DOD HFE sub TAG Meeting Minutes Form

Purpose of sub TAG meeting minutes:

The purpose of the sub TAG meeting minutes is to inform the Department of Defense Human Factors Engineering Technical Advisory Group (DOD HFE TAG) membership of the activities of the sub TAG and the major areas of concern being discussed and addressed.

General Information:

Please complete all sections:

SubTAG Name	System Safety, Health Hazards, Survivability
Date of the DOD HFE TAG **Date (month/day/year)**	05/21/2014
Number of Attendees at subTAG session	17
Organizations Represented (Agencies and/or organizations that employee members at the subTAG)	711 HPW, AFIT, NSWC, USA, MANPRINT, AMSAA, NASA, ARL, Boeing

SubTAG Chair's Name	SubTAG Chair's Organization	SubTAG Chair's Phone and Address
John Plaga	711 HPW/HP	937-938-3050, WPAFB, OH
SubTAG Co-Chair's Name	SubTAG Co-Chair's Organization	SubTAG Chair's Phone and Address
Maj Jay Clasing	Army Institute of Public Health	410-417-2835 APG, MD 21010
SubTAG Co-Chair's Name	SubTAG Co-Chair's Organization	SubTAG Chair's Phone and Address

AGENDA

Presentations and Panels (If none, state none).

Title of Presentation	Name of Presenter	Name of Agency or Organization Employing Presenter	Overview of Presentation (e.g., Paste Abstract Here or Generate a Brief Summary)
Application of Non-Linear Hearing Protectors in the Auditory Hazard Assessment Algorithm for Humans (AHAAH)	Dr. Paul Fedele	U.S. Army Research Laboratory (ARL)	See attached.
Maximizing Performance with HSI/MANPRINT & Soldier Survivability	Rich Zigler	ARL SLAD, Army Research Laboratory's Survivability/Lethality Analysis Directorate	See attached.
Review of Science, Technology, and Devices to Monitor Human Physiological and Cognitive Performance	John Plaga	711 HPW/HP	See attached.
The F-22 Helmet Mounted In-Flight Physiological Monitoring System and Beyond	Dr. Lloyd Tripp	711 HPW/RHCP	See attached.
Development of a Multi-axial Neck Injury Criterion for Aircraft Ejection	Lt Col Jeff Parr	Air Force Institute of Technology	See attached.

******Please provide the briefing to the TAG coordinators for posting on the TAG website, if the briefing is unclassified and cleared, via the provided CD******

Issues and Concerns (If none exist, state none)
NONE

Title of Concern or Problem	Advocate or Organization That Raised Issue	Group Discussion Summary Related to Topic	Actions, if any to be taken

Elections (If none held state none)

Position Being Filled	Current Person	Current Agency/Organization	Candidates Nominated (Name/Agency-Organization)	Final Sub TAG Selection (Based on Voting)
subTAG co-chair	Vacant	N/A	Maj Jay Clasing, Army Institute of Public Health	Maj Jay Clasing

******Please also provide the new individuals contact information******

Open Actions (If none exist state none)
NONE

Title of Concern or Problem	Advocate or Organization That Raised Issue	Group Discussion Summary Related to Topic	Actions, if any to be taken

General Notes (Optional):

Abstracts below:

Title: Application of Non-Linear Hearing Protectors in the Auditory Hazard Assessment Algorithm for Humans (AHAAH)

ABSTRACT:

The Auditory Hazard Assessment Algorithm for Humans (AHAAH) accurately propagates pressure-time impulses through the linear and non-linear parts of the auditory system and calculates the potential for hearing damage based on the stresses and strains produced in the basilar membrane. An publicly available ARL technical report, published in December 2013 - ARL-TR-6748, describes AHAAH's use. This version of AHAAH can also calculate the potential for hearing damage when hearing protection (HP) is used. AHAAH's HP Module (HPM) applies measured hearing protection insertion losses, measured by the Real Ear Attenuation at Threshold (REAT) method, and treats the hearing protector as one more transport step into the auditory system. The HPM currently models hearing protection devices as sound-level-independent, linear, transport steps. In this linear mode, attenuation remains constant, regardless of how high or low the amplitude of the pressure wave may become. However, the AHAAH HPM contains several HPs that were specifically designed to be level-dependent. In all cases, applying any of these level-dependent HPs in a linear, level-independent mode yields very conservative (overly protective) results based only on low-amplitude REAT data. Based on the need to accurately assess level-dependent hearing protection, we describe how we added a non-linear, pressure-amplitude-dependent modeling capability for assessing the performance of level-dependent HPs. We describe the added non-linear electro-acoustic circuit elements that have values that change with the amplitude of the waveform and thus reproduce the non-linear performance measured for specific hearing protection devices. The non-linear HP values adjust the HP's attenuation based on the pressure amplitude of the applied waveform. We compare wave-form non-linear HP model results with measured insertion losses obtained using an auditory test fixture and impulses from 120 dBP to 190 dBP and instantiate that non-linear HP model performance accurately predicts the available measurements of non-linear HP performance. The non-linear HP performance model will be incorporated into AHAAH's HPM and made available with the release of AHAAH version 2.1.

Title: "Maximizing Performance With HSI/MANPRINT & Soldier Survivability"

Abstract

Three general topics are presented in the interest of placing future focus on areas where MANPRINT and its Practitioners may gain benefit and understanding. In the first topic, the DoD acquisition process can be confusing until understanding of both process and its terminology is gained. Simple but applicable insights taken from Defense Acquisition University Program Management training and from four decades of DoD acquisition and commercial practical experience are presented both for planning and for practical purposes. The second topic will broadly touch upon a number of collaborations that have taken place in a major acquisition program in the effort to perform the MANPRINT concept of system assessment: 1) analyze and understand the design; 2) detect questions of design and verify that they are actually issues; 3) collaborate with others in the effort to resolve the issue; and 4) perform the HSI/MANPRINT assessment in support of an upcoming Milestone Decision. For the final topic, a number of different MANPRINT Soldier Survivability successes and technical examples will be presented that should be of interest and potential use to Practitioners.

TITLE: Review of Science, Technology, and Devices to Monitor Human Physiological and Cognitive Performance

ABSTRACT:

Military combat operational flight is a costly endeavor utilizing expensive equipment and systems and highly trained individuals in a physically and cognitively challenging environment in both combat and combat training situations. Safety and avoidance of mishaps is of critical importance to the USAF and especially to the ACC Surgeon General who is responsible for the performance, health and safety of combat flight. The need to monitor the real-time status of a pilot's capability, as a way of predicting sub-optimal performance before it occurs or is seen behaviorally, while identifying automatically executable mitigation strategies in the face of potential performance decrements is real. This presentation will discuss SURVIAC's (Booz Allen Hamilton) review of literature and technology to determine the current state of the art for devices that will monitor human physiological and cognitive performance (HPCP) for Headquarters (HQ), Air Combat Command (ACC), Office of the Command Surgeon, Modernization Division (ACC/SGR).

The objective of this research was to search for, review, and analyze research findings and information on available and emerging physiologic sensor technologies with the long-term goal of in-flight monitoring. In-flight monitoring focused on physiologic and performance measures that are susceptible to stressors such as sleep loss, extended duty day, and the specific physiologic conditions faced by pilots in cockpit/ground station environments. The scientific literature search strategy focused on piloting simulator studies and lab studies, where the focus is on stressors and their effects on the performance parameters relevant to piloting behavior, such as auditory and visual vigilance, decision-making, reaction time, and mathematical, logical and spatial reasoning. Physiological measures are those that correlate with degraded performance, such as electroencephalography (EEG) indices, eye tracking, blink rate, blood pressure, rate of respiration, force of muscular contraction, glucose levels, heart rate and heart rate variability, lactate thresholds, oxygen saturation, [ratio of expired air], and skin temperature.

SURVIAC developed a technical literature database search strategy to discover documents pertaining to physiological monitoring, physiological sensor development and cognitive performance, and searches were conducted within selected databases. Findings were compiled into a brief bibliography providing an overview of the current state of the art for these technologies. SURVIAC further investigated the state-of-the-art in these noninvasive physiological monitoring technologies and devices, to assess their value to in-flight pilots, and pilots at Unmanned Aerial Systems (UAS) ground stations. To conduct this assessment, SURVIAC identified and contacted subject matter experts (SMEs) from the United States, Germany, France, Canada, United Kingdom, Israel, Australia, the Netherlands, Japan, and Russia, and visited laboratories at Wright-Patterson Air Force Base (WPAFB), OH, to validate which technologies and devices were currently under investigation for use in the noninvasive monitoring of subjects in simulators or while in-flight. SURVIAC noted that technological advances have been made over the last few years in measurement via EEG, electrooculography (EOG), electrocardiography (ECG or EKG), Galvanic Skin Response (GSR), thermal imaging of the face, radio frequency impedance interrogation (RFII), pulse and cerebral oximetry, cerebral blood flow, voice stress, and photo-plethysmography (PPG).

SURVIAC's technology evaluations included devices that monitor blood pressure, breathing rate, force of muscular contraction, glucose levels, heart rate, lactate thresholds, oxygen saturation, and skin temperature. Cognitive performance technology evaluated included devices that measure attention, blink rate, brain waves, and oxygen saturation. These technologies were evaluated for their availability, validity of measurement to performance outcome, Technology Readiness Level (TRL) and Cost.

The findings provided HQ ACC/SGR with a catalogue of available science and technology to measure human physiological and cognitive indications and predict performance outcomes to enable real-time risk management decisions during military operations.

TITLE: The F-22 Helmet Mounted In-Flight Physiological Monitoring System and Beyond

ABSTRACT:

Pilots who fly the F-22 have experienced in-flight hypoxic like symptoms and as a result, the Raptor fleet was grounded for four months1. One of the requirements for return to flight was that all F-22 pilots would fly with a finger mounted oxygen saturation sensor which provided pilots with real-time assessment of their blood oxygen saturation (SaO2) levels during flight2. There were, however, signal interference that resulted in artificially low oxygen readings which were being interpreted as in-flight hypoxia. Other factors that introduced artifact included: squeezing the stick and or throttle with instrumented finger which caused the blood in the finger to be forced from the area beneath the sensor and resulting in artificially low oxygen readings. Other issues include, blood poling in the hands during +Gz acceleration, again causing lower than normal oxygen saturation readings. To resolve these issues the 711th Human Performance Wing, Wright-Patterson AFB OH, developed a helmet mounted oxygen saturation monitoring capability that underwent extensive testing over the course of 120 days and then entered a flight test program at both Edwards and Nellis AFB's. During the flight tests pilots wore both the finger and helmet mounted systems. Post flight evaluation of the data showed the flight helmet system to provide significantly better signal quality compared to the finger mounted system. Additionally, a review the work leading up to flight test, the flight test evaluation, results and what the future holds for in-flight monitoring and flight simulators for training. The First unit was equipped three months following flight test and the entire F-22 fleet was equipped seven months later.

1. Alaska Dispatch | Sep 20, 2011
2. 477th Fighter Group Public Affairs November 2011

Title: Development of a Multi-axial Neck Injury Criterion for Aircraft Ejection

ABSTRACT:

This presentation will discuss the development of a multi-axial neck injury criterion useful for understanding the likelihood of injury during aircraft ejection. This research effort relies upon existing data from decades of human subject data collected at AFRL as well as data on post mortem human subjects collected from experiments sponsored by AFRL and the FAA to propose a criterion that is based upon the state of the art analysis methods. This presentation will review the criterion currently employed for the Joint Strike Fighter and propose requirements for a revised criterion to address issues present within the existing criteria. Additionally, a framework will be provided for the use of such a criterion and affiliated tools to aid the development of pilot ejection and helmet systems throughout the acquisition life cycle. An initial formulation of a revised criterion will then be discussed. This discussion will demonstrate a vision for the application of the proposed criterion within qualification testing and discuss the development of the criterion from a collage of human subject test data at non-injurious exposures and PMHS data at injurious levels. Finally, this criterion and its desired use will be discussed within a broader Systems Integration Framework.