

## IX. CLINICAL LABORATORY EVALUATIONS

1. Urinary Ca, P, Na, K, and Cl
2. Urinary color, specific gravity, pH, glucose, protein, bile, blood, and microscopic (i.e., routine urinalysis - inflight)
3. Plasma volume
4. Serum electrolytes (Ca, Na, K, Cl, and P)
5. Total protein - plasma
6. Blood glucose
7. Ca and  $PO_4$  - serum
8. pH,  $pO_2$ , and  $pCO_2$  - blood
9. Hemoglobin
10. Hematocrit
11. Blood cell morphology (RBC, WBC, and diff - smear will suffice for platelets)
12. Reticulocyte count
13. RBC fragility (osmotic)
14. RBC mass and survival
15. Bleeding and coagulation times

\* \* \* \* \*

### NOTES:

1. The testing of techniques may be on standard and unknown specimens; however, specimen handling techniques peculiar to the spacecraft environment constraints must be demonstrated.

2. Clinical laboratory evaluations on B2 list will be retained in planning for follow-on phases as either postflight analyses on preserved specimens or pre- and postflight determinations. Provisions for them on an individual basis is not expected to be reflected in the IMBLMS breadboard except for the demonstration of sample identification, labeling, preservation, and storage techniques for general categories of sample sources (i.e., blood, plasma, serum, urine, etc.).

## X. ENVIRONMENTAL MEASUREMENTS

1. Temperature
2. Pressure
3. Humidity
4. Atmospheric composition ( $O_2$ ,  $CO_2$ ,  $N_2$ , and  $H_2O$  in FBB)
5. Spacecraft motion (see Note)

\* \* \* \* \*

### NOTES:

1. The measurement of temperature, pressure, atmospheric composition, and humidity in the FBB are considered essential to its function because of their basic relevance to other experiments.

2. The impact of measurement of spacecraft motion (acceleration) on the computer system will be considered, although it is not expected that it will be performed on the FBB.

3. Consideration of the measurement of toxic contaminants shall be included in all phases of the IMBLMS program.

## XI. IMBLMS BREADBOARD REQUIREMENTS - GENERAL

1. Spaceflight specimen handling and fluid transfer techniques and sample identification and storage techniques are to be demonstrated by the contractor in this IMBLMS Breadboard testing procedures. The breadboard will include such equipment as may be pertinent.

2. The contractor shall prepare history and physical examination formats for measurement categories I through VIII and provide for their display and entry into and retrieval from the data bank in the IMBLMS breadboard.

3. Every effort must be made to select the measurement techniques which show the most promise for future development into flight hardware, at this point in time, it should be recognized that some techniques currently proposed for the FBB will not be the ones to be included in the final FBB to be delivered to the NASA at the end of the Phase B3 program. Certain techniques by mutual agreement may turn out to be inadequate, too complex or time consuming to perform, or their subsequent conversion to flight hardware may be impractical or unfeasible, in which case they will be replaced by another method, if and when such a method is readily available and can be developed within the allotted schedule and budget constraints.

WORK STATEMENT TASKS

PHASE B3

- I. FBB DEFINITION
- II. FBB DESIGN
- III. FBB ASSEMBLY
- IV. FBB TEST PLANS AND PROCEDURES
- V. FBB TESTING
- VI. TEST DATA ANALYSIS
- VII. EDU REQUIREMENTS

13 MONTHS COMPETITIVE CONTRACTS

1.1 M EACH

B3 STATUS - SEPTEMBER 10, 1969

CONTRACTORS

TASK

|     |                      |
|-----|----------------------|
| I   | Complete             |
| II  | Complete             |
| III | Complete in October  |
| IV  | Complete - In Review |
| V   | Start September      |
| VI  | Start September      |
| VII | In Final Report      |

### IMBLMS Phase C1 Tasks

The goal for Phase C1 of the IMBLMS program is to initiate the design and development of a flight system.

#### Task I, Design

This includes all the subtasks and related efforts dedicated to accomplishing the Preliminary Project Design for a flight version of IMBLMS.

##### I.1 Preliminary Design Requirements

##### I.2 Preliminary Design Drawings, Analysis, and Supporting Activities

#### Task II, Program Planning

This task will determine the detailed planning needs for Phases C2 and D and will document the information in a series of Management, Technical, and Cost Plans.

#### Task III, Flight Design Mockup (non-functional)

This task is directed at assembling a non-functional mockup of the flight version IMBLMS and developing the plans and procedures for subsequently conducting a time line analysis.

#### Task IV, Time Line Analysis

This task will conduct the time line analysis using the flight version IMBLMS mockup and procedures developed in Task III. Results and recommendations will be documented in a final report.

#### Task V, Develop Vehicle Interfaces

This activity will be concerned with defining the requirements for interfacing the flight version IMBLMS with three specific vehicles (identified by NASA in the fifth month of this Phase C1) and formulating the preliminary design concepts for the respective vehicle interfaces.

PHASE C1 APPENDICES INFORMATION

- Selected Measurements List

- Preferred Techniques

NASA Selection Not Possible

Contractor Has Choice Between Preferred Techniques

Contractor Has Independent Option

- Preferred Equipment/Design Approach

- Equipment Design and Performance Requirements

- Interface Information

- Operating Criteria

- Safety Considerations

- Data Network Requirements

## ESTIMATED INTERFACE REQUIREMENTS

- Weight

|        |                                                     |
|--------|-----------------------------------------------------|
| Ascent | 1200 - 1500 Lbs.<br>(Includes 500 Lbs. Peripherals) |
| Return | 150 - 200 Lbs. (Per Resupply)                       |

- Volume

|        |                                                                          |
|--------|--------------------------------------------------------------------------|
| Ascent | 265 - 350 Ft. <sup>3</sup><br>(Includes 62 Ft. <sup>3</sup> Peripherals) |
|--------|--------------------------------------------------------------------------|

- Dimensions (Approximate)

|          |                                                                      |
|----------|----------------------------------------------------------------------|
| Consoles | 2 Each - 5 Ft. X 5.5 Ft. X 2 Ft.<br>3 Each - 5 Ft. X 3.5 Ft. X 2 Ft. |
|----------|----------------------------------------------------------------------|

- Power

|         |        |
|---------|--------|
| Average | 700 W  |
| Peak    | 1800 W |
| Standby | 50 W   |

(Total is Mission Dependent)

- Thermal

|         |              |
|---------|--------------|
| Standby | 170 BTU/Hr.  |
| Operate | 2000 BTU/Hr. |

## ESTIMATED INTERFACE REQUIREMENTS

### Operational Mode

- Temperature Control  $75^{\circ} \text{ F} \pm 5^{\circ} \text{ F}$
- Zero "G" when Conducting Weightlessness Experiments
- 12 - 15 Hours/Man/Week
- Maintenance Requirements Unknown
- 6 - 8 Hours/Day      6 Days/Week
- M.D. Crewmember Mandatory - Primary Operator
- Maintenance Technician Essential - Multi-Discipline Crewman
- Psychologist Crewmember Desirable - Secondary Operator

## ESTIMATED INTERFACE REQUIREMENTS

### Operational Mode (Continued)

- Waste Management Sampling Needed
- Waste Disposal Needed (All Wastes)
- Structural Mounting of Consoles and Peripherals
- All Consoles in Same General Area
- Console and Subject in Viewing Cone of Operator
- Training Requirements Unknown
- Vacuum Source (Controllable)
- Pressurizing Gas Capability ( $1/4 - 1/2$  psia Above Ambient)

### ESTIMATED INTERFACE REQUIREMENTS

- Data System - Accept, Compress, Handle, Process, Display, and  
Condition for Transmission to Ground
  - o Building Block Type
  - o Backup Non-Computer Mode Capability
  - o Range of Options - Self-Containment  
to  
Almost Complete S/S DMS Dependency
  - o Requires Interface with S/S Transmitter and Receiver
- Analog (Includes TV)
- Digital, Maximum Rate 64 KBS
- Film, for Use with AAP or S/S Camera
- Tape, for Digital and Analog (Including TV) Data

PHYSICAL CHARACTERISTICS  
OF  
DATA MANAGEMENT SYSTEM

Equipment Configuration: Currently Unknown

Computer Configuration: Probably --

Add Time: 2 - 4 microseconds  
Word Size: 24 - 32 bits  
Core: 16 K expandable  
Interrupts: multiple  
Weight: 30 - 100 lbs.  
Size: .5 to 2 ft.<sup>3</sup>  
Mass storage: Tape or disk  
A/D Conversion  
Rate: 10 K SPS of 8 bit words

## DATA MANAGEMENT SYSTEM

• PURPOSE: To provide for onboard

- o Flexibility and Growth
- o Accuracy
- o Faster and simpler operations
- o Better experimental control
- o Safety indications
- o Effective man/machine interface

• FUNCTION:

- o Input (wired and manual)
- o Condition signals
- o Control and interrupt
- o Process and/or compress
- o Display
- o Format for output
- o Housekeeping, events, and status

• TYPES OF OUTPUT:

- o Analog
- o Digital
- o Alphanumeric
- o Film (camera and TV)
- o Magnetic tape

### TRADE-OFF FACTORS

Considered in Sizing OWS Data Management  
System for IMBLMS

1. Accuracy, Reliability, and Degree of "Special Purpose"  
Hardware to Pre-process IMBLMS Data
2. Worst-case Experiment Selections (Accuracy and Duration  
Required)
3. Capacity of Onboard Computer to Control, Process, and  
Compress Data
4. Capacity of Data Relay Satellite
5. Capacity of Ground Telemetry Network
6. Capacity of Ground Computer Support

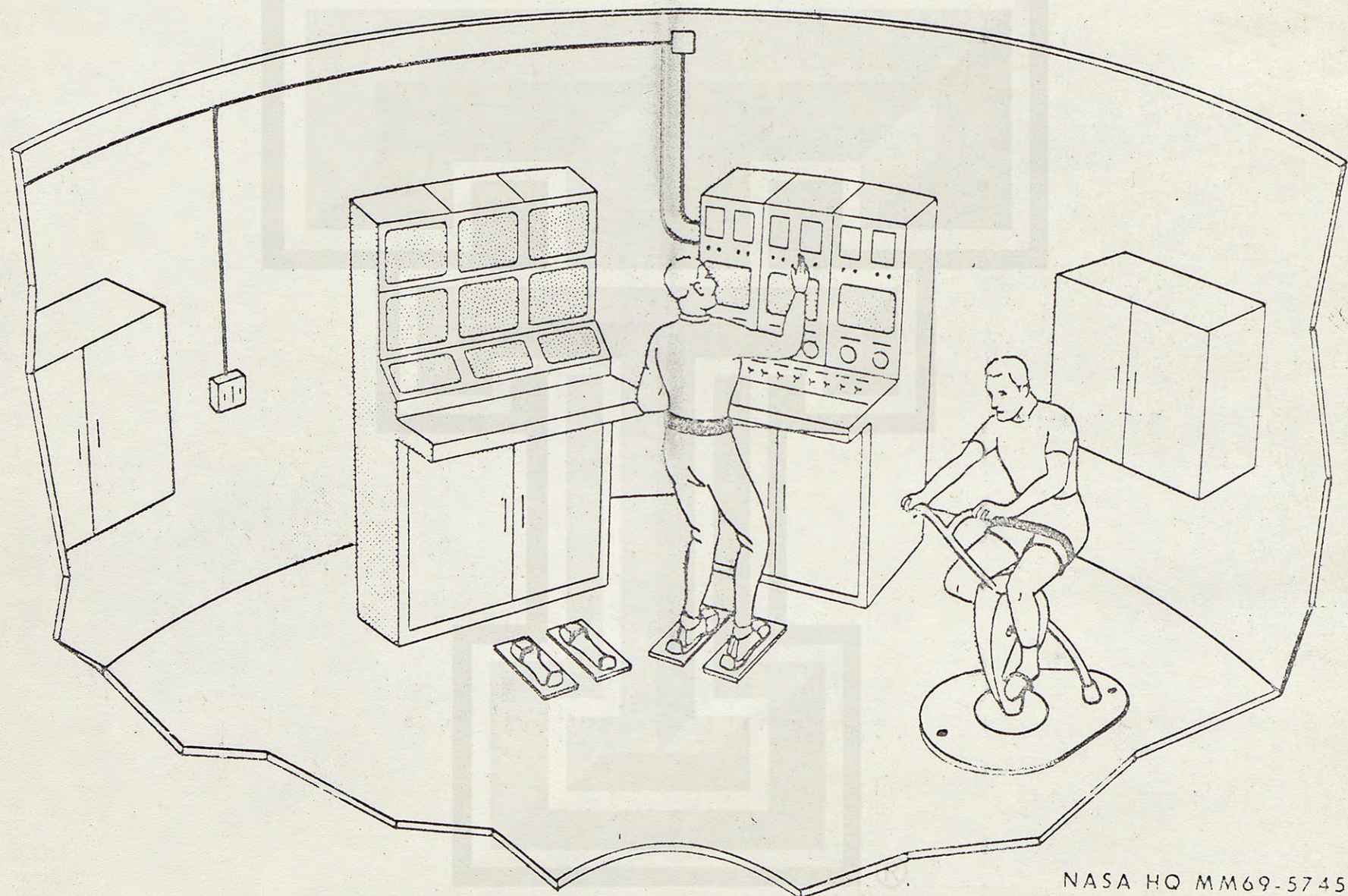
SOME HIGH SAMPLE RATE PARAMETERS IN IMBLMS

| <u>MEASUREMENT</u>                           | <u>NO. OF<br/>LEADS</u> | <u>SAMPLING<br/>RATE/LEAD (SPS)</u> |
|----------------------------------------------|-------------------------|-------------------------------------|
| Electro-oculogram (EOG)                      | 2                       | 500                                 |
| Electroencephalogram (EEG)                   | 3                       | 500                                 |
| Electromyogram (EMG)                         | 1                       | 5,000                               |
| Vectorcardiogram (VCG)                       | 3                       | 500                                 |
| Phonocardiogram (PCG)                        | 1                       | 5,000                               |
| Arterial Blood Pressure<br>(Korotkoff Sound) | 1                       | 500                                 |
| Blood Flow (Doppler Flow Meter)              | 1                       | 500                                 |
| Ballistocardiogram                           | 3                       | 500                                 |

# IMBLMS

(25)

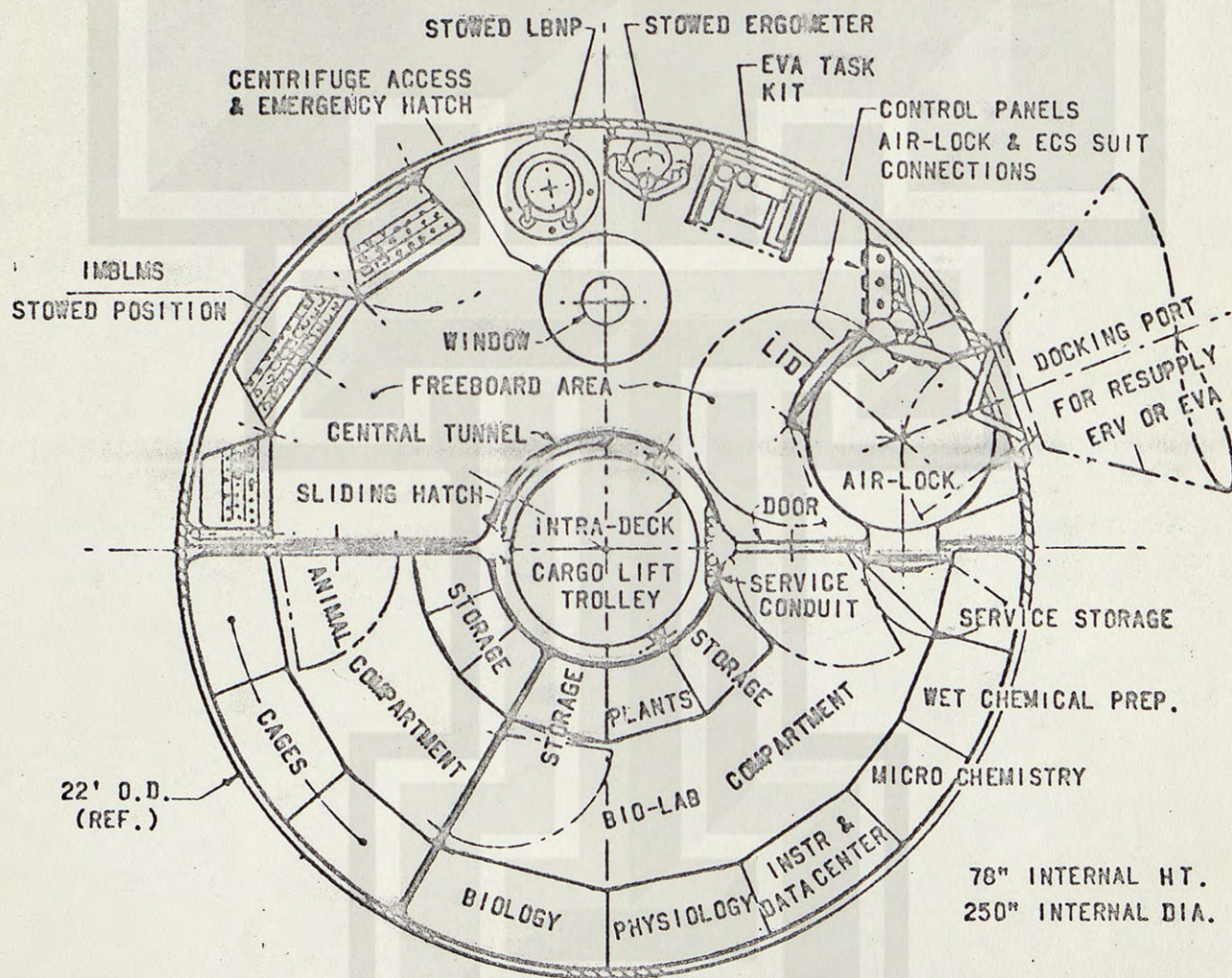
INTEGRATED MEDICAL/BEHAVIORAL LABORATORY MEASUREMENT SYSTEM



NASA HQ MM69-5745

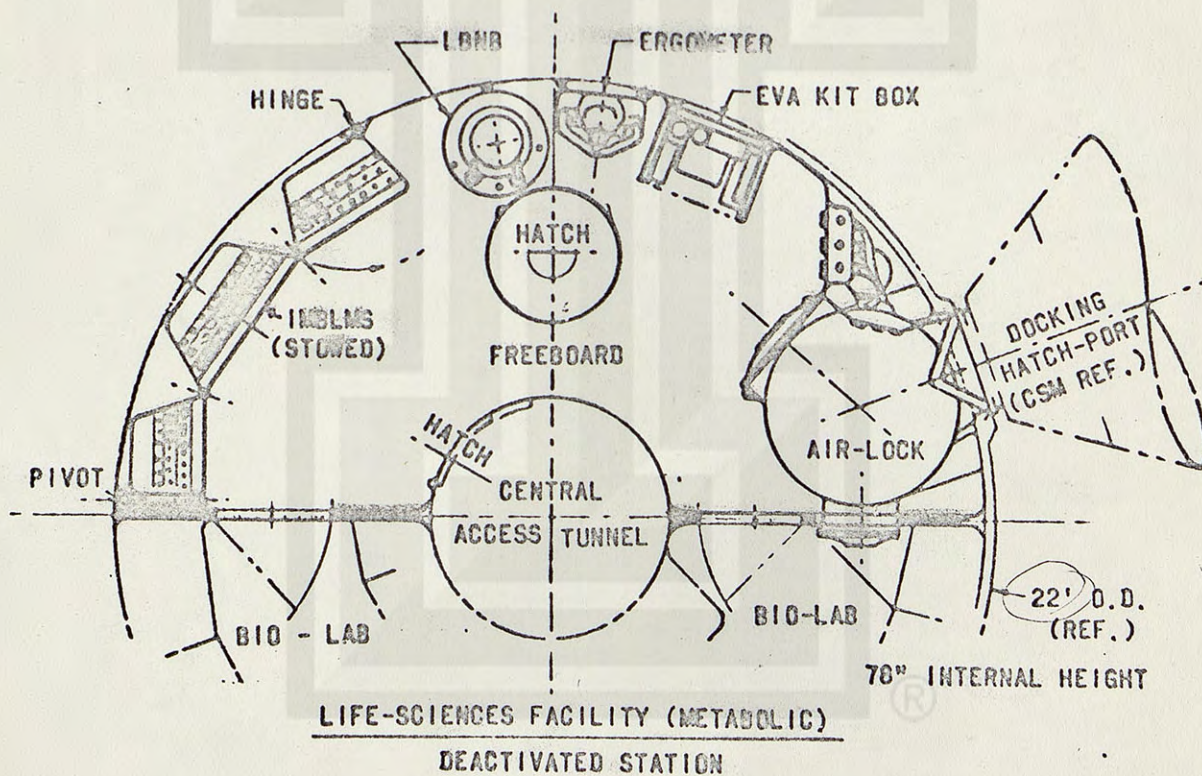
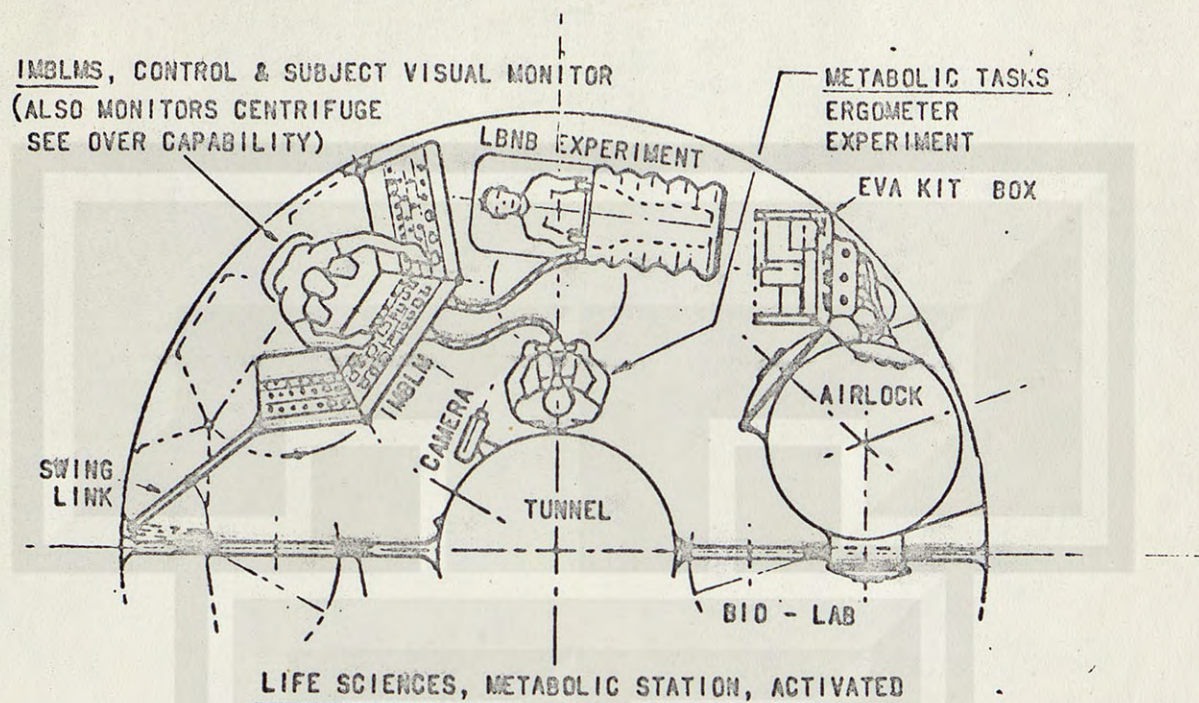
6-27 69

26

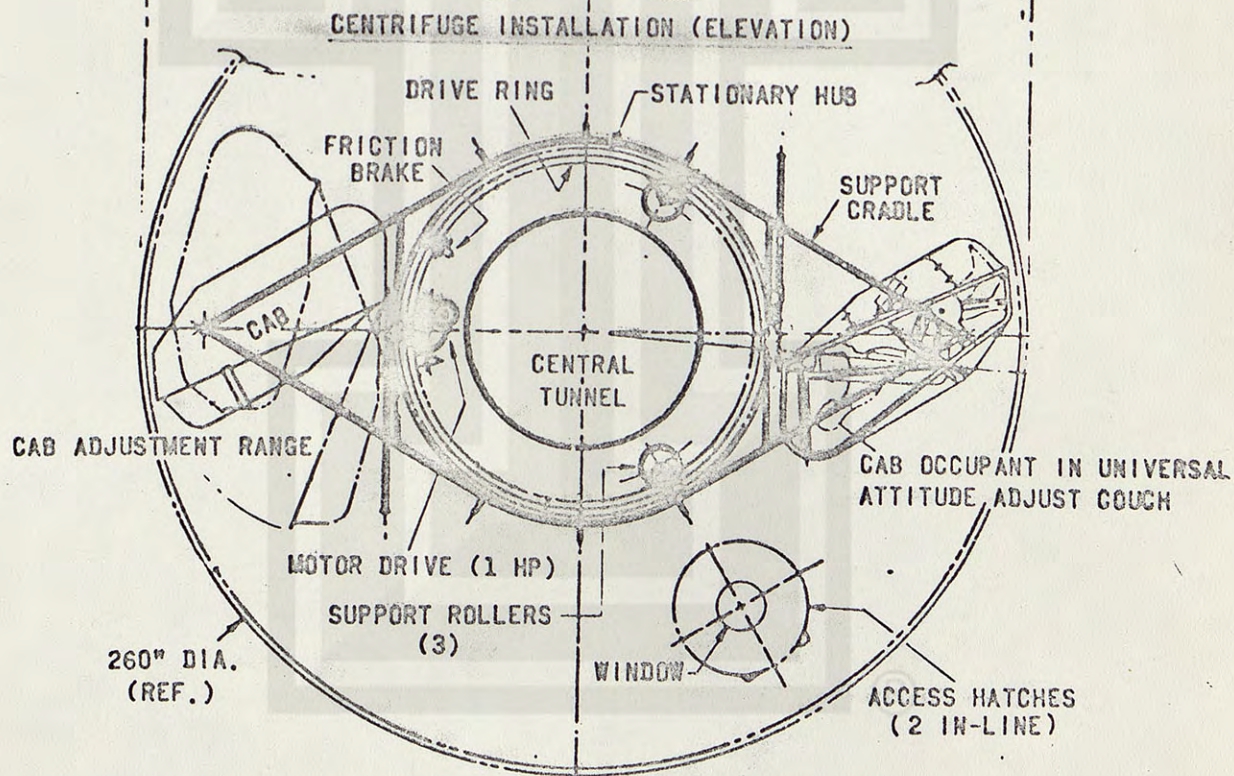
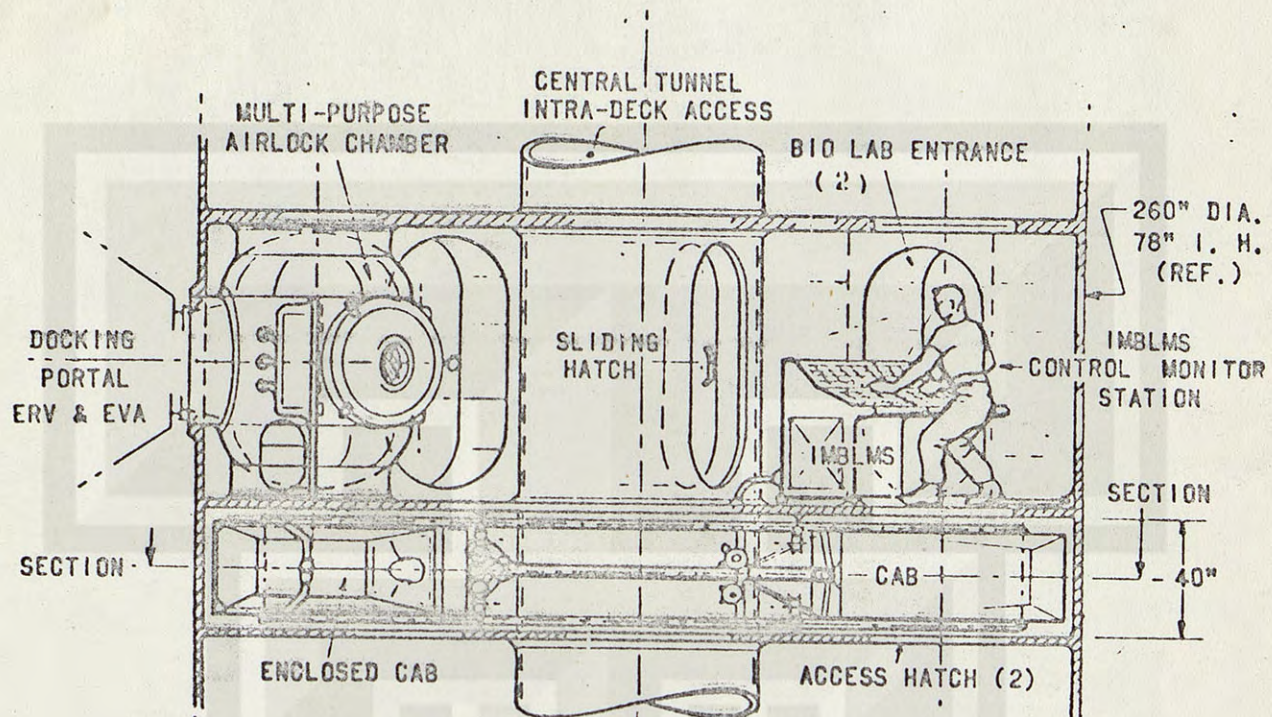


LIFE SCIENCES FACILITY ALLOCATION  
(PLAN VIEW)

27

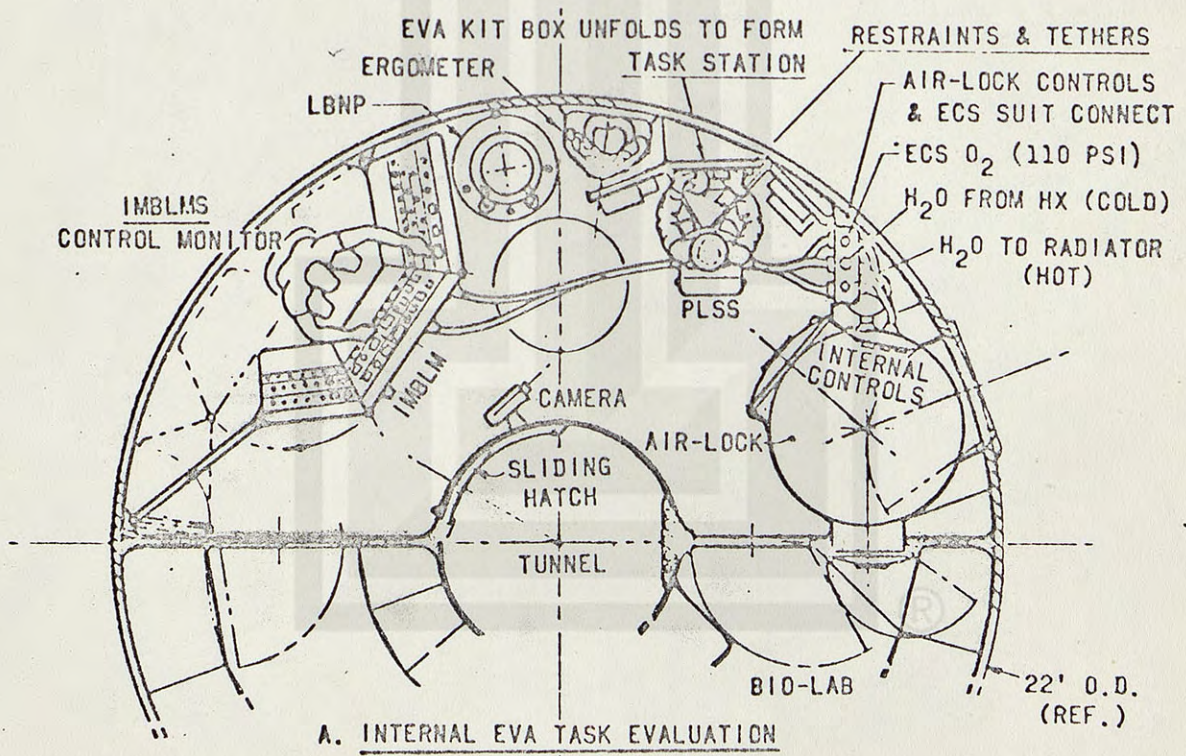
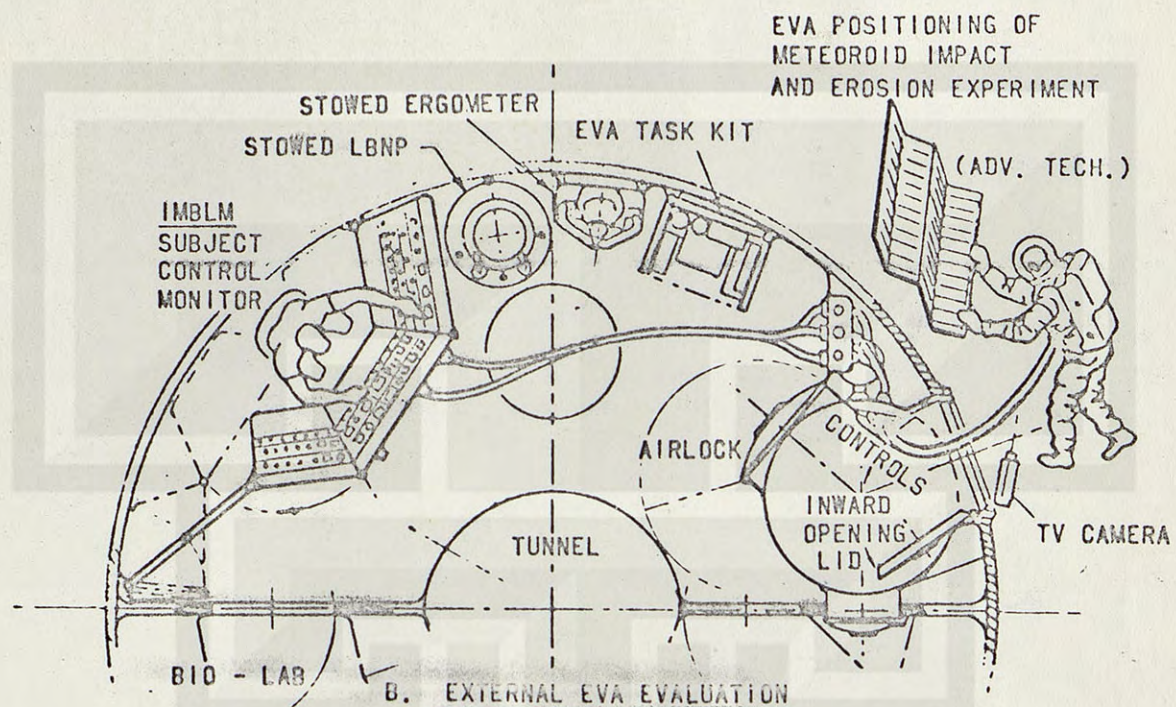


LIFE SCIENCES FACILITY (METABOLIC)



CENTRIFUGE INSTALLATION, PLAN VIEW

LIFE SCIENCES FACILITY, CENTRIFUGE ACCOMMODATION



LIFE SCIENCES FACILITY, EVA TASK UTILIZATION