<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>Space Station</td>
<td>1997-2003</td>
</tr>
<tr>
<td>Humans Return to the Moon</td>
<td>2004</td>
</tr>
<tr>
<td>Lunar Presence</td>
<td>2005</td>
</tr>
<tr>
<td>Lunar Habitat</td>
<td>2007-2009</td>
</tr>
<tr>
<td>Humans Land on Mars</td>
<td>2018</td>
</tr>
</tbody>
</table>

* Schedule currently under scrutiny by various outside Advisory Committees
Biomedical Programs

Goals

• Develop an understanding of the physiological, psychological and behavioral adaptation to space

• Ensure the health, well-being, and performance of humans in space and on return to Earth’s gravity

• Promote the application of biomedical research to improve the quality of life on Earth

Objectives

• Determine the acute and long-term physiological and behavioral adaptation to space

• Determine the psychological and sociological implications of space flight

• Determine the crew performance and mission consequences of the physiological, psychological and behavioral adaptation to space

• Develop adequate monitoring techniques and countermeasures

• Verify adequate models and/or analogs for space
INFLIGHT VALIDATION

Training Protocols
Design Requirements
Procedures
Selection Criteria
Other Procedures

Undersea Habitat Model
- Contained Link w/Outside EVA-Type Activity
  - Crew Coordination
  - Group Dynamics
  - Selection & Training
  - Immunology Studies*
  - Environmental Monitoring

Antarctic Model
- Isolation
- Self-Sufficiency
- Very Long-Duration
  - Psychological C/I
  - Crew Coordination
  - Group Dynamics
  - Selection & Training
  - Immunology Studies
  - Circadian Rhythms
  - Stress Related
  - Endocrinology
  - Advanced HIF Testing
  - Environmental Monitoring
  - Instrument Testing
  - Galactic Cosmic Radiation

GROUND VALIDATION MODELS

Simulations/Aviation
HYPOTHESIS TESTING
Computer Modelling

Feedback

Hypothesis

BASIC RESEARCH

* if longer than 2 weeks
Justification for Using the Antarctic as an Analog

- Similarities Between Extended Duration Space Missions and Antarctica Conditions
  - Long Duration
  - Extreme Environments
  - Isolated Location
  - Delayed Communications
  - Confinement
  - Small Group Dynamics
  - Diverse skill mix
  - Various Nationalities
Goal

- To use the Antarctic as an analog for space exploration to study human behavior and performance, physiology under stress, and environmental health.

Areas of Research Interest

- Space Human Factors
- Human Physiology
- Environmental Health
NASA Proposed Biomedical Research in the Antarctic (Continued)

- **Space Human Factors**
  - Crew Selection and Training
  - Isolation
  - Psychological Support/Countermeasures
  - Human-Machine Interactions
  - Work Station/Habitability Requirements
  - Workload
  - Small Group Dynamics
  - Command and Control Structure
  - Crew Composition: Gender, Nationality, Skill Mix

- **Human Physiology**
  - Stress-Related Endocrinology/Immunity issues
  - Circadian Rhythms and Sleep Disorders
  - Sedentary Issues Related to General Fitness/Motivational Aspects of Exercise

- **Environmental Health**
  - Microbiology and Toxicology Issues
  - Epidemiology of Infectious Diseases
<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
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<tbody>
<tr>
<td>Initial Meeting of the Science Working Group</td>
<td>October 11-12, 1990</td>
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<tr>
<td>NASA/NSF Research Announcement Release</td>
<td>March 1, 1991</td>
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<td>Proposal Submission Deadline</td>
<td>June 1, 1991</td>
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<td>Investigation Selection</td>
<td>Summer 1991</td>
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<tr>
<td>Investigation Initiation</td>
<td>Fall 1991 (FY92)</td>
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</table>
Charge to the Committee

The NASA/NSF Science Working Group is charged with defining specific science requirements and priorities for biomedical research to be conducted using the Antarctic as an analog for space exploration.
Attachment 9