



Tips for Successful Flight Analogs Science

Human Research Program
Research Operations & Integration
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Why Propose Using Spaceflight Analogs?



- Throughput and larger N
- More crew time, less cost, fewer constraints
- Simulated mission conditions not currently available inflight (Lunar and Mars scenarios)
- Better controlled and repeatable conditions
 - Similar to *some* (but not all) flight conditions
- Ground validation or feasibility for flight implementation
 - Countermeasures testing
 - New equipment or software
 - New operations concepts or procedures



Credit: NASA

Analog Examples

■ Isolation & Confinement / Distance from Earth

- Human Exploration Research Analog (HERA)
 - 45-day missions, 4-person crew
 - Isolated, confined, and controlled
 - MCC support
- Polar Stations
 - 9-12+ months winter-over
 - Isolated, confined, and extreme

■ Altered Gravity

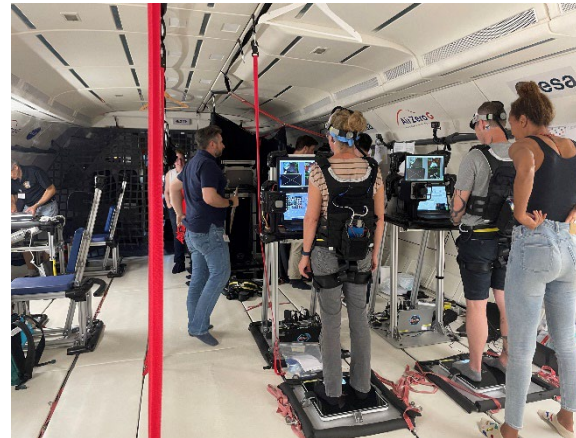
- Strict head down-tilt bedrest (HDT)
 - 30-60 days (typical)
- Parabolic flight



Credits: NSF



Credit: NASA



Credit: Sara Whiting, NASA



Credit: DLR

Approach to Analog Platform Selection



- Not required to use a specific facility (unless the grant call specifies)
 - Funding HRP Element(s) and ROI work with PIs to identify the best platform
- Just because we've never used a facility before (or haven't in a while), doesn't mean we can't or won't
 - Platform selection is driven by the science requirements
- Partnerships with international, commercial, academic, or military facilities are possible
 - One-off facility uses can be PI-lead without ROI's involvement
 - We're happy to help, as needed
 - E.g., Deep sea diving teams, wilderness expeditions, university-owned facilities
 - Exception: NSF Antarctic Stations require ROI's support



Structure of an Analog Study



- Analog studies are generally performed as a *complement*
 - Group of studies requiring a common platform and/or scenario
 - Able to be integrated on a non-interference
- ROI team assists in adapting your study to the selected analog
 - Integration phase
 - Define each PI's study requirements
 - Deconflict constraints or confounds within the complement
 - Preparation phase
 - Test HW/SW and procedures: Stand-alone and as an integrated complement
 - Work with other PIs in the complement to agree on data sharing (reduces redundancy)
 - Build mission/study timelines and daily schedules
 - Recruit test subjects
 - Implementation phase



Tips for PIs New to Analogs Research



- Know your requirements and the analog platform's capabilities
 - Communicate needs early! - Analog planning typically starts a year or more in advance
 - Know what analog environments or conditions you need (or must avoid)
 - Know what minimum N you need!
 - Familiarize yourself with analogs capabilities before designing your study
 - E.g., HERA uses VR simulated EVA, not a sand box or rock yard → no capability for suited EVA simulations
 - Be specific and list any constraints (e.g., “test during rest” vs. “test after supine for 5 min. with eyes closed”)
- Flexibility is required
 - Think about both ideal vs. minimum (‘good enough’) requirements (e.g., “4 surveys is ideal, but this 1 will be good enough if we’re tight on time”)
 - Don’t flex beyond minimum required for sound science! - **bad data is worse than no data**
 - Include reasonable “windows” (e.g., “MD1” vs. “MD1 – MD5”)
 - Assume some degree of data sharing
 - **Remember, this is *applied* research**
 - Practicality over “purity”, without compromising sound science

Tips for PIs New to Analogs Research



- Plan for the right number of test subjects
 - HERA has a crew of 4 but often has 1-2 backups during pre-mission → plan for up to 6 test subjects!
- Consider training requirements and study personnel
 - Some analogs allow PIs onsite for training of support teams and test subjects, *some do not!*
 - Assume no access to PIs for Antarctic stations unless nominally scheduled to be there for other work
 - Choose a right-sized study team for responsiveness
 - Quick-turn or after-hours decisions or consultation is sometimes needed mid-study
 - Periodic data checking identifies missing data or quality issues faster (i.e., better likelihood of resolving)
- Validate test protocols and HW/SW before shipping them
 - Verify time requested is adequate for the task/test
 - Verify HW/SW licenses are active and updated
- Plan for the unexpected
 - Provide more consumable supplies than the bare minimum
 - Consider providing spare parts or whole backup devices, if possible
 - Think about requirements or constraints for how to deal with missed or “off-nominal” data collections





<https://www.nasa.gov/analog>

Thank you & ask questions!

