

# Human Research Program

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Crew health and performance is critical to successful human exploration beyond low-Earth orbit. Risks include physiologic effects from radiation, hypo-gravity, and planetary environments, as well as unique challenges in medical treatment, human factors, and behavioral health support. The goal of the Human Research Program (HRP) is to provide human health and performance countermeasures, knowledge, technologies, and tools to enable safe, reliable, and productive human space exploration.

In its fifth year of operation, the HRP continued to establish its management architecture of evidence, risks, gaps, tasks, and deliverables. Products were delivered to support the preliminary design of the Constellation Program vehicles. Experiments continued on the International Space Station (ISS), on the ground in analog environments that have features similar to those of space flight, and in laboratory environments. Data from these experiments furthered NASA's understanding of how the space environment affects the human system. These research results contributed to scientific knowledge and technology developments that address the human health and performance risks.

## Objectives

These are the specific objectives of the HRP:

1. Develop capabilities, necessary countermeasures, and technologies in support of human space exploration, focusing on mitigating the highest risks to crew health and performance. Enable the definition and improvement of human space flight medical, environmental, and human factors standards.
2. Develop technologies that serve to reduce medical and environmental risks, reduce human systems resource requirements (mass, volume, power, data, etc.), and ensure effective human-system integration across exploration mission systems.
3. Ensure maintenance of agency core competencies necessary to enable risk reduction in the following areas: space medicine; physiological and behavioral effects of long-duration space flight on the human body; space environmental effects, including radiation, on human health and performance; and space human factors.

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The program is comprised of six major elements that are focused to accomplish specific goals for investigating and mitigating the highest risks to astronaut health and performance. These six elements are: ISS Medical Project, Space Radiation, Human Health Countermeasures, Exploration Medical Capability, Space Human Factors and Habitability, and Behavioral Health and Performance. These elements provide the program's knowledge and capabilities to conduct research to address the human health and performance risks as well as advance the readiness levels of technology and countermeasures to the point of transfer to the customer programs and organizations.

## Partnerships and Collaborations

The HRP works with universities, hospitals, and federal and international agencies for the purpose of sharing research facilities and multiuser hardware, and for collaboration on research tasks of mutual interest. The HRP uses bed rest facilities at the University of Texas Medical Branch in Galveston, Texas, to study changes in physiologic function associated with weightlessness. Many of these changes occur in people subjected to bed rest with the head tilted downward at a 6-degree angle.

Facilities at the General Clinical Research Center in Stony Brook, New York, and the Lerner Research Institute at the Cleveland Clinic/University of Washington support the HRP. These facilities provide bed rest and 6-degree head-down-tilt simulation along with a zero-gravity locomotion simulator, which is a treadmill used by a person lying down such as during bed rest.

The NASA Space Radiation Laboratory at the Department of Energy's Brookhaven National Laboratory in Upton, New York, is used to conduct research using accelerator-based simulation of space radiation. The HRP also uses radiation research facilities at the Loma Linda University Medical Center in Loma Linda, California.

The National Space Biomedical Research Institute (NSBRI)—an academic institute funded by the HRP—investigates the physical and psychological challenges of long-duration human space flight. Founded in 1997 through a NASA competition, the NSBRI is a nonprofit research consortium that connects the research, technical,

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and clinical expertise of the biomedical community with the scientific, engineering, and operational expertise of NASA. Additional information about the NSBRI can be found at: [www.nsbri.org](http://www.nsbri.org).

The HRP also maintains collaborative relationships with the ISS International Partners through various working groups. These relationships enhance the research capabilities of all partners and provide synergism of research efforts. Some of the working groups HRP participates in include:

- International Space Life Sciences Working Group (Canada, Japan, Germany, Ukraine, France, and the European Space Agency)
- U.S.-Russian Joint Working Group
- European Union in Radiobiology Research Program
- International Council of Radiation Protection

The HRP organizes and participates in international collaborative meetings and coordinates research and technology workshops. The workshops are conducted to inform researchers outside of NASA about the HRP's research and to obtain information about research going on outside of NASA. Some of the workshops include:

- International Space Life Sciences Working Group  
<http://www.nasa.gov/exploration/about/islswg.html>
- Meeting of the U.S.-Russian Joint Working Group
- Human Research Program Investigators' Workshop  
<http://www.dsls.usra.edu/meetings/hrp2010/>
- 61st International Astronautical Congress  
<http://www.iafastro.com/?title=IAC2010/>
- 21st Annual NASA Space Radiation Investigators' Workshop  
<http://www.dsls.usra.edu/meetings/radiation2010/>
- 18th International Academy of Astronautics Humans in Space Symposium  
<http://www.dsls.usra.edu/meetings/IAA/>

## Education and Outreach

The Human Research Program Education and Outreach Project is committed to using NASA's space research and exploration to educate the nation in science, technology, engineering, and mathematics. Project activities and materials target educational communities, the general public, policymakers, and the media using formal and informal venues. The project has made notable strides in their K-12 programs and outreach efforts. Their primary grade programs include the 21st Century Explorer, Fit Explorer, and Sports and Exploration, while their secondary programs include Math and Science @ Work and Exploring Space through Math.

Each year, the HRP compiles and publishes an annual report highlighting major programmatic and technical accomplishments. These reports can be found at: [http://www.nasa.gov/exploration/humanresearch/research\\_info/overview/program\\_docs\\_detail.html](http://www.nasa.gov/exploration/humanresearch/research_info/overview/program_docs_detail.html).

To learn more about the Human Research Program Education and Outreach Project, please visit: <http://www.nasa.gov/exploration/humanresearch/education/index.html>.