Optimizing Crew Performance in Long Duration Space Exploration: Best Practices for Team Training & Cohesion Measurement

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Project: CONSTELLATION PEGASUS

Cohesion Optimization in NASA Spaceflight Teams Experiencing Long-duration Assignment:

Training and Indices for Optimizing Performance and Gaining Astronaut Synergy Under Stress
Co-Investigators & Core Research Team

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At a Glance...
- 50,000 + students
- 12 colleges
- Study and research agreements with 98 institutions in 36 countries
- 84 master’s and 29 doctoral degree programs

Centers of Excellence
- Photonics
- Simulation and Training
Core Issues

- Exploration of new, uncharted worlds = team endeavor
- Expeditionary teams co-exist in all aspects of daily life within isolated, confined, extreme (ICE) & culturally diverse environments
  - Depend upon one another + mission control to complete mission goals & for their very survival
  - Minor breakdowns in within-team or between-team performance threaten mission success & crew member psychological/biological health
Critical Questions

- What are the best methods for **training** crews for **maintaining cohesion** and **optimal performance** during LDSF?

- What methods and technologies can be developed to **monitor individual and crew coping with the behavioral conditions** of spaceflight?
Approach

- Project Advisory Board
- Review of existing evidence:
  - Cohesion & team performance in analogue environments
    (Meta-analysis & qualitative review)
- Archival analogue data analysis:
  - U.S. Navy Submarine Teams
  - Air Traffic Control Teams
- Preliminary guidelines for instructional strategies
- Experimental plan detailing initial cohesion metrics and data collection procedures for validating instructional strategies
Project Advisory Board

- William (Bill) S. O’Keefe
  Manager II, Station Systems Department
  United Space Alliance (USA)

- John Mathieu, Ph.D.
  Dept. Head, Professor & Cizik Chair in
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- Jay Goodwin, Ph.D.
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- Active Astronaut (TBD)

- Albert W. Holland, Ph.D.
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  Flight Surgeon, NASA Johnson
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- Mark Reagan, M.S.
  Station Training Lead, NASA
  Johnson Space Center

- William (Bill) S. O’Keefe
  Manager II, Station Systems Department
  United Space Alliance (USA)
Approach - continued-

- Lab based & field based training/metric validation studies
- Two workshops:
  - *Team Training in Complex Environments: A Practical Approach to the State of the Science*
  - *Team Training for Cohesion and Performance in Complex Environments: Evidence-based Guidelines and Best Practices*
- Validated instructional strategy & cohesion metric
- Guidelines for automating cohesion measurement
Deliverables

I. Evidence-based guidelines/best practices for training designed to maximize team cohesion, and team performance

II. Validated instructional strategies for mitigating and managing performance failures due to lack of cohesion among spaceflight crew and coordinating ground crew

II. Validated index to measure and diagnose cohesion in order to avoid performance failures from cohesion decrements over the course of a mission
Progress to Date...

- Project advisory board finalized

- Archival analogue data analyses:
  - 26 U.S. Naval Submarine multi-team systems
    - 15 individuals dispersed among 3 component teams
  - Experimental debriefing strategy based on team self-correction processes facilitated component team performance and improved multi-team level coordination processes

- Review of existing evidence
  - Literature search: 500 articles pooled, 152 articles reviewed

- White papers:
  - Methodology for graphically depicting stressor interactions & development over time during LDSF
  - Conceptual model
Thank You

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