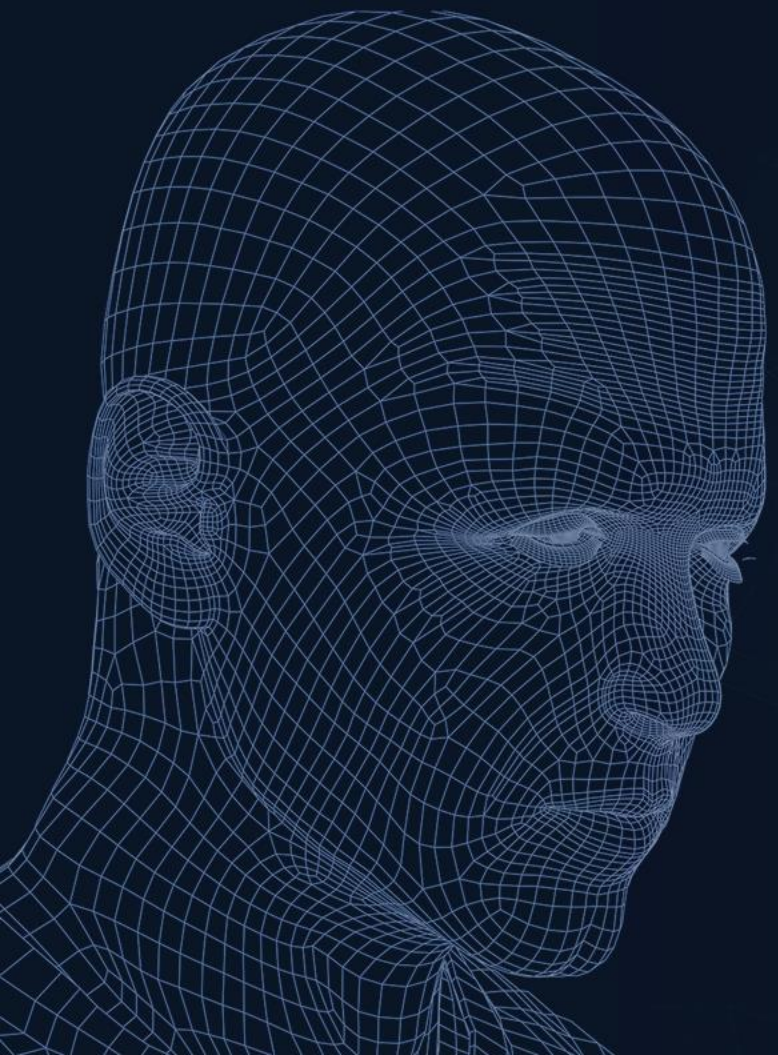
Human Systems integration division

Psychophysiological Research Laboratory



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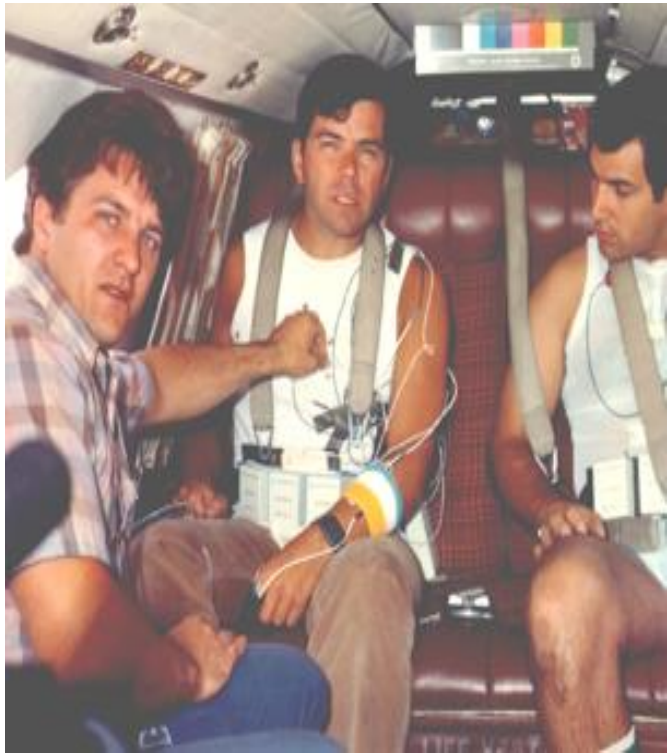
PRL Goals:

- Investigate relationships between physiology and behavior.
- Examine impact of the environment on health and performance.
- Study how humans adapt in space, land, sea, and air vehicles.
- Assess and correct hazardous operator states.
- **Ambulatory monitoring in operational environments.**



Why Ambulatory Monitoring is Needed

- In harsh environments there is a need for continuous ambulatory monitoring to capture how physiological parameters respond to everyday activities, stress, and environmental factors.
- It can detect early signs of health issues potentially preventing complications by allowing for prompt interventions.
- Images on left and center are from pilot studies conducted with firefighters and air traffic controllers wearing physiological monitors.
- Image on the right is an interior view of a US Army Command-and-Control Vehicle (C2V) where crew were monitored for susceptibility to motion sickness.

11. Cowings, P.S, Toscano, W.B., DeRoshia, C., Tauson, R. (2001). Effects of Command-and-Control Vehicle (C2V) Operational Environment on Soldier Health and Performance. Journal of Human Performance in Extreme Environments. 5(2),66-91.

PRL Methodology:

Assessment: Converging Indicators

- Physiological measures
- Performance metrics
- Subjective self-report scales

Correction: Autogenic Feedback Training Exercise (AFTE)

- Self-recognition and regulation of autonomic responses
- Combines several physiological and perceptual training techniques (i.e., biofeedback and Autogenic Therapy)
- AFTE used to mitigate motion sickness symptoms and improve performance

Transfer of NASA Technology to NAMRU-D: Mitigating Motion Sickness with Autogenic Feedback Training Exercise

- **Problem:** Motion sickness poses a significant safety risk, particularly in the context of aviation.
- **Aims:**
  - Train NAMRU-D personnel to administer AFTE to participants in laboratory study.
  - Determine effects of **2-hours** of AFTE for mitigating symptoms of motion sickness and spatial disorientation.
- **Participants:** 26 men and women; 6 were active-duty military pilots.
- **Methods:**
  - Participants were given a rotating chair test before and after training.
  - 2 hours of AFTE training given over four days (30-minutes each day).
  - AFTE sessions consisted of alternating trials of relaxation and arousal (3-minutes per trial).
  - 13 participants were trained by NASA (remotely) and 13 by NAMRU-D at local site.
  - Dependent variables: motion sickness tolerance (number of minutes) and symptoms.
- **Results:**
  - Significant increase in motion sickness tolerance ($p=0.0003$) and reduction in symptoms ($p=0.0015$).
  - No significant differences between men and women.
  - Demonstrated similar training effects in administering AFTE by NASA and NAMRU-D trainers.

Reference: Cowings PS, Toscano WB, Espinosa FE, 2024. Transfer of NASA Technology to the DOD: Mitigating Motion Sickness with Autogenic Feedback Training Exercise, NASA-TP-20240005631.

Navy Collaboration 2024-25
Study in Progress

Evaluation of Autogenic Feedback Training Exercise as a Countermeasure to Cybersickness

- **Problem:** Cybersickness is common occurrence with Virtual Reality (VR) exposure which limits individual's cognitive and motor performance. Time for habituation incurs significant cost in terms of time.

- **Aims:**
  - Evaluate AFTE effects on individual symptoms both during and after VR exposure.
  - Evaluate habituation to VR environments with and without AFTE.
  - Evaluate individual cognitive performance during VR exposure.

- **Participants:** 44 men and women recruited from general population.
- **Methods:**
  - Participants randomly assigned to AFTE or Control (no training) group.
  - AFTE subjects given four, 30-minute training sessions on two consecutive days.
  - All participants given 5 VR exposures (each 30-minute max) while performing a cognitive task (short-term memory) .
  - Dependent variables: performance metrics (response accuracy and latency) and symptoms.

EVALUATION OF AFTE AS A MOTION SICKNESS MITIGATION STRATEGY AT U.S. NAVY TRAINING AIR WING

- **Problem:** Current methods for mitigating airsickness include pharmaceuticals and habituation training, both of which have limitations and potential negative effects. Utilization of current strategies is not standardized, and new technology warrants modernization. AFTE is a nonpharmacological adaptation training method shown to improve motion sickness and overall performance.
- **Objectives:**
  - Evaluate the short- and long-term effectiveness of AFTE for mitigating airsickness, enhancing flight performance, and decreasing anxiety and compare to Barany chair training.
  - Evaluate AFTE within the Navy's airsickness mitigation program. This study builds on recent efforts to transfer AFTE knowledge from NASA to the Navy and targets real-world use.
- **Military Relevance:** This study will inform and facilitate the adoption of AFTE across DoD aviation training, including the Air Force. AFTE could lead to significant budgetary savings (e.g., reduced training delays and attrition), increased training efficiency and effectiveness, and improved readiness in Naval and Air Force aviation.

Proposal Submitted in FY25: 711 HPW Studies and Analysis Intramural Proposal (status: in review)