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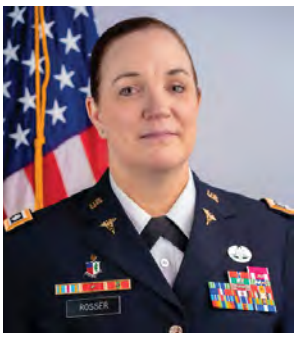
FEATURED

AMTI Project Spotlight: Covid-19 Airway Management Isolation Chamber (CAMIC)

Page 10

ALSO INSIDE:



TATRC Welcomes 'Mover & Shaker' from OTSG as New Deputy!
- Page 16

Does Blast Exposure to the Torso Cause a Blood Surge to the Brain?
- Page 4

Project Crimson Soars at MSSPIX '21 Event
- Page 8

In this Issue:

TATRC Awards Projects to Accelerate Availability of Remote Controlled Ventilators and Infusion Pumps

"Virtual Hospital" Capabilities Extend Scale and Impact of Tele-Critical Care for COVID-19

TATRC has awarded a total of approximately $2.8M in funding to three project teams to accelerate interoperability, remote control, and automation of mechanical ventilators and infusion pumps for integration into the National Emergency Tele-Critical Care Network (NETCCN) platforms in support of tele-critical care of COVID-19 patients. This effort will create and add "virtual hospital" capabilities to NETCCN and provide hospital-like functionality to the platform.

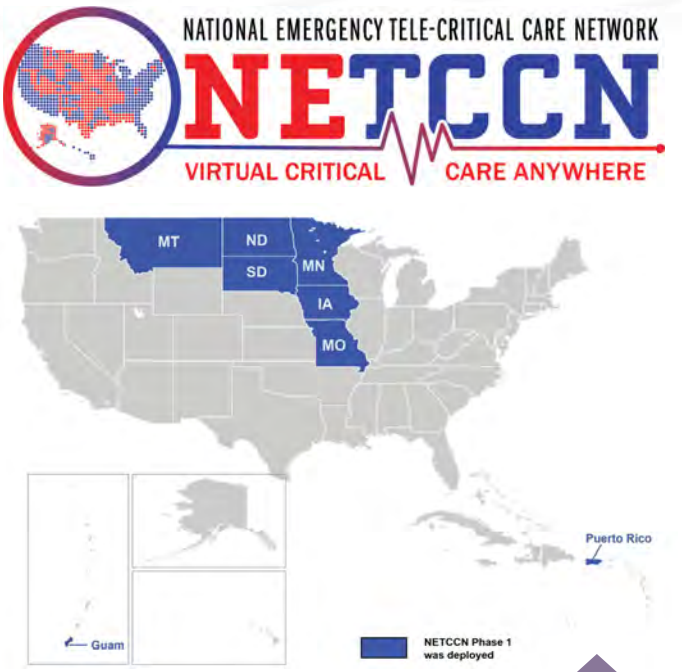
NETCCN consists of networks of critical care clinicians and providers that can deliver virtual care "from anywhere to anywhere" through the use of cloud-based, low-resource telemedicine platforms. Initial deployment of the NETCCN has supported several hospitals and other facilities in Guam, Puerto Rico, Iowa, Minnesota and the Dakotas and is expanding availability to assist wherever there is a lack of adequate critical care expertise and resources necessary to care for COVID-19 patients.

"The addition of 'virtual hospital' capabilities to NETCCN represent a key strategy to enhance the scope and impact of tele-critical care support to resource-limited environments. By accelerating development and inclusion of medical devices that utilize interoperable, remote control, and autonomous technologies, we can augment the knowledge, skills, and abilities of local caregivers," said TATRC Director, COL Jeremy Pamplin.

Currently, clinicians delivering critical care at a distance have limited ability to monitor, assess, and control the operation of essential medical devices like monitors, intravenous pumps, and ventilators used in the care of COVID-19 patients due to proprietary interfaces, absence of remotely controllable functions, and the need for custom licensing agreements.

TATRC is funding teams led by the following:

- Cognitive Medical Systems to develop standards-aligned remote control of the Thornhill Medical MOVES® SLC™ ventilator and NeuroWave AccuPump across the NETCCN architecture.



Map of NETCCN Phase 1 deployment.

- Massachusetts General Hospital to develop a comprehensive framework for the safe, remote operation of high-acuity medical devices and to add the support for remote control data visualization for the Medtronic PB980 ventilator and NeuroWave AccuPump by passing patient and device data from these devices through DocBox to NETCCN systems.

- Nihon Kohden OrangeMed Inc. to develop, test, and implement the NKV-550 ventilator remote control function in collaboration with NETCCN performers, cybersecurity experts, and medical device interoperability experts.

Awarded teams will begin working with NETCCN teams and TATRC's Device Interoperability and Autonomy Coordinating Center (DIACC) to initiate these projects and make these capabilities available to support COVID-19 patients nationwide.

For more information on the NETCCN initiative, please visit: https://www.tatrc.org/netccn.

Does Blast Exposure to the Torso Cause a Blood Surge to the Brain?

Exposure to explosion-induced blast waves is suspected to cause traumatic brain injury (TBI). In order to prevent and develop effective personal protective equipment against this non-impact injury for our Warfighters, it is essential that we understand the underlying pathways by which such exposure can lead to blast-induced TBI. The proposed causes of this injury include a direct mechanism (i.e., the interaction of the blast wave with the head) and an indirect mechanism (i.e., the interaction of the blast wave with the body). A few studies reporting changes in brain tissues of animals exposed to a head-only blast support the direct-mechanism hypothesis. In contrast, despite years of research, the role of the indirect mechanism in causing blast-induced TBI remains inconclusive. To address this gap, Dr. Jaques Reifman, Director of the Biotechnology High Performance Computing Software Applications Institute (BHSAI) Data Sciences Division (DSD) here at TATRC, led an interdisciplinary study to investigate the potential effects of the indirect mechanism on the brain vessels and tissues.

The BHSAI DSD team, in collaboration with the New Jersey Institute of Technology (NJIT; Newark, NJ) and the University of Utah (UT; Salt Lake City, UT), conducted experiments and developed computational models to determine whether the indirect mechanism can damage the brain vasculature, the brain tissue, or both. To this end, using medical images acquired by the UT team and intravascular-pressure measurements from torso-only exposures (i.e., shock-tube experiments with blast exposures limited to the torso of a rat) conducted by the NJIT team, the BHSAI DSD team developed three-dimensional computational models of the neck and cerebral vasculature to characterize the pressure propagation through the blood vessels. Using these models, the team simulated the cerebral blood flow resulting from the torso-only exposure and predicted the amount of blood entering the brain and the resulting stresses in the brain vessels. In addition, the BHSAI DSD team developed a 3-D model of the rat brain to determine whether the torso-only exposure could induce significant strain in the brain tissues.

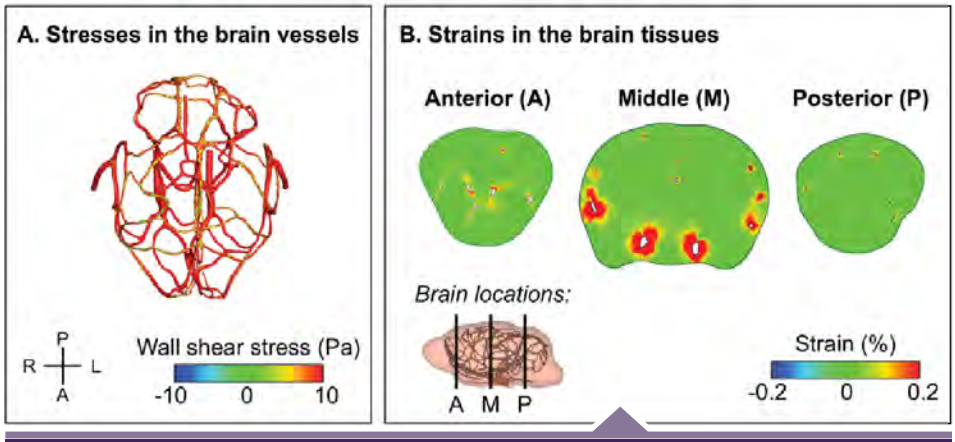


Figure 1. (A) Compared to a blast-free condition, the substantial increases in the peak shear stress in the cerebral vasculature of a rat caused by a torso-only exposure indicate that the indirect mechanism may cause vascular injury. (B) The predicted minimal increases in the peak strain in the brain tissues of a torso-only-exposed rat indicate that the indirect mechanism is very unlikely to cause strain-induced damage to the tissues.

From the computer simulations, when compared to a blast-free condition, the BHSAI DSD team of researchers determined that a torso-only exposure increased the peak mass flow rate at the base of the brain by up to 255% and increased the wall shear stress throughout the entire cerebrovascular network by up to 290% (Figure 1A). In contrast, the simulations also showed that a torso-only exposure caused minimal strain increases (<1%) in the brain tissues (Figure 1B).

These results indicate that the indirect mechanism causes a sudden and abundant stream of blood to rapidly propagate from the torso through the neck to the cerebral vasculature. This blood surge, in turn, considerably increases the wall shear stresses in the brain vasculature, which may lead to vascular injury. However, because the predicted brain-tissue strains were much lower than the damage-causing levels identified in the literature, the results indicate that the indirect mechanism of blast exposure does not cause brain-tissue injury.

Dr. Reifman noted that "this very elegant interdisciplinary work allows us to ascertain with a high degree of confidence that, while a blast exposure to the human torso can potentially lead to brain-vessel pathologies, it is unlikely to directly damage brain tissues."

The full details of this study, which was supported by the DoD Defense Health Program, Joint Program Committee 5 managed by Military Operational Medicine Research Program at Ft. Detrick, Maryland, can be found in Rubio et al. Frontiers in Bioengineering and Biotechnology 8:573647, 2020.

TATRC Hosts DHA Deputy Assistant Director, BG Simonson!

COL Jeremy Pamplin, Commander, welcomes BG Katherine Simonson, Deputy Assistant Director for Research & Development, J-9, DHA to TATRC.

Mr. Geoff Miller, MMSIV Division Chief, walks BG Simonson through a simulated, casualty scenario, as demonstrated by TATRC's MMSIV team.

Mr. Nate Fisher, MedRAS Division Chief, shows BG Simonson some of the research initiatives in autonomous systems and robotics.

Earlier this past fall, Team TATRC had the privilege of hosting BG Katherine Simonson, Deputy Assistant Director, for Research & Development, J-9, at the Defense Health Agency for a briefing on our current and future projects and initiatives! After a comprehensive briefing with our Command team, BG Simonson was able to meet the medics and see our simulation scenario before she rolled up her sleeves to get hands-on with demonstrations from our Medical Modeling Simulation, Innovation, and Visualization (MMSIV) and Medical Robotics and Autonomous Systems (MedRAS) Divisions!

A nurse by training, BG Simonson was able to spend valuable time with MAJ Patricia Schmidt, TATRC's first-ever Nurse Scientist, and Acting Chief for the MMSIV Division, which proved to be a natural fit given their similar backgrounds.

A native of Brooklyn and Elmira New York, BG Simonson is a Distinguished Military Graduate of Canisius College in Buffalo, New York. Her education includes a Bachelor of Science in Nursing from the State University of New York at Buffalo and a Masters of Nursing from the University of Washington in Seattle, WA. She was commissioned into the Regular Army in 1990.

BG Simonson is a graduate of the AMEDD Officer Basic and Advanced Courses, Medical Management of Chemical Biologic Casualty Course, AMEDD Critical Care Nurse Course, the Combined Arms and Services Staff School, and U.S. Army Command and General Staff College and the Army War College.

We're grateful for BG Simonson's time and valuable insight, and look forward to the next visit!

TATRC MedRAS presents at DSI DoD Robotics & Unmanned Systems Summit

Mr. Fisher at the DoD Robotics and Unmanned Systems (UxS) Summit delivering an overview of the TATRC MedRAS portfolio during his presentation entitled: "MedRAS: Augmenting Medical Capability and Capacity for the Future Force."

This past August, Mr. Nathan Fisher, Chief of TATRC's Medical Robotics and Autonomous Systems (MedRAS) Division, presented at the DoD Robotics and Unmanned Systems (UxS) Summit in Alexandria, VA, sponsored by the Defense Strategies Institute (DSI). DSI's 9th Annual Unmanned Systems & Robotics Summit focused on the multi-domain functionality and networked approach to UxS capabilities across air, land, and sea on the future battlefield. The two-day Summit was designed to look at common challenges and capabilities across Services, rather than focus in on a precise platform, domain or acquisition. This event was an educational forum for technology providers and decision makers across the U.S. Military, federal government agencies, academia, and the private sector who are responsible for using or advancing UxS and robotic capabilities. The distinguished speaker line up included many senior leaders, including LtGen Eric Smith, USMC Commanding General, Combat Development Command, Dr. Stuart Hatfield, HQDA G-8 Robotics and AI Branch Chief, and Maj Gen Heather Pringle, USAF Commander Air Force Research Laboratory, among others.

Mr. Fisher gave an overview of the TATRC MedRAS portfolio during his presentation entitled: "MedRAS: Augmenting Medical Capability and Capacity for the Future Force." The presentation covered numerous research topics exploring ways emerging technologies in robotics, autonomous systems, and Artificial Intelligence (AI) can be extended to medical applications to provide a medical force multiplier during Multi-Domain Operations near the point of injury, during pre-hospital evacuation, and at Medical Treatment Facilities. Specific topics included forward-deployed telerobotic surgery, semi-autonomous and remotely-managed care systems, and the use of unmanned vehicles for transporting medical supplies and potentially patients.

Mr. Fisher's presentation was well received and the topics of leveraging unmanned systems for autonomous search and rescue and medical resupply were of particular interest to the audience. Describing the DSI Summit, Mr. Fisher expressed that "it was an excellent forum to share our MedRAS research portfolio with the broader DoD Robotics and UxS community and led to many fruitful follow-up discussions with interested groups regarding potential opportunities for future collaboration."

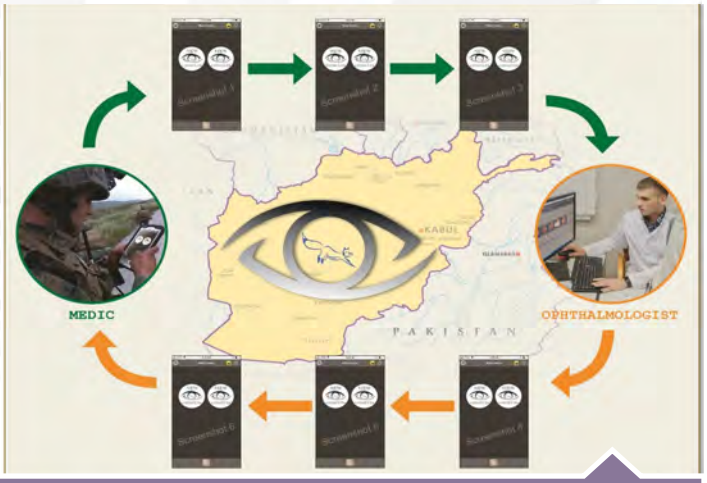
For more information on TATRC's MedRAS Research Portfolio, please contact Mr. Nathan Fisher at: nathan.t.fisher3.civ@mail.mil.

Project FOXTROT Shines at this Year's HIMSS

TATRC's Digital Health Innovation Center (DHIC)'s project 'FOXTROT' (Forward Operating Base Expert Telemedicine Resource Utilizing Mobile Application for Trauma) was presented this past August at the Healthcare Information and Management Systems Society (HIMSS) 2021 conference by LTC Gary Legault, the Virtual MEDCEN Director.

The FOXTROT platform provides a secure HIPAA-compliant tool that connects the providers at the point of injury, regardless of their location, to an assigned ophthalmologic specialist at a higher level of care. Providers can be assigned depending on the on-call schedule for each location or facility. FOXTROT leverages TATRC's Mobile Health Care Environment-Research (MHCE-R) and its accompanying mobile app, mCare, as a solution to treat ocular trauma. As has been previously reported in prior TATRC Times, FOXTROT was deployed to Afghanistan in 2019, and in August 2020. Those findings were published in JAMA Ophthalmology.

According to Dr. Gary Legault, who delivered the presentation, "Ophthalmic injuries occur commonly in deployment. We know most providers have minimal knowledge about the eye and therefore need a simple way to contact us. FOXTROT provides that solution and is a secure method for consulting an ophthalmologist and the application walks the provider through an eye exam."



Operational view and diagram of Project 'FOXTROT.'

Since October of 2020, a total of 78 consults have been placed from Joint Base Andrews Emergent Care Center (ECC) to ocular specialists on duty at that location. The flexibility of this mobile application and provider portal solutions allow providers to receive more robust consults including images and patient history, and to communicate with providers at the ECC employing the secure messaging capability. This technology has replaced traditional consult mechanisms at this location for ocular specialty consults.

NETCCN Initiative Progresses to Phase 2 & Engage to Support Delta Variant Surge

The current rise in COVID-19 cases due to the COVID-19 Delta variant have resulted in numerous requests for virtual care support using the National Emergency TeleCritical Care Network or NETCCN system. The NETCCN project is now in its second phase, which includes providing on demand support for locations in need, while continuing to refine and advance the NETCCN systems core capabilities.

There are 3 performer teams providing NETCCN applications to sites in need, and an additional performer providing operational support services. As of mid-September, the performer teams were engaged in providing direct support to hospitals in Florida, Idaho, Minnesota, Missouri, Texas, and Washington. In mid-September, NETCCN was caring for 84 patients in a single day.

At the time of this writing, NETCCN is live and helping providers and communities in the following sites:

- Palm Beach Fire and Rescue, Palm Beach, Florida
- Clearwater Valley Health, Orofino, Idaho
- St. Mary's Health, Cottonwood, Idaho
- Alomere Health, Alexandria, Minnesota
- Carris Health, Willmar, Minnesota
- Coryell County Memorial Hospital, Gatesville, Texas
- Dimmit Regional Hospital, Carrizo Springs, Texas
- Rolling Plains Memorial Hospital, Sweetwater, Texas
- Sabine County Hospital, Hemphill, Texas
- Ward Memorial Hospital, Monahans, Texas
- Jefferson Healthcare, Port Townsend, Washington
- Newport Hospital, Newport, Washington
- Tri-State Memorial Hospital, Clarksville, Washington
- Whidbey Health, Coupeville, Washington

For more information on the NETCCN initiative, or how to get involved, please visit: www.tatrc.org/netccn.

Project Crimson Soars at MSSPIX '21 Event

TATRC's MedRAS division collaborated with Near Earth Autonomy to integrate its cutting edge Peregrine Autonomy System with the L3Harris FVR-90 UAS aircraft at MSSPIX '21.

It's bird! It's a plane! No, it's Project Crimson! While not truly a superhero, this TATRC-sponsored SBIR effort sure showed some hero-level capabilities in its first official live prototype assessment at the Maneuver Support, Sustainment, and Protection Integration eXperiments 2021 (MSSPIX '21) at Ft. Pickett, VA this past fall. MSSPIX is a collaboration between the Maneuver Support Center of Excellence and the Sustainment Center of Excellence and one of the Army's live prototype assessments, part of the Army's Campaign of Learning. MSSPIX '21 provided a valuable learning venue to better understand military problems and potential solutions through experimentation in a Multi-Domain Operations relevant environment in support of Army Modernization.

The goal of Project Crimson is to develop an autonomous unmanned aerial system (UAS) system for "Just-in-Time" delivery of blood products and other critical medical supplies to remote, contested battlefield environments to support prehospital casualty care. To meet the outlined project goals, TATRC's Medical Robotics and Autonomous Systems (MedRAS) division collaborated with Near Earth Autonomy to integrate its cutting edge Peregrine Autonomy System with the L3Harris FVR-90 UAS aircraft.

Move over, Amazon! Altogether, this combined platform supports the delivery of up to 8 units of temperature-controlled whole blood, or 20 pounds of cargo, at distances up to 400 kilometers away. The FVR-90 aircraft is unique hybrid Vertical Takeoff and Landing UAS. This means that it can take off in a similar fashion to a helicopter, without the need for forward infrastructure (e.g. a runway or mechanical launch and recovery system), but still travel at the high speeds and far distances of a traditional winged aircraft. This allows the aircraft the flexibility to deliver cargo to unprepared landing zones in austere environments, a key differentiator compared to other long-range delivery methods. The aircraft navigates autonomously to delivery zones specified by the field user through route planning and GPS navigation. Upon arrival, the system scans the landing area via LIDAR to identify any potential ground obstacles and then autonomously lands in an ideal, safe location. Alternatively, depending on operational requirements, the aircraft can release its cargo pods while in the air, either during hover at low altitudes or during forward flight using a parachute drop mechanism. During the MSSPIX event, each of these delivery modes were successfully demonstrated across three remote and unprepared delivery zones with varying obstacles and terrain.

MedRAS Division Chief, Nathan Fisher and Biomedical Engineer, Zack Buono led the Project Crimson involvement in MSSPIX '21 on the government side, in partnership with the technology performers, Near Earth Autonomy and L3Harris. This event allowed soldiers to interact with the system first-hand in an operationally relevant environment to provide valuable feedback to the technology developers. Nate and Zack have been guiding the technology development of this system in coordination with stakeholders from across the operational community. "Throughout the development of this project, we have had strong support from the operational community and

Project Crimson
continued to page 9

Project Crimson *continued from page 8*

From left to right: Mr. Nate Fisher, MedRAS Division Chief, Mr. Zack Buono, MedRAS Biomedical Engineer, and Mr. Don Choate, long time TATRC partner, in attendance at the MMSPIX '21 event.

Final systems check before Project CRIMSON takes flight at MSSPIX '21.

capability developers, which ultimately led to the success we achieved at the MSSPIX event. All involved are eager to see this technology in the field because of its potential to contribute to future missions and save lives", stated Mr. Fisher.

The event was well attended by project stakeholders from key groups such as the U.S. Army Special Operations Command, U.S. Army Institute for Surgical Research, Marine Corp Warfighter Lab, Medical Capability Development and Integration Directorate, the Joint AI Center, and others. Attendees conveyed a high-level of support of the project's capabilities with interest in supporting future technology maturation and transition. The Project Crimson team is currently planning the next phase of technology maturation with a planned test and evaluation event in 2022.

For more information on Project Crimson, please contact Mr. Nate Fisher at: nathan.t.fisher3.civ@mail.mil.

AMTI
ADVANCED MEDICAL TECHNOLOGY INITIATIVE

PROJECT SPOTLIGHT

Covid-19 Airway Management Isolation Chamber (CAMIC)

COVID-19 has drastically changed the world. Its airborne spread and prolonged, silent transmission have wreaked havoc on an unprepared enterprise - the military was no exception. During the early phases of the outbreak, hospitals struggled to increase personal protective equipment (PPE), and frequent exposures decreased the number of available healthcare workers. This threat remains as novel variants cycle through populations.

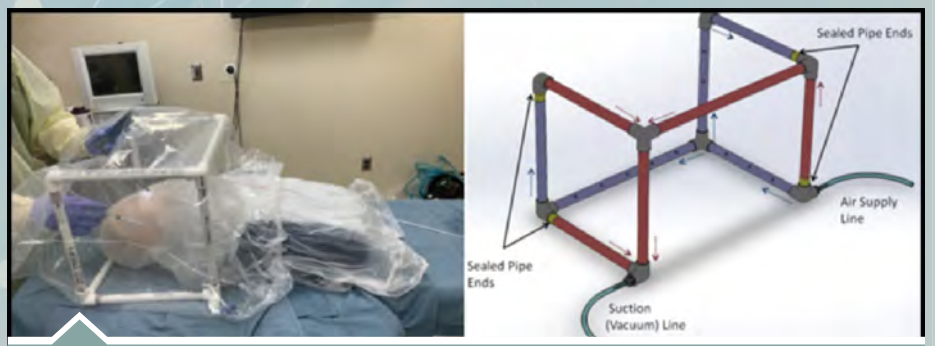


Figure 1: Original CAMIC Design - From EUA Documentation showing CAMIC prototype (left) and CAMIC Design Schematic (Right)

Physicians that work close to patients' airways are particularly vulnerable. At the start of the pandemic, PPE was hard to come by and had to be rationed and reused. Well established airway algorithms were abandoned and instead early intubation and mechanical ventilation was initially advocated to treat COVID patients. This created an artificial demand for ventilators as high flow oxygen, nebulizers and positive pressure (CPAP/BiPAP) were often skipped. Innovation was abundant in hospitals around the world to find solutions to many of these problems.

During the first few weeks of the pandemic, a group of Army physicians developed a novel device to help protect healthcare workers and act as an adjunct to reduce the spread of the virus. LTC Steven Hong, an Otolaryngologist at Walter Reed National Military Medical Center (WRNMMC), had envisioned a barrier device to potentially protect clinicians as they perform intubations. He shared this idea with several colleagues, and thus the COVID-19 Airway Management Isolation Chamber (CAMIC) was born. Working collaboratively together with LTC Douglas Ruhl, an Otolaryngologist at Madigan Army Medical Center; MAJ Paul Wistermayer, an Otolaryngology resident at Madigan Army Medical Center; MAJ Charles Riley, an Otolaryngologist at Fort Belvoir Community Hospital; CPT Timothy Blood and CPT Jonathan "Nate" Perkins, both Otolaryngology residents at WRNMMC; 2LT Joseph Krivda, a medical student at the Uniformed Services University; and Mr. Nathan Fisher, the Chief of the Medical Robotics and Autonomous Systems Division at TATRC CAMIC became a reality.

"It all started when LTC Hong called us. After brainstorming about this intubation barrier, we realized this idea could address several problems we faced while treating COVID patients", said LTC Ruhl. They ultimately created CAMIC. It was a barrier device made of PVC pipe that attached to filtered suction and medical oxygen. The CAMIC contains air from around a patient's head and actively removes particles – analogous to a small, portable negative pressure environment. "Since the CAMIC contains infective particles during airway treatments,

***CAMIC** continued to page 11*

CAMIC *continued from page 10*

Figure 2. CAMIC used in operating room to assist with intubation at the Combat Support Hospital, Iraq (August 2020). Photograph courtesy of MAJ Del Slonaker.

Figure 3. FEES CAMIC design variant that allowed an endoscopist and speech therapist to safely perform a swallow study. Pictured MAJ Paul Wistermayer; Photo courtesy of LTC Douglas Ruhl.

like high-flow oxygen, a nebulizer, or a CPAP, it will hopefully decrease the need for ventilators by allowing physicians to return to more normal airway protocols", said Ruhl.

The team of Army Physicians worked tirelessly – they created scientific protocols, made makeshift labs in their clinics and tested numerous prototypes. They slept in the hospital many nights and used virtual meetings to coordinate their efforts across the nation. They worked with several DoD organizations to obtain patents for the Army and to obtain FDA Emergency Use Authorization for their device in record time. "From identification of a dire problem, to a tested solution and product to bring forward to the FDA for clearance and two provisional patents along the way in less than 3 weeks' time is unprecedented," said Hong.

The AMTI funding from TATRC allowed this team of innovators to obtain particle detectors to facilitate their testing and 3D print various components to prototype. This coordinated development aligns perfectly with the core pillars of the AMTI Program: the CAMIC is a cost-effective device that is easily accessible to anyone; it has been tested and approved by the FDA and allows clinicians to safely perform their duty; and the device decreases the spread of disease which increases

CAMIC *continued to page 12*

CAMIC *continued from page 11*

Figure 4. Design iteration demonstrating successful use of the CAMIC during otologic (cholesteatoma) surgery (Left) and lateral skull base (middle cranial fossa with repair of cerebrospinal fluid leak) surgery (Right). This device was attached to the operating microscope to facilitate the surgery. Pictured LTC Douglas Ruhl; Photos Courtesy of CPT Scott Walton.

Figure 6. Clinical testing mockup of the collapsible operational CAMIC. Photos courtesy of Nate Fisher.

readiness. Scientific results were published in several medical journals. USAMRDC secured two domestic and one international patent for novel components on the CAMIC. The Army licensed the device to a civilian medical product company, PrepTech LLC, who manufactured the CAMIC for distribution across the country. The freely available assembly instructions, published effective, safety research, FDA backing, and optional commercial product, positively impacted the Military and Civilian healthcare systems.

Designs for the CAMIC were sent to clinicians in austere environments in USAFRICOM and devices were sent to Combat Support Hospitals in Iraq and Afghanistan. "The thing that really told us the significance of our project was hearing direct feedback from people that were deployed, that CAMIC was being used out in theater," said Hong.

The CAMIC can also contain particles from infected patients as they move around the hospital or are in close quarters from others to minimize spread of disease. This may be of use on aircraft carriers to prevent outbreaks. Therefore, the next steps of our project aim to create a smaller, more portable device. Prototypes have been built and are being tested at TATRC and USAMMDA. Other clinical variations of the device have been used to safely perform surgeries such as tracheostomies, skull base surgery and airway procedures.

Figure 5. Use of the CAMIC during tracheostomy surgery. Pictured LTC Steven Hong; Photo Courtesy of CPT Nathan Perkins.

The CAMIC's development team was recognized and received the Federal Laboratory Consortium's "Excellence in Technology Transfer Award" – a competition among all federal laboratories. LTC Ruhl noted, "Overall, this was a stressful project that yielded remarkable results. It was incredible to have so many military organizations working in tandem for a common purpose. That allowed us to accomplish many things in a short amount of time and hopefully help others during this demanding health crisis."

For more information on the AMTI Program, please reach out to AMTI Program Manager, Ms. Holly Pavliscsak at: holly.h.pavliscsak.ctr@mail.mil.

What I Have Learned From AMTI:

A Perspective from AMTI Recipient COL (Ret) Don Goss, DPT, PhD

Many, many thanks to the TATRC leadership for championing the AMTI program! Initially managed by Mr. John Winston, and now Ms. Holly Pavliscsak, this program has had a remarkable impact on the Baylor University-Keller Army Community Hospital Division 1 Sports Physical Therapy Fellowship at West Point, NY, and has taught our team, and me personally, very much over the last 7+ years. First, I would like to highlight the program's capabilities and then discuss specific research lessons learned. Over the past 7+ years, we have added research athletic trainers, physical therapists, research assistants, and research coordinators to our team. We have purchased computers, wearable device sensors, cameras, and various office supplies. We have 5 completed studies and 3 ongoing that would not have been possible without the resources provided by the AMTI program. I would like to sincerely thank LTC (Ret) Shane Koppenhaver, PT, PhD, and Irene Davis, PT, PhD for their encouragement and mentorship as we prepared that first AMTI grant proposal in 2012/2013. Without their assistance, none of this would have been possible.

With our first AMTI award, we intended to compare real time biofeedback for gait retraining (changing running form from a rearfoot strike pattern to a forefoot strike). The challenge at West Point was that Cadets must run in uniform and are not permitted to run with a phone or iPod. MAJ Jamie Morris observed poor compliance with the feedback devices, but after putting runners in partial minimalist footwear (Nike Free flyknit 3.0), we learned that rearfoot strikers are at 6 times greater risk of developing knee pain over a 12 month follow up when they remain using a rearfoot strike in these shoes with minimal cushioning (Morris et al., 2018).

Next, we tested a sock with sensors sewn in the metatarsal heads and heel. The sock was designed to give feedback to runners. Lt Col Dan Watson observed 18 - 19 previously injured runners transitioned from rearfoot strike to forefoot strike with the coaching provided from the Sensoria software application. They remained injury free at their six month follow up. Lt Col Watson won a technology award and a best poster award at the 2018 American Physical Therapy Association's Combined Sections Meeting. After that meeting, MAJ Brian Stoltenberg published a validity of the Sensoria Smart Sock and Milestone pod paper (Stoltenberg et al., 2019; Goss et al., 2020).

MAJ John Mason was the recipient of his first AMTI award in 2016 to study blood flow restriction training and its ability to prevent atrophy following knee surgery. The funding brought a new capability to the USMA PT clinics that helped many Cadets and other DoD beneficiaries, as well as demonstrating the effectiveness with the study (Mason et al., 2021).

LTC Darren Hearn and our team received an AMTI award in 2018 to evaluate force and pressure sensing insoles combined with motion capture during a drop landing task in new Cadets during their first week at West Point. This grant supported his PhD dissertation and we confirmed that asymmetries led to increased injury risk.

Dr. Erin Miller's Gait Retraining Enhances Athletes' Technique funding supported her dissertation and even with COVID limitations slowing research progress, we collected enough data to observe significant asymmetries in running biomechanics after ACL reconstruction which will assist us in rehabilitation after these surgeries. Her dissertation defense was an especially proud moment for our team in late 2020 as Erin was our first hire with AMTI funding in 2014. She has provided outstanding work for this team for over 7 years and continues to add her skills and talents to our team today. Without this AMTI funding, none of the work above would have been possible.

Overall, we have learned that gait retraining is appropriate for previously injured runners. We do not try to change the way everyone runs, but if runners are sustaining injuries and having issues, we know how to help them. We have learned it is not as much about the shoes as it is how you run. Continuing to use a rearfoot strike pattern in minimalist shoes is not a good idea. Blood flow restriction is a useful tool post operatively to prevent atrophy. Finally, there are gait asymmetries that exist post-surgery that need to be addressed.

Once again, I am so thankful for this program which has taught us so much and has shaped the way we work with hundreds and thousands of active-duty Service Members. Our 15 fellowship graduates from 2015-2019 have spread the lessons learned to 13 locations across the DoD to serve as mentors to the younger PT Officers and other health care professionals in the Holistic Health and Fitness initiative. I have also shared our lessons learned with the 91 PT staff that I supervised at Womack Army Medical Center, Fort Bragg, NC in 2019-2020. We use many of these principles and lessons learned in our running class at Fort Bragg helping previously injured Soldiers to run injury free (SOMA presentation, 2021).

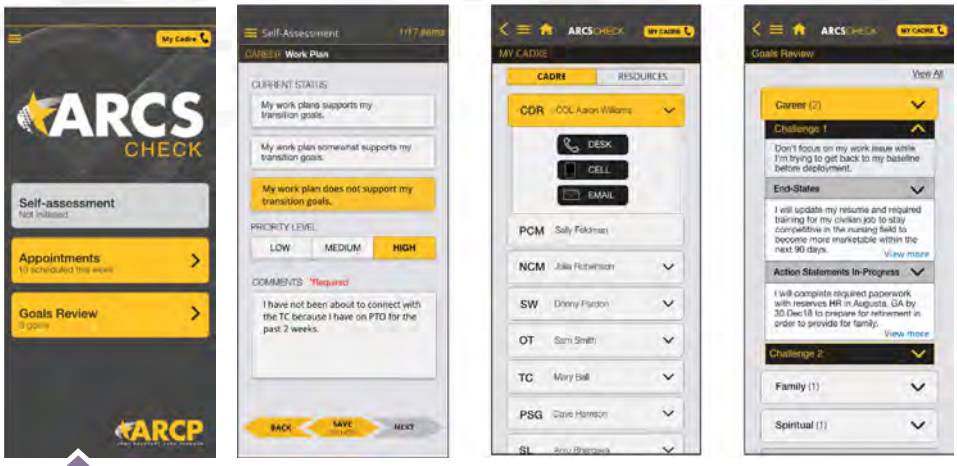
None of this would have been possible without AMTI!

Thank you, thank you, and thank you!

COL (Ret) Don Goss

DHIC Utilizes MHCE to Assist Soldier's with Comprehensive Recovery Plans

The U.S. Army Medical Command's (MEDCOM) Army Recovery Care Program (ARCP), is the program where the Army's Wounded, Ill and Injured (WII) Soldiers go to heal and transition. Currently, the ARCP includes 14 discrete Soldier Recovery Units (SRU). These units replaced the Warrior Transition Units (WTUs) and focus on supporting complex case management and remote medical management of Reserve and National Guard Service Members who are healing at home while they go through the process of reaching a medical retention determination point.



Some example screenshots from the ARCS Check mobile App.

As part of the process of recovering in the ARCP, Soldiers complete what is known as the Comprehensive Recovery Plan (CRP). It is a plan of action that focuses on the Soldier's priorities by developing focused goals and it is meant to empower them to be active members of their transition.

The goal of this project is to expand access to the CRP self- assessment through a secure interface on the Soldier's personal mobile device. To achieve this goal, DHIC leverages the existing, Mobile Health Care Environment (MHCE) system, established by TATRC. As a government system, MHCE maintains all proper government information technology credentials, including, but not limited to, multi-factor authentication, an Authority to Operate and Privacy Impact Statement.

DHIC began its long-standing relationship utilizing the MHCE with the Warrior in Transition command in 2009, with the deployment of the mCare application at five Community Based Warrior Transition Units to conduct a nine month randomized controlled trial at these sites. mCare is the secure, mobile application arm of TATRC's own MHCE. The success from the previous efforts lead to a trajectory where the CRP interfaces with Soldiers on their own mobile devices.

An MOU was signed in August 2018 between TATRC and the WTC that launched this ARCP CRP project. Currently, the MHCE system / mCare app exchanges data with the ARCP system through this Representational State Transfer Application Programming Interface (REST API). The REST API based data exchange makes the current CRP self-assessment data accessible to the Soldier, who can then edit and update information back to the ARCP system through the mCare app.

The ARCS Check app was developed and nested within the existing mCare application to provide the user interface most closely resembling the desktop interface of the CRP. This allows the app to leverage the mCare / MHCE technology and security features. Lastly, the MHCE provider portal will be used to create user accounts, but user data, including CRP responses, cannot be stored or accessed from that portal to help ensure a Soldier's data privacy and integrity.

The CRP is a dynamic plan of action focused on the Soldier's priorities to comply with their medical and military responsibilities. As part of the ARCP, it supports Soldiers through their medical recovery and potential transition from the military and is a key element of such. Currently, the app is undergoing alpha testing internally with our stake holders, but the goal includes initiating a proof of concept effort in 1-3 SRUs. This effort will inform the decision to expand other elements of the CRP into this mobile application, and will determine if in fact this app increases access and improves self-assessment completion rates. This project is funded by the core Program Objective Memorandum funding for the MHCE system.

Mr. Michael H. Mobley, CIO, Chief, Infrastructure Support Division MEDCOM, ARCP stated, "I definitely look at our collaboration over the past few years and think it will benefit our population and I can see the possibility for further expansion of our capabilities and how it will positively affect readiness."

For more information on the FOXTROT initiative, please contact Ms. Jeanette Little at: jeanette.r.little.civ@mail.mil.

Science Director's Corner:
"Turning Data to Better, Faster Decisions"

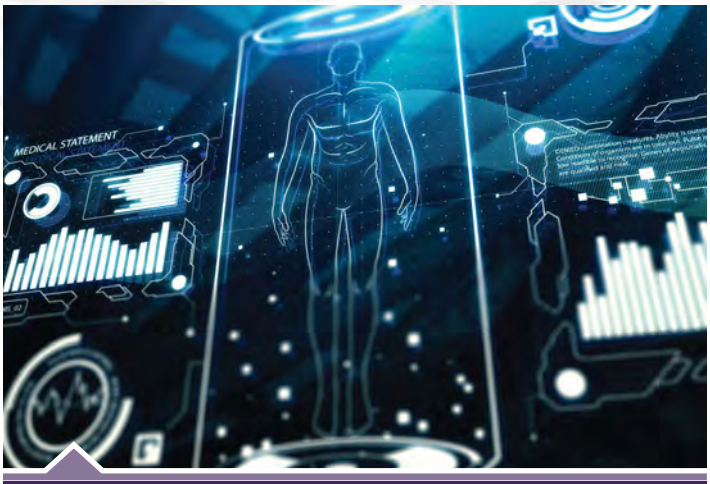
Mr. Matt Quinn,
Science Director, TATRC

Data, and data collection, is an essential component to TATRC's mission of fusing data, humans and machines into solutions that optimize Warfighter performance and casualty care. TATRC's work to combat COVID has helped accelerate progress in building and using digital health tools to collect data and in building the ecosystem and data commons to turn that data into decisions both for operational use, as well as to fuel research and development of artificial intelligence (AI).

A principal challenge of studying and improving casualty care, whether on battlefields, during emergencies, or in disasters like COVID, has been collecting the data, especially in sufficient quantity and quality. A combat medic's top priority is caring for his or her patient in that moment, and not necessarily focusing on documentation. The same can be said about a nurse or EMS worker during a wicked COVID surge.

So if data is our currency, how do we ensure that we're capturing it at the point of need? There are a variety of answers to this question and TATRC has an array of projects that help us better understand what works and what does not. For example, use of digital health tools like those used by TATRC's National Emergency Tele-Critical Care Network (NETCCN) teams automatically capture many important aspects of care delivery as a result of their use. There is no need for a frontline care-giver to record that they conducted a real-time video consultation with a virtual clinician when the NETCCN system is used for that video consultation and collects that data automatically. Another example is the use of pattern recognition. Computers – with the proper training – are good at identifying patterns and can provide great insight – with precious little input from a combat medic – to gather and capture information about a casualty or their treatment.

The next critical step is translating 'data to decisions' – by humans, by machines (technology) or human-technology teams. Indeed, data on its own is not valuable in helping clinicians and leaders at echelon make better, faster decisions. TATRC's NETCCN teams and the TATRC Operations Cell work together to provide situational awareness of the National Emergency Tele-Critical Care Network through a consolidated NETCCN Operations Portal. As NETCCN has scaled from supporting a handful of hospitals to - on some days – nearly twenty across the nation, manual management of the initiation of missions, progress, determination of continued need, and capacity of the teams is simply not something that could or should be done manually. The NETCCN digital health tools themselves, and more importantly the collaboration of the NETCCN teams, incorporation of a Cross-Platform Application Module (to harmonize data, provide cross-NETCCN platform views, and other critical functions for scaling and situational awareness), and a NETCCN Operations team, are all necessary to enable effective decision making by NETCCN clinicians and leaders at all levels.



TATRC's work to combat COVID has helped accelerate progress in building and using digital health tools to collect data and in building the ecosystem and data commons to turn that data into decisions both for operational use, as well as to fuel research and development of AI.

Finally, how do we bring this data together for researchers and data scientists to identify insights and build AI tools? In the past weeks, the Johns Hopkins University Applied Physics Lab has demonstrated a prototype Warfighter data commons (WFHDC). Under a protocol approved by the U.S. Army Medical Research and Development Command's Institutional Review Board, this data commons is receiving data from multiple NETCCN teams to enable these capabilities. The key, though, is that this platform supports secure access to curated data and the appropriate tools for a wide variety of researchers and data scientists to do their work. We're excited to share more about the WFHDC as this effort progresses!

For more information on NETCCN, the WFHDC effort, or to review the latest Press Releases on this initiative, please visit www.tatrc.org/netccn.

EMPLOYEE SPOTLIGHT

TATRC Welcomes 'Mover & Shaker' from OTSG as New Deputy!

LTC Sharon L. Rosser has joined TATRC as our newest Deputy Director! LTC Rosser hails from Colton, South Dakota. She began her career, over 30 years ago, in the South Dakota National Guard between her junior and senior year of high school as a Combat Medic. After returning home from Advanced Individual Training at Fort Sam Houston, she was anxious to get life started and went to see the recruiter to join Active Duty. Based on needs of the Army, she was reclassified to a Hospital Food Service Specialist and served at Joint Base Lewis-McChord and Fort Sam Houston. After 4 years, she attended Respiratory Therapy school and served at Brooke Army Medical Center for another 4 years until being accepted in the Interservice Physician Assistant Program (IPAP).

Upon graduating IPAP in May 2001, Sharon was commissioned as a Second Lieutenant. She earned a Doctor of Science in Physician Assistant Studies with a focus in Emergency Medicine from Baylor University in 2007, a Master of PA Studies and a Bachelor of Science degree from University of Nebraska (Go Huskers) in 2004 and 2001 respectively. From 2012 to 2013, LTC Rosser completed a one-year fellowship in Emergency Medicine / Critical Care Point of Care Ultrasound at Brooke Army Medical Center.

LTC Rosser is an active advocate for the PA Profession, currently serving as the President for the Society of Army Physician Assistants. She also enjoys spreading knowledge through presentations. LTC Rosser has lectured extensively on the use of point of care ultrasound for multiple audiences to include austere environment care, emergency medicine care, and primary care. She is a subject matter expert in Emergency Medicine education for PAs.

Her assignments include deployments to Kosovo, Iraq and Afghanistan, and past positions include Battalion / Brigade PA, Emergency Medicine PA (EMPA), EMPA Residency Director, and Primary Emergency Medicine and Ultrasound Faculty, IPAP. LTC Rosser has also served as the Executive Officer and Director of Hospital Based Programs for the Medical Center of Excellence (MEDCoE) Graduate School and Graduate Education Manager for Post-Graduate Training of PAs. LTC Rosser comes to TATRC from the Office of The Surgeon General where she served as the Director of Comprehensive Pain Management from August 2017 to May 2019 and as the Secretary of the General Staff from May 2019 until July 2021.

Some of LTC Rosser's awards and decorations include Legion of Merit, Bronze Star Medal (1 OLC), Meritorious Service Medal (2 OLC), Army Commendation Medal (6 OLC), Army Achievement Medal (13 OLC), the Combat Medical Badge, Expert Field Medical Badge and Army Staff Identification Badge. Her skill identifiers are Instructor (5K), Strategist (6Z), and Emergency Medicine Physician Assistant (M2). She is a member of the Order of Military Medical Merit and an Iron Major recipient.

LTC Sharon L. Rosser,
TATRC Deputy Director

Sharon has been married to her very supportive husband, Michael (Mike) for 28 years and they share two adult daughters Jasmyn Rosser and Taylor (Christian) Graham, one granddaughter, Blakely, and two

LTC Rosser
continued to page 17

LTC Rosser
continued from page 16

large dogs Tucker (King Shepherd) and Ranger (German Shepherd). Although LTC Rosser and her husband didn't pick the two large dogs, they wouldn't give them away either (though, she said she would love to give their hair away). Both daughters "gifted" them the lovable beasts by bringing them home after moving out.

LTC Rosser loves riding motorcycles. She spent 26 years riding on the back of Mike's bike, but she is the proud owner and rider of her own Harley Davidson since Fall 2019. LTC Rosser and her husband spent their 25th anniversary riding through Germany, Italy, Croatia and Slovenia!

As a South Dakota girl, LTC Rosser doesn't have a home state NFL team to cheer on and she can't choose between her two favorites (The Chiefs and The Packers) so she has been known to wear both jerseys on the same day! She also has family who are Vikings fans but you won't find her in a Vikings jersey!

Sharon joined Orange Theory Fitness in 2017 when Mike was stationed overseas as a DA Civilian. Upon his return, she took him to watch one of her classes thinking he would never join – he signed up on the spot and they have been attending the 5am class together since November 2018.

She loves hiking with Tucker and Ranger and she is learning to love kayaking.

TATRC is excited to welcome such a spirited and high energy leader to the Command team!

TATRC's Science Cell Expands its Expertise with New Human Factors Engineer!

Benjamin Knisely, Ph.D., joins TATRC's Science Cell as a Human Factors Engineer. He serves as a contractor supporting Mr. Matt Quinn, and the rest of the Science Cell. In this role, Dr. Knisely will work to provide human factors guidance on various projects across programs and to identify broader trends regarding human performance and military healthcare systems design.

Dr. Knisely recently graduated from the University of Maryland with a Ph.D. in mechanical engineering, focusing on human factors and design methodology. For his dissertation, he developed a methodology to promote accessible product design for specialized end-user populations, leveraging a diverse array of tools including machine learning, mathematical optimization, and structured knowledge elicitation techniques. While implications for the work are broad, Dr. Knisely's primary application of interest was patient-facing medical devices. He is eager and looking forward to seeing how his experience might overlap and inform his work here at TATRC.

Prior to working on his Ph.D., Ben worked for the U.S. Department of Labor – Mine Safety and Health Administration as a technical support engineer. Here, Ben performed underground investigative mine ventilation surveys across the country to evaluate compliance with federal safety and health regulations. Additionally, he aided in responding to mine emergencies, performing onsite monitoring and analysis of mine atmospheres. Ben also has a B.S. degree in mechanical engineering from the Pennsylvania State University.

Dr. Knisely was born and raised in Harrisburg, PA and currently lives in Rockville, MD with his fiancée Julie. They will be married in July 2022. In his free time, Ben likes to stay active by lifting weights and running. He also really enjoys cooking, a hobby he picked up as a line cook during his undergraduate studies.

Benjamin Knisely, Ph.D., Human Factors Engineer

The TATRC Family is thrilled to have this wonderful and unique asset join the team!

EMPLOYEE SPOTLIGHT

Congratulations to TATRC's Newest Employee of the Quarter, Ms. Tiffany Williamson!

Ms. Tiffany Williamson, the Administrative Assistant and "glue" for our Digital Health Innovation Center (DHIC) at Fort Gordon, GA is TATRC's newest Employee of the Quarter for the 4th Quarter FY21. Tiffany was selected due to her stellar and extraordinary contributions to the organization.

For this past quarter, she served as the sole government purchase card holder for the entire organization, at a time when end of year spending was at its critical peak. This shortfall and gap between having a government credit card holder at Fort Detrick placed a great deal of additional stress on Tiffany during this time frame. However, she rose to the occasion, and absorbed all of the additional workload, while managing her other duties in a fashion that demonstrated her commitment to the organization's mission at all times. In short, Tiffany kept the organization functioning seamlessly when it came to necessary and critical end of year spending outside of service contracts.

Tiffany is an incredibility proactive employee, who is always the first to meet every deadline, whether its completing required training, helping the DHIC team, or stepping in to assist her fellow admins, she never drops any of her responsibilities, regardless of how tedious or mundane they may be.

Furthermore, she is masterful at juggling the cross coordination between the Fort Detrick office and numerous activities at Fort Gordon to ensure that we meet and exceed all standards for running a successful satellite office for our headquarters. Those duties range from housekeeping, maintenance, and schedule coordination for shared spaces with sister agencies like the Department of Clinical Investigations and the Information Management Division at Dwight David Eisenhower Army Medical Center.

Ms. Tiffany Williamson, Administrative Assistant Digital Health Innovation Center (DHIC)

She also ensures that every contractor on her team is kept up and running by scheduling appointments to replace CAC cards when they are due to expire, and is highly organized in all of your work endeavors.

She is a wonderful example of dedication on a daily basis and we are excited to congratulate her on this well-deserved award!

TATRC's MMSIV Division Gains Long-Awaited PO!

Anne was born in Lansing, Michigan and grew up in the suburbs west of Philadelphia. She attended Villanova University where she received a BA in psychology. At George Washington University in D.C., she earned her Master's degree in Education and Human Development majoring in Counseling, especially within schools. For five years, she worked as a School Counselor, leading small and individual counseling sessions as well as teaching classroom guidance lessons. Anne led the elementary counselors in the development of a county-wide curriculum for the in-class lessons.

For the next 15 or so years, Anne raised three sons and became very involved with their lives through her many hours volunteering and involvement with the elementary school PTA and by acting as the Team Parent for their travel ice hockey teams. Going back to school, Anne became a National Certified Medical Assistant and worked at a local pediatrician's office. She also taught at Frederick Community College as an Adjunct Professor, successfully bringing 4 new cohorts of medical assistants to the local medical community. Most recently, Anne worked for the Frederick Health Department. When the pandemic hit in March 2020, Anne helped lead a team to sort and deliver PPE to local nursing homes, assisted living centers and doctor's offices, as well as to FCPS in anticipation of children returning to school. She also worked with the first pop-up testing sites and helped run the first two vaccine clinic sites in the County.

As part of the MMSIV team, Anne diligently works as a Project Officer and Research Assistant. Anne can be found behind the scenes supporting her division director, MAJ Patricia Schmidt, and keeping fellow team members on track with research projects. She also helps prepare some of the technology used by the medics in the NEXUS lab, as well as preparing various documents needed for VIP visits and the individual projects within the division.

In her spare time, Anne enjoys reading (particularly biographies and historical fiction), crocheting (which she learned sitting on the cold bleachers of Skate Frederick while her boys had ice hockey practice—GO CAPS!), Sudoku, and visiting with her sons over home-cooked meals.

Ms. Anne Gallo, Project Officer Medical Modeling, Simulation, Informatics and Visualization (MMSIV)

A warm welcome to Anne from the team here at TATRC!

Congratulations & Happy Retirement, Mr. Dempsey!

After 15 years of outstanding and meticulous accounting, our 'Budget Brain' and all-around Resource Management Maestro, Mr. Greg Dempsey, TATRC's Chief Financial Officer, has officially retired! Throughout his tenure, Greg has been a devoted, beloved, and invaluable member of the TATRC family. It is bittersweet to see him go, but he has trained his crew well and has been critical in the search for his replacement candidate, so we know we'll be in good hands!

COL Jeremy C. Pamplin (left) presented numerous awards and certificates to Mr. Greg Dempsey (right) for his 15 years of outstanding service with TATRC.

Inspite of COVID-19 restrictions, the TATRC family was in attendance physically and virtually to congratulate Mr. Dempsey on his well-deserved retirement.

As they say, 'the days move slow, but the years move fast.' Joining TATRC in 2006 after a distinguished 27 year career as an Army Comptroller, Greg has had a front row seat to watch the organization grow as leadership changes, mission shifts, and Command directives took a group that once existed solely to manage Congressional Special Interest funds and turned it into USAMRDC's newest Command and a standalone research and prototyping lab for medical robotics, simulation, virtual health, and much more! What once seemed like a slow shift over many years, for Greg now seems, as he puts it, "a pretty amazing transformation, made possible by dedicated, hardworking people driving forward as a team."

In order to give him a proper, well deserved TATRC send-off, and to thank him for his loyal and stellar performance, the Team held a farewell & retirement reception in his honor. Reflecting on his time here, Greg said, "It's not about the job so much as it's about the people, and our people are, and have always been, amazing."

Greg wasted no time embracing retirement! He jet-setted off to Notre Dame's Warren Golf Course the morning after his last day. When considering the years to come, he's optimistic and eager to get more time closer to the places and people he loves.

"Those that know me know I'm a huge sports fan, namely a Notre Dame sports fan. We've looked forward to moving closer to family and closer to Notre Dame. We get to be more involved and it's the best of both worlds."

Our sincerest thanks for your loyal friendship and dedicated support over the years, Greg, and congratulations on a well-deserved retirement! You will be dearly missed by all of us, but we wish you all the best in retirement!

Magnificent Miller Moves onto New "Med-Sim" Opportunity!

Farewells are always bittersweet. Especially when they involve someone as innovative and inspiring as our resident "SimMan" and MMSIV Division Chief, Mr. Geoff Miller. After six years with us, Geoff officially hung up his TATRC hat and headed down the road to fulfill a brand new role as the Director of the Johns Hopkins University Medicine Simulation Center! A truly outstanding opportunity for him, and we are thrilled to see what incredible things he comes up with next in the simulation world!

Mr. Quinn, TATRC's Science Director (left), stated, "Geoff's legacy is embedded everywhere you look here at TATRC."

A highly respected TATRC team member since August 2015, Geoff has proven to be an invaluable asset whose extraordinary vision and pioneering spirit established our NEXUS lab, and skyrocketed TATRC into the sights of MRDC HQ, Army Futures Command, and beyond. Geoff's unique ideas helped to transform our outdoor field environment and served as the driving force in how we showcase our medical simulation scenarios today.

To send him off and show our gratitude for all he's done, the team came together for an in-person farewell reception where various staff members shared stories and words of appreciation, including our Deputy Director, LTC Sharon Rosser, our Chief of Staff, Ms. Cheryl Merritt, our Science Director, Mr. Matt Quinn, our Senior Enlisted Advisor, SSG Andrew Smith, as well as a special appearance from USAMRDC Operations, SGM Mario Wible, who presented Geoff with the USAMRDC Commander's Coin.

All thumbs up from USAMRDC Medics & TATRC's MMSIV Division as they wish Mr. Geoff Miller the best of luck in his newest endeavors at JHU.

While it's hard for us to "LEGO®," (those of you who know Geoff know that his LEGO® obsession knows no bounds) we know that Geoff will continue to innovate and expand horizons in the world of medical simulation. As Mr. Quinn stated, "Geoff's legacy is embedded everywhere you look here at TATRC," and we look forward to honoring that legacy by continuing on with the same spirit and passion as Geoff shared with all of us!

Team TATRC wishes you the best of luck in your new role at JHU!

***With Geoff's departure, MAJ Patty Schmidt is serving as the Acting Division Chief for MMSIV and can be reached at: patricia.m.schmidt10.mil@mail.mil.*

TATRC

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