SAAC NOTAM

-Notice To Aerospace Majors-

THE OFFICIAL STUDENT NEWSLETTER OF THE JOHN D. ODEGARD SCHOOL OF AEROSPACE SCIENCES

Smartsealz

Nick Wilson, PhD, Associate Professor, Aviation

"Smartsealz" started on the New Faculty Bus Tour in August 2014. A new colleague and future friend from the Electrical Engineering department, Dr. Kouhyar Tavakolian, sat next to me on the bus and we started discussing potential research ideas. If I recall, he asked me a simple question to the effect of, "Do you have any ideas for an upcoming grant opportunity?". Well, having just returned from airline/aerospace industry in the recent weeks, I was well-versed into the current state of the business including a substantial change to the regulations associated with pilot duty and rest regulations, known as FAR Part 117. This new regulation aimed to reduce risks of pilot fatigue through more careful management of duty periods, rest, rolling calculations of duty days and hours as well as introducing requirements to acclimate pilots after crossing timezones, etc. I was involved with generating training materials at a regional airline at the time which would be provided to new hire and recurrent pilots on the new regulation. All of the new complex regulations got me thinking that, despite the best attempts to regulate when a pilot should be fatigued or not be fatigued, there was no real objective measure of

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whether the pilot was actually fatigued other than company management of their duty schedule and their personal attestation of fitness for duty. This personal attestation by both pilots was now required to be signed and returned to the gate agent prior to departure. At what point is a pilot objectively fit for duty?

This conversation continued during the remainder of the tour of Western North Dakota and also included discussion of a related topic of pilot *situational awareness*. Between pilot fatigue and situational awareness, my new colleague and I started to discuss how we can improve these common challenges in aviation. It turns out, his specialty was in cardiac heart rate variability (HRV). Simply stated, HRV looks at the specific beat-to-beat measures of an individual's traditional electrocardiogram QRS 'sine' wave (ECG, or EKG depending on your discipline) or through features of a photoplethysmogram (PPG) signal which measures blood perfusion in the capillaries via optical sensors. In addition to this, he also had experience with collection, processing and analysis of other physiological measures, including our 'brain waves' collected through electroencephalogram (EEG). These physiological measures, when analyzed independently, or combined with inputs from the aircraft's sensors (e.g. altimeter or heading) could be used for predictive analytical measures of pilot fatigue or operator state monitoring.

While having these discussions, I started to think about incidents or accidents which could have been avoided or at least potentially mitigated through technology. I offered that the aviation headset provided a convenient – and relatively unburdened - platform for mounting of either (or both) physiological sensors (similar, now, to many smartwatches) or tactile or haptic vibration actuators to alert the pilot of changes to fatigue state as well as changes to the airplanes navigational state, such as deviations from altitude or heading. In reality, these small vibro-tactile actuators can be used to provide

an alternative method of alerting the pilots for almost any condition ranging from nearby traffic conflicts, to proximity to terrain, or arrival an instrument approach minimums. It's similar to the concept of a highway rumble strip, intended to keep a driver in their lane.

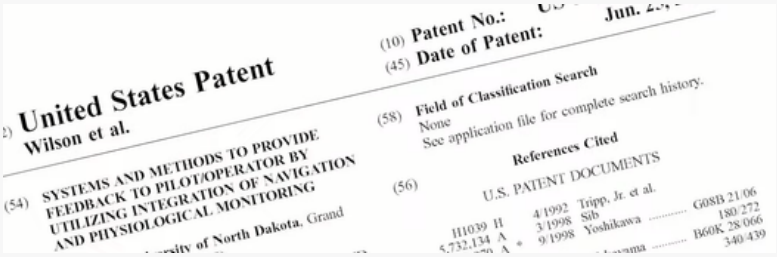
The motivation to incorporate these tactile signals was to augment the available sensory inputs available to pilots, when visual or auditory inputs were not adequate or not currently functional for the pilot (e.g. they were asleep, distracted, or task saturated). Changing the tactile feedback pattern (e.g. _ _ -- _ _, or - - -. Or ~ ~ ~), the amplitude (strength) of the pattern or the location on the head where the feedback can be provided to the pilot (above or below the ear) could all be used to communicate different risk patterns. More planned research is needed here. (Cont. Page 3)

Smartsealz (Cont.)

In 2015, we applied for a patent on the technology concept we coined as “Smartsealz” through the Office of Intellectual Property, Commercialization and Economic Development (IPCED). Fast forward through a few grant applications, research projects, publications, and company discussions, and in 2019 were awarded a patent titled Systems and methods to provide feedback to pilot/operator by utilizing integration of navigation and physiological monitoring. During this time, we’ve been fortunate to receive some venture funding, seed funding and company research partnerships to keep the research and development process going forward in one way or another. We’ve developed several versions of the prototype which has been successful in using haptic feedback to trigger alerts for altitude and course deviations, which was the initial intention of the tactile cueing addition to the headset. Currently, we have a white paper submitted to the Federal Aviation Administration (FAA) to seek interest for additional research funding.

In case students are wondering, “research” (the other part of their faculty role outside teaching and service) regularly includes opportunities for students to contribute to research as participants or research assistants. Through the various research projects, we’ve probably had around two dozen students involved in various development activities or paid graduate assistantships as well as several dozen involved as paid research participants over multiple studies.

Common questions related to the application of this technology are “Well, what if I don’t wish to have any physiological data recorded and analyzed?” Answer: Then don’t! In fact, although we originally envisaged the headset to include some element of physiological recording, there is no requirement to include this feature of the proposed technology. Individual pilots or the organizations they work for can and should have discretion over if or how (a) physiological monitoring, and/or (b) aircraft data could be incorporated into


United States Patent
Wilson et al.
(10) Patent No.:
(45) Date of Patent:
(54) SYSTEMS AND METHODS TO PROVIDE FEEDBACK TO PILOT/OPERATOR BY UTILIZING INTEGRATION OF NAVIGATION AND PHYSIOLOGICAL MONITORING
(58) Field of Classification Search
None
See application file for complete search history.
(56) References Cited
U.S. PATENT DOCUMENTS

(c) the patented tactile cueing provided to the pilot. Common, objective data from aircraft flight instruments such as altitude, heading, bank angle, airspeed, GPS track or any other non-human data can and should be used to develop parameters for triggering tactile cue alerts to the headset and increasing pilot situational awareness and aviation safety.

In an ideal world, we (e.g. UND) would hopefully license the “Smartsealz” concept out to a capable industry member who could bring the useful safety feature into the hands of pilots around the globe. We had a few discussions, but if anyone knows of any capable aviation companies who are looking to differentiate their headset, send them my way!

For a summary of the concept, we also created a marketing video with the support of venture funding from the State of North Dakota and talented video professionals. You know who you are!

Watch the Youtube Video: https://tinyurl.com/smartsealz

For more information on Smartsealz,

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Annette's Legacy

Amanda Higginbotham, SAAC Director of Technology

Safety; a concept communicated by our CFIs in briefings, explained by our superiors in Safety Week videos, and implemented by each of us during flight. To be “safe” might only be understood as an IMSAFE check to new aviators, but that single word has vast meaning. Aviation safety is the concept of acknowledging past events, adapting present circumstances, and changing future outcomes.

Knowing this, the aerospace administration opened the Annette Klosterman Aviation Safety and Data Analytics Lab. For those who have not heard the name, Annette was a 2007 Commercial Aviation graduate from UND. Her bright smile, warm personality, attention to detail, and passion for aviation made her an admired CFI. However, only five months after completing her education, Annette received a new pair of wings. She and her student, Adam Ostapenko, were killed during a cross-country flight when their Piper Seminole collided with a flock of migrating geese...it was a heartbreaking moment for all those who knew her.

Annette’s legacy has been kept vividly alive through a memorial scholarship, established by her parents. Jim and Jan Klosterman turned an unthinkable occurrence into a blessing for others, dedicated to empowering women with similar attributes as their daughter. Inspired by this, UND decided to dedicate the lab in Annette’s honor. During the official opening ceremony on April 22nd, many people – from President Armacost and Dean Kraus to Delta Vice President Patrick Burns and Stephanie Odegard – gathered in loving memory of Annette’s life. Even though rooted in a tragic event, the opening was a beautiful recognition of the joys – and dangers – of our chosen career path. Annette, you may be out of our sight, but you are never out of our minds nor our hearts. Your impact will

forever be intertwined with this new addition to the John D. Odegard School of Aerospace Sciences. The lab, which will host new initiatives to gather safety statics, trends, and standards, will continue to host classes for years to come.

Safety; using the experiences of others to protect lives.

Thank you, Annette.

SAAC word search

E Q O J X G H N D A Y Z U L A O H
R C Q J Z W K L F T Z S S U A F Y
F T A F F B G Q D O W T R D B Y P
T R X P K O F N E K N V P A D W O
H H D T S U G I C A L O S O M T X
M B E E R O R U L D R Q U B Q E I
P F I R E R R T T H R U S T D X A
P G C S M Y R E A T I R X U S F A
E C A P S O A H A R D G T U H F V
W B T Z P D S H X O C I O B G O I
K U H R D Z B P T N T H Y Q R E A
F M I K B R L Q H L N X E U Z K T
D A V H V W C L A E U F N R Q A O
H C R Y A A O Q V Z R W U J B T R
B F P X Z I X Q Q F A E C O V D U
M Q S C Z G D Z T Y N Y W M V A N
W E A T H E R T I L Z J S X Z J D

NORTHDAKOTA
AEROSPACE
RUNWAY
SPACE
TAKEOFF

HYPOXIA
THRUST
WEATHER
MARS

AIRPORT
ALTITUDE
ARCHER
AVIATOR
THERMOSPHERE

AtSc Research

Devin Bissell, Graduate Research Assistant,
Dept. of Atmospheric Sciences

When you think about meteorologists researching severe weather, what's the first image that pops into your head? It's probably something similar to what you would see in Twister or Storm Chasers: someone fearlessly driving a truck or armored car into the center of the storm hoping to gather desperately needed data. While this type of research is important and does happen, there are many other aspects of severe storm research that tend to fly under the radar, so to speak.

One of the aspects that is often overlooked is what happens at the top of those cumulonimbus clouds, miles above any possible tornado. It might seem unimportant, since the top of a storm isn't going to cause millions of dollars in destruction. However, strong storms can have significant impacts on the chemical composition of the stratosphere, the second layer of our atmosphere. The conditions in the stratosphere tend to be very different than what we experience at Earth's surface, but the vertical motions in thunderstorms can rapidly move pollutants to levels they would never reach otherwise. Because of a lack of observations near the cloud tops, there are many unanswered questions about this process. How much of these pollutants are carried into the stratosphere by thunderstorms and how long do they stay there? How exactly does the introduction of these new chemicals impact our changing climate? And of course, how accurately do our current forecast models simulate all of this?

These are some of the questions I am focusing on as part of my Master's thesis working with Dr. Gretchen Mullendore in UND's Atmospheric Sciences department. Through this research, I have had the privilege of collaborating with scientists from NASA, NOAA, Harvard, the University of Oklahoma, Texas A&M University, and others for NASA's Dynamics and Chemistry of the Summer

Stratosphere (DCOTSS) campaign. To gather data from the outflow of thunderstorms, we coordinate flights of the ER-2 aircraft, a modified U-2 that can reach altitudes of up to 70,000 feet, with a dozen instruments on board. Amazingly, we have been able to target small plumes of material that were injected into the stratosphere by storms days earlier and thousands of miles away, but this spring the goal is to fly as close as possible to thunderstorms as they are occurring. Hopefully, these data will help answer some of the questions that have alluded scientists for years.

My personal research will incorporate some of these data, as well as observations from ground-based radars, to see how well model forecasts represented the environments we flew through. I am also compiling an archive of thousands of storms across the country that were forecast by the High-Resolution Rapid Refresh model last summer that can be analyzed and compared to observations. With this information, hopefully we will be able to continue improving storm simulations and use them to get a better understanding of how thunderstorms can have an impact on climate change.

Time to UpLift!

Emmelinne Miller (SAAC Director of Programming) and
John Dulski (Aviation Safety and Operations Major)

Mental health has always been a part of the aerospace industry, although it has not been emphasized until recently. Within UND's Aerospace College, there have been many projects this school year to assist students through their mental health struggles, including aviation-specific training for the UND counseling center staff, efforts to hire an embedded aerospace psychologist, and creating the first collegiate aerospace peer support program!

Peer support programs are a proven asset for mental wellness at the nation's leading airlines. After much help from those who run peer support programs in the airlines and US Air Force Academy, we are excited to bring such a program to our campus. **Our program is called UpLift and will launch in the Fall of 2022.**

UpLift's peer supporters will serve as a resource for all students in the Aerospace College dealing with various life challenges and support in a time of need. Supporters will not be mental health experts – they will be trained in understanding and recognizing when a peer is struggling so that they can offer confidential assistance and identify appropriate resources for the individual reaching out. Students will be able to reach out to peer supporters with questions about their personal struggles, uncertainties about their aviation medical, and other mental health concerns.

The new embedded aerospace psychologist will manage UpLift rather than students or the Dean's Office. This ensures that our peer supports are adequately trained by a professional and that the program runs smoothly as the years progress.

If you are interested in becoming a peer supporter, please visit this link - **tinyurl.com/UNDUplift.** The application requires a few short essay answers, as well as one peer reference.

These are the minimum requirements to become a peer:

- You must be starting at least your second year at UND.
- Be in good academic standing.
- Have a declared aerospace major.
- Most importantly, UpLift peers should be empathetic students that are truly invested in helping their fellow classmates.

The application deadline to become a peer supporter for Fall 2022 is *May 10, 2022*.

New SAAC Members

This past month, current SAAC members had the pleasure of reviewing, interviewing, and choosing new council members! After a marathon 2-days of interviews, we are pleased to announce our newest members of UND's Student Aerospace Advisory Council: Arjun Jagada and Julianne Lore!

Aerospace Mentorship Program

Formerly known as the Peer Mentorship Program, the newly revamped **Aerospace Mentorship Program** will fully debut with new mentors in the Fall 2022 Semester. This will differ from the UpLIft program and will serve as an opportunity for new students to make connections with more experienced peers to navigate their journey in the Aerospace school. Similar to programs by airlines and other aerospace organizations, mentors will be a guiding hand to incoming students and be a source of information, advice, and support for their academic success while at UND.

To be a mentor, you are required to have completed three semesters in the JDOSAS and complete a short interview after the application is reviewed. All Aerospace majors can apply! **Mentor applications will open on May 2nd and will close on May 31st.**

Mentees will be open to incoming students entering the college. Mentee applications will open in Fall 2022.

We strongly encourage you to apply to the Aerospace Mentorship Program! Make a difference for future Aerospace students. **Visit our website and sign up to be an Aerospace Mentor!**

Graduating Seniors:

Congratulations! From everyone on SAAC, we wish you the absolute best in all your future endeavors. You have worked so hard over the last years and your dedication doesn't go unnoticed. Through hard classes, tough instructors, and everything in-between you have persevered and made it to the end. Whether Grand Forks is home for you or you are moving across the world, remember that your UND family is so proud of you and always wishes you clear skies!

Thank you all for another great year! We are looking forward to seeing everyone back on campus in the fall. Happy summer!

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Sundays at 4:00PM Robin 136