HOW TO GET ON BOARD SPACE STATION FREEDOM

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NASA Headquarters

ABSTRACT

Space Station Freedom will accommodate researchers with interests in science, technology and commercial applications. NASA sponsors will be responsible for selecting the U.S. researchers for Space Station Freedom. The four NASA sponsors are: Office of Space Science and Applications (OSSA), Office of Aeronautics and Space Technology (OAST), Office of Commercial Programs (OCP), and the Office of Space Flight (OSF). The areas of research responsibility for each sponsor are presented. The researcher solicitation vehicles used by OSSA and OAST and the methodology for researchers seeking sponsorship from OCP and OSF as well as the pricing policy are discussed.

Descriptions of flight planning, payload integration and operations functions are presented. Three categories of payloads and their respective payload integration times are discussed. Researchers are advised to contact a NASA sponsor and a source which lists the points of contact for the NASA sponsors is noted.

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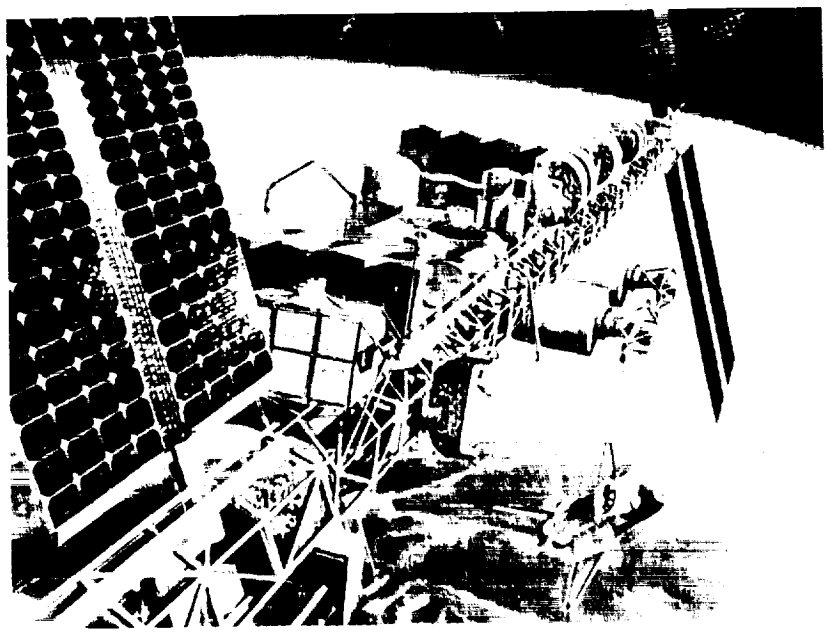

Presentation to the
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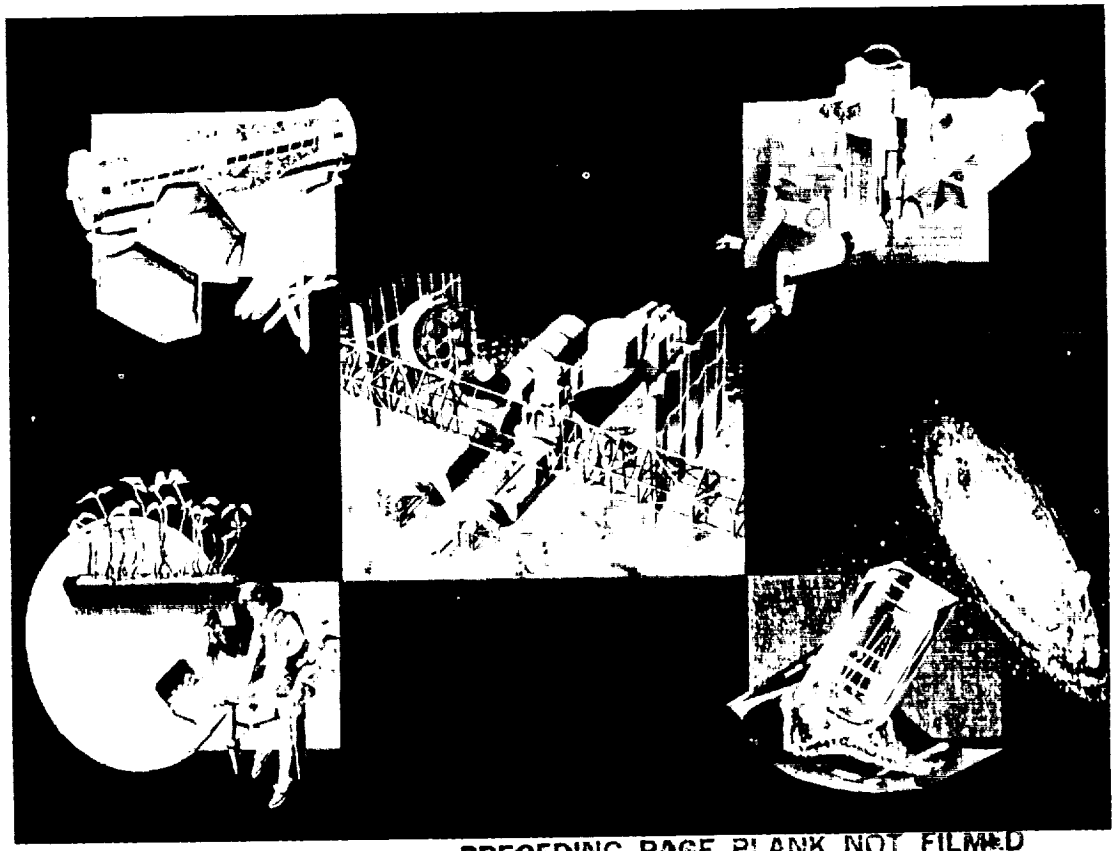
Spacelab/Space Station
Utilization Program

SPACE STATION FREEDOM RESEARCH



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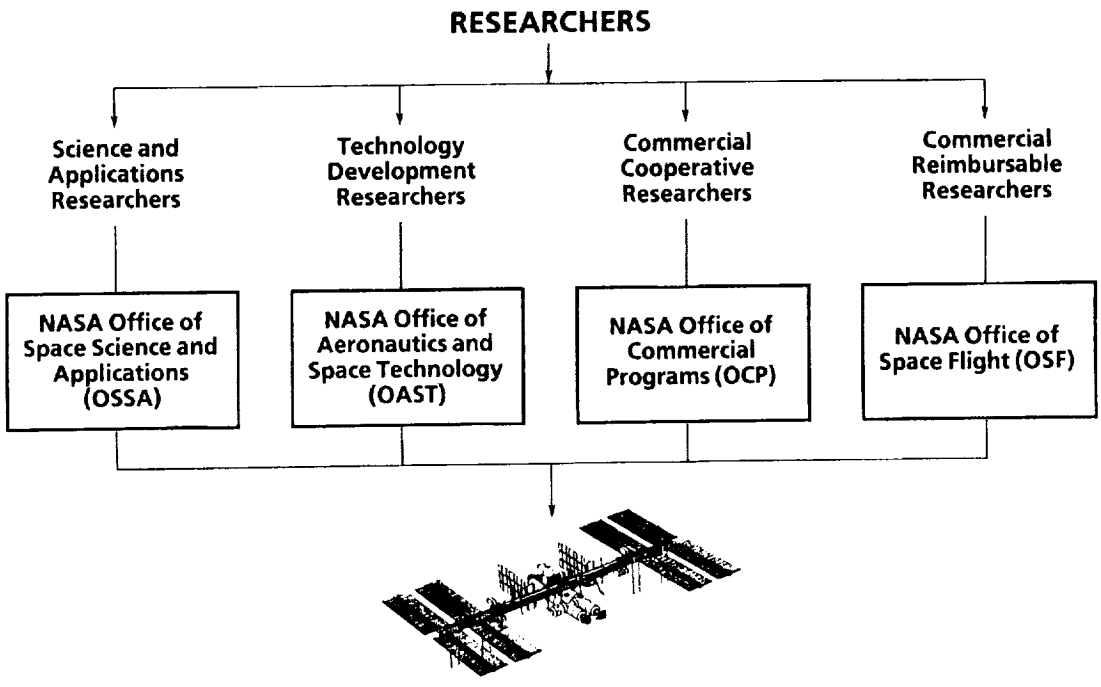
GETTING A SPONSOR

- Space Station Freedom research capabilities are shared by Canada, ESA, Japan and NASA
- Researchers who wish to use NASA's share enter the program through a NASA sponsor
- NASA sponsoring organizations are the primary agents for initiating, selecting and implementing research
- Each NASA sponsoring organization is allocated a block of Freedom's accommodations and resources

GETTING A SPONSOR (Continued)

- The sponsor develops research plans:
  - -- Within the sponsor's mandate
  - -- Responsive to its research community
- To achieve their goals, sponsors:
  - -- Perform outreach to their constituencies
  - -- Develop mechanisms to select payloads for flight
  - -- Advocate for their research needs within the agency
  - -- Manage their research program, including payload development, integration and operations
  - -- Fund research, as appropriate to their mandate

NASA SPONSORING ORGANIZATIONS



SCIENCE AND APPLICATIONS RESEARCHERS

- Sponsored by Office of Space Science and Applications (OSSA)
- Includes research by other government agencies, such as NIH, NSF, etc.
- Life Sciences Research
  - -- Ensure the health, safety and productivity of humans in space
    - Monitor crew health
    - Develop countermeasures to adverse effects of prolonged exposure to low gravity
  - -- Acquire fundamental scientific knowledge in space life sciences
    - Study the effects of gravity on living systems

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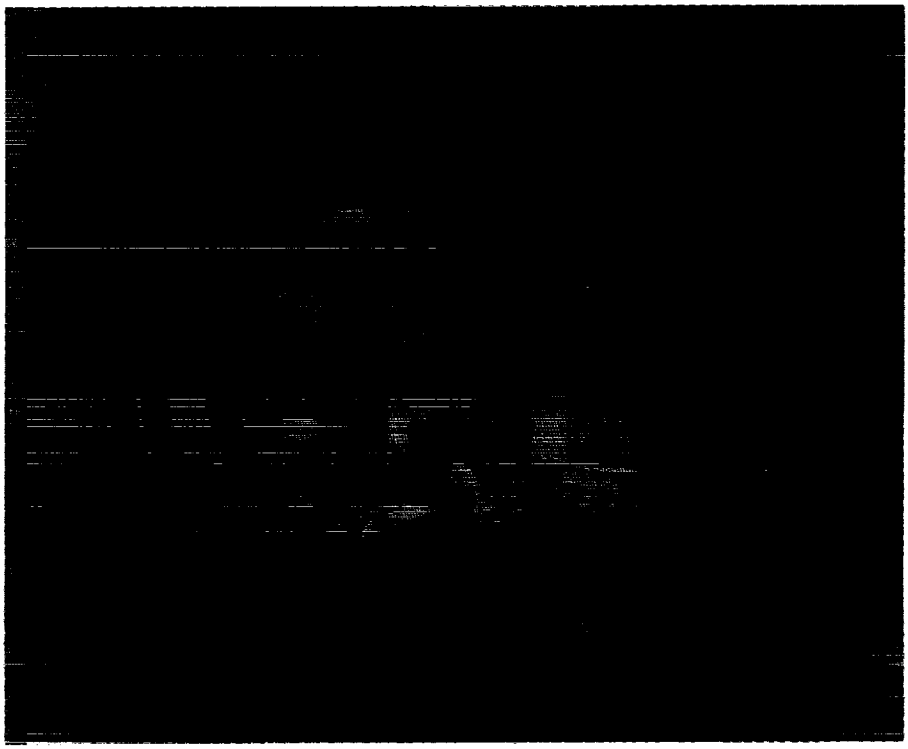
LIFE SCIENCES RESEARCH



2.5m Centrifuge Facility

SCIENCE AND APPLICATIONS RESEARCHERS

- Microgravity Science and Applications
  - -- Materials Science
    - Electronic and photonic materials
    - Metals and alloys
    - Glasses and ceramics
  - -- Fundamental sciences, including the study of
    - Fluid dynamics and transport phenomena
    - Combustion science
    - Gravitational physics
  - -- Biotechnology experiments
    - Macromolecular crystal growth
    - Cell and molecular science

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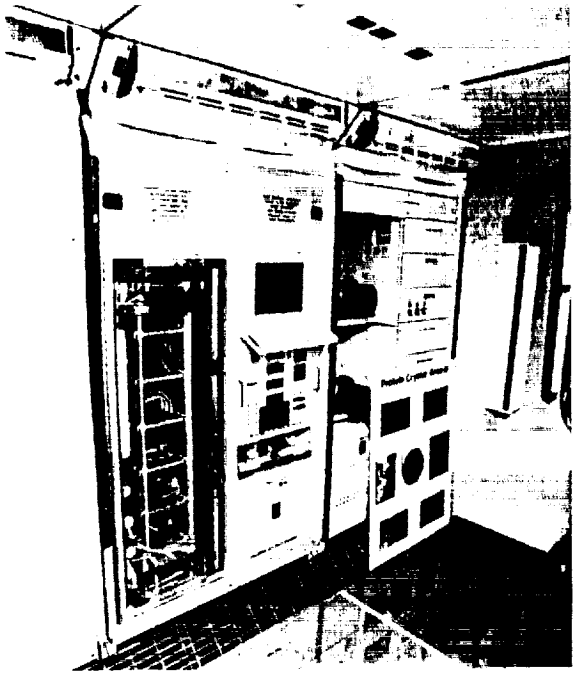
MICROGRAVITY SCIENCE & APPLICATIONS



Protein Crystal Growth Facility

Insulin Crystal

SCIENCE AND APPLICATIONS RESEARCHERS

- OSSA issues Announcements of Opportunity (AOs) and NASA Research Announcements (NRAs)
- AOs solicit proposals which involve major hardware procurements
- NRAs solicit proposals for utilizing existing hardware or involving minor hardware development
- AOs and NRAs solicit proposals for ground-based and research in space (e.g., Spacelab and Space Station)
- Four NRAs for Microgravity Science and Applications have already been released. Future NRAs will be released on a regular schedule.
- First AO/NRA for Life Sciences to be released approximately 2 years before First Element Launch (first AO/NRA expected 1994)

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TECHNOLOGY RESEARCHERS

- Sponsored by Office of Aeronautics and Space Technology (OAST)
- OAST is responsible for the development of enabling and enhancing technologies for the Nation's future space missions
- Includes technology experiments by other government agencies, such as DOD R&D
- Flight experiment program objective is to:
  - -- Validate technology in space
  - -- Obtain data which are unobtainable on the ground
- OAST emphasizes small and inexpensive experiments
- OAST solicits proposals through the periodic release of AOs
- Next OAST AO expected to be released within next few weeks

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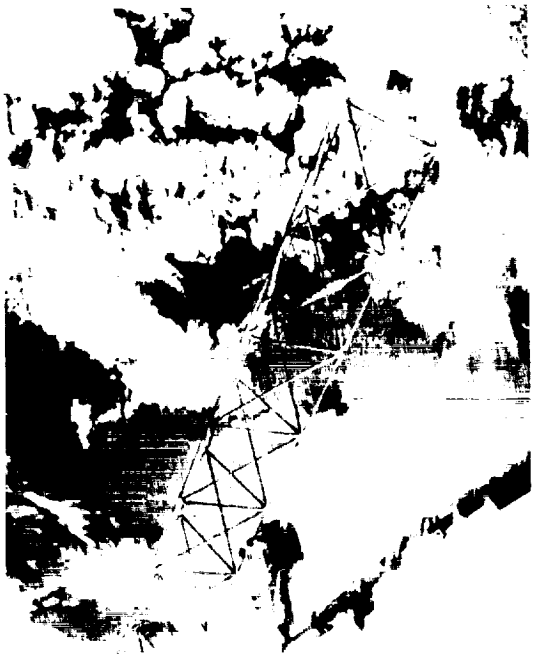
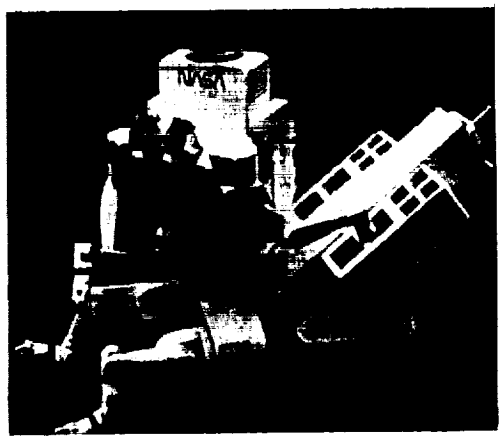
TECHNOLOGY RESEARCH



Structure



Automation & Robotics

FREEDOM

TECHNOLOGY RESEARCHERS

- Technology Development Areas:
  - -- Structural Dynamics
  - -- Robotics
  - -- Sensors and Information Systems
  - -- Life Support Systems
  - -- Materials and Environmental Effects
  - -- Fluid Transfer and Storage
  - -- Thermal Management
  - -- Power Systems
  - -- Propulsion

COMMERCIAL COOPERATIVE RESEARCHERS

- Sponsored by the Office of Commercial Programs (OCP)
- Objective of commercial cooperative research is for NASA to provide industry assistance, services, and access to facilities to encourage the commercial use of space
- Commercial cooperative researchers are those who are partially funded by NASA
- Commercial cooperative researchers generally provide some type of compensation or *quid pro quo*
- Agreements between OCP and researcher dependent upon degree of risk researcher is willing to take

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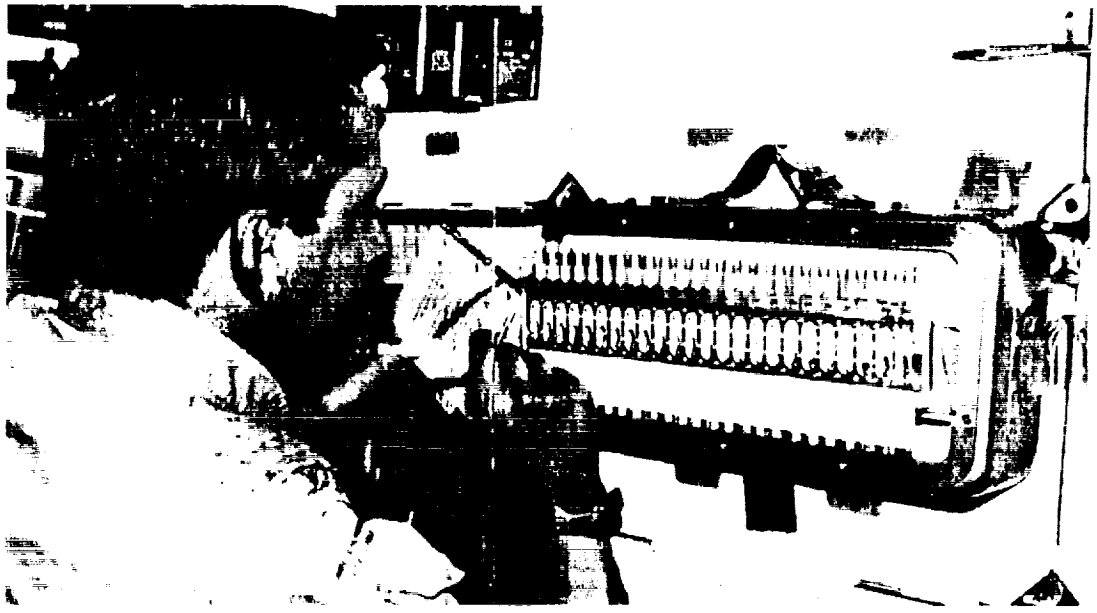
COMMERCIAL RESEARCH



Protein Crystal Growth Experiment

COMMERCIAL COOPERATIVE RESEARCHERS

- Centers for the Commercial Development of Space (CCDSs) are the primary commercial cooperative user entry points
- Seventeen CCDSs focus on the following disciplines
  - -- Automation and robotics
  - -- Remote sensing
  - -- Biotechnology
  - -- Materials processing in space
  - -- Space power
  - -- Space structures
  - -- Communications

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COMMERCIAL REIMBURSABLE RESEARCHERS

- Sponsored by the Office of Space Flight (OSF)
- Researcher who pays the established price for use of Space Station (including *pro rata* Space Shuttle transportation to and from Freedom)
- Submits request for flight and earnest money to OSF
- Negotiates agreement with OSF
- The point of contact is NASA OSF Policy and Plans Division

COMMERCIAL REIMBURSABLE RESEARCH

REIMBURSABLE PRICING POLICY

- Cost to reimbursable researcher will be dependent upon two factors:
  - -- Pricing policy
  - -- Cost basis
- Pricing policy defines the algorithm for charging for use of the Station:
  - -- Accommodations
  - -- Resources
  - -- Standard services
- Cost basis defines the dollar cost for each "unit of use"
- Pricing policy and cost basis are under agency development and review
- Pricing policy will be set by the Administrator and reviewed by Congress
- Public review and comment period required
  - -- Will be announced in Federal Register
  - -- Current plan for release early 1993

REIMBURSABLE PRICING POLICY CONCEPT

- Reimbursable pricing policy concept currently under development
- Shuttle and Spacelab policies used as a base
- Two standard service packages
  - -- Round-trip transportation and integration
  - -- On-orbit operations
- Round-trip transportation and integration price based on:
  - -- Weight
  - -- Volume
  - -- Length

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REIMBURSABLE PRICING POLICY CONCEPT (Continued)

- On-orbit operations price based on:
  - -- Space
  - -- Energy
  - -- Crew time
  - -- Length of stay
- Optional services available
- Final pricing structure (i.e., policy) will be determined after a thorough management review
- Cost basis to be defined based upon degree of cost recovery

FLIGHT PLANNING

- The Space Station Freedom program has developed a planning process that identifies when a payload flies
- Flight planning provides the researcher with a commitment to fly
- The process uses a 5 year planning horizon
  - -- Researchers are not directly involved this far in advance unless the payload is very complex

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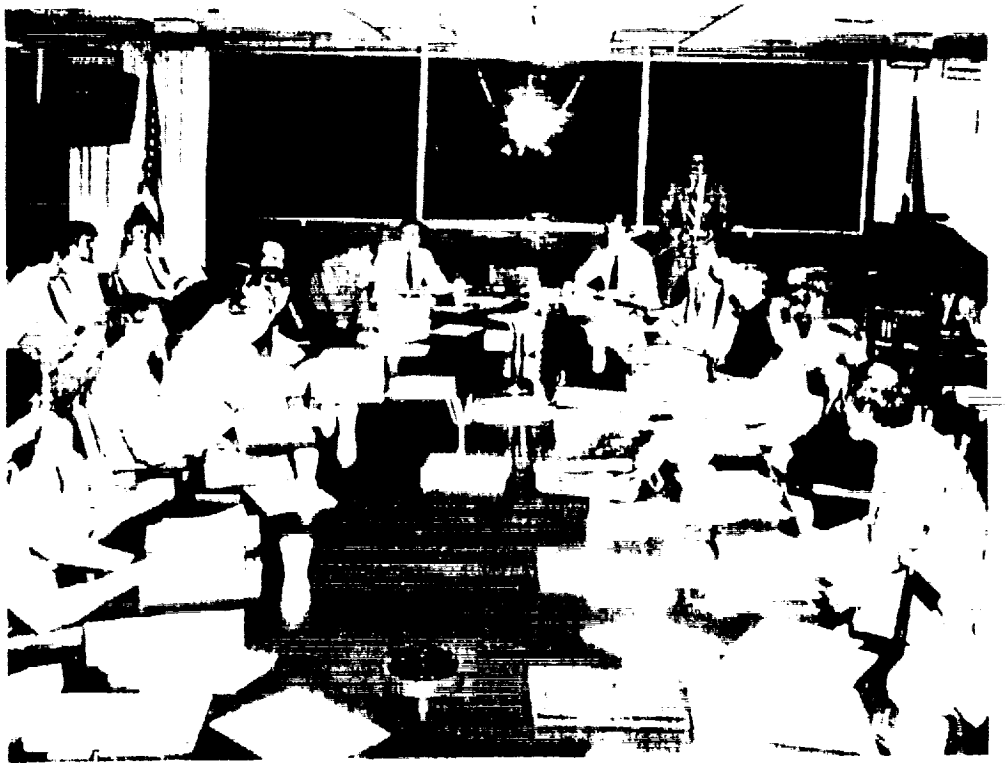
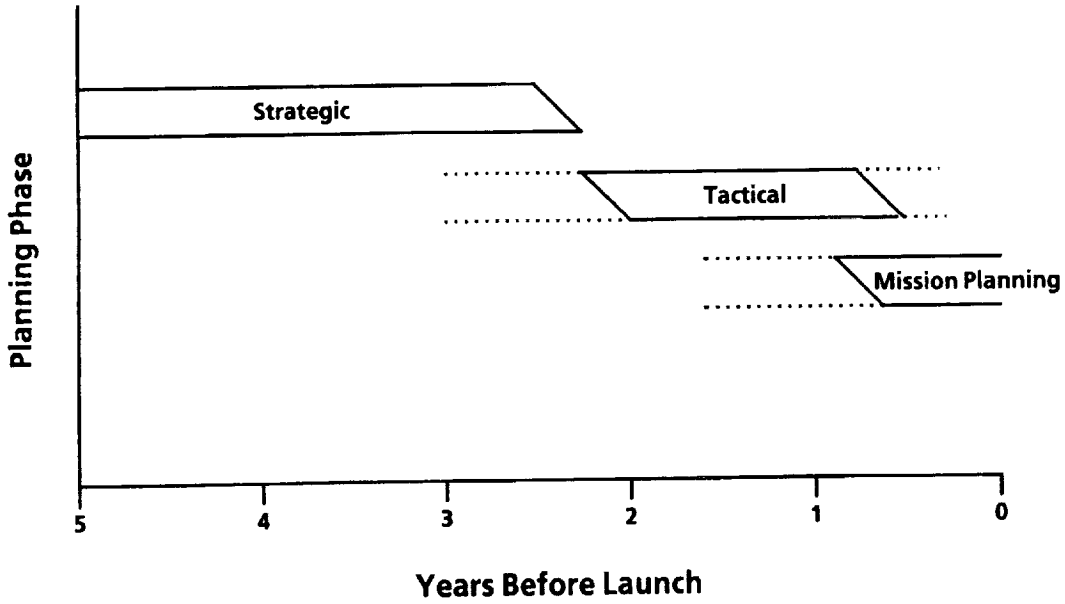
FLIGHT PLANNING



FLIGHT PLANNING



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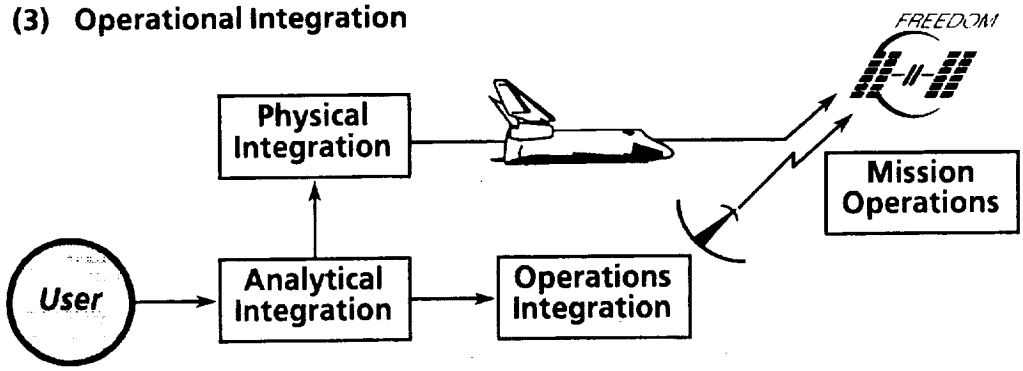
WHAT IS PAYLOAD INTEGRATION?

- Payload integration is the process used to assemble a complement of payloads for flight on Space Station Freedom and return to Earth
- The payload integration process can be characterized by three individual integration functions:
  - (1) Analytical integration
  - (2) Physical integration
  - (3) Operational Integration



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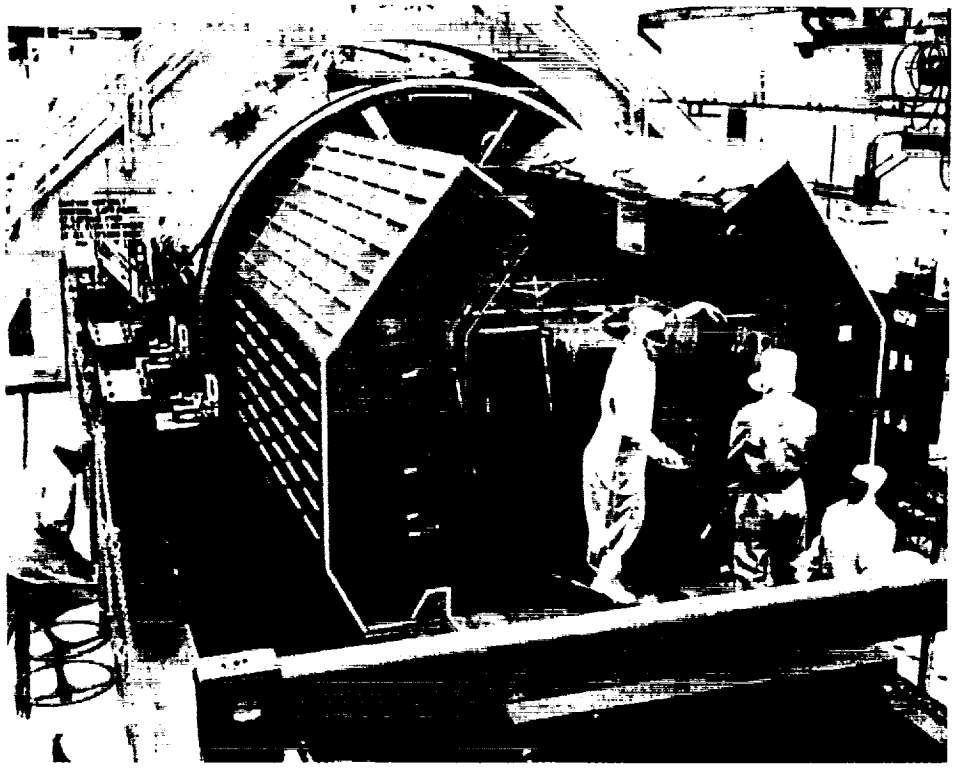
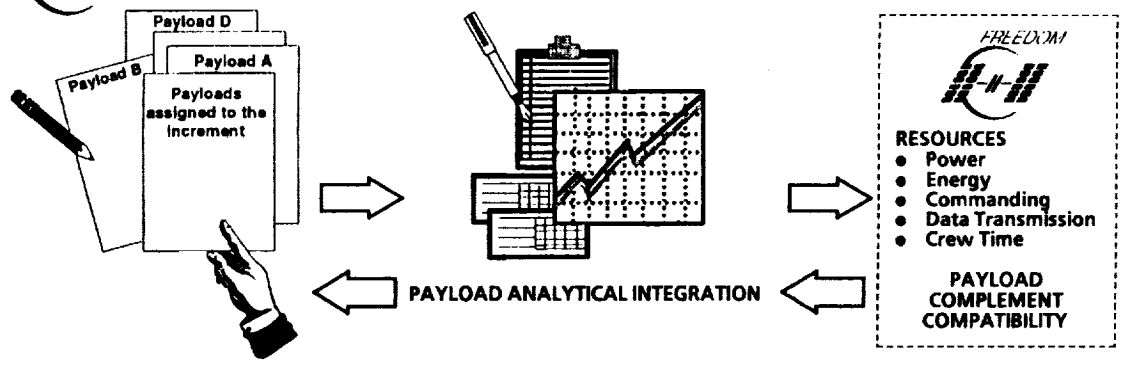
PAYLOAD INTEGRATION



PAYLOAD ANALYTICAL INTEGRATION



- The Payload Analytical Integration function includes:
  - -- Technical assistance and support to the user
  - -- Assurance that user and program requirements are met
  - -- Assurance of compatible interfaces
  - -- Verification of the safety of the payload and payload complement for launch and on-orbit operation

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PAYLOAD PHYSICAL INTEGRATION

- The Payload Physical Integration function includes:

  (1) Development of procedures for physical integration and testing

  (2) Functional testing of the payload (optional service)

  (3) Integration of payloads into carriers

  (4) Performance of final pre-launch interface verification testing for the integrated payload carrier

  (5) Support to on-orbit payload integration and deintegration

  (6) Performance of post-landing physical deintegration

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PAYLOAD OPERATIONS INTEGRATION

- The Payload Operations Integration function includes:

  (1) Operations planning for payloads

  -- Assurance of operational compatibility of payload complements

  -- Generation of payload operations agreements

  -- Development and management of payload operations timelines

  (2) Training and simulation exercises for flight and ground crew

PAYLOAD OPERATIONS

- The Payload Operations functions:
  - -- Provide interface to crew
  - -- Build and uplink commands
  - -- Build and uplink crew procedures
  - -- Payload replanning
    - Research support
    - Hardware malfunctions
    - Other anomalies
    - Update orbital conditions
    - Update resource consumption
  - -- Data Management
    - Process and provide payload data
    - Provide video/data playback
  - -- Support payload performance assessments

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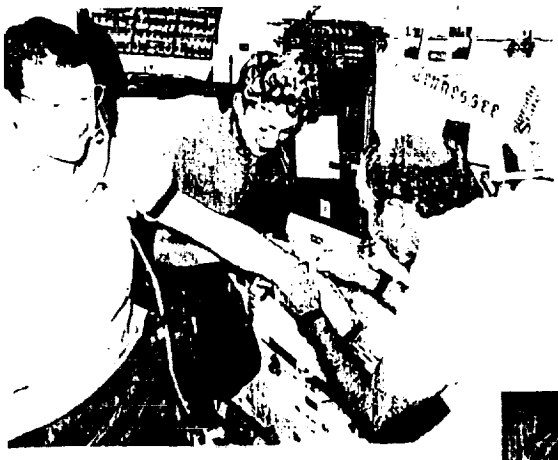
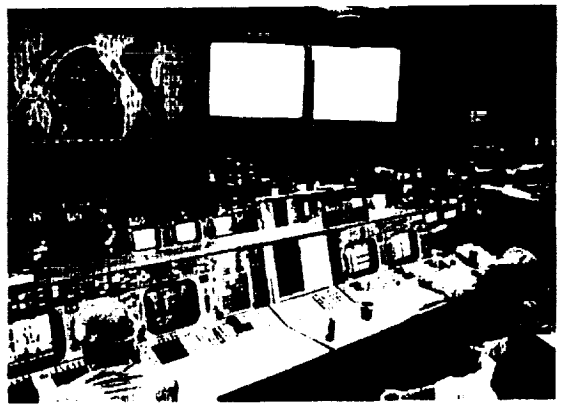
PAYLOAD OPERATIONS





PAYLOAD INTEGRATION AND OPERATIONS

PROGRAM PROVIDES

- ✓ Strategic Planning
- ✓ Accommodations/resources
- ✓ Roadmap of information required to be provided by users
- ✓ Analytical Integration Services
  - -- Design evaluation
  - -- Safety evaluation
- ✓ Integration process: rack integration into log module, SSF, and return
- ✓ Payload operations support
- ✓ Payload Accommodation Manager

USER PROVIDES

- ✓ Payload requirements
- ✓ Safety, integration, and operational documentation
- ✓ Data and support in reviews
  - -- Design data
  - -- Safety data
- ✓ Payload
- ✓ Payload operations support
- ✓ Principal Investigator

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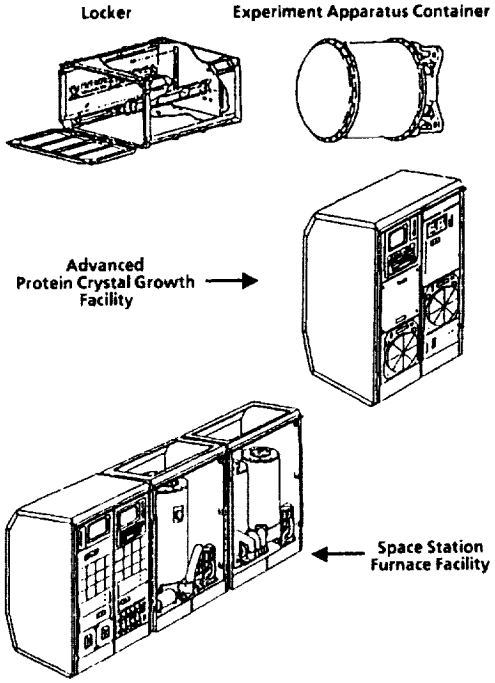
SPACE STATION FREEDOM PAYLOAD INTEGRATION PROCESS STATUS

- The payload integration process is currently under study to better reflect the changing requirements of the payload community and support more flexibility within the process
  - -- The payload trend is moving toward the smaller, simpler payloads
  - -- The aim is to define a process that will accommodate a large number of payloads with a wide range of requirements while minimizing cost and allowing quick integration

PAYLOAD



Sub-Rack Payloads:
- -- Existing flight-qualified containers
- -- Simple interfaces and operations
- -- Standard integration agreements

Rack Payloads:
- -- Unique user-provided and integrated
- -- International Standard Payload Rack interfaces
- -- Moderately complex operations
- -- Standard integration agreements

Multi-Rack Payloads:
- -- Unique user-provided racks
- -- Integrated on orbit
- -- Non-standard interfaces
- -- Complex operations
- -- Non-standard agreements

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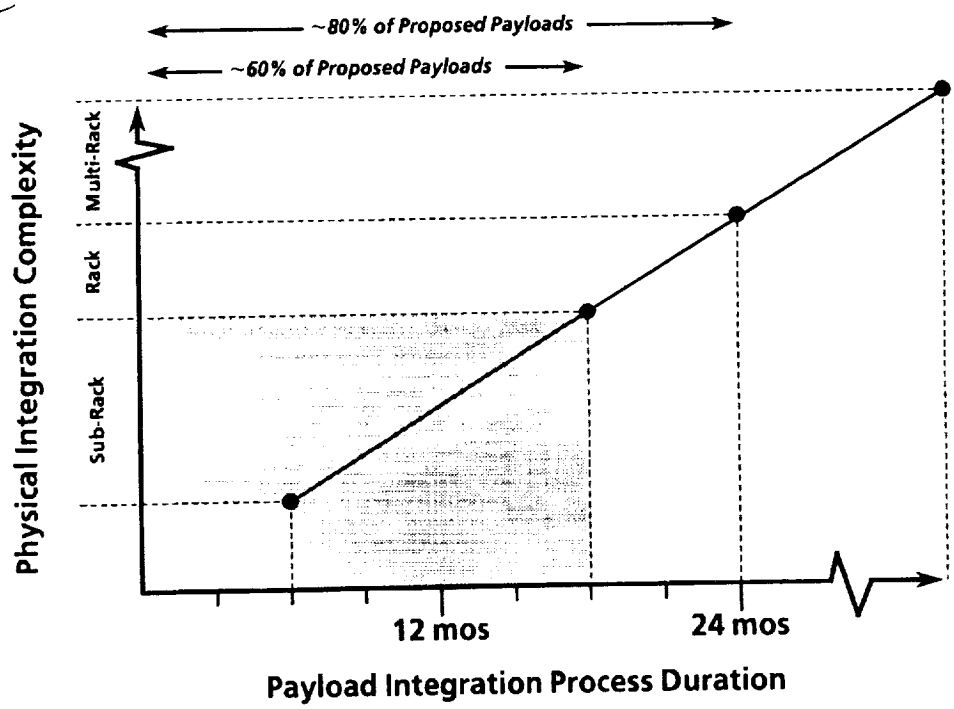
A SPACE STATION FREEDOM RACK

INTEGRATION TIME VS. COMPLEXITY



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SUMMARY

- Those who wish to perform research on Freedom may contact one of the four NASA sponsoring organizations
- The payload integration process is being streamlined to better accommodate researchers
- The points of contact for each of the NASA user sponsoring organizations are identified in article available at the NASA Headquarters booth:

  "How to Get On Board Space Station Freedom"
- Contact NASA Headquarters if you have any questions:

  Dr. John-David Bartoe, Director, User Integration Division
  Barry Epstein, User Development Program Manager
  (202) 453-1181

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HOW TO GET ON BOARD SPACE STATION FREEDOM

Points of Contact

Science and Applications Opportunities
Dr. Roger Crouch
Microgravity Science & Applications Division
Office of Space Science & Applications
NASA Headquarters/Code SN
Washington, DC 20546

Dr. J. Richard Keefe
Life Sciences Division
Office of Space Science & Applications
NASA Headquarters/Code SB
Washington, DC 20546

Technology Development Opportunities
Dr. Judith H. Ambrus
Space Experiments Office
Office of Aeronautics and Space Technology
NASA Headquarters/Code RSX
Washington, DC 20546

Commercial Cooperative
James Fountain
Office of Commercial Programs
PS05
George C. Marshall Space Flight Center
Huntsville, AL 35812

Commercial Reimbursable Opportunities
Office Space Flight
NASA Headquarters/Code MB
Washington, DC 20546

For General Information about Space Station Freedom Research Capabilities and Opportunities:
Dr. John-David Bartoe, Director
User Integration Division
Spacelab/Space Station Utilization Program
NASA Headquarters/Code MG
Washington, DC 20546
(202) 453-1181

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SESSION 2:
RESEARCH PLANS AND OPPORTUNITIES

SPACE STATION FREEDOM UTILIZATION CONFERENCE

AUGUST 4, 1992