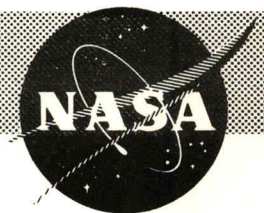




## SKYLAB FAMILIARIZATION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



## ERRATA

The Skylab Familiarization handout should be updated to reflect the following:

PAGE 9    was:    SL-3 Launch July 24, 1973  
          is:    SL-3 Launch July 29, 1973

PAGE 10   was:    SL-4 Launch October 28, 1973  
          is:    SL-4 Launch October 31, 1973  
          was:    CSM Splashdown November 23, 1973  
          is:    CSM Splashdown December 26, 1973

PAGE 21   was:    IU/DP-1 255.1  
          is:    IU/DP-1 245.3  
          was:    IU/DP-IB 2101.8  
          is:    IU/DP-IB 2285.1

PAGE 31   was:    CSM 2106.4  
          is:    CSM 2287.5  
          add:    2272.5 as the S-band transmitter frequency

PAGE 82   change:    Frequency of 10W transmitter to 230.4



## SKYLAB FAMILIARIZATION

## PRESENTATION OUTLINE

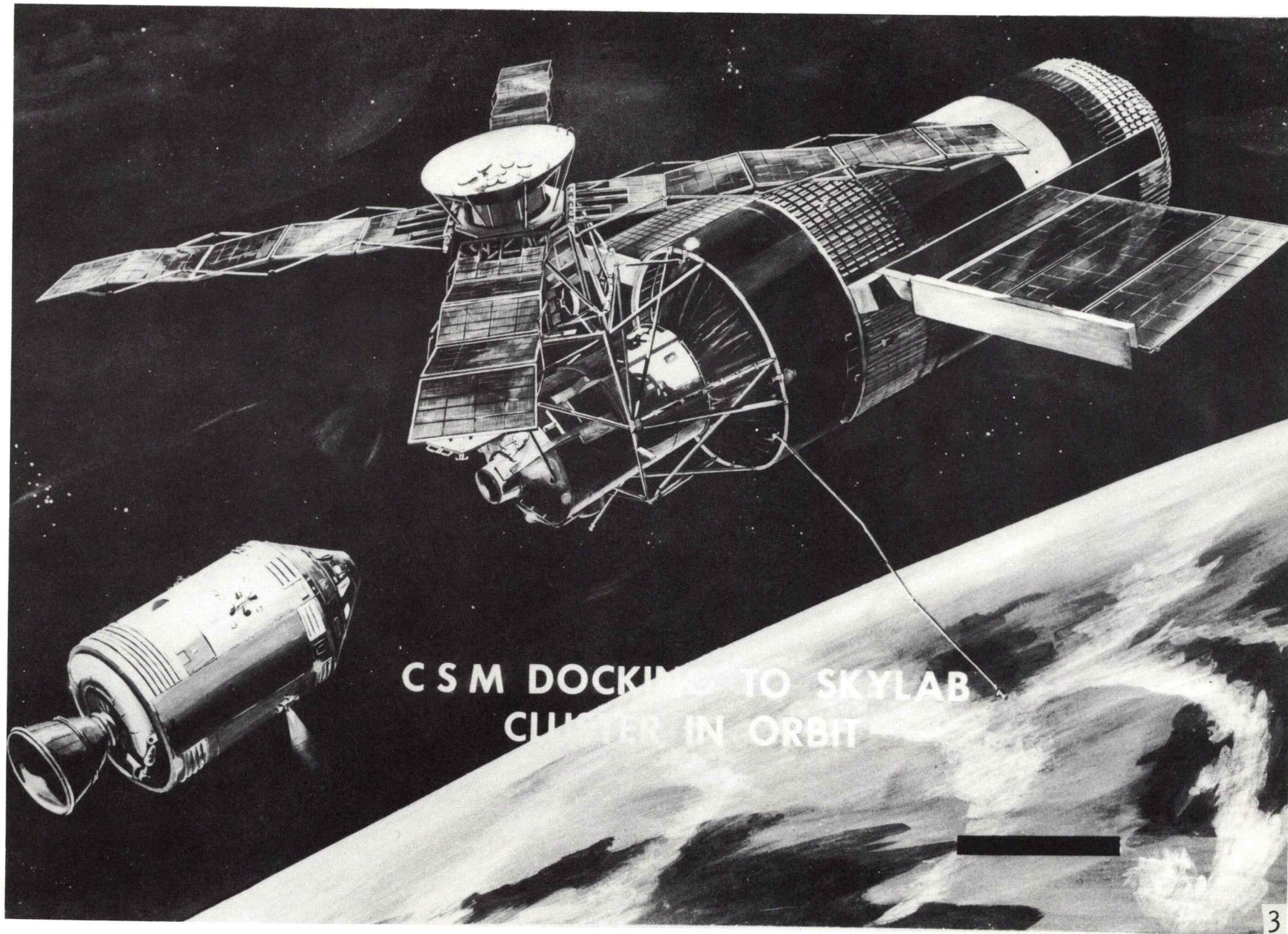
### 0 MISSION

- LAUNCH VEHICLE AND SATURN WORKSHOP DESIGN AND PROGRAM OBJECTIVES
- OVERVIEW OF THE SKYLAB EXPERIMENTS
- OVERVIEW OF THE FOUR SKYLAB MISSIONS
- SKYLAB 1 MISSION
- SKYLAB 2, 3, AND 4 MISSIONS
- COMPOSITE SUMMARY OF THE FOUR SKYLAB MISSIONS

### 0 SATURN WORKSHOP MODULES

- OA SYSTEMS INTERFACES; COMMUNICATIONS, POWER TELEVISION, CAUTION AND WARNING
- ATM FUNCTIONAL DESCRIPTIONS AND EXPERIMENTS
- MDA FUNCTIONAL DESCRIPTIONS AND EXPERIMENTS
- AM FUNCTIONAL DESCRIPTIONS
- OWS FUNCTIONAL DESCRIPTIONS AND EXPERIMENTS





## SKYLAB MISSION DESCRIPTIONS

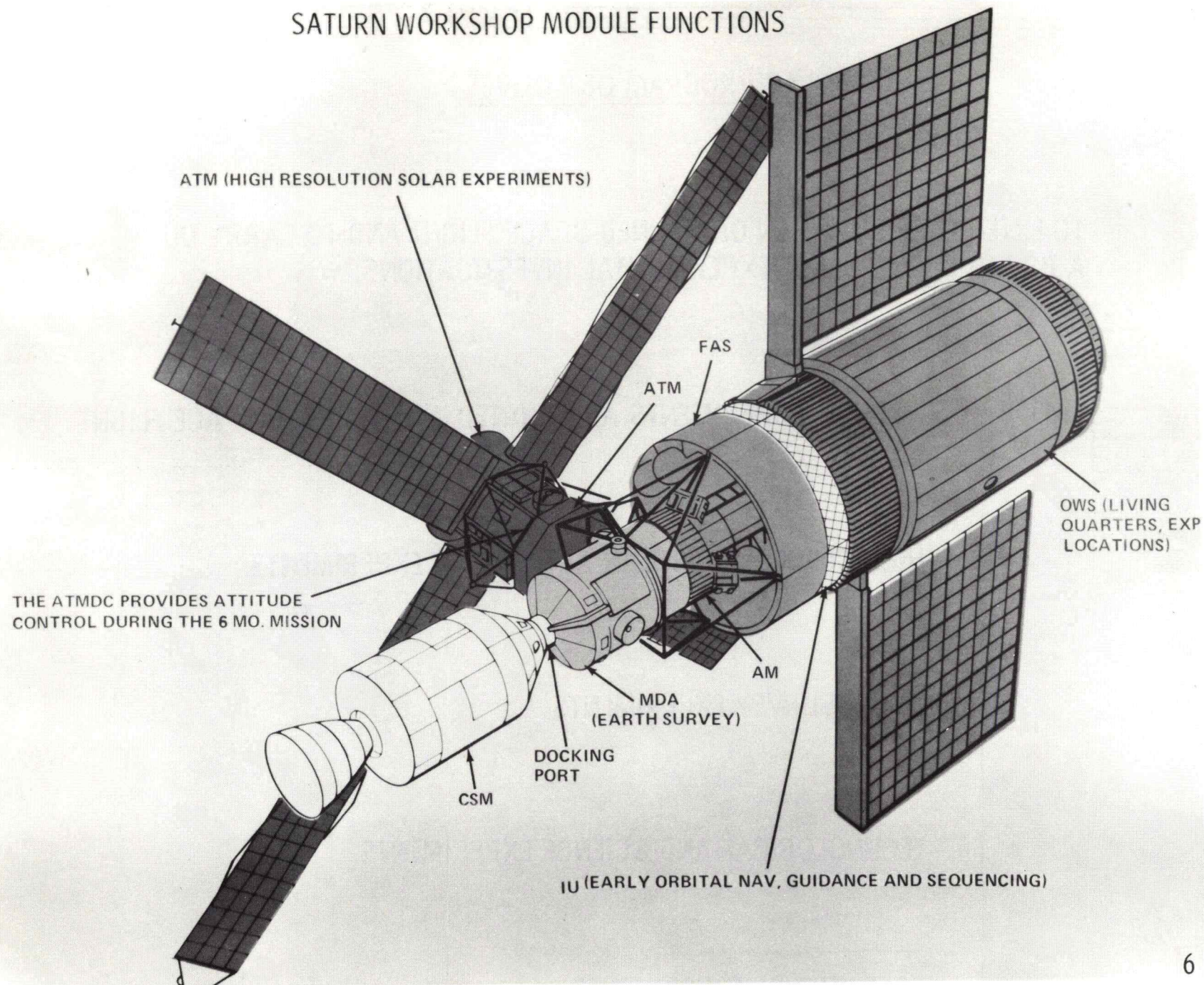


## SKYLAB PROGRAM OBJECTIVES

TO EXTEND THE DURATION OF MANNED SPACE FLIGHT AND TO CARRY OUT  
A BROAD SPECTRUM OF EXPERIMENTAL INVESTIGATIONS

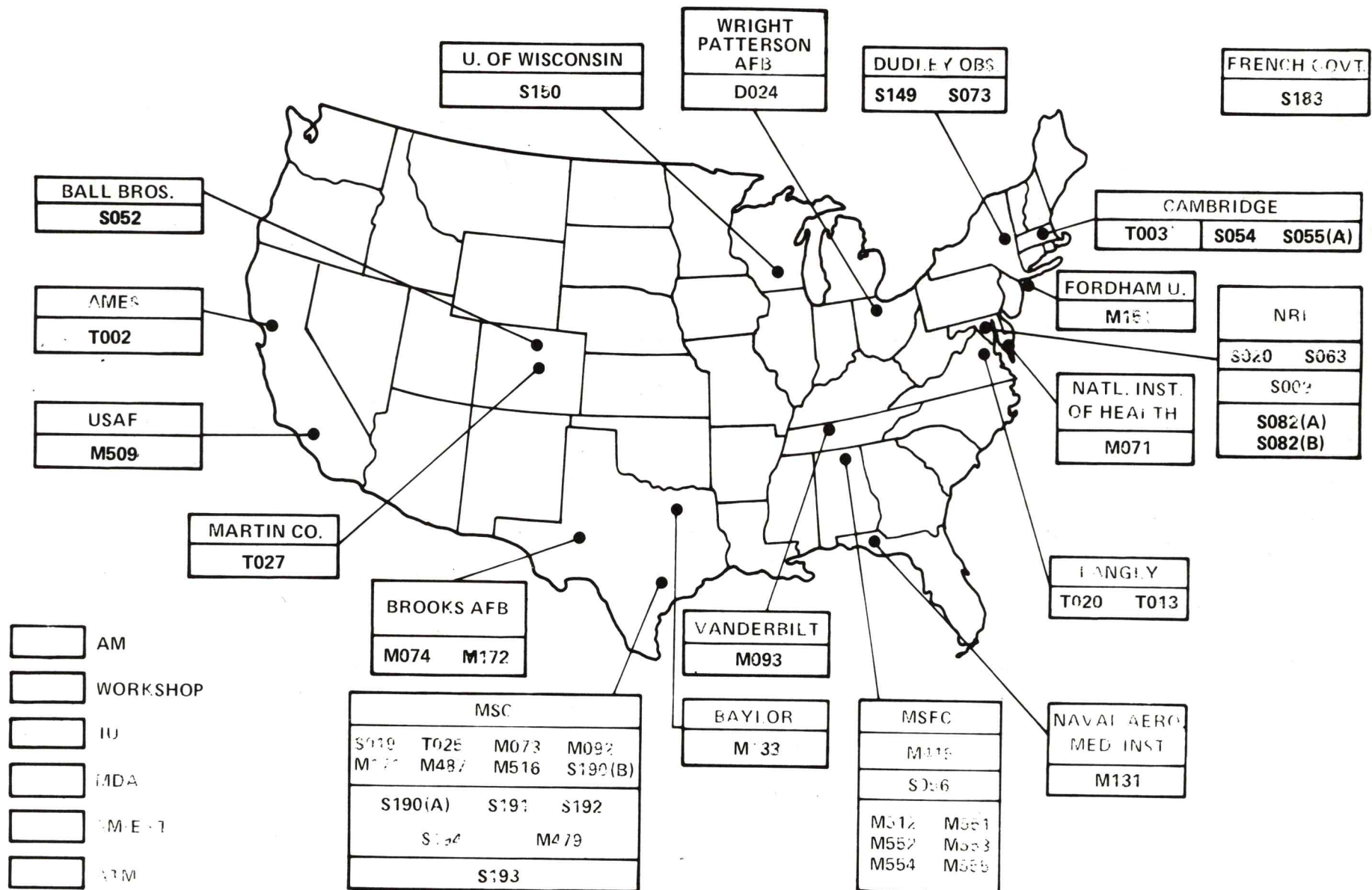
- 0 MEDICAL EXPERIMENTS ASSOCIATED WITH MANNED SPACE FLIGHT
- 0 HIGH RESOLUTION SOLAR ASTRONOMY EXPERIMENTS
- 0 EARTH SURVEY EXPERIMENTS
- 0 TECHNOLOGICAL AND SCIENCE EXPERIMENTS
- 0 OPERATIONAL EXPERIMENTS

## SATURN WORKSHOP MODULE FUNCTIONS

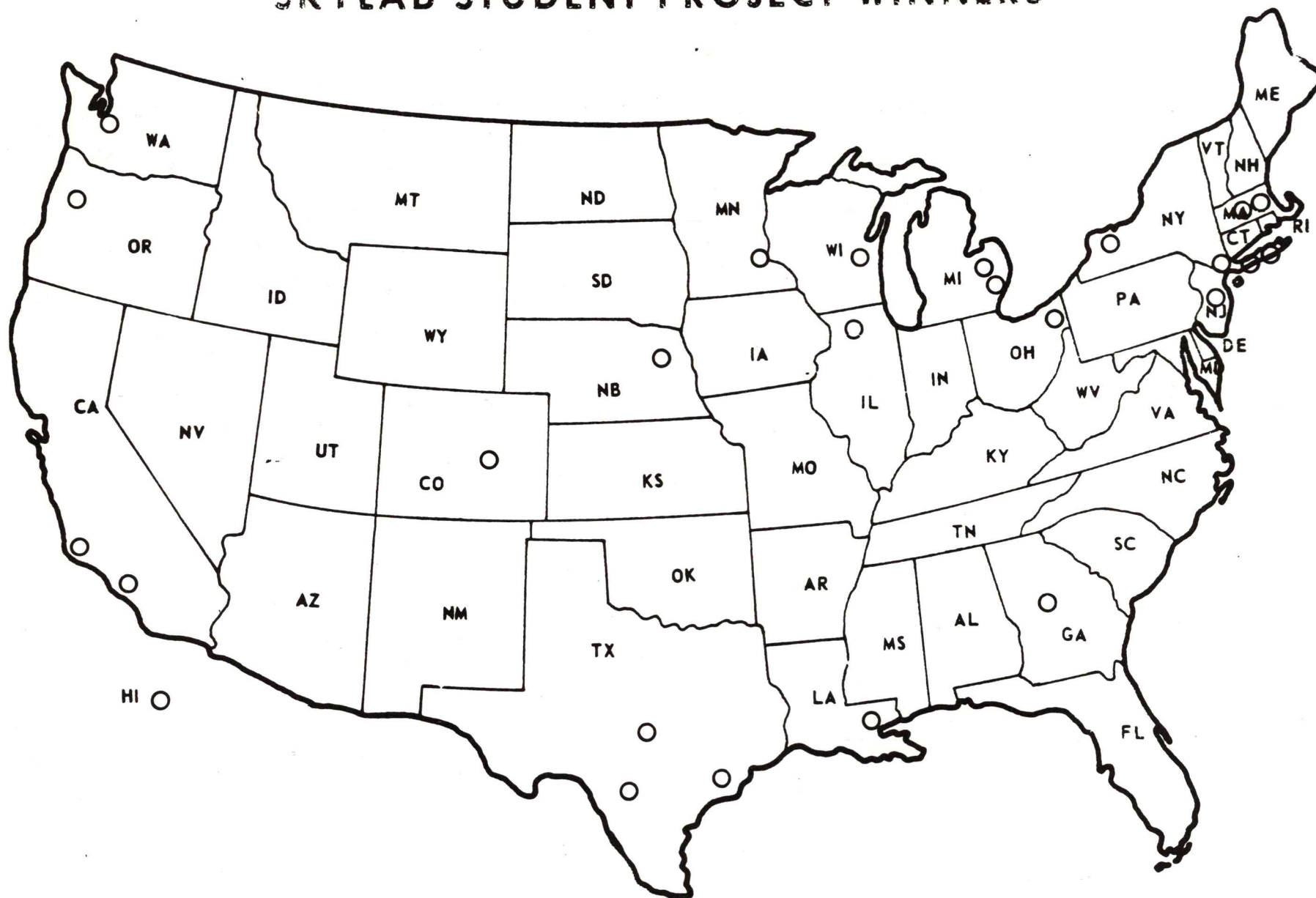




# SKYLAB EXPERIMENTS PRINCIPAL INVESTIGATOR LOCATIONS



## KYLAB STUDENT PROJECT WINNERS







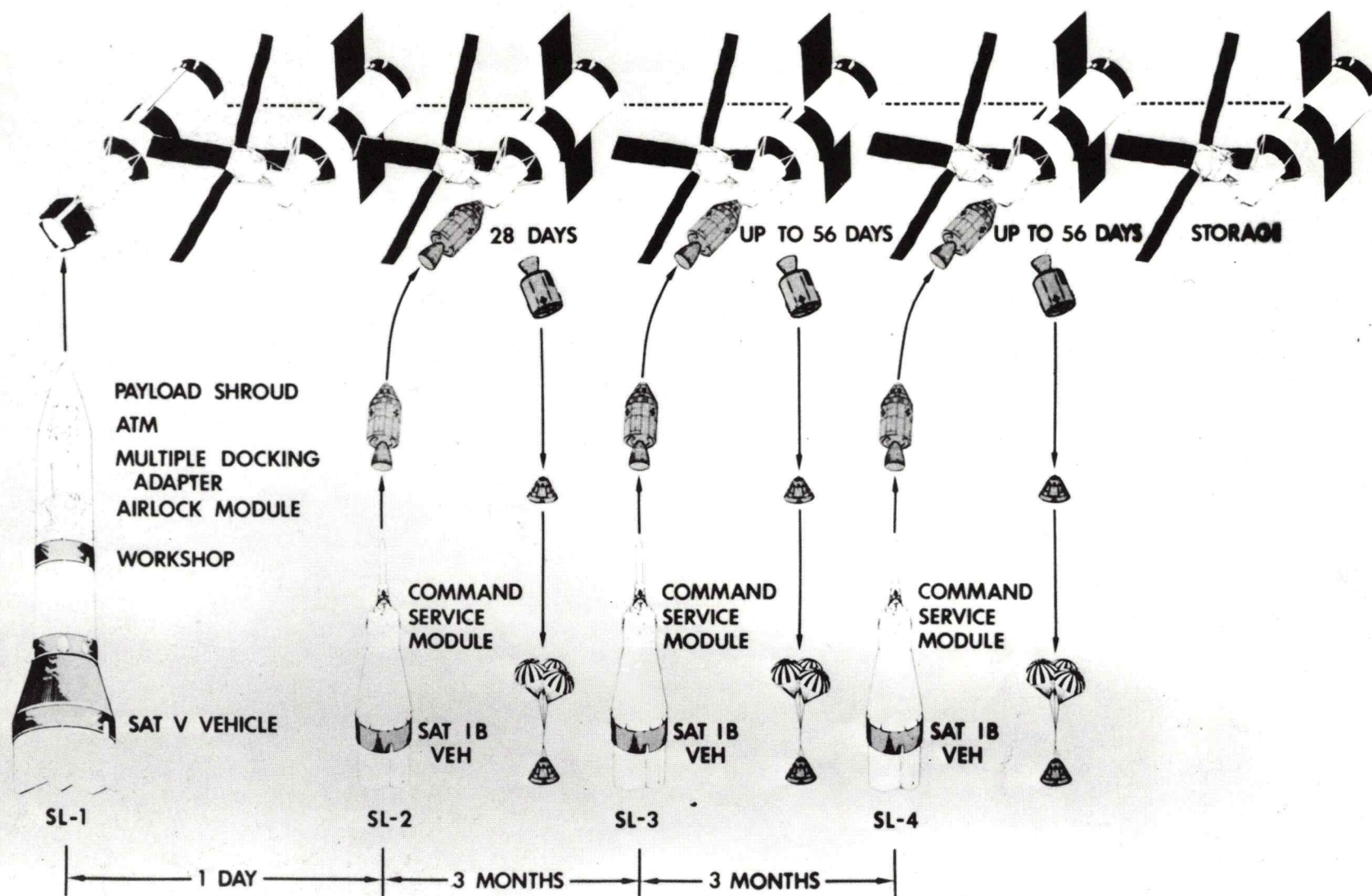
## SKYLAB PROGRAM MAJOR MISSION EVENTS

- o SL-1 LAUNCH APRIL 30, 1973
  - FROM LAUNCH COMPLEX 39A BOOST UNMANNED WORKSHOP TO 233.8 NM ORBIT
  - ACTIVATE WORKSHOP FOR HABITATION
  
- o SL-2 LAUNCH MAY 1, 1973
  - FROM LAUNCH COMPLEX 39B BOOST MANNED CSM TO 81 x 120 NM ORBIT
  - RENDEZVOUS CSM WITH WORKSHOP~8 HRS GET
  - CSM SPLASHDOWN MAY 29, 1973 (28 DAYS)
  
- o SL-3 LAUNCH JULY 24, 1973
  - FROM LAUNCH COMPLEX 39B BOOST MANNED CSM TO 81 x 120 NM ORBIT
  - RENDEZVOUS CSM WITH WORKSHOP~ 8 HRS GET
  - CSM SPLASHDOWN SEPTEMBER 24, 1973 (56 DAYS)

SKYLAB PROGRAM MAJOR MISSION EVENTS (cont)

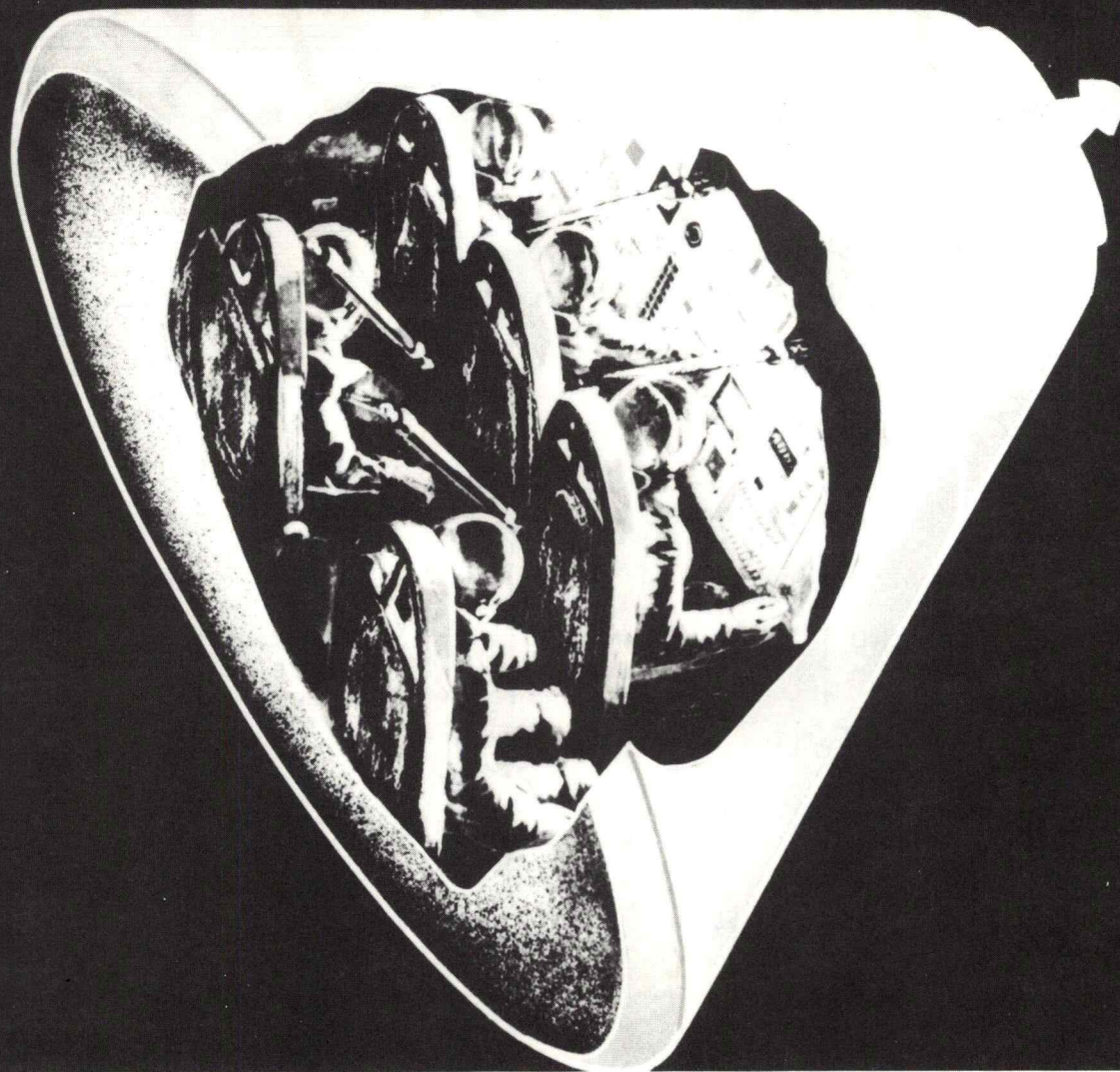
- o SL-4 LAUNCH OCTOBER 28, 1973
  - FROM LAUNCH COMPLEX 39B BOOST MANNED CSM TO 81 x 120 NM ORBIT
  - RENDEZVOUS CSM WITH WORKSHOP ~8 HRS GET
  - CSM SPLASHDOWN NOVEMBER 23, 1973 (56 DAYS)
  
- o SL-R
  - RESCUE 3 WORKSHOP CREW MEMBERS IN THE EVENT OF A DISABLED DOCKED CSM
  - TWO CREWMEN UTILIZE NEXT IN LINE CSM AND LV, AS-209 USED FOR SL-4
  - TIME TO RESCUE FROM TIME OF FAILURE VARIABLE (10-48 DAYS)

# SKYLAB ACTIVATION AND OPERATION





# SKYLAB CREW RESCUE COMMAND MODULE



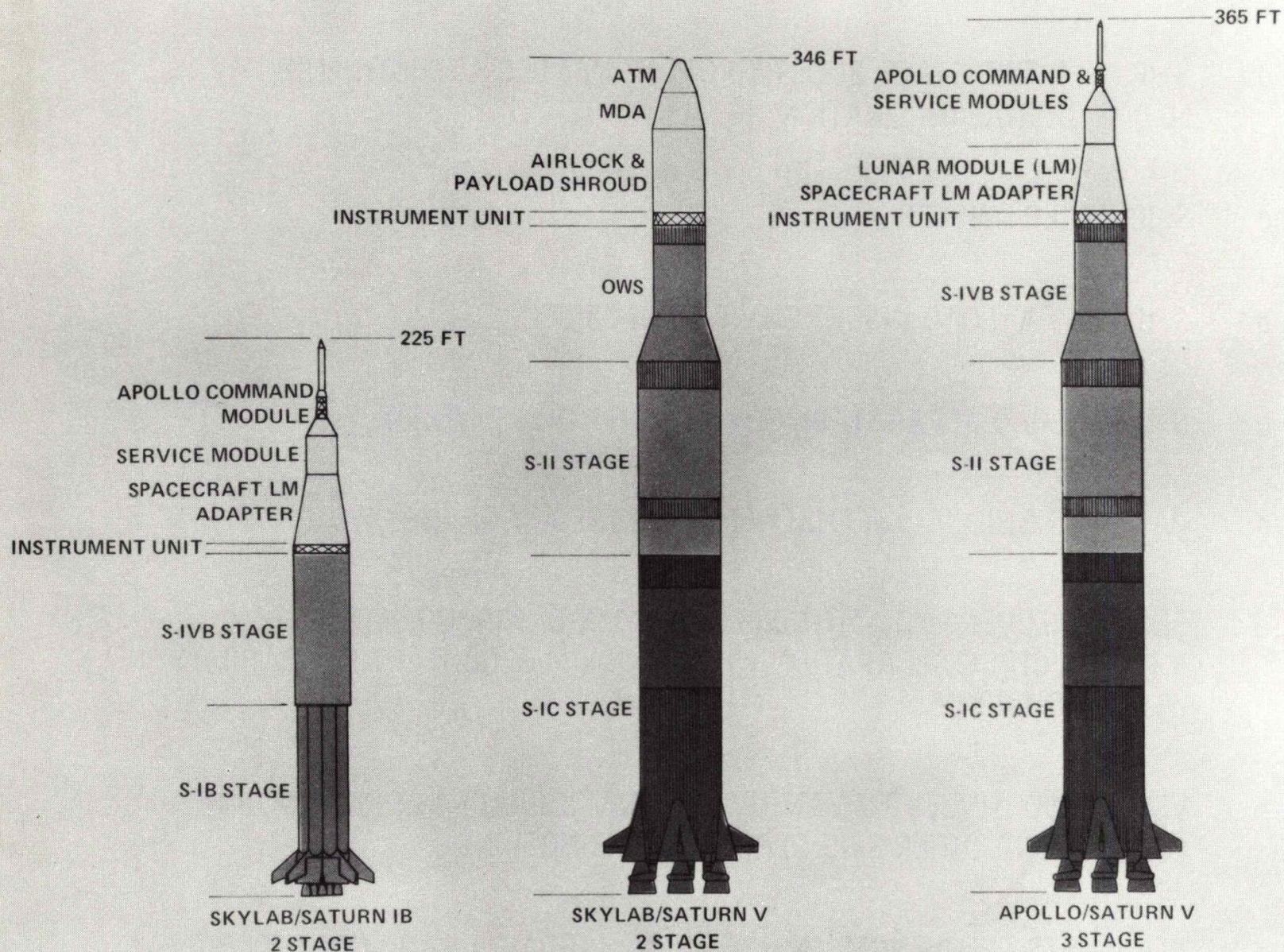


SL-1 LAUNCH TO PAYLOAD SHROUD JETTISON

- 0 S-IC, S-II TWO STAGE BOOST TO ORBIT 44.7 DEG AZIMUTH AND 50 DEG ORBITAL INCLINATION
- 0 S-IC WATER IMPACT
- 0 S-II AND PAYLOAD INSERTION AT 9 MIN 38 SEC
- 0 S-II/PAYLOAD SEPARATION, S-II PASSIVATION IN ORBIT
- 0 RADIATOR SHIELD IS JETTISONED FROM THE AFT OF THE OWS
- 0 SL-1 MANEUVERS TO ATTITUDE FOR PAYLOAD SHROUD JETTISON, A PYROTECHNIC SEPARATION WITH MINIMUM RECONTACT PROBABILITY WITH SWS AND CSM
- 0 VEHICLE CONTINUES TO MANEUVER TO RETROGRADE IN PREPARATION FOR ATM AND OTHER SWS DEPLOYMENT FUNCTIONS
- 0 ALL EVENTS, SEQUENCES, NAVIGATION, GUIDANCE, AND CONTROL HAVE BEEN CONTROLLED BY THE INSTRUMENT UNIT (IU)



# LAUNCH CONFIGURATIONS





# SKYLAB WORKSHOP LAUNCH CONFIGURATION

SKYLAB PAYLOAD

SATURN V

LAUNCH COMPLEX 39A

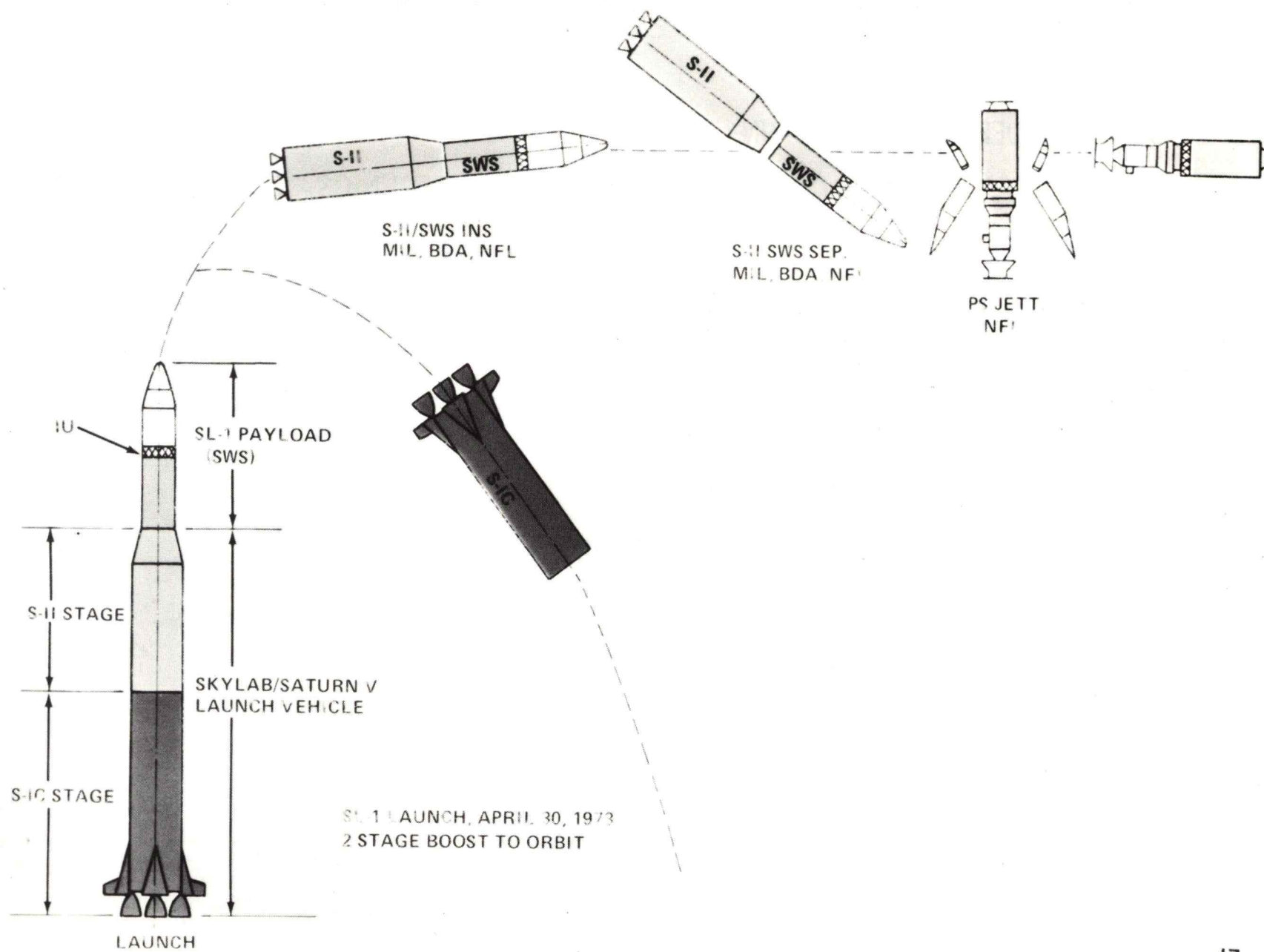


SL-1 LAUNCH TO PAYLOAD SHROUD JETTISON

- o S-IC, S-II TWO STAGE BOOST TO ORBIT 44.7 DEG AZIMUTH AND 50 DEG ORBITAL INCLINATION
- o S-IC WATER IMPACT
- o S-II AND PAYLOAD INSERTION AT 9 MIN 38 SEC
- o S-II/PAYLOAD SEPARATION, S-II PASSIVATION IN ORBIT
- o RADIATOR SHIELD IS JETTISONED FROM THE AFT OF THE OWS
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- o VEHICLE CONTINUES TO MANEUVER TO RETROGRADE IN PREPARATION FOR ATM AND OTHER SWS DEPLOYMENT FUNCTIONS
- o ALL EVENTS, SEQUENCES, NAVIGATION, GUIDANCE, AND CONTROL HAVE BEEN CONTROLLED BY THE INSTRUMENT UNIT (IU)



# SL-1 MISSION (DAY 0)



## SL-1 ORBITAL EVENT SEQUENCING

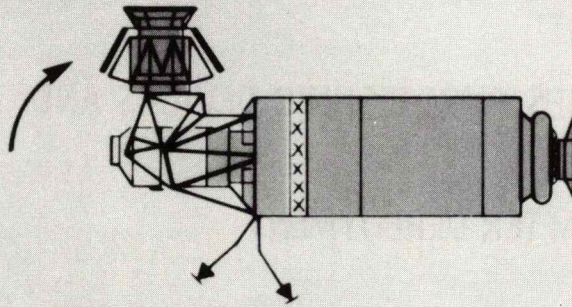
- o ATM DEPLOYMENT ~ 3 MIN
  - ATM IS DEPLOYED VIA A SERIES OF PYROTECHNICS, SPRINGS, LATCHES, AND MOTORS
  - INITIAL SEQUENCING VIA IU, AM DIGITAL COMMAND SYSTEM IS USED AS A BACKUP AS WITH OTHER DEPLOYMENTS
- o AM DISCONE ANTENNA DEPLOYMENT
  - GROUND COMMANDED TO RELEASE RETAINING DEVICES
  - SCISSOR ASSEMBLY AND SPRINGS FOLD OUT ANTENNAS
- o ATM SOLAR ARRAY SYSTEM DEPLOYMENT
  - TWO FUNCTIONS, DECINCHING AND DEPLOYMENT
  - DECINCHING EMPLOYS PYROTECHNICS TO RELEASE MECHANICAL LOCKS ON SAS
  - DEPLOYMENT UTILIZES TORQUE MOTORS, CABLES, MECHANICAL LATCHES, AND LIMIT SWITCHES

SL-1 ORBITAL EVENT SEQUENCING (cont)

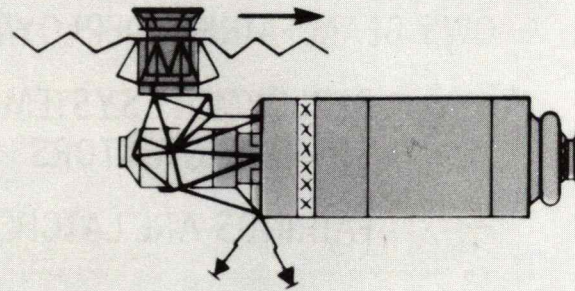
- o OWS BEAM FAIRING DEPLOYMENT
  - DEPLOYMENT SYSTEM USES PYROTECHNIC DEVICES AND SPRING ACTUATORS
  - FAIRINGS ARE LATCHED AFTER DEPLOYMENT
- o OWS WING DEPLOYMENT
  - PYROTECHNICS AGAIN USED TO UNCINCH PANELS
  - PANELS DEPLOY ACCORDIAN STYLE
- o OWS METEOROID SHIELD DEPLOYMENT
  - A CYCLINDRICAL CASING AROUND OWS
  - DEPLOYED BY PYROTECHNICS AND TORSION BAR
  - ALL DEPLOYMENT SYSTEMS ARE SEQUENCED BY THE IU WITH BACKUP CAPABILITY VIA STDN AM DCS
- o THRUSTER ATTITUDE CONTROL SWITCHOVER FROM IU TO ATM ON THIRD ORBIT
- o ATM TACS TO ATM CMG CONTROL BETWEEN 9 AND 12 HOURS GET



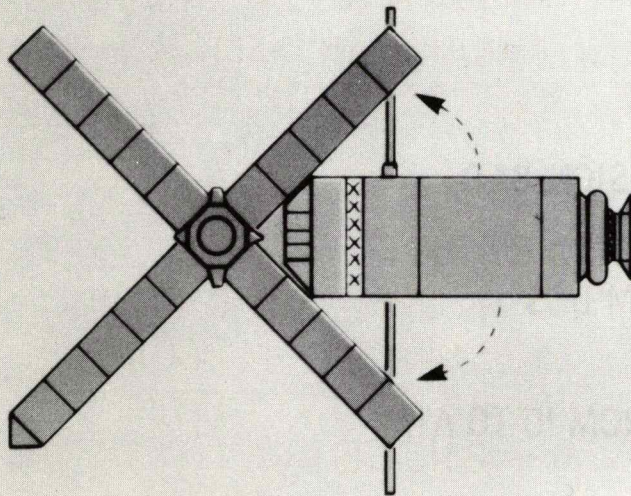
# SL-1 MISSION (DAY 0)



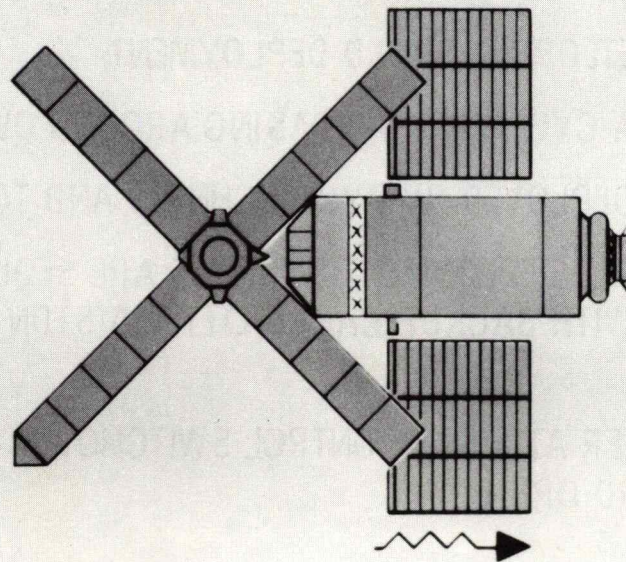
ATM DEPLOYMENT  
NFL MAD



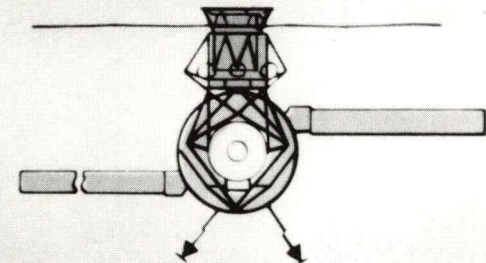
ATM SAS DEPLOYMENT  
MAD



OWS BEAM FAIRING DEPLOYMENT



OWS WING DEPLOYMENT







SL-1 LV COMMUNICATIONS LINKS

<u>STAGE/CARRIER</u>	<u>FREQ (MHz)</u>	<u>SYSTEM ACT PERIOD</u>	<u>REMARKS</u>
S-IC/AF-1	256.2	LIFTOFF	NON-ORBITAL, BOOST ONLY
S-IC/AP-1	244.3	LIFTOFF	NON-ORBITAL, BOOST ONLY
S-II/BF-1	240.2	LIFTOFF TO END OF BATTERY LIFETIME	PASSIVATION SUPPORT REQUIRED TO INSERTION PLUS 90 MINUTES
S-II/BF-2	232.9		
S-II/BP-1	248.6		
IU/DF-1	250.7	LIFTOFF TO END OF BATTERY LIFETIME	DF-1, DP-1, AND C-BAND SUPPORT TO ~ 14 HOURS, DP-1B BATTERY LIFETIME ~ 40 HOURS
IU/DP-1	<del>255.1</del> 245.3		
IU/DP-1B	2101.8 2285.1		
IU/C-BAND	5765.0		

SWS COMMUNICATIONS LINKS

<u>MODULE</u>	<u>FREQUENCY</u>	<u>SYSTEM ACT PERIOD</u>	<u>REMARKS</u>
ATM	231.9	ACTIVATED AFTER ATM SAS DEPLOYMENT	ATM RF LINK COMPLETELY SWITCHABLE
ATM	237.0	ACTIVATED AFTER ATM SAS DEPLOYMENT	CONFIGURED INITIALLY FOR RECORDER DOWNLINK
ATM	450.0	RECEIVER/DECODER POWERED UP AT APCS ACTIVATE (27 min GET)	TAPE RECORDER DUMPS AND NAVIGATION UPDATES NOMINAL STDN COMMAND ACTIVITY

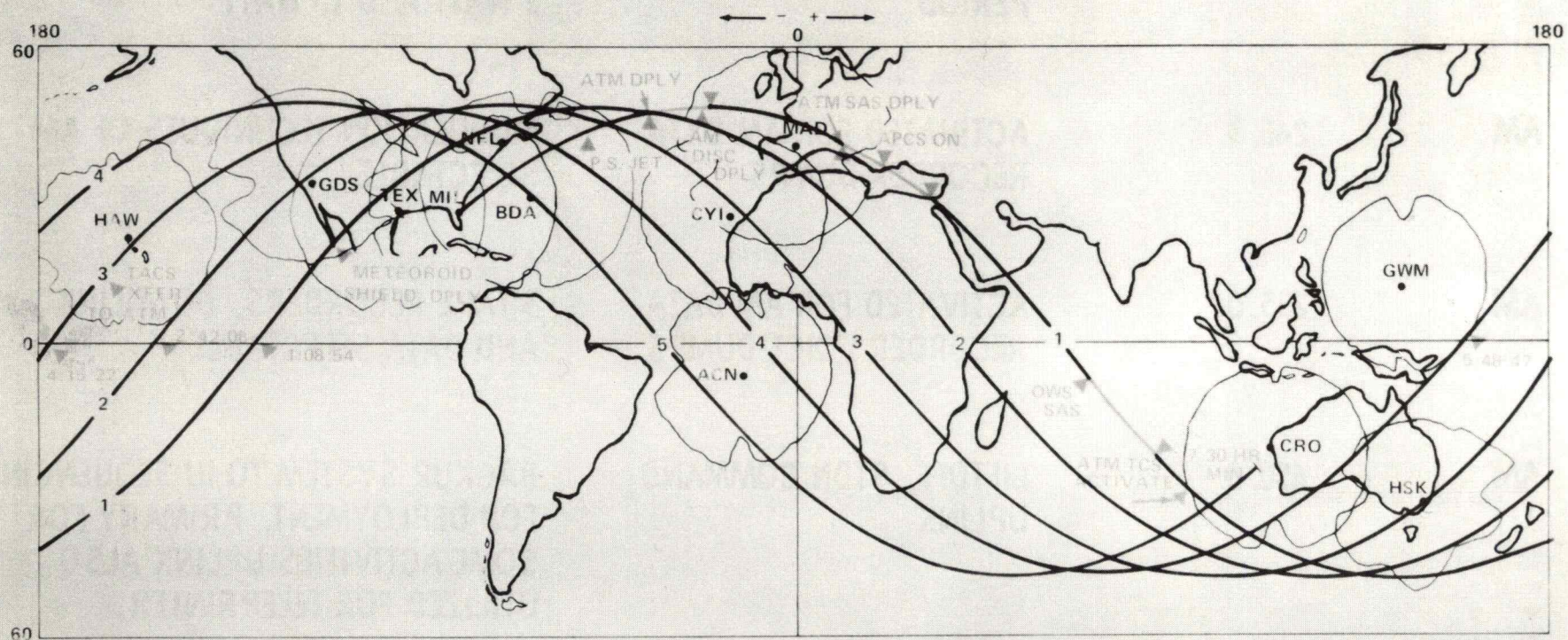


### SWS COMMUNICATIONS LINKS

<u>MODULE</u>	<u>FREQUENCY</u>	<u>SYSTEM ACT PERIOD</u>	<u>REMARKS</u>
AM	230.4	LIFTOFF THROUGH ORBITAL PERIOD	PRIMARY RT DOWNLINK, 2 XMTRS, 2 WATT AND 10 WATT
AM	246.3	ACTIVATED FOR AM DATA RECORDER DUMPS	MODULATION TECHNIQUES OF AM SELECTABLE
AM	235.0	ACTIVATED FOR AM DATA RECORDER VOICE DUMPS	3 TAPE RECORDERS, DOWNLINK AND DATA SELECTABLE
AM	450.0	LIFTOFF, STDN COMMAND UPLINK	BACKUP SYSTEM TO IU SEQUENCING FOR DEPLOYMENT, PRIMARY FOR SOME ACTIVITIES UPLINK ALSO UTILIZED FOR TELEPRINTER



# SL-1 ORBITAL GROUND TRACE



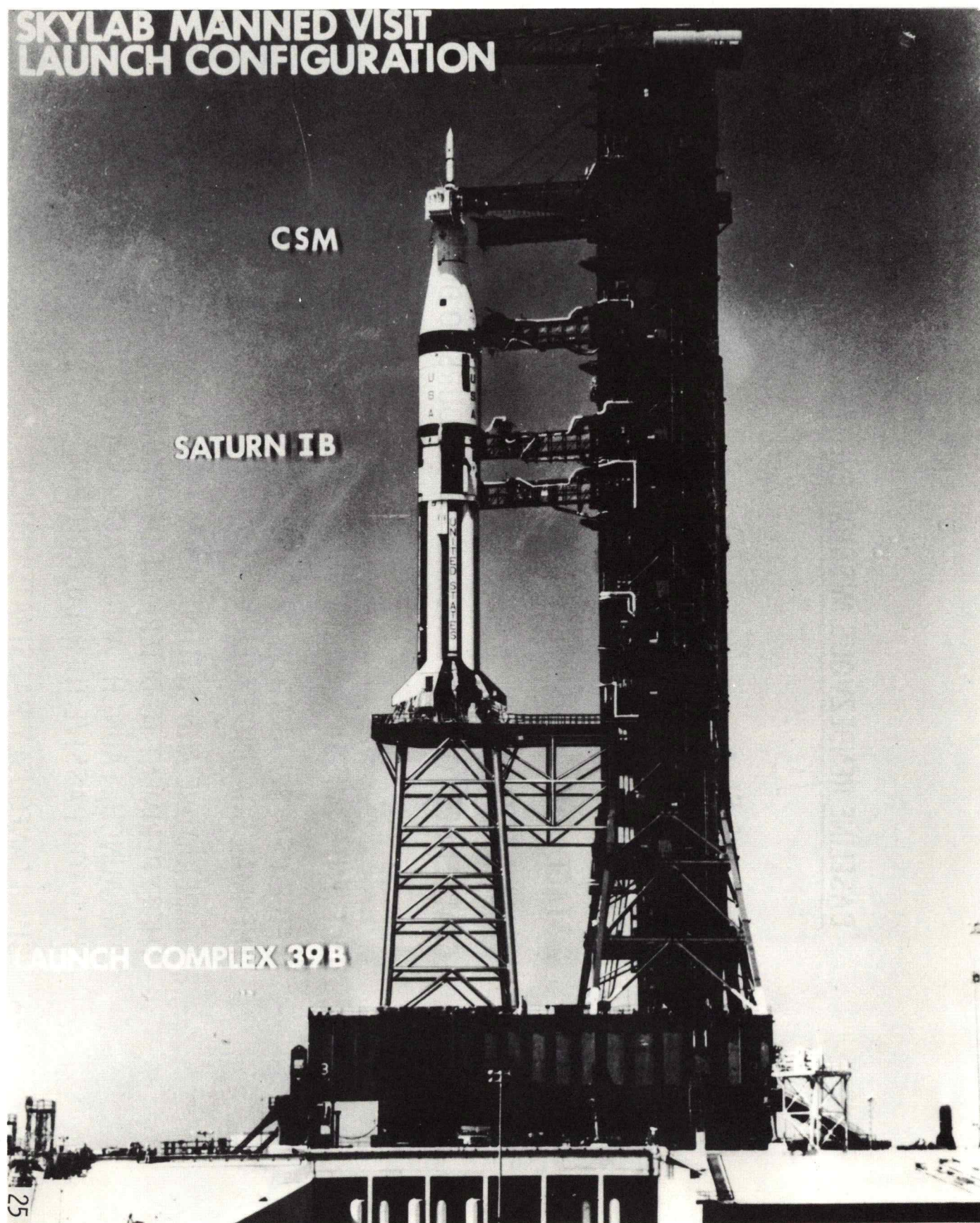


# SKYLAB MANNED VISIT LAUNCH CONFIGURATION

CSM

SATURN IB

LAUNCH COMPLEX 39B





## BASELINE RENDEZVOUS MISSION EVENTS

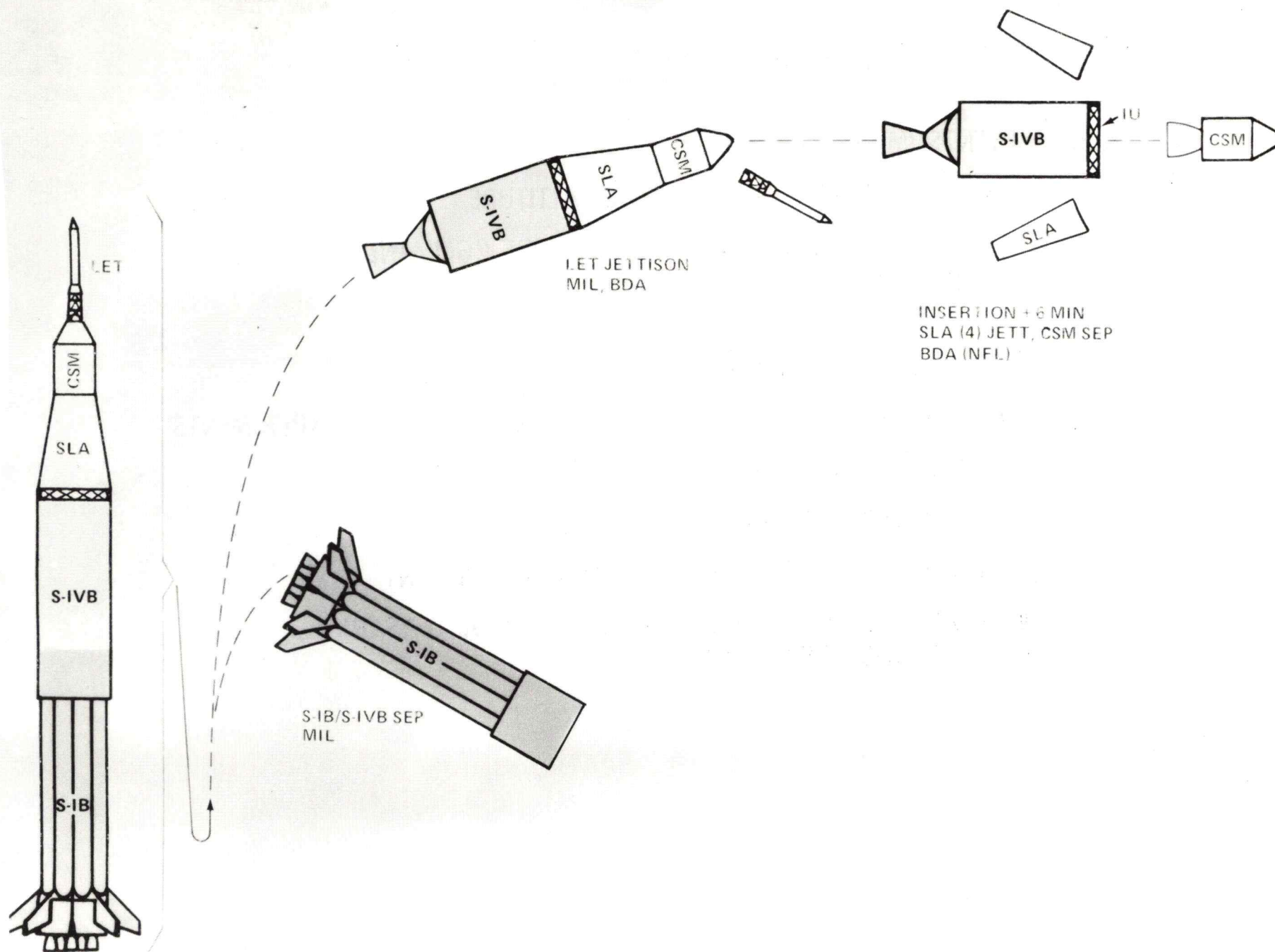
### 0 SL-2, SL-3, AND SL-4

- LAUNCH COMPLEX 39B TO 81 x 120 NM ORBIT
- LAUNCH AZIMUTH 51.4 37.4 DEG EAST OF NORTH
- 2 STAGE (S-IB AND S-IVB) BURN TIME 10 MIN 01 SEC
- CSM/LV SEPARATION 6 MIN AFTER INSERTION
- CSM RENDEZVOUS WITH WORKSHOP (8 HOURS TO DOCK)

### 0 SL-2 LV EVENTS (MISSION PARTICULAR)

- AFTER CSM SEPARATION LV SYSTEMS SUPPORT THE M415 THERMAL COATING EXPERIMENT
- TEMPERATURE AND ATTITUDE DATA PRIMARY IN SUPPORT OF THE EXPERIMENT TO DETERMINE DEGRADATION EFFECTS OF PRELAUNCH, LAUNCH, AND SPACE ENVIRONMENT OF MATERIALS USED FOR PASSIVE THERMAL CONTROL
- SIMULTANEOUSLY PASSIVATE VEHICLE

# SL-2, 3, AND 4 MISSION (DAY 1)

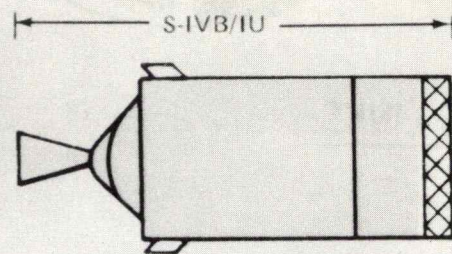




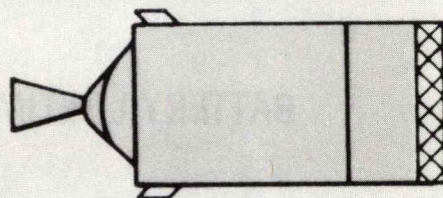
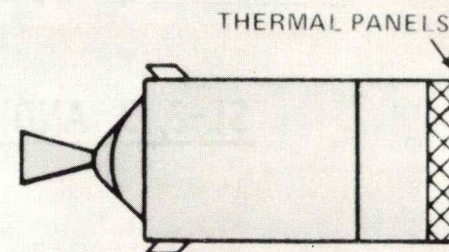
BASELINE RENDEZVOUS MISSION EVENTS (cont)

- o SL-3 LV EVENTS (Mission Particular)
  - PASSIVATE VEHICLE IN RETROGRADE ATTITUDE
  - ON-BOARD COMPUTER (LVDC) DATA DUMPS COMMANDED BY STDN
  
- o SL-4 LV EVENTS (Mission Particular)
  - AFTER CSM SEPARATION INITIATE S150 GALACTIC X-RAY EXPERIMENTS
  - DOWNLINK EXPERIMENT DATA (RT AND RECORDED)
  - SIMULTANEOUSLY PASSIVATE VEHICLE
  - CONTINUE TO PERFORM MANEUVERS FOR EXPERIMENT
  - ON-BOARD COMPUTER AND RECORDER (LVDC AND ASAP) DUMPS COMMANDED BY STDN

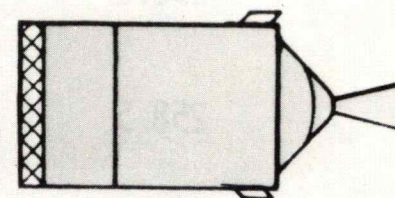
# SL-2, 3 & 4 LV SL-4 MISSION (DAY 1)



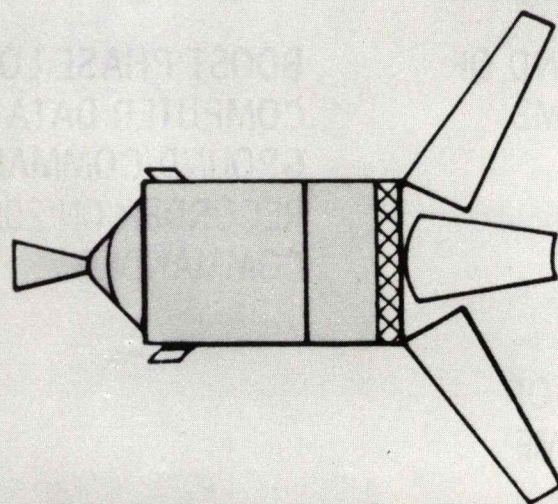
M415 THERMAL COATING EXPERIMENT AND PASSIVATION SL-2



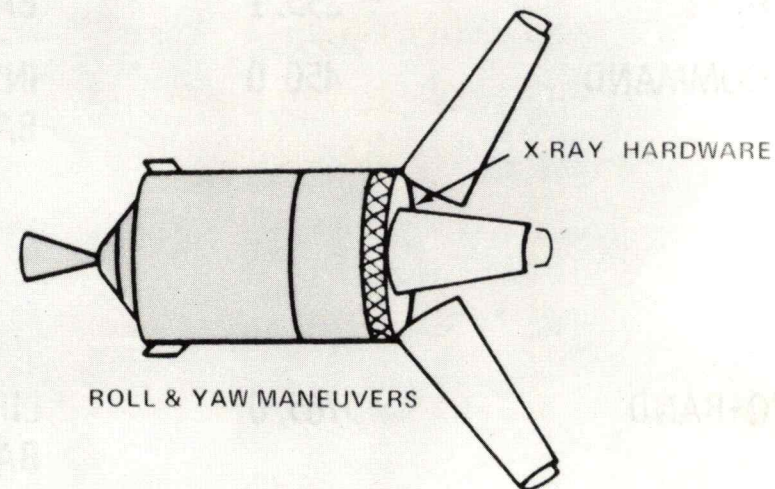
PASSIVATION SL-3



RETROGRADE MANEUVER



S150 GALACTIC X-RAY EXPERIMENT & PASSIVATION



ROLL & YAW MANEUVERS



SL-2, 3, AND 4 COMMUNICATIONS LINKS

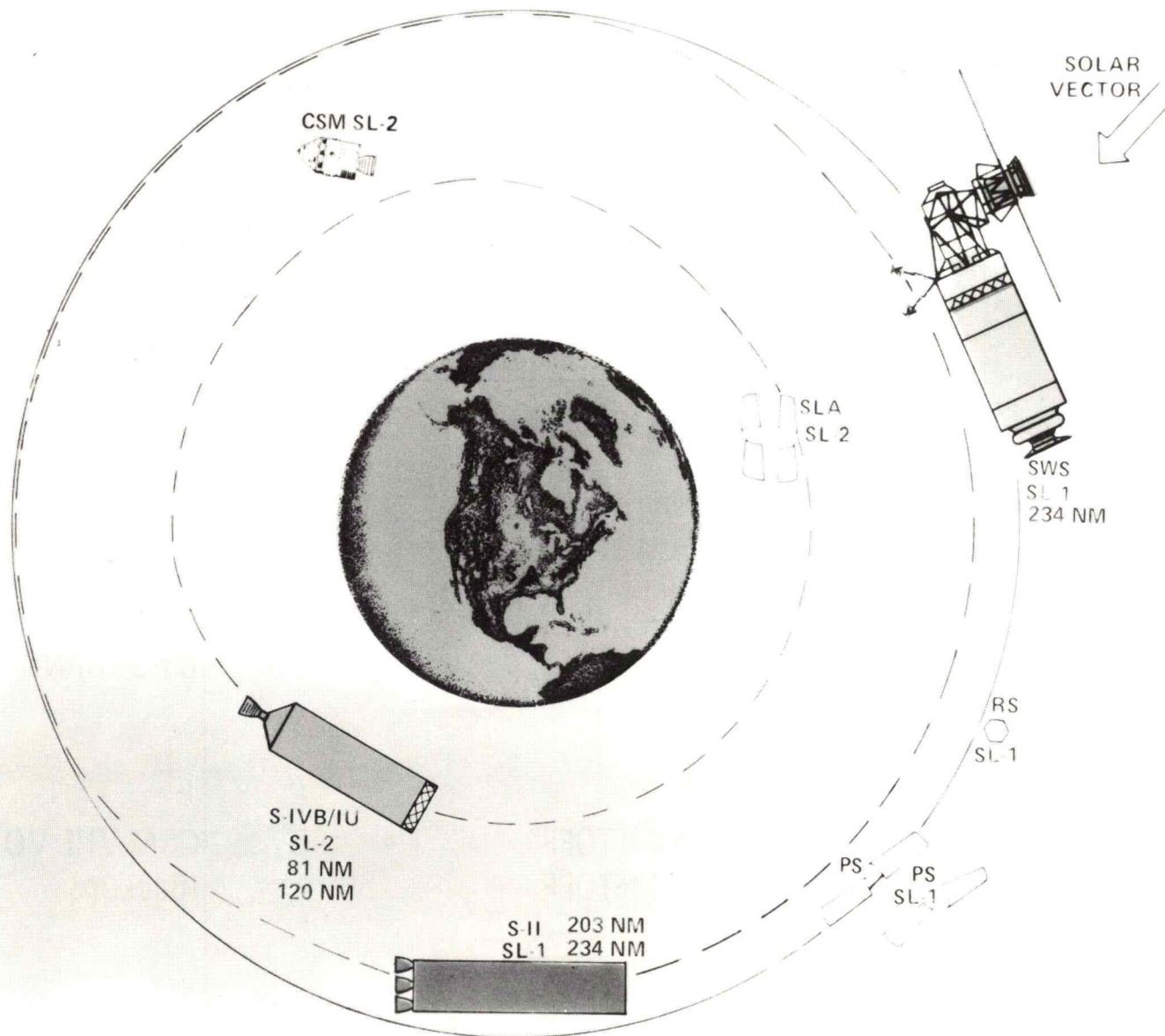
<u>STAGE/CARRIER</u>	<u>FREQ (MHz)</u>	<u>SYSTEM ACT PERIOD</u>	<u>REMARKS</u>
S-IB/GF-1	240.2	LIFTOFF	NON-ORBITAL, BOOST ONLY
S-IB/GP-1	256.2	LIFTOFF	NON-ORBITAL, BOOST ONLY
S-IVB/CP-1	258.5	LIFTOFF TO END OF BATTERY LIFETIME	BATTERY LIFETIME ~ 10 HRS
IU/DF-1	250.7	LIFTOFF TO END OF	BATTERY LIFETIME ~ 14 HRS
IU/DP-1	255.1	BATTERY LIFETIME	
IU COMMAND	450.0	INSERTION TO END OF BATTERY LIFETIME	BOOST PHASE LOCKOUT, COMPUTER DATA DUMPS GROUND COMMANDED, RECORDER ON 208 GROUND COMMANDED
IU/C-BAND	5765.0	LIFTOFF TO END OF BATTERY LIFETIME	

SL-2, 3, AND 4 COMMUNICATIONS LINKS (cont)

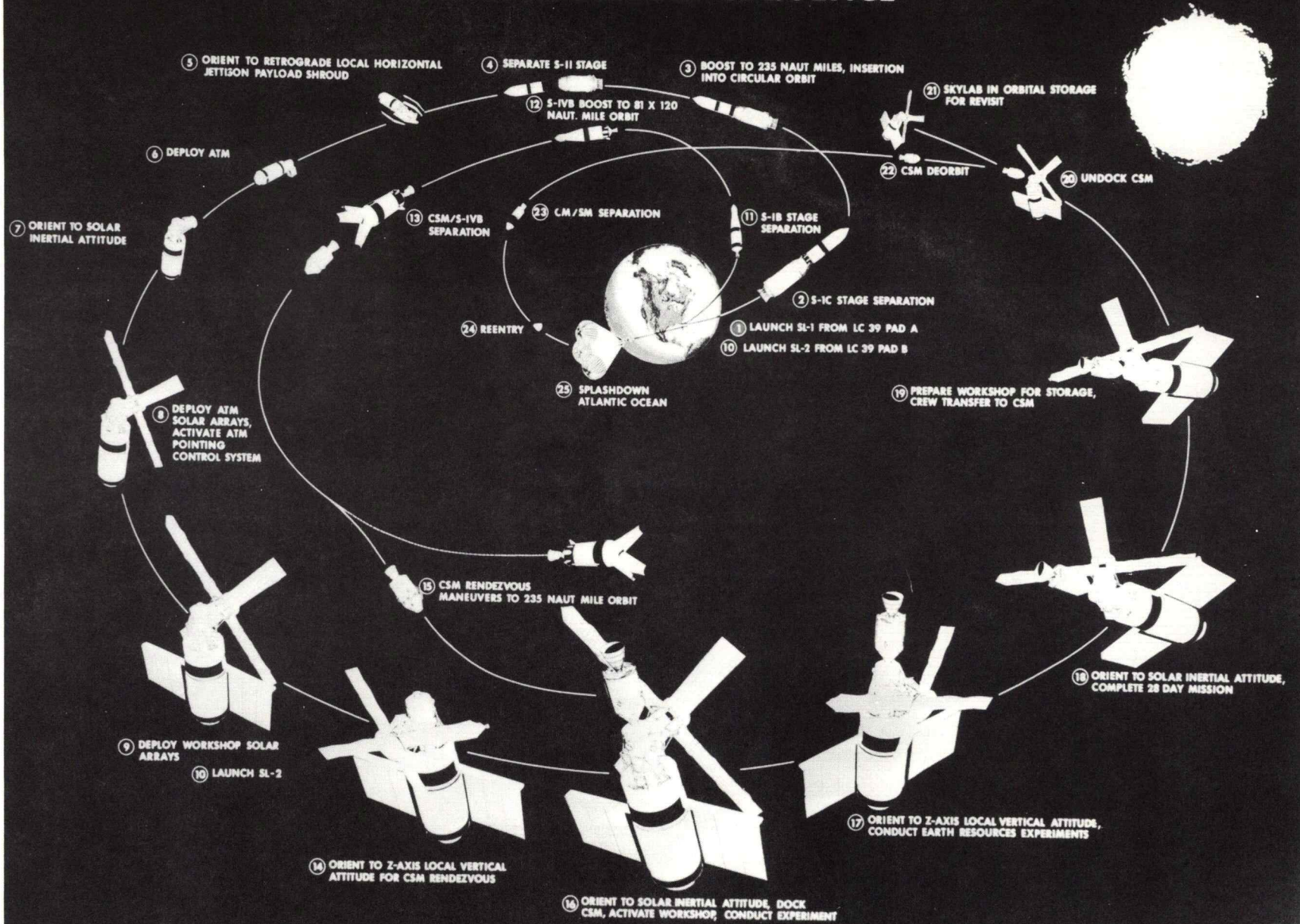
<u>STAGE/CARRIER</u>	<u>FREQ (MHz)</u>	<u>SYSTEM ACT PERIOD</u>	<u>REMARKS</u>
CSM	<del>2106.4</del> 2287.5	LIFTOFF	CONTAINS VOICE COMMAND, TELEMETRY AND RANGING ON USB
	2272.5		TAPE DATA DUMPS, RECORDED VOICE AND TV MODULATED BY S-BAND
CSM	296.8	LIFTOFF	CSM VHF VOICE DOWNLINKS
	259.7	LIFTOFF	(Backup)



# SKYLAB MISSION (DAY 1)



# SKYLAB PROGRAM SL-1 & 2 MISSION SEQUENCE





## SATURN WORKSHOP MODULE DESCRIPTIONS

### SKYLAB GENERAL CHARACTERISTICS

0	CONDITIONED WORK VOLUME	12, 500 CU. FT.	(354 CU. METERS)
0	WEIGHT (INCLUDING CSM)	199, 750 LBS.	(90. 606 KILOGRAMS)
0	OVERALL LENGTH	117 FT.	(35. 1. METERS)
0	WIDTH (OWS, INCLUDING SOLAR ARRAYS)	90 FT.	(27 METERS)



## SATURN WORKSHOP MODULE DEFINITIONS

ORBITAL ASSEMBLY      =      SATURN WORKSHOP      +      CSM

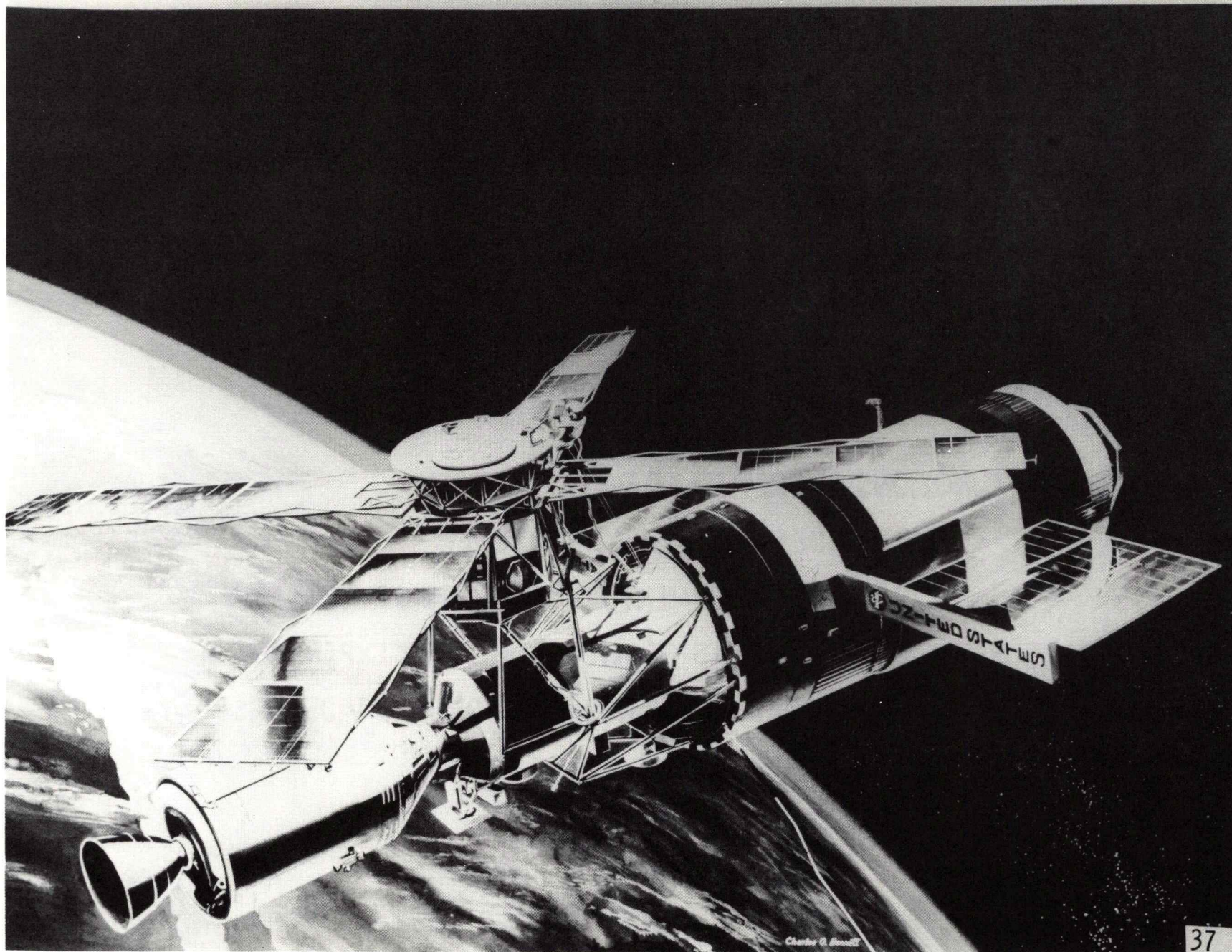
$$OA \quad + \quad SWS \quad + \quad CSM$$

**SATURN WORKSHOP      -      APOLLO TELESCOPE MOUNT + AIRLOCK MODULE  
+ MULTIPLE DOCKING ADAPTER + INSTRUMENT  
UNIT (Inactive)**

$$\text{SWS} = \text{ATM} + \text{AM} + \text{MDA} + \text{IU}^*$$

- The Instrument Unit (IU) is a structural part of the payload, however, it is classified as part of the launch vehicle

# SKYLAB CLUSTER





## OA TELEVISION SYSTEM

- o **ATM TV PROVIDES TELEVISION DATA FROM ATM EXPERIMENTS TO ATM C&D CONSOLE**
  - **TO THE TV SUBSYSTEM IN THE MDA FOR TRANSMISSION TO THE STDN VIA CSM LINKS**
  
- o **FUNCTIONS OF THE ATM TELEVISION SYSTEM**
  - **PROVIDE VIDEO DISPLAYS TO CREW**
  - **PROVIDE EXPERIMENT POINTING ASSISTANCE**
  - **MONITOR AREAS OF INTEREST SEEN BY EXPERIMENTS**
  - **PROVIDE VIDEO DOWNLINK FOR GROUND VIDEO DISPLAYS**

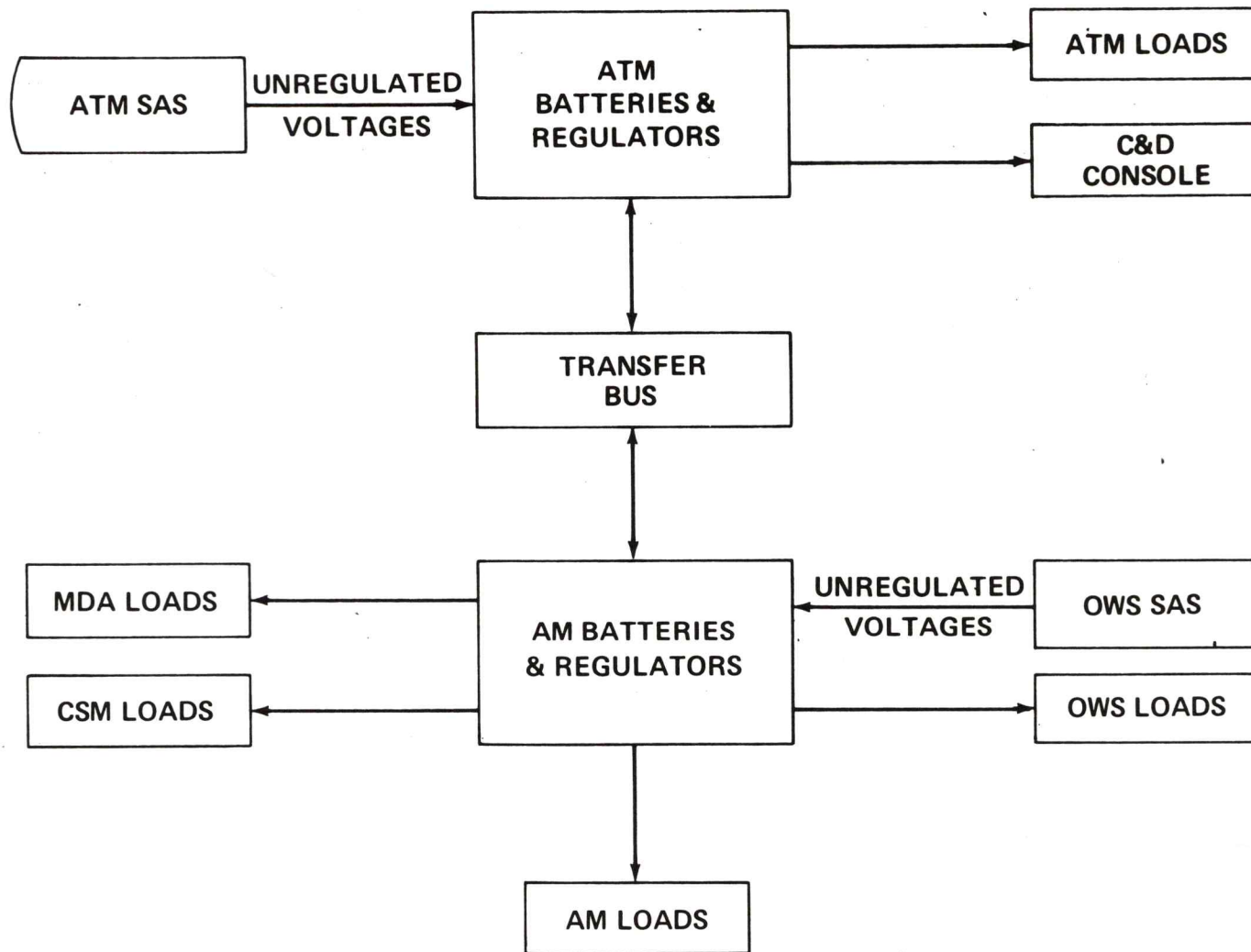




## OA ELECTRICAL POWER SYSTEM

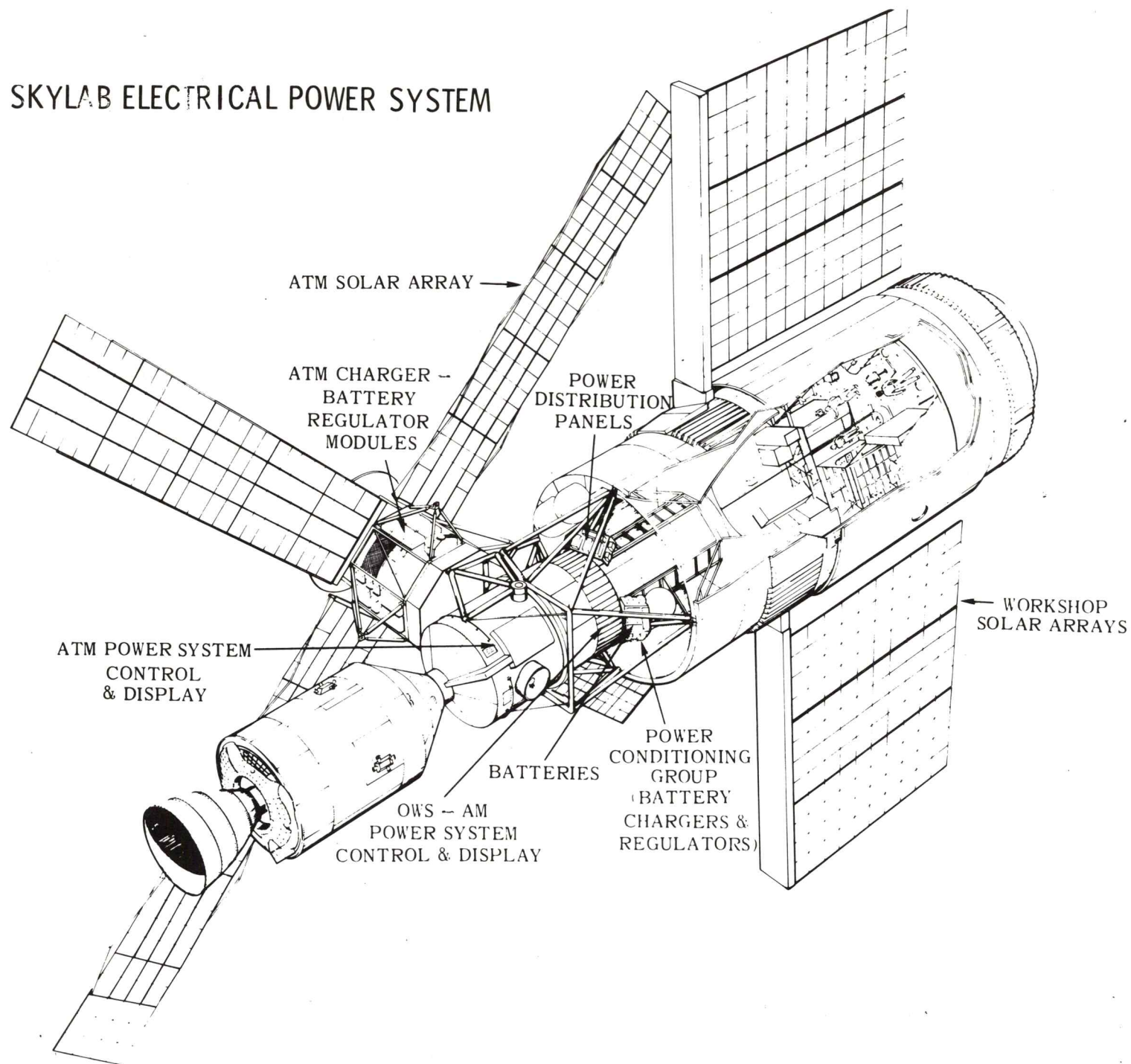
- o ATM EPS GENERATES, CONDITIONS, CONTROLS, AND DISTRIBUTES 26 TO 30 VOLTS VDC POWER TO ATM SYSTEMS, EXPERIMENTS AND TRANSFER BUSES
- o ATM SOLAR ARRAY SYSTEM PROVIDES UNREGULATED POWER TO POWER CONDITIONING AND STORAGE MODULES DURING SUNLIGHT PASS
- o SYSTEM IS MANUALLY PARALLELED WITH THE AM POWER SYSTEM, HAVING A SHARING CAPABILITY OF 2500 WATTS IN EITHER DIRECTION
- o ATM COULD BE REQUIRED TO PROVIDE FULL ELECTRICAL POWER INDEPENDENTLY

## OA ELECTRICAL POWER SUBSYSTEM (PARALLEL)



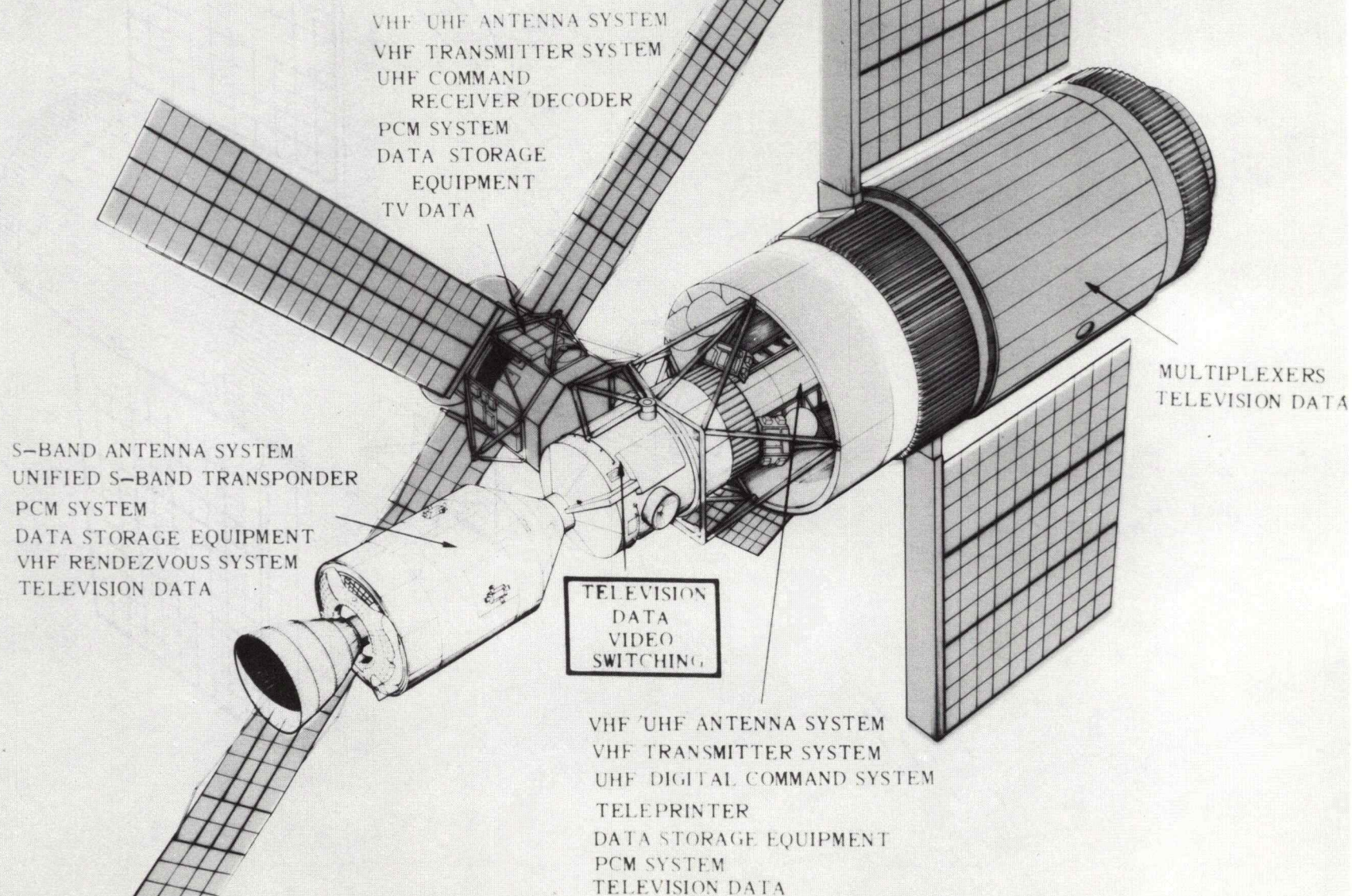


## SKYLAB ELECTRICAL POWER SYSTEM



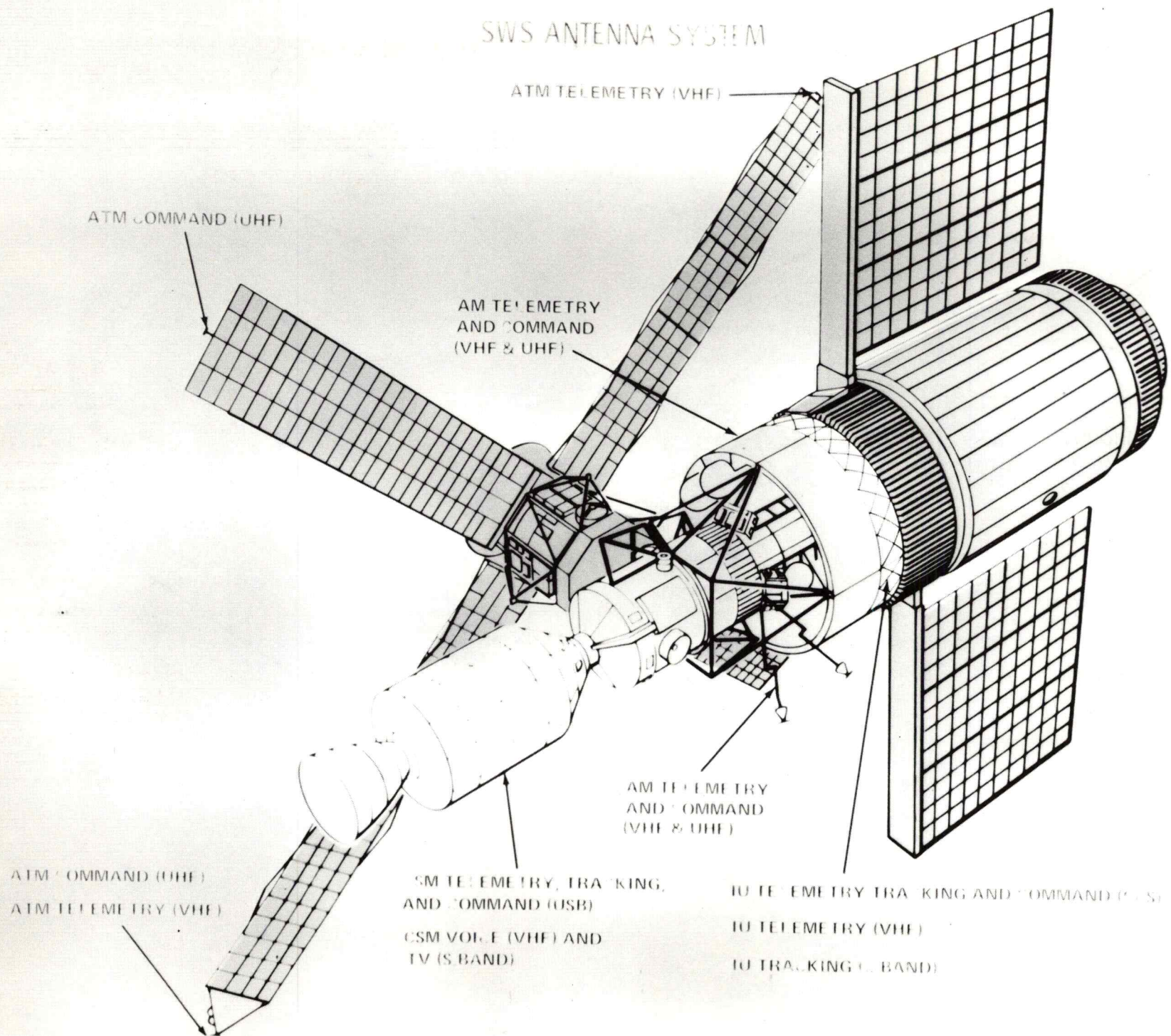


# DATA AND COMMUNICATIONS SYSTEM

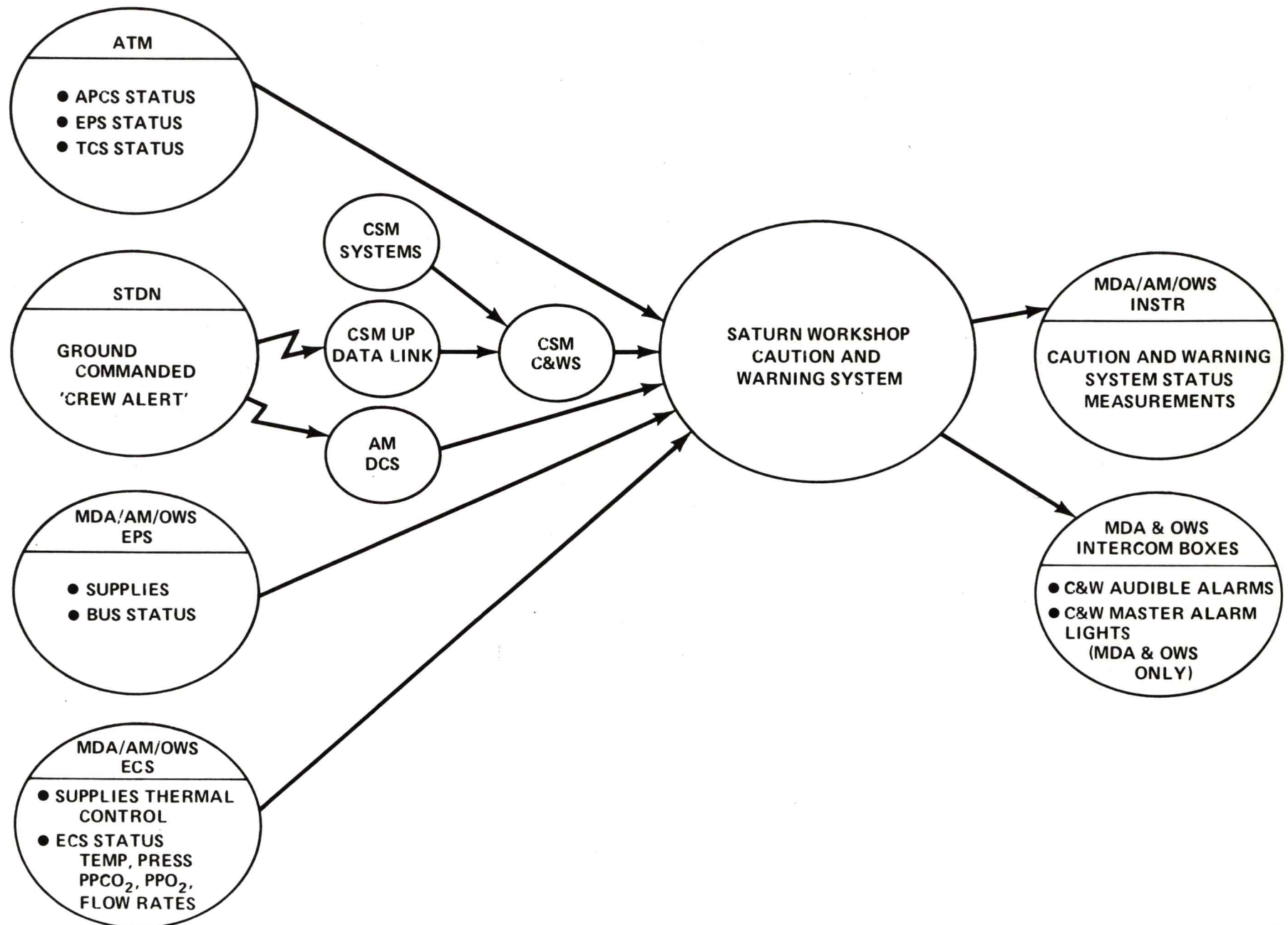




# SWS ANTENNA SYSTEM



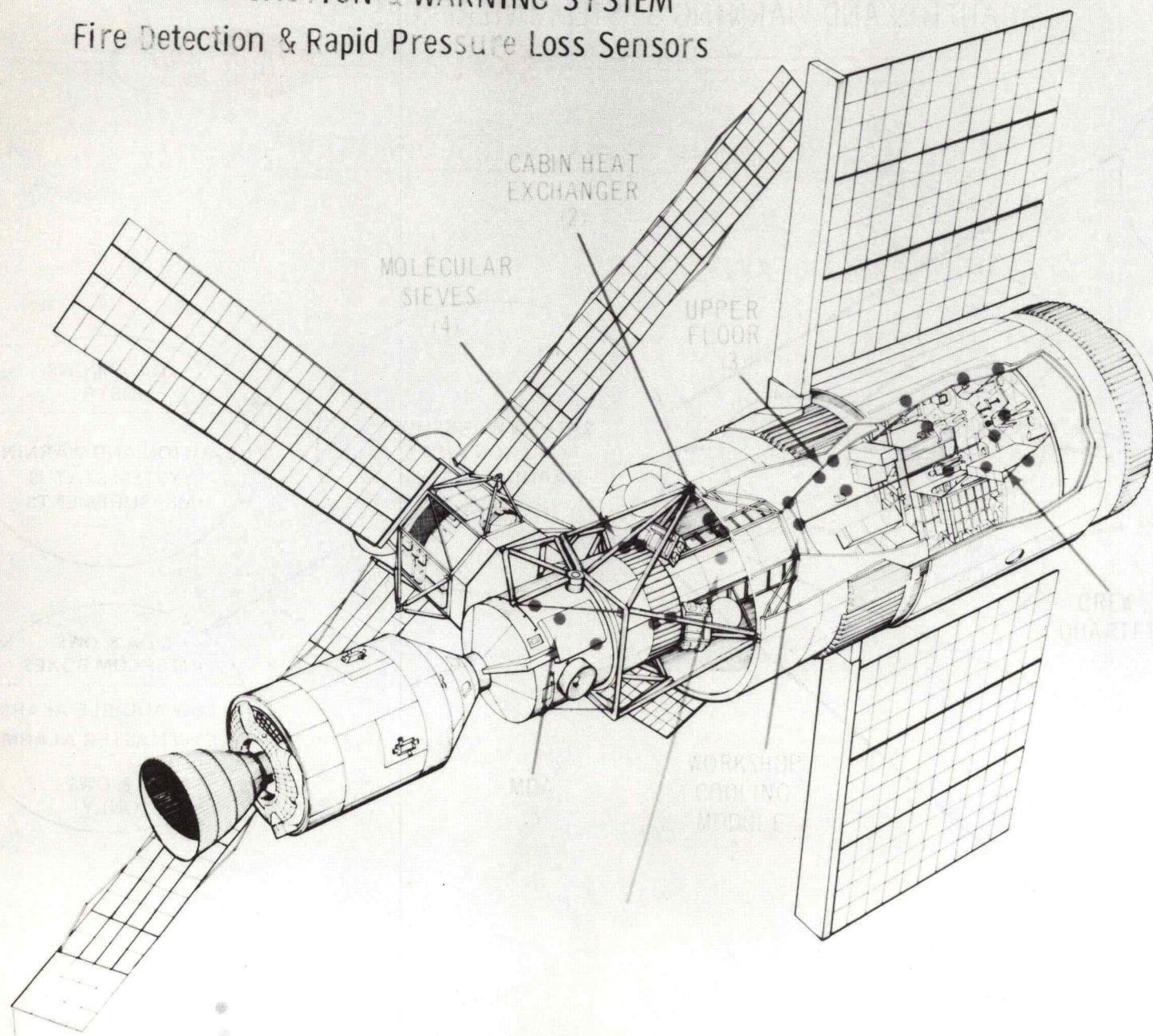
## CAUTION AND WARNING SYSTEM INTERFACES



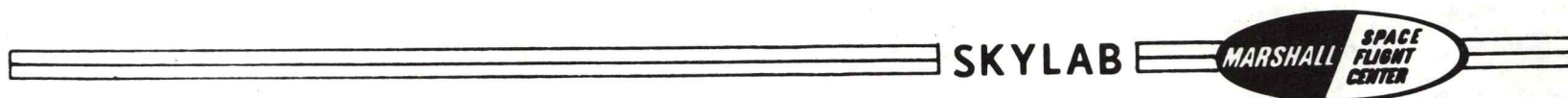


# SKYLAB CAUTION & WARNING SYSTEM

## Fire Detection & Rapid Pressure Loss Sensors



NOTE. APPROXIMATELY SEVENTY ADDITIONAL CAUTION & WARNING SENSORS ARE LOCATED THROUGHOUT CLUSTER



## MAJOR FEATURES OF THE APOLLO TELESCOPE MOUNT

- 0 FIVE MAJOR SOLAR EXPERIMENTS
- 0 PRECISE THERMAL CONTROL FOR EXPERIMENTS
- 0 CLUSTER ATTITUDE CONTROL
- 0 PRECISE SUN POINTING FOR EXPERIMENT OPERATION
- 0 PRIMARY ELECTRICAL POWER FOR ATM OPERATION
- 0 CLUSTER ELECTRICAL POWER
- 0 TELEMETRY AND COMMAND SYSTEM WITH GROUND

WEIGHT                      24, 650 LB                      (11, 092 KILOGRAMS)

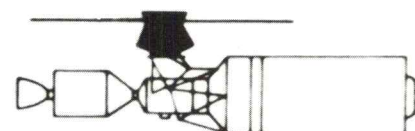
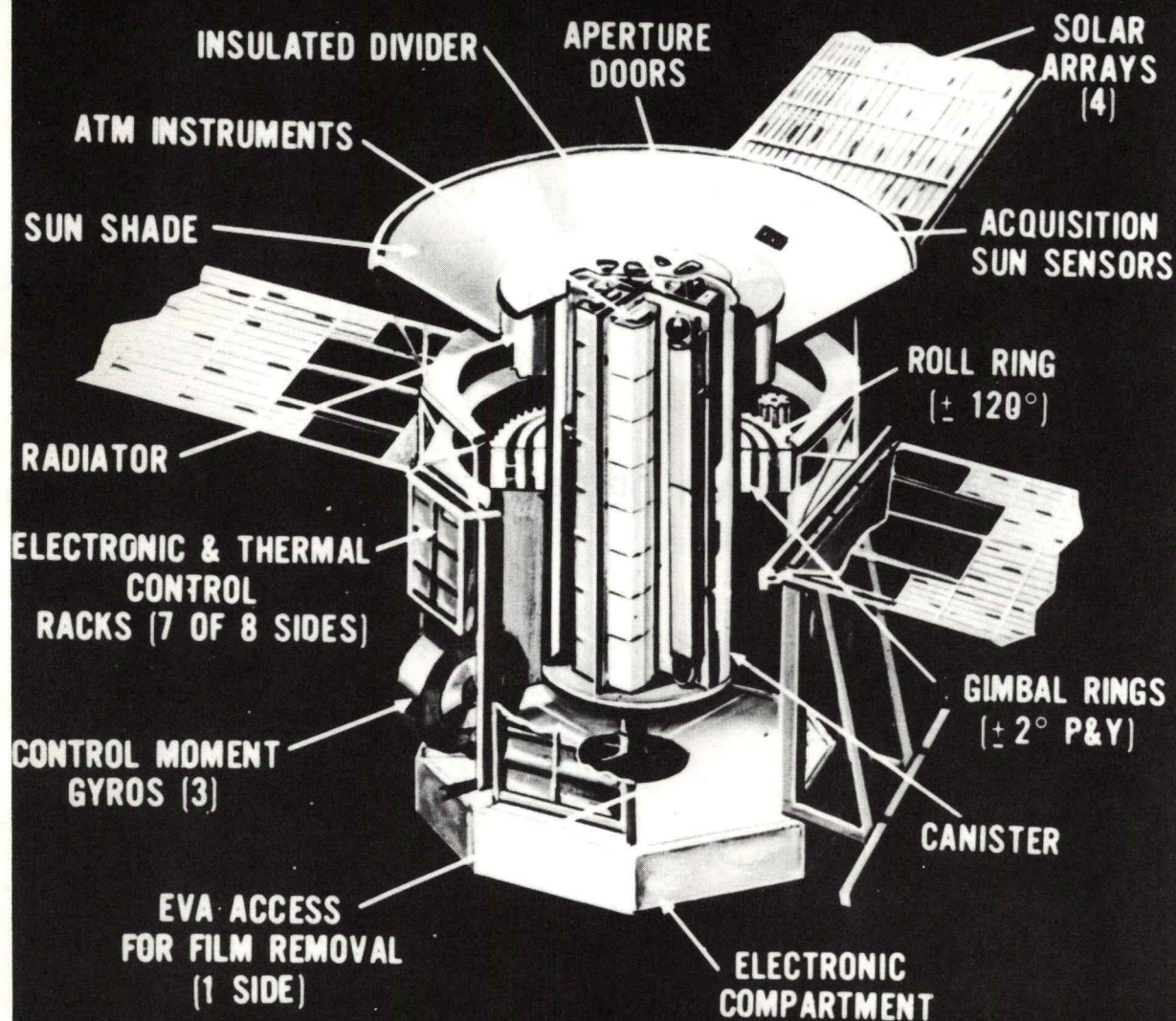
DIMENSIONS (CANISTER)

DIAMETER	7 FT	(2.1 METERS)
LENGTH	11 FT	(3.3 METERS)





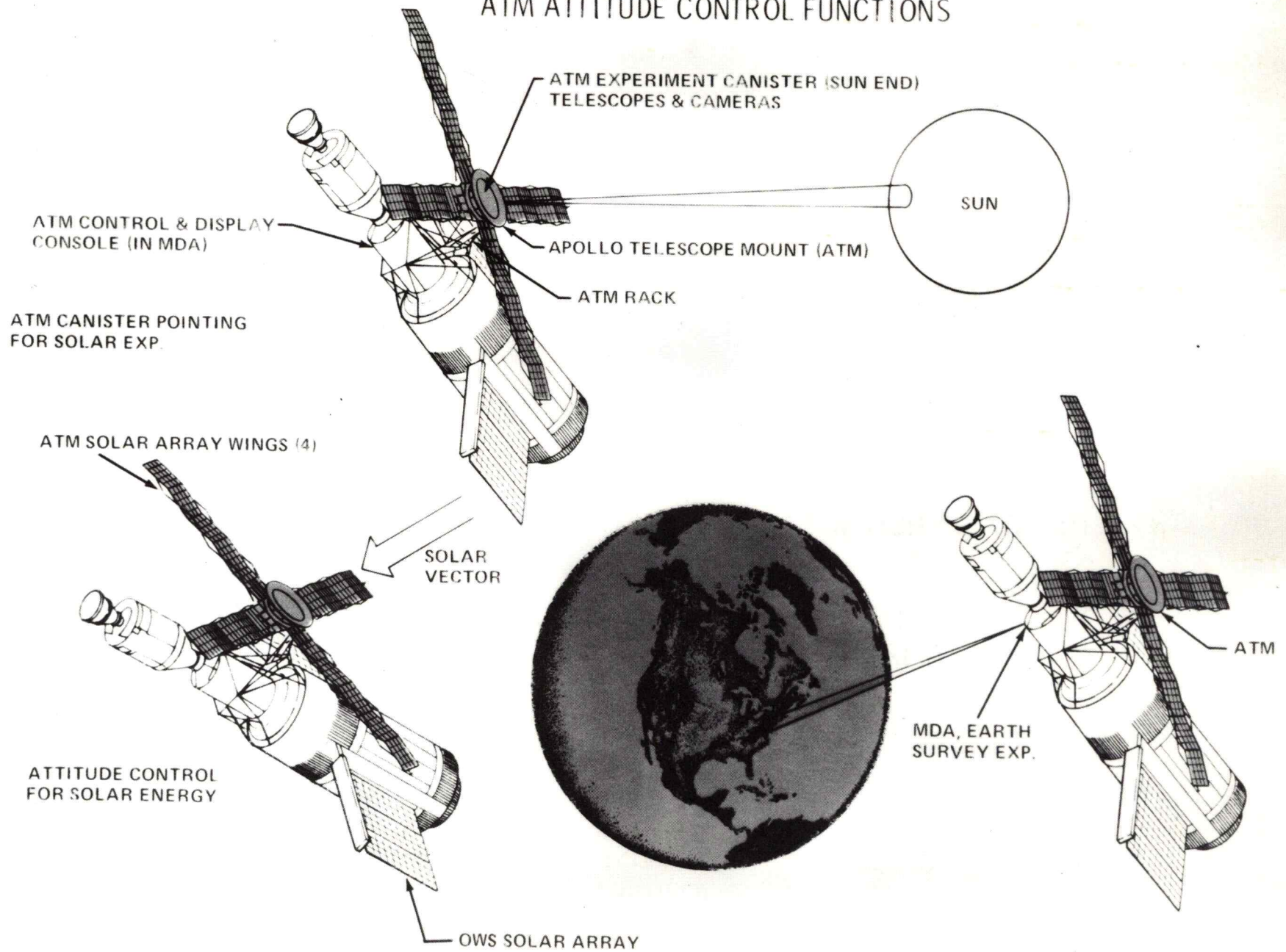
# APOLLO TELESCOPE MOUNT (ATM)



## CHARACTERISTICS

- **WEIGHT**  
24,650 LBS.  
11,181 KILOGRAMS
- **WIDTH (MAX)**  
11 FT.  
3.4 METERS
- **HEIGHT (TOTAL)**  
14 FT. 7 IN.  
4.4 METERS
- **SOLAR ARRAY-SPAN**  
98 FT.  
29.9 METERS

## ATM ATTITUDE CONTROL FUNCTIONS







## ATM EXPERIMENTS

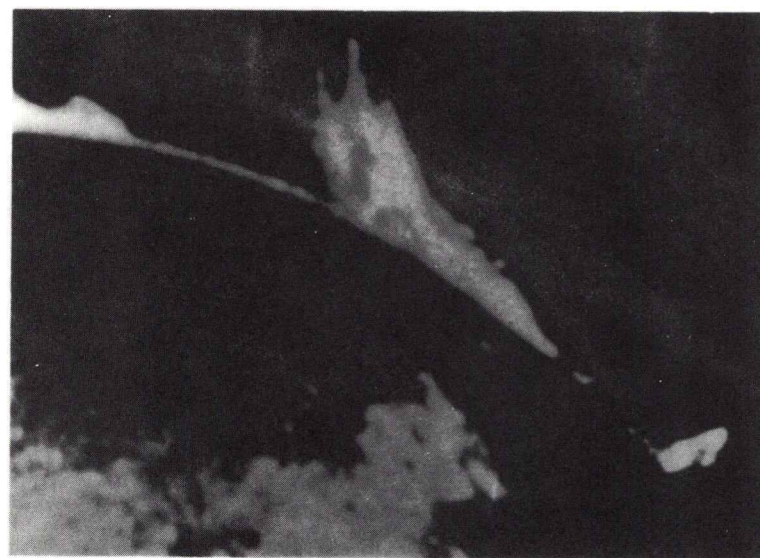
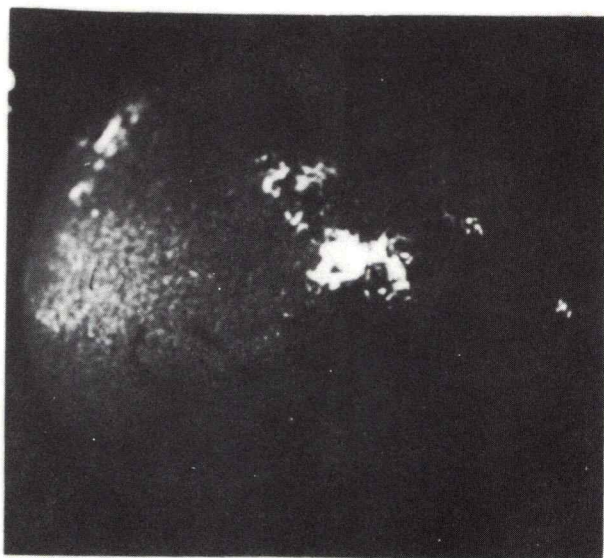
### OBJECTIVES

- 0 TO OBTAIN SYNOPTIC OBSERVATIONS OF THE SOLAR CORONA TO MONITOR BRIGHTNESS FORM AND POLARIZATION
- 0 TO OBTAIN HIGH SPECTRAL RESOLUTION PHOTOGRAPHS OF FLARE SPECTRA
- 0 TO OBTAIN PHOTOMETRIC OBSERVATIONS OF THE SOLAR ATMOSPHERE
- 0 TO PROVIDE OBSERVATIONS AND VIDEO IMAGES OF THE COMPLETE SUN FOR UTILIZATION IN FLARE DETECTION AND POINTING CONTROL

### CONCEPT

- 0 THE ABOVE OBJECTIVES ARE MET USING VARIOUS TELESCOPES, CORONOGRAPHS, SPECTROLIELIOGRAPHS, AND SPECTRO-HELIOMETER, OPERATED REMOTELY FROM MSC DURING UNMANNED PHASES

# SKYLAB SOLAR ASTRONOMY EXPERIMENTS

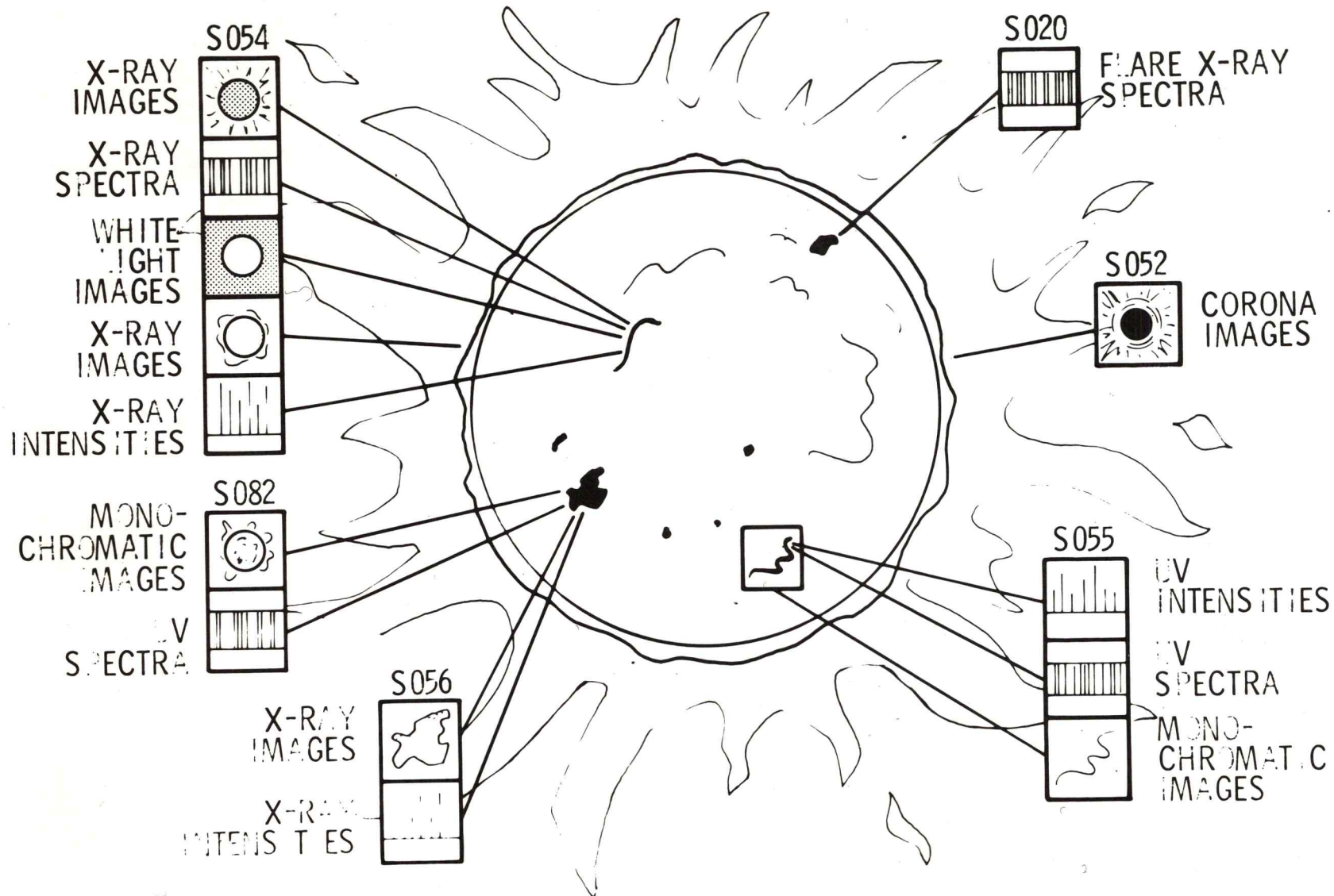


## OBJECTIVES

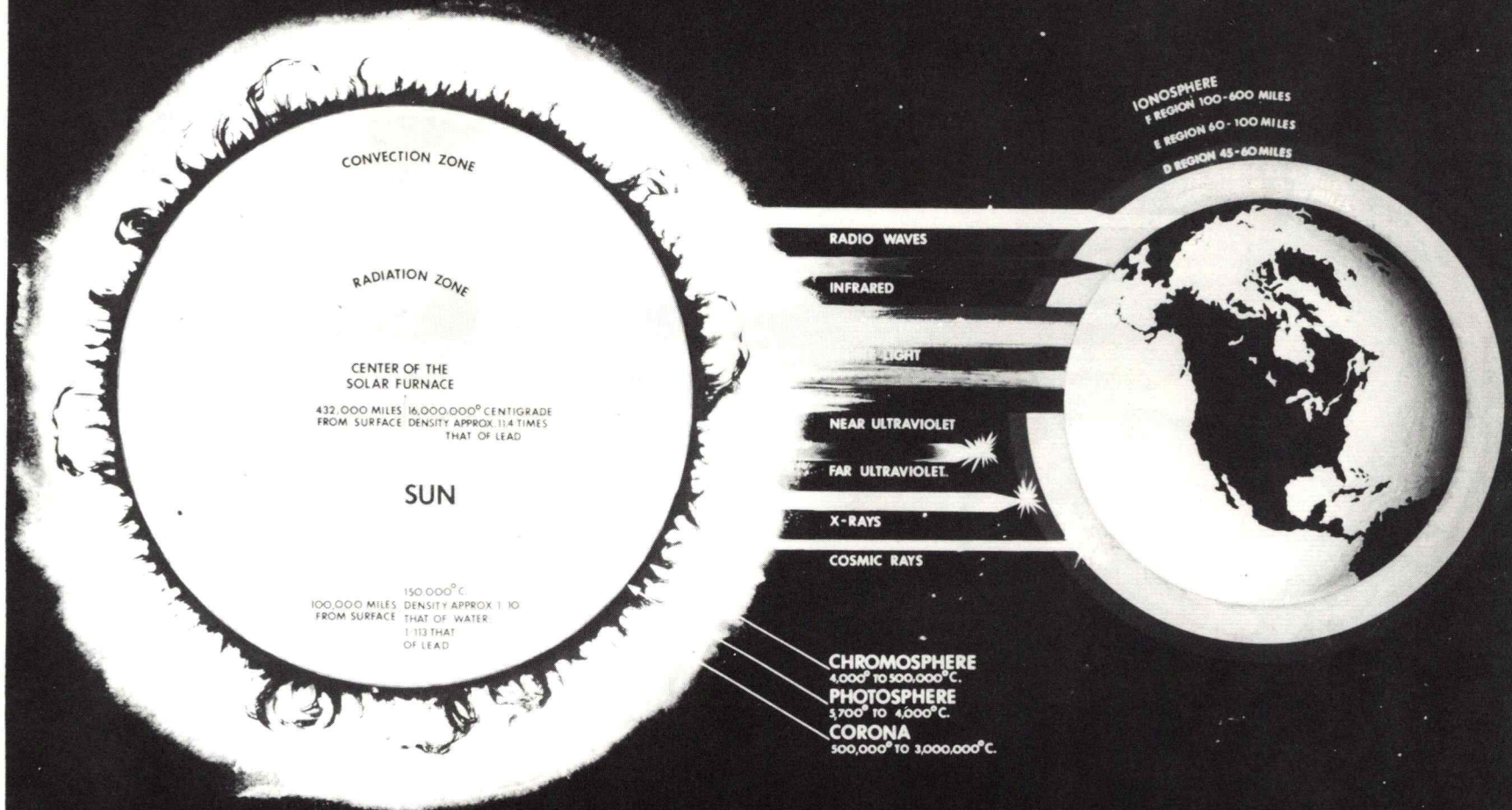
- LEARN MORE ABOUT THE UNIVERSE, SPACE ENVIRONMENT, AND THE SOLAR SYSTEM AND THEIR EFFECT ON EARTH AND MANKIND.
- ACQUIRE DATA ON SOLAR PHENOMENA WITH INCREASED SPECTRAL AND SPATIAL RESOLUTION IN THOSE WAVELENGTHS NOT AVAILABLE IN GROUND-BASED OBSERVATIONS.



# SKYLAB SOLAR ASTRONOMY

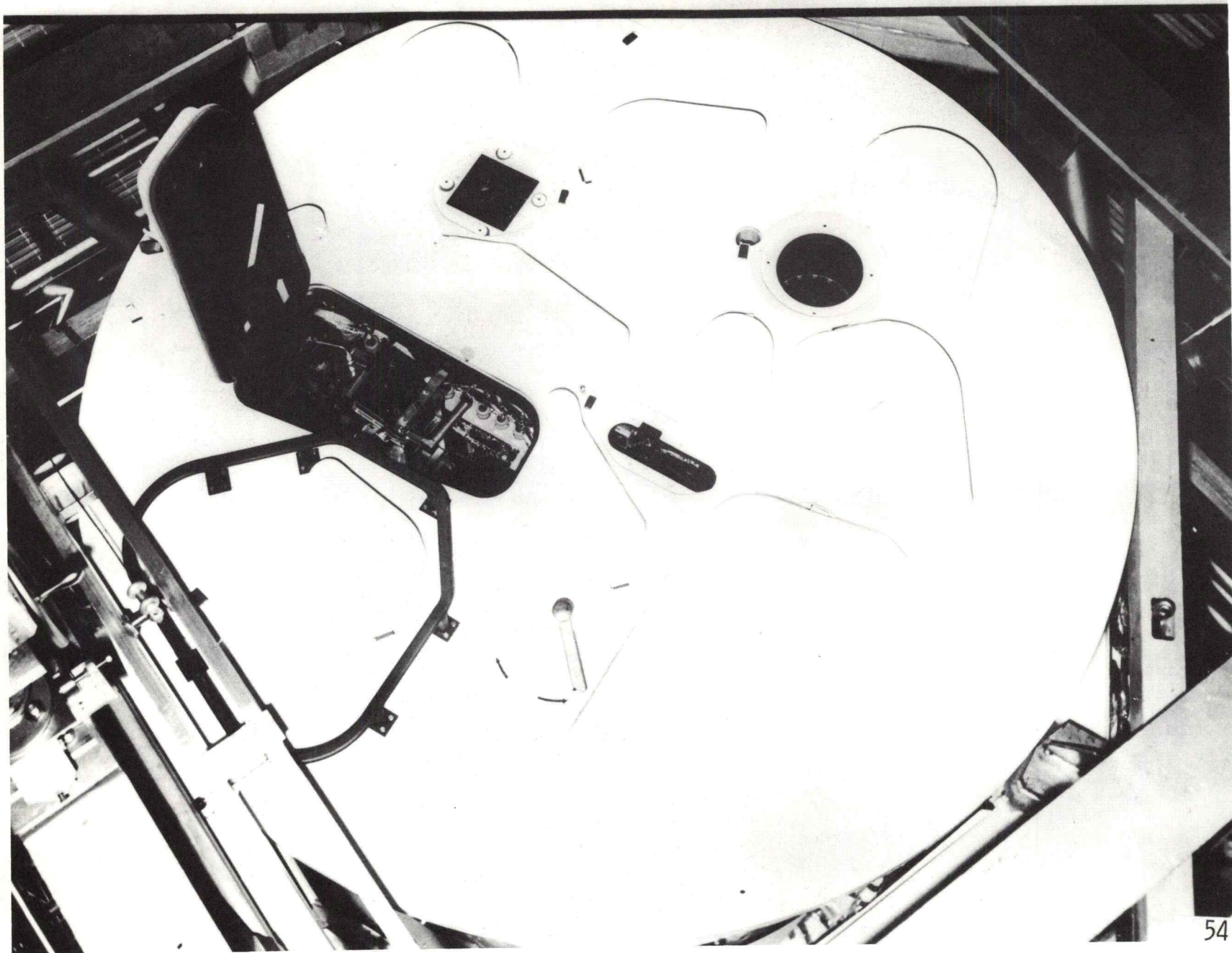


# ATMOSPHERIC ABSORPTION OF SOLAR EMISSIONS

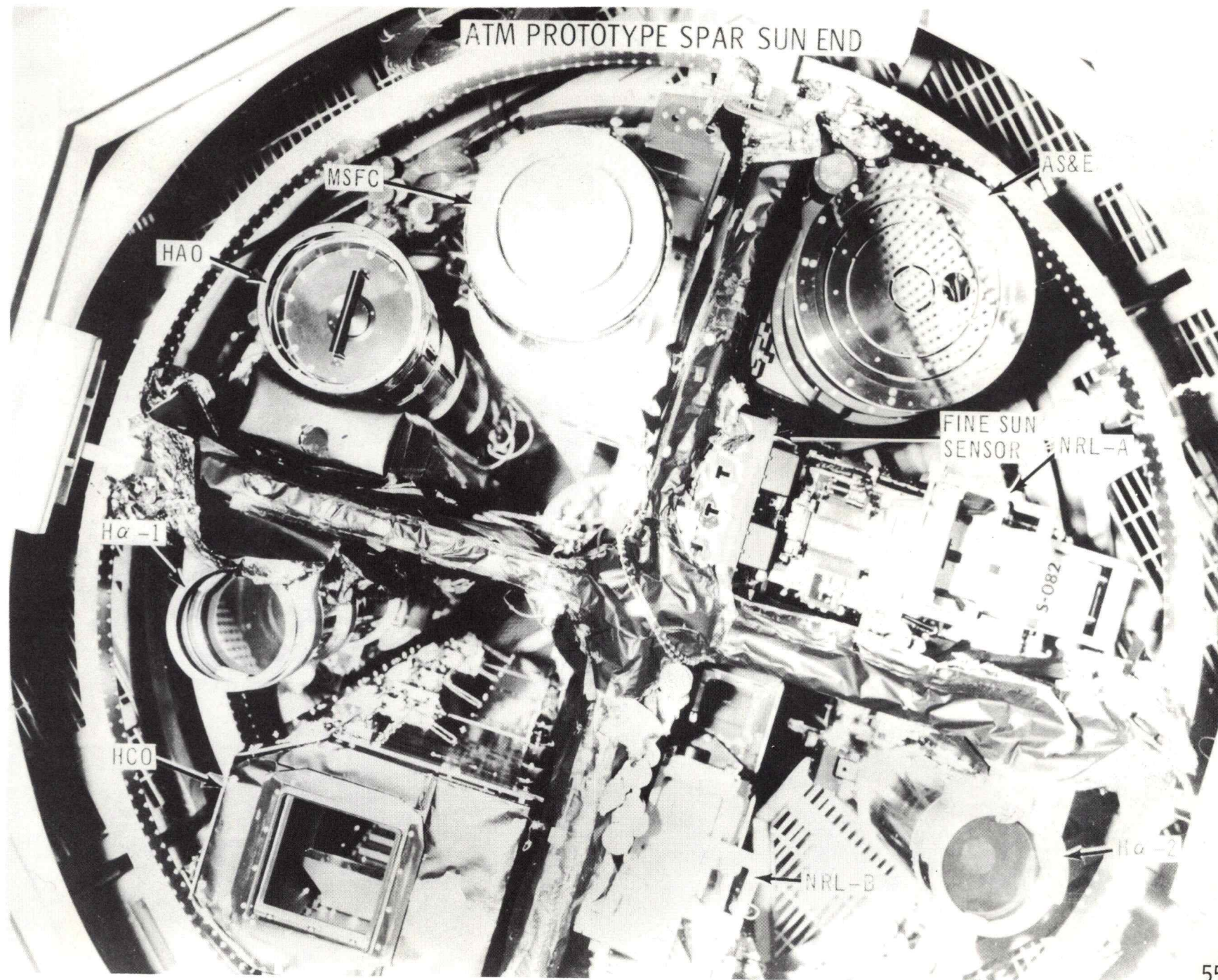




ATM PROTOTYPE SUN END

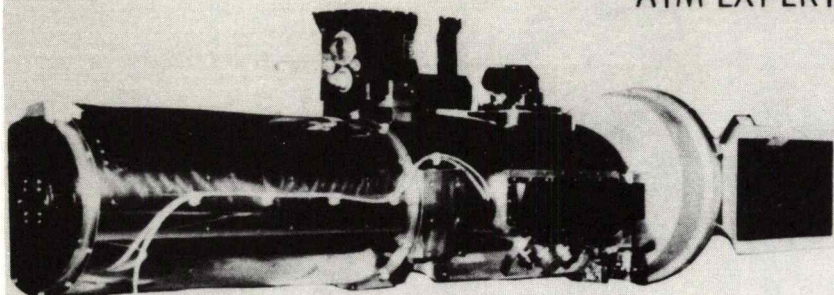




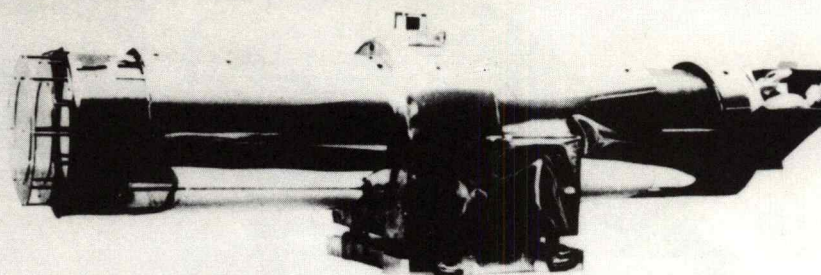




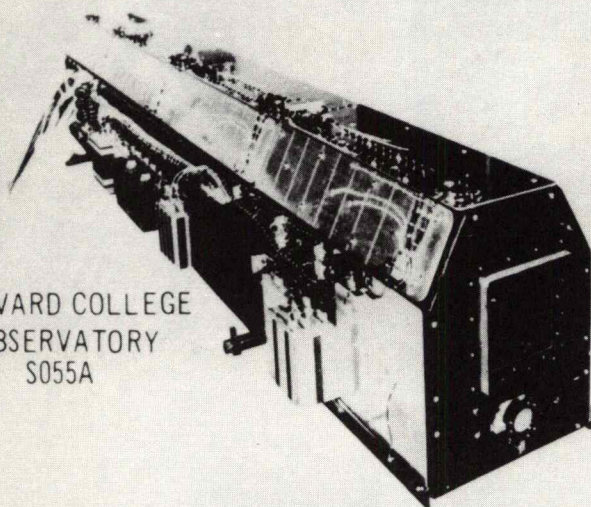
# ATM EXPERIMENT PROTOTYPES



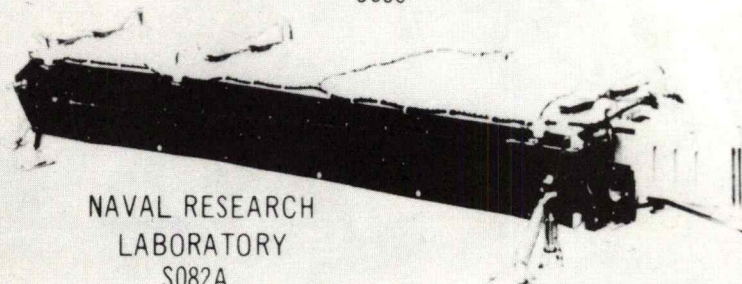
H-ALPHA TELESCOPE



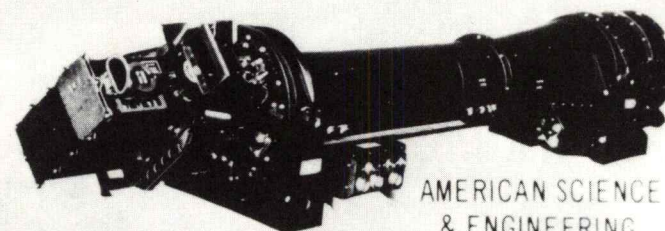
MARSHALL SPACE FLIGHT CENTER  
S056



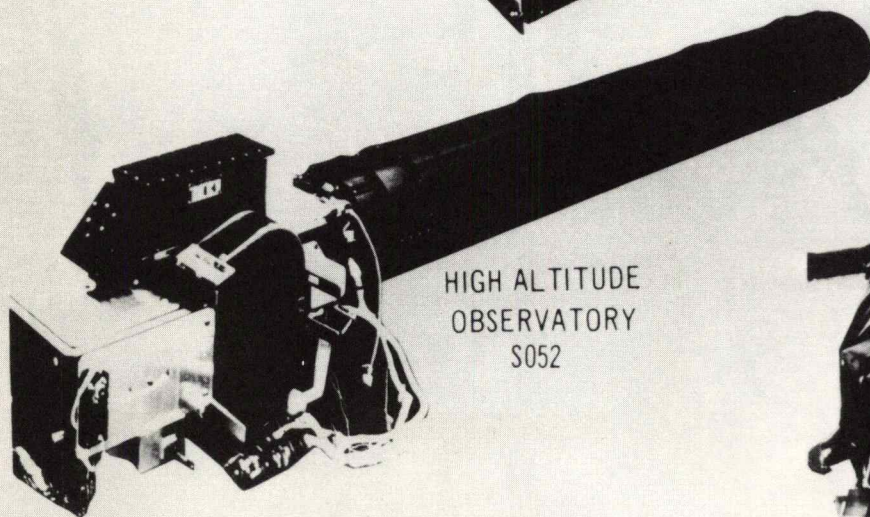
HARVARD COLLEGE  
OBSERVATORY  
S055A



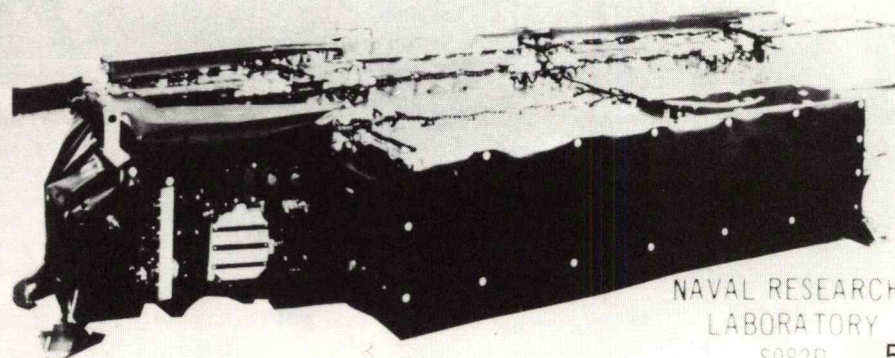
NAVAL RESEARCH  
LABORATORY  
S082A



AMERICAN SCIENCE  
& ENGINEERING  
S054




HIGH ALTITUDE  
OBSERVATORY  
S052



NAVAL RESEARCH  
LABORATORY  
S082B



## ASTRONAUT'S ROLE IN ATM/SOLAR EXPERIMENTS OPERATION

- |                     |   |
|---------------------|---|
| 1. SENSING          | 0 INITIAL ACQUISITION AND POINTING                                  |
|                     | 0 FINE ALIGNMENT AND TRIM   |
| 2. COMPUTING        | 0 TRIM FOR STABILITY DURING "DRIFT MODE" OBSERVING PERIODS          |
|                     | 0 SETS AND CONTROLS CAMERA EXPOSURE SEQUENCES                       |
| 3. MAINTENANCE      | 0 MONITORS EXPERIMENT OPERATION                                     |
|                     | 0 INSURES PROPER FUNCTIONING OF ATM                                 |
| 4. DATA ACQUISITION | 0 RECOVERS EXPOSED FILM   |
| 5. SCIENTIST ROLE   | 0 DETERMINES SOLAR EVENTS OF INTEREST AND DIRECTS SYSTEM TO OBSERVE |
- 

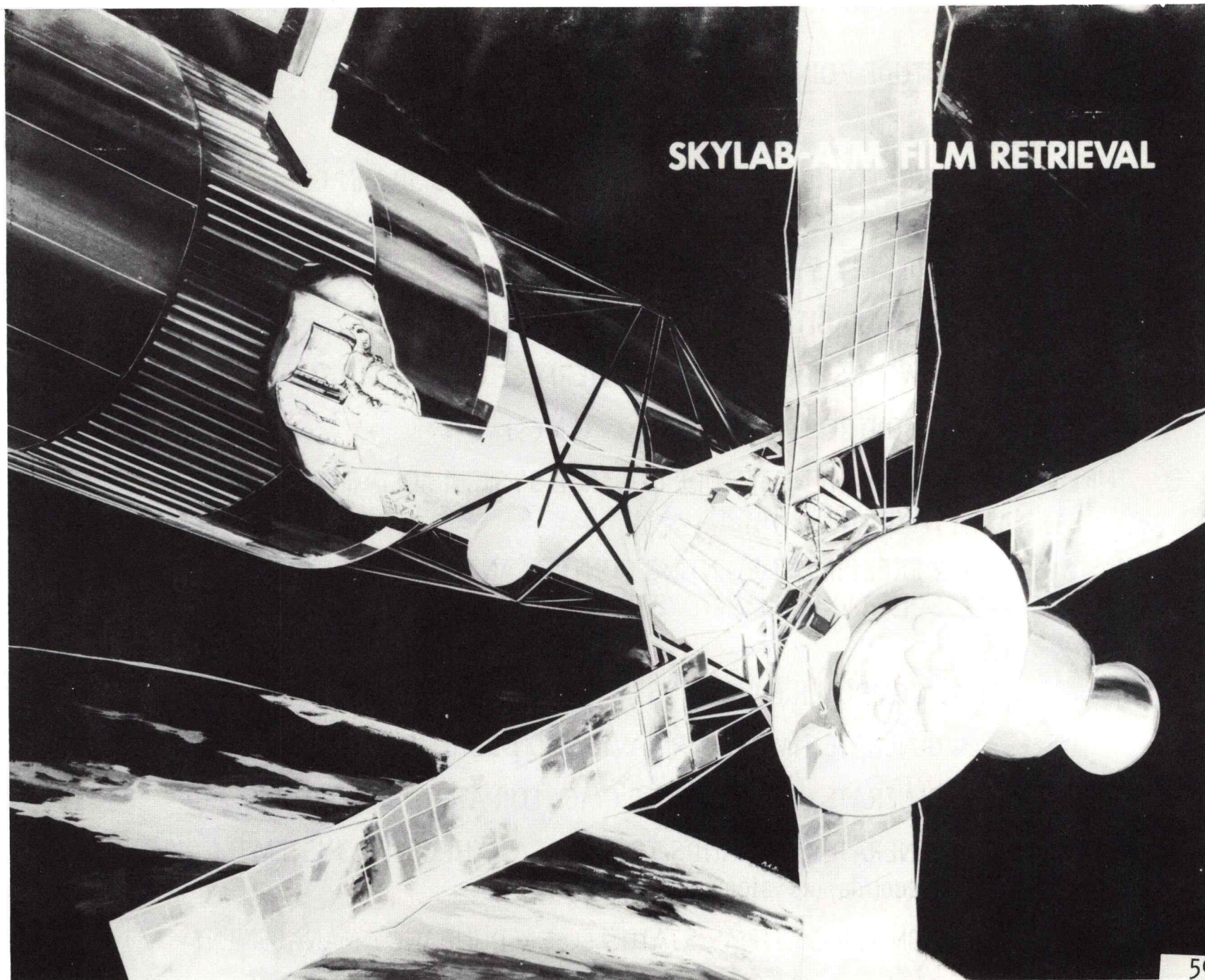




## ATM UNMANNED OPERATIONS

- 0 TO OPTIMIZE THE INFORMATION AND BENEFITS FROM THE ATM, THE DECISION WAS MADE TO OPERATE THE ATM, AS MUCH AS POSSIBLE WITH LIMITED CHANGES, DURING THE STORAGE OR UNMANNED MODE
- 0 THREE OF THE FIVE ATM EXPERIMENTS CAN OPERATE UNDER THESE CONDITIONS:
  - HAO (S052) - WHITE LIGHT CORONAGRAPH
  - HCO (S055A) - UV SCANNING POLYCHROMATOR / SPECTROHELIOMETER
  - AS&E (S054) - X-RAY SPECTROGRAPHIC TELESCOPE
- 0 DURING EIGHT HOURS OF THE DAY MSC MISSION CONTROL WILL BE IN FULL OPERATION AND ALL THREE EXPERIMENTS WILL PERFORM UP TO COMMAND CAPABILITY
- 0 DURING REMAINING SIXTEEN HOURS LIMITED OPERATION OF S055A ONLY WILL BE POSSIBLE
- 0 S052 AND S054 INFORMATION WILL BE RECORDED ON FILM AND RETURNED TO EARTH ON MISSIONS SL-3 AND SL-4. S055A INFORMATION WILL BE TELEMETERED TO EARTH APPROXIMATELY ONCE AN ORBIT







## ATTITUDE POINTING AND CONTROL SYSTEM

- o ASSUMES ATTITUDE CONTROL FROM IU AT 4 HRS 30 MIN GET
- o APCS PRIMARY SYSTEMS
  - 2 ATM DIGITAL COMPUTERS (ATMDC)
  - 1 WORKSHOP COMPUTER INTERFACE UNIT (WCIU)
  - 3 CONTROL MOMENT GYROs (CMGs)
  - 6 THRUSTER ATTITUDE CONTROL SYSTEM COLD GAS THRUSTERS (TACS)
  - 2 EXPERIMENT POINTING CONTROL ANALOG COMPUTERS FOR SOLAR EXPERIMENTS (EPC)
- o DIGITAL COMPUTER FUNCTIONS
  - GENERATE TIMING FOR NAVIGATION SCHEME
  - GENERATE COMMANDS TO CMGs FOR ATTITUDE CONTROL
  - GENERATE COMMANDS TO COLD GAS THRUSTER SYSTEM (Secondary System)
  - MONITOR SYSTEMS STATUS FOR REDUNDANCY MANAGEMENT
  - UPDATE SYSTEMS STATUS FOR COMPUTER SWITCHOVER

ATTITUDE POINTING AND CONTROL SYSTEM (cont)

- o WORKSHOP COMPUTER INTERFACE UNIT
  - PROVIDES INTERFACE WITH DIGITAL COMPUTERS AND ATM SUBSYSTEMS
  - FORMATS COMPUTER INPUT AND OUTPUT DATA PARALLEL/SERIAL, D/A AND A/D, ETC
  - STORES SYSTEMS STATUS FOR CONTINGENCIES
- o CONTROL MOMENT GYROS
  - PRIMARY ACTIVE SYSTEM FOR ATTITUDE CONTROL
  - CMG FOR EACH VEHICLE AXIS
  - GIMBAL DRIVE COMMANDS ORIGINATE FROM DIGITAL COMPUTER
  - GIMBAL DRIVE COMMANDS PRODUCE TORQUE ON OA FOR ATTITUDE CONTROL



## ATTITUDE POINTING AND CONTROL SYSTEM (cont)

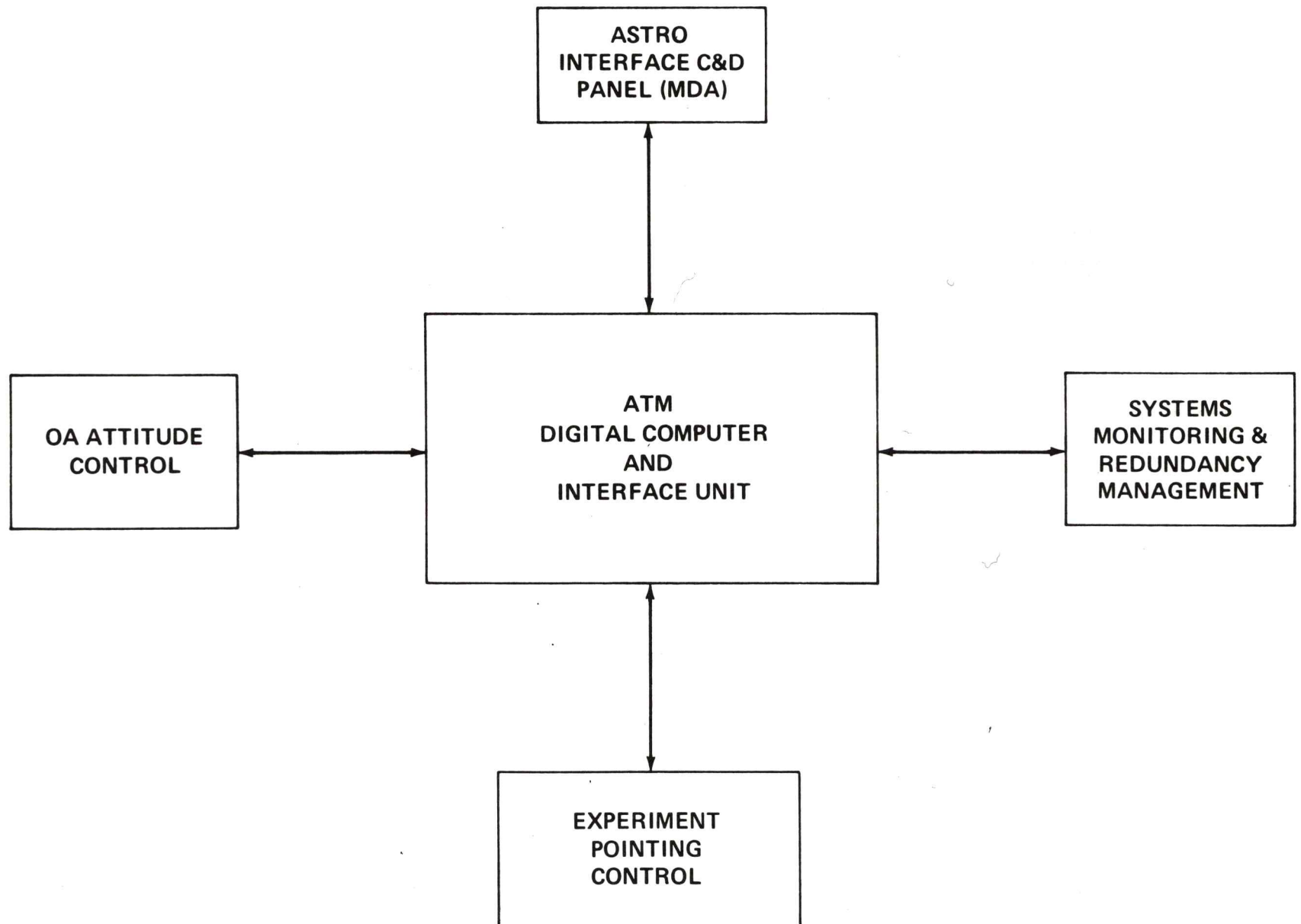
### 0 COLD GAS THRUSTERS

- SECONDARY ACTIVE SYSTEM FOR ATTITUDE CONTROL
- USED BY IU DURING EARLY ORBITAL PERIOD
- USED BY ATM PRIOR TO CMG SPINUP AND DURING CMG DESATURATION
- $\text{GN}_2$  LOCATED ON AFT OF OWS

### 0 EXPERIMENT POINTING CONTROL

- INDEPENDENT OF THE ACS
- THE EPC PROVIDES CONTROL OF THE CANISTER FOR FINE POINTING THE EXPERIMENTS TO TARGETS OF OPPORTUNITY ON THE SUN

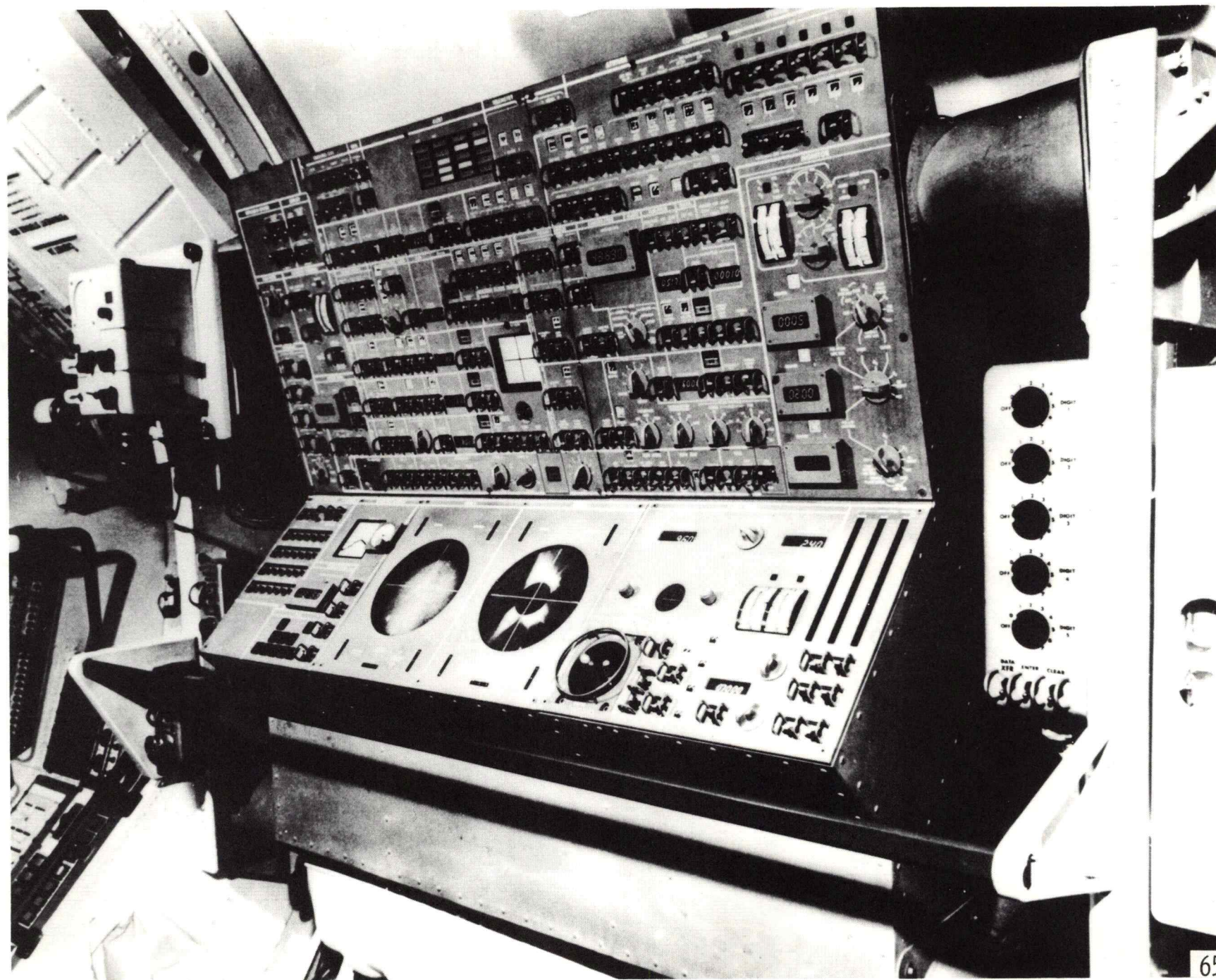
## ATM DIGITAL COMPUTER FUNCTIONS





## ATM CONTROL AND DISPLAY PANEL

- o CONTROL AND DISPLAY PANEL (C&D) LOCATED IN THE MULTIPLE DOCKING ADAPTER (MDA)
- o C&D PANEL PROVIDES ASTRONAUT INTERFACE WITH ATM SUBSYSTEMS
- o ASTRONAUT INTERFACES INCLUDE:
  - ATM DIGITAL COMPUTER
  - ATM SOLAR ARRAY SYSTEM
  - ATTITUDE POINTING SYSTEM
  - ATM EXPERIMENT SYSTEMS
  - ATM TELEVISION CAMERA SYSTEM





## ATM INSTRUMENTATION AND COMMUNICATIONS SYSTEM

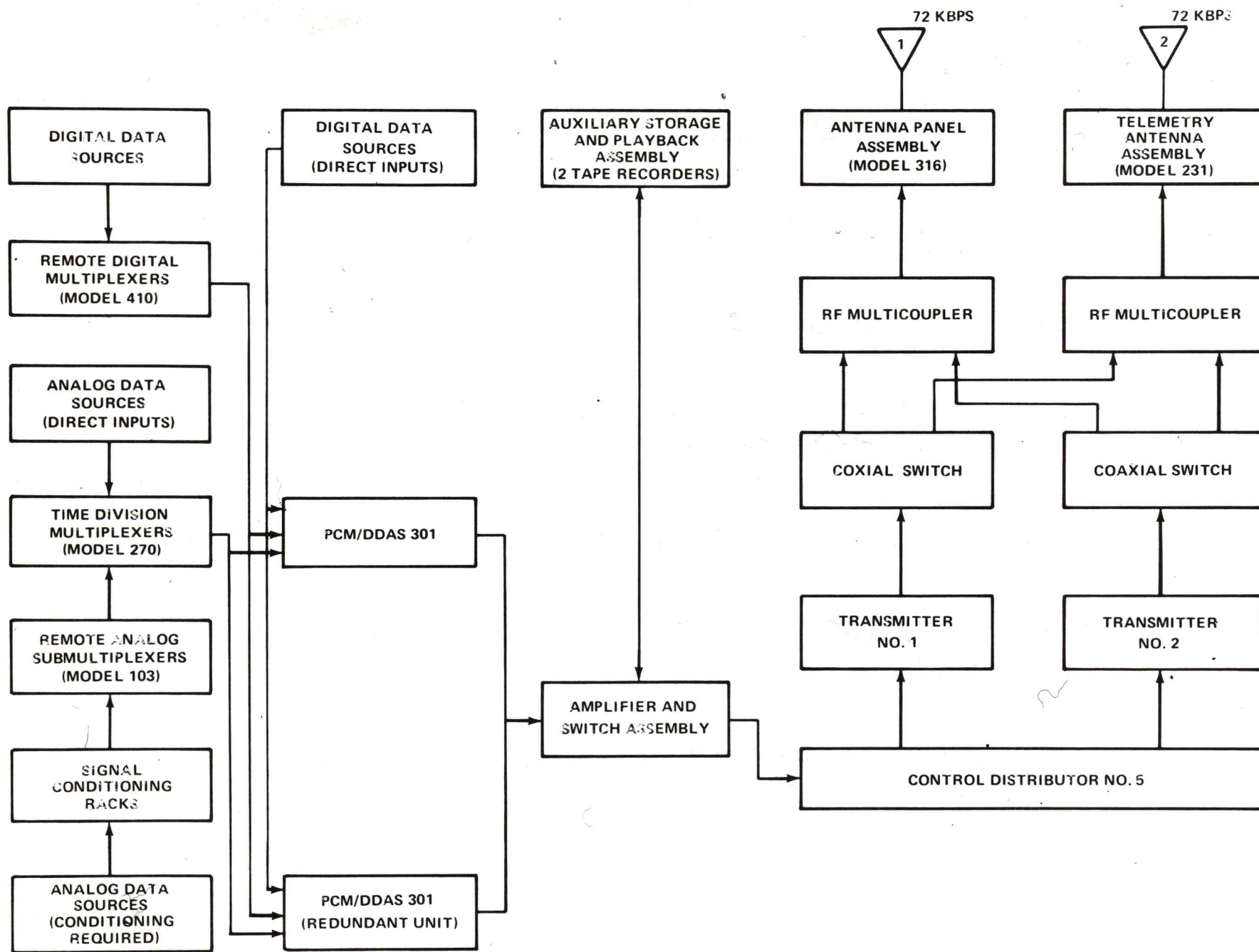
- 0 TELEMETRY SYSTEM
- 0 DIGITAL COMMAND SYSTEM
- 0 DIGITAL ADDRESS SYSTEM
- 0 TELEVISION SYSTEM

### ATM TM SUBSYSTEM

- o ATM TM SUBSYSTEM SIMILAR TO APOLLO IU TM SYSTEM
- o SYSTEM IS POWERED UP DURING EARLY ORBIT
- o EITHER TRANSMITTER MAY TRANSMIT EITHER THE RECORDER OR REAL-TIME DATA SIMULTANEOUSLY
- o BOTH TRANSMITTERS MAY TRANSMIT THE SAME DATA SIMULTANEOUSLY
- o PRIMARY AND BACKUP RECORDERS HAVE A 90 MINUTE RECORD CAPABILITY
- o MUST BE DUMPED EVERY 90 MINUTES BY GROUND OR ON-BOARD COMMAND FOR AT LEAST 5 MINUTES



# ATM TM SUBSYSTEM

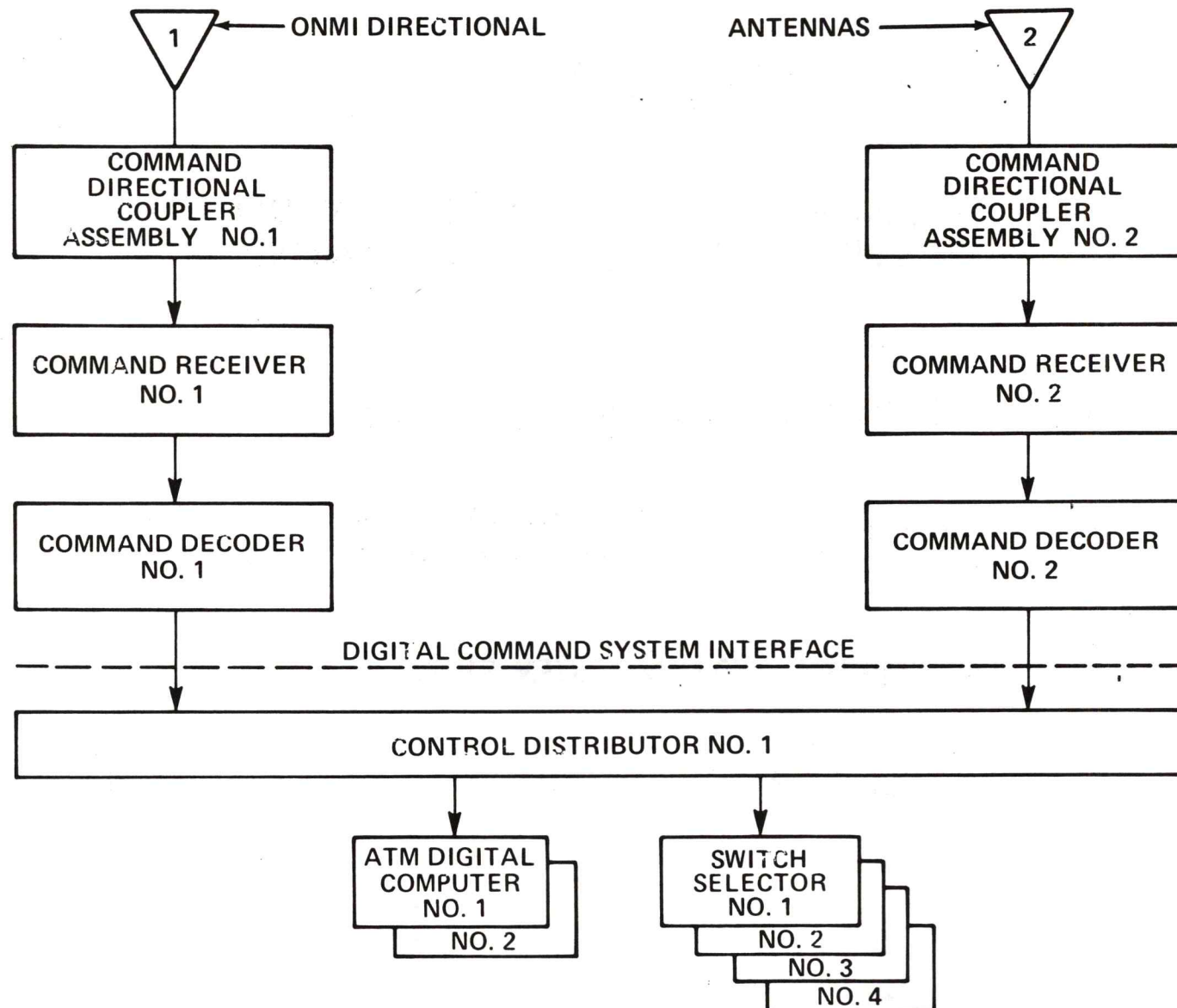


### ATM DIGITAL COMMAND SYSTEM (DCS)

- o PROVIDES CAPABILITY TO COMMAND SUBSYSTEMS AND EXPERIMENTS DURING MANNED AND UNMANNED PHASES VIA THE STDN
- o ATM DCS IS TWO INDEPENDENT PARALLEL SYSTEMS
- o TWO SYSTEMS ARE CONNECTED IN ACTIVE REDUNDANCY; ONLY ONE SYSTEM IS REQUIRED TO PROCESS UPLINKED DATA
- o COMMAND UPLINK IS 450 MHz PSK/FM SIGNAL
- o SWITCH SELECTOR OR COMPUTER COMMANDS MAY BE UPLINKED



## ATM DIGITAL COMMAND SYSTEM (DCS)

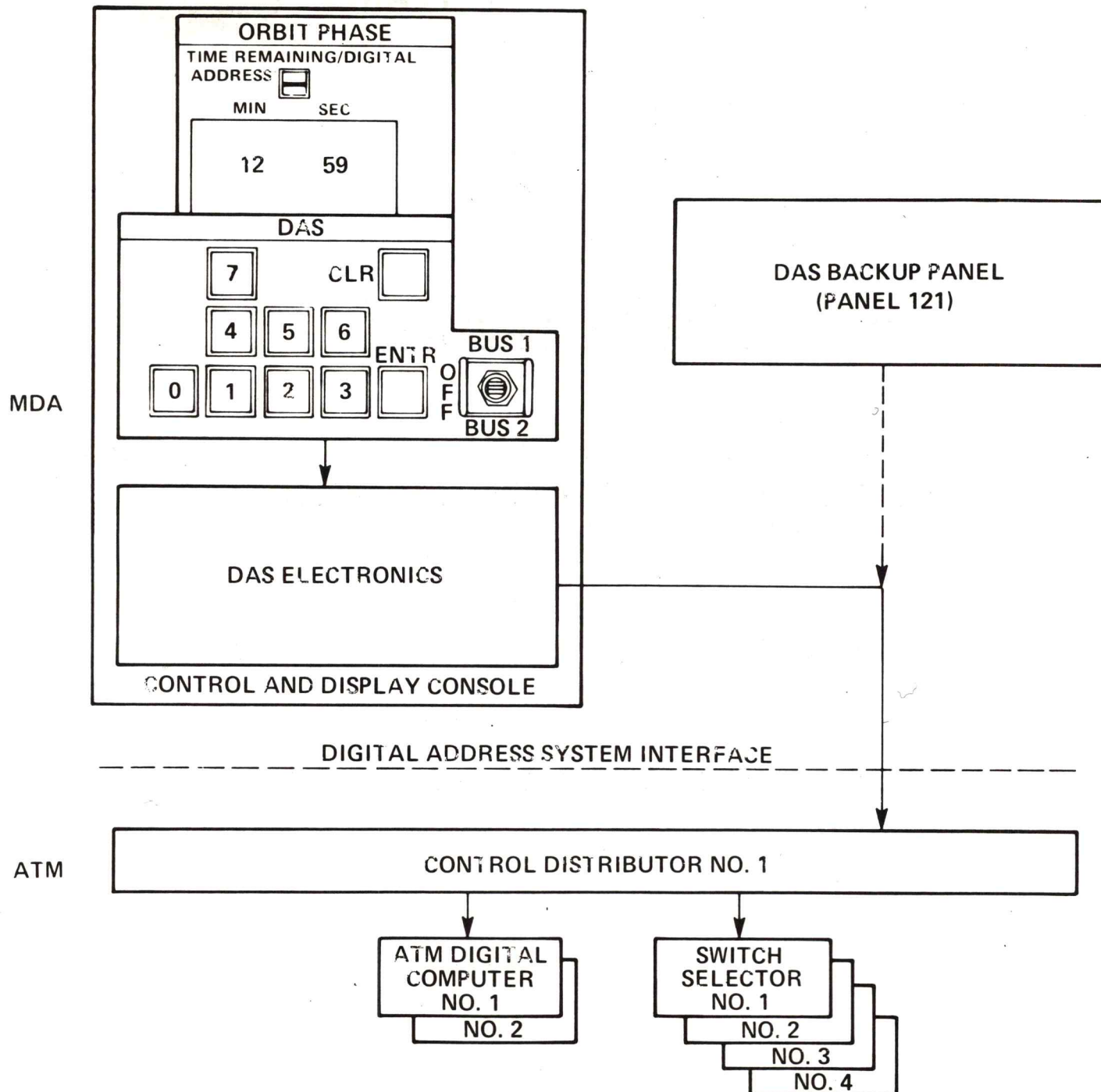


### ATM DIGITAL ADDRESS SYSTEM (DAS)

- o PROVIDES ON-BOARD CAPABILITY FOR ASTRONAUT COMMANDING OF THE ATM DIGITAL COMPUTER UPDATES, SWITCH SELECTOR OUTPUTS, AND EXPERIMENTS
- o INTEGRAL PART OF THE ATM CONTROL AND DISPLAY PANEL
- o BACKUP DIGITAL ADDRESS SYSTEM IS AVAILABLE



# ATM DIGITAL ADDRESS SYSTEM (DAS)



**MAJOR FEATURES OF THE MULTIPLE DOCKING ADAPTER**

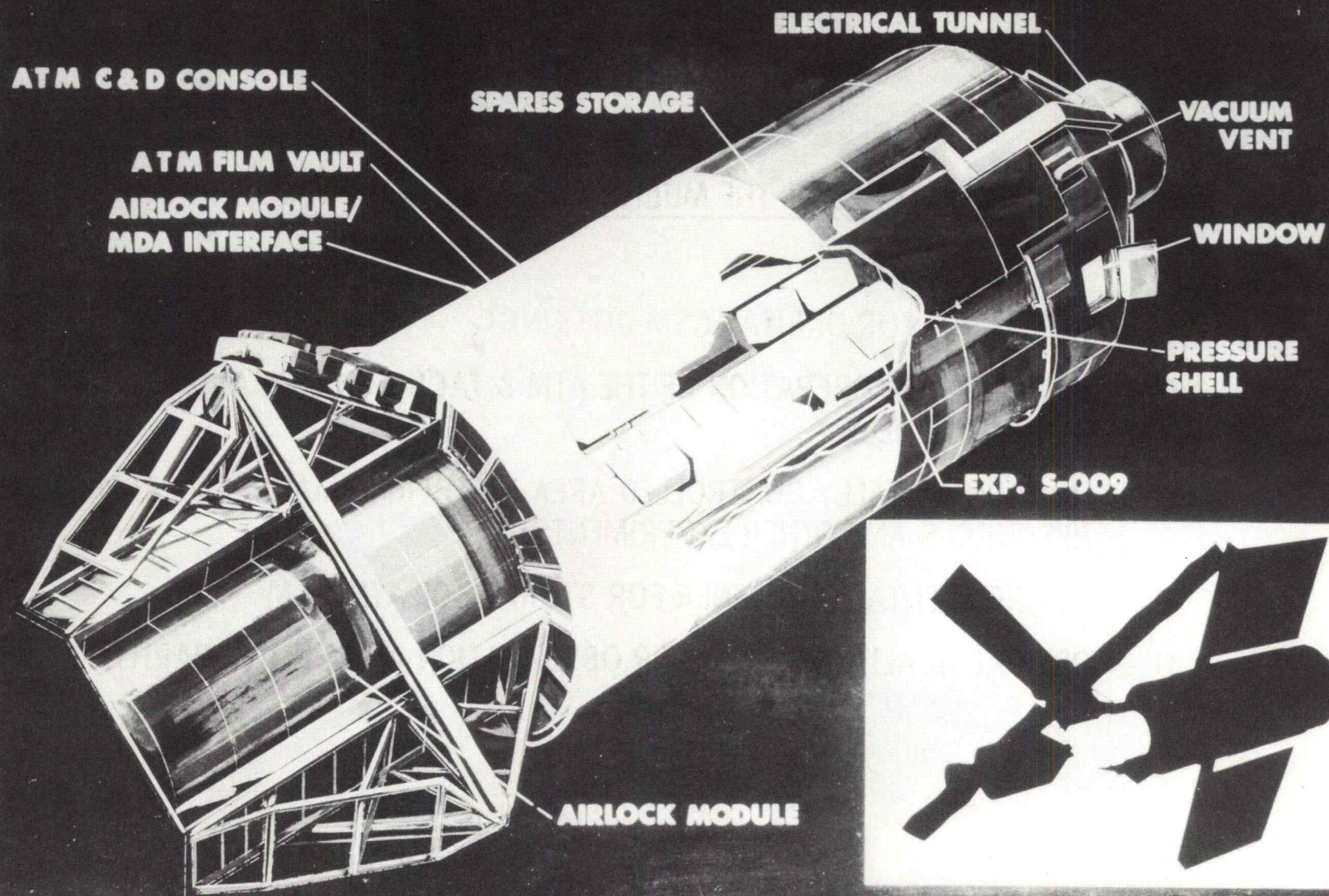
- 0 TWO PORTS FOR ORBITAL CSM DOCKING**
- 0 LOCATION FOR OPERATION OF THE ATM & TACS CONTROL AND DISPLAY PANELS**
- 0 ENVIRONMENTALLY CONTROLLED AREA FOR PERFORMANCE OF EARTH RESOURCES AND OTHER EXPERIMENTS**
- 0 ENVIRONMENTAL CONTAINER FOR STORAGE OF ATM FILM**
- 0 OPTICAL QUALITY WINDOW FOR OBSERVATION AND PHOTOGRAPHY**

**WEIGHT - 13, 800 LBS.**

**DIMENSIONS - 10 FT. DIAMETER  
17 FT. LENGTH**

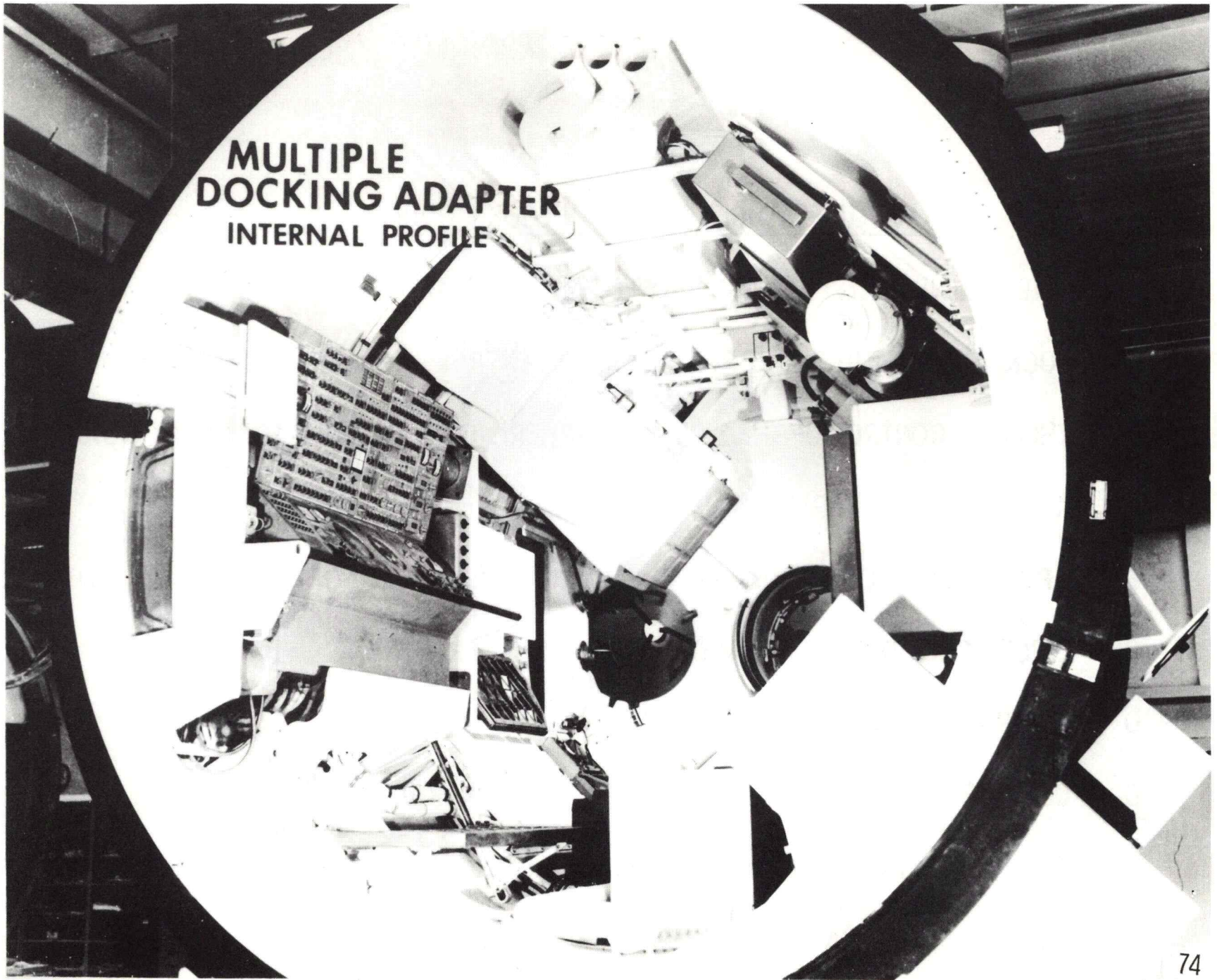


# MULTIPLE DOCKING ADAPTER





**MULTIPLE  
DOCKING ADAPTER  
INTERNAL PROFILE**





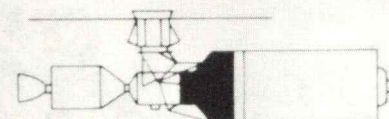
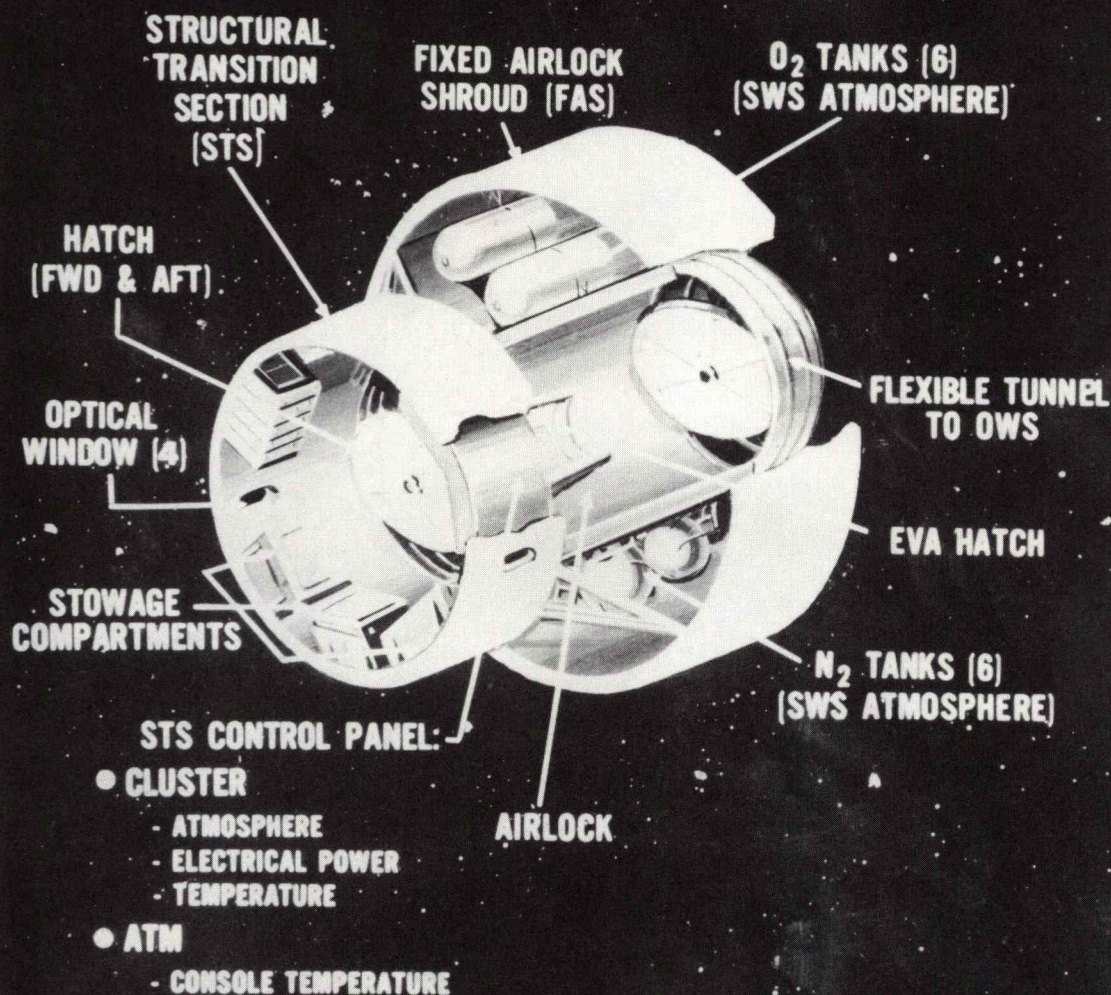


### MAJOR FEATURES OF THE AIRLOCK MODULE

- 0 INTERCONNECTING PASSAGE BETWEEN MDA AND OWS
- 0 LOCK, HATCH AND SUPPORT SYSTEM FOR EXTRAVEHICULAR ACTIVITY (EVA)
- 0 THERMAL CONTROL OF THE SWS ATMOSPHERE (COOLING ONLY FOR MDA/OWS)
- 0 ATMOSPHERIC SUPPLIES AND CONTROLS
- 0 APOLLO TELESCOPE MOUNT (ATM) LAUNCH SUPPORT AND ORBITAL DEPLOYMENT
- 0 ELECTRICAL POWER SYSTEM CONTROL AND DISTRIBUTION
- 0 INSTRUMENTATION
- 0 CLUSTER INTERCOMMUNICATION AND FAILURE WARNING
- 0 COMMAND SYSTEM LINK WITH GROUND NETWORK
- 0 CONTROLS, DISPLAYS AND TELEPRINTER



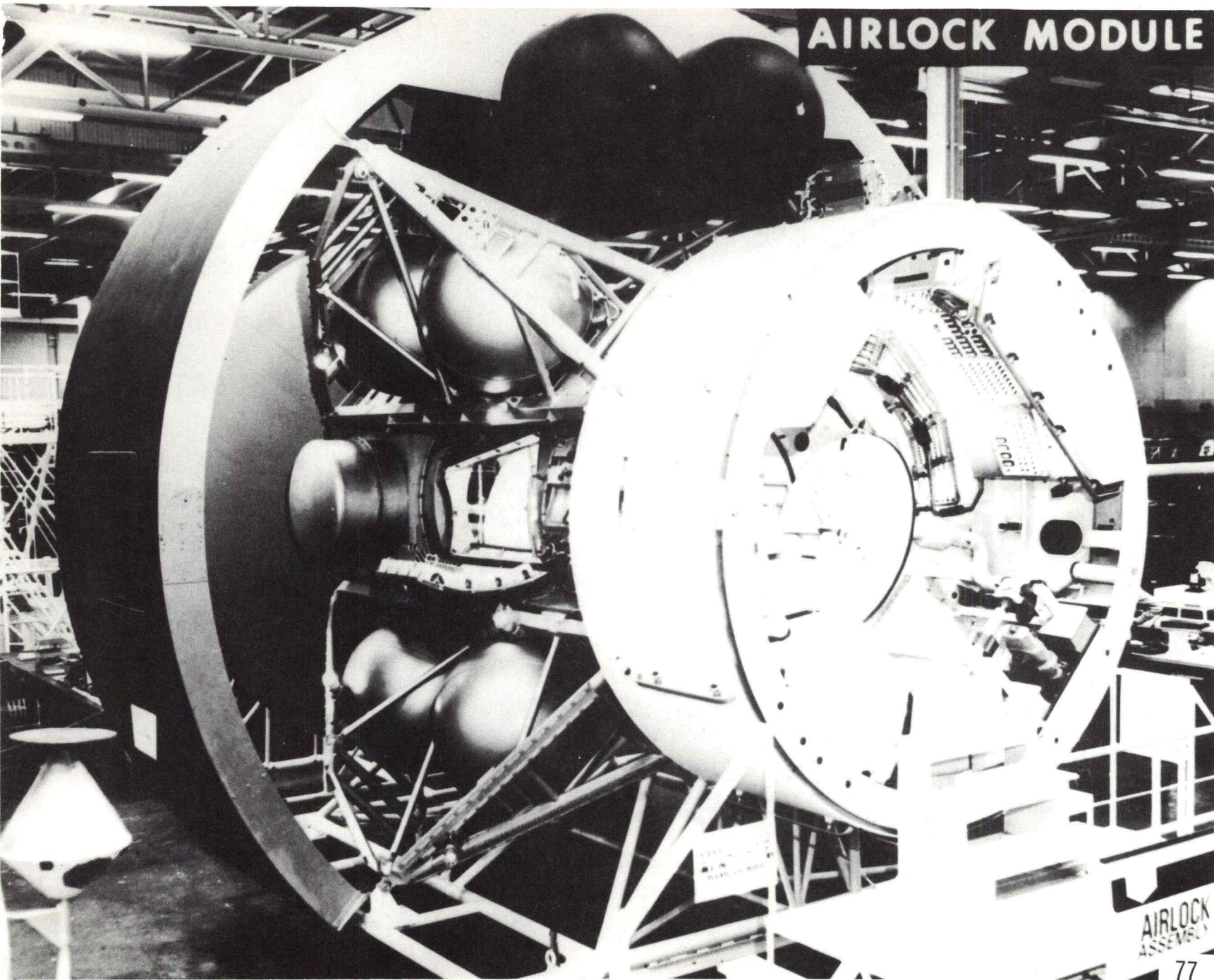
## AIRLOCK MODULE (AM)



## CHARACTERISTICS

- **WEIGHT (LOADED)**  
49,000 LB  
22,050 KILOGRAMS
- **DIAMETER:**  
10 FT  
3.0 METERS
- **LENGTH (TOTAL)**  
17 FT  
5.1 METERS
- **VOLUME (HABITABLE)**  
579 CU. FT  
17.37 CU. METERS





## AM TELEMETRY SYSTEM

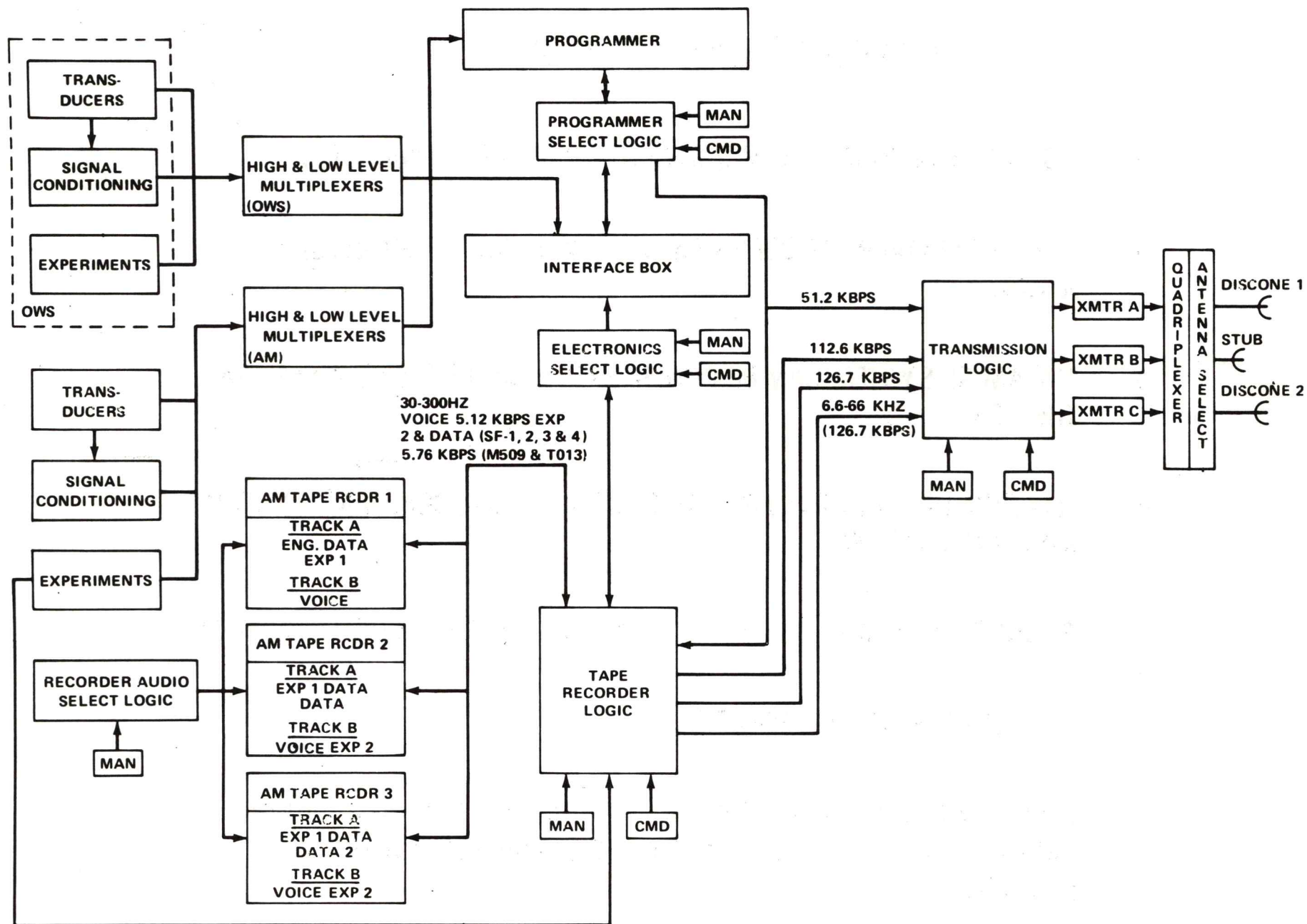
- o SIMILAR TO GEMINI SYSTEM
- o PROVIDING A 51.2 KBPS REAL-TIME BIT STREAM TO THE TRANSMISSION SUBSYSTEM
- o PROVIDE RECORDABLE DATA TO THE RECORDING SYSTEM
- o 4 TRANSMITTERS IN THE SYSTEM, 3-10 WATT, AND 1-2 WATT (Not Shown) FOR LAUNCH
- o TRANSMISSION LOGIC COMMANDABLE ONCE ORBIT IS ACHIEVED
- o ONLY 1 DOWNLINK IS ACTIVE UNLESS RECORDERS ARE BEING DUMPED
- o RT DATA TRANSMITTED CONTINUOUSLY
- o CAPABILITY EXISTS TO TRANSMIT 3 DOWNLINKS SIMULTANEOUSLY OVER 1 ANTENNA



## AM RECORDERS

- o AM HAS THREE 2-TRACK TAPE RECORDERS
- o RECORDERS ARE SELECTABLE BY STDN OR ASTRONAUT
- o RECORDERS RECORD ENGINEERING DATA, BIOMED DATA, EXPERIMENT DATA, AND ASTRONAUT VOICE
- o FOR THE MOST PART, RECORDER TRACK SELECTION AND DATA IS SELECTABLE
- o PLAYBACK TO RECORD RATIO 22:1, A 5 MINUTE PLAYBACK TIME, WITH PARTIAL PLAYBACK CAPABILITY

# AM TELEMETRY AND RECORDER SUBSYSTEMS

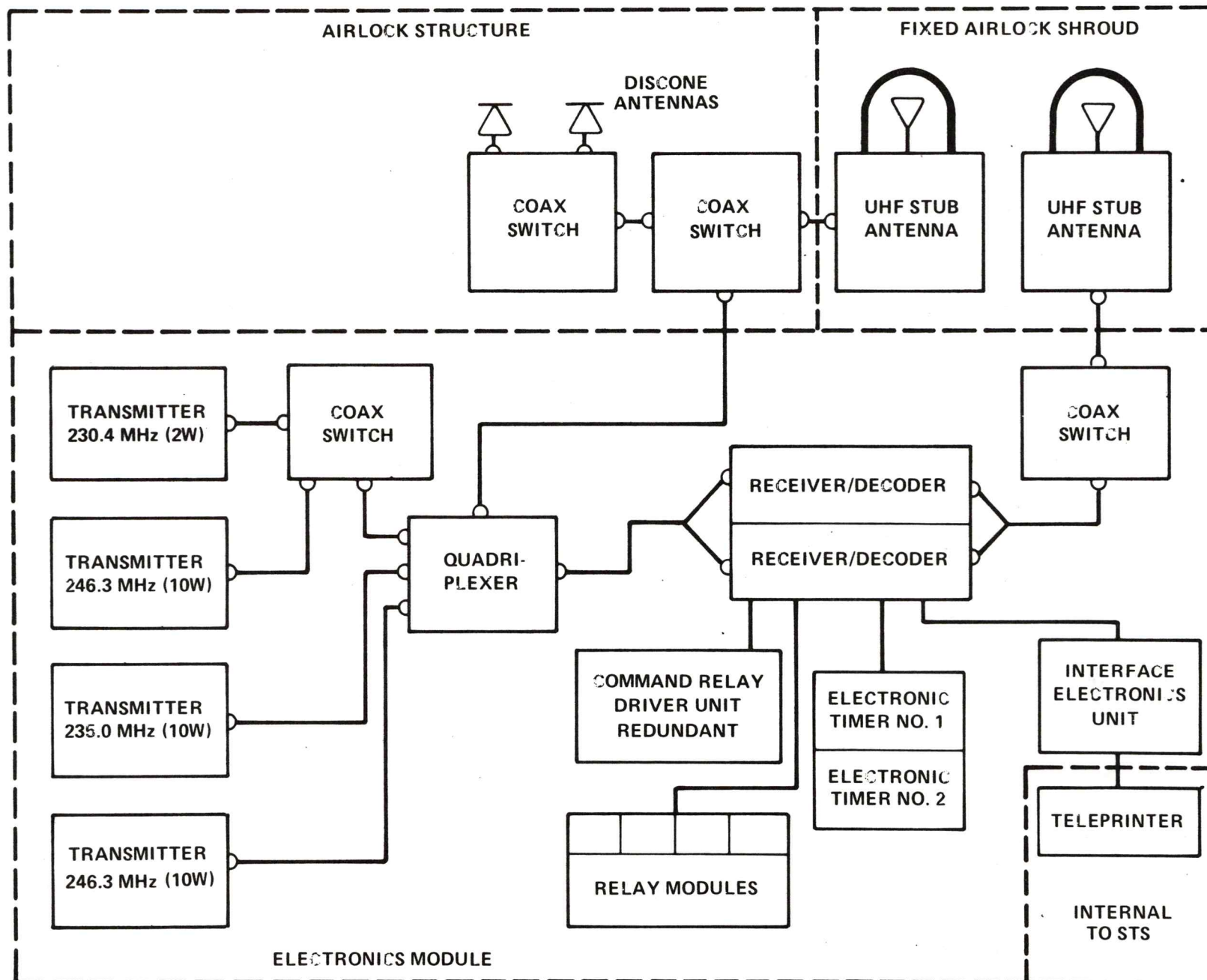




AM DIGITAL COMMAND SYSTEM

- o CONSISTS OF PRIMARY AND SECONDARY RECEIVER/DECODER
- o ONLY 1 RECEIVER DECODER CAN BE COMMANDED (Addressed) AT A TIME
- o THE AM RF SYSTEM CAN BE CONFIGURED ~32 DIFFERENT WAYS VIA THE DCS
- o TELETYPE UPLINK AT 450 MHz IS ROUTED VIA AM COMMAND SYSTEM INSTRUMENTATION
- o BACKUP SYSTEM TO INSTRUMENT UNIT (IU) DURING SWS ACTIVATION
- o UPDATES TIMING REFERENCE SYSTEM
- o PRIMARY MEANS OF DUMPING AM RECORDERS AND CONFIGURING AM MODULATION TECHNIQUES DURING UNMANNED PORTION OF MISSION

# AIRLOCK RF SYSTEM





## MAJOR FEATURES OF THE WORKSHOP MODULE

- 0 CREW QUARTERS
- 0 FOOD MANAGEMENT SYSTEM
- 0 WASTE MANAGEMENT SYSTEM
- 0 CONTAINS 24 EXPERIMENTS AND WORK AREA
- 0 SCIENTIFIC AIRLOCK
- 0 STORAGE AREAS

### WEIGHT

78,000 LB

(35,100 KILOGRAM)

### DIMENSIONS

DIAMETER

22 FT

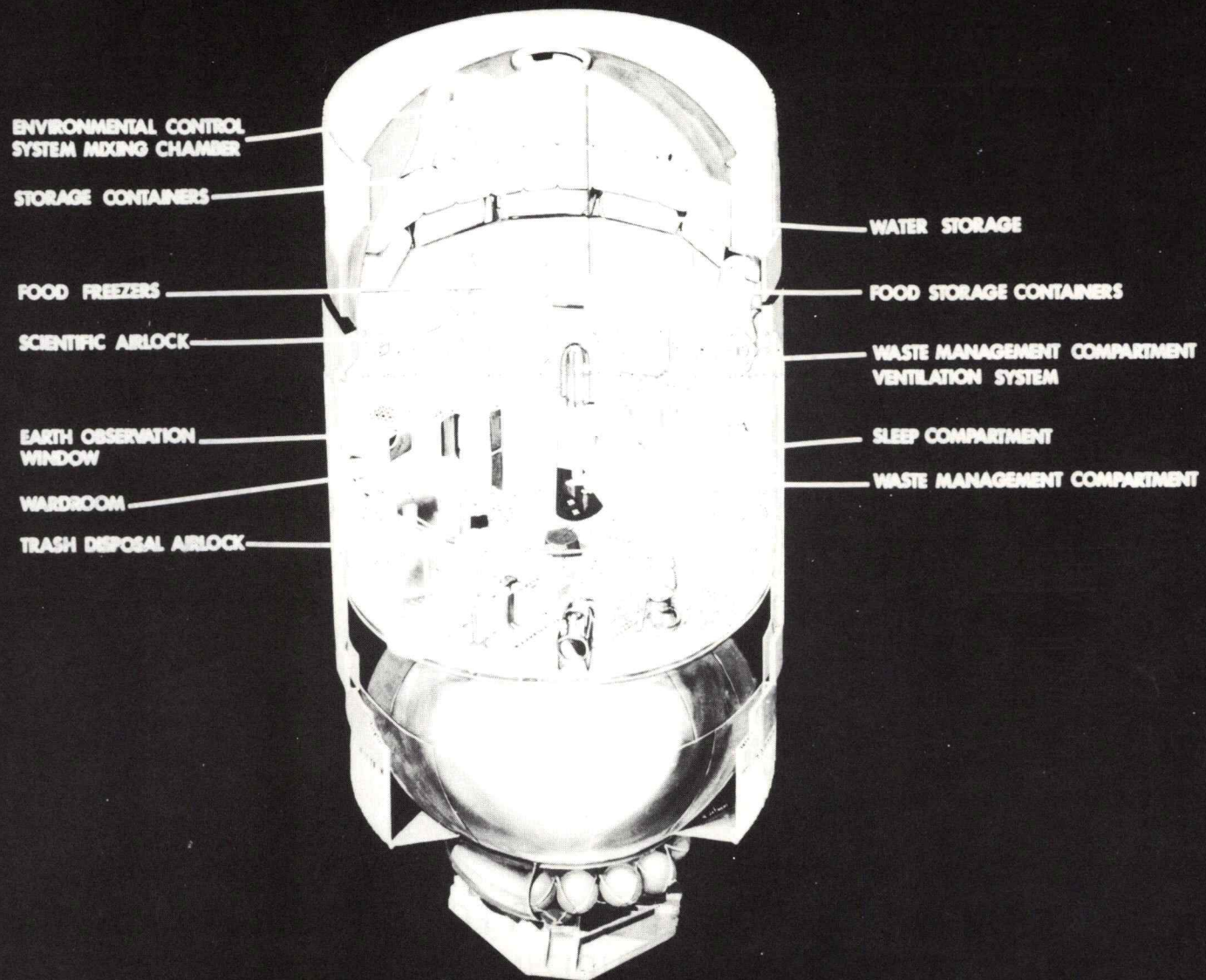
(6.6 METERS)

LENGTH

48 FT

(14.6 METERS)

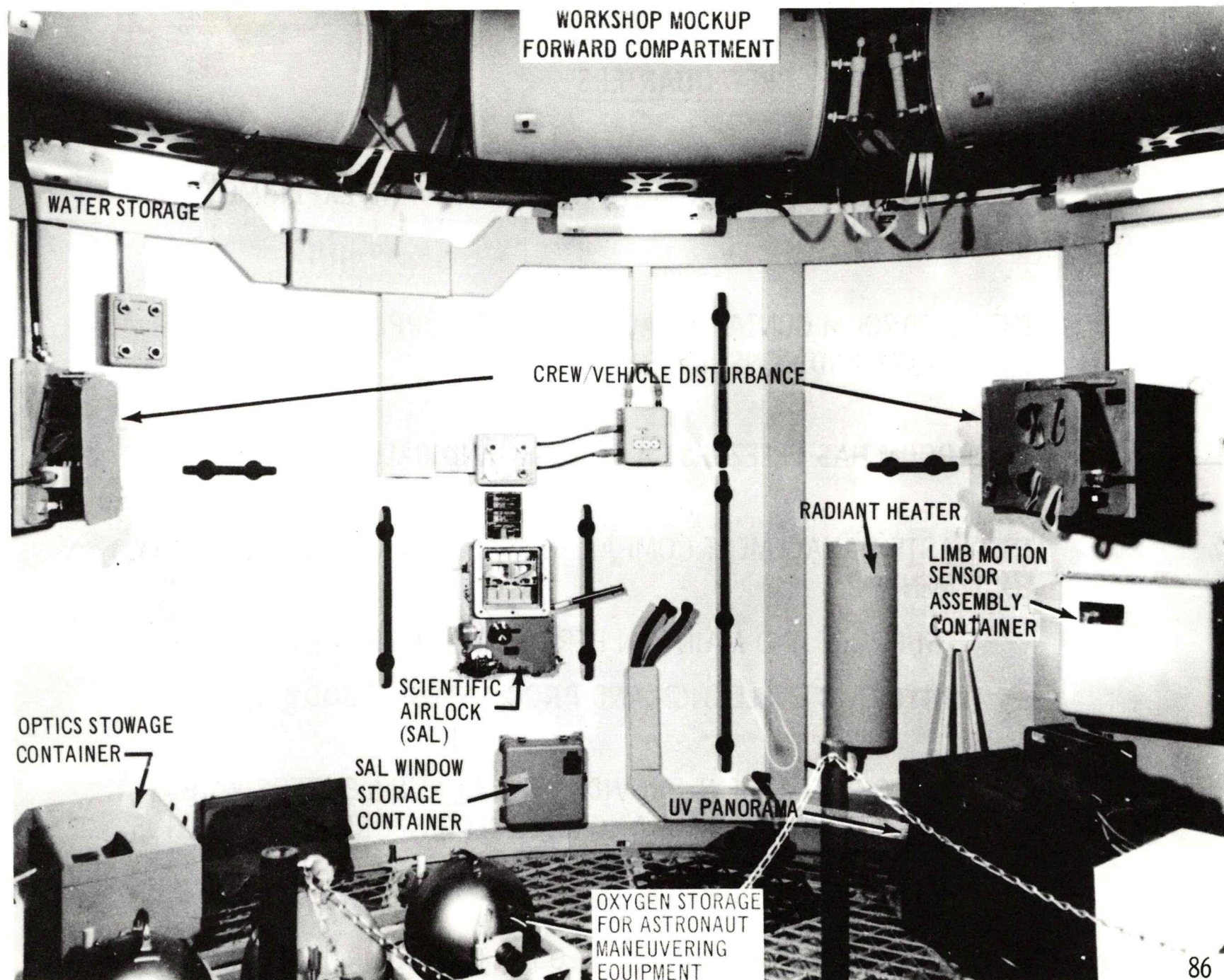
# SKYLAB ORBITAL WORKSHOP





### FORWARD COMPARTMENT

- o CONTAINS 10 WATERTANKS, 25 STOWAGE COMPARTMENTS FOR WASTE MANAGEMENT, PERSONNEL HYGIENE, PHOTOGRAPHIC AND MAINTENANCE EQUIPMENT
  
- o CONTAINS SCIENTIFIC AIRLOCKS FOR EXPOSING HARDWARE TO SPACE WITHOUT DEPRESSURIZING THE HABITATION AREA





## CREW QUARTERS

- o CONTAINS SLEEP COMPARTMENT, WARDROOM AND EXPERIMENT COMPARTMENT
- o THE WARDROOM CONTAINS FACILITIES AND SUPPLIES NECESSARY TO PREPARE AND CONSUME FOOD
- o WARDROOM HAS FREEZERS, A CHILLER, AND GALLEY
- o THE WASTE MANAGEMENT COMPARTMENT CONTAINS THE NECESSARY EQUIPMENT TO
  - SUPPORT AND MAINTAIN PERSONAL HYGIENE
  - HYGIENIC COLLECTION AND PROCESSING OF BODY WASTES
- o THE SLEEP COMPARTMENT PROVIDES THE 3 CREW MEMBERS WITH PRIVATE SLEEPING ACCOMODATIONS, UTILIZING PRIVACY CURTAINS, PARTITIONS AND SLEEP RESTRAINTS
- o THE EXPERIMENT COMPARTMENT IS USED TO PERFORM EXPERIMENTS AND AS A CONTROL CENTER FOR THE OWS



# SKYLAB WORKSHOP CREW COMPARTMENT

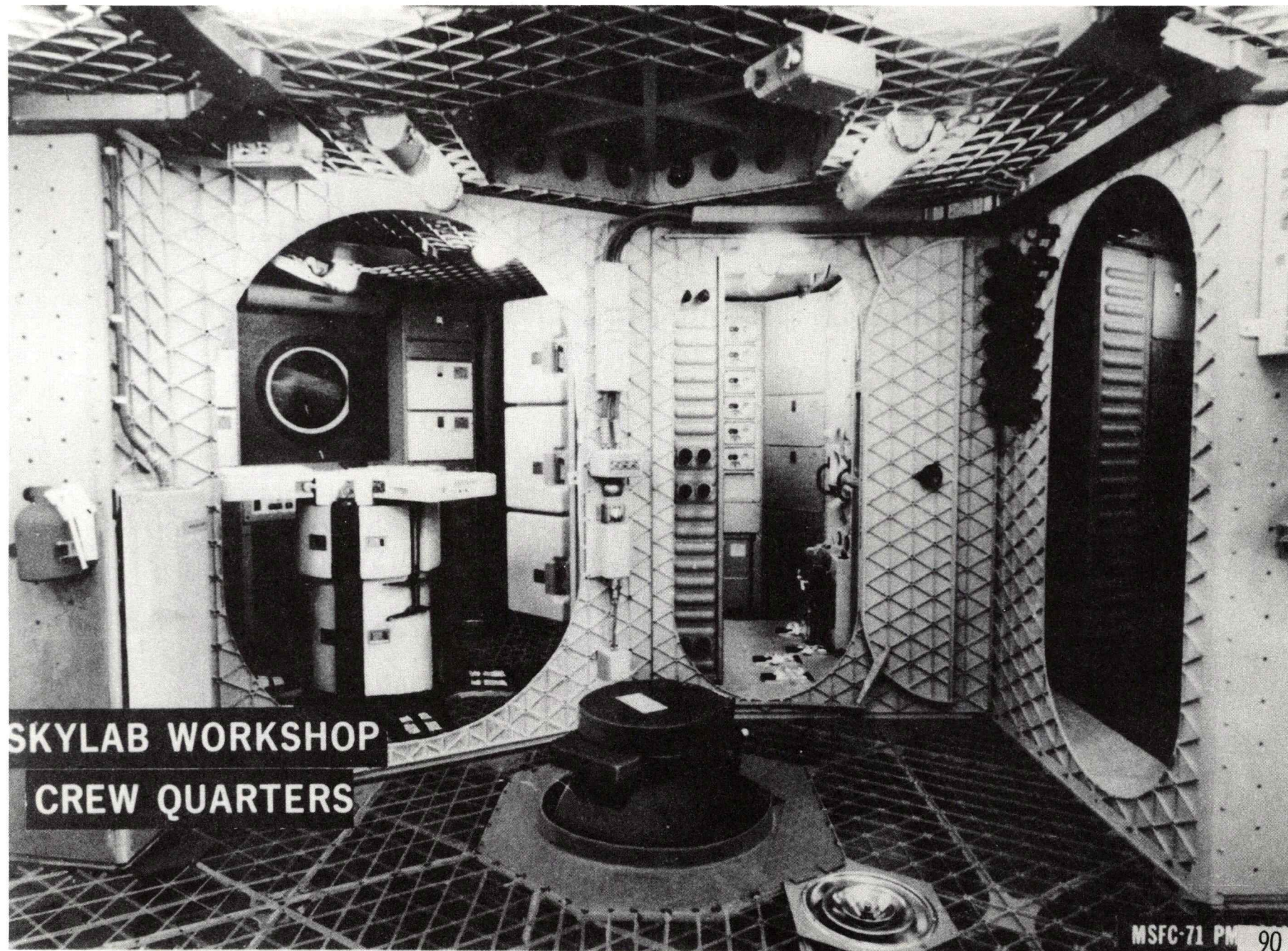




## TRASH AIRLOCK AND WASTE TANK

- 0 TRASH AIRLOCK INTERFACES WITH CREW COMPARTMENT AND WASTE TANK (S-IVB Lox Tank)
- 0 WASTE TANK IS RECEPTIVE TO ANY ITEM THAT IS BIOLOGICALLY ACTIVE AFTER ITS USE
- 0 ANY ITEM THAT IS BIOLOGICALLY INACTIVE AFTER ITS USE IS PLACED IN SWS PERMANENT STORAGE





SKYLAB WORKSHOP  
CREW QUARTERS

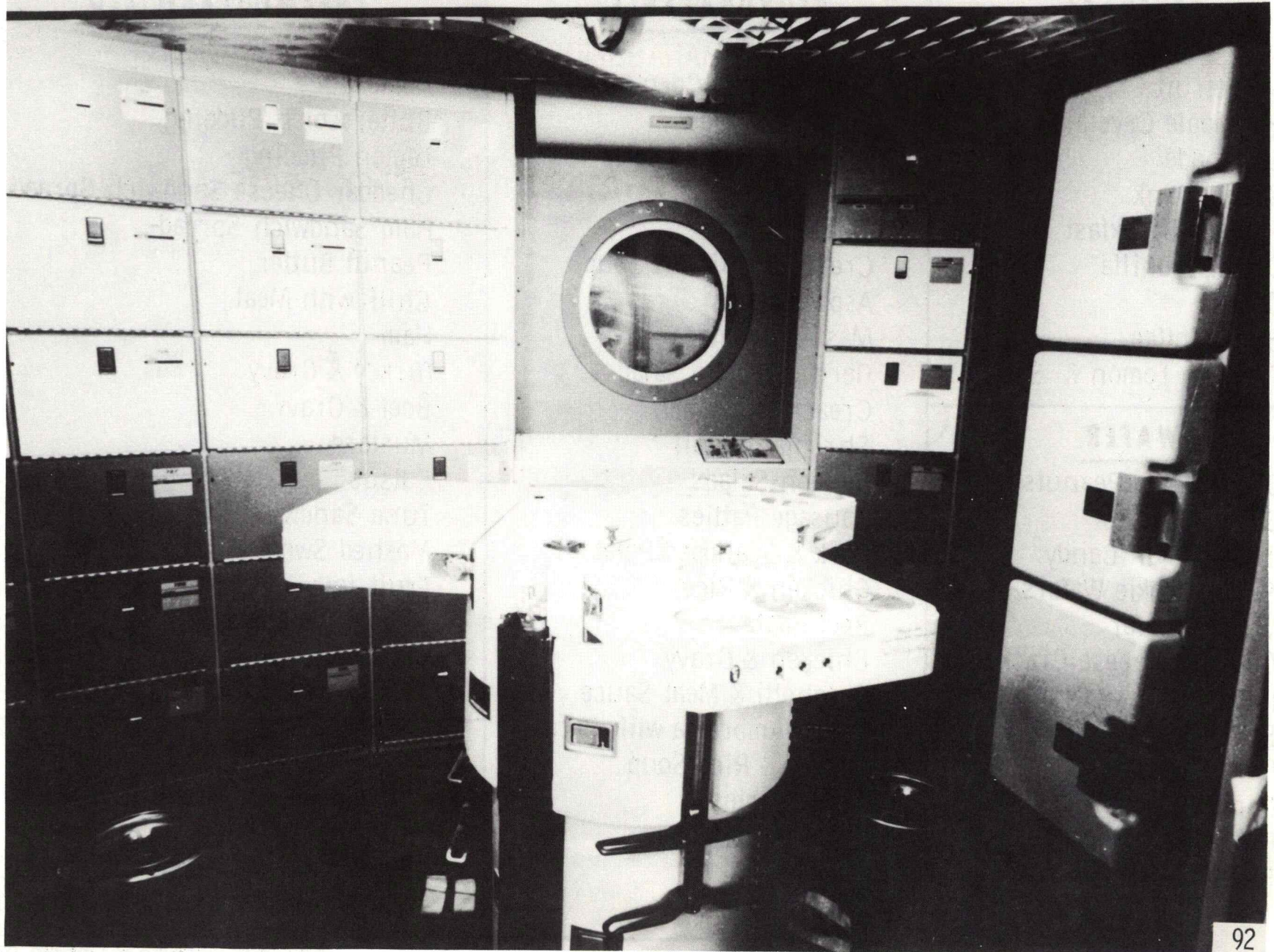
MSFC-71 PM 90



## FOOD MANAGEMENT

- O FOOD AND BEVERAGE - 140 DAY SUPPLY
  - APPROXIMATELY 1000 LBS. OF DEHYDRATED, WET PACK, PERISHABLE AND FROZEN FOODS
  - o FREEZER/REFRIGERATOR PROVIDED:
    - 250 LBS. FROZEN FOOD
    - 50 LBS. PERISHABLES
  - FOOD HEATER WITH 150-157<sup>0</sup> F. CAPABILITY
  - o FOOD MANAGEMENT TABLE WITH RESTRAINTS FOR ASTRONAUT, FOOD AND UTENSILS AND WITH WATER HEATER, CHILLER AND DISPENSERS
- O WATER REQUIREMENTS
  - o DRINKING AND FOOD PREPARATION - 8 LBS. PER MAN PER DAY
  - o CLEAN-UP/PERSONAL HYGIENE - 2.5 LBS. PER MAN PER DAY
  - o WATER SUPPLY IN STAINLESS STEEL CONTAINERS: 6000 LBS. TOTAL
  - o WATER SAMPLING AND TREATMENT
- O SCOURING PADS, CHEMICAL WIPES PROVIDED FOR CLEAN-UP

# OWS HIGH FIDELITY MOCKUP FOOD MANAGEMENT





## SKYLAB FOOD LIST

### BEVERAGE

Orange Crystals  
 Grapefruit Crystals  
 Pineapple Crystals  
 Lemonade  
 Grape Drink  
 Instant Breakfast  
 Drink, Vanilla  
 Cocoa  
 Black Coffee  
 Tea with Lemon & Sugar

### WAFER

Dry Roasted Peanuts  
 Dried Apricots  
 Jellied Fruit Candy  
 Sugar Cookie Wafers  
 Vanilla Wafer  
 Cheddar Cheese Cracker  
 Ham & Cheese Cracker  
 Bacon Wafers  
 Hard Candy  
 Mints  
 Melba Toast  
 Biscuit (Cracker Type)

### REHYDRATABLE

Rice Krispies  
 Sugar Coated Corn Flakes  
 Scrambled Eggs  
 Cream of Tomato Soup  
 Pea Soup  
 Potato Soup  
 Cream of Chicken Soup  
 Asparagus  
 Mashed Potatoes  
 German Potato Salad  
 Cream Style Corn  
 Shrimp Cocktail  
 Salmon Salad  
 Sausage Patties  
 Pork & Scalloped Potatoes  
 Chicken & Rice  
 Beef Hash  
 Chicken & Gravy  
 Spaghetti & Meat Sauce  
 Peach Ambrosia with Pecans  
 Turkey & Rice Soup  
 Strawberries

### THERMOSTABILIZED

Pineapple  
 Applesauce  
 Butterscotch Pudding  
 Lemon Pudding  
 Cheddar Cheese Sandwich Spread  
 Ham Sandwich Spread  
 Peanut Butter  
 Chili with Meat  
 Ham  
 Turkey & Gravy  
 Beef & Gravy  
 Mustard  
 Catsup  
 Tuna Sandwich Spread  
 Mashed Sweet Potatoes  
 Fruit Jelly  
 Stewed Tomatoes  
 Creamed Peas  
 Pears

### FROZEN

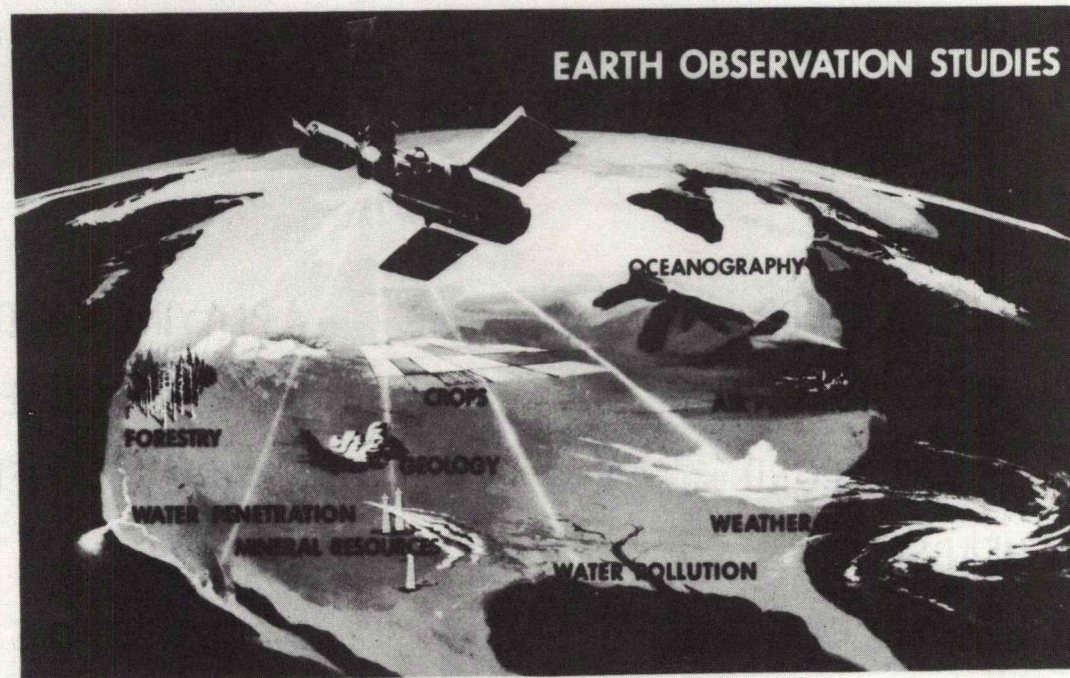
Coffee Cake	Pre-Buttered Roll
White Bread	Lobster Newburg
Cake	Prime Rib of Beef
Filet Mignon	Vanilla Ice Cream

OFF DUTY EQUIPMENT PROVISIONS

3 TAPE PLAYERS	4 PLAYING CARD DECKS
2 SPEAKERS	5 CARD DECK RETAINERS
1 SPEAKER CORD	5 CARD RETAINERS
4 HEADSETS	36 BOOKS
16 HEADSET EARPIECES	3 BOOK COVERS
2 MICROPHONES	1 DART BOARD
1 SHORT POWER CORD	12 DARTS
3 LONG POWER CORDS	3 EXER-GYMS
240 BATTERIES	6 HAND EXERCISERS
48 TAPE CASSETTES	1 BINOCULARS
	3 BALLS



# SKYLAB EARTH RESOURCES EXPERIMENTS

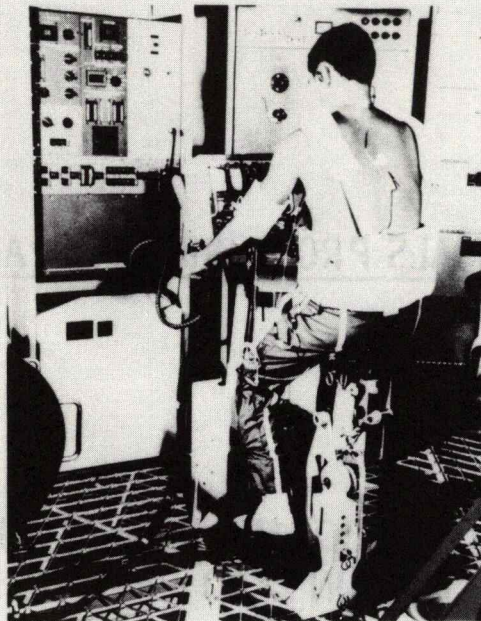
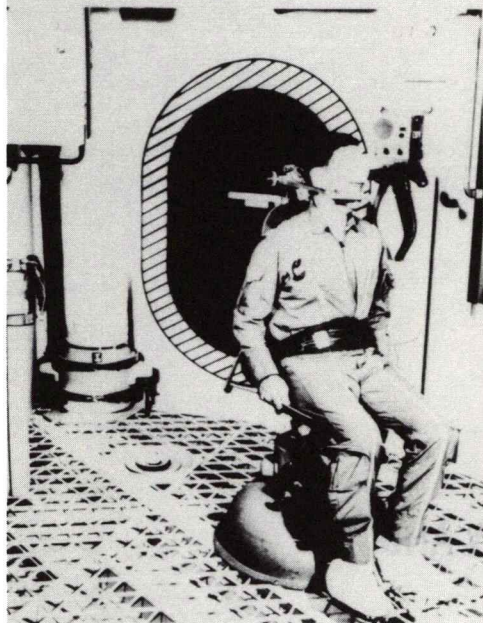


## OBJECTIVES

- PERFORM PHOTOGRAPHIC ANALYSIS OF CROPS, FORESTRY, UNDERGROUND WATER, SNOW COVER, GEOLOGY.
- LOCATE AND EVALUATE AIR AND WATER POLLUTION.
- EXAMINE OCEAN SURFACES, ICE AND CLOUD FORMATIONS, AND SEA SURFACE TEMPERATURE TO AID IN WEATHER PREDICTION AND CONTROL
- ASSESS EARTH SENSING TECHNIQUES AT ORBITAL ALTITUDES COMPARED TO GROUND BASED DATA IN ANALYZING EARTH RESOURCES DISCIPLINES



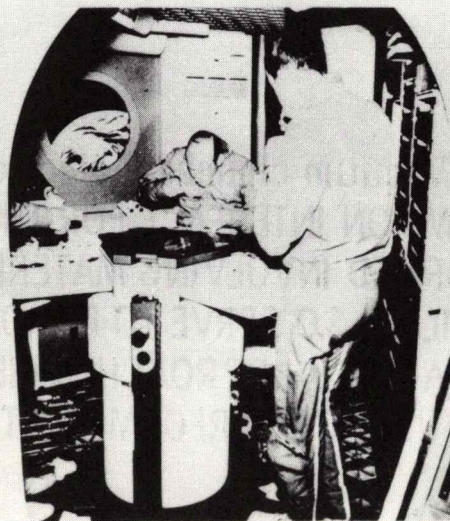
# SKYLAB MEDICAL EXPERIMENTS



## OBJECTIVES

DETERMINE EFFECT OF LONG DURATION SPACE FLIGHT ON MAN; PERFORM INVESTIGATIONS OF:

- CARDIOVASCULAR DECONDITIONING
- BONE MINERAL CHANGES
- GAINS/LOSSES OF BODY BIO-CHEMICALS
- HEMATOLOGY, IMMUNOLOGY, NEUROPHYSIOLOGY PULMONARY AND ENERGY METABOLISM





**TECHNOLOGY: M512 - MATERIALS PROCESSING IN SPACE**

**OBJECTIVES**

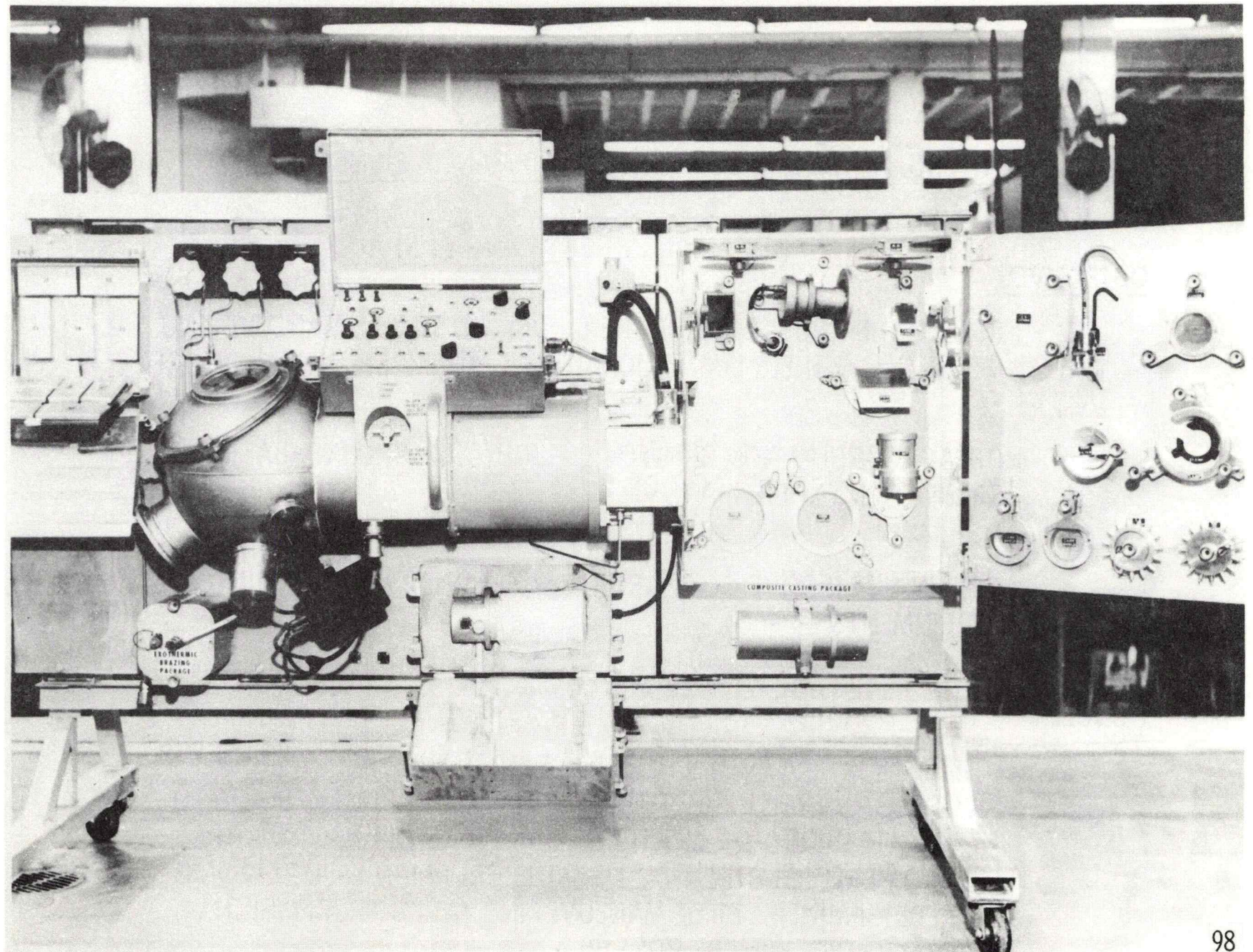
- o TO STUDY THE PHENOMENA OF MOLTEN METAL FLOW AND FUSION CHARACTERISTICS IN ZERO-GRAVITY

**CONCEPT**

- o THE M512 FACILITY (Vacuum chamber, electron beam gun, etc) WILL PROVIDE A COMMON INTERFACE FOR THE FIVE DIFFERENT TASKS TO BE PERFORMED INVOLVING MATERIALS SCIENCE AND TECHNOLOGY. IT WILL ALSO SERVE TO DEMONSTRATE A SYSTEM USING A "FACILITY APPROACH" WHERE COMMON HARDWARE WILL BE USED TO PERFORM MULTIPLE EXPERIMENTS



## MATERIALS PROCESSING IN SPACE DEVELOPED AT HUNTSVILLE





## OPERATIONS: T020 - FOOT CONTROLLED MANEUVERING UNIT

### OBJECTIVES

- 0 ADD TO THE KNOWLEDGE OF THE DESIGN OF SIMPLE MANEUVERING DEVICES AND THEIR LIMITATIONS USING AN EXPERIMENTAL DEVICE
- 0 OBTAIN CORRELATION BETWEEN INFLIGHT AND GROUND-BASED SIMULATION EXPERIMENTS
- 0 OBTAIN SUBJECTIVE COMPARISON WITH OTHER MANEUVERING EXPERIMENTS

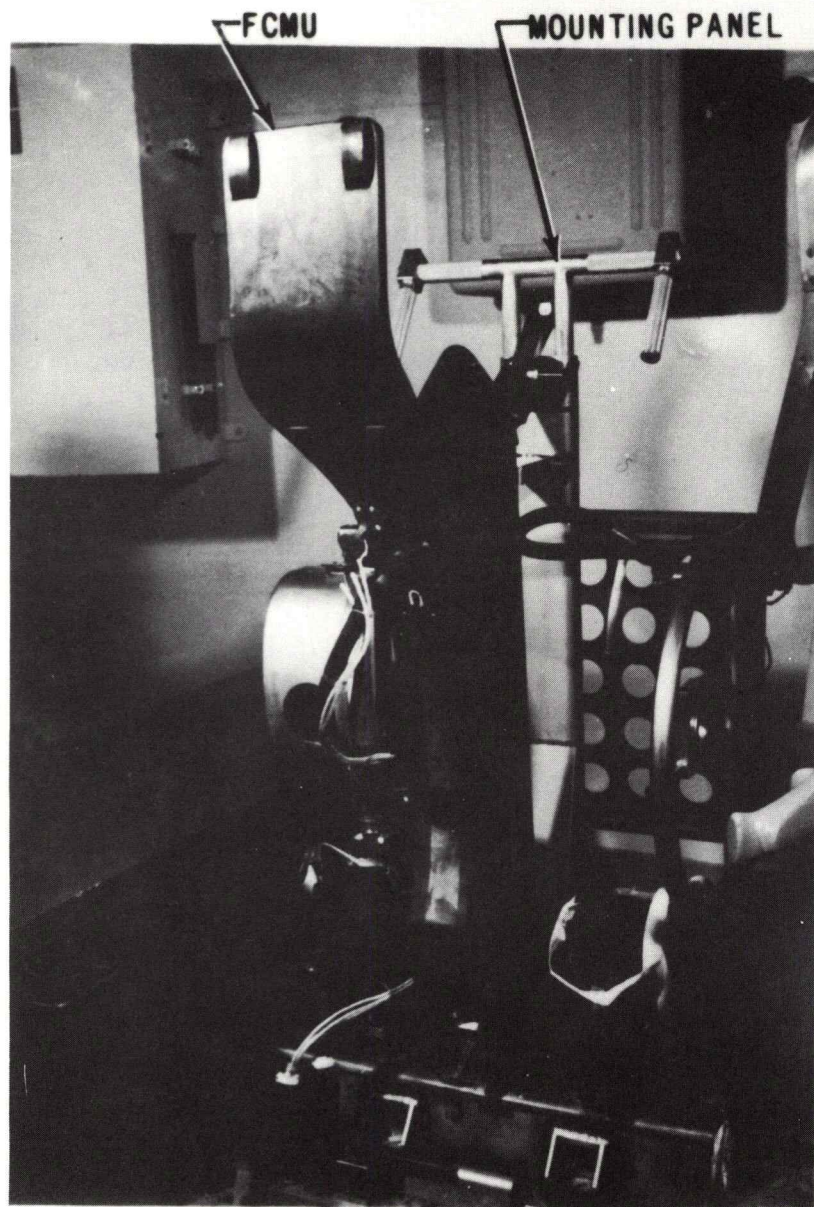
### CONCEPT

- 0 UTILIZATION OF A FOOT-OPERATED SYSTEM WILL ALLOW THE TEST PILOT TO CONTROL HIS ATTITUDE ABOUT ALL THREE AXES AND TO TRANSLATE ALONG THE VERTICAL AXIS WHILE HIS HANDS ARE FREE TO PERFORM OTHER TASKS. THE CREWMAN WILL PERFORM A PREDETERMINED SET OF MANEUVERING TASKS FROM WHICH AN EVALUATION WILL BE POSSIBLE

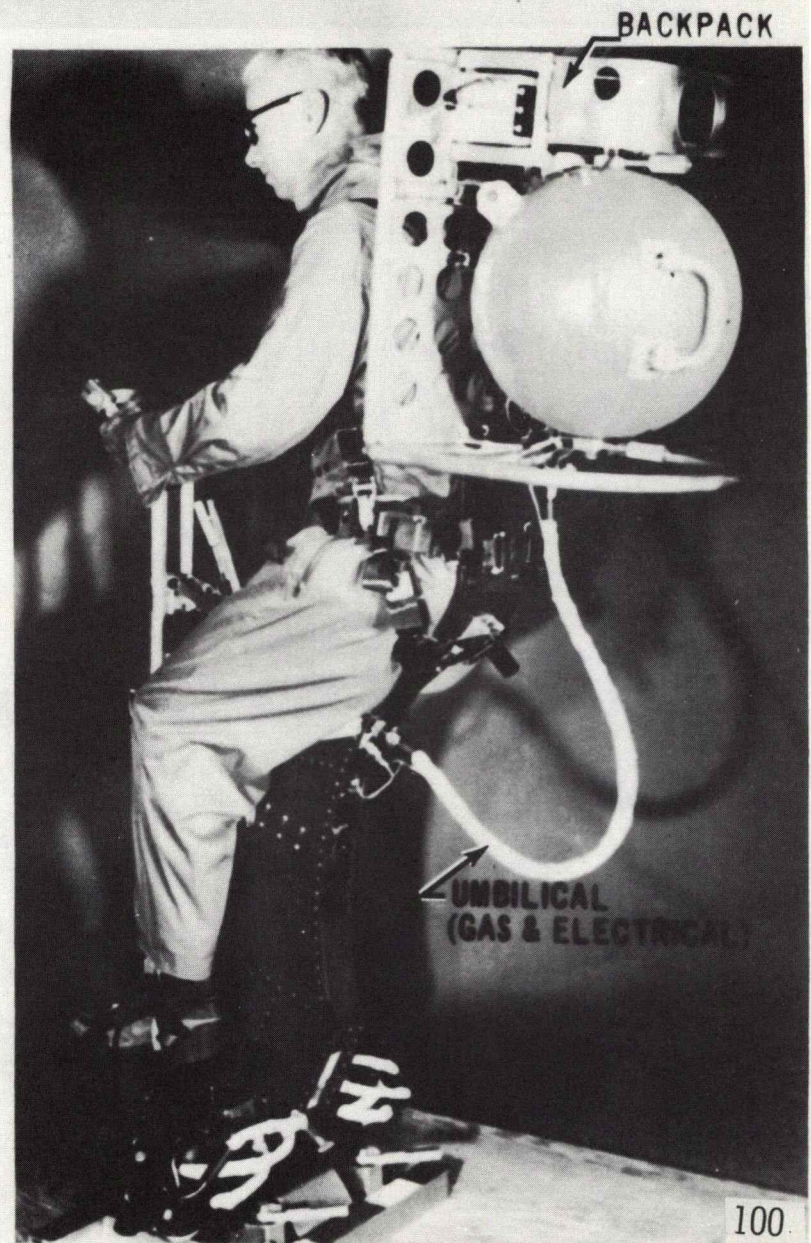


# FOOT CONTROLLED MANEUVERING UNIT

## SKYLAB EXPERIMENT T020



FCMU STOWED

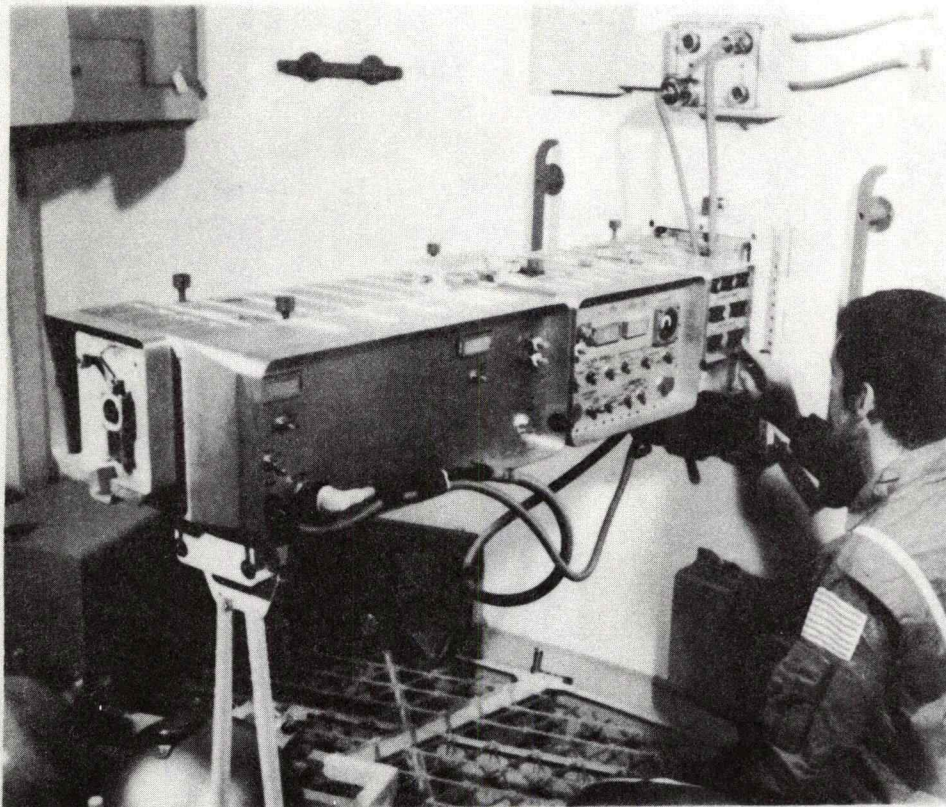


FCMU OPERATIONAL



# ATM CONTAMINATION MEASUREMENT

## SKYLAB EXPERIMENT T027



### PURPOSE

- TO DETERMINE THE CHANGE IN OPTICAL PROPERTIES OF VARIOUS TRANSMISSIVE WINDOWS, MIRRORS, AND DIFFRACTION GRATINGS CAUSED BY THE DEPOSITION OF CONTAMINANTS (ROCKET NOZZLE EXHAUST, OWS LEAKAGE AND WASTE DUMPS, AND OUTGASSING OF STRUCTURAL AND ABLATIVE MATERIALS).
- TO MEASURE THE SKY BRIGHTNESS BACKGROUND CAUSED BY SOLAR ILLUMINATION OF THE PARTICULATE CONTAMINANTS FOUND ABOUT THE OA.

### SIGNIFICANCE

THE DATA IS USED TO STUDY THE GENERAL PROBLEM OF SPACECRAFT ATMOSPHERIC CONTAMINATION. IN PARTICULAR IT WILL HELP IN THE INTERPRETATION OF THE DATA FROM ALL OF THE ATM, EREP, AND OTHER ASTRONOMY EXPERIMENTS.

# SUMMARY OF DATA FROM MSFC ATM AND COROLLARY EXPERIMENTS

<u>RETURNED SPECIMENS</u>	<u>VOICE</u>	<u>LOG BOOKS</u>	<u>FILM</u>	<u>T/M</u>	<u>TV</u>
M551	ALL EXCEPT	M479	M479	PROTON	S052
M552	M415	M551	M551	SPECTO-	S082A
M553	S150	M552	M553	METER	S082B
M554	PROTON	M553	████████	T013	H-1
M555	SPECTRO-	M554	T013	S183	H-2
S009	METER	M555	M487	M415	
D024		████████	S183	████████	
T003		S009	████████	S150	
████████		M487		S054	
		S183	S052	S055A	
		T002	S054	S056	
		████████	S082A		
			S082B		
		ALL ATM	H-1		



## SUMMARY OF SCHEDULING AND LOCATION OF MSFC AIM AND COROLLARY EXPERIMENTS

### MISSION:

#### SL-2

M415-IU

M551-MDA

M552-MDA

M553-MDA

M554-MDA

M555-MDA

**\*T020-OWS**

S009-MDA

PROT SPEC

-MDA

\*\*T013-OWS

M487-OWS

S183-SAL

T002-OWS

D024-AM

T003-CLUSTER

**T027-SAL**

**S073-SAL**

†ATM EXP'S

#### SL-3

**\*T020-OWS**

PROT SPEC

-MDA

\*\*TOB-OWS

M487-OWS

S183-SAL

T002-OWS

D024-AM

T003-CLUSTER

**T027-SAL**

**S073-SAL**

†ATM EXP'S

#### SL-4

M479-MDA

**\*T020-OWS**

PROT SPEC

-MDA

\*\*T013-OWS

M487-OWS

S183-SAL

T002-OWS

T003-CLUSTER

**T027-SAL**

**S073-SAL**

S150-IU

†ATM EXP'S

\*T020 RUNS ARE DEPENDANT UPON CABIN PRESSURE PATTERNS

\*\*T013 RUNS ARE DEPENDANT UPON AVAILABLE TIME SINCE PREPARATION IS TIME CONSUMING

†S053, S054, S055A WILL BE OPERATED DURING UNMANNED PERIODS AS WELL



## TYPICAL CREW DAY

		GMT HOURS													
		1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
CREWMAN	CDR	PH	EAT		SYSTEMS HOUSE- KEEPING	DUMP TRASH AIRLOCK		EAT	CREWMEN MOBILITY EXPERIMENT			PH			
	SPT	PH	EAT	ASSIST S073/T027				EAT		SYSTEMS HOUSE- KEEPING			PH		
	PLT	PH	EAT	S073/T027				EAT	CREWMAN MOBILITY EXPERIMENT			PH		SYSTEMS HOUSE- KEEPING	

		GMT HOURS													
		2300	2400	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	
CREWMEN	CDR	EAT		MISSION PLANN- ING	R+R	PH		SLEEP							
	SPT	EAT		MISSION PLANN- ING	R+R	PH		SLEEP							
	PLT	EAT		MISSION PLANN- ING	R+R	PH		SLEEP							

PH - PERSONAL HYGIENE



# SKYLAB EXPERIMENTS

NO.	TITLE	PRINCIPAL INVESTIGATOR
D024	THERMAL CONTROL COATINGS	MR. CARL BOEBEL, WRIGHT PATTERSON AIR FORCE BASE
ESS	EXPERIMENT SUPPORT SYSTEM	SUPPORTS EXPERIMENTS M092, M093, M131 & M171
M071	MINERAL BALANCE	DR. DONALD WHEDON, NATIONAL INSTITUTE OF HEALTH
M073	BIOASSAY OF BODY FLUIDS	DR. CAROLYN LEACH HUNTOON, MSC
M074	SPECIMEN MASS MEASUREMENT	COLONEL JOHN ORD, M.D., BROOKS AIR FORCE BASE
M092	IN-FLIGHT LOWER BODY NEGATIVE PRESSURE	DR. ROBERT L. JOHNSON, MSC
M093	VECTORCARDIOGRAM	{ DR. NEWTON ALLEBACH, NAVAL AEROSPACE MEDICAL INSTITUTE DR. RAPHAEL SMITH, VANDERBILT UNIVERSITY
M131	HUMAN VESTIBULAR FUNCTION	DR. ASHTON GRAYBIEL, MR. EARL MILLER, NAVAL AERO. MED. INST.
M133	SLEEP MONITORING	DR. J. D. FROST, BAYLOR SCHOOL OF MEDICINE
M151	TIME & MOTION STUDY	DR. JOSEPH KUBIS, FORDHAM UNIVERSITY
M171	METABOLIC ACTIVITY	MR. EDWARD L. MICHEL, MSC
M172	BODY MASS MEASUREMENT	COLONEL JOHN ORD, M.D., BROOKS AIR FORCE BASE
M415	THERMAL CONTROL COATINGS	MR. HARRY THAYER, MSFC
M479	ZERO GRAVITY FLAMMABILITY (B)	MR. HOWARD KIMZEY, MSC
M487	HABITABILITY & CREW QUARTERS	MR. C. C. JOHNSON, MSC
M509	ASTRONAUT MANEUVERING EQUIPMENT	MAJOR C. E. WHITSETT, USAF
M512	MATERIALS PROCESSING IN SPACE	MR. P. GORDON PARKS, MSFC
M551	METALS MELTING	{ MR. R. HOPPE, MSFC
M552	EXOTHERMIC HEATING	
M553	SPHERE FORMING	{ MR. E. HASEMEYER, MSFC
M554	COMPOSITE CASTING	
M555	GALLIUM ARSENIDE CRYSTAL GROWTH	MR. R. SIEDENSTICKER, WESTINGHOUSE
M516	CREW ACTIVITIES & MAINTENANCE	MR. ROBERT L. BOND, MSC

# SKYLAB EXPERIMENTS

NO.	TITLE	PRINCIPAL INVESTIGATOR
S009	NUCLEAR EMULSION	DR. MAURICE SHAPIRO, NAVAL RESEARCH LABORATORY
S019	UV STELLAR ASTRONOMY	DR. KARL G. HENIZE, MSC/NORTHWESTERN UNIVERSITY
S020	UV/X-RAY SOLAR PHOTOGRAPHY	DR. RICHARD TOUSEY, NAVAL RESEARCH LABORATORY
S063	UV AIRGLOW HORIZON PHOTOGRAPHY	MR. DONALD PACKER, NAVAL RESEARCH LABORATORY
S073	GEGENSCHNITT/ZODIACAL LIGHT	DR. JERRY WEINBERG, DUDLEY OBSERVATORY
S149	PARTICLE COLLECTION	DR. C. L. HEMENWAY, DUDLEY OBSERVATORY
S150	GALACTIC X-RAY MAPPING (B)	DR. WILLIAM KRAUSHAAR, UNIVERSITY OF WISCONSIN
S183	ULTRAVIOLET PANORAMA	DR. GEORGES COURTES, LABORATOIRE D'ASTRONOMIE SPATIALE (FR)
S190(A)	MULTISPECTRAL PHOTOGRAPHIC CAMERAS	DR. J. F. DORNBACH, MSC (PROJECT SCIENTIST)
S190(B)	EARTH TERRAIN CAMERAS (ETC)	MR. K. G. DEMEL, MSC (PROJECT SCIENTIST)
S191	INFRARED SPECTROMETER	DR. T. L. BARNETT, MSC (PROJECT SCIENTIST)
S192	MULTISPECTRAL SCANNER	DR. C. L. KORB, MSC (PROJECT SCIENTIST)
S193	MICROWAVE RADIOMETER/SCATTEROMETER & ALTIMETER	MR. DALLAS EVANS, MSC (PROJECT SCIENTIST)
S194	L-BAND RADIOMETER	DR. B. PRICE, UNIVERSITY CALIF., BERKLEY
S228	TRANS-URANIC COSMIC RAYS	SUPPORTS EXPERIMENTS S190(A), S190(B), S191, S192, S193 & S194
ESE	EREP SUPPORT EQUIPMENT	MR. ROBERT RANDLE, AMES RESEARCH CENTER
T002	MANUAL NAVIGATION SIGHTINGS (B)	DR. W. LEAVITT, DEPARTMENT OF TRANSPORTATION
T003	IN-FLIGHT AEROSOL ANALYSIS	DR. BRUCE CONWAY, LANGLEY RESEARCH CENTER
T013	CREW/VEHICLE DISTURBANCE	MR. D. E. HEWES, LANGLEY RESEARCH CENTER
T020	FOOT CONTROLLED MANEUVERING UNIT	DR. GEORGE P. BONNER, MSC
T025	CORONAGRAPH CONTAMINATION MEASUREMENT	DR. J. MUSCARI, MARTIN DENVER
T027	ATM CONTAMINATION MEASUREMENT	DR. R. MAC QUEEN, HAO, BOULDER, CO
S052	WHITE LIGHT CORONAGRAPH	DR. R. GIACCONI, AS&E, CAMBRIDGE, MA
S054	X-RAY SPECTROGRAPHIC TELESCOPE	DR. LEO GOLDBERG, HCO, CAMBRIDGE, MA
S055A	UV SCANNING POLYCHROMATOR/ SPECTROHELIOGRAPH	MR. J. MILLIGAN, MSFC, AL
S056	X-RAY TELESCOPE	DR. R. TOUSEY, NAVAL RESEARCH LABORATORY
S082A	XUV CORONAL SPECTROHELIOGRAPH	DR. R. TOUSEY, NAVAL RESEARCH LABORATORY
S082B	UV SPECTROGRAPH	DR. R. TOUSEY, NAVAL RESEARCH LABORATORY



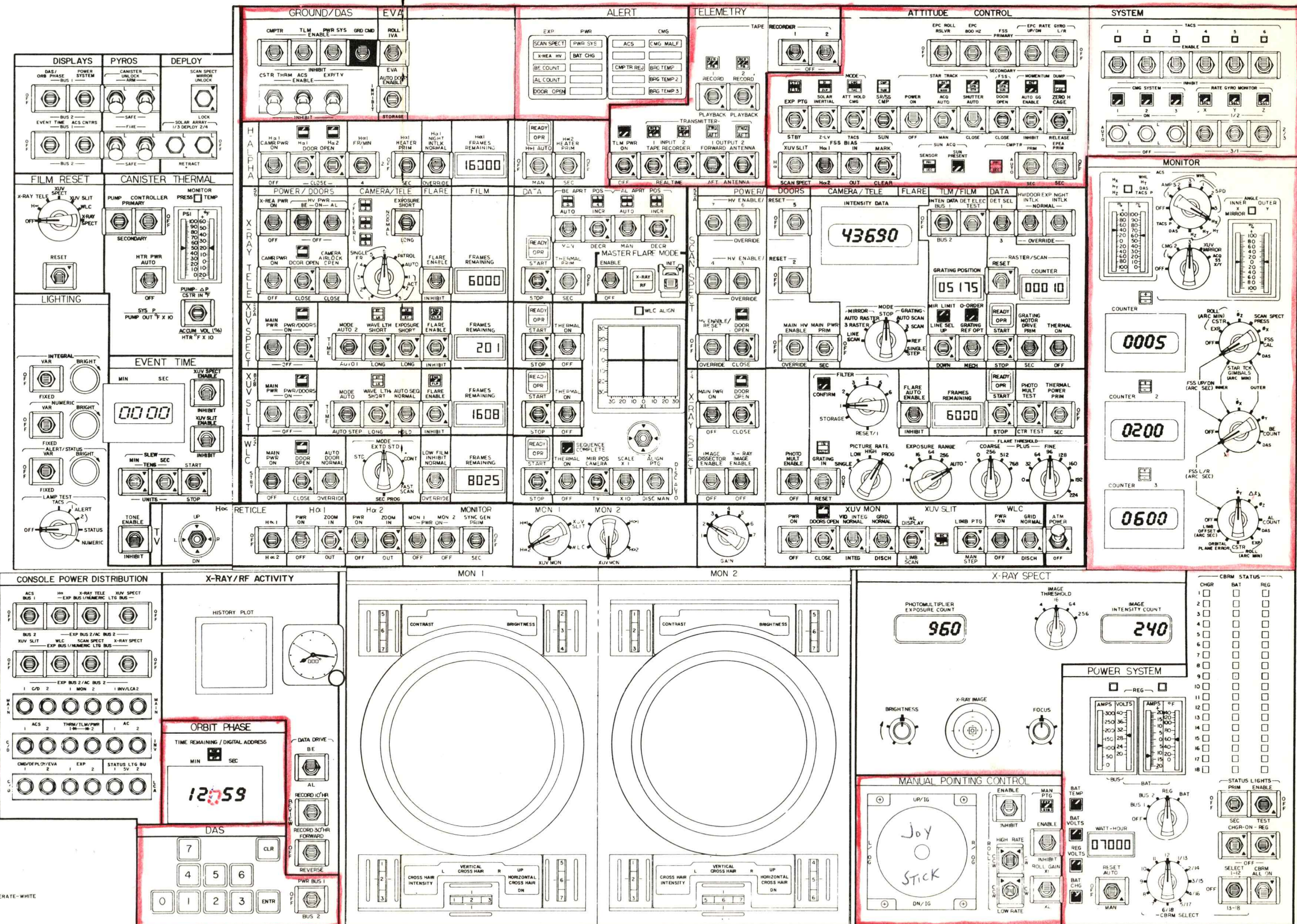
# SKYLAB EXPERIMENTS (CONTINUED)

NO.	TITLE	PRINCIPAL INVESTIGATOR
M518	MULTIPURPOSE FURNACE	
M556	VAPOR GROWTH OF II-VI COMPOUNDS	DR. H. WIEDEMEIR, RENSSELAER POLYTECHNIC
M557	IMMISCIBLE ALLOY COMPOSITIONS	MR. J. REGER, TRW
M558	RADIOACTIVE TRACER DIFFUSION	DR. UKANWA, MSFC-S&E-SSL
M559	MICROSEGREGATION IN GERMANIUM	{ DR. F. PADOUANI TEXAS INSTS. DR. F. VOLTMER
M560	GROWTH OF SPHERICAL CRYSTALS	DR. H. WALTER, UAH
M561	WHISKER-REINFORCED COMPOSITES	DR. T. KAWADA, NAT. RESEARCH INST.
M562	INDIUM ANTIMONIDE CRYSTALS	DR. H. GATOS, MIT
M563	MIXED III-V CRYSTALS GROWTH	DR. W. WILCOX, USC
M564	METAL & HALIDE EUTECTICS	DR. A. YUE, UCLA
M565	SILVERGRIDS MELTED IN SPACE	DR. A. DERUYTHERRE, CATH. UNIV. BELGIUM
M566	COPPER-ALUMINUM EUTECTIC	DR. E. HASEMEYER, MSFC-S&E-PE

## SKYLAB STUDENT EXPERIMENTS

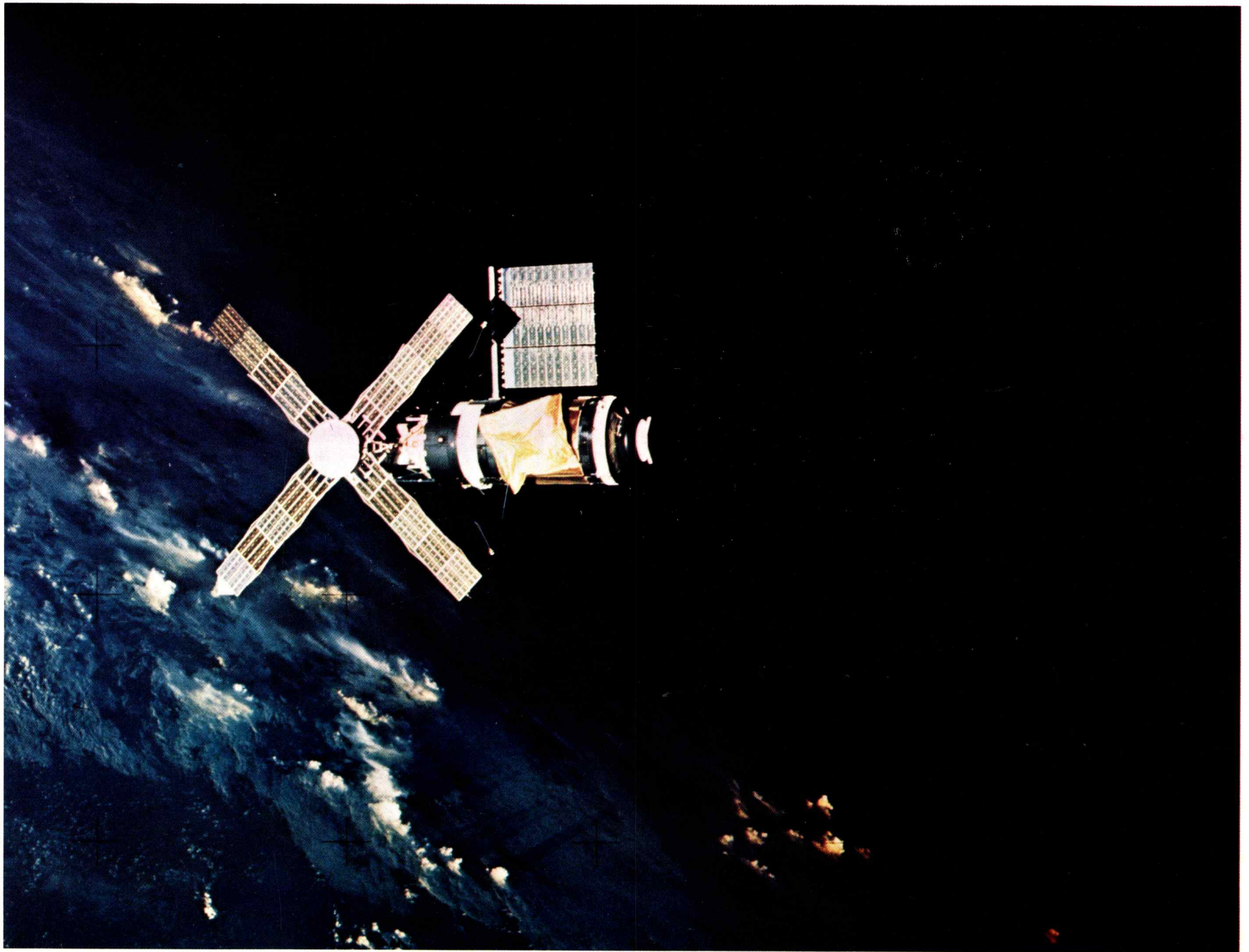
- |                                   |                                  |
|-----------------------------------|----------------------------------|
| * ED11 HEAT ABSORPTION            | ** ED52 WEB FORMATION            |
| * ED12 VOLCANO STUDY              | ** ED61 PLANT GROWTH             |
| * ED21 LIBRATION CLOUDS           | ** ED62 PLANT PHOTOTROPISM       |
| * ED22 OBJECTS IN MERCURY ORBIT   | ** ED72 CAPILLARY STUDY          |
| * ED23 QUASAR SPECTROGRAPHY       | ** ED74 MASS MEASUREMENT         |
| * ED24 STELLAR X-RAY CLASSES      | ** ED63 CYTOPLASMIC STREAMING    |
| * ED25 X-RAYS FROM JUPITER        | ** ED76 NEUTRON ANALYSIS         |
| * ED26 UV FROM PULSARS            |                                  |
| ** ED31 BACTERIA AND SPORES       |                                  |
| ** ED78 WAVE MOTION               |                                  |
| ** ED32 IN-VITRO IMMUNOLOGY       | * DATA ONLY                      |
| ** ED41 MOTOR SENSORY PERFORMANCE | ** HARDWARE FABRICATION REQUIRED |





PDD Section 19 for Sw. listing.  
and Definitions





SKYLAB SILHOUETTED AGAINST EARTH, DARK SKY, AS VIEWED FROM COMMAND/SERVICE MODULE





## NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SKYLAB CLUSTER IN EARTH ORBIT—This excellent view of the Skylab 1 space station cluster in Earth orbit was photographed from the Skylab 2 Command/Service Module during the final “fly around” inspection by the CSM. Clouds cover much of the Earth in the background. Sun reflection on the clouds at bottom right gives off an interesting coloration. This is a good view of the Earth’s terminator. The gold-colored diamond-shaped material on the Orbital Workshop (OWS) shields the vehicle from the powerful rays of the sun. The parasol covers the area where the OWS’s micrometeoroid shield is missing. The one remaining OWS solar array system wing has been fully deployed successfully, because of efforts by the astronauts to free the previously stuck solar array beam. The solar panel on the opposite side of the OWS is completely missing.