Research on the International Space Station

The International Space Station

It's About Life on Earth . . . and Beyond!

The International Space Station (ISS) is an exciting gateway to new frontiers in science and human space exploration. In a laboratory where one of the fundamental forces of nature — gravity — is greatly reduced, never before possible research in a variety of disciplines will be possible. World class research linking fundamental biological and physical sciences and medicine will be conducted through the collaboration of scientists from around the world while applications are generated for the benefit of humankind.

The governments of

- **The United States**
- **Canada**
- **Europe**[1]
- **Japan**
- **Russia**

are collaborating with commercial, academic and other affiliates in design, operation and utilization of this unprecedented orbital laboratory.

[1] The European states of Belgium, Denmark, France, Germany, Great Britain, Italy, the Netherlands, Norway, Spain, Sweden and Switzerland are represented through membership in the European Space Agency (ESA).

Why ISS Research?

The challenges of expanding our human experience into the frontier of space are substantial. We must learn to keep a crew healthy, safe and productive in an environment which is unique in the 4 billion year evolutionary history of life as we know it. We must learn how to live and work in space and how to do so at a reasonable cost. Our access to the space environment in the ISS also opens up a new realm of research in medicine, physics, chemistry and biology, because only in space can we eliminate the effects of gravity and study the results. This will be particularly important as the ISS allows long term studies, such as studying multiple generations of simple organisms in space to see how they evolve in the absence of gravity.

Goals for ISS Research

1) Conduct research to enable safe and productive human habitation of space.

2) Use the space environment as a laboratory to test the fundamental principles of biology, physics and chemistry.

3) Enable and promote commercial research in space

4) Use space research opportunities to improve academic achievement and the quality of life.

Approach

Initial ISS research will validate research facilities' performance and provide baseline data. As we evolve into more capabilities on the ISS, we are building a framework for long-range planning and research opportunity announcements involving the designation of flight "increments." Increments are an average 4 month focused activity determined by crew rotations and flights to/from ISS. Each increment has a theme that focuses on a primary science theme or related activities. The first several increments will involve; bringing space to the public, radiation, bone and muscle research, plants in space, and "from molecules to matter" - using space to probe the forces that structure our world.

ISS research opportunities (access, selection, evaluation) are governed by a set of principles:

1) Broad participation by the world's community of researchers from academia, government agencies, and industry.

2) Leveraging resources and expertise through agreements with various government, university, and research organizations to broaden the effectiveness of our programs.

3) Investigator initiated research portfolio. (The research done in space is determined by demand - through investigator's competed research proposals.)

4) Supported science and technology research projects reviewed by scientific or technical peers with 95% of these projects selected from open competition.

5) Optimize the productivity of the highly diverse range of scientific, technological, and commercial investigations through optimal ISS research implementation.

6) Devote approximately 30% of Space Station resources for commercial users.

7) Evaluate performance, ultimately in terms of long-term impacts on our society; the development of products to better life on Earth and the advances that will enable human exploration of space.

RESEARCH AND COMMERCIAL PROGRAMS

1) Physical Sciences
   - developing the fundamental scientific base for human and robotic forays into outer space
   - utilizing the unique space environment for basic and applied scientific knowledge to fulfill innate curiosity as well as to improve the human condition on Earth.

2) Fundamental Space Biology
   - Determine the potential for life to evolve as it transitions into space
   - Determine the consequences of long-term adaptation to space

3) Space Medicine / Bioastronautics
   - Provide a fundamental understanding of the long term consequences of exposure to space; molecular and cellular mechanisms underlying bone loss, muscle atrophy, and nervous system adaptation, exposure to radiation, and other health risks.
   - Providing medical care in space
   - important contributions to medical issues in space and on Earth.

4) Commercial Programs
   - Develop new or improved products (pharmaceuticals, chemicals, food production, ceramics, etc.) using insights gained in space and the advantages of the space environment.
   - Observe, measure, predict and replicate experiments over the course of weeks and months for sustained progress in the exploitation of the space environment for human good.