DEPARTMENT OF DEFENSE

HUMAN FACTORS ENGINEERING TECHNICAL ADVISORY GROUP (DOD HFE TAG)

MEETING 72

30 APRIL – 04 MAY

2018

HURLBURT FIELD, FL

TABLE OF CONTENTS

MEETING THEME:

SPECIAL/SPECIALIZED OPERATORS: PERSONNEL, TRAINING, AND ACQUISITION CHALLENGES

Special and specialized operators are small, elite groups that perform unique duties throughout the military, federal government workforce, and industry. The methods used to acquire equipment, select personnel, and train for these specialized operations vary within these specific disciplines. Fortunately, shared knowledge and lessons learned from these unique and elite groups can lead to better acquisition and training decisions, and improve performance for all of these specialties. Additionally, unique attributes associated with the operators themselves drive further considerations in human factors engineering, survivability, and habitability considerations.

Many organizations within the Federal Government have specialized operators: Special Forces in the DoD, Astronauts in NASA, Antarctic scientists in the NSF, Hurricane Hunters in NOAA and USCG, Smoke Jumpers in the Department of Interior, US Air Marshalls and Secret Service in the Department of Homeland Security. These and other specialists require special support relating to the domains of Human Systems Integration. The focus of this DoD HFE TAG is to identify unique requirements for these specialized groups, inspire collaboration amongst agencies with similar requirements, and to share lessons learned within these unique disciplines.

AGENDA

Monday, 30 April

0730 – 1600	Meeting Registration	Mezzanine
0800 – 1700	G-45 (by invite only)	Ton Son Nhut
1430 – 1515	New Member Orientation	Broadway
1515 – 1700	Executive Committee Meeting	Bagram
1800 – 2000	No Host Mixer	Back Porch Restaurant, Destin

Tuesday, 01 May

0730 – 1600	Meeting Registration	Mezzanine
0800 – 1145	Meeting 72 Plenary Sessions Dr. Richard Arnold, DOD HFE TAG Chair Col Chris Borchardt, USAF Dr. James Petro, HPT&B, OASD (R&E) Lt Col Rebecca Carter, USAF Dr. Frank Butler, CTCC, JTS CDR Jeff Grubb, USN Nathan Jones, MARCORSYSCOM, PM TRASYS Dr. Kevin Geiss, USAF, 711 HPW/RH-COI Dr. Stephen Dorton Dr. Steve Merriman John Plaga, USAF, 711 HPW/AFRL	Ton Son Nhut
1145 – 1315	Lunch	
1315 – 1500	Human Performance Measurement I	Broadway
1315 – 1500	Design: Tools and Techniques	Ton Son Nhut
1315 – 1500	Safety, Survivability, and Health Hazards	Bagram
1515 – 1530	Break	
1530 – 1700	Human Performance Measurement II	Broadway
1530 – 1700	Mixed Reality	Ton Son Nhut
1530 – 1700	Extreme Environments	Bagram

AGENDA

Wednesday, 02 May

0730 – 1600	Meeting Registration	Mezzanine
0730 – 0830	Technical Society/Industry (TS/I)	Broadway
0800 – 0945	Human Factors Standardization	Ton Son Nhut
0800 – 0945	HFE/HSI I	Bagram
0830 – 0945	Training I: Innovative Solutions	Broadway
0945 – 1000	Break	
1000 – 1145	Training II: Strategies for Enhanced Effectiveness	Broadway
1000 – 1145	MIL–STD–1472H Working Group	Ton Son Nhut
1000 – 1145	HFE/HSI II	Bagram
1145 – 1315	Lunch	
1315 – 1500	Modeling & Simulation I	Broadway
1315 – 1500	HSI Mil Handbook Working Group	Ton Son Nhut
1315 – 1500	Personnel Selection & Classification	Bagram
1515 – 1530	Break	
1530 – 1700	Modeling & Simulation: Human Behavior Panel	Broadway
1530 – 1700	Standardization Overflow Session	Ton Son Nhut
1530 – 1700	Poster Session	Bagram
1800 – 2000	Dinner – Boathouse in Valparasio	

AGENDA

Thursday, 03 May

0730 – 1600	Meeting Registration	Mezzanine
0800 – 0945	Army Collective HSI CBA Team	Broadway Ton Son Nhut
0800 – 0945	Cyber I	Bagram
0945 – 1000	Break	
1000 – 1145	Trust in Autonomy Special Interest Group	Broadway
1000 – 1145	Healthcare Special Interest Group	Ton Son Nhut
1000 – 1145	Cyber II (Workshop)	Bagram
1145 – 1315	Caucuses & Lunch	
	Army & Navy Caucus	Broadway
	Air Force and TS/I Caucus	Ton Son Nhut
	FAA, NASA, DHS, VHA Caucus	Bagram
1315 – 1700	Tours	

Friday, 04 May

0800 – 1200	Operating Board Meeting	Ton Son Nhut

PLENARY SUMMARY

Plenary Session 0800–1145 Tuesday 01 May 2018

Location: The Soundside Club at Hurlburt Field, Okaloosa County, Florida

Meeting Theme: Special/Specialized Operators: Personnel, Training, and Acquisition Challenges

Special and specialized operators are small, elite groups that perform unique duties throughout the military, federal government workforce, and industry. The methods used to acquire equipment, select personnel, and train for these specialized operations vary within these specific disciplines. Fortunately, shared knowledge and lessons learned from these unique and elite groups can lead to better acquisition and training decisions, and improve performance for all of these specialties. Additionally, unique attributes associated with the operators themselves drive further considerations in human factors engineering, survivability, and habitability considerations.

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DoD HFE TAG plenary speakers are invited to bring success stories and/or current challenges in the optimization of system-level solutions to support the design, integration, and use of autonomy. Topical presentations specific to your program of interest to human factors professionals are welcome as well.

The plenary session is expected to feature 8 speakers.

- Presentations of 20 minutes in length are appropriate.
- Meeting information and registration website is https://www.acq.osd.mil/rd/hptb/hfetag/. There is no registration fee for this meeting.
- Conference hosting request was approved by USD(ATL) in March 2018.
- All presentations should be unclassified and releasable to Distribution A. There may be international attendees in attendance.
- Travel and per diem costs will be the responsibility of travelers' home organizations. Directions, dining, and local lodging are provided in a separate attachment.

What is the DOD HFE TAG?

The Department of Defense Human Factors Engineering Technical Advisory Group (DOD HFE TAG) is composed of technical representatives from the Department of Defense (DoD), National Aeronautical and Space Administration (NASA), Federal Aviation Administration (FAA) and the Department of Homeland Security (DHS) with research and development responsibility in human factors and related disciplines.

There is no limitation on the number of uniform or civilian representatives from the above governmental entities. Representatives from organizations and activities with allied interests and technical experts in special topical areas are also invited to attend specific meetings.

Also participating in the HFE TAG are official representatives of technical societies or industry associations with a stated interest in human factors. These representatives must be credentialed by the HFE TAG before attending. Refer to the Technical Society/ Industry (TS/I) site for more information.

Origin

The Department of Defense Human Factors Engineering Technical Group (DoD HFE TAG) was implemented by a Memorandum of Understanding signed by the Assistant Secretaries of the Services in November 1976 for the purpose of coordinating and communicating research and development at the working level among the services and other Government agencies involved in Human Factors Engineering. The first HFE TAG meeting convened on August 9–10, 1977 in Fort Washington, Pennsylvania.

Goals

The major goal of the HFE TAG is to provide a mechanism for the timely exchange of technical information in the development and application of human factors engineering by enhancing the coordination among Government agencies involved in

HFE technology research, development, and application. The HFE TAG also assists, as required, in the preparation and coordination of tri-service documents, and sponsors in-depth technical interaction, which aids in identifying HFE technical issues and technology gaps.

Scope

Because of the diversity of the subject matter covered by the HFE discipline, the scope of the technical areas addressed by the HFE TAG is broad. For the purposes of the HFE TAG, HFE is defined as dealing with the concepts, data, methodologies and proce- dures which are relevant to the development, operation and maintenance of hardware and software systems. The subject matter subsumes all technologies aimed at under- standing and defining the capabilities of human operators and maintainers.

Composition

The Department of Defense Human Factors Engineering Technical Advisory Group (DOD HFE TAG) is composed of technical representatives from the Department of Defense (DoD), National Aeronautical and Space Administration (NASA), the Federal Aviation Administration (FAA), and Department of Homeland Security (DHS) with research and development responsibility in human factors and related disciplines.

TAG Proponent

Dr. James "Ben" Petro

Acting Director, Human Performance, Training and Biosystems (HPT&B) within the Office of the Assistant Secretary of Defense for Research and Engineering (OASD(RE))

More information about the TAG, including details and presentations from previous meetings, is available at: http://www.acq.osd.mil/rd/hptb/hfetag

Any questions, concerns, or requirements can be directed to the 2018 TAG Chair Dr. Richard Arnold, Naval Medical Research Unit, Wright-Patterson AFB, richard.arnold.10@us.af.mil

PLENARY SESSION SPEAKERS

OVERVIEW

0800 – 0810 Richard Arnold, John Plaga
Introduction to TAG

0810 – 0830 Col Chris Borchardt
Unique Pilot-Physician Contributions

0830 – 0845 James "Ben" Petro
Welcoming Remarks & Report on the Status of TAG

0845 – 0905 Lt Col Rebecca Carter
AFSOC Priority Gaps

0830 – 0845 Frank Butler
Tactical Combat Casualty Care

0830 – 0845 CDR Jeff Grubb
Organizing to Support the Special Operator: Observations from the TALOS Baselayer Project

0830 – 0845 Nathan Jones
Effective Technique for Defining Work Statements for Specialized Operators and Training Services

0830 – 0845 Kevin Geiss
The DoD's Human Systems Community of Interest

0830 – 0845 Stephen Dorton
A Summary of the Mission, Structure, and Activities of the Human Systems Division of the National Defense Industry Association and Its Relationship to the HFE TAG

0830 – 0845 Steve Merriman
Technical Society/Industry SubTAG

0830 – 0845 John Plaga
SAFE Association

0830 – 0845 Cynthia Null
Facilitaor Briefing

PLENARY SESSION SPEAKERS

Col Christopher J. Borchardt

Topic: Unique Pilot-Physician Contributions

Cases will be presented that demonstrate the valuable relationship between Pilot-Physicians and the missions they support. Pilot-Physicians bridge the clinical and operational environments in unique ways that provide opportunities for early identification of operational challenges effecting health from a perspective that is often only available to them and those they support (single seat fighters for example). They are trained and experienced in understanding physiologically acceptable normal conditions and are more inclined to report abnormal conditions than typical aircrew who may be concerned with career impact and other confounding motivations. Pilot-Physicians are also often assigned to MAJCOM Headquarters where they are able to contribute to acquisition programs early in their requirements development as well as having greater visibility on platform specific problems that may be occurring at multiple bases or in unusual patterns. Lastly, Pilot-Physicians have access to broad research capabilities in the 711th Human Performance Wing where additional resources can be engaged to analyze a problem in ways that aren't available at most military bases. This talk will highlight several successful projects and outline ongoing efforts to familiarize the audience with the multidisciplinary approach taken by the Pilot-Physician community.

Biography

Col (Dr.) Christopher J. Borchardt is the Human Systems Integration Advisor, Headquarters, Air Force Special Operations Command, Hurlburt Field, Florida. He is responsible for optimizing warfighter human performance under adverse conditions and generating acquisitions requirements for developing weapons systems.

Col Borchardt was commissioned through the Health Professions Scholarship Program following undergraduate studies at Andrews University in Michigan and prior to attending medical school at Loma Linda University in California. As a lifelong aviation enthusiast he earned an FAA private pilot license while in college. His experience includes supporting C-21, C-141, KC-135, F-16, and F-

PLENARY SESSION SPEAKERS

15E Strike Eagles missions in garrison and deployed. He has participated in eight USAF accident and safety investigation boards to include the only B-2 Stealth Bomber mishap and the first combat loss of an F-16 northwest of Baghdad.

Col Borchardt is board certified in Aerospace Medicine and Occupational Medicine by the American Board of Preventive Medicine and is a fellow of the Aerospace Medical Association. He has performed hurricane relief efforts in Honduras and combat medevac critical care air transport throughout Iraq in Army UH-60 Black Hawk helicopters.

EDUCATION

- 1992 Biology & Health Sciences, Andrews University, Berrien Springs, Michigan (matriculated to medical school prior to degree)
- 1995 Aerospace Medicine Primary, USAF School of Aerospace Medicine, Brooks AFB, Texas 1996 Doctorate of Medicine, Loma Linda University School of Medicine, Loma Linda, California
- 1997 Transitional Internship, Kettering Medical Center, Kettering, Ohio
- 2002 Air Command and Staff College (correspondence)
- 2003 Master's degree in Public Health, University of Texas, San Antonio, Texas
- 2005 Residency in Aerospace and Occupational Medicine, USAF School of Aerospace Medicine, Brooks AFB, Texas
- 2010 Air War College (correspondence)

ASSIGNMENTS

- July 1997–June 1999 Medical Director, Flight Medicine Flight, Wright-Patterson AFB, Ohio July 1999 – June 2002 Flight Surgeon, Bioenvironmental & Acceleration Branch, AFRL, Wright-Patterson AFB, Ohio
- June 2002 – June 2003 AFIT Master's Degree, University of Texas, San Antonio, Texas
- June 2003–May 2005 Residency in Aerospace Medicine, Brooks AFB, Texas
- June 2005–July 2008 Chief, Aerospace Medicine, Seymour-Johnson AFB, North Carolina July 2008–June 2010 Chief, Human Performance Sustainment Division, 711th Human Systems Wing, Brooks City-Base, Texas
- June 2010–June 2012 Commander, 436th Aerospace Medical Dental Squadron, Dover AFB, Delaware
- June 2012–December 2012 Deputy Commander, 380th Expeditionary Medical

Group, Al Dhafra, UAE

- December 2012–Human Systems Integration Advisor, Headquarters, Air Combat Command, Langely AFB, Virginia

FLIGHT INFORMATION

- Rating: Command Flight Surgeon, FAA Private Pilot
- Flight Hours: more than 1500
- Aircraft Flown: C-141B, C-141C, CES182R, UH-1V, UH-1N, C-21A, C-5A, T-6A, T-38A, T-37B, C-130H, C-130J, C-20B, C-37A, KC-135E, KC-135R, KC-10, E-4, T-1A, C-17A, UH-60A, UH-60L, F-16D, F-15E

MAJOR AWARDS AND DECORATIONS

- Meritorious Service Medal with one oak leaf cluster
- Air Medal
- Air Force Achievement Medal
- Iraq Campaign Medal
- Humanitarian Service Medal

OTHER ACHIEVEMENTS

- Federal Aviation Administration designated Aviation Medical Examiner (1997)
- Air Force Materiel Command Flight Surgeon of the Year (2000)
- Associate Professor, Wright State University School of Public Health (1998-2002) Diplomate of American Board of Preventive Medicine in Aerospace Medicine (2005) Diplomate of American Board of Preventive Medicine in Occupational Medicine (2008) Fellow and Life member, Aerospace Medical Association

EFFECTIVE DATES OF PROMOTION

- Second Lieutenant Apr 21, 1992
- Captain May 25, 1996
- Major May 25, 2002
- Lieutenant Colonel May 25, 2008

PLENARY SESSION SPEAKERS

Dr. James "Ben" Petro, HPT&B, OASD (RE)

Topic: Welcoming Remarks and Report on the Status of TAG with regards to OSD Support/News

Biography

Dr. Ben Petro is the Acting Director, Human Performance, Training and Biosystems (HPT&B) within the Office of the Assistant Secretary of Defense for Research and Engineering (OASD(RE)), where he is responsible for overseeing and coordinating a broad range of DoD research targeted to optimize warfighter effectiveness. When not acting, Dr Petro serves as the HPT&B Associate Director for Medical and Life Sciences Research. In this role, Dr Petro provides technical advice to OASD(RE) senior leadership and strategic oversight of the Department of Defense's (DoD) life sciences portfolio, including the research and development of novel medical tools and technologies, optimization of health and performance, and human effects of non-lethal weapon systems.

Dr. Petro recently completed an assignment with the Office of the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs where he served as the Principal Director for Chemical and Biological Defense and as the Acting Deputy Assistant Secretary of Defense for Chemical and Biological Defense. In this capacity, he led the development and implementation of DoD's Chemical and Biological Defense Program (CBDP) 2014 Strategy and Business Plan, strengthened DoD chemical and biological defense cooperation with key Allies and International Partners, and instituted new mechanisms for coordination and communication that increased CBDP efficiency and productivity.

Dr. Petro previously served on the White House National Security Council staff where he developed policies to address challenges from naturally occurring infectious diseases and chemical and biological (CB) weapons and oversaw and coordinated policy implementation across the Federal government. Dr. Petro developed The National Strategy for Countering Biological Threats, the Nation's first Strategies for Medical Countermeasures against Weapons of Mass Destruction and Domestic Chemical Defense,

and a number of Presidential Policy Directives and Executive Orders for National public health preparedness and prevention of infectious diseases and CB threats.

Prior to serving at the White House, Dr. Petro directed the Knowledge Integration Program Office within the Department of Homeland Security's Science and Technology Directorate where he led the Department's technical research and laboratory programs to identify, characterize, prioritize and mitigate hazards posed by chemical, biological, radiological and explosives threats. Dr. Petro also previously served as a Program Manager in the Defense Intelligence Agency, where he managed a suite of programs to assess and counter chemical and biological weapons threats.

Dr. Petro earned his Ph.D. in Microbiology and Immunology from Vanderbilt University, a Master's of Science in Strategic Intelligence from the National Defense Intelligence College, and is a graduate of the Federal Executive Institute's Leadership for a Democratic Society Program. He has published in peer-reviewed journals including Science, Studies in Intelligence, and Biosecurity and Bioterrorism. Dr. Petro is a recipient of the Secretary of Defense Exceptional Civilian Service Medal, the National Security Council Outstanding Service Award, the Defense Threat Reduction Agency Meritorious Civilian Service Medal, the Defense Intelligence Agency Meritorious Civilian Service Medal, the Central Intelligence Agency Studies in Intelligence Award and the Director of National Intelligence Galileo Award.

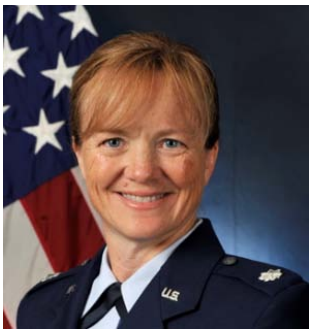
Lt Col Rebecca Carter

Topic: AFSOC Priority Gaps

AFSOC medical modernization provides mission enabling medical and human performance capability to AFSOF personnel through rapid equipping, COTS-first procurement and actionable research and development. Devices are developed and designed to minimize weight and power, but also to enhance usability and human interface requirements.

PLENARY SESSION SPEAKERS

Biography



Lieutenant Colonel Rebecca W. Carter serves as Chief of the Medical Modernization Division (SGR) for Headquarters, Air Force Special Operations Command at Hurlburt Field, Florida. She guides development of knowledge and equipment to enhance battlefield trauma care, optimize Battlefield Airman performance, and advance austere force health protection and support. Lieutenant Colonel Carter leads medical research and development for a diverse portfolio including blood and blood filtration products, hemorrhage and resuscitation therapeutics, diagnostics, fluid warming, advanced ultrasound, CBRN defense, medical simulation and training, and human performance. She also directs a robust program for transitioning commercial medical capability into SOF medic equipment sets.

Frank K. Butler, MD, FAAO, FUHM, FAUAS, CAPT MC USN (Ret.)

Topic: Tactical Combat Casualty Care

Biography

Dr. Butler is a retired Navy Undersea Medical Officer and an ophthalmologist who served as a Navy SEAL platoon commander prior to attending medical school at the Medical College of Georgia, where he was President of Alpha Omega Alpha, the medical honor society. He spent most of his career in Navy Medicine supporting the Special Operations community and was the first Navy physician selected to serve as the Command Surgeon for the U.S. Special Operations Command.

Dr. Butler has been married to his wife Debbie for 46 years. They live in Pensacola, Florida and

have four grown children: Jennifer, Jeff, Chris, and Meredith.

In his current position at the Joint Trauma System, he chairs the Department of Defense's Committee on Tactical Combat Casualty Care, helping to ensure optimal battlefield trauma care for our country's wounded service men and women. He also serves as co-chair of the Decompression Sickness and Arterial Gas Embolism Treatment Committee for the Undersea and Hyperbaric Medical Society.

Dr. Butler spent five years at the Navy Experimental Diving Unit in Panama City, FL, where he helped to pioneer numerous advances in SEAL diving capabilities. Later, as Director of the SEAL Biomedical Research Program for 15 years, his landmark projects included laser refractive surgery in the military, diving and hyperbaric ophthalmology, advanced diving procedures for Navy SEALs, the Naval Special Warfare decompression computer, and Tactical Combat Casualty Care (TCCC).

The set of evidence-based, best practice battlefield trauma care guidelines embodied in TCCC has now been recognized as one of the major advances in combat casualty care achieved during the recent conflicts in Afghanistan and Iraq and has been credited with saving the lives of many hundreds of casualties from those wars. Tactical Combat Casualty Care is the prehospital component of the DoD's Joint Trauma System and TCCC is now the standard for battlefield trauma care throughout the US Military and in the militaries of many allied nations.

Dr. Butler has over 120 publications in the medical literature. He has been awarded the U.S. Special Operations Command Medal by Admiral Bill McRaven, the Academy of Underwater Arts and Sciences NOGI Award for Distinguished Service to the diving community, the Auerbach Award for contributions to Wilderness Medicine, the Norman McSwain Award for leadership in Prehospital Trauma Care and the first Committee on Tactical Combat Casualty Care Award for outstanding contributions to battlefield trauma care. He was recently honored by a Navy Forward Surgical Hospital in Iraq naming the road to the hospital "Frank Butler Boulevard" in honor of his work in developing and advancing TCCC concepts.

PLENARY SESSION SPEAKERS

CDR Jefferson D. Grubb, MSC, USN

Topic: Organizing to Support the Special Operator: Observations from the TALOS Baselayer Project

The Tactical Assault Light Operator Suit (TALOS) project is an effort develop a system to improve the survivability, lethality, situational awareness, and overall performance of Special Operations Forces (SOF) Operators. In 2013, U.S. Special Operations Command stood up a Join Acquisition Task Force, consisting of acquisition professionals, engineers, and operators from multiple SOF units to design and build a prototype TALOS system. This presentation will discuss the challenges and benefits of such an organization with specific reference to development of the TALOS Baselayer. Ultimately, the tight integration of managers, engineers, and operators streamlined the design of the Baselayer and improved the odds that component technologies will transition.

Biography

CDR Jeff Grubb is a Naval Aerospace Experimental Psychologist currently serving as the Human Factors Lead for U.S. Special Operations Command's Joint Acquisition Task Force Tactical Assault Light Operator Suit (JATF-TALOS). He holds a Bachelor of Science degree in Psychology from the University of Alaska Fairbanks and a Ph.D. in Developmental Cognitive Neuroscience from the University of Denver. His Navy career has included pilot-vehicle interface work at NAVAIR's Human Systems Department, selection test development and administration at the Naval Aerospace Medical Institute, training systems research at the Naval Air Warfare Center Training Systems Division, and management of the Air Warfare Training Development portfolio at PMA-205.

PLENARY SESSION SPEAKERS

Nathan Jones, MARCORSYSCOM

Topic: Effective Technique for Defining Work Statements for Specialized Operators and Training Services

Contracting for specialized operations and training services is often a difficult task. Ambiguities in requirements generation, documentation, and interpretations exist between all stakeholders in a service contract award and lead to misunderstandings, cost over-runs, and/or under performance. The interests of Government are addressed by Request for Proposal's (RFPs) which are guided by specific laws, rules, and guidelines developed to ensure efficiencies of cost and schedule while ensuring competitive fairness; however, the failures are often in the process of adequately defining the services needed.

This presentation will present a Performance Work Statement (PWS) Capability Analysis that can be utilized to improve the process. The analysis is based on a job-task analysis, but structured specifically to enable acquisition of services. The analysis can be utilized for defining the requirements, defining the performance requirements in the contract, utilized in source selection, and utilized for contract surveillance post award.

Biography

Nathan Jones is the Manpower, Personnel, and Training Technical Support Lead at MCSC PM TRASYS. Mr. Jones is a graduate of Embry Riddle Aeronautical University with BS in Human Factors Psychology and American InterContinental University with MBA in Project management. He is currently a Marine Corps Systems Command selectee for the Executive Potential Program and is performing a detail with NASA Office of the Chief Engineer. He has 18+ years of experience in human performance, human-systems integration, assessments, and acquisition program experience. His is responsible for overseeing PM TRASYS' training front end analyses, Verification & Validations (V&Vs), training effectiveness evaluations (TEEs), and training domain expertise for PM TRASYS. He has been directly involved in the development of RFPs for the past 10 years at PM TRASYS and served on numerous Source Selections.

PLENARY SESSION SPEAKERS

Dr. Kevin T. Geiss, SES

Topic: The DoD's Human Systems Community of Interest

The Human Systems Community of Interest (HS COI) provides a framework for Service, Agency, and DoD Executives, Scientists, Engineers, and Human Systems Integration Practitioners to share information, ideas, and best practices; identify opportunities; measure progress; jointly plan and coordinate

programs across Department of Defense (DoD), and report on the state of the health of Human Systems and related science and technology. The HS COI comprises three subareas: (1) Personalized Assessment, Education, and Training; (2) Protection, Sustainment, and Warfighter Performance; and (3) System Interfaces and Cognitive Processes. The purpose of this talk will be to introduce the HS COI to the DoD HFE TAG attendees with the goal of building awareness and increasing opportunities for collaboration.

Biography

Dr. Kevin T. Geiss, a member of the Senior Executive Service, is Director, Airman Systems Directorate, 711th Human Performance Wing, Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio which provides science and leading-edge technology to define Airman capabilities, vulnerabilities and effectiveness; train warfighters; integrate operators and weapon systems; protect Air Force personnel; and sustain aerospace operations. The directorate is an 800-person research and development organization that is the heart of Airman-centered science and technology for the Air Force with facilities at Wright-Patterson AFB, Ohio and Ft. Sam Houston, Texas. Dr. Geiss also serves as the DoD Chair for the Human Systems Community of Interest.

PLENARY SESSION SPEAKERS

Dr. Stephen Dorton

Topic: A Summary of the Mission, Structure, and Activities of the Human Systems Division of the National Defense Industry Association and Its Relationship to the HFE TAG

The Human Systems Community of Interest (HS COI) provides a framework for Service, Agency, and DoD Executives, Scientists, Engineers, and Human Systems Integration Practitioners to share information, ideas, and best practices; identify opportunities; measure progress; jointly plan and coordinate

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Biography

Steve Dorton is a Human Factors Scientist and Director of the Human-Autonomy Interaction Laboratory (HAIL) at Sonalysts. He works with a cross-disciplinary team to tackle a variety of defense and national security problems. His current research interests include collective intelligence, crowdsourcing, argumentation, and decision support. Steve has served along with Sheryl Cosing as the Technical/Service Industry (T/SI) liaison to the National Defense Industrial Association (NDIA) Human Systems Directorate (HSD) for the last three years, working to foster collaboration and mutual benefit between the NDIA/HSD and the DODHFETAG.

PLENARY SESSION SPEAKERS

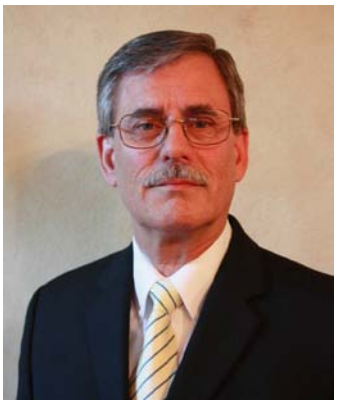
Steve C. Merriman

Topic: Technical Society/Industry SubTAG

This presentation provides a short overview of the TS/I organization. This SubTAG was created in 1978 to facilitate communication and data exchange between the DOD HFE TAG and industry, via selected technical societies and industry organizations. TS/I members represent professional/technical/industrial organizations with an interest in furthering HFE, NOT their home organizations. Representatives may NOT advocate their home organizations products or services. TS/I members respond to TAG needs for interchange and coordination in specific HFE areas. They maintain liaison with their parent organization to ensure a two-way flow of information is maintained. Currently, 10 organizations are representatives in TS/I; hopefully representation will increase to cover a broader range of organizations. This presentation covers the following areas:

- SubTAG Overview and Background
- Objectives and Scope
- Membership Policy
- Information Exchange Mechanisms
- Value to the DOD HFE TAG

Biography



Steve Merriman has 50 years of experience as a practitioner of human factors engineering (HFE), crew station integration, user interface design, training system design, and human systems integration (HSI). Steve has supported NASA on the Space Shuttle program, US Army

on manned ground combat vehicles and unmanned air and ground vehicles, and the US Navy/USMC on 50+ military aircraft. From 1987 through 2015, he served in a variety of technical leadership positions with The Boeing Company. From 1967 until 1987, he held systems acquisition and R&D positions with the Naval Air Systems Command, Naval Air Development Center, the Office of the Secretary of Defense, and the DOD Training and Performance Data Center. Steve is an active member of several technical societies and government-industry associations, and is heavily involved in HFE/HSI standard development. He is a Human Factors and Ergonomics Society Fellow, Aerospace Medical Association Associate Fellow and a Boeing Associate Technical Fellow (retired). He is also a current member of the US Air Force Scientific Advisory Board and serves on National Academies of Sciences and Engineering panels.

John Plaga

Topic: SAFE Association

The SAFE Association is dedicated to the preservation of human life. It provides a common meeting ground for the sharing of problems, ideas and information. SAFE, is a non-profit international association headquartered in Oregon, with chapters located throughout the world. SAFE members represent many fields including equipment manufacturers, distributors, engineers, health professionals, management, government including members of the military and the many sub-fields associated with the design, operation, safety and survivability of all land, space, air and sea vehicles to include related life-sustaining equipment, systems, and training. SAFE's chapters sponsor meetings and workshops that provide a forum for the exchange of ideas, information on member's activities, and presentation of new equipment, and procedures encompassing government, private, and commercial application in the related disciplines of safety and survival. SAFE culminates each year's activities with the annual SAFE Symposium. Presentation topics range from survival to the latest aircraft egress aids, cockpit design, restraint systems, and crew training. The Symposium offers an international group of professionals the opportunity to share problems and solutions in the related fields of safety and survival.

PLENARY SESSION SPEAKERS

Biography

John Plaga is a Supervisory Senior Research Aerospace Engineer in the Human Systems Integration (HSI) Directorate, 711th Human Performance Wing, AFRL, Wright-Patterson AFB OH. He is currently the Force Projection Branch Chief, which is responsible for providing HSI support to Tanker, Mobility, Agile Combat Support, and Fighter/Bomber Directorates. He was previously involved in HSI activities that included participating in the Program Execution Working Group for the HSI High Performance Team, working with the AF Developmental Planning community to address HSI early in the acquisition life cycle, and advising the KC-46 Aircraft Program Office on HSI matters. In addition, Mr. Plaga advised the Predator/Reaper Systems Group on HSI aspects of Ground Control Station design, developed HSI tools for system acquisition, and made HSI-related recommendations for virtual game-based training tools. Mr. Plaga has a Master's Degree in Human Systems Integration from the Naval Postgraduate School and a Bachelor's Degree in Aeronautical/Astronautical Engineering The Ohio State University. He was previously involved in ejection seat related research in AFRL, including the development and testing of a data collection system for the ADAM manikin, Foreign Comparative Testing of the Russian K-36 Ejection seat, and the assessment of the Fourth Generation Technologies Demonstration program. He has been involved in injury assessment for numerous ejection qualification efforts such as the Joint Helmet Mounted Cueing System, T-6A, F-22, NASA T-38, and F-35. Mr. Plaga has been involved in other efforts such as the design of new manikin head-forms, development of a Universal Mobile Aircrew Restraint System, and improved helicopter crashworthy seating systems. John has been a member of the SAFE Association since 1991 and is currently the Vice President of the Wright-Brothers Chapter. He has previously served as Chapter President, Secretary, and Awards Chair. Mr. Plaga also previously held positions on the SAFE Association Board of Directors as Science & Technology Chairman (2012), Secretary (2013), Publications Committee Chair (2014) and member of Symposium Committee (2016). He was awarded the SAFE Association Individual Achievement Award in 2000, and was part of the teams for the Team Achievement Awards in 1994, 1998, and 2003. John is also an Honorary Life Member of both the Wright Brothers Chapter and of the SAFE Association.

PLENARY SESSION SPEAKERS

Richard D. Arnold, Ph.D.

Biography

Richard Arnold serves as Director, Aeromedical Research at Naval Medical Research Unit Dayton

(NAMRU-D). His Naval research career began in 1999 when he was commissioned as a US Naval Aerospace Experimental Psychologist. After completing officer indoctrination training at Newport, RI and the aeromedical officer's course and flight training at NAS Pensacola, FL he was assigned to Naval Aerospace Medical Institute, Pensacola, FL where among other duties he administered the Navy's aviation selection testing program. He was subsequently assigned to Naval Air Warfare Center, Training Systems Division, Orlando, FL, where he conducted research on simulation technologies and training effectiveness. Upon leaving active duty service in 2006 Dr. Arnold worked as a private consultant until 2008, at which date he returned to the Navy as a staff scientist at Naval Aerospace Medical Research Laboratory (NAMRL), NAS Pensacola, FL. He was promoted to Scientific Director in 2010. His research at NAMRL included work in aviation personnel selection and fatigue countermeasures. As Scientific Director he was responsible for execution of NAMRL's research mission, spanning a range of aeromedical and aviation human factors topics such as motion sickness countermeasures, spatial orientation, fatigue effects and countermeasures, hypoxia detection and mitigation, visual performance, personnel selection, and aeromedical standards. In 2011 he relocated with the laboratory, as directed by the Base Realignment and Closure Act of 2005, to Wright-Patterson AFB, OH, at which time the Research Directorate of NAMRL became the Aeromedical Research

PLENARY SESSION SPEAKERS

Directorate of the newly established NAMRU-D. Dr. Arnold is an active member of the Aerospace Medical Association, serves on the Executive Committee of the International Symposium on Aviation Psychology, serves on the Editorial Board of Theoretical Issues in Ergonomic Science, and has served as an ad hoc reviewer for numerous scholarly publications.

SESSION AGENDAS: TUESDAY

SubTAG: Human Performance Measurement

Chairs: LT Joseph Mercado, USN, and Justin Stofik

Human Performance Measurement I

01 May 2018 | 1315 – 1500
Broadway

1315 – 1340	**24/7 Combat Fitness System: Current Capabilities, Use, and Future Applications** Adam J. Strang, PhD, AT *AFRL, 711 HPW*
1340 – 1405	**Performance in Noise: Impact of Degraded Speech Intelligibility on Sailor Performance in a Navy Command Environment** Leland S. Stone *Visuomotor Control Laboratory, Human-Systems Integration Division, NASA Ames Research Center*
1405 – 1430	**Dietary Intake and Energy Expenditure of Pararescuemen During Routine Training** Adam J. Strang, PhD, AT *AFRL, 711 HPW*
1430 – 1455	**Unique Human Factors Aspects of Intelligence-Surveillance Analyst Performance: Toward A Specialized Cognitive Assessment Battery** Kathleen G. Larson & Rik Warren *USAF, AFMC 711 HPW*

Human Performance Measurement II

01 May 2018 | 1515 – 1700
Broadway

1515 – 1545	**Effect of High Deck Accelerations on Surgical Tasks** Eric Pierce *Naval Surface Warfare Center Panama City Division*
1545 – 1615	**Optimizing Marine Corps Readiness with Physical Fitness Best-Practices and Data-Driven Methods for Injury Avoidance** Lisa Lucia, Timothy Clark, & Laura Cassani *Aptima*
1615 – 1645	**Comparing the Effects of Transcranial Direct Current Stimulation with Electroencephalographics Electrodes versus Hal Sport Neuromodulation System During a Multitasking Environment** Nathaniel Bridges *711 HPW, RHCP*

SESSION AGENDAS: TUESDAY

SubTAG: Design: Tools and Techniques (DTT)

Chair: Michael Feary

01 May 2018 | 1300 – 1445
Ton Son Nhut

1300 – 1305	**Welcome and SubTAG Business**
1305 – 1330	**Strategic Planning Tool for Mission Analysis and Course of Action Determination** Bob Pokorny & Chuck Rogers *Intelligent Automation, Inc.*
1330 – 1355	**Leveraging Crowdsourcing and Collective Intelligence in Complex Problem Solving** Stephen Dorton *Sonalysts, Inc.*
1355 – 1420	**Human Performance Modeling Techniques: WIN-T System Case Study** Christopher Plott *Alion Science & Technology*
1420 – 1440	**Tools Panel Discussion**
1440 – 1445	**Chair Election**

SESSION AGENDAS: TUESDAY

SubTAG: Safety, Survivability, and Health Hazards

Chair: Cindy Whitehead

01 May 2018 | 1315 – 1515
Bagram

1315 – 1345	**Air Force Special Operations Command (AFSOC) Training Health Monitoring** Cadet Austin Hoover *US Air Force Academy*
1345 – 1415	**Camouflage Material To Shroud From Night Vision Goggles** Michael Sedillo *711th Human Performance Wing*
1415 – 1445	**Guidance For Selecting Health-Care Products Using Human Factors** Helen Fuller *VA Center for Patient Safety*
1445 – 1515	**Government Applications For Wearable Robotics, Panel** *Cindy Whitehead (NAVSEA 05H), Joseph Parham (Natick Soldier Engineering & Research Directorate), Kendra Betz (VA Center for Patient Safety)*

SESSION AGENDAS: TUESDAY

SubTAG: Mixed Reality

Chairs: Marianne Paulsen and Elizabeth Abdeen

01 May 2018 | 1530 – 1715
Ton Son Nhut

1530 – 1540	**Introduction and Business** Marianne Paulsen *NUWC Division Keyport*
1540 – 1600	**The Virtues and Vices of Using Virtual Versus Augmented Reality in Creating Realistic Simulations** Kyle Pettijohn, Chad Peltier, LT Adam Biggs, USN *Naval Medical Research Unit Dayton*
1600 – 1620	**Virtual, Augmented, and Mixed Reality for Aircraft Maintenance (VAMRAM): Opportunities and Challenges** David Eisensmith *Air Force Research Laboratory*
1620 – 1640	**Behavioral Fidelity Issues in Mixed Reality Training Systems** Dennis J. Folds *Lowell Scientific Enterprises*
1640 – 1700	**An Augmented Reality Framework for Representing Individual Differences in Tactical Casualty Combat Care Training** Kelly Hale *Design Interactive*
1700 – 1715	**Session Closeout** Marianne Paulsen *NUWC Division Keyport*

SESSION AGENDAS: TUESDAY

SubTAG: Extreme Environments

Chairs: Rachael Lund and John Plaga

01 May 2018 | 1515 – 1700
Bagram

1515 – 1520	**Extreme Environments Introduction and Business** *Rachael Lund (NSWC Dahlgren) and John Plaga (711 HPW, USAF HSI)*
1520 – 1545	**Restraint System Technology for Helicopter Mobile Aircrew** Stuart Nightenhelser *Wolf Technical Services Inc.*
1545 – 1610	**Effects of Extreme Hypobaric Environments upon the Brain** Paul Sherman *USAF 711 HPW*
1610 – 1635	**Overview of Neck Injury Criteria** Lt Col Jeff Parr *Air Force Institute of Technology*
1635 – 1700	**Discussions and Review Extreme Environments Charter** *Rachael Lund (NSWC Dahlgren) and John Plaga (711 HPW, USAF HSI)*

SESSION AGENDAS: WEDNESDAY

SubTAG: Technical Society/Industry (TS/I)

Chairs: Steve Merriman and Barbara Palmer

02 May 2018 | 0730 – 0830 & 1700 – 1800
Broadway

0730 – 0740	**TS/I Welcome and Overviews** Steve Merriman and Barbara Palmer
0740 – 0800	**SAE G-45 Update on the Human Systems** Steve Merriman *SAE International, G-45 Human Systems Integration Committee*
0800 – 0830	**How Do You Know If Someone Actually Knows Something?** Neil Ganey Northrop-Grumman
1700 – 1710	**Chartered Institute of Ergonomics and Human Factors (CIEHF) Overview** Bob Smillie *Chartered Institute of Ergonomics and Human Factors (CIEHF)*
1710 – 1730	**INCOSE** Jennifer Narkevicius *The International Council on Systems Engineering (INCOSE)*
1730 – 1800	**TS/I Business Meeting**

SESSION AGENDAS: WEDNESDAY

SubTAG: Standardization

Chair: Alan Poston

02 May 2018 | 0800 – 0945
Ton Son Nhut

0800 – 0810	**Introduction**
0810 – 0820	**Ship Bridge Design Criteria for MIL-STD-1472H** John Winters
0820 – 0830	**Development of a Human Systems Integration Standard** Steve Merriman
0830 – 0840	**DoD HSI Standards Working Group** Chelsey Lawson
0840 – 0850	**Development of a Human System Integration Handbook** Chelsey Lawson
0850 – 0900	**Flight Symbology Working Group** Bob Copeland
0900 – 0910	**High Priority Operations (HPO) Analysis** Steve Merriman
0910 – 0920	**Update of DOD-HDBK-743** Bob Copeland
0920 – 0930	**Task Analysis Workshop** Chelsey Lawson
0930 – 0945	**Election of Chair, New Business, and Second Thoughts** Bob Copeland

SESSION AGENDAS: WEDNESDAY

SubTAG: Training I: Innovative Training Solutions

Chair: Kelly Hale

Training I: Innovative Training Solutions

02 May 2018 | 0830 – 0945
Broadway

0830 – 0840	**Training Introduction and Business** Kelly Hale *Design Interactive, Inc.*
0840 – 0905	**SSBN Training** Aaron Clark *NUWC Keyport*
0905 – 0930	**Investigating the Utility of Physiological Measures to Verify Stress Responses and to Support Adaptive Navy Firefighting Training** Jim Pharmer and Anna Skinner *NAWCTSD; Design Interactive, Inc.*
0930 – 0945	**Towards a Unifed Model of Gamification** Ian Dykens, Angelique Wetzel, and Stephen Dorton *Sonalysts, Inc.*

SESSION AGENDAS: WEDNESDAY

Training II: Strategies for Enhanced Operational Effectiveness

02 May 2018 | 1000 – 1145
Broadway

1000 – 1020	**Aegis Doctrine Visualization Tool (ADVT): Enhancing Training and Preventing Errors** Megan Kozub *NSWC DD*
1020 – 1045	**Going from Ordinary to Extraordinary: Targeted Cognitive Enhancement Program as a Means to Train Special Operations** LT Adam Biggs, Joseph Hamilton, Kara Blacker *Naval Medical Research Unit Dayton*
1045 – 1110	**Moving Beyond Levels: Creating Value in Military Organizations with Evaluation Data** Eric Surface, Kurt Kraiger *ALPS Insights, Inc.*
1110 – 1125	**Practical Adaptive Immersive Training Systems** Bob Pokorny NAWCTSD; Design Interactive, *Inc.*
1125 – 1145	**Training Closing Remarks and Discussion** Kelly Hale *Design Interactive, Inc.*

SESSION AGENDAS: WEDNESDAY

SubTAG: HFE/HSI

Chair: Cindy Whitehead

HFE/HSI I

02 May 2018 | 0800 – 0945
Bagram

0800 – 0820	**Rapid Human Centered Design in Rocket Propelled Grenade (RPG) Net Improvement** Richard Thompson *Naval Surface Warfare Center-Dahlgren Division*
0820 – 0840	**Speech-to-Text for Enhanced PED (STEP)** David Williamson *711th Human Performance Wing/RHXM*
0840 – 0900	**Human Systems Integration Risk Management Tool** Zac Zimmerlin, Booz-Allen Hamilton, William Kosnik *Human Systems Integration Directorate, Wright-Patterson AFB*
0900 – 0920	**HSI and Set-Based Design: A novel design approach for exploring HSI domain tradeoffs** Gordon Gattie *Naval Surface Warfare Center-Dahlgren Division*
0920 – 0945	**The Case for UX** Neil Ganey *Northrup Grumman Corporation*

SESSION AGENDAS: WEDNESDAY

HFE/HSI II

02 May 2018 | 1000 – 1145
Bagram

1000 – 1020	**Decision Making Support for Human-Machine Collaboration in Complex Environments: Creation of Automated Assistance** Andrea Postlewate *Naval Air Warfare Center-Air Division*
1020 – 1040	**Reconsidering Complexity as a Cognitive Entity in Human System Integration** Mustafa Canan & Rik Warren *711th Human Performance Wing/RHXM*
1040 – 1100	**HSI Challenges Around the World: Strengthening Our Craft Through Multinational Partnerships** Gordon Gattie *Human Systems Integration Directorate, Wright-Patterson AFB*
1100 – 1145	**HSI Domain Collaboration: Lessons Learned and Product-Centric Use Cases, Panel** *Frank C. Lacson (AUSGAR Technologies); Bill Kosnik (USAF Space Command); John Plaga (USAF 711th Human Performance Wing); Hector Acosta (USAF Air Education and Training Command)*

SESSION AGENDAS: WEDNESDAY

SubTAG: Personnel Selection & Classification

Chairs: James Johnson and LT Michael Natali, USN

02 May 2018 | 1315 – 1500
Bagram

1315 – 1325	**Personnel Selection & Classificaiton: Introduction and Business** *LT Michael Natali (USN, NAMI) & James Johnson (USAF, AFPC/DSYX)*
1325 – 1350	**Examining the Relationship among Cognition, Age, and Air Traffic Control Training Performance** Linda Pierce and Julia Buck *FAA, CAMI*
1350 – 1415	**Development and Validation of Job Opportunities in the Navy (JOIN)** *Stephen Watson (USN, OPNAV) and Michael Crookenden (DXC Technology*
1415 – 1440	**Benchmarking ASVAB (MAGE) Requirements Across Career Fields** James Johnson, Sophie Romay, and Laura Barron *USAF, AFPC/DSYX*
1440 – 1500	**Evolution of U.S. Navy Aviation Selection** LT Micahel Natali *USN, NAMI*

SESSION AGENDAS: WEDNESDAY

SubTAG: Modeling and Simulation

Chairs: John Ramsey, Mihriban Whitmore, and Alex Hoover

Modeling and Simulation

02 May 2018 | 1315 – 1500
Broadway

1315 – 1325	**Modeling and Simulation/Healthcare SIG Joint Session Introduction and Business** *John Ramsay (NSRDEC), Mihriban Whitmore (NASA), Tandi Bagian (NCPS), Hellen Fuller (NCPS)*
1325 – 1400	**The Interagency Modeling and Analysis Group (IMAG), the Multiscale Modeling Consortium (MSMC) and Potential Synergies with Human Factors Modeling and Simulation** Beth Lewandowski *NASA*
1400 – 1420	**Mechanical Ventilation Simulation** Dario Rodriquez *United States Air Force School of Aerospace Medicine*
1420 – 1440	**Subject-Specific Multiscale Modeling for Lower Extremity Injury Risk Assessment** Jonathan Kaplan *NSRDEC*
1440 – 1500	**Closing Remarks – Future of M&S in Healthcare** *John Ramsay (NSRDEC), Mihriban Whitmore (NASA), Tandi Bagian (NCPS), Hellen Fuller (NCPS)*

SESSION AGENDAS: WEDNESDAY

Modeling and Simulation: Human Behavior Representation Panel

02 May 2018 | 1515 – 1700
Broadway

1515 – 1645	**Modeling and Simulation Panel Discussion: Human Behavior Representation** *Moderator: John Ramsay (NSRDEC); Panelists: LTC Glenn Hodges (NPS), Ben Connable (RAND), Matt Walsh (RAND), Randy Brou (ARI)*
1645 – 1700	**Discussions and Closing Remarks** John Ramsay (NSRDEC) *NASA*
1400 – 1420	**Mechanical Ventilation Simulation** Dario Rodriquez *United States Air Force School of Aerospace Medicine*

SESSION AGENDAS: THURSDAY

SubTAG: Cyber Warfare

Chairs: Marianne Paulsen and Lauren Reinerman-Jones

Cyber Warfare I

03 May 2018 | 0800 – 0945
Bagram

0800 – 0805	**Introduction and Business** *Marianne Paulsen (NUWC Keyport) and Lauren Reinerman-Jones (UCF-IST)*
0805 – 0835	**Research Based Scientific Advances to Continuous Insider Threat Evaluation (SCITE) Program** Thomas W. Christ *Intelligence Advanced Research Projects Activity (IARPA)*
0835 – 0905	**Metaphor Displays in Cyber Data Visualization** Dennis Folds *Lowell Scientific Enterprises*
0905 – 0925	**Oppositional Cyber Techniques Based in Human Centric Design** Kimberly Ferguson-Walter *Space and Naval Warfare Systems Center Pacific*
0925 – 0940	**Cyber Workshop Quick Look** Marianne Paulsen *Naval Undersea Warfare Center Division Keyport*
0940 – 0945	**Session Closeout** *Marianne Paulsen (NUWC Keyport) and Lauren Reinerman-Jones (UCF-IST)*

SESSION AGENDAS: THURSDAY

Cyber Warfare II: Workshop

03 May 2018 | 1000 – 1145
Bagram

1000 – 1005	**Welcome and Workshop Introduction** Facilitator: Marianne Paulsen *Naval Undersea Warfare Center Division Keyport*
1005 – 1015	**Preliminary Job Task Analysis of a Cyber Kill Chain and Application to Cyber Defense** Janae Lockett-Reynolds *Department of Homeland Security*
1015 – 1030	**Workshop Orientation and Kickoff**
1030 – 1130	**Workshop Activities**
1130 – 1140	**Facilitated Group Discussion**
1140 – 1145	**Session Closeout**

SESSION AGENDAS: THURSDAY

Healthcare Special Interest Group

Chairs: Tandi Bagian, Jill Marion, and Mihriban Whitmore

03 May 2018 | 1000 – 1145
Ton Son Nhut

1000 – 1010	**Introduction and Business** *Tandi Bagian, Jill Marion, Mihriban Whitmore*
1010 – 1020	**Purchasing for Safety in Healthcare** Hellen Fuller and Kendra Betz *VA National Center for Patient Safety (NCPS)*
1020 – 1030	**Human Trust in Robot-Assigned Surgery** Svyatoslav Guznov, Joshua Tyler, Scott Thallemer *Air Force Research Laboratory, 711 HPW*
1030 – 1040	**Simulation Strategies to Teach Procedural Time-Outs: A Randomized, Controlled Trial** Doug Paull and Rob Kononowech *Veterans Administration National Center for Patient Safety*
1040 – 1050	**Heuristic Evaluation of Computerized Consulation Order Templates** Himalaya Patel *Center for Health Information and Communication, Department of Veterans Affairs*
1050 – 1110	**Eight Steps to Resilient Healthcare Operations** Tandi Bagian *VA National Center for Patient Safety (NCPS)*
1110 – 1145	**Questions and Answers for Panelists**

SESSION AGENDAS: THURSDAY

Trust in Autonomy Special Interest Group

Chair: Lauren Reinerman-Jones

03 May 2018 | 1015 – 1145
Broadway

1015 – 1020	**Opening Remarks** Lauren Reinerman-Jones *UCF-IST*
1020 – 1140	**Trust in Autonomy Panel Discussion** Panelists: Daniel Barber, Julie Marble, Joseph Lyons, Joseph Mercado, and Dylan Schmorrow
1140 – 1145	**Closing Business** Lauren Reinerman-Jones *UCF-IST*

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ABSTRACTS

HUMAN PERFORMANCE MEASUREMENT I

Tuesday Afternoon, 1315 – 1500, 01 May 2018

Chaired by LT Joseph Mercado , USN, & Justin Stofik

1315 – 1340

24/7 Combat Fitness System: Current Capabilities, Use, and Future Applications

ADAM J. STRANG

Air Force Research Laboratory, 711th Human Performance Wing

The goal of AFRL's STRONG (Signature Tracking for Optimized Nutrition and Training) lab is to develop metrics and measurement technologies that can be used in real-time to sense, assess and augment operator performance during military training. Over the past four years, STRONG has been vetting a number of individual performance technologies, such as wearable physiological sensors, physical and cognitive tests, movement screens, and stacked prediction models. In 2017, STRONG began to aggregate and streamline data from these technologies into a single software application. The resultant platform, which is comprised of software, sensors, tests, and analytics, is known as the 24/7 Combat Fitness System (24/7 CFS). Currently, 24/7 CFS is being used to accelerate in-house R&D, as well as to support the daily function of human performance teams embedded within special operations units in a live beta test. Here, we will provide an overview of system components, capabilities and operational application. We will also give a progress update on the beta test, as well as provide a glimpse into future system capabilities, including improved analytics, next-gen wearable sensors, and D3 custom visualizations.

1340 – 1405

Detecting Sub-Clinical Neural Impairment using Oculometric Technology

LELAND S. STONE

Visuomotor Control Laboratory, Human-Systems Integration Division,
NASA Ames Research Center

Specialized operators (e.g., astronauts, special forces, fighter pilots, smoke jumpers, submariners etc...) are not only individuals selected for their extraordinary capabilities and trained at length to perform difficult tasks at high levels under high-stress situations, they often have to overcome unnatural environmental conditions (e.g. high G or vibration, blast waves, high CO2 or low O2 levels, etc..) that may impact their performance in subtle ways that are difficult to detect subjectively or to measure objectively, but that could nonetheless threaten mission success or escalate/integrate to threaten their long-term health. We have been developing and validating a potentially deployable Comprehensive Oculomotor Behavioral Response Assessment (COBRA) technology (Liston & Stone, 2014) that uses a high-fidelity video-based eye tracker and a carefully crafted behavioral task to provide18 largely independent measures of human eye-movement behavior in a 5-minute test. This test can be used to reliably detect, quantify, and characterize small deviations from an individual's baseline performance. The goal is to deliver a tool to objectively

screen for adverse performance effects after exposure to altered environments, and ultimately to assist in operational decisions about readiness to perform or the need to stand-down for recovery or medical evaluation. The tool could also be used to validate objective Human-System Integration (HSI) mission requirements by objectively defining maximum appropriate exposures to such environments.

In addition to meeting the requirement to be sensitive enough to detect mild impairments before they become overt, the multidimensionality of COBRA provides for potential specificity whereby neural impairments of different sources (e.g., Traumatic Brain Injury, sleep deprivation, alcohol consumption) can be distinguished by their characteristic differential responses across the COBRA constellation of metrics. Thus far, we have used COBRA to measure the effects of TBI (Liston, Wong, & Stone, 2017), of sleep deprivation (Flynn-Evans et al., 2017; Tyson, Flynn-Evans, & Stone, 2017), and of low-dose alcohol. We have found highly significant effects across a range of oculometric measures, yet distinct patterns of deficits specific to the cause of the impairment. Although further validation studies examining these and other operationally relevant stressors (e.g., hypercapnia, hypoxia) are necessary and greater deployability much be achieved prior to field use, high-fidelity oculometric technologies, such as COBRA, show promise as operational decision tools, as HSI requirement development/validation tools, and perhaps even as future medical diagnostic tools.

1405 – 1430

Dietary Intake and Energy Expenditure of Pararescuemen During Routine Training

ADAM J. STRANG

Air Force Research Laboratory, 711th Human Performance Wing

Overview: Pararescuemen are elite combat operators that undergo rigorous training to develop, maintain, and improve mission performance. Recently, Pararescue units have embedded human performance organizations (HPOs - comprised of strength coaches, physical therapists, psychologists, etc.) to improve injury outcomes, accelerate recovery, and optimize performance gains for operators. However, nutrition remains an overlooked and under-valued component of training and recovery. Because of this, researchers at AFRL and the University of Nevada Las Vegas (UNLV) sought to profile the typical energy expenditure and dietary intake of Pararescuemen to determine if typical dietary intake was adequate for meeting training and recovery goals while garrisoned.

Methods: Twelve Pararescuemen underwent anthropometric tests (e.g., body fat %, body mass, height, etc.), a resting metabolic rate assessment, and an aerobic fitness test (i.e., VO2max). These data were used to create personalized metabolic profiles so that heart rate (HR) could be used to estimate operators' caloric expenditure during routine training. Pararescuemen then wore HR monitors during a pair of routine training days while also recording dietary intake using food logs.

Results: The average daily diet intake of Pararescuemen (2,288 kcal) was 43% less than the average energy expenditures (4,021 kcal). Moreover, average carb intake (2.9 g/kg of body mass) was substantially less than recommendations for this type of operator (5.0 g/kg) and accounted for only 39% of daily calories (11% less than the military recommendation). Conversely, Fat intake was high, with 35% of daily calories coming from this source (recommended fat intake is x < 30%). Protein intake (1.7 g/kg of body mass) was within the recommended range.

Conclusion: Pararescuemen expend high amounts of energy during routine training, which is similar to other elite military groups. However, energy intake of Pararescuemen was much lower than energy expenditure, indicating an energy imbalance that can have negative short and long-term effects for training, performance, and recovery. Of specific concern was low carb intake, which is known to accelerate the onset of physical fatigue and decreased cognitive function (e.g., attention and memory). A potential cause of the disproportionate carb and fat intake found in these operators is over-reliance on convenience foods (e.g., protein supplements used throughout the day paired with fast food in the evenings), which were commonly reported.

1430 – 1455

Unique Human Factors Aspects of Intelligence-Surveillance Analyst Performance: Toward A Specialized Cognitive Assessment Battery

KATHLEEN G. LARSON & RIK WARREN
USAF, AFMC, *711th Human Performance Wing*

In Intelligence, Surveillance, and Reconnaissance (ISR), Eyes-on-Analysts view full motion video feeds to identify Essential Elements of Information (EEI) for long periods of time. As a result, Eyes-on-Analysts experience more fatigue and workload than other positions in a Process, Exploit, and Disseminate (PED) cell. Several human factors and psychological factors are related to an analyst's tasks such as visual search, sustained attention, motivation / engagement, patterns of life, prospective memory, working memory, change blindness, and inattention blindness. These factors are mainstays of psychological and human factors research, but they are often studied in isolation using highly-controlled, artificial tasks with a definite sequence of well-structured and defined short-duration trials. These procedure are used for experimental rigor, ease of data collection, and to enable clean and unambiguous data analyses. Further the subjects are often college students who have limited time and experience. This forces experimental tasks that are relatively easy to learn and limits the duration of the experiments to not more than a few hours and just a few session. Often an experiment is one session of less than one hour including time for Informed consent and filling of questionnaires.

It is an open question the degree to which, or even whether or not, conclusions drawn from such academic research are relevant or applicable to the special conditions and needs of ISR analysts. Some of the special conditions include: complex tasks requiring

extensive training; rich real-world scenarios which can have periods of little activity and periods of intense activity; items to be searched or tracked are not always clearly defined due to ambiguities; and within-scenario distractions from attention-grabbing events which are not relevant or important to the task at hand. Other differences from laboratory research include: stress and fatigue due to long sessions lasting eight or more hours; pressure to be accurate and complete due to importance of the task and the consequences of mistakes; noisy working conditions; and possibility of interruptions and distractions by co-workers. Due to the differences between the laboratory conditions and those of ISR analysts, we are in the process of assessing the appropriateness of extant performance-predicting tools, such as cognitive batteries, for the selection and training of specialized ISR operators. We will discuss our progress in developing a specialized ISR operator-focused battery.

DESIGN: TOOLS AND TECHNIQUES
Tuesday Afternoon, 1300 – 1445, 01 May 2018
Chaired by Michael Feary

1305 – 1330

Strategic Planning Tool for Mission Analysis and Course of Action Determination

BOB POKORNY & CHUCK ROGERS
Intelligent Automation, Inc.

The Air Force Research Laboratory was interested in building better tools for Air Force mission planners to consider military and soft power factors when planning. Soft power factors include Political, Military, Economic, Social, Information, and Infrastructure (PMESII) considerations. AFRL sought (1) enhanced visualizations for PMESII factors and (2) transition of the improved design tool to the field.

Our approach began by learning (1) current planning practice and (2) the state of planning tools in the AF. We learned that AF documentation already leads mission planners to consider military and soft power. We collaborate with a company that develops AF planning tools that are used at a few operational sites (Intelligent Software Solutions). We worked with SMEs who could elaborate the documentation and provide perspective on important mission planning steps.

To transition any visualizations for full PMESII or other considerations to AF planners, we realized we needed to embed improvements within existing tools that were in use at some AF sites. While not providing a clean plate on which to design the best possible interface, it is a more likely transition path.

We learned about the needs of AF planners and the current tools. We followed a user-centered design approach to incorporate improvements to the existing interface. Some added improvements to the existing planning tool are (1) Mission Analysis tools; (2) Course of Action

Determination methods, and (3) illustrations of the expected effects of possible actions on all PMESII factors. We will illustrate our designs.

We plan to discuss (1) how this work relates to the theme of this HFETAG meeting, Specialized Operators: Personnel, Training, and Acquisition Challenges, (2) generality of our designs across DoD organizations, and (3) use of this tool in training.

1330 – 1355

Leveraging Crowdsourcing and Collective Intelligence in Complex Problem Solving

STEPHEN DORTON

Sonalysts, Inc.

Modern systems (technologies, organizations, etc.) are increasingly complex and interconnected, meaning that holistic approaches are required to characterize problems and formulate solutions. For a given system or organization, there may be over a dozen groups of stakeholders, each with their own pockets of knowledge that are relevant to the problem at hand. Collective intelligence is the principle that large groups of people can accomplish more together than they could alone. Collective intelligence is a critical enabler to characterize and solve such complex problems. Design thinking methods have been successful in performing rapid problem definition and identification of solutions with large and diverse crowds of participants. Similarly, crowdsourcing and human computation methods have shown promise in a variety of applications. These methods have been leveraged to develop web-based technologies that enable rapid and efficient crowdsourcing of problems and solutions from a diverse set of contributors. These technologies aim to overcome challenges with current approaches, which include (but are not limited to) conflicts of interest and biases, balancing local vs. global priorities, and providing a means for continuous assessment and improvement. We will discuss initial results, insights, and lessons learned from deploying a visualization-based voting tool on a number of studies. Furthermore, we will discuss current research on developing methods and tools for structured, visually-driven, argumentation to identify and resolve organizational/systemic inefficiencies. We will discuss future work and next steps for this research given the progress made and the lessons learned.

1355 – 1420

Human Performance Modeling Techniques: WIN-T System Case Study

CHRISTOPHER PLOTT

Alion Science & Technology

We recently completed an effort looking at modifications to the Army's WIN-T communications/data networking system using IMPRINT to explore the impacts of the modifications prior to implementation. This included:

-Modeling baseline setup/maintenance activities vs procedural improvements --- This is basic modeling

-How we went about developing the personnel moderators for having an Infantryman vs Skilled Technician perform some of the tasks --- How to do personnel analysis

-How we developed a Complexity Scorecard for assessing task demand/complexity --- How to develop custom metrics based on the literature

-A sensitivity analysis for troubleshooting tasks --- How to effectively exercise models

Our focus would be on the modeling techniques and approaches to quantifying human-related data, rather than the outcomes of the effort per se.

SAFETY, SURVIVABILITY, AND HEALTH HAZARDS
Tuesday Afternoon, 1315 – 1515, 01 May 2018
Chaired by Cindy Whitehead

1315 – 1345

AFSOC Training Health Monitoring

CADET AUSTIN HOOVER
U.S. Air Force Academy

A majority of Air Force Special Operations training bases are located in hot weather environments to include Lackland, Kirtland, and Hurlburt Field. These hot climates pose the risk of heat related injuries to include heat exhaustion and even heat stroke. To tackle this problem, our capstone team is working for AFRL to develop a system that can monitor and display an individual's core temperature. Our team has done this through a created application on an Apple watch. The application uses an algorithm, previously studied by Dr. Mark Buller (US Army), that takes the input of heart rate and displays on the watch the output of core temperature. In addition to core temperature, the watch's interface gives time, heart rate, and a measurement bar indicating an individual's health status. To obtain the most accurate core temperature from heart rate, our team has been conducting tests with monitoring devices to include a Komodo Smart Sleeve, Polar Team Pro Shirt, and the heart rate device on the Apple watch. As the heart rates are obtained they are run through the algorithm to obtain the predicted core temperature, and compared to a baseline via a swallowed core temp tracking pill. The goal is to find which monitoring device has the best combination of comfort and accuracy in predicting an individual's core temperature. Ultimately, it is our hope that this system can one day be used in programs from Indoc to the Battlefield Airman Prep course with goal of monitoring airman and preventing heat injuries.

1345 – 1415

Camouflage Material To Shroud From Night Vision Goggles

MICHAEL SEDILLO
711th Human Performance Wing

Future conflicts may find U.S. military personnel separated from their units attempting to evade capture from forces equipped with night vision technologies. The introduction of a new, combat-proven camouflage material touted as able to shroud personnel from these technologies garnered interest at the U.S. Air Force Research Laboratory (AFRL) and

spurred both a laboratory and field evaluation of the material. During the field evaluation at Angel Thunder 2017 search and rescue exercise (SAREX), Survival/Evasion/Resist/Escape (SERE) Specialists recommended this technology be incorporated into a new Evasion Chart (EVC) to make the proven EVC even more useful to evaders. Working with the manufacture Ametrine Inc, a combination EVC and camouflage tarp was created incorporating design features recommended by the SERE Specialists. The intent was to maximize survival utility into the already proven EVC to further enhance a survivor's ability to successfully survive, escape and evade. The new camouflage evasion chart was taken to the Navy SERE School in upstate Maine to validate the new survival design features. The EVC proved highly effective in critical survival applications including water procurement, improvised shelter construction and first-aid.

1415 – 1445

Guidance For Selecting Health-Care Products Using Human Factors

HELEN FULLER

VA Center for Patient Safety

Based on reports of safety concerns related to products used in healthcare environments, it is clear that not all items are equal in terms of usability, compatibility, and functionality. Hospital systems use a wide variety of products when providing care to patients, and this variability may contribute to purchasers failing to fully understand and define the needs for these products. Some purchasing decisions in the Veterans Health Administration (VHA) utilize well-defined procedures such as investigation by Integrated Product Teams (IPTs), which includes a hands-on evaluation of multiple options prior to creating a national contract. Ideally, all products would go through rigorous functionality and usability testing under a variety of conditions prior to purchase, but such an approval process does not currently exist. The Purchasing Checklist aids purchasers in investigating patient safety concerns related to usability when planning a purchase when extensive hands-on evaluation is not possible. The checklist includes steps such as assembling a team that includes key representatives, considering the purchase needs and options, performing heuristic evaluation of the product literature and other available information, and documenting trade-offs to identify the best option.

1445 – 1515

Government Applications For Wearable Robotics, Panel

Cindy Whitehead (NAVSEA 05H), Joseph Parham (Natick Soldier Engineering & Research Directorate), Kendra Betz (VA Center for Patient Safety)

Exoskeletons are being developed to support and augment human physical capabilities. They are being considered for industrial work, for medical applications, and to support the warfighter during mission operations. This panel session will introduce exoskeletons and how they're currently being studied and used at government agencies. This panel will include:

- Introduction to Exoskeletons; commercial uses; standards development (Whitehead)
- Warfighting Applications and Research (Parham)
- Medical Applications and Research (Betz)
- Industrial Applications and Research (Whitehead)

HUMAN PERFORMANCE MEASUREMENT II
Tuesday Afternoon, 1515 – 1700, 01 May 2018
Chaired by LT Joseph Mercado , USN, & Justin Stofik

1515 – 1545

Effect of High Deck Accelerations on Surgical Tasks

ERIC PIERCE
Naval Surface Warfare Center Panama City Division

Effect of High Deck Accelerations on Surgical Tasks Study is a series of experiments directed by Naval Surface Warfare Center Panama City Division to quantify the ability of US Navy medical personnel to perform critical trauma resuscitative and damage control surgical procedures onboard US Navy ships under high sea states. Phase III was sponsored by Office of the Chief of Naval Operations N81 Assessments Division, Deputy, Medical Analysis Branch (N813) and the Advanced Medical Development Program Office. Testing occurred aboard USNS Brunswick Expeditionary Fast Transport (T-EPF-6) during the second quarter of 2017 while traveling between Norfolk, VA and San Diego, CA. Two surgical teams each consisting of a General Surgeon, Certified Registered Nurse Anesthetist, Perioperative Nurse, Corpsman, and two Surgical Technologists provided resuscitation and damage control surgery to 112 medical surrogates emulating Improvised Explosive Device blast type injuries. Sea conditions encountered reached the upper threshold of the ship's underway safe operating limits, with 43% of the medical treatments conducted under North Atlantic Treaty Organization (NATO) scale sea state 4 conditions. Analysis of the data suggests these types of procedures may be successfully performed aboard non-traditional ships while underway in relatively severe motion conditions. Motion Induced Interruptions, Motion Sickness Incidence, and Motion Induced Fatigue had little measurable impact on patient outcome.

1545 – 1615

Optimizing Marine Corps Readiness with Physical Fitness Best-Practices and Data-Driven Methods for Injury Avoidance

LISA LUCIA, TIMOTHY CLARK, & LAURA CASSANI
Aptima

Common musculoskeletal injuries threaten military readiness and result in lost or restricted duty days and significant medical costs. Many of these injuries occur during routine physical training, and are likely preventable. The United States Marine Corps has responded to this challenge by creating a new "service-level division for [the] development and implementation of policy, standards, guidance, and reporting of all matters related to general physical fitness, occupational fitness, performance nutrition, body composition, martial arts, water survival, and sports medicine/injury prevention based on requirements and direction from higher headquarters" (fitness.marines.mil). As part of this division, Force Fitness Instructors (FFIs) create physical training (PT) plans for their assigned Marine units. Presently, they lack tools and automated methods for evaluating plan effectiveness, optimizing personalized training for individuals, and accessing and disseminating domain knowledge and resources. A second major goal of the Force Fitness Readiness Division (FFRD) is to support the many avenues of communication that should exist between unit Marines, FFIs, and others with extensive exercise and injury prevention expertise (e.g., Athletic Trainers, Strength & Conditioning, Exercise Physiologists). With these open health and fitness communication channels, FFIs should be better equipped with the right knowledge to facilitate timely plan adjustments (e.g., exercise modifications) for those who have prior injuries or specific physiological concerns. To address these challenges, Aptima is leading the FitForce Planner project. FitF

1615 – 1645

Comparing the Effects of Transcranial Direct Current Stimulation with Electroencephalographics Electrodes versus Hal Sport Neuromodulation System During a Multitasking Environment

NATHANIEL BRIDGES

711 HPW/RHCP

INTRODUCTION: The ability to monitor and respond to multiple events simultaneously can be extremely overwhelming on a human operator's cognitive state resulting in a decline in performance. However, within the past several years researchers have provided evidence that transcranial direct current stimulation (tDCS) can be used as a countermeasure to augment and enhance performance during multitasking environments. To date, there has been very little research conducted comparing different tDCS devices to improve cognition. This study examined the efficacy of tDCS using a 5 electroencephalographic (EEG) electrode array compared to the halo sport neuromodulation system over the motor cortex (M1) while multitasking. In addition, FaceLab (eye tracker) was incorporated to record the participants scanning pattern.

METHODS: Forty-Five active duty military members participated in the two day study. The participants were randomly assigned to three groups, each group consisted of thirteen males and two females. On the first day, each participant performed a training session of the multi-attribute task battery (MATB) which consisted of five different difficulty levels each lasting four minutes in duration. The difficultly levels were provided in sequential

order and increased in a linear manner. On the second day, the participants were either provided on-line anodal tDCS via 5 EEG electrodes, on-line anodal tDCS via halo sport neuromodulation system or a null condition (no electrodes) while performing MATB.
RESULTS: The findings indicate that on-line anodal tDCS via EEG electrodes and halo sport neuromodulation system improved multitasking performance compared to the null condition at each of the five difficulty levels. Although the halo sport neuromodulation system displayed the greatest enhancement, there was not a significant difference between the halo sport neuromodulation system and the EEG electrodes. Eye scanning patterns displayed underlying evidence that administering on-line anodal tDCS during a multitasking environment accelerated information processing capabilities resulting in less fixation and higher performance.

DISCUSSION: The results provided evidence that on-line tDCS can be used as a countermeasure to combat an operator's performance decrement during a multitasking environment. Although the halo sport neuromodulation system displayed the greatest enhancement, both electrode conditions improved multitasking performance compared to the null condition. As well, eye scanning patterns provided underlying evidence that tDCS may enhance information processing efficiency. orce Planner aims to support FFIs in creating and tailoring personalized PT plans for their assigned Marine units. The goal is to maximize physical fitness and force readiness by designing and developing a web-based PT planning application that incorporates scientifically-grounded practices from the sports-medicine field and deploys plans directly to Marines' mobile devices. With this system in place, we are closing the gap by enabling integrated feedback and access to fitness resources, tracking and monitoring progress over time, as well as providing mechanisms for individualized interventions. Furthermore, by monitoring progress made toward specific PT plan goals and observing FFI-initiated plan modifications, we can learn more about the characteristics that make plans more successful in terms of healthy development and injury avoidance. The objective of these efforts is to maximize operational readiness, enhance situation awareness in terms of health management, and minimize injuries by tailoring individual training programs according to physical fitness best-practices and data-driven recommendations.

MIXED REALITY

Tuesday Afternoon, 1530 – 1715, 01 May 2018

Chaired by Marianne Paulsen & Elizabeth Abdeen

1540 – 1600

The Virtues and Vices of Using Virtual Versus Augmented Reality in Creating Realistic Simulations

KYLE PETTIJOHN, CHAD PELTIER, LT ADAM BIGGS, USN

ABSTRACTS

Naval Medical Research Unit Dayton

Virtual and augmented reality (VR and AR) systems are portable and can create customizable scenarios to represent a wide array of possibilities. As such, these systems offer a unique opportunity to enhance or extend the operational or training environments of special operators. VR systems create a self-contained and simulated world, which may make them better suited for training applications. AR systems allow for access to critical information without eliminating situational awareness of the current physical surroundings. Both systems have the potential to improve training through new simulations; however, augmented reality has a further capability as this technology could be integrated into systems for live operations. For example, augmented systems could feed real-time information to operators in harsh environments.

Despite the obvious benefits of each system, their use also raises several questions. For example, what is the most important information to give to an operator? What is the best possible display configuration to achieve optimal human performance? How do you avoid creating a cognitive overload of information? Are there fundamental differences between the systems in terms of their efficacy or propensity to cause nausea, eyestrain, or headache? These questions are critical to the design of VR and AR systems if they are to be widely adopted by special operators throughout government agencies.

The current discussion will focus on a project that combined mixed reality and motion with a shooting task that involved a simulated .50 caliber machine gun. Because motion can dramatically alter the difficulty of operating this weapon, and firing a .50 cal from a ship or moving vehicle is common among the weapon's intended uses, the combination of mixed reality and motion presents a suitable test of different systems when applied to a realistic task. Participants wore either an HTC Vive headset or a Microsoft HoloLens while firing a mock M2 Browning .50 caliber machine gun from the bow of a ship. Fire and cease fire instructions were displayed through the devices, and people moved the gun in real space to aim and fire. This was done while they experienced no motion, motion that was synchronized with the visual display, or motion that was decoupled from the visual display. The purpose of the de-synchronized condition was to simulate a situation where the devices are used while the wearer is on board a moving ship and there is certain to be a mismatch between experienced and simulated motion. The project allowed for the assessment of potential simulator sickness and human performance measures between the devices in different motion environments. The preliminary results demonstrate their value even under suboptimal motion conditions. Future work could examine making more complex (e.g., friend or foe) decisions, simulating different motion environments, and varying the type and amount of information provided to the operator to determine the optimal use of mixed reality for both training and operations.

1600 – 1620

ABSTRACTS

Virtual, Augmented, and Mixed Reality for Aircraft Maintenance (VAMRAM): Opportunities and Challenges

DAVID EISENSMITH
Air Force Research Laboratory

The application of virtual, augmented, and mixed reality (V/A/MR) technology to aircraft maintenance has the potential to enhance maintainer proficiency, augment maintainer capability, and provide reliable digital data access and data capture at the point of maintenance. However, there are also many challenges which need to be overcome to realize these benefits. Hence, members of the Air Force Research Laboratory recently formed an integrated product team – the VAMRAM IPT – to identify and reduce risks for enterprise-wide implementation of V/A/MR technology for maintenance training, maintenance assist, and integrated maintenance data access and capture. The IPT is teaming with end users and stakeholders to plan near-term efforts to quantify benefits, costs, and technical maturity levels and to identify opportunities for incremental implementation. One critical partnership is between AFRL at Wright-Patterson AFB, the 412th AMXS at Edwards AFB, and a unit of the Air Force Education and Training Center at Hill AFB. This presentation will describe (a) the opportunities and challenges identified by the IPT and its collaborators, (b) the IPT approach to addressing gaps and incrementally transitioning technology, and (c) some near-term demonstrations the team is planning.

1620 – 1640

Behavioral Fidelity Issues in Mixed Reality Training Systems

DENNIS J. FOLDS
Lowell Scientific Enterprises

The notion of *behavioral fidelity* in a training system refers to the extent to which the behavior of the trainee during training corresponds to the behavior of interest in the transfer conditions. Behavioral fidelity is contrasted with the *physical fidelity* of the training device, which describes the extent to which the various hardware and software components of the device match the actual components to be used in the transfer conditions. Behavioral fidelity may be further decomposed into the sensory, cognitive, and psychomotor components of behavior. The behavioral fidelity framework drills down into the individual tasks to be trained, and the relative importance of the sensory, cognitive, and psychomotor components of each task to skill on that task. Some tasks are entirely dependent on just one of these components, and thus the behavioral fidelity of that component is paramount. For example, rifle marksmanship is entirely dependent on psychomotor performance; it matters little whether the target is depicted realistically. In contrast, learning to play chess is not dependent on whether the chess moves are performed by mouse clicks, keyboard entries, or moving actual pieces on a chessboard. Nor does it matter whether the depiction of the chess pieces is highly realistic. Learning to play chess well is entirely dependent on cognitive fidelity. The opponent must play competently, and the learner must acquire skill at anticipating moves, perceiving risks and opportunities, and applying heuristics. Mixed reality training systems provide an

opportunity to improve behavioral fidelity compared to virtual-only or real-only training systems. The more common application of mixed reality technology is to change the sensory component of training, by blending or merging virtual and real visual imagery. Less common perhaps, but certainly possible, is to use mixed reality to change the psychomotor component of training. Mixed reality may also affect the cognitive component of training, although it is probably uncommon for training developers to specifically target the cognitive component when planning to use mixed reality. Another part of the behavioral fidelity framework is how feedback on task performance is generated. Specifically, sometimes feedback can be inherent to task performance, sometimes given in an after action review, and sometimes just through verbal feedback from the trainer. Mixed reality could be used to improve feedback, by generating feedback inherent to task performance where it otherwise would not occur. Using a mixed reality maintenance training system as an example, in the presentation I present some exemplar training tasks and show how the behavioral fidelity framework can guide more judicious use of mixed reality technologies in training. I also discuss some pitfalls, in which mixed reality can degrade the behavioral fidelity of a training system.

1640 – 1700

An Augmented Reality Framework for Representing Individual Differences in Tactical Casualty Combat Care Training

KELLY HALE

Design Interactive

Extremity hemorrhage, tension pneumothorax, and airway obstruction are three potentially survivable battlefield wounds (Kotwal et al., 2011). Over 80% of American fatalities with survivable wounds from Iraq and Afghanistan wars died from hemorrhage (Lawton, Granville-Chapman, and Parker, 2009). Approximately 20% of these wounds resulted from penetrating explosives or firearm fragments that damage blood vessels in body areas such as the large soft tissue of the limbs and torso (Champion et al., 2008). Modeling these injuries such that they provide the necessary cues and landmark features to train Combat Lifesavers (CLS) and Combat Medics (CM) is difficult, especially when using inflexible mannequins that cannot represent individual differences (e.g., gender or race). We introduce AugMedic, an augmented reality (AR) trauma care training system that can overcome limitations of static mannequin wound representation. AugMedic has the potential to not only deliver cost effective battlefield trauma care, but also provide visual and biofidelic representations of individual differences with the end goal of improving transfer of training to the battlefield. The purpose of this effort was to evaluate AR visualization methods and supporting database capabilities to appropriately represent individual differences in combat trauma and provide a realistic care advantage in treatment within battlefield settings.

ABSTRACTS

EXTREME ENVIRONMENTS
Tuesday Afternoon, 1515 – 1700, 01 May 2018
Chaired by Rachael Lund and John Plaga

1520 – 1545

Restraint System Technology for Helicopter Mobile Aircrew

STUART NIGHTENHELSER
Wolf Technical Services, Inc.

Restraint system technology for helicopter mobile aircrew has undergone substantial progress in recent years. Technology advances over the gunner's belt include gains in survivability, injury mitigation, crash sensing, usability, and compatibility across aircraft types and aircrew vest types. Discussion of recent innovations will include the following topics, along with demonstration of some representative mobile aircrew restraint systems.

- Energy absorption capabilities for mitigating acceleration injuries
- Payout control set by the user to limit maximum webbing excursion, prevent ejection and reduce flail injuries
- Electronic sensing of a crash pulse
- Electronic and mechanical sensing of webbing excursion during an event
- Actuation based on webbing velocity instead of webbing acceleration, to prevent nuisance locking
- Field-replaceable webbing assemblies, facilitating easy maintenance
- Compatibility of each restraint system with types of aircraft and survival vest
- System lifetime and maintainability

1545 – 1610

Effects of Extreme Hypobaric Environments upon the Brain

PAUL SHERMAN
USAF 711 HPW

PURPOSE: Repeated human exposure to hypobaric conditions is associated with increased white matter hyperintensities (WMH), degradation of axonal integrity, and neurocognitive processing decrements. The goal of human and animal research studies is to characterize the pathophysiologic response of the brain to high altitude and understand its association with white matter injury.

MATERIALS AND METHODS: Brain magnetic resonance imaging fluid-attenuated inversion recovery data from 41 astronauts (ASTR) were quantified for WMH volume, subcortical

and periependymal. This was compared to previously reported data from 106 U-2 pilots (U2P) and to 320 health-matched control subjects (nonparametric group comparisons). Ninety-six U.S. Air Force (USAF) aircrew trainees were evaluated while undergoing initial occupational hypobaric exposure. Standard USAF procedure is a 30-minute exposure to 25,000 feet (7,620 meters). Quantitative arterial spin labeling (ASL) and proton magnetic resonance spectroscopy (MRS) data were acquired on subjects at T-24 hours, T+24 hours, and T+72 hours. Voxels were placed in the bilateral frontal white matter (FWM) and anterior cingulate cortex (ACC). Controls were 68 healthy subjects meeting the same physical and physiological criteria minus hypobaric exposure.

RESULTS: ASTR mean WMH total volume (mL) was 0.6618 +/- 0.1289 compared to 0.8663 +/- 0.0502 for U-2 pilots and 0.2353 +/- 0.0100 for controls. Both U2P and ASTR have a significantly higher WMH volume compared to controls, with no significant difference between ASTR:U2P. Statistically significant increases in cerebral blood flow (CBF) across both white and gray matter in aircrew personnel with hypobaric exposure were observed when using gender and age as covariables (white matter $p<0.001$, gray matter $p=0.048$). This difference is dependent upon age as a covariable, although there is no significant difference in age between the exposed and control subjects ($p>0.10$). ACC sampled areas demonstrated significant single MRS factor differences in all tested metabolites, except glutathione, in aircrew personnel with hypobaric exposure: glutamate, choline, N-acetylaspartate, myoinositol $p<0.05$; creatine, glutamate+glutamine $p<0.01$. FWM glutathione ($p=0.029$) demonstrated significant single MRS factor differences in the FWM. Age dependency was a covariant in all single factors.

CONCLUSION: Astronauts demonstrate similar increased WMH burden to high-altitude pilots. Recent demonstration of intracranial fluid shifts and brain plasticity changes in astronauts suggests further analysis of white matter integrity is warranted. There is a highly significant ASL/increased CBF response after a single exposure to hypobaria, with age being a significant contributor, possibly reflecting differences in central nervous system maturation. There was a significant difference in most neurometabolites after exposure to hypobaria. These differences may be representative of changes at a cellular level in response to, or preceding, changes in blood flow versus age-related differences or differing WMH between the two groups.

1610 – 1635

Overview of Neck Injury Criteria

LIEUTENANT COLONEL JEFF PARR
Air Force Institute of Technology

Research on developing improved neck injury criteria to aid the design and developmental testing of escape systems and helmet mounted displays for the Air Force and Department of Defense has been ongoing at the Air Force Institute of Technology since 2012 in collaboration with the 711 Human Performance Wing, Aerospace Physiology and

Performance Branch. This presentation will outline the research accomplishments to date, including the development of the human based Multi-Axial Neck Injury Criteria (MANIC) and follow on work that demonstrated a method to develop transfer functions to make the MANIC directly applicable to developmental testing with anthropomorphic test devices ATDs). Currently the MANIC is in the process of being incorporated into the Air Force Life Cycle Management Centers (AFLCMC) escape system specification that sets for requirements for new as well as upgraded Air Force escape systems.

TRAINING I: INNOVATIVE TRAINING
Wednesday Morning, 0830 – 0945, 02 May 2018
Chaired by Kelly Hale

0840 – 0905

SSBN Training

AARON CLARK
NAVSEA Naval Undersea Warfare Center Keyport

The US submarine fleet maintains a continuous nuclear deterrent presence at sea. This requires an extremely high operational tempo with each ballistic missile carrying submarine (SSBN) operationally deployed nearly 9 months each year. To sustain this deployment rate, SSBNs are each manned with two full crews that alternate taking the submarine to sea. When the submarines are not at sea they are in maintenance periods, leaving little time to complete training and certification. Therefore, when a SSBN crew is not at sea they are completing their training and certifications for their next patrol, allowing them to deploy with a minimal amount of at-sea workup. This requires a robust training infrastructure of high-fidelity simulators and team trainers, along with standard classrooms and labs at the SSBN homeports. This presentation will outline some of the training solutions the SSBN fleet has developed since its inception in 1960, and describe some of the challenges faced by the current COLUMBIA-Class submarine program in recapitalizing the fleet to continue their deterrent mission to 2080 and beyond.

0905 – 0930

Investigating the Utility of Physiological Measures to Verify Stress Responses and to Support Adaptive Navy Firefighting Training

JIM PHARMER AND ANNA SKINNER
NAWCTSD; Design Interactive, Inc.

As physiological sensor technology and processing power continue to improve, we are beginning to realize the potential to utilize physiological stress and workload measures in scenario based training, particularly within the context of training designed to support stress inoculation. Incorporating these measures into training will allow us to determine whether training scenarios are ecologically valid with respect to the stress-related

physiological responses (e.g., heart rate, skin conductivity, etc.) that would be experienced in operational environments. Moreover, we can begin to use these measures as cues for adaptive training interventions. For example, making scenarios more or less challenging or stressful based on real time physiological responses to training scenarios. The purpose of this presentation is to discuss recent and ongoing US Navy efforts focused on objectively assessing the stressfulness of simulation based training exercises for advanced Navy Firefighting and Damage Control. Data were collected during both the Basic and Advanced firefighting courses over multiple days. The goal of this initial investigation was to determine the technical feasibility of assessing individual stress during training from both a sensor and data science perspective. The high heat, humidity, and personal protective equipment (PPE) associated with training coordinated firefighting skills in a high fidelity simulation presented unique challenges for sensor ruggedization, placement, data collection, as well as the integration and interpretation of multiple sources of physiological data gathered in this context. These challenges and implications for use of these data to support real time adaptive training interventions will be discussed.

0930 – 0945

Towards a Unified Model of Gamification

IAN DYKENS, ANGELIQUE WETZEL, AND STEPHEN DORTON

Sonalysts, Inc.

Gamification methods have become increasingly popular in recent years as organizations evaluate and refine their approach to operator training. The benefits of gamified training include operator behavior modification, skill development, and currency maintenance, which make gamification appealing to the DoD. However, critical findings within extant literature question the efficacy of gamified training schemes citing the unknown relationships among game elements, operator psychology, pedagogical theory, and desired training outcomes. Furthermore, there continues to be a lack of consensus regarding the effects of even the simplest game elements such as earning points, badges, and the use of leaderboards (PBL). Best practice guides and heuristics exist for implementation of gamified training; however, these guides fail to substantiate the connection between gamification methods and operator psychology (i.e. motivation and engagement). In an effort to reconcile the dearth of gamification literature with contemporary models of operator psychology, researchers have begun developing a unifying model of instructional gamification. The unified model will be applied to facilitate the development of next-gen gamified learning management systems (LMS) by providing a framework of validated affiliations between game elements, operator psychology, and desired training outcomes. Within the current report is an examination of prior literature and an overview of the paralleling models of gamification and operator motivation. Additionally, a summary detailing the empirical validation of the unified model using a Gamified Training Architecture (GTA) in conjunction with an in-service combat system.

ABSTRACTS

TRAINING II: INNOVATIVE TRAINING
Wednesday Morning, 1000 – 1145, 02 May 2018
Chaired by Kelly Hale

1000 – 1020

Aegis Doctrine Visualization Tool (ADVT): Enhancing Training and Preventing Errors

MEGAN KOZUB

NSWC DD

Computer visualization techniques can be instrumental in enhancing retention and interpretation of spatial information, and aid the performance of numerical tasks. While tables can provide precise information, the format can be challenging to interpret rapidly or to visualize unaided. An efficient solution may be to extend the textual and numerical information with an additional visual layer, making it possible to draw more intuitive inferences about the data in the table.

The objective of this research is to explore the effects of adding graphical visualization on construction of a numerical table in naïve and experienced individuals. Currently, numerical tables are used to define ships doctrines. A ship doctrine includes the rules and instructions sets used for engaging enemy weapons and friend/foe target identification. It is one of the most critical elements for protecting the ship from an enemy attack and for identifying friend or foe. An incorrectly developed doctrine can lead to catastrophic events.

Knowledge elicitation focus groups were held with Subject Matter Experts (SMEs) and doctrine instructors to provide input and feedback on the capabilities of a prototype. The feedback has been included in a visualization prototype to ensure accurate representation of the training/data. The objective of this brief will be to discuss and demo the prototype.

1020 – 1045

Going from Ordinary to Extraordinary: Targeted Cognitive Enhancement Program as a Means to Train Special Operations

LT ADAM BIGGS, USN, JOSEPH HAMILTON, KARA BLACKER

Naval Medical Research Unit Dayton

Cognitive enhancement has received a lot of attention in recent years, not all of which has been positive. There is an ongoing debate about the nature of cognitive enhancement in the academic literature, where the primary goal appears to be far transfer. That is, training a cognitive ability that in turn causes some improvement in a notably different area of the

individual's life. These investigations include such far reaching intended impacts as training working memory to reduce ADHD symptoms. However, there has been mixed evidence regarding the success of these training programs. Evidence is often inconsistent for far transfer outcomes, although near transfer, which describes effective transfer from training tasks to similar contexts, has been supported more often.

Near transfer is especially important for special operations personnel because, by definition, these personnel have a specialized mission set with more concrete assigned responsibilities. For example, hostage rescue teams have a more well-defined set of responsibilities than general infantry, and hurricane hunters have a more well-defined set of responsibilities than general meteorologists. This specialization allows for more targeted selection and training criteria, which cognitive training can further enhance through a training regimen specifically designed to create near transfer from conceptually or contextually similar tasks. The combination creates the possibility to enhance special operations training across multiple federal entities while also finding the best use to date for cognitive training programs.

The current discussion will focus on cognitive training potential as it pertains to Department of Defense (DoD) special operators who engage in lethal force decisions. Although this responsibility is undertaken by many different people within the DoD, particular focus will be given to military operators who engage in room clearing. Recent evidence has suggested a link between some cognitive abilities and lethal force decisions, most notably inhibitory control and the likelihood of inflicting a civilian casualty. A preliminary study demonstrated a correlation between response inhibition and civilian casualties inflicted at baseline sessions during a room clearing scenario. Further support for a causal relationship was provided by demonstrating that inhibitory control training reduced the number of civilian casualties from pre- to post-training. Another investigation complemented these findings by using trained shooters and live ammunition during the pre-test and post-test assessments. The latter study also demonstrated improved lethal force decision-making through fewer rounds fired at non-hostile targets.

Taken together, these investigations provide proof-of-concept that a cognitive enhancement program can benefit special operations due to the more focused responsibilities and well-defined needs of those operators. The ideal conditions will include established evidence of a causal link between the cognitive ability involved and the targeted task to be improved, which represents the first needed step in any such training program. From there, additional studies should clarify the most beneficial training regimens with the caveat that special operations can benefit substantially from near transfer improvement without being too concerned about far transfer.

1045 – 1110

ABSTRACTS

Moving Beyond Levels: Creating Value in Military Organizations with Evaluation Data

ERIC SURFACE AND KURT KRAIGER

ALPS Insights, Inc.

Learning and development (L&D) activities help organizations, teams and individuals build the capabilities they need to achieve their objectives and complete their missions successfully. Learning and development are critical in creating organizational, team and personal advantage. This means learning's alignment with objectives and its effectiveness at every step of the process has real impact on outcomes and objectives. Having actionable insights to optimize learning and learning outcomes and their impact on performance, mission outcomes and objectives is more important than ever before.

Typically, training evaluation has provided data for learning professionals and unit leaders to make decisions about individual learning, training program effectiveness and impact on objectives. Although training evaluation provides data, current practice often does not have the desired result and fails to move the needle. 96% of organizations reported evaluating training, but only 44% and 36% indicated their evaluation efforts helped their organization meet its learning and mission/business goals, respectively (ATD, 2015). This lack of effectiveness—viewed in the current context of the need for learning to achieve competitive advantage, the billions spent on training, and the critical need for data to optimize learning and to increase its impact—creates opportunity to improve the process.

Do you evaluate learning, but struggle to use the data to create value for your organization and learning enterprise? If so, you are not alone. While most organizations evaluate learning, evaluation impacts learning and strategic organizational goals less than half the time. What if you could empower all stakeholders to have an impact and create value within their roles with evaluation data?

1110 – 1125

Practical Adaptive Immersive Training Systems

BOB POKORNY

NAWCTSD; Design Interactive, Inc.

Students and trainees often learn skills best in realistic immersive conditions. Simulation-based training is often a surrogate for the actual environments, due to safety and expense considerations. Training or assessing performance in complex environments is often seen as difficult and complex. We will present methods for practical and affordable assessment and training in simulated complex environments.

Typical approaches to building adaptive instruction involve complex student models, with Bayes nets or ML processes to facilitate diagnosis. After diagnosis, more complex processes are used to construct a finely tuned explanation of what the system believes the student needs.

Our approach is simpler. Assessment is developed by applying Expert Policy Capture. Our application of Expert Policy Capture involves experts reviewing the performance of trainees performing in a simulation. Experts provide (1) scores reflecting overall quality, and (2) critiques of how the trainee could have performed better. These critiques are turned into scoring rules that (1) approximate the overall quality score of expert(s); (2) represent the student performance based on actions takes within a domain; and (3) assessments of patterns of user actions.

The assessment system is used to trigger instructional remediations. While the assessment system will typically identify many weaknesses in student performance, the instructional system will be most effective if it focuses on one or at most a few mistakes. Students learn best by active interactions with the content contextualized within tasks. Instructional remediations provide interactions between the student and content that helps the trainee understand think and act more like an expert.

Our presentation will describe examples of how this approach has worked, and a review of evidence of the effectiveness of this approach.

TECHNICAL SOCIETY/INDUSTRY
Wednesday Morning, 0730 – 0830, 02 May 2018
Wednesday Evening, 1700 – 1800, 02 May 2018

Chaired by Steve Merriman & Barbara Palmer

0740 – 0800

SAE G-45 Update on the Human Systems

STEVE MERRIMAN

SAE International, G-45 Human Systems Integration Committee

This presentation will describe the background, current activities and plans for developing and publishing a best practice standard for Human Systems Integration. The initial version is aimed at supporting DoD systems acquisition programs; future revisions should expand the document to be responsive to HSI requirements from additional federal agencies.

0800 – 0830

How Do You Know if Someone Actually Knows Something?

NEIL GANEY

Northrop-Grumman

How can you tell if someone has the ability to do certain work, particularly if you've never worked with them? Alternately, how can you ensure that a program has the right personnel with the right knowledge, skills, and abilities? These are the questions that have

driven recent efforts to define the competencies required for Human Factors Engineers. This paper will focus on how some organizations are approaching this. It will address how the appropriate knowledge, skills, and abilities were identified. It will also discuss how competency can be assessed for these areas.

1700 – 1710

Chartered Institute of Ergonomics and Human Factors (CIEHF) Overview

BOB SMILLIE

Chartered Institute of Ergonomics and Human Factors (CIEHF)

This presentation will describe the CIEHF organization and provide information on its history, focus, products and activities.

1710 – 1730

INCOSE

JENNIFER NARKEVICIUS

The International Council on Systems Engineering (INCOSE)

This presentation will describe the INCOSE organization and the HSI Working Group in particular. It will also summarize HSI Working Group achievements, as well as recent and current projects.

HFE/HSI I

Wednesday Morning, 0800 – 0945, 02 May 2018

Chaired by Cindy Whitehead

0800 – 0820

Rapid Human Centered Design in Rocket Propelled Grenade (RPG) Net Improvement

RICHARD THOMPSON

Naval Surface Warfare Center-Dahlgren Division

In the height of war, shortfalls of a system's design are often brought to light. These shortfalls can threaten life and mission success unless a quick solution can be found. When solutions are developed rapidly, it is often the case that the user's needs and limitations are ignored even when the system is specifically designed for their safety. One such example was the design of Rocket Propelled Grenade (RPG) safety netting. The RPG threat was significant and an urgent solution was needed. In order to adequately protect tactical vehicle occupants, netting was quickly designed to surround the vehicle including installation over all vehicle windows. Very shortly after the RPG netting was fielded, occupants began reporting symptoms of motion sickness and eye fatigue. As a result, vehicle occupants began removing the netting from the front windshield at the expense of

their own safety. Investigators turned to basic cognitive and perception research, rapid prototyping techniques, and basic user assessments to improve the RPG net design. By leveraging work already done (i.e., basic research), establishing likely hypotheses and taking advantage of rapid prototyping and mock-up design techniques, an improved RPG net design was completed that benefits the Warfighter in the time frame needed.

0820 – 0840

Speech-to-Text Enhanced PED (STEP)

DAVID WILLIAMSON

711th Human Performance Wing/RHXM

Air Force Special Operations Command (AFSOC) has expressed an urgent need to significantly improve manpower efficiencies during Intelligence, Surveillance and Reconnaissance (ISR) Processing, Exploitation, and Dissemination (PED) operations. In current ISR PED operations, full motion video (FMV) analysts are required to maintain constant vigilance of video surveillance captured from various airborne ISR assets. During the initial phase of that process, the FMV analyst verbally calls out items of interest to a screener who then types that information into a chat room for dissemination. This places a significant burden on the screener who simultaneously must maintain communication with the remotely piloted aircraft (RPA) crew and others supporting the mission while also attending to the real-time callouts so they can be captured. The Speech to Text for Enhanced PED (STEP) program developed at the Air Force Research Laboratory (AFRL) improves the ISR PED process by automating the capture, transcription, and dissemination of FMV callouts by introducing automatic speech recognition technology. The current version of STEP integrates with Nuance Communications' Dragon NaturallySpeaking, a widely available commercial off-the-shelf speech recognition program, for all speech transcription tasks. Researchers from AFRL customized the Dragon product by using over 30,000 lines of operational chat and adapting it to the vocabulary and sentence structure used by FMV analysts. The result is a highly accurate automated transcription capability that can significantly reduce the workload of the screener and improve the efficiency of PED operations. This presentation will discuss results of various evaluations of the STEP system with AFSOC analysts and the plans to transition STEP into the Distributed Ground Station – Special Operations Forces (DGS-SOF) program of record.

0840 – 0900

Human Systems Integration Risk Management Tool

ZAC ZIMMERLIN, BOOZ-ALLEN HAMILTON, WILLIAM KOSNIK

Human Systems Integration Directorate, Wright-Patterson AFB

The Human Systems Integration Risk Management Tool (HSI-RMT) is a software-based interactive application designed to track, analyze, and mitigate human performance risk associated with the development of systems. It spans system development from concept

formation to sustainment, that is – across the system acquisition lifecycle. HSI-RMT combines two previously developed tools: the HSI Capabilities and Requirements Tool (HSI-CART) and the HSI Program Risk Assessment Tool (HSI-PRAT). The former addresses HSI in capability requirements planning and the latter human performance considerations in system acquisition. HSI-RMT overlays a risk management approach onto the two tools in order to help the HSI practitioner identify, analyze, and mitigate human performance risk to program success. Tool content, in the form of best practice questions, was developed by Air Force HSI and industry subject matter experts. HSI-RMT promises to be a useful tool to help HSI practitioners manage human-centric risk across the system lifecycle. A demonstration will be given.

0900 – 0820

HSI and Set-Based Design: A Novel Design Approach for Exploring HSI Domain Tradeoffs

GORDON GATTIE

Naval Surface Warfare Center-Dahlgren Division

Set-Based Design (SBD) provides a new approach toward building large complex systems, such as naval vessels and large-scale human-machine teams. SBD emphasizes a multi-disciplinary approach with concurrent engineering teams identifying key system variables early and delaying more detailed system design through exploring design space tradeoffs. SBD differs from traditional naval architecture design methods, such as the classical design spiral, which includes more detailed alternatives upfront but requires more redesign if the proposed system does not meet requirements. Toyota was an early adopter of SBD, and was able to reduce time to market while also delaying design decisions through cost, knowledge, and influence. NAVSEA first employed SBD in a major acquisition program when designing the Ship-to-Shore Connector (SSC), the replacement for the Landing Craft Air Cushion. The HSI team was one of six design teams that contributed significantly to SSC design during the Preliminary Design phase. Programs often employ HSI practitioners who focus mainly on human factors engineering, but often incorporate other HSI domains. SBD offers an approach for HSI practitioners to explore tradeoffs between HSI domains, resulting in a more effective systems design over the long term. This brief will provide a SBD overview, lessons learned from SSC design development, and potential applications for practitioners.

0920 – 0945

The Case for UX

Neil Ganey

Northrup Grumman Corporation

The history of Human Systems Integration (HSI) is not that old, but it is quite interesting. Starting around World War II, military leadership began to see the value giving additional focus to the men and women tasked with operating and maintaining its systems. However, it would be about 40 more years before something approximating the HSI that we know was created. Do you know what spurred the creation of HSI? Do you know how the HSI

domains were decided? Which one wasn't part of the original set? This presentation will delve into those topics. Then, we will use that historical backdrop as the frame through which we will consider the case of User Experience and whether it should become the newest domain of HSI.

HFE/HSI II
Wednesday Morning, 1000 – 1145, 02 May 2018
Chaired by Cindy Whitehead

1000 – 1020

Decision Making Support for Human-Machine Collaboration in Complex Environments: Creation of Automated Assistance

ANDREA POSTLEWATE
Naval Air Warfare Center-Air Division

Unmanned Aerial Vehicle (UAV) sensor operator (SO) tasks require the acquisition and understanding of a myriad of disparate sensor data sources to make decisions and act in an operational environment. The most effective way to translate these data into a manageable format for actionable operator information remains an area for study (e.g., Jang & Liccardo, 2007). This format must support the quick synthesis and transformation of data into actionable information that aids operator decision making (DM) in complex environments. To address this issue, Naval Air Warfare Center (NAWC) Training Systems Division, NAWC Air Division, and NAWC Weapons Division are collaborating in an Office of Naval Research-sponsored program. A prior study conducted in a controlled laboratory environment examined expert SO DM during a simulated surveillance and reconnaissance mission. The SO searched an area of interest for suspicious Contacts of Interest and classified other contacts within an allotted time. Coded interview results revealed that expert UAV SO's used five factors to deem a contact as high priority: the contact (1) is not transmitting an Automatic Identification System (AIS) signal, (2) is large, (3) is fast moving, (4) spontaneously pops up on radar, and/or (5) matches the shape or design of targets found in the past (Zemen, Postlewate, & Pagan, 2017). These findings were used to develop the Computer Assistant Trained Identification Algorithm (CATIA) that will aid operator DM and acquire experience from expert operators to improve the classifications through machine learning. CATIA processes images from AweSim, a UAV SO simulator, and metadata to provide a classification based on: AIS information (if available), size, speed, and shape. Additionally, a metric of how confident the algorithm is of its classification is communicated to the operator. The combination of the CATIA and AweSim capabilities aim to reduce the workload of SO's and help novices perform more like experts. These capabilities will be tested in an upcoming experiment.

ABSTRACTS

1020 – 1040

Reconsidering Complexity as a Cognitive Entity in Human System Integration

MUSTAFA CANAN & RIK WARREN
711th Human Performance Wing/RHXM

The whole is greater than the sum of its parts is the motto of system science. Mathematically, this argument has been investigated using the principles of set theory. Set theory principles underlie the probabilistic foundation of studies which investigate reasoning, judgment, and decision making processes of humans regarding the system and the environment. In a human systems integration (HSI) context, these set-theory principles become limiting factors for the perception of the whole. Our information age accentuates these human factors limitations because the human component of a system is vulnerable to the irregularities of information. Integrating human factors into a system introduces new human judgment effects into a system. Hence complexity can emerge beca use humans can make erroneous knowledge claims regarding the system. This presentation discusses HSI with an emphasis on human comprehension of system analysis, design, assessment, and operation by considering the mathematical axioms of quantum probability theory (QPT). By augmenting existing approaches, QPT explains why conjunction and disjunction effects occur, and it explains how the whole can be greater than the sum. This approach validates the systems science motto by expanding the human probabilistic framework.

1040 – 1100

HSI Challenges Around the World: Strengthening Our Craft Through Multinational Partnerships

Gordon Gattie
Naval Surface Warfare Center-Dahlgren Division

The United States Armed Forces aren't the only ones struggling with incorporating human systems integration principles into their science, technology, research, and development efforts. Our international colleagues encounter similar challenges as their programs develop. One vehicle for exchanging best practices and fostering collaboration across international boundaries was established during the late 1950s, and remains a strong partnership mechanism. The Technical Cooperation Program (TTCP) is an international organization that collaborates in defense scientific and technical information exchange; program harmonization and alignment; and shared research activities for Australia, Canada, New Zealand, United Kingdom, and United States. Within TTCP, the Human Resources and Performance Group Maritime Human System Performance Action Group addresses various maritime HSI challenges. This Action Group includes representatives from the aforementioned nations. This brief includes similarities and differences among research priorities and lessons learned from different countries will be reviewed. This brief also contains our group's focus areas and related aligned activities where researchers from member nations are participating in multinational research collaborations. Specific

collaborations include: command space layout, command team effectiveness metrics, and fatigue risk management. Opportunities for engagement and collaboration will be discussed.

1100 – 1145

HSI Domain Collaboration: Lessons Learned and Product-Centric Use Cases, Panel

Frank C. Lacson (AUSGAR Technologies); Bill Kosnik (USAF Space Command);
John Plaga (USAF 711th Human Performance Wing);
Hector Acosta (USAF Air Education and Training Command)

Collaboration between Human Systems Integration (HSI) domains is widely prescribed as a best practice and is essential for conducting HSI analysis. However, domain collaboration – in practice – is often challenging due to organizational barriers, unclear product relationships, and a time-constrained environment (especially during technical reviews). This results in lost opportunities to conduct HSI analyses in a timely manner, greater costs due to duplication of effort, and reduce effectiveness of trade studies. How can collaboration be conducted in a timely and effective manner?

This panel will first introduce the roles/expectations for an HSI Integrator Role, focusing on product-centered collaboration. A use case will be presented to frame the collaboration opportunities in the context of a major acquisition program. Panelists will then share challenges, lessons learned, and best practices on common combinations of internal (HSI domain) collaborations based on their practitioner experience. Below is a sample of common collaborations with Human Factors Engineering (HFE).

- HFE with Training (e.g., Mission and Task analysis)
- HFE with Manpower, Personnel (e.g., Job and Role analysis)
- HFE with Safety and Occupational Health (e.g., Human-Environment analysis)
- HFE with Survivability and Force Protection (e.g., Fatigue and workload analysis)
- HFE with Habitability (e.g., Facility design analysis)

Collaborations with HSI with external Domains (e.g., Systems Engineering, Logistics, Cybersecurity) will also be discussed. Afterwards, a Q&A session gives the audience an opportunity to share their own experiences and collaboration opportunities. This discussion can be part of a common process to guide internal and external collaborations for upcoming HSI guidance documents (e.g., HSI MIL-HDBK). Improving the body of knowledge on HSI domain collaboration allows practitioners to conduct their analyses in an efficient and timely manner. Program Managers benefit by having greater awareness of the types of analyses that have the greatest Return on Investment.

PERSONNEL SELECTION & CLASSIFICATION

ABSTRACTS

Wednesday Afternoon, 1315 – 1500, 02 May 2018

Chaired by James Johnson and LT Michael Natali, USN

1325 – 1350

Examining the Relationship among Cognition, Age, and Air Traffic Control Training Performance

LINDA PIERCE AND JULIA BUCK

FAA, Civil Aerospace Medical Institute

Researchers have consistently found that cognitive ability and age relate to success in air traffic control (ATC) training and incumbent job performance. Younger trainees/controllers with higher aptitude scores are more likely to succeed in training at the FAA ATC Academy and in the field and on-the-job. The relationship between cognitive ability and success in ATC is expected given that many of the worker requirements (skills, abilities, and other personal attributes) an Air Traffic Control Specialist (ATCS) needs to be successful are cognitive. Researchers at the FAA's Civil Aerospace Medical Institute (CAMI) have initiated a new research program to understand better the relationship among cognitive ability, age, and success in ATC training. What cognitive abilities are the best predictors of success in ATC Academy training? What cognitive abilities involved in learning to control air traffic are most likely to degrade with age? We have elected to use the Automated Neuropsychological Assessment Metrics® (ANAM®) test suite to assess the cognitive abilities of ATC trainees attending the Air Traffic (AT) Initial Qualification course at the FAA Academy. The ANAM® test suite represents the evolutionary product of three decades of DoD-sponsored computer-based test development. Initially we will determine the utility of the ANAM® test suite for assessing ATC trainees selected, in part, based on their cognitive abilities as measured by the Air Traffic Skills Assessment (ATSA) exam. The first step in our research program is to assess the extent to which the ANAM® test suite scores of the ATC trainees vary and are useful in predicting success in the AT Initial Qualification course. We will present a description of our research program and results from our preliminary assessments.

1350 – 1415

Development and Validation of Job Opportunities in the Navy (JOIN)

STEPHEN WATSON AND MICHAEL CROOKENDEN

USN, OPNAV and DXC Technology

Presentation will describe the process to build a combined job-preference/job-preview measure as an alternative to conventional interest inventories for the purpose of identifying the best match between a Sailor or recruit and assigned job. Criteria for building a successful instrument are discussed and the resulting test instrument is described, with particular emphasis on the Human Factors criteria and implementation. The exhaustive and lengthy process of instrument testing and validation leading to final approval for Navy-wide deployment is reviewed. The convergent validation of the

approach, taxonomy, and instrument are presented, based on two samples totaling [approximately] 10,000 U.S. Navy Sailors, showing encouraging results for predictive validity in specific real-world criteria. Sample item characteristic, gender differences, and factor analytic results are also presented with a discussion of the utility of such psychometric outputs. The described developmental and validation methodologies may be considered non-traditional in an academic environment but prove invaluable when building a novel instrument which must, and does, demonstrate direct impact on job performance: training, promotion, and retention.

1415 – 1440

Benchmarking ASVAB (MAGE) Requirements Across Career Fields

JAMES JOHNSON, SOPHIE ROMAY, AND LAURA BARRON

USAF, AFPC/DSYX

Like other Services, the U.S. Air Force (USAF) requires both minimum ASVAB (Armed Forces Qualification Test, AFQT) scores for enlistment, and separate minimum ASVAB scores for entry into each of 120+ individual enlisted career fields. While some USAF career fields have ASVAB (Mechanical, Administrative, General or Electronic; MAGE) standards that are met by nearly 100% of Air Force qualified recruits, other career fields have ASVAB requirements that make more than 55% of qualified Air Force recruits ineligible. Although large-scale systematic studies in the 1970s and early 1980s were conducted to establish appropriate aptitude entry requirements by career field, career fields have changed substantially, with often unsystematic changes to minimum entry standards by individual career field managers who may lack an enterprise-wide perspective. The current study examines appropriateness of entry standards by surveying re-trainees who achieved a 5-skill level in 2+ Air Force career fields. Study results provide information regarding (mis)alignment of career field entry requirements, and provide validation of an alternative task learning difficulty benchmarking procedure.

1440 – 1500

Evolution of U.S. Navy Aviation Selection

LT MICHAEL NATALI

USN, Naval Aerospce Medical Institute

The Aviation Selection Test Battery (ASTB) has been the primary tool for selecting United States Navy, Marine Corps, and Coast Guard aviators for over 75 years. This brief will cover the evolution of the ASTB from its origins in World War II to our latest iteration, the ASTB-E, released in December 2013. From interviews in the early days to computer adaptive testing today, this presentation will discuss the past and current research and validity findings throughout the test's development.

MODELING AND SIMULATION

ABSTRACTS

Wednesday Afternoon, 1315 – 1500, 02 May 2018

Chaired by John Ramsey, Mihriban Whitmore, & Alex Hoover

1325 – 1400

The Interagency Modeling and Analysis Group (IMAG), the Multiscale Modeling Consortium (MSMC) and Potential Synergies with Human Factors Modeling and Simulation

BETH LEWANDOWSKI

NASA

The Interagency Modeling and Analysis Group (IMAG) and Multiscale Modeling (MSM) Consortium community is advancing the state of the art in multiscale modeling of biomedical topics. These computational tools have the potential to be transferred to human factors topic areas and applied in areas of human factors research and design efforts. The IMAG consists of representatives from multiple government agencies, including National Institutes of Health (NIH), National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), multiple agencies in the Department of Defense (DoD), Department of Energy (DOE), multiple components of the Food and Drug Administration (FDA), and Intelligence Advanced Research Projects Activity (IARPA), https://www.nibib.nih.gov/research-funding/interagency-modeling-and-analysis-group-imag. IMAG fosters the growth of multiscale modeling applied to biomedical, biological and behavioral challenges, provides funding mechanisms and facilitates collaborations among diverse expertise. IMAG strives to move the field of biological computational modeling forward towards the realization of predictive models in biological, clinical and environmental domains. In addition, IMAG promotes assessment and reporting of model credibility within the application context and dissemination of multiscale models that are repeatable, reproducible and reusable to the larger biomedical, biological, and behavioral research community.

Multiscale, biomedical modeling uses mathematics and computation to represent and simulate a physiological system at more than one biological scale. Biological scales include atomic, molecular, molecular complexes, sub-cellular, cellular, multi-cell systems, tissue, organ, multi-organ systems, organism, population, and behavior. These multiscale biomedical models may also include dynamical processes which span multiple time scales. The Multiscale Modeling (MSM) Consortium is made up of the researchers who have been awarded relevant MSM grants through the IMAG funding opportunity announcements and other initiatives promoted by the agencies within IMAG. The MSM is made up of working groups, including, the biomechanics, cell-to-macroscale, clinical and translational issues, committee on credible practice of modeling and simulation in healthcare, computational neuroscience, high performance computing, integrated multiscale biomaterials experiments and modeling, model and data sharing, MSM for medical devices, multiscale

systems biology, population modeling, public dissemination and education, and theoretical and computational methods working groups. The mission of the IMAG/MSM Consortium is stated here, https://www.imagwiki.nibib.nih.gov/content/frequently-asked-questions-faq.

The focus of the MSM projects are to develop new multiscale modeling methodologies that apply to biomedical, behavioral and biological applications. The funded projects include developing MSM models for cardiovascular disease, electrophysiology research, cellular, sub-cellular and genetic structure and function, biomaterials, biomechanics, drug delivery, neurophysiology research and cancer research. There are several MSM methodologies that have been advanced by this group, including mechanistic theory-based modeling, agent-based modeling, finite element modeling, complex emergent behavior, facilitation of information flow between spatial scales, optimization of clinical workflows and stochastic simulation. These technologies have the potential to be applied in many fields, including human factors.

There are also some specific tools developed within the MSM that may have applicability to human factors research. Three neurophysiology tools include the NeuroML project (https://www.neuroml.org/), GENESIS (http://genesis-sim.org/) and Neuron (https://www.neuron.yale.edu/neuron/). These tools support neural system simulations at various system levels, including biochemical components, neurons and networks of neurons. These tools paired with biomarker and neurophysiology data and psychological test results have the potential to advance research in areas such as attention, work load and fatigue. The Virtual Family (VF) (https://www.itis.ethz.ch/virtual-population/virtual-population/vip2/) is a set of anatomically correct whole-body models of an adult male, an adult female, and two children based on high-resolution magnetic resonance imaging (MRI) data of healthy volunteers. Organs and tissues are represented by three-dimensional, highly detailed CAD objects. These models have potential application in anthropometrically compatible design and injury prediction. BIGDATA (http://ivlab.cs.umn.edu/NSFNIHBIGDATA/) is designed to couple data-intensive modeling, simulation and visualization with human design facilities. The MSM application for this modeling effort is for next-generation medical device prototyping, however it could likely aid the design of many human-system interaction designs.

The IMAG/MSM community is advancing the state of the art in multiscale modeling of biomedical, biological and behavioral topics. These computational tools have the potential to be transferred to human factors topic areas and applied in multiple areas of human factors research and design efforts.

1400 – 1420
Mechanical Ventilation Simulation
DARIO RODRIQUEZ

United States Air Force School of Aerospace Medicine

Background: During Operations Iraqi Freedom and Enduring Freedom the early transport of ill/injured warfighters via the en route care system is often credited as one of the reasons for such a high survival rate. As many as 66 percent of combat casualties suffering traumatic injury required mechanical ventilation as a life sustaining intervention. Managing these patients necessitates dedicated training towards addressing the various complications they encounter requiring mechanical ventilation, as lung injury/diseases are among the top five problems noted during transport. Recent assessment identified as much as a 50 percent or greater failure rate of students attending training courses. In theatre data suggests the need for advancement in management of lung injury to potentially improve patient outcomes. This has warranted an enhancement in training platform's capabilities to meet the demands of commanders to provide a ready medical force. In response our research team set out to develop an objective/measurable simulation training tool that can generate autonomous real-time feedback in order to provide appropriately trained clinicians in the management of mechanically ventilated patients.

Methods: Partnered with industry (IngMar Medical) to develop a mechanical ventilation simulator utilizing pathophysiologic models, standards of care, clinical practice guidelines, and Acute Respiratory Distress Syndrome Network (ARDSNet) data for management of mechanically ventilated patients. The model will simulate respiratory distress during mechanical ventilation including the most common complications: pneumothorax, right mainstem intubation, plugged endotracheal tube, kinked endotracheal tube, bronchospasm, ventilator failure, precipitous fall in lung compliance, precipitous fall in oxygenation, precipitous increase in carbon dioxide.

Results: A simulated torso was developed and integrated with an appropriately equipped Special Medical Emergency Evacuation Device (SMEED) affixed with medical equipment utilized during Critical Care Air Transport Team (CCATT) missions. The torso includes a lung model, upper airway, and head with reproducible computerized algorithms with the ability to simulate respiratory distress. The simulator is responsive to providers interventions in treating conditions encountered during mechanical ventilation.

Discussion: Throughout the continuum of care, life-threatening complications in the mechanically ventilated patient must be recognized quickly and remedied in an effort to mitigate any untoward consequences. In the aeromedical environment recognizing sudden deterioration is complicated by low light, ambient noise and limited access to diagnostics. By providing real life simulations of the most common life threatening events during mechanical ventilation, the proposed system will instruct caregivers in the appropriate troubleshooting and diagnosis of each complication (pneumothorax, mainstem intubation, bronchospasm, etc), promoting earlier recognition and time sensitive treatment. The

primary objective is to provide training producing practice patterns more consistent with current/emerging Best Practice and Joint Trauma System Clinical Practice Guidelines.

1420 – 1440

Subject-Specific Multiscale Modeling for Lower Extremity Injury Risk Assessment

JONATHAN KAPLAN

NSRDEC

Musculoskeletal injuries are a serious problem in the military and injury risk may be exacerbated by issuing new equipment that adds additional load or has not been proven to be safe in operational scenarios. Equipment evaluations are extremely time and resource expensive and do not typically provide insight into the long-term use of such devices that may result in progressive degenerative diseases or acute injuries. Understanding these long term ramifications during the equipment acquisition would provide insight to long term health care costs that are not typically understood during the original decision. Current equipment evaluation methods do not provide the capability to measure the effect of equipment beyond gross body movements. Multiscale computational models using advanced medical imaging modalities are in development. These models will utilize data that is currently captured during biomechanical equipment evaluations of products and will translate full body scale data across multiple scales to the joint, tissue and cellular levels.

NSRDEC is currently developing a pipeline that combines multiple imaging modalities, motion analyses and strength measures to create subject-specific models that can be virtually manipulated to test new devices. An increase in or modification of joint load can result in increased joint pain, reduced performance and an increased risk of musculoskeletal injury – information that is not captured using current methods. The goal of this project is to create subject-specific models of the knee joint to simulate the effect of new equipment at the body level and see the implications this has on cartilage health. Modeling the stress and strain distribution on cartilage may provide insight into osteoarthritis (OA) progression as well as irregular loading at the knee that can result in other soft tissue injuries, ACL tears for example. Once loading is simulated at the tissue level, submodels can also be made that examine the effect of the body scale loads on the cellular and fiber level of cartilage. Collagen fiber orientation in cartilage is a useful metric in determining the tissue's ability to resist loading and cellular deformation is an indicator of chondrocyte death – a precursor to OA.

Computational modeling also allows for testing cyclic fatigue over a given period of time. With ever increasing computational power, it may be soon possible to simulate Solider movement and tasks over an extended period of time to see what effect of wearing a new piece of equipment over a day, 72 hour mission and eventually a Soldier's career will have on their joints. This would allow for the ability to test new equipment over the lifespan of specific subjects to validate the device's intended purpose, screen a Soldier for capacity to

work under a specific MOS and to see what long term injuries may occur on a subject-specific basis over the course of a Soldier's career.

This presentation will focus on an overview of multiscale computational modeling, imaging and the performance methods used to translate full body scale metrics to the joint, tissue and cellular level and how this can be applied to specific DoD and military applications. Some possible applications include infantry movement during a prolonged march, physical augmentation of the human system due to an exoskeleton and the long lasting impact of body borne load.

MODELING AND SIMULATION:
HUMAN BEHAVIOR REPRESENTATION
Wednesday Afternoon, 1515 – 1700, 02 May 2018

Chaired by John Ramsey

1515 – 1645

Modeling and Simulation Panel Discussion: Human Behavior Representation

Moderator: John Ramsay (NSRDEC); Panelists: LTC Glenn Hodges (NPS), Ben Connable (RAND), Matt Walsh (RAND), Randy Brou (ARI)

Problem Statement: Simulations that support analysis, training, experimentation, testing and acquisition decisions affecting special operational forces presently lack the ability to represent individual human behavior(s) that reflect the cognitive, physical, and psychological effects of stress, fatigue, will, injury, etc. on performance. Further, when individual entities are aggregated into teams or units, the effects of stress, fatigue, etc. are not modeled at the aggregate level to provide a realistic representation of their effects on the unit's behavior and performance. The lack of a human behavior representation (HBR) results in poor assumptions and decisions that have cascading affects on lives of the special operations community.

Panel Description: The Human Behavior Representation Panel will discuss the gap that exists in current models and simulations in how to represent the complexity of a human under various conditions; It will discuss a new effort proposed by in the U.S. Army to address the problem; and experts in Modeling, Human Performance, Social Science, Artificial Intelligence, and Military operations will speak about and take questions on the subject of human representation in simulation.

Questions we'd like to address:

1. Can we represent human behavior in our simulations? Other than the obvious reasons (improved training, more realism), why go through all of the effort?
2. Do we need to represent human behavior or just the effects of that behavior on performance? What are the risks in one versus the other?
3. Can we leverage what's being done in the game industry to improve our human behavior/performance representation? If so how?
4. Is there a consensus across the SOF community on which aspects of performance representation need to be improved and what would be considered good enough? Different mission sets most likely will require different approaches/views.
5. Does the research done to date support the development of a basic HBR? Yes/No; Why? Why not? In your view what's missing?
6. What are the big hurdles to overcome in trying to develop/promote a basic HBR model?

CYBER WARFARE I

Thursday Morning, 0805 – 0835, 03 May 2018

Chaired by Marianne Paulsen & Lauren Reinerman-Jones

0805 – 0835

Research Based Scientific Advances to Continuous Insider Threat Evaluation (SCITE) Program

THOMAS W. CHRIST

Intelligence Advanced Research Projects Activity (IARPA)

The Scientific advances to Continuous Insider Threat Evaluation (SCITE) Program is a 36-month IARPA program which seeks to advance the science and practice of insider threat detection through two separate research thrusts:

Thrust I is the Active Indicators (AI) and associated automated detection tool research to develop and validate AIs as automated stimuli that induce indicative responses from insider threats engaged in espionage.

Research Status 25 months into a 36-Month program:

- Most experimental results are in the "right" direction, *i. e.,* there is some signal there.
- The logic-based and habit-based AIs have performed better than the emotion-based AIs.
- To date, we haven't seen individual powerful, dispositively indicative, AIs.
- While continuing to search for individual powerful Active Indicators we are beginning to implement, in parallel, the incorporation of multiple indicators into a Bayes Net model.

- The three Thrust I performers involvement in the program ended at the conclusion of Year 2 of the program.

Thrust II research goals are (1) development and validation of enterprise engineering inference models that forecast the performance (% of threats discovered) of existing and proposed insider threat detection enterprises and (2) enabling models of continuous evaluation and insider threat detection systems that accurately estimate performance of existing and proposed systems to identify individuals exhibiting analyst-defined concerning behaviors.

Research Status 25 months into a 36-Month program:

- At the end of month 18 two of the three Thrust II performers were discontinued.
- The successful continued performer developed a multi-modeling technique which is currently being used to model the IEMs of a national lab and a public university.
- We hope to see Inference Enterprise Modeling established as an academic discipline.

0835 – 0905

Metaphor Displays in Cyber Data Visualization

DENNIS FOLDS

Lowel Scientific Enterprises

Cyber operations in military and civilian sectors rely on human operators to perceive conditions, identify threats, evaluation response options, make decisions, and assess effectiveness. Unlike kinetic events in conventional military action, cyber events may not be well associated with specific geographical locations nor with specific physical objects. As computers became ubiquitous in the workplace, office metaphors were used to help people understand and talk about computer functions. Terms such as file, folder, directory, and desktop helped people associate computer phenomenology with items already common in the workplace. Unintended software errors were called bugs and intentional malware viruses.

As computers became networked and internet technologies emerged, new metaphors were needed, such as page, server, host, service, and port. The networking of computers also provided new vectors for malevolent acts such as theft and destruction of intellectual property, and spying. It also gave rise to a new domain of military and intelligence operations that include deception, degradation of capability, and denial of access. Software was developed to help monitor for malware, intrusions, and attacks. People were assigned and trained to use that software to control cyber defenses, and in some cases to conduct offensive cyber operations. The user interfaces for those software systems have largely been built around the office and networking metaphors, mapped where possible to geographic locations. The complexity of the phenomena of interest in cyber operations often exceeds the capacity of those metaphors to represent it, especially

for non-specialists. In an initial phase of research, I identified and explored some alternate metaphors to use in cyber operations. These include using human faces (or caricatures of human faces), an apartment complex, an agricultural field of sunflowers, and a "well-oiled machine." In the presentation I show these concepts and discuss how they could be used, and also share some attempts that did not seem to work well.

0905 – 0925

Oppositional Cyber Techniques Based in Human Centric Design

KIMBERLY FERGUSON-WALTER

Space and Naval Warfare Systems Center Pacific

Research on developing improved neck injury criteria to aid the design and developmental testing of escape systems and helmet mounted displays for the Air Force and Department of Defense has been ongoing at the Air Force Institute of Technology since 2012 in collaboration with the 711 Human Performance Wing, Aerospace Physiology and Performance Branch. This presentation will outline the research accomplishments to date, including the development of the human based Multi-Axial Neck Injury Criteria (MANIC) and follow on work that demonstrated a method to develop transfer functions to make the MANIC directly applicable to developmental testing with anthropomorphic test devices ATDs). Currently the MANIC is in the process of being incorporated into the Air Force Life Cycle Management Centers (AFLCMC) escape system specification that sets for requirements for new as well as upgraded Air Force escape systems.

CYBER WORKSHOP

Thursday Morning, 0805 – 0835, 03 May 2018

Chaired by Marianne Paulsen & Lauren Reinerman-Jones

1005 – 1015

Preliminary Job Task Analysis of a Cyber Kill Chain and Application to Cyber Defense

JANAE LOCKETT-REYNOLDS

Department of Homeland Security

We present initial results of a Job Task Analysis (JTA) conducted from the perspective of both cyber intruders and cyber defenders. The results of the JTA capture Human Systems Integration (HSI) considerations and provide insight into human performance risks, and knowledge, skills and abilities (KSAs) required for a robust cyber defense workforce. Associated data requirements, decision points, (re)actions, and error conditions will be captured, as discovered. The analyses will be performed using a cyber related kill chain scenario, with a follow-up goal of performing JTA on the specific steps that correspond with each phase of the scenario. Further analysis and results will be submitted for presentation at the Human Factors and Ergonomics Society (HFES) Conference in September 2018.

This project is part of an ongoing, collaborative, inter-agency effort to determine how HSI can help increase situation awareness, enhance vigilance, decrease cyber intrusions, and mitigate impacts of potential user error. Considerations will be aimed toward the development of a set of design guidelines for training and user-interface concepts that support sustained human performance on cyber tasks (i.e., detection, prevention and mitigation of cyber intrusions) under varying operational, environmental, and tactical conditions.

1015 – 1025

Human Centric Challenges in the Cyber Kill Chain

MARIANNE PAULSEN

Naval Undersea Warfare Center Division Keyport

Human error accounts for 52% of data and security breaches and the impact is exacerbated by failure to follow policies and procedures, targeted social engineering, and lack of threat awareness. This workshop is part of an ongoing, collaborative, inter-agency effort to determine how Human Systems Integration (HSI) can help strengthen US cyber defense through user centric design. Preliminary task analysis focused on the Reconnaissance Phase of the Cyber Kill Chain (CKC) was presented at National Defense Industry Association HSI Conference March 2018. In support of this TAG event the analysis was expanded to include the Weaponization, Command and Control, and Actions on Objectives CKC phases.

The goal of today's workshop is to make recommendations for Human Factors Engineering (HFE) research, analysis, and design that could positively impact human performance and therefore overall system performance across the phases of the CKC. Attendees will be placed into groups and provided with all supplies required for participation. Facilitators will present a fictional cyber threat scenario and guide attendees through the phases of the CKC. As accomplished HFE practitioners, attendees will be asked to employ technical judgement to indicate where human performance attributes and application of HFE principles have the potential to enhance cyber defender system performance. Consideration of constructs such as vigilance, workload, human error, and situational awareness is encouraged. Attendees will also be asked to identify ongoing efforts, capabilities or tools they are aware of that are aimed at human performance in cyber.

HFE SME input from this workshop will be analyzed for trends and recommendations will be developed for directing resources for human centric research, analysis, and design. Products will be promulgated to all workshop attendees and submitted to the OSD TAG Proponent as part of the TAG report. The findings will contribute to the future direction of an ongoing, inter-agency effort between NAVSEA, DHS, and SPAWAR aimed toward development of a holistic set of design guidelines for training and operational user-interface concepts in support of a robust cyber defense workforce.

ABSTRACTS

HEALTHCARE SPECIAL INTEREST GROUP
Thursday Morning, 1000 – 1145, 03 May 2018
Chaired by Tandi Bagian, Jill Marion, and Mihriban Whitmore

1010 – 1020
Purchasing for Safety in Healthcare
HELEN FULLER AND KENDRA BETZ
VA National Center for Patient Safety (NCPS)

Safety reports related to products and devices used in health care demonstrate that not all items are equal in terms of usability, compatibility, and functionality, which can result in patient safety concerns. Hospital systems use a wide variety of products when providing care to patients. This variability may contribute to purchasers failing to fully understand and define the needs for these products. In addition, it is necessary to define what a high-quality product is, including what minimal technical requirements it must meet. The Veteran's Health Administration (VHA) is the largest health care system in the United States, providing both the opportunity to learn from a large group of health care providers and significant purchasing power. Purchasing for Safety is a procedure for investigating medical devices or products with an end goal of improving the purchasing decision.

One component of the VHA Purchasing for Safety toolkit is the Clinical Limits of Use Tool (CLOUT) for Medical Devices and Technology. CLOUT is an innovative and evolving project that provides a framework for objective product evaluation. The key elements of the framework include device descriptions and features, common usage scenarios, applicable regulation and coding, existing test standards, performance expectations, care, maintenance and storage requirements, and education and training needs. Assimilation of the reviewed information directs identification of the clinical limits of use of the device; mitigation strategies to address these limits can then be implemented. CLOUT for Wheeled Mobility Devices provides a comprehensive example for implementing the established process that can be applied to any medical device or technology to support appropriate application in the clinical setting and direct procurement decisions while prioritizing safety.

Ideally, all products would go through rigorous functionality and usability testing under a variety of conditions prior to purchase, but such an approval process does not currently exist for all medical devices and products in health care facilities. The Purchasing Checklist aids purchasers in investigating patient safety concerns related to usability when planning a purchase when extensive evaluation of a device/product is not possible. It is particularly valuable to those who will not be able to perform hands-on investigation of a product prior to purchase. The checklist includes steps such as assembling a team that includes key

representatives, considering the purchase needs and options, performing heuristic evaluation of the product literature and other available information, and documenting trade-offs to identify the best option.

1020 – 1030

Human Trust Factors in Robot-Assisted Surgery

SVYATOSLAV GUZNOV, JOSHUA TYLER, SCOTT THALLEMER
Air Force Research Laboratory, 711 HPW

Robot-Assisted Surgery (RAS) has been increasingly used within the DoD hospitals with a 100% jump in the number of surgeries from 2012 to 2016 including general, gynecology, and urology surgery types. RAS enhances surgeons' performance by providing increased dexterity, improved sitting ergonomics, elimination of tremors, and 3-D visualization. These benefits have direct impact on patients' health including reduced risk of infection, smaller incisions, and shorter hospital stays. Additionally, RAS affords flexibility of remote operation, which can be invaluable for the Air Force and other Services when access to qualified surgeons is restricted.

While RAS provides these benefits, challenges to adopting the technology have been reported, which can be grouped into technology concerns (e.g., lack of tactile feedback), teaming challenges (e.g., surgery team members are no longer co-located), and DoD environment challenges (e.g., personnel turnover). As a result, surgeons often choose not to use RAS or to use it for easier cases where the advantages of RAS are not maximized. Previous research in other domains (military and research robotics) have shown that one of the key drivers of appropriate use of complex technology is calibrated trust. Trust has been defined as an individual's belief that the system will accomplish a certain objective and willingness to accept vulnerability and uncertainty. In the case with RAS, if the trustor (e.g., surgeon) has insufficient trust the robot will be under-used resulting in missing an opportunity to use a safer procedure and incurring financial losses. There also might be cases where a surgeon's over-trust in RAS results in misuse, which can have even more severe consequences such as endangering patient's life. Overall, human-machine trust literature has recently made large advancements in understanding the factors that drive trust and reliance in robots, yet little research have been focused on trust in RAS, especially within the DoD.

The Air Force Research Laboratories (AFRL) RHXS branch at Wright-Patterson AFB and the 81st Surgical Operations Squadron at Keesler AFB are currently working on the project to measure the baseline of trust and identify trust facilitators and barriers in RAS within the Air Force and DoD. The findings can be used for modifications to RAS training and future RAS designs. This effort will also contribute to the body of scientific knowledge of human-machine interaction and trust in the medical robotics domain.

1030 – 1040

ABSTRACTS

Simulation Strategies to Teach Procedural Time-Outs: A Randomized, Controlled Trial

DOUGLAS E. PAULL, RICHARD J. SCHILDHOUSE, ROBERT KONONOWECH, AND SARAH SIMPSON

Veterans Administration National Center for Patient Safety

Introduction: The most important countermeasure in the prevention of incorrect surgery and invasive procedures remains the time-out. Organizational strategies to improve time-outs include effective education and training. The study hypothesis was that learners subjected to didactic + screen-based simulation (SBS) would have improved time-out performance when compared to didactic + reading an article controls and that the performance would approximate that for the "gold standard" didactic + manikin-based simulation (MBS). The null hypothesis was that SBS would not lead to improvements in time-out performance compared to controls.

Methods: Medical students and residents (n=62) were randomized to Group I-didactic + reading an article on time-outs, Group II-didactic + SBS, and Group III-didactic + MBS curricula. A baseline time-out self-confidence survey and knowledge test were administered to each participant. One to two weeks following the initial learning session, each student/resident completed a standardized patient simulation scenario where they conducted a time-out. Standardized patient simulations were videotaped and performance assessed by two independent raters based on successful patient and procedure site identification; review of medical images; and marking the site.

Results: Group I, II, and III time-out performance for the videotaped standardized patient simulation, as defined as percentage of all three behaviors demonstrated (patient/site identification, review of medical images, and marking of the site) were 54.5 %, 69.2%, and 81.7%, respectively ($p < 0.05$, Groups II, III vs. I). Time-out performance scores were also superior for didactic + MBS than didactic + SBS (p=0.037).

Discussion: This study confirms the value of didactic + MBS in improving time-out performance. In addition, didactic + SBS learning had a salutatory impact on time-out confidence, knowledge and performance suggesting it may be useful for time-out training, especially for large groups of learners.

1040 – 1050

Heuristic Evaluation of Computerized Consultation Order Templates

APRIL SAVOY, HIMALAYA PATEL, MINDY E. FLANAGAN, MICHAEL WEINER, AND ALISSA L. RUSS

Center for Health Information and Communication, Department of Veterans Affairs

Objective: The speed of computer-mediated referrals may be affected by the usability of templates for ordering consultations. This study's goal was to improve referral communication by identifying, grouping, and prioritizing usability problems in computerized consultation order templates.

Methods: With a purposive sample of 26 templates from three Department of Veterans Affairs medical centers, three evaluators performed a usability heuristic evaluation. The evaluation used 14 domainindependent heuristics and three supplemental references: one new domain-specific heuristic, six usability goals, and clinicians' coded statements on the ease of use of 10 sampled templates.

Results: Evaluators found 201 usability violations, a mean of 7.7 violations per template (*SD* = 3.4). Minor violations outnumbered major violations almost twofold, 115 (57%) to 62 (31%). About 68% of violations were linked to five heuristics: *aesthetic and minimalist design* (17%), *error prevention* (16%), *consistency and standards* (14%), *recognition rather than recall* (11%), and *meet referrers' information needs* (10%). Severe violations were attributed mostly to *meet referrers' information needs* and *recognition rather than recall*. Observed violations had potential negative impacts on efficiency, effectiveness, safety, learnability, and utility. Evaluators demonstrated 80% agreement with clinicians in distinguishing between easy and difficult templates.

Discussion: While the most frequent violations involved interaction design and presentation, the most severe violations involved access to information. Poor support for referring clinicians' information needs had the greatest potential negative impact on efficiency and safety.

Conclusion: The results support the following design considerations: communicate consultants'
requirements, facilitate information seeking, and support referrer-initiated communication.

1050 – 1110

Eight Steps to Resilient Healthcare Options

TANDI BAGIAN
VA National Center for Patient Safety (NCPS)

A significant focus of organizational literature related to healthcare in the past decade has addressed how to transform healthcare operations into High-Reliability Organizations, which are characterized by their ability to achieve and sustain very high levels of safety. According to Weick and Sutcliffe (2007), a key principle of HROs is a commitment to resiliency. "The hallmark of an HRO is not that it is error-free but that errors don't disable it" (Weick and Sutcliffe, 2007, p. 14). The concept of organizational resilience refers to the reliability and safety of complex systems; resilient organizations can recognize, adapt to, and handle unanticipated perturbations (Woods et al., 2006).

With the goal of promoting resilience in healthcare operations, we propose the following eight steps. 1) Ensure a **well-trained workforce**, with processes in place to maintain

training. 2) Introduce **operational checklists** that are dynamic and systematically updated with clarifications and new information. 3) Institute **team-based operations**, including coaching on techniques for performing well as a clinical team and how to effectively speak up. 4) Conduct **proactive assessments** of expected tasks and use-scenarios to help clinicians understand what could go wrong. 5) Utilize the **Clinical Limits of Use Tool** (CLOUT) to target practice on critical areas in the user- task-environment matrix. 6) Perform **Gap Analysis** and plan what to do when presented with an operational scenario different than anticipated. 7) **Imagine** what could go wrong, beyond what has been previously seen and documented. 8) Prepare the team for **Mission Change**, including responding to situations that shift the course of action away from what was expected, requiring the adoption of a new team plan on the fly.

The steps proposed align with the Capability Maturity Model, developed in the 1980s and 1990s for the DoD, which focuses on the optimization of processes. It allows healthcare to fit its actions for system improvement, offering a perspective based on in-use mission development for Space Operations.

TRUST IN AUTONOMY SPECIAL INTEREST GROUP
Thursday Morning, 1015 – 1145, 03 May 2018

Chaired by Lauren Reinerman-Jones

1020 – 1140

Preliminary Job Task Analysis of a Cyber Kill Chain and Application to Cyber Defense

DANIEL BARBER, JULIE MARBLE, JOSEPH LYONS, JOSEPH MERCADO, DYLAN SCHMORROW

Panel Discussion

Several models are emerging in the area of trust in autonomy, but an overarching question deals with should trust in autonomy be trained or designed into a system. This expert panel will address that topic in more detail as it pertains to trade-offs between training and design of trust in autonomous systems. Specifically, they will described features and functions that should be trained or designed. The panel will also describe platforms or systems that might lend themselves better to training or design of trust. They will be asked to identify what they see as key gaps to address in trust in autonomy moving forward.

GENERAL INFORMATION

Venue Information

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Hours Info: Office – Mon to Fri, 0800 - 1300, 1400 – 1600

Dress Code

- Army: Class B
- Air Force: Blues
- Navy: Service Khaki
- Marines: Service "C"
- Coast Guard: Tropical Blue Long
- Civilian: Business Casual

Any questions, concerns, or requirements can be directed to the 2018 TAG Chair Dr. Richard Arnold, Naval Medical Research Unit, Wright-Patterson AFB, richard.arnold.10@us.af.mil