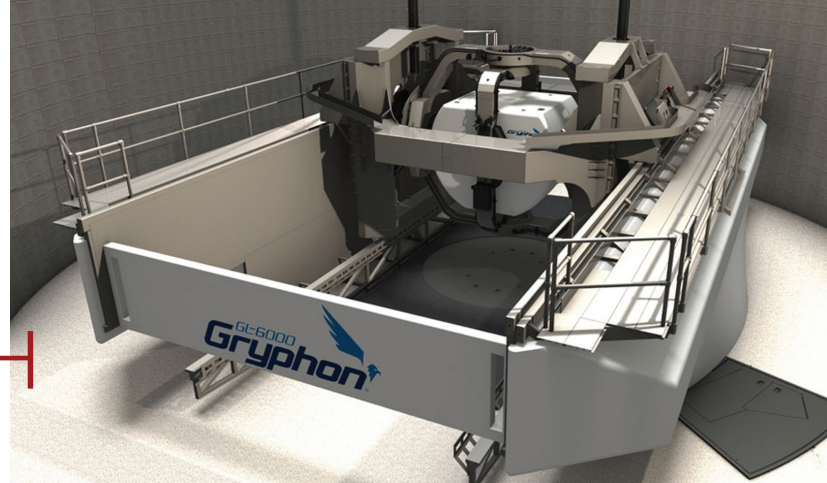**AIRCREW TRAINING** SYSTEMS

GL-6000 RESEARCH
APPLICATIONS

The precision engineering and innovative design of the GL-6000 makes it possible to replicate not only the unique acceleration environments common to flight and space travel, but also rotational and linear acceleration components that are far below the thresholds of human detection. Combining these unique motion capabilities with fully customizable visual and auditory sensory input, researchers can isolate and test sensory perception in ways only limited by their individual creativity.

- Develop advanced motion cueing algorithms for driving, locomotive and aviation simulator design

- Evaluate Artificial Gravity (AG) simulation for Orbital and Suborbital space research

- Analyze pilot performance during simulated Lunar and Martin landing gravity transitions

- Perform motion sickness desensitization and adaptation research to unusual G-environments

- Study the effects of stress, mental workload and fatigue on performance and manual control

- Compare human spatial orientation and motion perception in unusual rotational and gravity environments

- Track sensorimotor control of reaching movements during suborbital space flight take off manual control tasking

- Develop advanced eye-movement based detection algorithms for G-induced Loss of Consciousness (GLOC)

- Compare motion sickness symptom development during sinusoidal oscillations with and without concordant visual, proprioceptive and auditory cues

- Determine human physiological response to various potential sub orbital space flight acceleration profiles

- Monitor human performance degradation during aircraft carrier launch and landing following prolonged sleep deprivation

- Simulate and recreate aircraft accidents

- Determine adaptation to Coriolis inducing head movements in a sustained-G flight simulator

- Track human orientation perception during vehicle roll tilt in Hyper-Gravity

- Study the effects of Hyper-Gravity on manual control tasking ability

- Measure cognitive workload while under using Functional Near Infrared (fNIR) Spectroscopy

- Predict adaptation to altered gravitational states

- Analyze transference of Virtual Reality based sensorimotor adaptation to real world motion environments

GL-6000 RESEARCH
CASE STUDIES

HUMAN ORIENTATION PERCEPTION DURING VEHICLE ROLL TILT IN HYPER-GRAVITY

This experiment will study human perception of vehicle roll tilt in different gravitational environments. In the primary experiment, subjects will be placed in the cab of a long-arm centrifuge, spun up to the desired gravitational level (1, 1.5 or 2 Earth G's aligned with the longitudinal or Z-axis), and then be passively rolled in the dark to a series of angles at different rates. Subjects will continuously report their perception of the roll angle using a somatosensory indicator which they will attempt to keep aligned with the direction of gravity. It is hypothesized that gravitational level, roll angle, and roll rate will effect subjects' perceptions of orientation.
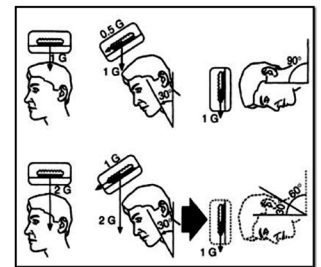
OBJECTIVES:

- To study the steady-state and transient dynamics of perception of the G-excess illusion during cab rotation in roll

- To improve G-excess spatial disorientation training

- To collect preliminary data for a current National Space Biomedical Research Institute grant solicitation

OPTICAL BRAIN MONITORING USING FUNCTIONAL NEAR INFRARED (FNIR) SPECTROSCOPY TO MEASURE COGNITIVE WORKLOAD WHILE UNDER G

An accurate measure of mental workload in human operators is a critical element of monitoring and adaptive aiding systems that are designed to improve the efficiency and safety of human–machine systems during critical tasks. Functional near infrared (fNIR) spectroscopy is a field-deployable non-invasive optical brain monitoring technology that provides a measure of cerebral hemodynamics within the prefrontal cortex in response to sensory, motor, or cognitive activation. This study seeks to determine the efficacy of using fNIR spectroscopy to measure cognitive workload while under G by testing a group of naive subjects at several standardized mental workload, memory and cognition tasks at various G levels in the GL-6000.

OBJECTIVES

- To determine differences in cognitive performance and mental workload at various G levels

- To validate the fNIR optical brain monitoring system under G loading

- To develop protocols and metrics for future testing of aviators during Upset Prevention and Recovery Training, Spatial Disorientation and Tactical Flight Training
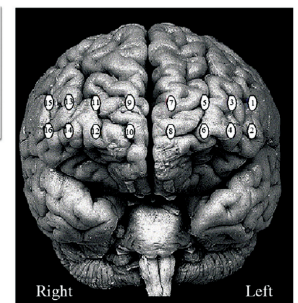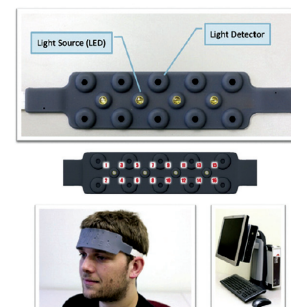
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