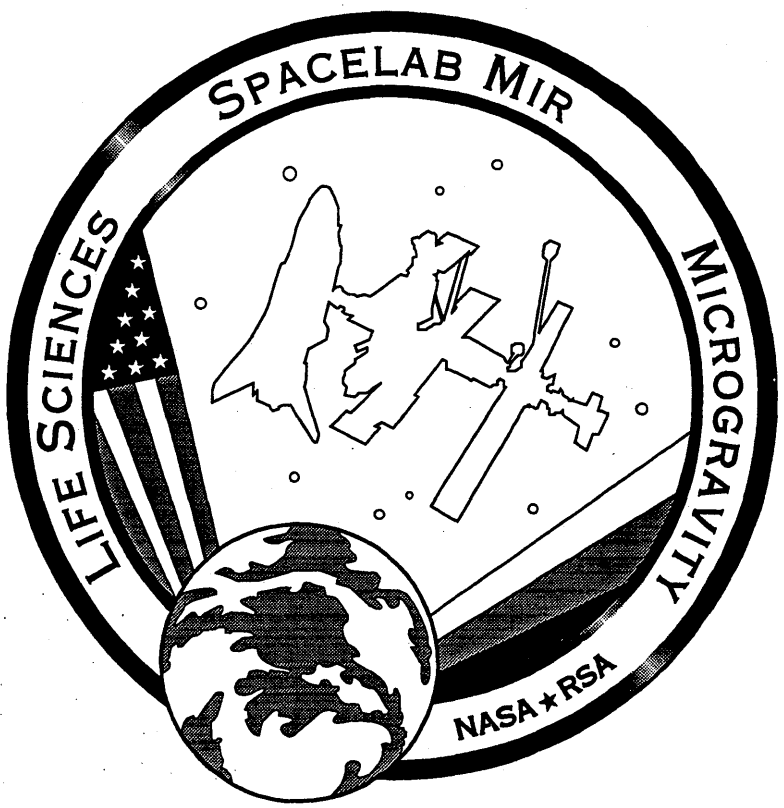
JSC-26733

MISSION SCIENCE REQUIREMENTS DOCUMENT

SPACELAB-MIR (STS-71)



NASA
National Aeronautics
and Space Administration

Lyndon B. Johnson Space Center
Houston, TX

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Studies on Orthostatic Tolerance with the Use of Lower Body Negative Pressure
Experiment 3.1.1

INVESTIGATORS

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HYPOTHESES

- There is a significant loss of orthostatic tolerance before the end of the first month in orbit.
- There is no significant change in orthostatic tolerance beyond the first month in orbit.
- There is a significant difference in cardiovascular response to LBNP stress in Mir crew members after 90 days in orbit compared to that previously measured in space shuttle crew members after 1 to 2 weeks in orbit.

OBJECTIVE

Evaluate the in-flight orthostatic tolerance of crewmembers using LBNP and compare the results to postflight orthostatic intolerance after long periods in space flight.

FUNCTIONAL OBJECTIVES

Lower Body Negative Pressure (LBNP)

The following protocol is performed: baseline data is collected at 0 mm Hg decompression for 10 mins, followed by data collection during five 5-min stages at 10, 20, 30, 40, and 50 mm Hg decompression below ambient pressure, and ending with data collection during recovery at 0 mm Hg for 5 mins. Data collected includes arterial BP, HR, and continuous ECG, decompression level, left ventricular stroke volume, and (if possible) ultrasound cardiac dimensions during the stepwise LBNP decompression tests. The Mir LBNP Chibis device is used during the Mir phase, and the NASA LBNP device is used during the Shuttle docked phase.

Transfer Session

All data collected during the Mir 18 mission are transferred from the Mir to the Shuttle and stowed for return.

Table 3.1.1 Studies on Orthostatic Tolerance with the Use of Lower Body Negitive Pressure

Functional Objective	PHASE				
	Pre-flight	Mir 18 In-flight	STS-71 In-flight	Post-flight	Mir 19 In-flight
LBNP "Ramp" Protocol	X	X	X	X	
Transfer Session			X		

SESSION DESCRIPTION

1. Session ID: CP:I:7 Rev. Date: 06/20/95

2. Session Title: "Ramp" Protocol (CP-LBNP-3.1.1)

3. Session Timelining:

   3.1 Scheduled Day(s):

   FD6

   3.2 Crewtime Usage:

   1g: 632 man-mins = 10.53 man-hrs
   0g: 632 man-mins = 10.53 man-hrs

4. Session Scenario:

While operator configures LBNP and AERIS for testing, subjects will perform subject prep. Prior to LBNP ingress, baseline Echo measurements will be taken (Echo measurements are taken throughout the duration of the session). Subject will then ingress LBNP for "Ramp". The standard U.S. LBNP test consists of 10 mins of baseline data at 0 mmHg decompression, measurements during 5 stages of 5 min duration each at 10, 20, 30, 40, and 50 mmHg decompression below ambient pressure, and recovery measurements during 5 mins at 0 mmHg.

5. Session Constraints:

   1. Data and video downlink is highly desired during this session.

   2. It is highly desirable that no exercise occur within the 24 hrs preceding each session for each subject. However, if exercise is required for operational reasons, it should be of the minimum acceptable intensity and duration.

   3. No nicotine, alcohol, or caffeine within 12 hrs before testing.

   4. No medication within 24 hrs before a session.

   5. No heavy meal for 4 hrs before testing.

   6. No food for 2 hrs before testing.

   7. Session is required to be scheduled immediately following performance of CP:I:6, Baroreflex Testing.

   8. This session can replace the LBNP countermeasure session on either FD9 or FD10.

   9. The first (Unstow/setup) and last (Power down/temp stow)

steps of the science flow must be performed once each data collection day.

6. Session Operational Module and Time Requirements:

N/A

7. Session Science Flow:

1g time (min)	0g Time/factor	Oper/ Subj	Activity
30	30/1.00	1/0	(Op1): Unstow/set up LBNP/AERIS
20	20/1.00	3/3	(Op1): Complete set-up; (Subj): Subject prep
10	10/1.00	3/3	Echo measurements
10	10/1.00	3/3	Ingress LBNP
45	45/1.00	3/3	LBNP Ramp (0-50 mmHg)
12	12/1.00	3/3	Egress LBNP
20	20/1.00	1/0	Power down/temp stow

SESSION DESCRIPTION

1. Session ID: CP:I:10 Rev. Date: 06/20/95

2. Session Title: Final Stowage LBNP (CP-LBNP-3.1.1)

3. Session Timelining:

   3.1 Scheduled Day(s):

   FD 11 (End of mission minus 1 day)

   3.2 Crewtime Usage:

   1g: 70 man-mins = 1.17 man-hrs
   0g: 70 man-mins = 1.17 man-hrs

4. Session Scenario:

   Final stow of LBNP device.

5. Session Constraints:

   1. Session is required to be scheduled after the last performance of CP:I:7, "Ramp" Protocol.

6. Session Operational Module and Time Requirements:

   N/A

7. Session Science Flow:

1g time (min)	0g Time/factor	Oper/ Subj	Activity
10	10/1.00	2/0	Disassemble LBNP
50	50/1.00	1/0	Final stow of LBNP/AERIS Device