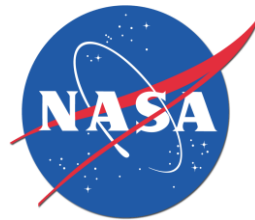


# **The Effects of Physiological Self-Regulation Training using LaRC MindShift Invention Technology on Users' Psychophysiology and Cognitive Performance**

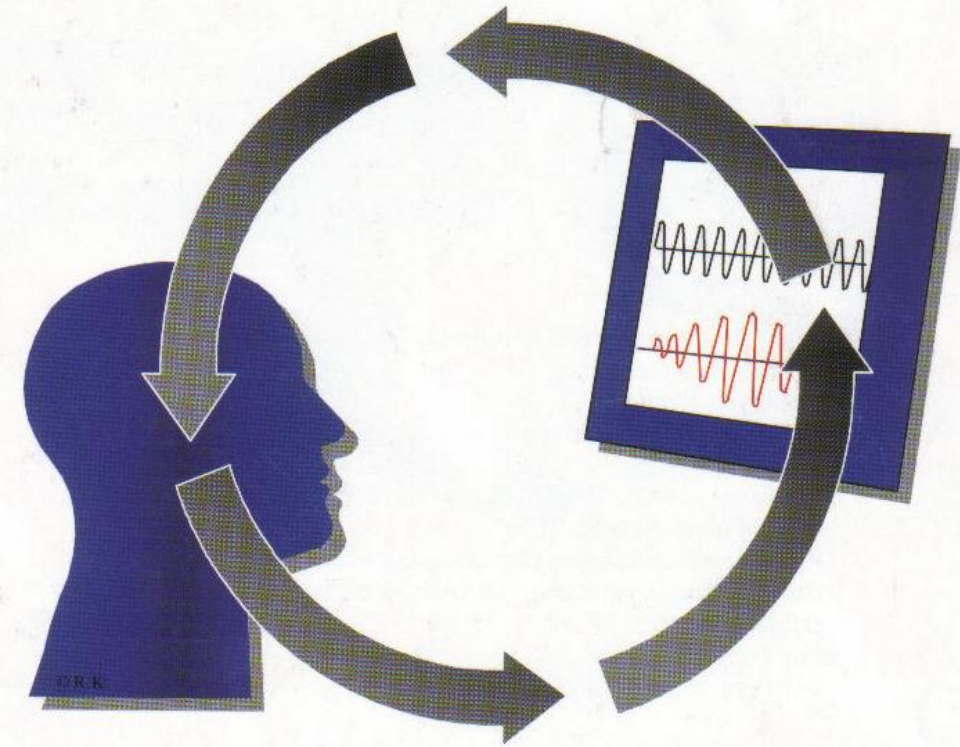
Brittany N. Neilson



TEXAS TECH  
UNIVERSITY.



# Physiological Self-Regulation



- Traditionally used for medical and clinical applications
- Shown efficacious for treatment of various disorders (e.g., ADHD) and reduction of stress
- “Better able to manage their cognitive resources” (Prinzel, Pope, & Freeman, 2002)
- Recent integration into gaming systems

# Physiological Self-Regulation Gaming Technology

- User experience adapted to physiological responses, which can be influenced by:
  - cognition
  - motivation
  - emotion
- Potentially useful and engaging method for ***physiological self-regulation training***
  - Used to improve physiological responses to stress, fatigue, cognitive performance, and behavioral functioning

# Relevance to NASA's Mission

## System Factors

- Airspace demand
- Interface demand
- Other related task demands

**Task Load**

## Operator Factors

**Work Load**

- Skill
- Strategy
- Experience

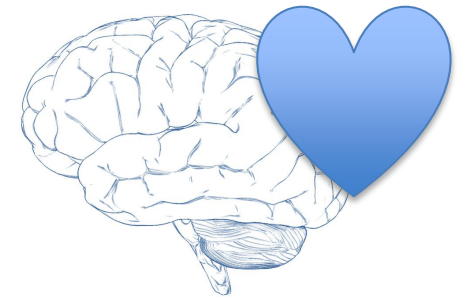
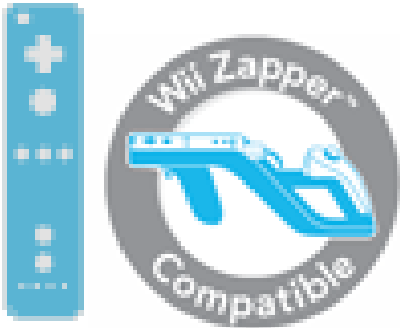
Higher-order  
cognition &  
stress

# MindShift Invention Technology

- Created by Alan Pope and Chad Stephens, NASA Langley (LaRC patent case, LAR 18144-1)
- With MindShift, a person is able to play off-the-shelf Nintendo™ Wii™ games enhanced with biofeedback

# MindShift Invention Technology

Game  
Performance

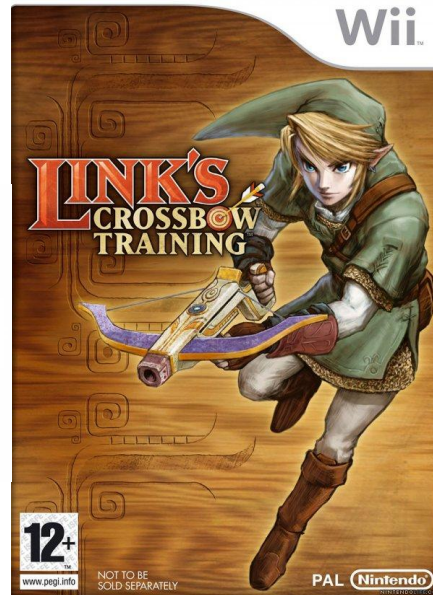


VG  
Challenge



S-R  
Challenge

# MindShift Invention Technology: Link Crossbow Training Game



# **MindShift Invention Technology: Link Crossbow Training Game**

## **Physiological Modulation: Pulse Photoplethysmography**

- PP is a passive, noninvasive technology that reads the heartbeat from a sensor on the earlobe
- Studies have related heart rate to physical exertion, stress and anxiety



# MindShift Invention Technology: Wii Sports Golf Game

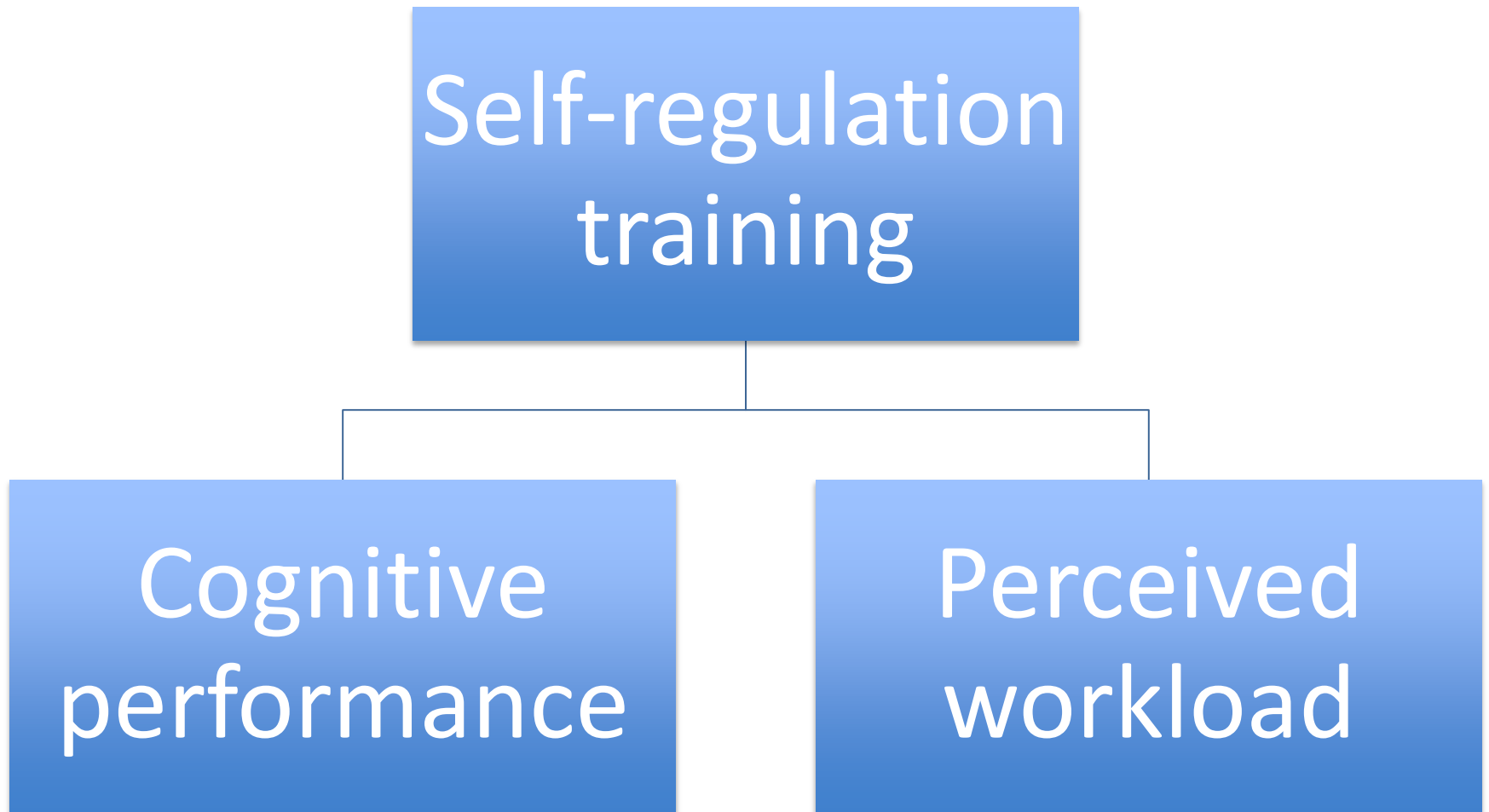


# MindShift Invention Technology: Wii Sports Golf Game

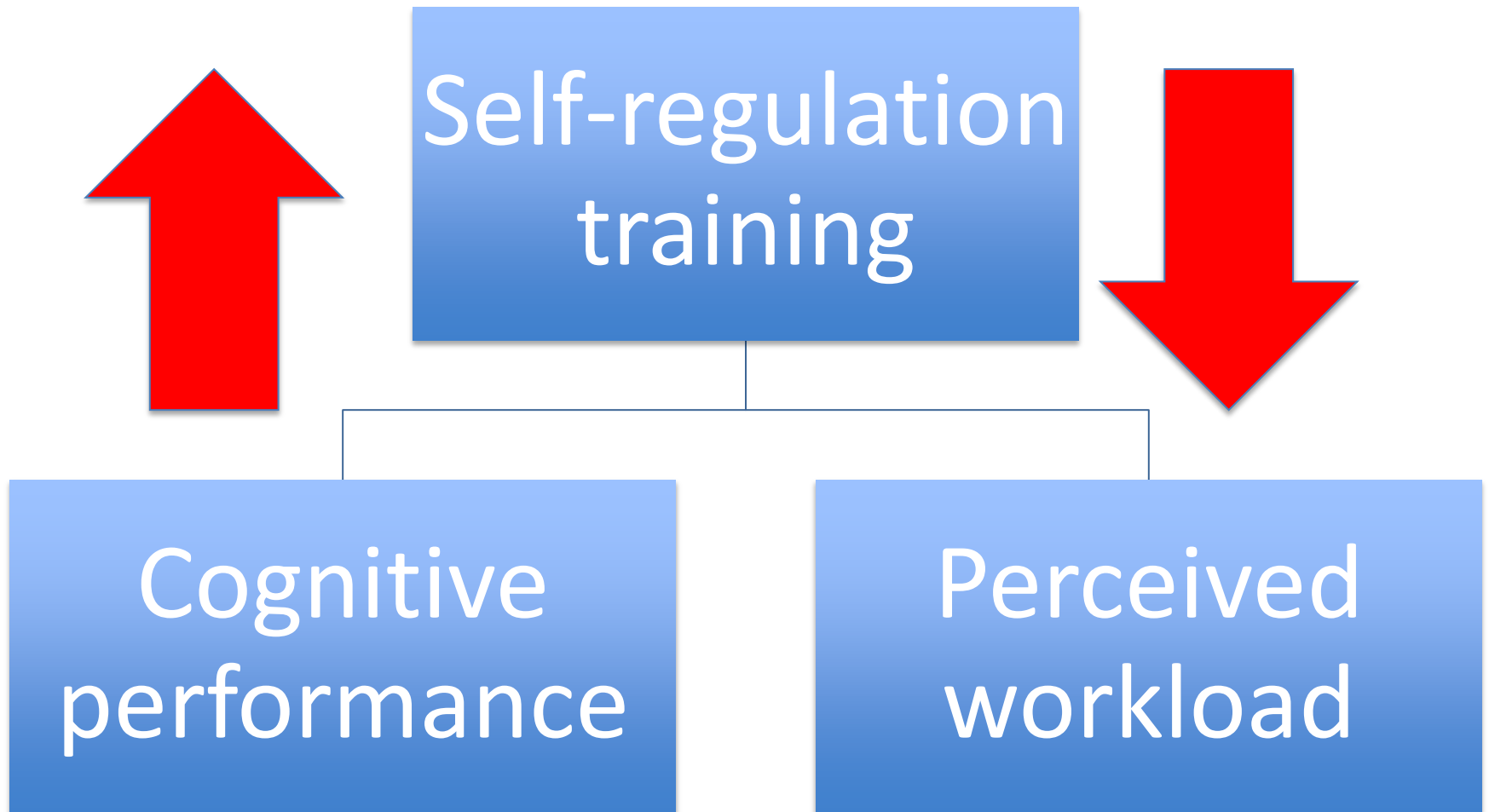
## Physiological Modulation: Electroencephalography

- EEG is a passive, noninvasive technology that reads electrical activity of the brain from sensors on the scalp
- Studies have related activity of the brain to attention, engagement, stages of sleep

# Purpose of Investigation



# Hypotheses

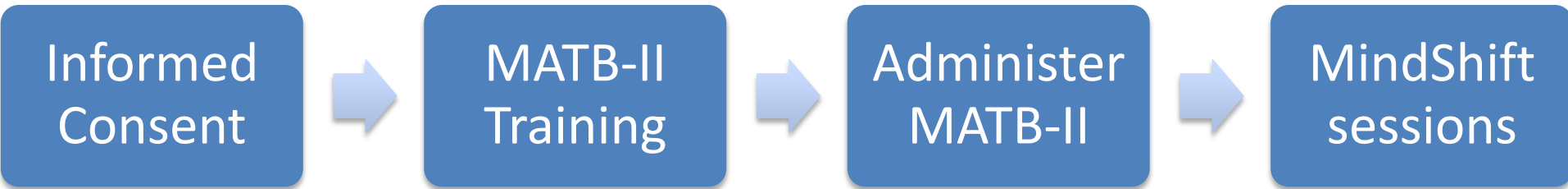


# Method

- 11 participants (6 men and 5 women) were recruited
  - Exclusionary criteria: experience with BCI/ biofeedback technology used in study, history of neurological disorder, TBI, cardiovascular disorder, or smoking.
  - $\geq 18$  years of age
  - Roughly equal representation of gender
- Approved by NASA LaRC IRB

# Procedure

## Session 1:



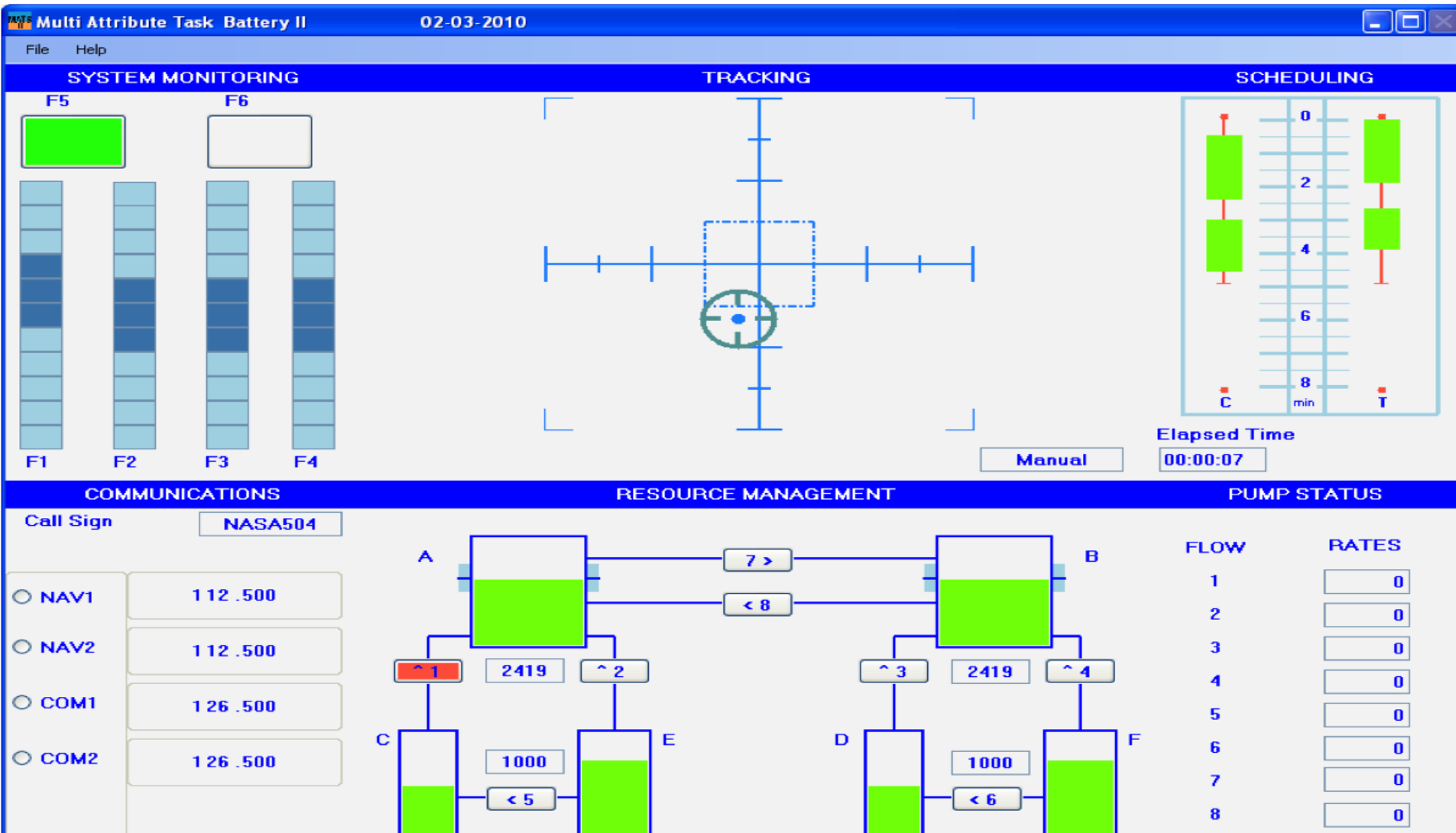
-Administer WRS after each task

## Proceeding Sessions 2-4:



Last session will include debriefing after experimental session

# Pilot Simulation Task: MATB-II (Comstock & Arnegard, 1992)



# Preliminary Analyses

Session	FOM from MATB-II	Self-reported WL
1	$M = 54.9$ $SD = 5.424$	$M = 63.6$ $SD = 16.545$
4	$M = 64.3$ $SD = 1.356$	$M = 29.0$ $SD = 5.657$

*Approximately 48 participants should be recruited based on 80% power, a medium effect size ( $d = .25$ ), and an error probability of 5% with two tails (Erdfelder, Faul, & Buchner, 1996).*



# Implications for Applications of Proposed Research

- To enable aerospace operators to hone their stress management and attention skills in physiologically-augmented leisure activities engaged in off-the-job in order to positively affect their on-the-job performance (Pope & Prinzl, 2005).



# Implications for Applications of Proposed Research



- Applicability to skill training on manually controlled critical tasks, such as UAV teleoperation, enabling these cognitive skills to be trained concurrently with manual skills.

# Thank you for your attention!

Questions can be addressed at this time.

For further questions, contact me:

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