02 June 2016

Trip Report
Department of Defense
Human Factors Engineering Technical Advisory Group
(DOD HFE TAG) Meeting #70 – NASA Langley, Hampton, VA
09-13 May 2016

The 70th meeting of the DoD HFE TAG was held in Hampton, VA and hosted by the NASA Langley Research Center, Hampton, VA. The meeting was chaired by Dr. William Kosnik, Wright-Patterson Air force Base, OH (william.kosnik.1@us.af.mil)). The theme of the meeting was ***"System-level Solutions to support the Design, Integration and Use of Autonomy."*** Approximately 260 people attended this TAG meeting, representing the Office of the Secretary of Defense (OSD), Army, Navy, Air Force, NASA, FAA, Coast Guard, National Laboratories, Veterans Health Administration, Department of Homeland Security, several human factors-related technical societies and industry associations. Additional personnel representing government, industry and academia attended the meeting as invited speakers. Selected briefings from TAG-70 may be made available on the DoD HFE Tag website at a later date.

- DoD HFE TAG Background, attachment (1)
- TAG-70 Theme, Attachment (2)
- Program Summary, attachment (3)
- DOD HFE TAG attendees, attachment (4) (when available)
- DOD HFE TAG Policies, attachment (5)

MONDAY, 09 May 2016 Workshops, Special Sessions, Etc.

On Monday, The TAG sponsored a modeling and simulation workshop. A special session was also held, focusing on Autonomy. The DOD HFE TAG executive committee met and a new member orientation session was held.

TUESDAY, 10 May 2016

0800 Plenary Session - Welcome and Opening Remarks

Dr. Patrick Mason (OASD (R&D) Director, Human Performance, Training and BioSystems) welcomed the attendees to the 70th TAG meeting. He announced that Dr. Jeffrey Thomas would be the next TAG chair. The TAG now supported by the military services, NASA, FAA, DHS, as well as the newest supporter, the Veterans Health Administration. Dr. Mason indicated that DEPSECDEF Robert Work considers the "third offset strategy" to be "human-Machine Collaborative Combat Networks." The "pillars" of this initiative consist of Learning Machines, Human-Machine Collaboration research, Autonomous Weapons, Assisted Human Operations and Human-Machine Combat Teaming. Human-machine teaming is a very "hot" topic. The TAG's Mixed Reality SubTAG and the "Trust in Autonomy" Special Interest Group, and the CYBER Special Interest Group are addressing issues in this important area.

Dr. Bill Kosnik, TAG Chair, also welcomed the attendees. He summarized the modeling and simulation workshop and the Autonomy workshop, both held on Monday. He reviewed changes in the SubTAG composition and mentioned that the Sustained Operations (SUSOPS) SubTAG would be chaired by **Dr. Tom Nesthus** (FAA, CAMI). Also, the Test and Evaluation SubTAG would be chaired by **Darren Cole**.

Ms. Faith Chandler (NASA HQ Office of the Chief Technologist - Director, Strategic Integration) spoke on autonomy and focused her presentation on some of NASA's more interesting Space and Aeronautics missions. There are 10 NASA centers in the USA, with a $3 Billion annual budget. NASA employs 18,000 people directly and another 10,000 contractor personnel. The primary "exploration destinations" at NASA are currently the International Space Station (ISS) with 2-day one-way travel; the Moon with 3-7 day one way travel; LaGrange points with 8-10 day one way travel; an asteroid with 3-12 month one way travel; and Mars, with 6-9 month one way travel. NASA currently has 28 missions planned, with another 30 candidate missions on the books. A twenty-year roadmap is maintained for NASA, including technology development needs. NASA's executive council decides on which projects to pursue. NASA's TechPort web page contains additional information: http://techport.nasa.gov/home .

Dr. Robin Hemphill (VHA Chief, Patient Safety and Risk Awareness Officer) and **Tandi Bagian** (VHA Director, HFE, VA National Center for Patient Safety) spoke on "Intentionally Designing Healthcare." Human error in medicine remains the third most prevalent cause of death in the United States! The VHA's goal is to have a High Reliability Organization. The VHA is the largest integrated health organization in the US. It serves US veterans through 153 hospitals. It has a reporting system that handles 100,000 patient records annually, with 1/3 of them involving human error. The VHA is just now creating a feedback system to provide use/effort information back to industry.

Dr. Bill Mueller, MD (HSI Director, Air Force Life Cycle Management Center) discussed the relatively new organization being formed in AFLCMC. The HSI group was established two years ago in order to ensure there is a long-term HSI capability in Air Force programs. HSI has increased its influence since 2004, primarily through AF medical funding. In 2006, the AFHSIO (Air Force HSI Office) was established under AF/CV (Chief of Staff) as a policy office. In 2008, the 711th Human Performance Wing was established, primarily located at Wright-Patterson Air Force Base. The HSI office at AFLMC was established in 2014. The goal is that, by 2020, qualified and experienced HSI specialists will be supporting every major system project office (SPO), including people, products, and processes. The Air Force has three primary HSI organizations; AFHSIO, 711th HPW and AFLCMC. A need for at least 60 HSI specialists in AFLCMC has been identified. Current plans are for the Air Force to stand up the full organization in FY19.

Dr. Tom Nesthus (FAA, Civil Aerospace Medical Institute) spoke on US Commercial Flight Crew Fatigue Risk Management. The new FAA crew member fatigue requirement is stated in 14 Code of Federal regulations (CFR) Part 117. The regulation was initially released for comments in September 2010. The FAA received whopping 8,000 comments, which were all

adjudicated. The final rule came out in January 2012 and was fully implemented in 2014. The rule calls for optional implementation of a Fatigue Risk Management System (FRMS).

Col Chris Borchardt (USAF, Air Combat Command, ACC/A5M) spoke on "Meaningful Work and Trust in the Automated World." Autonomy is everywhere already. Unfortunately systems are being designed to single points of failure. What is needed is "appropriate autonomy" where there is a good match of tasks to humans and the human's work is meaningful.

Dr. Richard Arnold (Naval Aero Medical Research Unit-Dayton) spoke on "Recent Developments in Aviation Human Factors Research at Naval Aero Medical Research Unit-Dayton). The unit has in vivo toxicology and in vitro toxicology capabilities. Areas of specialization include: altitude/hypoxia, fatigue assessment and mitigation, motion sickness and countermeasures, spatial disorientation mitigation, aviation personnel selection testing, en route care and vision standards/visual protection. The unit is staffed with approximately 40 personnel. Some of the recent research has determined that it takes a full 24 hours to fully recover from hypoxia effects.

LtCol Troy Faaborg (AF HSI Office) spoke about the Joint HSI Working Group. The DoD received Congressional tasking in 2004 to develop a joint report on HSI by 2007. The JHSIWG was established in 2007. The working group has four primary areas of interest:

- HSI Competency (HSI was added to DAU curriculum)
- Policy and Process (MER, SEP, specific guidance)
- Research & Development/Technology
- Information sharing and coordination.

Some current areas of interest include the development of an HSI Standard (being led by SAE International), insertion of more HSI training into the Defense Acquisition University (DAU) curriculum, establishing an "HSI Footprint" (Army Lead), and HSI Process Framework (USAF Lead).

1300 HFE/HSI SubTAG

The first presenter was **Col. Bill Mueller** (HSI Director, AFLCMC) who spoke on his recent support to the F-15 C/D program. This tactical aircraft has had recent depressurization problems. The F-15 C/D models are equipped with Liquid Oxygen (LOX) bottles (vice OBOGS). There seems to be three areas contributing to the overall problem:

- Cabin depressurization
- Lack of understanding of Oxygen/back-up systems
- Over-emphasis on hypoxia

Pilots (humans) are more efficient at off-gassing of carbon dioxide at altitude, resulting in hypocapnea. Current computer physiological models may be subject to review to ensure they faithfully represent human physiology under these depressurization conditions. Hypocapnea can lead to cerebral vasoconstriction and cerebral hypoxia.

Mr. Frank Lacson (Pacific Science and Engineering) introduced the "HSI Framework," that identifies and links 400 different HSI activities performed during the system acquisition lifecycle. This framework will be useful in identifying tasks for the new HSI Standard; the 711th HPW representative to the SAE G-45 committee will ensure that the HSI Framework is considered as a source document for the HSI standard..

1530 Unmanned Systems I

The first presentation was made by **Dr. Grant** Taylor (US Army AMRDEC Aviation Development Directorate) who spoke on "Supporting Manned-Unmanned Teaming (MUM-T) Operations with Dynamic Multi-vehicle Autonomy and Interface Design." The work was performed in a simulation environment at Moffett Field, CA. Personnel controlled one or more UAVs from an Apache helicopter. Measures of performance included workload and eye tracking. Situation Awareness was assessed from a design perspective.

The second presentation was by **Brian Moon** (Perigean Technologies LLC) who spoke on "Designing for Autonomous Cargo Operations." The presentation covered several design challenges and discussed the design solutions they developed. A contact number for him is 540-429-8126.

The next presentation was by **Jen Pagan** (Chair of the Unmanned Systems SubTAG), who spoke on "Decision-making Support for Human-Machine Collaboration in Complex Environments." Decision-making support for the human-machine collaboration work was provided by Naval Air Warfare Center/TSD Orlando. Decision support was necessary to help operators cope with information overload. The goal was to enhance decision making through the use of decision support, better data integration and cueing. More experiments are planned.

Major James Wallister, (USAF/AFIT) spoke on "Can Autonomous Agents be Teammates?" He says the answer is definitely "yes." Human/computer teaming can yield better performance. A transition is in progress from robots as tools to teammates.

Wednesday, 11 May 2016

0700 Technical Society/Industry SubTAG I

The TS/I SubTAG met to review technical/industry society achievements and plans. Twelve people attended the meeting, representing six societies. The TS/I SubTAG meeting was co-chaired by **Ms. Barbara Palmer** (Booz Allen Hamilton, barbara_palmer@bah.com) and **Mr. Stephen C. Merriman** (American Systems, scmerriman@tx.rr.com).

The first presentation was by **Ms. Julie Naga** (UX Strategy & Interactive Design, Booz Allen Hamilton) who spoke on "What HSI Could Glean from Lean UX." HSI and UX are distant relatives, with the same general goals but very different methods. UX has its foundations in Agile software development, Design Thinking and Lean Startup Method. It typically operates within the Agile software development framework.

The second presentation was by **Mr. Owen Seely** (Navy Dahlgren) who provided an update on the DoD HSI Standards Working Group. This working group was chartered in 2014 and completed an analysis in 2015 that served as the basis for documenting the gap in HSI standards. Following a series of technical discussions and decision meetings with the Defense Standards Program Office (DSPO) and Defense Standardization Council (DSC), the WG decided to pursue the development of a non-government standard (NGS) that will be adopted by the DoD for use on contracts as a "best practice" process standard. After two years of preparations and analysis, the DoD HSI Standards WG selected SAE International to develop the DoD HSI Standard Practice. The SAE G-45 HSI Technical Committee will lead the industry team with broad government participation from the military services and Joint HSI community. During the next 24 months as the HSI Standard Practice is being developed, the DoD HSI Standards WG will also be developing an accompanying and complimentary HSI Military Handbook (MIL-HDBK). While the HSI Standard Practice will discuss the HSI programmatic requirements and process for contractors, the MIL-HDBK will provide guidance to DoD Program Managers and HSI specialists on how to use/tailor the HSI Standard Practice and execute additional HSI tasks unique to the government.

Dr. Bill Kosnick (WPAFB, Ohio) spoke on "How the Air Force Executes HSI." The 711th Human Performance Wing (HPW) provides HSI consultants and support to Major Commands (MAJCOMS), SPOs science and technology, acquisition programs and other/joint areas. Their mission is to ***Optimize warfighter capability through a human-centric approach to system development, acquisition, and sustainment.*** The 711th is made up of three distinct entities: Human Effectiveness Directorate (711 HPW/RH, US Air Force School of Aerospace Medicine (USAFSAM), and the Human Systems Integration Directorate (711 HPW/HP). The HSI Directorate is manned by about 65 personnel. Programs receiving support include: IAE, MQ-1/9, RQ-4, KC-46 ATS, PAR, T-X, C-130J, F-22, F-15 EPAWSS, F-35, and JSTARS.

0800 Unmanned Systems II

Dennis Folds, PhD (Georgia Tech Research Institute) spoke on "Supervisory and Executive Control of Unmanned Systems: Conceptual Framework and User Interface Impacts." Dennis made two major points. First, we should look at the operator role as being on a continuum: Direct Performance)---Manual Control (e.g., stick and rudder)—Supervisory Control—Executive Control. The operator role in a given function drives the information requirements. So, if you are changing the level of control, you need to closely examine the adequacy of information being presented to the operator.

Alan Hobbs, PhD (NASA Langley) spoke next on "Pilot Critical Incident Reports as a Means to Identify Human factors in the Operation of Remotely Piloted aircraft." The concern is for RPAs in the National Airspace System (NAS). RPA pilots were asked about hazardous events they may have witnessed; over 90 incidents were reported. An anonymous system may be established to take future reports.

Terry Stanard, PhD (AFRL, 711th HPW (711 HPW/RHCI) spoke on "SPECTRE: A Sensor Management workstation Leveraging Human-Automation Teaming." Visual target acquisition and tracking are difficult tasks. Selected cameras were automated in an area to turn

toward a tracked target and align their Line of Sight (LOS) with the target. Additional camera views, thought to be useful, were "docked" for easy selection by the operator. In this experimental setting, performance increased by 14%. Future testing will involve more cluttered environments. Potential applications for this approach include base security and perimeter defense.

James Ray Comstock, PhD (NASA Langley Research Center) next spoke on "Using simulation to Assess UAS Detect and Avoid Acceptability for Air Traffic Controllers and Ground Control Station Pilots." The essence of this research was to examine the effectiveness of providing collision warnings at various distances and times from impact. Please also see: http://www.tandfonline.com/doi/abs/10.1080/10407413.2012.729382?journalCode=heco20 General information on the NASA technical reports are located at: http://www.sti.nasa.gov/ Additional information may be obtained at the NASA Technical Reports Server: http://ntrs.nasa.gov/search.jsp

The last presenter was **Zhuming Ai, PhD** (Computer Engineer, Naval Research Laboratory) who spoke on "Human-UAV Hybrid Team in Real-Time Environment Exploration." This research is exploring how real-time human-machine hybrid systems can improve efficiencies over robotic systems by using speed search, redirection to high-value target areas, etc.

1230 Trust in Autonomy Special Interest Group

The first presenter was **Tamara Chelette** (Chief, Strategic Planning, US Air Force Research Laboratory) who spoke on "My Co-Pilot is a Time Machine." The effort reported upon was a joint USAF/DARPA activity. They used a toolbox-based approach to insert high levels of automation into existing systems (Aircrew Labor In-Cockpit Automation System (ALIAS) in order to reduce workload and reduce manning.

The second presenter was **Gerald Matthews** (University of Central Florida) who spoke on "Tracking Fatigue and Reliance on Automation in Multi-UAV Operation." This talked covered stress, fatigue and workload.

The next presenter was **Anthony Baker** (Embry-Riddle Aeronautical University) who spoke on "Factors Affecting Performance of Human –Automation Teams." This research is exploring how to repair trust in automated systems after an automation failure (dissertation research). Focus is on transparency and "explainable" systems.

The last presenter was **Anna Trojillo** (NASA Langley) who spoke on "Using Natural Language to Enhance Mission Effectiveness." In this experimentation, it was found that, although voice control takes longer, it reduces workload. Overall subject preference, however, was for using a mouse, due to the quickness of being able to respond to critical commands.

1500 Design: Tools and Techniques SubTAG

The first presenter was **Ms. Angela Seebok** (Alion Science and Technology, Inc.) who spoke on "Using Model-based Tools to Support Human Automation Interaction." Three projects were used as examples:

- Automated Design Advisor Tool: Applied to flight deck design
- MIDAS-FAST: Robotic Arm operations application
- S-PRINT: Space Performance research integration tool effectively predicted performance in automated systems.

The second presenter was **Mr. Roger Spondike** (Booz Allen Hamilton) who spoke on "Air Force Human Systems Integration Capabilities and Requirements Tool (HSI-CRT)." This tool drives HSI specialists through about 300 questions at early stages of acquisition, in order to ensure that HSI issues are considered appropriately.

The last presenter was **Joshua Poore, PhD** (Draper Labs) who spoke on "Making Software a Human Sensor for Integration and Performance." Any tool that people use to perform a task can be instrumented. When instrumented, that tool can become a sensor for capturing how people perform tasks with that tool. Draper's Software as a Sensor™ technology instruments web applications to capture user interactions with them. These data then can be used to assess how users' strategies in interacting with applications and how applications' features are being used cohesively. For more information, please visit: http://www.draper.com/softwareasasensor

1700 Technical Society/Industry SubTAG II

Dr. Stephen Harris (Rational Blue) presented on "Formal Methods in HSI: Implications for Autonomous Weapon Systems." The term "appropriate automation" is bantered around but what does it really mean? How do we know what it is? How do we know if we have it? Steve took us back to basics by defining a "system" as:

- A collection of elements
- Interconnected
- Interactive
- Serves a purpose or conforms to principles (e.g., natural laws)

Any system must have a feedback loop in order to ensure that it stays oriented to its purpose. This was a very thoughtful and entertaining presentation that fully engaged the group!

Thursday, 12 May 2016

0800 Cyber Security Special Interest Group

The first presenter was **Gina Thomas** (Air Force Research Laboratory, 711th HPW/RHCV) who spoke on "A Functional and Organizational Cyber Unification Space." This categorization-oriented work is an attempt to help focus future Cyber research.

The second presenter was **Lisa Billman, PhD** (AFLCMC/HNCY, Mitre) who spoke on "Standardization in Cyber." Primary challenges are in Security and reference documents. Cyber is the 5th domain (Space, Air, Land, Sea, and Cyber). Fundamental guidelines for display of cyber

information are missing. Reference documents include ANSI/HFES 200, ISO 9241-2101, NAVSEA Common Presentation Layer Standard 03-01, MIL-STD-2525 Appendix L, MIL-STD-1472G, and the SPAWAR Common User Interface Style Guide (CUSIG), 2015. An additional reference is the "Air Operations Center Weapon system Modernization Program Capability Provider Handbook Volume IV Style Guide for AOC Weapon System (WS) 1`0.2, May 2014. Efforts completed to date include:

- AF Mission Task Analyses for Offensive and Defensive Missions
- AFRL SBIR Reports
- Cyber Command and Control Mission System Next Generation

According to the ISTQB Foundational Usability Testers course, HF issues in Cyber include: Usability, Operational suitability, Accessibility, Function allocation, timing in system response, color vision (12% of operators have a color deficiency), interface content, missing or confusing content. Cyber documentation is of generally poor clarity. Future work should focus on verifying concordance across standards, providing adequate feedback. Cyber HF professionals should support HSI standard projects. They should also work on educating the Cyber community about DODD 5000.01 and DODI 5000.02 and specific HSI requirements.

The next presenter was **Anita D'Amico, PhD** (Secure Decisions) who spoke on "Cyber Security Visualization-State of Practice." Secure Decisions is a small business that studies cyber work and creates visualizations. This presentation addressed several important topics and made recommendations. A plea was made to study "what is out there" and apply it to Cyber. (anita.damico@securedecisions.com)

The last presenter was **Diane Staheli** (Associate Staff Member, Cyber Systems and Operations Group, MIT Lincoln Laboratories) diane.staheli@ll.mit.edu who spoke on "Collaborative Data Analysis and Discovery for Cyber Security." She reported on a Navy project, involving site visits and interviews, to collect information on how Cyber people collaborate (Managers, Directors, Supervisors, and Analysts). Communication diagrams were used to determine who collaborates with whom, what data are primary for each job…what information is secondary and what isn't used at all.

1030 HFE/HSI Session II

The first presenter team consisted of **John Dachos**, **Sean Driscoll** (NSWC Dahlgren), **John Winters** (BCI), and **Ms. Sazanne Hanna** (Defense Science Technology Group-Australian Defence Force) who spoke on "Combat Information Center (CIC). Current and Future Capabilities." There are no unique (dedicated) workstations on ships anymore; although there are unique peripheral controls and displays. Older ships, that might be manned by 3,000 sailors, are now manned by about 150. The HSI process used at Dahlgren consists of five phases:

- Preparation (requirements, research, contracts)
- Data collection (mockups, scenarios, fleet interaction)
- Design Space (rack layouts, build in Human Performance Lab and conduct walkthroughs)
- Finalize Design (VIP tours, Fleet events, peripherals)
- Brief

Ships may have 10 different scenarios they need to support, with over 200 different tasks. Scenario development must address all tasks supporting all scenarios. Fleet interactions cover functionality, living quarters, power/cooling, efficiency (all HSI areas), plus crew interactions, anthropometry, analyses, cognitive walkthroughs. Some equipment on ships aren't used anymore, but there isn't budget available to remove them..The Spatial Analysis Link Tool (SALT) is used to evaluate the geometric efficiency of spaces; it evaluates the efficiency of links for different priority operations. Also, there is a need to evaluate SOP compliance based on Navy culture. Dahlgren has developed a rule set for placing peripherals at workstations. A2/AD contingencies will add manning to all CICs so that needs to be taken into consideration.

Nita Shattuck, PhD (Naval Postgraduate School) then spoke on "Graduate Education Opportunities in Human Systems Integration." Undergraduate programs exist at the USAF Academy and San Jose State. HSI Short courses are taught at Georgia Tech and NPS. HSI Certificate programs are at AFIT, Georgia Tech, Missouri Science and Technology, UCSD, Virginia Tech and NPS. Distance Learning programs are at Georgia Tech and NPS. A distance learning graduate program is at NPS, as is an HSI Graduate program.

1330 Human Factors Standardization (HFS) SubTAG: The Human Factors Standardization SubTAG meeting was chaired by Mr. Alan Poston (aposton86@comcast.net). Following the introduction of attendees, the SubTAG continued with its agenda.

Status Reports:

a. **Occupant-centric Platform: Ms. Dawn Woods** (Army Soldier Systems Center, Natick, MA) provided an update on the Occupant Centric Platform (OCP) program. This was a 6.3 effort, funded with multi-million dollars over five years. The market survey and technical assessments are documented in NATICK/TR-14-019.

b. **MIL-STD-1474, Noise Limits. Mr. Bruce Amreim**, RDECOM, reported that the latest version of the military standard was published on 15 April 2015.

c. **NASA HSI Practitioner's Guide: Mihriban Whitmore** briefly described this document.

d. **MIL-STD-1787: Bob Copeland** provided status on this document.

e. **MIL-STD-1472, Human Engineering.** Daniel Wallace reported that there are over 200people on the team to update the "G" revision of this standard. The H version will remove the gender barrier and introduce costs.

f. **DOD Standard Working Group: Jeff Markiewiez** updated attendees on progress that has been made.

g. **SAE International HSI Standard: Steve Merriman** reported that the DoD had asked SAE International to lead development of a new industry best practice standard. The kickoff meeting was to be held on 17-18 May in Crystal City, VA. The project is expected to last about two years. Subject matter experts are being recruited to assist.

h. **DID Activity: Alan Poston** reported that DI-HFAC-81894 Task Performance Analysis Report had been cancelled.DI-HFAC-80745 (HESAR) was updated in December 2015. DI-HFAC-80747C (HEDAD-M) update is nearing completion. DI-HFAC-XXXX on Human View Architecture is in early formative stages.

i. **Process Standard to Improve Safety and efficiency of Powered Hand Tools: Ghazi Horani** (Navy and Marine Corps Public Health center) reported on this new standard.

Friday, 13 May 2016

0830 Extreme Environments SubTAG

The first presenter was **Kerry McGuire, PhD** (NASA Johnson Space Center) who spoke on "Increasing Crew Autonomy for Future Human Spaceflight Missions." Most of the work in this area is toward getting "Mars-ready." The one way time delay in communications is anywhere from 3 minutes to 22 minutes, depending upon how fare Mars is from Earth at any time. Increasing autonomy will depend upon there being trust in virtual teams.

The next speaker was **Joseph Nuamah** (NC State University) who spoke on "EEG-based Artificial Neural Network Classification of Intuition and Analysis Cognition." It was hypothesized that: EEG Workload Index = Beta/Alpha + Theta. It was hypothesized that workload index would be higher when humans are analyzing versus intuiting. Two neural networks were built to analyze data and determine if the hypothesis was supported.

The next presentation was by **Ms. Jocelyn Dunn, PhD Candidate** (Purdue University) who spoke on "Measuring Stress from Behavioral, Biological, and Psychological Perspectives During Simulated Mars Missions in Hawaii." Ms Dunn lived in a dome in Hawaii for eight months!

People lived in the Dome for 4, 8 and 12 months. They conducted food studies, made surveys of the terrain, exercised and performed team-based tasks. They had to wear space suits anytime they left the dome. There was a 20 minute time delay in communicating with "the outside world." So, the environment characteristics were: confinement, communication delays, food restrictions, lack of privacy, resource restrictions, stress and frustration. Psychological data were taken, as well as biological samples, behavioral data and environmental data. The levels of stress tended to increase over time and individual's perceptions of health declined over time. Hair samples were analyzed for cortisol/cortisone, a stable measure. Urine samples were taken as a volatile measure of stress. Wearable wrist devices produced data every minute. For more information, visit: http://hi-seas.org/

The next presenter was **Ms. Brenda Cook** (711th HPW at Wright-Patterson AFB), who spoke on "Investigating Hypoxia: Challenges and Lessons Learned." At 50,000 feet a person has

6-9 seconds of consciousness without sufficient oxygen. Oxygen systems are not comprehensively checked for function; a pressure check every 180 days is generally the norm. In the future, there may be an in-cockpit display of Oxygen system function. Hypoxia mishap investigations are generally difficult. The goals of the 711th HPW are to improve hypoxia training, develop hypoxia recognition techniques, develop decision-aids to help recognize hypoxia prior to full effect, Optimize overall HSI, and investigate integration of aircraft and pilot system state.

The last speaker was **Christian Kijora,** (US Coast Guard, CG-1B3) who spoke on "Coast Guard Arctic Operations." Recently, there has been a 118% increase in maritime transit through the Bering Straits. The coast Guard has 14 missions and arctic surveillance is one of them. The USCG is the only agency in the US operating Icebreakers. There is currently only one icebreaker that can break polar arctic ice. The USCG is currently developing requirements for new heavy and medium ships. In the arctic, conditions are:

- Air Temperature: -60degrees F to 115 degrees F
- Sea State: up to 8
- Sea Temperatures: 28.8 degrees F to 87 degrees F
- Currents: To 8 knots

When deployed, crews may go 80 continuous days without resupply. The challenge is to break 6 feet of ice at 3 knots. The Coast Guard is seeking information from Oil Rigs in cold areas to better characterize the extreme environment conditions. The Coast Guard has identified significant difference areas over "normal" operations:

- Human performance differences
- Control operations with gloves, arctic wear
- Noise is constant
- Need for tele-medicine
- Cold weather maintenance, duration outside, heat and sweat
- Crew size – 130 persons

1100 DOD HFE TAG Operating Board Meeting:

The Operating Board meeting was chaired by Dr. Bill Kosnik, DOD HFE TAG Chair. Topics discussed are as follows:

- **Next Meeting - TAG-71 Meeting:** The meeting will be held at the FAA Technical Center in Egg Harbor City, New Jersey, the first or second week in May 2017. The theme will be "Collaboration." Special sessions (workshops, etc.) will be held on the Monday.
- **Following Meeting:** TAG-72 will be held in Florida the following year, either at Hurlbert Field or at Eglin AFB.
- **SubTAG Changes:** The UCI (User-Computer Interaction) SubTAG is merging with Controls and Displays SubTAG.
- **Non-DoD Chairs:** Dr. Mason agreed to open chairmanship to other Federal agencies.
- **TAG Name Change:** The majority of the Operating Board agreed to retain "DoD' in the Name of the TAG.
- **TAG Mentoring Program:** Mentoring session was not advertized well enough this meeting.

Respectfully Submitted:

Stephen C. Merriman, DOD HFE TAG TS/I Credentialed Representative of SAE International, SAFE Association, and AsMA/HFA
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ATTACHMENT (1)

DOD HFE TAG Background

The DoD HFE TAG was begun via memorandum of agreement signed by the Service Secretaries in November 1976. Goals of the TAG were established as follows:

- Provide a mechanism for exchange of technical information in the development and application of human factors engineering.
- Enhance working level coordination among Government agencies involved in HFE technology research, development and application.
- Identify human factors engineering technical issues and technology gaps.
- Encourage and sponsor in-depth technical interaction, including subgroups as required in selected topical areas.
- Assist as required in the preparation and coordination of Tri-Service documents such as Technology Coordinating Papers and Topical Reviews.

The TAG addresses research and technologies designed to impact man-machine system development and operation throughout the complete system life cycle. Topics include:

- Procedures for use by HFE specialists, system analysts and design engineers in providing HFE support during system development and modification
- Methodologies to identify and solve operator/maintainer problems related to equipment design, operation and cost/effectiveness
- Mechanisms for applying HFE technologies, including formal and informal approaches to validation and implementation, and the determination of time windows for application.

The TAG comprises technical representatives from Government agencies with research and development responsibilities in the topical areas mentioned above. Additional representatives from activities with allied interests affiliate with the TAG as appropriate. Technical experts in special topic areas may augment attendance at specific meetings. Also participating in the TAG are official representatives of technical societies (e.g., Human Factors and Ergonomics Society, SAFE Association) and industrial associations (e.g., Government Electronics and Information Technology Association) with a stated interest in HFE. These representatives may attend subgroup and general plenary sessions and they must be credentialed by the TAG prior to attending any meetings.

To facilitate detailed technical information exchange, the TAG is composed of committees and subgroups, or "SubTAGs." Committees are established to address specific issues or problems and are disestablished upon completion of their tasks. SubTAGs address problems of a general or continuing nature within a specific field of HFE technology. Membership in SubTAGs and committees may include non-government personnel involved in research, development and application. Attendance by non-government individuals is possible if the person is either sponsored by a government agency or if accepted by the TAG chair prior to the meeting. Chairing of the various subgroups and committees is rotated among the Services, NASA, FAA, DHS and TS/I members, as provided in individual charters.

TAG PROPONENT
Dr. Patrick Mason
Director, Human Performance, Training and BioSystems (HPTB) Research Directorate
Office of the Assistant Secretary of Defense (Research and Engineering)
More information about the TAG, including details and presentations from previous meetings, is available at: http://www.acq.osd.mil/rd/hptb/hfetag

The current sub-groups typically meeting at the HFE TAG meeting are as follows.

Sub-TAGs:

- Cognitive Readiness
- Controls and Displays
- Design: Tools and Techniques
- HFE/Human Systems Integration: Management and Applications
- Human Factors in Extreme Environments
- Human Factors Standardization
- Human Factors Test and Evaluation
- Human Factors in Training
- Human Modeling and Simulation
- Human Performance Measurement
- Mixed Reality
- Personnel Selection and Classification
- System Safety/Health Hazards/Survivability
- Sustained Operations
- Technical Society/Industry
- Unmanned Systems
- User-Computer Interaction

Special Interest Groups:

- Cyber Security
- Trust in Autonomy

ATTACHMENT (2) Meeting Theme

Meeting Theme:

System-level Solutions to Support the Design, Integration and Use of Autonomy

Incorporation of autonomy into real-world operational environments will create a more complex system, with new interdependencies and new relationships among various operational elements, and will require humans and machines to work together in new and different ways. Existing system performance metrics, certification criteria, and safety standards are insufficient to address the added complexities and novel characteristics of advanced autonomy. The challenge for this TAG is to identify a path forward in addressing these and other issues, including development of system-level performance metrics, certification of complex socio-technical systems that include autonomous components, and criteria for function allocation between humans and autonomy that consider system-level constraints.

ATTACHMENT (3)

Program Summary

Monday, 9 May

1130 – 1500 Modeling & Simulation Special Session
1500 – 1600 Executive Committee meeting
1515 – 1745 Autonomy Special Session
1745 – 1815 New member orientation

Tuesday, 10 May

Location

0800 – 1130 Meeting 70 Plenary Session

- Dr. Patrick Mason, OASD(R&E), Director HPT&B: TAG Proponent Welcome Remarks
- William Kosnik, DoD HFE TAG Chair: Introduction and Remarks
- Mr. David Miller, NASA Chief Technologist
- Dr. Karl Van Orden, SPAWARSYSCEN PAC
- Col William Mueller, USAF AFMC
- Dr. Thomas E. Nesthus, FAA Civil Aerospace Medical Institute
- Col Chris Borchardt, USAF ACC
- Dr. Richard Arnold, Naval Aeromedical Research Unit - Dayton

1130 – 1300 Lunch Break

1300 – 1500 HFE/HSI (I)
1300 – 1500 Training (I)
1500 – 1530 Break
1530 – 1730 Modeling & Simulation (I)
1530 – 1730 Unmanned Systems (I)
1830 Mixer

Wednesday, 11 May

0800 – 1000 Tech Society/Industry Meeting
0800 – 1000 Unmanned Systems (II)
0800 – 1000 Trust in Autonomy Special Interest Group
1000 – 1030 Break
1030 – 1100 TAG Mentors Introduction
1100 – 1230 Speed Mentoring Session & Working Lunch
1100 – 1230 Lunch Break
1230 – 1430 Mixed Reality
1230 – 1430 Sustained Operations
1230 – 1430 Controls & Displays
1430 – 1500 Break
1500 – 1700 Human Performance Measurement
1500 – 1700 Design: Tools & Techniques (I)
1500 - 1700 Training (II)
1700 - 1800 Service Caucuses
Air Force
Army

DHS/USCG
FAA
NASA
USN/USMC
Tech Society/Industry
VHA

Thursday, 12 May

0800 – 1000	Standardization (I)
0800 – 1000	Cyber Security Special Interest Group (I)
1000 – 1030	Break
1030 – 1230	Standardization (II)
1030 – 1230	Modeling and Simulation (II)
1030 – 1230	HFE/HSI (II)
1230 – 1330	Lunch Break
1330 – 1530	Poster and Demo Session
1330 – 1530	Cyber Security Special Interest Group (II)
1330 – 1530	Design, Tools, & Techniques (II)
1530 - 1730	Tours
1830 – til	Dinner??

Friday, 13 May

0830 – 1030	Extreme Environments/Safety, Survivability & Health Hazards
0830 – 1030	Personnel
0830 – 1030	Cognitive Readiness
1030 – 1100	Break
1100 – 1300	Operating Board Meeting / Working Lunch

ATTACHMENT (4)

DOD HFE TAG ATTENDEES
(When Available)

ATTACHMENT (5)

DoD HFE TAG Policies

1. Membership (General membership policies are outlined in the Operating Structure, under "Group Composition.")

1.1 Individuals who are not affiliated with Government agencies (but who are associated with technical societies or industrial associations with a stated interest in human factors engineering) wishing to affiliate with the TAG may contact the current Technical Society/Industry SubTAG Chair to ascertain eligibility under the TAG Operating Structure. Once eligibility has been ascertained, the individual should submit a letter on the organization's letterhead, confirming his/her status as the organization's representative, to the current Chair of the Technical Society/Industry SubTAG.

1.2 Emeritus Membership may be approved by the Executive Committee on a case-by-case basis for a former TAG member who is retired from government service or defense industry. Emeritus Membership is automatically deactivated during any period or re-employment with the government or defense industry.

2. Meeting Sites (Sites are recommended by the service caucus whose turn it is to host the TAG with a view toward a balance in geographic location and meeting facilities.)

2.1 TAG members are encouraged to recommend potential meeting sites.

2.2 Organizations who wish to host the TAG should contact their Service Representative or the current TAG Chair.

3. Agenda (The agenda is determined approximately three months before the scheduled meeting. The Chair Select selects the topics from those recommended by the Service Representatives, hosting agency and the TAG Coordinator.)

3.1 TAG members are encouraged to suggest potential agenda topics or topics suitable for tutorial sessions to their Service Representative, the current TAG Chair, or the TAG Coordinator.

4. Registration (Registration fees and the date of the close of registration are announced in an information letter sent approximately two months before the scheduled meeting.)

4.1 All attendees are expected to pre-register and prepay by the announced close of registration.

4.2 Only individuals receiving late travel approvals may pre-register on-site. Payments made at the meeting site must be in cash.

5. Minutes (The Minutes of each meeting serve as the principal mechanism for the reporting of TAG activities. The Minutes will be published as a draft document on the website.)

5.1 Individuals or agencies desiring to be included on the distribution list for a specific meeting should contact the TAG Coordinator.

6. SubTAGs and Committees (See the Operating Structure, section entitled "TAG SubTAGs," for specific information regarding the purposes and operating procedures of SubTAGs and committees.)

6.1 All SubTAGs and committees are encouraged to meet in conjunction with the TAG at least once each calendar year.

6.2 All SubTAGs and committees meeting in conjunction with the TAG are required to provide a chairperson for the specific meeting.

6.3 All SubTAG and committee chairpersons are to submit a brief report of each meeting to be included in the set of TAG Minutes covering the SubTAG/committee meeting time frame.

6.4 All SubTAGs and committees are required to provide the TAG Coordinator with an up-to-date list of their membership for use in the distribution of TAG announcements.

6.5 All SubTAGs are required to submit to the Executive Committee a Charter including, but not limited to, statements regarding:

- objectives
- membership policies
- meeting schedule
- scope
- chair selection/tenure

6.6 Committees are required to submit to the Executive Committee a document including, but not limited to, brief statements regarding:

- objectives
- membership policies
- chair selection/tenure

6.7 Rotation of the chair position is determined by SubTAG charter. If the position cannot be filled by the appropriate service at the election meeting, the SubTAG may progress to the next service willing to chair the SubTAG

7. SubTAG Establishment

7.1 Groups interested in addressing technical areas not covered by existing SubTAGs may request the TAG Chair to provide meeting time.

7.2 Formal SubTAGs and committees may be established by recommendation of the Executive Committee.

8. Chair/Representative Selection (General selection procedures are outlined in the Operating Structure under "Conduct of Business.")

8.1 A Service caucus may be called by the TAG Chair or the current Service Representative.

8.2 Methods of determining the Chair Select and Service Representatives are Service dependent.

8.3 Unexpired terms of office will be filled by appointment by the Executive Committee, until a caucus of the Service can be called at the next regularly scheduled TAG meeting.

9. Funding The funding required for the organization, conduct, franking, and documentation of all TAG meetings shall be done jointly by the three Services and other selected agencies. The specific mechanisms to obtain and allocate funding from the Services/agencies shall be arranged by the Current Chair, Chair Select, and Immediate Past Chair.

10. Policy Changes

10.1 Additions to or amendments of the above policies may be recommended by submitting the suggested change(s) in writing to the TAG Chair.

10.2 Policies may be amended by a majority vote of those Operating Board members in attendance at the Operating Board meeting at which amendments have been proposed.

Amended 14 November 1989 at TG-23, Killeen, Texas.

Amended 3 May 1994 at TAG-32, Oklahoma City, Oklahoma.

Amended 8 May 1996 at TAG-36, Houston, Texas.

Amended 7 November 2002 at TAG-48, Alexandria, Virginia.