



Naval Medical Research Unit - Dayton  
Wright-Patterson AFB, Ohio



# Science Update

Volume 2, Issue 3

Summer 2012

## NAMRU-D 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.

## Inside this issue:

- Assessing Safety of Women Serving on Submarines 2
- Aeromedical Directorate visited by Republic of Singapore Scientists 2
- Middle Eastern Sand Inhalation Combined with Cigarette Smoke 3
- Hypoxia Roundtable 3
- NAMRU-D Scientist Leads Fatigue Workshop 4
- HFE TAG comes to Dayton 5
- NAMRU-D Products & Presentations 5
- CO's Corner 6

## NAMRU-Dayton Changes Leaders

CDR Daniel Hardt

CAPT Doug Forcino assumed command of Naval Medical Research Unit – Dayton (NAMRU-D) during a change of command ceremony held at the U.S. Air Force Institute of Technology on 11 June 2012. CAPT Forcino formally took charge of the U.S. Navy’s aeromedical and toxicological research laboratories by relieving CAPT Keith Syring, who served as NAMRU-D’s first Commanding Officer.

During his two year command, CAPT Syring successfully presided over the \$50 million transfer of the Naval Aerospace Medical Research Laboratory (NAMRL) from Naval Air Station Pensacola, Florida, to merge with the Environmental Health Effects Laboratory (EHEL) at Wright-Patterson Air Force Base under mandate by the Base Closure and Realignment Commission (BRAC). As stated by RDML Bruce Doll, Medical Advisor, Allied Command Transformation (NATO), during his Key-Note Address: “CAPT Syring deftly navigated [NAMRU-D] through the development of several critical mission areas and skillfully merged two distinguished, disparate organizations into a collaborative and cohesive unit”. Under CAPT Syring’s watch, NAMRU-D has developed several premier research facilities in the DoD, which include state-of-the-science research capabilities in normobaric hypoxia, disorientation and spatial awareness, *in vitro* screening techniques and inhalation toxicology. The personnel at NAMRU-D have been on the cutting edge for addressing military relevant risks, such as the reproductive health of female crew members aboard submarines, the hypoxia threat to Naval Aviators and Air Force Pilots, the toxicity of alternative military fuels and military explosives, and the respiratory health risk from burn pit emissions. For his meritorious leadership at NAMRU-D, CAPT Syring was presented the Legion of Merit by CAPT Richard Haberberger, Commanding Officer, Naval Medical Research Center. CAPT Syring reports in July as Deputy Commander, U.S. Army Medical Research and Materiel Command, Fort Detrick, Maryland. During the final address to his crew, CAPT Syring emphasized the importance of achieving a balance in life, particularly between work and family, and thanked his staff for helping him succeed. NAMRU-D wishes CAPT Syring and family fair winds and following seas! (story continued on page 4)



CAPT Forcino accepting his new position, as NAMRU-D CO, from presiding officer, CAPT Richard Haberberger, CO, NMRC.



CAPT Douglas Forcino arriving to assume command of Naval Medical Research Unit - Dayton.

ties in normobaric hypoxia, disorientation and spatial awareness, *in vitro* screening techniques and inhalation toxicology. The personnel at NAMRU-D have been on the cutting edge for addressing military relevant risks, such as the reproductive health of female crew members aboard submarines, the hypoxia threat to Naval Aviators and Air Force Pilots, the toxicity of alternative military fuels and military explosives, and the respiratory health risk from burn pit emissions. For his meritorious leadership at NAMRU-D, CAPT Syring was presented the Legion of Merit by CAPT Richard Haberberger, Commanding Officer, Naval Medical Research Center. CAPT Syring reports in July as Deputy Commander, U.S. Army Medical Research and Materiel Command, Fort Detrick, Maryland. During the final address to his crew, CAPT Syring emphasized the importance of achieving a balance in life, particularly between work and family, and thanked his staff for helping him succeed. NAMRU-D wishes CAPT Syring and family fair winds and following seas! (story continued on page 4)

## Assessing Safety of Women Serving on Submarines

CDR Daniel Hardt & Dr. Kimberly Bynum

In 2010 the United States Department of the Navy announced a historic policy change to allow women to serve on submarines, one of the few assignments that remained unavailable to women. Implementation began by assigning three female officers to guided-missile attack and ballistic missile submarines, with these particular vessel-types being chosen due to their larger living space areas which would require only minor modifications to accommodate the addition of female crew members. All female officers would be required to complete the normal 15-month long submarine officer training course before commencing their tours.

One of the major concerns facing the decision to place female crew aboard submarines involves the US Navy's exposure standards for onboard atmospheric contaminants, since the existing guidelines were established for male crew members only. To examine the current exposure standards, NAMRU-Dayton scientists studies used male and female rats to evaluate the general, reproductive and developmental health effects of mixtures of the three most critical submarine atmospheric components—carbon monoxide, carbon dioxide, and oxygen—at concentrations representing current submarine standards for normal operating conditions. These studies were designed to determine whether the existing standards for these gases are sufficient to protect the health of both male and female submarine crew members, while additionally evaluating the effects of these critical gas mixtures on the female reproductive



Washington. President Barack Obama and first lady Michelle Obama greet the U.S. Navy's first contingent of women submariners in the Blue Room of the White House. (White House photo by Pete Souza/Released)

system, including fetus development as well as the resulting offspring.

Results from these initial studies indicated that the existing atmospheric standards are appropriate and do not currently require adjustment. As this initial study comes to a close, the focus of developmental and reproductive toxicology studies at NAMRU-Dayton will shift to other chemicals that are commonly found in the atmospheres aboard submarines in continuing efforts to ensure that our submariners, both male and female, are protected while serving their tours of duty.

## Aeromedical Directorate visited by Republic of Singapore Scientists

Dr. Richard Arnold



A delegation of aeromedical and human factors researchers from the Republic of Singapore visited NAMRU-Dayton Aeromedical laboratories on 8 May 2012. While at Wright-Patterson AFB for a multi-day meeting with their US Air Force research collaborators, the Singaporeans took an afternoon to visit with NAMRU-Dayton researchers to explore topics of mutual interest and the potential for research collaboration. The Singaporean delegation included members from the Republic of Singapore

Defense Science and Technology Agency, DSO National Laboratories, and the Republic of Singapore Air Force.

The visitors presented an overview of their current research capabilities and priorities, including such topics as physiological response to extreme environments, fatigue and operational stress, visual performance, biomechanics of performance, and human performance augmentation. A discussion with Navy researchers ensued, highlighting many areas of mutual interest showing great promise for future research collaboration.

Following the presentation by the visiting scientists, NAMRU-Dayton researchers provided public domain tours of NAMRU-Dayton's aeromedical laboratories, including the cognitive readiness and resilience laboratory, hypoxia laboratory, motion sickness countermeasures laboratory, the new Disorientation Research Device (DRD-Hercules), Visual Vestibular Sphere Device, and Vertical Linear Accelerator. Highlighted research included ongoing work on in-cockpit detection of hypoxia, individualized fatigue modeling, and the mitigation of motion sickness using intranasally delivered scopolamine. Ultimately the visit provided a useful scientific exchange with a key ally, and opened new avenues for communication and potential research collaborations.

Pictured to the left: Dr. Jeffrey Phillips describing some of NAMRU-D's latest hypoxia research.

## Middle Eastern Sand Inhalation Combined with Cigarette Smoke

Dr. Brian Wong

A recently published NAMRU-D collaborative study was the first to characterize the respiratory toxicity of inhaled Iraqi sand alone and in combination with cigarette smoke. The collaborative effort involved researchers from the Navy, Armed Forces Institute of Pathology, US Army Center for Environmental Health Research, North Carolina State University Veterinary School (Dr. David Dorman, study primary author), and The Hamner Institutes for Health Sciences in North Carolina. This study was designed to determine if toxicity could be detected when laboratory rats inhaled a combination of cigarette smoke, and sand or silica, compared with either alone. The sand was obtained from the Camp Victory area, and was irradiated prior to use to eliminate the potential for microbial infection. In this study, rats "smoked" cigarettes (for 3 hrs/day) or inhaled clean air over a 6 week period. During the last 2 weeks of those exposures, the rats were exposed to sand or silica (for 19 h/day, 7 d/wk) or clean air. As expected, rats exposed to cigarette smoke did show significant effects, including decreased body weight gain and decreased

motor activity, as well as clearly significant airway damage. Cigarette smoke inhalation resulted in changes consistent with pulmonary inflammation and stress response in rats, whether or not rats were co-exposed to either sand or silica. Signs of toxicity, such as damaged airway tissues, were only minimally seen in rats exposed to sand or silica alone. The small amount of tissue damage observed in the nose and lung was confirmed in lung gene and protein expression. The lungs of sand-exposed rats did have elevated levels of certain metals present in the sand, but at this time it is unclear what role, if any, these compounds played in the minimal toxicities observed. Without cigarette smoke, the respiratory toxicity of Iraqi sand was minimal, and based on most indicators, was less than that seen following silica exposure. Further studies under consideration include longer-term exposure to middle-eastern sands and studies to establish whether the soluble metals found in these samples play some role in the mild respiratory effects that were observed in the present study.



Helmand Province, Afghanistan. Naval Mobile Construction Battalion (NMCB) 5 is caught in a sandstorm. (U.S. Navy photo by Mass Communication Specialist 2nd Class Ace Rheume/Released).

## Hypoxia Roundtable

Dr. Jeffrey Phillips

On May 18<sup>th</sup> 2012 a Hypoxia Modeling, Physiologic Monitoring, and Mitigation Roundtable was held in Atlanta, GA under the auspices of The Technical Cooperation Panel (TTCP) Human Resources and Performance (HUM) Group. The meeting brought representatives from five European allied governments, industry, and from across the US services to discuss novel approaches to mitigate the occurrence of in-flight hypoxia. Dr. Jeffrey Phillips and Dr. Rick Arnold from NAMRU-D were both in attendance. Dr. Phillips presented his research comparing detection times of several technologies proposed

for in-cockpit hypoxia identification. The data for gas sensors clearly showed that hypoxia detection occurred a full six minutes earlier when compared to more conventional hypoxia detection sensors such as pulse or reflectance oximetry. Dr. Phillips' presentation also addressed an observed delay in cognitive performance recovery following exposure to hypoxia. The apparent delay in recovery bolsters the argument for an early warning system that does not require operators to self-

detect hypoxia, providing more time for life-saving corrective action. During the afternoon roundtable the discussion focused on identifying an effective and reliable system to provide early hypoxia detection across military aviation platforms. Although many ideas were expressed, a general consensus was reached that the development of an in-cockpit hypoxia detection and warning system will require a significant research and development effort. The Office of



Patuxent River, MD. (U.S. Navy photo by Mass Communication Specialist 2nd Class Kevin S. O'Brien/Released).

Naval Research plans a follow-up meeting as well as an industry day in the near future to identify potential off-the-shelf solutions from industry. NAMRU-D researchers are continuing research efforts into this critical area of need for the fleet.

## NAMRU-D Scientist Leads Fatigue Workshop

Dr. Beth Hartzler

As evidenced by the growing number of aviation mishaps, workplace accidents, and associated health problems, fatigue due to sleep loss continues to be a major concern for health and productivity in industrialized countries. Due to sustained operations and long-haul flights necessary to support the nation's ongoing military efforts, it is inevitable that aircrew and other military personnel will experience sleep loss, resulting in severe fatigue and greater difficulty fulfilling their role in the mission.



A flight captain taking a break on the flight deck (Justin Sullivan / Getty Images).

As part of the Aerospace Medical Association's 83<sup>rd</sup> Annual Scientific Meeting, a workshop led by Dr. John Caldwell, Chief Science Officer at Fatigue Science, Honolulu, and Dr. Lynn Caldwell, Senior Research Psychologist with the Naval Medical

Research Unit – Dayton, expounded on many of the fatigue-related issues most important for aircrews. The workshop was attended by nearly 80 people representing numerous countries and professional backgrounds, such as safety officers, general practice physicians, instructors. The variety of academic and research backgrounds present for the workshop was a testament to the severity of fatigue as a problem for not only military aviation, but also for the general population.

The primary focus of the workshop was to explain some of the potential causes of sleep loss, what effects fatigue may have on performance and health, and what options may be most effective to mitigate these effects. Drs. John Caldwell and Lynn Caldwell took turns explaining issues such as the importance of proper scheduling at helping to avoid fatigue, as well as effective countermeasures which are presently available to members of the different service areas. This workshop was also an excellent opportunity for those attending to ask questions of the presenters and of others in the room, and to exchange personal experiences and observations on fatigue-related concerns.

## Change of Command (cont.)



Left: Ceremony participants stand at attention during the playing of the National Anthem.

Right (left to right):  
CAPT Richard L. Haberberger, Jr.,  
CAPT C. Douglas Forcino, CAPT Keith A. Syring, RDML Bruce A. Doll.



Prior to CAPT Forcino's reassignment as Commanding Officer of NAMRU-D, he served as the Executive Officer of the Naval Health Research Center, located in San Diego, California. CAPT Forcino holds a B.A. in Biology from Shippensburg University (PA), M.S. and Ph.D. degrees in Physiology from the Ohio State University, and completed an American Heart Association Postdoctoral Fellowship at the Hershey Medical Center at Penn State prior to entering the Navy. CAPT Forcino has been at the forefront of Navy medical research for decades, innovating and integrating new technologies. During his initial address to his new command, CAPT Forcino acknowledged the attendance of BG Tim Jex, USAF, Commander, 71<sup>st</sup> Human Performance Wing; and Col Daniel Samsel, USAF, Vice Commander, 88<sup>th</sup> Air Base Wing, and emphasized the importance of joint ventures and cultivating tri-service cooperation.

## HFE TAG comes to Dayton

LCDR Wilfred Wells



Department of Homeland Security, the Office of the Secretary of Defense, and the FAA.

The theme of the 67<sup>th</sup> HFE TAG meeting revolved around evaluating human factors solutions to system design and human performance challenges in unmanned systems. The meeting provided a venue for the Human Factors Engineering community to discuss current practice, exchange technical information, and coordinate Human Factors Engineering research efforts

The 67<sup>th</sup> meeting of the Department of Defense Human Factors Engineering Technical Advisory Group (HFE TAG) was held April 30<sup>th</sup> through May 3<sup>rd</sup> in Dayton, hosted by the USAF 71<sup>st</sup> Human Performance Wing. More than 200 people were in attendance, including representatives from the Navy, Air Force, Army, NASA, Coast Guard, the

Department of Homeland Security, the Office of the Secretary of Defense, and the FAA. across DoD laboratories and other government agencies. Some of the challenges for future Unmanned Aircraft Systems operations that were discussed included: interoperability, modeling & simulation, personnel selection, autonomy, airspace integration, communications, propulsion & power, training, interface design, and test & evaluation.

Several of NAMRU-Dayton's Aeromedical Directorate staff presented their research at the four day meeting, including Dr. Fred Patterson, who presented his work on spatial strategies and training for spatial disorientation, and Dr. Jeffrey Phillips, who delivered a presentation on the recovery of cognitive and perceptual performance after a hypoxia-related performance deficit. Dr. Joseph Chandler presented the results of his study on measurements and mitigations of individual differences to fatigue susceptibility, and Dr. Richard Arnold discussed the identification of crew task and skill requirements across multiple Unmanned Aircraft Systems.

HFE TAG-67 meeting provided NAMRU-D aeromedical researchers a great opportunity to share their research, highlight the lab's capabilities, and develop cross service collaborations for future research efforts.

## NAMRU-D Products & Presentations

- Arnold, R. D., Williams, H. P., Vincenzi, D. A., Mangos, P. M., & Shrader, D. M. (2012, May). *Identification of crew task and skill requirements across multiple unmanned aircraft systems*. Presentation given at the 67<sup>th</sup> Human Factors Engineering Technical Advisory Group Meeting, Dayton, OH.
- Caldwell, J., & Caldwell, J. L. (2012, May). Understanding and managing fatigue in aviation. Workshop presentation given at the 83rd Annual Scientific Meeting of the Aerospace Medical Association, Atlanta, GA.
- Caldwell, J. L., Chandler, J. F., & Hartzler, B. M. (2012). Battling fatigue in aviation: Recent advancements in research and practice. *Journal of Medical Science*, 32, 47-56.
- Chandler, J. F. (2012, May). *Measurement and mitigation of individual differences in fatigue susceptibility*. Presentation given at the 67<sup>th</sup> Human Factors Engineering Technical Advisory Group Meeting, Dayton, OH.
- Chandler, J. F., Arnold, R. D., Horning, D. S., Turnmire, A. E., Hartzler, B. M., & Sill, C. B. (2012, May). *Preliminary field validation of a self-administered fatigue screening tool in a population of student naval flight officers*. Poster presented at the 83rd Annual Scientific Meeting of the Aerospace Medical Association, Atlanta, GA.
- Dorman, D. C., Mokashi, V., Wagner, D. J., Olabisi, A. O., Wong, B. A., Moss, O. R., ... Chapman, G. D. (2012). Biological responses in rats exposed to cigarette smoke and Middle East sand (dust). *Inhalation Toxicology*, 24, 109-124.
- Mumy, K. L., Doyle, T. L., & Mattie, D. R. (2012, May). *Evaluation of the potential occupational effects of military fuels through the use of dermal and lung in vitro models*. Poster presented at the 2012 Joint Army, Navy, NASA, Air Force Meeting, San Antonio, TX.
- Phillips, J. B., Simmons, R. G., & Horning, D. S. (2012, May). *Post-hypoxic recovery of cognitive and perceptual function*. Presentation given at the Poster presented at the 83rd Annual Scientific Meeting of the Aerospace Medical Association, Atlanta, GA.
- Mumy, K. L. (2012). Evaluation of the potential occupational effects of military fuels through the use of dermal and lung *in vitro* models. *Proceedings of the Joint Army, Navy, NASA, Air Force (JANNAF) 26<sup>th</sup> Safety and Environmental Protection Joint Subcommittee Meeting (JANNAF JSC CD-68)*.
- Mumy, K. L. (2012, May). *Dermal and lung in vitro models to evaluate potential occupational effects of military fuels*. Presentation given at the 2012 Toxicology and Risk Assessment Conference, Cincinnati, OH.
- Patterson, F. R. (2012, May). *Cockpit spatial strategies*. Presentation given at the 67<sup>th</sup> Human Factors Engineering Technical Advisory Group Meeting, Dayton, OH.
- Patterson, F. R. (2012, May). *Improving cockpit design standards to enhance spatial awareness*. Panel discussion presented at the 83rd Annual Scientific Meeting of the Aerospace Medical Association, Atlanta, GA.
- Patterson, F. R. (2012, May). Training for spatial disorientation: Avoidance, recognition, and recovery. Presentation given at the 67<sup>th</sup> Human Factors Engineering Technical Advisory Group Meeting, Dayton, OH.
- Phillips, J. B. (2012, May). *Post-hypoxic recover of cognitive and perceptual function*. Presentation given at the 67<sup>th</sup> Human Factors Engineering Technical Advisory Group Meeting, Dayton, OH.
- Williams, H. P., Hartzler, B. M., Eggan, S. M., Wells, W. H., Varino, F. R., & Arnold, R. D. (2012). *Proceedings of the unmanned aircraft system/ remotely piloted aircraft (UAS/IRPA) human factors and human systems integration research workshop* (Report No. NAMRU-D-12-41).

## Commanding Officer's Corner

*CAPT C. Douglas Forcino*

As I write this, it has been several weeks since the change of command and I cannot believe the time is passing so quickly. It is truly an honor and privilege to serve as the CO of NAMRU-Dayton. I am nothing but impressed with the staff and the programs that are underway here. Both the Aeromedical and the Environmental Health Effects Directorates are diligently working in their state-of-the-science facilities to address some of the most pressing operational medical challenges faced by our warfighters. I look forward to diving even deeper into the command's research programs in the upcoming weeks.

I would like to thank everyone who attended the Change of Command ceremony, including RDML Bruce Doll, BG Timothy Jex, and COL Daniel Semsel. The Air Force's presence at the ceremony was a testament to CAPT Syring's leadership in fostering the spirit of jointness in the new facilities at Wright-Patt. The collaborations and joint initiatives already established before my arrival will greatly assist me during my time as NAMRU-D's CO. I also want to thank those who put in numerous hours in making the ceremony a success, especially our Executive Officer, CAPT Rita Simmons. I would also like to wish CAPT Simmons fair winds and following seas as she embarks on a new journey as CO of NAMRU-San Antonio.

As CO, I will strive to ensure that every aspect of our operations has a customer focus and that our investigators have every opportunity to be successful in their research. From what I have already observed, I am certain my expectations will be surpassed. During his farewell speech, CAPT Syring spoke frankly about the importance of balancing family and home-life with the workplace and I echo his sentiment. Although I know the entire NAMRU-D staff is deeply committed to improving Navy medicine through research, I hope none of us ever forget the love and support of family members who help to make our continued success possible. By achieving this healthy balance, we will not merely sustain, but will enhance, the outstanding climate of research excellence and fleet-relevance that pervades the lab.



Captain C. Douglas Forcino, USN  
Commanding Officer

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

### **NAMRU - Dayton**

#### **Commanding Officer**

*CAPT C. Douglas Forcino, MSC, USN*

#### **Executive Officer**

*CAPT Jeffrey Andrews, MSC, USN  
(Arriving September 2012)*

Naval Medical Research Unit - Dayton  
Wright-Patterson Air Force Base  
2624 Q Street, Building 851, Area B  
WPAFB, OH 45433-7955



Phone: 937-938-3872

Fax: 937-904-8814

[www.med.navy.mil/sites/nmrc/Pages/namrud](http://www.med.navy.mil/sites/nmrc/Pages/namrud)

Use your  
smartphone  
to access  
our website!

