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## **LIFE SCIENCES RECRUITMENT OBJECTIVES**

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### **ABSTRACT**

The goals of the Life Sciences Division of the Office of Space Sciences and Application are to ensure the health, well being and productivity of humans in space and to acquire fundamental scientific knowledge in space life sciences. With these goals in mind, Space Station Freedom represents substantial opportunities and significant challenges to the Life Sciences Division. For the first time it will be possible to replicate experimental data from a variety of simultaneously exposed species with appropriate controls and real-time analytical capabilities over extended periods of time. At the same time, a system for monitoring and ameliorating the physiological adaptations that occur in humans subjected to extended space flight must be evolved to provide the continuing operational support to the SSF crew. To meet its goals, and take advantage of the opportunities and overcome the challenges presented by Space Station Freedom, the Life Sciences Division is developing a suite of discipline-focused sequence. The research phase of the Life Sciences Space Station Freedom Program will commence with the utilization flights following the deployment of the U.S. laboratory module and achievement of Man Tended Capability. Investigators that want the Life Sciences Division to sponsor their experiment on SSF can do so in one of three ways: submitting a proposal in response to a NASA Research Announcement (NRA), submitting a proposal in response to an Announcement of Opportunity (AO), or submitting an unsolicited proposal. The scientific merit of all proposals will be evaluated by peer review panels. Proposals will also be evaluated based on relevance to NASA's missions and on the results of an Engineering and Cost Analyses. The Life Sciences Division expects that the majority of its funding opportunities will be announced through NRAs. It is anticipated that the first NRA will be released approximately three years before first element launch (currently scheduled for late 1995). Subsequent NRAs will be released on a rotating two year cycle.



# LIFE SCIENCES RECRUITMENT OBJECTIVES



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Space Station Freedom Program



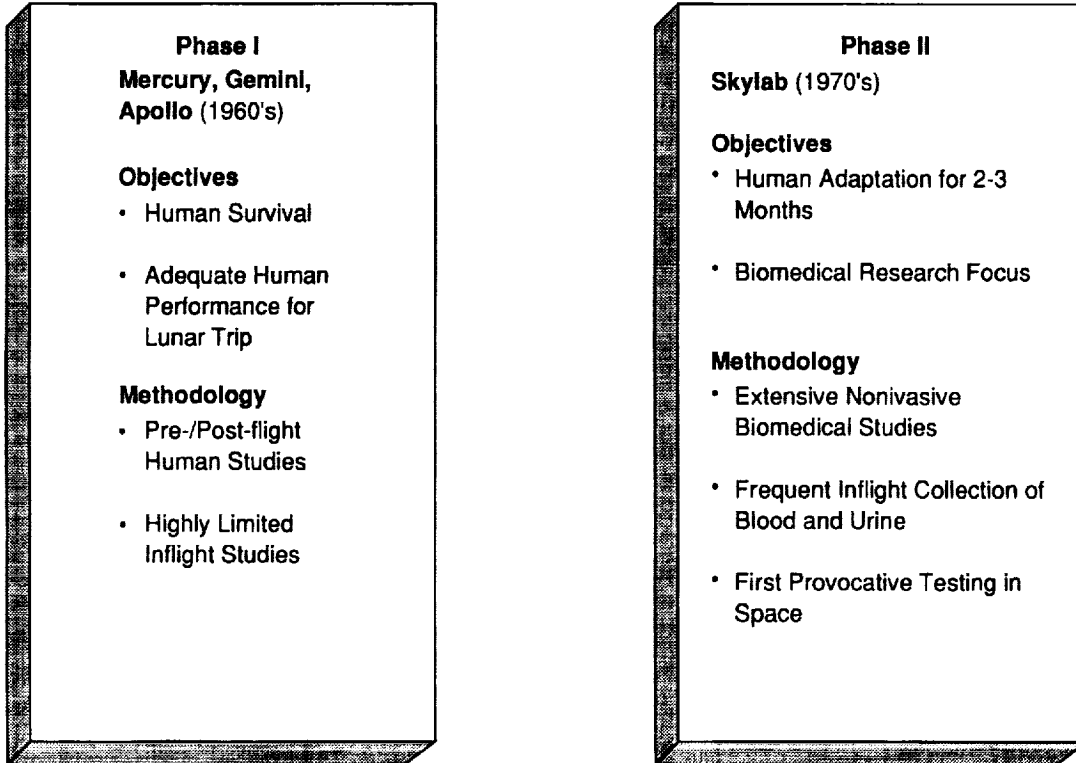
## SPACE LIFE SCIENCES GOALS AND OBJECTIVES

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- **Ensure the health, safety, and productivity of humans in space**
  - **Acquire fundamental scientific knowledge concerning biological sciences**
- 
- **Expand our understanding of life in the Universe**
  - **Develop an understanding of the role of gravity on living systems**
  - **Provide for the health and productivity of humans in space**
  - **Promote the application of life sciences research to improve the quality of life on Earth**



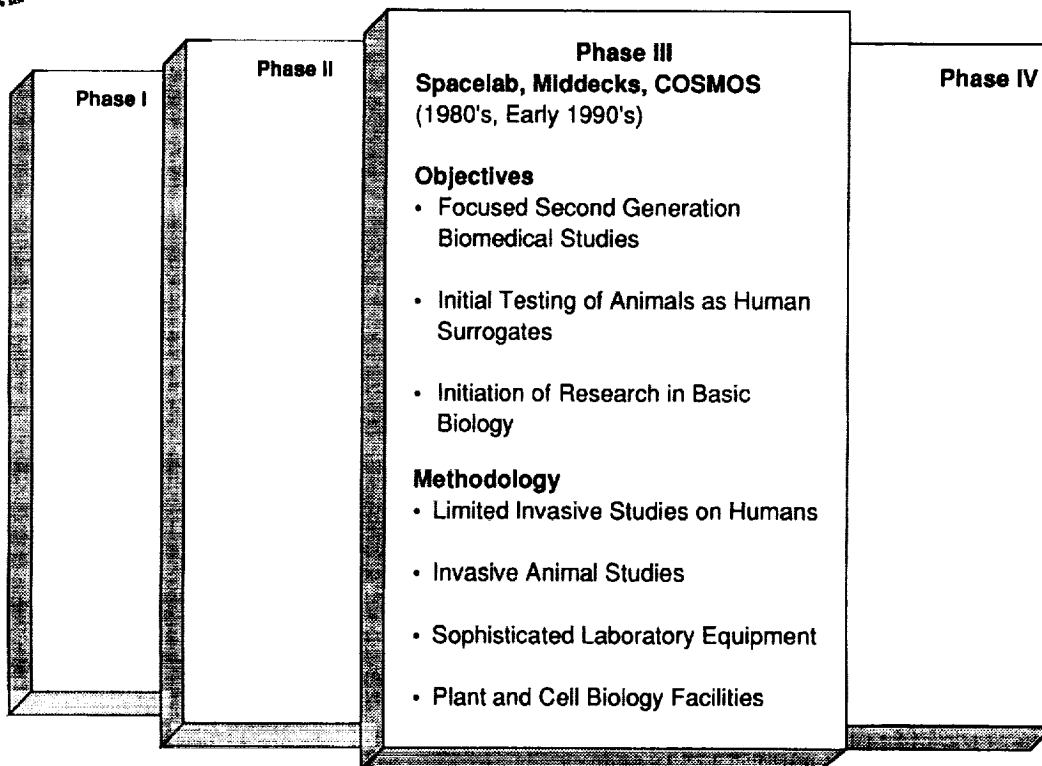
## LIFE SCIENCES SPACE RESEARCH STRATEGY



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## LIFE SCIENCES SPACE RESEARCH STRATEGY





## Phase IV

### Late Spacelab, MIR, Early Space Station Freedom (Mid-Late 1990's)

#### Objectives

- Third Generation Biomedical Studies (Countermeasures Emphasis)
- Development of Animal Models
- Develop Foundations for Exploration
- Fundamental Studies in Basic Biology

#### Methodology

- Integrated International Laboratories
- Comprehensive Laboratory Research Facilities
- Carefully Controlled Human, Animal, and Plant Studies
- Replications as Required

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## IMPETUS FOR SPACE STATION FREEDOM

"...back to the Moon, back to the future. And this time, back to stay. And...a journey into tomorrow...a manned mission to Mars." President George Bush, 1989.

"...the Space Station is deemed essential as a life sciences laboratory, for there is simply no Earth-bound substitute. The Space Station is a critical next step if the U.S. is to have a manned space program in the future." Report of the Advisory Committee on the Future of the U.S. Space Program, 1990.

"[Space Station] Freedom will provide the means to acquire basic knowledge on mechanisms of gravity perception while paving the way for extended-duration exploration missions with humans." Space Life Sciences Strategic Plan, 1992.



## RECENT RECOMMENDATIONS TO THE LIFE SCIENCES

- Life Beyond the Earth's Environment: The Biology of Living Organisms in Space. NRC Space Science Board. Neal S. Bricker, Chairman. 1979
  - Focused on science priorities for Spacelab missions
- A Strategy for Space Biology and Medical Science: for the 1980s and 1990s. NRC Space Science Board. Jay M. Goldberg, Chairman. 1987
  - Focused on developing priorities for late STS and early space station program
- Exploring the Living Universe: A Strategy for Space Life Sciences. A Report of the NASA Life Sciences Strategic Planning Study Committee. Frederick C. Robbins, Chairman. 1988.
  - Focused programmatic requirements for Space Station Freedom
- Life Sciences Discipline Working Group Science Plans. 1991
  - Focused on discipline specific science
  - Developed prioritized list of critical questions within each discipline
- NASA Advisory Council, Aerospace Medicine Advisory Committee Report. Harry Holloway, Chairman. 1992
  - Focused on meeting requirements for Moon/Mars missions
  - Developed prioritized list of science questions across disciplines

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## SPACE LIFE SCIENCES CUSTOMERS

1. MISSION IMPLEMENTORS
  - Requirement Capability for human exploration of space
  - LSD Product Deliverables identified by AMAC strategy
2. SCIENCE COMMUNITY
  - Requirement Access to space for conduct of scientific research
  - LSD Product Support of science described in discipline plans
3. PUBLIC
  - Enhance the quality of life on Earth
  - Stimulate the imagination
  - Motivate science and engineering education

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## CATEGORIES FOR LIFE SCIENCES DISCIPLINES

### *Human Physiology and Performance*

Behavior, Performance and Human Factors  
Regulatory Physiology  
Cardiopulmonary  
Musculoskeletal  
Neuroscience

### *Life Support*

Environmental Health  
Radiation Health  
Life Support, including CELSS

### *Gravitational Biology*

Cell and Developmental Biology  
Plant Biology

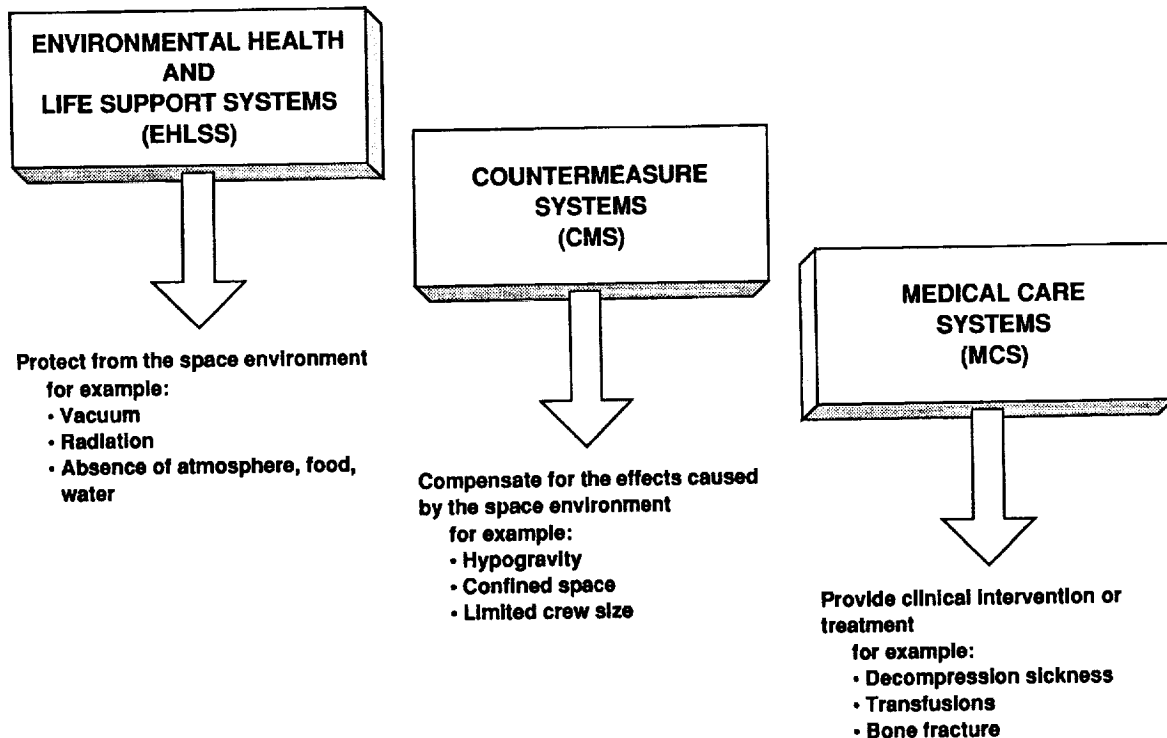
### *Exobiology*

Exobiology  
Planetary Protection

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## ENABLING LIFE SCIENCES RESEARCH THRUSTS FOR HUMAN EXPLORATION MISSIONS





## DEFINITIONS OF CRITICALITY, ROBUST AND CONSTRAINED PROGRAMS

Category	Criticality			
	1	2	3	4
EHLSS	<b>Constrained</b>		<b>Robust</b>	
CMS				
MCS				
Enabled Science	<b>SEI CRITICALITY NOT APPLICABLE</b>			
Basic Science	<b>SEI CRITICALITY NOT APPLICABLE</b>			

**Criticality 1:** Consensus that answer is required for Mars mission (known effect and known problem for mission).\*

**Criticality 2:** Answers might be required, science basis to evaluate risk is not adequate.

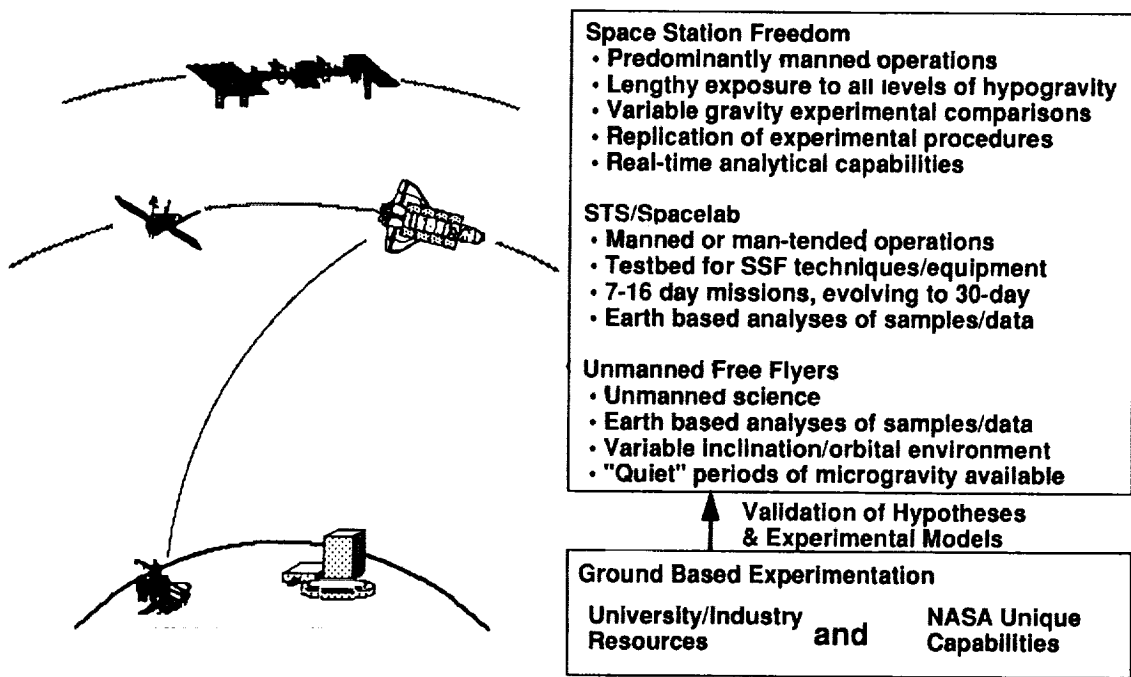
**Criticality 3:** Required for practical optimization of resources (or countermeasure effectiveness) and minimization of risk.

**Criticality 4:** Important science that is relevant to exploration mission.

\* Crewmembers must be able to effectively perform mission tasks in transit vehicles and on planetary surfaces; and must recover, in a reasonable time, upon return to Earth



## LIFE SCIENCES RESEARCH RESOURCES

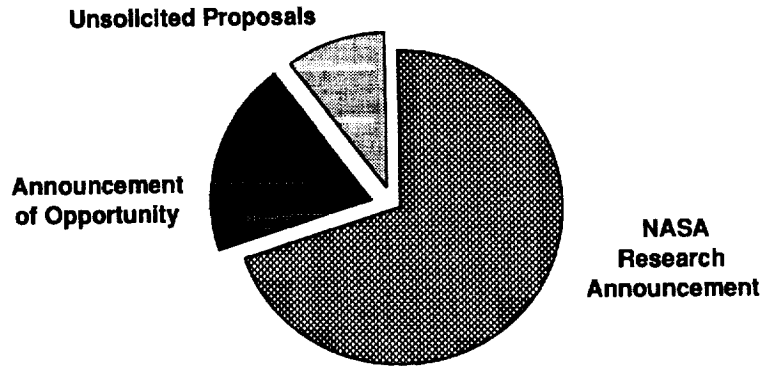


Life Sciences planning matches Science Requirements with the most appropriate Platform






## METHODS OF FUNDING



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 <b>SOLICITED PROPOSALS</b>		
	NASA Research Announcements (NRA)	Announcements of Opportunity (AO)
Types of investigations	<ul style="list-style-type: none"> <li>ground-based research</li> <li>flight experiments not requiring major hardware development</li> </ul>	<ul style="list-style-type: none"> <li>flight hardware development oriented projects</li> </ul>
Funding mechanism	<ul style="list-style-type: none"> <li>usually grants</li> </ul>	<ul style="list-style-type: none"> <li>usually contracts</li> </ul>
Funding level	<ul style="list-style-type: none"> <li>varies, depending on requirements/justification</li> </ul>	<ul style="list-style-type: none"> <li>varies usually larger than NRA due to complex nature of hardware development</li> </ul>
Evaluation process	<ul style="list-style-type: none"> <li>peer reviewed science</li> <li>NASA programmatic evaluation</li> </ul>	<ul style="list-style-type: none"> <li>peer reviewed science</li> <li>NASA programmatic evaluation</li> <li>more involved "CEM" evaluation than NRA</li> </ul>

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## UNSOLICITED PROPOSALS

- Investigator initiated
- Mailed directly to appropriate Program Manager
- Evaluated like NRA/AO
- Appropriate for small, low cost experiments utilizing existing hardware/facilities

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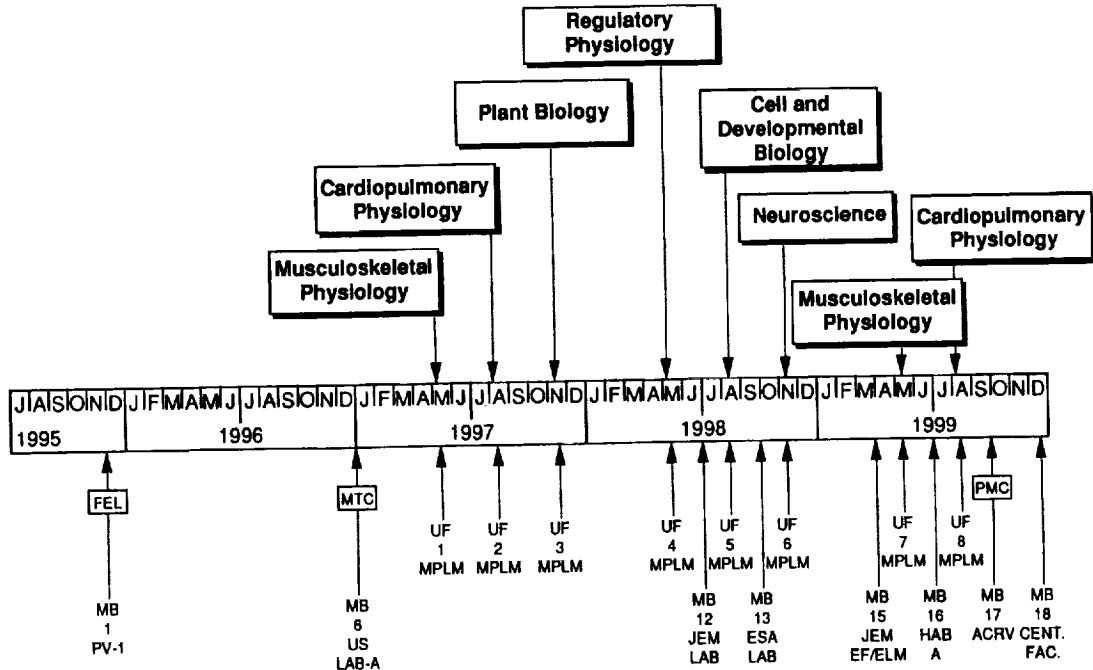
## SOLICITATION OF RESEARCH ON SPACE STATION FREEDOM

- Primary method of solicitation/funding will be through discipline focused NASA Research Announcements (NRA).
  - Discipline sequence will be determined in consultation with the scientific community and our international partners.
- NRAs will announce submittal dates for established discipline sequences.
- Nominal two year cycle from solicitation to funding.

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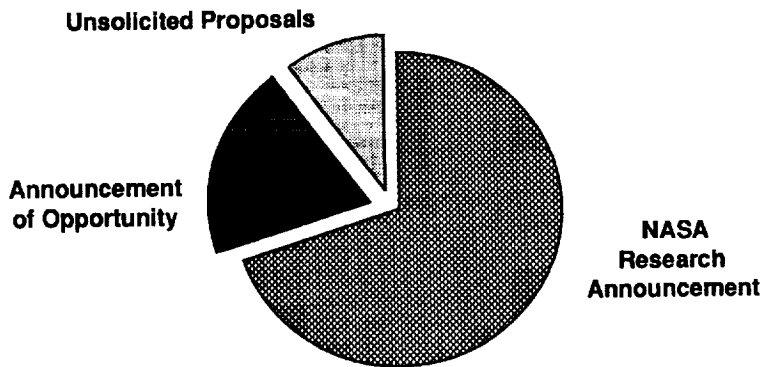
# EXAMPLE DISCIPLINE FOCUSED INCREMENTS



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# METHODS OF FUNDING



Target Funding Range \$60 - \$100 K per year



## PROPOSAL EVALUATION CRITERIA

- Scientific merit - determined by an extramural peer review panel
- Relevance to NASA's mission - determined by NASA
- Engineering, Cost, and Management Review - standardized review performed by NASA. Used to assess costs, development risks, hardware availability, potential incompatibilities, and the technical aspects of implementing the proposed investigation.

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## TYPES OF FLIGHT OPPORTUNITIES ON SPACE STATION FREEDOM

### Utilization of common-core facilities

- Nominal use
  - facilities used as provided, no additional hardware built
  - solicitation to integration/flight cycle = 2 years
- Experiment Unique Equipment required
  - additional hardware or significant modifications to facilities required
  - solicitation to integration/flight cycle > 2 years
- Small and Rapid Response Payloads
  - small experiments
  - integrated tissue sharing protocols
  - integration/flight may be accomplished in 6 months

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## SUPPORT PROVIDED BY THE NASA GRANT

- Experiment definition, development, and ground based data collection.
- Development of Experiment Unique Equipment (EUE) - if approved.
- Postflight data analysis

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## OTHER SUPPORT PROVIDED BY NASA

- Experiment Integration
  - Physical
  - Analytical
- Use of common-core facilities and hardware
- Mission operations/ logistics
- Inflight data collection
- Data Archive

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