DEPARTMENT OF DEFENSE

HUMAN FACTORS ENGINEERING TECHNICAL ADVISORY GROUP (DOD HFE TAG)

MEETING 71

CO-HOSTS: FAA AND DHS

WILLIAM J. HUGHES TECHNICAL CENTER, ATLANTIC CITY

22–25 MAY 2017 | ATLANTIC CITY, NJ

TABLE OF CONTENTS

GENERAL INFORMATION

Meeting Facilities

All meeting functions other than the tours will be held on the main floor of the William J. Hughes Technical Center. A map of the facilities may be found on page 4–5 of the program.

Registration

Registration is free for federal employees. The registration desk will be located at the table outside of the auditorium from 7:30 AM until 11:30 AM Monday through Wednesday. To avoid lines, members are strongly encouraged to preregister. All attendees must register.

Tours

Due to limited capacity tours are available for those who preregistered only.

Meeting Rooms

All meeting rooms for the sessions are located on the first floor of the William J Hughes Technical Center. Note that some of the rooms have limited capacity. Room locations may change based on capacity needs, so please check the schedules on the door or check on the social media site to make sure your room has not changed.

Session chairs are encouraged to solicit presentations from the individuals in their sessions at least 1 week prior to the meeting and load the presentations on the computers in the designated meeting rooms. This will save time.

Audiovisual Equipment for Talks

LCD Projectors (e.g., for PowerPoint presentations) and PC laptop computers will be provided in each meeting room. VGA cables will be available if needed. Please give a copy of your presentation to the session chair a week prior to the meeting and bring a copy with you.

Poster Sessions

All poster sessions will be held after the plenary session on Tuesday in a designated area of the cafeteria. Posters will be attached to dividers using Velcro. Locating the posters in the cafeteria will allow an extended viewing time for the posters. Authors of posters are asked to have their posters in place by the end of the plenary session and may leave their posters in place until Thursday afternoon.

Coffee Breaks

There are vending machines near the cafeteria and there is a cafeteria that will be open from 7:00 AM until 3:30 PM.

ATM Machine

An ATM machine is located on the main level of the WJHTC as indicated on the map. The Jersey Shore Federal Credit Union is also located on the main level.

Non Smoking Policy

Smoking is not allowed in the building at any time. Smoking is allowed in designated areas only. Please see the map for designated smoking areas. Note that if you leave the building to smoke, you will need someone to let you back into the building.

Badges

All persons attending the meeting must wear their government-issued identification badge or visitors pass at all times when at the facility. Government ID or visitor's badges must be visible at all times.

GENERAL INFORMATION

Cell Phone Use

Please silence all cell phones and other mobile devices while attending sessions. Cell phones may be used in designated areas only. Designated areas include the Cafeteria, in the Atrium under the airplane, between the double doors near the CAD rooms.

Photography

Attendees may not take photos or make video or audio recordings of the speakers or their visual aids without the permission of the speakers.

WI-FI Access

Participants who need WI-FI access while at the meeting can pick up directions for connecting to the guest WI-FI at the registration desk.

Message Board

A message board will be available by the registration desk for posting hard-copy messages and announcements.

Social Media

Stay up-to-date by following the DoD HFE TAG on Facebook, LinkedIn and Twitter (@DoDHFETAG).

Parking

Special parking and security will be set up for the DoD TAG. Once you are on Amelia Earhart Blvd there will be signs directing you to a gate on the right where you will park and obtain a pass (Gate 18 - just before the Security Operations Center Building). There will be personnel available to check you in. Please have your ID. Once you are checked in someone will direct you to the shuttle van/bus. The shuttle van/bus will take you to the meeting location within the main building of the William J. Hughes Technical Center.

Please do not bring firearms (such as service revolvers) with you.

On Google Maps, you can search for Amelia Earhart Blvd., Egg Harbor Township, NJ

ANNOUNCEMENTS

Facilitators

For the first time, facilitators will be present at this meeting. NASA has provided support for facilitators to be present at the meeting and capture important information. The goal is to build upon collaborative efforts, facilitate information exchange, describe specific products and benefits of TAG meetings, and actively facilitate and document collaborations that leverage the work of the organizations in attendance.

TAG Welcomes Veterans Health Administration

The DoD HFE TAG and affiliates NASA, FAA, and DHS are pleased to welcome its newest affiliate, the VHA. The TAG provides a federal interagency venue for VHA and the Defense Health Agency (DHA) to collaborate with each other and with other federal department and agency HFE experts and stakeholders to leverage expertise and improve the safety and effectiveness of medical and healthcare delivery systems.

Caucuses

All registered meeting participants are invited to participate in their respective service caucus on Wednesday.

NEW Human Factors in Healthcare SubTAG

Per TAG procedures a HF in Healthcare (HFHC) SubTAG Special Interest Group (SIG) will hold both formation and content session(s) at TAG 71. Content will focus on HF related to patient safety. The new HFHC SubTAG can be expected to attract new individual participant members to the TAG from agencies such as the FDA, NIH Agency for Healthcare Research and Quality, and various Chem-Bio programs in defense and homeland security. It also provides a home for growing application of historically medical knowledge to legacy HF research.

Invitation to new TAG members from the Healthcare HF community

By its Charter and Governance, any Federal employee with a stake in human factors is welcome as a participant and member of the TAG. TAG meetings are government sponsored without registration fees by its DOD Proponent, preapproved for DOD travel, and are hosted by agency affiliated on government facilities on a rotational schedule. The Charter also provides a means by which non federally employed representatives of Human Factors- relevant technical societies and industry can be nominated and credentialed as TAG members by the Executive Board for 2 year renewable terms. All other participants in TAG venues are by conditional invitation of the TAG Chair. (These are guests, typically academic or industry PIs on federal research funds nominated for invitation to present their work in SubTAG sessions by their TAG Member program managers).

Future Meeting Information: TAG 72

TAG 72 will be hosted by the Air Force. Date and location TBD.

EVENT HIGHLIGHTS

MONDAY, MAY 22

New Member Orientation

If you are new to the DoD HFE TAG, have recently missed a few of our annual meetings, or simply want to reconnect with new friends and old, please join the DoD HFE TAG 71 Executive Committee and a host of other veteran colleagues for an informal, informative discussion about the TAG. It is the perfect time for introductions, networking, and to receive a brief overview of the TAG including our organizational structure, history, strategic partnerships, products, as well as current news. Plus, we want to get to know you - our new members! Expect for New Member Orientation to last no more than 45–60 mins.

SAE G-45 (closed meeting)

In concert with and in support of systems engineering, the Human Systems Integration (HSI) Committee focuses on processes, tools, requirements, and guidelines to assure satisfactory human-system integration. Committee scope includes human factors Engineering (HFE); manpower, personnel and training (MPT); environment, safety and occupational health (ESOH); personnel survivability and habitability. The primary focus areas of the SAE G-45 HSI committee are: defining, assessing and optimizing human-system interfaces; maximizing human and human-system performance and; minimizing personnel-driven customer ownership costs. Human modeling and design for ease of maintenance are included within the G-45 scope.

FAA/NASA RTT (Closed meeting)

The FAA /NASA Research Transition Team meeting allows the FAA and NASA to discuss and coordinate research.

Executive committee meeting (Closed Meeting)

Human Modeling and Simulation Workshop

TUESDAY, MAY 23

Plenary Session

Poster Session

WEDNESDAY, MAY 24

Service Caucuses

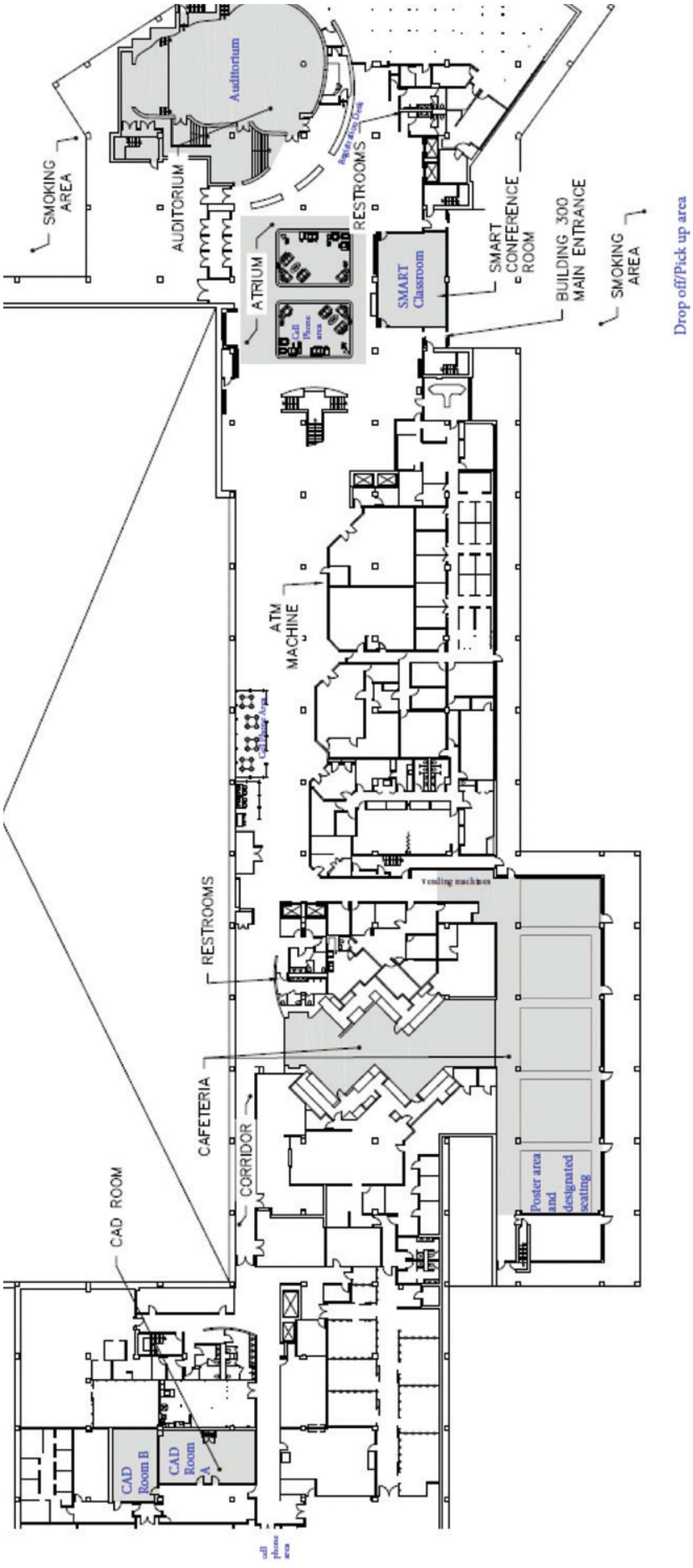
All participants are encouraged to join in their respective service caucus meetings.

THURSDAY, MAY 25

HSI MIL-HDBK Working Group

Tours

Tours of some of the facilities such as the NextGen Integration Evaluation Capability, the Research, Development & Human Factors Laboratory, the Integration and Interoperability Facility, the Coast Guard Facility and the Transportation Security Laboratory.



SMOKING AREA
AUDITORIUM
Auditorium
Registration Desk
RESTROOMS
ATRIUM
Cell Phone area
SMART Classroom
SMART CONFERENCE ROOM
BUILDING 300 MAIN ENTRANCE
SMOKING AREA
Drop off/Pick up area
ATM MACHINE
Cell Phone Area
RESTROOMS
Vending machines
CAFETERIA
CORRIDOR
CAD ROOM
Poster area and designated seating
CAD Room B
CAD Room A
cell phone area

MEETING THEME:

Making Sense of Big Data: The role of Human Factors Engineering in Surviving and Thriving in a World of Ubiquitous Data

We are moving toward a culture that is increasingly data-driven. New sources of data provide a wealth of information on human and system performance, yet the sheer volume of data can be daunting. Government entities have access to an amazing velocity, volume, and variety of information on systems and the users of the systems. Figuring out how to effectively leverage this data is an issue being faced by all branches of the government. Major corporations are already making progress in this area, using analytics to derive meaningful insights from data and converting knowledge into action. Although the right data at the right time have the potential to improve decision making, lead to new insights, improve operational effectiveness, and save lives, too much data or data that are not organized in the right way can be a liability, overwhelming users and hindering decision making. Technological advances have made it possible to generate large volumes of data, but what do we do with them once we have access? Do we have the tools and expertise to make meaningful decisions? Can we pull data from isolated silos and combine them in ways to dynamically resolve our pressing issues? Are we prepared to meet the challenges of dealing with terabytes or petabytes of data? Do we have insight on how to organize and display data without overwhelming the user? No single agency has the expertise or budget to address all of these questions in isolation; however, combining knowledge across agencies can significantly boost progress. This meeting seeks to take a broad agency perspective by sharing tools, lessons, and insights for addressing the big data problem.

AGENDA

Monday, 22 May		Location
0800-1000	SAE G-45 Committee Meeting	CAD A
1000–1100	Meeting Registration	
	SAE G-45 Committee Meeting	CAD A
	FAA/NASA RTT Follow-up (closed meeting)	CAD B
1100–1230	Luncheon Break	Cafeteria
1300–1450	Meeting Registration	
	New Member Orientation	CAD B
	HM&S Workshop	Smart Classroom *(Preregistration required)*
	SAE G-45 Committee Meeting	CAD A
1500–1650	Executive Committee Meeting	CAD B
	HM&S Workshop	Smart Classroom *(Preregistration required)*
	SAE G-45 Committee Meeting	CAD A
1800–2000	No Host Mixer	Gourmet Italian Cuisine 325 S. Pitney Road, Galloway.

Tuesday, 23 May		Location
0715–0800	Meeting Registration	
0800–1130	Meeting Registration	
	Plenary Session	Auditorium
1130–1140	Meeting Registration	
	Introduction of Facilitator Function	Auditorium
1140–1220	Poster Session	Cafeteria
1210–1300	Luncheon Break	Cafeteria
1300–1445	HFE/HSI I	Auditorium
	Controls and Displays	CAD A
	Training	CAD B
1515–1700	HFE/HSI II	Auditorium
	Controls and Displays II	CAD A
	Mixed Reality	CAD B
1715–1800	Working Groups	TBD

AGENDA

Wednesday, 24 May		Location
0700–0750	Meeting Registration	
	Technical Society/Industry	CAD B
0800–0945	Trust in Autonomy	CAD B
	Design: Tools and Techniques	CAD A
1015–1150	Unmanned Systems (UAS)	Auditorium
	Modeling & Simulation I	CAD A
	Extreme Environments	CAD B
1200–1300	Luncheon Break	Cafeteria
1300–1445	Cybersecurity	Auditorium
	Healthcare Special Interest Group – Session I	CAD A
	Human Factors Standardization	CAD B
1515–1700	Human Performance Measurement I	Auditorium
	Modeling & Simulation II	CAD A
	Personnel	CAD B
1700–1800	Service Caucuses	

Thursday, 25 May		Location
0700–0750	Meeting Registration	
0800–0945	Human Performance Measurement II	Auditorium
	Healthcare Special Interest Group II	CAD B
1000–1200	Operating Board (closed meeting)	Auditorium
1015–1200	HSI MIL HDBK Working Group	CAD A
	Safety/Survivability/Health Hazards	CAD B
1200–1300	Luncheon Break	Cafeteria
1300–1730	Tours (preregistration required)	Location TBD

PLENARY SESSION SPEAKERS

Bios

Dr. James B. "Ben Petro", PhD, MSSI: "Welcome to DoD HFE TAG"

Acting Director, Human Performance, Training, and BioSystems (HPTB) Research Directorate

Dr. Ben Petro is assigned to the Office of the Assistant Secretary of Defense for Research and Engineering (OASD(RE)), where he serves as the Associate Director for Medical Research and Engineering. 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) 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 was responsible for *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 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 explosive 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.

PLENARY SESSION SPEAKERS

Bios

Natesh Manikoth

FAA Chief Data Officer

Natesh Manikoth is the Federal Aviation Administration's (FAA) Chief Data Officer (CDO) responsible for managing and exploiting the information assets of the agency. It is his responsibility to focus on opportunities, threats, capabilities and gaps related to managing the FAA's information assets. The CDO is responsible for creating business value from the FAA data assets and providing leadership and innovation in the enterprise information management arena.

Prior to taking over the CDO role, Mr. Manikoth was the FAA's Chief Scientist and Technical Advisor (CSTA) for the National Airspace System (NAS) Software in the Next Generation Air Transportation System (NextGen) organization providing expert technical guidance, advice, and leadership in all software related areas of the FAA system acquisition and development process. As such, Mr. Manikoth's primary focus areas were the sustainable acquisition practices for software intensive systems and cybersecurity.

Before joining FAA in 2012, Mr. Manikoth was the Chief Technology Officer for the Transportation, Central and Local Government Sector for Xerox services. He has nearly 30 years of experience with the development and deployment of large scale systems.

Stephen Dennis : "Challenges for Data Enriched Decision Making"

Data Analytics Engine Director, HSARPA, Science & Technology Directorate, DHS

Stephen Dennis provides leadership and guidance to information analysis and critical infrastructure protection programs within the Homeland Security Advanced Research Projects Agency (HSARPA) of the Science & Technology (S&T) Directorate of the Department of Homeland Security (DHS). Mr. Dennis provides technical guidance for information analysis, collaboration and sharing related to Data Analytics research and development at DHS. Mr. Dennis also serves as the S&T APEX Program Manager for the Border Enforcement Analytics Program to improve utilization of DHS Big Data sources for ICE Homeland Security Investigations. He has over thirty years of experience managing research programs in information analysis and processing automation within the Intelligence Community and other federal agencies. Mr. Dennis holds a Master of Business Administration and a Master of Science Degree in Electrical Engineering from the University of Maryland, College Park.

PLENARY SESSION SPEAKERS

Bios

Dr. Joseph V. Cohn : "Predictive Analytics for Healthcare: Setting the stage for future success"

The Defense Health Agency Advanced Biomedical Technology Development Program

Captain Joseph Cohn is an Aerospace Experimental Psychologist (AEP) in the U.S. Navy's Medical Service Corps currently assigned as the Director for Advanced Development, in the Defense Health Agency's Research, Development and Acquisition Directorate, responsible for the oversight and management of the $1.7 billion Defense Health Program RDT&E program and ensuring that resultant technologies successfully transition across the Military Health System. Across his career, he has directly managed over $300M in Basic, Applied, Advanced Technology Development, Advanced Component Development and Prototype, and Small Business Innovation Research funds, developing performance-enhancing biomedical and human systems technologies for the Army, Navy, Air Force and Marine Corps.

CAPT Cohn has co-authored over 80 Human Performance and Biomedical related publications, chaired numerous panels and workshops and been invited to speak at national and international conferences. He co-edited a 3-volume book series focusing on developing, implementing and assessing training systems, a book on enhancing human performance in high risk environments and a book focusing on modeling individual and group decision making processes. He is DAWIA Certified Level 3 Science & Technology Manager, DAWIA Certified Level 1 Program Manager and DAWIA Certified Level 1 Engineer. His military decorations include: the Defense Meritorious Service Medal (2), the Joint Meritorious Unit Award (2), the Meritorious Service Medal (4), the Navy Commendation Medal (3), the Army Commendation Medal, and the Navy Achievement Medal (2). He was a co-recipient of both the Undersecretary of Defense (AT&L)'s 2016 award for his leadership in establishing cooperative research efforts with the Indian Ministry of Defense, and the 2014 Award for Excellence, recognizing his support for DoD's Ebola efforts. In 2013 he received the Admiral Jeremy M. Boorda Award for Outstanding Integration of Analysis and Policy-Making. In 2012, he received the AEP Society's Michael G. Lilienthal Leadership Award. From 2009 through 2012 he served as the first President of that Society. In 2009 he received the Association of Medical Service Corps Officers of the Navy's "Best in Innovation" Award for developing a portable Traumatic Brain Injury diagnosis tool. In 2007 he received that Association's "Best in Innovation" and "Best in Presentation" Awards for developing neurocognitive technologies to enable Warfighter resilience. In 2006, he received that Association's "Best in Innovation" Award for developing a portable near-infrared technology for detecting TBI. In 2006 he received the Navy Modeling & Simulation Award, Training Category, from ASN (RD&A). From 2006 to 2009 he was the AEP Assistant Specialty Leader, responsible for recruiting new officers, mentoring over a dozen junior officers and addressing the administrative needs of 30+ officers. He is a Fellow of the American Psychological Association, and the Society of Military Psychologists, & Associate Fellow of the Aerospace Medical Association. He served as co chair (2 years) of the International Cross Cultural Decision Making Conference, was the Principal Human Systems Subject Matter Expert to the 2015 National Defense Industrial Association's Human Systems Division Conference and is the Deputy Chair, Human Performance Committee, Aerospace Medical Association.

PLENARY SESSION SPEAKERS

Bios

Dr Kevin T. Geiss : “Airman Systems Directorate: Enabling Airman-Machine Teams”

711 HP Wing Director, Airman Systems Directorate, 711th Human Performance Wing, Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio

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 a 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 enlisted in the U.S. Marine Corps Reserve in 1986 and served in field artillery, communications and military police units during his service. He spent nine years as a defense contractor supporting Air Force research programs at Wright-Patterson Air Force Base, Ohio. He began his civilian career with the Air Force in 2002 in the Human

Effectiveness Directorate of the Air Force Research Laboratory at Wright- Patterson AFB. He was then detailed to the White House Office of Science and Technology Policy, where he performed policy and budget review of Department of Defense science and technology programs and resolved policy and funding issues with the Office of Management and Budget. He was also responsible for leading interagency policy committees on national and homeland security.

In 2008, Dr. Geiss joined the Department of the Army as the Program Director for Energy Security. He was responsible for the development and implementation of the Army Energy Security strategy through coordination across all Army Headquarters staff and Secretariat offices. Dr. Geiss led the Army Energy Security program to address power and energy issues for the facilities and installations domain, in weapon systems, and for contingency operations.

Following his position as Program Director for Energy Security, Dr. Geiss served as Deputy Assistant Secretary of the Air Force for Energy, Office of the Assistant Secretary of the Air Force for Installations, Environment and Logistics in Washington, D.C. Dr. Geiss was responsible for providing oversight and direction for all matters pertaining to the formulation, review, and execution of plans, policies, programs, and budgets for the effective and efficient use of energy to support the global Air Force mission.

PLENARY SESSION SPEAKERS

Bios

Mr. Timothy W Bush: "An Overview of the Air Force Human Systems Integration Directorate"

Technical Advisor for the Human Systems Integration Directorate, 711th Human Performance Wing, Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio

Mr. Timothy W Bush is the Technical Advisor for the Human Systems Integration Directorate, 711th Human Performance Wing, Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio. The 711th Human Performance Wing Human Systems Integration Directorate (711 HPW/HP) provides Human Systems Integration (HSI) capability to the United States Air Force. Major areas of emphasis include a human-centered approach to capability requirements definition and development planning, embedded HSI analysts in MAJCOM requirements offices (A5), embedded practitioner support and reach-back support to System Program Offices, and expanded support to AF Medical Service (AFMS). HSI facilitates the systematic integration of human-centered domains to optimize total system performance and decrease cost, and informs the life cycle decision making process with a human-centered focus.

Mr. Bush entered civil service upon graduation from the University of Kentucky in 2000 and was assigned to the Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio. He later served as the lead life support and pilot flight equipment engineer for the F-35 Lightning II. Mr. Bush was then selected as the Air Force Technical Expert for Life Support and was responsible for the airworthiness of life support and pilot protection systems across the Air Force. Mr. Bush then broadened his technical base beyond his life support foundation as the Flight Systems Chief Engineer for the F-15 Saudi Advanced program. Mr. Bush returned to human centric work when he was selected as the Technical Advisor for the Human Systems Directorate, AFRL.

WORKSHOP

Human Factors Modeling & Simulation Workshop

22 May
1300–1450 & 1500–1650
Smart Classroom
Moderator: John Rice
HM&S Chair

For the third year, the Human Modeling and Simulation SubTAG is organizing an engaging computational modeling hands on workshop. This year will focus on the use of a very powerful open source bio mechanical (and related) modeling tool, OPENSIM, initially developed and currently based at Stanford University with funding from NIH and now maintained by its user community.

As in the past, this HFE TAG workshop is being designed with Program Managers in mind to give them a greater understanding of how these tools can support various HF aspects of their programs. No advanced computer of human anatomy/physiology knowledge or skill is required.

This year's workshop is being provided by our own OpenSim user, Dr. John Ramsay, Research Biomechanics Engineer US Army Natick Soldier Systems Center.

Participants will be provided with instruction to download OpenSim which is approved for use on the DREN for the workshop and a take home tool.

Objectives:

Expose HF Program Managers to a low cost modeling tool for use in design and testing human physical engagement or interaction with systems.

Help demystify computational modeling of humans as components in integrated human-machine-environment systems R&D for non computational HF professionals.

Demonstrate the utility and power of the OpenSim human modeling tool for analysis of human ergonomic effects related to human machine systems integration, through facilitated hands on use of the the OpenSim tools. OpenSim being one of several such tools.

Help participants understand the growing user sourced open software benefits and limitations as cost saving resources for in house and contracted R&D.

WORKSHOP

Content:

Pre session DREN APPROVED software loading to participants' personal computers for use in the hands on sessions and for take-away.

Didactic orientation to open source computational tools for HF and related work.

Didactic instruction with examples specific to the OpenSim tools and community of users.

Facilitated small group hands on use of OpenSim to actually study or solve selected use cases.

Group sharing of solutions and discovery made during the hands on exercises.

Concluding discussion of the growing open source community resource movement and its fit (advantages and disadvantages) in government HF R&D contracting.

SESSION AGENDA

Controls & Displays – Session I

23 May 2017 | 1300-1445 | CAD A

Chairs: Marianne Paulsen & Allison Mead

1300-1305	**Introductions** Marianne Paulsen, Allison Mead - C&D SubTaG Chairs
1305-1330	**Development and Evaluation of a Guidance Display in Support of Precision Airdrop** Eric Geiselman, Laurie Quill – U.S. Air Force
1330-1355	**Information sharing needs for operators in the Netted Navy** Alan Lemon - SPAWAR Systems Center Pacific
1355-1420	**Experience Matters: Why evaluating emerging control and displays technology is hard.** Patrick Mead - Naval Surface Warfare Center Dahlgren
1420-1445	**A Framework for Analyzing and Discussing Level of Human Control Abstraction** Clifford Johnson – Air Force Institute of Technology

ABSTRACTS

Development and Evaluation of a Guidance Display in Support of Precision Airdrop

Eric Geiselman, U.S. Air Force, Laurie Quill, Human Factors Solutions

A multi-year effort is being completed at the Air Force Research Laboratory aimed at minimizing the effect of human performance variability on airdrop accuracy. An overall program objective is to afford single-pass airdrop from relatively high altitude using bundles under conventional parachute drag devices. To support achievement of the overall goals, an Airdrop Guidance (ADG) display format was developed as a pilot/vehicle interface intended to provide continuous flight direction and status information during the airdrop tasks. Due to the specialized functionality of the system, the ADG display interface currently resides on a flightdeck auxiliary display instead of being integrated "under the glass" as a component of the avionics suite. The design solution addresses performance variability associated with flight surrounding the "Green Light" activation—or release of the payload at pre-calculated point in space. Pilots participated in both simulated and actual flight test evaluations of the ADG system. Evaluations included comparison of the ADG to "legacy" airdrop methods at various release altitudes and "out-the-window" visual conditions. Results suggest improved performance measured by both aircraft position at Green Light, and error found between actual flightpath and the desired flightpath. Subject matter expert subjective feedback regarding the use of the ADG display will also be presented. Implementation of the ADG shows potential for increasing overall airdrop accuracy and transition of the system into a deployable system is underway

Information Sharing Needs for Operators in the Netted Navy

Alan Lemon, Karl Van Orden, Robert Gutzwiller
SPAWAR Systems Center Pacific

For users of command and control (C2) systems, the speed of war is only outpaced by the rapacious growth of data on offer. The military at large is struggling to make sense of massive stores and collections of data, in everything from reconnaissance systems to intelligence sharing networks. One issue plaguing operators is the need for sharing information between watchstanders quickly and effectively. Often, decision-makers on board Navy ships, who are responsible for the ship's safety and for guarding other high value units, are constrained by this sharing effectiveness. With multiple dedicated roles for a large number of operators, these sharing challenges increase. For example in multi-domain operations, each dedicated domain (air, surface, sub-surface) communicates their perspective outward. These perspectives must be coordinated and then occasionally re-distributed as part of command and control. Such coordination can be difficult to achieve.

The Task Force Netted Navy idea is the newest conceptualization of networked battlefields. The Navy envisions platforms that can share data, collaborate on solutions to problems, and order the delivery of effects from other blue ships. The reliance on sharing information in this vision of the future has both a technical, systems-driven set of challenges, as well as cognitive challenges for the operators and decision-makers who must operate the systems. As mentioned, the data sharing limitations on board a ship between watchstanders and systems may determine whether the operators take certain actions or not. When the time to transfer this knowledge is long or the knowledge cannot be easily reduced or transverse classification gaps, the ship may incur additional risk and decreased effectiveness during operations.

Coalescing this data into actionable knowledge for decision-making is necessary to employ military power. Ideally, human factors engineering, as part of the Human-Systems Integration process, is able to construct cognitive models of command situational awareness, workflows, processes, and procedures (WPPs). These provide researchers and designers with insights on how teams quickly and accurately share information and the information needed to support decision-making. Such information can be used in whole system redesign. We also suggest that solutions slightly altering existing design can be promoted. Based on observations of shipboard training exercises, we believe that simple iconography and alerting can reduce the user's cognitive burden of assimilating and acting upon disparate information. We suggest a novel way to increase the utility of existing displays by visually amplifying track and taxonomic data for "prioritized" tracks (as selected by user) and a change in the use of large screen displays. We believe this approach can improve team situation awareness, enhance shared understanding of the battle problem among the watch team, and partially mitigate observed operator error.

ABSTRACTS

Experience Matters: Why evaluating emerging control and displays technology is hard.

Patrick Mead, David Keller, Megan Kozub
Naval Surface Warfare Center Dahlgren Division

As new control and display technologies become available in the commercial market it is important to access the potential impacts and utility they may have on military systems, and the benefits or costs they may have to warfighter performance. However, in doing such assessments comparisons are typically made with current technologies serving as the baseline, often overlooking critical design considerations and how familiarity and expertise with older technologies may bias results. This can lead to an "apples and oranges" type comparison wherein the maturity of newer technologies and their ability to add value to the warfighter and their task may be under or over estimated. This research provides an example of such an evaluation wherein an initial comparison of emerging gestural control technologies and mouse control resulted in different conclusions when training was present and absent. In an initial study novice participants completed a Fitt's pointing task with mouse, gaze and non-gaze supported gestural controls assessing speed, accuracy, and workload. Participants received only a brief five minute introduction to the novel gesture controls prior to completing the experiment. The results showed that when gaze and gestures based controls were combined performance was improved. Based on this result it was concluded that non-gaze supported gestures were not a viable control alternative, and that gaze supported gestures while viable as a control option may not be worth the added investment to integrate. Taken by itself, this result may lead designers to avoid such technologies in favor of the traditional mouse control, despite the possible new capabilities afforded by novel interaction methods. As a follow on, the initial study was replicated using experienced participants. Prior to the assessment participants completed a multisession training program allowing them to develop some mastery of the gestures based controls. Participants completed training sessions using all three controls followed by a final post training assessment. As expected, incorporating training improved performance for the gestures based controls, while mouse performance remained constant. More importantly, the results indicated that both gaze and non-gaze supported gestures were in fact viable alternatives to the mouse with respect to speed, accuracy, and workload. Non-gaze supported gestures became equivalently fast and accurate compared with mouse control, with some difference in subjective workload. While gaze supported gestures were actually found to be significantly faster than mouse control, with equivalent accuracy and subjective workload. The results of these two studies elicit two conclusions. First, that familiarity and expertise can have a dramatic impact on the conclusions drawn from such evaluations, and second that the even with just a few hours of exposure participants may be able to achieve some measure of proficiency with new technologies. Given that many participants will be experts with current control and display technologies researchers and designers should carefully consider whether a fair assessment of newer technologies can be made with novice participants, and to what extent they must be familiarized and trained on the new technologies before comparing their performance with both new and old alternatives.

A Framework for Analyzing and Discussing Level of Human Control Abstraction

Clifford Johnson, Michael Miller
Air Force Institute of Technology

Levels of Autonomy (LoA) provide a method for describing function allocation between operators and autonomous system elements. Unfortunately, LoA does not provide the user interface designer a clear method to distinguish among interface concepts which impose varying levels of operator workload or result in predictable human or system performance changes. In 2012 the Defense Science Board (DSB) released a document entitled "The Role of Autonomy in the DoD Systems." This report recommends that the DoD "Abandon efforts to define levels of autonomy and develop an autonomous system framework that: [1] Focuses on how autonomy supports specific capabilities [2] Identifies cognitive functional responsibilities to be delegated to the human or the computer; and [3] Makes visible the systems level trades inherent in the design of autonomous capabilities"

The current research suggests an alternate classification scheme, specifically Level of Human Control Abstraction (LHCA). LHCA describes how an operator controls a system based on the control tasks performed and the level of detail of decisions made by the operator verses the system. The framework consists of five levels: Direct Control, Augmented Control, Parametric Control, Goal Oriented Control, and Mission Capable Control. Control configurations of both real world and hypothetical systems can be categorized within this framework. Conclusions about the operations of systems categorized within the framework can be drawn consistently across system domains, demonstrating the usefulness of the LHCA framework. This potentially provides a framework that satisfies the DSB recommendation and is directly related to human workload and performance.

The LHCA conceptual framework will be shown to be applicable and useful for achieving the goals of the DSB. This framework facilitates further research into the level of detail of operator verses system decisions, potentially yielding improved human and system performance. Additionally, this framework may have additional implications to enable

improvements in manpower and training for DoD systems. Finally, system requirements could be developed using the LHCA conceptual framework, mandating that system designers match appropriate system control to DoD mission needs.

SESSION AGENDA

Controls & Displays – Session II

23 May 2017 | 1515-1700 | CAD A

Chairs: Marianne Paulsen & Allison Mead

1515-1520	**Introductions** Marianne Paulsen, Allison Mead - C&D SubTaG Chairs
1520-1545	**Mitigating the Effects of Cognitive Overburden with a Dual-Mode Tactile and Bone Conduction System** Timothy White- U.S. Army Research Laboratory (HRED)
1545-1610	**Leveraging Automated Performance Measurement in Complex Scenario-Based Simulation Environments: A Need to Understand Workload & Perceived Quality of Feedback** John Killilea - NAWCTSD
1610-1635	**Evaluation of Virtual Environment Menu Designs** Betsy Abdeen - Naval Undersea Warfare Center Division
1635-1700	**Virtual Reality Hands-on Demonstration using Samsung Gear VR** Marianne Paulsen – Naval Undersea Warfare Center Division

ABSTRACTS

Mitigating the Effects of Cognitive Overburden with a Dual-Mode Tactile and Bone Conduction System

Timothy White, Kimberly Myles
U.S. Army Research Laboratory (HRED)

Cognitive overburden can have grave consequences in the outcome of the operational mission if it is not managed appropriately ¬– ¬overwhelming Soldiers and restraining their decision making skills, resulting in potential mission failure, injury, or death. From a Soldier perspective, information is primarily disseminated via the visual and/or, sometimes, auditory channels, which are limited in the capacity of information they allow Soldiers to perceive, process, and interpret, at any one time. An alternative communications system, an integrated tactile and bone conduction system, is being explored to increase the capacity of information Soldiers can interpret at any one instance, by aiding in the reduction of cognitive workload so often faced on the battlefield, and thereby improving decision making and the general outcome of missions. The tactile functionality of an integrated system enables vibration to be applied to the skin to convey critical information; most critical when the visual and/or auditory channels are unavailable due to voluminous amounts of data being directed through these channels, or due to competing environmental factors such as operational time of day, noise pollution, and masking. In addition, the bone conduction functionality of an integrated system enables sound waves to be transmitted via the bones of the skull versus the air. This affords the user the option to communicate in low noise while also attending to other environmental sounds, or communicate in high noise while wearing hearing protection. These capabilities enhance situation awareness and reduce workload. This dual-mode, integrated system can potentially reduce information bias, false positives, and information complexity, introduced by numerous data systems, through team communications in real time. This can enhance the capability of teams to work through decisions and actions as events occur to reduce information bias and reduce the negative impact of cognitive overburden in combat environments

ABSTRACTS

Leveraging Automated Performance Measurement in Complex Scenario-Based Simulation Environments: A Need to Understand Workload & Perceived Quality of Feedback

John Killilea, NAWCTSD, Mitchell Tindall, NAWCTSD, Beth Atkinson, NAWCTSD, Bill Schmermund, NAWCTSD , Mark Bunn, ASEC, Chris Stubbs, ASEC, ASEC

Background: The development of complex simulator-based training environments has resulted in significant improvements in fidelity for organizations interested in human performance. However, this has often occurred at the expense of the instructor running the system during training sessions. Unfortunately, due to the number of applications and displays that need to be managed, these individuals often have many tasks that compete for their attention, which may impact their ability to detect critical aspects of individual/team performance. This may hinder the ability to provide timely and detailed diagnostic feedback. One approach to overcome this issue is to delegate operators to run simulators and allow instructors to focus on monitoring student performance and providing feedback to teach skills. Unfortunately, in a resource constrained environment this optimal situation is not always feasible.

Method: A technology is currently being developed for the P-8A that supports collection of automated performance measurement that supplements observer based grade sheets to increase standardization and objective outcome metrics. To understand the impacts of introducing such a technology into an inherently complex environment, the authors are seeking to collect baseline (i.e., prior to system implementation) data associated with the workload of instructors and perceived quality of feedback. For the latter, responses are sought from both instructors and students undergoing training. Additionally, as part of the ongoing development of the system, iterative usability feedback is sought to allow for user interface improvements.

Results: Although this is an ongoing study, this presentation will provide an overview of the results to-date regarding instructor workload, as well as highlight areas in which instructors and students identify strong or weak feedback associated with mission outcomes. While recent usability testing results have identified areas for system improvement, there is an overall high user satisfaction with the system.

Conclusions: As technology is introduced to support instructors in the management of large amounts of performance data to enhance diagnostic feedback, data collection will continue to ensure an understanding of the potential positive and negative impacts. Although these types of systems are intended to garner instructor support, careful attention will need to be paid to both real-time and debrief displays to mitigate detrimental

side effects due to introduction of yet another system to monitor. Additionally, mechanisms to parse and review data should be considered to ensure trust in the results and a means to identify, as well as understand, key areas that require positive reinforcement or remediation.

Impacts: If designed to optimize human-computer interaction, technologies that aid instructors should demonstrate the following: 1) reduce instructor workload, 2) increase diagnostic feedback to aid students with understanding how to correct performance shortfalls, and 3) identify critical areas for targeted remediation. Finally, if discrete event data is fed into an overarching database application, the details will allow for big data analytics to understand training trends that increase efficiency in the training pipeline and can be used to identify critical skills that are not being fully developed in the training environment.

Evaluation of Virtual Environment Menu Designs

Betsy Abdeen, Marianne Paulsen
Naval Undersea Warfare Center Division Keyport

There is immense potential for the application of rapidly emerging virtual reality (VR) technologies in DoD system design, development, and evaluation. Well-established design guidance is available for conventional software interfaces, but guidance for designing controls and displays for virtual environments is lacking. As such, it is unknown whether existing human computer interface design recommendations based on human visual characteristics and usability best practices for 2D environments are valid for 3D environments. This evaluation aimed to establish a scientific process for defining the proper type of virtual reality menus, provide menu design recommendations for virtual reality, and document the evaluation techniques. Evaluators wore an HTC Vive (fully immersive virtual reality headset) to interact with four different menu types (carousel, circle, list, and cube) inside a virtual warehouse scenario. Evaluators were asked to perform four different tasks (learn to operate a machine, retrieve an item, label a hazard diamond, and schedule an event) within the warehouse utilizing the four different menu structures. Following each menu type assessment, evaluators rated the menus for ease of use for the tasks. At the end, evaluators chose which menu they felt was most appropriate to each task. In order to determine the optimal human computer interface (HCI) design approach for virtual reality environments and to develop style guidance for human computer interfaces within virtual environments, this evaluation identified user preferences for VR menus. Preliminary results will be presented and recommendations for menu design within virtual environments will be provided. This evaluation is relevant to future research for virtual reality training for warfighters. Creating a standardized process for evaluating and designing virtual reality user facing components will greatly increase usability of future, virtual and augmented training systems.

SESSION AGENDA

Cyber Security Special Interest Group

24 May | 1300-1445 | Auditorium

Chairs: Lauren Reinerman-Jones, Marianne Paulsen & Ajoy Muralidhar

1300-1315	**Introductions** Lauren Reinerman-Jones, Marianne Paulsen & Ajoy Muralidhar - Cyber Security SubTAG Chairs
1315-1345	**Insider Threat Detection in Financial and Espionage Simulated Environments** Gerald Matthews - University of Central Florida
1345-1415	**Operator Situation Awareness for Cyberspace Defense** Robert Gutzwiller - Space and Naval Warfare Systems Center
1415-1445	**Cybersecurity: Ghost in the Machine** Alex Hoover - Department of Homeland Security

ABSTRACTS

Insider Threat Detection in Financial and Espionage Simulated Environments

Lauren Reinerman-Jones, University of Central Florida, Gerald Matthews, University of Central Florida, Eric Ortiz, Soar Technology, Ryan Wohleber, University of Central Florida

Insider Threat (IT) is a pervasive threat to both military and civilian cybersecurity. The Intelligence Advanced Research Projects Agency (IARPA) is supporting a novel approach to countering IT with its Scientific Advances to Continuous Insider Threat Detection (SCITE) Program. Its aim is to develop and test stimuli (active indicators or AIs) that can be embedded in automated systems to monitor for evidence of Insider Threat (IT) behavior. The AI should elicit a response that distinguishes between Insiders and legitimate employees. By contrast with passive monitoring approaches, the aim is to provoke the Insider into revealing diagnostic information. We will discuss recent SCITE research at UCF that aims to embed AIs in simulations of relevant work environments including financial investigation and espionage. It is expected that AIs will elicit characteristic eye movements in Insiders, which can be monitored unobtrusively with an eyetracker.

There are substantial challenges to detecting deception in real work environments. Existing research on lie detection is typically performed in highly structured, artificial settings, in which the person is directly interrogated. In addition, the various task environments in which ITs operate are highly diverse, so that methods for detecting the IT may not generalize. Nevertheless, existing work on deception suggests possible detection strategies. Specifically, stimuli relevant to the Insider's illicit aims may elicit implicit (unconscious) responses such as gaze aversion.

We will outline two simulation environments that may be used in implementing and validating the AI approach to IT detection. Both require the participant to perform investigative work at a desktop workstation. They instantiate the "honeytoken" approach to counter-espionage, where a honeytoken is a digital entity, such as a locked file that may lure the attacker into performing actions that betray them to cyberdefenders. In our simulated environment, as the person works, they are occasionally presented with stimuli (AIs) that would only be of interest to an insider. Their eye movements are monitored continuously so that the response to the AI may be analyzed. We expect that ITs and control participants performing equivalent normal work will show different eye responses.

One simulation is based on financial investigation. Participants adopt the role of a Swiss bank employee, performing directed information search under the direction of a local bank manager, by searching for information in paper and computer files. Control participants perform only legitimate activities as directed. Insider participant are also working for the US tax authorities, searching for information on possible tax evaders. A parallel espionage simulation places participants in the role of a Russian intelligence officer. They must monitor video feeds of buildings in a Middle Eastern environment to determine when they can be searched for information on terrorist plots. Insiders are US agents who must also monitor buildings that are off limits to them. In both cases, AIs include signals that illicit information may be temporarily acquired.

We will discuss initial findings from our empirical studies that suggest insider intent may be reflected in reduced eye fixation frequencies, especially in screen areas where illicit information may be available. We will also review possible practical applications, including automated screening of employees in sensitive occupations requiring structured investigative work.

Operator Situation Awareness for Cyberspace Defense

Robert Gutzwiller
Space and Naval Warfare Systems Center Pacific

Rationale: Humans generally seek to gather elements of information and derive meaning from them. The challenge is to know what to gather, the *right* elements, and be able to quickly derive the *true* understanding. Severe consequences are in play if you fail; while driving, for example, a crash is more likely under conditions that reduce awareness of the driving environment (Lee, 2008). Similar attention demands and challenges exist in the complex and rapidly evolving environment of cyberspace, from learning, vigilance, situation awareness and interacting with automation (Gutzwiller, Fugate, Sawyer, & Hancock, 2015). The notion of cyber situation awareness (CSA; Bass, 2000) captures the cognitive and system concepts related to the need for perception, comprehension and projection, as in Endsley's famous model of SA (Endsley, 1995; 2015). Sorely needed in this domain is emphasis on the user-centered design and promotion of human importance and centrality in cyber defense. While more and more data can be gathered and represented, it is a much more difficult problem to make sense of it; developing CSA is indeed a sociotechnical system challenge.

Methods: To improve operator cyber SA, through measurement and experimentation, we suggest a four phase plan and discuss progress including an experiment's results. In Phase 1, the goal is to build on existing task analytic work (D'Amico et al., 2005; Erbacher et al. , 2010; Gutzwiller et al., 2016; Mahoney et al., 2010). In Phase 2, CSA must be measurable to adjudicate future interfaces and training efficacy. Robust human-in-the-loop measurement is necessary. Building on Phase 1, more effective measures can be developed. It is not necessarily new methodology that is needed; existing SA metrics may be adequate if they address both individual and team. The more difficult metrics of SA to develop – comprehension and projection – rely on a complex set of elements and emerge from Phase 1 knowledge. In Phase 3, understand gained by measuring CSA is then stressed by assessment in the context of a whole system, testing the whole interface. Operators using these systems should be exposed to situations requiring significant workload shifts, and unexpected "off-nominal events" (Wickens, 2000). In the final Phase 4, we emphasize the need for iteration. In Phase 3 for example, a key gap in operator knowledge may be identified that changes and updates operator goals in a goal-directed task analysis (Phase 1). This changes what must be measured for CSA (Phase 2), then changing design of a new cyber tool. The tool must be redesigned and then re-subjected to "stress" tests (Phase 3).

Results: Report some of the progress made on assessing the situation awareness of network defenders, as informed by cognitive task analyses, reviews of available situation awareness research, and recent experimental work.

Conclusion/ Potential impact to mission/warfighter: A user-centric approach is vital for cyber defense. The depth of existing HFE for cyberspace is shallow, and there is a struggle to allocate resources to address these concerns. A phased plan provides interaction levels that many can contribute to and thus quickly advance understanding of CSA.

Cybersecurity: Ghost in the Machine

Alex Hoover
Department of Homeland Security

Discussion of the challenges associated with cybersecurity in government from the perspective of the blue (defensive)and red (adversarial) cyber operators, as well as grey (users of the systems being protected) using the idea of holons from Arthur Koestler's book, Ghost in the Machine

SESSION AGENDA

Design: Tools & Techniques

24 May | 0800-0945 | CAD A

Chairs: Michael Feary & Chelsey Lever

0800-0815	**Introductions** Michael Feary, Chelsey Lever - DTT SubTAG Chairs
0815-0835	**User-Centered Design Tools and Techniques for Understanding Multi-Echelon Information Needs for Fire Support Command and Control** Pamela Savage-Knepshield, Charles Hernandez - U.S. Army Research Laboratory, Human Research and Engineering Directorate
0835-0855	**The Cost of Not Accommodating the Warfighter** Christopher Plott - Alion Science and Technology
0855-0915	**Developing a Risk Management Tool for HSI Analysts** Zachary Zimmerlin - Booz Allen Hamilton
0915-0935	**Integration of Agile and Human Centered Design Development Processes for Safety and Mission Critical Systems** Christopher Plott - Alion Science and Technology
0935-0945	**Discussion & Closing Remarks** Michael Feary, Chelsey Lever - DTT SubTAG Chairs

ABSTRACTS

User-Centered Design Tools and Techniques for Understanding Multi-Echelon Information Needs for Fire Support Command and Control

Pamela Savage-Knepshield, Charles Hernandez
U.S. Army Research Laboratory, Human Research and Engineering Directorate

Fire Support Command and Control (FSC2) empowers commanders to plan and execute the delivery of lethal and non-lethal fires by providing capabilities to visualize integrated fires, enhance situational awareness, and increase collaboration among Army and Joint fires staff. Many FSC2 capabilities are transitioning to web-based apps or widgets that can be accessed via a secure internet as part of the Army's Command Post Computing Environment. One of the first systems undergoing this transformation is the Advanced Field Artillery Tactical Data System (AFATDS). It provides fully automated support for planning, coordinating, controlling and executing fires and effects at operational and tactical levels of command. As the AFATDS program moves away from its traditional "green box", the FSC2 Product Director is seizing the opportunity to reduce time to train by focusing on system usability. The Human Factors Engineering (HFE)/ Human Systems Integration (HSI) team's goal is to reduce training in half from 4 to 2 weeks through efficient, effective system design. This entails understanding information needs and flow at all echelons across the joint services; appropriately allocating functionality between the Soldier and system; and implementing role-based access, content and control. This briefing will highlight the HFE/HSI strategy and user-centered design activities that have been conducted during the past year as well as activities that are planned to meet our goal.

The Cost of Not Accommodating the Warfighter

Christopher Plott
Alion Science and Technology

The purpose of this effort was to help determine how to quantify system design trades against Warfighter characteristics and capabilities in terms of mission performance, short and long term costs, and/or safety/survivability risk. Having methods and data to do this effectively can help human system integration (HSI) practitioners better speak the language of program managers and their peers from other disciplines. This enables HSI practitioners to better advocate for designs that accommodate the warfighter.

ABSTRACTS

The tasks performed for this study include:

a. Conducting a literature review to identify state-of-the-art algorithms, methods, tools, and metrics that can support the analysis of trade-offs against target Army personnel populations. We focused on supporting the quantification of the trade-offs in terms of 1) short and long term costs, 2) human, system, and mission performance, and 3) human, system, and mission risks.

b. Developing processes that integrate the identified algorithms, methods, tools, and metrics into a manageable and repeatable approach that can be used by HSI professionals, system developers, and program managers.

c. Using a real or conceptual system, to create a case-study walkthrough of the approach that demonstrates how the analysis is done, and the how products of the analysis supports the trade-off decisions.

d. Produce a final report that includes the approach and how to access available tools and methods that support it.

This presentation addresses what we have accomplished so far in this ongoing effort. We have determined where to get baseline data for assessing warfighter accommodation and costs, such as existing databases and acquisition documents. We have developed methods using and visualizing these data for assessing accommodation. These methods include population-data-based approaches as well as HSI-guidance-based approaches. We have developed methods for translating non-accommodation into costs by tying into existing cost estimating data bases, tools, and assessments. This allows an analyst to predict the increasing costs of not accommodating the warfighter across the system lifecycle. We address human/system/mission performance risk assessments through both traditional (but not always fully utilized) human factors and safety methods. These include visualizations of risk data gathered from standards and empirical research (e.g., auditory exposure) with safe, “protection needed” and hazardous zones. We have developed a set of prototype tools, process primers, and case-studies to support the HSI practitioner in performing these assessments. Analysts can input information on the to-be-developed system, and identify anticipated costs. Further, they can use the tools to evaluate different scenarios to conduct tradeoff analyses.

ABSTRACTS

Developing a Risk Management Tool for HSI Analysts

Zachary Zimmerlin, Booz Allen Hamilton, Bill Kosnik, Air Force/DoD, Barbara Palmer, Booz Allen Hamilton

Risk management is an integral part of the Human Systems Integration (HSI) process.. Last year we reported on a tool designed to assist the HSI analyst in determining human-centered needs early in the systems requirements definition process. Using an approach based on the systems engineering Risk Identification, Integration and Ilities tool (AFIT, 2010), the HSI Capabilities and Requirements Tool (HCART, Spondike, 2016) uses a yes/no question format to assess the risks associated with not addressing human-centered requirements and needs in the requirements definition process. The analyst answers questions related to accomplishing key HSI activities in terms of risk probability and consequence severity within each of the HSI domains. However, the current tool makes no recommendations on how to reduce HSI risks. To correct for this gap, we are revising the tool to more objectively assess risk and provide mitigations strategies to help reduce risk going forward. We are also expanding the tool into the Post Milestone B phases of the acquisition life cycle by adapting content from the Human Systems Integration Framework (HSIF) tool (Lacson, F. et al. (2016), the Department of Defense Risk, Issue, and Opportunity Management Guide for Defense Acquisition Programs (DASDSE, 2017), and the risk management literature. We will present our progress to date.in

Methods: Subject Matter Experts (SMEs) evaluated, prioritized, and consolidated each question. Once the validity of questions was determined, a human factors (HF) engineer began development of the tool using up-to-date user experience (UX), usability, and HF best practices and principles. The HF engineer incorporated user feedback from the previous tool, the Human Systems Integration-Capabilities and Requirements Tool (HSI-CRT), into the design of the new tool. The HF engineer developed a working prototype of the current tool using Axure. Once cleared for commission, programming began in the development platform, Cloud 9, using HTML, CSS, and JQuery. The HF engineer is currently testing the program as development progresses to correct for any usability issues. This project is currently underway and will be completed by the time of the conference.

ABSTRACTS

Integration of Agile and Human Centered Design Development Processes for Safety and Mission Critical Systems

Angelia Sebok, Christopher Plott, Brett Walters
Alion Science and Technology

The Agile development process is being implemented in an increasing number of product and system development efforts. Initially intended as a more flexible and adaptive approach to software development, the benefits of the Agile process were quickly applied to a variety of other efforts: hardware development, training material development, marketing materials, and customer services. However, the Agile process has the potential to minimize or insufficiently consider the role of the human in the design process. In particular, safety and mission critical systems require that the role of users is accurately defined and carefully evaluated, and that rigorous analytical and validation testing methods are applied for safety critical aspects. A new process, such as Agile, has the potential to disrupt those design considerations and must be evaluated before being adopted.

The current processes for safety and mission critical systems ("waterfall") can formally and explicitly identify, address, and validate the issues associated with the safety critical nature of these projects. Systems that have the potential to cause loss of life or significant injury are safety critical, and systems with the potential to cause a mission failure are mission critical.

This presentation describes a project that investigated the use of Agile and human centered design (HCD), in industry and government agencies, for safety and mission critical products and systems to identify best practices and lessons learned. This work included a literature review and a series of informal and formal interviews. The informal interviews were conducted to get an understanding of how Agile processes are used in practice, to identify questions, and to identify candidates for the formal interviews. The formal interviews were performed to identify best practices and lessons learned. This presentation describes the methods used for the literature review and interviews, and it describes the results the analyses.

In summary, Agile and HCD processes have been combined successfully in a variety of projects, and they have been used successfully for safety and mission critical systems, such as medical instrumentation, unmanned vehicle control systems, cybersecurity system development, and security monitoring software development. However, modifications to a "typical" Agile process are needed. A longer initial data gathering phase, referred to as "Sprint 0" is needed to identify the appropriate users or surrogate users, perform analyses to characterize their capabilities and limitations, and develop a set of meaningful user stories. Roles for the human factors specialists should be clearly identified in advance. These include interface designers who work one to several cycles ahead of the development team, user experience specialists who work on a daily basis with the developers, and usability specialists who test the product increments either as they are developed or in more comprehensive testing events. Documentation of user requirements, testing, and verification results are also needed and provide the basis for certification by relevant government agencies.

SESSION AGENDA

Extreme Environments

24 May | 1015-1150 | CAD B

Chairs: John Plaga & Rachael Lund

1015-1035	**Exploratory Research to Identify and Mitigate Chronic and Acute Neck Pain during Flight** Anthony Ligouri, 711th HPW/RHCPT
1035-1055	**An Overview of Biodynamic Response Modeling in the EGRESS Environment** Anthony Ligouri - 711th HPW/RHCPT
1055-1115	**Ecological Visual and Auditory Cues to Support Spatial Orientation During Aerial Refueling** Stephanie Kane - Charles River Analytics
1115-1135	**How Can We Reduce 50% of Transient Patient Monitor Alarms in the Neuro Intensive Care Unit?** Catriona Miller - U.S. Air Force School of Aerospace Medicine Department of Aeromedical Research
1135-1150	**Discussion & Closing Remarks** John Plaga, Rachael Lund – Extreme Environment SubTAG Chairs

ABSTRACTS

Exploratory Research to Identify and Mitigate Chronic and Acute Neck Pain during Flight

Ed Eveland, John Buhrman
711 HPW/RHCP

Background – Helmet induced neck and other spinal associated pain, both acute and chronic, are getting attention from DoD due to increasing pilot disability and retention rates. A primary area of concern is helmet-mounted devices (HMDs), which are often implicated in reports of acute neck pain and cervical vertebrae damage when worn in high-G acceleration environments. HMDs can also affect aircrew performance, fatigue, and comfort, especially during extended missions. The Aircrew Biodynamics and Protection (ABP) team of the 711th Human Performance Wing is currently conducting research which will be used to establish new neck and spinal injury criteria and models to help the Air Force anticipate problems and provide guidelines for future helmet development.

Methods – ABP is conducting research in collaboration with the USAF School of Medicine (USAFSAM) to investigate the risk of chronic neck injury and fatigue due to different helmet configurations, flight scenarios, and aircrew gender. This includes experiments to measure helmet mass properties, identify asymmetries, assess muscle activity using electromyography (EMG), and conduct static and dynamic acceleration, windblast, and vibration testing. In conjunction with human modeling, these capabilities create a diverse "toolkit" for use in identifying critical characteristics of different helmet systems that might be precursors to injury and fatigue.

Results – Our research to date has demonstrated the viability of several concepts that are expected to be transitioned to program offices for mitigation of aircrew injury. These include interim limits on helmet properties for prevention of both acute and chronic neck injury, pilot bracing techniques for mitigation of neck loading, and mitigation strategies to reduce cockpit vibration effects on extended missions. In the sustained high-G realm, at the request of HMS program offices, we are examining muscle activity and fatigue, including gender effects. Research is also being conducted to investigate the efficacy of new restraint and protection concepts, and establish new chronic and acute injury criteria based on new seating systems and accommodating the expanded pilot population. Evaluation of "static" myoelectrical activity with varying helmet configurations is also planned.

Conclusions – The ABP team is conducting and planning research to address the urgent issues of aircrew spinal and neck pain, including both identifying the underlying injury mechanisms as well as proposing new mitigation solutions. This research is expected

to improve performance, reduce risks to aircrew, decrease costs, and ultimately lead to better long term health of our aircrew.

Potential Impact/benefit – Considering the ABP input allows a more “human-centric” process where human performance in these extreme environments is considered as well as helmet technology. When paired, this should result in more comfort to the aircrew, allowing them to operate more effectively, improving mission capability and with fewer long term health considerations. Benefits to helmet designers can include evaluation of prototypes to provide early feedback before reaching end state in the acquisition process

An Overview of Biodynamic Response Modeling in the EGRESS Environment

Casey Pirnstill
711th HPW/RHCPT

The human biodynamic response in the ejection environment is still a very relevant research area of interest to the United States Air Force (USAF). Contemporary and next generation fixed wing aircrafts present many new challenges and questions within the realm of aircrew protection, and accurate risk of injury prediction, given current mathematical models, is not possible. The expanded flight envelope and capabilities of cutting edge current and next generation aircrafts, the expanded spectrum of pilot anthropometry and weight, and increasing trends in helmet mass and inertia properties present serious injury risks to our aircrew that can be both costly and life threatening. Testing is required to evaluate and assess these injury risks. Due to the high cost of rocket sled ejection testing and the high number of variables needed to be tested within an ejection seat qualification program, computer modeling and simulation of the human response in the ejection environment is a useful and much needed complimentary capability to better assess and understand these injurious test cases and to better determine optimal sled configurations to run on the rocket sled facility.

RHCPT has a number of kinematic multibody and finite element (FE) modeling efforts currently in use and/or in development for use in investigating the human and anthropomorphic test dummy (ATD) response both in our in-house impact test facilities, the horizontal impulse accelerator (HIA), vertical drop tower (VDT), and vertical impact accelerator (VIA) and the ejection environment. The Articulated Total Body model (ATB), originally developed in the 1970’s and updated through the 2000’s, is the Air Force Research Lab’s (AFRL) legacy modeling capability for humans and manikins in dynamic environments. The structure of ATB serves as the basis for other multibody modeling capabilities currently under development, including a 50th percentile Hybrid III Aerospace manikin model and ACES II ejection simulation developed by RHCPT in collaboration with AFLCMC and Mathworks, and a rigid body finite element human model in our VDT environment developed by ATA and L3 Technologies. Principles used in creating these simpler rigid multibody models are also being expanded to create more anatomically- correct models of the human spine. Rigid multibody models are currently being developed to investigate forces experienced by each individual vertebrae of the spine that will give further insight into the human spine response beyond the small handful of data points provided by manikins without costly invasive human or cadaver testing.

A number of finite element models are also being developed within RHCPT. Finite element models, although they generally incur much higher computational costs, give us the ability to investigate local forces, stresses, and strains anywhere in the model, investigate variations in loading pathways during dynamic events, and postulate possible injury mechanisms in sufficiently detailed human models. Many finite element human models exist in the literature today, but few are suited specifically for study in the ejection environment. Currently usable FE models within RHCPT include a detailed human neck and head musculoskeletal model developed in collaboration with the University of Singapore, and the detailed and fast-running 50th percentile Hybrid III automotive manikin models available from LSTC. Current developments in finite element models include a 50th percentile Hybrid III aerospace manikin and a suite of human models that covers both male and female 5th, 50th, and 95th percentile aircrew sizes.

Ecological Visual and Auditory Cues to Support Spatial Orientation During Aerial Refueling

Stephanie Kane, Ryan Kilgore
Charles River Analytics

Spatial perception in the cockpit remains paramount for safe and effective flight. Unfortunately, during visually intensive activities such as aerial refueling, maintaining accurate spatial perception is challenging. In these situations, the pilot is intensely focused outside of the cockpit and cannot move focus to reorient themselves on traditional heads down, foveal displays within the cockpit. When the pilot are able to access cockpit displays, these displays present critical state information digitally over foveal vision displays. However, this format, frequently presented as text or display bugs on scales, is insufficiently compelling to compete with other “strong-but-wrong” preattentive sensory cues as it must be visually extracted, translated, and interpreted, which is a cognitive, but not perceptual task. Given the challenges of extracting useful motion cues from traditional presentation methods, the perceptual system falls back to other more compelling cues that easily out-compete available foveal stimuli but are subject to

significant “strong-but-wrong” errors, such as spatial disorientation phenomena like “the leans.” Such decision aids insufficiently reduce pilot workload or improve safety during complex operations, as pilots may attend to more natural and compelling channels for orientation and motion information as opposed to visual cockpit displays, such as the attitude indicator.

To address these challenges, we are designing and demonstrating a set of ecological displays to enable efficient perception of spatial orientation through natural visual and auditory cues that extend beyond the foveal visual system. We have applied mature ecological interface design (EID) techniques (Burns and Hadjukiwicz, 2004; Kilgore and St-Cyr, 2006; Kilgore, 2007) to develop EASI-HAWK’s auditory and visual displays. EID is an approach to perceptually grounded interface design that was developed specifically to address the challenges of cognitive work within highly constrained physical systems, such as pilot control of aircraft in flight. These displays will enable robust, direct perception and disambiguation of orientation and motion cues critical to maintaining awareness of aircraft, specifically roll and pitch. Within these efforts, we have designed and prototyped a set of preliminary displays to begin informal evaluations with representative users to evaluate these displays. While we are initially targeting displays for JSF pilots, these have applicability across other aircraft and challenging aviation events, such as carrier-based landings.

How Can We Reduce 50% of Transient Patient Monitor Alarms in the Neuro Intensive Care Unit?

Catriona Miller, United States Air Force School of Aerospace Medicine Department of Aeromedical Research, Neeraj Badjatia, University of Maryland School of Medicine, Shiming Yang, University of Maryland School of Medicine, Sarah Wade, United States Air Force School of Aerospace Medicine, Peter Hu, University of Maryland School of Medicine

Background : Alarms from Vital Signs Monitors are a major distraction when over 95% are not critical. We tested the hypothesis that a significant reduction in non-critical alarms could be achieved by institution of specific vital signs (VS) alarm limit based on the analysis of the frequency and duration of the patient monitor alarms.

Methods: We retrospectively analyzed patient VS in an 22- bed Neuro-Intensive Care Unit (NICU) and collected alarm data between October 31, 2015, and January 28, 2016, from networked patient VS monitors (GE Solar) using the BedMasterEX (Excel Medical LLC, FL) system. This system collects all patient monitor alarms and VS (trends every 2 seconds) in real time. Alarm VS name, industry-defended alarm categories, duration, and frequency were recorded and analyzed. In the effort to reduce the individual vital signs alarms, the hypoxia (SpO2 low), tachycardia (heart rate: HR high), and hypertension

(systolic blood pressure: SBP high) limit settings were further analyzed Based on the current Neuro ICU default settings ($SpO2 \leq 90\%$, $HR \geq 130$ bpm, and $SBP \geq 180$ mmHg) and recorded vital signs, new alarm threshold ($SpO2 \leq 88\%$, $HR \geq 135$ bpm, and $SBP \geq 185$ mmHg) and their associated alarm duration and frequency were compared with the current default settings. The rate of alarm reduction in frequency and duration were reported.

Results: There were 670,865 alarms (8,392 hours) recorded during the 3-month study period resulting in 339 alarms per bed per day. The majority of the alarms were classified as patient advisory alarms (n = 605,261, 90%); only 0.2% were in the patient crisis alarm category. The most frequent physiologic alarms were respiratory rate high ($RR \geq 30$ bpm) (22%, n = 133,804, total alarm duration t=611 hours), followed by SpO2 low (9.5%), SBP high (6.9%) and tachycardia (5.6%). Most of the alarms were transient alarms; 38%, 50%, and 57% of the alarms were less than 2, 4, and 6 seconds, respectively. Analysis of alarms with different limit settings based on 2 seconds collection VS showed that by changing the current NICU alarm threshold settings of SpO2 low ($\leq 90\%$, n = 44,091, t = 663 hours) to $SpO2 \leq 88\%$, tachycardia ($HR \geq 130$ bpm, n = 23093, t = 224 hours) to $HR \geq 135$ bpm, and SBP high ($SBP \geq 180$ mmHg, n=33,846, t=633 hours) to $SBP \geq 185$ mmHg, the alarm frequency could be reduced by 46%, 42%, and 19%, respectively.

Conclusions: Alarm fatigue from physiologic alarms in NICU is well recognized but safe solutions to reduce the alarms have not been established. Our study suggests that by combining a 2- to 6-second alarm delay and changing alarm thresholds of SpO2 by 2%, HR by 5 bpm and SBP by 5 mm Hg could reduce more than 50% of transient NICU alarms. Further study is needed to determine what impact such a change would have upon the safety of patients being cared for in the Neuro ICU. A study is on-going which implements our alarm reduction algorithms in one unit of a 2 unit NICU.

SESSION AGENDA

Healthcare Special Interest Group – Session I

24 May | 1300-1445 | CAD A

Chair: Tandi Bagian

1300-1325	**Introductions** John Rice, Robin Hemphill, Tandi Bagian
1325-1345	**User-Centered Design Process of the Marine Corps Warfighting Lab Expeditionary Medicine** Chelsey Lever - NSWCDD
1345-1405	**Prototype Design of Real Time Multi-Patient Monitoring System for Critical Care Air Transport Team (CCATT)** Catriona Miller - U.S. Air Force School of Aerospace Medicine Department of Aero-medical Research
1405-1415	**VA SimLearn Update** VA SimLearn - VHA
1415-1435	**Operating Room Fire Risk Assessment: A Case-Controlled Study** Sarah Simpson - VA National Center for Patient Safety
1435-1445	**Application of Human Factors and Usability Engineering to Medical Devices Development and Review** Hanniebey Wiyor - Food And Drug Administration

ABSTRACTS

User-Centered Design Process of the Marine Corps Warfighting Lab Expeditionary Medicine

Chelsey Lever
NSWCDD

The Marine Corps Warfighting Lab (MCWL) Expeditionary Medicine (ExpMed) Branch seeks to identify concepts that will enhance survivability for infantry Marines. ExpMed's 2014-2016 campaign focused on creating optimal emergency medical care for the austere scenarios outlined by General James Amos' Expeditionary Forces 2021 (EF-21) Capstone Concept. EF-21 scenarios require a force that is "light enough for rapid response" and "self-sustaining under austere conditions." To meet the medical care needs necessitated by the Marine's future approach to fighting, ExpMed created two programs: Resuscitative Care and Medical Common Operating Picture. The Resuscitative Care portfolio of projects will be discussed in this brief. The portfolio contained three major thrusts during this campaign, including Shock Trauma Section, Forward Surgery Sustainment, and Patient Movement.

A design, test, and redesign cycle from subsystem level to system of systems level was utilized in the development of equipment surrogates for the three projects. The cycle culminated at a Marine Air Ground Task Force (MAGTF) Integrated Exercise (MIX) during Rim of the Pacific exercises in July 2016. The three projects (along with the MedCOP) formed an integrated solution, consisting of three modified medical treatment facilities to fit the 96-hour EF-21 scenario. The medical treatment facilities were deployed via ground and air across multiple locations at Marine Corps Base Camp Pendleton and Marine Corps Air Ground Combat Center Twentynine Palms in California.

During the MIX, data collectors were present at each medical treatment facility. The data collection team consisted of Navy Medical Officers and HSI engineers. The team collected a vast amount of data to analyze the suitability of surrogate equipment; effectiveness of the modified medical treatment facilities; the adequacy of the reduction in medical personnel to meet the emergency medical care for the EF-21 scenario. Findings from the collected data and observations will be further discussed during the brief.

HSI engineers played significant roles in equipment design and integration; training development and conduct; and data collection and analysis. These roles enabled designs that focused on the future needs of the Navy and Marine Corps operators and the interface to collect valuable user feedback during the exercise.

ABSTRACTS

Prototype Design of Real Time Multi-Patient Monitoring System for Critical Care Air Transport Team (CCATT)

Catriona Miller, United States Air Force School of Aerospace Medicine Department of Aeromedical Research, Peter Hu, University of Maryland School of Medicine, Shiming Yang, University of Maryland School of Medicine, Sarah Wade, United States Air Force School of Aerospace Medicine Department of Aeromedical Research

Background: From point of injury through hospital care, a vast quantity of high-quality continuous, electronic data is collected, but our ability to generate data has far outstripped meaningful analysis or decision-support for real-time patient care. This data has the potential to provide clinicians with an unprecedented view of dynamic physiologic response to injury, illness, and intervention. Military critical care air transportation teams (CCATT) rapidly evacuate critically injured patients out of theater and provide ICU level care in a noisy, vibration filled, severely confined environment with limited visibility, making patient care and monitoring challenging. To address these challenges, we sought to develop a novel display system that allows for remote monitoring of multiple patients simultaneously sand increased situational awareness of patient vital signs trends, physiologic status, physiologic events, and the need for intervention.

Methods: We surveyed 47 military and civilian doctors and nurses to identify features of the ideal multi patient monitor interface and features. A triple redundant data server was established to collect continuous vital signs (VS) streams from 230 bedside monitors 14 units in R. Adams Cowley Shock Trauma Center. Each minute, about 9 million data points are streamed to the data server for processing into the viewer.

Result: We surveyed a total of 47 clinicians: 20 military and 27 civilians (24 were Doctors, 18 Nurse Practitioners/Registered Nurses, 5 Respiratory Therapists). A panel of subject matter experts, including military doctors and a CCATT provider, evaluated the feedback and identified which suggestions to act upon to design the viewing platform.

For the past 16 months, the prototype CCATT viewer has been running continuously without failure in a level 1 trauma center, displaying 230 patients/beds in 14 clinical units with up to 72 hour continuous VS data of 1-minute temporal resolution. It routinely shows up to 9 VS streams in complete trajectories, if available: Shock index(SI), heart rate, systolic blood pressure, oxygen saturation, intracranial pressure, etc., which are often monitored for patients with shock, burns, trauma, or respiratory failure. With asynchronous communication, it can tolerate temporary network failure. For a typical 16-bed unit, the viewer takes less than 200 milliseconds to render and display all patient data. The prototype display allows clinicians to track and monitor vital sign trends in

various patient locations with a display of the patients' physiological status over time in a single real time customizable patient monitor, with critical physiologic changes coded as green, yellow, and red based on threshold values gleaned historically from episodic, manually collected and processed data.

Conclusion: During medical care, especially in a noisy, busy and confined transport aircraft, loosely organized physiological data and over-saturated information may prevent the small clinical teams from identifying, triaging and providing effective and timely care to patients. The viewer provides an at a glance view of aggregated patient information from multiple data sources, with critical physiologic changes highlighted

Operating Room Fire Risk Assessment: A Case-Controlled Study

Sarah Simpson, VA National Center for Patient Safety, Ann Arbor, MI, Robert Kononowech, VA National Center for Patient Safety, Ann Arbor MI, Douglas Paull, VA National Center for Patient Safety, Ann Arbor MI; Georgetown University School of Medicine, Washington, DC, Julia Neily, VA National Center for Patient Safety, White River Junction, VT, Peter Mills, VA National Center for Patient Safety, White River Junction, VT, Lisa Mazzia, VA National Center for Patient Safety, Ann Arbor MI, William Gunnar, VA National Surgery Office, Washington, DC, Robin Hemphill, VA National Center for Patient Safety, Ann Arbor MI

Background: It is estimated that 50–200 operating room (OR) fires occur in the United States every year (American Society of Anesthesiologists, 2008). These fires are unexpected and potentially catastrophic with the possibility of patient injury or death (Overbey et al., 2015). Operating fires require three components: heat, oxygen, and fuel often labeled the "fire triad or triangle" (Kaye, Kolinsky, & Urman, 2014). Fire risk assessments (FRA), based largely on the fire triangle, have been promoted in an effort to identify high risk operations so that specific precautions can be taken to prevent a fire. One such FRA gives 1 point each for surgical site above xiphoid; open source oxygen e.g. nasal cannula; and ignition source such as electrocautery or laser (Mathias, 2006). However, to our knowledge, such tools have yet to be validated. The purpose of this study was to compare the calculated score for matched-pair cohorts of operating room cases, those in which an OR fire occurred and those in which no fire occurred to determine the discriminatory properties of the FRA.

Methods: Data was obtained using the VA National Center for Patient Safety (NCPS) Root Cause Analysis (RCA) database. After review, 60 of the 148 reported fires from 2000-2015 were determined to meet inclusion criteria. Cases were excluded for having no associated fire, occurring outside the OR, consisting strictly of a device fire away

from the patient, or missing information. The remaining OR fires cases were subsequently matched in a 1:1 fashion with another serious adverse surgical event (non-fire) based on facility characteristics (VHA Operative Complexity, 2014) and surgical procedure (Levels of Surgical Complexity). All cases and controls were assigned a FRA score by reviewing the RCAs.

Results: Of the OR fire cases evaluated, 29 cases (48.3%) had a FRA score of 3 and 31 cases (51.7%) had a FRA score of less than 3. For controls, two cases (3.3%) had a FRA score of 3 and 58 cases (96.7%) had a FRA score of less than 3. A FRA score of 3 (OR= 28 [95%CI, 5.31-578.8]; P <0.01) was associated with statistically significantly higher odds of fire than a FRA score of less than 3.

Conclusion: The results of this study support the concept of FRA (Mathias, 2006). A score of 3, indicative of high risk, was strongly associated with actual fire cases and exceedingly rare among non-fires. However, the 31 cases of OR fire identified that did not score 3 would not have been predicted by the FRA. Further study of this sub-group will be necessary.

This material is based upon work supported by the Department of Veterans Affairs National Center for Patient Safety and a JP-1 Grant #DM150022 from the Department of Defense. The contents of this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs or the United States Government.

Application of Human Factors and Usability Engineering to Medical Devices Development and Review

Hanniebey Wiyor
Food And Drug Administration

To discuss the regulatory basis and scope of Human factors and Usability engineering applications to medical device development and review process at the US food and Drug Administration. The application of Human factors and Usability engineering to medical devices is to ensure that medical devices are safe and effective for the intended users, uses and use environments. This discussion will include examples of applicable use errors as appropriate.

Specifically, the Human Factors Pre-Market Evaluation Team (HFPMET) located at the Center for Devices and Radiological Health (CDRH) mandate includes review of medical devices for:

- Pre-market submissions when use error could lead to serious harm for device submissions for clearance or approval
- Post-market signals when there is concern that there are use errors that are resulting in severe harm. Note, post market reports typically do not clearly indicate use error.
- Guidance development, national and international standards development, panel discussions and presentations when human factors is a relevant consideration in the discussion (e.g. robotic surgical devices, duodenoscope reprocessing issues, patient labeling, etc.) or human factors is a discipline represented within a process under discussion (e.g. risk management, design controls, etc.

SESSION AGENDA

Healthcare Special Interest Group – Session II

25 May | 0800-0945 | CAD B

Chair: Tandi Bagian

0800-0805	**Introductions** John Rice, Robin Hemphill, Tandi Bagian
0805-0825	**Using Natural Language Processing (NLP) to Leverage Text Reports in the VHA Corporate Data Warehouse (CDW) to Support Provider Decision-Making for Patient Care** David Eibling - VA Pittsburgh Surgical Service Line
0825-0845	**Big Data Challenge: Do Multiple Vital Sign Sensors Improve the Prediction of Emergency Blood Transfusion in Adult Trauma Patients?** Catriona Miller - U.S. Air Force School of Aerospace Medicine Department of Aero-medical Research
0845-0945	**Group business activity: discuss charter, elect chair and co-chair, etc.** John Rice, Robin Hemphill, Tandi Bagian

ABSTRACTS

Using Natural Language Processing (NLP) to Leverage Text Reports in the VHA Corporate Data Warehouse (CDW) to Support Provider Decision-Making for Patient Care

David Eibling, VA Pittsburgh Surgical Service Line, Augie Turan, VA OI&T

Problem: Patient care requires knowledge of prior medical history in order to predict future disease trajectories and drive clinical decision-making. Many veterans have active medical histories that date back many decades, often involving significant medical events that have occurred in many different VA and DOD facilities. The most significant information typically is recorded in text notes, often measured in the tens of thousands of pages for a single veteran with multiple chronic illnesses. Moreover, most patient-specific text data is recorded with the goal of documenting care processes rather than veteran-specific events and current (at the time of collection) status, leading to the "needle-in-the-haystack' data overload challenge. Current VA data retrieval paradigms do not facilitate comprehensive text searches, hence missing information may lead to flawed knowledge of prior events and trajectories, and critical themes may even be missed altogether. Even when data is available, the time required to filter text for needed information exceeds, often substantially, the time available for real-time use.

Background: For more than a decade the VHA has daily accrued patient information on millions of encounters from each of its 130 medical centers and thousands of clinics. The goal of this accrual was to enable analytics to support operational decision-making, as well as disease-oriented research. CDW data is mirrored in a secure research environment (Veteran's Informatics and Computer Infrastructure or VINCI) in which data analytics are performed to support thousands of VA researchers seeking to uncover implicit knowledge hidden in data from over 9 million veterans.

Methods: Over one million unstructured text notes are accrued to the CDW each day. We had previously explored the feasibility of employing iKnow, a novel NLP program resident in Cache', the infrastructure of VistA, to examine these notes within the VINCI environment. We have concluded that this application can meet the goal of facilitating the use of the CDW data for both operational and research purposes. The functionality of iKnow seemed to be superior to other NLP applications due to its unique "bottom-up" data analysis paradigm. We postulated utilizing iKnow to examine archived clinical text notes for a single veteran might also facilitate patient care by identifying dominant themes and facilitating detailed "drill-down" to specific events and outcomes. We developed a secure web-based application that accesses text notes within VINCI, and then indexes them to support patient care.

Results: The resultant web-based web-based application, which we have termed "Voogle Notes," meets or exceeds our expectations in providing exceptionally rapid in-depth search of large quantities of text notes for a specific veteran. Active physican user-trials are currently beginning. We will describe the iKnow indexing and search paradigms, as well as demonstrate the use of Voogle Notes using de-identified patient records.

Big Data Challenge: Do Multiple Vital Sign Sensors Improve the Prediction of Emergency Blood Transfusion in Adult Trauma Patients?

Catriona Miller, United States Air Force School of Aerospace Medicine Department of Aeromedical Research, Colin Mackenzie, University of Maryland School of Medicine, Shiming Yang, University of Maryland School of Medicine, Stacy Shackelford, United States Air Force, Sarah Wade, United States Air Force School of Aerospace Medicine Department of Aeromedical Research, Peter Hu, University of Maryland School of Medicine

INTRODUCTION: Recognizing the need for immediate transfusion of uncrossmatched type-O packed red blood cells (UnXRBC) or predicting need for massive transfusion (MT) is difficult. Prehospital and emergency department (ED) vital signs (VS) may underestimate shock. We evaluated the three most commonly available patient VS monitor sensor readings prehospital and during the first 15 min of inhospital resuscitation for prediction of transfusion needs. We hypothesized that more VS sensors and more continuous VS would more accurately predict the need for emergency blood transfusion.

METHODS: VS data from adult trauma patients admitted to a Level I trauma center from 2009-2012 were reviewed. Initial prehospital VS [systolic blood pressure (SBP), heart rate (HR), and peripheral capillary oxygen saturation (SpO2)] were abstracted. The VS included 5-lead electrocardiogram (ECG) sensor-derived HR, photoplethysmograph (PPG) sensor-derived SpO2 and pulse rate, and non-invasive blood pressure cuff-derived SBP. After hospital arrival, continuous VS from the ECG and PPG were collected every 2 seconds for the first 15 minutes; SBP was intermittently measured. Additional VS features were calculated which included mean, maximum, mininimum, dose of SBP120 bpm, dose of SpO21 using continuous VS recorded for the first 5 and 15 minutes post admission. Four logistical regression models were used to predict three outcomes. The four models were Model 1: prehospital initial VS (HR, SBP, SpO2); Model 2: ECG-derived VS only; Model 3: PPG+ECG-derived VS, and Model 4: ECG+PPG+SBP-derived VS. The three outcomes measured were need for UnXRBC; use of ≥5 units of blood within 4 hours (MT1); and use of ≥10 units within 24 hours (MT2). Models 2, 3, and 4 were evaluated at 5 and 15 min post admission. All models were adjusted for age and gender. Area under receiver operating characteristic curves (AUROC) was used to evaluate predictive power. Delong's method compared AUROC's; p<0.05 was considered statistically significant.

RESULTS: 9285 patients with over 13 million continuous VS data points within 15 minutes of trauma admission were analyzed. Patients were predominantly male (68.2%) with mean age of 42.9 ±19 years. Among all patients, 3.3%, 1.8% and 1.0% received UnXRBC, MT1, and MT2 respectively. Prehospital initial VS (Model 1) predicted UnXRBC (AUROC=0.78), MT1 (AUROC=0.80) and MT2 (AUROC= 0.82). At 5 minutes post admission, model 2, 3, 4 predicted UnXRBC (AUROC=0.73, 0.77, 0.85), MT1 (0.74, 0.78, 0.87) or MT2 (0.73, 0.80, 0.89) respectively. At 15 minutes, model 2, 3, 4 predicted UnXRBC (AUROC=0.77, 0.81, 0.89), MT1 (0.78, 0.82, 0.90) or MT2 (0.79, 0.83, 0.92) respectively. Predictive ability (AUROC) was significantly improved with additional VS sensors and longer duration of VS monitoring.

CONCLUSION: Continuous automated vital signs were superior to manually recorded data for prediction of blood use and massive transfusion outcomes. Automated analysis of the combination of ECG, PPG and BP sensors will further improve transfusion prediction and assist early identification of hemorrhage. Algorithms will initially be utilized for decision support and eventually will be incorporated into autonomous patient care.

SESSION AGENDA

HFE/HSI – Session I

23 May | 1300-1445 | Auditorium

Chairs: Rebecca Iden & Liz Haro

1300-1305	**Setup and Welcome** Rebecca Iden, Liz Haro – HFE/HSI Chair/Co-Chair
1305-1325	**Human Factors Evaluation of Hand Held Mine Detectors** Amy Simpson - Defence Science and Technology Group, Australia
1330-1350	**Application of the Goal Directed Task Analysis to Understand User Goals and Information Requirements** Karl Van Orden, Rebecca Iden - SPAWAR Systems Center Pacific
1355-1415	**Human Systems Integration/Human Factors Engineering (HSI/HFE), Usability Scorecard** Julia Ruck, Chris Jais - PM DCGS-A
1420-1440	**Data-Informed Decision Making for Safety Program Interventions** Cindy Whitehead - Naval Surface Warfare Center Dahlgren

ABSTRACTS

Human Factors Evaluation of Hand Held Mine Detectors

Amy Simpson
Defence Science and Technology Group, Australia

Background: The human factors of mine detectors have rarely been assessed within the Australian military. As such detectors have been purchased and used with limited consideration of how the detector affects fit, integration, body movement, and ultimately discomfort & user performance. It is acknowledged that there are many other aspects integral to mine detector systems; however, if the human factors are sub-optimal then this can present tactical risks to the soldier and ultimately there is the risk the detector will not be used at all.

Method/Results: The Defence Science and Technology Group (DST Group) has provided Human Factors support to the characterisation, as well as the design development, of hand held mine detectors. This paper will provide an overview of three approaches to evaluating a hand held mine detector:

- Early Human Factors Analysis;
- Physical Ergonomics Assessment;
- Trials with representative users.

This paper will discuss the human factors components that were addressed in the evaluations, as well as the limitations of these evaluations. The common issues identified with the design of hand held mine detectors will also be presented. They are summarised as:

- Ability to adjust the detector to personal preference;
- Compatibility of start-up and calibration times with time critical missions;
- Ease of employing the detector in different postures;
- Ability to identify and differentiate between auditory tones;
- Compatibility of the detector with night vision goggles;
- Ability of the soldier to carry out actions on contact whilst carrying the detector.

The paper will end with a discussion on future recommendations for mine detector systems.

Conclusion: The primary aim of this paper is to present the approaches that were undertaken to evaluate the human factors of hand held detectors with the objective of promoting further discussion about these approaches and the utility of different approaches during the conference.

Potential impact to mission/warfighter: The opportunity to evaluate and improve the human factors of hand held detectors helps to reduce the likelihood of fit, integration & usability issues on military operations.

Application of the Goal Directed Task Analysis to Understand User Goals and Information Requirements.

Karl Van Orden, Rebecca Iden
SPAWAR Systems Center Pacific

The speed of war is rapidly increasing with ever evolving threats and tactics. Decision-making to employ military power to counter the enemy actor is inextricably linked and must keep pace. Significant engineering challenges lie ahead for the Navy to overcome the increasingly dynamic and rapidly changing situations with respect to the manner in which operations are carried about within shipboard combat information centers. Although various ships' systems have improved over time, system operators still perform as they did twenty-five years ago. Shipboard systems interfaces are still being designed in a function-centered manner, where data and information from various processors is posted into disparate display windows, and operators—or teams of them—are required to integrate and understand the breadth and depth of the information users require to employ a measured response. Our current effort (Battle Management Aids Development and Experimentation; BMASED) is focused on applying task-centered design that enable efficient decision-making under highly dynamic and stressful conditions.

To understand the information requirements of decision makers and their respective tasks, we have employed the Goal Directed Task Analysis (GDTA; Endsley & Jones, 2012). GDTA works to capture the tacit and experiential knowledge by eliciting the goals of an operator and understanding the necessary information streams for situational awareness. As proof of concept our initial focus has been on Navy Tactical Action Officers (TAO).

Our presentation will focus on our implementation of GDTA, surprise findings, data management, and supplemental activities to support the creation of a generalizable but highly detailed TAO goal hierarchy.

ABSTRACTS

Human Systems Integration/Human Factors Engineering (HSI/HFE), Usability Scorecard

Julia Ruck, Chris Jais
PM DCGS-A

The Warfighters ability to make sense of big data requires systems that evidence both the characteristics of utility and usability. It is critical that the design of these systems incorporate HFE/HSI methods and principles that result in positive usability outcomes. One of the major barriers to achieving such a design is a lack of consideration for system usability at the organizational level. Presently there is a gap in the ability to systematically and methodologically identify organizational shortcomings that result in poor system usability. This gap results in increased ownership costs, such as maintenance and the cost of retrofitting usability, and decreased Warfighter effectiveness, increased cognitive workload, and lower rates of user adoption of the technology.

At PM DCGS-A, we have developed a Usability Scorecard to standardize the assessment of an organization's Usability Maturity. Usability Maturity includes all of the practices, processes, and structures an organization has in place in order to design highly usable systems. The Usability Scorecard acts as a tool for an organization to closely monitor their Usability Maturity and identify shortcomings prior to them becoming programmatic risks and impacts to the user experience. As data volume continues to increase, the expectation from the Warfighter for systems capable of reducing cognitive workload increases. Programmatic leadership as well as software developers require a systematic way of identifying usability-related risks from the earliest stages of requirements composition. The Usability Scorecard becomes an early-warning tool to make corrective actions before the down-stream impact in the software development lifecycle is realized.

The Usability Scorecard is not merely a tool, but a model for the essential qualities commiserate with the practices that result in highly usable systems. It is based off of industry standards and existing usability field research, ranging from longitudinal studies of Usability Professionals (i.e. Human Factors Engineers, Cognitive Engineers, etc.) to industry specifications, such as Common Industry Specification for Usability–Requirements (CISU-R) and the J. Earthy Usability Maturity Model. Pulling and coalescing from the large body of evidence to a streamlined checklist provides organizations an opportunity to track usability thresholds and milestones and implement course corrections before a design even takes shape.

The Usability Scorecard has five major categories: Program Usability Maturity, Requirements Management, Research Methods and Maturity, User Interface Design and Sustain and User Acceptance. The scorecard calculates overall programmatic Usability Maturity in the form of a numerical score per category and a risk classification.

Its prospective foresight mitigates the down-stream impact of poor usability by enabling the organization to adjust practices from an informed Usability Maturity perspective early-on.

Data-Informed Decision Making for Safety Program Interventions

Cindy Whitehead
NSWC Dahlgren

This presentation will discuss methods used by the Navy Ergonomics Program to successfully advocate for personnel safety in the face of limited resources. The Navy Ergonomics Program leverages existing safety and cost data to advocate for ergonomics improvements and generate new success stories. Resources are limited, both of personnel and for funding. Without either, the safety of maintenance personnel is at risk. To preserve existing personnel resources, safety managers must advocate to resource sponsors for additional funding to address ergonomics hazards. Existing data such as recordable injuries, Federal Employee Compensation Act data, worker population, and production throughput provide objective evidence of an existing hazard as well as its impact on worker health, safety, productivity, and medical compensation costs. Recommendations may include new design efforts, commercial-off-the-shelf products, training, or process changes. Each proposed solution is evaluated based on their value in terms of cost, implementation, and effectiveness. Post-implementation, updated metrics are tracked to document the effectiveness and return-on-investment of the implemented solution. Solutions are publicized throughout the Navy safety community via communities of practice, website, or publication to allow other sites to apply the solution to reduce existing ergonomics risk.

SESSION AGENDA

HFE/HSI – Session II

23 May | 1515-1700 | Auditorium

Chairs: Rebecca Iden & Liz Haro

1515-1520	**Setup and Welcome** Rebecca Iden, Liz Haro – HFE/HSI Chair/Co-Chair
1520-1540	**Introduction to the Department of Transportation Human Factors Coordinating Committee (HFCC)** Kenneth Allendoerfer - Federal Aviation Administration Maura Lohrenz - DOT Volpe National Transportation Systems Center
1545-1605	**Visual Analytics, Human Factors and Organizational Issues** Dennis Wightman - Department of Homeland Security
1610-1700	**Panel: Leveraging Design Thinking Concepts to Improve DoD Product Development** Steve Dorton, Scott Tupper – Sonalysts Chuck Curtis – Undersea Warfighting Development Center Steve Fultz – Undersea Weapons Program Office

ABSTRACTS

Introduction to the Department of Transportation Human Factors Coordinating Committee (HFCC)

Kenneth Allendoerfer, Federal Aviation Administration, Maura Lohren, DOT Volpe National Transportation Systems Center

Department of Transportation Human Factors Coordinating Committee

The Secretary of Transportation established the Human Factors Coordinating Committee (HFCC) in 1991 to be the focal point for human factors issues within the Department of Transportation (DOT). Since its inception, the HFCC has successfully addressed cross-cutting human factors issues in transportation. The HFCC includes liaisons from each of the DOT modal administrations and includes researchers, practitioners, program managers, and other stakeholders.

The goals of the HFCC are:

- Coordinate cross-modal human factors activities,
- Provide human factors information and support to DOT senior level policy and decision makers,
- Promote human factors research and applications in transportation, and
- Serve as DOT's human factors liaisons with the international transportation research and development community.

The HFCC has influenced the implementation of human factors projects within and between modal administrations, provided a mechanism for exchange of human factors and related technical information among modal administrations, and provided synergy and continuity in implementing transportation human factors research. The HFCC has been recognized by the Research and Innovative Technology Administration (RITA) in creating Intermodal Research Clusters modeled after the HFCC. Additionally, in 2010, The DOT Safety Council continues to leverage the expertise within the HFCC to adopt strategies incorporating human factors principles and methods to address the roughly 80 percent of transportation accidents associated with human error.

The HFCC maintains a current list of important human factors issues in transportation and provides guidance on these topics to the wider community. For example, the HFCC recently identified the impact of fatigue on safety critical operator performance as an issue in all modes of transportation and created the multi-modal Operator Fatigue Management (OFM) program.

Current areas of interest are:

- Automation
- Operator Distraction
- Fatigue
- Aging
- Human Systems Integration
- Safety Culture
- System Design
- Training
- Human Error

Because these key transportation human factors issues are also important to the military domains, the HFCC provides a natural connection point between the DOT, DoD, and DHS human factors communities. Representatives from DoD, DHS, NASA, and other agencies participate in the HFCC as auxiliary members and contribute their expertise and perspectives to the HFCC's activities. Strengthening connections among human factors experts across domains and disciplines provides increased opportunities for collaboration, sharing of knowledge and resources, and leveraging the government's human factors capabilities.

Visual Analytics, Human Factors and Organizational Issues

Dennis Wightman
Department of Homeland Security

Visual analytics is a method of exploring large sets of data through the means of software tools that allow humans the ability to visualize the relationships among and between these data in a meaningful way. The visual material is usually depicted in the form of graphs, scatter plots, maps, or any other rendering that shows the underlying relationships within the database allowing the analyst to draw conclusions about the relationships. This discussion will describe and highlight the issues that come into plan when using such a tool to present data from large data files. Specifically this presentation will address the use of such software in the effort to provide a compelling visual representation of ergonomic process data coupled with worker injury and accident data. This analysis was used to examine the effect of work processes and design on worker injuries and accidents. Topics to be covered are experience with implementing a visual data analytics program in a large organization and the implications for human factors practices.

ABSTRACTS

Leveraging Design Thinking Concepts to Improve DoD Product Development

Stephen Dorton, Sonalysts , Scott Tupper, Sonalysts , Mike Erwin, Sonalysts, Chuck Curtis, UWDC TAG, Steve Fultz, PMS-404

"Design Thinking is a human centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology and the requirements for the business success"

– Tim Brown (2017)

Design Thinking processes are changing the way DoD program managers design, test and refine new warfighting capabilities. First implemented in response to a challenge from, then COMSUBLANT, VADM John Richardson to make submarine sonar and combat system displays more intuitive, design thinking is helping to deliver new, better warfighting capabilities faster, effectively helping to create the acquisition "HOV lane" advocated by now CNO Richardson (CNO PA, 2015). The Tactical Advancements for the Next Generation (TANG) forums and the Tactical Ideation Development Events (TIDEs) are two such design thinking approaches that have been successfully implemented in DoD applications. These workshops bring the end-users into direct contact with the program managers and resource sponsors charged with providing requirements and funding, which enables getting a new idea over the acquisition "valley of death" and into the hands of the warfighter. Using design thinking and Human Factors methods (such as brainstorming and rapid prototyping), fleet users are able to directly articulate not only their vision for what they need, but also how they would use it, and why the new vision improves the status quo. All of this occurs with the program managers and resource sponsors involved as part of the team from the ground level, easing transition from ideation to fielded use. By using design thinking, ideas that would have taken hundreds of pages of documentation and months or years' worth of "Request for Information (RFI) cycles" to understand the warfighters needs can now take place over a span of days. It is this direct and intentional mix of the users, developers, technical experts, and stakeholders/decision makers that allows the design thinking processes to flourish. This panel presentation will describe the core elements of successful design thinking events (attendee diversity, developing research insights, brainstorming, rapid prototyping exercises, war-gaming of potential solutions, group sharing and feedback, and identifying the way path ahead for further development), the outcomes and benefits of using these methods, and how to leverage these outputs to turn ideas into reality. The panel will provide perspectives on the execution and benefits of design thinking from the point of the design thinking lead, the human factors engineer, the wargaming/simulation lead, the end user, and the program manager/stakeholder. We will discuss and field questions on how to design and execute an event, analyze and exploit data from an event, and what it is like to participate in a design thinking event as an end user and as a program manager.

SESSION AGENDA

Human Performance Measurement – Session I

24 May | 1515-1700 | Auditorium

Chairs: LT Joe Mercado & Justin Stofik

1515-1540	**Using big data and a rapid software-based assessment to predict airport screening officers' visual search competency** Ben Sharpe, Stephen Mitroff - TSA
1540-1605	**Big Data Techniques for Making Sense of ISR Eye Movement Data** John Plaga - U.S. Air Force
1605-1630	**Effects Of Reduced Speech Intelligibility On Performance In A Combat Information Center (CIC) Simulation** John Ziriax - Naval Surface Warfare Center Dahlgren/Human Systems Engineering
1630-1655	**Collection of Human Factors Metrics for the Augmented Reality Sandtable** Christopher Garneau, Michael Boyce - U.S. Army Research Laboratory, Human Research and Engineering Directorate (ARL-HRED)
1655-1700	**Closing Remarks** Joe Mercado, Justin Stofik – Human Perf Measurement Chairs

Using big data and a rapid software-based assessment to predict airport screening officers' visual search competency.

Ben Sharpe, Kedlin Co., Stephen Mitroff, Kedlin Co., Justin Ericson, Kedlin Co., Darryl Smith, TSA

With increases in data storage and processing abilities, it is possible to examine massive, diverse datasets to learn new facts that were previously impossible to uncover. Many government agencies have been collecting vast amounts of data over many years, and the research and data processing tools now exist to make sense of these vast stores of data. Agencies that had the foresight to save data can now work with data scientists to learn exciting new insights. In this presentation we will provide a case study example of how this process can work to provide positive outcomes and help government agencies best inform operational objectives.

The TSA gathers data across a wide range of platforms. For example, TSA has data on screening officers related to each bag viewed, performance on a variety of assessments (e.g., covert tests), hours worked, and more. Each of these points may be informative, but it is difficult to (a) gather the data, (b) combine the data across platforms, and (c) process the data to uncover meaningful patterns. In a TSA-funded project, Kedlin Company, a private tech company, partnered with The George Washington University to combine innovative mobile and web technologies to help overcome these hurdles, revealing that it is possible to titrate down the various measures to identify individuals who are more likely to excel as screening officers.

TSA officers completed a 10-minute assessment on a tablet-based XRAY simulator (derived from Airport Scanner; Kedlin Co.). The Airport Scanner platform is a publicly available mobile app, and data from the app (>2.8 billion trials; >11 million users) have been used for research. Performance on the assessment significantly related to TSA on-job performance metrics of effectiveness (e.g., detecting real threat items covertly introduced into the checkpoint) and efficiency (e.g., officers who performed well on the app were quicker to process passengers at the checkpoint). These findings suggest that it is possible to quickly identify potential hires based on their core visual search competency, which could provide the ability to make new hires and assess current employees to best meet operating objectives of efficiently and effectively processing passengers at the checkpoint.

There are several takeaways from this project. First, this project demonstrates the creation of an integration platform across multiple sources of data. Second, a simple, scalable app-based measure was able to significantly predict operational success, suggesting it is possible to simplify the vast amounts of data down to the most meaningful aspects to focus efforts. This is especially important when data are difficult and/or costly to acquire (e.g., covert testing for the TSA) and highlights the relative ease of collecting massive amounts of data from a tablet based tool. Third, this project involved non-obvious stakeholders (e.g., a professional game developer) that were able to provide new insights for the TSA, demonstrating how having the right people on the team is key. Finally, this project demonstrates how it is possible to leverage public/private/university relationships to get access to a unique set of expertise to benefit an agency's mission.

Big Data Techniques for Making Sense of ISR Eye Movement Data

Rik Warren
U.S. Air Force

Eye tracking provides a rich source of data in Intelligence, Surveillance, and Reconnaissance (ISR) research. Understanding the dynamics of eye scanning behavior can provide a helpful window into the attention processes of analysts and how this impacts their accuracy and performance over the course of a long shift. Since it can be expected that experts' search scans are more efficient, such data can help differentiate novices from experts, and help assess the relative effectiveness of candidate analyst augmentation aids. However, due to the complexity of the required analysis, the number of data files, and the file sizes, much of the collected and stored data remains unanalyzed or under-analyzed.

Data collected from a typical ISR eye tracking study lasting only 30 minutes are typically stored in large files that range from 30-100 megabytes each. Data lasting a full 8 hour shift naturally can produce massive files. This can lead to thousands of potential comparisons that need to be made in a single study and yields output that is nearly as complex as the eye tracking input data! Solving these problems requires the use of big data techniques.

This presentation describes a technique and metric for computing similarity ratings to compare eye tracking scanpaths using algorithms that are similar to those used in DNA protein sequence comparisons. It also describes plans to use batch processing of the data using a supercomputing system, not only to generate similarity score output, but to also parse the output data.

This project utilizes the Matlab package ScanMatch alongside user-written Matlab scripts to compute multiple similarity comparisons of surveillance eye-tracking data as well as the use of additional algorithms to parse the complex output arrays.

ABSTRACTS

Effects Of Reduced Speech Intelligibility On Performance In A Combat Information Center (CIC) Simulation

John Ziriax, Naval Surface Warfare Center Dahlgren/Human Systems Engineering, M. David Keller, Naval Surface Warfare Center Dahlgren/Human Systems Engineering, Benjamin Sheffield, Walter Reed National Military Medical Center, Douglas Brungart, Walter Reed National Military Medical Center, William Barns, Sonalysts ,Inc.

Background: Noise-induced hearing loss is a common permanent injury suffered by Navy and Marine Corps personnel. In addition, exposure to noise may produce temporary hearing loss during critical situations. Noise exposure standards were designed to prevent injury, but do not address the direct effects of noise on the performance of operational tasks. The goal of this experiment was to characterize the impact of reduced speech intelligibility (SI) due to impaired hearing on operational performance in a simulated shipboard CIC while simultaneously assessing effects on non-hearing impaired watchstanders.

Methods: A simulated CIC was constructed with four watchstations: two were occupied by CIC-qualified participants (36 total participants in 18 teams) and two by experimental confederates. One of each participant pair, assigned as the CIC Watch Officer (CICWO), had normal hearing throughout the experiment. The other, assigned as the Tactical Action Officer (TAO), was exposed to four SI levels. Speech shaped noise was used to produce three reduced SI levels (50%, 65%, and 80% SI) determined by individual performance on an adaptive modified rhyme test, in addition to a quiet condition (100% SI).

Each watchstation had three consoles: a tactical display, a chat screen, and a video feed. The experimental scenario consisted of eight segments with the four SI levels randomly assigned to the first four segments and again to the last four segments. As timed events were displayed on the consoles, participants and confederates interacted over two audio networks.

Results: Changes in SI had little effect on the visual tasks like monitoring the Tacsit. This was not the case for verbal communication. A noteworthy example occurred when a hostile patrol boat unexpectedly fired two missiles. Following the missile launch, the TAO was ordered to kill the incoming missiles and destroy the attacking ship. The latency of the TAO's acknowledgement and passing of the 'kill' orders increased with decreasing SI. Also, the number of times the orders were repeated by the CICWOs and/or the confederates also increased with decreasing SI. Some TAOs failed to respond altogether. With decreasing SI, other measures of operational performance also declined, and speech amplitude increased in the both participants and confederates.

Conclusions: Thanks to our confederates' expertise and our participants' willingness to engage with the scenario, the experiment provided a reasonably realistic simulation of an operational CIC. It is not surprising that an operational task requiring frequent voice communications would suffer when hearing is compromised. While compensation by the impaired person is expected, compensation by those with unimpaired hearing extends the impact.

Potential impact to mission/warfighter: Hearing challenges can cause reduced operational performance in affected individuals and in the unaffected crewmates. Compensations may reduce the impact of hearing loss, but may come at a cost to the effectiveness and efficiency of the CIC team.

Send correspondence to john.ziriax@navy.mil. The Office of Naval Research Noise-Induced Hearing Loss Program sponsored this work. The authors gratefully acknowledge the Center for Surface Combat Systems Unit Dam Neck for their support.

Collection of Human Factors Metrics for the Augmented Reality Sandtable

Christopher Garneau, Michael Boyce
U.S. Army Research Laboratory, Human Research and Engineering Directorate (ARL-HRED)

The Augmented Reality Sandtable (ARES) is a research testbed developed by by the Army Research Laboratory (ARL) that leverages commercial off the shelf technology to provide interactive data visualization with a tangible user interface. ARES components include a Microsoft Kinect that reads the topography of the sand, a projector to display content, a tablet with apps that enable tactical scenario authoring and additional interaction and analyses, a standard monitor, and a desktop computer. As the ARES project has grown, the need for standardized metrics to assess human performance within experimental studies has become apparent in order to enable meaningful insight both within and across studies. Being that ARES is a nontraditional interface with multiple modes of interaction (i.e., direct manipulation of the sand, interaction via the tablet's graphical user interface, the use of Xbox controllers, and voice or gesture recognition), it is a challenge to find a clear multimethod approach to data collection. On top of the modes of interaction, there are also the variables of viewing angle, projector distortion, and the perspective of the user, all of which could potentially impact results and obfuscate the meaning of traditional terminology. In the current effort, human factors related metrics in use for current and future research on the ARES project are investigated. These metrics cover physiological, qualitative (e.g., interviews, self-report surveys), and quantitative (e.g., time on task, accuracy) data. This effort will describe

the reasoning behind the selection of the various metrics, the pros and cons based on data collection with ARES, and how the use of the selected metrics has enabled insight into various research questions. In addition to sharing findings and lessons learned from experimentation related to the ARES project, it is hoped that the discussion will garner feedback from the community on how best to standardize data collection for human factors experimentation across modeling and simulation platforms.

SESSION AGENDA

Human Performance Measurement – Session II

25 May | 0800-0945 | Auditorium

Chairs: LT Joe Mercado & Justin Stofik

0800-0830	**Supporting Performance Measurement through Standardization: Developing a Human Performance Markup Language (HPML)** John Killilea - NAWCTSD
0830-0900	**Using big data to enhance checkpoint security: What can we learn from big data that we cannot learn from existing systems?** Adam Biggs - Naval Medical Research Unit Dayton
0900-0930	**Measured Difference in Subject Matter Expertise** Nathan Jones - MCSC PM TRASYS
0930-0945	**Discussion & Closing Remarks** Joe Mercado, Justin Stofik – Human Perf Measurement Chairs

ABSTRACTS

Supporting Performance Measurement through Standardization: Developing a Human Performance Markup Language (HPML)

Michael Tolland, Aptima, Courtney Dean, Aptima, Beth Atkinson, NAWCTSD, Mitchell Tindall, NAWCTSD, John Killilea, NAWCTSD

Background: As interest grows for big data analytics, one prime opportunity to leverage existing data sources is automated performance measurement and assessment capabilities. The use of automated, system-based performance measures allows instructors to supplement observed strengths and weaknesses with objective data. Currently, fleet communities lack a standardized way to represent human performance data requirements that is generalizable, interoperable, and transparent. Because of this gap in standards, developers are tasked with the challenge to implement technology in environments that lack the right type of data.

Method: The Simulation Interoperability Standards Organization (SISO) Product Development Group (PDG) for Human Performance Markup Language (HPML) is a collaborative opportunity for organizations to build consensus and refine what to include in a standard that would support the implementation of human performance measurement capabilities. HPML is an XML-Schema-based language intended to cover all beneficial components of human performance in training and operational environments. In practice, HPML provides a framework for defining how a system can utilize available data to determine if trainees achieve desired outcomes based on the mission context. As a standard, HPML would provide a systematic way for representing generic concepts, as well as mission specific concepts which are required to capture the experiences associated with human performance and human behavior.

Results: Based on earlier study group participation and the results of discussions to date from the PDG, HPML currently includes several components (see SISO-REF-061-2015 HPML Study Group final report). Computations include the algorithms, triggers, and other calculations. Instances and Periods highlight how Measures and Assessments are related in specific contexts or domains. At a granular level, Measures identify relevant data sources and their relationship for calculating an output, while Assessments define how to classify calculations (e.g., percentage, expert vs. novice) and provide the context for comparison of what was expected versus what was observed. The combination of Measures and Assessments build the Results, which detail the output across a given period of measurement and provide an output of the broader mission success and outcomes (e.g., mission objectives). The final area under consideration by the group is Competency. This construct refers to knowledge or skills necessary to complete a mission essential task that may build over time reflecting the development of expertise.

Conclusions: Although no standard method of expressing human performance measures exists, modeling, simulation, and training communities would benefit from a human performance measurement standard to create a consistent method for defining how measures and assessments of humans or other systems are developed. However, this alone will not solve the challenges of implementing assessment systems. This standard will benefit from increased input from a wide range of military, industry, and academic institutions to ensure it meets current and future needs for big data analytics associated with understanding human performance.

Impacts: Several benefits could be realized by the instantiation of standards to govern implementation of measures of human performance including: 1) with consistency in implementation, measurement reuse becomes possible, 2) increased availability of the right data will enable reliable measurement across training and operational contexts, 3) reduced instructor workload when assessing performance, due to automated measures providing outcome-based measures as a supplement to observer measures, and 4) as a culmination of these individual benefits, our communities can move toward achieving a full understanding of force-wide proficiency.

Using big data to enhance checkpoint security: What can we learn from big data that we cannot learn from existing systems?

Adam Biggs, Naval Medical Research Unit Dayton, Ben Sharpe, Kedlin Co., Steve Mitroff, George Washington University

Many government agencies have access to vast datasets that could greatly enhance decision-making processes involving national security. Although data can be easily measured in terms of gigabytes or terabytes, it is difficult to quantify the contribution of these big data initiatives. In turn, this opacity creates a challenge in establishing how these initiatives translate into security policy. This presentation will focus on one essential area of national security—airport checkpoints—and we will provide tangible examples of how one big data initiative has yielded new insight into checkpoint security.

Our data platform is a mobile technology app called Airport Scanner, which simulates an airport security checkpoint and instructs participants to locate prohibited items in luggage. Typical visual search tasks collect several hundred trials during a single session, and most laboratory experiments accumulate only several thousand total trials across an experiment. To date, Airport Scanner has collected more than 2.9 billion visual search trials, which makes it the most extensive, diverse, and complete (i.e., all item parameters are known for each trial) visual search research dataset based on actual human behavior. These data allow for empirical assessments about specific items, combinations, or examinations that would be otherwise untenable in laboratory-based studies. For example, take a particular target that only appears on 0.05% of trials (or once every 2,000 bags); this data set would have 1.4 million examples of an otherwise rare occurrence. Such robust numbers create an opportunity to examine rare instances that arise naturally while maintaining substantial variability.

Thus far, several published studies have utilized this dataset to answer security relevant questions. For example, although search professionals know that rare targets are more difficult to find than commonplace targets, this dataset further established the problem space. Specifically, searchers are worse at finding targets that appear on 1% of trials versus ~5% of trials, but accuracy becomes exponentially worse for any targets below 1%. Another empirical evaluation involved an assessment of salience, or how much an item stands out in a particular bag. How often an item appeared actually had a larger impact on accuracy than how much an item stood out. This finding is counter-intuitive, but it could alter training recommendations and visual search strategies. Another problem involves multiple targets in a single bag. For example, if a searcher finds a water bottle, does that same searcher become biased to find similar targets rather than conceptually different targets, such as guns or knives? With this dataset, we were able to provide empirical evidence that such target biasing does occur, and these biases do significantly impair performance for contraband.

These findings offer only a few examples regarding big data use and checkpoint security procedures. Policy can then be developed around these issues with a key emphasis on scope because the datasets are large enough to statistically compare various challenges. Airport Scanner is one such tool for accomplishing this mission, and further adaptations to the application designed for government use are further enhancing our ability to utilize big data for practical applications.

Measured Difference in Subject Matter Expertise

Nathan Jones
MCSC PM TRASYS

It is common for all types of human performance assessments to utilize subject matter expertise in providing measures. However, how reliable is that expertise? This presentation will provide several examples of measured differences in subject matter expertise feedback during assessments. Understanding your results should include understand the reliability of your experts. This presentation will discuss what to be aware of, why this should be measured, and how to measure it.

SESSION AGENDA

Mixed Reality

23 May | 1515-1700 | CAD B

Chairs: Joshua Kvavle & LT Daniel Walker

Welcome & Introductions
Joshua Kvavle, Daniel Walker – Mixed Reality Chairs

Using Immersive Virtual Reality Technologies with Non-Haptic Control for Big Data Visualizations and TradeSpace Analytics
Michael Hamilton - Institute for Systems Engineering Research - Mississippi State University

Building a Virtual Environment to Investigate Cooperative Teaming
Jamie Lukos - SPAWAR Systems Center Pacific

Discussion & Closing Remarks
Joshua Kvavle, Daniel Walker – Mixed Reality Chairs

Using Immersive Virtual Reality Technologies with Non-Haptic Control for Big Data Visualizations and TradeSpace Analytics

Michael Hamilton
Institute for Systems Engineering Research - Mississippi State University

US Department of Defense (DOD) systems design teams are moving to "Set Based Design" which requires assembly of diverse inputs, models, historical data and simulation into a single very large tradespace of possible design options. The key idea is to defer narrowing the set of choices until the entire space of possibilities is more fully understood. Research is be conducted with the Engineer Research and Development Center (ERDC) to develop a big data visualization module for the Engineered Resilient Systems (ERS).

ERS is used to build combat systems that are responsive to increasing complex and dynamic military missions as well as provide tools that significantly amplify design options (tradespaces) during the early stages of the DOD acquisition process. The immersive data visualization module use VR headsets (Oculus/HTC VIVE) and a non-haptic controller (Leap Motion) to allow stakeholders the ability to visualize the tradespace options and data plots in an immersive 3D environment. The system allows the users to manipulate the data in the 3D space and create new subset of data directly from the visualization environment.

In the long term, the objective is to be able to conduct decision-based tradespace analytics such as Pareto Frontier and other tradespace reduction techniques completely in the virtual space. Afterwards, the resultant transformed datasets can be exported back into traditional analytic toolsets for further exploration. User interface design for immersive virtual systems is a priority for this research effort. Currently, there are no natural affordances or military standards for 3D interface development in virtual environments. The study of different interface design approaches will be conducted to ensure that the visualization system is adequate in regards to usability for the end user.

ABSTRACTS

Building a Virtual Environment to Investigate Cooperative Teaming

Jamie Lukos, SPAWAR Pacific, Mohammad Alam, SPAWAR Pacific, Heidi Buck, SPAWAR Pacific, Joseph Snider, UCSD

The newest, most technologically advanced VR devices allow for robust immersion experiences. Recent developments in low-cost omni-directional walking platforms (e.g., Virtuix Omni) and room-scale gameplay (e.g., HTC Vive) further increase the immersive experience of a virtual setting and can deliver limitless possibilities in synthetic environment innovation. Combining these technologies could potentially provide vastly superior training environment than currently available in restrictive physical environments. We are investigating team dynamics and performance on a virtual battlefield using a custom two-player first-person shooter game to explore brain responses to varying demands on cooperation. Warfighters are often put in situations that require trust/cooperation between partners. This environment is built to examine the behavioral relationships and physiological correlates of these interactions as participants simultaneously perform both cooperative and solo missions while walking in a virtual battlespace. Developed in collaboration with Navy SEALs, a related effort is being performed in an MRI where subjects navigated through a simulated cargo ship searching for enemies using video game controllers (Snider et al., 2013). Preliminary results indicated that cross-brain connectivity in the default mode network was higher when subjects cooperated compared to acting alone. We have transitioned this study to an immersive motion-enabled environment, which we believe will significantly enhance the real-world validity of the task. We are performing the virtual battlespace cooperative teaming task in three conditions: seated navigation using a game controller, walking in place with the Virtuix Omni walking platform, and walking in physical space using the HTC Vive whole-room VR environment. We hypothesize that the act of self-propulsive walking during the task will enhance engagement and immersion, resulting in better overall task performance, less motion sickness, and the development of better team dynamics compared to artificially moving through the environment using a hand-held game controller. Furthermore, we hypothesize that we will be able to detect differences in cortical activation during cooperative teaming and that the extent of these differences will correlate with team performance. In future years, we hope the virtual battlespace cooperative teaming task will be extended to interactions with autonomous agents to investigate cooperative strategies in human-machine teaming.

SESSION AGENDA

Modeling & Simulation – Session I

24 May | 1015-1150 | CAD A

Chairs: John Rice, Ranjeev Mittu & LT Lee Sciarini

1015-1030	**SubTAG Business Meeting: Part 1 Review of HM&S Mission and Purpose** John Rice, John Ramsay – SubTAG Chairs
1030-1045	**Decision Support Using an Integrated Human-Exosuit Computational Model Framework** Leia Stirling - MIT / NASA
1045-1115	**Gaps in Integrated Modeling and Simulation for Human Systems Integration Community of Practice** DHS T&S HSI TBD - DHS HSI
1115-1130	**Helmet-mounted Displays in Tactical Flight Platforms, Results from Recent Fixed and Rotary Wing Flight Tests at OPL** Thomas Schnell - Operator Performance Laboratory (OPL)
1130-1150	**Barriers to Collaboration and Reuse of Computational Models** John Rice, Rick Severinghaus – Modeling & Simulation Chair/NMSC Chair

ABSTRACTS

SubTAG Business Meeting: Part 1 Review of HM&S Mission and Purpose

John Rice, John Ramsay
SubTAG Chairs

The SUBTAG participants will review its' Mission, Purpose and types of activity to explore new ways to more effectively leverage the TAG venue and increase SubTAG's observable productivity. Session alternatives such as the use of small accountable working groups, and/or the use of project or program (vs individual) technical mentors or advisors will be considered along with other suggestions form the SubTAG participants. The discussion will take place in 2 parts (Session 1&2). This part will set out questions and brief comments to be considered for more detailed discussion in the Second Session.

Decision Support Using an Integrated Human-Exosuit Computational Model Framework

Leia Stirling
MIT / NASA

Many challenges exist in simulating the dynamics of tightly coupled systems, such as exoskeletons or exosuits and human operators. There are currently no high fidelity models that attain accurate representations of both a human operator and wearable device. Enabling synergistically integrated wearable system designs that augment human performance, or the environments in which a human can operate, requires a tool to evaluate dynamic mobility and agility of the human-suit system, in particular the underlying human movements that generate the suit motions, the surface interaction forces and deflections, and the corresponding joint torques. Computer-based modeling, or model-based engineering, provides a method to perform iterative analysis that would typically incur enormous costs through manufacturing and testing of physical components. Inclusion of the human-suit interactions within the design process systematically drives the design to incorporate human factors from the start, reversing the conventional process of mechanical design followed by an evaluation of the resulting impact on the operator. Further, these models enable decision support across a variety of questions of interest to the human factors community, including assessment of fit, the dynamics required across the range of motion or specific motion tasks, and the muscles recruited to achieve the required forces and torques. These estimated parameters can lead to a model-based assessment of injury risk and the selection of appropriate operational tasks. In this discussion, we present the methodology for an model, and musculoskeletal models. We apply this framework to a Mark III space suit and highlight questions each underlying model can aid in answering.

ABSTRACTS

Gaps in Integrated Modeling and Simulation for Human Systems Integration Community of Practice

DHS T&S HSI TBD
DHS HSI

The Human Systems Integration construct was proposed and adopted by the DoD and subsequently by DHS to provide real time integration of 7 (8) historically disconnected, systems engineering, human factors and related specialties , training and personnel management functions all of which held stakes and roles in military systems acquisition. The Community continues to struggle function as a sustained integrated community of practice in many acquisitions programs. DHS HSI staff has noted that in spite of the rapid increase in human modeling and simulation technology and use, there are few, if any models that specifically integrate the activity and/or input/output of models that may exist individual HSI domains. The purpose of this discussion it to highlight gaps and barriers/limitations in the development and use of integrated Human Systems Integration domain models for HSI application in research and acquisition. Although it is assumed that all of the 7 HSI domains make use of many models within the domain, there is little knowledge of those models among other HSI domains nor any known effort to coordinated M&S investment in integrating the modeling data used in each of the domains much less integrating models to support HSI as an integrated process.

Helmet-mounted Displays in Tactical Flight Platforms, Results from Recent Fixed and Rotary Wing Flight Tests at OPL

Thomas Schnell
Operator Performance Laboratory (OPL)

Helmet Mounted Displays (HMDs) are rapidly emerging as display interfaces in advanced tactical platforms. HMDs promise much improved situation awareness in a wide range of environmental and dynamic conditions. HMDs are ideal to show earth-referenced symbology and imagery that is generated from database as well as on and off-board sensors. The good news is that HMDs are like a fresh canvass onto which avionics designers can draw a lot of information. Unfortunately, that is also the bad news, because it is easy to overload the cognitive system of the pilot with too much information. Therefore, HMD symbologies have to be designed with the utmost care and usually, less is more. The fact that HMDs can move around also requires consideration

of factors such as spatial orientation ability, latency, and alignment. This paper presents data from two recent flight tests that were performed by OPL in 2016. One flight test involved the investigation of pilot spatial orientation ability using a 5th generation fighter HMD during live flight in a close-air-support (CAS) scenario in the instrumented L-29 fighter jet trainer at the OPL. Results of the utility of different off-boresight symbologies are shown. The second flight test involved the assessment of a Lidar sensor and HMD symbology for landings in the Degraded Visual Environment (DVE). This test was performed on OPL's MI-2 rotorcraft testbed with landings into the DVE dust landing zone at the Yuma Proving Ground (YPG). Display symbologies are presented and human factors issues are discussed.

Barriers to Collaboration and Reuse of Computational Models

John Rice, Rick Severinghaus
Modeling & Simulation Chair/NMSC Chair

The National Science Foundation (NSF) recently published results of study conducted with the (NFP) National Modeling & Simulation Coalition (NMSC) to identify Challenges to M&S. In addition to many technical challenges, they specifically identified non-technical sociological, behavioral and programmatic issues as contributing factors that limit collaboration and reuse of models across or even within government departments or agencies. Computational modeling is currently undergoing exponential growth and is used in virtually every endeavor of human activity. However, the M&S community of practice remains scattered within practitioners' silos of practice. Thus, the highly-desired cost saving from collaboration and reuse remains an elusive mythical construct. As a chartered federal interagency organization for human factors research with specific interests in human M&S, the TAG is ideally suited to begin to explore means for lowering the barriers to reducing duplication, overlap and fragmentation of M&S investment in HF applications. We will discuss technical, social, and programmatic issues that limit collaboration cross federal agencies for development of models or use of simulation to address shared capability requirements and gaps.

SESSION AGENDA

Modeling & Simulation – Session II

24 May | 1515-1700 | CAD A

Chairs: John Rice, Ranjeev Mittu & LT Lee Sciarini

1515-1520	**Welcome & Opening Remarks** John Rice, John Ramsay – SubTAG Chairs
1520-1540	**Big Data & Predictive Human Models** Steven Beck - SantosHuman Inc.
1540-1610	**Issues of Concern to HF M&S Community of Practice** **DHS TSA**
1610-1640	**SubTAG Business Meeting: Part 2 Review of HM&S Charter and Election of Chairs** John Rice, John Ramsay – SubTAG Chairs
1640-1700	**Creditable PRACTICES for Computational HF Model Development and Use** John Rice – SubTAG Chair

ABSTRACTS

Big Data & Predictive Human Models

Steven Beck
SantosHuman Inc.

In the course of a day, can you find anything that humans do not somehow interact with? How many items or processes can you identify that are not designed within a computer environment? The answers to these questions define the scope of applications for digital human models (DHM) that predict human behavior and performance. Santos® is a premier physics-based predictive virtual human that can assess warfighter-centric performance issues at the earliest stages of design. In support of the effort to model and predict human performance, Big Data will play an increasingly significant role for continued technical superiority in next generation warfighter equipment.

The crux of Santos's novelty stems from optimization-based prediction. Using optimization to predict posture, motion, muscle activation, and other aspects of human performance provide a unique construct with which to incorporate various constraints and objective functions. The constraints essentially provide boundary conditions for the model, while multiple objective functions drive the model. Consequently, this construct can be used to study how and why people behave the way they do and what drives their actions.

Above and beyond the traditional digital human models, a predictive dynamic human model can ultimately play an integral role in simulating the effects of human decision making. This, in turn, depends heavily on Big Data, which can essentially provide a virtual human with a history and with past knowledge. Not only can pre-existing databases feed digital human models, but crowd sourced applications that relate to mission planning and equipment distribution, coupled with models that predict potential injuries from excessive loads, can result in large amounts of input that must be processed. As Big Data Analysis techniques become more robust and sophisticated, opportunities to gain more information about human activity and performance will increase. This will not only provide advanced decision engines, but entire populations can be represented with a single digital human model. If we can do this, predicting human performance and physical behavior will not be restricted to physics but can include things like culture, education, training, and gender. However, regardless of how fast massive amounts of data can be gathered and processed, data is still "the past". When "the future" is radical enough, Big Data must ultimately be coupled with a predictive human model to provide outcomes for what-if scenarios for which data may not exist.

This talk will provide an overview of how optimization is used to simulate human physical behavior and motion, and how it can be used to study what drives human performance. It will then touch on the ease with which additional capabilities, like strength and fatigue constraints, can be incorporated. Given the underlying method, various applications to Warfighter performance will be demonstrated. Finally, it will conclude with concepts of how crowdsourced information can help populate smart decision aids for equipment distribution and how human models could potentially leverage data-based cognitive models.

Issues of Concern to HF M&S Community of Practice

DHS TSA

The nature of potentially serious threats to nation has changed in many ways. Not the least of increasing threats is small groups or even individuals with intent to do harm to the population or infrastructure for whatever reasons. There is growing interest in relevant social and behavioral modeling and simulation however it seems to be only loosely coordinated at best. It is clearly a human modeling and simulation activity. The TSA has identified a need to collaboratively explore the state of art and gaps in modeling behavior and decision making by potentially harmful human actors. This discussion will begin to explore opportunities to leverage the HF TAG to minimize duplication, fragmentation and overlap of human threat modeling and simulation. Related research is being done in several federal departments and agencies however it is difficult to locate stakeholders in this kind of modeling and simulation in part due to the wide range of descriptions of the subject matter which contributes to fragmentation and duplication of uncoordinated investments. As a categorically human M&S area of research, the HFE TAG may provide a venue for finding and leveraging opportunity for collaboration.

SubTAG Business Meeting: Part 2 Review of HM&S Charter and Election of Chairs

John Rice, John Ramsay
SubTAG Chairs

Discussion is continuation from Session 1.

ABSTRACTS

Creditable PRACTICES for Computational HF Model Development and Use

John Rice
SubTAG Chair

This discussion addresses growing risk of misusing or abusing computational models as tools in acquisition programs. There are philosophy of science advocates for the idea that Computational Modeling may be the 3rd science following Scientific Observation and Experimentation. However impressive that may be, the reality for now is that it is a potentially powerful tool being rapidly adopted as a miraculous solution for difficult programmatic problems. The risk is in misuse and abuse. As attractive as the 'band-wagon' may be, program managers need to understand how to 'read the music' before jumping on. Considering the use of any kind of computational modeling 'system' as a tool for any aspect of any program must be done with the same care as any other type of system acquisition starting with clearly defined expectations and detailed requirement for the model(s) to be use. No amount of data makes bad models better. Incomplete or poorly defined requirements for models prevent effective validation and lead to often wishful accreditation. Models are not cheap, and for now reuse of models developed for even similar application carries high risk without independent accreditation for the new use. The TAG provides a venue for discussion of ways to promote safe and effective use of M&S in any program. As a community of HF M&S practitioners we may need to explore work processes and front end activity to improve the requirements specification that define M&S applications for specific programs

SESSION AGENDA

Personnel

24 May | 1515-1700 | CAD B

Chair: LT Mike Natali

1515-1535	**The Aviation Selection Test Battery Series E: Preliminary Results and Discussion** Mike Natali – Personnel SubTAG Chair
1540-1600	**Career Enlisted Aviator (CEA) Experience in Pilot Candidate Selection Method (PCSM)** Laura Barron - U.S. Air Force (HQ AFPC Strategic Research & Assessment)
1605-1625	**Selection & Classifications Systems from an Operational Recruiting Perspective: Factors Bearing on Successful Implementation** Hector Acosta - Air Force Recruiting Service
1630-1650	**Machine Learning: An Attempt to Predict Academic Attrition in Naval Air Traffic Control Training** Jaelle Scheuerman - Naval Research Laboratory
1650-1700	**Closing Remarks** Mike Natali - Personnel SubTAG Chair

ABSTRACTS

The Aviation Selection Test Battery Series E: Preliminary Results and Discussion

Mike Natali
HFE TAG 71 Personnel Committee

The Aviation Selection Test Battery Series E (ASTB-E), released in December 2013, is the most up-to-date version of the selection test used to select naval aviation candidates for the United States Navy, Marine Corps, and Coast Guard. The new version features computer adaptive testing format (CAT) versions of cognitive abilities and job knowledge tests (previously only available in static format); a personality inventory: the Naval Aviation Trait Facet Inventory (NATFI); a psychomotor assessment battery: the Performance Based Measures Test (PBM); and a biodata measure: the Biographical Inventory Response Verification (BIRV). These new enhancements improve the test's validity and help the services find better qualified aviation candidates. With the ASTB-E operational for three years, initial aviation training performance data from individuals who were selected for flight school based on their ASTB-E scores are now available. This presentation will discuss how well the ASTB-E predicts various training performance criteria including initial ground school grades, primary flight training grades, and attrition of student aviators and flight officers. Improvements from previous versions of the ASTB will be discussed as well as significant findings from the various subtests.

Career Enlisted Aviator (CEA) Experience in Pilot Candidate Selection Method (PCSM)

Laura Barron, Mark Rose
U.S. Air Force (HQ AFPC Strategic Research & Assessment)

In 2016, the Air Force selected its first enlisted pilots since the 1940s. Although the Air Force aimed to follow much the same process used in screening other AF (officer) pilots, the experiences of enlisted pilot candidates differ substantially from those of typical pilot candidates. Specifically, many enlisted pilot candidates had already served for many years as career enlisted aviators (CEAs, e.g., loadmasters, RPA sensor operators, flight engineers) within the Air Force. As such, the purpose of this research was to evaluate the extent to which CEA flying experience should be credited as part of the Pilot Candidate Selection Method (PCSM), building on prior research on the statistical relationship between private pilot flying hours and AF pilot training success. Pilot SMEs who had worked directly with CEAs completed a survey regarding the extent to which the flying tasks expected of all Undergraduate Pilot Training graduates were performed by each CEA career field. The expected task proficiency level of experienced

members in each CEA career field was then compared to the typical task proficiency level associated with varying levels of private pilot flying hours which are currently credited in PCSM. Results showed a substantive level of overlap between the flying tasks performed by pilots and the flying tasks performed by the enlisted positions of RPA sensor operators, flight engineers, and (to a lesser extent) aircraft loadmasters and in-flight refuelers. Analyses show the extent to which experience in these career fields may be compared to private pilot flying experience as part of PCSM to allow for fair evaluation of enlisted pilot candidates with and without CEA experience.

Selection & Classifications Systems from an Operational Recruiting Perspective: Factors Bearing on Successful Implementation

Hector Acosta
Air Force Recruiting Service

Successful selection & classification systems depend on a large matrix of supporting activities and impact a considerable set of operational realities. This presentation addresses factors bearing on and affected by these critical personnel process components from the perspective of operational recruiting. The lifecycle analytic approach applied for this presentation examines interdependencies and limitations that impact both the effectiveness of screening and selection systems, but also their viability as these activities interact with market dynamics and operational constraints. Such factors as the movement of test results across information systems, the quality of those data, and any and all time lags associated with data availability as part of recruit processing must be reconciled with the size of the effective pool of qualified applicants for jobs, and then, the very real constraint of the functional size of the volunteer pool for less attractive or more demanding specialties. Using real experiences involving specialties that are historically "challenging to fill," the presentation begins by presenting a high level overview of a typical big pipe recruiting process, including some notional production numbers, a real world range of post-accession attrition rates, and the impact of these on a typical accession requirements process. This is followed by examining very real, but not at all obvious, relationships between these post-accession factors and the impacts and necessary characteristics of screening and selection systems on the whole accession enterprise. This presentation aims at increasing awareness and at beginning an important discussion of a set of advanced development and implementation considerations that should be kept in mind at the threshold of technology transition and that are arguably unique to personnel systems.

ABSTRACTS

Machine Learning: An Attempt to Predict Academic Attrition in Naval Air Traffic Control Training

Jaelle Scheuerman, Naval Research Laboratory, Noelle Brown, Naval Research Laboratory, Denson Smith, State Farm Insurance, Michael Trenchard, Naval Research Laboratory, Stephanie Myrick, Naval Research Laboratory

BACKGROUND: Attrition rates due to poor academic performance are particularly high for air traffic controller programs (e.g., FAA and Navy). The Naval Air Technical Training Center (NATTC) in Pensacola, Florida, which trains Navy and Marine Corps Air Traffic Controllers (ATC), has reported rates of 31%, 19% and 30% over FY 14, FY 15 and FY 16 respectively. Currently, ATC candidates are selected for training based upon a minimum score achieved on specific components of the Armed Services Vocational Aptitude Battery (ASVAB). However, ASVAB scores do not appear to be sufficient for predicting who will succeed in training. In large part because the ASVAB was designed to determine whether individuals were qualified to enlist in the military and to assess which occupations may be an appropriate fit. Importantly, it was not designed to measure specific cognitive aptitudes central to success in ATC training (e.g., Held & Carretta, 2013).

We hypothesized that including assessments of working memory and spatial ability along with the current selection process would improve the ability to predict attrition. In addition, we expected the use of machine learning approaches to reduce the dimensionality of our data space and allow for better prediction of academic attrition with a relatively small sample size.

METHOD: One hundred twenty-one ATC students from NATTC in Pensacola participated during a waiting period before starting the training program. Eighty-eight were males, all were between the ages of 17and 27 (M = 20.8, SD = 2.4), and 78 were US Navy. Officers and foreign nationals were excluded.

Before beginning the ATC program students were notified by NATTC they were eligible to participate in research related to their training. Trainees who opted to participate completed computerized versions of the Direction Orientation Task (DOT), n-back task (Shelton, Elliott, Hill, Calamia & Gouvier, 2009), Automated Operation Span and Automated Symmetry Span (Unsworth, Heitz, Schrock, & Engle; 2005) and a demographic questionnaire.

Participant grades from the ATC training program at NATTC were collected as a measure of training performance. We applied a regression approach with jackknife classification in an attempt to predict academic attrition using AFQT scores, demographic information, and performance on the cognitive assessments.

RESULTS: Eighty-eight percent of the academic attrition rate occurred during the first of three learning units. Thus, the model results focused on Unit 1 attrition. Using importance estimates, we reduced our dataset from over 100 variables to a much smaller subset of six variables that were contributed by AFQT score and n-back. The model fit of the best model was MCC = 0.35 which we determined was acceptable for such a small dataset. The model was much more accurate at predicting academic success (.86) than academic attrition (.47).

CONCLUSION: Overall the results suggest the current screening and a measure of attention are useful in predicting training success; however, predicting attrition was much more difficult due to the small sample size and similarity in the parameters between those who failed Unit 1 and those who passed. We believe this model can be improved by using a larger sample size and measuring additional factors such as motivation and personality to determine their contribution to success in the AC A program.

POTENTIAL IMPACT: Together, the results may inform NATTC of supplemental screening materials that can be used to predict attrition and help reduce the duration and cost of training. However, any recommendations are made with extreme caution due to the limitations of our sample size.

SESSION AGENDA

System Safety/Health Hazards/Survivability

25 May | 1015-1200 | CAD B

Chairs: LTC Jay Clasing & Neil Ganey

1015-1020	**Introductions** Jay Clasing, Neil Ganey – SubTAG Chairs
1020-1040	**Evaluating relationships between active and latent human error in aviation mishaps and hazards** Andrew Miranda - Naval Safety Center
1040-1100	**Effects of Low Frequency Sound on Aircrew** Christine Brown, Kristen Semrud - Naval Air Warfare Center Aircraft Division
1100-1120	**Development Test and Evaluation (DT&E) Bottle Liquid Scanner** Mike Barrientos - Department of Homeland Security
1120-1140	**A case study on the effect extreme environments can have on manned shelters when not properly designed to be manned** Leticia Pacheco - Army Research Lab, Human Research and Engineering Directorate
1140-1200	**Discussion & Closing Remarks** Jay Clasing, Neil Ganey - SubTAG Chairs

ABSTRACTS

Evaluating relationships between active and latent human error in aviation mishaps and hazards

Andrew Miranda
Naval Safety Center

The DoD Human Factors Analysis and Classification System (HFACS) is the standardized taxonomy used to classify human error identified in mishaps and hazards. Among its primary purposes are identifying specific error tendencies (classified as active failures, known as Unsafe Acts) and how mistakes often result from difficult working conditions shaped by higher-level influences (classified as latent failures, known as Preconditions, Supervision, and Organizational Influences). For example, a hard landing may be the result of an aviator not following procedures (unsafe act). But that occurred because critical information was not communicated (precondition), and it was influenced by inadequate risk assessment (supervisory) and organizational culture (organization).

We applied a conditional probability methodology for analyzing relationships between active and latent failures. Instead of counting frequencies of certain factors associated with certain severity levels, we wanted to know if there were more meaningful relationships between the HFACS tiers. Our primary research questions were, "What latent factors have the strongest influence on the probability of unsafe acts?" and "Does influence change depending on severity level?" A common and advantageous approach to questions of uncertain probabilities is to use Bayes' Theorem. This lets us minimize misinterpretations that would arise if we simply counted the factors or calculated overall probabilities, because Bayes' Theorem considers the prior occurrences of both active and latent failures. This technique is often used in health care to correct for false positives within medical tests. We applied Bayes' Theorem to historical HFACS data from 2011 through 2016 among all Naval and Marine Corps aviation Class A through D mishaps, plus hazard reports.

There are three ingredients needed to calculate a Bayesian probability from HFACS data, all of which are captured across the repository of safety reports: probability of the unsafe act, probability of the latent failure, and probability of the latent failure given the unsafe act occurred. The resulting Bayesian probability indicates how much the latent failure influences the likelihood of the unsafe act. The results allow us to determine the relationships between latent factors and unsafe acts, as well as potential differences across severity levels.

There were two key findings. First, we found that some latent factors have greater influence on likelihood of unsafe acts and that influence changes depending on severity level. For example, Climate/Cultural Influences produced higher probabilities

of Performance-Based Errors in hazard reports and minor Class D mishaps, but have stronger influence on Judgment/Decision-Making Errors in more severe Class A and B mishaps. Our second finding was outside the Bayesian analysis and more revealing of potential deficiencies within the HFACS reporting system. We found an overall reporting disparity between HFACS tiers, and that active failures are much more likely to be reported than latent failures, particularly as severity increases. The important takeaways from this project are that 1) failures within certain latent factors can take different paths to disaster, depending on severity level, and 2) a potential need to assess the strengths and weaknesses of the HFACS reporting system.

Effects of Low Frequency Sound on Aircrew

Christine Brown, Kristen Semrud, Dennis Gordge
Naval Air Warfare Center Aircraft Division

Background: The Naval Air Warfare Center Aircraft Division (NAWCAD) has experienced an increase in the number of physiological episodes reported from fleet aviators flying jet aircraft. Many of these events occur at altitudes that do not require supplemental oxygen and have no reported failures or malfunctions. In addition to examining traditional root causes such as inadequate oxygen, oxygen contamination, and cabin pressurization issues, NAWCAD is exploring alternative causes that could result in aircrew experiencing symptoms that they would attribute to hypoxia. Previous research (Bolin et al, 2011; Jeffery et al, 2013) has demonstrated that low frequency sound or infrasound, such as that created by wind turbines, can produce physiological effects such as nausea, dizziness, headache, and fatigue which are similar responses to hypoxia. The same frequencies produced by wind turbines can be produced by jet engines; however, no research had been done to determine whether jet engines create similar physiological effects on pilots. The NAWCAD Protection and Sustainment team conducted this study to investigate low frequency sound as one possible alternative root cause for aircrew experiencing hypoxia-like symptoms.

Methods: This study hypothesized that low frequency sound in F/A-18 and T-45 aircraft can result in a physiological response that can be confused with hypoxia. Phase I of this study collected acoustic data in the cockpits on an F/A-18C, F/A-18F, and T-45C between August and November 2015. The pilot and co-pilot, in the case of a two seat platform, wore microphones installed on both shoulders of their safety vest to record low frequency sound pressure levels while executing typical maneuvers of the given platforms at various altitudes. Phase II was conducted in August–September 2016 in the Auditory Performance Laboratory at the Naval Air Station Patuxent River to determine the physiological response to infrasound between 1Hz and 20Hz with in-lab human

subject testing. The presence and extent of the physiological response was measured by SYNWIN psychomotor task battery performance, a vision test, and a physiological self-assessment.

Results: The analysis of Phase I data revealed the presence of infrasound on all three aircraft; however, physiological responses were not collected during this phase. For Phase II, self-assessment forms, composite SYNWIN task battery scores and visual acuity assessments were compiled for each subject group exposed to both pink noise and infrasound. No significant trend was observed in the composite scores for the subjects in relation to the low frequency sound.

Conclusion: Due to a lack of discernible differences between infrasound exposures and pink noise exposures, the study concluded that infrasound is not the cause of increased physiological episodes reported at altitudes that do not require supplemental oxygen. Future studies could be considered regarding low frequency vibrations as an alternative cause of hypoxia-like symptoms.

Potential impact to mission/warfighter: NAWCAD Protection and Sustainment team continues to research physiological episodes reported with hypoxia-like symptoms at altitudes that do not require supplemental oxygen.

Development Test and Evaluation (DT&E) Bottle Liquid Scanner

Janae Lockett-Reynolds, DHS/Science & Technology/Capability Development Support/Office of Systems Engineering/HSI, Mike Barrientos, DHS/Science & Technology/Capability Development Support/Transportation Security Lab, Thomas Malone, DHS/Science & Technology/Capability Development Support/Office of Systems Engineering/HSI

Development Test and Evaluation (DT&E) conducts various test activities for Bottle Liquid Scanner (BLS) Program at the Transportation Security Laboratory in Atlantic City, NJ as part of the developmental lifecycle process for such systems. The presentation will cover the historical timeline of the BLS program, DT&E objectives for BLS, system description of BLS systems tested at the lab, and tests activities conducted by team. These activities include the recent collaboration of efforts with the Human Systems Integration (HSI) Branch a component branch of the Capability Development Support Division of DHS. The role of HSI for BLS is to include the end-user perspective by conducting usability analyses for the development of BLS systems.

ABSTRACTS

A case study on the effect extreme environments can have on manned shelters when not properly designed to be manned.

Leticia Pacheco
Army Research Lab, Human Research and Engineering Directorate

Weapon systems and Warfighters often find themselves deployed to locations with harsh environmental conditions, i.e., extreme hot or cold temperatures, and extremely dry or humid environments. This can present unique challenges not only for the equipment, but for the Warfighters who are subjected to these harsh conditions while operating, maintaining, and sustaining the equipment. Many times, these unique challenges do not become apparent until the system is operated in the extreme environmental conditions consistently, over an extended period of time. While every attempt is made during test and evaluation to capture these unique challenges, data is best collected from an operationally realistic environment representative of the deployment site. Two months of temperature data from inside a manned shelter was collected during some of the hotter months of the year for the Gulf Region and was analyzed. The analysis revealed that temperature in the shelter surpassed the upper temperature limit of 85° and reached to temperatures that ranged between 90° to 100° consistently for a significant portion of every day over the two month period. Contractor support personnel had implemented administrative controls with a rotation policy that called for their personnel to rotate out after an hour of exposure. Warfighters were encouraged to do the same, however they rotated out every two hours depending on their personnel situation. Moreover, because the shelter was not designed to be manned, the shelter did not have a thermostat for temperature regulation, i.e. air conditioning or heating, and dehumidification purposes, as required by MIL-STD-1472. The ability to regulate temperature in manned shelters is critical to ensuring Warfighters are provided a safe working environment; a workspace free from exposure to extreme heat or cold. While administrative controls, i.e. rotating out personnel to limit exposure, can be an immediate response to minimize the effect, it is not a long term solution. Implementing an administrative control policy assumes manpower availability is sufficient to enforce the policy. Furthermore, it transforms a design issue to a manpower issue, and does not address the root cause. This places an undue burden on an already strained or limited work force, essentially making the administrative control policy unfeasible. Work environments that expose Warfighters to extreme heat or cold, can lead to injury and or death, and can negatively affect Warfighter vigilance and performance if not addressed adequately.

SESSION AGENDA

Tech Society/Industry

24 May | 0700-0750 | CAD B

Chairs: Barbara Palmer & Steve Merriman

0700-0705	**Introductions** Barbara Palmer, Steve Merriman – TSI Chairs
0705-0715	**SAE International G-45 Committee Developing HIS Standard for DoD Use** Steve Merriman - SCMerriman Consulting LLC
0717-0727	**Bridging the Documentation-Implementation Gap: Tailoring HFE Activities for Incrementally Fielded Software Programs** Frank Lacson, Ana Borja - Pacific Science & Engineering Group
0729-0739	**Human Readiness Assessment: A Multivariate Approach** H.C. Neil Ganey - Northrop Grumman Aerospace Systems
0741-0750	**Human-System Integration and the Problem of Assured Human Control Authority over Autonomous Systems** Steven Harris - INCOSE/Jenius LLC

ABSTRACTS

SAE International G-45 Committee Developing HSI Standard for DoD Use

Stephen Merriman
SCMerriman Consulting LLC

Background: DODD 5000.01 and DODI 5000.02 have required Human Systems Integration on major acquisition programs since April, 2013. There is currently no program guidance available for prime contractors in implementing HSI on major system acquisition programs. This standard is intended to provide this guidance. The standard is intended to augment the HSI Program Plan DID and HSI Report DID, which were previously authored by the SAE International G-45 committee.

Methods: More than 20 subject matter expert teams were formed in mid-2016 to author individual sections of the new standard. Following drafting, all sections will be reviewed for appropriateness, level of detail, and writing style. Following assembly of a first complete draft in May 2017, a senior review group composed of military service, academia and industry experts will review and comment. The standard will be revised in accordance with comments, and will then be subjected to SAE balloting, DOD assessment and approval for use. This presentation will provide a description of the standard, individual sections and overall project status.

Results: As of the May 2017 TAG meeting, standard sections should be drafted and integrated. Beginning in late May 2017, a senior review group will assess the standard and provide comments.

Conclusions: This will be the first HSI standard generally applicable to defense systems. It should provide significant assistance to the DOD in communicating HSI requirements to industry. However, there is still more work to be accomplished. The DoD needs additional standards in four HSI domain areas: manpower, personnel, habitability, and force protection and survivability; without these standards, the overarching HSI standard will be only partially effective.

Potential impact to mission/warfighter (if applicable): Implementation of this standard will help to assure a minimum standard of Human Systems Integration on future defense programs. This should serve to improve operator, maintainer and supporter effectiveness and performance while minimizing personnel-driven ownership costs.

ABSTRACTS

Bridging the Documentation-Implementation Gap: Tailoring HFE Activities for Incrementally Fielded Software Programs

Frank Lacson, Pacific Science & Engineering Group, Ana Borja, Space and Naval Warfare Systems Command, Matthew Risser, Pacific Science & Engineering Group, John Gwynne, Pacific Science & Engineering Group

DoD Instruction 5000.02 (Operation of the Defense Acquisition System) describes system acquisition models beyond the classic model (Model 1: Hardware Intensive Program). Of interest in IT systems is Model 3: Incrementally Fielded Software Intensive Programs. However, many of the current HFE and HSI tools, processes, and best practices have been developed to be effective within the constraints of waterfall software development, where requirements, software development, and user testing are conducted serially. Adapting HFE for agile software development – where requirements, engineering, and user testing occur in parallel builds – requires tailoring of analyses and methods towards compressed acquisition schedules and frequent coordination with system stakeholders. Opportunities and challenges also exist for those conducting System Engineering Technical Reviews (SETRs), as reviewers standardize the guidance and expectations for HSI-related systems engineering documents.

This presentation describes a technical approach and process intended to address gaps in HFE/HSI documentation and implementation in Navy IT systems (i.e., programs in PEO C4I and PEO EIS). This process contains of a list of HFE activities and products compiled from a comparative analysis of best practices and lessons learned from relevant efforts. Two use cases (HFE Practitioner and SETR Oversight) demonstrate the preparation and execution activities for one of the two Model 3 SETRs used in SPAWAR: Build Technical Review (BTR) and Fielding Technical Review (FTR). Although originally intended for Navy IT systems, the authors welcome feedback and insight from other Services and similar hardware-focused efforts (e.g., Rapid Acquisition). Feedback from practitioners from other HSI domains is also appreciated, as this process shifts from an HFE to an HSI-wide solution.

For HFE and HSI Practitioners, effective tailoring of analyses spreads the impact to a wider set of systems stakeholders such as Architecture, Requirements, Testing, and Training. This is especially useful for systems spanning across multiple increments (e.g., development in Increment 1, requirements in Increment 2). For the Warfighter, providing early operational feedback on properly scoped capabilities sets reasonable expectations while promoting acceptable system acceptance and suitability. For Technical Warrant Holders and those conducting SETRs: improved clarity of HFE-related entrance and exit criteria that reduces programmatic Risks and Issues.

ABSTRACTS

Human Readiness Assessment: A Multivariate Approach

H.C. Neil Ganey, Andre Garcia, Jeff Wilbert
Northrop Grumman Aerospace Systems

Technology Readiness Levels (TRL) are a framework, originally created by NASA and later adopted and tailored by the US Department of Defense (Graettinger, Garcia, Siviy, Schenk, Van Syckle, 2002) to track the progress and maturity of a given technology. There are a number of derivative readiness level frameworks that have spun off the original TRL framework such as System Readiness Levels, Software Readiness Levels, Integration Readiness Levels, and Manufacturing Readiness Levels, just to name a few. Most of the time, these frameworks have an associated readiness assessment used to identify or assess the precise readiness level status. Human Readiness Levels (HRLs) are a framework used to identify the level of readiness or maturity of a given technology as it relates to its usability and its refinement to be used by a human(s) (Phillips, 2010; O'Neil, 2014). There are a number of HRL frameworks or similar (e.g. Human Factors Readiness Levels), yet little attention has been paid to how these technologies are actually evaluated for readiness. The purpose of this paper is to review the literature of Human Readiness Levels and introduce a new multivariate Human Readiness Assessment that emphasizes workload, situation awareness (SA), and usability.

Human-System Integration and the Problem of Assured Human Control Authority over Autonomous Systems

Jennifer Narkevicius, INCOSE/Jenius LLC, Steven Harris, Rational LLC

This topic was introduced in the TS/I Subgroup meeting at HFE TAG 70 in Langley, VA. This talk will briefly report on progress related to the topic and invite follow-on discussion with interested parties from TS/I. The topic responds to an identified gap in technical guidelines to industry for meeting requirements specified in DOD Directive 3000.09, dated 21 Nov 2012, which establishes policy and assigns responsibilities for the design, development, acquisition, testing, fielding and employment of autonomous and semi-autonomous weapons systems. For purposes of the HFE TAG, DODDIR 3000.09 requires that autonomous weapons systems will (a) function as anticipated; (b) complete engagements in a timeframe consistent with commander/operator intent, or seek human input; (c) be sufficiently robust to minimize unintended engagements or loss of control to adversaries; and shall incorporate hardware and software designed with

appropriate human-machine interfaces and controls to achieve these goals. The purpose of this presentation is to invite TS/I members to examine the challenges of autonomous systems – particularly those that incorporate some form of intelligence – with the goal to identify requirements for effective technical solutions to meet the mandate.

After this topic was introduced at HFE TAG 70, discussions continued among members of the TS/I Subgroup and with other interested parties – notably DARPA, the Robotics and Autonomous Systems (RAS) study group of the Eisenhower School of the National Defense University (NDU), and the Institute for Human and Machine Cognition.

This issue is currently seen by some as a policy question, rather than a technical or technology question. Ongoing studies at NDU have identified a significant and increasing technology gap in the US computing technology base, compared with that of China. This gap is examined in light of a call by neuroscientist Sam Harris, in a June, 2016, TED Talk, for a "Manhattan Project." In a similar vein entrepreneur Elon Musk recently announced that he has formed a new start-up company to develop a direct neural lace human-computer interface, following on an earlier announcement on the formation of an OpenAI initiative to develop an artificial general intelligence (AGI). Taken together, Musk's announcements would seem to reflect accelerating emergence of a cyborg-like technology base. DARPA has announced an ongoing effort called Offensive Swarm-Enabled Tactics (OFFSet) to address a technical gap – US forces lack the technologies to manage and interact with swarms of robotic systems and the means to quickly develop and share swarm tactics suitable for application in diverse, evolving combat situations. These developments in the public discourse reflect clear and present challenges to policy, practice and the technology base of HFE/HSI.

Autonomous systems will continue to evolve with increasing authority to execute more complex missions. Properly configured, such systems will serve as significant force multipliers. Improperly configured, such systems could easily represent a significant vulnerability

SESSION AGENDA

Training

23 May | 1300-1445 | CAD B

Chairs: Jen Pagan & Kelly Hale

1300-1325	**Human Factors Training for Nonpractitioners** Judi See - Sandia National Laboratories
1325-1350	**Training Needs Analysis of a Multiteam Systems Aviation Capability: Development of a Multi-level Framework** Andrea Postlewate - StraCon Services Group, LLC.
1350-1405	**An Architecture for Big Data in Navy Maritime Patrol Training & Operations: The Post Mission Assessment for Tactical Training & Trend Analysis (PMATT-TA) System** John Killilea - NAWCTSD
1405-1430	**Utilizing Big Data to Inform Pilot Models of Precision Landing Mode to Advance Fleet Training Systems** Alexis Neigel - Naval Air Warfare Center Training Systems Division
1430-1445	**The Task Process Factor Tool (TPF) - Knowledge Management System - Process and Analytics to ensure performance improvement** Dan Liddell - Department of Homeland Security

ABSTRACTS

Human Factors Training for Nonpractitioners

Judi See
Sandia National Laboratories

Background: Sandia National Laboratories conducted a pilot study of a novel approach for human factors training and awareness in 2015-2016. The approach was designed for nonpractitioners who are responsible for meeting DOE O 452.2 safety requirements during assessments of nuclear explosive operations in the Nuclear Security Enterprise. The most recent update of the order in January 2015 includes more rigorous and comprehensive human factors requirements throughout the entire lifecycle of nuclear explosive operations. However, very few of the staff involved in safety assessments for nuclear explosive operations have a working knowledge of human factors.

Methods: The approach involved developing one-page descriptions of 18 fundamental human factors topics. One topic per month was distributed to the pilot study participants via e-mail. Each topic consisted of four basic elements: (1) real-world example to convey the consequences of failure to incorporate human factors, (2) core concepts for that particular topic, (3) relevance of the topic specifically for nuclear explosive operations, and (4) references for additional information. The principal investigator collected feedback from recipients after the last topic was distributed in June 2016.

Results: Feedback indicated the approach was successful in generating awareness of the value and applicability of human factors. All of the participants applied the information from one or more topics on the job during safety assessments. By the end of the pilot study, most respondents rated their current knowledge of human factors as “somewhat” to “much” better, stating they were now aware of a broader range of human factors concerns.

Conclusions: Pilot study participants viewed the approach very favorably. All four elements of each topic were critical to the success of the study. The approach is currently being expanded to include nuclear safety staff at other sites throughout the Nuclear Security Enterprise. As a result of feedback from the pilot study, the principal investigator developed a job aid that consolidates key points from the 18 topics into a single page. The job aid is designed to facilitate identification of human factors concerns during nuclear safety study observations and deliberations. The pilot study approach provides a model that could be used for human factors awareness and training for various other types of nonpractitioners.

Potential impact to mission/warfighter: Increased awareness regarding the importance of human factors is a critical step to enhance safety and mitigate failures during high-consequence nuclear explosive operations. Increased attention to human factors throughout the nuclear explosive operations lifecycle ultimately will be reflected in improved mission safety and performance at the Air Force and Navy sites where warfighters maintain nuclear weapons.

Training Needs Analysis of a Multiteam Systems Aviation Capability: Development of a Multi-level Framework

Betsir Zemen, Naval Air Warfare Center Training Systems Division, Andrea Postlewate, StraCon Services Group, LLC., Jennifer Paga, Naval Air Warfare Center Training Systems Division

Despite reliance on system-of-systems (SoS) aviation capabilities to support air-to-air missions, Navy training is often limited to the platform or unit level, where entire multiteam systems (MTSs) rarely practice and train at the integrated level. A MTS consists of two or more teams working together to achieve a common goal while simultaneously pursuing unique subteam goals (Zaccaro, Marks & DeChurch, 2012). For MTSs to perform effectively, team members must understand the capabilities and limitations of their own platforms, other platforms, and their inherent interdependencies. Team members are also challenged with being able to shift attention from within-platform to cross-platform activities based on environmental needs (Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005). Thus, a MTS perspective is required for effective training and evaluation of SoS aviation capabilities. This presentation will discuss the results of a training needs analysis for a SoS aviation capability at the MTS level. First, a domain analysis was conducted to understand the capability requirements through task identification, followed by a cognitive task analysis (CTA) to identify the knowledge, skills, and abilities needed to perform these tasks. The results from the CTA led to the development of a multi-level framework used to organize competencies, identify the level of origination of competencies, and specify how competencies manifest at each level of the MTS. Utilizing a multi-level framework facilitates a more robust analysis of the individual, team, platform, and MTS competencies required for successful execution of the SoS capability since individual or team level findings do not necessarily generalize to higher levels of the MTS (Klein & Kozlowski, 2000). This multi-level framework can be used as a model for future performance assessment and training evaluation of MTSs used to support air-to-air missions, and potentially assist other multiteam systems within the Navy.

ABSTRACTS

An Architecture for Big Data in Navy Maritime Patrol Training & Operations: The Post Mission Assessment for Tactical Training & Trend Analysis (PMATT-TA) System

John Killilea, Beth Atkinson, Mitchell Tindall
NAWCTSD

Background: In June 2010, the Navy's maritime patrol community recognized an urgent need. They lacked a centralized system to efficiently and objectively assess force-wide proficiency of mission skills. Current practice relies on post mission products and data calls to piece together an understanding of aircrew expertise and shortfalls. Yet, this this method is inherently flawed due to missing or incomplete data, biased data due to latency or human error and limitations, and a time consuming process resulting in outdated information.

Method: To address this need, a modular, web-based system was developed to increase data accessibility. The Post Mission Assessment for Tactical Training & Trend Analysis (PMATT-TA) system enables the capture of pertinent data to provide a comprehensive picture of aircrew proficiency. Specifically, PMATT-TA was designed to store tactically relevant mission data (e.g., environmental characteristics, expendables deployed), aircrew narratives that explain the context surrounding the mission, and aircrew qualification attempts. Due to its complexity, an iterative usability and feedback loop was established with the fleet to support incremental enhancements to meet full mission capabilities. A beta test period with a single Command Patrol Reconnaissance Wing was implemented over a six month period to allow for system refinement and development of a Concept of Operations.

Results: Since initial fielding, the system has met several maritime patrol community objectives. First, it has increased crew availability by a fourfold reduction in post mission reporting time. Specifically, qualitative reports indicate that post mission report time has been reduced from 4-6 hours down to approximately 30 minutes. Realizing this benefit required close interaction with fleet users during beta testing to identify areas for increasing usability and efficiency opportunities. After three software updates during beta testing to address key usability issues, reports from users indicated that the system was 200% more streamlined. Additionally, stakeholders requiring event-based data can access the information in real-time, often eliminating the need for official military message traffic. Furthermore, the system allows for collaborative data entry, resulting in a reduction of individual workload and increased tactical awareness throughout the community.

Conclusions: Successfully moving a research effort to transition in the fleet requires flexibility and a willingness to approach feedback as a dynamic process in which the system is a work in progress. Two additional objectives will be realized throughout FY17–18. First, improved access to both aircraft and simulator data will be enhanced when a capability to supplement observer-based grade sheets with automated performance measures is integrated within the simulation-based trainers. This capability will increase standardization and objective outcome metrics. Additionally, a capability is under investigation to capture aircraft data direct from the mission computer logs for import into the database. The second in-progress objective is to continuously enhance reporting capabilities to meet a range of outputs that facilitate post mission reporting requirements of the fleet.

Impacts: Initial results indicate time and workload reductions through the implementation of this centralized database management system. Ongoing work promises to impact the consistency and accuracy of data reported, while further reducing operator workload for post mission reporting. In general, this type of modular, automated system that links related tactical and performance information provides a means to reduce workload, to improve feedback quality, and to increase consistency of metrics for more meaningful trends. However, significant challenges remain to ensure that the outputs of the system remain relevant.

Utilizing Big Data to Inform Pilot Models of Precision Landing Mode to Advance Fleet Training Systems

Alexis Neigel, Heather Priest, Courtney McNamara
Naval Air Warfare Center Training Systems Division

Big Data is becoming pervasive in the development and transition of Naval training systems. In this presentation we will describe current Fleet training systems that utilize Big Data to inform the modeling of aircraft flying in Precision Landing Mode (PLM; formerly Maritime Augmented Guidance with Integrated Controls for Carrier Approach and Recovery Precision Enabling Technologies [MAGIC CARPET]) across several training simulators. PLM is software meant to improve carrier landing performance. While PLM has many benefits, such as increased safety and reduced costs, the early rollout (anticipated in fiscal years 2017 and 2018) of PLM has several implications for Fleet training. These include fewer opportunities for live flight training and a greater potential for mode confusion errors. However, these limitations can be overcome by increasing the amount of simulation-based training utilizing PLM. We conclude with a discussion on the role of Big Data in creating realistic models of aircraft with PLM

and how this increased fidelity can improve the training and performance of Fleet personnel, particularly those operating the flight deck.

The Task Process Factor Tool (TPF) - Knowledge Management System - Process and Analytics to ensure performance improvement

Dan Liddell
Department of Homeland Security

The TPF tool is a data and repository system that provides the necessary data collection capability to pinpoint performance results coupled with operational conditions. The tool is designed to identify performance when an employee is conducting a task to a specified standard (accuracy and speed). The tool supports testing and compliance capabilities across individual operator, supervisor, manager and senior manager levels. Output from the tool identifies the knowledge, skills and values required to successfully perform a job, and supports leadership in gaining insights into best practices or gaps that are deemed critical to the success of the overall security system. Unique features of the tool include the integrated scope of tasks that must be performed to ensure performance. Other key features include enhanced user interfacing, near real time communications to ensure there is learning spread rapidly across the work force, a process compliance and verification process f or mitigation of risks, comprehensive and multilayer metrics and insight into how equipment and capital should be allocated to ensure optimal people-machine interfacing. The tool when utilized in a disciplined performance improvement system, is designed to support data driven improvement strategies."

SESSION AGENDA

Trust in Autonomy Special Interest Group

24 May | 0800-0945 | CAD B

Chair: Lauren Reinerman-Jones

0800-0820	**Enhancing Assessment for Augmented Soldier and Team Performance** Clayton Burford - Army Research Lab
0820-0840	**Information Overload Mitigation Strategies Using Adaptive Automation** Daniel Cassenti - U.S. Army Research Laboratory
0840-0900	**Warfighter Evaluation of Threat: Optimization of Trust in an Autonomous Team-Mate** Gerald Matthews - University of Central Florida
0900-0920	**Developing and managing the unique relationships envisioned for future quantified warriors and their machine partners** Charlene Stokes - Air Force Research Laboratory/HMSS
0920-0945	**Chair Discussion** Lauren Reinerman-Jones – Trust in Autonomy SubTAG Chair

ABSTRACTS

Enhancing Assessment for Augmented Soldier and Team Performance

Joseph McDonnell, Dynamic Animation Systems, Clayton Burford, Army Research Lab, Kara Orvis, Aptima, Lauren Reinerman, University of Central Florida Institute for Simulation and Training (UCF IST), Mark Riecken, Trideum, Grace Teo, University of Central Florida Institute for Simulation and Training (UCF IST)

The U.S Army's Research Lab (ARL) seeks to develop and transfer discoveries and innovations to the fighting force to maintain supremacy, as well as improve individual and team performance. However, the effects and effectiveness of the innovations are not always determined appropriately. This is because historically labs independently manage assessment based on their own specific needs and circumstances. Additionally, the understanding of human dimension measurements and interpretations remains poorly defined and vague in the minds of many stakeholders. What is lacking is a consistent, uniform, and systematic approach to the assessments of many current and emerging innovations and interventions and their effects. A clear emphasis on scientific principles and a unified approach will enable decision makers to assess competing or complementary technologies free of bias and invalidity. For example, we believe establishing a common meaning for a given assessment "construct" tied to stakeholder needs and relevant to the assessment of the human dimension will be beneficial to the multi-lab community. Furthermore, unstandardized and unsystematic assessments make it difficult to compare technologies, challenges proper selection of assessment measures, and impacts the adequacy of assessment. ARL has established a collaborative multi-lab initiative to enhance assessment via the Unified Multi-modal Measurement for Performance Indication Research, Evaluation, and Effectiveness (UMMPIREE) project. The UMMPIREE project team has selected the initial focus area of Human Machine Teaming for applying our phased approach with an emphasis on trust in autonomy.

Information Overload Mitigation Strategies Using Adaptive Automation

Daniel Cassenti, U.S. Army Research Laboratory, Alexis Niegel, University of Central Florida

As the data-gathering capabilities of the U.S. military advance, Big Data (Mayer-Schönberger & Cukier, 2013) may be useful in aiding military personnel in decision-making. However, using Big Data to inform decision-making is not without its limitations. In this presentation we will discuss how problems of information overload (see Eppler & Mengis, 2004) may be overcome by integrating adaptive automation, which consists of software-provided aids meant to boost or maintain performance when

performance is in or nearing a decline. We will review the multi-level cognitive cybernetics (MLCC) approach (Cassenti, Gamble, & Bakdash, 2016) to adaptive automation and how this led to experimentation related to the optimization of timing and triggering adaptive aids. Specifically, we will address what the results of the experiments will indicate about the need for human control over the activation of aids. Is performance optimized when the user has complete control of adaptive aids or should the software be programmed to trigger at signs of difficulty? Furthermore, what measures should be used to indicate task difficulty? Is it best categorized as increased flow of information to the user, regardless of the user's responses, or should the software ignore the rate of information in deference to user behaviors? The proposed set of experimental studies will address these questions. We will discuss our paradigm for empirical investigation and any preliminary results available at that time. Big Data is at once a benefit for the availability of information, but also a detriment as information processing requirements make filtering through the data and using it for decision making difficult. We hope that our empirical investigative approach will help us to understand how to (1) mitigate problems associated with information overload and (2) make Big Data a benefit rather than a hindrance for the Warfighter.

Warfighter Evaluation of Threat: Optimization of Trust in an Autonomous Team-Mate

Gerald Matthews, University of Central Florida, April Rose Panganiban, Air Force Research Laboratory

Warfighters' capacity to recognize and counter threats during military operations will increasingly require working with autonomous systems such as robots and unmanned vehicles. These systems may have superior capabilities to humans in detecting and analyzing potential threats, including human threats. Autonomous systems may deploy an increasing range of sensors for both physico-chemical cues to threat and for psychological cues such as facial expressions indicating stress or aggression. The relevant technology has considerable potential for enhancing Warfighter effectiveness, but it also raises a number of interlocking human factors challenges. First, optimization of trust in autonomous "team-mates" is critical. However, as sensors and data processing software become more sophisticated, it is difficult for the human to calibrate trust appropriately. It is difficult to provide transparency into machine algorithms, for example. Second, accommodating autonomous system errors becomes challenging. It may be difficult to tell whether an error reflects a low-level sensor failure, high-level software deficiencies, or even whether an apparent error is really a machine failure at all. Discrepancies between human and machine evaluation of threat may on occasion result from the machine's superior threat analysis capabilities. Third, teaming with autonomous machines introduces novel forms of cognitive workload and stress on top of those inherent in military operations. The human must deal with increased levels of uncertainty over the machine's capabilities and decisions, as well as acknowledging limits to their situational understanding. Autonomous systems may become capable of evaluating human functioning, and modifying their functions adaptively, as a human team-mate would do. Such adaptive functions may threaten the human's sense of control and competence.

These various human factors challenges suggest a need for research that can inform system design and training strategies. We will outline the goals and methodology of a new collaboration between Air Force Research Laboratory and University of Central Florida that will contribute to such a research effort. Warfighters' attitudes towards autonomous systems will reflect their existing mental models for intelligent computer systems. We plan to investigate factors that may influence trust, in the military/security context, such as whether the machine is making a physics-based or psychological judgment of threat. We will utilize enhanced understanding of operator mental models in designing a simulated environment for investigating human trust in an autonomous system, in a scenario where the participant must team with an autonomous robot to patrol a small city to determine if terrorist activity is present. We will elaborate this methodology, and suggest future directions for application of improved understanding of trust in autonomous machine partners.

Developing and managing the unique relationships envisioned for future quantified warriors and their machine partners

Charlene Stokes
Air Force Research Laboratory/HMSS

Human-machine teaming is the foundation of the DoD's Third Offset Strategy. As with leading industry such as IBM, a new paradigm for machine or agent systems is symbiotic cognitive learning systems, where the human and agent collectively and seamlessly learn, adapt and collaboratively perform complex cognitive tasks instead of, or in addition to, procedural action-oriented tasks – The agent functions and is perceived as a teammate. The new vision for U.S. Army ground robotics is "robot as a member of the unit." The U.S. Airforce is targeting "synergistic airman-autonomy teams." The U.S. Navy's goal is a hybrid force of "heterogeneous unmanned/manned naval systems." These visions of the future go well beyond the traditional brittle automation paradigms with limited flexibility or consideration of human operators. As such, novel, multimodal, interdisciplinary, and systems-driven approaches are required. First and fundamentally, on the agent side, artificial intelligence, multi-agent systems, robotics, machine vision, natural language processing, speech technologies, human-computer interaction, social computing, user experience and interactive design are key areas of consideration. Second, greater attention will need to be given to the human side of the equation. As collaboration and teaming are social endeavors that require social-emotional (S-E) skills for optimal functioning, understanding, leveraging, and training for S-E skills will be critical for successful human- machine collaboration. Integration of theories and evidence from the behavioral, biological and social sciences such as cognitive science, neuroscience, physiology, social psychology, human factors and organizational psychology (teams and training) must be considered to achieve the future outlined in the Third Offset Strategy.

HMSS Mission: Optimize warfighter and autonomous system performance by harnessing the inherent social cognitive underpinnings of human-machine teams (HMT) through empirically validated and structured application of appropriate social cues (e.g., agent characteristics, team training, climate management).

Objective: Establishing validated metrics and guidelines through empirical research and development (R&D) efforts fusing social cognitive psychology, team, motivation and training research and theory in an HMT context – lab and applied R&D with fielded technology/COTS whenever possible. A multimodal approach is used as it is essential for the “sensory/perception” input to optimize machine learning algorithms and enable targeted augmentation or adaptation. Moreover, our purpose is to simulate the intelligent machine partner of the future and develop an understanding of how users perceive and respond to this much more intimate coupling with machines – a true human-centric approach to facilitate effective augmentation.

Impact: The largely unconscious, social affective cues of interaction have been relatively neglected, leaving a wide and critical gap in our understanding of HMT, which could result in untapped efficiency, effectiveness, trust, and use of future systems.

Initial Findings – Embedded social cues impact HMT dynamics with a virtual agent:

- Increased perceived ability to cope with the demands of the task.
- Stronger relationship between trust and reliance.
- Acceptance and belief in the value of physiological assessment.

SESSION AGENDA

Unmanned Systems

24 May | 1015-1150 | Auditorium

Chairs: Tom Alicia & Laura Milham

1015-1020	**Introductions** Tom Alicia, Laura Milham – Unmanned Systems SubTAG Chairs
1020-1045	**Successful UAS Integration within Multi-Jurisdictional Areas** Tiffany Vinson, John Valencia - City of San Diego, Office of Homeland Security
1050-1115	**Human-Autonomous Agent Teaming: Improving Teamwork Outcomes with Team Building Interventions** Patrick Mead - U.S. Air Force
1120-1145	**The Impact of Dynamic Multi-vehicle Autonomy and Advanced Pilot/Vehicle Interface Design on Manned-Unmanned Teaming (MUM-T) Operations** Grant Taylor - U.S. Army Aviation Development Directorate
1145-1150	**Closing Remarks** Tom Alicia, Laura Milham – Unmanned Systems SubTAG Chairs

ABSTRACTS

Successful UAS Integration within Multi-Jurisdictional Areas

Tiffany Vinson, City of San Diego, Office of Homeland Security, John Valencia, City of San Diego, Office of Homeland Security, Matthew Miller, San Diego Law Enforcement Coordination Center

The City of San Diego encompasses 372.4 square miles, 1.39 million residents, the largest international land border crossing in the world, an international airport with its own State-chartered jurisdictional authority, a port with its own State-chartered jurisdictional authority, two regional airports, and is home to Navy Region Southwest, Naval Base San Diego, Naval Base Point Loma, MCAS Miramar, MCRD San Diego, US Coast Guard Sector San Diego, and is located near MCAS Pendleton, 32nd Street Naval Base, and Naval Base Coronado. With levels of government and interests overlapping within a single area, coordination can quickly become difficult. The demand for airspace is high in San Diego, and has grown since the recent proliferation of civilian-operated unmanned aircraft systems. Absent clear policies and messaging, human factors can result in careless and reckless use. The multi-jurisdictional demands for safety and security in the region are complex, and recklessly-flown unmanned aircraft systems can result in unnecessary activation of force protection measures. Given the recent tactics and techniques utilizing unmanned systems promoted and used by Foreign Terrorist Organizations (FTOs), specifically IS, the need for clear policies and messaging to the public for safe operation is needed to help law enforcement more clearly identify harmless civilian users versus malicious actors.

The City of San Diego Office of Homeland Security initiated an internal UAS working group to discuss issues within the jurisdiction. It became immediately clear that a single-agency solution would not only fall short of meeting the needs of residents and public agencies, but would result in confusion and possible patchwork of policies throughout the region. The decision was made to include regional partners to provide a broader view of issues and collaborate on a single solution. A policy was developed, shared with regional partners, and all local agencies within the county are encouraged, and have shown interest in, adopting the same or similar to account for human factors. The UAS policy and regional coordination results in greater public education and compliance with FAA UAS rules and regulations. As a result, local air traffic control towers, including military bases, will likely see a reduction in inappropriate use of airspace and can develop Letters of Authorization with user groups and streamlined response systems to unmanned system notifications to the tower. This presentation discusses the concept of utilizing public policy and messaging to mitigate the risk of human error resulting in security breaches or unnecessary activation of mission assurance force protection measures.

ABSTRACTS

Human-Autonomous Agent Teaming: Improving Teamwork Outcomes with Team Building Interventions

James Walliser, U.S. Air Force, Patrick Mead, Naval Surface Warfare Center Dahlgren Division, Tyler Shaw, George Mason University

Human interaction with technology is fundamentally social (Nass, Steuer, & Tauber, 1994). This claim is supported by the Computers Are Social Actors (CASA) paradigm which suggests that humans can be induced to treat a computer with the same social rules and dynamics that guide human-human interactions (Nass, Fogg, & Moon, 1996). The military is continuing to explore concepts that will increase the presence of autonomous agents on the battlefield and moving toward a teammate paradigm (e.g. Manned-Unmanned Teaming (MUM-T), the Loyal Wingman) (Dept. of Air Force RPA Vector, 2013). Recent research has shown that a team structure between a human and an autonomous agent can support improved affect and performance relative to a non-team structure (Walliser, Mead Shaw, 2016).

Social psychologists define teams as interdependent social groups with shared identity and goals (Salas, Dickenson, Converse, and Tannenbaum, 1992). However, much of the research in human-autonomous agent teaming, has focused on the design characteristics of the autonomous agent and failed to account for social interaction between teammates. The underlying social framework that guides behavior is an overlooked factor that may play an important role in supporting effective human-autonomous agent teams. Research has shown that human teams, even those comprised of experts, are not guaranteed to be effective (Salas, Sims, & Burke, 2005). Successful teams often require focused team building interventions which can foster improved social interactions. In this study, participants played a serious game called Strike Group Defender (SGD) to explore social interactions between humans and autonomous agents. Participants completed a missile defense scenario while interacting with a human or autonomous teammate. Participants that received the team building intervention completed a goal setting and role clarification exercise. Those that did not receive the team building intervention played a cooperative puzzle game. Both the human and autonomous teammates were operated by a human confederate. Results indicated that the building intervention improved affect toward the teammate, increased the likelihood of adaptive teamwork behaviors, and led to higher performance scores. These findings can complement work focused on the design characteristics of autonomous teammates. Furthermore, it suggests that when autonomous agents are framed as teammates, effectiveness can be improved by addressing the underlying social interaction between humans and autonomous teammates.

ABSTRACTS

The Impact of Dynamic Multi-vehicle Autonomy and Advanced Pilot/Vehicle Interface Design on Manned-Unmanned Teaming (MUM-T) Operations

Grant Taylor, Thomas Alicia, Terry Turpin
U.S. Army Aviation Development Directorate

Background. MUM-T is a military warfighting concept that teams manned aircraft with unmanned aerial systems (UAS). The intent is to increase situational awareness (SA) and survivability by positioning UAS downrange while the manned aircraft remains in a secure position. Recent fielding of the Army's AH-64E Apache has brought MUM-T from concept to reality, allowing Apache crewmembers to receive and control the sensor payload, weapons, and flight path of the teamed UAS. The current teaming ratio of manned to unmanned aircraft is one to one, with a goal to expand to multiple UAS by 2035.

Problem. Controlling multiple UAS without imposing excessive workload on the manned aircraft crewmembers requires the development of a new employment concept and cockpit design.

Methodology. A team of university researchers developed the algorithms that support autonomous UAS behaviors. A separate team of human factors researchers designed an advanced helicopter crewstation tailored to support MUM-T operations. These efforts combined to demonstrate in simulation that a single operator could control up to three UAS while executing realistic MUM-T scenarios with manageable pilot workload and SA. This research was an initial step in achieving the goal of a single operator controlling multiple UAS during MUM-T operations.

Autonomous UAS behaviors. The autonomous UAS behaviors were designed around an operational concept called Delegation of Control (DelCon). To execute this concept the manned aircraft crewmember calls a "play" like a coach, expressing his objective (e.g. "search area 3"), and each UAS under his control executes a set of complex behaviors with minimal human input. The "plays" that were demonstrated during this experiment included area reconnaissance, route reconnaissance, points of interest reconnaissance, and cooperative missile engagements of targets.

Crewstation design. The cockpit design was optimized for multiple UAS control and included a side-to-side glass cockpit with touchscreen interaction (displaying sensor video and a tactical map), a movable game-type hand controller with its own touch-screen display (for sensor manipulation and autonomy management), an aided target recognition system, and other advanced features.

Experiment execution. The experiment was conducted over a two day period per subject pilot. Eight military pilots flew four MUM-T missions teamed with one or three UAS, with or without autonomy support (a 2x2 within subjects design). Dependent measures included mission performance (e.g. total mission time, target detection rate, etc.), eye tracker data, subjective ratings of workload, SA, trust in automation, and interface usability, and an in-depth final debrief interview.

Experiment results. Objective and subjective test results demonstrate that the combination of autonomous behaviors and an improved cockpit design allows a single pilot to effectively manage up to three UAS while executing complex tactical missions with manageable workload, improved SA, and improved mission performance.

Impact on the warfighter. The capability to team a manned aircraft with multiple UAS assets will further enhance the benefits provided by current MUM-T systems: improved battlefield SA, mission productivity, and aircrew survivability. A combination of autonomous UAS behaviors and cockpit interface design is expected to facilitate teaming with multiple UAS assets while maintaining manageable pilot workload.

POSTER SESSION

23 May | 1140-1220 | Cafeteria

Cognitive Readiness SubTAG

Shelter Liner Acoustic Properties and Impacts on Solider Performance

Breanne Hawes
NSRDEC

Emerging energy efficient technologies are being evaluated as a part of the Army Strategic Energy Security Goal, which aims to reduce energy usage in Soldier operating bases. In shelters specifically, insulating shelter liners decrease heat transfer through walls. Several different liner materials are currently being evaluated based on energy savings and other specifications, but it is equally important to consider the effects of the technologies on Soldier behavior and cognition. More specifically, the effect of the shelter liner on sound in the shelter which may affect Soldiers' attention and concentration. Researchers at Natick Solder Research Design and Engineering Center are currently evaluating three shelter liners. The current evaluation consists of two phases, in-laboratory and in-field evaluation of liner acoustic properties. The in-laboratory phase consists of three studies looking at the effect of tone 1. frequency 2. amplitude 3. location on attention and specifically executive control. Study 1 and 2 are complete showing slight trends in the effects of varying tone properties. For the in-field phase, two of the liners have been evaluated based on interior tent properties (sound reflection) and exterior-interior tent properties (sound transfer and absorption). A data visualizer has been created to map the sound properties of the shelters equipped with different liners. This visualizer shows that one liner allows less sound transfer from outside-in than the other. The data from the two phases will be coupled to create predictive models to add to the evaluation and down-selection of shelter liners.

Controls & Displays SubTAG

Information sharing needs for operators in the Netted Navy

Alan Lemon
SPAWAR Systems Center Pacific

Reference C&D section for abstract.

POSTER SESSION

Cyber Security Special Interest Group

Operator situation awareness for cyberspace defense

Robert Gutzwiller
Space and Naval Warfare Systems Center Pacific

Reference Cyber Security SIG section for abstract.

Extreme Environments SubTAG

How Can We Reduce 50% of Transient Patient Monitor Alarms in the Neuro Intensive Care Unit?

Catriona Miller
U.S. Air Force School of Aerospace Medicine Department of Aeromedical Research

Reference Extreme Environment section for abstract.

HFE/HSI SubTAG

Big Data for the Coast Guard

Chris Kijora
U.S. Coast Guard

Abstract: How the US Coast Guard utilizes vast amounts of data to maintain SA

Background: Brief history of the USCG missions and assets…

There are a total of 211 aircraft in CG inventory. This figure fluctuates operationally due to maintenance schedules. Major Missions: Search/Rescue, Law Enforcement, Environmental Response, Ice Operations, and Air Interdiction. Fixed-wing aircraft (C-130 Hercules turboprops and HU-25 Falcon jets) operate from large and small Air Stations. Rotary wing aircraft (H-65 Dolphin and HH-60 Jayhawk helicopters) operate from flight-deck equipped Cutters, Air Stations and Air Facilities.

All vessels under 65 feet in length are classified as boats and usually operate near shore and on inland waterways. Craft include: Motor Lifeboats; Motor Surf Boats; Large Utility Boats; Surf Rescue Boats; Port Security Boats; Aids to Navigation Boats; and a variety of smaller, non-standard boats including Rigid Inflatable Boats. Sizes range from 64 feet in length down to 12 feet.

A "Cutter" is any CG vessel 65 feet in length or greater, having adequate accommodations for crew to live on board. Larger cutters (over 210 feet in length) are under control of Area Commands (Atlantic Area or Pacific Area). Cutters at or under 175 feet in length come under control of District Commands. Cutters, usually have a motor surf boat and/or a rigid hull inflatable boat on board. Polar Class icebreakers also carry an Arctic Survey Boat (ASB) and Landing Craft.

Methods: The USCG manages data sources from a wide range of assets and must focus on efficient consolidation methods.

Results: reliability of data, usability, successes, operator training/impacts

Conclusions: Areas of improvement(usability)….automation aids for tasks such as SAR missions/future research

Potential impact to mission/warfighter: The far reaching missions and workload intensive missions have great impacts on situational awareness, fatigue, crew rotation/manpower, error rates, and so much more.

Google searches: https://washingtontechnology.com/articles/2015/03/03/insights-okeefe-dhs-big-data.aspx

Coast guard assets: https://www.uscg.mil/datasheet/

Healthcare Special Interest Group

Big Data Challenge: Do Multiple Vital Sign Sensors Improve the Prediction of Emergency Blood Transfusion in Adult Trauma Patients?

Catriona Miller
U.S. Air Force School of Aerospace Medicine Department of Aeromedical Research

Reference Healthcare SIG section for abstract.

Operating Room Fire Risk Assessment: A Case-Controlled Study

Sarah Simpson
VA National Center for Patient Safety

Reference Healthcare SIG section for abstract.

POSTER SESSION

Application of Human Factors and Usability Engineering to Medical Devices Development and Review

Hanniebey Wiyor
Food And Drug Administration

Reference Healthcare SIG section for abstract.

Mixed Reality SubTAG

Building a Virtual Environment to Investigate Cooperative Teaming

Jamie Lukos
SPAWAR Systems Center Pacific

Reference Mixed Reality section for abstract.

Modeling & Simulation SubTAG

Big Data & Predictive Human Models

Steven Beck
SantosHuman Inc.

Reference M&S section for abstract.

Trust in Autonomy Special Interest Group

Trust in Automated Helicopter Landing Aids

Marc Pfahler
CSRA

Helicopter pilots are frequently required to land in challenging environmental conditions (e.g., brownouts, obstructed landing zones, pinnacle landing points, etc.). Advances in sensor technologies can now provide helicopter pilots with increasingly detailed spatial and temporal information about their aircraft's surroundings. The Human Insight and Trust (HIT) team of the Air Force Research Laboratories (AFRL) in collaboration with the Army AMRDEC Aviation Development Directorate are currently developing automated technologies aimed at assisting helicopter pilots with landings. These aids use sensor data (e.g., LADAR) to build a virtual 3-dimensional environment in real time and give pilots suggestions for safe landing zones (LZs). These systems will be supervised by the pilots who need maintain appropriate trust and reliance throughout the landing process.

We are currently preparing for an initial study intended to evaluate the factors that drive trust in these automated aids. This study will leverage the HIT team's in-house high-fidelity UH-60 helicopter simulator. The participants will conduct a series of landing trials using the automated landing aid technologies. We will collect a variety of metrics including performance, trust, reliance, workload, situation awareness, and usability questionnaires.

This effort will result in the development of automated landing aid technologies for degraded visual environments and obstructed landing zones. The feedback received from this study combined with future validation efforts are anticipated to help these landing technologies to transition for the US Army UH-60 A/L and the United States Air Force HH-60G/W CSAR helicopters. Additionally, the methodology from this research will be applied to other tasks where pilots interact with automation or autonomous systems as well as where calibrated trust and reliance are critical components.

EXECUTIVE COMMITTEE

Chair (Army)	Jeffrey Thomas	jeffrey.a.thomas132.civ@mail.mil
Vice Chair	Richard Arnold	richard.arnold.10@us.af.mil
Immediate Past Chair	William Kosnik	william.kosnik.1@us.af.mil
Army Representative	Dawn Woods	dawn.l.woods6.civ@mail.mil
Navy Representative	AJ Muralidhar	ajoy.muralidhar@navy.mil
Air Force Representative	John Plaga	john.plaga@us.af.mil
NASA Representative	Cynthia Null	cynthia.h.null@nasa.gov
FAA Representative	Vicki Ahlstrom	vicki.ahlstrom@faa.gov
DHS Representative	Janae Lockett-Reynolds	janae.lockett-reynolds@hq.dhs.gov
TS/I Representatives	Steve Merriman Barbara Palmer	scmerriman@tx.rr.com palmer_barbara@bah.com
VHA Representative	Tandi Bagian	tandi.Bagian@va.gov
Social Media Director	Rachael Lund	rachael.lund@navy.mil
TAG Mentors Lead	Allison Mead	allison.mead@navy.mil
OSD Proponent Rep	Bonnie Novak (Contractor)	bonnie.b.novak.ctr@mail.mil

CHAIR CONTACTS

SubTAG	Chair	E-mail Addresss
Cognitive Readiness	Joe Geeseman	joe.geeseman@navy.mil
Controls & Displays	Allison Mead	allison.mead@navy.mil
Controls & Displays	Marianne Paulsen	marianne.paulsen@navy.mil
Cyber Security Special Interest Group	Marianne Paulsen	marianne.paulsen@navy.mil
Cyber Security Special Interest Group	Lauren Reinerman-Jones	lreinerm@ist.ucf.edu
Cyber Security Special Interest Group	Ajoy Muralidhar	ajoy.muralidhar@navy.mil
Design Tools & Tech	Michael Feary	michael.s.feary@nasa.gov
Design Tools & Tech	Chelsey Lever	chelsey.lever@navy.mil
Extreme Environments	Rachael Lund	rachael.lund@navy.mil
Extreme Environments	John Plaga	john.plaga@us.af.mil
Healthcare Special Interest Group	Tandi Bagian	tandi.bagian@va.gov
HFE/HSI	Rebecca Iden	rebecca.iden@navy.mil
HFE/HSI	Elizabet Haro	elizabet.haro@navy.mil
Human Perf Measurement	Joe Mercado	joseph.mercado@navy.mil
Human Perf Measurement	Justin Stofik	justin.stofik.1@us.af.mil
Mixed Reality	Daniel Walker	daniel.walker@navy.mil
Mixed Reality	Joshua Kvavle	kvavle@spawar.navy.mil
Modeling & Simulation	Ranjeev Mittu	ranjeev.mittu@nrl.navy.mil
Modeling & Simulation	John Rice	john.rice@noboxes.org
Modeling & Simulation	Lee Sciarini	lwsciari@nps.edu
Personnel	Mike Natali	michael.w.natali.mil@mail.mil
Standardization	Al Poston	aposton86@comcast.net
Sustained Operations	Thomas Nesthus	tom.nesthus@faa.gov

CHAIR CONTACTS (CONTINUED)

SubTAG	Chair	E-mail Addresss
Sustained Operations	Nancy Wesensten	nancy.wesensten@faa.gov
System Safety/Health/Hazards/Survivability	Jay Clasing	jay.e.clasing.mil@mail.mil
System Safety/Health/Hazards/Survivability	Neil Ganey	neil.ganey@gmail.com
Tech Society/Industry	Steve Merriman	scmerriman@tx.rr.com
Tech Society/Industry	Barbara Palmer	palmer_barbara@bah.com
Test & Evaluation	Darren Cole	darren.cole.1@us.af.mil
Training	Kelly Hale	kelly@designinteractive.net
Training	Jen Pagan	jennifer.pagan1@navy.mil
Trust in Autonomy Interest Group	Lauren Reinerman-Jones	lreinerm@ist.ucf.edu
Unmanned Systems	Thomas Alicia	thomas.j.alicia.civ@mail.mil
Unmanned Systems	Laura Milham	laura.milham@navy.mil

PARTICIPANT CONTACT LIST

Abdeen, Elizabeth
Human Systems Engineer
Naval Undersea Warfare Center, Keyport
elizabeth.abdeen@navy.mil
360-315-3380

Acosta, Hector
Senior Personnel Research Analyst Headquarters
Air Force Recruiting Service
hector.acosta.2@us.af.mil
210-565-0308

Ahlstrom, Vicki
Technical Lead
Federal Aviation Administration
vicki.ahlstrom@faa.gov
609-485-5643

Alicia, Thomas
Engineering Research Psychologist
US Army Aviation Development Directorate
thomas.j.alicia.civ@mail.mil
650-604-3963

Allendoerfer, Kenneth
Branch Manager
Federal Aviation Administration
kenneth.allendoerfer@faa.gov
609-485-4864

Bagian, Tandi
Director, Human Factors Engineering Division
VA National Center for Patient Safety
tandi.bagian@va.gov
734-930-5888

Anderson, Dennis
Assistant Professor of Orthopedic Surgery
Beth Israel Deaconess Medical Center / Harvard Medical School
danders7@bidmc.harvard.edu
617-667-5380

Barrientos, Michael
Technology Lead
Department of Homeland Security
mike.barrientos@hq.dhs.gov
609-813-2765

Beck, Steven
President & CEO SantosHuman Inc.
steve.beck@santoshumaninc.com
319-333-0918

Besser, James
Human Systems Integration Branch Head
Naval Surface Warfare Center, Dahlgren Division
james.besser@navy.mil
540-653-9610

Biggs, Adam
Research Psychologist
Naval Medical Research Unit Dayton
adam.biggs.1@us.af.mil
937-656-2067

Borja, Ana
HSI Technical Warrant Holder
Space and Naval Warfare Systems Command
ana.borja@navy.mil
858-537-0506

*Participants listed granted permission to distribute information during registration and prior to April 21, 2017

PARTICIPANT CONTACT LIST

Bolinger, Regina
Scientific and Technical Advisor
FAA NextGen Portfolio Management & Advanced Technology Development
regina.bolinger@faa.gov
202-267-8828

Brevett, Carol
Principal Scientist
Chemical Security Analysis Center / Leidos
carol.brevett@st.dhs.gov
410-436-1761

Brown, Christine
Environmental Engineer
Naval Air Warfare Center Aircraft Division
christine.d.brown@navy.mil
301-342-8067

Bruno, Patricio
National Associate Medical Director for Training
VA/Simulation Learning and Research Network
drpgbruno@icloud.com
407-631-9514

Burford, Clayton
S&T Manager
Army Research Laboratory
clayton.w.burford.civ@mail.mil
407-208-3022

Burns, Cheryl
Engineering Psychologist
Army Research Laboratory
cheryl.a.burns12.civ@mail.mil
502-624-1607

Capers, Deidrick
Human System Integration Specialist
Millennium Corporation
deidrick.r.capers.ctr@mail.mil
803-378-7711

Cassenti, Daniel
Research Psychologist
Army Research Laboratory
daniel.n.cassenti.civ@mail.mil
410-278-5859

Chappell, Sherry
Scientific & Technical Adviser for Human Factors
Federal Aviation Administration
sheryl.chappell@faa.gov
202-267-8856

Chatelier, Paul
Research Associate Professor
Naval Postgraduate School
pchat@mindspring.com
831-601-7329

Cheng, Andrew
Research Engineer
Federal Aviation Administration
andrew.cheng@faa.gov
609-485-4904

Cole, Shannon
Intelligence Optimization Analyst
Transportation Security Administration
shannon.cole@tsa.dhs.gov
703-601-5345

Culver, Christine
Technical Editor and Writer
DHS Science and Technology Directorate Capability Development Support
christine.culver@associates.hq.dhs.gov
202-254-8933

Davis, Darrell
VP and Chief Process Improvement Officer
Xcelerate Solutions
darrell.davis@tsa.dhs.gov
630-362-5775

Curtis, Charles
Engineer
Undersea Warfighting Development Center
charles.t.curtis@navy.mil
860-694-2745

Diaz, Gabe
M&S Technology Lead
DoD M&S Coordination Office, OSD (AT&L)
gabriel.d.diaz.ctr@mail.mil
571-372-6670

Dischinger, Charles
Discipline Deputy for Human Factors
National Aeronautics & Space Administration
charles.dischinger@nasa.gov
256-544-9526

Dressel, Jeffrey
Engineering Psychologist
Transportation Security Administration
jeffrey.dressel@tsa.dhs.gov
571-227-4505

PARTICIPANT CONTACT LIST

Eibling, David
Physician
VA Pittsburgh Healthcare System
david.eibling@va.gov
412-360-6359

Erwin, Mike
Operations Analyst
Sonalysts, Inc
erwin@sonalysts.com
860-326-3679

Fuller, Helen
Biomedical Engineer
VA National Center for Patient Safety
helen.fuller@va.gov
734-930-5881

Ganey, H.C. Neil
Human Factors Engineer
Northrop Grumman Aerospace Systems
neil.ganey@gmail.com
321-586-8117

Garland, Charles
Systems Integration Engineer
Air Force Life Cycle Management Center Engineering Directorate
Charles.Garland@us.af.mil
937-656-9990

Gaskins, Ryland
Sr. Human Performance Optimization Specialist
ODASD Health Affairs - Health Readiness Policy and Oversight
ryland.c.gaskins2.ctr@mail.mil
703-681-8193

Goddard, Donald
Ergonomist
United States Army Public Health Center
donald.e.goddard.civ@mail.mil
410-436-2736

Garza, Ruben
Director, Defense Med Mod & Sim Office
DHA Education & Training Directorate
ruben.garza44.civ@mail.mil
210-896-3565

Geiselman, Eric
Engineering Research Psychologist
Air Force Research Laboratory
eric.geiselman@us.af.mil
937-255-8889

Greenwell, Brandon
Data Scientist
U.S. Air Force School of Aerospace Medicine
brandon.greenwell.1.ctr@us.af.mil
937-938-3132

Gutzwiller, Robert
Scientist
Space and Naval Warfare Systems Center Pacific
gutzwill@spawar.navy.mil
619-553-6002

Hall, Terri
Engineering Manager
Lockheed Martin
terri.l.hall@lmco.com
770-494-5458

Hamilton, Michael
Assistant Research Professor
Institute for Systems Engineering Research
michaelh@iser.msstate.edu
601-619-5133

Hardy, David
Division Chief
Air Force Operational Test and Evaluation Center
david.hardy.4@us.af.mil
505-846-1376

Hawes, Breanne
Research Psychologist
Natick Soldier Research, Development, and Engineering Center
Breanne.K.Hawes.civ@mail.mil
508-233-5123

Hernandez, Charles
Human Factors Specialist
Army Research Laboratory
charles.l.hernandez2.civ@mail.mil
580-442-5051

Higginbotham, Keith
Human Systems Integration
Advanced Development Programs,
Lockheed Martin Aeronautics
keith.d.higginbotham@lmco.com
817-777-6636

Hudson, Irwin
Science & Technology Manager
Army Research Laboratory
irwin.l.hudson.civ@mail.mil
407-384-5544

PARTICIPANT CONTACT LIST

Iden, Rebecca
Human Factors Engineer
Space and Naval Warfare Systems Center Pacific
rebecca.iden@navy.mil
619-553-8004

Johnson, Clifford
Human Systems Integration Analyst
Air Force Institute of Technology
clifford.johnson.6@us.af.mil
937-656-6679

Johnston, Derek
Human Systems Analyst
United States Air Force Human Systems Integration Office
derek.b.johnston.ctr@mail.mil
703-588-8486

Jones, Nathan
Manpower, Personnel & Training Lead
Marine Corps Systems Command
nathan.jones1@usmc.mil
407-381-8735

Kelley, Timothy
Scientist
Naval Surface Warfare Center, Crane Division
timothy.d.kelley1@navy.mil
812-854-4755

Kijora, Christian
Human Factors Engineer
United States Coast Guard
christian.a.kijora@uscg.mil
202-475-5092

Korbelak, Kristopher
Engineering Psychologist
Department of Homeland Security/Transportation Security Administration
kristopher.korbelak@tsa.dhs.gov
571-227-1645

Kosnik, William
HSI Analyst
Air Force Research Laboratory
william.kosnik.1@us.af.mil
719-554-3792

Krois, Paul
Manager
FAA NextGen Human Factors Division
paul.krois@faa.gov
202-267-1180

Lacson, Frank
Senior Human Factors Engineer
Pacific Science & Engineering Group
franklacson@pacific-science.com
858-535-1661

Larsen Quill, Laurie
Human Factors/Human Systems Psychologist
Human Factors Solutions LLC
llquill1234@gmail.com
937-287-3436

Lee, Xiaogong
Senior Technical Advisor
Aviation Research Division
xiaogong.lee@faa.gov
609-485-6967

Lemon, Alan
Human Systems Integration, Ux Design Engineer
SPAWAR Systems Center Pacific
alan.g.lemon@navy.mil
619-553-9226

Lohrenz, Maura
Chief, Aviation Human Factors Division
US DOT Volpe National Transportation Systems Center
maura.lohrenz@dot.gov
617-494-3459

Marion, Jill
Deputy Director, Office of Surveillance and Biometrics
Food and Drug Administration
Jill.Marion@fda.hhs.gov
301-796-6128

Matthews, Gerald
Research Professor
University of Central Florida
gmatthews@ist.ucf.edu
407-882-0119

Lockett-Reynolds, Janae
Deputy Director, Office of Systems Engineering, Human Systems Integration
Department of Homeland Security janae.lockett-reynolds@hq.dhs.gov
202-254-6611

Malone, Thomas
President
Carlow International Incorporated
thomas.malone@associates.hq.dhs.gov
703-444-4666

PARTICIPANT CONTACT LIST

Markiewicz, Jeff
Human Systems Integration Warfare Systems Integration Manager
Naval Sea Systems Command
jeffrey.markiewicz@navy.mil
202-781-1147

Mead, Patrick
Applied Research Scientist and Engineer
Naval Surface Warfare Center, Dahlgren Division
patrick.mead1@navy.mil
540-653-5186

Mead, Allison
Combat System Test
Naval Surface Warfare Center, Dahlgren Division
allison.mead@navy.mil
540-653-7347

Mentel, Karen
HSI Engineer
Naval Surface Warfare Center, Dahlgren Division
karen.mentel@navy.mil
540-653-7556

Merriman, Stephen
Human Systems Integration Specialist
SCMerriman Consulting LLC
scmerriman@tx.rr.com
214-533-9052

Milecki, Heather
Human Factors Engineer
Sonalysts, Inc.
hmilecki@sonalysts.com
703-412-9246

Milham, Laura
Senior Research Psychologist
Naval Air Warfare Center Training Systems Division
laura.milham@navy.mil
407-380-8230

Miller, Matthew
Private Sector Program Manager
San Diego Law Enforcement Coordination Center
Matthew.miller@sd-LECC.org
619-997-1441

Miller, Catriona
Director of Research Initiatives
Center for Sustainment of Trauma and Readiness Skills,
U.S. Air Force School of Aerospace Medicine
catriona.miller.1@us.af.mil
410-328-1959

Mitroff, Stephen
Associate Professor
The George Washington University
mitroff@gwu.edu
202-994-6912

Moralez, Ernesto
Lead, Human-Systems Interface Technical Area
Aviation Development Directorate
ernesto.moralez.civ@mail.mil
650-604-6002

Morrison, Don
Analyst
Transportation Security Administration
donald.morrison@tsa.dhs.gov
703-581-5728

Nass-Flores, Melissa
Biomedical Engineer, Human Systems Integration
Naval Surface Warfare Center, Dahlgren Division
melissa.nass-flores@navy.mil
540-653-4631

Natali, Michael
Aerospace Experimental Psychologist
Naval Aerospace Medical Institute
michael.w.natali.mil@mail.mil
850-452-2691

Neigel, Alexis
Post-doc
Army Research Laboratory
alexis.neigel@gmail.com
407-748-0730

Novak, Bonnie
Advisory Scientist
Strategic Analysis, Inc.
bonnie.b.novak.ctr@mail.mil
571-372-6433

Null, Cynthia
Technical Fellow, Human Factors
NASA Engineering and Safety Center
cynthia.h.null@nasa.gov
650-604-1260

O'Leary, Jennifer
Scientist
Naval Undersea Warfare Center, Newport
jennifer.oleary@navy.mil
401-832-4297

PARTICIPANT CONTACT LIST

Ogren, Lauren
Human Factors Engineer
Naval Undersea Warfare Center
lauren.ogren@navy.mil
401-832-7722

Orr, Sarah
HSI Engineer
711th Human Performance Wing
sarah.orr.1@us.af.mil
937-656-6502

Palmer, Barbara
Program Manager
Booz Allen Hamilton
palmer_barbara@bah.com
937-781-2803

Patrick, Darby
Human System Integration Lead
Lockheed Martin Aeronautics Company
darby.l.patrick@lmco.com
817-935-1030

Parham, Joseph
Research Anthropologist
Natick Soldier Research, Development and Engineering Center
joseph.l.parham2.civ@mail.mil
508-233-5787

Paulsen, Marianne
Human Systems Integrator
Naval Undersea Warfare Center, Keyport
marianne.paulsen@navy.mil
360-315-3410

Perron, Janet
Principal Human Factors Engineer
The MITRE Corporation
jperron@mitre.org
781-271-5243

Plaga, John
Supervisory Senior Aerospace Engineer
711th Human Performance Wing
john.plaga@us.af.mil
937-255-7577

Phillips, Hank
MILDEP for Research & Engineering (4.6)
Naval Air Warfare Center Training Systems Division
henry.phillips@navy.mil
407-380-4243

Plott, Christopher
Human System Integration Lead
Alion Science & Technology
cplott@alionscience.com
720-389-4524

Poston, Alan
Human Factors Engineer
Human Factors and Ergonomics Society
aposton86@comcast.net
410-922-7725

Purcell, Kevin
Ergonomist
United States Army Public Health Center
kevin.p.purcell2.civ@mail.mil
410-417-2833

Ramsay, John
Research Biomechanics Engineer
Natick Soldier Research, Development, and Engineering Center
john.w.ramsay4.civ@mail.mil
508-233-4496

Rice, John
DHS S&TD Modeling & Simulation Liaison
Department of Homeland Security
john.rice@noboxes.org
757-318-0671

Rippy, Lisa
Associate Director for Aeronautics
NASA Langley Research Center
lisa.o.rippy@nasa.gov
757-746-0755

Rodriguez, Ernest
Master Black Belt
Transportation Security Administration
ernest.rodriguez1@tsa.dhs.gov
202-304-8675

Rohrer, Randi
Technical Fellow-Human Factors Engineering/HSI
Boeing Defense, Space & Security
randi.m.rohrer@boeing.com
480-891-4214

Rubinstein, Joshua
Senior Research
Psychologist Army Research Laboratory
joshua.s.rubinstein.civ@mail.mil
410-278-5461

PARTICIPANT CONTACT LIST

Ruck, Julia
Human Systems Integration Lead
PM Distributed Common Ground System - Army
julia.k.ruck.ctr@mail.mil
443-861-2417

Savage-Knepshield, Pam
Research Psychologist
Army Research Laboratory
pamela.a.savage-knepshield.civ@mail.mil
443-395-2221

Schmorrow, Dylan
Chief Scientist
Soar Technology, Inc.
dylan.schmorrow@soartech.com
703-424-3138

Schnell, Tom
Professor/Director
University of Iowa
thomas-schnell@uiowa.edu
319-631-4445

Schultz, John
Head, Human Systems Engineering Branch
Naval Surface Warfare Center, Dahlgren Division
john.l.schultz1@navy.mil
540-653-2133

Scott, Rosalyn
Regional Director, Specialty Care Center of Innovation (West)
Veterans Health Administration
rosalyn.scott2@va.gov
562-826-8000

Seely, Rachel
Human Factors Scientist
Federal Aviation Administration
Human Performance Team
rachel.seely@faa.gov
202-267-7163

Schutte, Paul
Engineering Research Psychologist
Aeroflight Dynamics Directorate/Aviation
Applied Technology Directorate
paul.c.schutte2.civ@mail.mil
757-878-0123

See, Judi
Systems Analyst
Sandia National Laboratories
jesee@sandia.gov
505-844-4567

Severinghaus, Richard
CEO & Director
CRTN Solutions, LLC
rick@crtnsolutions.com
757-348-4709

Shaw, Brian
Senior Project Leader
The Aerospace Corporation
brian.e.shaw@aero.org
310-336-5134

Skujins, Romans
Systems Engineer
Air Force Life Cycle Management Center
romans.skujins@us.af.mil
937-656-9605

Smillie, Robert
President
Foundation for Professional Ergonomics
robert.smillie@cox.net
858-748-4385

Springs, Sherry
Human Systems Engineer
Naval Surface Warfare Center, Dahlgren Division
sherry.springs@navy.mil
540-653-9525

Smith, Katie
Coordinator-Human Sys Community of Interest
Strategic Analysis, Inc.
ksmith@sainc.com
703-797-4576

Stirling, Leia
Assistant Professor
Massachusetts Institute of Technology
leia@Mit.edu
617-324-7410

Stohr, Eric
Sr. Human Factors Engineer
Basic Commerce and Industries
eric_stohr@teambci.com
540-663-3321

Taylor, Grant
Engineering Research Psychologist
Army Aviation Development Directorate
grant.s.taylor.civ@mail.mil
650-604-1747

PARTICIPANT CONTACT LIST

Stokes, Charlene
Lead Systems Engineer
The MITRE Corporation
charlene.stokes@yale.edu
937-919-3778

Taylor, John
Human Factors Engineer
Northrop Grumman Corporation
johnktaylor3@gmail.com
321-361-2610

Thomas, Gina
Research Engineer
Air Force Research Laboratory
gina.thomas.2@us.af.mil
937-255-0813

Thomas, Jeffrey
Program Analyst
HQDA G-1 Human Systems Integration
jeffrey.a.thomas132.civ@mail.mil
703-695-5853

Trenchard, Michael
Electronics Engineer
Naval Research Laboratory
michael.trenchard@nrlssc.navy.mil
228-688-4633

Truitt, Todd
Engineering Research Psychologist
Human Factors Branch
todd.truitt@faa.gov
609-485-4351

Turpin, Terry
Military Operations Analyst/Project Pilot
Aviation Development Directorate
terry.s.turpin.ctr@mail.mil
650-604-5278

Valencia, John
Executive Director
City of San Diego, Office of Homeland Security
valenciaj@sandiego.gov
619-533-6765

Vinson, Tiffany
Homeland Security Coordinator
City of San Diego, Office of Homeland Security
tvinson@sandiego.gov
619-533-6765

Walker, Daniel
Human Resources Officer
Naval Supply Systems Command
daniel.walker@navy.mil
717-605-1132

Wallace, Daniel
HFE Technical Warrant Holder
Naval Sea Systems Command
daniel.f.wallace@navy.mil
540-653-8097

Whitehead, Cindy
Human Systems Engineer
Naval Surface Warfare Center, Dahlgren Division
cindy.whitehead@navy.mil
540-653-8257

Wenzel, Elizabeth
Research Psychologist
NASA Ames - Human Systems Integration Division
Elizabeth.M.Wenzel@nasa.gov
650-604-6290

Whitener, Connie
Operations Research Analyst - MANPRINT
U.S. Army Yuma Proving Ground
Connie.M.Whitener.CIV@mail.mil
928-328-6031

Wightman, Dennis
Senior Human Factors Engineer
Department of Homeland Security Science and Technology Directorate HSI Division
Dennis.Wightman@associates.hq.dhs.gov
561-704-2770

Wiyor, Hanniebey
Human Factors Regulatory Officer/Senior Assistant Engineer
Food and Drug Administration
hanniebey.wiyor@fda.hhs.gov
240-402-5121

Woods, Dawn
Human Factors Engineer
Natick Soldier Research, Development and Engineering Center
dawn.l.woods6.civ@mail.mil
508-233-5069

PARTICIPANT CONTACT LIST

Wilper, Barbara
Retired
Federal Aviation Administration
bwilper@verizon.net
703-765-4262

Woods, Mitchell
Senior Principal Human Factors Engineer
Deputy Assistant to the Secretary of Defense-Systems Engineering
Mitchell.a.woods.ctr@mail.mil
571-372-6553

Wynne, Kevin
Postdoctoral Research Fellow
711th Human Performance Wing
Kevin.Wynne.ctr@us.af.mil
937-656-4558

Yaeger, Daniel
Engineer
USARMY Communications Electronics R&D Engineering Center / BANC3, Inc.
daniel.r.yaeger.ctr@mail.mil
443-395-0866

Zimmerlin, Zachary
Human Factors Scientist
Booz Allen Hamilton
Zimmerlin_Zachary@bah.com
937-476-2371

Yuditsky-Mittendorf, Tanya
Research Psychologist
Federal Aviation Administration
tanya.yuditsky@faa.gov
609-485-5375

Ziriax, John
Research Psychologist
Naval Surface Warfare Center, Dahlgren Division
john.ziriax@navy.mil
540-653-3607