



Human Research Program Human Exploration Research Analog (HERA) Experiment Information Package

June 2014

**Flight Analogs Project
Human Research Program**

NASA FLIGHT ANALOGS PROJECT
HERA EXPERIMENT INFORMATION PACKAGE

Please use this document as an overview to the capabilities of the HERA for the purpose of preparing research protocols. Questions related to this document can be directed to:

Ronita L. Cromwell, Ph.D.
Flight Analogs Project
Project Scientist
ronita.l.cromwell@nasa.gov
281-483-7261

Joseph S. Neigut
Flight Analogs Project
Project Manager
joseph.s.neigut@nasa.gov
281-483-2204

NASA FLIGHT ANALOGS PROJECT HERA EXPERIMENT INFORMATION PACKAGE

Table of Contents

INTRODUCTION	4
HERA FEATURES	4
NASA FLIGHT ANALOGS PROJECT FUNCTION	6
INVESTIGATOR RESPONSIBILITIES	6
INVESTIGATOR PREPARATIONS FOR HUMAN SUBJECTS BOARDS	7
INVESTIGATOR RESOURCE/FISCAL RESPONSIBILITIES	7
SERVICES PROVIDED BY THE FLIGHT ANALOGS PROJECT TEAM	7
HERA STANDARDIZED CONDITIONS	8
HERA DIETARY CONDITIONS.....	8
CAMPAIGN CHARACTERISTICS AND STUDY REQUIREMENTS	8
SUBJECTS REQUIREMENTS.....	8
SUBJECT DAILY AND WEEKLY WORK REQUIREMENTS.....	9
HERA SUBJECT RECRUITMENT AND SCREENING	10

Table of Figures

Figure 1 Schematic representation of the HERA.....	5
Figure 2 HERA First Level.....	5
Figure 3 HERA Second and Third Levels	6

NASA FLIGHT ANALOGS PROJECT

HERA EXPERIMENT INFORMATION PACKAGE

INTRODUCTION

The NASA Flight Analogs Project (FAP) conducts research utilizing ground-based facilities that provide simulation scenarios and environments analogous to those encountered during exploration missions. The FAP supports the accomplishment of Human Research Program (HRP) objectives by investigating, acquiring, utilizing or operating high-fidelity ground analogs of the space exploration environment aiming at the conservation of spaceflight resources while expeditiously and efficiently addressing research questions for future manned exploration missions.

The information within this document describes the standard conditions and capabilities provided for experiments performed in the Human Exploration Research Analog (HERA), as well as the services provided by FAP.

The Human Exploration Research Analog (HERA) plans for campaigns of incremental duration began in 2014 with four 7-day missions. A campaign is defined as one integrated protocol with one primary mission scenario consisting of multiple missions in order to meet study subject requirements. Studies designed to utilize the capabilities of HERA described in this document are integrated with other investigations on a non-interference basis and run together as one integrated campaign.

Planned mission durations may range from 7 days up to 60 days. The HERA planning schedule currently anticipates 4 missions per year (one per quarter) of 14-day duration, in 2015 and increasing to 30-day duration tests in 2016 and eventually to 60-day duration. This tentative schedule is subject to change.

HERA FEATURES

The HERA is a two-story, four-port habitat unit residing in Building 220 at NASA Johnson Space Center (JSC). It is cylindrical with a vertical axis, and connects to a simulated airlock and hygiene module (Figure 1). The total space comprises 148.1 m³, distributed as follows: core (56.0 m³), loft (69.9 m³), airlock (8.6 m³) and hygiene module (14.1 m³) (Figures 2 & 3).

HERA facility capabilities includes a network that allows electronic research data and voice to be exchanged between the crew and ground controllers located in Building 220. The research data can be securely accessed by remote investigators real-time or near real-time through the JSC Telescience Center. HERA has a surveillance video and audio system, flight-like timeline and procedure viewer to provide a space mission experience.

Currently, the HERA represents an analog for simulation of isolation, confinement and remote conditions of mission exploration scenarios. Studies suitable for this analog may include, but are not limited to behavioral health and performance assessments, communication and autonomy studies, human factors evaluations and exploration medical capabilities assessments and operations.

NASA FLIGHT ANALOGS PROJECT

HERA EXPERIMENT INFORMATION PACKAGE

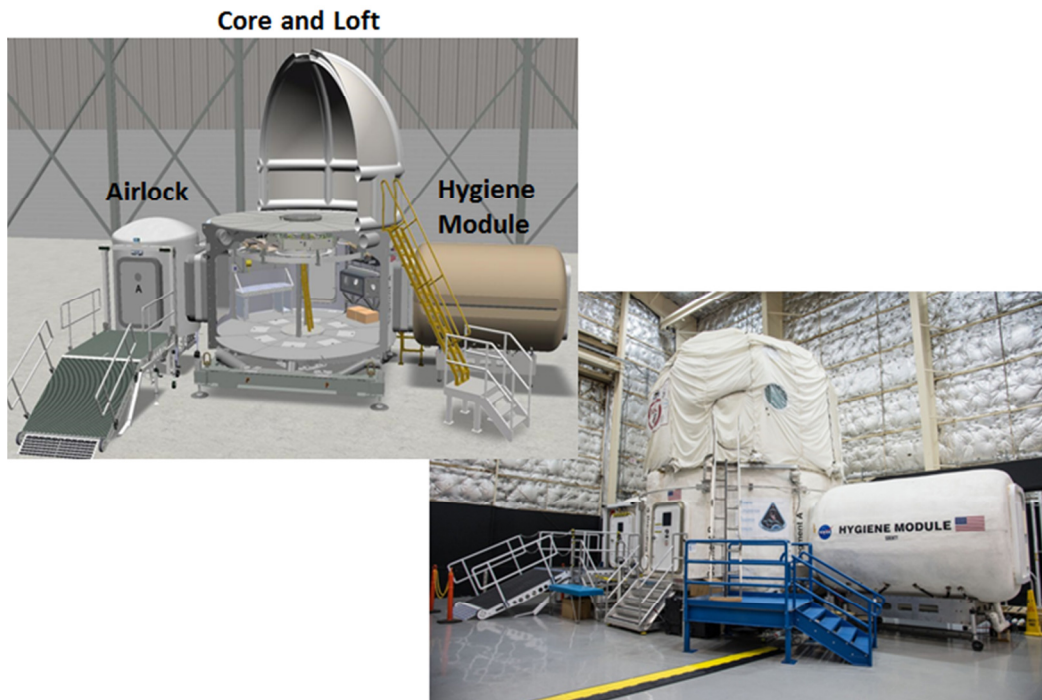


Figure 1 Schematic representation of the HERA

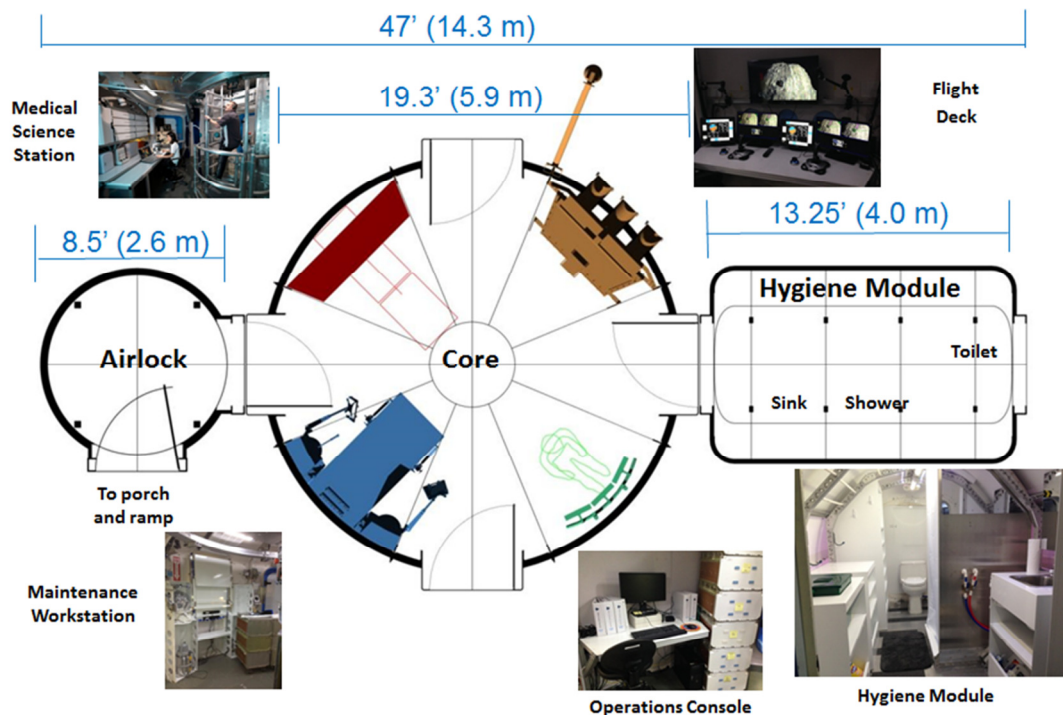


Figure 2 HERA First Level

NASA FLIGHT ANALOGS PROJECT

HERA EXPERIMENT INFORMATION PACKAGE

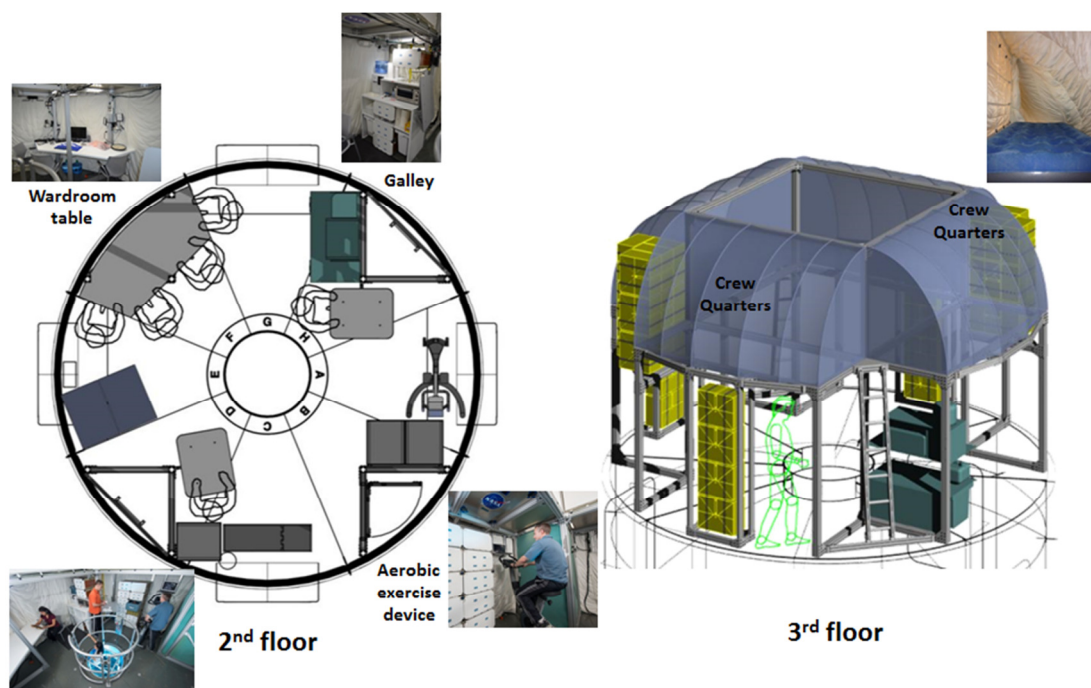


Figure 3 HERA Second and Third Levels

NASA FLIGHT ANALOGS PROJECT FUNCTION

- Provides a set of standardized HERA study conditions to insure consistency across all studies
- Maximizes resources by combining individual investigations into integrated studies
- Prepares complement protocol submissions for the JSC Institutional Review Board (IRB)

INVESTIGATOR RESPONSIBILITIES

- Meet with Flight Analogs Project team and investigators of other studies to develop integrated protocols
- Ensure that investigator study requirements are compatible with the standard conditions of HERA to the degree that this is possible without compromising scientific results
- Provide for on-site study support at the HERA facility at Johnson Space Center, Houston, TX including investigator resources and scientific expertise.
- Budget for costs associated with on-site support
- Carry out investigator science according to protocols with integrity and professionalism
- Participate in periodic data debriefs
- Provide complete experimental data sets to the NASA Life Sciences Data Archive

NASA FLIGHT ANALOGS PROJECT HERA EXPERIMENT INFORMATION PACKAGE

- Provide manuscript(s) within 2 years of study completion for inclusion into the final project report

INVESTIGATOR PREPARATIONS FOR HUMAN SUBJECTS BOARDS

- Work with the FAP Project Scientists to determine needed approvals from the investigator's home institution.
- Prepare individual protocol submissions with the assistance of FAP Project Scientists to the JSC IRB

INVESTIGATOR RESOURCE/FISCAL RESPONSIBILITIES

- The investigator will provide resources for their experiment unique requirements
- Provide subject consent briefings for the specific study
- The investigator will have responsibility for the costs of any investigator protocol-specific screening requirements, equipment, and other investigation-specific requirements.
- The investigator is responsible for costs associated with his specific protocol operations
- The investigator is responsible for test subject travel costs for follow up testing required beyond the standard schedule

SERVICES PROVIDED BY THE FLIGHT ANALOGS PROJECT TEAM

- Coordinate investigator meetings
- Coordinate preparation and submissions to the JSC IRB.
- Recruit and perform standard subject screening through the JSC Test Subject Screening (TSS) facility, subject reimbursement, and transport
- Provide monitors and coordinators to oversee study operations
- Provide medical monitors through the TSS when needed
- Develop and manage schedules and the associated logistics to implement integrated studies
- Enable the capability to transfer electronic data from HERA to remote investigators via the Telescience Center (TSC)
- Coordinate logistics for shipment of investigator equipment
- Receive investigator hardware shipment and coordinate with the investigator for setup and checkout of their hardware.
- Provide test subject and medical staff orientations
- Conduct integrated Test Readiness Reviews, safety walk-throughs and operations check-outs prior to starting the study
- Provide a daily operational status report
- Coordinate post-study subject follow up testing if required

NASA FLIGHT ANALOGS PROJECT

HERA EXPERIMENT INFORMATION PACKAGE

HERA STANDARDIZED CONDITIONS

- Duration: 14, 30 and 60 days specific to science requirements. **Note:** this solicitation is for a **30** day mission
- Room Temperature: 72° F. (+/- 5 degrees)
- Light/Dark Cycle: Lights on 0700, lights out 2300, 7 days per week, no napping is permitted
- Monitoring of study operations 24 hours a day

HERA DIETARY CONDITIONS

Participating subjects will be provided a minimum of 3 meals each day. Feasibility of studies with specific dietary needs will be assessed on a per study basis.

CAMPAIGN CHARACTERISTICS AND STUDY REQUIREMENTS

A HERA Campaign is defined as one integrated protocol with one primary mission scenario. An integrated protocol consists of a number of individual investigator studies that can be combined on a non-interference basis. Each campaign is expected to consist of 4 to 8 missions, providing a total of 16 to 32 subjects for each study. Power analyses for each study will determine the number of missions needed to achieve the required study sample size.

- Each HERA mission will consist of:
 - *Access to the subjects for mission activities:*
 - Up to five days of pre-mission activities (i.e. baseline data collection (BDC), training, informed consent), final duration will be dependent on research requirements.
 - In phase (confinement) for 14, 30 and 60 days depending on campaign requirements. **Note:** this solicitation is for a **30** day mission.
 - Up to three days of post mission activities (i.e. BDC, debriefing), final duration will be dependent on research requirements.
- To support the isolation requirement, no access to email, phone calls or the internet will be allowed, family conferences are scheduled. FAP personnel will send personal messages along with news in periodic uplinks (exception for family emergencies which require intervention) consistent with simulating the space flight condition.
- A limited mission control center will be located with Building 220 to support HERA operations. The extent of investigator support during the testing will be determined in each case.

SUBJECTS REQUIREMENTS

- Four subjects per mission.
- Single or mixed gender, aiming at 50/50 male: female ratio for each test unless science requirements are different.
- Age 26 to 55. Other age groups can be accommodated if required by the study.
- Height limited to 6'2" maximum.

NASA FLIGHT ANALOGS PROJECT

HERA EXPERIMENT INFORMATION PACKAGE

- Technical skills demonstrated through professional experience. Advanced degree (e.g. M.S., M.B.A. degree) or equivalent years of experience.
- Must have demonstrated motivation and work ethic similar to the “Astronaut stereotype”.
- Below are some examples of astronaut selection criteria that may help to guide subject selection for HERA campaigns:
 - The requirements for Astronaut Candidates are a bachelor’s degree from an accredited institution in engineering, biological science, physical science, or mathematics. Quality of academic preparation is important.
 - An advanced degree is desirable and may be substituted for experience as follows:
master’s degree = 1 year of experience,
 - Doctoral degree = 3 years of experience.
 - Teaching experience, including experience at the K – 12 levels, is considered to be qualifying experience for the Astronaut Candidate position; therefore, educators are encouraged to apply.
 - Additional requirements include the ability to pass the NASA long-duration space flight physical, which includes the following specific requirements: Distant and near visual acuity must be correctable to 20/20 in each eye, and blood pressure not to exceed 140/90 measured in a sitting position.

SUBJECT DAILY AND WEEKLY WORK REQUIREMENTS

The operational plan uses the ISS Program nominal 24-hour work day structured as a guideline. Below is the HERA mission plan:

- Subjects awake at 0700 and are off duty at 2300 with one shift operation for all subjects.
- Sleep period (8.0 hours).
- Post-sleep period, includes morning meal (1.5 hours).
- Daily planning conferences, medical conferences, work preparation, and plan familiarization (2.0 hours).
- Work, consisting of scheduled research tasks and HERA operations tasks, i.e. HERA maintenance, flight simulator for an asteroid based rendezvous mission, public affairs office, education outreach, etc. (6.5-8.0 hours).
- Midday meal (1 hour).
- Exercise period (1.25-2.5 hours, includes time for setup, cardiovascular/resistive exercise, stowage, hygiene (cool down and cleanup)).
- Pre-sleep period, includes evening meal (2.0 hours).
- A nominal 7 day work/rest cycle will consist of 5.5 days available for working planned utilization and non-utilization activities and 1.5 consecutive off-duty days. Housekeeping and 1.0 hour of scheduled work on the weekends is included in the 5.5 working days.
 - Rationale: The crew week should align as closely as possible to the typical ground work week. Nominal scheduling of consecutive days off during a 7 day week for ISS crews is a behavioral health and medical countermeasure necessary for maintaining individual health and performance as well as maintaining performance and effective functioning of the entire crew as a unit. In a nominal 7-day week the crew works 5 days and the 6th day is a half duty day for housekeeping and 1 hour of scheduled work. The 7th day is a full

NASA FLIGHT ANALOGS PROJECT HERA EXPERIMENT INFORMATION PACKAGE

off duty day. For planning purposes, the one hour of scheduled work may be planned across the 6th and 7th day.

HERA SUBJECT RECRUITMENT AND SCREENING

The NASA JSC TSS provides advertising, recruiting and health screening for subject candidates. Once subjects pass the health requirements of the TSS, they will be provided to FAP to coordinate any additional screening required by investigator studies. Only subjects who pass all screening criteria will be considered for enrollment in the campaign.