In-Flight Physiological Monitoring: The 5th Generation Fighters and Beyond

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Background

- 5th Generation Fighterpilots are experiencing hypoxic like symptoms in-flight 2010-2011
- Raptor fleet grounded for 4 months (Alaska Dispatch | Sep 20, 2011)
- Returned to flight – pilots to wear finger pulse oximeter sensor as part of return to flight (477th Fighter Group November 2011)
- Finger pulse oximeter:
  - sensor sensitive to movement, Blood pooling during acceleration, and griping hard surfaces that can cause false readings
  - In-flight data only accurate 25% of the time

Helmet Ear Cup Integrated Oxisensor: 5th Generation Fighter SAB 120 Day Challenge: 15 Nov 2011

Helmet-Mounted Pulse Ox System Integration

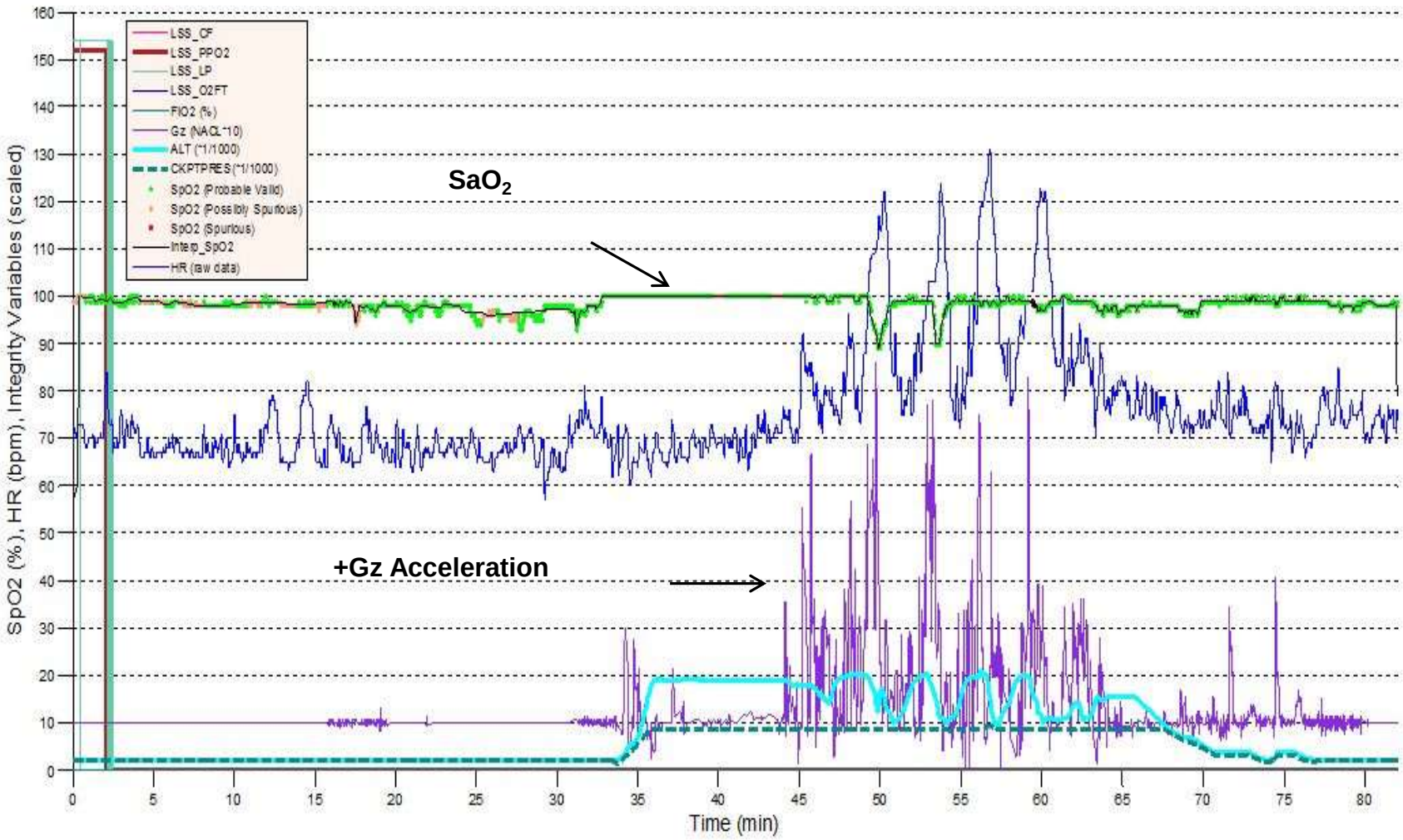
Cabling follows Comm Cord

In-line disconnects

WristOx Display

Current Helmet Ear Cup Integrated Oxisensor:

In-Flight Helmet Mounted Pulse Oximeter Data



Tactical Aircrew Physiological & Cognitive Monitoring System (TAPCOMS)

In-flight Cerebral Oxygen

Kobayashi & Miyamoto 2000

JASDF evaluation of cerebral O2 in flight

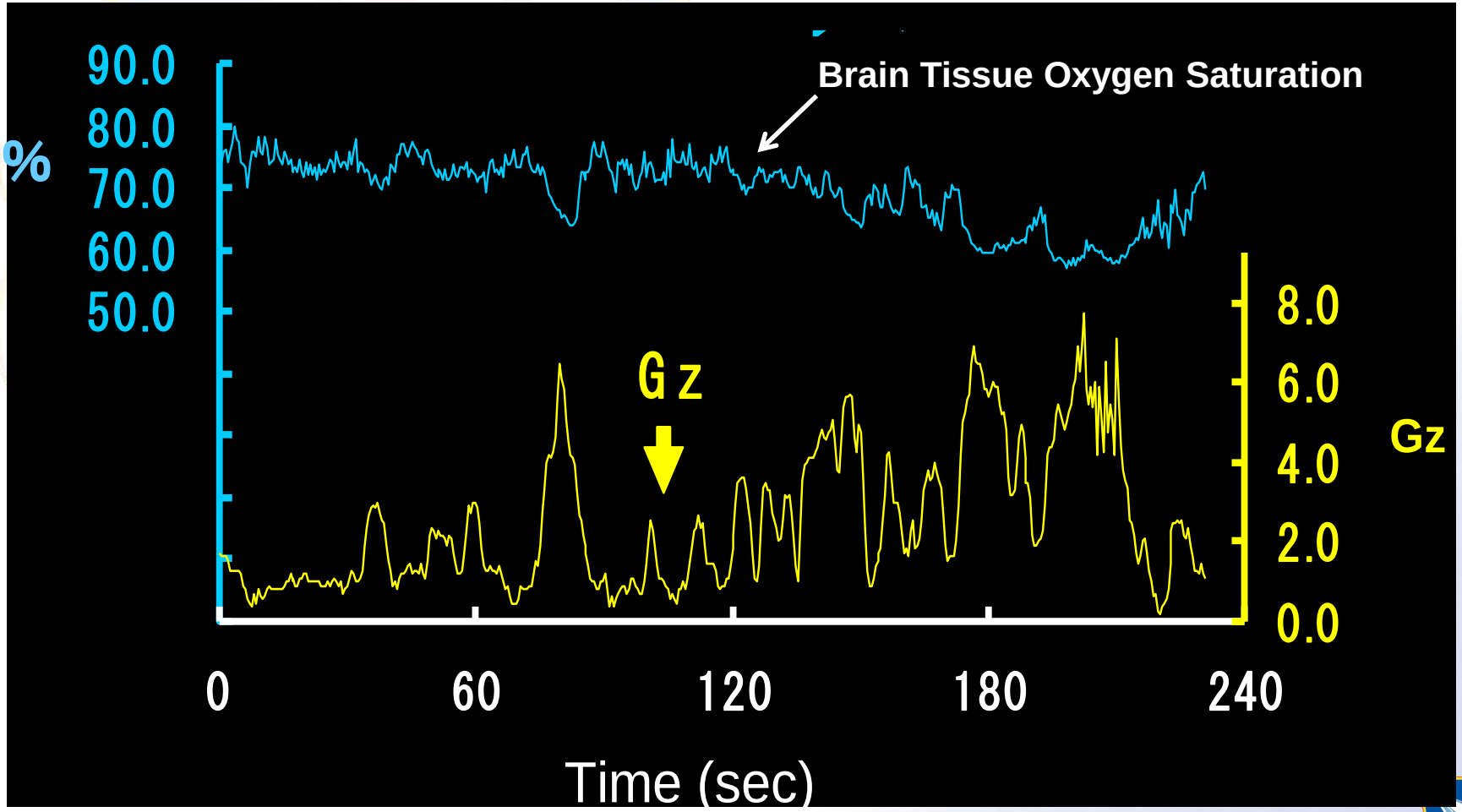
Demonstrated the efficacy of measuring cerebral O2 during aircraft maneuvering

711th/RHC actively pursuing a collaborative research agreement with JASDF

Unclassified

Brain Tissue Oxygen Saturation Changes In-flight Air Combat Maneuvering

(Kobayashi, 2003)



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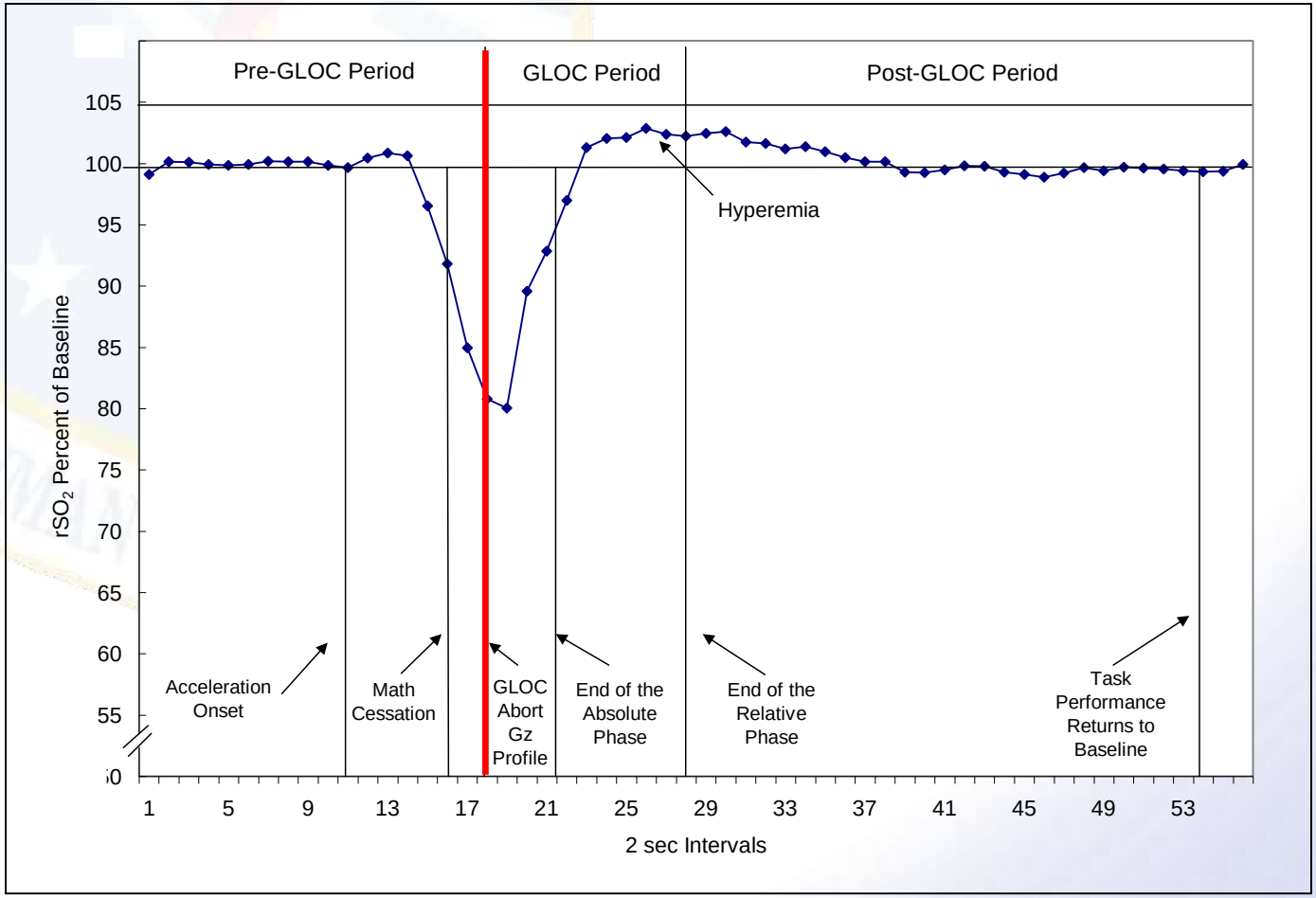
Brain Tissue Oxygen Saturation & Cognition
Pre- During and Post G-Induced Loss of Consciousness

(Tripp et al. 2010)



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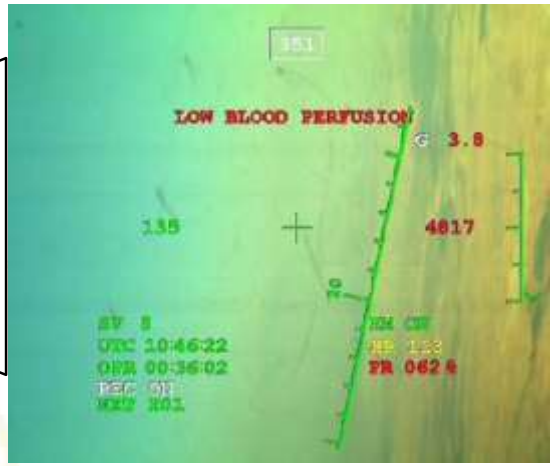
Integration of Dynamic Light Scattering Sensors into Digital Joint Helmet Mounted Cuing System

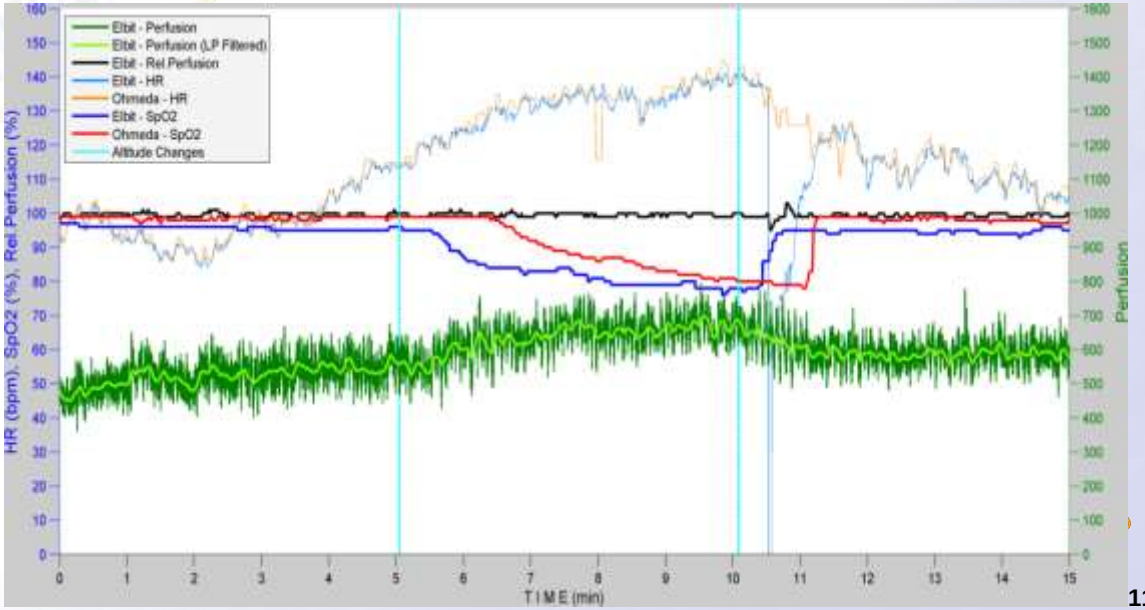


- Measures
  - Arterial blood Oxygen Saturation
  - Blood perfusion
  - Heart rate
- Warnings
  - Low blood perfusion – G-LOC
  - Low O_2 Saturation – Hypoxia

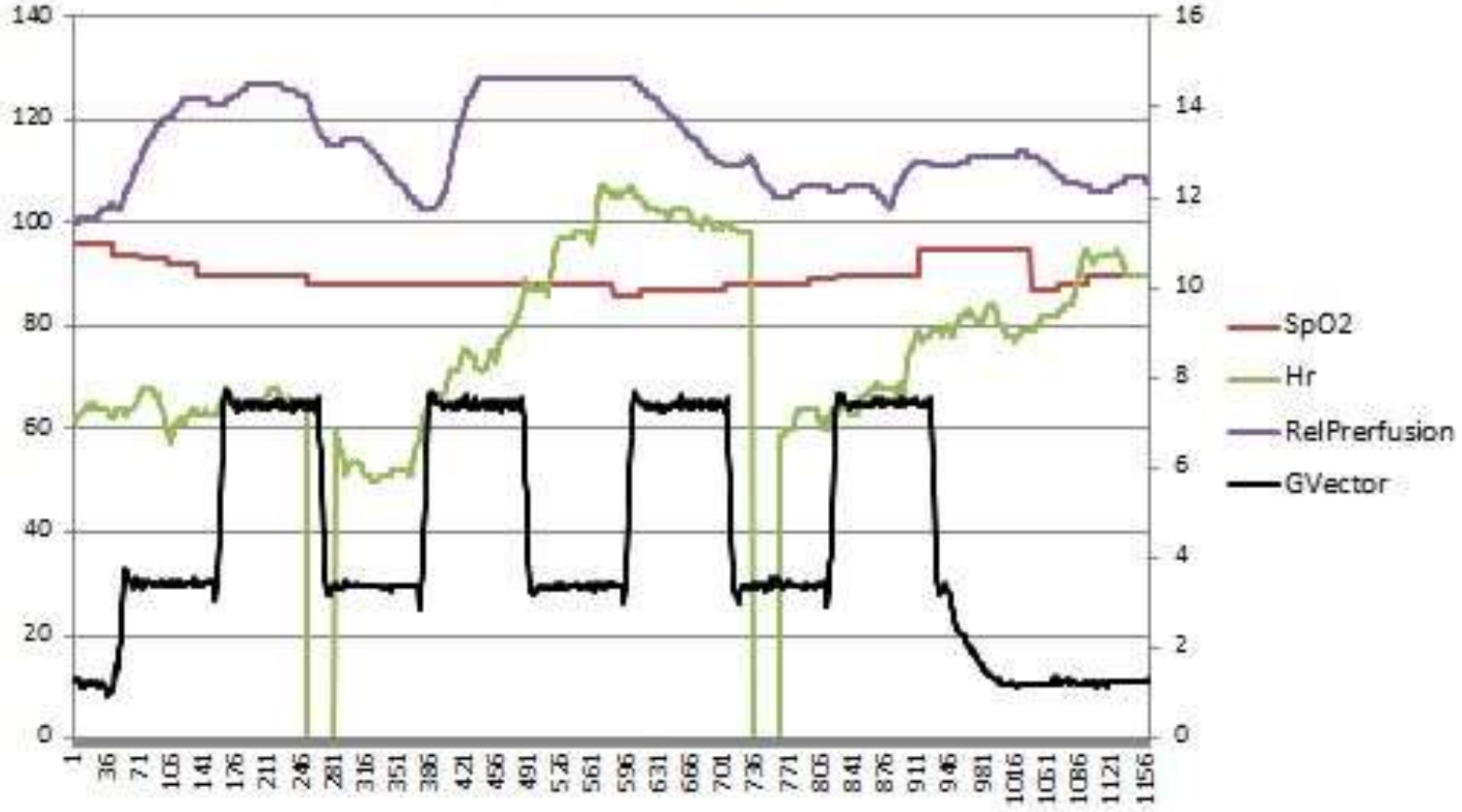
Hypoxia Cognitive Testing

Approach

- 15 subjects are participating in this study
- Flight simulation cognitive task
- Hypoxia exposure to 25K ft.
- ROBD – produce altitude breathing air equivalent



Acceleration Testing Brooks City Base
18-22 January 2016
5-9Gz SACM



Oxygen Mask Integrated CO2/O2 Monitoring System

- **This included the ability to measure and record:**
  - **The partial pressure of oxygen**
  - **The partial pressure of carbon dioxide**
  - **The total pressure**
  - **Temperature**
  - **Humidity**
  - **The mass flow of air through the system**

Hydration Monitoring

Dehydration → Decreased Cognition → Decreased G-tolerance

Ghost of the System

Questions