FLIGHT EVALUATION OF AN ACOUTIC ORIENTATION INSTRUMENT (AOI). K.K. Gillingham* and J. E. Tees. Armstrong Laboratory, Brooks AFB TX 78235-5000 and NASA Life Sciences, 8600 Fox Chase Dr., Dayton, OH 45432-5044.

INTRODUCTION. An AOI provides an auditory display of primary flight parameters in theory allowing the pilot to maintain spatial orientation while seated in a seat. The US Air Force has been testing an auditory flight simulator-tested AOI, which displays airspeed and vertical velocity as well as other auditory images, and bank angle as lateralization of those images, was evaluated in flight in a Jetech Queen Air aircraft.

METHODS. The performance of 8-instrument-rated pilots during five experimental maneuvers (straight and level, 30° banked turn, steep turn, level-off from 30° bank, and all three combinations of bank and pitch) under four conditions (instrument hood, hood + AOI, blind, and blind + AOI) was measured with respect to absolute vertical velocity and bank angle deviations (mean, IHS, and variance). ANOVA and post-hoc statistical comparisons of the four conditions were accomplished. RESULTS. In all maneuvers the blind + AOI condition resulted in significantly better (p<.05) bank angle control than was obtained in the blind-only condition, and bank angle control in the blind + AOI conditions was significantly different from that obtained under either hood condition. Although vertical velocity control tended to be better in the blind + AOI than in the blind-only condition, statistical significance was reached only in straight and level flight. CONCLUSION. The AOI enables a pilot to maintain bank angle control in the absence of vision. It is potentially useful in vertical velocity control is also evident, but the vertical velocity display needs to be improved.

DYNAMICS OF THE G-EXCESS ILLUSION. K. A. Butler*, M. Reches*, F. E. Guedry 3, B. J. McGrath, and A. H. Rupert 3. 1. Naval Aerospace Medical Research Laboratory, Pensacola, FL 32508-5700. 2. NASA, Johnson Space Center, Houston, TX 77058. 3. Aerospace Medical Research Laboratory, Brooks AFB, TX 78235.

INTRODUCTION. The G-excess illusion is increasingly recognized as a cause of aviation mishaps especially when pilots perform high-speed, steeply banked turns at low altitudes. Centrifuge studies of this phenomenon have examined the perception of subject orientation and/or target displacement during maintained hypergravity with the subject's head held stationary. The transient illusory perceptions produced by moving the head in hypergravity are difficult to study because the high angular velocity ensures the presence of strong Coriolis cross-coupled semi-circular canal effects that mask immediate transitory otolith-organ effects. The present study reports perceptions following head movements in hypergravity that involve movement of the subject's head maintained at a constant attitude with low angular velocity to minimize cross-coupled effects. METHODS. Fourteen subjects flew on the NASA KC-135 were exposed to 1.8 G for torso at 0°, or +30° and head at 0° (both axes). Statistically significant increases in error at 3 G, 1 G, and 0 G were observed when the body was pitched backward in the -30° and -45° positions and head at 0°. RESULTS. In this experimental paradigm, the following conclusions have been shown to have no independent effect on the mean error in reported attitude: (a) separate sensitivity to roll vs pitch axis, (b) repeated tests with digital feedback, and (c) separate gravity of the vector at 1 or 2 G. Level has been shown to have an error inducing effect when the neck is extended while keeping the head level.

THE EFFECT OF VISUAL SCENE INFORMATION ON THE SOMATOGRAVIC ILLUSION. F. N. Prevost, D. C. Vanner, and K. K. Gillingham*. Armstrong Laboratory, Brooks AFB, TX 78235-5000; Southwest Research Institute, San Antonio, TX 78208-2224

INTRODUCTION. The somatogravic illusion (SGI) occurs when a shift in perceived gravity occurs while the subject is exposed to a varying gravitational force vector created by a sustained linear acceleration that is misinterpreted as a change in pitch or bank attitude. Since the SGI typically occurs under degraded visual conditions, this study attempted to determine which visual scene cues are most effective in overcoming the SGI. METHODS. Nine subjects (seven pilots) were exposed to 5.67 m/s² acceleration (+30 deg pitch SGI) in the presence of the following 12 visual scenes. They experienced the SGI both with their eyes closed and while viewing visual scenes depicting acceleration over a shoreline through a wide field-of-view (40° x 60°) head-mounted display. The scenes contained horizon, perspective, texture, and color cues in both isolation and various combinations. Subjects indicated the direction of "down" during the final 7 s of each trial, and also rated the amount of linear vector produced by the scenes. RESULTS. None of the scenes significantly reduced the magnitude of the SGI relative to the eyes-closed pitch illusion (+66° deg). Significant reduction was induced by some scenes, but it did not correlate with the ability of the scenes to reduce the SGI, even in the most visually dependent subjects. CONCLUSION. Although visual scene displays reliably reduce the magnitude of the SGI and other orientation illusions remains uncertain. The capability to elicit vision may not be sufficient for overcoming the SGI.


INTRODUCTION: Aeromedical evacuation is on the brink of some extraordinary advances in patient care technology. With the explosion of biomedical technology over the past 15 years, a plethora of computer based patient assessment technologies have emerged. These new technologies are providing the flight nursing corps with endless research opportunities in the area of advanced medical equipment applications in the aircraft environment. METHODS: Some of the current off-the-shelf items which may apply to in flight patient care include: 1) pulse oximetry, for non-invasive arterial oxygen saturation measurement, 2) automated blood pressure monitoring of multiple pressure points, 3) transcranial Doppler, for measuring cerebral blood flow. Research in the application of these devices will require the development of experimental protocols, in flight test and evaluation, data collection and analysis, and plans for emergency medical equipment and training requirements. RESULTS: An increase in the quality in flight patient care will be the major benefit derived from this process. CONCLUSION: The result of these efforts will culminate in the transformation of aeromedical patient care into the 21st century.
The final design configuration to date will be discussed with future space program Test Facility evaluations will be demonstrated for various medical contingencies. will be given. Also, parabolic flight and underwater Weightless Environmental allow for medical capabilities within CF’R, functional within the STS, delivery systems), and personnel (patient and crew medical officers). It must be supply, IV pump, transport monitor, transport aspirator, and intravenous fluids Health Maintenance Facility (HMF) by providing a restraint/interface system for all and transportation to earth. The CMRS will support all medical capabilities of the Vehicle (ACRV) for support of an ill or injured crewmember requiring stabilization universally deployable medical restraint/workstation on Space Station Freedom. NASA Johnson Space Center, Houston, Texas.


The CMRS is a prototype system designed and developed for use as a universally deployable medical restraint/workstation on Space Station Freedom (SSF), the Shuttle Transportation System (STS), and the Assured Crew Rescue Vehicle (ACRV) for support of an ill or injured crewmember requiring stabilization and transportation to earth. The CMRS will support all medical capabilities of the Health Maintenance Facility (HMF) by providing a restraint/interface system for all equipment (Advanced Life Support packs, defibrillator, ventilator, portable oxygen supply, IV pump, transport monitor, transport aspirator, and intravenous fluids delivery systems), and personnel (patient and crew medical officers). It must be functional within the STS, ACRV, and all SSF habitable volumes. The CMRS will allow for medical capabilities within CPR, ACLS, and ATLS standards of care. This must all be accomplished for a worst case transport time scenario of 24 hours from SSF to a definitive medical care facility on earth.

A presentation of the above design prototype with its subsequent one year SSF/STP hardware testing and ground based simulations testing will be given. Also, parabolic flight and underwater Weightless Environmental Test Facility evaluations will be demonstrated for various medical contingencies. The final design configuration to date will be discussed with future space program impact considerations.

DELIVERY OF CARDIOPULMONARY RESUSCITATION IN THE MICRO- GRAVITY ENVIRONMENT. M. R. Barratt* and R. D. Billica*. KRUG Life Sciences and Medical Operations, NASA Johnson Space Center, Houston, TX.

INTRODUCTION. The microgravity environment presents several challenges for delivering effective cardiopulmonary resuscitation (CPR). Chest compressions must be driven by muscular force rather than by the weight of the rescuer’s upper torso. Airway stabilization is influenced by the neutral body posture. Rescuers will consist of crewmembers of varying sizes and degrees of physical deconditioning from space-flight. Several ACLS features were designed to accommodate these factors were tested in the one g environment, in parabolic flight, and on a recent shuttle flight. METHODS. Utilizing study participants of varying sizes, different techniques of CPR delivery were evaluated using a recording CPR manikin to assess adequacy of compressive force and frequency. Under conditions of parabolic flight, methods tested included conventional positioning of rescuer and victim, free-floating "aircraft." The CPR were planned, straddling the patient with active and passive restraints, and utilizing a mechanical cardiac compression device (CCAD). Multiple restraint systems and ventilation methods were also assessed. RESULTS. Distances of effective CPR were adequate but rapidly fatiguing. The CCAD was able to provide adequate compressive force, but positioning was problematic. CONCLUSIONS. Delivery of effective CPR in microgravity will be dependent on adequate restraint and patient restraint, technique, and rescuer size and preference. Free-floating CPR may be employed as a stop-gap method until patient restraint is available. Development of an adequate CCAD would be desirable to compensate for the effects of deconditioning.