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From the Desk of...

COL Dan Kral, Director, TATRC

As I sit and write this year's Holiday message on behalf of all the hard-working, dedicated men and women of the Telemedicine & Advanced Technology Research Center, I am continually reminded by the news articles appearing on my multiple desktop screens that the world is still a dangerous place and seemingly more dangerous each and every day. I'm reminded of the fact that not everyone on this planet we call Earth shares the same values and beliefs as the United States, and that even within our own population there remains significant divide about who we are as a people, and what we will be as a Nation in years to come. But it's also these very same news articles that continue to provide us the focus we need to remember why we do what we do. It's simply because today, maybe more than ever in the history of the world, we are putting such an incredible burden on the young shoulders of our men and women in uniform, and in return, don't they deserve the very best we can give them? I say yes, and I'm always excited to come to work and be surrounded by my fellow citizens who also believe that answer to be yes. This is what we do, and this is what we believe, and I for one am eternally grateful for the opportunity to be surrounded by such a diverse group of passionate visionaries. So, my holiday message this year is one of reflection and hope for each and every one of you, that you might be reminded of why you do what you do, and the greater good that it serves all of us in this wonderful Nation we call the United States of America. On behalf of all of us at TATRC, to all of you: Happy Holidays and a very Happy New Year!

Daniel R. Kral
COL, MS

IN THIS ISSUE:

New Virtual Health Research Task Area Established

TATRC's research portfolio just grew a bit larger, with an eye on future health. Based on guidance from the Assistant Secretary of the Army (Acquisition, Logistics, and Technology) ASA in 2016, the U.S. Army Medical Research and Materiel Command (USAMRMC) re-programmed $18 million annually of Army Research Development Test & Evaluation funds in the Fiscal Year (FY) 19-23 Program Objective Memorandum to re-focus some of the ongoing initiatives further into the future. This was intended to provide better balance between near, mid, and long-term capability objectives for the Army. As a result of this guidance, in FY19, USAMRMC will have three new task areas supporting research to enhance the Multi-Domain Battle Concept by treating, evacuating and returning to duty injured and / or wounded Warfighters.

TATRC's Director, COL Dan Kral, played an instrumental part by providing formal input on potential topics for consideration into these new research efforts; and as a result of his contributions the 3 topics selected were based on his feedback.

One of the three new task areas to provide maximum Army Warfighter payoff for investment is Virtual Health (VH). The overarching objective of this new VH research task area is to develop future enterprise process architectures and integrated physical solutions capable of supporting prolonged field care in conditions with limited or lacking traditional field communications.

Ms. Jeanette Little, who also serves as the Lab Manager for TATRC's Mobile Health Innovation Center, has been designated as the Capability Area Manager for the VH Research Task Area. The FY19 VH research funding ($1.698M) must align with these early stage research (6.2 RDTE) activities in order to be considered favorably for funding. Due to limited FY19 funding, the initial call for proposals was limited to an intramural call to specific research laboratories, and proposals were submitted on 9 November 2017. However, in FY20, the VH research funding will be expanded and open to both intramural and extramural applicants.

mHIC's Home Diabetic Monitoring Study Completes Patient Recruitment Goals

TATRC and Clemson University's research project provides remote home monitoring to diabetic patients assigned to case managers at Madigan Army Medical Center (MAMC) and Nellis Air Force Base (NAFB). It reached a critical milestone this fall. In late October, the study's recruitment goals were effectively achieved (a combined enrollment of n=127), meaning that the required number of patients have successfully been enrolled in both the control and experimental groups. Each participant will be followed for another 12 months, which means that the research study will be in ongoing data collection mode until late October 2018. This is a significant and noteworthy milestone as patient recruitment is often a major hurdle in executing a research study.

According to mHIC's Program Manager, Ms. Amanda Schmeltz, recruitment has been a great success. "The response to this study has been outstanding. The research associates based out of MAMC and NAFB completed recruitment goals three times faster than anticipated. Furthermore, our research partners have reported minimal withdrawal rates. The real gem of this study is the introduction of specific 'health tips' to the mobile user's device, which their care team has algorithmically tailored to each individual patient's level of psychological commitment, which are statistically validated levels of commitment a patient is working through based on their particular circumstances. We couldn't be more excited about this novel approach to home care and personalized mobile medicine. There will be a tremendous amount of data to be analyzed when all is said and done, and we expect this new model to give the clinical research and practice community a number of insights into best-practice of reaching out and meeting a patient wherever they are."

The mHIC team looks forward to providing interim data in the coming months, as it becomes available.

BHSAI Scientists Work to Predict Adverse Drug-Drug Interactions

Prescription drugs and medications are safe when we take them as directed. However, once we start taking more than one type of drug, our risk of experiencing adverse health reactions due to the combination increases. Although we now have over 1,000 drugs approved by the Food and Drug Administration (FDA), most drug combinations are never evaluated for safety. If certain drug combinations have the capacity to affect our health, we need to be able to flag them.

Given the large number of commercial drugs, it is not practical to perform clinical safety evaluations for all combinations. This is why we typically only become aware of such effects from incidents reported after the drugs have reached the market. Scientists at TATRC's Biotechnology High Performance Computing Software Applications Institute (BHSAI; www.bhsai.org) have recently developed enhanced techniques to mine, systematize, and predict adverse drug-combination effects based on information in extensive databases of patient-reported events.

Sponsored by the U.S. Army's Network Science Initiative and the Defense Threat Reduction Agency (DTRA), the BHSAI focuses on developing computational models and solutions that address human health. The BHSAI team developed a methodology to predict thousands of adverse health effects based on millions of patient-reported events combined with databases containing macromolecular drug interactions. These studies showed that roughly 10% of all drug combinations have the potential to cause an adverse effect. The results for individual drugs, drug combinations, and adverse health effects are available via AVOID (AdVerse effects Of Interacting Drugs)—a searchable web-accessible database. The system has been used hundreds of times worldwide since its release in the summer of 2017.

Dr. Sven Wallqvist is BHSAI's Senior Researcher leading this effort.

Dr. Sven Wallqvist, Senior Research Scientist at the BHSAI, commented that "One of our main challenges as scientists today is how to make use of all the medical and chemical data that is already out there. Here, we combined data from millions of public health records with millions of drug-protein interaction data to build prediction models for thousands of adverse effects. The key to making progress is the ability to manipulate, combine, and use these data sources to make knowledge products that are easily accessible on desktops, tablets, and smartphones." A description of this effort was recently published in BMC Pharmacology and Toxicology[1].

The system, which contains prediction data for approximately 800 FDA-approved drugs and their combinations, can be searched using commonly used drug names and/or ailments. The web-page can be publically accessed at http://avoid-db.bhsai.org.

A screenshot of the AdVerse effects Of Interacting Drugs (AVOID) database, which is publically accessible at http://avoid-db.bhsai.org.

References:

[1]Liu R, AbdulHameed MDM, Kumar K, Yu X, Wallqvist A, Reifman J. Data-Driven Prediction of Adverse Drug Reactions Induced by Drug-Drug Interactions. BMC Pharmacol Toxicol. 2017; 18(1):44. DOI: 10.1186/s40360-017-0153-6.

TATRC Team Braves Record Heat to Complete 2017 Army Ten Miler

The 33rd annual running of the United States Army Ten-Miler was completed on 8 October this year. Over 35,000 people braved record heat conditions to complete the ten miler course which originated from, and finished, in the Pentagon south parking lot — winding through picturesque, downtown Washington DC and past the National Mall and historic monuments.

The race is open to anyone, active duty and civilian alike, and today it is recognized as the second-largest ten-miler in the United States. About 57% of this year's runners were active-duty, Reserve and National Guard members or retired military, DOD civilians or military dependents. The race attracts runners, and their supporters, from all over the world. Since its inception in 1985, the Army Ten-Miler has grown immensely in popularity, with registration for this year's race selling out in less than 2 hours. The Army Ten-Miler's registration proceeds support Army Morale, Welfare and Recreation, a comprehensive network of support and leisure services designed to enhance the lives of soldiers and their families.

This year, TATRC sent a formal team to compete in the race. Although TATRC employees have participated in the Army Ten-Miler nearly every year, this was the first time TATRC participants ran together as a formal team. TATRC's Team, known as "Run-Walk-Kral," consisted of Ron Yeaw, Harvey Magee, and TATRC Director, COL Dan Kral.

TATRC's runners really earned their finishers coin this year as record breaking heat and humidly nearly derailed the entire race. The coolest recorded temperature of the day was 75 degrees with the high being in the 80s. Per the National Weather Service Meteorologist, 75 degrees is a full *7 degrees* warmer than any temperature recorded in October in DC going back to 1872. That, combined with a 72 degree dew point (a dew point equal to the current temperature equates to 100% humidity), and you have the potential for severe heat-related injuries.

According to mHIC's Deputy Lab Manager Mr. Ron Yeaw, "running conditions from this year's race went from 'this is going be tough' to 'this is going to be dangerous' pretty quickly. When race officials closed the entire left-hand side of the road to allow for ambulances to get past the runners, I knew things had gone south."

According to local emergency officials, 87 runners ended up in medical tents, and 39 people were taken to the hospital. Out of concerns for safety, race organizers called the race at 10:07 am, downgrading it to a "recreational run" due to the extreme conditions. The course was then abbreviated by a full mile, and anyone who had not finished prior to that point, did not receive an official race time. Team TATRC persevered, however, with every runner crossing the finish line!

This year's winner was Spc. Haron Lagat (49:23), with Army soldiers sweeping the top 5 places for the 2nd consecutive year. COL Kral stated, "Running the race is about more than physical fitness, it's about being part of something bigger than yourself. The Army Ten-Miler is NOT a race, but simply a fun run at an individual pace to promote camaraderie and esprit-de-corps!"

Mr. Harvey Magee, of the MMSIC Lab concluded, "2017 was only my second Army Ten-Miler, but participating in this event heightened further my commitment to America and to our military brothers and sisters who share that military bond as only we can. Hats off to so many families and friends who either ran or welcomed us with encouraging shouts & banners along the way. I'm a racquetball player, not a marathon runner, so this distance was a challenge, but as I saw others - young and old - hanging in there, and as we were encouraged by military bands, we went the distance as a symbol of our continuing commitment to who we are and what we do."

The 2018 Army Ten-Miler will be run on 7 October. Let's hope for cooler conditions next year!

Fun Run: Mr. Ron Yeaw, Mr. Harvey Magee and COL Dan Kral show TATRC spririt at the Army Ten-Miler.

TATRC Recognized at the 2017 Excellence in Partnership Awards

Congratulations to Team TATRC for having not one, but two Labs recognized for their outstanding efforts in two key areas: TATRC's Mobile Health Innovation Center (mHIC) and our Medical Modeling & Simulation Innovation Center (MMSIC)!

On 15 November, two of TATRC's labs were honored by the Coalition for Government Procurement at their 2017 Excellence in Partnership Awards. TATRC's Deputy Director, Mr. Timothy McCarthy, was on hand at the black tie event to accept the American Innovation Award at the Fairview Park Marriott in Falls Church, VA on behalf of both mHIC & MMSIC. This prestigious award is presented to an organization or individual (government or contractor) for creating innovative solutions and processes to solve the government's challenges in procurement and technology.

Mr. Tim McCarthy, TATRC's Deputy Director, accepted awards for both mHIC and MMSIC. Congratulations to both teams!

TATRC's mHIC Lab was recognized specifically for their innovative Mobile Health Care Environment (MHCE) project, and the MMSIC lab, was recognized for their collaborative work on the BioGears® project.

The MHCE System allows patients to use personal mobile devices to communicate in an appropriately authenticated, secure and HIPAA compliant fashion with their healthcare providers. MHCE was uniquely acquired and developed by modifying commercial off-the-shelf technologies (COTS) from the mobile banking industry, a completely different approach to traditional COTS (off-the-shelf or customization) procurement. It is a highly versatile system that can be leveraged for numerous clinical applications. Patient data is not only encrypted at rest, but also while in transit to their providers.

The BioGears® engine is a closed-loop system that uses physics-based lumped parameter models to model real-time system-level physiologic behaviors. BioGears® maintains homeostatic conditions by modeling control system feedback mechanisms and models a variety of patient injuries and treatments through manipulation of the lumped parameter models. The current BioGears® code-based, methodology documentation, validation data, and software development kit (SDK) are available for download via an open source Apache 2.0 license at www.BioGearsEngine.com.

The Coalition for Government Procurement is the single most effective voice for commercial service and product companies selling in the federal market. For more than 35 years, the Coalition has brought together public and private sector procurement leaders to work toward the mutual goal of common sense acquisition. Members have access to the latest federal compliance and policy information that is critical to a successful Federal business. Their Excellence in Partnership Awards honor acquisition officials who have made significant strides in promoting and utilizing multiple award contracting vehicles. Awards are given to individuals, organizations, and contractors involved in procurement with GSA, VA, DOD, DHS and other government agencies.

Thank you to our long standing partner, Irving Burton Associates, Inc. for submitting the nominations on both mHIC and MMSIC for this prestigious award!

Congratulations to our mHIC & MMSIC Labs for all your hard work, and to everyone who made these projects possible!

The TATRC AAMTI Team Unveils New Upgrades to Proposal Submission System

TATRC manages the AMEDD Advanced Medical Technology Initiative (AAMTI) Program that facilitates bottom-up technology innovation while simultaneously informing top-down acquisition throughout Army Medicine. To submit a proposal to the system for consideration, Army Innovators must utilize the AAMTI Proposal Submission System.

The previous AAMTI Proposal System was designed to process, track and evaluate proposal submissions. It originally required a user name and password to access until 2016, when the system began requiring a milnet computer and Common Access Card (CAC) to access. The original system was created and utilized as a way to simply process proposals. Documentation for reporting, financial management and correspondence were all kept in separate databases, or in paper files. Correspondence was conducted primarily through email and reports were submitted through individually generated email requests and returned in the same manner.

The new and much improved AAMTI Proposal Submission System that debuted in October 2017, is a major overhaul of the functionality and versatility of the original system. Over an 18 month process, Mr. Jason Laird, TATRC's Senior Application Developer and Mr. Keith Boone, TATRC's Senior Database Administrator and Oracle Database Developer, collaborated with AAMTI's Program Manager, Ms. Holly Pavliscsak and AAMTI Project Officer, Ms. Sharon Garlena to define the functional requirements and processes that needed improvement. Ms. Katherine Weaver, TATRC's Budget Analyst was also key in providing feedback on the design of the financial aspects needed for the system. The goal of this overhaul effort was to improve the functionality of the AAMTI Proposal Submission System, by providing an intuitive and efficient system. By expanding upon the original system, and building out existing but dormant functionality, they were able to migrate from a proposal entry and processing system, into a true proposal management system that fully supports the entire process from proposal submission through the evaluation, award and management.

Highlights of the new AAMTI Proposal Submission System:

New AAMTI Proposal Submission Home Page: The AAMTI Proposal Submission System has a new home page where first time users will be prompted to start the approval process in order to establish an account for submissions. Once permission is granted, users can access the AAMTI Extended Innovation Fund (EIF) site, AAMTI Rapid Innovation Fund (RIF) site, AAMTI SharePoint page, templates, and POCs for administrative and technical issues. The site can be reached at the following address: https://tatrc.amedd.army.mil/AAMTI/

Under the AAMTI Proposal Submission System's Home Page, the AAMTI EIF and RIF sites serve as the platform for proposal entry and administrative project management which includes reports, financial reporting, requests for extensions, and publication and presentation submission. The complimentary AAMTI SharePoint site can also be reached from the home page and serves as a repository for the AAMTI Program Documentation, templates, example documents, consultant list, reference material, success stories and more to assist AAMTI Innovators in their submissions.

Separate Extended Innovation Funding (EIF) and Rapid Innovation Funding (RIF) sites: In 2017, the AAMTI program created two distinct funding mechanisms: RIF and EIF, for which the period of performance for each category is limited to 6 and 18 months respectively. The EIF program has a structured submission and review process, while the RIF program accepts proposals continuously. To support both the EIF and RIF, the AAMTI Proposal Submission System now has two separate sites, one for each funding mechanism and both sites can be accessed through the AAMTI Home Page. Users can also toggle between the sites to manage their AAMTI submissions.

Introduction of Submitter and Innovator Roles: Previously, individuals who submitted proposals to the AAMTI

AAMTI Home Page

AAMTI Rapid Innovation Funding (RIF) site

AAMTI Extended Innovation Funding (EIF) site

program were known as Principal Investigators (PIs); as of 2017, they will now be referred to as Innovators. Innovators must be military or civilians employed at an AMEDD military treatment facility. However, starting with this new website rollout, proposals can now be entered and managed in the AAMTI Proposal Submission System by identified "submitters" who can be military, civilian or contractors acting to support the administrative functions of proposal submission and award management for the sponsored Innovator.

Report Submission: Required reports can now be submitted directly through the AAMTI Proposal Submission System, at either the RIF or EIF sites under the Reports Menu. Innovators and submitters can upload Interim Reports, Final Reports and QUAD charts at this location instead of emailing them to AAMTI management staff. This allows for improved accountability and tracking for both the Innovator and AAMTI Program.

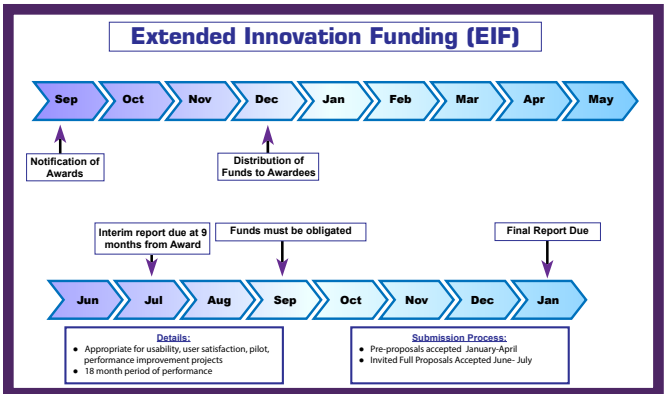
Reports are associated with the proposal record and are easily located and queried. Additionally, as part of this new feature, emails are auto generated based on the recorded due date from the AAMTI Proposal Submission System at 90, 60 and 30 days prior to the due date, and 30, 60 and 90 days after a report is due. These notifications are sent directly to the Innovator(s) and Submitter(s) on file for that specific AAMTI award. From the auto report reminder email, Innovators/Submitters can utilize a provided hyperlink that drops them directly into the report portion of the web site for easy access.

Presentations and Publications: The new AAMTI Proposal Submission System provides the ability for AAMTI Innovators to upload presentations and publications associated with their AAMTI award, providing the ability to quantify successes within the program. Previously, presentations and publications associated with AAMTI awards were provided ad hoc.

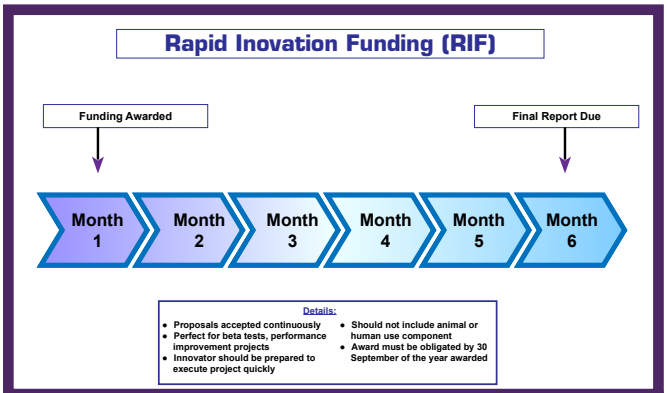
Request for Extensions: AAMTI awardees from time to time request extensions primarily for contracting or clinical investigation delays. The new AAMTI Proposal Submission System provides a formal process for submission and approval of extensions, as opposed to previous ad hoc requests for extensions that Innovators submitted, often in a disjointed manner, to one or multiple AAMTI administrators.

Financial Reporting: The budget template that is now

Upgrades *Continued on page 8*



AAMTI Rapid Innovation Funding (RIF) site



AAMTI Extended Innovation Funding (EIF) site

Upgrades *Continued from page 7*

embedded in the AAMTI Proposal Submission System provides entry of budgetary components directly into the AAMTI system and associates the budget with the record. Additionally, Innovators are now required to provide accounting of estimate vs. actual expenditures and record any associated contracts for improved accountability and tracking.

Enhanced Evaluator: AAMTI submissions are evaluated by a group of peer reviewers who score and provide comment. Previously, comments were only available by solicitation of the AAMTI submitter, and now are available at each stage of the submission process providing submitters with actionable information to improve their submission. Evaluators in this new iteration have enhanced management capability to improve their ability to view, print and evaluate proposals.

Administration: The enhanced functionality and efficiency from an administrative standpoint is improved in every aspect of the new AAMTI Proposal Submission System. There are now numerous quantifiable reports, query of record, group emails, as well as, printable and exportable functionality throughout the system.

We will continue to refine several portions of the AAMTI Proposal Submission System over the next year, but are always looking for ways to improve the overall platform. In the near future as submissions are entered, Innovators will receive a survey on the AAMTI Proposal Submission System that will help us refine the system to ensure that it is easy to utilize and intuitive.

The new version of the AAMTI Proposal Submission System migrates most of the functionality from three different information systems into one central management system for the AAMTI program. It automates every aspect of the collection of proposals and management of the awards for both the RIF and EIF, from proposal submissions through evaluations, award, reporting, fiscal management and request for extensions. Previously, AAMTI proposals were submitted through the AAMTI Proposal Submission System, and evaluations were conducted through the original system, but all other processes were completed through email exchange only.

"The rollout of this new AAMTI Proposal Submission System centralizes submission and management for Innovators and improves efficiency and accountability for AAMTI Administrators. We are very excited about the new capabilities and enhancements that this upgrade provides," said Ms. Holly Pavliscsak, AAMTI's Program Manager.

Please feel free to contact Ms. Pavliscsak to learn more at holly.h.pavliscsak.ctr@mail.mil and visit the AAMTI Proposal Submission System Site at https://tatrc.amedd.army.mil/AAMTI/.

FY19
Extended Innovation Funding (EIF) Timeline

Date(s)	Milestone
8 JAN – 13 APR 2018	Pre-Proposal Submissions Accepted
16 APR – 16 JUN 2018	Pre-Proposal Evaluations
25 JUN - 3 AUG 2018	Opening Date for Full Proposal Submissions (Invitation Only)
6 AUG - 13 SEP 2018	Full Proposal Evaluations and award recommendations completed
30 SEP 2018	Award Notifications

Integration of an Operational Telemedicine System with a Bi-Directional Cross Domain Solution

TATRC's Operational Telemedicine Lab has partnered with Remote Diagnostics Technology (RDT) and General Dynamics to conduct technical research into establishing bi-directional medical communications across multiple security classification domains between medical personnel on site in an operational environment and clinical specialists at a Role III Combat Support Hospital or Role IV Medical Treatment Facility (MTF) ("brick & mortar" hospital). Bi-directional communications serve the purpose of providing contextual awareness of a patient's condition to the clinical specialist that uses this information to provide medical direction and guidance to the operational medical personnel. The capability to establish this connectivity will support the Department of Defense's Virtual Health initiatives and further enable Virtual Health support directly to the warfighter in ongoing operations. However, one of the most significant challenges is that the U.S. Army operates their operational network, the tactical radio network, as a classified network and the Garrison expertise within the Role IV MTFs, such as San Antonio Military Medical Center, use the unclassified network. Additionally, while deployed Role III Combat Support Hospitals generally have access to the classified "SIPRNET", the unclassified "NIPRNET" is more readily available to the clinical staff, is the preferred network for conducting medical information exchange, and is the network on which the enterprise electronic medical record system resides. Senior Project Manager for TATRC's Operational Telemedicine Lab, Mr. James Beach stated, "Without the ability to securely establish a controlled medical information bridge between the security classification domains, the capability to leverage the entire medical enterprise to support ongoing operations through Virtual Health capabilities will be compromised."

Bi-directional communications facilitate tele-mentoring between forward deployed personnel and a provider in the fixed facility.

An example of secure medical data capture on a classified network in an operational setting.

The objectives of this project are to demonstrate the ability for bi-directional transmission of medical data, video, and audio with RDT's TEMPUS-Pro Operational Telemedicine System through General Dynamics' Tactical Cross Domain Solution (TCDS) that establishes a controlled gateway between the classified tactical radio network and the unclassified network. TATRC has used the TEMPUS-Pro and the TCDS in several medical information technology field evaluations involving medics from both ground and air evacuation platforms and from Roles I & II medical treatment facilities, but only to pass the field-generated DD1380 Tactical Combat Casualty Care Card to the AHLTA-T electronic medical record. The newly designed TCDS and direct interface to the TEMPUS-Pro device will enable the full use of the operational telemedicine system's inherent capabilities to connect forward deployed medical personnel with clinical specialists in CONUS-based hospitals to facilitate on-demand requests for advanced medical direction and guidance. During a technology assessment conducted in Redmond, Washington, MSG Kevin Ross, Combat Medic, described the benefit of this bi-directional connectivity, stating, "The reach-back concept … works because it gives the young soldier the ability to connect directly to a higher echelon of care and allow him to go through a step by step method of instruction that not only enhances that soldier's ability to perform the task, but greatly improves the survivability of the patient."

For more information, please contact: Mr. James Beach at *james.w.beach2.civ@mail.mil*.

Telehealth 2.0 – New Research Project Kicks Off!

TATRC's Mobile Health Innovation Center (mHIC) has formally launched a new research project entitled "Telehealth 2.0 Providing Continuity of Behavioral Health Clinical Care to Patients Using Mobile Devices" in partnership with the Defense Health Agency (DHA), Psychological Health Center of Excellence and Carl R. Darnall Army Medical Center at Fort Hood. Additionally, the University of Texas Health Science Center in San Antonio is providing research support services to assist in this effort. This new research study will explore options to connect Behavioral Health providers at Fort Hood with a means to connect from their desktop computer to their existing patients through the patient's personal mobile device. The intent of this demonstration project is to examine and address the security and privacy concerns of session initiation protocol (SIP)-based teleconferencing, from the providers' desktop to the patient, regardless of location. Fort Hood is a location where numerous troops are often on temporary TDY assignments to other CONUS and OCONUS locations, and in the instance of a 3-month temporary assignment, it would be ideal to allow the established provider / patient relationship to be maintained over a long distance.

mHIC Deputy Lab Manager, Mr. Ron Yeaw, sees this as an important step forward for the use of mobility in military medicine. "As Telehealth capabilities move beyond secure messaging and provider consults, mobile technology must mature with it. TATRC's Mobile Health Care Environment framework was designed from its inception to do just that… support these advanced capabilities, and we are now finally getting a chance to flex some of that infrastructure in support of secure video teleconferencing."

Currently, the project has already received first level Institutional Review Board approval for the protocol and is undergoing the Human Research Protection Office review. The mobile device interface design has been completed, and the TATRC team is working closely with the DHA Video Network Center to ensure interoperability with their next generation, SIP based communication platform. Patient engagement is expected to begin in June 2018!

For more information, please contact: Mr. Ron Yeaw at ronald.e.yeaw2.civ@mail.mil

TATRC Supports the 2017 Bold Alligator Exercise

While falling leaves dropped this Autumn in Maryland, TATRC got its feet wet in Exercise "Bold Alligator," a large-scale, multinational littoral warfare (amphibious) exercise hosted by the United States military that focuses on reinforcing relationships and military doctrine. This year's military exercise, led by Commander, U.S. Fleet Forces Command and Commander and U.S. Marine Corps Forces Command, involved 4,000 marines, sailors, airmen and soldiers encompassing more than 12 ships and coalition, North Atlantic Treaty Organization, and allied partner nations' forces from nine countries, including Canada, Mexico, United Kingdom, France, Norway, and Brazil, participating at sea, on land, and in the air at Camp Lejeune, North Carolina and Virginia.

In a Joint-service collaborative effort, the Marine Corps Warfighting Lab (MCWL) and the Naval Surface Warfare Center Dahlgren Division (NSWCDD) provided the subject matter expertise and engineering support to adapt the existing experimental MCWL tactical communication system. Asymmetric Command & Control for Expeditionary Systems & Services (ACCESS) was used to link and interface with the Medical Communications for Combat Casualty Care (MC4) / TATRC's electronic DD Form 1380, Tactical Combat Casualty Care (TCCC) Card from the Army Nett Warrior baseline smartphone.

During this year's Bold Alligator exercise, U.S. Marine Corps Corpsmen assigned to the Shock Trauma Team - Air (STT-A), the Role 2 treatment facility which integrated MCWL Expeditionary Medicine experimental concepts, worked on simulated casualties at Camp Lejeune, NC and generated 6 digital TCCC cards on an Army Nett Warrior during the exercise, and more records were generated and received during the training period. Two issues were encountered during the exercise, which prevented a greater number of records being sent: 1. Rain and moisture invaded the space between the juggernaut case and S5, making the touch screen unreliable and 2. Corpsmen did not make time to enter TCCC cards when throughput of casualties and task loading was high.

Following casualty treatment and while stabilized

Alligator *Continued on page 11*

mHIC's mCare Research Accepted for Publication in the Journal of Military Medicine

TATRC's Mobile Health Innovation Center (mHIC) team was notified in mid-October that their journal article entitled: "Does 'mCare' improve quality of life and treatment satisfaction among Service Members rehabilitating in the community? Results from a 36-week, randomized controlled trial," has been accepted for publication in the Journal of Military Medicine. This article was authored by key members of mHIC's Lab, specifically: mHIC Lab Manager Ms. Jeanette Little, Ms. Holly Pavliscsak, Ms. Mabel Cooper, Dr. Louis Goldstein and Dr. Stephanie Fonda.

As suggested in the title, the article outlines aspects of the implementation of the mCare app, in conjunction with the back-end Mobile Health Care Environment—Research usage by caregivers, for our transitioning warrior's, particularly amongst Traumatic Brain Injury patient's and / or those afflicted with Post Traumatic Stress Disorder and / or mental / behavioral health afflictions, on their treatment outcomes and quality of life reporting. Of the 182 participants recruited, 95 were randomized to receive standard care plus mCare, and 87 were randomized to receive standard care alone. The active period of the study lasted for 36 weeks, with data collection for the outcome measures taking place at baseline, 12, 24, and 36 weeks through a web-based survey system, *Survey Monkey®*. The mCare system used text message prompts to notify users when there was new information to view and respond to within the mCare application (i.e. appointment reminders or health tips). The system also used a secure website, MHCE-R, which case management team members utilized to track all data from the mobile devices and which generates escalation triggers to the care team. Standard Care involved at least one contact per day by the Service Member's Platoon Sergeant, and one contact per week by their case manager. Semi-structured interviews and surveys were also implemented to assess both groups.

Journal of Military Medicine

While no statistically significant differences were noted in regards to quantitative data collections on treatment outcomes, qualitatively both patient users of mCare, and their service provider's reported the use of mCare favorably and as a valuable tool. The article goes on to discuss these findings and the reported virtues of mCare, as well as lessons learned going forward.

TATRC's Senior Project Officer Mr. Robert Chewning stated, "These kinds of results are exactly why we do this work. We are inspired by our wounded warrior population and are honored that our mobile outreach platform is helping them with their health."

The exact publication date is not yet known, but is expected in early 2018. Stay tuned for this exciting read!

Alligator *Continued from page 10*

casualties were awaiting casualty evacuation, the Corpsmen completed the data entry on the digital TCCC card with the handheld Army Nett Warrior smartphone. Records were compressed by an average of 87% through the NSWCDD developed algorithm. Then Corpsmen transmitted the saved records over the Iridium satellite constellation, using the 9800 BAUD Iridium unclassified, encrypted ACCESS radio, simultaneously, to two locations each containing a simulated Theater electronic health record (EHR) system: one at Dahlgren, VA with the engineering team, and another located at Camp Lejeune, NC, for experimental observers and engineers. Members of the engineering team confirmed that identically signed TCCC card records sent by the Corpsmen at the STT-A were received by both simulated Theater EHR systems, which were located over 300 miles apart. This exercise demonstrated the ability for not only the United States military services to use a common digital casualty support application, but that the application can easily be used in a multi-national force effort, as well.

TATRC's Operational Telemedicine Project Manager, Mr. Tom Bigott stated, "Bold Alligator is the largest exercise that TATRC-sponsored prototype technologies have supported and been used in, and reflects the Joint-Service collaborative efforts between the research communities."

For more information, please contact: Mr. Tom Bigott at thomas.r.bigott.civ@mail.mil

TATRC's Support of Bold Quest 17.2 Exercise

Bold Quest 2017 is a Department of Defense led demonstration that brings military personnel from 14 countries to Savannah, GA to conduct communication and coordination exercises on Fort Stewart. United States military service members and NATO Headquarters staff are joined by troops from Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, New Zealand, Poland, Sweden and the United Kingdom. The demonstration looks towards interoperability by improving communication and information sharing across a wide variety of coalition networks and resources.

At Bold Quest 17.2 Exercise, TATRC provided direct support to PEO Aviation to demonstrate telemedicine capabilities over a variety of network architectures that were integrated into a Medical Evacuation (MEDEVAC) UH-60 Black Hawk helicopter.

TEMPUS-PRO Dashboard

TATRC provided subject matter expertise as well as equipment, which allowed a PEO Aviation led team to meet their demonstration objectives and goals to transmit data over a variety of communication networks. The Tempus Pro physiological monitoring device with a receiving laptop (hosting i2i software) and Nett Warrior End User Devices (EUD) (hosting the USAFRL BATDOK app and the MC4 / TATRC DD1380 app) were used for the demonstration of in-flight telemedicine capabilities. The U. S. Army Aviation and Missile Research Development and Engineering Center's Software Engineering Directorate Aviation Interoperability Lab and Prototype Integration Facility personnel, along with TATRC personnel, conducted integration and validation of the system components over a 3G cellular network and an Iridium Satellite communications network at Hunter Army Airfield, GA. During the validation, the physiological monitor and the EUDs were able to transmit telemetry data, video, still imagery, and DD 1380 encounters with a stable communications link. These communications links were more stable than the tactical radio communications that were evaluated in the past. In addition to the 3G and iridium networks tested during Bold Quest patient evacuation missions, TATRC supported PEO Aviation in testing a "Through the Rotor" Satellite capability that maintained an uplink of 228 Kbps communication link from the antenna through the aircraft's rotor system operating at full speed to the satellite, and a downlink of 2.16 Mbps from the satellite through the rotor system to the aircraft antenna. The successful demonstration of these three network capabilities highlighted the potentially enhanced ability for a medic in flight to contact a medical provider anywhere around the world. With these types of communication systems integrated on MEDEVAC aircraft, a flight medic conducting operations in an austere or isolated environment can establish a vital connection from the middle of Africa back to the United States over Satellite or Cellular connections.

During the exercise, the Georgia Army National Guard MEDEVAC unit, Hurricane Force, provided support for the MEDEVAC mission scenarios. SSG Dietrich, an experienced MEDEVAC medic, conducted a week of MEDEVAC operations employing the aforementioned medical devices in flight throughout the Bold Quest Exercise. During the multiple MEDEVAC mission scenarios that took place each day, SSG Dietrich successfully documented and transferred medical telemetry and patient care information using the physiological monitor and Nett Warrior EUD, along with the BATDOK app and MC4 app. During the exercise, the


3G cellular provided the greatest communication capabilities between the medic in flight and the ground station.

mHIC Team Member Recognized for Dedicated Efforts Supporting the MHCE

On 13 November Mr. Robert Chewning, Senior Project Analyst, was recognized by TATRC Director COL Dan Kral at the monthly 'All Hands' Meeting for his dedicated efforts and numerous contributions to TATRC's mHIC Lab. One of the unique roles that Rob provides is to help with the Defense Business Certification (DBC) renewals for the Mobile Health Care Environment (MHCE) Research and Enterprise systems. The research portion of the MHCE is critical to the execution of a number of pilot and Randomized Clinical Trials that TATRC is in partnership with other key players. Particularly over the last year, obtaining DBC endorsement to continue to do research and development activities has been challenging, if not nearly impossible due to the very tedious reviews that have to occur at both the Defense Health Agency (DHA) and Department of Defense levels.

To successfully renew the MHCE problem statements, the system needed to have a status change made at the DHA level to show that the services it provided were not slated to be replaced or replicated by the new Electronic Health Record. The TATRC team and the MHCE Functional Sponsors had been told it was next to impossible to get this status change made, but Rob never gave up. He systematically and patiently worked to document, inform and educate all the necessary parties, until the MHCE system status was changed, allowing for our next DBC endorsement to be renewed. If Rob had not been successful,

COL Dan Kral recognizes Mr. Rob Chewning, (pictured center) for contributions to mHIC shown here with Mr. Ron Yeaw.

a number of research trials were in jeopardy of being stopped before the data collection was completed. Rob's tenacity paid off, and TATRC is very indebted to his hard work in helping us to complete our mission.

COL Dan Kral stated, "Rob's accomplishments in this area are nothing short of extraordinary. Words cannot express the gratitude we have for Rob's passion and commitment to do all that was humanly possible to support our mHIC projects. His keen sense of responsibility in the performance of his duties reflects great credit upon himself, and is in keeping with the highest tradition of the United States Army. I extend a sincere and heartfelt thanks for his contributions and congratulate him on a job well done!"

3G cellular provided the greatest communication capabilities between the medic in flight and the ground station in transmitting patient demographics, treatment, pictures, and video with the physiological monitor and with the EUD testing the ability to transmit the DD 1380 encounter. The added benefit with the 3G cellular and iridium systems testing is that it also provided the medic with the capability to make a voice connection with the EUD to the "home base," or to other phone lines that would further enhance telementoring communications.

In summary, PEO Aviation was able to successfully demonstrate telehealth and telemedicine off-boarding capabilities from MEDEVAC aircraft in flight using non-military, non-linear communication systems during the Bold Quest 17.2 Exercise. These systems will enhance evacuation platforms by providing worldwide communications and improving the quality of patient care over current MEDEVAC platforms and by providing clear and stable physiological monitor screens, and affording constant, quality patient assessments. SSG Dietrich stated, "I thoroughly enjoyed participating first hand in this exercise and actually using these real-world technological advancements that will improve patient care, as well as make a difficult job easier." She was also very pleased to have the opportunity to provide direct user feedback to improve the system and MEDEVAC operations.

For more information, please contact: Mr. Carl Manemeit at carl.h.manemeit.civ@mail.mil.

Employee Spotlight

Hats Off and Congratulations to Ms. Anna Hagarman, TATRC's Q1 Employee of the Quarter

Ms. Anna Hagarman, Conference Planner / Marketing & Meeting Support is EOQ for Quarter 1.

A hearty "Hoo-ah" to Ms. Anna Hagarman, of the Marketing & Public Affairs group for being recognized as the TATRC Q1 Employee of the Quarter! She continuously models and effortlessly exemplifies the characteristics and qualities as stated in the Employee of the Quarter Charter Memo: "The Employee of the Quarter should model behaviors of a good employee including a positive, professional attitude, respectful of institutional policies, helpful to co-workers, exhibiting good customer service and people skills, and a record of good attendance." She not only meets this, but exceeds it regularly! Anna is an exemplary employee, whose "can do" spirit is evident in everything she tackles. Her commitment to TATRC's many and evolving missions has been unwavering, and the execution of her tasks and responsibilities has been flawless.

Anna is responsible for preparing and processing all conference approval packets for TATRC staff. People do not realize what all goes into those documents. Those packets are extremely tedious and time consuming, and she does it happily, with a smile and in the 4 years of working here, TATRC has never been denied or disapproved for travel. She even assists with compiling MRMC Command-wide packets, because of the level of detail and precision she puts into them. She is an A+, stellar performer, who always provides a high level of support to all the TATRC labs and staff, that is often unrecognized and taken for granted. She is a true, unsung hero, who is always behind the scenes, "making good stuff happen" without a lot of fanfare.

Her additional duties and accomplishments include assisting in the planning, oversight and execution of two very successful Open House events, both of which were high visibility, herculean efforts, that came off without a hitch. Additionally, Anna plays a KEY and critical role in the development of the TATRC Times, which is significant, because it is through this vital mechanism, that our strategic messaging is distributed and communicated. In all, Anna deserves this award for her continued dedicated, reliable, and outstanding customer service and for her can do attitude to TATRC, not only for this quarter, but for the past 4 years. Congratulations Ms. Anna!

This Quarter's TATRC TRIVIA...

Question: Who was TATRC's original Main Conference Room named after and dedicated to at the Headquarters location in Ft. Detrick, MD?

(Answer in Next Issue!)

Answer to Last Issue's TATRC TRIVIA...

Q: What is the most recent and newest addition to TATRC's Organizational construct, which goes back to the original roots of TATRC? (HINT: Think "Telehealth")

A: TATRC's newly established Virtual Health Support Office (Formerly known as Telehealth).

mHIC Welcomes New Administrative Team Member!

Tiffany Williamson, Administrative Support Officer

TATRC's mHIC Team in Ft. Gordon, GA is excited to announce the arrival of Ms. Tiffany Williamson who is joining the team as an administrative support officer. Ms. Williamson, born in Augusta, Georgia, and self-proclaimed former military "brat," has lived in various places including Germany and Kentucky. At the age of 19, she joined the United States Army as an Automated Logistical Specialist. Tiffany was deployed to Afghanistan in 2011, in which she received the Army Commendation Medal for her exceptional meritorious service during the deployment. In 2013 she ended her Army career with an honorable discharge in order to pursue college full time.

Tiffany has a MBA Degree in Management and a Bachelor's Degree in Business Administration with a concentration in Health Services from Strayer University. Her professional background includes Business Administration, Human Resources, and logistics. She aspires to become a subject matter expert within her field and is eager to be an asset to the TATRC organization.

Tiffany has a passion for helping people and increasing innovations for healthcare through research and technology. She enjoys traveling, shopping, bowling and is very family oriented. Tiffany aspires to start a not for profit organization for teen girls within the community that would teach self-confidence, self-love, values, morals, business ethics, investments, women empowerment, and the pursuit of achieving goals and dreams. She feels a moral duty and social responsibility to give back to the community. According to Tiffany "if I can encourage one person on this earth, then I have fulfilled my purpose." Team TATRC is happy to have you on board, Tiffany!

TATRC Welcomes New Project Officer to the VHSO, Terrance (TJ) Brown

Mr. Terrance "TJ" Brown has joined our TATRC team as a Project Officer primarily supporting the Virtual Health Support Office (VHSO). He is former Navy and comes with a wealth of experience.

Born and raised in Seattle, Washington, TJ entered the Navy right after high school and spent 24 years on active duty, during which he earned his Bachelors of Science degree in Business Management.

While in the Navy, he served on several submarine platforms and executive staffs in support of the U.S. Submarine Force. One of his many highlights during his career that he is most proud of was him being named "Sailor of the Year," while being stationed on board the Navy's Deep Submergence Vessel NR-1. While in the Navy, he served as an Administrative Officer, Personnel Officer, Transient Officer, Legal Service provider, and had several other duties. After his naval career, he settled in Norfolk, Virginia and worked as an Executive Management Assistant and Administrative Specialist for the Regional Maintenance Center for surface ships.

TJ is married to his lovely wife Nora who is also a Navy veteran. They have two dogs, both Terriers named Oreo (Yorky) and Draper (Silky). He enjoys working out, reading fiction, riding, and working on his motorcycle. The family moved to Augusta from Virginia to be closer to his son and their new Granddaughter. Welcome to the Team, TJ!

Mr. Terrence Brown, VHSO Project Officer

Employee Spotlight

mHIC Lab Welcomes New Project Officer

Ms. Yukia Green, our latest mHIC Project Officer.

Ms. Yukia Green joins the TATRC family as one of our newest Project Officers, with expertise in Program and Project Management directly supporting TATRC's mHIC Lab in Ft. Gordon, GA. She is ecstatic about the opportunity to grow with such an amazing and ever expanding team!

The oldest of three siblings, Yukia was born in small-town, Douglas, Georgia and after graduation, joined the U.S. Navy. During her tenure, she worked as a supply specialist aboard submarine tender, USS Frank Cable in Agana, Guam at the time. Because of her drive and initiative, Yukia was selected for recruiting duty and went to work at the Navy Recruiting District in New Orleans. After two years as a recruiter, she worked aboard the USS Carl Vinson, an aircraft carrier, as head of retail operations at Naval Station Norfolk, Virginia. After 8 years of active duty, she left the military and began her work as a federal civilian serving in capacities such as Commander's Secretary at the Naval Support Activity in New Orleans, Program Support Manager / Executive Secretary for the 31st Intelligence Squadron at Ft. Gordon and Program Support Manager in Medical Administration for the Associate Director's Office at Dublin VA Medical Center.

Yukia has earned a BS degree in Business Management and an MBA with a concentration in HR Management from the University of Phoenix. She is currently working on a second Master's degree in Adult Education and Training.

At TATRC's mHIC Office Yukia serves as a Project Officer for both current health and future Virtual Health research missions.

Yukia is engaged to her military sweetheart and is planning for a 2018 Summer wedding. They have one "fur-baby," a Yorkshire terrier named Kenzo, who cannot be convinced that he is not human. Yukia enjoys couponing, shopping, traveling, and spending time with family and friends. The mHIC staff is happy to have you join the team, Yukia!

TATRC Welcomes New QA Tester to the HTIC Team

Team HTIC adds a new resource to their lineup! Mr. Scott Brazelton has joined our TATRC team as a Software Quality Assurance (SQA) Tester primarily supporting the Health Technology Innovation Center's (HTIC) Linked Problem List project, as well as HTIC's Team Fitness Tracker. Scott brings his 10 years of web and client application QA testing experience along with 5 years of software development experience to the table and will be working as a support contractor through Laulima Government Solutions, LLC.

Scott has a Bachelor's Degree in Management Information Systems from the University of Virginia's College at Wise. He was recruited directly out of college as a QA tester. Over the last 5 years, he has also had positions as a software developer for web services, client applications, and test automation projects.

Mr. Scott Brazelton joins HTIC as Quality Assurance Tester.

Scott previously lived in the Chicago area, but currently resides in Abingdon, Virginia with his Fiancé Emily and two sons (Timothy and Christhian).

In his spare time, he enjoys spending time with his family, running, gaming, watching hockey, and working on his car.

TATRC warmly welcomes Scott to the team!

TATRC's Virtual Health Support Officer Gets a Much Needed Assist!

Ms. Ondine Doore, Telehealth Manager to support VHSO.

TATRC's Virtual Health Support Office (VHSO) is pleased to announce a new Telehealth Manager to assist in this rapidly expanding initiative! Ms. Ondine Doore, CMS, CSSGB, PMO, will be directly supporting Dr. Francis McVeigh, Chief Scientist and Lead for the VHSO. She will be working on existing telehealth programs for synchronous recorded health history via electronic information and telecommunications technologies in support of long distance clinical healthcare; patient and professional health related education, and health administration. She will also be supporting the VC3 Program Lead in establishing and managing the VC3 Program to provide real time two-way interaction between a person (patient, caregiver, or provider) and will provide information and updates on programs to other program offices, and serve as the POC for receiving and dissemination of information. Ondine will have a primary role in gathering data to support business case development, analysis, and evaluation of various telehealth initiatives throughout the regional Health Command Central and will be creating a database for collecting, storing, processing, and performing data analysis to provide useful information. Additionally, Ondine will train telehealth system users on accessing, navigating, and utilizing telehealth systems and will ensure compliance with various DoD, Department of the Army, MEDCOM, and MHS policies on networks, systems, and Information Assurance. This includes ensuring compliance with The Joint Commission policies on telemedicine. Ondine will provide subject matter expertise in deployable Tele-Behavioral and Operational Telehealth programs for Military Medicine to support TATRC and assist with the coordination of Defense Health Agency (DHA) JOMIS theater telemedicine communications planning.

Born and raised in Florida, Ondine enlisted in the U.S. Army after High School and did her first AIT at Ft. Gordon, GA in the Signal Corp, then went onto Ft. Huachuca, AZ in Intelligence. She was one of the first women to go through Basic Training in the Army's new separation training for women. After her AIT, she spent time at Stuttgart Army Base in Germany. When she returned state side, she transitioned to Ft. Mead, MD, and went to the University of Maryland where she received her Bachelors in Business, Management; with Certifications as a SCRUM Master, Six Sigma Green Belt, and Program Management Operations.

In 1988, she completed her service and began a career in Healthcare Management. She has 18 years of diverse experience within the Healthcare industry; from managing small multi-modality medical groups to hospital departments, as well as managing overall operations, IT infrastructures, software development, staffing, patient care, to acquisitions and mergers. In 2006, she left the private healthcare industry for the DoD and Federal sector as a Senior Program Manager managing several large programs and portfolios and is not new to Telehealth. In 2013, she served as a Program Manager for DCoE Telehealth and Technology at NCR and worked with both DHA and DCoE in evaluating guidelines and standards across all Military Services for Telehealth technologies.

Ondine has been married for 31 years to her husband Mark, and together have three wonderful and beautiful children Stephen, Christine, and Merissa. They currently have three four legged grand babies and a cat named Kali. Together they enjoy being with their children, family, and friends and have fun camping, hunting, fishing, and being at the beach. TATRC is proud to have Ondine join Dr. McVeigh and the VHSO initiatives!

TATRC's VHSO Keeps its Finger on the Pulse of Efforts Across the MHS

There have been many recent and projected changes within the DoD, Defense Health Agency (DHA) and sister Services regarding organizational roles and responsibilities. The intent of this article is to provide our readers a better understanding of the DoD's Virtual Health / Telehealth missions and to highlight TATRC, as well as other organizations' focus areas. By knowing what other specific organizations are concentrated on, it will help in the selection of collaborators and / or informational points of contact for research and other initiatives. The terms 'virtual health' (VH) and 'telehealth' (TH) are being used interchangeably throughout the DoD, and as such, in this article as well.

To quote an old saying, 'If you want to go fast-go alone, if you want to go far-go with others.' Dr. Fran McVeigh, TATRC's Chief Scientist and Lead for the Virtual Health Support Office stated, "Having been involved in rolling out and expanding telehealth initiatives and programs for over two decades, it is my experience that enduring programs are those in which all involved understand one another's roles and work together toward a common goal - in our case - providing quality care wherever and whenever needed. Telehealth enhances our chances of meeting this goal."

Current:

Congress: The National Defense Authorization Act (NDAA) for Fiscal Year 2017 stipulated the following (however it is important to note that many of these initiatives are being discussed and the final guidance is forthcoming): DHA will be responsible for: The administration of all services' military treatment facilities, including budgetary matters, information technology, health care administration and management, administrative policy and procedure, military medical construction, and other appropriate matters. The Army Surgeon General will continue to serve as the principal advisor to the Secretary of the Army and the Chief of Staff of the Army on all health and medical issues of the Army, including strategic planning and policy development relating to such matters. The Army Surgeon General will serve as the chief medical advisor to the DHA Director on matters pertaining to military health readiness requirements and safety of members of the Army. The Army Surgeon General acting under the authority, direction, and control of the Secretary of the Army, shall recruit, organize, train, and equip medical personnel of the Army.

The NDAA for Fiscal Year 2017 further stipulated that telehealth including mobile health applications, be enhanced throughout the direct care and purchased care components of the military health system.

DHA: Its integrated system of readiness and health's vision is: Unified and Ready; it's Mission is, The Defense Health Agency, a Combat Support Agency, leads the Military Health System (MHS) integrated system of readiness and health to deliver the Quadruple Aim—increased readiness, better health, better care, and lower cost. The agency's goals are to empower and care for our people; optimize operations across the Military Health System; co-create optimal outcomes for health, well-being and readiness; deliver solutions to combatant commands. DHA is scheduled to stand up a Joint TH Program Office in 2019, however in the interim, each Service will serve as their own Program Office.

Army: The Army Virtual Health's (VH) mission is to support our Total Force by cross-leveraging medical capability when and where it is needed in Garrison and deployed environments, increasing readiness, enhancing access and experience of care, reducing per capita cost and improving population health.

Because of the benefits of VH in terms of increased access, enhanced experience, and increased readiness, the Army is expanding the use of VH in both Garrison and deployed environments across roles of care.

VH also helps Army Medicine leverage clinical expertise across all time zones to provide vital medical capability at the point of need. Recently, the Army established the Virtual Medical Center (VMC) at Brooke Army Medical Center in San Antonio, Texas.

VMC: The mission of the VMC is to serve as the organizational structure by which providers deliver VH services using synchronous and asynchronous capabilities in both Garrison and deployed settings across all roles of care. Once fully developed, the VMC will be the tactical hub of VH for the Army. It will implement innovations for the enterprise and synchronize VH efforts across the AMEDD.

As it reaches out to deployed Service Members, the VMC will help in the current fight by connecting subspecialty expertise in Garrison to Soldiers in combat zones. It will also be a key element of the future fight, as air superiority is challenged, medical evacuations become scarce and expertise is needed to keep wounded Soldiers alive and well for longer periods of time.

Although the VMC is a relatively new concept, it builds

on Army Medicine's previous 20 years of experience. LTG Naja West, Army Surgeon General stated, "By implementing virtual health innovations for deployed Soldiers in all environments and across the range of military operations, the Army Medical Department can improve battlefield medical capabilities."

VMC Goals: VMC's near and longer term goals include asynchronous and synchronous support to deployed forces and deploying units, expanding subspecialty consultation support, and after hours care for primary and urgent care.

TATRC: TATRC has long been involved in building, deploying and managing telehealth demonstration projects and conducting telehealth research; e.g. AKO asynchronous tele consultations since 2004 (now known as the Army Teleconsultation Program); tele-dermatology; Specialized MEDCOM Response Capabilities-Telehealth; PATH (Pacific Asynchronous Telehealth—which will serve as a platform for the new Global Teleconsultation Portal); CENTCOM Tele-Behavioral Health since 2010; expansion of Garrison telehealth across 18 time zones, 30 countries and over seventy specialties involved; research in connecting Wounded Warriors to their case managers and platoon sergeants via cell phones; and countless other research, demonstrations and proofs of concepts focused on the operational environments needs to capture, document, and disseminate medical data throughout the roles of care. A majority of TATRC's research is focused on the near and midterm time frames and has mainly been funded by the Joint Program Committees (JPC), (Defense Healthcare Program dollars) and some funding has come from the Army Surgeon General. In FY17, Department of Defense Appropriations Act increased research funding to support research in Medical Capability in Dispersed Operations (MCDO) above the budget request. This is 6.1-6.2 Research, Development, Testing & Evaluation funding focused on 2028 and beyond. The nature of this basic and early applied research is to investigate and identify new scientific / technical paradigms that could be applied to either identified needs / gaps or to currently accepted practices (with no gaps identified) that could be improved or streamlined by leveraging new scientific principles or emerging technologies.

As a result, the Medical Simulation and Information Sciences (MSIS) under JPC-1, was successfully able to request additional funding and establish three new research task areas to support research to enhance the Multi-Domain Battle Concept by treating, evacuating and returning to duty injured and / or wounded Warfighters. The three new task areas to provide maximum Army Warfighter payoff for investment are: (1) Virtual Health; (2) Medical Robotics; and (3) Autonomous and Unmanned Capability. The overall objective of the Virtual Health research task areas are to develop future VH enterprise process architectures and integrated physical solutions capable of supporting prolonged field care in conditions with limited or lacking traditional field communications.

As of January 2017, TATRC established the Virtual Health Support Office (VHSO) to assist the Army's VH Office, by focusing on the operational environments to ascertain their TH capability status; monitoring and documenting ongoing demos and proofs of concept; and to make recommendations on how to enhance the delivery of VH in the operational settings. Additionally, TATRC retains the responsibility of conducting monthly CENTCOM tele-Behavioral coordination telcons to include coordinating the ongoing efforts of connecting the right individuals to address issues and ensure proper follow up. Furthermore, the VHSO provides back up management of the Army's asynchronous teleconsultation and tele-dermatology programs.

Air Force: The primary focus of Air Force Medical Service Telehealth has been developing the tele-imaging systems to serve the specialty communities of radiology, cardiology, endoscopy and pathology. The AFMS has also developed several telehealth modalities to deliver both synchronous and asynchronous teleconsultations between primary care and specialty providers. They are only now beginning to offer virtual video visits between providers and patients, primarily in the realm of behavioral health.

Navy: Navy Virtual Health (VH) services span ten time zones, nine countries and territories, and over thirty clinical specialties while supporting all echelons of care including the Fleet. Their future direction is to augment existing capabilities with expansion of the VH footprint, increase readiness, provide additional clinical specialties, and maximize support ("Never Alone" concept) to forward deployed Sailors, Marines, the units and providers. Recently, VH providers delivered remote guidance to shipboard staff to perform a series of scenario-driven, life-saving procedures during an offshore exercise, 'Dawn Blitz.'

The Navy's Connected Corpsmen in the Community Pilot is providing more convenient and easy access for active duty services members, by using enlisted medical staff with a virtual reach back to a licensed, independent practitioner at an alternate location.

In the second quarter of 2017, the Medical Operations

VHSO *Continued from page 19*

Group appointed the Navy as the interim Program Management Office for "Telehealth to the Patient's Location" titled Virtual Video Visits (V3). V3 includes the utilization of two-way interactive audio and video appointments with a primary or specialty care provider in a secure location and a patient in their home, at work or another secure location. Health care may be delivered via a variety of devices (VTC, web-cam, smart phone, tablet, laptop, and desktop). V3 provides a means to leverage health care to improve patient access and satisfaction, provider capacity and satisfaction, and facilitate patient engagement for outcomes that are the same as face to face appointments or better.

Military Healthcare System (all three Services and DHA): The MHS will incorporate TH modalities across the TH domains (provider to patient; provider to provider; patient to system) to provide medical capability to remote and operational areas and locations where the patient and / or the provider is outside traditional care settings. Recently, the MHS TH working group received Defense Business Certification approval and funding to deploy a Global Teleconsultation Portal (asynchronous capability-Army in the lead); Remote Health Monitoring (San Antonio Market-Army and Air Force in the Lead, in the National Capital Region-DHA and Navy have the Lead); and V3, in which the Navy has the lead. This was only accomplished because of the hard work done by all three Services' telehealth MHS workgroup personnel working together as a team—a true testament to what needs to be done moving forward.

Projected:

Uncertainty remains as changes in DHA's and the Services' roles and responsibilities continue to occur that will affect current and future TH programs. Challenges in the deployed environments such as reaching back to medical specialist outside of the deployed setting and throughout the deployed environments will continue to be difficult in their low to no-communication environments, especially in an environment where cyber warfare is a threat. However, it is important to note that today, due to the efforts of some clinical and administrative champions, we do have telehealth capabilities in some Role one and two locations and other places around the world.

In future conflicts, we may no longer have air superiority allowing for on demand medical evacuation to occur, thus we will have to provide care for longer periods of time, with a minimal number of specialists on the ground. We need to address these scenarios and offer solutions, aka 'Plan B', on how best to meet these challenges when our preferred options are not available.

Continued collaboration among the Services and DHA will make the transition to a Joint Program TH Office easier. Needless to say, leadership's guidance and support as well as having knowledgeable and informed personnel at all levels involved, is needed if we are to meet the challenges of delivering quality care anytime to anywhere.

Let us never forget, 'If we want to go fast-go alone—if we want to go far-we must go with others.'

For more information, please contact: Dr. Francis McVeigh at francis.l.mcveigh.civ@mail.mil.

TATRC's Flying Laboratory Featured at AUSA's Innovator's Corner

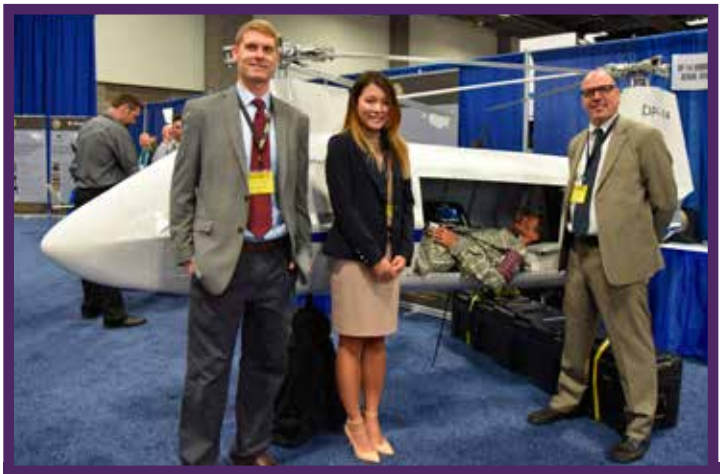
In early October, the ongoing research efforts of TATRC's Operational Telemedicine Lab and two of its members, Mr. Nathan Fisher and Ms. Rebecca Lee, were thrust into the limelight of the Association of the U.S. Army (AUSA) Annual Symposium when the Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology ASA(ALT) requested USAMRMC to display and present the prototype "Emergency Medical Resupply & Enroute Care Unmanned Aerial Systems Research Platform" in ASA(ALT)'s "Innovator's Corner" which served as a technology display area. The Innovator's Corner displays innovative, cutting edge Science and Technology (S&T) projects, developed by or in partnership with Army laboratories including the U.S. Army Corps of Engineer's Engineer Research and Development Center, the Army's Capabilities Integration Center, the Research Development and Engineering Command, Army Research Laboratory, Armaments Research, Development and Engineering Center, and Communications and Electronics Research, Development and Engineering Center. The Innovator's Corner also provided an opportunity for attendees to learn about Army laboratories' capabilities and priorities and provided a unique and interactive forum to discuss critical technical challenges facing Army scientists and engineers. In addition to manning the booth, TATRC's Nathan Fisher was invited to formally present TATRC's current and future research initiatives aimed at leveraging Unmanned Systems as force multipliers to support medical mission areas within the Army's future Multi-Domain Battlefield concept.

For the conference, the Dragonfly Pictures' (DPI) DP-14 research platform and Unmanned Aerial System (UAS) was on display to show how TATRC plans to use the prototype's heavy fuel tandem helicopter as a "flying laboratory" platform to test and evaluate UAS emergency medical resupply concepts and emerging enroute care prototype capabilities intended to support future UAS Casualty Evacuation missions. This Joint Program Committee-6 funded project is a joint effort between DPI, TATRC, and the U.S. Army Aeromedical Research Lab to develop the test platform and a Data Acquisition System (DAS) which will capture vehicle acceleration effects and environmental data within the interior cargo space of the UAS. In future projects, the DP-14 will be used as a "flying test bed" to validate and verify semi-autonomous and autonomous patient management systems, test communication infrastructures to enable remote patient monitoring, and command, control, and supervision of medical telemetry and patient management systems by remote experts while enroute, and to develop adaptive flight parameters for UAS based on injury profiles.

Regarding the use of unmanned vehicles for medical evacuation, Fisher stressed to attendees that "The ideal scenario is that you have a medevac platform with a dedicated medical crew that can take care of a patient while flying en route. That's always Plan A. I like to call this Plan B. It's a situation where you can't get a medevac there in time, or there are no medevac assets available due to the threat situation or due to the fact that they are just at capacity."

The display attracted numerous Senior DoD Officials and VIP visitors including Army Chief of Staff General Mark A. Milley, Acting Assistant Secretary of the Army for Acquisition, Logistics, and Technology, Ms. Steffanie B. Ester, and former Secretary of Defense William Cohen. TATRC's research in unmanned medical resupply and casualty evacuation aligns closely with General Milley's remarks at last year's AUSA meeting discussing the use of UAS in the future medical missions as a part of the Army's Multi-Domain Battle concept. At the time, he referenced the use of robotics and autonomous systems to perform medical missions in support of dispersed units in anti-access / area denial (A2/AD) environments such as Megacities, which would be enabled by research that TATRC is performing using the DP-14. Ms. Lee quipped "AUSA provided really great visibility at all levels. It was also rewarding to see the communities be more receptive to the use of UAS for medical missions. This hasn't always been the case, so opportunities like AUSA give us a chance to inform others how TATRC is trying to leverage such capabilities in its research projects."

For more information, please contact: Mr. Nathan Fisher at nathan.t.fisher3.civ@mail.mil.



Mr. Nate Fisher and Ms. Rebecca Lee with SBIR Partner Mr. Michael Piaseki (right) and the DP-14 prototype.

TATRC Puts a Spotlight on Exciting AAMTI Funded Research on Living Bioprosthetic Mesh

Bench to Battlefield: In Vivo Combination of Commercially Available Materials to Generate Living Bioprosthetic Mesh

Because of their theoretical ability to resist bacterial colonization and portability, biologic meshes hold immense promise for abdominal wall reconstruction in battlefield casualties and during complex ventral hernia repair in the presence of moderate to severe contamination within the peritoneal cavity. Despite advances in the development of bioprosthetics and improvements in surgical techniques, mesh infection remains a challenging and costly complication. Infection has been reported in as many as 30% of cases following mesh use in contaminated operative fields regardless of the material used, with hernia recurrence rates reported up to 43%. An estimated 365,400 ventral hernia repairs are performed annually in the United States at a total cost of $3.2 billion; this includes 17,400 ventral hernia repairs performed annually in military and VA hospitals at a cost of $152 million to the United States Military Health System. Given the high recurrence rates, it is imperative that quality initiatives be undertaken to discover measures that would reduce recurrence and re-operation rates, improve patient care, and reduce health care costs for such a common problem.

Using a rat model of mesh infection, the Tripler Army Medical Center (TAMC) laboratory previously demonstrated that augmenting a bioprosthetic mesh with mesenchymal stem cells (MSC) derived from bone marrow markedly enhances its resistance to bacterial infection and preserves mesh integrity (Plast Reconstr Surg Glob Open 2016;4:e751). MSCs have been shown to benefit wound healing not only by promoting tissue regeneration and increasing the recruitment of macrophages and endothelial cells into the wound, but also by possessing immunomodulatory and antimicrobial activity against both Gram-negative and Gram-positive pathogens.

To date, the chief impediment to the direct clinical application of this very promising stem cell therapy on the battlefield or in the unplanned, emergent operative setting is logistical, requiring labor-intensive and resource-intensive isolation and culture of MSCs typically harvested from bone marrow or adipose tissue. Innovative cryopreservation technology, however, has enabled the development of commercially available matrices derived from human placental tissue (Osiris Therapeutics, Inc.) marketed to contain viable, non-immunogenic, human MSCs. These stem cell-containing matrices have demonstrated safety and efficacy in clinical trials for wound repair and have shown beneficial effects on infection control, but they lack the tensile strength necessary for successful hernia repair.

The purpose of this AAMTI-funded project was to evaluate an "off the shelf" MSC-containing product (Stravix Cryopreserved Placental Tissue; Osiris Therapeutics, Inc.)

Mesh *Continued on page 23*

mHIC Finds New Work With An Old Partner

On 1 November, four key team members of TATRC's Mobile Health Innovation Center (mHIC) spent the afternoon at the Warrior Care & Transition (WCT) Command, in Crystal City, Virginia. The purpose of the meeting was to ensure that all the documentation and other logistics were aligned to make certain that the WCT could begin using mHIC's Mobile Health Care Environment – Enterprise (MHCE-E) system for remote monitoring of Warriors in Transition. The group discussed ways in which the systems could communicate and complement each other's efforts for soldier's self-assessments and support the creation and achievement of solider transition goals. The MHCE-E system was originally created back in 2009 for our transitioning Warriors, and is now coming full circle into the future in terms of achieving our warriors' recovery and transition goals in partnership with the WCT unit social workers and occupational therapists. This was the first of a series of meetings that will continue to take place to ensure that the projects used by the MHCE Research system are successfully migrated to the MHCE-E system and in use before FY19 by the WCT Command. The TATRC team is excited to see lessons learned from the research, migrating to real world use cases, and the functional proponents from the MHCE system. The WCT are enthusiastic about the future alignment of our shared mission to reach into the patients' life space.

TATRC's Senior Project Officer Mr. Robert Chewning noted, "The work that the WCT team performs to care for our wounded warrior population is truly remarkable and we are honored that this collaboration will push the bar forward for allowing patients to manage their health remotely using their own personal mobile devices."

Mesh *Continued from page 22*

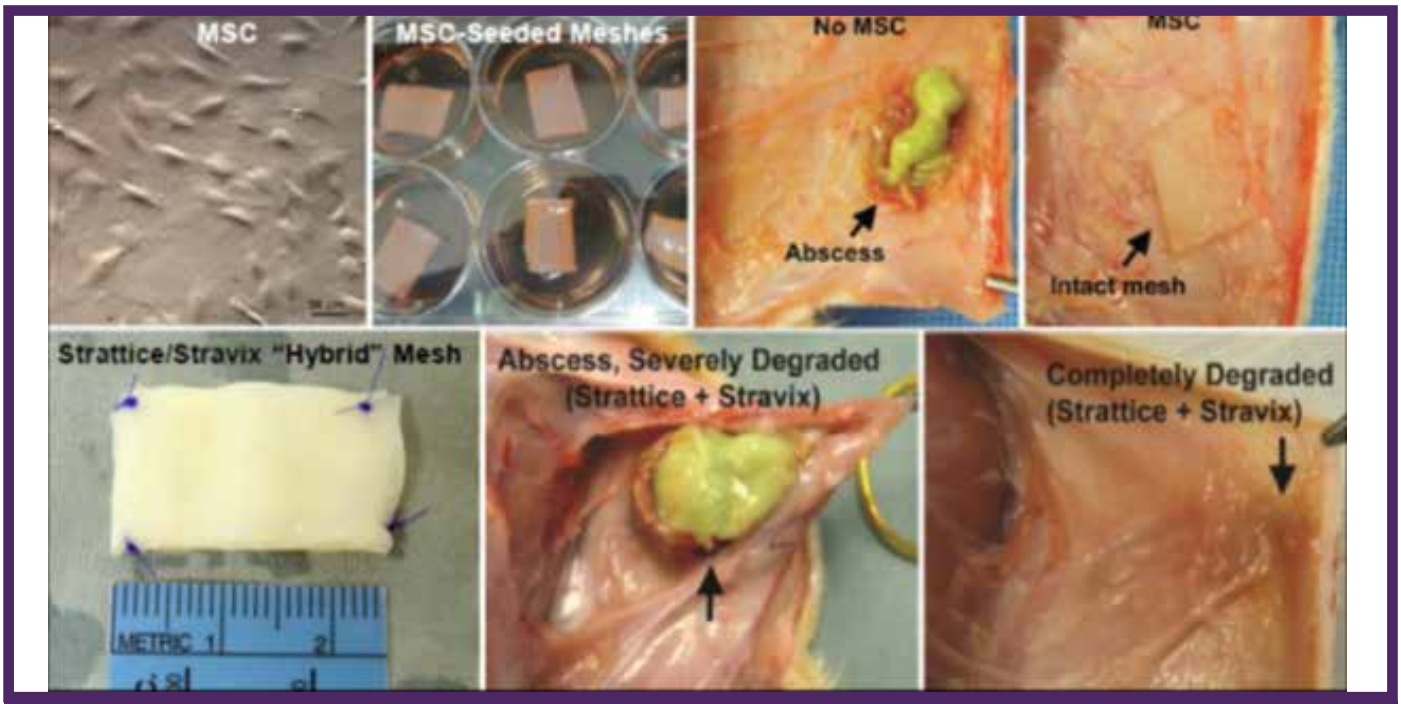
in combination with an otherwise acellular bioprosthetic mesh frequently utilized for contaminated hernia repair (Strattice; LifeCell Corp.) as a novel, realistic, and practical alternative to overcome the logistical and economical hurdles of traditional stem cell therapy. The specific aim of this study was to determine whether the "hybrid mesh" (Strattice + Stravix) similarly improves infection resistance in vivo after inoculation with Escherichia coli (E. coli) as demonstrated previously by the TAMC laboratory in bone marrow-derived MSC-seeded bioprosthetic mesh.

Twenty rats were implanted subcutaneously with 1 piece of Strattice and 1 piece of hybrid mesh (Strattice + Stravix sutured at the corners). Rats were inoculated with either sterile saline or 106 colony-forming units of E. coli before wound closure (n=10 per group). At 4 weeks, explants underwent microbiologic and histologic analyses. In the E. coli–inoculated animals, severe or complete mesh degradation concurrent with abscess formation was observed in 100% (10/10) hybrid meshes and 90% (9/10) Strattice meshes. Histologic evaluation determined that meshes inoculated with E. coli exhibited severe acute inflammation, which correlated with bacterial recovery ($p<0.001$). Unexpectedly, viability assays performed at the time of surgery failed to verify the presence of numerous live cells in Stravix, which may be a causative factor as to why Stravix was not found to improve infection resistance of a bioprosthetic mesh in vivo. Therefore, the search for a readily available, affordable, and mechanically durable MSC-containing bioprosthetic for the repair of contaminated abdominal wall defects continues. The results of this project were published in the journal Plastic and Reconstructive Surgery Global Open in August 2017.

"The AAMTI funding for this project has made possible the pursuit of measures intended to reduce infection-related hernia recurrence rates, improve patient care and quality of life for military personnel, retirees, and their dependents, and dramatically reduce the financial burden on the United States Military Health System. This project also augmented the training of TAMC general surgery residents (CPT Ally Ha and CPT Erik Criman) involved in the study to help them develop as investigators committed to advancing health care through research," said Lisa Pierce, Biomedical Research Scientist and Chief of Cell and Molecular Physiology at TAMC.

Future work will utilize the established mesh infection model to test newly introduced products or those under development, and to investigate more complex mesh infections with additional clinically relevant bacterial strains.

For more information, please contact AAMTI Program Manager: Ms. Holly Pavliscsak at holly.h.pavliscsak.ctr@mail.mil.



Bioprosthetic meshes seeded with mesenchymal stem cells (MSC) resisted infection and degradation when inoculated with E. coli, while Stravix cryopreserved human placental tissue did not improve infection resistance of a bioprosthetic mesh.

AAMTI Project Spotlight: Use of High-Resolution Relational Resonance-Based Electroencephalic Mirroring (HIRREM®): a Closed-loop Neurotechnology for Optimization of Brain Oscillations

There is tremendous interest to develop new technologies that can have transformative impact on human brain functioning. The objectives span the gamut from supporting recovery for the severely injured, to optimizing the skills of elite performers. Researchers from the DoD, universities, and industry, are pioneering and collaborating to achieve breakthroughs for our most complex organ. This article introduces one such potential breakthrough for advancement of brain function, which has involved participation from the U.S. Army Research Office (ARO), Brain State Technologies (BST), Wake Forest School of Medicine (WFSM), Womack Army Medical Center (WAMC), the Defense and Veterans' Brain Injury Center (DVBIC), and the Uniformed Services University of Health Sciences (USUHS).

Through an AMEDD AAMTI Rapid Innovation Fund (RIF) Award, WAMC is evaluating the feasibility of self-use allostatic neurotechnology devices developed by BST in Scottsdale, Arizona. The technology works through noninvasive monitoring of brain electrical activity, high resolution spectral analysis (frequency bins as narrow as 0.01 Hertz), and algorithms to convert selected frequencies into real-time acoustic stimulation – audible tones of variable pitch and timing, delivered through standard earbud headphones (Fig. 1). Allostasis refers to "stability through change," and the allostasis paradigm does not assume that there is any single "normal" form of brain function. Allostasis rather models that all biological function should be changing, adaptive, and anticipatory, for successful engagement with the complex needs of changing environments. The net effect is to support auto-calibration of neural oscillations, or a process whereby the brain itself can make its own unique self-optimizing adjustments, on its own terms. One expression of self-optimization is reduction of hemispheric asymmetries that may be related to chronic or traumatic stress (Fig. 2).

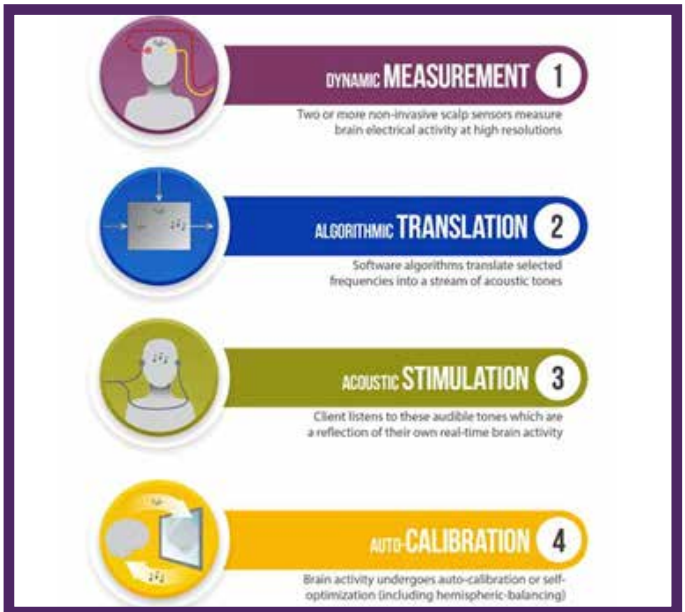


Fig. 1 (top). Sequential steps applied by closed-loop allostatic neurotechnology. Steps iterate to facilitate self-optimization of brain activity. Cables shown for Step 1 are indicative of an office-based intervention (cf., Fig. 3).

The self-use device was adapted from the core technology of HIRREM®, (high-resolution, relational, electroencephalic mirroring, also developed by BST). HIRREM® has been studied as an office-based intervention to treat insomnia and other conditions at WFSM since 2011. In 2014, the ARO made a phase one award to BST to produce devices for regulation of circadian rhythm. To achieve the award objectives, BST engineered their technology to operate in a self-use configuration, for self-directed optimization of brain electrical activity, improved sleep, attenuation of the effects of stress on the brain, and ultimately reduction of circadian misalignment. In March 2015, the company successfully delivered a working self-use prototype, which has since undergone two iterations and is available currently as the B2v2 (Fig. 3).

The RIF to WAMC will permit feasibility testing of BST's self-use device in 30 U.S. Army Special Forces Soldiers. The purpose of the device is explained as well as its possible benefits. Soldiers are asked to use it for 10-20 minutes per session, at a minimum of two to three times weekly, up to twice per day, for 4-6 weeks. At the end of the period, service members are asked whether they did or did not use the device and why, what they experienced, and any changes they may

AAMTI Spotlight *Continued from page 24*

have noticed since using it. Preliminary data show that Soldiers embrace the use of the device during travel or in the privacy of their homes. The only suggestion for improvement was to modify the headband so that it was easier to achieve adequate sensor contact. BST has already modified the headband allowing for much improved operations. There have not been any adverse effects reported.

These results will inform an upcoming research protocol this fall to BST to lead a controlled clinical trial (2018-19) that evaluates office-based HIRREM® as a way to remediate persisting symptomatology after mild traumatic brain injury. A second trial (2020-21) will examine whether integration of the self-use device with HIRREM® can support even more scalability and cost effectiveness of an allostatic brain optimization strategy. Overall partners for the trials are Principal Investigator Dr. Sung Lee, BST; Dr. Wes Cole, Senior Scientist at DVBIC, Fort Bragg, NC; Dr. Y. Sammy Choi, WAMC, and Dr. Michael Roy (COL, RET), Center for Neuroscience and Regenerative Medicine, USUHS.

The burdens of suffering from traumatic stress and Traumatic Brain Injury are enormous. Military service members and their loved ones are affected disproportionately. Medications have modest benefit at best, and entail non-trivial risk. Many standard behavioral treatments have limitations including low uptake and minimal impact on sleep disturbance. There is still no FDA-approved treatment for pain and sensory disturbances attributable to TBI. "Every brain is different – and always changing – and it may be critical for strategies to approach and respect the brain accordingly. As researchers, we are excited to see what this technology can do," said Dr. Y. Sammy Choi, a driving axiom of the researchers introduced in this article. "When the brain is viewed as the organ of central command, multiple benefits are predicted from the use of interventions that can genuinely advance its functionality." U.S. Army medical research divisions to include TATRC, are playing a critical role to support the testing of the far-reaching technologies and ideas associated with this axiom.

Fig. 3 (bottom). B2v2®, self-use device for closed-loop self-optimization of brain activity (photo courtesy of Brain State Technologies, Scottsdale, Arizona).

Some of the information regarding this feasibility project was presented at the Military Health System Research Symposium, Kissimmee, FL, 27-30 August 2017.

For more information, please contact AAMTI Program Manager: Ms. Holly Pavliscsak at holly.h.pavliscsak.ctr@mail.mil.

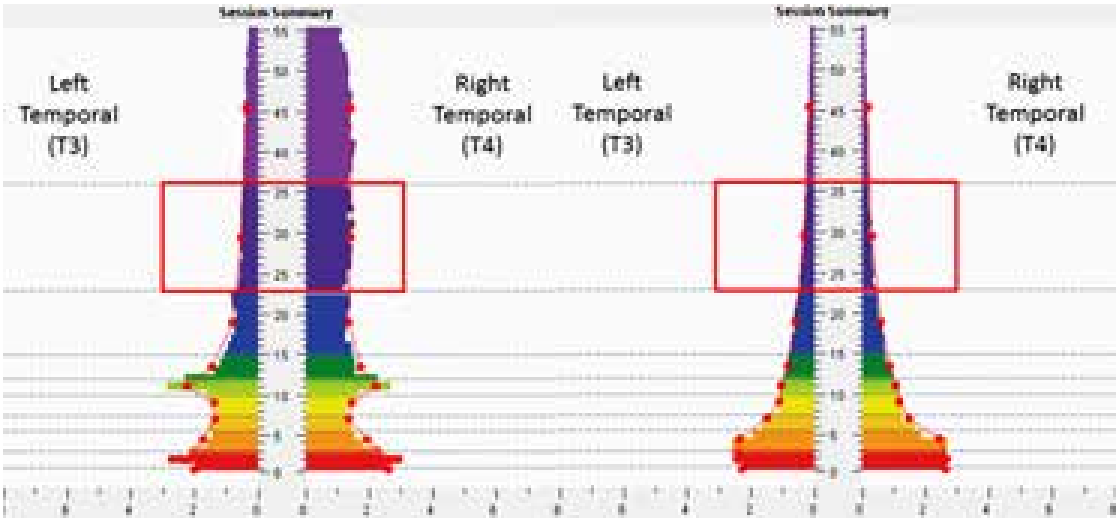


Fig. 2 (middle). Spectrographs of bilateral temporal lobe activity, before and after use of closed-loop allostatic neurotechnology (HIRREM). Left and right sides of each panel show averaged activity (one minute) for left and right temporal lobes, respectively. Amplitudes (microvolts) and frequencies (Hz) are shown on horizontal and vertical axes, respectively.

MMSIC Lab Manager Presents at IOM's Global Forum

Mr. Geoffrey Miller, Lab Manager and Research Scientist at TATRC's Medical Modeling and Simulation Innovation Center (MMSIC), was invited to present to the Global Forum on Innovation in Health Professional Education, Improving Health Professional Education and Practice through Technology, at the National Academies of Sciences, Institute of Medicine, in Washington DC on 16 November. At this forward-thinking forum, Mr. Miller presented on the future of Autonomous Intelligent Mentoring (AIM): Applying Game Technology to Advance Medical Education. Mr. Miller began this research and technology development at Eastern Virginia Medical School, and is continuing to pursue the development of these technologies to advance and augment education and assessment of health professionals.

The main goal of any training program is to prepare trainees to perform effectively on post-training tasks in a real-world setting. Ideally, to achieve this goal, learners must have access to expert instruction, assessment and individualized feedback. This is frequently very difficult to provide on an individualized level, leaving many learners without this valuable experience. More recently though, computer vision systems, machine learning and artificial intelligence are demonstrating great promise to ensure that every learner, has equal access to expert instruction, assessment and performance improvement feedback, unique to their particular learning needs.

The importance of deliberate and repetitive practice and feedback are well recognized features of medical simulation which lead to effective learning[1,2]. To provide adequate opportunity of these key features, learners must have access to appropriate simulation devices, equipment, faculty mentoring, expertise and feedback and individualized time to acquire a designated skill to the defined level of competence or mastery. Though this model is achievable, it comes at a high cost in terms of availability of devices, equipment, faculty expertise and time. In some cases, this limits the opportunity for learners to have adequate, individualized opportunity to achieve desired performance outcomes or the opportunity to receive "expert" mentoring. Further, as clinical demands increase on medical educators, their availability to observe, mentor students and provide meaningful feedback is becoming more difficult, especially at the individualized level. Finally, faculty observations of clinical procedural skills mainly rely on subjective criteria regarding the actual precision of real-time human performance metrics. The objective measurement of these human performance metrics is missing in terms of simulator(s) and faculties' ability to provide feedback for performance improvement of procedural skills.

The AIM concept seeks to 1) develop a low-cost solution, focused on the measurement of human performance related to specific real-time, 3D psychometric measurements of clinical procedural skills (Figure 1), 2) improve and increase opportunities for individual, independent, deliberate practice, with real-time, objective assessment and expert feedback for procedural skill acquisition, 3) collect and curate a library of human clinical procedural skill performance models using a common standard, open source approach, and 4) provide universal access to expert instruction with individualized autonomous feedback for learners and performance analytics for instructors.

Initial research using the AIM concept addresses the need to model expertise and provide procedural mentorship and training, and objective performance feedback regarding the physical performance during endotracheal intubation, which cannot be measured by current airway simulators. The AIM concept leverages off-the-shelf computers and the Microsoft™ Kinect™ motion capture devices, to acquire real-time, 3D time-space objective measurement of human performance, compared to a master performance model of expected psychomotor skill. The master performance model was developed by recording the performance of acknowledged expert airway management clinicians and developing an aggregate model (Figure 2), which is mapped against the learner to provide corrective performance assessment, and individualized corrective feedback.

These expert clinical procedural performance models are also essential to efforts investigating medical robotics and

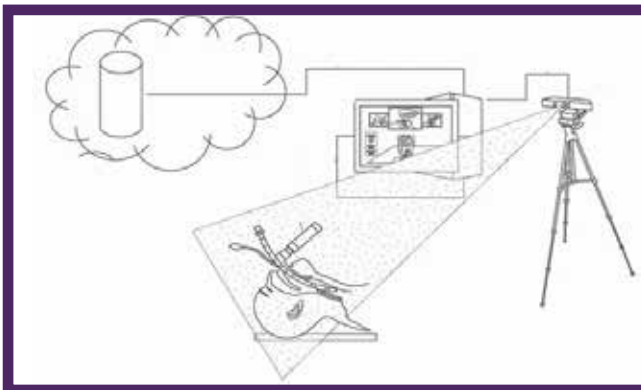


Figure 1. Schematic representation of the AIM Figure 1. Schematic representation of the AIM concept. A 3D computer vision system observes the procedure and feeds the data to the computer, which then compares the observation with the mastery performance model and provides feedback.

medically intelligent/autonomous systems for the military. These systems will require libraries of performance models to begin to teach these future systems "how to perform" like expert clinicians. TATRC's labs are actively investigating these concepts and lines of research in current and future projects.

The AIM concept is a first step in providing comprehensive, real-time interactive expert instruction including active visual cues, and dynamic individualized feedback to users. The current version of the AIMS intubation model has successfully demonstrated effectiveness on a wide array of airway simulators from a variety of simulator manufacturers. Mr. Geoff Miller notes, "we are getting much closer to ensuring that every learner has equal access to expert teaching, assessment and feedback, no matter when or where they are training. The use of these technologies may provide an invaluable resource to health professions and instructors across the entire Military Health System, and to future military medical robotics and medically intelligent systems development."

For more information on the AIM concept, please contact Mr. Miller at geoffrey.t.miller4.civ@mail.mil

Mr. Geoff Miller addressed the IOM November 14.

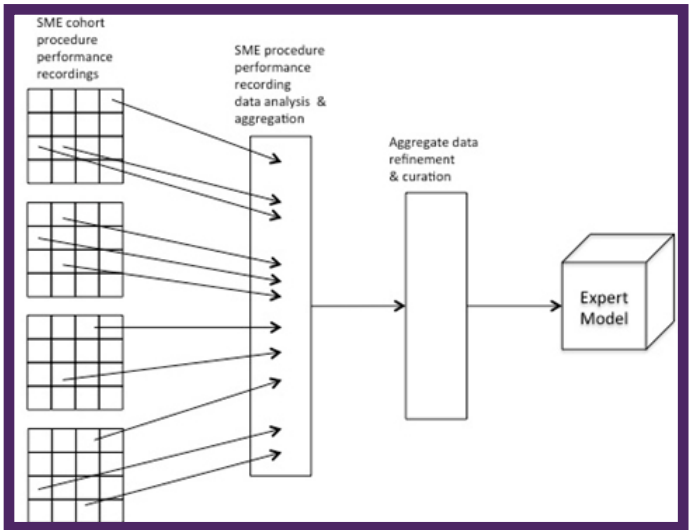


Figure 2. Mastery performance models are created by recording a minimum of 10 expert clinicians over the course of 10 or more concurrent procedural performances. These recordings focus on 3D tracking of human performance and instrument manipulation to ensure construct validity and variations of technique. Measurements are calibrated to fit a common scale, recordings are aggregated and refined to become the master model, accounting for technique variations which have no bearing on outcome.

References:

1. Issenberg SB, McGaghie WC, Petrusa ER, Gordon DL, Scalese RJ. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. Medical Teacher, Vol. 27, No. 1, 2005, pp. 10–28.

2. Ericsson KA. Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. Academic Medicine, 79 (10, Suppl), 2004, pp. S70–S81.

Upcoming Events:

13-17 January: IMSH Annual Conference; Los Angeles, CA

15 January: Martin Luther King Jr. Day (Federal Holiday)

6-8 February: AUVSI Unmanned Systems Defense Conference; National Harbor, MD

19 February: George Washington's Birthday (Observed)

5-9 March: HIMSS Annual Conference; Las Vegas, NV

11 March: Daylight Saving Time (Spring Forward)

26-28 March: AUSA Global Force Symposium & Expo; Huntsville, AL

50 Years After Vietnam, Hueys Fly by Themselves

Joined by a number of key stakeholders from all branches of service on 25 - 26 October at the "Flying Circus" in Bealeton, VA, members of TATRC's Operational Telemedicine Lab witnessed on the first day, what was likely the first public, totally autonomous flight of a Vietnam era UH-1 Huey aircraft equipped with the Office of Naval Research (ONR) Autonomous Aerial Cargo Utility System (AACUS) prototype. That Vertical Take-off and Lift (VTOL) Unmanned Aerial System (UAS) demonstration was followed the next day by TATRC's SBIR partner, Kutta Technologies, which leveraged the ONR AACUS system and same UH-1 aircraft to demonstrate the potential for combat medics on the ground to issue commands to an approaching or departing emergency medical resupply UAS, and then monitor patients onboard that same aircraft during a simulated UAS Casualty Evacuation (CASEVAC) mission.

Kutta Technologies demonstrated a fully autonomous Huey aircraft prototype.

Kutta Technologies successfully demonstrated their Phase II SBIR research in developing two novel methods of providing situational awareness, limited command & control, and telemedicine data exchange, allowing a medic in the field to effectively interact with an Autonomous UAS for medical missions (medical resupply and CASEVAC) for situations in which traditional MEDEVAC assets are unavailable or denied access. Kutta's technology was integrated with the ONR AACUS and Aurora's Autonomous AEH-1 Huey to demonstrate medical missions using a Nett Warrior handheld device and radio representative of fielded handheld tactical radios (PRC-152). By leveraging already fielded and familiar platforms, a combat medic, with little or no training in the operation of unmanned vehicles, is able to interact at a task or goal level with a UAS that has been assigned to a CASEVAC mission in a situation in which traditional manned medical evacuation assets are not available. In addition to integrating command and control capabilities, the demonstration also involved transmitting telemetry from the aircraft using the platform's native radios to an Android EUD on the ground to upload patient data and records to AHLTA-T. Altogether, the event simulated a realistic CASEVAC scenario where a medic could call, land, and wave off a UAS for a medical evacuation while maintaining situational awareness of the patient's condition while they're in transport.

For the 2-day event, the coordinators obtained a special FAA clearance to perform a non-line of sight UAS demonstration where the vehicle flew 2 mile trips between the airfield and a nearby civilian airport. The vehicle was able to fly autonomously using an onboard sensor suite that enabled it to detect and avoid obstacles and evaluate the landing zone and onboard mission, route, and path planning capabilities to execute missions. The sensor suite and autonomy capability, known as the Tactical Aerial Logistics System (TALOS), is a platform agnostic autonomy kit that has been demonstrated on other aircraft including the Boeing H-6U Unmanned Little Bird, and three different Bell 206 aircraft and is a successor of previous TATRC-funded research.

TATRC's Robotics Project Manager, Mr. Nathan Fisher commented that "AACUS offers next-generation vehicle autonomy for VTOL UAS, allowing UAS to bring multi-mission utility to the future battlespace. Today we have demonstrated that medics can effectively interact with these next-generation UAS during medical missions through an intuitive interface application. This provides an opportunity for future UAS to augment traditional medical assets in a time of need."

For more information, please contact: Mr. Nathan Fisher at nathan.t.fisher3.civ@mail.mil.

Attendees at the Phase II SBIR demonstration of Kutta Technologies in Bealeton, VA.