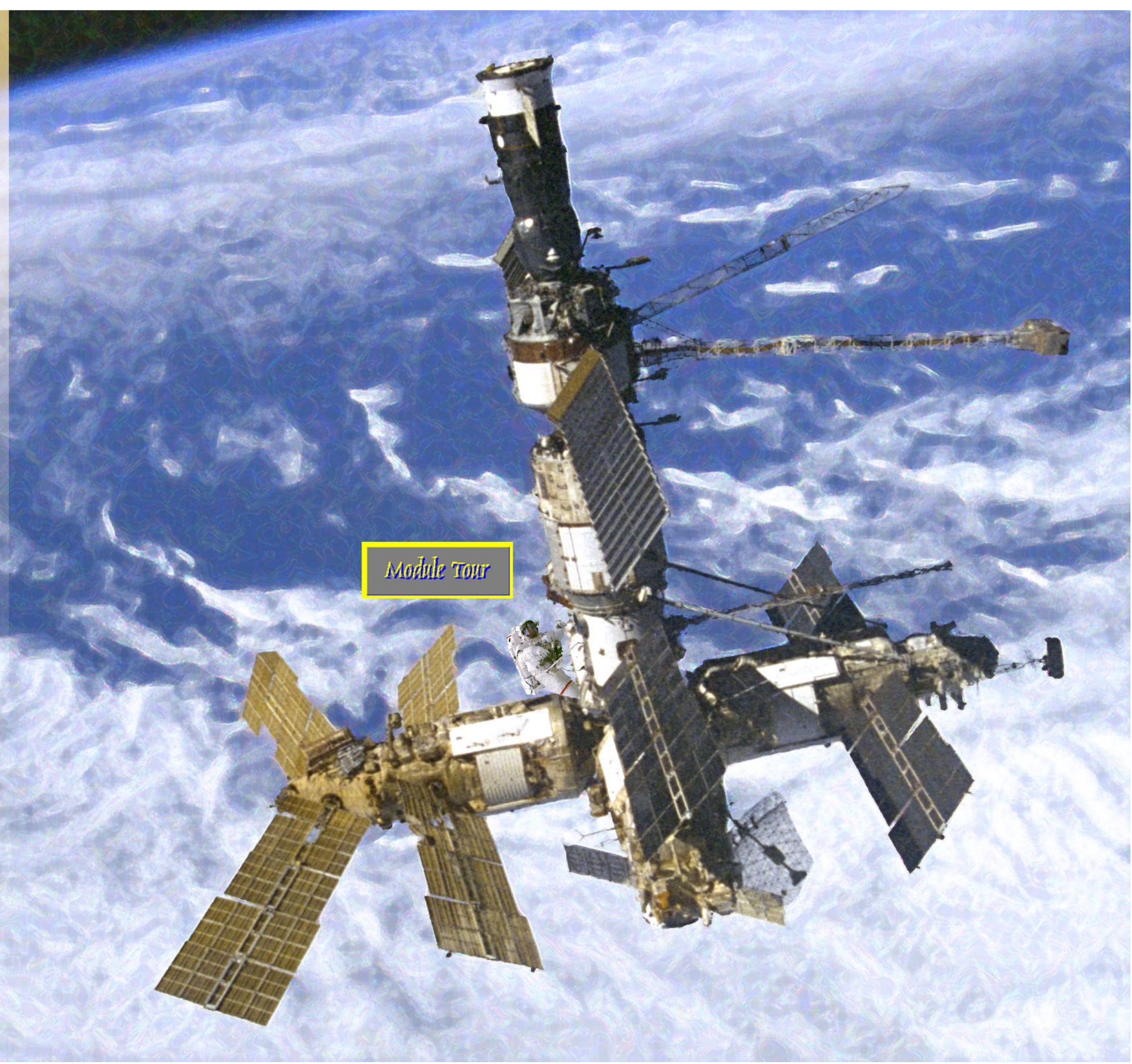
Phase 1:
A Journey to Mir
1994-1998



Module Tour

List of Experiments

List of Experiments by Increment

Bone Mineral Loss and Recovery After Shuttle/Mir Flights (E598)

SCIENCE OBJECTIVES

The science objectives of the study "Bone Mineral Loss and Recovery after Shuttle/Mir Flights" include:

1. Determine regional losses in bone mineral density and lean body mass by comparing postflight with preflight measurements.

2. Determine the regional rate and extent of recovery of the bone mineral and lean tissue following return to 1-g.

3. Determine the muscle strength in the legs and back and relate these measurements to the loss and recovery of bone.

4. Determine changes in the levels of serum and urinary markers of bone metabolism by measuring these markers pre-, in- and postflight.

5. Determine changes in calcium homeostasis by performing stable isotope calcium kinetics studies pre-, in- and postflight.

FUNCTIONAL OBJECTIVES

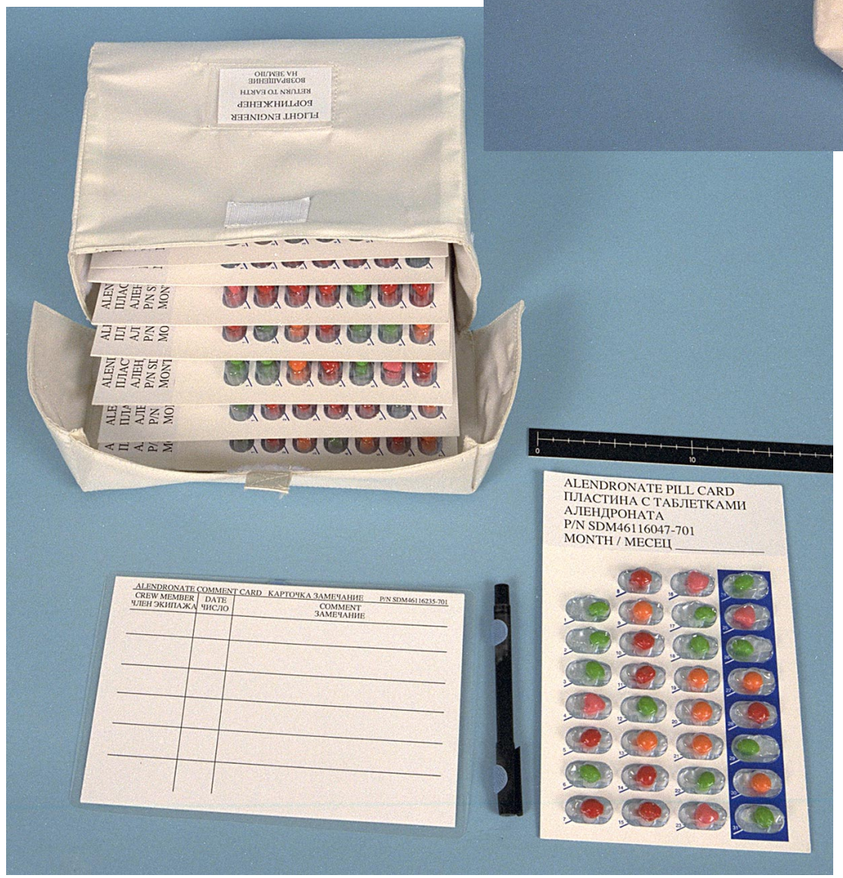
Participating crewmembers of the Phase IC NASA/Mir missions will receive the following tests:

1. Densitometry testing (DEXA) will be used to measure whole body and regional bone mineral, as well as whole body and regional lean tissue.

2. Muscular fitness will be determined by isokinetic muscle strength testing. It will be used as an indicator of a crewmember's load-bearing physical activity throughout their participation in the study.

3. Blood will be collected by simple venipuncture to measure serum levels of various markers of bone metabolism.

4. Urine will be collected in 24-hour void-by-void collections to measure urinary excretion of markers of bone metabolism.



S97-10744

Figure HLS-1 Alendronate Kit Contents

S97-10743

Figure HLS-2 Alendronate Kits

5. Calcium kinetics studies will be performed using a dual stable isotope technique. This testing involves multiple days of sample collections, including blood, urine, feces, and saliva.

HARDWARE DESCRIPTIONS

- Alendronate Kit
  - Alendronate pill cards
  - Comment card
- Blood Tube Kit
  - 7mL and 5mL blood tubes
- Blood Collection Kit
  - Tourniquet, catheters, extension sets, ethyl alcohol wipes, gauze pads, iodine pads, OpSite dressing, micropore tape, wrist bands, 1 mL saline, multisample blunt cannula, 1 mL heparin lock flush, 2 mL wash vacutainer, butterfly needles, bandaids, vacutainer holder, tubex injector, pilot pen

D.I.D.
Antigen Kit

D.I.D.
PCBA Cartridge Kit

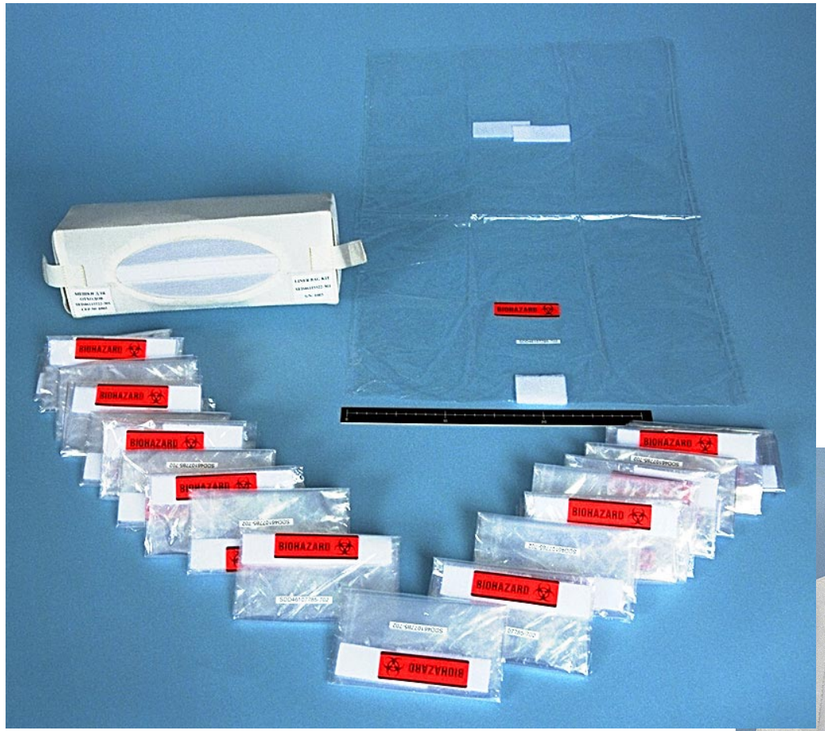
D.I.D.
Alendronate Kit

Principal Investigator:
Linda C. Shackelford, M.D.,
NASA/JSC/SD5
Manager, Bone and Mineral Laboratory
(281) 483-7100

Scott Smith
(281)483-7204

PCBA ACCESSORY KIT ASSEMBLY

P/N: SEM46115888-301
Qty: 1
Mass: 1 kg
Power: N/A
x,y,z: 23 x 23 x 12 cm
DID#: SLM46115852



07

Figure HLS-3 Liner Bags

S97-11789

Figure HLS-4 Blood Tubes Sorted by Crewmember

- Calcium Kinetics Tracer Kit
  - Injectable calcium, ingestible calcium, calcium carbonate tablets
- Mir Urine Collection Kit (See Renal Section)
- Frozen Urine Kit
  - Plastic urine tubes
- Metabolic Log Book
- Frozen Saliva Collection Kit
- PCBA Cartridge Kit (See SMP: E598)
- PCBA (See SMP)

SUPPORTING HARDWARE

- Bar Code Reader (BCR)
- BCR batteries, Battery pack
- BDL Accessory Kit (Lost in Spektr)
- Centrifuge (See OPS)
  - Mir centrifuge
- Portable Clinical Blood Analyzer (PCBA) Accessory Kit (See SMP: E598)
- Thermoelectric Freezer (TEF) (See OPS)
- Thermoelectric Holding Facility (TEHOF: Up on STS-89)(See OPS)
- Glove Kit
- Liner Bag Kit

S97-11790

Figure HLS-5 Blood Tube Kit

D.I.D.

Sleep Blood Tube Kit

D.I.D.

Tracer Kit

D.I.D.

Frozen Urine Syringe Pouch Kit Assembly

D.I.D.

Frozen Saliva Collection Kit

PCBA CARTRIDGE KIT

P/N: SEM46111311-302
Qty: 2
Mass: .275 kg (ea)
Power: N/A
x,y,z: 12.8 x 11.8 x 6.5 cm
DID#: SLM46114368

ALENDRONATE KIT

P/N: SEM46115887-301
Qty: 3
Mass: .727 kg (ea)
Power: 0
x,y,z: 26.5 x 12.5 x 17.5 cm
DID#: SLM46115853

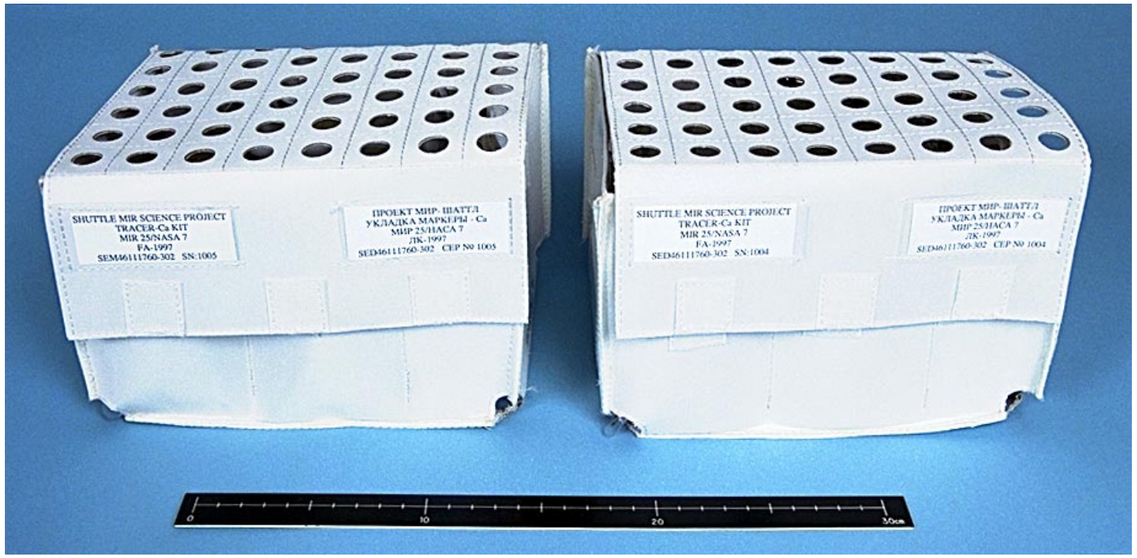


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Figure HLS-6 Calcium Kinetics Tracer Kits

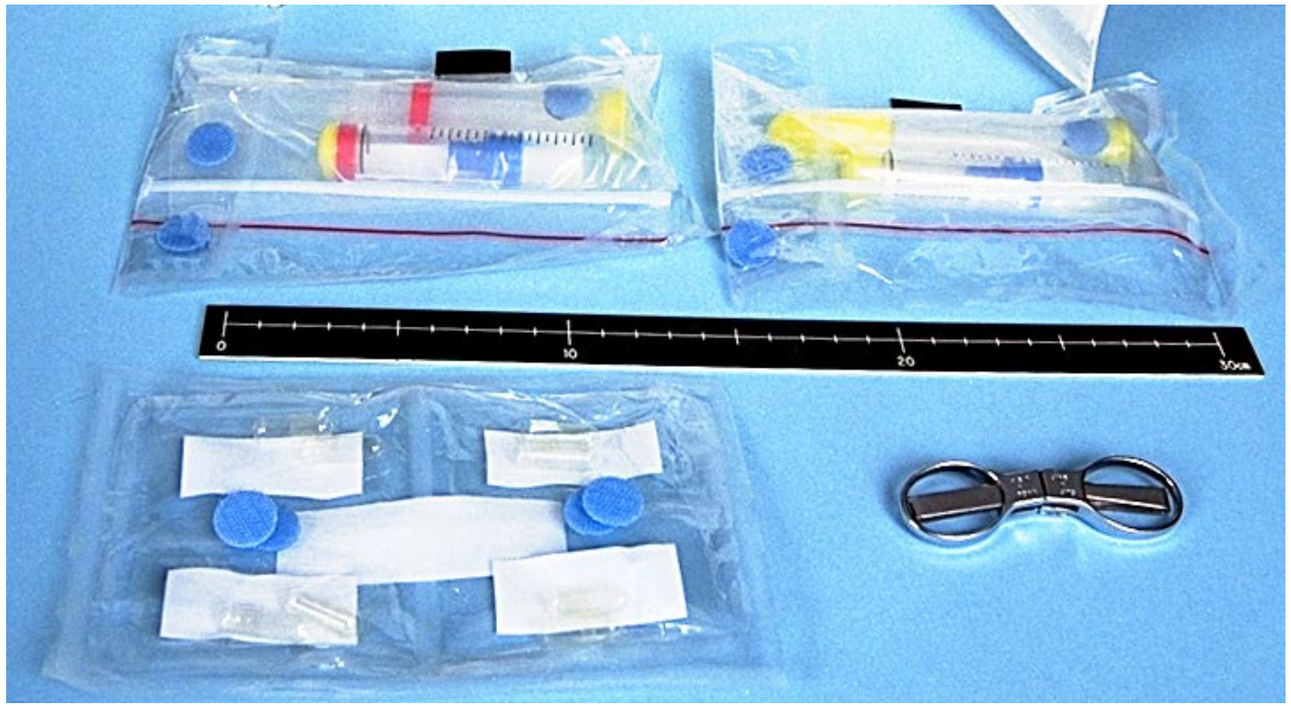

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Figure HLS-7 Calcium Kinetics Tracer Kit Contents

S97

Figure HLS-8 Calcium Kinetics Tracer Kit Packets and Scissors

LINER BAG CONTAINER

P/N: SEM46111577-702
Qty: 1
Mass: .80 kg (ea)
Power: N/A
x,y,z: 29.0 x 10.0 x 8.0 cm
Loc: Spektr, L1
DID#: SLM46111631

LINER BAG ASSEMBLY

P/N: SED46115522-301
Qty: 2
Mass: .854 kg (ea)
Power: N/A
x,y,z: 29.5 x 10.5 x 8.0 cm

BLOOD TUBE KIT

P/N: SED46111789-302
Qty: 1
Mass: 2.204 kg
Power: N/A
x,y,z: 30.6 x 22.1 x 12.5 cm

LARGE TRACER KIT ASSEMBLY

P/N: SEM46109818-302
Qty: 1
Mass: .5 kg
Power: N/A
x,y,z: 17 x 9.5 x 17.8 cm
Loc: Spektr, A3
DID#: SLM46109742

TRACER KIT

P/N: SED46111760-302
Qty: 2
Mass: 1 kg
Power: N/A
x,y,z: 17 x 9.5 x 17.8 cm
Loc: Spektr

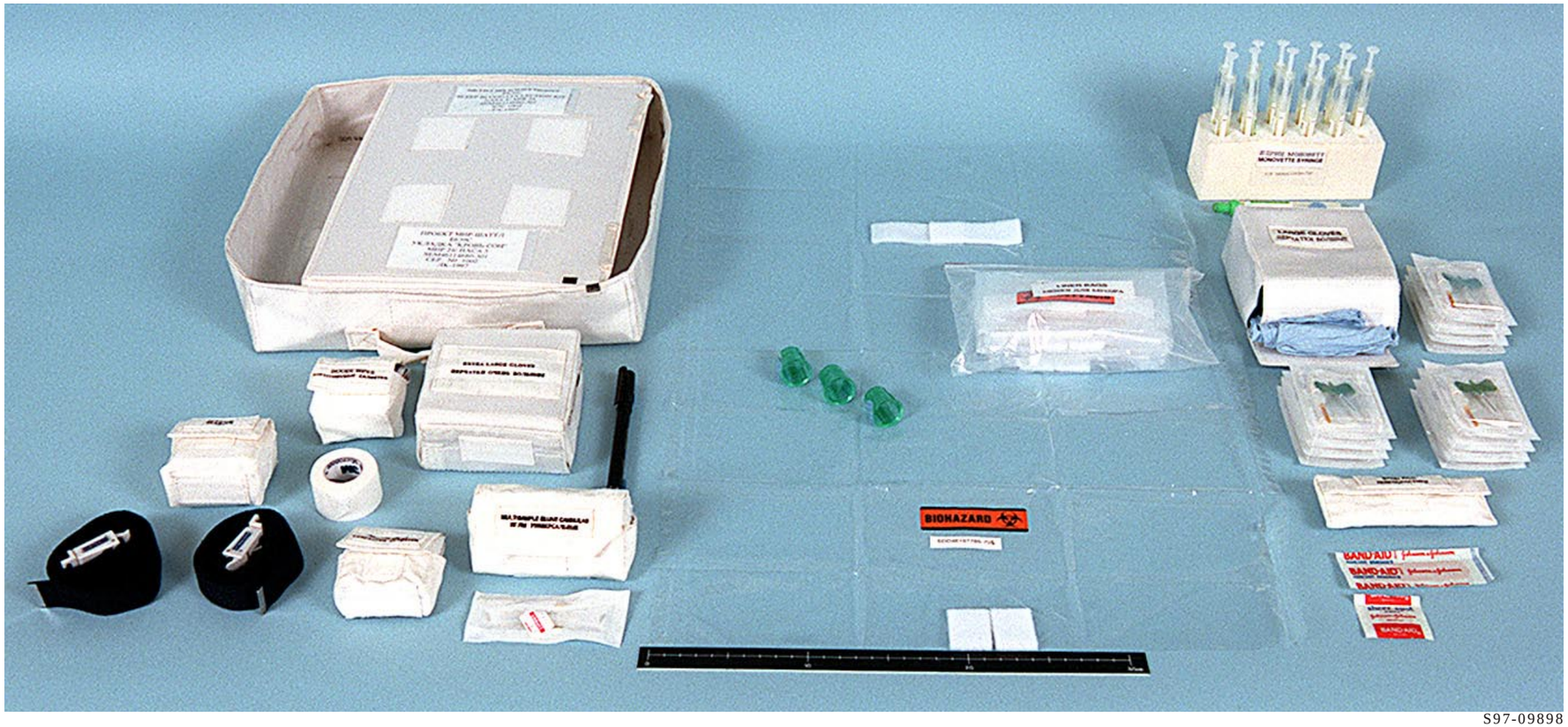
BLOOD COLLECTION KIT

This kit contains medical supplies to support the required blood draws. The following components are stowed with each Blood Collection Kit.

- Tourniquet
- Alcohol wipes
- Sterile gauze pads
- Micropore tape
- Monovette Syringe
- Multi-sample Blunt Canula
- Vacutainer Holder
- Butterfly needles
- Band-Aid, flex
- Band-Aid, spot
- Pilot pen
- Gloves

S97-09896

Figure HLS-9 Blood Collection Kits Opened



S97-09898

Figure HLS-10 Blood Collection Kits Contents

D.I.D.

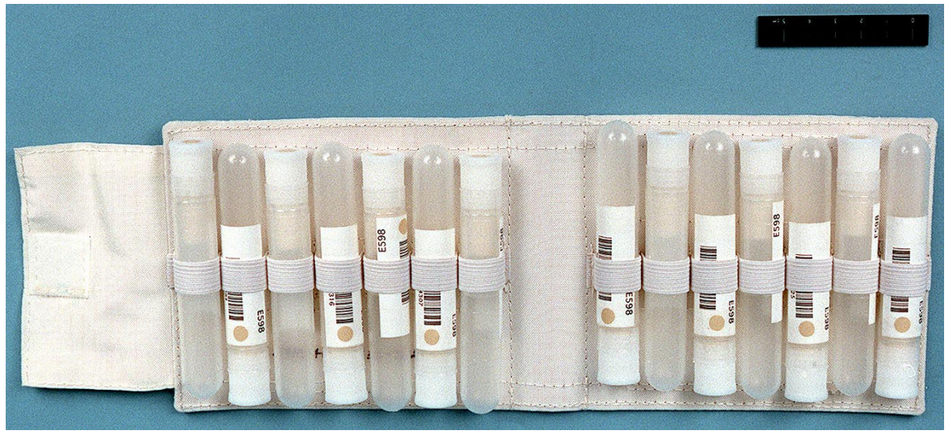
Sleep Blood Collection Kit

BLOOD COLLECTION KIT, MEDIUM

P/N: SED46111793-302
Qty: 6
Mass: 1.803 kg
Power: N/A
x,y,z: 29.9 x 29.8 x 6.5 cm

S97-09503

Figure HLS-11 Frozen Saliva-Ca Kit



S97-09504

Figure HLS-13 Frozen Saliva-Ca Kit Opened

S97

Figure HLS-12 Frozen Urine Kit Opened

S97

Figure HLS-14 Frozen Urine Kit Contents

FROZEN SALIVA KIT

P/N: SEM46109830-302
Qty: 9
Mass: .175 kg (ea)
Power: N/A
x,y,z: 13.75 x 12.0 x 3.5 cm
DID#: SLM46109746

FROZEN SALIVA KIT

P/N: SEM46109830-301
Qty: 2
Mass: .41 kg (ea)
Power: N/A
x,y,z: 13.75 x 12.0 x 3.5 cm

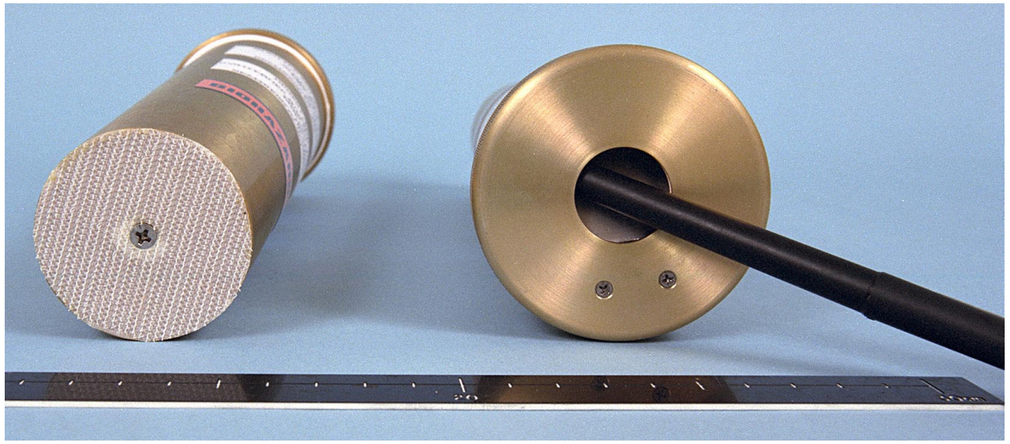
FROZEN URINE SYRINGE KIT

P/N: SEM46109829-301
Qty: 4
Mass: 6.8 kg
Power: N/A
x,y,z: 37.1 x 11.6 x 16.7 cm
Loc: N/A
DID#: SLM46111626

MIR SHARPS CONTAINERS

The Mir Sharps Container is reflown hardware that is used for disposing of hazardous material. The Mir Sharps Container is designed for the safe disposal of sharp blood collection trash (needles, catheters, broken glass tubes, etc).

The device has two components: the waste cup and the lid. The lid has a door with a spring-loaded hinge that allows one-way entry into the container (objects can enter but not exit). The narrow diameter of the waste cup prevents the needles from randomly floating and pointing the sharp end back towards the top of the container. There is also a magnet mounted in the base of the cup, which attracts metal needles away from the opening. The container has a Velcro patch, which allows it to be attached at various locations during inflight activities. The sharps container can be emptied, cleaned, and reused after a mission. The only modification consists of the removal of the radioactive hazard decal and the addition of a Russian identification label.



S97-10779

Figure HLS-17 Sharps Container Opening

S97-10780

Figure HLS-15 Sharps Containers/Labels

S97-10778

Figure HLS-16 Velcro Locations on Sharps Containers

D.I.D.

Sharps Container

SHARPS CONTAINER

P/N: SEM46109770-301
Qty: 5
Mass: .237 kg (ea)
Power: N/A
x,y,z: 26 x 7 cm diameter
DID#: SLM46109744

SLEEP BLOOD COLLECTION KIT

P/N: SEM46114680-301
Qty: 3
Mass: 3
Power: 5.1 kg
x,y,z: 31 x 31 x 7 cm
Loc: Spektr
DID#: SLM46113682

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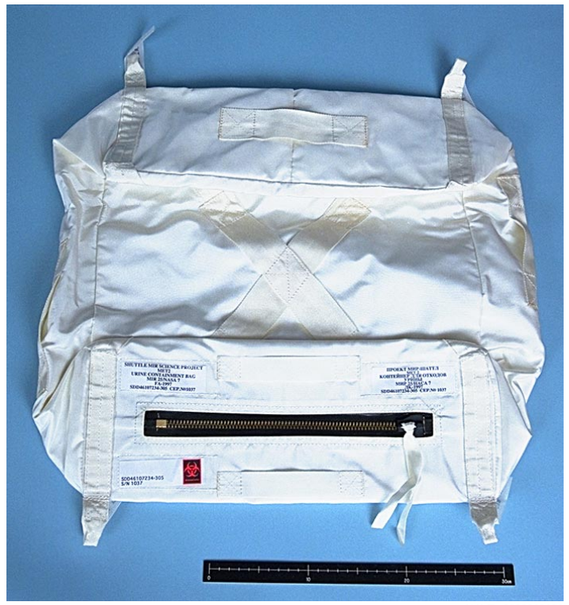
23

Figure HLS-18 Twelve Urine Containment Bags

S97-XXXXX
27

Figure HLS-19 Front Interior of the Urine Containment Bag



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26

Figure HLS-20 The Top of the Urine Containment Bag

S97-XXXXX
24

Figure HLS-22 Bottom of the Urine Containment Bag

S97-XXXXX
25

Figure HLS-21 Top of the Bag with the Ends Folded Down

D.I.D.

Urine Sample Container Assy

URINE CONTAINMENT KIT

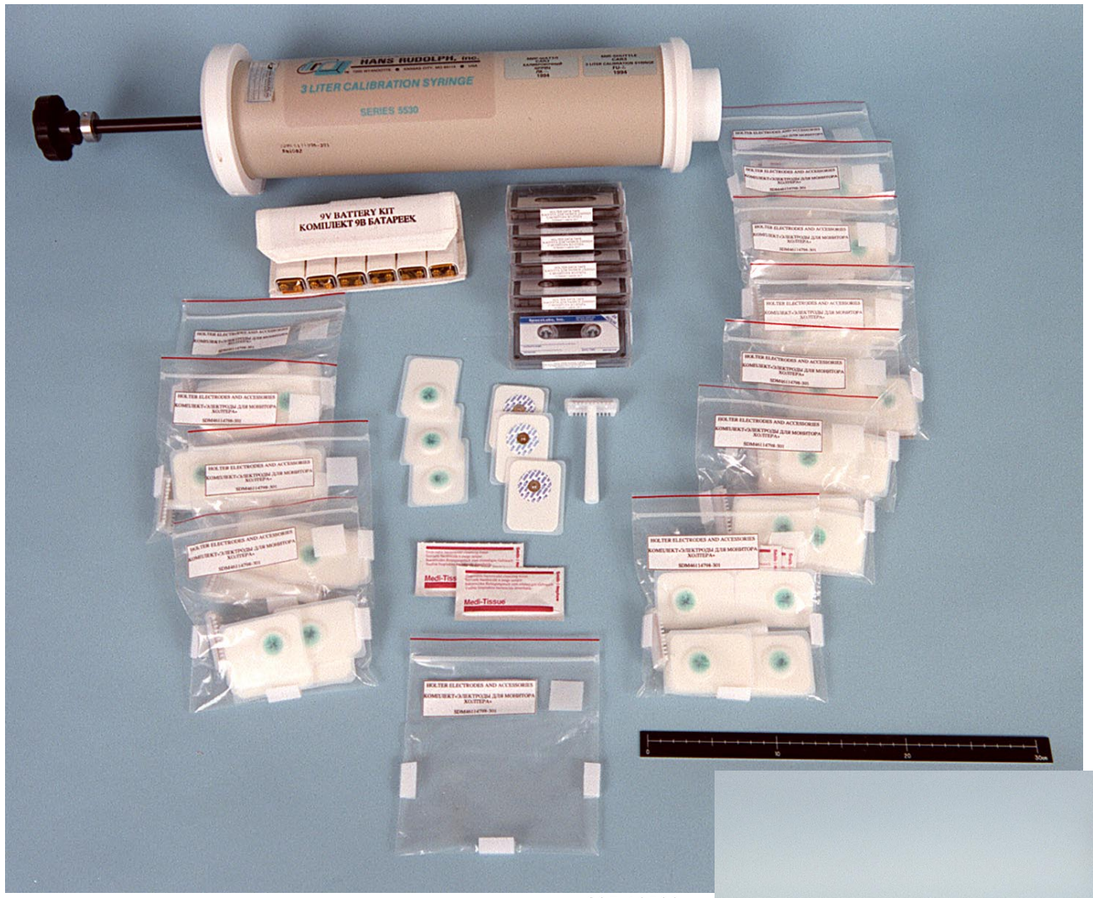
P/N:	SDD46107234-305
Qty:	12
Mass:	9.6 kg
Power:	N/A
x,y,z:	25.4 x 25.4 x 7.6 cm
Loc:	N/A
DID#:	SLM46113438

Adaptive Changes in Cardiovascular Control at µG and Autonomic Mechanisms During Prolonged Weightlessness (CARDIO) (E712/E709)

EXPERIMENT DESCRIPTION

Early in microgravity conditions, multiple neurohumoral regulatory mechanisms are activated to compensate for a significant headward fluid shift and restore the normal operating conditions of the human cardiovascular system, defined by the hemodynamic state that prevails in the upright posture at 1-g. Adaptations include hypovolemia, which contributes to orthostatic intolerance on return to Earth.

Microgravity minimizes the dynamic demands on cardiovascular neural control mechanisms. The overall level of physical activity is decreased and no postural adjustments are required. Furthermore, the unique characteristics of microgravity modify afferent neural traffic and may produce conflicting information originating from multiple peripheral sources (decrease in venous and arterial pressure, increase in cardiac volumes). This regulatory environment may degrade important control mechanisms. This adaptation occurs rapidly and is complete within a few days or weeks of spaceflight. Lack of precision of individual neurocirculatory reflexes may predispose to disorderly or chaotic systemic responses to stress after return to 1-g, e.g. orthostatic intolerance.



S97-10590

Figure HLS-23 Cardio Hardware: 3L Calibration Syringe, Data Tapes, and Electrodes Kit

SCIENCE OBJECTIVES

1. To explore and define the mechanisms by which the autonomic nervous system regulates the circulation to support tissue perfusion, particularly in the brain, during short term and long term adaptation to microgravity and after return to the 1-g environment.
2. To test the above hypotheses by answering these questions:
   a) Does efferent sympathetic nerve activity increase appropriately in response to baroreflex and non-baroreflex mediated stimuli before and after spaceflight?
   b) Can integrated, clinical tests of autonomic function detect abnormalities of the autonomic nervous system pre- and postflight, and furthermore define the effects and time course of adaptation during spaceflight?
   c) Does regulation of the cerebral circulation change in parallel with or independent of regulation of the systemic circulation before, during, or after adaptation to microgravity?

S97-10589

Figure HLS-24 Medikro Computer and Related Cables

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49-22-03-601 ext.3061

David Robertson, M.D.
Vanderbilt University
(615)343-6499

HOLTER DATA TAPE ASSEMBLY

P/N: SEDM46114806-301
Qty: 5
Mass: .3 kg
Power: N/A
x,y,z: 10.79 x 6.98 x 1.78 cm
DID#: SLM46114347

HOLTER ELECTRODES AND ACCESSORIES ASSEMBLY

P/N: SEDM46114798-301
Qty: 5
Mass: .15 kg
Power: N/A
x,y,z: 15.24 x 15.24 x 1.26 cm
DID#: SLM46114347

3L CALIBRATION SYRINGE

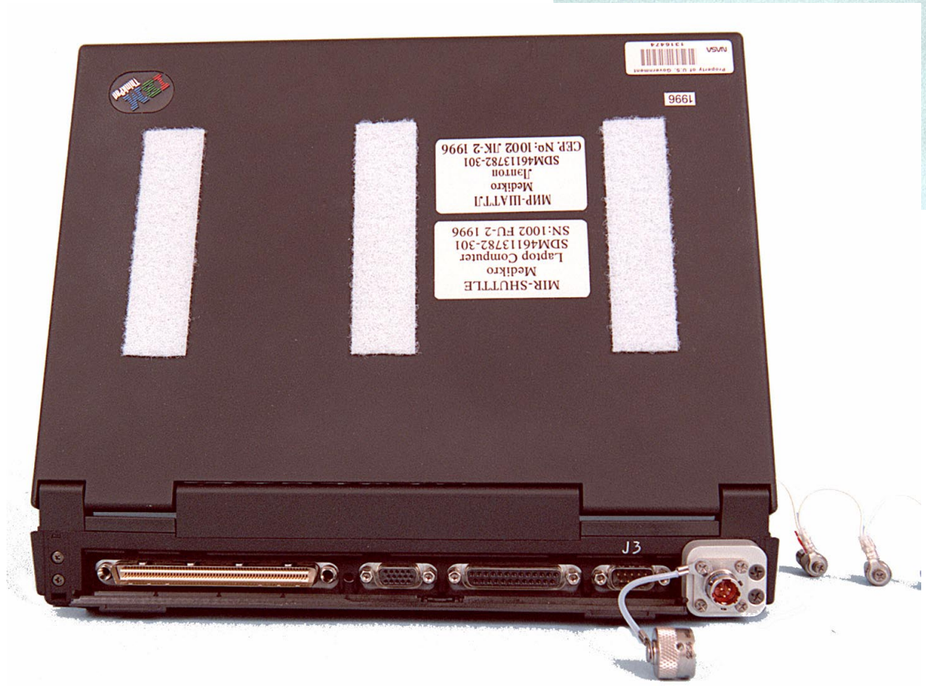
P/N: SDM46111966-301
Qty: 1
Mass: 1.97 kg (ea)
Power: N/A
x,y,z: 52.20 x 14 cm
DID#: SLM46112048

MEDIKRO LAPTOP COMPUTER

The Medikro Laptop Computer provides data handling, data storage and data processing for Cardiopulmonary diagnostics and research. The Medikro Laptop Computer consists of a 750C IBM (International Business Machine) ThinkPad laptop computer equipped with a Medikro 9433 Transducer Interface Unit (Medikro OY, Kuopia Finland). This unit fits in the 3 1/2" floppy drive bay of the ThinkPad. It is a compact instrument for Cardiopulmonary diagnostics and research. The system can record heart rate and blood pressure, inspiratory and expiratory pulmonary air flows and volumes, expiratory strain pressure during Valsalva maneuvers, loading pressure inside an LBNP (Lower Body Negative Pressure) chamber, and a variety of other biosignals from external devices. The system can also be used as a spirometer. The Transducer Interface Unit has 3 air pressure transducer channels. The first channel, black ring, can read up to 20 psi (1.4 kg/cm^2) and is used for Valsalva measurement. The third channel, red ring, can read pressure up to 60 psi (4.2 kg/cm^2) and is used to measure hand grip measurement. The unit also has 1 channel capable of reading - 1.2 to +3.8V DC (channel 3) and 12 channels capable of reading +5 or -5V DC (channels 4-15).

S97-10588

Figure HLS-26 Tube Ports to the Transducer Interface on the Side of the Medikro



S97-10587

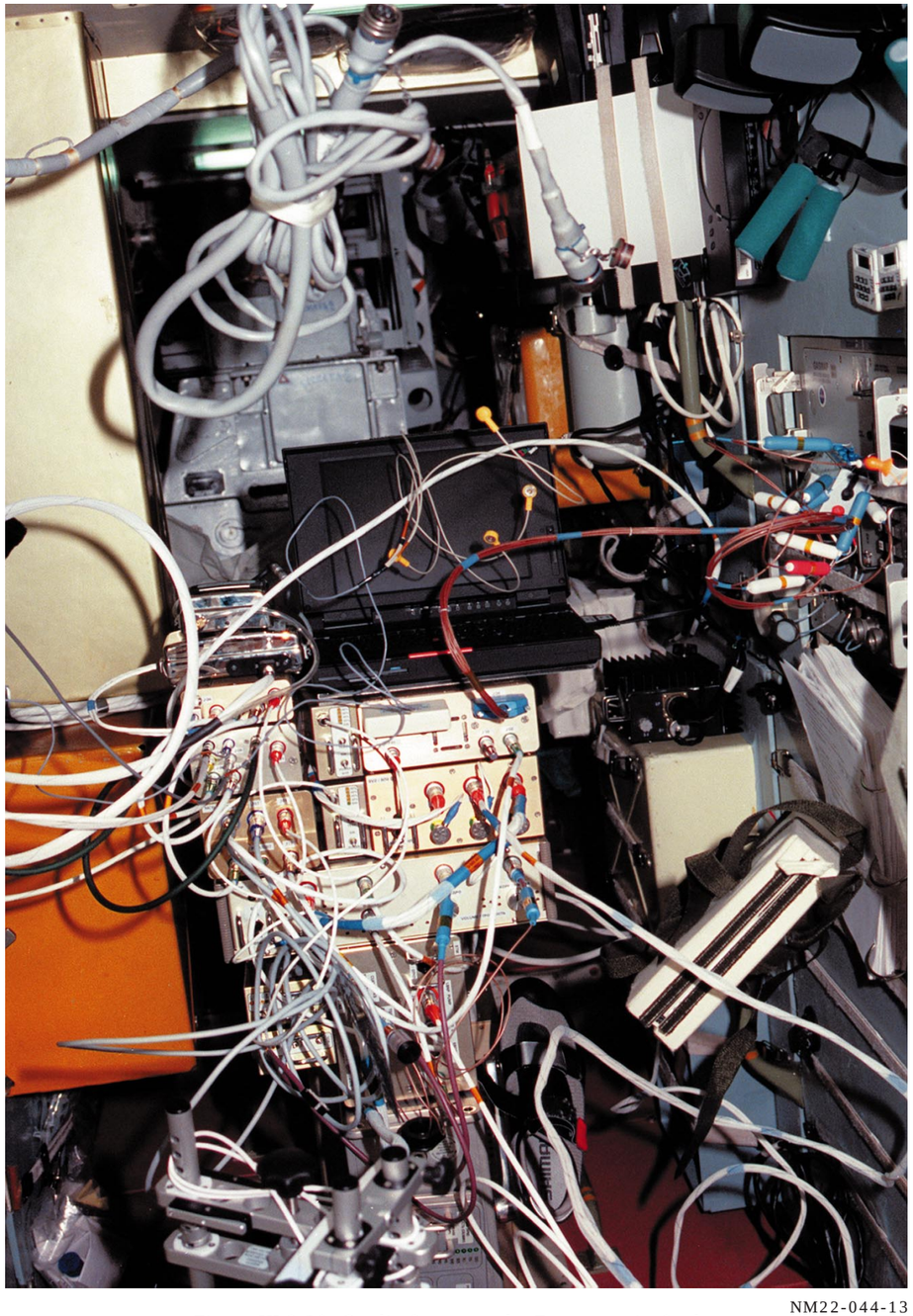
Figure HLS-25 Medikro Back Ports

S97-10586

Figure HLS-27 Medikro Side

MEDIKRO LAPTOP COMPUTER

P/N: SDM46113782-301
Qty: 1
Mass: 2.3 kg
Power: 0
x,y,z: 31.0 x 22.0 x 5.5 cm
DID#: SLM46108869



NM22-044-13

Figure HLS-28 Cardio Setup on the Ergometer in Spektr

AUTONOMIC FUNCTION KIT (ANF) 1

This kit includes all consumables and other supplies required for the AFT and LBNP experiments. See Table HLS.1 for a list of kit components.

TABLE HLS.1
AUTONOMIC FUNCTION KIT

Nomenclature	Flight Qty.	Notes
Medikro Hard Drive	2	Flight Kit Only
GASMAP Personal Accessory Kit	3	Includes Mouthpiece and Nose Clip
Mouthpiece	1	Quantity/Kit
Nose Clip	1	Quantity/Kit
GASMAP Experiment Accessory Kit	1	
3-Liter Syringe Adapter	1	
Catheter Filter	4	Quantity/Kit
Capillary Tube Assy	4	Quantity/Kit
Ziploc Bag	1	Quantity/Kit
Saliva Filter	25	Quantity/Kit
Mouthpiece	1	Quantity/Kit
Nose Clip	1	Quantity/Kit
Alcohol Wipes	12	Quantity/Kit
Holter Data Tapes	11	
Holter Electrodes and Accessories	12	
Electrode, 24-hour	6	Quantity/Kit
Ziploc Bag	1	Quantity/Kit
Alcohol Prep Pad	2	Quantity/Kit
Razor	1	
Flow Transducer / Mouthpiece	4	
Valve Assembly	2	
Flow Pressure Tube	3	
Valsalva Pressure Tube	3	
9-Volt Battery Kit	1	9-Volt Batteries
9-Volt Battery	12	
Large Handgrip Balloon	1	
Handgrip balloon tubing	1	
Cold Glove Assembly	2	

AUTONOMIC FUNCTION KIT 1

P/N: SJM46114296-302
Qty: 1
Mass: 8.8 kg
Power: 0
x,y,z: 45 x 44 x 16 cm
DID#: SLM46114347

AUTONOMIC FUNCTION KIT 2

P/N: SJM46114297-301
Qty: 1
Mass: 7.4 kg
Power: 0
x,y,z: 41.5 x 39.5 x 19.5 cm
DID#: SLM46113479

GAS ANALYZER SYSTEM FOR METABOLIC ANALYSIS PHYSIOLOGY (GASMAP) (LOST IN SPEKTR)

The GASMAP is used to monitor and analyze a crewmember's inhaled and exhaled breath stream to determine gas concentrations. The primary gases of interest are N_2, O_2, CO_2, Ar, C_2H_2, SF_6, He, and $C^{18}O$.

The GASMAP hardware consists of an analyzer module located in the Spektr module. A commercial MS-DOS compatible laptop computer can be connected to the 8PU drawer to control the GASMAP, although with E709/712 the Medikro Laptop computer will be connected to the front of the GASMAP with the Medikro Data Cable Assembly and used instead of the GASMAP laptop. The GASMAP contains the necessary hardware to perform respiratory gas analysis, gas volume measurement, and data acquisition of other parameters related to metabolic assessment.

Analyzer Module

The analyzer module contains all the sensor and electronic hardware in the GASMAP. The major sub-assemblies are the Random Access Mass Spectrometer (RAMS), its roughing system, the gas delivery system, the Interface Shell (IS) computer and the power distribution system. The module is controlled via a keypad and LCD display at the front panel or by a laptop computer.

S97-05301

Figure HLS-29 GASMAP Experiment Accessory Kit

S97-05299

Figure HLS-30 GASMAP Personal Accessory Kit (Part of ANF Kit 1)

Calibration Module

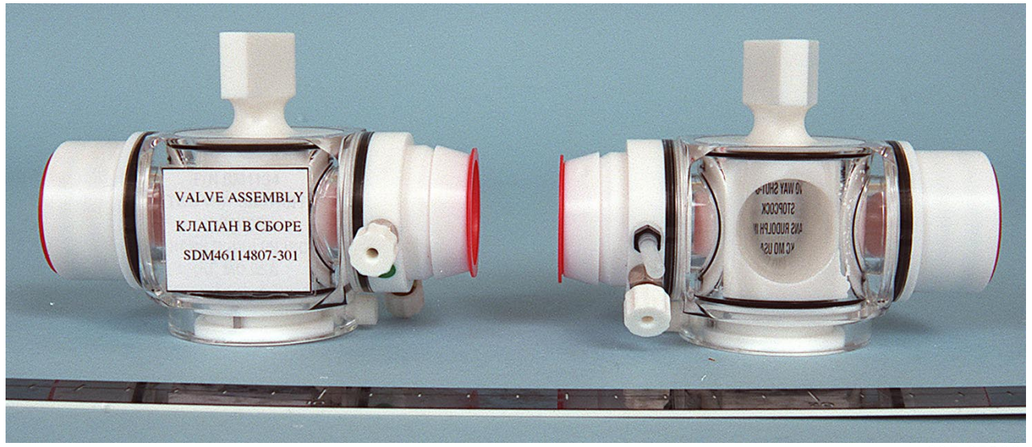
The calibration module contains high pressure calibration gas and is designed to be two-failure tolerant. Three .5L Whitey cylinders are installed and contain calibration gas at 1200 psi. Each cylinder has a fill valve at the rear of the tank assembly. The top cover of the drawer must be removed to fill the tanks. A 1500 psi rupture disk is in series between the fill valve and the tank to assure the tank is not over-pressurized. A 0-1500 psi pressure gauge is mounted on the front panel for each tank, and the gauge is always active so that valves do not have to be opened to observe the pressure in the tank. A Whitey "Soft-Seal" manual shut-off valve is mounted below the gauge on the front panel for each tank. Gas is then directed through a regulator that is factory set to 15 psi. On the low pressure side of the regulator, two 20 psi relief valves are mounted to protect against regulator failure. The gas is then directed to a

solenoid manifold which is controlled by the 8PU drawer. The two exits of the solenoid manifolds are taken to the common gas outlet at the front panel. The solenoid drivers reside in the IS of the 8PU drawer. No electronics reside in the 4PU drawer other than the solenoids themselves. The gas exhaust fitting is the same compression fit type that exists on the analyzer module.

Metabolic Gas Analyzer System (MGAS) Calibration Syringe And Adapter

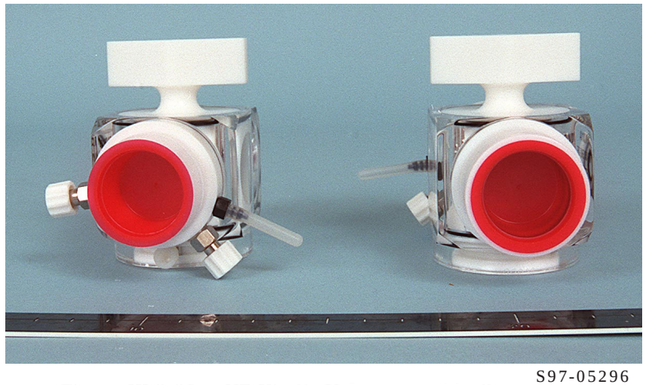
NOTE: The actual MGAS is not used in this experiment. Only the MGAS Calibrated Syringe is employed.

The MGAS Calibration Syringe is used to calibrate the flow in the Medikro laptop computer by injecting a pre-measured amount of air. The Adapter presses into the MGAS Calibration Syringe and allows the syringe to be attached to the Valve Assembly. The Calibration Syringe uses a 3 liter modified Hans Rudolph calibration syringe.



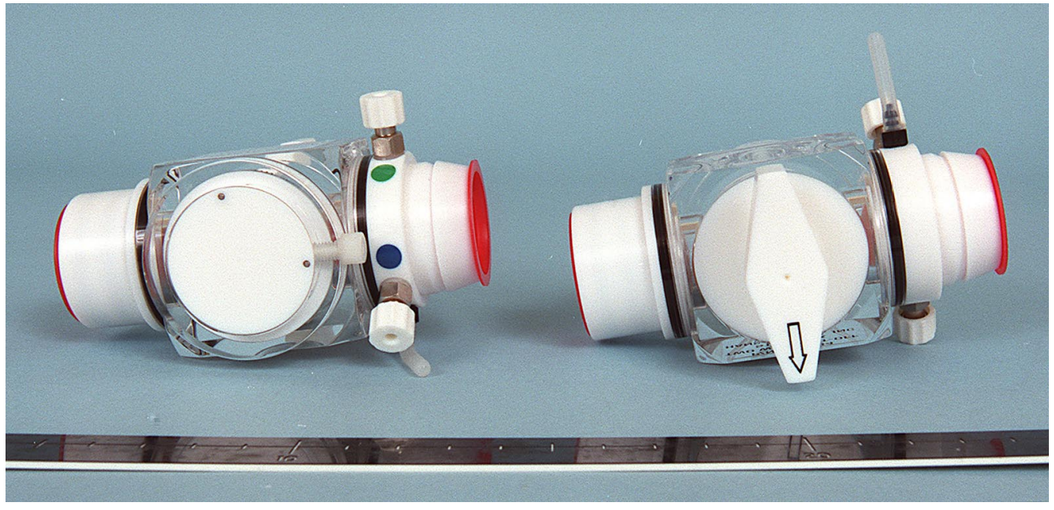
S97-05298

Figure HLS-31 ANF Kit 1's Valve Assembly Side



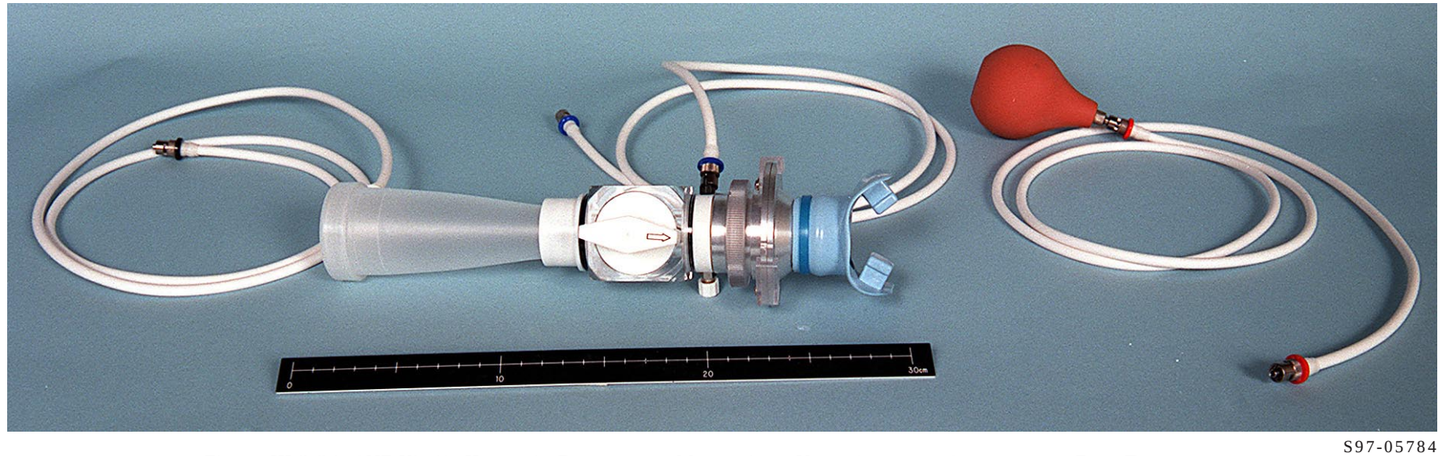
S97-05296

Figure HLS-32 ANF Kit 1's Valve Assembly Connectors



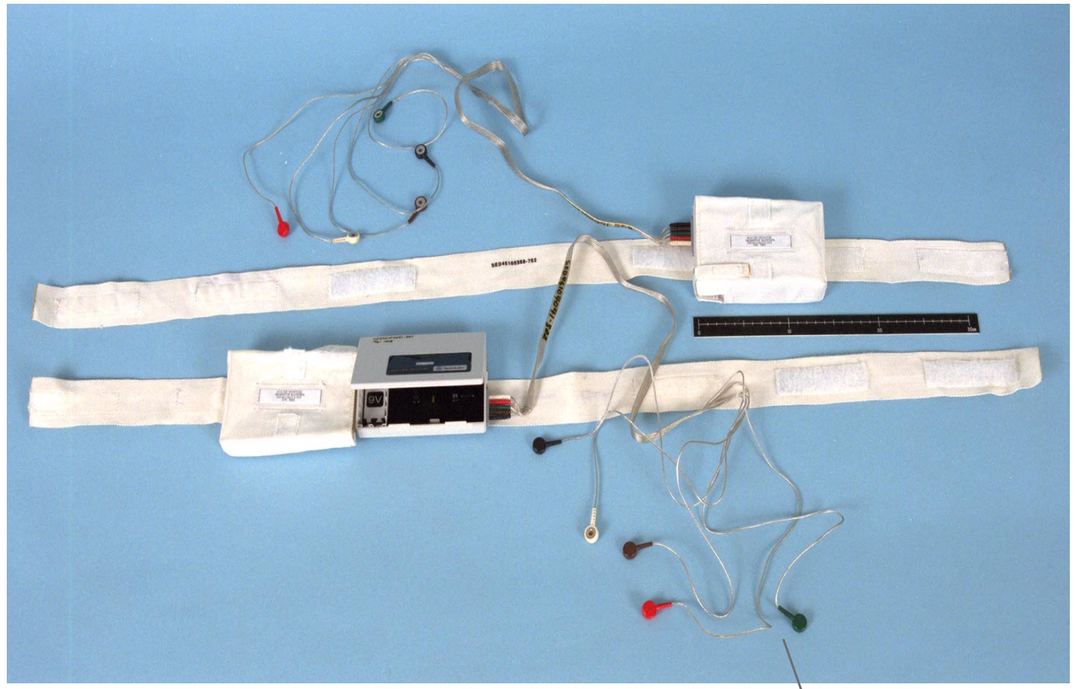
S97-05297

Figure HLS-33 ANF Kit 1's Valve Assembly Side



S97-05784

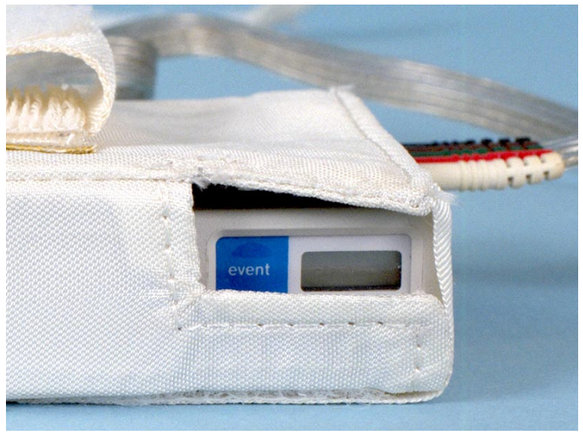
Figure HLS-34 ANF Kit 1's Handgrip Balloon and Mouthpiece, Valve Assembly Adapter, and Flow Transducer



S97-09549

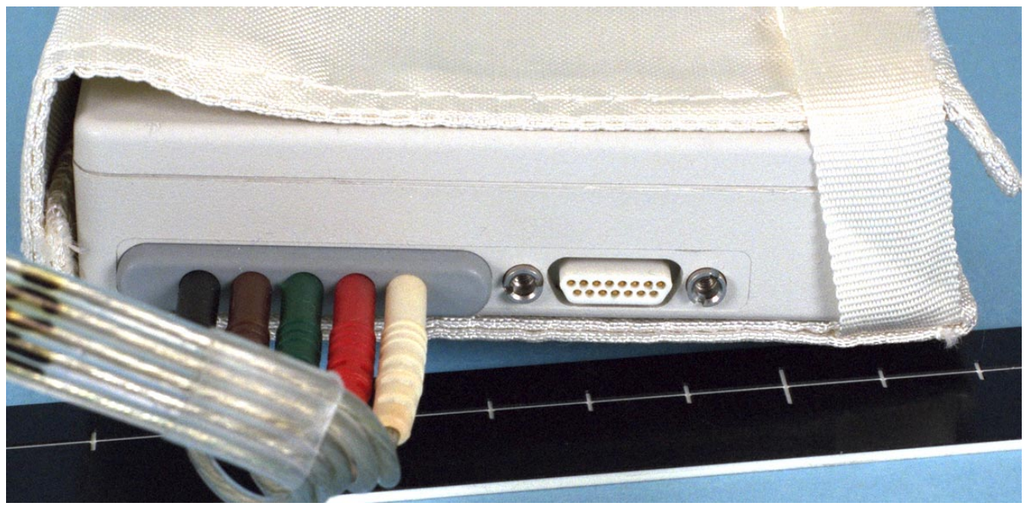
Figure HLS-35 Holter Monitor Assemblies

Flown Loose



S97-09547

Figure HLS-36 Holter Monitor Viewing Window



S97-09546

Figure HLS-37 Holter Monitor Electrode and Data Connections

TABLE HLS.2
CARDIO LOOSE ITEMS

Nomenclature	Flight Qty.	Notes
Holter Monitor Assembly	2	
Cardiovascular Belt Assy	1	Included in Holter Monitor
Holter Monitor	1	
Holter Electrode Harness	1	Length: 1.10 Meters Included in Holter Monitor
Cable Assembly, Medikro Data	1	Length: 2.4 Meters
ThinkPad to Power Adapter Cable	1	Length: 2.13 Meters
Power Adapter Assembly	1	With Cable P/N SEM46114706-301
Laptop PC Power In Cable Assy	1	Length: 1.5 Meters
Medikro to MEDEX RS-232 Cable Assy	1	Length: 1.83 Meters

(*) These items are being flown as individual items on STS-86 and STS-89.

Holter Monitors

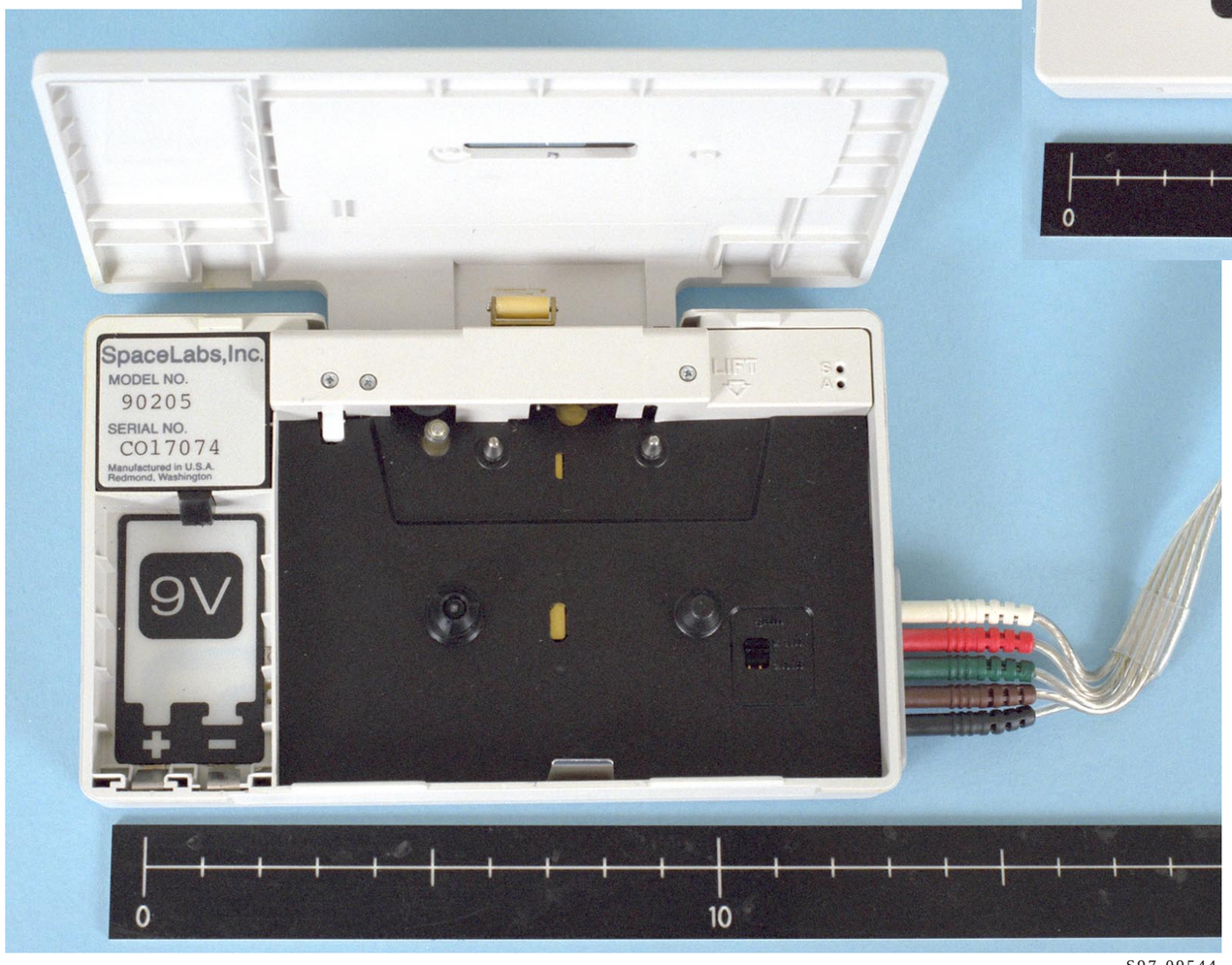
The Holter Monitor is an ambulatory Electrocardiogram (ECG) consisting of five electrodes with a cassette tape for recording data and a time track. The device is powered by a 9-Volt battery. (Also used for SMP.)

D.I.D.

Holter Monitor

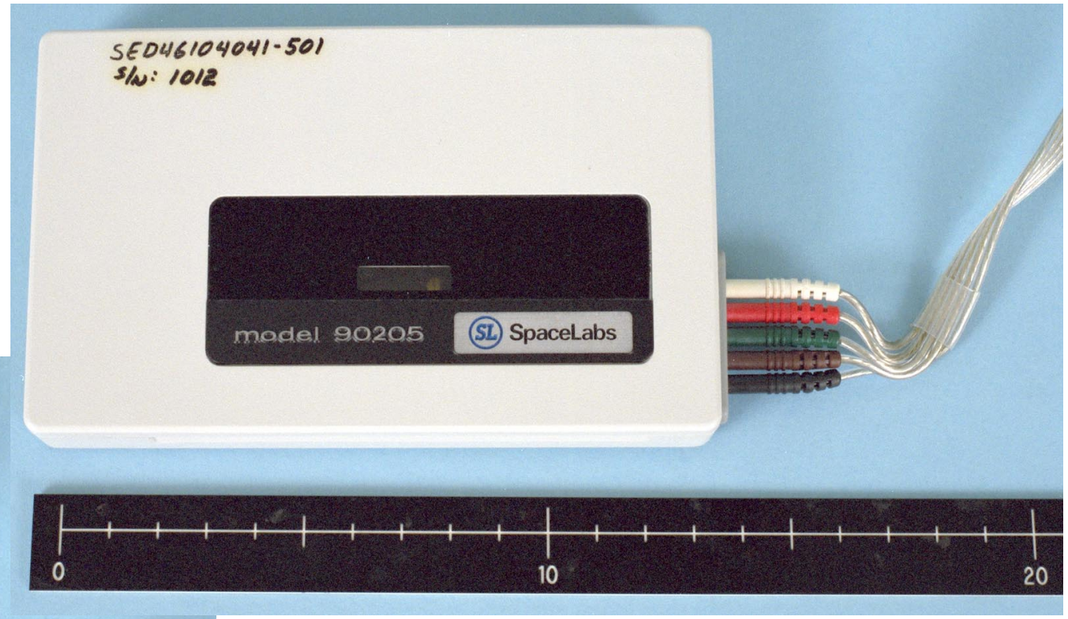
HOLTER MONITOR ASSEMBLY

P/N: SED46106015-303
Qty: 2
Mass: 0.60 kg (ea)
Power: 0
x,y,z: 14.0 x 8.5 x 3.0 cm
DID#: SED46105933



S97-09544

Figure HLS-38 Holter Monitor, Lid Open



S97-09545

Figure HLS-39 Holter Monitor, Lid Closed

TABLE HLS.3
MEDEX UPGRADE KIT

Nomenclature	Flight
MEDEX Booting Disk for Laptop	1
Low Temperature Probe	1
MEDEX Laptop Hard Disk	1
Spare Multiplex board (MUX card)	1
Optical Disks	2
SPARE Hard Disk for Laptop	1
ZEH Booting diskette	1
Reconfigured ECG cable	1

MEDEX CONSUMABLES KIT

P/N: D-MX-951
Qty: 1
Mass: .94 kg
Power: N/A
x,y,z: 29.7 x 23.6 x 5.5 cm
DID#: SLM46114347

MEDEX UPGRADE KIT

P/N: D-MX-960
Qty: 1
Mass: 1.73 kg
Power: N/A
x,y,z: 29.7 x 23.6 x 5.5 cm

HOLTER DATA TAPE ASSEMBLY

P/N: SDM46114806-301
Qty: 5
Mass: 0.30 kg
Power: N/A
x,y,z: 10.79 x 6.98 x 1.78 cm
DID#: SLM46114347

S97-05304

Figure HLS-40 ANF-1 “Cold Glove” Assembly

COLD GLOVE ASSEMBLY

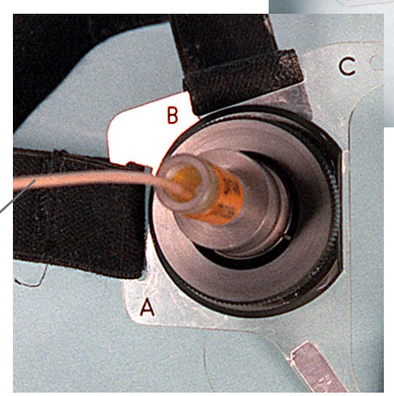
The Cold Glove Assembly is used to provide rapid, sustained, severe cooling of a crewmember's hand to elicit an increase in the subject's blood pressure and heart rate. The Cold Glove Assembly will fit over the crewmember's hand and is the flight analog to the ground-based practice of placing the hand in a bucket of ice water. The Cold Glove Assembly consists of a mitt with two gel packs that contain a substance which remains gelatinous at freezing temperatures. During flight, the device is frozen in the Thermoelectric Freezer (TEF) and stored in the Thermoelectric Holding Facility (TEHOF). The subject's hand is inserted into the mitt and pressure is applied via a strap on the outside of the mitt for good contact between the mitt and the subject's hand.

THERMOELECTRIC HOLDING MODULE (TEHOF) (SEE OPS)

The unit can be configured into a refrigerator or a freezer. The TEHOF can be used to maintain the temperature of precooled samples at the following temperature set points: refrigerator, freezer, or preset between -24°C and +15°C preflight. The usable cold volume is 0.9 ft^3. The TEHOF can be equipped with one or two racks which can be adjusted to six different positions. The refrigerator/freezer can be used to cool blood, body fluids, and cell samples, as well as solutions and fluids intended for injection. It may also be used to house small animals, to incubate amphibian zygotes, and to stow animal food supplies.

S97-05777

Figure HLS-42 Transcranial Doppler Ear Piece without Probe



Small Parts Kit 2 (probe only)

S97-05776

Figure HLS-41 Transcranial Doppler Probe and Restraint System

S97-05775

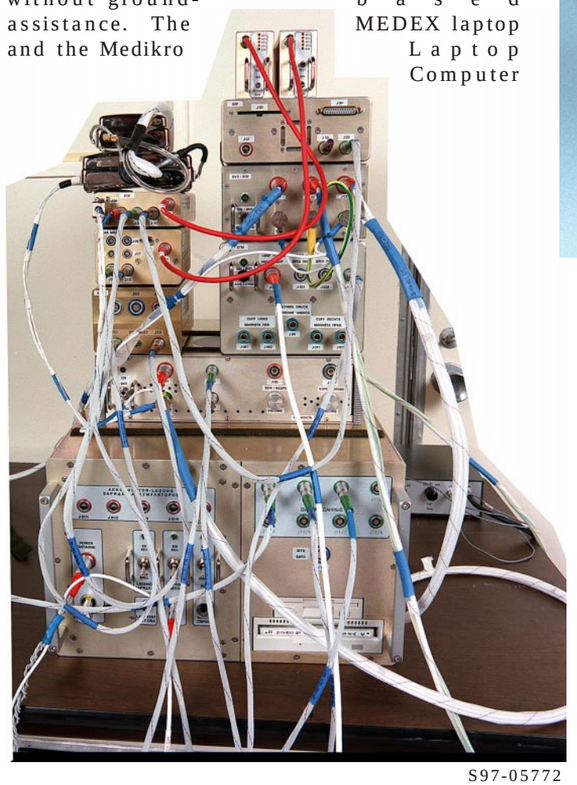
Figure HLS-43
MEDEX Transcranial Doppler Head Sensor Restraint System with Probe

THERMOELECTRIC FREEZING MODULE (TEF) (SEE OPS)

The TEF is used to quick “chill” samples that will be stowed frozen in the TEHOF. The TEF receives power from the Mir Utility Panel (MUP) and data is routed through the TEHOF. The usable cold volume is 0.18 ft^3.

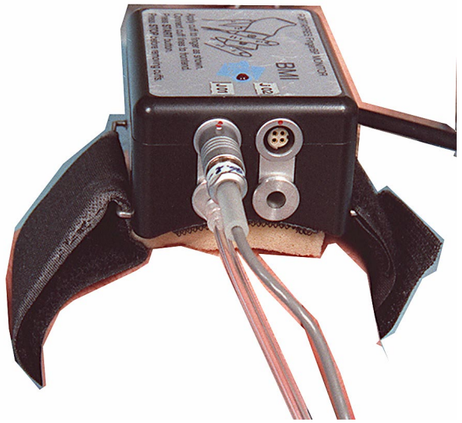
MEDEX

The German MEDEX is an advanced medical experiment support system designed for space applications. The first space-borne application was utilized during the German-Russian mission MIR'97. The design concept is based on the integration of medical instruments into small, battery powered Measurement Modules, which transmit physiological data via a daisy chained cable link to a Central Unit (ZEH). A laptop computer serves as an intelligent terminal of the CDU, offering capabilities for numerical and graphical display of procedures and data as well as for command input via keyboard. The Central Data Unit provides for data acquisition and extensive real-time processing capabilities as well as high data storage capacity. Although interfaces to the Mir orbit-to-ground data links are available, the prominent feature of the system is the ability to support medical experiments without ground-based assistance. The MEDEX laptop and the Medikro Laptop Computer will be connected with an RS-232 cable. Some of the MEDEX components to be used are the Transcranial Doppler, the Portapres, and the Electrocardiograph.



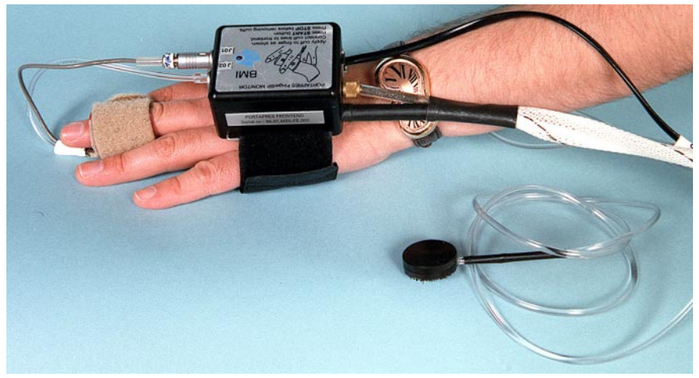
S97-05772

Figure HLS-44 MEDEX Modules (Training)



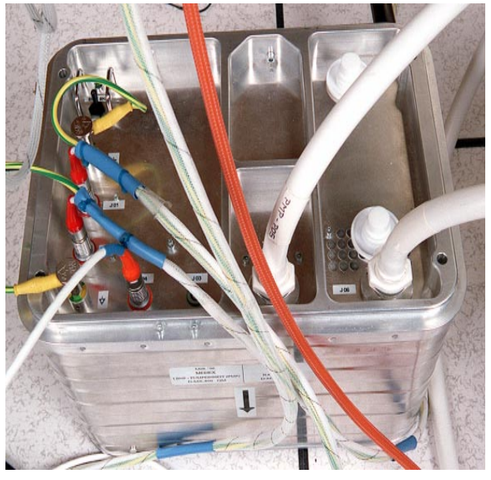
S97-05780

Figure HLS-45 Side View of the Portapres



S97-05779

Figure HLS-46 Front View of the Portapres



S97-05767

Figure HLS-47 LBNP Pump (Training)

Chibis

This LBNP device is controlled by the MEDEX System.

Transcranial Doppler (TCD)

The TCD acquires unilateral middle cerebral artery mean blood flow velocity profiles.

Portapres

The Portapres is a device which measures continuous blood pressure in the finger.

Basis Module

The basis module controls: (a) the electrodes for Electrocardiograph to trace the electric current produced by the contraction of the heart muscle, (b) Arm blood pressure cuff.

S97-05766

Figure HLS-49 CHIBIS (Training)

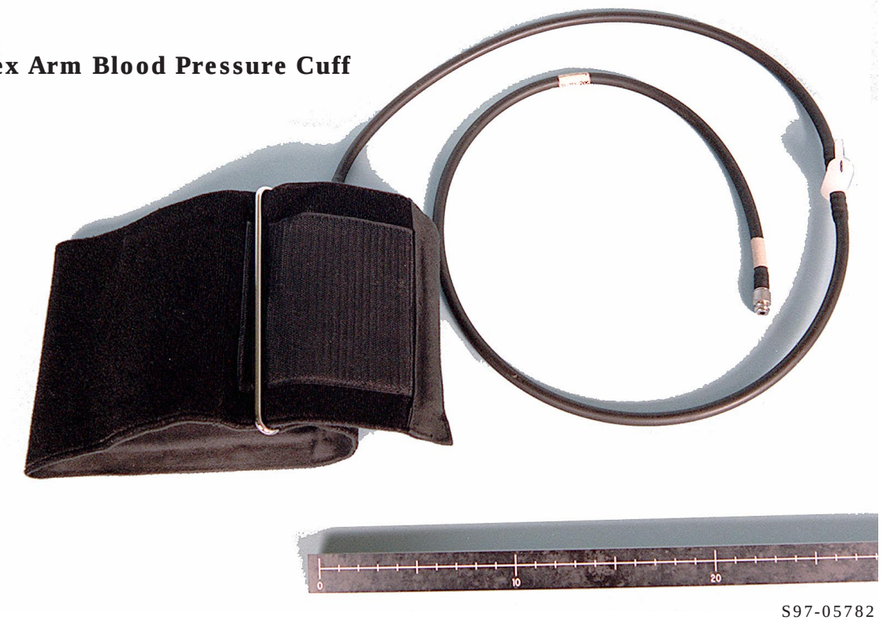
S97-15721

Figure HLS-48 MEDEX Upgrade Kit (Left) and MEDEX Consumables Kit (Right)

S97-15722

Figure HLS-50 Contents of the MEDEX Upgrade Kit (Left) and the MEDEX Consumables Kit (Right)

Medex Arm Blood Pressure Cuff



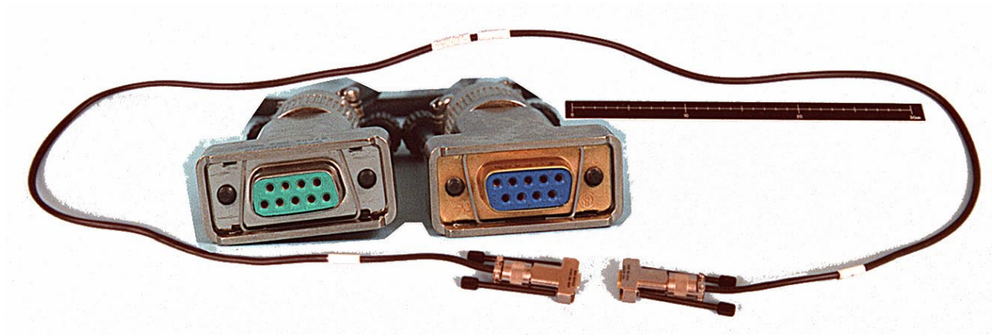
S97-05782

Figure HLS-51 MEDEX Arm Blood Pressure Cuff

Stressor Module (STM)

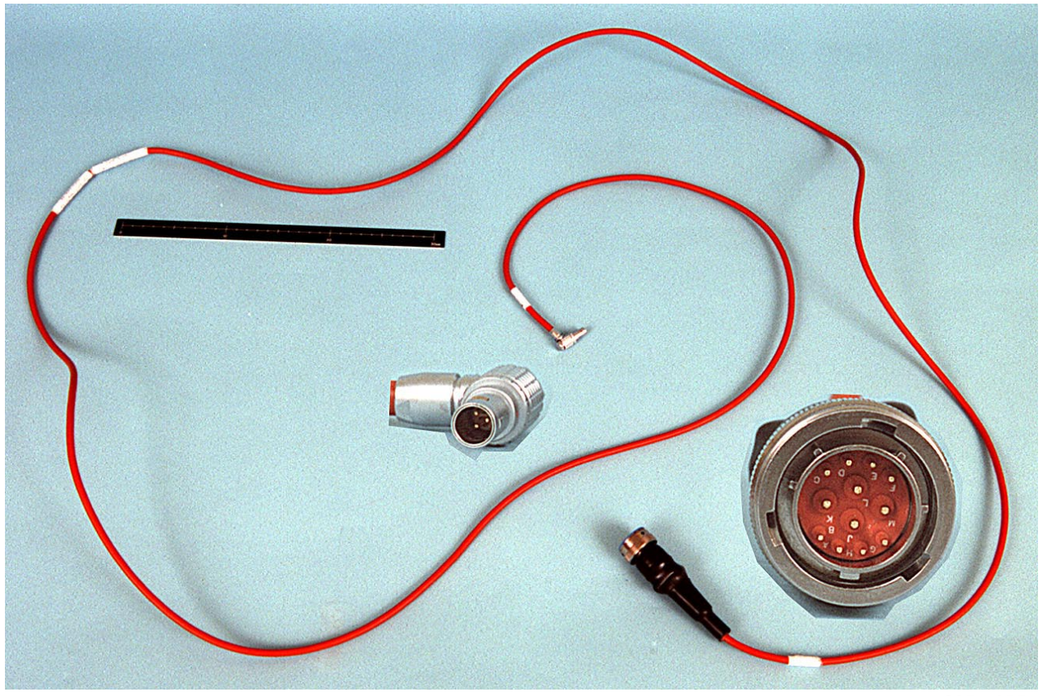
The STM will control and monitor the negative pressure applied to the Chibis.

Medikro Cables



S97-10580

Figure HLS-52 MEDEX/Medikro RS-232 Cable (data cable)



S97-10574

Figure HLS-53 Laptop PC Power On Cable

MEDIKRO TO MEDEX RS-232 CABLE

P/N: SEM46114710-301
Qty: 1
Mass: 0.40 kg
Power: N/A
x,y,z: 183 x 1 x 1 cm

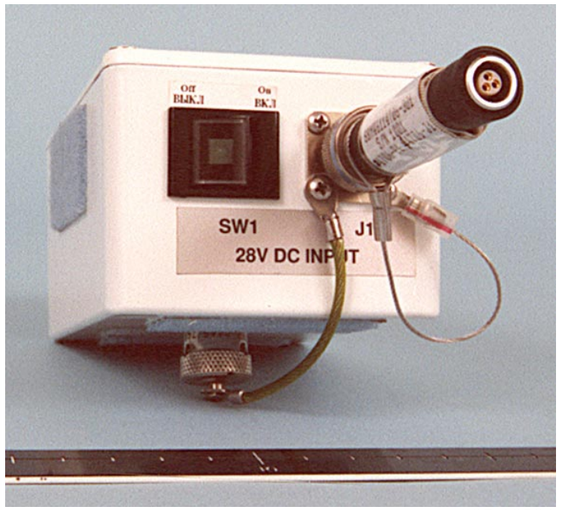
LAPTOP PC POWER ON CABLE

P/N: SED46110326-302
Qty: 1
Mass: 0.60 kg
Power: N/A
x,y,z: 300 x 1 x 1 cm

Medikro Power Adapter

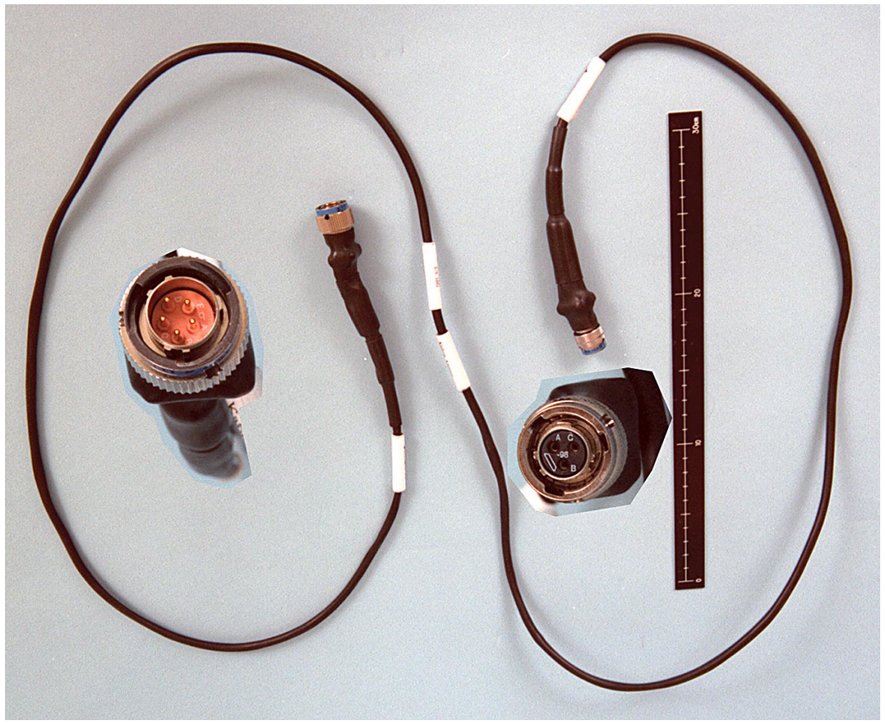
S97-10582

Figure HLS-54
Medikro Power Adapter Assembly Output Connector



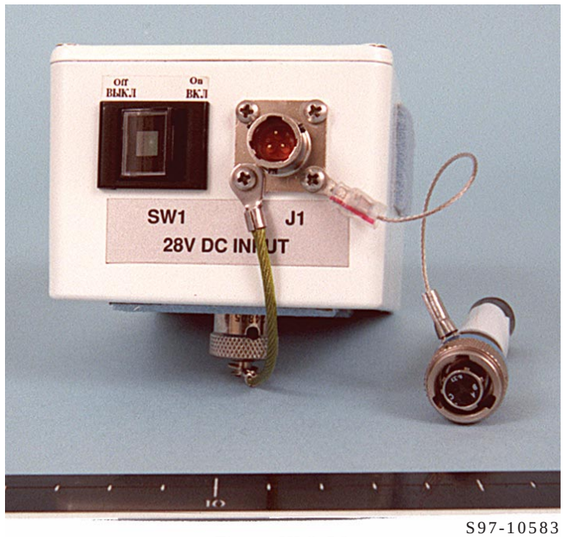
S97-10584

Figure HLS-55 Medikro Power Adapter Assembly with Tethered Adapter Cable



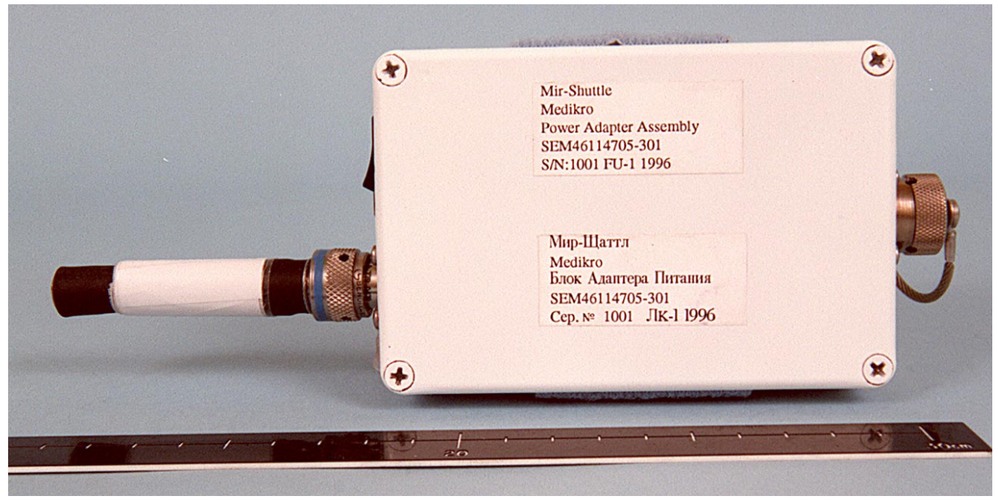
S97-10581

Figure HLS-57 ThinkPad to Power Adapter Cable



S97-10583

Figure HLS-56
Medikro Power Adapter Assembly Side Connectors



S97-10585

Figure HLS-58 Medikro Power Adapter Assembly Base

MEDIKRO TO POWER ADAPTER CABLE

P/N: SEM46113806-301
Qty: 1
Mass: 0.40 kg
Power: N/A
x,y,z: 231 x 1 x 1 cm

MEDIKRO POWER ADAPTER ASSEMBLY

P/N: SEM46114705-301
Qty: 1
Mass: 0.60 kg
Power: N/A
x,y,z: 14 x 9 x 6 cm

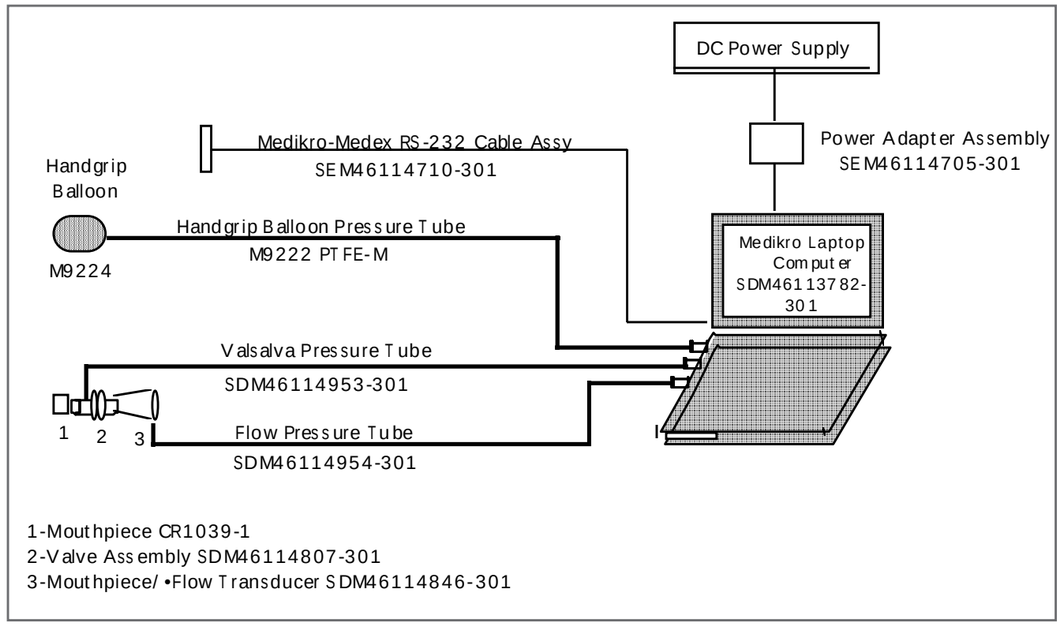


Figure HLS-59 Hardware Interface with Systems

HARDWARE INTERFACE WITH SYSTEMS

See Figure HLS-59 for Hardware Interface with Systems. ✳

S96-13200

Figure HLS-60 ANF-1 Handgrip Balloons

Crewmember and Crew-Ground Interactions During NASA/ Mir Flights (E628)

EXPERIMENT DESCRIPTION

During future space missions involving a space station or a trip to Mars, international crews will be engaged in complicated activities over long periods of time. A number of interpersonal issues likely to impact on these missions must be addressed in order to ensure healthy crewmember interactions and optimal performance. A review of the literature of space analog studies on Earth, anecdotal reports from previous space missions, and the principal investigator's own work involving astronauts and cosmonauts have isolated crew tension, cohesion, and leadership as important interpersonal issues.

The hypotheses will be tested by having both the crewmembers and personnel in ground control complete subscales from three standard mood and interpersonal group climate questionnaires: Profile of Mood States, Group Environment Scale, and Work Environment Scale. Along with a critical incident log and an experiences questionnaire, these measures will be completed pre-, in-, and postflight. By using the interrupted time-series analysis and a number of predicted correlations, a test of the six hypotheses will be made and discussed.

S96-18955
Figure HLS-61 Crewmember and Crew-Ground Interactions Logbooks and Ballot Box

SCIENCE OBJECTIVES

To complete subscales from 3 standard mood and interpersonal group climate questionnaires: Profile of Mood States, Group Environment Scale, and Work Environment Scale.

HARDWARE DESCRIPTIONS

MIPS-2 COMPUTER HARD DISK DRIVE

The Mir Interface to Payload System (MIPS)-2 computer will be programmed to allow completion of the Questionnaire Packet. Programming will be done in advance by the space agency and will include both English and Russian versions.

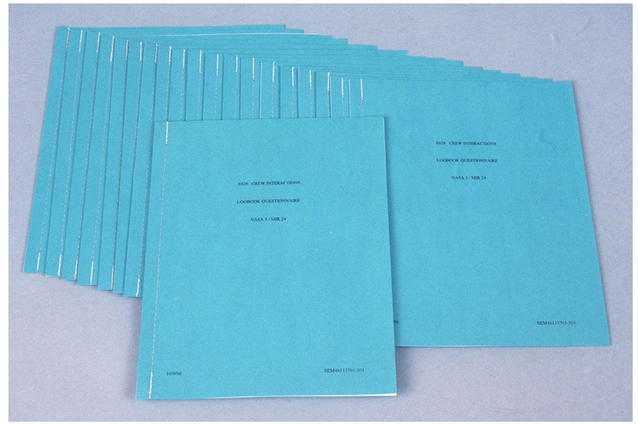
LOG BOOK

Each crewmember will be supplied a questionnaire backup log book for use if the MIPS-2 computer is unavailable.

S96-18953
Figure HLS-62 Crew Interactions Ballot Box with Logbook Partially Inserted

HARDWARE TRANSFER

The MIPS-2 magneto-optical disk and the log books contained in the ballot bag are transferred to Mir from the Space Shuttle. The Space Transportation System (STS)-89 crewmember removes the items from the middeck locker and transports them to the Mir hatch. The Mir-25 crew retrieves and stows the items on Mir until data collection.



S96-18956
Figure HLS-64 English (Blue) Logbooks

S96-18954
Figure 63 Russian (Orange) Logbooks

Principal Investigators:
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University of California (San Francisco)
Professor of Psychiatry, UCSF; Associate Chief of Mental Health, SFVAMC
(415)750-2072

Gas Analyzer System for Metabolic Analysis Physiology (GASMAP)

(Currently Lost in Spektr)

HARDWARE DESCRIPTIONS

The GASMAP system consists of the following four functional systems:

- A mass spectrometer
- A volumetric flow transducer
- A laptop computer
- A calibration assembly

MASS SPECTROMETER

At the heart of GASMAP analyzer is a compact commercial-off-the-shelf quadrupole mass spectrometer modified to satisfy National Aeronautics and Space Agency (NASA) and Mir space flight requirements. Its commercial designation is Random Access Mass Spectrometer (RAMS).

VOLUMETRIC FLOW SENSOR

The flow sensor is of the turbine variety. The turbine sensor electronics incorporates digital compensation circuitry to remove overshoot due to the finite inertia of the turbine during direction reversal conditions.

LAPTOP COMPUTER

Only with a laptop can GASMAP controls and data be displayed in Russian Cyrillic. Use of an external computer is a necessity if high-speed transmission or electronic capture of the raw data are not available.

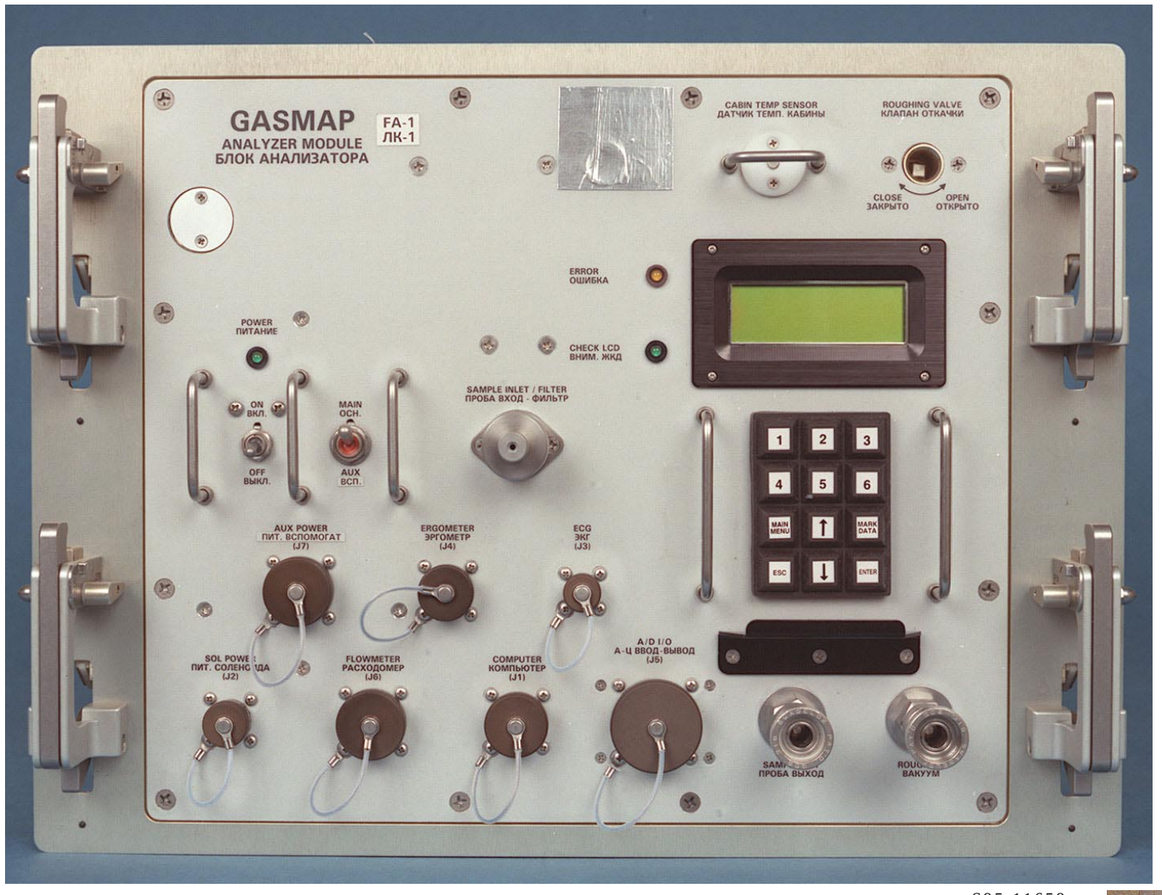
CALIBRATION MODULE

The calibration module contains three calibration gas cylinders with the following gas mixtures:

Cylinder 1 80% N_2, 20% O_2

Cylinder 2 84% O_2, 15% CO_2, 1% Ar

Cylinder 3 (NASA) 62% O_2, 10% He, 10% Ar, 10% N_2, 5% CO_2, 2% SF_6, 0.7% C_2H_2, 0.3% $C^{18}O$



S95-11659

Figure HLS-65 GASMAP Analyzer Module Front Panel

S96-00186

Figure HLS-66 GASMAP Roughing Tool

D.I.D.

GASMAP

Principal Investigator:
Floyd Booker
NASA/JSC/EA5
System Engineer
(281)483-7467

Tim Snyder
(281)280-2457

GASMAP UNIT ANALYZER

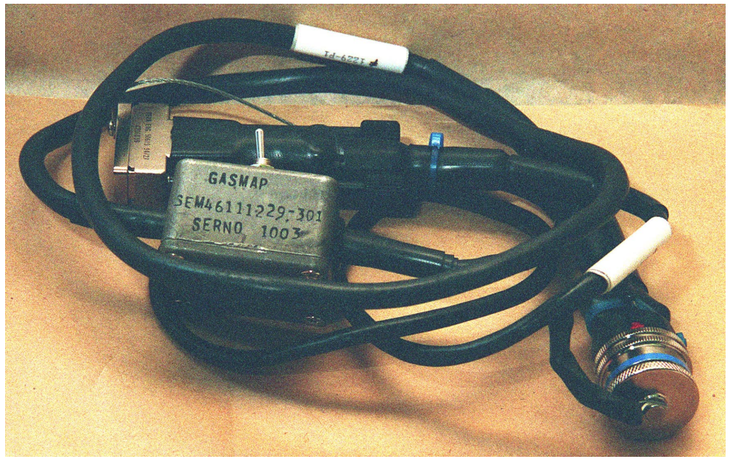
P/N: SSDM46111190-301
Qty.: 1
Mass: 55.70 kg
Power: 150.00 W
x,y,z: 66.50 x 48.90 x 35.40 cm
Loc.: Spektr, A5

GASMAP ROUGHING TOOL

P/N: 413666-001
Qty.: 1
Mass: 0.20 kg
Power: None
x,y,z: 10.30 x 7.60 x 1.80 cm
Loc.: PR, SIC3-III-6

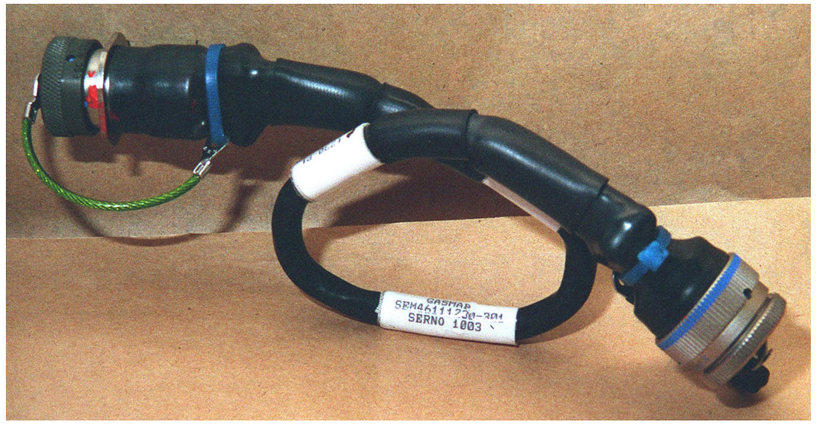
S96-00181

Figure HLS-67 GASMAP Power Cable



S96-00182

Figure HLS-68 GASMAP Programming Cable



S96-00183

Figure HLS-69 GASMAP AUX Power Cable

S96-00187

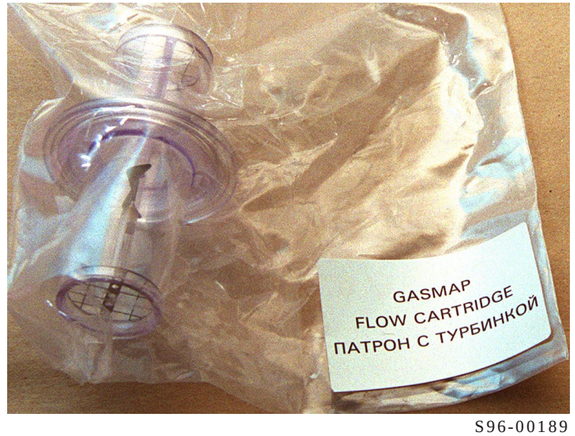
Figure HLS-70 GASMAP Mouthpiece Adapter

S96-00184

Figure HLS-71 Velcro Restraint

S96-00185

Figure HLS-72 GASMAP Flow Cartridges



S96-00189

Figure HLS-73 GASMAP Catheter Filters

GASMAP AUX POWER CABLE

P/N:	SEM46111230-301
Qty.:	1
Mass:	0.50 kg
Power:	None
x,y,z:	12.70 x 3.00 x 19.10 cm

GASMAP CATHETER FILTER

P/N:	412824-001
Qty.:	6
Mass:	1.20 kg
Power:	None
x,y,z:	1.90 x 1.90 x 1.90 cm
Loc.:	PR, SIC3-III-6

GASMAP FLOW CARTRIDGE

P/N:	408583-002
Qty.:	2
Mass:	0.10 kg
Power:	None
x,y,z:	7.60 x 5.10 x 5.10 cm
Loc.:	PR, SIC3-III-6

GASMAP 4PU/8PU POWER CABLE

P/N:	SEM461112227-301
Qty.:	1
Mass:	0.20 kg
Power:	None
x,y,z:	12.70 x 3.00 x 15.24 cm
Loc.:	PR, SIC3-III-6

GASMAP PROGRAMMING CABLE

P/N:	SEM46111229-301
Qty.:	1
Mass:	0.50 kg
Power:	None
x,y,z:	20.30 x 4.80 x 20.30 cm
Loc.:	PR, SIC3-III-6

GASMAP FLOW CARTRIDGE

P/N:	408583-002
Qty.:	2
Mass:	0.10 kg
Power:	None
x,y,z:	7.60 x 5.10 x 5.10 cm
Loc.:	PR, SIC3-III-6

S96-00191

Figure HLS-74 GASMAP Sample Catheters

S96-00193

Figure HLS-75 GASMAP Velcro Pads

S96-00192

Figure HLS-76 GASMAP Restraint Belt

S96-13179

Fighrue HLS-77 GASMAP Kit Contents Displayed

VELCRO RESTRAINT CABLE STRAP

P/N:	528-43074-1
Qty.:	10
Mass:	0.02 kg
Power:	None
x,y,z:	20.32 x 1.30 x 0.30 cm
Loc.:	PR, SIC3-III-6

MOUTHPIECE ADAPTER

P/N:	SDD46113121-301
Qty.:	2
Mass:	0.12 kg
Power:	None
x,y,z:	6.17 x 6.09 x 4.30 cm
Loc.:	PR, SIC3-III-6

Assessment of Humoral Immune Function During Long-Duration Spaceflight (E621)

EXPERIMENT DESCRIPTION

The overall objective is to evaluate the in-vivo function of the humoral arm of the immune system during spaceflight. Based on the decreases observed in other immune system functions, it is hypothesized that the ability to mount an antibody response to new antigens or to recall antigens is depressed during spaceflight.

After baseline blood and saliva samples are collected, a subject is injected with an antigen (pneumococcal vaccine). Follow-up blood and saliva samples are collected at 7, 11, 14, 17, 21, and 28 days post-immunization for determination of antibody titers. The samples are processed in the centrifuge and frozen for return. The degree of response will be compared to typical responses obtained from normal, healthy individuals.

SCIENCE OBJECTIVES

The science objectives for the Assessment of Humoral Immune Function During LDMs (3 to 6 months) are:

1. Determine the effects of long-duration spaceflight on baseline levels of immunoglobulins (IgG, lgA, IgD, IgE, and IgM) in serum and assess the ability to produce appropriate antibodies in response to a specific antigenic challenge.
2. Assess secretory immune function by measuring salivary lgA and lysozyme levels.
3. Evaluate the responsiveness of B cells to polyclonal activators immediately after spaceflight.

FUNCTIONAL OBJECTIVES

The functional objectives for the Assessment of Humoral Immune Function During LDMs are:

1. Saliva collection
2. Blood and serum collection
3. Immunization

HARDWARE DESCRIPTIONS

The Humoral Immunity (HI) Experiment support hardware consists of the HI Experiment Kit and the Antigen Kit.

HI EXPERIMENT KIT

1. The kit contains a Nomex container with pouches, elastic loops, foam blocks, and Velcro (modified version of Peripheral Mononuclear Cells Blood Collection Kit).
2. The kit contains required blood and saliva sample collection vials with necessary blood collection equipment (gauze, alcohol wipes, butterfly needles, adhesive bandages, and other such items).
3. The kit contains epinephrine (0.5 mL/dose) and benadryl (1.0 mL/dose) syringes for administration in case of an allergic reaction.
4. Antigen syringe plungers are stowed in this kit so antigens cannot be injected without epinephrine and benadryl being readily available.

S97-09534

Figure HLS-78 HI Experiment Kit Contents

S97-09894

Figure HLS-79 HI Experiment Kit Label

D.I.D

Antigen Kit

D.I.D

Humoral Immunity Experiment Kit

Principal Investigator:
Clarence F. Sams
NASA/JSC/SD4
Director, Cell Biochemistry
(281)483-7160

Patricia Giclas, Ph.D.
(303)398-1217

HI EXPERIMENT KIT

P/N:	SED46112573-301
Qty:	1
Mass:	.86 kg
Power:	0
x.y.z:	29.7 x 14.7 x 6.4 cm
DID#:	SLM46109722

S97-09533

Figure HLS-81 Humoral Immunity Kit Contents

S97-09532

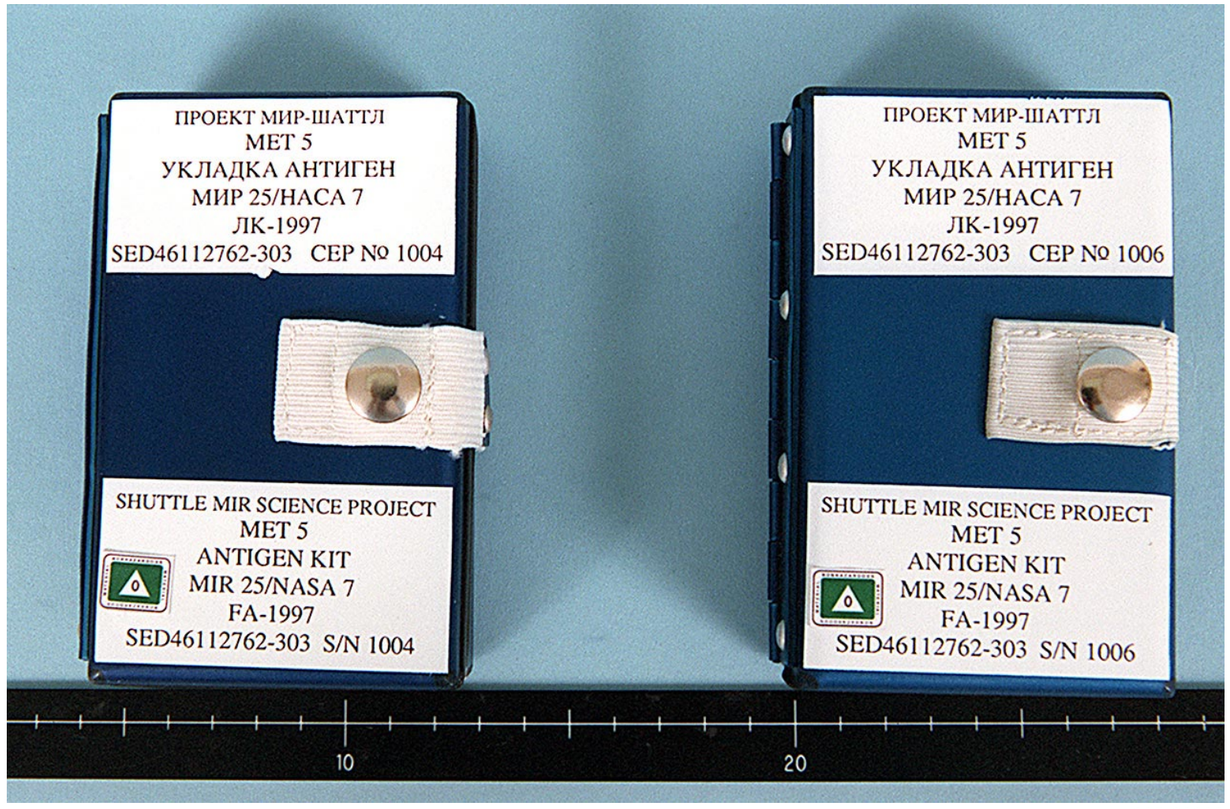
Figure HLS-80 Humoral Immunity Kit Contents

HI CHEMICALS (QUANTITY OF DOSES LISTED PER KIT)

1. Pneumococcal Vaccine (4 doses at 0.5 mL/dose)
   - 25µg each of 23 types of purified polysaccharides from Streptococcus pneumonia in saline solution with 0.25% phenol or 0.01% thimerosal as a preservative
   - Hazard Level: Zero

2. Epinephrine (3 doses at 0.5 mL/dose)
   - Concentration: 1:1000
   - Hazard Level: Zero

3. Benadryl (1 dose at 1.0 mL/dose)
   - 50mg/mL Diphenhydramine
   - Hazard Level: Zero



S97-09893

Figure HLS-82 Antigen Kits

ANTIGEN KIT

1. An anodized aluminum box is lined with foam.
2. The box is a modified version of the Fixative Tube Kit flown as part of the Inflight Blood Collection System Work Tray on Space Life Sciences-2.
3. Glass antigen syringes are wrapped with Teflon tape to prevent shattering.
4. Syringe plungers are removed and stowed in the HI Experiment Kit.
5. The kit contains four antigen syringes, each filled with 0.5 Milliliter (mL) of pneumococcal vaccine.
6. The kit contains antigen syringes which must remain at 2 to 8 °C until used.

SUPPORTING HARDWARE (SEE OPS)

Sharps Container

- Contains Used Needles
- Aluminum Container

Bar Code Data Logger

(Replaced with Bar Code Reader for Increment 7.)

Mir Centrifuge

Mir Freezer System

Thermoelectric Freezer (TEF) and Thermoelectric Holding Facility (TEHOF). ✳

S97-20350

Figure HLS-83 Antigen Kit Opened

ANTIGEN KIT ASSY (MIR)

P/N: SED46112762-303
Qty: 2
Mass: .19 kg (ea)
Power: N/A
x,y,z: 12.4 x 7.6 x 3.7 cm
DID#: SED46114328

MAGNETIC RESONANCE IMAGING (MRI) AFTER EXPOSURE TO MICROGRAVITY (E586)

EXPERIMENT DESCRIPTION

Measurements on the crew of Spacelab-Japan (SL-J) demonstrated significant muscle-specific atrophy after only 8 days in weightlessness. Published bed-rest studies by the investigator have documented the degree of expected atrophy after 4 months of disuse. This investigation proposes to repeat these muscle measurements on long-duration mission crewmembers. Previous bed-rest studies by the investigator have shown that when normal subjects are put in bed rest, partially unloading the spinal column, significant intervertebral disc expansion occurs.

This expansion reverts to normal shortly after reambulation following bed rest lasting days to a few weeks. Longer duration bed rest (17 weeks), however, results in some residual expansion that remains for some time following reambulation.

Results from SL-J revealed that 8 days of weightlessness do not result in residual expansion 24 hours after landing.

It is speculated that disc expansion during flight may be causally related to the back pain reported to occur during flight and that longer duration space flight will result in residual disc expansion that may pose some risk of disc damage during the landing and early postflight period.

This disc expansion with back muscle atrophy may be causally related to the back pain experienced after long duration space flight. Several space experiments have documented altered hematopoietic activity which may be related to cellularity changes in the bone marrow.

This investigation will measure the intervertebral disc cross-sectional area, muscle volumes and spinal bone marrow cellularity of the crewmembers before and after the NASA/Mir flights to test the following hypotheses:

1. Significant intervertebral disc expansion occurs during space flight which will remain for some period of time after return to earth's gravity.

2. Muscle specific atrophy occurs during weightlessness. As a result of the inflight exercise countermeasure regime, the degree of atrophy will be less than the atrophy that occurs during bed rest of similar duration without exercise, but similar to that anticipated for bed rest with resistive exercise.

3. Spinal bone marrow cellularity decreases (increased percentage of fat) during space flight and is correlated with bone loss in the spine to be measured in a separate protocol.

SCIENCE OBJECTIVES

1. To measure the intervertebral disc size before and after long duration space flight to determine if residual disc expansion remains after returning to 1-g environment.

2. To measure the muscle volumes of the calf, thigh, back, and neck before and after flight.

3. To measure the bone marrow cellularity of the spine before and after flight.

4. The results of science objectives 1 and 2 will be compared to data from bed rest with and without exercise countermeasures.

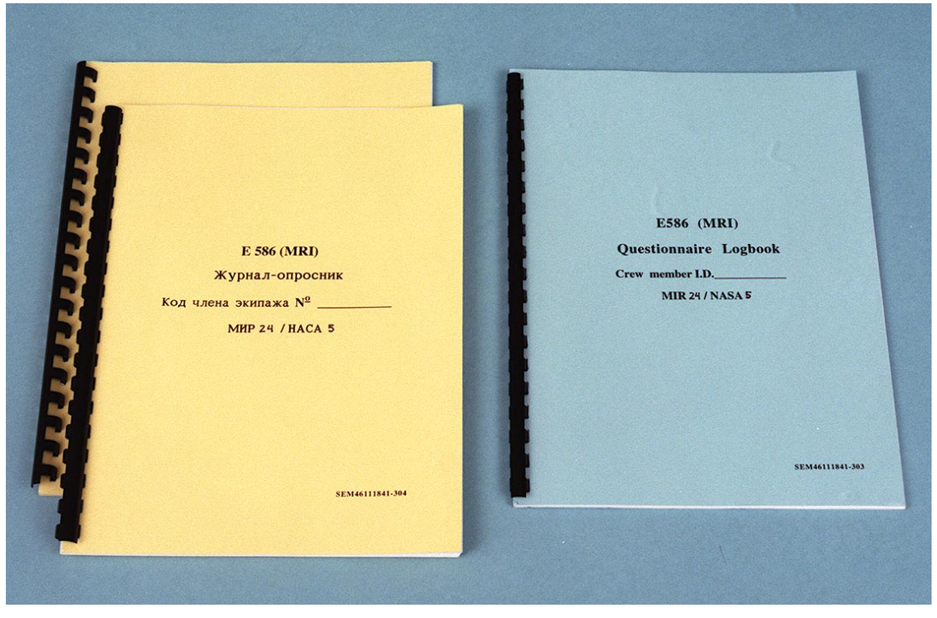
   The results of objective 3 will be compared with measurements performed before and after long duration bed rest from control and treated subjects.

5. To document the occurrence of back discomfort during and after flight and evaluate the association with residual disc expansion.

LOGBOOK/BACK PAIN QUESTIONNAIRE

The MIPS-2 back pain questionnaire is used inflight to document crewmember back pain or discomfort.

The questionnaire is completed every day using the MIPS-2 Computer for Flight Day 3 through Flight Day 13 and then whenever back pain occurs. The questionnaire is also completed postflight from R+0 through R+10 and then whenever back pain occurs until R+30. ✳



S96-18952

Figure HLS-84 MRI Logbooks

Principal Investigator:
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Diane McMahon
(281)280-2504

FRAMES OF REFERENCE FOR SENSORI-MOTOR TRANSFORMATIONS (E701)

EXPERIMENT DESCRIPTION

The scientific goals will be pursued in a series of psychological experiments conducted in microgravity. Subjects will be asked to perceive differences in stimuli either visually or haptically. These sensory modulaties will be studied both independently and in coordination. The independent analysis will serve to identify the intrinsic reference frames associated with each sense. Making comparisons with the independent tasks of 2 modalities will test whether exposures to microgravity invokes global changes in sensory perception or whether modifications are restricted to a particular sensory system. Finally by performing tasks which require a simultaneous effort with the 2 sensory modalities, we will test for a role of gravity facilitating visuo-motor transformations.

SCIENCE OBJECTIVES

1. To identify the role of gravity in defining the reference frames used to do visual, proprioceptive and haptic information. By extension, measure the adaptation of the perceptual system to an environment lacking gravity.

2. To test the hypothesis that gravity can be used to align visual and motor frames of reference.

3. To collect fundamental baseline data on the capacities of the human visual proprioceptive and haptic perceptual systems under conditions of microgravity:

   - Visual Perception of Length
   - Perception of Orientation
   - Force Magnitude
   - Force Direction
   - Haptic Perception of Length
   - Hand Orientation in Space
   - Haptic Perception of Orientation
   - Visuo-motor Coordination
   - Visuo-Haptic Coordination
   - Visuo-motor Realignment

ASSOCIATED HARDWARE

ROBOTOP Joystick
PCMCIA Card Kit
Video Monitor
COGNILAB Experimental Post

HARDWARE DESCRIPTION

CONTROL COMPUTER

The Control Computer provides automatic execution of the experiment. It presents stimuli to the subject on the flat-screen video monitor and/or via the ROBOTOP joystick and records responses from the subject via push button input, a variable control knob, and the ROBOTOP joystick.

FACE MASK

The Face Mask is used to position the eyes of the subject at a fixed distance from the screen.

OPTICAL TUNNEL

The Optical Tunnel is an opaque cylinder that extends from the face mask to the screen, thus excluding external visual cues from the surrounding environment.

ROBOTOP JOYSTICK

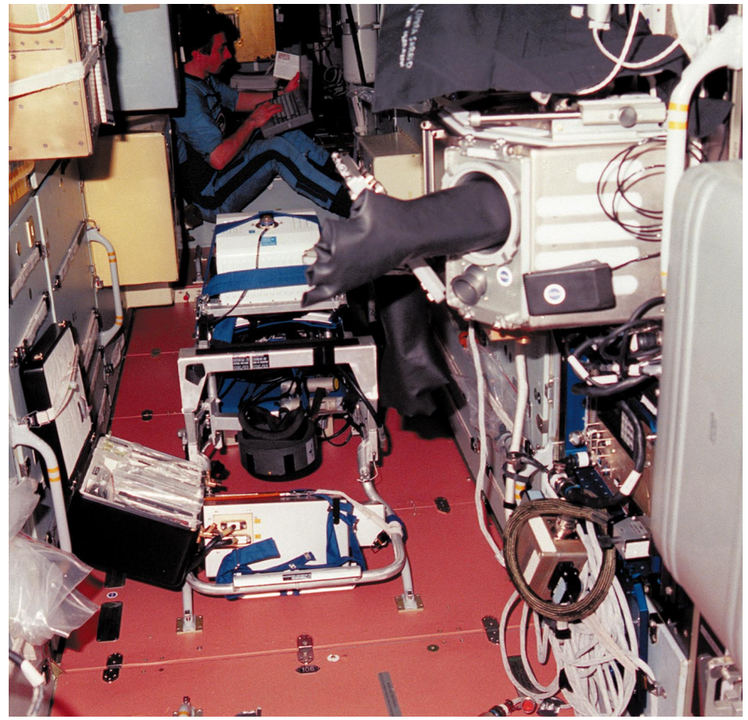
The ROBOTOP Joystick is a three-axis manipulandum having two lateral (+/-6 cm in X and Y) and one rotational degree of freedom (+/-135° around Z). Subjects manipulate the joystick with the hand. Optical sensors in the joystick measure the movement of the handle along each of the three axes. Motors attached to each axis are programmed by the Control Computer to resist certain movements attempted by the subject, or to apply forces or torques to the hand of the subject. The maximum resistance attainable with the motors is 25 N for translation and 10 Nm for rotations. A three-axis sensor in the Joystick shaft measures the forces and torques applied between the joystick and the hand.

BODY RESTRAINT SYSTEM

The Body Restraint System is an aluminum chair with belts that restrain the subject at the hips, shoulders, and feet. The belts are fitted with quick-release buckles to allow easy exit in an emergency. The chair is attached to handrails on the floor of the Mir Station and provides fixed support for the Video Monitor, Mask, Optical Tunnel, and Joystick. ✳

S96-19004
Figure HLS-85 Cognilab PCMCIA Card Partially Inserted into Kit

S96-19003
Figure HLS-86 Cognilab PCMCIA Cards in Front of Kit



NM23-012-03
Figure HLS-87 Cognilab in Priroda

Principal Investigator:
Susan Minor
NASA/JSC/SM4
(281)483-1213

PCMCIA CARDS KIT

P/N:	COG/101
Qty.:	1
Mass:	0.60 kg
Power:	None
x,y,z:	10.60 x 5.50 x 8.40 cm
Loc.:	Spektr, A6

Renal Stone Risk Assessment: Dried Urine Chemistry (E651B)

EXPERIMENT DESCRIPTION

Previous data collected immediately after short-term spaceflight indicate that metabolic and environmental changes occur during flight that increase the risk of calcium oxalate and uric acid stone formation (Whitson, et al., 1993). In this study, we will assess the renal stone-forming potential of humans during long duration spaceflight and determine how long after flight the increased risk exists.

Urine will be collected before, during and after flight. Diet, exercise and medications will also be monitored before and during the urine collections in order to assess any influences other than microgravity.

The following hypotheses are addressed in this study: 1) renal stone risk will increase during spaceflight as compared to preflight assessments, 2) risk of calcium-containing stones will increase with mission duration, 3) stone-forming potential will return to preflight levels within 14 days after flight.

The microgravity environment in the Shuttle or the International Space Station provides tremendous challenges for development of the technology and hardware required to conduct medical research.

Due to limited on-orbit space, stowage, power and refrigerator/freezer availability, the ability to conduct medical experiments is severely restricted. New technology developed at NASA/JSC may be able to overcome these limitations through the use of dried urine technology. This advanced technology will be tested in a parallel study involving liquid urine samples to assess the potential risk for renal stone formation.

This study is critical since knowledge of the space flight induced metabolic and environmental changes that influence the urinary environment will be used to develop the appropriate countermeasure protocols to minimize inflight renal stone risk.

This experiment directly addresses NASA's objectives to optimize crew safety, well-being and performance by understanding the effects of prolonged hypercalciuria and the development of prophylactic methods to minimize/eliminate the risk of renal stone formation during spaceflight.

SCIENCE OBJECTIVES

1. To quantitate the pre-, in-, and postflight risk of renal stone formation during extended duration spaceflight.

S97-15691

Figure HLS-88 Inflight Urine Storage Tube Kits

S97-15689

Figure HLS-89
Inflight Urine Storage Tube Kit with Interior Tube Card Displayed

2. To determine the risk factors which are affected by flight duration.

3. To estimate the contribution of dietary and environmental factors to the risk of renal stone formation.

4. To evaluate the efficacy of the dried urine chemistry to preserve human urine samples.

Principal Investigators:
Peggy Whitson
NASA/JSC/CB
(281)483-7046

INFLIGHT URINE STORAGE TUBE KIT

P/N:	SEM46109828-304
Qty:	2
Mass:	1.63 kg (ea)
Power:	N/A
x,y,z:	37 x 16 x 11 cm
DID#:	SLM46111625

HARDWARE DESCRIPTIONS

INFLIGHT URINE STORAGE TUBE KIT

This kit is a Nomex container that holds 90 syringes (with thimerosal and thymol preservatives) used to collect urine on orbit. The syringes are secured to pallets with elastic loops. The pallets are attached by Velcro to the interior of the container.

URINE COLLECTION KIT

Urine collection is performed using urine collection devices, wet wipes, and catheter tape. The bags, wipes, and tape are stowed in a Nomex bag. Urine is drawn from the bag through a silicone septum with a syringe. Samples are stored at room temperature.

MIR PRESERVED URINE KIT

The Thymol/Thimerosal syringes are labeled and stowed in the syringe pallet. Samples are stowed at ambient temperature.

FOOD, FLUID AND ACTIVITY LOG

A food/fluid/exercise/medication log is kept 24 hours prior to and on the day of urine collection.

S97-15663

Figure HLS-91 Urine Collection Kit Contents

S97-15662

Figure HLS-90 Urine Collection Kit Opened

S97-15665

Figure HLS-92 Urine Collection Kit Bottom

D.I.D.

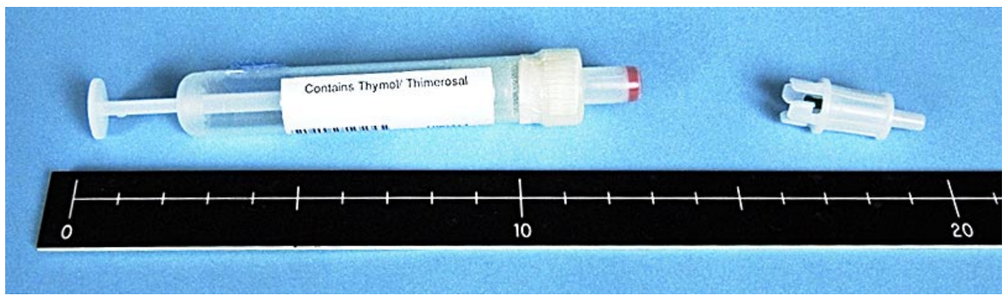
Urine Collection Kit

URINE COLLECTION KIT LAUNCH, STOWED AND DEPLOYED CONFIGURATION

P/N: SED46106984-305
Qty: 7
Mass: 15.54 kg
Power: N/A
x,y,z: 25.8 x 26.4 x 19.8 cm
DID#: SLM46109741

S97-15672

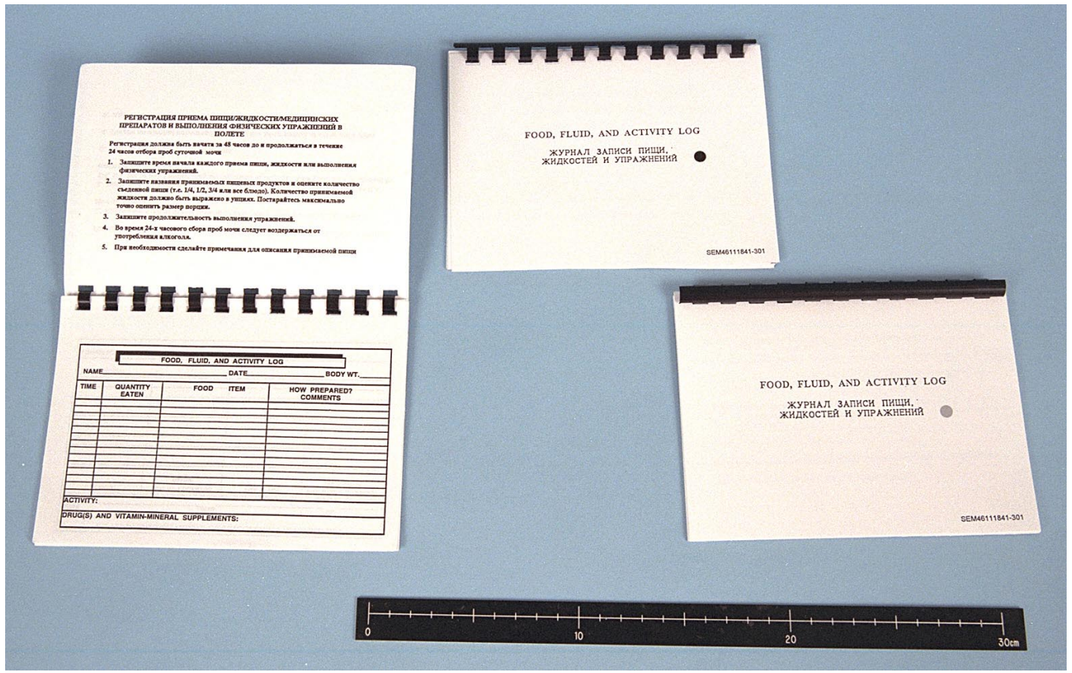
Figure HLS-93 Mir Preserved Urine Kit



S97-15673

Figure HLS-94 Thymol Syringe and Adapter Cap

Figure HLS-95 Preserved Urine Syringe Kit Closed



S97-10771

Figure HLS-96 Food, Fluid and Activity Log

D.I.D.

Preserved Urine Syringe Pouch Kit Assembly

D.I.D.

Dried Urine Chemistry Kit

FOOD, DRINK, & EXERCISE: LOG BOOK METABOLIC (DIETARY)

P/N: SEM46111841-301
Qty: 3
Mass: 0.45 kg (ea)
Power: 0
x,y,z: 12.8 x 17. x .5 cm

PRESERVED URINE SYRINGE KIT

P/N: SEM46109828-303
Qty: 2
Mass: .45 kg (ea)
Power: 0
x,y,z: 36.8 x 15.9 x 11.4 cm
DID#: SLM46111626

PRESERVED URINE SYRINGE KIT (Thimerosal)

P/N: SEM46109828-302
Qty: 1
Mass: 1.7 kg (ea)
Power: 0
x,y,z: 36.8 x 11.4 x 15.9 cm
DID#: SLM46111626

DRIED URINE CHEMISTRY KIT

The Dried Urine Chemistry Kit is a Nomex kit containing the Urine Sample Card Holder, the Aspirator Syringe (20ml), the Dried Chemistry Storage Bags, and the Dried Chemistry Trash Bags.

Along with the Urine Collection Devices and the Dried Chemistry Drying Box, this kit contains all the equipment needed to take Dried Urine samples.

Dried Chemistry Storage Bag

The Dried Chemistry Storage Bag consists of an aluminized-plastic pouch and three Scavenger Sachets held inside with Velcro and a Bag Closure.

The Dried Urine Sample Cards are placed into the Dried Chemistry Storage Bag; the bag is closed with the Bag Closure; and the bag is stowed.

Scavenger Sachet

The Scavenger Sachet is a commercial oxygen scavenger in a small pouch containing an iron compound.

The Scavenger Sachets are pre-packaged three to a Dried Chemistry Storage Bag and are held inside with Velcro.

Urine Sample Card

The Urine Sample Card is a plastic frame holding an absorbent paper mat and is packaged two to a Urine Sample Card Holder.

The urine-soaked Urine Sample Cards are removed from the Urine Sample Card Holder and placed into the Dried Chemistry Drying Box to dry; then the Dried Urine Sample Cards are placed in the Dried Chemistry Storage Bag.

S97-04733

Figure HLS-97 Dried Urine Chemistry Kit Nomex Bag

S97-04732

Figure HLS-98 Dried Urine Chemistry Kit Contents

S97-04712

Figure HLS-99 Dried Urine Chemistry Kits Closed

DRIED URINE CHEMISTRY KIT

P/N: SJD46115453-301
Qty: 1
Mass: 3.1 kg
Power: 42 W (for the drying box)
x,y,z: 34 x 33 x 18 cm
DID#: SLM46115459

DRIED URINE CHEMISTRY KIT

P/N: SJD46115453-302
Qty: 1
Mass: 3.1 kg
Power: N/A
x,y,z: 34 x 33 x 18 cm
DID#: SLM46115459

DRIED URINE CHEMISTRY KIT

P/N: SJD46115453-303
Qty: 1
Mass: 3.1 kg
Power: N/A
x,y,z: 34 x 33 x 18 cm
DID#: SLM46115459

Dried Chemistry Trash Bags

The Dried Chemistry Trash Bag includes the Dried Chemistry Device Containment Bag. The used Urine Sample Card Holders (with the Urine Sample Cards removed) are placed into the Dried Chemistry Device Containment Bags which are then discarded.

Aspirator Syringe (20ML)

The Aspirator Syringe (20ml) is a plastic syringe with a standard male Luer tip. The Aspirator Syringe (20ml) is fitted to the Urine Sample Card Holder and used to draw urine into the Urine Sample Card Holder from the Urine Collection Device.

DRIED CHEMISTRY DRYING BOX KIT

The Dried Chemistry Drying Box consists of the Card Holder Module, the Fan Module, and the Odor Filter Module.

The three modules are assembled into a unit, the urine-soaked Urine Sample Cards are placed into the Card Holder Module, the Fan Module is turned on for 2-24 hrs, then the dried Urine Sample Cards are removed and placed into the Dried Chemistry Storage Bags.

Figure HLS-100 Dried Chemistry Drying Box Kit Contents

D.I.D

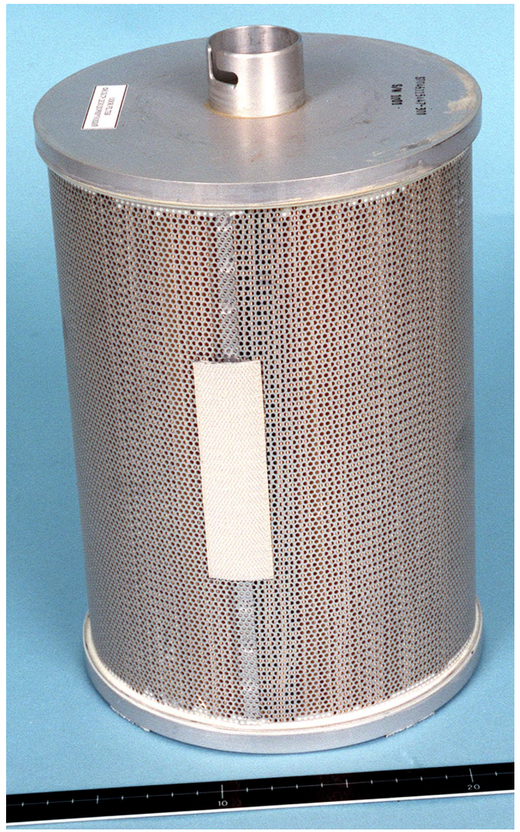
Dried Chemistry Drying Box Kit

DRIED CHEMISTRY DRYING BOX KIT

P/N: SJD46115454-301
Qty: 1
Mass: 7.1 kg
Power: 42 W
x, y, z: 34 x 31 x 18 cm
DID#: SLM46114452

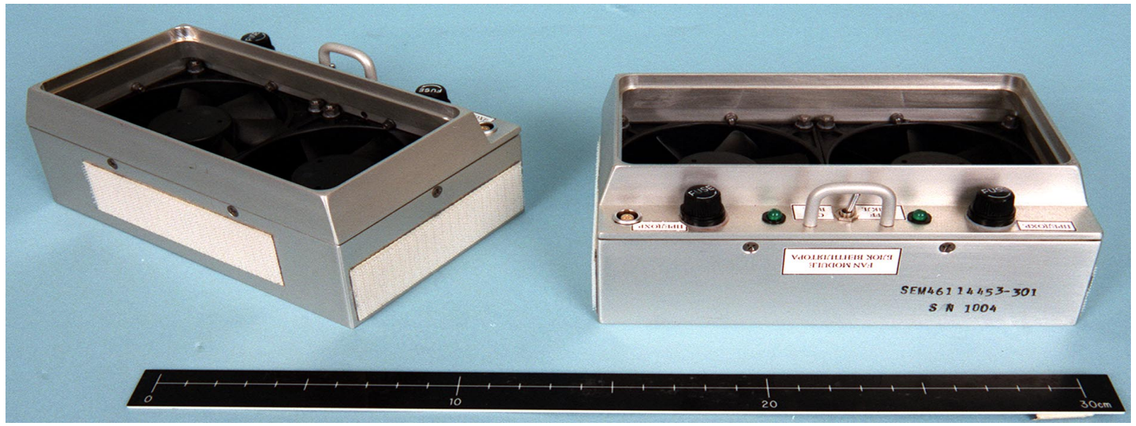
S97-04728

Figure HLS-101 Odor Filter Interface



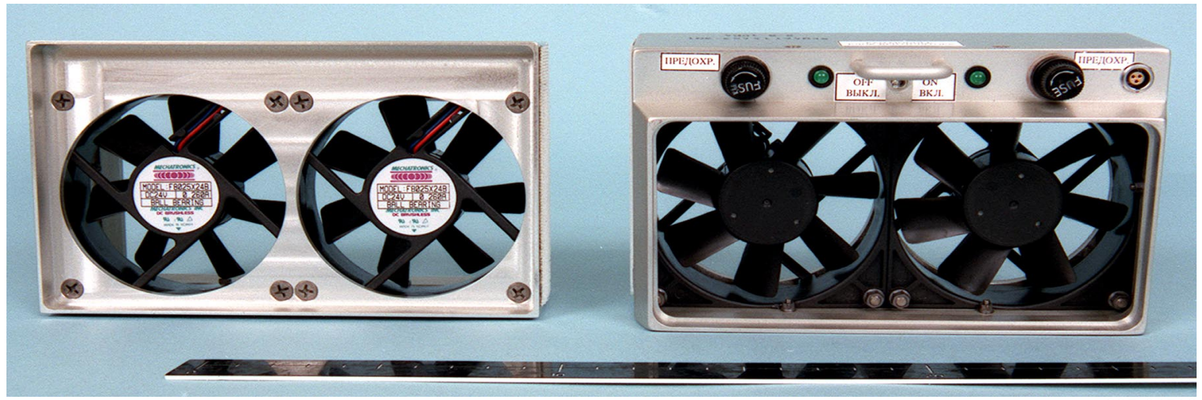
S97-04729

Figure HLS-102 Odor Filter



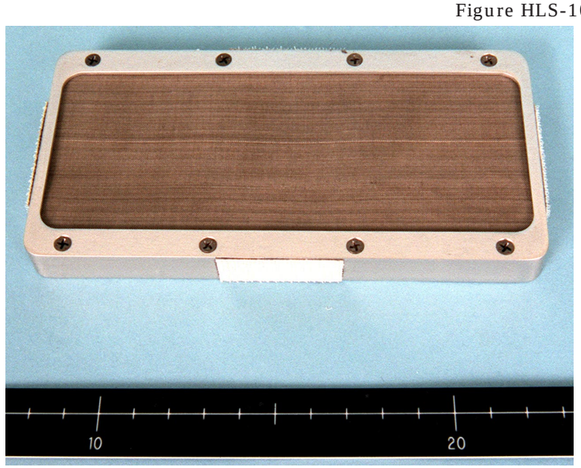
S97-04717

Figure HLS-103 Fan Modules



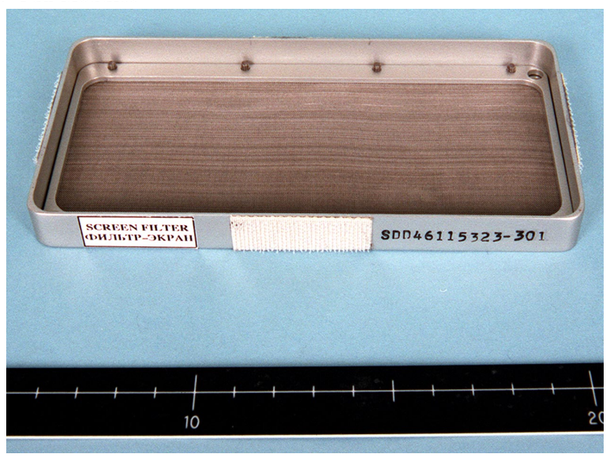
S97-04718

Figure HLS-104 Fan Modules



A

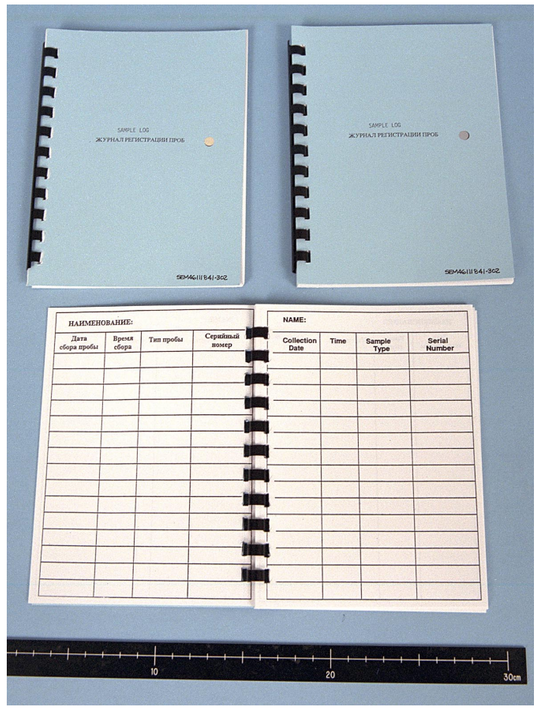
S97-04721



B

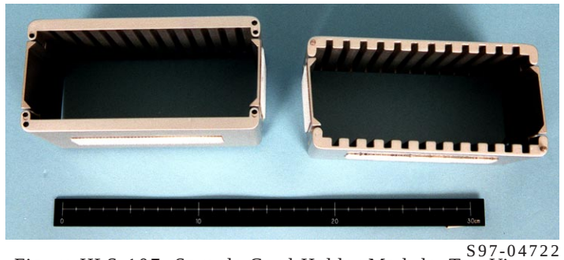
S97-04720

Figure HLS-105 Screen Filter, Both Sides



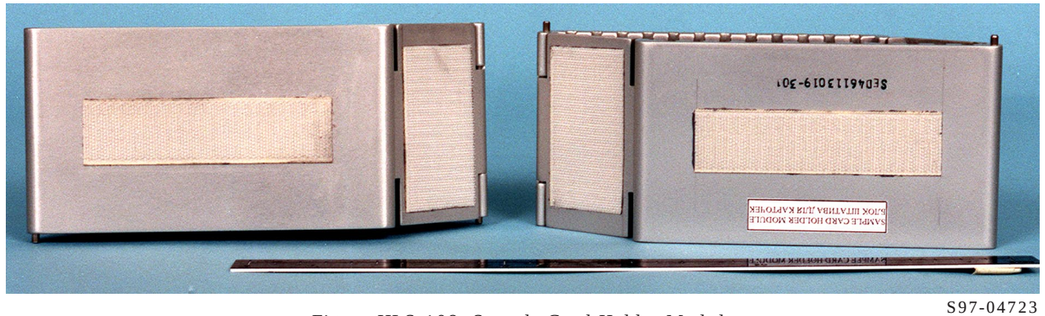
S97-11799

Figure HLS-106 Sample Logbooks



S97-04722

Figure HLS-107 Sample Card Holder Module, Top View



S97-04723

Figure HLS-108 Sample Card Holder Module

Urine Sample Card Holder (Formerly Dried Urine Collector)

The Urine Sample Card Holder is a plastic housing containing two Urine Sample Cards and has a blunt cannula that connects to the Urine Collection Device.

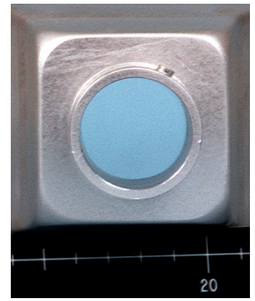
The Urine Sample Card Holder is connected to the Urine Collection Device and the Aspirator Syringe is connected to the Urine Sample Card Holder; urine is drawn into the collector; the collector is opened and the two Urine Sample Cards are removed and placed into the Dried Chemistry Drying Box.

Sample Logbook

This log book will serve to record inflight urine samples, blood samples, and saliva samples. ✳

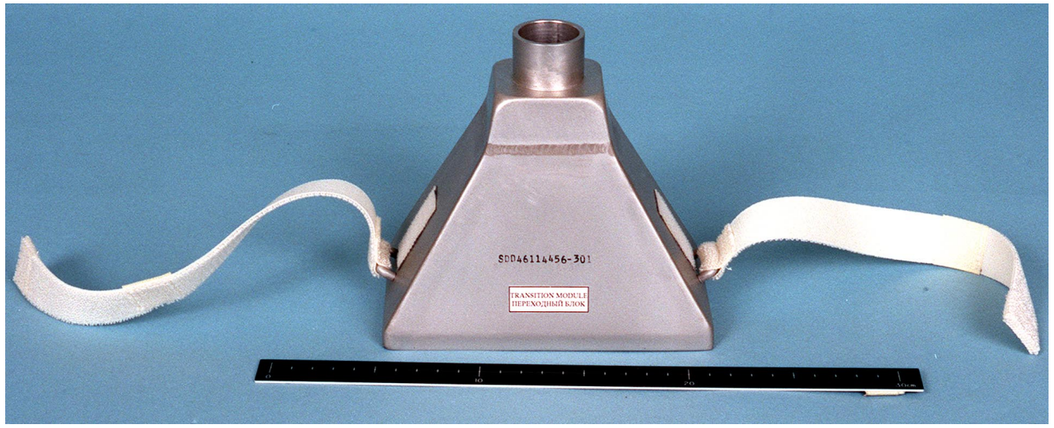
S97-04726

Figure HLS-109 Transition Module, Inner View



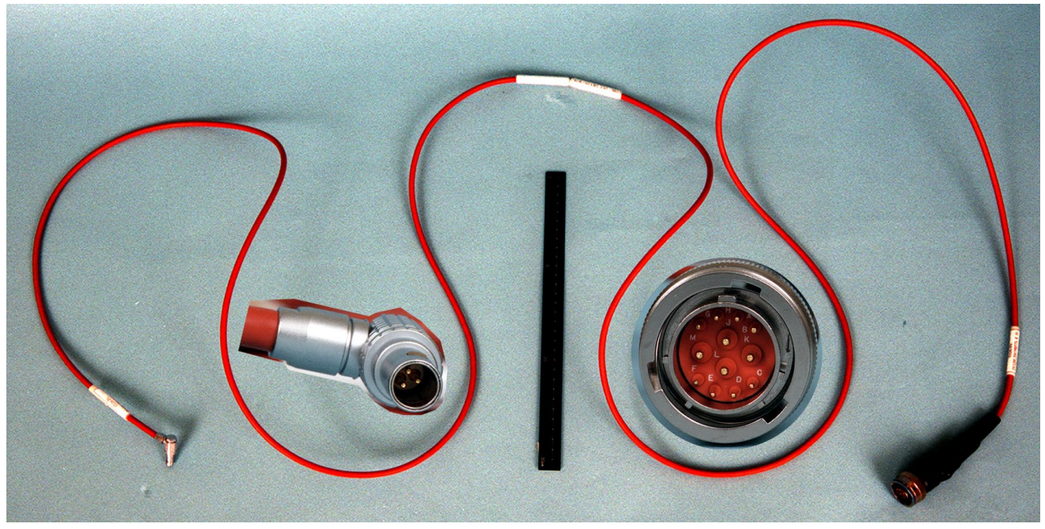
S97-04725

Figure HLS-110
Transition Module Interface



S97-04727

Figure HLS-111 Transition Module



S97-04715

Figure HLS-112 Power Cables and Connectors

LOG BOOK METABOLIC (SAMPLE)

P/N:	SEM46111841-301
Qty:	3
Mass:	.072 kg
Power:	N/A
x,y,z:	13 x 18 x 7 cm
DID#:	SLM46111631

Sleep Experiments Combined (E639C)

S96-18991

Figure HLS-113 Sleep Experiments Hardware in Kits

S96-19009

Figure HLS-114 Sleep Experiments Hardware

D.I.D

Sleep Blood Collection Kit

Principal Investigators:
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University of Pittsburg
Professor of Psychiatry;
Director of Human
Cronobiology Center
(412)624-2246

SLEEP BLOOD TUBE KIT

P/N: SED46114681-301
Qty.: 1
Mass: 2.3 kg
Power: None
x, y, z: 34 x 22 x 14 cm

SLEEP BLOOD COLLECTION KIT

P/N: SEM46114680-301
Qty.: 3
Mass: 5.10 kg total
Power: None
x, y, z: 31 x 31 x 7 cm

SHARPS CONTAINER

P/N: SEM46109770-301
Qty.: 2
Mass: 0.3 kg
Power: None
x, y, z: 26 x 7 x 5 cm

MIR BLOOD COLLECTION BELT ASSEMBLY

The Mir Blood Collection Belt Assembly is reflown hardware. The Mir Blood Collection Belt is an assembly of one nomex fanny pack used during an inflight blood collection session and one nomex and durette trash bag attached to a belt. The trash bag has changeable Teflon liner bags. It is worn by a crewmember during inflight blood collection for convenient storage of blood collection items and trash disposal. The following components make up the Mir Blood Collection Belt Assembly:

- Liner Bag Assembly
- Belt Assembly
- Fanny Pack Assembly
- Ink Marking Pen (Black)

S96-18930

Figure HLS-115 Blood Collection Belt, Front

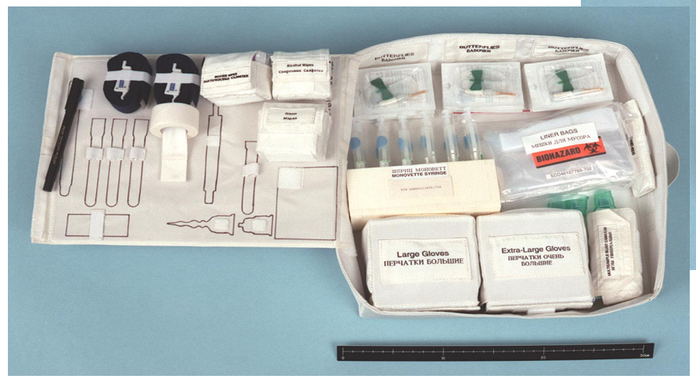
S96-19017

Figure HLS-116 Blood Collection Belt, Back

BLOOD COLLECTION KIT

This kit contains medical supplies to support the required blood draws. The following components are stowed with each Blood Collection Kit.

- Tourniquet
- Alcohol wipes
- Sterile gauze pads
- Micropore tape
- Monovette Syringe
- Multi-sample Blunt Canula
- Vacutainer Holder
- Butterfly needles
- Band-Aid, flex
- Band-Aid, spot
- Pilot pen
- Gloves



S96-19014

Figure HLS-117 Blood Collection Kit Contents

S96-19016

Figure HLS-118 Blood Collection Kits

S96-19013

Figure HLS-119 Blood Collection Kit Open

D.I.D.

Sleep Blood Tube Kit

BELT ASSEMBLY, BLOOD COLLECTION

P/N: SEM46109801-303
Qty.: 1
Mass: 0.60 kg
Power: None
x, y, z: 30.3 x 16.2 x 7.0 cm

S96-18936

Figure HLS-120 Blood Tube Holding Kit

S96-18935

Figure HLS-121 Empty Blood Tubes

MSRR ELECTRODE PREPARATION KIT

The MSRR Electrode Sleep Kit contains hardware that is required for the crewmembers to prep, clean up, and apply electrodes and skull cap that go to the MSRR. The following components are in the MSRR Kit:

- Alcohol pads
- Electrode prep pads
- Electrodes (snaps)
- Mirror
- Skull caps
- Wet wipes
- Electrode prep needles
- Electrode prep tubes with gel
- Gauze pads
- Q-tips
- Tape (cloth)

S96-19008

Figure HLS-122 Electrode Preparation Kit

DISKETTE KIT ASSEMBLY

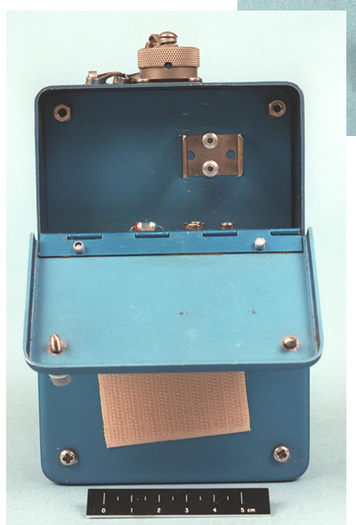
This kit contains floppy diskettes that will be the backup storage medium to the magneto optical drive for experiment data storage.

ELECTRODE IMPEDANCE METER (EIM)

The EIM is reflown hardware. The unit will be used to measure the impedance of the eight Medilog Sleep Research Recorder (MSRR) electrodes via a multi-pin electrode connector. The impedance of the electrode under test will be determined with respect to all other electrodes shorted together. The electrode impedance will be displayed digitally on a 3 1/2 digit liquid crystal display (LCD) powered by two 9-V Alkaline batteries. Maximum output current is 10 micro amperes rms. The dimension of the EIM is 12.9 x 10.8 x 5.7 cm, and mass is 0.6 kg.

A

B



S96-18949

S96-18950

Figure HLS-123
A. Electrode Impedence Meter Back Side
B. EIM with back compartment opened

S96-18951

Figure HLS-124 Electrode Impedence Meter Front View

BATTERY KITS

"AA" Battery Kit:

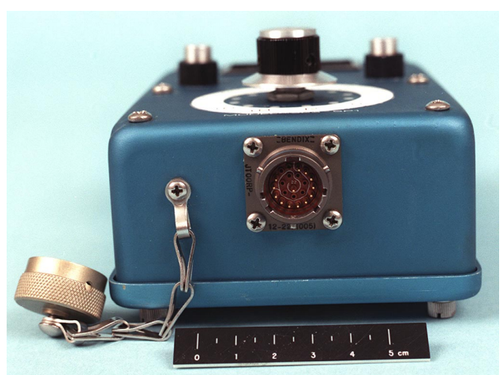
This kit contains twenty "AA" size batteries, which are spares to run the MSRR and voice recorder.

9-V Battery Kit:

This kit contains twelve 9-V batteries, which are spares to run the electrode impedance meter and the Night Headband Monitor.

MAGNETO-OPTICAL CARTRIDGE

The Magneto-Optical Cartridge operates on media with capacities of either 650 megabytes, 1 gigabyte, or 1.3 gigabyte per cartridge. The 650-megabyte rewritable media conforms to IS 10089 and ANSI X3.212-1992; the 650-MB write-once media conforms to ISO DIS 11560 and ANSI X3.220-1992, in a format known as C/C. The 1-gigabyte media, ZCAV format, is supported in write-once and rewritable versions, with the third format, LZ, providing 1.3-gigabyte capacity. The cartridge conforms physically and optically to the proposed ANSI standard cartridge. The cartridge consists of a double-sided magneto-optical disk, with a metal hub, enclosed in a plastic case.



S96-18948

Figure HLS-125
Electrode Impedence Meter Side View Showing Connector

S96-19011

Figure HLS-126 MSRR Assembly Kit Closed

MSRR ASSEMBLY

The MSRR Assembly consists of a recorder unit with attachment belt and pouch, eight-channel electrical harness, skull cap/electrode set, and electrode application kit.

S96-19010

Figure HLS-127 MSRR Assembly Kit Open

D.I.D.

MSRR Assembly Kit

The recorder is designed for nine-channel, multiparameter, ambulatory monitoring. Eight channels of physiological data can be recorded from four Electroencephalogram (EEG) electrodes, two lateral Electrooculogram (EOG) electrodes, and two chin Electromyogram (EMG) electrodes. The remaining channel is used for the binary clock signals automatically taken from the recorder's Real-Time Clock and subject-initiated event markers. Recordings can be played back postflight using a replay and display system.

The dimensions of the recorder units are 20 x 17 x 35 cm, and the mass is 0.96 kg. Main power is supplied by four Alkaline "AA" size batteries, which have a 24-hour usage life. The clock is powered by two lithium thionychloride batteries.

S96-19119

Figure HLS-128
Side view of
MSRR-open

S96-19117

Figure HLS-129 Medilog Sleep Research Recorder

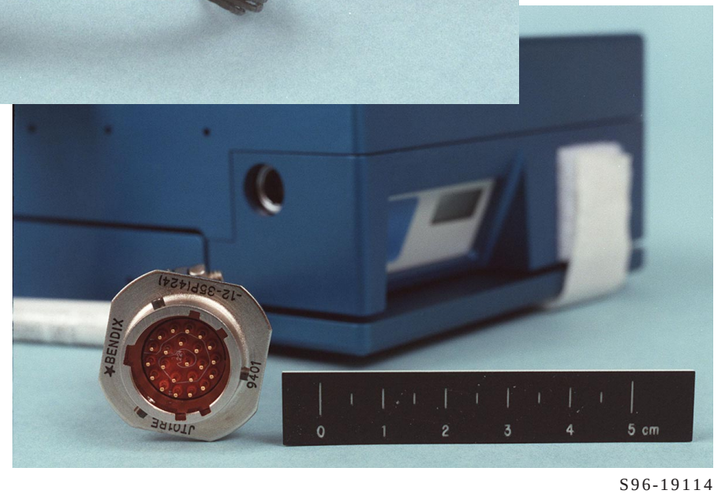
The recording medium is C-120 cassette tapes, which provide 24 hours of total recording time. The clock display uses a four-digit LCD display. The recorder contains all of the signal-conditioning circuitry, including the eight integral dual-purpose input amplifiers necessary to record EEG, EOG, and EMG.

MSRR TAPE KIT

The kit contains twenty-four C-120 cassettes tapes that are for storing data from the MSRR.

S96-19118

Figure HLS-130
Side View of MSRR



S96-19114

Figure HLS-131 Medilog Sleep Research Recorder Cable End

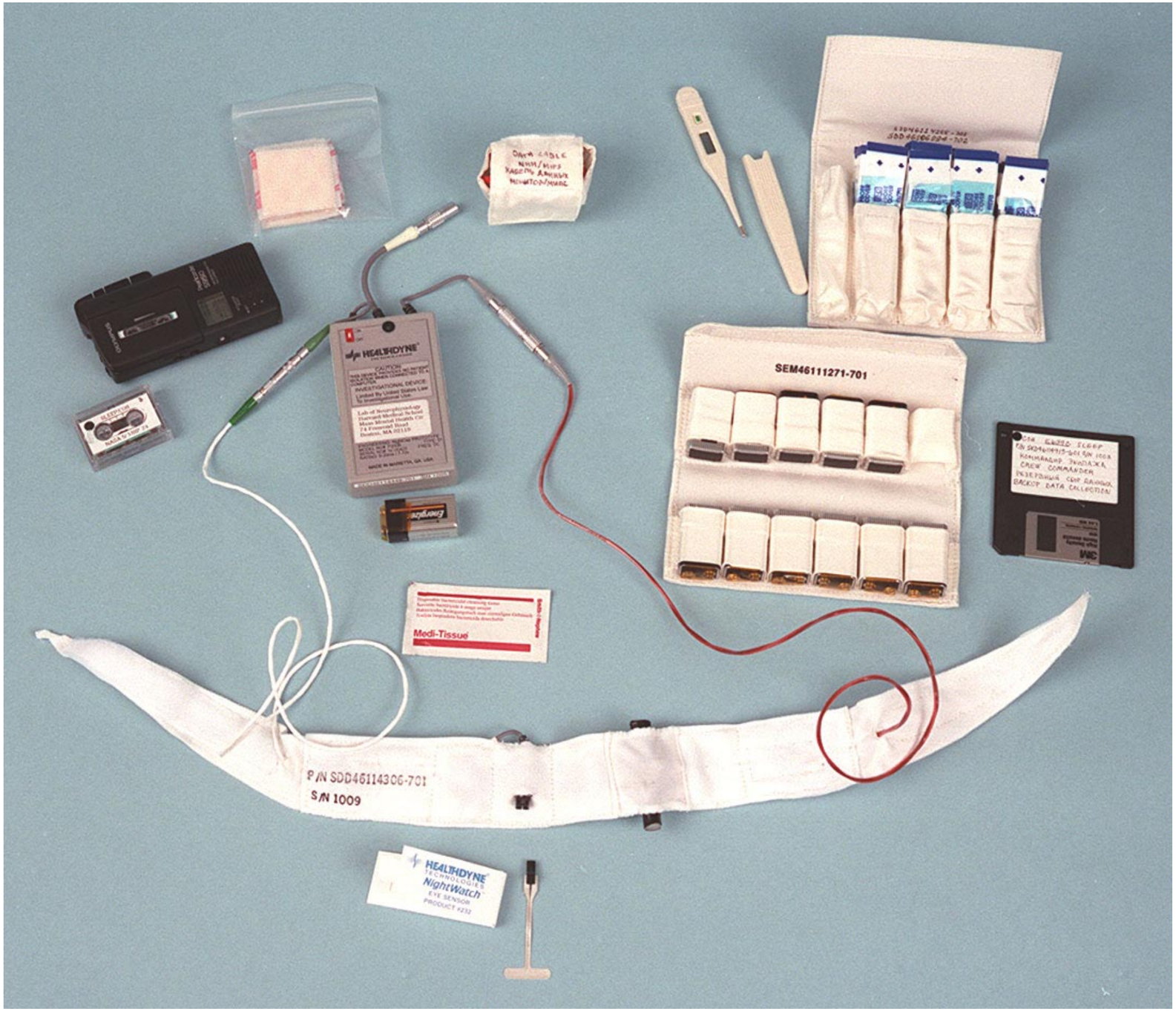
THERMOMETER KIT

This kit contains two oral digital thermometers that are off-the-shelf hardware and have disposable probe covers. The Becton Dickinson Model 2860 digital thermometer is an electronic temperature measurement device utilizing an LCD to indicate the temperature reading.

The thermometer is powered by a single Maxell Silver Oxide type SR41 battery. The thermometer weighs approximately 10 mg (.35 ounces) and measures 5.1 x 0.75 x 0.43 inches. The entire unit is water and alcohol resistant at 1-hour submersion. The body and case are a plastic, ABS resin. The switch decal is a vinyl chloride with acrylic adhesive.

MEDILOG SLEEP RESEARCH RECORDER (MSRR) ASSEMBLY KIT

P/N: SEM46114701-301
Qty: 1
Mass: 13.3 kg
Power: 0
x, y, z: 45.7 x 36.8 x 26.4 cm



S96-18987

Figure HLS-132 Night Headband Kit Contents

NIGHT HEADBAND KIT

Night Headband Monitor

The Night Headband is a two-channel recording device, which distinguishes wake, REM sleep, and non-REM sleep. One channel of the Night Headband monitors eye movements, and the other monitors body movements. The eye sensor circuit contains a low-pass filter with a 20-Hz cutoff, a high-pass filter with a 3-Hz cutoff, and a pass band gain of 60. The circuitry has an input impedance of 20 ohms. If the resultant output voltage exceeds 0.6 V, a voltage signal is applied to the eye movement sample-and-hold circuit. The high-pass filter provides a lower limit to the speed of eyelid movements that can be detected.

As demonstrated by combined PSG and Night Headband recordings, these limits make the eye sensor insensitive to slow rolling eye movements such as those seen at sleep onset, but very sensitive to blinks and the rapid eye movements of REM sleep.

The Night Headband monitor circuitry is contained in a wallet-sized case (10 x 7 x 2 cm) weighing only 150 g and capable of recording 5 to 10 nights of data on a single 9-V alkaline battery. Its internal memory can store data for up to 30 nights. Leads from the case connect to the eye and body sensors. The case also contains an RS-232 serial port for transferring data to a personal computer.

NIGHT HEADBAND KIT

P/N: SJM46114303-301
Qty: 4
Mass: 2.3 kg each
Power: 0
x, y, z: 31 x 17 x 14 cm

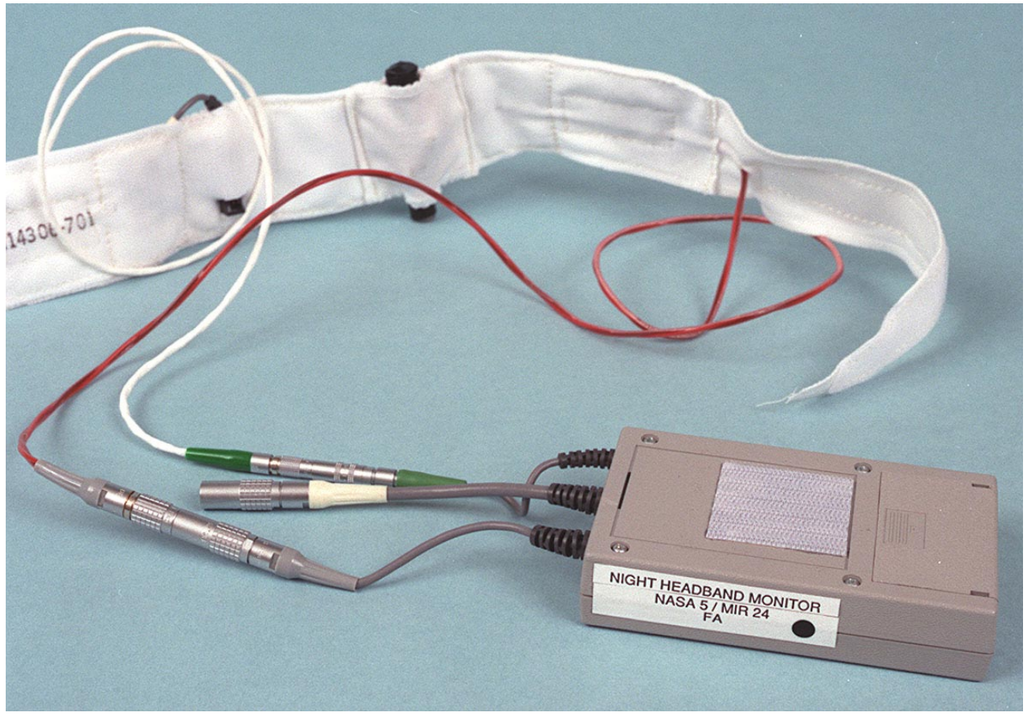


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Figure HLS-133 Night Headband Monitor Connected to Night Headband

Eye Sensor Mount and Cable

The Eye Sensor Mount, which is affixed to the inside of the Night Headband, is a male socket into which the eye sensor is plugged, providing both an electrical connection to the Night Headband and physical support for the disposable Piezoelectric Eye Sensor.

A 25-inch cable runs from the Eye Sensor Mount to the Night Headband Recording and Data Storage Unit. The mount (approximately 3 x 3 x 1 cm) and the cable weighs 21 g. An additional 30-inch extension cord, to run between the cable and the Night Headband Recording Unit, will be available for those subjects choosing to use it.

Disposable Piezoelectric Eye Sensor

The eye sensor is a disposable adhesive-backed piezoelectric film (25 x 6 x 0.25 mm) applied to the upper eyelid that is sensitive to underlying eye movements without restricting eye movement.

Head Movement Sensor and Cable

The head movement sensor is a small cylindrical inertia-sensitive system (1.5 x 1.5 x 1.5 cm); inside the cylinder, a brass rod is attached to one end of a stiff wire inside the headband. The other end of the wire is cemented into the base of the cylinder.

Movement of the device in any direction except parallel to the axis of the wire will cause the brass rod at the tip of the wire to swing horizontally.

With sufficient movement (approximately 1 mm), the mass contacts an electrically conductive ring attached to the wall of the cylinder, completing the circuit and applying battery voltage to the signal detector.

Stiffness in the wire damps the oscillatory behavior of the wire and prevents repeated contacts from a single movement.
Together with its cable, the head movement sensor weighs approximately 31 g.

Night Headband

The eye sensor mount and the body movement sensor are mounted in a Poly-Lycra (95 to -5 percent) headband 75 x 5 cm, or other flight-approved headband material.

The subject simply Velcroes the Night Headband around the head and affixes the eye sensor to the eyelid before retiring.

Night Headband-to-ThinkPad Data Cable

A 90-cm cable (60 g) runs from the Night Headband Recording and Data Storage Unit to the Mir Interface to Payload System (MIPS)-2L.

SHARED HARDWARE (SEE OPS)

S96-18945

Figure HLS-134 Sleep Skull Cap

MIR CENTRIFUGE

The general purpose Mir Centrifuge provides centrifugal acceleration for separation or processing of samples in hematology, bacteriology, microbiology, immunology, and other life sciences disciplines.

THERMOELECTRIC FREEZER (TEF)

Processed blood will be frozen in the TEF.

MIPS LAPTOP COMPUTER

The MIPS laptop computer is an IBM-based laptop computer specifically designed for the Mir Station. The Experiment software will reside on the MIPS laptop computer. ✳