Aeromedical Research and COVID-19

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Recently, all research where I'm employed at the FAA Civil Aerospace Medical Institute, Aeromedical Research Division, was redirected to focus on how to safely return to flying during the COVID-19 pandemic. We were not alone in doing this. To name a few, the International Air Transport Association,[4] the International Civilian Aviation Organization,[5] the National Aeronautics and Space Administration,[6] the airline industry,[1] the Centers for Disease Control,[2] the European Union Aviation Safety Agency,[3] the European Centre for Disease Prevention and Control,[3] the World Health Organization,[7] and universities all over the world have similarly refocused their research efforts to either directly fighting the virus, operating during the pandemic, or to the recovery of the aviation industry post-pandemic. In August, NASA hosted an online workshop of government, industry, and academia representatives to discuss droplet cabin airflow modeling and COVID. In this time of little good news, this reflects well on the ability of medicine and aerospace medicine, in particular, to collectively respond to a global crisis. The public is starving for information to help them make decisions concerning if and when they can safely travel by air again. Now that the collaboration of our aerospace medical, public health, and clinical research institutions have been focused on the problem, I'm hopeful it will be sooner, rather than later, that we can deliver some encouraging news.

THE 711th HUMAN PERFORMANCE WING

Many thanks go to the U.S. Air Force 711th Human Performance Wing, another outstanding aeromedical research laboratory, for their excellent submission to this month's President's Page.

The 711th Human Performance Wing is a unit of the Air Force Research Laboratory (AFRL) within the Air Force Materiel Command headquartered at Wright-Patterson Air Force Base (WPAFB) in Dayton, OH. The Air Force established the Wing in 2008 in response to the 2005 Base Realignment and Closure law, which called for the relocation of Air Force research and development to WPAFB to achieve a joint center of excellence for aerospace medical research. Designed to provide interdisciplinary expertise, the Wing supports the Air Force by assuring an Airman's ability to execute the operational mission in any environment.

The Wing, which comprises the Airman Systems Directorate and the USAF School of Aerospace Medicine, has a functional alignment to support the Air Force Surgeon General, and has more than 1300 personnel representing more than 70 specialties.

Vision and Mission

The Wing's vision is to be recognized as Department of Defense (DoD) leaders in human performance to assure the Airman's readiness to execute the mission in any environment. The Wing's mission is to assure the dominant advantage in air, space, and cyberspace by advancing human performance.

Delivering Knowledge

The Wing delivers knowledge through its education and training mission in the USAF School of Aerospace Medicine (USAFSAM). Through its partnership with the Center for Sustainment of Trauma and Readiness (C-STARS) sites, it offers hands-on medical training, where students are able to get immersive training on managing patients with highly infectious diseases. During the COVID-19 pandemic, C-STARS experts were called on to help train aero-evacuation medical personnel.

The Wing's unique facilities are used to train students in the altitude chamber, reduced oxygen breathing device, and the DoD's only human-rated centrifuge. The Wing provides initial and refresher acceleration training for all Air Force fast-jet aviators, allowing students to experience up to 9 Gs.

Discovering Knowledge and Developing Technology

The Airman Systems Directorate comprises 5 Core Technical Competencies, 5 Product Lines, and 12 Core Research Areas. There are far too many research projects and product development efforts to describe here, so only a few examples are described below.

Wing scientists and engineers are developing solutions to the unique requirements of Special Warfare operators. The goal is to rapidly develop solutions to these complex problems by modifying commercial products or using in-house design and development capabilities. Once validated, technologies are transitioned to industry for large-scale manufacturing and sustainment. Some of their successful transitions are an underwater oxygen saturation sensor used to monitor students during water confidence training; an application designed to help combat medics wirelessly monitor multiple patients and efficiently document the care each patient receives; an in-line audio recorder used to capture training audio for debriefing students after training events; and an LED signaling gun for signaling aircraft without radio communication.

Some Air Force personnel have to work in confined spaces. Because those environments create added health and safety risks, an additional person has to "monitor" the technicians. The proposed solution, which involves wearable sensors, enables real-time

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sensing and remote assessment of aircraft technicians and their surrounding environments, offering improved safety and performance with significant reductions in required manpower.

Much of the information needed to operate globally is found in foreign language speech, text, videos, and images. This is especially problematic for less-spoken languages. To address this, the Human Language Technology team conducts research and development on automatic speech recognition, machine translation, optical character recognition, natural language processing, information extraction, information retrieval, and text-to-speech synthesis.

Delivering Solutions

The Wing delivers solutions through its four consult services which handle tens of thousands of requests each year. These include, the Operational Consult Service, the Aerospace Medical Consult Service, the Epidemiology Consult Service, and the Environmental Safety & Occupational Health Consult Service. The Wing's various laboratories operate 24/7 to process more than 1.4 million lab samples from across the DoD. The Wing's epidemiology lab works closely with the CDC to develop the flu vaccine each year.

Experts in the Operational Based Vision Assessment (OBVA) Laboratory study aircrew vision requirements and standards. The OBVA Lab is researching the F-35 Helmet Mounted Display System, the most advanced system in the world, providing synthetic see-through-the-aircraft day and night vision. Lastly, they are researching the human vision requirements and best industry practices for a 3D remote vision system in support of the new KC-46 tanker, which places the boom operator in the cockpit using augmented reality to refuel aircraft.

Responsiveness

The Wing responds rapidly and effectively to the real-world needs of our military, partnering with industry and academia where possible. Many Wing experts have strong relationships with Airmen, who directly provide insight and needs. Examples include shrinking the size and weight of equipment, lightening the load on special operators, and using advanced technology to alert instructors of student biometrics during water training. More recently, the Wing's responded to the COVID-19 pandemic by testing potential COVID-19 samples from military members and their beneficiaries, sent from military treatment facilities around the world. Further, Wing experts reconfigured this technology so that it could be used by both military and civilian hospitals, enabling medical personnel to remotely monitor patients infected with COVID-19, helping to protect medical professionals and lessening the amount of personal protective equipment (PPE) needed.

Future Directions

Wing experts are investigating how to network the Airman's decision making with Artificial Intelligence, data analytics, and automation in order to fuse the Airman and the machine. In the area of Systems Biology, Wing experts are investigating the complexity of biological systems to discover, enhance, and protect the underlying mechanisms contributing to the physical and cognitive state of our Airmen. Through basic research and the unique partnerships and in-house expertise to bridge the gap between research and application, the Wing is poised to impact our Airmen in the future.

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Fellows Class of 2020

The following AsMA members have achieved Fellows status and were approved by the Executive Committee:

Douglas Boyd
Natacha Chough
Rowena Christiansen
Ilaria Cinelli
Swee Weng Fan
Franz Hauer
Roger Hesselbrock
Stephen Houston
Jeffery Hovis
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