

Learning Objectives:

- 1 To understand advanced optical sensing technique for assessing flight line air quality.

*Monday, May 4
San Gabriel*

4:00PM

SLIDE: Human Performance and Safety

4:00 p.m.

[123] ASSESSING THE VALUE OF ADVANCED TECHNOLOGY AGAINST TRADITIONAL METHODS OF AVIATION TRAINING

C. TOSSELL¹, R. HOFFMAN², AND C. HAYS¹

¹USAF Academy, CO; ²United States Air Force, Andrews AFB, DC

INTRODUCTION: There is strong evidence demonstrating the effectiveness of simulation-based training in the acquisition and assessment of aviation skills. Although higher fidelity levels typically translate into better training, budget constraints may limit what technology an organization uses to supplement other air and ground flight training. Desktop technology and chair flying offer inexpensive and low fidelity ways to provide certain aspects of flight training to aviators. **METHODS:** This study assessed the value of both methods in providing students the opportunity to practice flight pattern procedures and radio calls. We compared the effectiveness of a desktop training tool designed to teach these skills against more traditional methods of training: chair flying (mentally and physically rehearsing while in a chair) and basic memorization from printed materials. Experienced aviators used a behaviorally-anchored rating scale to assess each subject's performance on a higher-fidelity simulator. **RESULTS:** The group trained through chair flying and the group that trained through desktop technology both exhibited significantly better performance on the simulator compared to the group that memorized printed material. Surprisingly, the group that participated in chair flying significantly outperformed the group exposed to the desktop training intervention. Additional reaction data was collected via survey. Results show the desktop trained group did have higher reported situation awareness scores. **DISCUSSION:** Implications of this research to aviation training programs are also addressed.

Learning Objectives:

- 1 Understand various methods of basic aviation training
- 2 understand how to experimentally test the effectiveness of training interventions

4:15 p.m.

[124] APPLICATION OF SPECTRAL ANALYSIS OF NOISE DATA TO DEFINE HEARING PROTECTION REQUIREMENTS FOR MILITARY AIRCREW

S.H. JAMES

QinetiQ, Hampshire, UK

INTRODUCTION: As each new aircraft has been introduced into UK military service there has been a general trend for the internal cockpit and cabin noise levels to increase. This, coupled with more stringent noise exposure legislation, means that by the very nature of military operations and training some personnel will routinely be exposed to noise levels that, without adequate hearing protection, will cause permanent hearing damage. When protecting personnel against high noise, care must, however, be taken not to mask the audio warning signals, communications and natural audio cues that military operators routinely use to aid mission effectiveness and flight safety. **METHODS:** The types and levels of noise experienced in twenty aircraft types was analysed and the contribution the electrical communications make to the daily dose received by the aircrew of those aircraft was calculated. With this understanding, a methodology based on detailed spectral analysis was developed that defines where improvements to hearing protection should be made if hearing damage risk is to be further reduced. **RESULTS:** The methodology applied to the aircraft data considered during this study showed distinct trends in hearing protection requirements within the fast jet and helicopter categories of aircraft, and that the helicopter trends matched the

requirements for a number of training and heavy transport aircraft. **DISCUSSION:** Solutions identified that could immediately meet these trends in hearing protection requirements include analogue Active Noise Reduction and double hearing protection systems incorporating a communications earplug. However, further work would be needed to confirm reliable detectability of natural audio cues with both technologies.

Learning Objectives:

- 1 To provide an understanding of how a methodology using detailed spectral analysis will benefit the identification of trends in hearing protection requirements across aircraft types.

4:30 p.m.

[125] EVALUATION OF SENSORIMOTOR PERFORMANCE DURING LUNAR LANDING

K.R. DUDA¹, L.R. YOUNG², C.M. OMAN², A.M. LIU², A.J. STIMPSON², AND T.K. CLARK²

¹Charles Stark Draper Laboratory, Cambridge, MA;
²Massachusetts Institute of Technology, Cambridge, MA

INTRODUCTION: Landing on the moon requires the selection and identification of a location that is level and free of hazards, along with a stable, controlled descent to the lunar surface. During crewed landings, astronauts will be expected to interact with automated systems, perform tasks such as landing aimpoint re-designation, or make adjustments to the descent trajectory and touchdown point through direct manual control. However, vestibular and visual sensorimotor limitations resulting from exposure to lunar gravity after short-term adaptation to weightlessness, sun angles, surface reflectivity, and dust blowback from the descent engine are likely to interfere with performance and safety. **METHODS:** Vehicle acceleration and rotation rate profiles of several candidate trajectories from the braking burn through touchdown were analyzed for their likelihood of causing spatial disorientation. The visual environment of the moon (lunar surface characteristics, lighting angles) was analyzed in terms of its effects on perception of size and distance, identification of hazards and suitable landing sites, and geographic and terrain awareness during the descent from lunar orbit and approach to landing. **RESULTS:** The candidate trajectories contain acceleration and rotation rate profiles that are likely to produce attitude perceptions that differ from actual vehicle state. The errors in attitude perception coupled with the dark, featureless, or fractal lunar terrain, low sun angles, and biases in the perception of object size and distance could result in reduced accuracy of pilot-in-the-loop control and safe lunar landing. **DISCUSSION:** Advanced display countermeasures for enhancing situation and terrain awareness will be required, along with appropriate pilot-interaction modes and vehicle flight dynamic augmentation to overcome performance limitations associated with lunar lighting, terrain characteristics, and pilot perceptions. This work was supported by the National Space Biomedical Research Institute through NASA NCC9-58-11.

Learning Objectives:

- 1 An in-depth understanding of the visual and vestibular conditions that lead to spatial and geographic disorientation during lunar landing.

4:45 p.m.

[126] THE RELATIONSHIP BETWEEN MOMENT LOADING, EMG AND FATIGUE IN NECK MUSCLES DUE TO DIFFERENT COMBINATIONS OF HELMET MASS AND BODY POSTURE

P.K. PARKER, AND N. SMITH

QinetiQ, Farnborough, Hampshire, United Kingdom

There is a requirement to understand the benefit of reducing helmet mass on neck muscle fatigue. A static tilt table method compared a 1.2kg and 1.8kg helmet with the same centre of gravity for their effects on neck muscle fatigue for body postures applicable to Rotary Wing (RW) aircrew. 10 male subjects were tested using both helmets at 50° and 90° to the vertical prone, and 25° supine. Subjects were required to support their head, neck and helmet under test for as long as possible. Tests were terminated at a maximum one hour. At