from 10 board-certified emergency medicine physicians indicates a high level of visual, injury, and treatment realism. The hardware required is a gaming computer and a Microsoft Mixed Reality headset. The complete setup costs approximately $2000. It can run without an internet connection, and has been utilized in a ROLE III deployed location (tent structure) in Iraq with good functionality (Figure 1).

The programming was completed by Exonicus, Inc, and Kitware, Inc assisted with physiology engine integration. Both of these vendors have expressed interest in continuing the progression of this project. The team also had additional support from Dr. Ryan Walsh from Vanderbilt University and Dr. Tam Pham from the University of Washington. TATRC supported this endeavor with funding from the AMTI Program's Rapid Innovation Fund in the amount of $245,977.

CPT Kyle Couperus, the PI of this project stated, "we are incredibly happy with what we have achieved as a result of TATRC's AMTI Program Funding, our team's hard work, and the vendor's support. We feel this technology shows how autonomous virtual reality simulation presents an achievable solution that can improve military medical training and readiness."

This project has been presented at multiple locations and venues, including the Special Operations Medical Scientific Assembly (2019), Military Health Science Research Symposium (2019), American College of Emergency Physicians Scientific Assembly (2019), Joint Services Symposium Emergency Medicine (2019), DHA Strategic Simulation Summit (2019), and three presentations at the International Meeting on Simulation in Healthcare (IMSH 2019) where it received the prestigious SimVentor Award out of 82 projects! Two manuscripts are pending publication, and there is ongoing research study recruitment at MAMC.

VR Trauma Simulation

continued to page 24

VR Trauma Simulation continued from page 23

Coalition partner evaluation (Latvian).

CPT. Couperus has applied for follow up funding and indicated the project has several future goals. "We propose expanding these virtual environments to include multiple echelons of care (ROLE I-III), and medical evacuation platforms. The rooms, equipment, and medical supplies in the simulator will correspond identically to real-world locations. The experience will be built around engaging simulations requiring active decision making to manage patients with the top battlefield killers: airway obstruction, tension pneumothorax, and hemorrhage. A mass casualty event with multiplayer functionality will be integrated into the training experience. We hypothesize that training individuals in identical virtual environments with autonomous interactive trauma scenarios will allow more rapid assimilation to deployed treatment environments, shorten the time to life-saving interventions, decrease the risk of psychological trauma, and help maintain medical provider readiness." The team is very excited to pursue these additional aims.

The project is under review by the American College of Surgeons Committee on Trauma, evaluating the feasibility of incorporation into Advanced Trauma Life Support training. Additionally, the Madigan team is actively communicating with several research programs to coordinate efforts and improve future integration and scalability. These include the University of Washington Advanced Modular Manikin/UWNEST programs, University of North Carolina & Biomojo, Biogears, IVIR, Inc (POINTS/JETS), and the University of Florida medical simulation development team. Overall, the scalability of this solution has multiple civilian, emergency medical services, and international training implications.

CPT. Couperus stated in closing, "We greatly appreciate TATRC's AMTI RIF funding support that enabled this exciting endeavor. This project has involved a large team who all deserve recognition for their original ideas and innovative contributions. A big thank you to MAJ Chad Gorbatkin, CPT Zachary Sletten, LTC Scott Young, CPT Alex Koo, CPT Robyn Essendrop, CPT Matthew Esposito, MAJ Jillian Phelps, CPT Karl Kmiecik, LTC(P) Carl Skinner, MAJ Jonathon Weyand, COL Jason Bothwell, MAJ Kristin Fiala, CPT Tony Hawkins, CPT Nicholas Walthers, Dr. Christopher Kang (MAMC), Dr. Ryan Walsh (Vanderbilt), and Dr. Tam Pham (University of Washington). This project would not have been achievable without such an incredible team!"

Holly Pavliscsak, who serves as TATRC's AMTI Program Manager stated, "The AMTI program provides seed funding to projects such as Virtual Reality Trauma Simulation that allows enthusiastic Innovators like CPT Kyle Couperus to have the support to make their great ideas come to life! The small investment made in this important project has produced multiple publications and presentations in the last year and has provided the justification for expansion to additional clinical applications and formal research".