TATRC TIMES
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TATRC Expands its Role at DHITS 2017

The 2017 Defense Health IT Symposium (DHITS) conference took place in Orlando, FL from 25-27 July. VADM Raquel Bono, Director, Defense Health Agency, opened up this year's conference with a call to "use health IT to better serve patients." The 3-day annual conference pulled together over 2,000 military medicine providers and IT professionals under the unifying message of "One Team, One Mission - Creating Our Future Together."

VADM Bono conveyed that the time has come to start the next chapter of Military Health System (MHS). "Health IT is providing us with more real-time information to better manage patient care." With the mammoth deployment of the new DoD electronic health record system, MHS Genesis, finally underway, this year's conference reflected a mood of eager anticipation of moving forward into this new era of MHS. Per VADM Bono, "Health IT is one of the foundational enterprise support activities. There is not another support function that touches everything we do. Combined with an enterprise approach to cybersecurity, the MHS can be a national leader of more connected and interoperable health care."

TATRC's Director, COL Dan Kral, had identified DHITS as a target-rich opportunity to introduce MHS to TATRC's expanded portfolio of projects that have been aligned to meet future state Military Medicine needs. "DHITS provides us one of the better opportunities to share our ideas, form new collaborations, and

DHITS *Continued on page 2*

Team TATRC gathers together in our expanded section of the MHS booth at this year's DHITS Conference.

IN THIS ISSUE:

DHITS *Continued from page 1*

conduct the necessary azimuth checks critical to long-term research," said Kral.

This was reflected in TATRC's larger footprint in both the exhibit hall and on the program agenda. Team TATRC was prominently featured within the DHA Exhibit Booth and had 3 separate kiosks this year, covering Direct & Beneficiary Care Research Areas, TATRC's AMEDD Advanced Medical Technology Initiative (AAMTI) Program and our expanded Virtual Health Research work, covering initiatives in both the Mobile Health Innovation Center (mHIC) and the new Virtual Health Support Office.

TATRC's Deputy Director, Mr. Tim McCarthy, stated, "Conferences like the Defense Health IT Symposium are a unique opportunity. DHITS is an exciting time of year to meet with our partners throughout the MHS community to, proverbially, sync our watches. As a research lab, our inherent role is to anticipate military medicine's far-forward technical needs, and the best way to do that is with clear, unencumbered, communication. To look at the collective MHS landscape and to take measure of the directions that our partners, and MEDCOM customers, are heading."

HTIC Lab Manager, Ollie Gray, discusses the Linked Problem List & Team Fitness Tracker projects with DHA Director, VADM Bono at DHITS 2017.

TATRC's presence was not only reflected on the tradeshow floor. COL Kral, as well as members of mHIC and the Health Technology Innovation Center (HTIC), each made presentations during scheduled breakout sessions. Ms. Ollie Gray, HTIC's Lab Manager, joined TATRC partner, and Director for Informatics Policy, Office of the Assistant Secretary of Defense for Health Affairs, COL John Scott to provide an overview on the Team Fitness Tracker, Joint Legacy Viewer Linked Problem List, and the SBIR on Virtual Medical Concierge. mHIC's Deputy Lab Manager, Mr. Ron Yeaw, combined elements of both mHIC and Operational Telemedicine's portfolio to give an overview of current and future virtual health capabilities for the battlefield. In two separate, joint sessions COL Kral and mHIC Lab Manager, Ms. Jeanette Little, outlined a possible future state for military medicine with a specific focus on the 'Why' of military medicine. Per the Director, "so much of what you often see at conferences is focused on the 'what' and the 'how'. But what is critical, however, is the 'why' …and that is what we [got] after participating this year at DHITS."

For HTIC Engineer Mr. Bob Connors, the biggest take away this year was the breakthrough emergences of numerous key enabling technologies that TATRC had its eye on for several years. Specifically, "It was interesting to hear VADM Bono mention 'Blockchain' several times during her presentation. We had initiated research in this area, so it sort of validated that we were on the right track."

Lead mHIC Project Officer, Mr. Robert Chewning was most appreciative of the opportunity to reengage previous mHIC customers in person. "mHIC is always looking for proponents to push MHCE / mCare forward into Operational use and we had the opportunity to do just that with Mr. Michael Mobley, the CIO for the Army Warrior Care and Transition System (AWCTS). Mr. Mobley's team was aware of mCare, had it installed on his phone, but never actually used it. We discovered during his conversation with Ms. Little that he has a need to introduce a mobile component for AWCTS and we are actively working with him now to see how we can utilize mCare to bridge his gap."

TATRC Marketing Director, Ms. Lori DeBernardis tracked TATRC's presence at DHITS on social media across the conference, ensuring TATRC's colleagues, alumni and external partners a front row seat for MHS's largest, and most vibrant, conference of the year. "The opportunity to get everyone in the MHS IT community together in one space like this is rare, so our team worked hard to get out and capture as much as possible for our social media presence. Sometimes it's all about the *one* connection, and my guys work hard to maximize the opportunity of that moment for TATRC."

The 2018 DHITS conference will be back in Orlando, from 24 – 26 July and we hope to see you there!

HTIC Tech Watch: *"Blockchain: An Emerging Technology with Significant Promise for Improved Healthcare Delivery"*

by Mr. Robert E. Connors

At the recent Defense Health Information Technology (DHITS) Conference in Orlando, Florida, senior Military Health Service leaders mentioned Blockchain technology in several of their keynote speeches. "Blockchain" is a shared, immutable record of peer-to-peer transactions, on a global network, built from linked transaction blocks, and stored in a digital ledger. Blockchain relies on established cryptographic techniques to enable participants in a network to store, exchange, and view information, without preexisting trust between the parties. Blockchain creates a disintermediation of trust that does not require a central broker, as all participants have access to a transparent, distributed ledger providing a secure exchange with no need for a complex trusted broker. Transactions to the Blockchain are added based on smart contract automated rules. Changes cannot be made to the Blockchain data without the consensus of the parties who hold public and private keys to the ledger. The Telemedicine and Advanced Technology Research Center's (TATRC's) Health Information Technology Center (HTIC) has been examining the promise of Blockchain technology for the past year. The time is ripe for the Defense Health Agency (DHA), Defense Healthcare Management Systems (DHMS), Army Medicine, and others to consider funding Blockchain pilot studies.

Jerry Cuomo from IBM states, "Blockchain has the potential to become the technological foundation for all electronic transactions conducted over the Internet." Many others argue that the technology most likely to change the next decade of business is the Blockchain. Nitin Gaur, Director at IBM Blockchain Labs, states, "We are living in the Age of Disintermediation, as evidenced by Uber, Facebook, Amazon, or Airbnb, all of which connect consumers directly to products or services. Disintermediation is the investment magnet for Blockchain-related ideas, riding on the success of the business, and underpinned by peer-to-peer and crowdsourcing models. Blockchain has tremendous potential to improve existing business processes, as well as to improve efficiencies in existing transaction systems, leading to exponential cost savings for the enterprise and the end consumer." Disintermediation simply refers to the removal of middlemen, such as formal Health Information Exchange (HIE) organizations, or Health Fiscal Intermediaries.

Blockchain is the underlying technology securing Bitcoin, and new implementations in finance and other industries are becoming reality. About 20 companies have emerged to create various Blockchain foundational fabric and application development tools. Industry consortiums like R3 Corda have formed to help create standards. Open source Blockchain initiatives, such as Linux Foundation's HyperLedger Initiative on GitHub, are accelerating innovative Blockchain technologies.

By sharing the same gathered data without redundancy, has the potential to improve the speed, accuracy and delivery of healthcare.

With respect to healthcare utility, Blockchain holds the promise for disrupting transactions that typically require intermediaries, such as health information exchanges or fiscal intermediaries. Blockchain can create an extremely secure, fully transparent, decentralized, longitudinal, life-long, digital accounting ledger, which points to all of a patient's health and fitness transactions. It supports distributed integration of healthcare information across a number of stakeholders. Although 75% or more of U.S. Hospitals have implemented Electronic Health Records (EHRs) to collect health information, these commercial EHRs were never designed to collect a patient's longitudinal, life-time data, and may now contribute to a fragmented system of health data. With Blockchain, a patient or his/her designated authority can permit designated parties access to discrete information controlled by this ledger, for a designated amount of time (conditional privacy).

In addition to enabling secure, interoperable HIE, Blockchain can prevent health data breaches and being held hostage to Ransomware; enable claims fraud detection, im-

Blockchain *Continued on page 4*

Blockchain

Continued from page 3

prove quality assurance and patient safety, facilitate precision medicine, and enhance health research for population health, pharmacovigilance, and biosurveillance. Some believe that Blockchain is the crucial element that will power Health 2.0, which typically refers to "patients gaining greater control over their healthcare and privacy through advanced technologies and access to information, and diminishing medical paternalism." The Office of the National Coordinator for Health IT recently sponsored a contest and received over 70 ideas on Blockchain use in healthcare. Beth Israel Deaconess Medical Center, Boston, MA, in partnership with the MIT Media Lab and local VA Medical Center VA, has created a proof of concept Electronic Health Record (EHR), known as "MedRec," which demonstrates how principles of decentralized Blockchain architectures could contribute to secure, interoperable EHR systems. Their work will soon be released on GitHub.

With regards to the next steps and potential research transition points, Ms. Ollie Gray, TATRC's HTIC Lab Manager, stated, "TATRC is currently seeking DoD and other government stakeholders who would like to work with TATRC on developing Blockchain technology to support specific health use cases and conduct research pilots. At the end of a successful pilot, TATRC would work with appropriated government authorities to transition the prototype to a production system in support of the stakeholder. Upon identification of stakeholders who wish to work with TATRC, TATRC will apply for various sources of funding to carry out the pilot studies." For those interested in working with TATRC's HTIC Team, please contact Ms. Ollie Gray at ollie.b.gray.civ@mail.mil.

Select Health Use Cases:

- Highly-secure, interoperable HIE, controlled by the patient. Blockchain provides a unified IT backbone that integrates multiple EHR and other health data sources.
- Improved claims processing, with detection and prevention of fraud. Centers for Medicare and Medicaid Services (CMS) is already prototyping Blockchain claims fraud solutions, and DHA and TRICARE fiscal intermediaries may want to do the same.
- Application of Blockchain to support health research outcomes, population health, pharmacovigilance, and biosurveillance studies. Because Blockchain can provide very large longitudinal data sets from patient populations, and also provide end-to-end encryption and anonymous patient identities, these sorts of studies can deliver more valid, reliable results over what can currently be derived through present procedures to aggregate limited use patient data sets mandated by Health Insurance Portability and Accountability Act (HIPAA).
- Use of the Internet of Things in combination with Blockchain technology for Patient-Reported Outcome Measures (PROMs).
- Patient-centric, direct, personal recommendations based on unique conditions, as Blockchain can gather data from many sources while protecting the patient's ID (as part of precision medicine).
- Supply chain management: drug delivery or tracking of which patients received which services, made possible through Blockchain digital accounting ledger.

Blockchain Public Ledger Advantages Over Traditional Central Health Information Exchange (HIE):

- Blockchain creates a **disintermediation** of trust that does not require a central HIE, as all participants have access to a distributed ledger providing secure exchange with no need for a complex trusted broker, as would be found in an HIE.
- Blockchain has **lower transaction costs** due to disintermediation, and near real-time processing versus higher transaction costs in a central HIE with low transaction volumes.
- Blockchain provides **secure digital identities** using public and private identities through encryption, obviating problems associated with synchronizing Master Patient Indexes in HIE.
- Blockchain **uses real-time, updated shared data,** vice having to deal with HIE normalizing different data standards.
- Blockchain provides **vast longitudinal data** to **support large population health studies**, vice limited data available in HIE.
- Blockchain **smart contracts** and permissioned groups provide **consistent data rules** and high data validity, consistency, reliability, completeness, and timeliness, vice HIE's that typically have inconsistent rules and hinder getting right patient, right information, at the right time.

AAMTI RIF: In Search of Cutting Edge Innovation

The AMEDD Advanced Medical Technology Initiative (AAMTI) is continuously seeking innovation. What is the definition of innovation? According to the Merriam Webster, it is "a new idea, method, or device." The business dictionary states that "innovation involves deliberate application of information, imagination and initiative in deriving greater or different values from resources." As the availability of new and disruptive technologies flood the market at ever-increasing speed, a nimble and focused method of identifying and demonstrating technologies and their impact on cost, access, quality, and safety of care (and medical readiness) becomes imperative. Determining how to accumulate crucial information on the latest innovations, evaluate them in a meaningful way and in turn, provide actionable information on the latest medical technologies, is the constant quest of the AAMTI program.

The AAMTI program has under gone a reassessment in the last year and will undergo realignment in the next year. The program was developed in 2000 and managed by TATRC, to support entrepreneurship and innovation within the AMEDD, by providing a funding path for small scale evaluations of great ideas, processes and products that come directly from military and civilian personnel in our medical treatment facilities. Supported by the Defense Health Program Operation and Maintenance funding the AAMTI program is not for research evaluations, but for the piloting of existing, commercial off-the-shelf technologies and government off-the-shelf products in AMEDD facilities. The AAMTI program fills the void between large scale acquisition efforts and traditional small scale research in that it allows for products that have been previously proven valuable in the civilian sector to be piloted within a unique military environment. Traditionally, the AAMTI program funded 20-25 projects per year that were around $250,000 or less, with each project having an 18-month evaluation cycle. Transitioning those great ideas into wide-spread adoption of products or processes has been the greater challenge.

In 2017, the AAMTI program, introduced the Rapid Innovation Fund (RIF) program as an optional program to the traditional AAMTI-funded projects. Unlike the traditional AAMTI projects, the AAMTI RIFs support projects that are under $35,000 and must be completed in 6 months or less. Because the traditional AAMTI projects allowed for an 18-month window of execution, traditional AAMTI projects did not provide information quickly enough on the technology forefront. The compressed assessment and reporting schedule that the RIF-funded projects provide, allow for distributable and actionable information in a much more opportune timetable.

Last year, the AAMTI program funded 15 Rapid Innovation Fund projects worth over $400,000, with each of the funded projects all under $35,000. Each funded project is required to provide a one page final report within 6 months of award, providing the uniqueness of the technology, methods of evaluation and recommendations for wider adoption or further evaluation in the AMEDD. Unlike the traditional AAMTI program, the RIF model gives a stronger chance of getting cutting-edge, innovative ideas expeditiously into the hands of leadership with its 6-month evaluation component. A great example of an AAMTI-funded project is the Moulage Tattoo project featured on page 8 of TATRC Times. This was the very first AAMTI funded RIF project, and is a shining example of what can be accomplished at the $35K price point by enthusiastic and creative innovators.

In the upcoming year, the AAMTI program has set an ambitious goal, which is to fund 80 RIF projects. One page summaries of the findings of each of the funded AAMTI RIF projects will be available for leadership in an e-book format. These summaries will also be available to AAMTI submitters to prevent duplication of future efforts.

As a reminder, AAMTI RIF projects must support the overall original intent of the AAMTI program by demonstrating advanced medical technologies and their impact on cost, access, quality, and safety of care and / or medical readiness. These AAMTI RIF projects provide senior AMEDD leadership with medical tech-watch capabilities on the newest products that are commercially available on the market today and continue to encourage medical technology entrepreneurship by our leading innovators at our military medical treatment facilities. Shifting the AAMTI program to a rapid innovation model provides improved reporting on cutting edge technologies, fills the void between acquisition and research and promotes products that should be recommended for further evaluation or adoption at a larger scale.

If you have a great idea and want to apply for AAMTI RIF support, more information can be found at www.tatrc.org under the AAMTI Program. The AAMTI Program POC is Ms. Holly Pavliscsak who can be reached at holly.h.pavliscsak.ctr@mail.mil or 240-566-2378.

AAMTI Featured Project: Effectiveness of Lifesaving Resuscitative Interventions and Damage Control Surgery in Blackout Conditions using Night Vision Technology

Point of injury care remains a focal point in military medicine. During special operations and conventional conflicts, military medical providers are frequently required to perform life-saving interventions under hostile conditions in low-light environments. Definitive surgical care and invasive resuscitative procedures are often delayed until a white light environment is permissible, potentially postponing lifesaving care. A team of researchers at Madigan Army Medical Center (MAMC) sought to determine if night optical device (NOD) technology could enable surgical capabilities in blackout conditions.

Using a cross-over design, six general surgeons performed 11 procedures on 3 swine, each in normal light operating conditions and on 3 swine, each in dark operating conditions using two-chamber NODs; half in light conditions first, and half in dark conditions first. Ambient light was measured using a light meter to control blackout conditions. The Operators, consisting of both residents and staff, had various levels of surgical experience and prior familiarity with NODs (novice and trained). Before live animal experiments, all surgeons had device and procedure familiarization and training on manikin models. A variety of procedures were performed during this study, from basic, resuscitative measures such as tourniquet application, placing peripheral and central venous access catheters and intra-osseous devices, to advanced maneuvers such as exploratory laparotomy, splenectomy and placement of a resuscitative endovascular balloon occlusion of the aorta (REBOA) device.

The research team from MAMC, consisted of LTC Matthew Eckert, Principal Investigator (PI), LTC Daniel Cuadrado (Co-PI), COL Matthew Martin, CPT Morgan Barron, CPT Michael Derickson, CPT John Kuckleman, CPT Cody Phillips and MAJ Shannon Marco. This project was funded by the AMEDD Advanced Medical Technology Initiative (AAMTI) program for $75,000 and the two-month study timeline occurred from April to May 2017.

Blackout conditions were confirmed with ambient light measurement. There were no significant differences in success rates for any procedure. There were no significant differences in operative times between dark versus light conditions for extremity tourniquet placement, femoral artery cut-down and clamping, resuscitative thoracotomy, and percutaneous REBOA placement. The following procedures took significantly longer in dark versus light: Focused Abdominal Sonography for Trauma (FAST) exam (98s vs 62s) p=0.046, peripheral intravenous line placement (140s vs 35s) p=0.043, intraosseous access (51s vs 26s) p=0.027, jugular vein cut-down and access (237s vs 104s) p=0.003, laparotomy and packing (71s vs 51s) p=0.049, stapled splenectomy (137s vs 74s) p=0.038, REBOA via cutdown (1,008s vs 338s) p=0.020, and cricothyroidotomy (177s vs 109s) p=0.010.

The results of the study suggest life-saving interventions can be safely and effectively performed in blackout conditions using NODs. Thus, this technology has the potential to push surgical capabilities closer to the point of injury, possibly saving Soldiers' lives. Surgeons attached to special operations units may be able to have more robust surgical capabilities in blackout conditions with the use of NODs. Based on a post-study survey of the surgeons involved, 100% concur that this technology can be pushed to medics, corpsmen and mid-level providers with appropriate training for point of injury care.

The lead PI for this project, LTC

Surgeon performing emergent exploratory laparotomy under blackout conditions using Night Optical Device (NODs) technology.

Night Vision

Continued on page 7

Night Vision *Continued from page 6*

Matthew Eckert stated, "This study demonstrates the successful ability to perform advanced resuscitative and damage control surgical procedures in forward tactical settings, under dark conditions with night vision technology. The ability to safely and effectively perform these procedures in potentially hostile forward locations may be a game changer for preventing potentially avoidable deaths on the battlefield."

To further support the AMEDD in the operational environment, the MAMC research team plans to study the use of NODs for training of surgeons in a currently validated American College of Surgeons Advanced Trauma Operative Management course (ATOM) and Advanced Surgical Skills for Exposure in Trauma (ASSET), using human cadavers. If proven feasible and comparable, MAMC would propose training military surgeons attached to special operations units with these courses using NODs prior to deployment.

This research will be submitted to the 2018 Western Trauma Association for presentation. Kudos to the MAMC Team for such an expeditious turn around on this AAMTI-funded project!

Additional surgical procedures are being tested during simulated field blackout conditions.

Extra, Extra, Read All About It … TATRC Mobile Health Usability Analysis Hits the Press

In an upcoming edition of the Journal of Mobile Technology in Medicine (JMTM), TATRC's Mobile Health Innovation Center (mHIC) will be featured with an original article entitled "Usability of a Mobile Application for Patients Rehabilitating in their Community." This article examines the usability of the mobile application ("mCare") and assesses how usability ratings related to the users' background characteristics and usage of mCare. The mCare app was originally developed in a partnership with five of the Army's Community Care Units (CCUs) to support injured Service Members rehabilitating in their communities. The article describes the high usability scoring of the mCare mobile application, and variations in scoring based on the users personal mobile device, living arrangements and other specific factors that influence perceptions of usability. Previous magazines have also reported on mCare's capabilities in this regard. Per the publication Telemedicine and e-Health, "Patient self-reports of usage also indicated that over 70% of Soldiers used mCare multiple times per week, and 78% believed that using mCare improved their overall [CCU] experience." Additionally, "Over 70% of users demonstrated routine use up to 6 months after initial download, surpassing industry reports for apps in the general marketplace."

The new article will be featured in Volume 6, Issue 3 and detailed information about the exact publication date can be found at http://www.journalmtm.com.

Congratulations, Team mHIC on this noteworthy publication!

AAMTI Project Spotlight: Temporary Tattoo Rapid Application Moulage Kits Now Available

Many medical combat training scenarios incorporate theatrical makeup, known as moulage, to simulate real life wounds. The Val G. Hemming Simulation Center (VGHSC) of the Uniformed Services University of the Health Sciences (USUHS) has developed a variety of temporary wound tattoos specifically for medical combat simulations. Thanks to the AMEDD Advanced Medical Technology Initiative (AAMTI) Rapid Innovation Funding (RIF), a library of customized medical illustrations were created from real-world injury references. Two specific temporary tattoo kits were designed to decrease the time and overall cost of moulage for the Advanced Trauma Life Support and Tactical Combat Casualty Care training courses.

Although temporary tattoos are not a new technology, they can provide several advantages when planning training events where moulage is required. Little to no prior moulage training for staff is required. Even novice personnel are able to apply a variety of wounds to a large number of patients in a short amount of time. Due to the rapid application process, less staff members are required for moulage application, allowing for more efficient use of personnel resources. The use of the moulage tattoos can further decrease the training costs of moulage by reducing the number of supplies needed to create realistic looking wounds. Also, if standardized wounds are needed, the tattoos provide a uniform set of wounds. The tattoos designed for this project were made available for distribution to both military and civilian medical simulation training sites.

Our training site partners provided feedback on the efficacy of the moulage tattoos. Over the course of the project, we received approximately 150 feedback forms from 14 military training sites and 13 civilian training sites. We solicited feedback from three main groups involved in medical simulation events: moulage artists, learners, and patients. Some of the learner feedback from US Army Special Operations Command (USASOC) at Ft. Bragg stated, "Great product! The tattoos worked really well without additional moulage but the additional simulated blood products really brought the realism." The patient feedback from the 15th MP Brigade at Ft. Bragg said, "Great training! Tattoos went on very smoothly and look realistic. Great job!" Finally, a moulage artist at the US Air Force School of Aerospace Medicine located at Wright Patterson Air Force Base claimed, "The tattoos work and look great. Makes moulage application quick and easy."

Some examples of temporary moulage tattoos.

There were however, three main criticisms of the tattoos that were received regardless of the training sites. The first dealt with the physical 2D quality of the paper. These tattoos are flat with no tactile, 3D qualities. As a learner from CSTARS, St. Louis stated, "When looking for a wound, I feel for entry and exit wounds. There was no way of feeling that type of injury." The second criticism was the quality of the tattoo paper itself. The comments on this included that the paper was "too shiny, wrinkled when dried, difficult to apply, and edges are visible." For this project, 3 brands of tattoo paper were evaluated. Internally, each brand was tested during a training event to mitigate and resolve the problem. After the event, a moulage artist stated, "I found the quality of tattoos varied widely with the type of paper that was used. One type of paper would need additional moulage to make it realistic, while another type of paper didn't." The third criticism revealed most users were unaware of how to apply the tattoos. This issue was mostly resolved after directions and a tattoo application video were created and sent to each end user. Such feedback was critical and has already led to the improvements of current moulage tattoos and will likely impact future tattoo designs.

There are several aspects of the moulage tattoos that will be explored further. One would address a concern listed above, by creating the ability to add physical 3D qualities to the printed tattoos that would not impact the speed, price, or visual quality of the tattoos. The improvement in quality and filament variety offered by 3D printers could offer the solution. The VGHSC team would also like to investigate the adoption of technology, such as augmented reality (AR), to extend the use of the tattoos. This could help learners understand underlying anatomy and associated clinical pathologies before treatment (e.g. see the airway under the skin before inserting a tube, or how a growing hematoma can cause compartment syndrome). Additionally, the team at VGHSC are actively investigating how to make this a commercially available product.

Ms. Betsy Weissbrod, Co-Principal Investigator for this AAMTI-funded Project said, "By conserving resources for training (money, time, and personnel), many areas of medical readiness training can benefit. The goal for creating new training tools, such as the temporary tattoo rapid application moulage kits, is to increase the proficiency for all medical personnel that can save the lives of those in harms way."

Moulage *Continued on page 9*

Moulage *Continued from page 8*

Overall, this RIF evaluation found that the use of moulage tattoos can significantly enhance the appearance of moulage wounds for medical training exercises. These benefits extend well beyond aesthetics.

"Moulage tattoos are a great addition to our simulation toolkit. We can now create combat wounds quickly and easily without the use of expensive theatrical make-up and reduce the need for trained moulage artists in our scenarios," stated Dr. Joseph Lopreiato, Associate Dean for Simulation Education and the Director of the VGHSC.

HTIC Prepares to Launch New & Improved Team Fitness Tracker

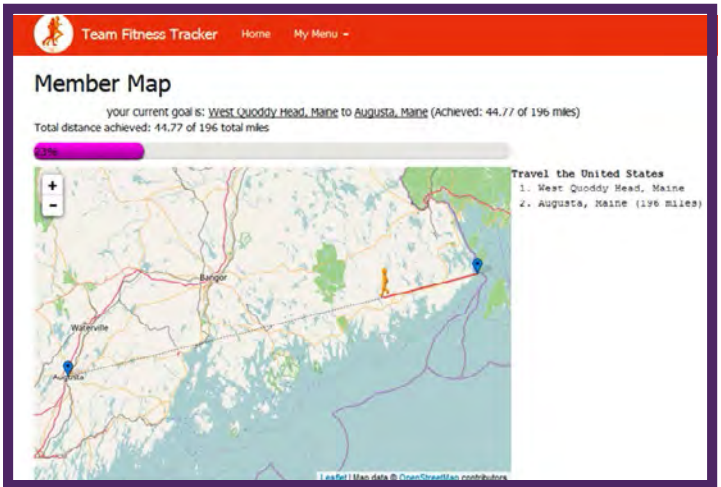
TATRC's Health Technology Innovation Center (HTIC), in partnership with the Consortium for Health and Military Performance (CHAMP), from the Uniformed Services University of the Health Sciences (USUHS), is prepared to launch a pilot project featuring a Team Fitness Tracker developed by TATRC's HTIC. The units that have been selected to participate in this exciting initiative are the US Army Florida National Guard, US Army Maryland National Guard, and the US Army 410th Hospital Center. Pending final Institutional Review Board (IRB) approval, the project will begin in October 2017.

The HTIC and CHAMP teams will visit each of the units to recruit study members, and if necessary, issue each member a new fitness tracker device for use during the project. The project is designed to examine whether activity tracking software, that is not device specific, can promote friendly competition among members by using personal and team dashboards, virtual awards, and progress maps. Master Fitness Trainers will be providing educational materials to assist with exercise routines, as well as contributing to unit blogs, in order to encourage active participation. While unit commanders will not have access to individual member's data, the software will provide the capability to produce reports that analyze overall team fitness and thus, readiness. TATRC's HTIC Lab Manager, Ms. Ollie Gray stated, "The hope is that this study will motivate team members to increase their physical activity on a daily basis to ultimately help improve or maintain readiness status, while at the same time promoting healthy competition among teams without concern for the fitness tracker manufacture.

Unit commanders are eager to pilot the Team Fitness Tracker which will provide a valuable tool to their Service Members. More information will be shared and available once the actual research is in progress. Please stay tuned as we facilitate this health and fitness journey.

Individuals Dashboard for Daily and Weekly Steps, as well as Weekly Sleep Record.

Team Dashboard for Daily and Weekly Steps.



Graphical representation of progress via walking thru the US.

Employee Spotlight

Congratulations to TATRC's Q4 Employee of the Quarter Ms. Dawn Petruzzello!

Ms. Dawn Petruzzello, Service Contracts Manager / Team LeadContractor

Ms. Dawn Petruzzello is a key member of the TATRC Resource Management staff, who provides critical contracting management support to all of TATRC. During this period, Dawn has been instrumental in liaisoning with the US Army Medical Research Acquisition Activity (USAMRAA), and specifically, Service Team 6, familiarizing with their submission and award requirements and working hard with TATRC personnel to translate and meet those requirements. She established a positive and constructive rapport with Service Team 6 members and provided significant feedback on their proposed processes and procedures. She was a strong advocate and organizational POC for TATRC CORs and Project Officers.

Additionally, Dawn worked diligently and tirelessly to identify all of TATRC's contracting requirements ahead of scheduled deadlines. She worked with the proponents to ensure their requirements were well defined and met their needs. She then worked with them to prepare the necessary supporting documents to ensure the proper awards were made. She constantly monitored the list of requirements that she established and confirmed that those milestones were met. She would contact the team chief to identify who was assigned the action and then relay this info to the TATRC proponent. Dawn created detailed spreadsheets to track the status of actions and their supporting documents. The volume of year end actions has been significant and Dawn has been at the helm to ensure all of them made it to USAMRAA in a timely fashion.

Of particular note during this quarter, was the work Dawn did supporting Cheryl Merritt, Director of Business Operations, who was working closely with USAMRAA to establish an overarching support ID/IQ contract for TATRC. Dawn provided critical admin support, formatting, quality control and helped with version management. This was a time consuming task, but Dawn worked hard to assure USAMRAA received the documentation they required.

Dawn does an outstanding job providing contract management support to TATRC. She is extremely diligent, conscientious and professional. She epitomizes exceptional customer support and is a worthy recipient of TATRC's Employee of the Quarter.

Congratulations, Dawn on this well-deserved award!

This Quarter's TATRC TRIVIA...

Question: 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")

(Answer in Next Issue!)

Answer to Last Issue's TATRC TRIVIA...

Q: TATRC's new Innovation Campus (TIC) is up and running! What was the name of the outdoor field environment <u>prior</u> to the new campus being built?

A: PITLab – Prototype, Integration and Testing Lab!

Op-T-med and BHSAI Collaborate to Implement Life-Saving APPRAISE on Mobile Devices for Warfighters

This year, two of TATRC Labs joined forces and teamed together. TATRC's Operational Telemedicine (Op-T-med) Lab and the Biotechnology High Performance Computing Software Applications Institute (BHSAI), began a collaborative effort to implement BHSAI's Automated Processing of the Physiologic Registry for Assessment of Injury Severity (APPRAISE) system on a mobile device. APPRAISE, is an artificial intelligence-based system that can alert medics when trauma patients are in need of massive blood transfusions without any human intervention. It collects and analyzes, in real time, vital sign information from the patient during pre-hospital transport. It then uses the results of that analysis to determine if the patient will need a blood transfusion before the patient arrives at the hospital with 78 percent sensitivity and 90 percent specificity, within 10 minutes of the start of monitoring.

BHSAI's award-winning, artificial intelligence based system, "APPRAISE".

Previously, APPRAISE had been tested in civilian markets on ruggedized PCs on board medical evacuation helicopters operated by Boston MedFlight, which services Harvard University Trauma Centers. By implementing APPRAISE onto a NETT Warrior type Android phone, the capability to detect early life threatening hemorrhage, became portable and integrated with the MC4 electronic DD1380 application so that users could document time-stamped APPRAISE scores on a patient's record. In addition to having the APPRAISE score displayed on the electronic DD1380 card application, TATRC's Op-T-med Lab also enabled a Visi Mobile patient monitor to wirelessly transmit the vitals data to the phone via Ultra Wide Band (UWB) secure wireless protocol to eliminate wires while reducing interference and detectability. Future efforts will include integrating data input to the APPRAISE algorithm running on NETT Warrior type Android End User Devices (EUDs) from additional monitoring systems such as the Propaq and Tempus Pro via the UWB protocol, as well as expanding the capability to display multiple patients and their APPRAISE scores on the same screen and post to multiple electronic DD1380 cards, thereby enabling medics to triage multiple patients more effectively in mass casualty scenarios.

TATRC's Operational Telemedicine Lab Manager, Dr. Gary Gilbert stated, "The Army NETT Warrior and SOCOM Advanced Tactical Android Kit EUDs and supporting equipment are already being fielded to designated Role 1 medics as standard combat gear. If the Boston MedFlight tested APPRAISE algorithm receives FDA clearance and is integrated on to those EUDs along with appropriate patient monitoring sensors, the Battlefield Airmen Trauma Distributed Observation Kit (BATDOK) application with a transmittable DD1380, and the PM JOMIS MCC (Mobile Computing Capability), our battlefield capability for triage, monitoring, and treatment of combat casualties prior to reaching Role 1 clinics and aid stations could be significantly upgraded without adding additional weight to combat loads."

Dr. Jaques Reifman, Director of TATRC's BHSAI added, "The APPRAISE has numerous advantageous features that will facilitate dissemination of the technology. For example, it uses standard vital signs as inputs (heart rate and blood pressures) that are readily available and familiar to medics. Also, the system assesses the reliability of the vital signs in real time, making sure that only those deemed to be reliable are used. Essentially, what APPRAISE does is to automate what experienced clinicians do: look at vital-sign patterns and identify those associated with life-threatening hemorrhage versus those associated with normal fluctuations."

AAMTI Project Spotlight: Virtually Connecting Deployed Soldiers to their Health Care Professional of Choice

Regionally Aligned Forces (RAF) stationed in Eastern Europe in support of Atlantic Resolve, have virtual access to health care from their Garrison provider or specialists at Landstuhl Regional Medical Center (LRMC), thanks to the Regional Health Command Europe (RHCE) "TeleHealth In A Bag" (THIAB) platform.

"THIAB is a telemedicine concept that enhances Soldier health care through an ability to rapidly extend the reach of the medical team," according to Sgt. 1st Class Todd Hall, RHCE's Virtual Health noncommissioned officer in charge. "This tool allows the health care team in the operational setting to seamlessly connect with specialists and other resources in Garrison."

In order to connect patients to specialists and providers from their home station, RAF providers are given a standardized telehealth equipment kit and issued a virtual exam conferencing space which represents a secure, HIPAA-compliant private video chat room.

THAIB leverages a secure web-based platform, which enables deployed units to connect to providers anywhere, and to share live diagnostic images with various peripheral device functions, including an otoscope, high definition examination camera, and heart and lung sounds using a stethoscope device.

"These peripheral devices can connect to any computer," said Steven Cain, RHCE's Virtual Health Deputy and Surgical Physician Assistant. "The best part is there is no extra software needed. The camera uses drivers already installed on the computer."

There are different ways units can use the THIAB system. For example, healthcare providers, including medics, can connect to other medical units in their area or back to a fixed, Garrison medical element such as Vilseck Army Health Clinic in Vilseck, Germany. Second, they can connect with their unit's organic provider or any one of 28 specialties at LRMC, Cain said.

One of the main uses of the THIAB to date, is to connect Soldiers with their embedded Behavioral Health (BH) providers and Unit Behavioral Health Officers.

"Think about the Soldier who has been seeing the BH provider in Garrison, but is now going to this stressful deployment," Cain said. "Who better to connect with the Soldier regularly than the person who has been seeing him for two years – we think that is a very powerful connection."

This virtual health capability isn't a new concept; Cain said that as early as 1992, providers at LRMC were trying to connect to Soldiers in remote locations with a satellite, computer and a printer for the photos. However, it took 23 minutes for the pictures to download and print.

"The need to reach back to organic unit medical resources in Garrison or back to the medical center has not changed, just the technology" Cain said. "Provided that an internet connection exists, we can leverage that connection to care for Soldiers. It's a readiness tool – to keep the group together, to keep them operational."

Sgt. 1st Class Todd Hall, RHCE's Virtual Health noncommissioned officer in charge, explains the components of the "Telehealth In a Bag" kit to medics and providers during a recent training event. THIAB connects Soldiers in deployed environments with Garrison health care providers and specialists at Landstuhl Regional Medical Center.

Maj. Daniel Weinstein, Regimental Surgeon for the 2nd Calvary Regiment in Vilseck, agrees that THIAB is a force multiplier.

"Integrating telehealth capabilities into our [aid stations], specifically for NATO's enhanced forward presence mission, has allowed us to sustain the fighter far forward from the [military treatment facilities] and typical Garrison level care," Weinstein said. "It also brings specialized care typically only seen at [hospitals] far forward allowing 2CR to reduce the number of [medical evacuations]. It has definitely expanded our ability to maintain readiness. It is the force multiplier that we need to revitalize our [aid stations and MTFs] moving forward."

U.S. Army Europe and NATO aim to expand their capability with THIABs to reduce unnecessary evacuations and improve readiness.

"Operational telehealth is the right thing to do. We believe we are helping to fill an unmet need," Cain said. "Bringing specialist care to the forward deployed or rotational Soldier, can help keep them operational, keep the unit together to help complete the mission."

AAMTI Spotlight *Continued on page 13*

AAMTI Spotlight Continued from page 12

Currently, there are eight kits deployed to units across Eastern Europe, Turkey and Africa, as well as a number of sites for just face to face communications.

"U.S. Army Europe bought eight THIAB kits," according to Cain. "The RHCE virtual health team lends the units the virtual exam room space and provides the training, support and mentoring to help them use the equipment."

Virtual health in Europe is growing rapidly. This growth is evident in the Garrison environment and is being accelerated in the operational medicine setting to support requirements in Theater, Hall said.

He went on to say that operational medical forces demanded a dynamic virtual health system that supports teams in austere locations.

"In late 2015, the United States Army Europe (USAREUR) Surgeon's Office requested assistance providing forward-deployed medics and providers with Virtual Health equipment to connect with other organic providers in support of Regionally Allocated Forces involved in 'Operation Atlantic Resolve,'" Hall said.

Originally, the medical devices to support operational forces and tele-mentorship were part of an AMEDD Advanced Medical Technology Initiative grant awarded by the Telemedicine and Advanced Technology Research Center.

"In the past, anyone on the medical team could only connect via data, voice and video, and not through the advent of peripheral medical devices capable of transmitting biometric data that supports an enhanced picture of the patient," Hall said.

At present, there are no other Army-wide enterprise solutions to provide this type of care to deployed forces in these locations outside of the THIAB.

"While we are trying to provide a capability to the Soldiers in the East, we are also trying to contribute to the body of knowledge in the Army and create an enterprise solution," Cain said.

For more information on the RHCE Virtual Health Program, visit https://rhce.amedd.army.mil/landstuhl/.

Medics and doctors familiarize themselves with the "Telehealth In a Bag" kit during a recent training event. THIAB connects Soldiers in deployed environments with Garrison health care providers and specialists at Landstuhl Regional Medical Center.

Upcoming Events:

3-5 October: Defense Innovation Challenges Conference; Tampa, FL

9 - 11 October: AUSA National Conference; Washington, DC

25 - 27 October: PCHA Connected Health Conference; Boston, MA

11 November: Veteran's Day

27 November - 1 December: I/ITSEC Annual Conference; Orlando, FL

28 November - 1 December: AMSUS Annual Conference; National Harbor, MD

TATRC HTIC Conducts Health IT Interoperability Tech Watch

As one part of its mission, TATRC serves as Army Medicine's scout for emerging technologies that have the potential to improve health access, availability, acceptability, continuity, cost-effectiveness, quality, and patient safety, in both theater and garrison-based environments. To that end, Mr. Robert Connors, Health IT Research Administrator, with TATRC's Health Technology Innovation Center Lab (HTIC), attended the Health and Human Services (HHS), Office of the National Coordinator for Health Information Technology's (ONC) 2017 Technical Interoperability Forum on 15 - 16 August.

The Forum reviewed the provisions of the 21st Century Cures Act, which charges ONC with improving interoperability among health IT systems, including reducing information blocking and enhancing the usability, accessibility, privacy, and security of health IT. Likewise, the law encourages continued engagement with industry stakeholders to inform them of both challenges and successes in achieving interoperability. The two-day conference focused on how ONC, federal partners, the healthcare industry, and the technology sector can come together to shape the technical aspects of interoperability to achieve these important goals. Over 200 healthcare clinicians, nurses, administrators, and technical personnel from government, academia, and industry attended the workshop to learn about new scientific and technical developments in advancing health information technology interoperability. The workshop provided panel discussions by domain experts, and ample time for comments, questions and answers. Audience participation was active. At one of the breaks, Mr. Connors chatted with Dr. John Fleming, MD, a former Navy physician, former Louisiana member of Congress, and current Deputy Assistant Secretary of Health Technology Reform for ONC, who stated, "Patients should manage and have access to their own medical record, although physicians should also have a version…three challenges to address before instituting this type of unified system are IT usability, security, and interoperability."

So what is interoperability? ONC is responsible for advancing connectivity and interoperability of health IT and follows the Institute of Electrical and Electronics Engineers (IEEE) definition of interoperability as "the ability of systems to exchange and use electronic health information from other systems without special effort on the part of the user." In 2013, the Healthcare Information Management and Systems Society (HIMSS) Board of Directors defined interoperability as "the ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged…Data exchange schema and standards should permit data to be shared across clinician, lab, hospital, pharmacy, and patient regardless of the application or application vendor." HIMSS also states that interoperability is "the ability of health information systems to work together within and across organizational boundaries in order to advance the effective delivery of healthcare for individuals and communities."

HIMSS further suggests foundational, structural and semantic definitions of interoperability. Foundational interoperability enables data exchange between computer systems and does not require data interpretation by the receiving information technology system. Structural interoperability is viewed as an intermediate form of interoperability, and refers to messaging formats that define the syntax of the data exchange. Structural interoperability ensures that data exchanges between information technology systems can be interpreted at the data field level. Semantic interoperability is the highest level of interoperability, and requires that the structuring of the data exchange and the vocabulary of the data are such that the receiving information technology systems can interpret the data to preserve the clinical or operational purpose and the meaning of the data across disparate electronic health record systems.

Why is interoperability important to the Military Health System (MHS) and Army Medicine? Interoperability is important to the MHS and Army Medicine because about two thirds of military beneficiaries actually receive their care in the civilian sector through TRICARE Network providers. Coordinating high-quality, cost-effective, continuous health care between the MHS Direct care system of Military Treatment Facilities (MTFs) and TRICARE civilian provider networks demands effective exchange of interoperable health information between both systems. MHS also shares considerable health information with the VA system as active duty separate and use VA facilities, or dual-eligible retirees seek care in both the VA and DoD systems. Besides being a provider of health services, MHS is also a payer of health services, and is interested in combining claims data and clinical observational data to conduct economic studies where data must be synthesized, analyzed,

and exchanged between various systems. Data interoperability is also of likely interest to MHS, Army, and other government research activities who are conducting clinical trial, vaccine, or pharmacovigilance studies, as these studies may involve the need to aggregate data from disparate sources.

What progress has been made over the past ten years in achieving interoperability, and where do we stand today? Federal interoperability progress dates from 2004 when President George W. Bush declared that every American should have an interoperable electronic health record by 2010. As such, the ONC for Health IT was formed via an Executive Order and began to set the strategic framework for delivering consumer-centric and information rich health delivery, promoting the adoption of Electronic Health Records (EHRs), between 2005 and 2008. Some notable achievements during that time included revisions to the Stark Act exceptions and anti-kickback laws to provide a safe harbor for donations of health IT products and services. The American Health Information Community formed and was instrumental in working with ONC to create a Health Information Technology Standards Panel (HITSP). ONC also began to develop the Nationwide Health Information Network (NHIN) to connect all health delivery providers through a series of state and regionally connected health information exchanges. TATRC was instrumental in designing and developing the adapter layer for the NHIN, which provided information discovery and orchestration services using services oriented architecture principles. TATRC also developed prototypes on behalf of the MHS Chief Information Officer for exchanging interoperable data between the Naval Medical Center in San Diego, VA San Diego, and Kaiser Permanente, San Diego. ONC also created the Certification Commission for Health Information Technology, which provided a formal process for certifying EHRs to qualify for meaningful use. ONC also coordinated a Federal Health IT Strategic Plan for 2008 to 2012. The Health Information Security and Privacy Collaboration formed across 42 states and territories during this time.

On 17 February 2009, The Health Information Technology for Economic and Clinical Health (HITECH) Act, enacted as part of the American Recovery and Reinvestment Act of 2009, was signed into law to promote

the adoption and meaningful use of health information technology. Since the passage of the HITECH Act, most individuals in the United States now have an electronic record of their health and care experience on file at their federal or civilian hospital or provider. In 2008, only 17 percent of physicians and nine percent of hospitals had at least a basic EHR. In 2015, 96 percent of hospitals and 78 percent of physician offices used certified EHR technology. Data Use and Reciprocal Support Agreements were established to onboard entities onto the NHIN, which was eventually privatized through the Healtheway, eHealth Initiative, and The Sequoia Project. Progress is also noted through a number of "Blue Button" initiatives established to enable consumers to easily access and download data from their providers' EHRs, including from TRICARE Online for military beneficiaries. Lastly, the Direct Project was launched to enable a secure, standards-based way to electronically send health information to known, trusted recipients over the Internet.

Despite great progress, the nation has not yet achieved full interoperability. Without a national patient ID, it is difficult for systems to exactly match patients, and they must use probabilistic matching algorithms, increasing the risk for exchanging misidentified medical information and potentially violating privacy. Systems continue to use proprietary medical languages, resulting in technically difficult mappings across vocabularies to achieve some level of semantic interoperability. Lastly, patients who typically use, on average, 7 providers / clinicians are forced to access individual, non-integrated health portals to view their data, which is typically in non-consumer friendly health language.

What challenges and opportunities remain in achieving full semantic interoperability for health information exchange? At the conference, Dr. Don Rucker, a former Siemens executive, and the new Director of ONC, emphasized that ONC is currently focusing on the following three objectives to achieve full interoperability:

1. Promoting common standards to facilitate the seamless and secure exchange of data. This includes the use of standardized, open application programming interfaces (APIs), and promotion of the HL-7 Fast Health Interoperability Resources (FHIR) standard. ONC is also working to coordinate related industry/vendor efforts such as the Health Services Platform Consortium, SOLOR (SNOWMED, LOINC, and RxNorm) for terminology standardization. Lastly, ONC is also working with a number of entities to promote national trust frameworks among parties, including the National Association of Trusted

Interoperability

Continued on page 16

Interoperability Continued from page 15

Exchange, CareQuality, Commonwell, Direct Trust, eHealthExchange, and others.

2. Building the business case for interoperability, particularly through delivery system reform efforts that change the way the Centers for Medicare & Medicare Services pay for care to reward quality over quantity of services; and

3. Changing the culture around access to information through: combating information blocking by vendors and delivery organizations; ensuring that individuals know they have a right to access and transmit their health information and that providers know they must provide access to the individuals; and reminding health care providers that they are legally allowed to exchange information in the course of treatment or coordinating care.

TATRC continues to promote interoperability in the prototypes it develops. For example, TATRC's HTIC Lab is currently building a Team Fitness Tracker (See Article on page 9) and Corporate Wellness Portal, to enable the collection and aggregation of disparate activity data from three different manufacturers' devices: Fitbit, Garmin, and Jawbone. Data is integrated and imported into the Team Fitness Tracker site using a third party service from Validic, Inc. In addition, TATRC developers recently built a HL-7 FHIR server in the TATRC Early Stage Platform, to enable the DoD/VA Office Joint Exploratory Team to study various health use cases involving FHIR. FHIR is a standard for exchanging healthcare information electronically. Per HL-7, "FHIR aims to simplify implementation without sacrificing information integrity. It leverages existing logical and theoretical models to provide a consistent, easy to implement, and rigorous mechanism for exchanging data between healthcare applications. FHIR has built-in mechanisms for traceability to the HL7's Reference Information Model (RIM), and other important content models. This ensures alignment to HL7's previously defined patterns and best practices without requiring the implementer to have intimate knowledge of the RIM or any HL7 v3 derivations." In addition, Joint Program Committee – 1 (JPC-1) recently requested that TATRC submit a full proposal for funding consideration to study the concept of SMART on FHIR, a set of open specifications to integrate apps with EHRs, portals, Health Information Exchanges, and other Health IT systems. Lastly, JPC-1 asked TATRC to submit a full proposal to determine the basic tenets of a DoD beneficiary Personal Health Record (PHR), accompanied by Personal Health Management Tools, aimed at promoting individual active duty military readiness. The envisioned PHR would enable DoD beneficiaries the ability to control release of information to other clinicians with a high degree of granularity, and with full interoperability. The PHR portal would also be able to integrate the patients' lifestyle data (activity, sleep, nutrition) with clinical observational data from multiple military, VA, and civilian clinicians.

Mr. Robert Connors stated, "I am honored to contribute to TATRC's efforts to further interoperability through the development of relevant prototypes. Further, as a retired beneficiary of military medicine, I look forward to the day when I can view all of my military and civilian health records in a single portal; add my lifestyle data, and be able to direct that information with full interoperability for use by my care-givers."

Phase 2 of mHIC's Diabetic Home Monitoring Study Opens Enrollment

In early July 2017, the Diabetic Home Monitoring Study based out of Madigan Army Medical Center (MAMC) and Nellis Air Force Base (AFB), began patient enrollment. This represents the start of phase 2 of a research partnership between TATRC's Mobile Health Innovation Center (mHIC), MAMC, Nellis AFB and Clemson University School of Public Health. The study will follow 120 patients over the course of 9 months using the mCare mobile application developed by TATRC's mHIC, and a suite of Bluetooth-enabled home monitoring devices, including fitness trackers, weight scales, blood pressure monitors and glucometers. Health information obtained from these devices is synced to the mCare app, as well as the MHCE-R provider portal, enabling the patients' case-managers and physicians to have nearly-instant visibility to these health stats, as well as triggering medical alerts at pre-determined thresholds, when applicable. Patients will receive weekly "health tips" which are designed to "activate" the patient's awareness and involvement in their self-care (based on medically accepted activation measurement tools). Patient and provider enthusiasm has been even greater than anticipated by the researchers. In less than two months' time, surprisingly, nearly 1/2 of all the patients targeted for this randomized controlled trial, had already been recruited and enrolled in the study (as of press). This research is novel as it focuses on the impact of patient activation for their clinical condition by leveraging remote home monitoring and mHealth education as part of a case management approach.

Mr. Ron Yeaw, Deputy Lab Manager for mHIC stated, "Preliminary mCare research testing feedback is already showing significant benefits to chronic diabetic patients and the lessons learned from the Phase 1 testing, have allowed the mHIC team to provide the most effective solutions. After a year of usability testing and preparation, the mHIC team is excited to have entered the clinical trials phase of this research."

AAMTI Project Spotlight: Wearable Technology May Assist Injured Runners

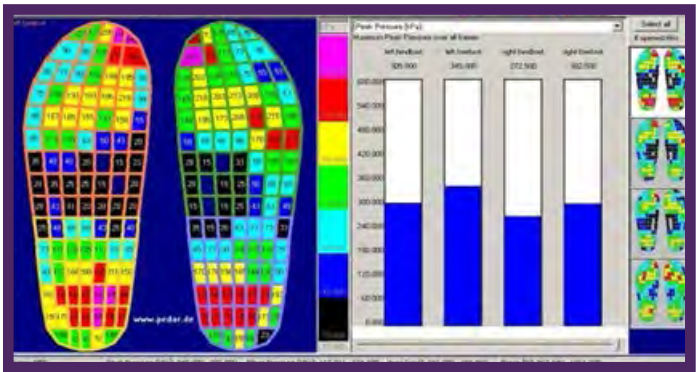
A non-rearfoot strike pattern, or decreased average vertical loading rate during running has been suggested to reduce injuries. Historically, transitioning a runner from a rearfoot to a non-rearfoot strike involved 8 – 18 visits of one-on-one feedback over 2 – 6 weeks. Wearable technology consisting of Bluetooth enabled instrumented socks were recently developed to provide runners with biofeedback. When the socks are paired with a smartphone, the runner receives live feedback regarding foot strike patterns, cadence, running pace, and total distance covered. The purpose of this AAMTI-funded project was to examine the effectiveness of this technology on its ability to train runners through the use of biofeedback following an injury. Secondarily, pain, functional outcome scores and biomechanical measures were examined through the training protocol. There is no precedent for utilizing this type of technology exclusively for 6 weeks without therapist monitoring of gait re-training.

A dynamic team consisting of Maj Daniel Watson, Ms. Erin Florkiewicz, Maj Eliza Szymanek, Dr. Greg Freisinger and COL Don Goss at the Baylor University – Keller Army Community Hospital, Division 1 Sports Physical Therapy Fellowship, partnered with Sensoria, a Washington state based, fitness technology company, to complete this project.

Nineteen rearfoot strike runners, who were recovering from a lower extremity injury or surgery, participated in this study. Injuries and surgeries included tibial stress fractures, anterior cruciate ligament reconstruction, patellofemoral pain syndrome, and a total hip arthroplasty.

At baseline, each subject ran on an instrumented treadmill to collect ground reaction force data and were then fitted for the instrumented socks. While completing a walk-to-run progression, the subjects ran with the instrumented socks to receive biofeedback. Follow-up data collections determined running foot strike pattern and ground reaction force data. If a transition to a non-rearfoot strike running pattern occurred, the subject stopped using the instrumented socks for 30 days and then returned for a final data collection on the instrumented treadmill.

Running sock is designed to provide real time feedback on footstrike patterns in runners.



Sensoria® Smart Sock evaluation provides real time biofeedback to runners.

Nearly all (18 out of 19 participants) transitioned to a non-rearfoot strike running pattern 8 weeks after beginning the walk-to-run progression with the instrumented socks. The subjects then continued the walk-to-run progression, but stopped using the instrumented socks. The majority (16 out of 18 participants) maintained the transition at the final data collection 5 weeks later.

Pain and functional outcome scores were not significantly different. Average vertical loading rate decreased between the initial (54.00 body weights/seconds) and the non-rearfoot strike collections (38.97 body weights/seconds, $p = 0.002$). This effect persisted 5 weeks later (46.95 body weights/seconds, $p = 0.009$). Cadence increased from the initial (168.51 steps/minute) to the non-rearfoot strike collection (173.30 steps/minute, $p = 0.045$), however, this effect did not persist at the 5 week follow-up (171.57 steps/minute, $p = 0.08$).

With technology provided feedback, this technology may assist a previously injured runner with a non-rearfoot strike running transition while decreasing average vertical loading rates. Longer follow-up is needed to verify that these previously injured runners are still running injury free. Other, more cost effective technologies need to be tested for their potential in order to be issued or loaned to DoD beneficiaries who are candidates for this type of real-time biofeedback for gait re-training.

COL Don Goss, Director and Associate Professor at Baylor University and one of the lead researchers on this project stated, "Service members and their families may be able to transition their running form safely and effectively without 8-12 or more out-patient visits, as has been done before. This technology shows real promise in helping runners alter their gait and run with a potentially less injurious running form."

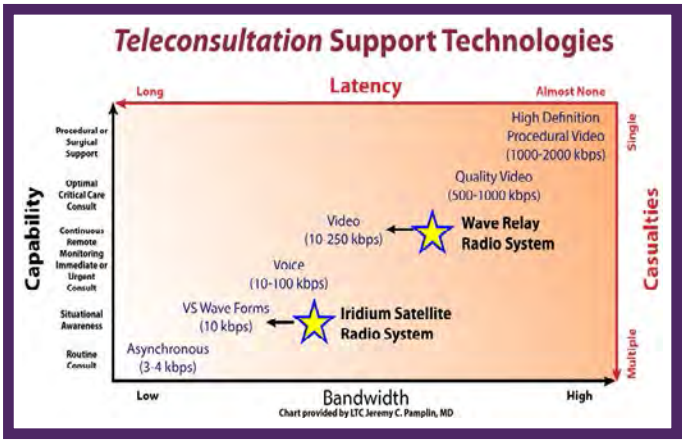
This study is now complete and was recently submitted to publish in peer reviewed literature. The study would not have been possible without the funding support received from TATRC's AAMTI Program.

PEO Aviation Collaborates with TATRC, USAMMA & MAMC for Medical Information Exchange at Army NIE 17.2

Mr. James Beach and Mr. Larry Markins from TATRC's Operational Telemedicine Lab, along with LTC Jeremy Pamplin, MD from Madigan Army Medical Center (MAMC), supported the Program Executive Office Aviation, Project Manager Aviation Systems in the assessment of potential mission command capabilities during the Network Integration Evaluation (NIE) 17.2 at Fort Bliss, Texas in July. Additionally, Mr. Jay Wang from the US Army Medical Materiel Agency also participated to collect information to support technology surveillance activities for the MEDHUB program. The mission command capabilities enabled enhanced communication capabilities on board United States Army aviation assets. During this assessment, TATRC collected data to support the characterization of the Iridium Satellite Radio and the Wave Relay Radio systems for telemedicine and documentation exchanges. This assessment was important to determine if the target communication systems provide the capacity to support more advanced telemedicine capabilities.

The TATRC assessment of these communication capabilities was funded through the Defense Health Program 6.7 and is being executed in three phases. Phase I and II are now complete. During Phase I, the Tempus Pro™ Physiological Status Monitor was integrated into both the Iridium Satellite Radio Network and the Wave Relay Radio Network. This integration phase entailed obtaining limited Airworthiness Releases to enable testing onboard a UH-60 series MEDEVAC helicopter at the Network Integration Exercise. During Phase 2, data collection occurred during 4 MEDEVAC missions, and information was collected from ground-based exercises conducted with the 1/601st General Support Aviation Battalion Flight Surgeon and C/526th Brigade Support Battalion. During the ground-based exercises conducted in White Sands Missile Range and Fort Bliss Maneuver Areas, clinical personnel were able to connect to LTC Jeremey Pamplin, who was stationed remotely at MAMC, to perform a Disease Non-Battle Injury telemedicine scenario, consisting of a patient presenting with an unknown insect bite that was assessed as black widow spider bite through the use of telemedicine. The final phase of the project is to complete the analysis of the information collected at NIE 17.2 and previous reports from telemedicine threads conducted at earlier exercises to further characterize the capabilities of tactical radio systems, and to report findings to PM Aviation Systems, PEO Aviation, the US Army Medical Department & School Capabilities Development and Integration Directorate, and the US Army Medical Research and Materiel Command.

The results of the assessment demonstrate that the current Iridium Satellite Radio system supports teleconsultation with voice and real-time vital signs, but is too limited to allow consistent asynchronous images that might provide remote



Mr. James Beach assists 2 Medics from the C/526th Brigade Support Battalion as they conduct a DNBI Telemedicine Scenario from "The Bridge to Nowhere" near McGregor Range on Fort Bliss with LTC Jeremy Pamplin on the remote end at MAMC.

Army NIE 17.2 *Continued on page 19*

Army NIE 17.2

Continued from page 18

consultants additional contextual awareness. The Wave Relay Radio system supported more advanced capabilities to include transmission of images and low quality video. This radio system is Line of Sight; thus, moving vehicle platforms creates an unstable communications link. The Wave Relay system, by itself, will not provide an end-to-end solution for over the horizon communications. However, it is able to be integrated into long-haul communications networks to provide a robust communications link for data, audio, and images.

While these assessments conducted at NIE 17.2 were limited to two communication platforms, this data and information from previous exercises, such as TATRC's CERDEC Ground Activity Event at Fort Dix, will be compiled to provide a "Teleconsultation Support Technologies" chart with concise information on the required bandwidth and radio systems necessary to support specific Telemedicine capabilities. According to Mr. James Beach, one of TATRC's Project Managers, "This type of information would help support Medical Planners when conducting mission planning to determine what organic and non-organic communications requirements have to be met to provide a desired level of Telemedicine Capabilities."

TATRC's Op-T-med Lab Gets a Prominent Seat at the AUSA Med Table

On behalf of the Army Medical Command, the Association of the United States Army Institute of Land Warfare sponsored an Army Medical Symposium and Exposition 24 - 25 July at the Grand Hyatt in San Antonio, Texas. This symposium provided a venue for collaborative discussion and education on key topics by identifying leading practices and innovations from Joint, Interagency, Intergovernmental, and Multinational organizations and industry partners that will better enable Army Medicine to prepare for future challenges in support of our Army and the Joint Force. Keynote speakers included LTG Sean B. MacFarland, Deputy Commanding General and Chief of Staff, United States Army Training and Doctrine Command, who spoke on the Army's future Multi-Domain Battle Concept, and LTG Nadja Y. West, Commanding General, United States Army Medical Command, The Surgeon General, United States Army, who spoke on the future of Army Health Care and Force Health Protection Readiness.

In addition to the plenary sessions, the meeting included several breakout panels. One such panel, chaired by COL Michael F. Breslin, Medical Evacuation Proponency Division Chief, United States Army Medical Department Center and School, focused on the future of Patient Evacuation in the Multi-Domain Battle. Among the panel members was TATRC's own Dr. Gary Gilbert, Operational Telemedicine Lab Manager, who discussed the Army's new Science & Technology Research Domains in Virtual Health, Medical Robotics, Medical Autonomy & Unmanned Capabilities, and Medical Manned-Unmanned Teaming. The first three of these new research task areas are managed by the MRMC Medical Simulation and Information Sciences Research Program, and the last is managed by the Military Operational Medicine Research Program. Army RDTE funding for these new task areas will commence in FY 2019. Dr. Gilbert discussed how technologies developed under these novel research areas can potentially be applied to patient evacuation under the Multi-Domain Battle Concept.

> ***"We need to do the research and development to make sure that when that happens, our patients are safe."***

When asked why we should consider applying emerging technologies in Artificial Intelligence, machine learning, and robotics to patient evacuation and enroute care, Dr. Gilbert cited LTG MacFarland's talk in which he suggested that in the Multi-Domain Battle Concept, tactical commanders may not be able to risk routine MEDEVAC "through the breach", meaning through the "no-man's land" between forward-deployed independent maneuver forces, and the main force in the rear. "We should do this because we have to in order to protect our patients," argued Dr. Gilbert. "If unmanned vehicles are deployed forward for logistical support missions, there is going to be significant pressure by tactical commanders to use those platforms to 'clear the battlefield'; we need to do the research and development to make sure that when that happens, our patients are safe."

Dr. Gary Gilbert presents on Virtual Health in Medical Robotics at AUSA Medical Conference.

Point of Care Teleconsultation Prototype Evaluated at CERDEC Ground Activity 2017

The call goes out: "Medic!" When you're a front line medic, attached with a dismounted patrol in an austere environment, and you hear that call, your heart begins to race. You ask yourself, "What kind of injury am I dealing with? Will I have the proper amount of gear?" Then you begin to rehearse your procedures in your head. You come up to the casualty and you begin your assessment. You come to the conclusion that the casualty needs surgical intervention now! Evacuation is hours out. What can you do to keep the casualty alive or relieve the pressure to save a limb or organ?

TATRC's Operational Telemedicine Lab is looking at capabilities that can provide assistance through teleconsultation. TATRC is researching and developing prototype teleconsultation applications and predictive algorithms to enable a medic to talk with a medical provider in the rear to provide guidance in these difficult situations and for prolonged field care. TATRC conducts prototype field evaluations on basic research capabilities to stream video, voice, and telemetry data over the tactical radio network, back to a Brigade Medical Company with reach-back capability to the surgeon. TATRC, along with PM Nett Warrior, the CERDEC Ground Activity (CGA), the US Air Force Research Lab (USAFRL), and industry partners are developing prototype software applications that can be installed on Nett Warrior End User Devices (EUDs) in order to monitor the casualty's vital signs with wireless medical sensors. Additionally, it can send video from the EUD back to the surgeon and enable the surgeon to conduct a virtualized, remote telepresence, imposing his hands into the video feed to guide the medic on a procedure, and researching machine learning predictive algorithm capabilities to provide the medic with a 20-30 minute warning on the potential of the casualty crashing.

Op-T-med staff demonstrating secure transmission of near real-time vital signs data and imagery from Point of Care.

One of the many simulated casualty scenarios evaluated using a variety of systems at CGA 2017.

TATRC evaluated new basic research technology concepts for the dismounted, mounted, and en route medical care telemedicine at CGA, Joint Base McGuire-Dix-Lakehurst, NJ. While at CGA, during the three-week evaluation, TATRC tested basic research capabilities to transmit medical data on a tactical radio network and had medical personnel evaluate these capabilities in simulated casualty scenarios, with the goal of providing situational awareness and electronic documentation of medical care. Some of the technologies tested and evaluated included: the USAFRL's Battlefield Assisted Trauma Distributed Observation Kit, a software application on an EUD that monitors the vital signs of up to 6 casualties wirelessly, and documents care on a DD 1380 encounter; the Naval Surface Warfare Center Dahlgren Division's Battlefield eTC3 card Data Transfer to EHR, a DD 1380 encounter compression to transmit over the horizon on Iridium networks; the Mobile Virtual Interactive Presence Capability to stream imagery from the dismounted medics EUD to the Physician at a medical treatment facility where the physician can introduce sports casting to guide a medic on difficult procedures; and Chat for Intelligence Surveillance Reconnaissance; to provide medics a capability to text message each other to provide

Teleconsultation *Continued on page 21*

Teleconsultation

Continued from page 20

situational awareness. For en route care, TATRC evaluated Remote Diagnostic Technology's new Corsium Suite, which is a web-based portal that displays multiple Tempus Pro data on the tactical network, and transmits the Tempus Pro data from evacuation vehicles to a server on the Brigade Tactical Network.

TATRC also had medics evaluate these technologies in addition to other concepts. One such concept was a tactical micro-cloud that provides situational awareness and updates to the DD 1380 encounters to all medics on the tactical network. Another concept evaluated was the Automated Processing of the Physiological Registry for Assessment of Injury Severity system, which is a computational platform for real-time analysis of vital signs, for identification of substantial bleeding in trauma patients specifically, hemorrhagic injuries. Finally, medics evaluated the Comprehensive, Robust, Adaptive Multi-Modality Image Compression Technique, which is data compression of imagery from ultrasound and other x-ray devices and transmit the encounters to be uploaded into the casualty's electronic health record. TATRC selects experienced medics and corpsmen to provide a subject matter expert opinion on these new research prototypes during the concept demonstration. The medics are taken out into a realistic field environment, and run through a variety of different casualty scenarios armed with the devices to treat and document care. The goal of the overall evaluation is to obtain invaluable insight on the feasibility of the prototypes, provide guidance on the direction for further development and improve basic tactics, techniques and procedures.

CGA provided an actual and virtual 75th Ranger Regimental network architecture to provide the tactical radio and satellite connectivity from the forward location to a simulated Ranger Regimental Headquarters Tactical Operational Center. The architecture provided an outstanding capability to test and evaluate up and coming research capabilities that will be connected on the military operational network. The network introduced satellite communication latency, bandwidth constraints such as additional operational user congestions.

Mr. Carl Manemeit, Deputy Lab Manager for TATRC's Operational Telemedicine Lab stated, "This annual evaluation exercise provides our vendors with early insight on tactical network limitations and bandwidth constraints that aid in the further development and advancement of their prototype system in an operational environment, which is priceless for Principle Investigators. Understanding the operational environment, allows for a better end product that can be delivered to the advanced developer and product developer."

HTIC's Early Stage Platform Available for Development & Testing

Do you have a HIT Project ready for secure R&D testing? If so, then we have a secure virtual solution for you! The Health Technology Innovation Center (HTIC) at the Telemedicine and Advanced Technology Research Center (TATRC) hosts the Early Stage Platform, commonly referred to as the ESP. The ESP is an accredited (DIACAP) state-of-the-art, high-tech virtualized platform that provides a software development and testing infrastructure for advanced research and development (R&D) Health Information Technology (HIT) projects. The ESP is designed to provide R&D solutions to the Military Health System (MHS) while mitigating acquisition risk to the enterprise.

The ESP is designed to support multiple internal / external users engaged in early stage HIT research of ideas, concepts, and demonstration prototypes with relevance to the MHS. Access to the ESP will enable users to develop and test applications in a secure environment with access to web services, such as a Fast Healthcare Interoperability Resources server and shared MHS services. The concern of using Personally Identifiable Information and Personal Health Information is eliminated by the availability of the longitudinal (up to 12 years) and consistent computer generated synthetic patient data, which is available to all projects using the ESP. Because the synthetic patient dataset can mimic big data sets, the ESP is an ideal environment to test models for analytics of big data.

HTIC's Lab Manager, Ms. Ollie Gray, is excited to make this resource available to promote development of HIT prototypes and data analytics.

If you would like to discuss access, please contact the HTIC Lab Manager, Ms. Ollie Gray, at 301 619-4057 or ollie.b.gray.civ@mail.mil to learn more about this exciting platform that is available!

TATRC Research Leaders Engage in the Annual MHSRS Conference

The Annual Military Health System Research Symposium (MHSRS) took place 27-30 August 2017 in Kissimmee, Florida. MHSRS is the Department of Defense's premier scientific meeting on Combat Casualty Care (CCC) combining three previous conferences, Advanced Technology Applications for Combat Casualty Care Conference (ATACCC); the Air Force Medical Service Medical Research Symposium; and the Navy Medicine Research Conference. The MHSRS conference is attended by more than 3,000 participants, with late-breaking updates and presentations in the fields of science, medicine, and technology.

The MHSRS is sponsored by the Assistant Secretary of Defense for Health Affairs. The plenary session, moderated by Dr. Terry Rauch and Dr. Kelley Brix kicked off on Sunday, 27 August. Dr. David Smith, the Assistant Secretary of Defense for Health Affairs, addressed the attendees "From the Lab to the E-Ring: Linking MHS Research to a National Security Strategy," followed by Vice Admiral Raquel Bono, Director, Defense Health Agency, who spoke on our challenge to be "Ready for Anything: Accelerating Innovation from the Bench to the Battlefield." The opening plenary session concluded with an interactive roundtable discussion focused on "Maintaining our Medical Readiness Edge: Research & Development Solutions for a Complex and Unpredictable Future," moderated by CAPT Joseph Cohn.

Platform and poster presentations from government, academic, and industry representatives rounded out the program. Plenary presentations kicked off each morning, as well as fifty break-out sessions spread throughout the symposium. This conference began in the mid-1990s as ATACCC, and was sponsored by the US Army Medical Research & Materiel Command, and TATRC has always taken an active role. This year, sixteen TATRC representatives participated on behalf of TATRC's major laboratories: Operational Telemedicine (Op-T-med), Mobile Health Innovation Center (mHIC), Health Technology Innovation Center (HTIC), Medical Modeling & Simulation Innovation Center (MMSIC), and the Biotechnology High Performance Computing Software Applications Institute (BHSAI).

The TATRC Team was fully engaged in the scientific program, which involved moderating and co-moderating numerous panels, delivering a multitude of presentations in various oral breakout sessions, and presenting a wide range of different topics in the poster sessions.

Dr. Jaques Reifman moderated a panel on Physiological Monitoring. Mr. Harvey Magee moderated a breakout session entitled "Advancing Military Medical Modeling & Simulation-Based Assessment" and, with Dr. Amber Linde, Joint Program Committee – 1, co-moderated a breakout session entitled "Military Medical Modeling & Simulation Applications of Medical Technology "Realities" to Improve Training Effectiveness."

During the breakout sessions Dr. Jaques Reifman, Lab Director, BHSAI, delivered two oral presentations. The first was about "Sleep, Caffeine and Cognitive Performance Prediction;" the second, entitled "Reproducible EEG Signals Discriminate Combat Veterans with PTSD." Dr. Gary Gilbert, Op-T-med Lab Manager, spoke about the "New Army Research Task in Medical Robotics and Medical Autonomous and Unmanned Platforms." Mr. Tom Bigott, from the Op-T-med Lab, spoke about "Active Research into the Combat Medic's Virtual Health Capability Solution Set for the Battlefield."

Not only was TATRC represented at MHSRS this year by our own internal staff, but many of our external industry partners presented some of the joint research being conducted. Mr. Brett Darcy, a TATRC partner from Heron Systems, presented on the "Virtual Medical Concierge Application: A Defense Health Agency Small Business Innovative Research Project to Enhance the Consumer Experience at Walter Reed Na-

Standing, L to R: Dr. Gary Gilbert, Ms Rebecca Lee, Ms Jeanette Little, Ms Mabel Cooper, Ms Holly Pavliscsak, Mr. Tom Bigott, Ms Amanda Schmeltz, Dr. Fran McVeigh, Dr. Jaques Reifman, Mr. Harvey Magee. Kneeling, L to R: Mr. Ron Yeaw; COL Daniel Kral, Director and Mr. Ed Kensinger.

MHSRS *Continued on page 23*

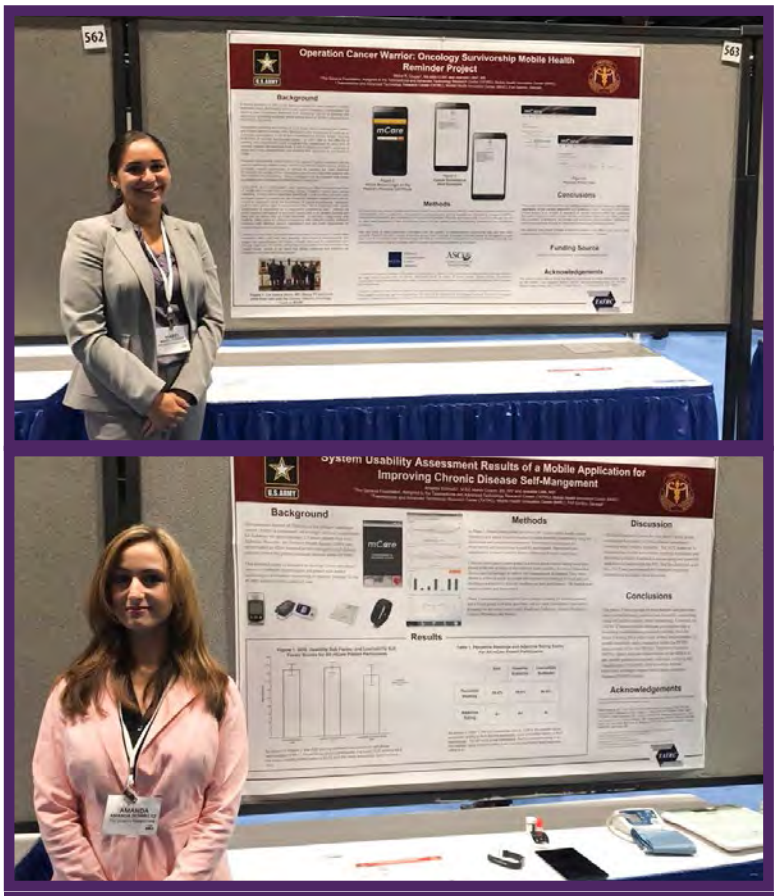
MHSRS *Continued from page 22*

tional Military Medical Center." Dr. Joel Williams, another partner from Clemson University, gave an oral presentation on "Exploring the Usability of a Mobile Application for Improving Chronic Disease Self-Management in the Patient Centered Medical Home Environment."

TATRC's presence was also prominent during the symposium's scientific poster session with numerous presentations from our mHIC and Op-T-med Labs, as well as our VHSO Program.

Counting both ATACCC and MHSRS meetings over the years, this represents an investment of twenty years of academic rigor and operational focus on combat casualty care. Mr. Harvey Magee, Technical Director of TATRC's MMSIC, noted "I have participated in every ATACCC, and now MHSRS, since 1999, when I first came to TATRC. No other venue exists where an attendee has the privilege to learn from so many DoD colleagues — the "best of the best" — who have served in, and been faced with, so many adverse and dangerous situations while providing the best healthcare in the world…and often conceiving innovative ways to do it better!"

As TATRC representatives seek to identify enabling technologies with the potential to be developed and integrated to enhance MHS deployed and home base healthcare, the MHSRS provides a pivotal opportunity to engage and understand end users' needs — often before anyone begins to communicate and document their needs as "requirements."



First time presenters, Ms. Amanda Schmeltz (bottom) and Ms. Mabel Cooper (top), showcase some of mHIC's innovative projects at MHSRS 2017.

Let's Get Social!

For more information on TATRC and its many initiatives, visit: www.tatrc.org or call 301.619.7927

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Augmenting The Future of Forward Surgical Care: TATRC Supports Augmented Reality Surgical Telestration Demonstration at USASOC

During his last deployment overseas, LTC Tyler Harris, an orthopaedic hand surgeon at Womack Army Medical Center (WAMC), had to perform a neurosurgical procedure as a result of an explosion. As he recounts it, the outcome was successful, but he kept "wishing a neurosurgeon could look over my shoulder and guide me through the procedure… one that I have never done." He committed to finding a technical solution upon his return, and that's what he did. His initial research led him to TATRC whose long history in operational telemedicine, was a natural and logical fit. After initial discussions with TATRC's Medical Modeling & Simulation Innovation Center (MMSIC), LTC Harris' "cold call" opened the door to further exploring his concepts including conducting technology assessments and prototyping new surgical simulation platforms.

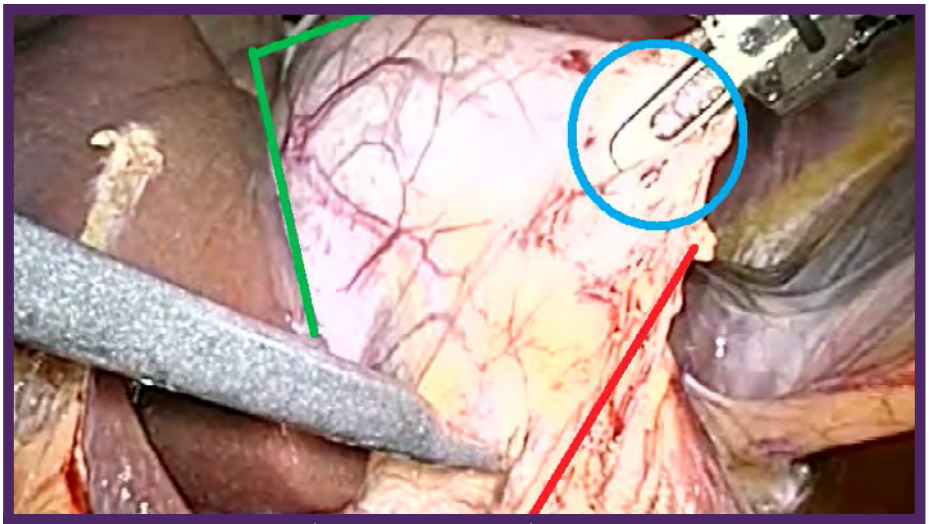
Driven by many factors, (e.g., geographical breadth and scope of Army Special Operations Forces missions, constraints of personnel and finances), innovative thinkers inside and supporting the Department of Defense (DoD) continue their quest to identify and improve technologies to support the Warfighters. In this case, it was the US Army Special Operations Command (USASOC), WAMC, TATRC's MMSIC team along with industry and academia, who put their heads together to see if Augmented Reality (AR) technologies and "telestration", could "… help forward providers to stabilize injuries that threaten life, limb, or eyesight," words penned by Ms. Eve Meinhardt, Public Affairs Office, WAMC.

Under the leadership of LTC Stephen DeLellis, a Deputy Surgeon at USASOC, a capability demonstration was conducted at the Medical Simulation Training Center, Ft. Bragg, NC, on 11 May. That experience was recently captured by Ms. Eve Meinhardt, in an article published on Army.Mil on 9 June. https://www.army.mil/article/189087/Technology_provides_ability_to_save_lives_through_telesurgery/

That article focuses on the clinical and operational leaders at the USASOC and WAMC, as well as the demonstration itself and informs readers of some of the challenges. There, you will learn more about how LTC Harris, guided LCDR Carl Long, a Navy physician assistant, through a femoral artery exposure. LTC Harris was in one location while LCDR Long, in a remote location, conducted the surgical procedure. LCDR Long wore a head-mounted display (HMD) and, once a communications link was established, LTC Harris could provide on-time, on-demand virtual support, able to see and hear the surgical environment, and more importantly provide real-time surgical expertise, including immediate visual guidance through telestration in LCDR Long's field of vision. By employing "telestration" technologies, LTC Harris could assess the injury, confirm anatomic structures and position, and confirm surgical steps and procedures, including the ability to verify the incision site, tissue dissection, and surgical instrument placement through diagramming on his computer, which LCDR Long could then see in his field of vision through

Telestration

Continued on page 25



Surgeons "telestrated" view through the display. Remote surgeon has annotated the surgeon's field of view to show areas of concern, instrument position and incision location. Image from An Evaluation Framework for Defining the Contributions of Telestration in Surgical Telementoring by Budrionis, et. al.

Telestration

Continued from page 24

the HMD overlaid on the simulated injury.

During the 3-day demonstration in May, experienced trauma surgeons provided intensive, focused education and simulation-based training on the procedure to be demonstrated: anterior approach to the external iliac artery, also known as the Blackhawk Down© injury. The audience consisted of general surgeons, physician assistants and special operations medics. After this intensive training session, verification of surgical skill competence was assessed on a newly prototyped surgical manikin. Finally, candidates were chosen to perform the procedure on the manikin while wearing the HMD, to develop understanding and use of the augmented technologies. Training continued all afternoon, as trainees deliberately and repetitively practiced the procedure, with real-time support and feedback to familiarize and perfect their newly acquired skills.

On the final day of the exercise, all the hard work paid off, with multiple mission successes in demonstrating the ability to project on-time, on-demand surgical expertise in a forward environment. LTC Harris stated that "TATRC's simulation team was instrumental to incubating and developing the initial ideas that grew into a successful demonstration of an augmented reality surgical telestration capability at Fort Bragg. By making the seminal connections and facilitating the necessary dialogue between USASOC, industry, and experienced researchers, TATRC fostered the current wave of interest in far-forward battlefield stabilization procedures. I came back from Afghanistan with an acute sense of the need for increased capability and several preliminary ideas. TATRC was the engine that propelled those ideas into reality."

As a result of the success of this demonstration, the team from WAMC, TATRC and USASOC are collaborating on an expanded research effort to accelerate these technologies' entry into the combat medical space. A new proposal was submitted by the team to the FY 18 AMEDD Advanced Medical Technology Initiative (AAMTI) and is now under review, for funding.

mHIC Lab Manager Speaks on Mobile Health in the Windy City

At the request of the United States Army Recruiting Command, Ms. Jeanette Little from TATRC, was invited to serve as a guest speaker at a continuing medical education event on Army research in Mobile Health Initiatives at the Norwegian American Hospital in Chicago on 14 September. Jeanette, who heads the Mobile Health Innovation Center (mHIC) within TATRC, also serves as the Capability Manager for Virtual Health (VH) Research.

This fall presentation was part of a larger effort by the United States Army Recruiting Command to generate interest in Military Medicine for physicians and other health professionals who are graduating from their professional training programs and exploring opportunities within the Army Medical Command. Ms. Little's presentation, entitled "Mobile Health Innovation" highlighted the current state of mobile health (mHealth) efforts in military medicine, both within and outside of the research environment. Furthermore, it emphasized the future state(s) of mHealth and VH for the military. Ms. Little also described lessons learned on user engagement and known challenges and barriers to acceptance of mHealth within the MHS.

Ms. Little stated, "I appreciated the opportunity to share my experiences with future healthcare providers and hopefully encourage them to consider pursuing a career in Army Medicine."

Approximately 100 people attended the presentation, including an Army Reserve Physician who had just returned from a tour of duty at JTF Bravo in Honduras, who provided additional insight and relevance to the use of Virtual Health to support ongoing military operations.

Norwegian American Hospital in downtown Chicago served as the site for the continuing Medical Education Summit that focused on Military Medicine.

Virtual Medical Concierge Prototype Application Achieves Initial Operating Capability at WRNMMC

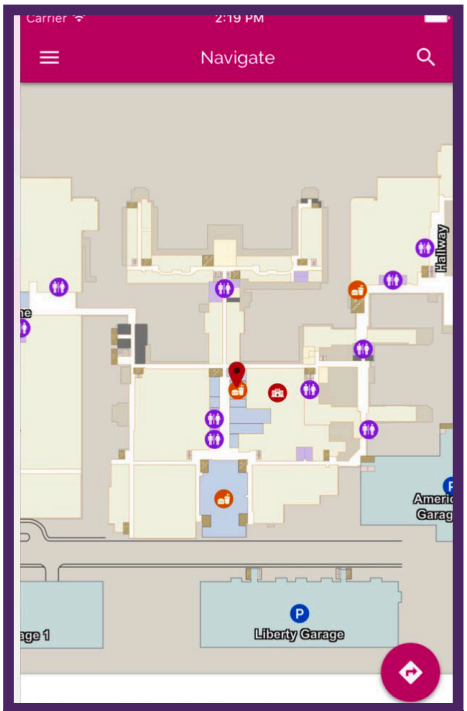
As previously reported in the March 2017 edition of the "TATRC Times," Heron Systems, Inc., a small company in Lexington Park, MD, was actively developing the Virtual Medical Concierge Application to provide indoor navigation to the complex Walter Reed National Military Medical Center (WRNMMC). The project was conceived by CAPT Kevin Dorrance, MC, USN (Retired), who was the Director of Medical Services. Mr. Robert Connors, Health IT Research Administrator, with TATRC's Health Technology Innovation Center Lab (HTIC), developed the concept into a Small Business Innovative Research (SBIR) Proposal, which was approved by the Defense Health Program for funding. Initial SBIR Phase I awards were made to three vendors, and based on its SBIR Phase I performance; Heron Systems, Inc. was down-selected to create a prototype working application. Approximately $1M has been spent to date to achieve initial operating capability.

On 17 August, Heron Systems released the application into the Apple and Android stores for download to mobile devices. Interested patients, staff and visitors may download the application for evaluation through the following stores:

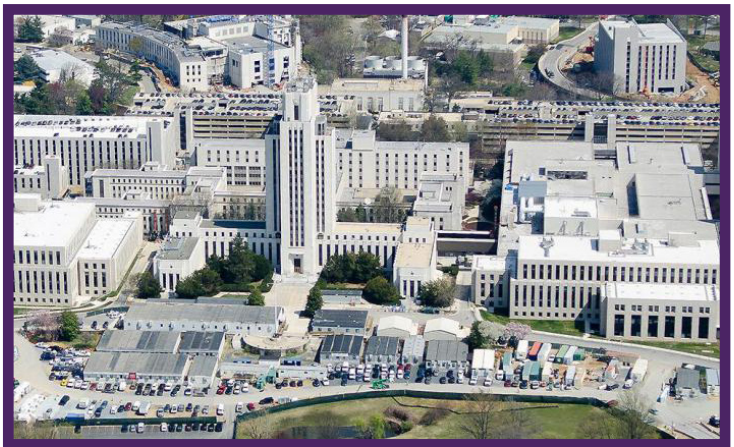
Apple App Store: https://itunes.apple.com/us/app/wrnmmc-virtual-medical-concierge/id1172258020?ls=1&mt=8

Google Play Store: https://play.google.com/store/search?q=Heron%20Medical%20Concierge&c=apps

Heron Systems worked closely with WRNMMC Facilities, Information Management, Public Affairs, Construction Management and Security Management personnel to develop the application and install ~300 Low Energy Bluetooth Beacons throughout the America and Arrowhead patient care and ancillary service areas. The application is designed to guide users using an indoor map of WRNMMC, and has the option for voice turn-by-turn directions. Users simply pick their destination from a comprehensive list of locations built into the application's location directory. As a security precaution, the WRNMMC indoor maps are only visible when the user is within range of a beacon, so there is no possibility that if a user loses his or her phone, that someone could map out the facility in advance of an ill-intended act. Maps are easily updated on the fly, which is a useful feature given the ongoing WRNMMC construction. Furthermore, WRNMMC staff can push important announcements, messages, and alerts to users via an Administrative console. The Administrative console also provides a view of Beacon status, including power status. Batteries should last a minimum of two years prior to need for replacement.



A screen shot from the app showing the navigation function within the facility.



Walter Reed National Military Medical Center located in Bethesda, MD serves as a test site for Heron Systems Navigation Beacons.

Ms. Staci R. Harrison, WRNMMC Office of the Chief of Staff, stated, "I look forward to working with TATRC and Heron Systems to determine the next steps regarding this project." Based on the response from application users, TATRC will be determining if an SBIR Phase II enhancement project is feasible and how it might be funded. The SBIR Phase II Enhancement would likely focus on integrating the Virtual Medical Concierge application with the patient's schedule and health profile, to be able to provide location-based, context sensitive information within WRNMMC. SBIR Phase II Enhancement projects are funded in part by the SBIR Program Office, but also require a match in funds from another source, which could be internal or external to DoD. According to Dr. Terry Newton, Army IM/IT Capabilities Manager, another likely transition mechanism for this research may be through the Defense Health Agency Patient Experience Working Group. San Antonio Military Medical Center and Madigan Army Medical Center have also expressed interest in learning more about the application.