Learning Objectives:
1 The importance of humans being included in the design and development of the Altair spacecraft.

[267] CLOSING THE GAPS IN BEHAVIORAL HEALTH AND PERFORMANCE RESEARCH
L.B. LEVETON
NASA, Houston, TX

While research is usually viewed as a process, a work in progress, in NASA´s Human Research Program (HRP), it is viewed as a product. Each of the individual research elements within HRP is charged with carrying out a scientific program of focused, applied research critical to managing and mitigating human system risk for exploration missions. Risk to the human system, accrues from living and working in the spaceflight environment and can affect the astronaut´s performance in carrying out the mission, or his or her health during spaceflight, with additional vested interest in mitigating health risks following spaceflight. Exploration missions to the lunar surface, even the shorter sortie missions, will have inherent behavioral health and performance challenges for the crews manning those missions, both in flight and on the ground. This presentation showcases the BHP research element and its successful strategy for transitioning research to medical and mission operations. It will focus on the sleep, fatigue and workload risk and provide a specific example how the research lines up from the evidence base to the deliverable and transitions into the hands of the practitioners – in this case – for medical or mission operations
Learning Objectives:
1 Discussion of the rist to the human system for living and working in space environment

[268] RESEARCH TO OPERATIONS: THE CRITICAL TRANSITION
J.A. FOGARTY
NASA, Houston, TX

Space Life Sciences Directorate (SLSD) specializes in transitioning technology and knowledge to medical operations. This activity encompasses funding a spectrum of research and technology efforts, such as understanding fundamental biological mechanisms altered by microgravity and executing technology watches for state of the art diagnostic imaging equipment. This broad spectrum approach to fulfilling the need to protect crewmember health and performance during long and short duration missions to the International Space Station, moon and Mars is made possible by having a line of site between research and operations. Currently, SLSD´s line of site is articulated in a transition to medical practice (TMP) process. This process is designed to shepherd information and knowledge gained through fundamental and mechanistic research toward the development of an operational solution such as a pre-flight selection criteria; an in-flight countermeasure, monitoring capability or treatment; or a post-flight reconditioning program. The TMP process is also designed to assist with the customization of mature hardware or technology for NASA specific use. The benefits of this process are that the concept of operational usability is interjected early in the research, design, or acquisition phase, and stakeholders are involved early to identify requirements and also periodically asked to assess requirements compliance of research or technology development project. Currently a device known as the actiwatch is being assessed for the final transition to operational use. Specific examples of research to operations transition success help to illustrate the process and bolster communication between the research and medical operations communities.
Learning Objectives:
1 To broaden the base of understanding of the process to transitions research into medical practice

Tuesday, May 5 ***4:00PM***
San Gabriel

SLIDE: Human Error & Safety

[269] VISUAL EFFECTS OF LONG TERM ACTIVE SMOKING: ARE AIRCREW FLYING NVG AIDED MISSIONS AT A DISADVANTAGE?
M.D. SHARMA, AND R. RAVI
Institute of Aerospace Medicine, Department of Human Engineering, Bangalore, Karnataka

WITHDRAWN

4:00 p.m.
[270] SLOPE AND DISTANCE ESTIMATION ERRORS IN A LUNAR ENVIRONMENT
C.T. ORAVETZ[1], L. YOUNG[1], AND H. HECHT[2]
[1]Massachusetts Institute of Technology, Cambridge, MA; [2]Johannes Gutenberg-Universitat, Psychologicsches Institut, Mainz, Germany

INTRODUCTION: Successful lunar excursions will require accurate terrain estimation. However, large systematic errors in slope and distance estimation commonly occur on earth. The problem is expected to be worse on the moon without aerial perspective and with deep shadows, Non-Lambertian regolith reflectance, absence of familiar objects, and lunar gravity. **METHODS:** Slope and distance estimates of real hills in a Mars analog environment (5 Ss) were measured using visual and haptic devices and repeated in a Virtual Reality (VR) environment (20 Ss). Slope, distance, and height estimates

of synoptically viewed Apollo panoramic images also were measured and compared to measurements obtained from topographical maps (25 Ss). **RESULTS:** Subjects significantly overestimated the slope of hills by 13-23deg in the Mars analog environment. Subjects significantly overestimated these hills by 9-14deg within the VR environment. Field slope estimates were significantly greater than in VR for nearby hills (25m) but not at 75m. Subjects significantly overestimated the slope of all lunar hills but the average errors were smaller (5-10deg) than for the Mars analog. Errors in lunar distance estimates varied greatly, ranging from a 5km overestimation error to a 4km underestimation error. The mean error for slope estimates of lunar craters was 5.1deg greater than for lunar hills. **DISCUSSION:** Slope was significantly overestimated in both Mars analog and lunar environments, which may impact an astronaut´s perceived metabolic cost and erroneously influence route decisions. Distance errors varied widely, with the larger errors occurring for the nearest and farthest distances. A VR training protocol for lunar missions should include accurate representation of the intended lunar region, and provide feedback of actual slopes, heights and distances within their landing areas. Our research suggests significant effects of sun elevation and distance on slope and distance estimation and should be further investigated.

Supported by the NSBRI (NASA NCC 9-58)

Learning Objectives:
1 The characteristics of the lunar environment that will impact visual perception will be discussed.
2 The slope, distance, and height errors made by subjects in lunar-like and lunar environments will be presented.
3 The reasons for developing a slope/distance/height estimation training protocol for astronauts will be discussed.

4:15 p.m.
[271] A PROBABILITY RISK ANALYSIS OF EN ROUTE AIR TRAFFIC CONTROL OPERATIONAL ERRORS
L.L. BAILEY[1], S.E. LOWE[1], AND D. SCHROEDER[2]
[1]Civil Aerospace Medical Institute, Oklahoma City, OK; [2]Oklahoma City, OK

INTRODUCTION: The Federal Aviation Administration has spent considerable resources trying to minimize the risk of serious operational errors (OEs) occurring while certified professional controllers (CPCs) are controlling traffic. Historically, the risk of an OE occurring based on the amount of time a controller is on position (i.e. controlling traffic) was examined using frequencies and percentages of OE occurrences. The results of these analyses demonstrated a higher frequency/percentage of OE occurrence earlier on position. However, frequencies and percentages of occurrence do not contain information about nonevents and thus do not reflect actual risks. We used archival data to develop a probability risk assessment for an OE occurring based on amount of time controllers are on position **METHODS:** Radar controller time on position data for six enroute centers having the highest frequencies of OEs were extracted from an FAA database for the 2006 calendar year. Time on position data were aggregated to 10-minute intervals. Each interval included the number of controllers who were on position and did not incur an OE and the number of controllers who did incur an OE. Probabilities were calculated for each 10-minute time interval and then were summed across time intervals to develop a time on position probability distribution. **RESULTS:** The probability of an OE occurring within any given 10-minute interval ranged from .002% (at the 90 min. interval) to .006% (at > 120 min. interval), resulting in an average probability of .004%. **CONCLUSION:** Contrary to the results of OE frequency distributions, the risk of an OE occurring fluctuates across 10-minute time intervals. The chances of an OE occurring within any given 10-minute interval is 1 in 25,000 position changes. These results highlight the degree to which OEs are rare events and thus difficult to mitigate through conventional awareness training.

Learning Objectives:
1 TTo understand the differences between percentages and probabilities
2 To understand the value of using probabilities to identify safety vulnerabilities
3 To understand the limitation of using probabilities to access safety risk

4:30 p.m.
[272] COMPARING ORGANIZATIONAL AND NATIONAL CULTURES OF SAFETY IN COMMERCIAL FLIGHT OPERATIONS: A CASE OF UNITED STATES AND EUROPE
T.L. VON THADEN[1], S.E. WOO[2], AND S.M. SPAIN[2]
[1]University of Illinois at Urbana-Champaign, Human Factors Division, Savoy, IL; [2]University of Illinois at Urbana-Champaign, Department of Psychology, Champaign, IL

The purpose of this study was to compare the culture of safety in flight operations of two commercial air carriers, one based in the U.S. and the other in Europe. We examined whether national culture is reflected in commercial airline pilots´ perceptions of their organizations´ safety culture. According to Hofstede´s (1997) seminal work comparing national cultures on four dimensions (power distance, individualism-collectivism, masculinity-femininity, and uncertainty avoidance), Americans tend to be more individualistic and more tolerant of uncertainties than persons from the European country in our study. These two dimensions (i.e., individualism-collectivism and uncertainty avoidance) speak directly to individuals´ tendency to follow rules and regulations, which is translated into safety culture. We measured the safety culture in the flight operations department of each organization based on four factors: Organizational Commitment, Formal Safety System, Operations Interactions, and Informal Safety System. Responses (US, N=303; EU, N=932), indicate that US pilots perceived a stronger culture of safety in the informal system ($t = 4.105$, $p < .001$), whereas the EU pilots responded more strongly to the formal safety system ($t = 4.899$, $p < .001$). In particular, the US pilots showed much more positive perceptions of their own authority than the EU pilots ($t = 9.821$, $p < .001$). Findings from this study open a window for future research, investigating how pilots´ attitudes toward safety rules and regulations are influenced by both organizational and national cultures.

Learning Objectives:
1 The relationship between perceptions of organizational safety and national culture are described
2 Organizational safety culture is explained

4:45 p.m.
[273] HFACS: A NEW APPROACH TO THE ANALYSIS OF INJURY CAUSATION AND SURVIVABILITY
M.E. LEWIS
RAF Centre of Aviation Medicine, AIHF, Bedfordshire,

INTRODUCTION: The Human Factors Analysis and Classification System (HFACS) was developed to systematically examine underlying causal factors of an accident. Although investigations usually establish what and how injuries occur, it is often more problematic to establish why the injuries occurred. The purpose of this study was to determine if it was possible to use HFACS in a new approach to the analysis of injury causation and survivability. The paper uses HFACS framework to examine aircraft accidents where injuries occurred to attempt to answer the critical questions of why the aircrew were injured, why they failed to escape and/or why they did not survive. **METHODS:** Aircraft accidents, from the years 1998-2008, in which injuries were sustained or survivability was of concern were identified from the RAF aircraft accident database for evaluation. The injury mechanisms involved were determined or had been previously established in the original investigation. In a similar way to analysing accident causes, the HFACS taxonomy was used to code the injuries to identify where unsafe acts, preconditions for unsafe acts, unsafe supervision and organisational influences affected injury outcome and survivability. **RESULTS:** The analysis indicated that all tiers of active and latent failures or conditions could be implicated in injury causation. Errors, primarily skill based, were commonly encountered in injury causation mechanisms and compromising survival techniques, but violations were rare. Within the latent conditions personal and environmental factors were involved as were failure to correct a problem and inadequate supervision. **DISCUSSION:** The analysis suggested that the general coding of the HFACS taxonomy is applicable to injury analysis. However, further filtering to the level of US DoD nanocodes show the nanocodes do not adequately describe or are not suited to coding for injury causation and survivability.