

**SPACE LIFE SCIENCES PERSPECTIVES FOR
SPACE STATION FREEDOM**

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ABSTRACT

It is now generally acknowledged that the life science discipline will be the primary beneficiary of Space Station Freedom. The unique facility will permit advances in understanding the consequences of long duration exposure to weightlessness and evaluation of the effectiveness of countermeasures. It will also provide an unprecedented opportunity for basic gravitational biology, on plants and animals as well as human subjects. The major advantages of SSF are the long duration exposure and the availability of sufficient crew to serve as subjects and operators.

In order to fully benefit from the SSF, life sciences will need both sufficient crew time and communication abilities. Unlike many physical science experiments, the life science investigations are largely exploratory, and frequently bring unexpected results and opportunities for study of newly discovered phenomena. They are typically crew-time intensive, and require a high degree of specialized training to be able to react in real time to various unexpected problems or potentially exciting findings. Because of the long duration tours and the large number of experiments, it will be more difficult than with Spacelab to maintain astronaut proficiency on all experiments. This places more of a burden on adequate communication and data links to the ground, and suggests the use of AI expert system technology to assist in astronaut management of the experiment. Typical life science experiments, including those flown on Spacelab Life Sciences I, will be described from the point of view of the demands on the astronaut. A new expert system, "PI in a Box," will be introduced for SLS-2, and its applicability to other SSF experiments discussed.

SSF UTILIZATION

SPACE LIFE SCIENCES: EXPERIENCE AND PLANS

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SSF UTILIZATION

WHY IS SSF VITAL TO SPACE LIFE SCIENCES?

LONG DURATION EXPOSURES

COMPARABLE TO MARS EXPLORATION

ANIMALS AND PLANTS AS WELL AS HUMANS

MULTIPLE GENERATIONS OF PLANTS AND ANIMALS

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WHAT DOES SSF OFFER FOR LIFE SCIENCES?

CREW TIME:

SUFFICIENT NUMBER OF SUBJECTS

SPECIALIZED EXPERIMENTERS

FLEXIBILITY TO REPLAN STUDIES

FACILITY REQUIREMENTS FROM LIFE SCIENCES

**TWO WAY COMMUNICATION AND DATA LINKS
EVENTUAL USE OF UPLINK VIDEO**

SAMPLE RETURN CAPABILITY

ON BOARD ANALYSIS

BIOISOLATION

NORMAL ATMOSPHERIC CONDITIONS

MAJOR ON-BOARD EQUIPMENT

BIOISOLATION:

GLOVE BOX TO PROTECT CREW AND SAMPLES

ANIMAL AND PLANT HOLDING FACILITIES

CENTRIFUGE:

PROVIDE 1-G CONTROLS

MAINTAIN 1-G SAMPLES UNTIL NEEDED

PERMIT STUDIES IN THE 0-1 G RANGE

HEALTH MAINTENANCE FACILITY



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SPECIALIZED ON-BOARD EQUIPMENT

LINEAR AND ANGULAR ACCELERATORS

IMAGING DEVICE

LOWER BODY NEGATIVE PRESSURE DEVICE



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HUMAN-ORIENTED RESEARCH

ISSUES RELATED TO ADAPTATION TO 0-G

CARDIOVASCULAR DECONDITIONING
PULMONARY FUNCTION ALTERATION
MUSCLE LOSS AND CHANGE OF FIBER TYPES
BONE LOSS AND CHANGE IN CALCIUM BALANCE
PLASMA AND RED BLOOD CELL LOSS
RENAL/ENDOCRINE SYSTEM
IMMUNE SYSTEM
SPACE MOTION SICKNESS AND NEUROVESTIBULAR
ADAPTATION



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PLANT AND ANIMAL EXPERIMENTS

COVER ALL BRANCHES OF PHYSIOLOGY
CURRENT ANIMAL SPECIES: RATS, MONKEYS, FISH
REQUIRE SOME SPECIALIZED CREW SKILLS



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RECENT LIFE SCIENCES EXPERIENCE

SPACELAB LIFE SCIENCES 1 (JUNE '92)

FIRST ALL LIFE SCIENCES MISSION

TWENTY INVESTIGATIONS/ SIX BODY SYSTEMS

HUMANS, RATS AND JELLYFISH STUDIED

SUCCESS DEPENDED ON CREW SKILLS

SPACELAB LIFE SCIENCES 2 SCHEDULED FOR 1993

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SPECIAL PROBLEM RAISED BY SSF FOR LIFE SCIENCE STUDIES

LONG DURATION TOURS

MULTIPLE DISCIPLINES AND EXPERIMENTS

FLEXIBILITY TO ADJUST PROTOCOLS AND TIMES

BUT

*THE CREW NEEDS TIMELY REMOTE COACHING, AND
GUIDANCE DURING CONDUCT OF THE EXPERIMENTS*

HIGH B/W COMMUNICATION TO PI'S IS AN APPROACH
ON-BOARD EXPERTS SYSTEMS ARE ALTERNATIVES

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