DOD HFE TAG-64
CONTROLS AND DISPLAYS SUBTAG REPORT

SUBMITTED BY:
Marianne Paulsen
SUBTAG CHAIR

02 November 2010

General Information

I. SubTAG Name: Controls and Displays

II. SubTAG Chairs: Marianne Paulsen
Naval Air Warfare Center-Training System Division
407-380-4743
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II. Number of SubTAG Members Present: 29

III. Organizations Represented (Sampling): 15

a. UCF
b. NASA-Ames
c. NSWC DD
d. AFRL
e. Navy-Medical
f. U.S. Army Aeroflightdynamics Directorate
g. California State University, Long Beach
h. San Jose State University
i. ARL-HRED
j. NASA-JSC
k. NAWCTSD
l. Society for Simulation in Healthcare
m. Purdue University
n. Mission Success Integration, LMSSC
o. US Army Research Lab
p. AFSOC
q. NASC
r. NASA-ARL
s. NSWC PCD
t. Eye-com Corporation
u. NAWC-Pax River

IV. Agenda

- NASA Vertical Motion Simulator Rotational Throttle Interface Evaluation; David Rozovski, UserCentrix LLC, Lafayette, IN

- Model-Based Human Systems Integration for Display & Control Requirements of Future Smarter Systems: A Conceptual Framework for Commercial Space Transportation; Tareq Z. Ahram, PhD., Institute for Advanced Systems Engineering University of Central Florida, Orlando, FL

- A Perspective on Computational Human Performance Models as Design Tools; Patty Jones, NASA Ames Research Center Moffett Field, CA

- One Indicator Three States: Weapon System Status and its Impact on Soldier Situational Awareness; Leticia J. Pacheco, Ph.D., Army Research Lab, Human Research and Engineering Directorate, Ft. Bliss Field Element, Texas

V. Abstracts: attached at end of file

VI. SubTAG Discussion Points

a. Speaker: Rozovski
Proprioceptive or haptic consistency was an unforeseen problem that was the biggest problem which highlighted the differences between fixed and rotary pilots.

b. Speaker: Mikutel
You need to get as much information as you can from a crew to determine cost. Optimal training effectiveness with lowest cost is the ultimate goal.

c. Speaker: Jones
NASA human health and performance community of interest website is open and registration is free.
Innocentive.com: you can put problems out on web and establish legal constraints and then people from around the world can submit proposed solutions.

d. Speaker: Pacheco
Stroop effect should be considered as people can perceive color before text.
Tab settings for target at graphic would help show that there are more decisions involved.
Next step is to evaluate mitigation strategies.
There is a lag in response after shooting. This is being worked on.

VII. SubTAG Business

a. Controls and Displays Sub TAG Chair: Marianne Paulsen (407)380-4743
b. Keith Higginbotham is incoming C and D cochair.
c. Charter will be reviewed and revised as necessary.

VIII. No SubTAG actions

IX. The Controls & Displays sub-TAG will meet during TAG-65 in May 2011.

David Rozovski
Summer 2010 DOD TAG Abstract
NASA VMS RTI EVAL

The tiltrotor is arguably the first aircraft able to equally combine the hover qualities of helicopters with the forward flight speed and efficiency of an airplane. This expanded envelop is accomplished through the ability to rotate the engine nacelles. With this rotation there are issues that must be considered in regards to the control inceptor design.

Both helicopters and airplanes are designed with controls that map congruently to the intended response of the aircraft. Due to tiltrotor's added degree of freedom in the rotation of the nacelles, power control inceptor design requires additional considerations not present in their counterparts. Since the advent of the XV-3, engineers have questioned what the most appropriate inceptor design is. Collectives, throttles, combinations of the two, and other designs have been tested, all with varying degrees of success.

Currently there are two accepted designs, a collective style inceptor that moves up to increase power and down to decrease it, and a throttle, in which pushing forward increases power and pulling back decreases it.

A novel inceptor design was recently tested at the Vertical Motion Simulator at the NASA Ames Research Center. The inceptor known as the Rotational Throttle Interface (RTI) was designed to mimic the rotation of the nacelles allowing the pilot to push or pull in the intended direction of travel regardless of nacelle orientation.

The purpose of this design feature was to reduce the number of mental rotations the pilot had to accomplish in order to control the aircraft, hopefully yielding better control performance and reduced training times.

Five test pilots evaluated NASA's Large Civilian TiltRotor (LCTR) Thrust Control Inceptor (TCL) against the RTI in 7 different flight scenarios. The TCL was tested fixed-based while the RTI repeated four flight scenarios on motion in addition to the fixed-based baseline.

Model-Based Human Systems Integration for Display & Control Requirements of Future Smarter Systems: A Conceptual Framework for Commercial Space Transportation

Tareq Z. Ahram

Employing Model-based Systems Engineering (MBSE) methodology and design principles to the development of smarter display and control systems has the potential of extending commercial space transportation research and drastically reducing systems development time. The potential market for commercial space transportation depends not only on the number of people who are willing to travel to space but also on the physical and mental ability of space travellers. Key display and control design parameters must be taken into account to minimize the risks and maximize the comfort for space transportation. Furthermore, there are major design aspects of the commercial space transportation, which are related to the health and comfort of space travellers. Commercial Space transportation can be compared to flight passengers regarding the minimum requirements for safe transportation. Passengers don't have to be able to pilot the vehicle or to perform complex tasks on board. This means, that any human may go to space providing that he/she is physically and mentally healthy enough to go and come back with a minimum risk to be hurt. A large percentage of the terrestrial population fulfils this minimum criterion, because a commercial spaceship specifically designed for travellers with limited to less than 3g's maximum acceleration. There is also no general upper limit for the age of space tourism (Hall,1997). Display and control design for commercial space transportation is highly affected by the following three main characteristics of the commercial space transportation environment, comfort and human rating:

- Vacuum
- Micro-gravity (Medical and Comfort aspects)
- High energy radiation

In terms of commercial space transportation, the traveller must become familiar with the display and control console on board the transportation systems. They also must be prepared for the experience of micro-gravity in terms of motion, perception and three-dimensional orientation. Most of this preparation should be aimed to avoid unnecessary stress as well as potentially risky situations imposed by unsafe behaviour.

This paper introduces Model-based Human Systems Integration (MB-HSI) framework for design and modeling of the next generation of display and control systems required for future commercial and automated space transportation missions. A conceptual framework and practical applications is proposed. The human systems component in complex systems design aims to ensure that human considerations have a prominent place in the integrated design and development of complex systems throughout the total system lifecycle. Future challenges that commercial space transportation are likely to face in this domain are also discussed.

Related References:

Hall, T., (1997) "Artificial Gravity and the Architecture of Orbital Habitats", Proceedings of 1st International Symposium on Space Tourism, Daimler-Chrysler Aerospace GmbH.

Meeting: Department of Defense Human Factors Engineering Technical Advisory Group (DoD HFE TAG)
Dates: October 25-29, 2010
Location: San Jose CA

Title: A Perspective on Computational Human Performance Models as Design Tools
Author: Patricia M. Jones, PhD, NASA Ames Research Center

Abstract:
The design of interactive systems, including levels of automation, displays, and controls, is usually based on design guidelines and iterative empirical prototyping. A complementary approach is to use computational human performance models to evaluate designs. An integrated strategy of model-based and empirical test and evaluation activities is particularly attractive as a methodology for verification and validation of human-rated systems for commercial space. This talk will review several computational human performance modeling approaches and their applicability to design of display and control requirements.

Biosketch:

Patricia M. Jones is currently the acting Deputy Director of Exploration Technology at NASA Ames Research Center. Previously, she was the acting Chief of the Human Systems Integration Division at NASA Ames. She received the B.S. in psychology from the University of Illinois at Urbana-Champaign and the M. S. and PhD in industrial and systems engineering from the Georgia Institute of Technology. Before joining NASA, she was an Associate Professor of Industrial Engineering at the University of Illinois at Urbana-Champaign. She has published more than sixty papers in the areas of human-machine interaction and computer-supported cooperative work.

Title: One indicator three states: Weapon System Status and its impact on Soldier Situational Awareness

Presenter: Leticia J. Pacheco, Ph.D., Human Factors Engineer, Army Research Lab, Human Research and Engineering Directorate, Ft. Bliss Field Element, Bldg. 516A Room 202, Ft. Bliss, Texas 79916, (915)568-9584, DSN: 978-9584, leticia.pacheco@us.army.mil

Synopsis: Simple and straightforward control design is a necessary component of optimal human-system interaction in complex weapon systems. Soldier situational awareness is negatively impacted when controls or indicators do not clearly convey information. That is information that influences decision-making and the course of action the Soldier takes. During high workload or stressful conditions, this ambiguity can lead to errors or missed opportunities. This presentation provides a case study on a weapon system, the automation status of the system, the indicator used to convey that status, and its impact on decision-making. The weapon system was assessed over several weeks of testing and use by trained Soldiers. Observations and data were collected through questionnaires and interviews with Soldiers participating in the event. Based on the findings, it became evident the weapon system status indicator needed to be redesigned to more clearly convey system status to the Soldier.