



Naval Medical Research Unit Dayton
Wright-Patterson AFB, Ohio



Science Update

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Summer

MISSION

To maximize warfighter performance and survivability through premier aeromedical and environmental health research—delivering solutions to the field, the Fleet, and for the future.

VISION

NAMRU-D is Navy Medicine's world class, global aeromedical and toxicology research leader. Our efforts and innovative products are aligned with operational requirements to solve the naval and joint warfighter challenges of the future.

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Introducing the Reduced Oxygen Breathing Environment (ROBE) at NAMRU-D



NAMRU-D hypoxia program now houses the Reduced Oxygen Breathing Environment, which reduces the amount of oxygen present in the air. Pictured above is LCDR Mike Tapia and Dr. Matthew Funke observing two other team members interaction with an assigned cognitive task.

By: LCDR Mike Tapia

As hypoxia related incidents continue to plague aviation, NAMRU-D Aeromedical Directorate pursues several strategies for in cockpit hypoxia detection and recovery from hypoxic stress. Continuing with this ongoing effort to mitigate the risks of hypoxia, NAMRU-D introduces the Reduced Oxygen Breathing Environment (ROBE), a 12 x 21 ft. room capable of simulating altitudes from sea level up to 30,000 feet mean sea level (MSL). With its open floor design, it can serve as both a training chamber and as a flexible research device.

Unlike the legacy altitude chamber which simulates altitude by reducing air pressure, the ROBE reduces the amount of oxygen present in the air. Both simulators induce hypoxic hypoxia through comparable reductions in the partial pressure of oxygen. However, the ROBE system does so without the

concomitant risks for decompression sickness or arterial gas embolisms associated with reduced pressure exposure. An additional benefit of the ROBE is its price tag. Both initial and lifecycle costs of the ROBE are a fraction of those for the hypobaric chamber. The ROBE also expands the capabilities of the single user hypoxia trainer, Reduced Oxygen Breathing Device (ROBD), by providing a mask-free breathing multiuser platform. By eliminating the...

Story continues on page 5



Reduced Oxygen Breathing Device (ROBD).

Joint Effort on Pilot Physiological Monitoring and Warning System



Naval Aviators on Naval Air Station Whidbey Island, Washington (USN Multimedia Gallery)

engine, avionics, and flight systems, however not one of these signals is from the pilot, the most critical part of the weapon system.

A non-invasive physiological monitoring system for pilots would be able to monitor a pilot's heart rate, blood oxygen saturation, eye metrics and potentially electroencephalogram (EEG). Such monitors could warn the pilot of redline or out-of-bounds physiological conditions that might compromise their performance and adversely affect the mission. The Air Force recently developed an ad hoc physiological sensing system for F-22 pilots after 25 hypoxic-like symptoms were reported by the pilots during operations. The non-invasive sensor was integrated into the ear cup of the helmet and was successful at monitoring the pilots' percent oxygen saturation at eye level during flight. This was not an off-the-shelf system but, rather, developed by the 711th HPW of AFRL to address an urgent need by the USAF Air Combat Command.

By: Dr. William Albery, Dr. Jeff Phillips, Dr. Lloyd Tripp

The Naval Medical Research Unit Dayton and the 711th Human Performance Wing of the Air Force Research Laboratory at Wright-Patterson AFB are jointly working on a Foreign Comparative Test (FCT) program to provide a physiological monitoring and warning system for both Air Force and Navy pilots. No physiological warning system for pilots of USAF or USN aircraft currently exists. Recent events, such as hypoxia-like symptoms of a pilot with the T-45, F-18, F-22 and F-35 aircraft, highlight the importance of having an in-flight pilot monitoring system in order to prevent a mishap that can lead to a loss of lives and aircraft. It is said the modern fighter aircraft provides over 1500 signals/sec to the pilot concerning

The Israeli Air Force has developed a physiological sensing flight helmet that can non-invasively measure blood perfusion changes, percent oxygen saturation, and heart rate. In addition, the Japanese Air Force has developed a portable pocket-sized near infrared spectroscopy (NIRS) monitoring system that shows promise as an in-flight physiological monitoring system. These systems will be tested at Wright-Patterson AFB starting fall 2015. The objective of this FCT program is to evaluate non-invasive physiological sensors to monitor pilot state in order to warn the pilot of an impending physiological problem that could lead to an in-flight mishap. The goal of the effort is to prevent aircraft mishaps due to the pilot's physiological state.

Invitation to Share Key Research Capabilities at University of Cincinnati

By: NAMRU-D Public Affairs

On June 5, 2015 four Naval Medical Research Unit Dayton (NAMRU-D) Environmental Health Effects (EHE) scientists presented core capabilities and research programs to University of Cincinnati (UC) faculty members. The invitation was from Dr. James Lockey, Pulmonologist at University of Cincinnati and Defense Health Board (DHB) Deployment Pulmonary Health Committee member, as follow up to his December 2014 visit to NAMRU-D.

The mission of the NAMRU-D Toxicology Directorate is to conduct basic and applied toxicology research to assess the risk, or reduce uncertainty in the risk, posed to Department of Defense (DoD) personnel (military and civilian), as well as civilian populations, that are potentially exposed to chemical contaminants and certain physical agents associated with DoD systems and operations.

In addition to the four presentations on specific research, CAPT Rees Lee, Executive Officer and Dr. Michael Gargas, Director of the Environmental Health Effects Research Directorate, presented the command brief and core capabilities of NAMRU-Dayton to UC faculty members. Specific NAMRU-D research presentations included: Dr. Karen Mumy, Deputy Director of Environmental Health Effects Research Directorate, presented Evaluation of the Toxicity of Alternative Jet Fuels for Military Use; Dr. Brian Wong, Research Toxicologist, presented PM Inhalation Studies: Toxicity assessment of fire extinguishing powder and Southwest Asian particulate matter and waste disposal combustion emissions; Mr. Arden James, Inhalation Engineer presented 1) Generating and Analyzing Particulate Matter (PM) for in vivo Inhalation Exposure Testing; and 2) Inhalation Toxicity of F-22 Cockpit Contaminants in Rats including Altitude Change as a Confounding Factor:

Development of the Exposure Systems and Validation Efforts; LCDR Carlis Brown, Department Head, Inhalation Toxicology presented Evaluation of Jet Fuel and Sound Exposure.

The 20 UC faculty members in attendance represented areas such as pulmonary health, environmental health, neurophysiology, programs at the Cincinnati Children's Hospital Medical Center, and programs at the UC College of Engineering. Scientific sidebar conversations were in full swing between each NAMRU-Dayton presentation. When asked if there are plans for future communications with the UC faculty Dr. Gargas indicated, "Most certainly." NAMRU-D looks forward to continued information exchanges and plans to invite the UC faculty up to Dayton in the near future.

Summer Interns Support Navy Medicine at NAMRU-D

Aeromedical Intern, Mr. Kevin Lee testing a realistic, dynamic representation of a suspended wire for a "high wire illusion" scenario that he programmed with NAMRU-D engineers as a part of his internship.



By: NAMRU-D Public Affairs

Naval Medical Research Unit Dayton (NAMRU-D) selected three qualified individuals to participate in a paid summer internship through Oak Ridge Institute for Science and Education (ORISE). Interns reported in May 2015 and are now finishing up their last weeks with the command.

Information Technology Intern, Ms. Stephanie Roberts, returned for her second summer to continue under the supervision of a NAMRU-D IT Specialist. "I wish to further my knowledge in computer engineering and hardware," said Roberts. Round two had her meticulously updating the command's computer assets list and updating antivirus software on laboratory machines. In an effort to enhance researcher's ability to maintain a secure commercial connection and analyze gathered research data, Roberts prepared computers to receive the Defense Research Engineering Network image and applied her understanding of the functionality of new Cisco switches. The experience, "will help her immensely during her next year of study that will include routers and switches," said her IT Specialist mentor.

Aeromedical interns, Mr. Kevin Lee and Ms. Katie Mack, were assigned to support multiple research projects such as Hypoxia, Fatigue, Vision Sciences, Spatial

Disorientation, and Motion Sickness. "I loved learning about the vision sciences [and] how the eye perceives color and the differences between those with normal vision and those with color deficiencies. I had a slight interest in optometry before, but this really re-sparked my interest!" said Mack. The two science interns witnessed an in motion hypoxia study and a motion sickness countermeasure investigation, which familiarized them with the in-theater applications for each research area.

In addition to scientific investigation, Lee and Mack worked with the Public Affairs Officer to research historical documents (i.e., photographs, interviews, and scientific publications) over the 5-year history of NAMRU-D and more than 70 years of legacy aeromedical research to support a command history book initiative, which will cover the origins of Aeromedical and Environmental Health Effects science in Navy Medicine.

Lee provided support to a spatial disorientation simulation project while applying his knowledge of mathematics and programming to develop a realistic, dynamic representation of a suspended wire for a "high wire illusion" scenario, which substantially enhanced the quality of the research project. "I never realized how much math is actually required for [spatial disorientation] simulation," Lee said, "It



"I wish to further my knowledge in computer engineering and hardware," said Ms. Stephanie Roberts, IT Intern, NAMRU-D.



"I loved learning about the vision sciences [and] how the eye perceives color and the differences between those with normal vision and those with color deficiencies. I had a slight interest in optometry before, but this really re-sparked my interest!"

takes a team of several people with different specialties to create a simulator. One person can do a lot. Many people can do a lot more."

Although August arrived quickly, each intern was more than able to support the NAMRU-D mission and accomplish various tasks in their short time here. Their NAMRU-D experience proved to be meaningful with practical application and confirmation of their chosen areas of study and ultimate career path.

Completed Study on Veteran's Respiratory Problems: Exposures to Camp Victory Ambient Particulate Matter and Burn Pit Emissions

By: Dr. Brian Wong

Military personnel deployed to southwest Asia (SWA), since the Desert Storm campaign in 1990 to the most recent, have reported various respiratory problems attributed to the inhalation of ambient particulate matter (PM), burn pit emissions, oil or sulfur fires or other types of hazardous inhaled materials. In 2009 the Veteran's Administration (VA) requested that the Institute of Medicine (IOM) investigate reports with a focus on burn pits. The IOM report in 2011 did not find a singular cause of the respiratory problems, but suggested that

long term health effects could be associated with exposure to a combination of PM and burn pit emissions.

Ambient particulate matter from sand storm in theater. (U.S. Navy photo by Mass Communication Specialist 2nd Class Ace Rheame/Released)



Scientists of the Environmental Health Effects Research Directorate (EHE) at the Naval Medical Research Unit Dayton (NAMRU-D) are at work to follow up on the IOM and other reports. The Defense Medical Research and Development Program (DMRDP), Military Operational Medicine Joint Program Committee 5 (MOMJPC5) awarded support to NAMRU-D/EHE for a laboratory animal toxicology study to investigate the potential health effects of exposure to airborne SWA PM alone and in combination with emissions from a model burn pit of solid waste combustion.

NAMRU-D recently completed the exposure portion of the study, in which laboratory rats inhaled SWA PM collected from Camp

Victory, Iraq. Exposures were conducted in NAMRU-D's whole-body exposure systems for 20 days. After the PM exposures, the laboratory rats were exposed to emissions from a simulated burn pit located at the Battelle Inc. West Jefferson Ambient Breeze Tunnel (ABT) facility, over a five day period. There were four groups of exposed laboratory rats at the completion of exposures:

1) a control (clean air), 2) a SWA PM-only, 3) a Burn Pit Emissions-only, and 4) a combination SWA PM and Burn Pit Emissions group.

A variety of toxicology



Solid waste disposal by open air burning. (Photo by U.S. Air Force/Senior Airman Julianne Showalter)

endpoint determinants are being evaluated 4-days, 30-days and 90-days after the last exposure by the NAMRU-D

research team. In collaboration with the US Air Force, the 711th Human Performance Wing/Behavioral Systems (HPW/RHDJ) will be analyzing samples from the exposed laboratory animals to measure changes in biomolecules. Biomolecule changes can be indicators of exposure or toxicity.

Ultimately, results from this study will provide more information about the contribution of PM and burn pit emissions to the respiratory toxicology in laboratory rats. Results may also inform future research that can focus on the most probable cause of respiratory problems in humans.

Scientists Present at Military Health Systems Research Symposium

By: Public Affairs Officer

On August 17, seven NAMRU-D researchers engaged in the 2015 Military Health Systems Research Symposium (MHSRS) in Ft. Lauderdale, Florida. Navy Rear Adm. Bruce Doll addressed the symposium as one that deliberately seeks Army, Air Force and Navy participation. This year's symposium was attended by a record number of conferees, over 1,700 military medical clinicians, military scientists, academia, and industry leaders. Four scientists from NAMRU-D presented their research during poster or speaking sessions.

Dr. Beth Hartzler, Research Psychologist, Aeromedical Directorate, presented her research on a pilot study with a focus on "The use of working memory training to increase fatigue resistance during sustained operations".

LCDR Michael Tapia, Aerospace Physiologist, Aeromedical Directorate gave a joint poster presentation with Uniformed Service University, US Marine Expeditionary Rifle Squad, and Marine

Expeditionary Force scientists on "a review of current operational policy and direction for future research initiatives" with a focus on the "Impact of tilt-rotor flight on troop performance".

NAMRU-D Environmental Health Effects (EHE) attendees, Dr. Brian Wong and Dr. Karen Mummy were both principle investigators on their respective research. Wong, Inhalation Toxicologist, collaborated and presented with US Army on a study titled Toxicological assessment of fire extinguishing powders by acute inhalation exposure in sheep.

Mummy, Deputy Director, EHE, presented her team's research on Neuro-electrophysiological characterization of brain function due to repeated jet fuel exposure in rats.

Throughout the week several NAMRU-D members participated in various planned and ad hoc working groups.



Rear Adm Bruce Doll addressed Military Health Systems Research Symposium attendees on 17 August in Ft. Lauderdale, Florida.

Photo credit: Melissa Myers, USAMRMC Public Affairs

con't Introducing the Reduced Oxygen Breathing Environment at NAMRU-D

...need for a mask, the ROBE provides a more realistic training environment to simulate likely hypoxic exposure scenarios in most aircraft and eliminates the tether a mask imposes to free the user unencumbered movement.

Although this technology was developed through a Small Business Innovation Research (SBIR) initiative that delivered two similar prototype training systems to Naval Air Station Pensacola and the Aviation Survival Training Center at Miramar, the

ROBE at NAMRU-D is the Navy's first operational hypoxia chamber built specifically for altitude research. As the next generation hypoxia trainer, the ROBE expected to replace the

hypobaric chambers at several aviation training centers across the United States in the near future. The first project using the ROBE began in August 2015 and compares symptomology between the three hypoxia devices – hypobaric chambers, ROBD and ROBE to determine if the reduced oxygen devices are valid alternatives for conducting altitude training in place of the hypobaric chamber. With the addition of this device, NAMRU-D remains at the cutting edge for applied hypoxia research and is prepared to function as the center for Naval Aviation training curriculum development.



NAMRU-D Biomedical Engineer, Mrs. Stephanie Warner explains the legacy altitude chamber lab, which is capable of simulating altitude by reducing air pressure.

NAMRU-D Welcomes Founder of Florida Institute for Human & Machine Cognition

By: NAMRU-D Public Affairs

Naval Medical Research Unit Dayton (NAMRU-D) welcomed a visit from Dr. Ken Ford, Founder and Chief Executive Officer of the Florida Institute for Human & Machine Cognition (IHMC) on July 6.

To kick off the day's events, Commanding Officer CAPT Jeffrey Andrews greeted Dr. Ford and introduced him to Executive Officer, CAPT Rees Lee; Director of Environmental Health Effects Research, Dr. Michael Gargas; and Director of Aeromedical Research, Dr. Richard Arnold. The group of five convened to discuss the mission and vision of NAMRU-D as a whole as well as a brief overview of the two science directorates' capabilities and current projects. Following the command overview, Dr. Gargas and Dr. Arnold led Dr. Ford on a tour of the laboratories to gain further awareness of NAMRU-D's research efforts.

The floor was given to Dr. Ford in the final hour of his visit to present IHMC's scientific spectrum at a Grand Rounds. The presentation was open to command and our co-located colleagues of the Air Force's 711th Human Performance Wing at Wright-Patterson Air Force Base. In his presentation, *Toward Amplified Humans: A Precipice of Research* at IHMC, Dr. Ford communicated how IHMC is concentrated on technological systems aimed at leveraging and extending human cognitive and perceptual capacities. Attendees were given the opportunity to ask Dr. Ford questions and it was made clear the excitement Dr. Ford has for science in each response he delivered. Such excitement for science is exactly how NAMRU-D likes to end every work day! NAMRU-D and IHMC's research areas may



Following tours of NAMRU-D laboratories, Dr. Ken Ford was invited to give a presentation at a Grand Rounds, which was open to NAMRU-D and our Air Force colleagues on July 7, 2015. Left to right: Dr. Richard Arnold, CAPT Jeff Andrews, Dr. Ken Ford, CAPT Reese Lee, & Dr. Michael Gargas.

investigate different areas but each are essentially serving the purpose of enhancing lives for the future.

IHMC was recently featured in the May 28 issue of TIME Magazine as an 'Iron Man Challenge' contending organization. The challenge, also known as the Defense Advanced Research Projects Agency (DARPA) Robotics Challenge, resulted in IHMC earning second place with their robot, Running Man. (To read more on the DARPA Robotics Challenge: <http://www.theroboticschallenge.org/>).

Meritorious Unit Commendation Presented to NAMRU-D

By: NAMRU-D Public Affairs

The Meritorious Unit Commendation (MUC) was presented during an All Hands on Aug 28, 2015 at Wright Patterson Air Force Base by CAPT Andrews, Commanding Officer, CAPT Lee, Executive Officer, and LCDR Pyles, Director of Administration. On behalf of the command, Mrs. Freda Gatewood accepted the MUC as the longest standing command member. The award recognizes NAMRU-D's meritorious service from October 2010 to October 2014. Citation can be seen below.



CAPT Lee, XO, NAMRU-D reads the citation to the command during an All Hands held on 28 Aug 2015

Citation:

For meritorious service from October 2010 to October 2014. The personnel of Naval Medical Research Unit Dayton displayed sustained superior performance by providing critical research capabilities in areas of Toxicology and Aerospace Medicine that allowed the navy and the Department of Defense to maintain mission essential capabilities and meet mission requirements. Following the Congressionally mandated assignment of women to submarines, Naval Medical Research Unit Dayton personnel conducted an extensive study using state-of-the-art facilities and top scientists in the field of Toxicology to show that inhaling the basic composition of submarine air does not pose reproductive or developmental health risks for mixed gender crews. Responding to the grounding of the F-22 Fleet in the wake of reports of possible hypoxia events, they identified and optimized use of key sensors that alleviated concerns about pilot safety and allowed reactivation of the F-22 Fleet. Furthermore, their handling of Records Management and Human Research Protection Programs led to process improvement methods that were recognized as best business practices for the Navy medicine enterprise. Their "people first" focus and stellar command climate surveys led to the command's selection as a winner of the 2014 "When Work Works" Award for its innovation in fostering a culture of workplace trust, effectiveness, and flexibility. By their truly distinctive accomplishments, unrelenting perseverance, and unfailing devotion to duty, the officers and civilian employees of Naval Medical Research Unit Dayton reflected credit upon themselves and upheld the highest traditions of the United States Naval Service.

JONATHAN W. GREENERT
Admiral, United States Navy

Dr. Caldwell - International Academy of Aviation and Space Medicine

By: NAMRU-D Public Affairs



Dr. Lynn Caldwell, Technical Advisor, Biomedical Sciences, NAMRU-D received the 2015 John Frazier Award from the SAFE Association, Wright Brother's Chapter. CAPT Andrews presented the achievement award to Caldwell on 1 September 2015. The award recognizes the accomplishments of outstanding senior scientist.

For over 20 years, Dr. Caldwell has made phenomenal contributions to the advancement of transportation safety through her research in fatigue

countermeasures with U.S. Navy but also with U.S. Army and the U.S. Air Force.

Currently, Dr. Caldwell is the director of the NAMRU-D Fatigue Assessment and Mitigation Laboratory of the Aeromedical Research Directorate and has five active projects.

In addition to the John Frazier Award, Dr. Caldwell was also inducted into the International Academy of Aviation and Space Medicine this past May (2015) for her distinguished contributions in aviation medicine.

Visit from Congressman Mike Turner's Military Legislative Assistances

By: NAMRU-D Public Affairs

On 25 August, 2015 Congressman Mike Turner's Military Legislative Assistances (MLA), Morley Greene and Jessica Calio visited NAMRU-D. Dr. Aaron Miller, Director for Human Effectiveness and Advancement, Wright State University joined the visit to also. The visit's focus was to speak with NAMRU-D leadership about the command's mission and functions, staffing, collaborations, and requirements for collaborations. CAPT Jeff Andrews, Commanding Officer; CAPT Rees Lee, Executive Officer; Dr. Rick



CDR Folga (far right) discusses the many capabilities of NAMRU-D's Disorientation Research Device with Dr. Miller; Congressman Mike Turner's Military Legislative Assistances, Morley Greene and Jessica Calio; Dr. Arnold; and CAPT Lee (far left).

Arnold, Aeromedical Research Director; and Dr. Mike Gargas, Environmental Health Effects Research (EHE) Director each assisted in a presentation of the command brief to the MLAs.

Following the brief, Dr. Arnold led the group on a tour of the Aeromedical laboratories. Tour stops included High Altitude Program labs (sensors, Reduced Oxygen Breathing Environment, Reduced Oxygen Breath Device, and mitigation devices), Fatigue Countermeasures, Disorientation Research Device, and Spatial Disorientation labs.

NAMRU-D Products & Presentations

- Caldwell, J.L. (Aug, 2015). Overview of sleep deprivation research and defense health agency joint program committee 5 fatigue mechanisms working group plans. Presentation at Office of Naval Research Restorative Sleep Workshop.
- Hartzler, B.M., Chandler, & J., Levin, C.S.S. (Aug, 2015). The use of working memory training to increase fatigue resistance during sustained operations: A pilot study. Presentation at Military Health Systems Research Symposium, Fort Lauderdale, Florida.
- Ruskin, K.J., Caldwell, J.A., Caldwell, J.L., & Boudreau, E.A. (Sept, 2015). Screening for sleep apnea in morbidly obese pilots. *Aerospace Medicine Human Performance*; 86 (9), 835-841
- Sweeney, L.M., MacCalman, L., Haber, L.T., Kuempel, E.D., & Tran, C.L. (July, 2015). Bayesian evaluation of a physiologically-based pharmacokinetic (PBPK) model of long-term kinetics of metal nanoparticles in rats. *Regulatory Toxicology and Pharmacology*, 73, 151-163.
- Welsch, Timothy, Balcus, J.A., McCarthy, S.M., & Tapia, M.L. (Aug, 2015). Impact of tilt-rotor flight on troop performance: a review of current operational policy and direction for future research initiatives. Presentation at Military Health Systems Research Symposium, Fort Lauderdale, Florida.
- Wong, B.A., Bazar, M.A., Hodges, S.E., & McCormick, S.J. (Aug, 2015). Toxicological assessment of fire extinguishing powders by acute inhalation exposure in sheep. Presentation at Military Health Systems Research Symposium, Fort Lauderdale, Florida.

Commanding Officer's Corner

The end of summer marks a hot streak at NAMRU-D with research and development efforts in full stride. Growth and productivity continue at our command and "Release the Kraken" is in the air as we honor our Navy heritage and all that is from the sea especially the mythical giant sea creature known as the Kraken designated as our mascot. It was also time to honor several key personnel, my sincere appreciation to LCDR Jenny Jo Mueller (Biochemist), Mr. Jim Reboulet (Inhalation Chemist) and Mr. Steve Evans (IT specialist) who detached and a Hooyah welcome to LCDR Dustin Huber (Naval Aerospace Operational Physiologist), Mr. Paul Bloomer (IT specialist), Mr. Anthony Barnett (Inhalation Technician), Mr. Travis Tidball (Inhalation Technician) and Mr. Joseph Brune (Inhalation Technician).

As always, the end of the fiscal year brings closure to research projects whose funding is expiring and presents significant financial challenges as the past year is closed out and preparation begins for a new and uncertain fiscal year. This was a busy and stressful time of the year and I am proud of our staff that has worked together and adapted, overcame, and improvised to consistently provide outstanding results and get the many jobs done despite many unforeseen and significant obstacles.

Deserved recognition was recently awarded by the Chief of Naval Operations with a Meritorious Unit Commendation (MUC) for meritorious service from October 2010, when the command was established, to October 2014. This award is a testament to the unprecedented professionalism, motivation, and skills of the NAMRU-D team who currently have several projects underway that have direct impact to our operational fleet forces. Our extensive and one-of-a-kind hypoxia sensor testing lab has finally identified one oxygen sensor out of 30 total to be a viable, near-term solution for an in-flight warning system for hypoxia incidents. This is time critical in response to recent spikes in the number of T-45 and F/A-18 hypoxia/decompression incidents and the high visible attention generated by Naval Aviation Enterprise top leaders. Future research needs to be conducted on carbon dioxide, pressure, and flow sensors to outfit a complete sensor suite that addresses the entire threat. It is essential that Office of Naval Research (ONR), Naval Air Systems Command (NAVAIR), and NAMRU-D collaborate efforts to expeditiously reach an engineering and physiological monitoring solution ready for mass production and introduction into the fleet.

In addition, our Environmental Health Effects Research scientists are actively involved in studying particulate matter, burn pit emissions, and other inhalation threats from deployed sites of southwest Asia that are connected to respiratory problems of those returning warfighters.

Research that matters and makes a difference is what NAMRU-D is all about. I encourage the continued quest for operationally relevant and suitable research and greatly appreciate all efforts and scientific endeavors to take care of our joint warfighters. Continue climbing, rolling, and booming into the awesome opportunities of future Research & Development.



Captain Jeffrey M. Andrews,
MSC, USN
Commanding Officer

Taking the Helm of Navy Medicine's Aeromedical & Environmental Health Research



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