HEADS UP

Human Effectiveness Directorate
Headquarters Newsletter

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Director's Corner

Summer greetings to you all!

I am happy to present this issue of the HE newsletter! Our folks have been busy and it shows by the number of awards and accolades you will find described within the following pages. I am very proud of everyone for the fantastic efforts and achievements evident throughout our directorate. Thank you, and keep up the great work!

As mentioned in my recent Director's Calls, the Human Effectiveness Directorate is facing several tough challenges. Force shaping initiatives, BRAC issues, standing up the Institute of Aerospace Medicine, and preparations for the upcoming October AFMC Unit Compliance Inspection are all in full swing. While we deal with the effects of these activities, I am confident that HE will continue its mission and do so very successfully. History tells me that, even under pressure, the men and women of this directorate can and will get the job done with flying colors. I appreciate your continued professionalism and dedication.

I encourage you to continue submitting your ideas and comments to help us further develop this publication to better meet your interests and needs.

Dr. Hendrick "Henk" Ruck, *SES*
Director
Human Effectiveness Directorate

Give 'til It Hurts!

Chris Arnold (HEOC) listens to post-donation instructions from Ms. Bonnie Ferguson, a Donor Center Technician, after giving blood at the HE Blood Drive on May 24. Overall, 39 units of blood were collected. HE's Battlespace Visualization Branch (HECV) currently holds the trophy for most donors (8). The next HE Blood Drive is scheduled for July 26. For more information, contact Mr. Steve Stokes at DSN 785-8907 or Lt Cindy Wales at DSN 986-6542. You may also sign up online at http://wpmc1.wpafb.af.mil/BloodDonorCal/ at any time.

AFRL biotechnology leader Dr. Frazier retires

Six years after Dr. John Frazier left academia to work for the Air Force Research Laboratory Human Effectiveness Directorate in 1994, he switched professionally from toxicology to biotechnology.

Air Force photo
HE Director Dr. Hendrick Ruck (left) presents Dr. John W. Frazier with a letter of appreciation from President George W. Bush at a recent retirement ceremony at Wright-Patterson Air Force Base. As an ST, the civilian equivalent of a one-star general, Dr. Frazier has led the Air Force Research Laboratory's ground-breaking research in predictive toxicology and biotechnology since 1994.

As he surveyed the Air Force biotechnology landscape, he saw that diplomacy and perseverance might be the prime nutrients for growing AFRL's 21st century biotechnology program.

Patiently explaining the benefits of biotechnology to various Air Force leaders paid off for Dr. Frazier and AFRL/HE, since biotechnology is now included in the laboratory's long-term product development goals and organizational planning.

"We've been able to insert biotechnology in terms of long-term goals, and I think we're in a better position than we've ever been in," Dr. Frazier said prior to his retirement ceremony held April 10 at Wright-Patterson AFB.

Dr. Frazier reflects on his career with a blend of satisfaction and optimism for the future.

"It's been exciting but there were some real difficult times explaining to senior managers what biotechnology is and what it would do for the Air Force," Dr. Frazier. "It's a long-term promise, it's not something you can turn around and give them a product in a year or two."

Calling him "a true leader in the scientific profession," AFRL/HE Director Dr. Hendrick Ruck praised Dr. Frazier's pioneering efforts in predictive toxicology.

Although Dr. Frazier's title remained senior scientist in quantitative toxicology—he was involved in toxicology for 24 years at Johns Hopkins University and his first six years at AFRL—the migration to biotechnology "was a total shift from what I'd done in toxicology," Dr. Frazier said.

He cites national and international collaborations as critical to success in biotechnology research.

"We've developed a network of collaborators who are doing lots of good work for us. We can't do everything ourselves, that's always an issue both intellectually as well as financially," Dr. Frazier said, noting strong partnerships with Wright State University and the University of California at Santa Barbara.

From 1994 to 2000 Dr. Frazier's Air Force work involved quantitative toxicology, the study of how chemicals and other materials adversely affect biological systems.

He led AFRL's efforts in predictive biotechnology—specifically, developing tools to predict the toxicity of new chemicals—and toxicokinetics, which looks at the relationship between chemical exposure and the movement of toxins through the body.

Many of the tools he developed are used today in the AFRL/HE Biosciences and Protection Division's programs on nano-particles toxicity.

Dr. Frazier advises young scientists to realize early on that every system—academic, corporate or military—has its advantages and disadvantages, Dr. Frazier said. "Learn how to figure it out and optimize your time utilization so you take care of the stuff you have to take care of that you may not want to, and then focus as much of your time as you can on your real goal, which is research."

On an emeritus basis, Dr. Frazier will continue leading AFRL's Cell-Like Entity project, which he initiated. The project seeks to build cell-like entities—the biological equivalent of transistors—that operate on the same principles as living cells.

He'll conduct that work long-distance from his new home in Virginia, where he'll survey the landscape again—literally this time.

"Since we built the house we have no landscaping… I like gardening and I have a blank palette to work with," Dr. Frazier said with a smile.

Nanotechnology, novel solutions key to political challenges and warfare in 2025

Special Operations Forces and unmanned aerial systems (UASs) will likely bear the burden of a war fought in 2025, if science and technology researchers can develop solutions to unique challenges posed by those combat tactics and by social and political uncertainties.

Credit: U. S. Air Force photo
Airman 1st Class Kyle Bridges sits in the sensor operator's chair at an RQ-1 Predator Unmanned Aerial Vehicle ground control station at Balad Air Base, Iraq. Scientific and socio-political analysts at a recent Futurist Conference hosted by the Air Force Research Laboratory's Human Effectiveness Directorate predicted the U. S. military will continue to increase its reliance on UAVs for reconnaissance and attack missions in future warfighting. (U.S. Air Force photo)

That was the consensus of technology experts and analysts from high-tech industry and academia who convened in Fairborn on May 31 at the first Air Force Research Laboratory Human Effectiveness Directorate (AFRL/HE) Futurist Conference to ponder the evolution of warfighting—and the world in general—during the next 20 years.

The event paired a panel of international leaders—in nanotechnology, unmanned aerial systems (UAS), human factors, international security and biomedical and chemical defense—with scientists and engineers from AFRL's human effectiveness, sensors and air vehicles directorates, Aeronautical Systems Center Capability Planning, and the Wright-Patterson detachment of the Air Force Weather Agency.

Humans may not be able to predict or shape the future to an ideal vision, but researchers can help the world prepare for a wide variety of possible scenarios, experts said.

"We find ourselves in an increasingly turbulent and uncertain world where technology changes so fast we constantly wonder what is next," said Dr. Hendrick W. Ruck, AFRL/HE director. "And it's a world where international peace and stability are out of the question, at least for now. We are here today precisely because of this state of the world."

"This is not an attempt to predict but to understand the future, and the range of contingencies for which we have to prepare," said Mr. Tate Nurkin, engagement manager for Jane's Strategic Advisory Services, who for eight years has analyzed the international security environment and emerging threats to the United States.

In 2025 the United States could find itself fighting battles with "anti-access" countries such as China and Korea to "the Long War" against terrorism, which would be fought mostly in allied countries using clandestine and special operations methods, Mr. Nurkin said.

Human effectiveness specialists must find novel solutions— without lowering eligibility and training standards— to expand the mission and ranks of an Air Force special forces cadre that filled only 54 percent of its 241 allotted pararescuemen slots in 2005, Mr. Nurkin said, and to streamline a soldier's physical envelope; for example, reducing pack weight from 160 to 80 pounds without sacrificing combat capability.

Nanotechnology plays a major role in future warfare, said Dr. Matthew M. Nordan, president and director of research for Lux Research, a globally recognized authority on business and economic impacts of nanotechnology.

Nanotechnology has gained a practical foothold in manufacturing, Nordan said, noting that the current proliferation of nanomaterials is "truly a renaissance of materials science similar to the plastics revolution of the 1960s."

Nanotechnology combinations are most powerful, Dr. Nordan said. For example, we should expect to see programmable field-reconfigurable munitions—similar to the Star Trek™ "set phasers on stun" capability—and unmanned aerial vehicles (UAVs) that can loiter infinitely, powered by nanostructured photovoltaics and batteries based on nanostructured electrons.

Nordan also believes that power will cease to be a limiting factor in engineering due to nanotechnology-based advances in energy capture and storage technology.

Structural elements such as aircraft wings may perform "double duty" by using printable electronics to imprint radar or solar cell structures onto their surfaces; by 2011 electronics embedded in clothing and pharmaceutical containers will be a reality, Nordan said.

As UASs assume a greater tactical role in Air Force reconnaissance, strike and support missions, they bring new human factors

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AFRL researcher wins Harold Brown Award

Dr. John A. Caldwell, a Principal Research Psychologist with the Air Force Research Laboratory's (AFRL) Human Effectiveness Directorate (HE), has been selected as the recipient of the 2005 Harold Brown Award, the Air Force Materiel Command's highest honor for significant contributions in the field of research and development.

"I feel very honored to receive this award," said Dr. Caldwell. "I am deeply grateful to everyone who worked to get the submission signed, sealed, and delivered. I consider this to be the highlight of my career!"

The Harold Brown Award is named for the former Secretary of the Air Force who later became the Secretary of Defense. Upon his departure from the Air Force, the award was established as a tribute to his outstanding service and dedication to the Air Force and the nation. It honors researchers who have made a substantial improvement to the operational effectiveness of the Air Force.

Dr. Caldwell's selection was announced by Dr. Mark Lewis, Chief Scientist of the Air Force. The award was presented by Mr. Michael Wynn, Secretary of the Air Force, during a formal ceremony at the Pentagon on May 4.

"This is a well-deserved honor for Dr. Caldwell," said Dr. Hendrick Ruck, director of the Human Effectiveness Directorate. "This prestigious award not only reflects well on him and his vast expertise in the field of experimental psychology, it also confirms the world-class talents of the scientists and engineers of the Air Force Research Laboratory as a whole. I am very proud to have him on the AFRL team."

Dr. Caldwell, a member of AFRL since 2002, was selected for the award in recognition of outstanding science and technology research focused on improving the safety and effectiveness of the human weapon system. Dr. Caldwell led a diverse team to design, conduct, and transition results of the only scientific investigations to quantify fatigue impact and associated countermeasures on pilot performance. He demonstrated a 50 to 70 percent flight performance increase with a new fatigue countermeasure. He rapidly transitioned results to operations as policy guidance and preventive measures to mitigate operational fatigue related to the warfighter. Dr. Caldwell's scientific findings enabled safe, effective pilot performance in sustained operations during operations Enduring Freedom and Iraqi Freedom.

USAF Photo by Mickey Sanborn
Dr. John Caldwell (left) receives the Harold Brown Award from Michael W. Wynne, Secretary of the Air Force, during the award ceremony at the Pentagon. Dr. Caldwell was selected for the award in recognition of his outstanding science and technology research focused on improving the safety and effectiveness of the human weapon system.

In addition to his responsibilities with the research laboratory, Dr. Caldwell also serves as an international consultant on the employment of fatigue countermeasures to sustain military flight performance under operationally-demanding circumstances, on the utilization of flight simulators and specially-instrumented aircraft to conduct applied human-performance research, and on the application and theory of psychophysiological measures for solving operational aerospace performance problems.

Dr. Caldwell received a Bachelor of Science degree in psychology from Troy State University and a Doctorate in general experimental psychology from the University of South Mississippi. He was also the recipient of the directorate's 2004 Air Force Research Laboratory Scientific and Technical Achievement Award, presented each year to a laboratory scientist or engineer for outstanding in-house technical achievement, and the Meritorious Civilian Service Award, the second highest award presented to civilians for service to the Air Force, in 1997.

HE Supports NATO on the Human Effects of Non-Lethal Weapons (NLW)

Dr. Michael R. Murphy, AFRL/HED, submitted the Final Report for a four-year NATO Research and Technology Organization (RTO) Technical Team on "The Human Effects of Non-Lethal Technologies (HFM-073)." The NATO Washington Summit and Defense Capabilities Initiative of 1999 recognized the need for a full spectrum of capabilities for future NATO actions. As part of a roadmap for developing a NATO NLW capability, three Technical Teams were authorized under the RTO in 2000: one on Measures of Effectiveness; one on Emerging Technologies; and one on Human Effects. The team on Human Effects was organized by the Human Factors and Medicine (HFM) Panel of which Dr. Ruck is a member. Participants from nine nations participated in HFM-073 and selected Dr. Murphy as Chair. Dr. Murphy led each of the 10 meetings of the group and integrated all inputs into the 130 page Final Report. The report addresses the importance of human effects research on medical, training, development, testing, and acceptance issues for NLW and includes a glossary on non-lethal technologies and their human effects. The Team has been approved for a NATO Lectures Series on the human effects of NLW and a new Exploratory Team on the Human Effects of Emerging NLW, including those utilizing directed energy. A NATO RTO project on NLW that involves Russia is also in the works.

National Representatives to NATO RTO HFM-073 who were hosted at HED at Brooks City-Base in November 2002: from left to right, Ulf Sundberg (Sweden), David Humair (Switzerland), Michael Murphy (U. S.), Dieter Reimann (Germany), Jiri Chaloupka (Czech Republic), Per-Christian Opstad (Norway), and Michel Hugon (France). (Representatives from the UK (Bob Inns) and the Netherlands (Tony Gaillard could not attend this meeting.)

PALM Team wins Star Team Award

Dr. Brendan Godfrey, Director of the Air Force Office of Scientific Research (AFOSR), recently selected the Warfighter Readiness Research Division's Performance and Learning Models (PALM) Team as recipients of the AFOSR Star Team award for 2006-2009. The Star Team Award recognizes excellence in basic research in AFRL Technology Directorates. Specifically, it recognizes a team of researchers who have demonstrated world class scientific or engineering achievement. It rewards team achievement, fosters excellence throughout the technical directorate research community, showcases Air Force research, and promotes the critical role of fundamental research within the Air Force's broad technology thrusts.

Members of HEA's Performance and Learning Models (PALM) Team earned the AFOSR Star Team award for 2006-2009 for excellence in basic research within the AFRL Technical Directorates.

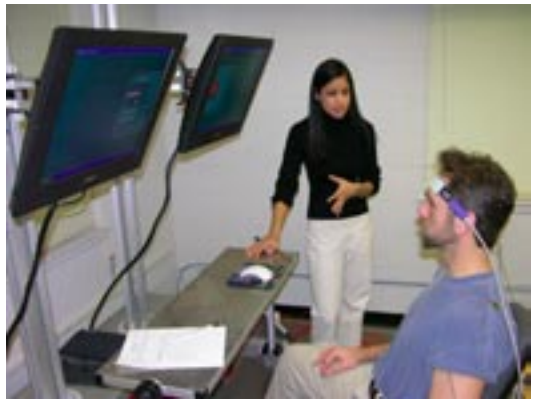
Continued... Nanotechnology, novel solutions key to political challenges and warfare in 2025

challenges, said Lt. Colonel (USAF Ret) Alan LaVoy, chief executive officer of Human Factors Prescriptions and a former United Airlines 737 pilot.

"Human beings are being squeezed between information and technology," LaVoy said, resulting in high stress levels on the job and the need to clarify skill requirements, crew selection and training, particularly for UAS operators.

Teamwork between airborne and ground-based crews is essential, LaVoy asserts.

"It's not just putting the technology out there. We have to disperse it in a useable, effective way," LaVoy said. "How do we get people who are flying these unmanned machines with a joystick from some dark hole outside Las Vegas to work with people sitting in airplanes in a combat zone?"



Credit: Photo by John Schutte AFRL/HE
A current AFRL research project seeks to improve UAV control station designs and determine a physical indicator that reliably predicts the onset of mental fatigue in operators. Here, biomedical researcher Julia Parakkat of AFRL's Biosciences and Protection Division, Biomechanics Branch explains a workstation mental acuity test to test subject Jeff Hudson. "There's a new wave of designs coming out for UAV control workstations," Ms. Parakkat said. "The aim is to get the warfighter out of the battlefield and engage in surveillance and combat missions from remote locations."

AFRL researcher wins gold, silver at international AF track meet

A distance of nearly 42 feet clinched a track and field victory for one Air Force Research Laboratory scientist during the Allied Air Component Command Headquarters Ramstein Track and Field Meet held June 7 at the Royal Air Force base in Cosford, England. The annual meet includes teams from the United States Air Force as well as the air forces of Germany, England, Belgium, and The Netherlands.

Lt "Cat" Carlson won a gold medal for her shot put throw measuring 41' 11" at the Allied Air Component Command Headquarters Ramstein Track and Field Meet June 7 at the Royal Air Force base in Cosford, England. The throwers from Germany and The Netherlands placed second and third, respectively.

Lt Cataleya "Cat" Carlson, a research chemist with the AFRL's Human Effectiveness Directorate, won a gold medal in shot put with a throw measuring 41' 11". She also earned a silver medal with a discus throw of 143' 3". Overall, the USAF women's track and field team took first place again this year. The men's team finished second.

This was Lt Carlson's second year participating in the meet, but she has been active in her sport for much longer.

To stay busy once her high school's basketball season ended, Lt Carlson decided to try her hand at track and field events and found that she performed well at the shot put and discus events. During her junior year of college, she began concentrating exclusively on her track and field abilities and started throwing year round. "It was a real change of pace," she said. "But it helped me reach the goals I set out for myself and it's what got me where I am today."

Lt Carlson is very enthusiastic about her participation in these Air Force events over the past two years. It not only provides an opportunity for her to interact with airman athletes from other countries, but it also allows her another venue in which she can represent her country. "To be able to represent not only my branch of service but my country as well is an honor," she said. "I always get pumped up to compete, but when I've got "USA" across my chest, that intensity reaches a whole new level."

"This was a great experience for Lt Carlson, the Air Force and the nation, being able to interact and foster foreign relations with these other countries and athletes," said Col Rick Riddle, chief of the directorate's Biosciences and Protection Division. "I'm very proud of her and her teammates."

Lt Carlson, also a volunteer track coach at Wright State University in Fairborn, plans to continue her training so she can compete at next year's meet in Germany.

AFMC's "101 Critical Days of Summer"

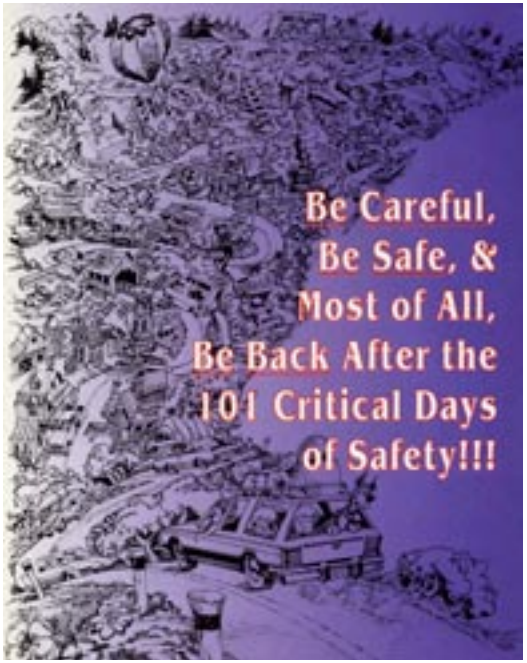
We're well on our way into summer! It's time for fun in the sun, relaxing days on the beach and on the water, road trips, and backyard parties with friends and neighbors. Summer also means some time away from the responsibilities of work, but not from our responsibilities to stay smart and safe as we enjoy a wide variety of summer activities.

For more information about AFRL's "101 Critical Days of Summer", please click on the link below.

(Link to 100 Critical Days of Summer)

Remember, we have a responsibility to ourselves, to our families, and to the Air Force to use good judgment and follow these rules of safety to ensure that everyone can enjoy the summer months without tragedy or pain.

Have a safe and enjoyable summer!



AFRL scientists bring home 4 awards from aerospace medicine conference

HE researchers recently brought home three of 15 association-level awards, plus a fourth constituent organization award for human factors research, presented May 15-19 at the Aerospace Medical Association (AsMA) annual meeting in Orlando, Florida.

Dr. William B. Albery

Dr. William B. Albery, a research scientist with HE's Aircrew Performance and Protection Branch (HEPG), received two awards: the Henry L. Taylor Founder's Award was presented at the Aerospace Human Factors Association (AsHFA) luncheon in "recognition of outstanding contributions in the field of Aerospace Human Factors." Dr. Albery was recognized for his contributions in the field of spatial disorientation countermeasures.

Dr. Albery also received the Kent K. Gillingham Award for "significant contribution to the fields of spatial orientation and situational awareness." Dr. Albery has more than 23 years experience in centrifuge-based research on spatial disorientation and situational awareness.

Dr. Fancis "Ted" Knox III, a Principal Scientist in HE's Biomechanics Branch HEPA, received the 2006 John Paul Stapp Award presented in honor of Air Force Colonel John Paul Stapp. The award recognizes outstanding individual contributions in aerospace biomechanics and progressive research in mechanical forces injury protection.

Dr. Ted Knox

Dr. Knox was honored for outstanding contributions in aerospace biomechanics and scientific progress in injury protection from ejection, vibration and impact. Dr. Knox's particular contributions include developing mass properties criteria for helmet mounted systems to prevent neck compression injuries and instrumented earplugs to measure head accelerations during race car crashes so that the relationship between head acceleration and injury can be established.

The instrumented earplugs are currently being used by the Indy Racing League and Champ Car drivers and the concept of measuring head accelerations is being further developed for the battlefield.

Colonel Peter Mapes

Colonel Peter Mapes, currently serving as pilot physician with HE, was awarded the Harry G. Moseley Award for the most outstanding contribution to flight safety. He was recognized for his leadership role in the fight for improvements in many areas related to aviation safety.

Colonel Mapes is an expert aviation epidemiologist who has developed a means of accurately forecasting the losses of both aircraft and people in aviation mishaps.

The AsMA is the largest, most-representative professional organization in the fields of aviation, space and environmental medicine. It serves as an umbrella group to provide a forum for a variety of disciplines to share their expertise and research projects.

AsMA's membership includes aerospace medicine specialists, flight nurses, physiologists, psychologists, human factors specialists, and researchers. Most are with industry, civil aviation regulatory agencies, departments of defense and military services, the airlines, space programs, and universities. Approximately 25% of the membership is international.

Aerospace medicine concerns the determination and maintenance of the health, safety and performance of persons involved in air and space travel.

AFRL
THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

Notables

- **Dr. Robert Thomas** of HE's Optical Radiation Branch (HEDO) was recently appointed secretary to the administrative committee for the American National Standards Institute Z136 Committee. This is an accredited United States National Consensus Standards for laser safety. This appointment reflects the significant contributions Dr. Thomas has made to this organization and will allow for the most up-to-date information on these standards to be communicated throughout the AF and DoD. This significant accomplishment reflects well on both Dr. Thomas and AF participation on this national committee.

- **Ms. Erica Doczy** of HE's Biomechanics Branch (HEPA) has been selected as the Science Spectrum magazine's Emerald Honors "Special Recognition Award". "Ms. Doczy has developed and integrated vibrant science and technology capabilities that have shown explosive growth in people,

Ms. Erica Doczy

resources, and collaborative linkages. Her accomplishments were specifically recognized by the Air Force Scientific Advisory Board (SAB) in October 2005 as a major contributor to the Airman Protection research area, and her work was highlighted as individually outstanding." Quote from Col Riddle. She will receive her award during the Minorities in Research Science Conference, 14-16 Sept., in Baltimore, Maryland.

- **Ms. Julia Parakkat**, a biomedical engineer within HE's Biomechanics Branch (HEPA) was recently selected winner of the best paper award from the Dayton Chapter of the American Society of Mechanical Engineers

Ms. Julia Parakkat

for her presentation on "Quantitative Methods for Determining US Air Force Crew Cushion Comfort" at the Dayton Engineering Sciences Symposium at Wright State University. Ms. Parakkat's presentation discussed results of a collaborative effort between HEPA and Wright State University's Biomedical Engineering Department. This effort helped develop objective methods for determining and predicting human tolerance of prolonged sitting in various military ejection seat cushions. Her winning paper was presented in the Human Factors session, one of 11 sessions in which a total of 63 abstracts were presented to105 attendees at the symposium.

- **Lt Cataleya Carlson** of HE's Applied Biotechnology Branch (HEPB) recently received the Best Student Poster award at the Toxicology and Risk Assessment Meeting in Cincinnati. The poster presented results of a study conducted to assess the toxicity of nanosized silver particles (Ag-15nm, Ag-30nm and Ag-55nm) in rat alveolar macrophages.

- **Mr. John R. Buhrman**, Biomedical Engineer for HE's Biomechanics Branch, won the annual Wright Research Site Civilian CAT III of the Year award. Mr. Buhrman delivered multiple Airman Performance and injury limit data to the Department of Defense and the Air Force Special Operations Command. Mr. Buhrman took 20 years of Brooks' altitude chamber research, to include 3,000 human altitude exposures and 2,000 Altitude Decompression Sickness symptoms, into a database for researchers and decision makers around the world to use in efforts to reduce disabilities.

- **TSgt Aaron J. Guilfoil**, NCOIC, Deployment Toxicology for HE's Applied Biotechnology Branch, received the annual Wright Research Site NCO of the Year award. TSgt Guilfoil reviewed 30 grants for submission to the Scientific Defense Threat Reduction Agency team to garner $17M in research funds. He is known as the "Inspection Pro" for his efforts in the vivarium inspection announced as "best in 20 years." He was lauded "best at Society of Armed Forces Military Laboratory Scientists (SAFMLS)" for his three presentations.

- **MSgt Gregory Sudberry**, NCOIC Logistics for HE's Applied Biotechnology Branch and the Det 1 First Sergeant, won the annual Wright Research Site SNCO of the Year award. MSgt Sudberry performance was noted "remarkable as a dual-hatted Det 1 First Sergeant & HEP BRAC coordinator who attended to the needs of 400 members." He was selected as a BRAC lead who wrote detailed plans for seven facilities for a potential 150 personnel move. He led relocation and transfer efforts for the unique AF capabilities--high-G onset centrifuge/ altitude chambers.