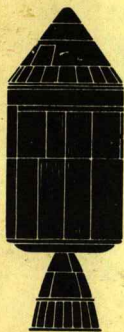


LOUIS ALEXANDER



APRIL 1, 1966

APOLLO TRAINING

APOLLO SPACECRAFT & SYSTEMS
FAMILIARIZATION

COURSE NUMBERS
APC-106 & APC-124

FOR TRAINING PURPOSES ONLY



NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION



APRIL 1, 1966

APOLLO TRAINING

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QUESTIONS RELATIVE TO THE CONTENTS OF THIS
DOCUMENT SHOULD BE DIRECTED TO:

S.I. JIMENEZ
B.C. GROVER
NAA, S&ID
DOWNEY, CALIFORNIA
EXTENSION 4325, 6, OR 7

CONTENTS

SECTION

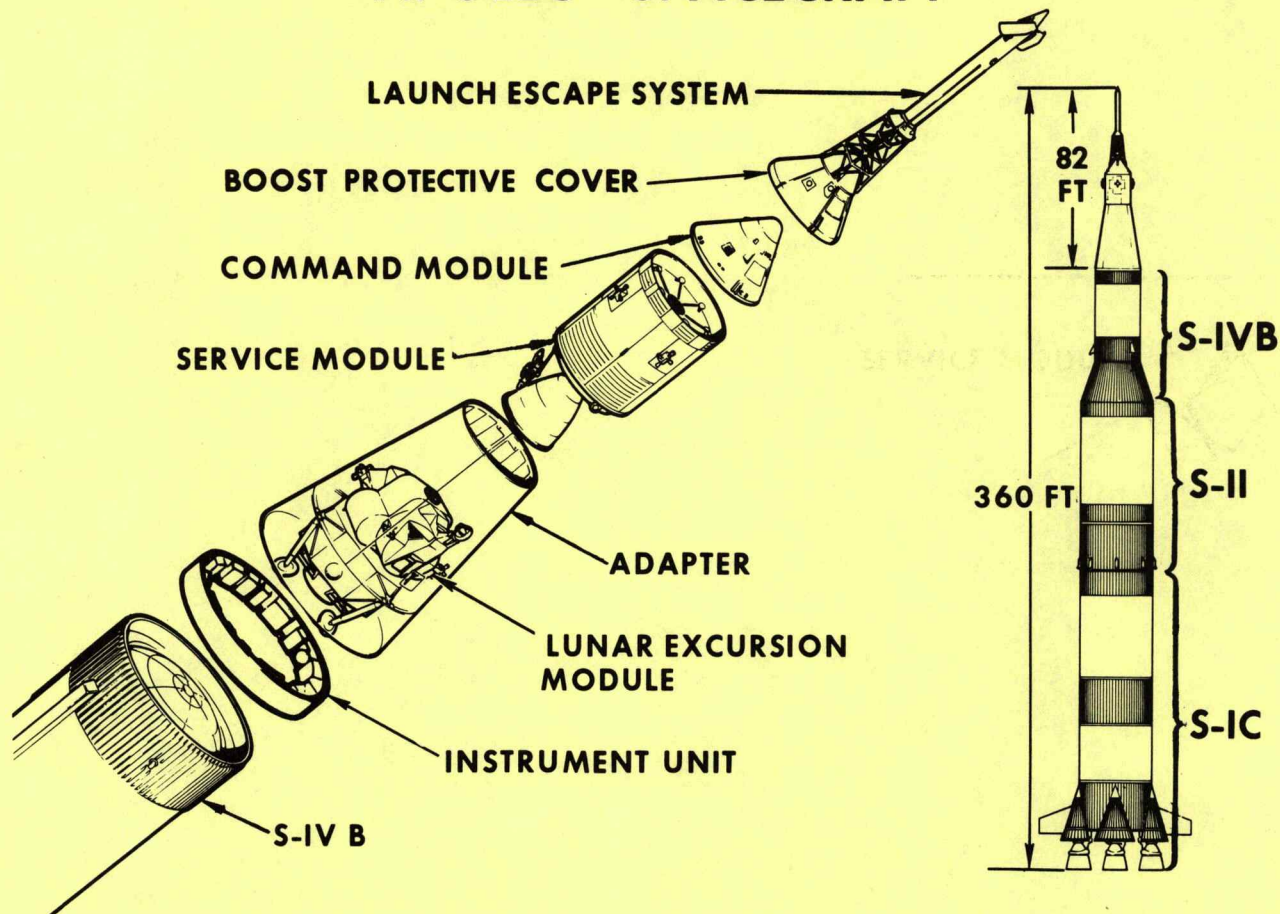
INTRODUCTION	1*
CSM SUBSYSTEMS	2*
APOLLO MISSION	3*
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CREW EQUIPMENT	11
APOLLO ABBREVIATIONS	LAST PAGE

*COURSE NO. APC-106

FAM-1012B



APOLLO SPACECRAFT



APOLLO ASSOCIATE CONTRACTORS

- MIT
AC ELECTRONICS

GUID & NAV EQUIP.-TECH MGMT
GUID & NAV EQUIP.-MFG

- CHRYSLER

S-1

- BOEING

S-1C

- NAA S&ID

S-11

- DOUGLAS

S-IV & S-IVB

- CONVAIR

LITTLE JOE II

- GENERAL ELECTRIC

ACCEPTANCE CHECKOUT EQUIP.

- GRUMMAN

LUNAR EXCURSION MODULE

- HAMILTON STANDARD

SPACESUIT & PORTABLE EQUIP.



NAA APOLLO SUBCONTRACTORS

SYSTEM/COMPONENTS

CONTRACTOR

STRUCTURES

ABLATIVE MATERIAL FOR HEAT SHIELD.....AVCO CORP-WILMINGTON, MASS.
BOOST COVER, LES TOWER, DOCKING PROBE, CANARDS
RADIAL BEAMS, FWD HEAT SHIELD & CREW COUCHES LOS ANGELES DIV OF NAA - INGLEWOOD, CALIF.
STAINLESS STEEL HONEY COMB PANELS AERONCA MFG CO - MIDDLETOWN, OHIO

ELECTRICAL POWER

BATTERIES ("A", "B" & "C").....EAGLE PICHER - JOPLIN, MO.
BATTERY CHARGER.....ITT - INDUSTRIAL PRODUCTS DIV - SAN FERNANDO, CALIF.
FUEL CELL MODULES.....PRATT & WHITNEY - EAST HARTFORD, CONN.
STATIC INVERTERS.....WESTINGHOUSE ELECTRIC CORP - LIMA, OHIO
CRYOGENIC GAS STORAGE.....BEECH AIRCRAFT - BOULDER, COLO.

ENVIRONMENTAL CONTROL AIRESEARCH MFG CO - LOS ANGELES, CALIF.

SEQUENTIAL EVENTS CONTROL

MASTER EVENT SEQUENCE CONTROLLER.....AUTONETICS DIV OF NAA - ANAHIEM, CALIF.
LAUNCH ESCAPE & PITCH CONTROL MOTORS.....LOCKHEED PROPULSION CO - REDLANDS, CALIF.
TOWER JETTISON MOTOR THIOKOL CHEMICAL CORP - ELKTON, MD.
EARTH LANDING PARACHUTE SUBSYSTEM NORTHROP - VENTURA - NEWBERRY PARK, CALIF.

STABILIZATION & CONTROL.....HONEYWELL CORP - MINNEAPOLIS, MINN.



NAA APOLLO SUBCONTRACTORS (CONT)

SYSTEM/COMPONENTS

CONTRACTOR

PROPULSION

CM REACTION CONTROL ENGINES.....	ROCKETDYNE DIV OF NAA - CANOGA PARK, CALIF.
SM REACTION CONTROL ENGINES.....	MARQUARDT CORP - VAN NUYS, CALIF.
POSITIVE EXPULSION TANKS (RCS).....	BELL AEROSYSTEMS - BUFFALO, N.Y.
PROPELLANT GAGING SYSTEM (RCS).....	GIANNINI CONTROL CORP - DUARTE, CALIF.
HELIUM TANKS.....	AIRITE PRODUCTS - LOS ANGELES, CALIF.
FUEL & OXIDIZER TANKS (SPS).....	ALLISON DIV OF GMC - INDIANAPOLIS, IND.
PROPELLANT GAGING & MIXTURE RATIO CONTROL.....	SIMMONDS PRECISION PROD - TARRYTOWN, N.Y.
SERVICE PROPULSION ENGINE.....	AEROJET GENERAL - SACRAMENTO, CALIF.

COMMUNICATIONS & DATA.....COLLINS RADIO CO.-CEDAR RAPIDS, IOWA

BEACON ANTENNA (R&D).....	MELPAR - FALLS CHURCH, VA.
C-BAND ANTENNA.....	RADCOM - COLLEGE PARK, MD.
CENTRAL TIMING SYSTEM.....	GENERAL TIME - ROLLING MEADOWS, ILL.
HF ANTENNAS (RECOVERY & ORBITAL).....	DEHAVILLAND - ONTARIO, CANADA
DIGITAL UP-DATA LINK.....	MOTOROLA, INC. - SCOTTSDALE, ARIZ.
VHF ANTENNA.....	LOS ANGELES DIV OF NAA - INGLEWOOD, CALIF.
TV CAMERA (BLOCK I).....	RCA - PRINCETON, N.J.
TV CAMERA (BLOCK II).....	WESTINGHOUSE - BALTIMORE, MD.
2 KMC HI GAIN ANTENNA.....	DALMO - VICTOR - BELMONT, CALIF.

MISSION SIMULATOR TRAINER.....GIP - LINK DIV - BINGHAMTON, N.Y.

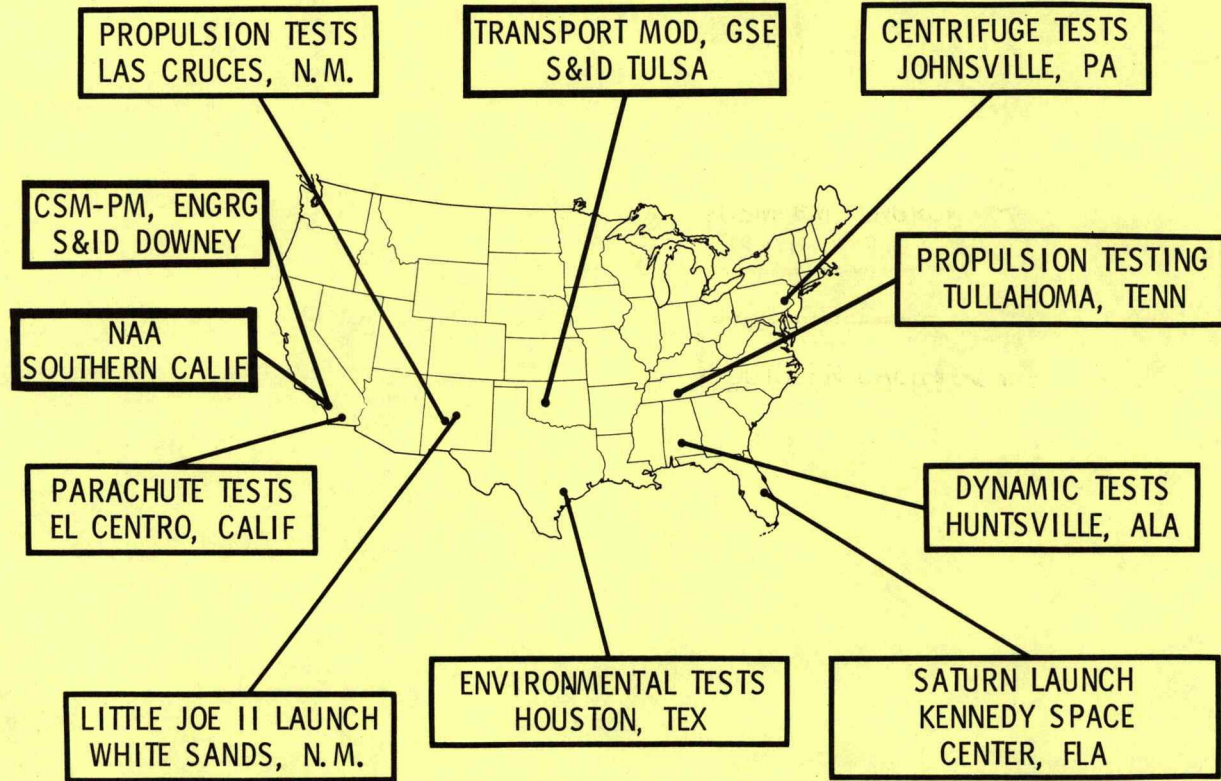
SYSTEMS INTEGRATED TEST EQUIPMENT.....AUTONETICS DIV OF NAA - AHAHEIM, CALIF.

DIGITAL TEST COMMAND SYSTEM.....CONTROL DATA CORP - MINNEAPOLIS, MINN.

ANTHROPOMORPHIC DUMMIES.....ALDERSON LABS - LONG ISLAND, N.Y.



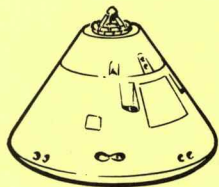
FACILITIES-NATIONWIDE



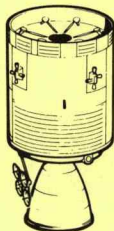
APOLLO SPACECRAFT & ID RESPONSIBILITIES

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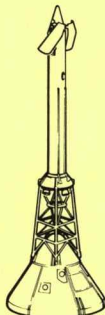
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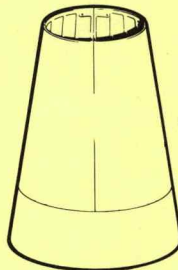
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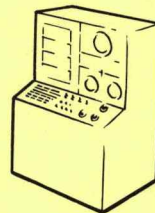
SM



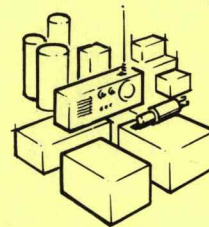
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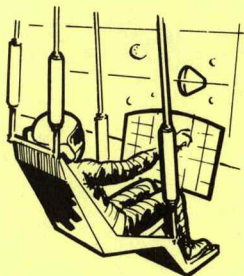
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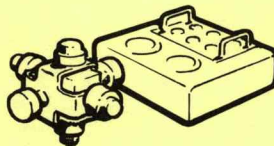
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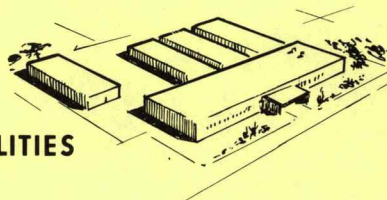
SPARES



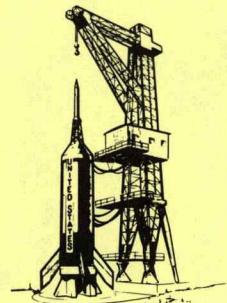
TRAINERS



MAJOR SUBS



FACILITIES



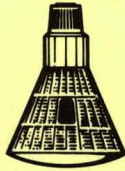
TEST SITE
ACTIVATION

INTERFACE WITH ASSOCIATE CONTRACTORS (GUIDANCE & NAVIGATION,
ACCEPTANCE CHECKOUT EQUIPMENT, LUNAR EXCURSION MODULE, ETC.)

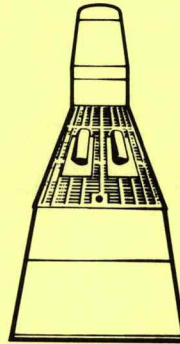
MANNED SPACECRAFT

114SD10175

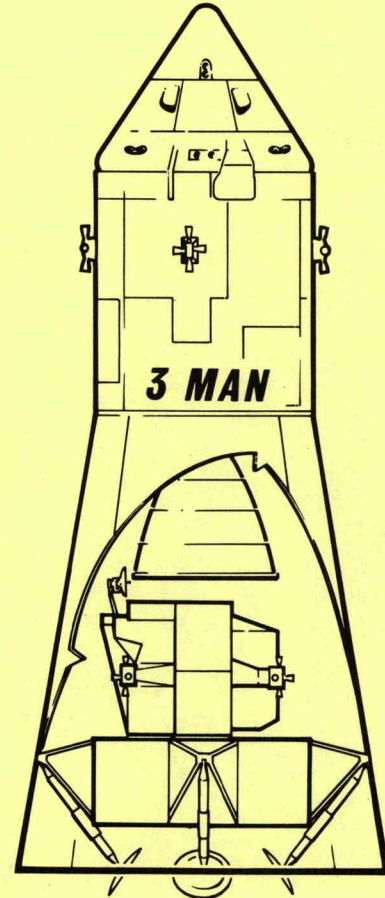
1



1 MAN



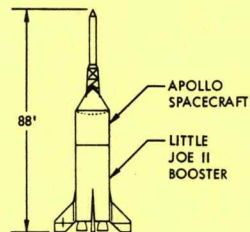
2 MAN



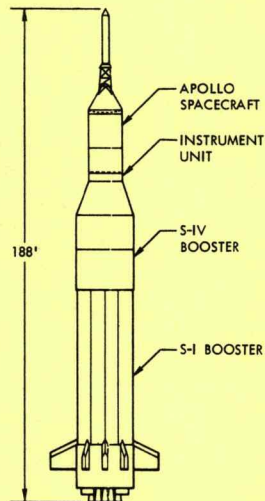
3 MAN

	MERCURY	GEMINI	APOLLO
PAYLOAD , LBS	3,500	7,000	250,000
BOOSTER	ATLAS	TITAN II	SATURN
THRUST , LBS	360,000	430,000	7,500,000

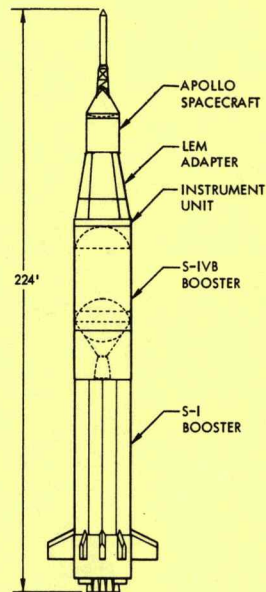
APOLLO LAUNCH VEHICLES



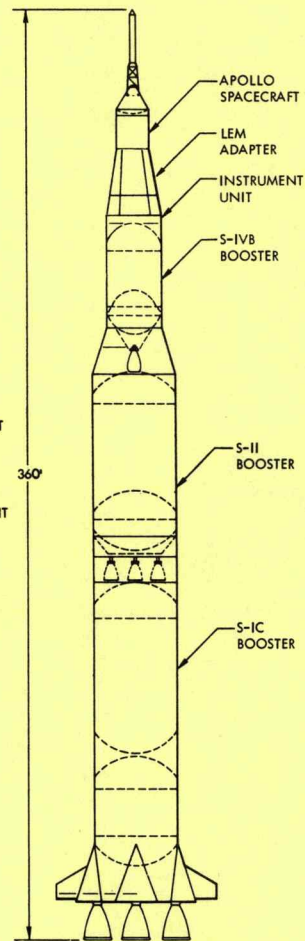
LITTLE JOE II



SATURN I

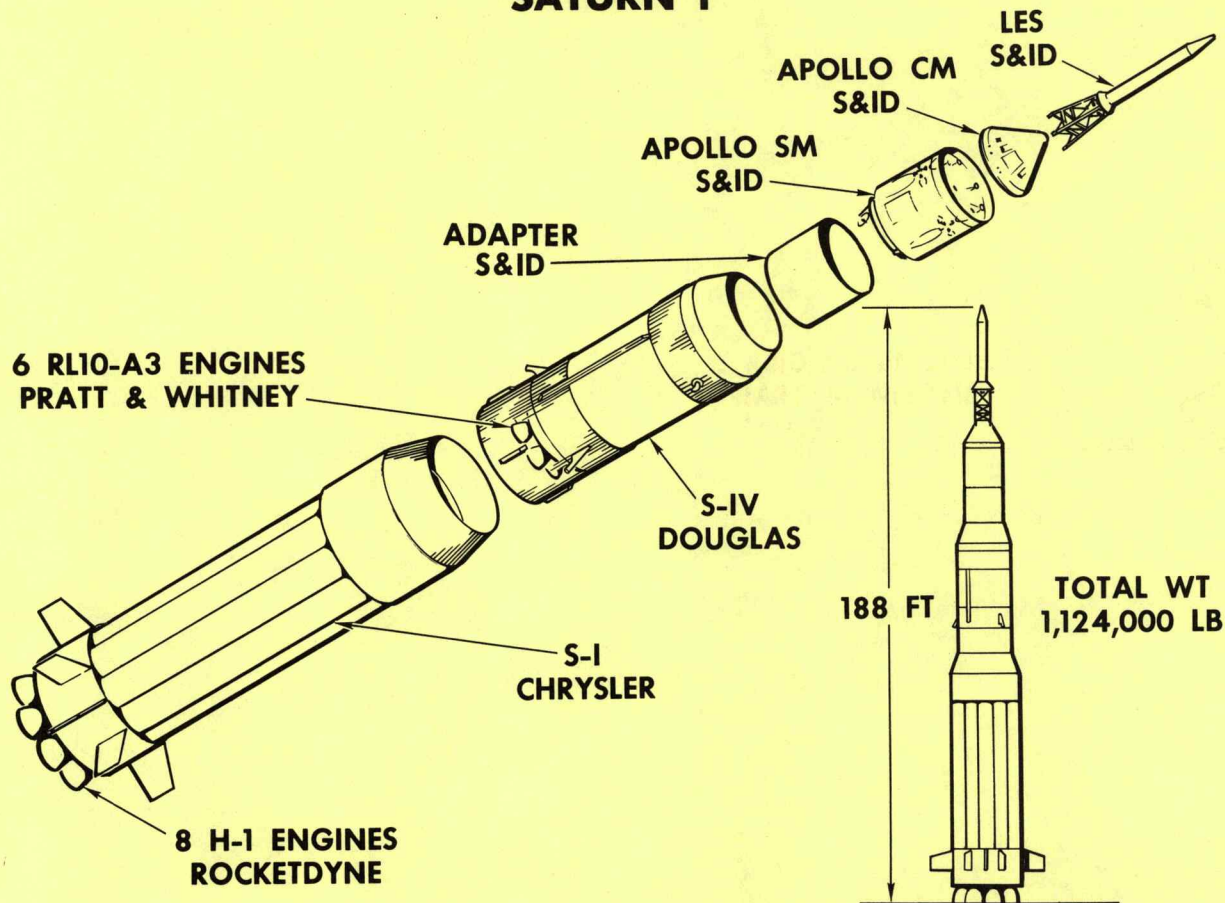


SATURN IB

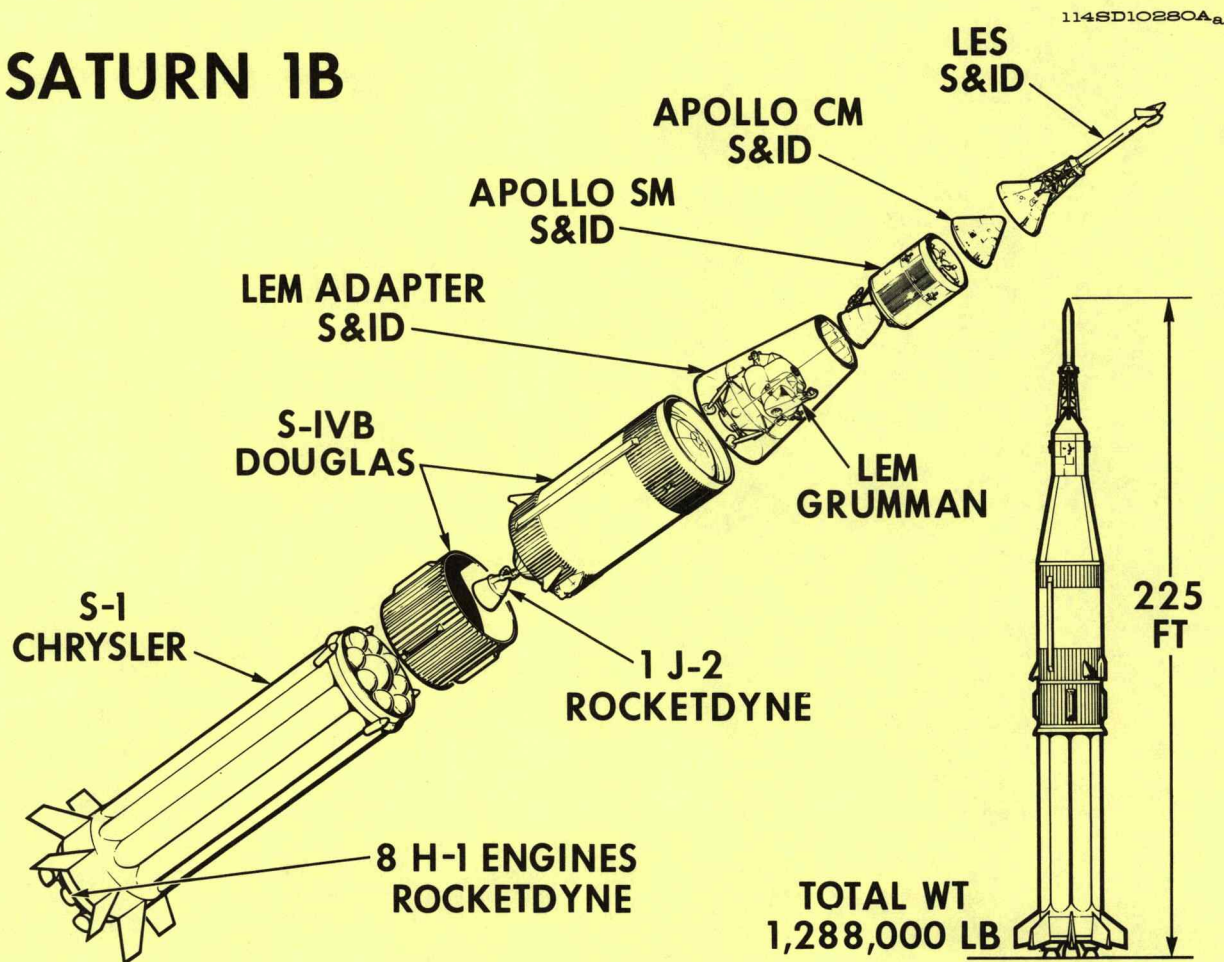


SATURN V

SATURN I

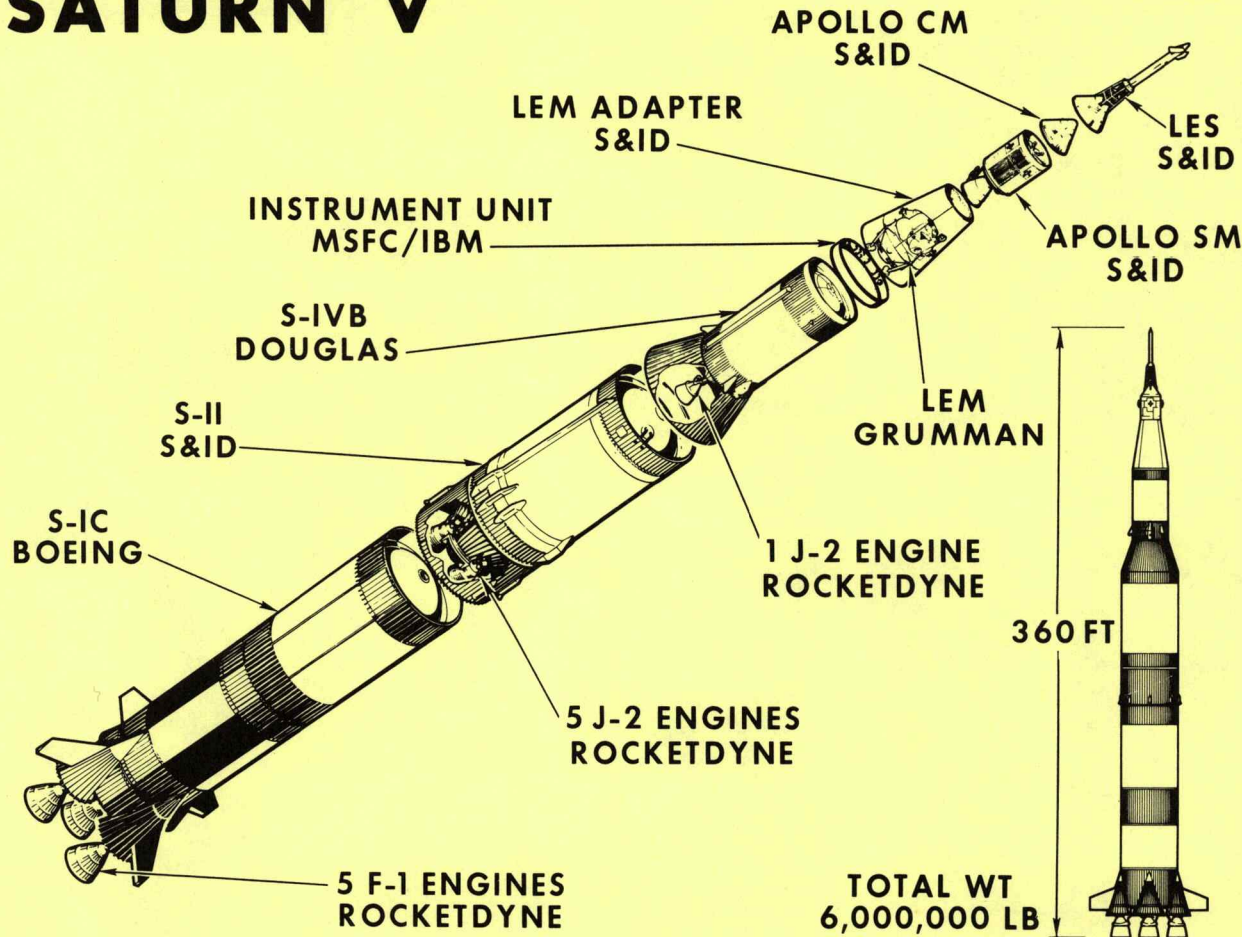


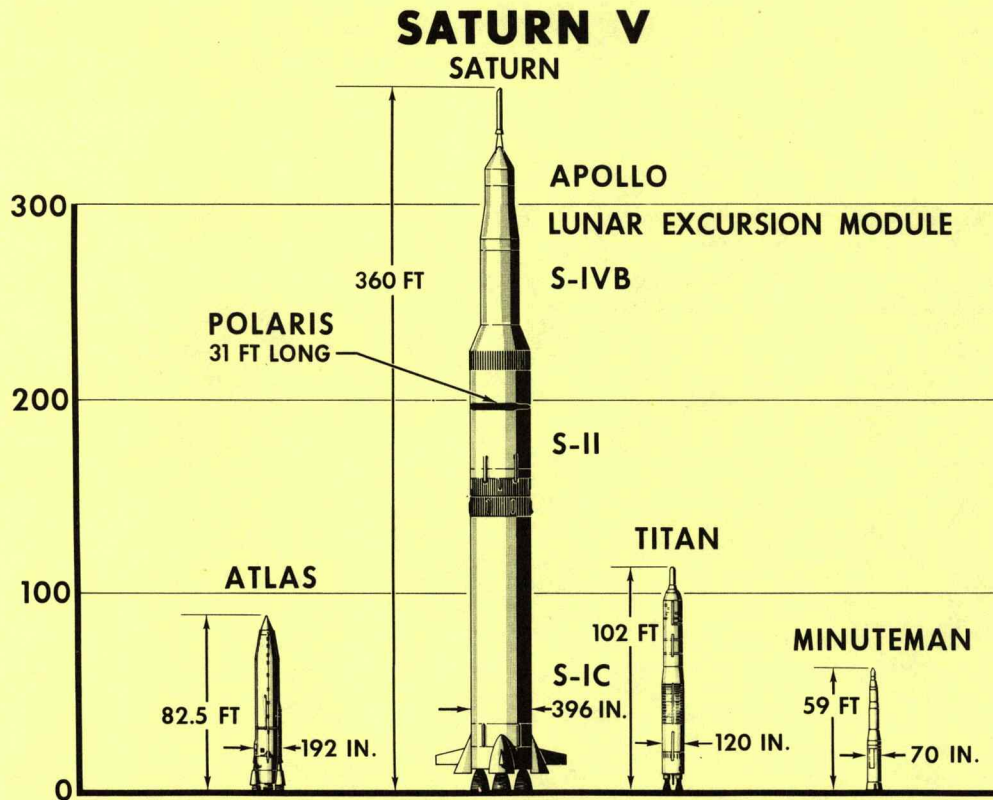
SATURN 1B



SATURN V

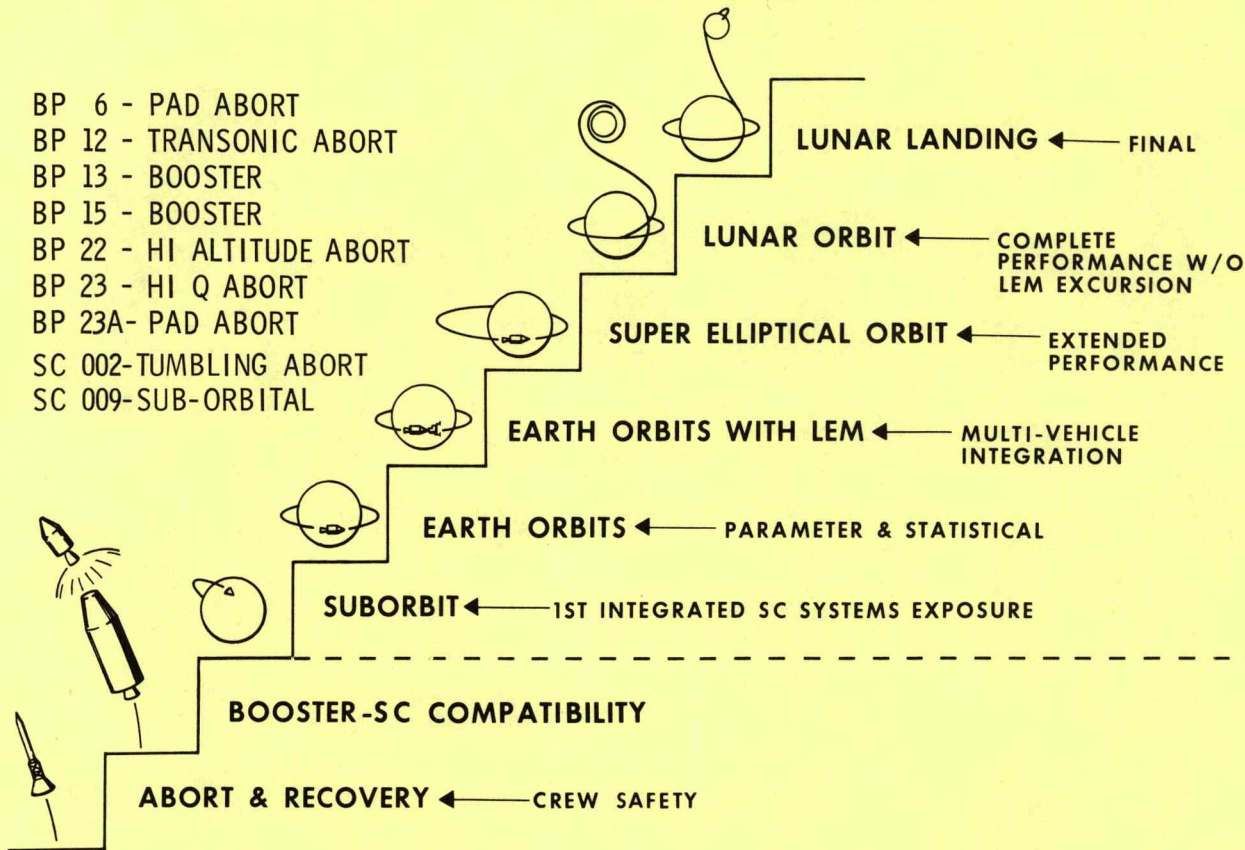
35SD10968





SPACECRAFT DEVELOPMENT FLIGHT CATEGORIES

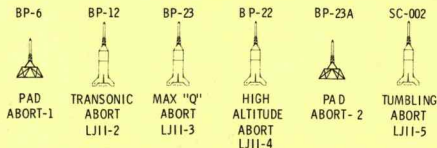
MAJOR STEPS TO ULTIMATE MISSION



APOLLO SATURN FLIGHT TEST PROGRAM

LITTLE JOE II

BOILERPLATES

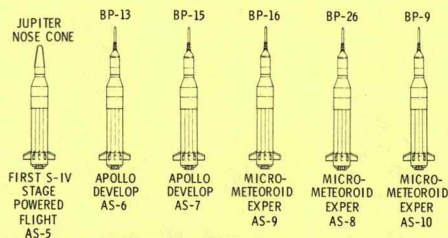


BLOCK I

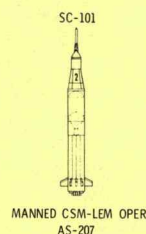
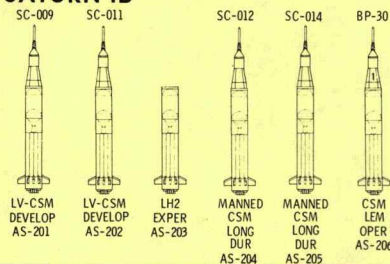
BLOCK II

WHITE SANDS MISSILE RANGE

SATURN I

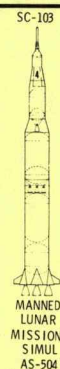
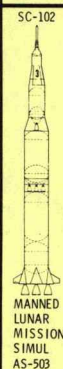
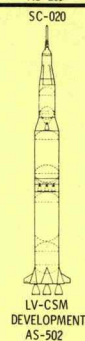
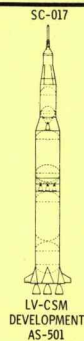


SATURN IB



KENNEDY SPACE CENTER

SATURN V

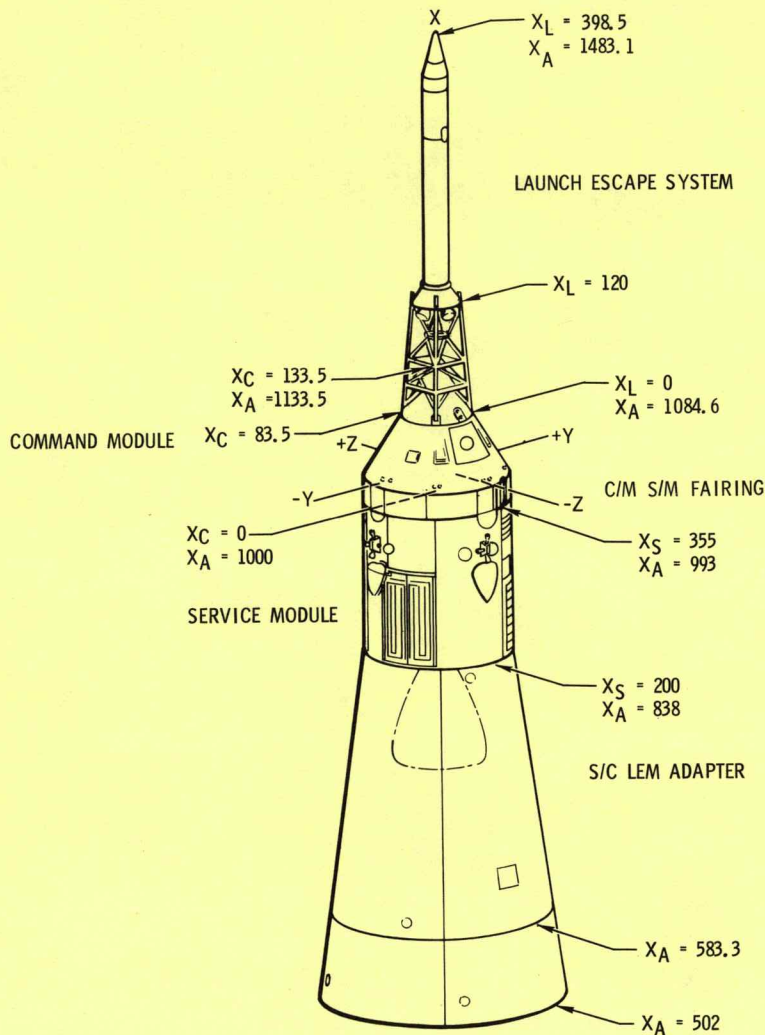


KENNEDY SPACE CENTER



COMMAND SERVICE MODULE SUB-SYSTEMS

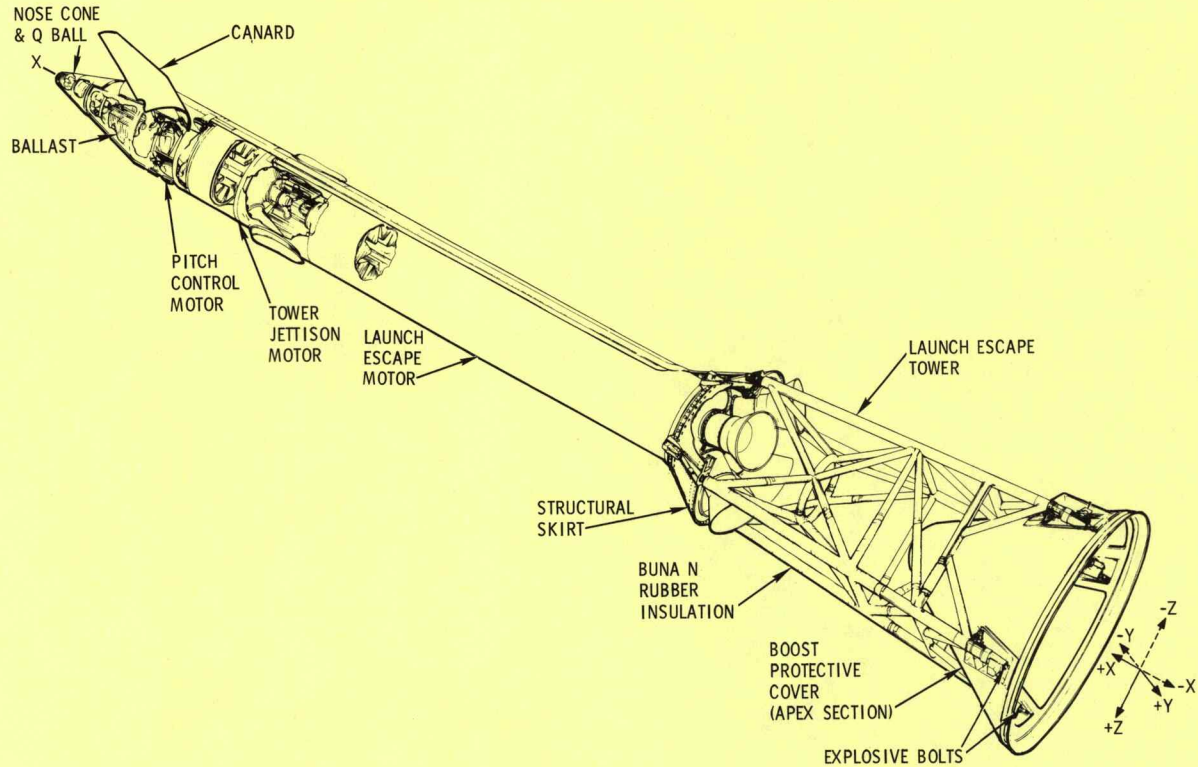
APOLLO INTEGRATED STATIONS & AXIS



ST-106D

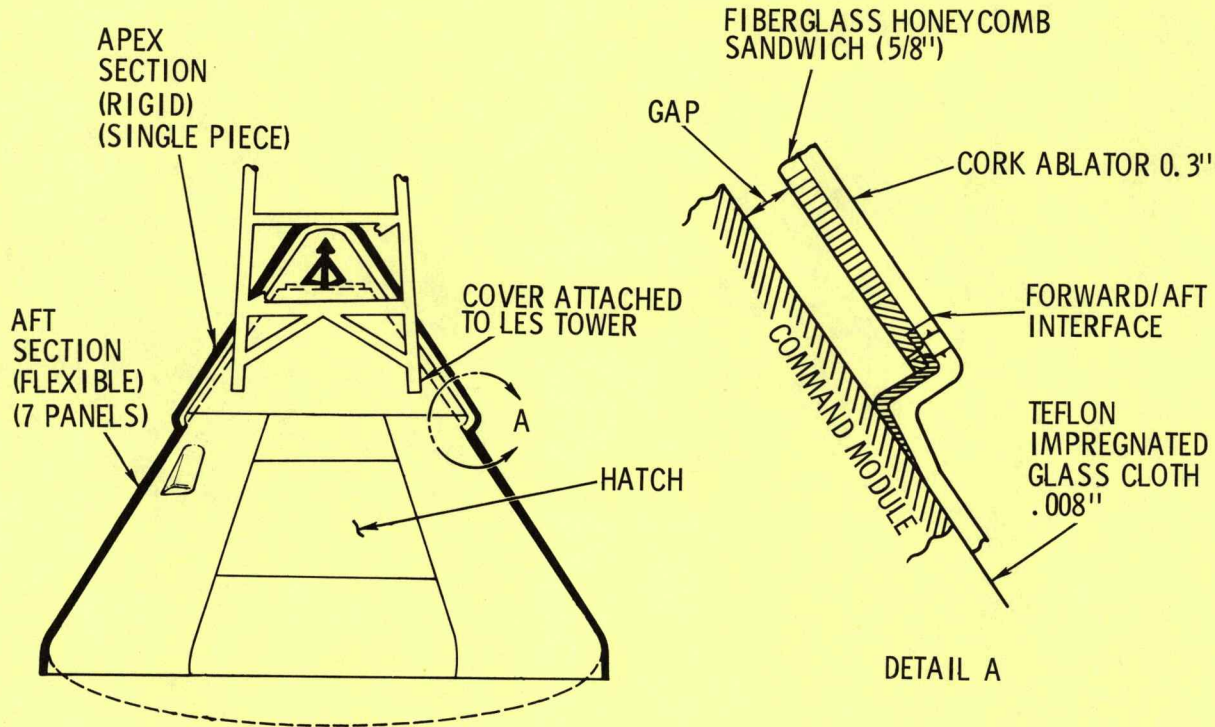


LAUNCH ESCAPE SYSTEM



BOOST PROTECTIVE COVER

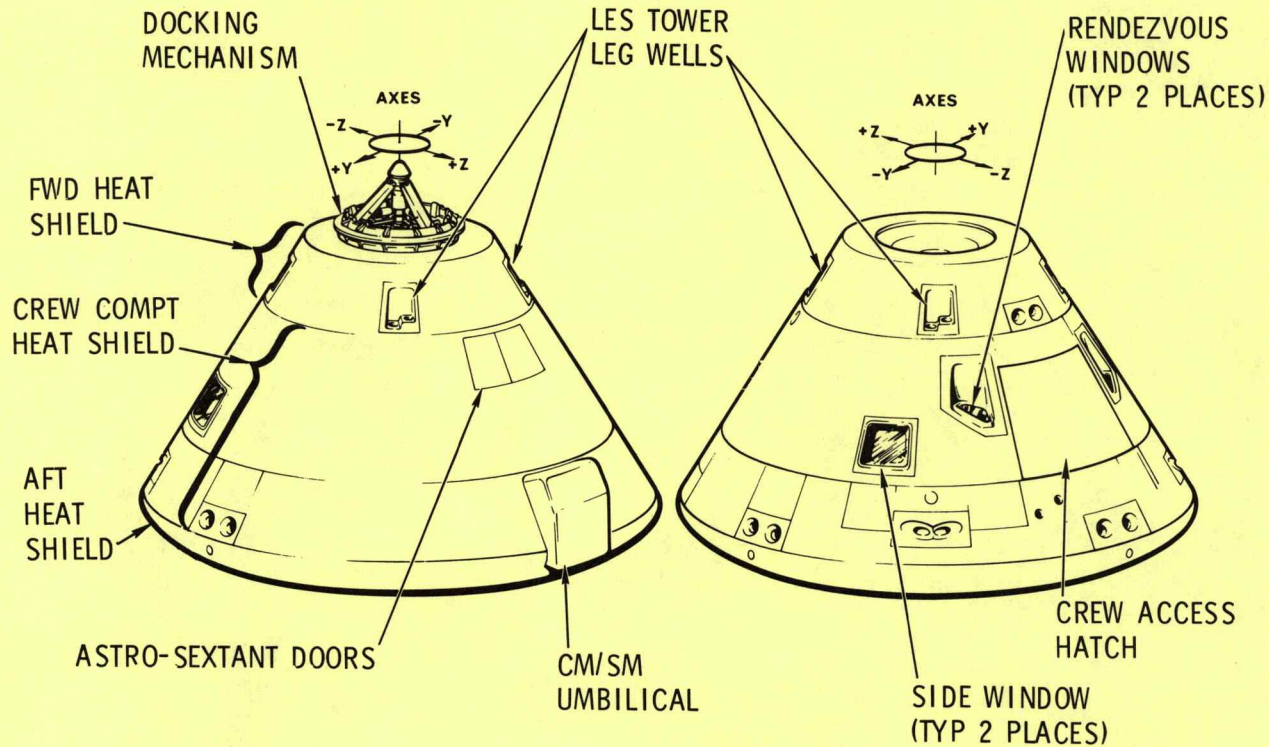
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COMMAND MODULE EXTERIOR

(BLOCK II)

2

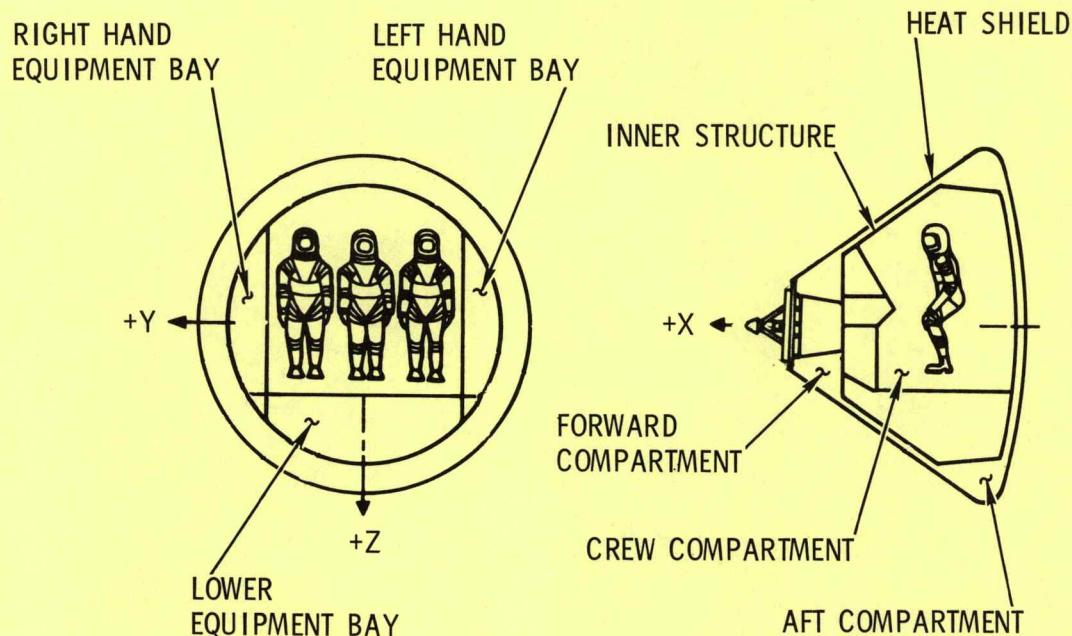


ST-260



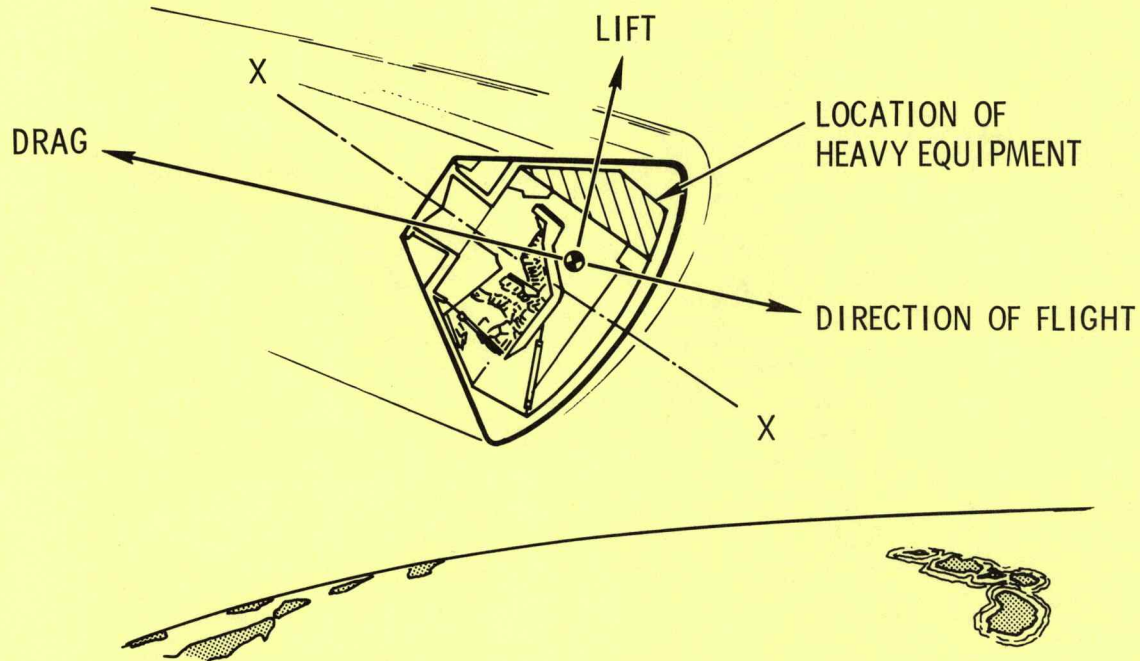
COMMAND MODULE COMPARTMENT CONFIGURATION

2



COMMAND MODULE AERODYNAMICS

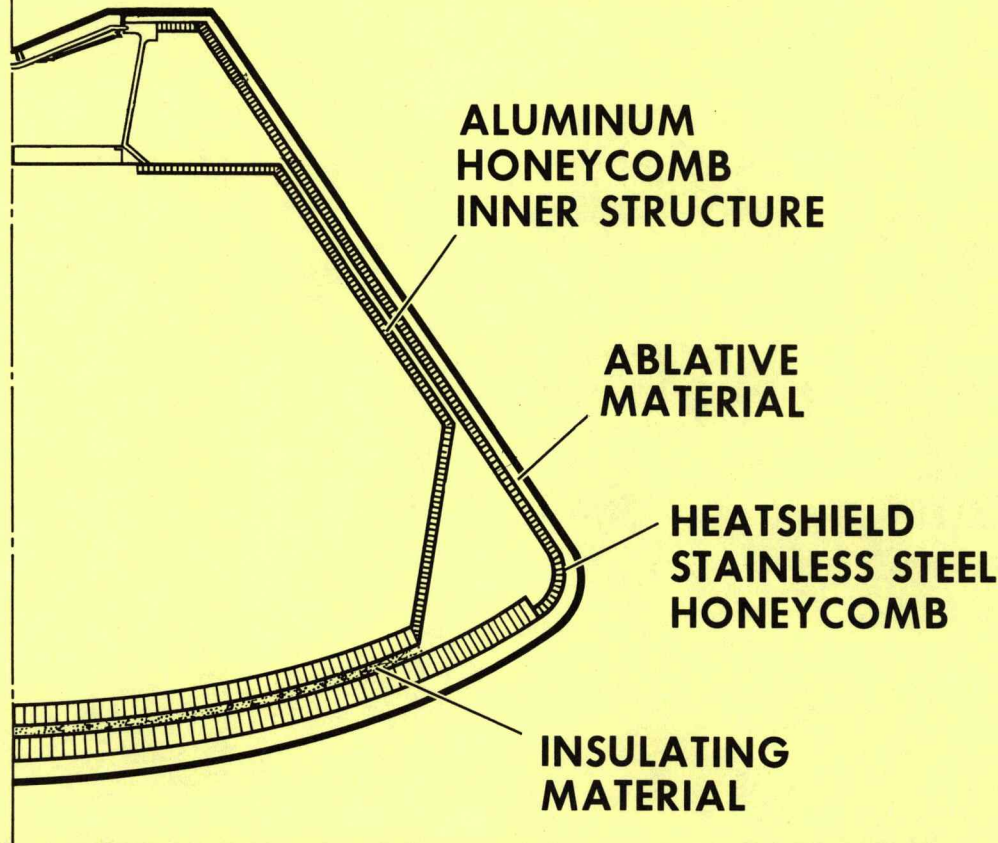
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FAM-1511



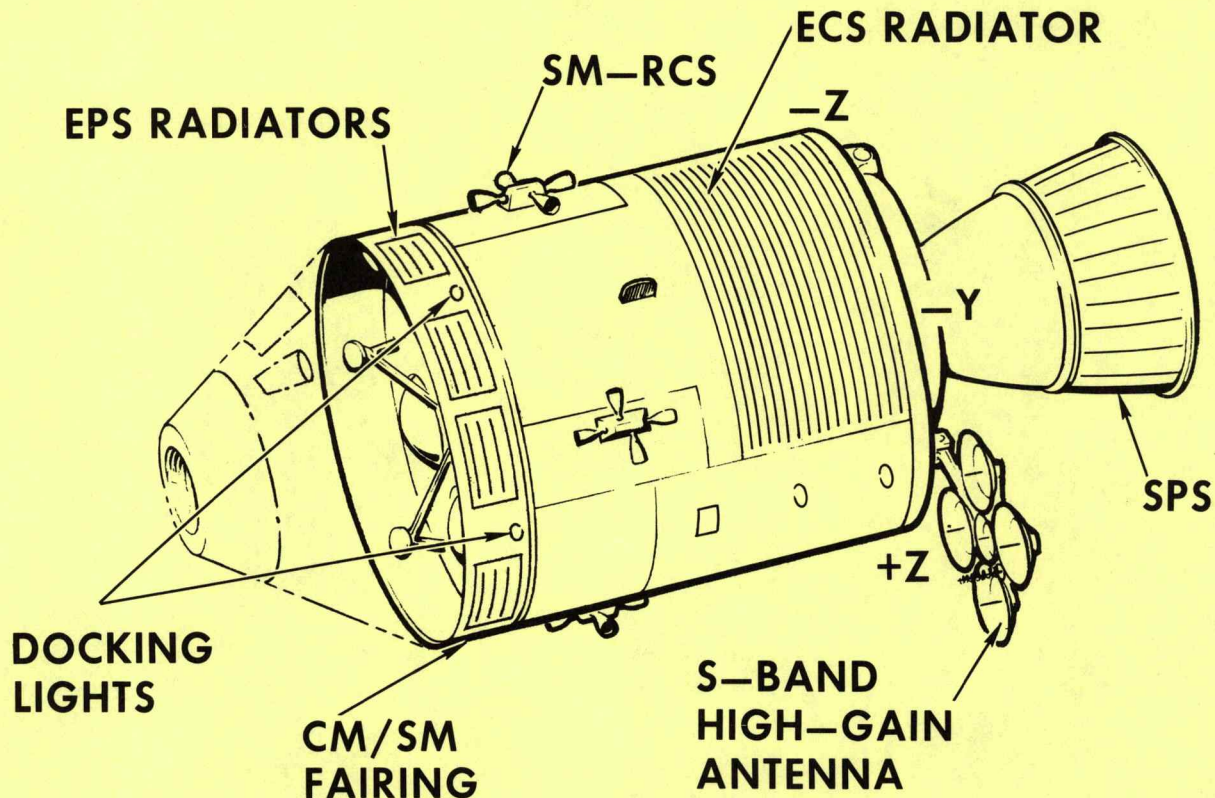
COMMAND MODULE STRUCTURE



SERVICE MODULE

BLOCK II

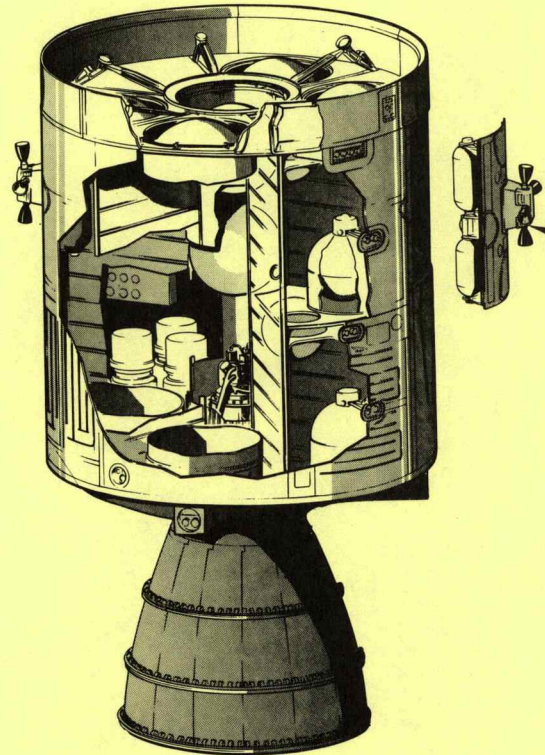
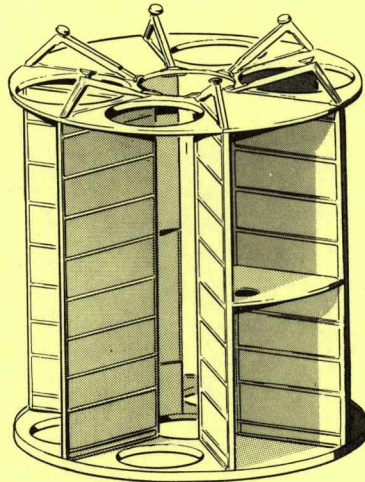
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SERVICE MODULE

BLOCK I

2

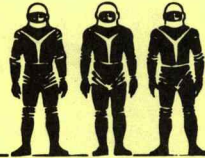
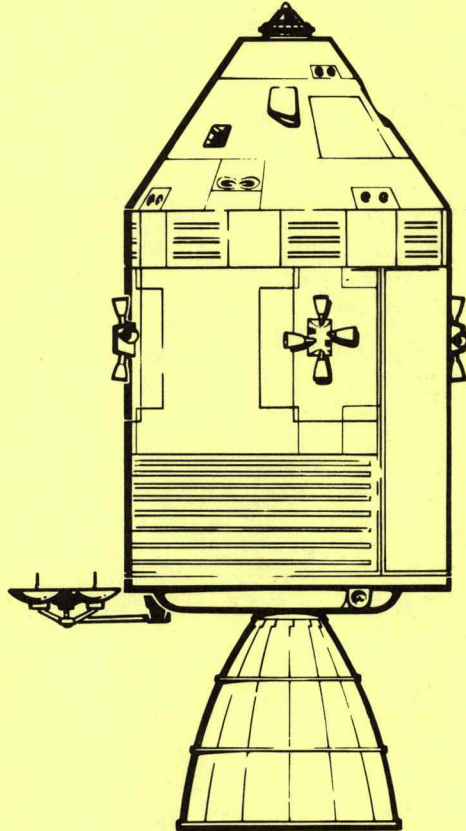


RD-1005B

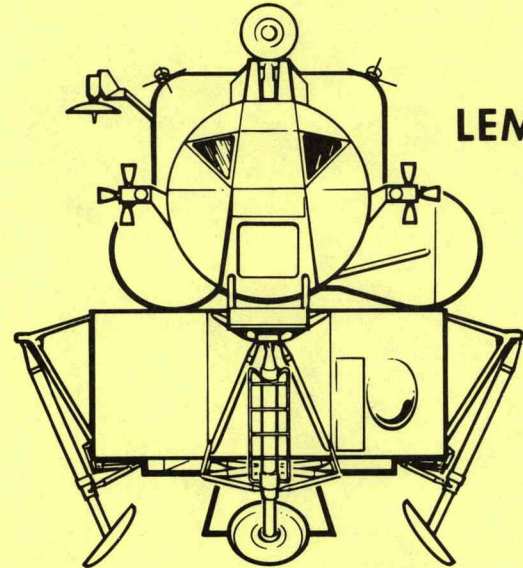
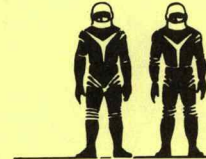


CSM & LEM COMPARISON

2



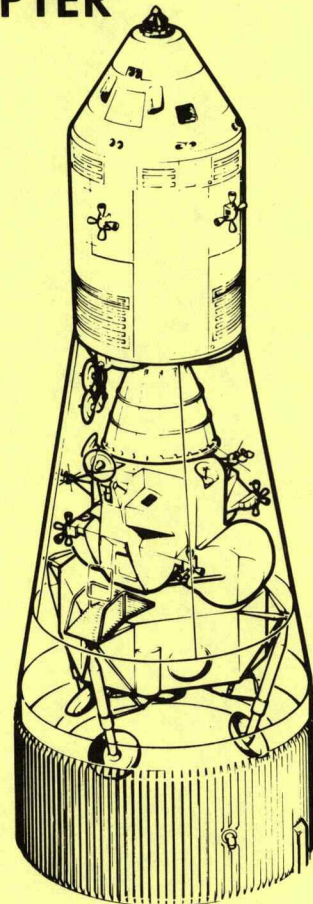
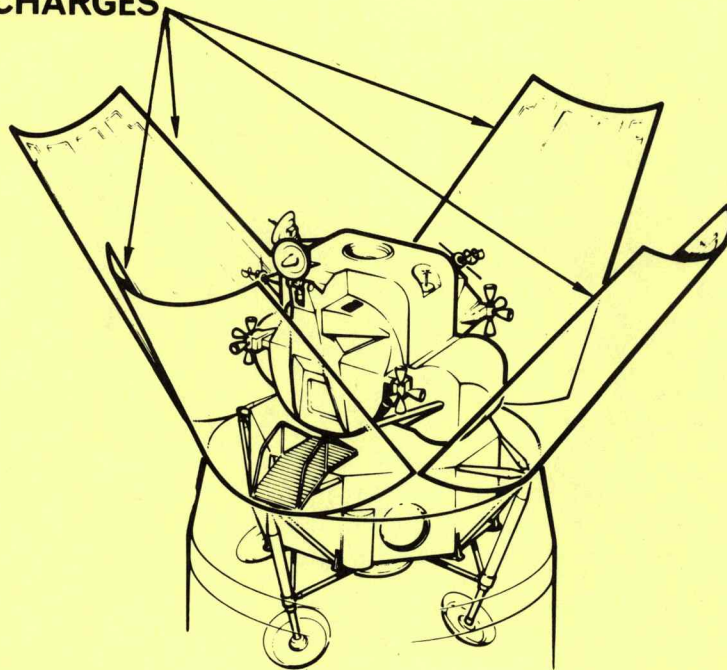
CSM



LEM

SPACECRAFT/LEM ADAPTER

PANEL SEPARATION
BY LINEAR
CHARGES



FAM-1503C



SEQUENTIAL EVENTS CONTROL SYSTEM

MAJOR FUNCTIONS

- LAUNCH ESCAPE
- VOTES EDS AUTO ABORT
- L. E. TOWER JETTISON
- ADAPTER SEPARATION
- CM - SM SEPARATION
- SM JETTISON
- EARTH LANDING

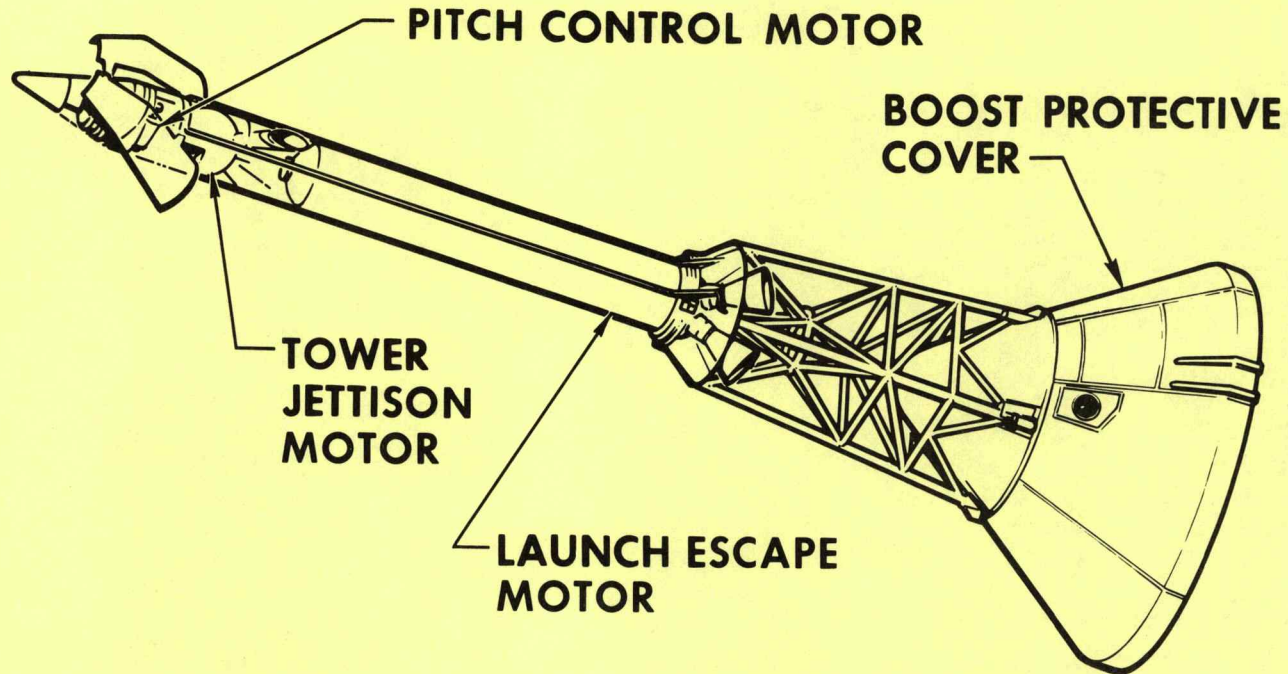
COMPOSED OF:

- SEQUENCE CONTROLLERS
MASTER EVENT SEQUENCE
CONTROLLER
EARTH LANDING SEQUENCE
CONTROLLER
SM JETTISON CONTROLLER
CM - RCS CONTROLLER
- INTERFACING HARDWARE
LAUNCH ESCAPE SYSTEM
EARTH LANDING SYSTEM
EMERGENCY DETECTION SYSTEM
MECHANICAL SEPARATION DEVICES



LAUNCH ESCAPE SYSTEM & BOOST PROTECTIVE COVER

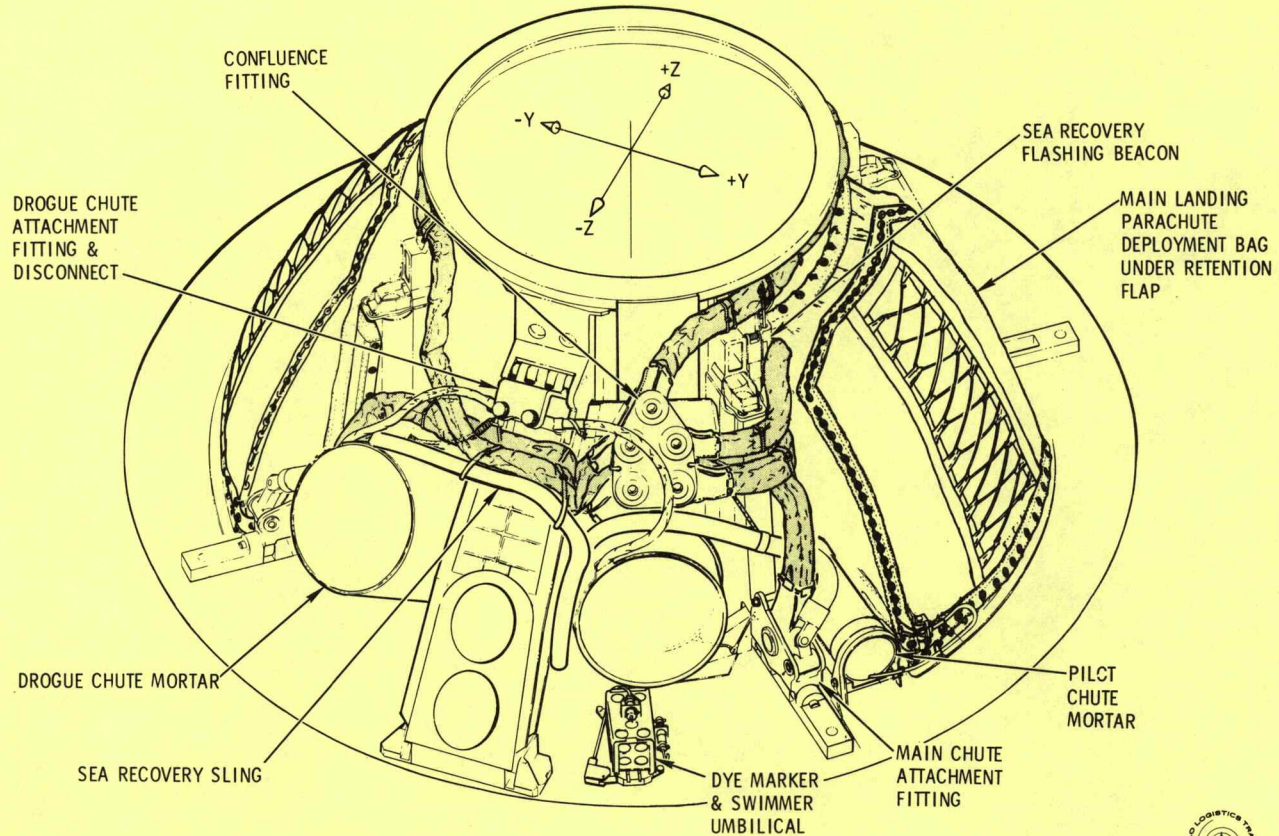
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ELS EQUIPMENT

BLOCK I

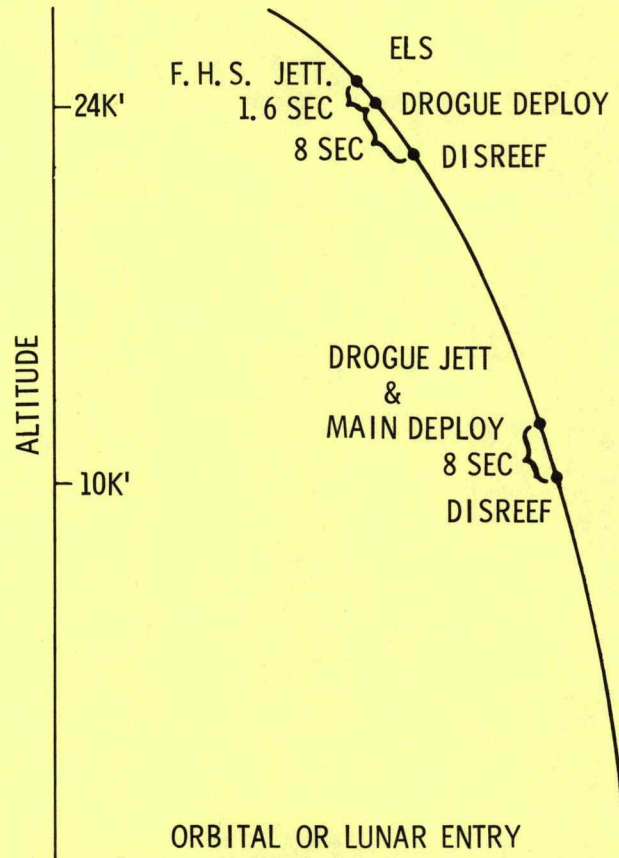
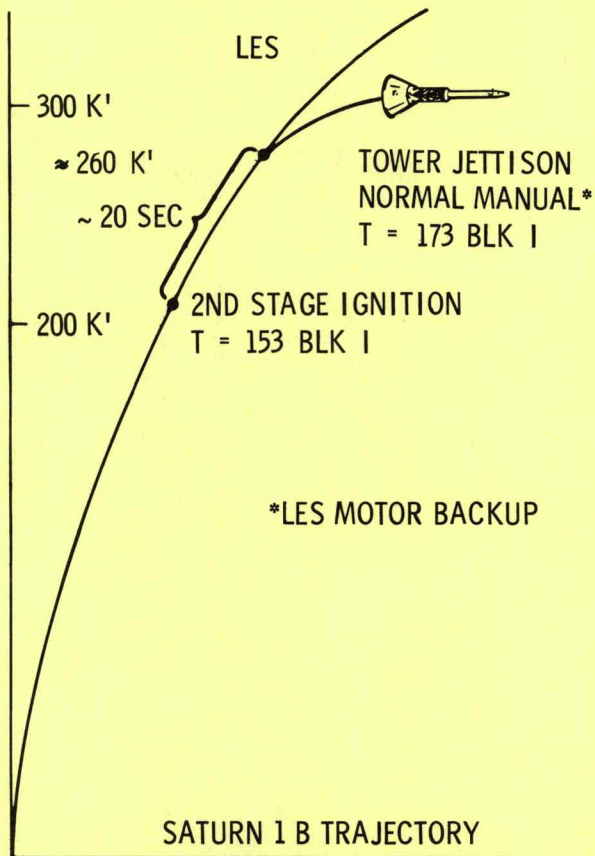
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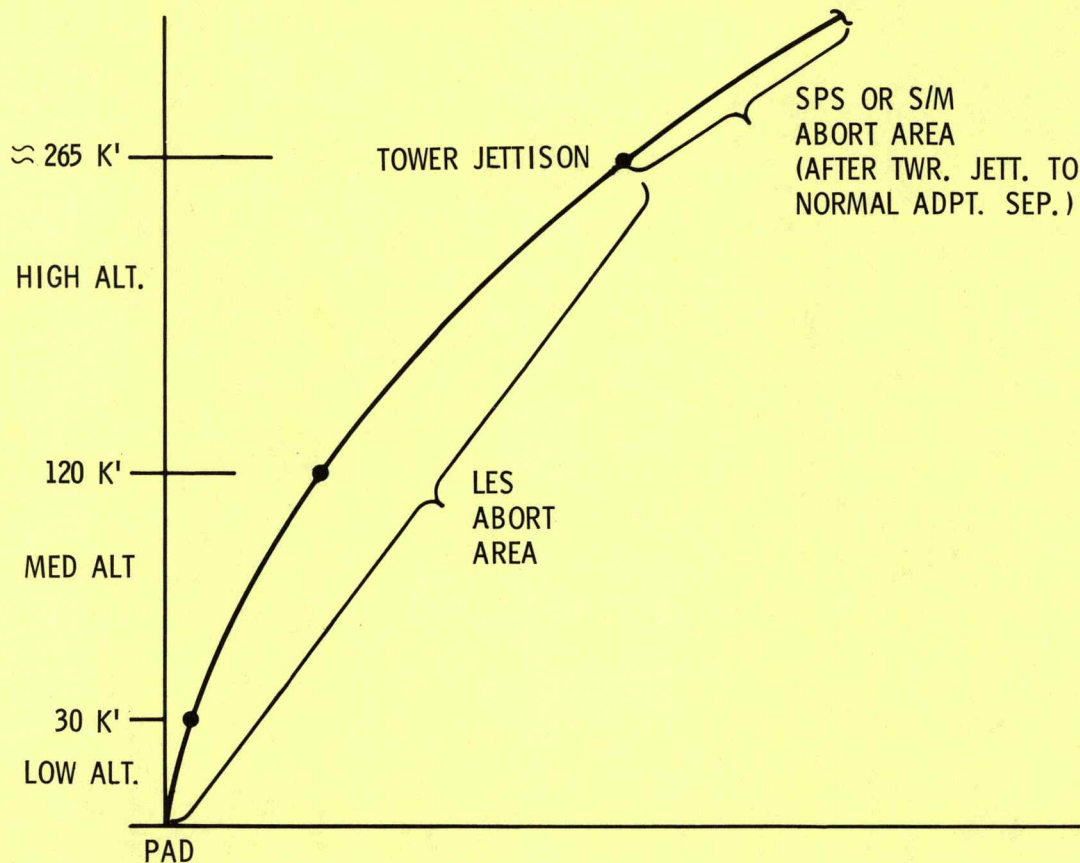
SEQ-18G



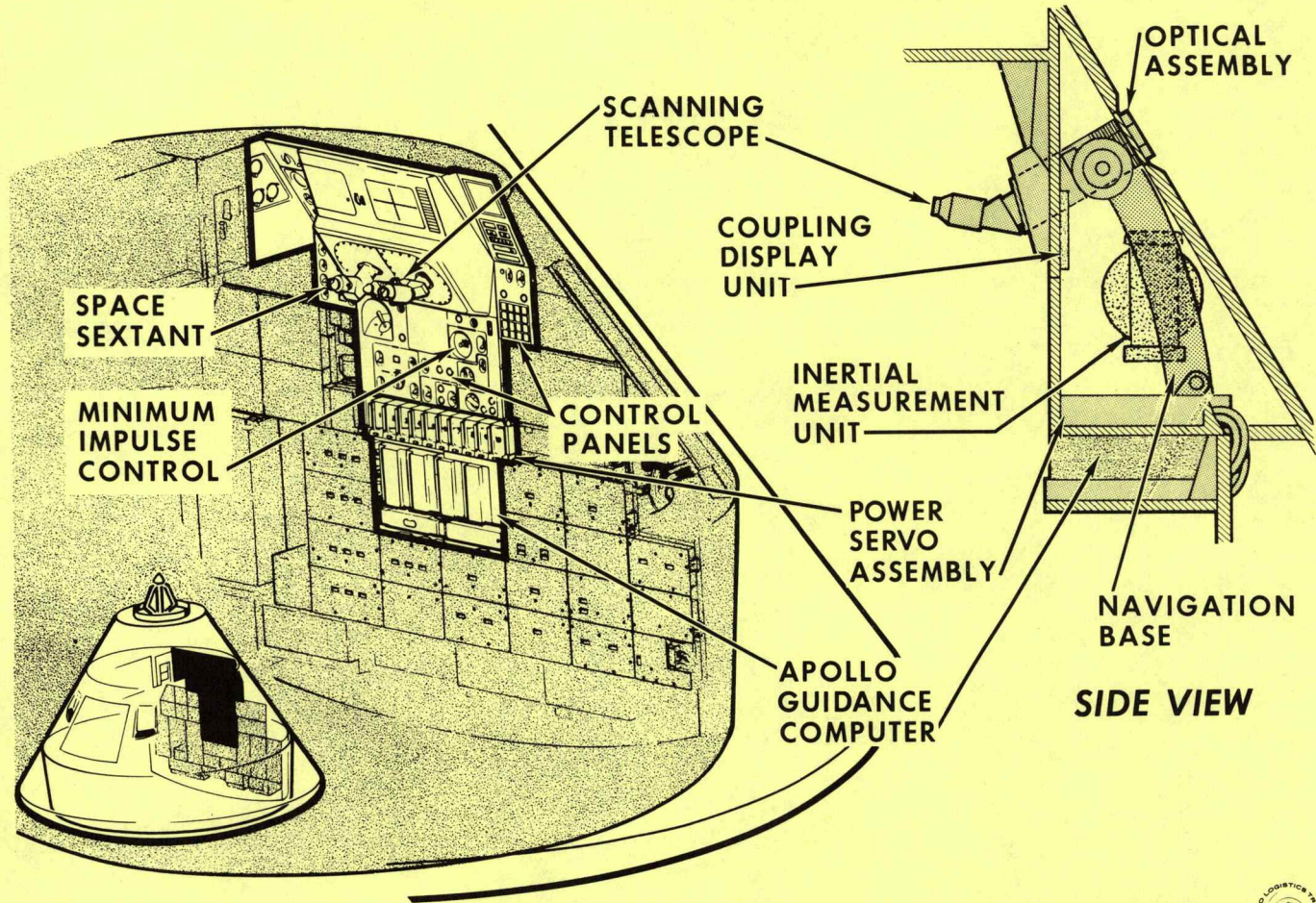
NORMAL MODES OF OPERATION



ABORT DESIGNATIONS

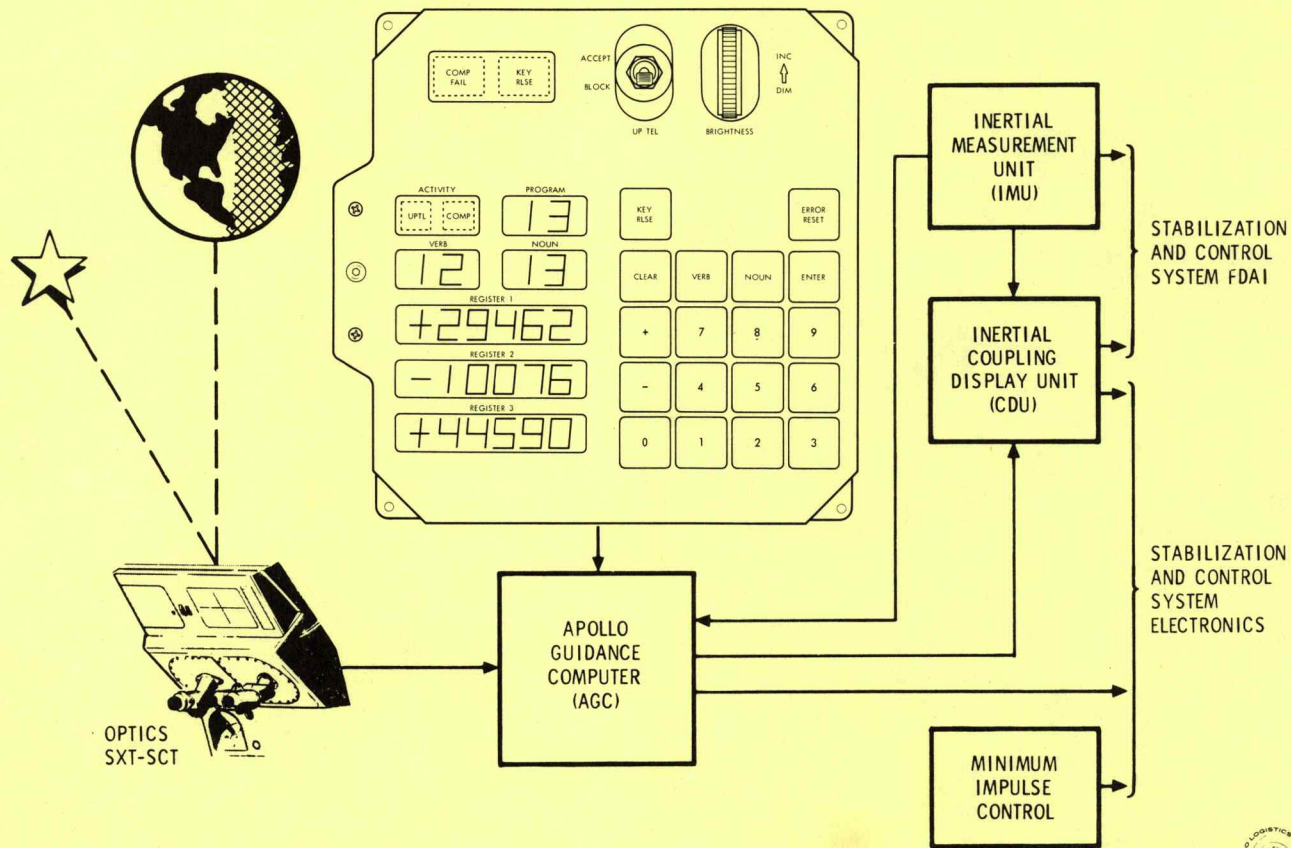


GUIDANCE AND NAVIGATION SYSTEM



GUIDANCE & NAVIGATION SYSTEM

2

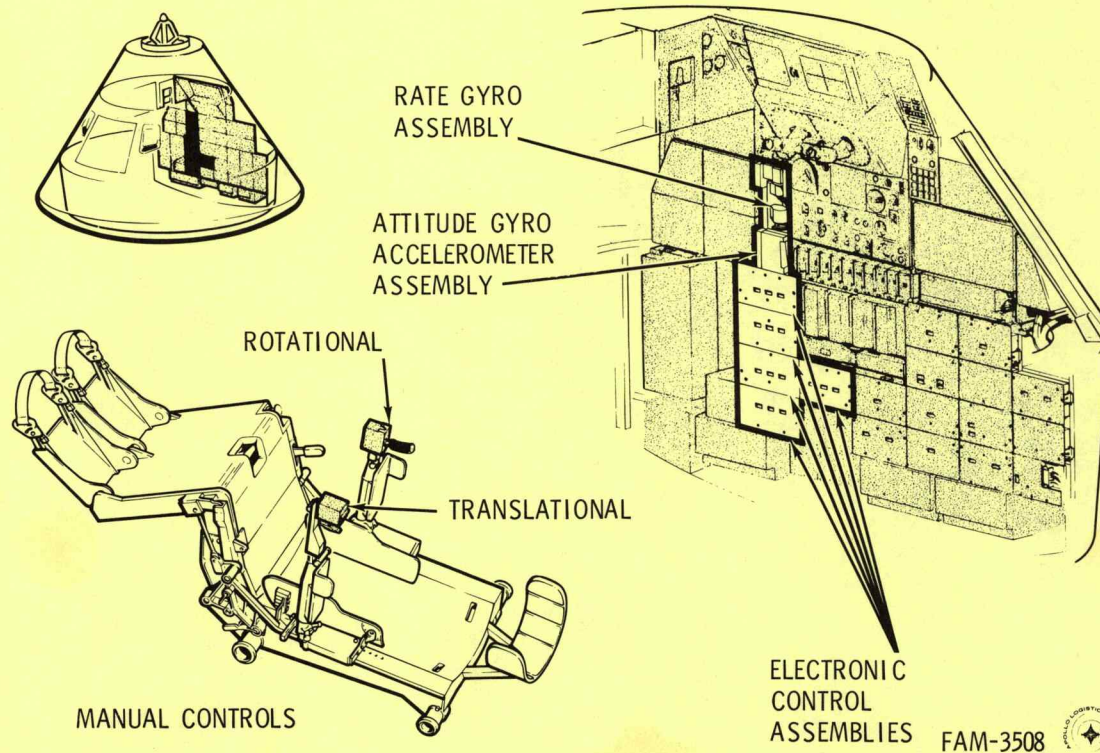


FAM-3507

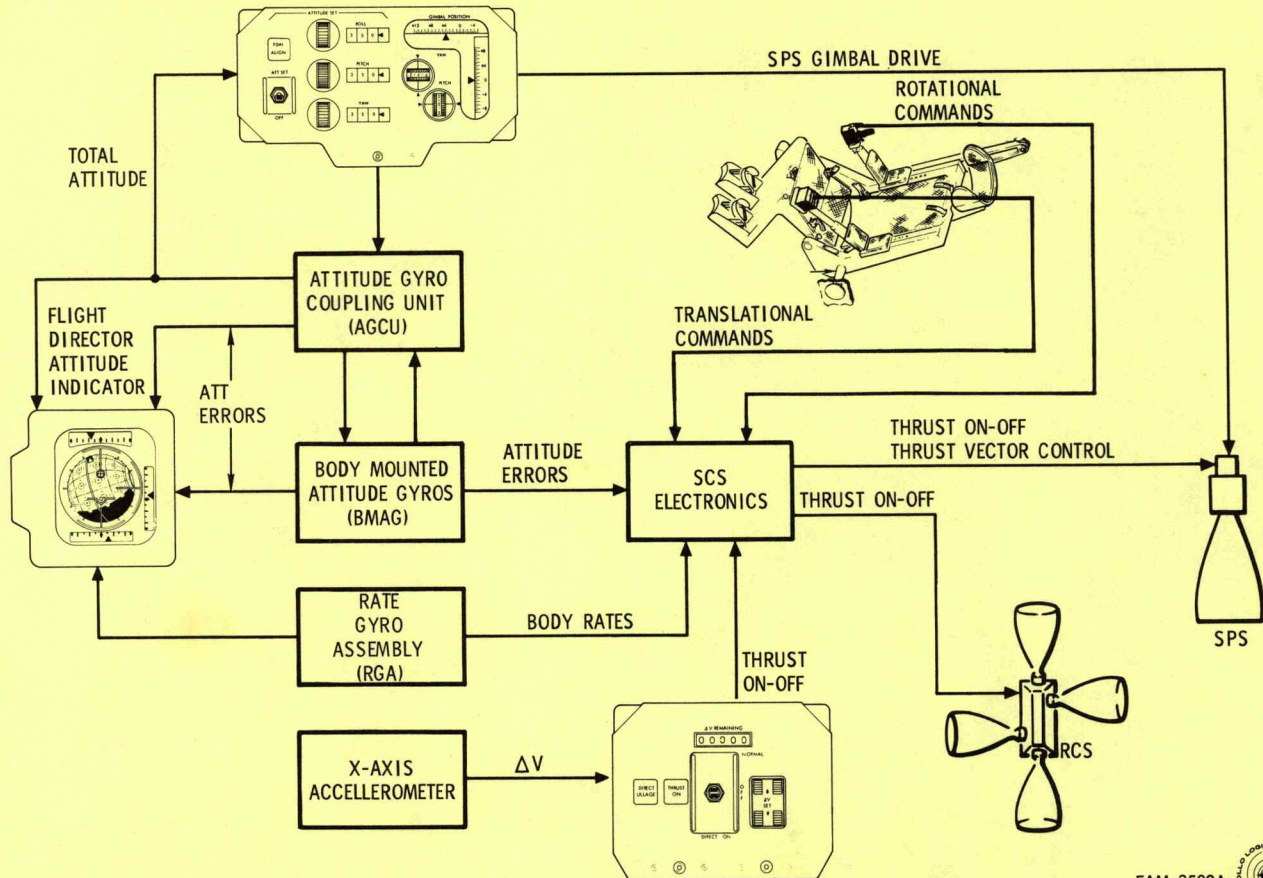


STABILIZATION AND CONTROL SYSTEM

2

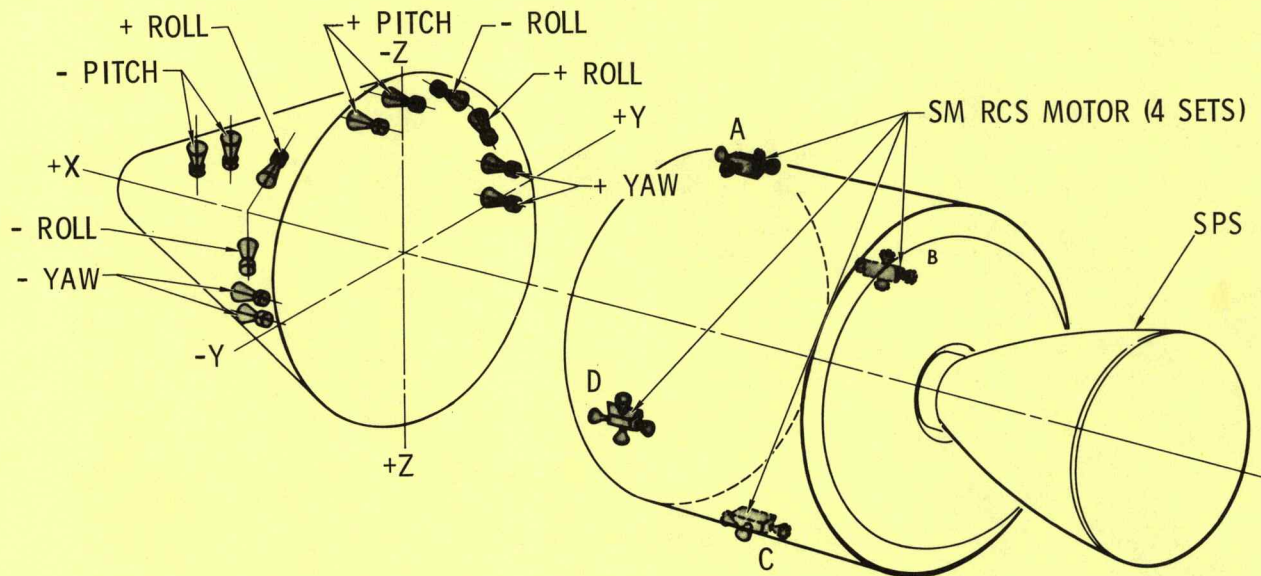


STABILIZATION & CONTROL SYSTEM



ENGINE LOCATION

2



REACTION CONTROL SUBSYSTEM

2

S/M REACTION CONTROL

- 4 INDEPENDENT SUBSYSTEMS (A, B, C & D)
- 16 ENGINES TOTAL
- ENGINE THRUST: 100 LB
- PROPELLANT: HYPERGOLIC
 - FUEL: 50/50 UDMH/HYDRAZINE
 - OXIDIZER: NITROGEN TETROXIDE (N_2O_4)

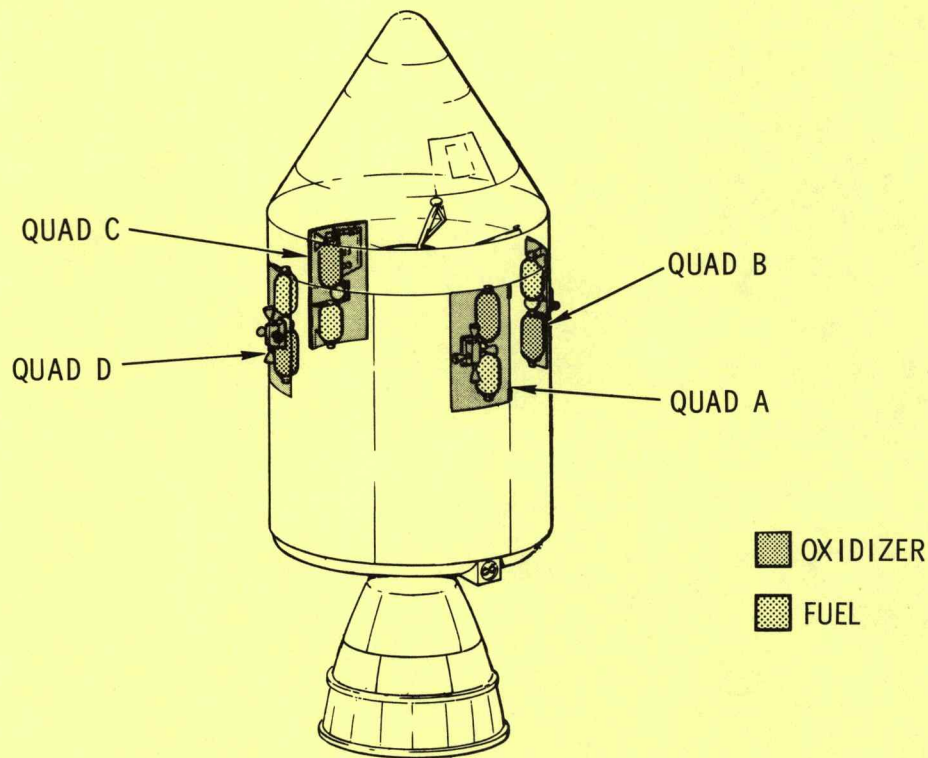
C/M REACTION CONTROL

- 2 INDEPENDENT SUBSYSTEMS (A & B)
- 12 ENGINES TOTAL
- ENGINE THRUST: 93 LB
- PROPELLANT: HYPERGOLIC
 - FUEL: MONOMETHYL-HYDRAZINE (MMH)
 - OXIDIZER: NITROGEN TETROXIDE (N_2O_4)

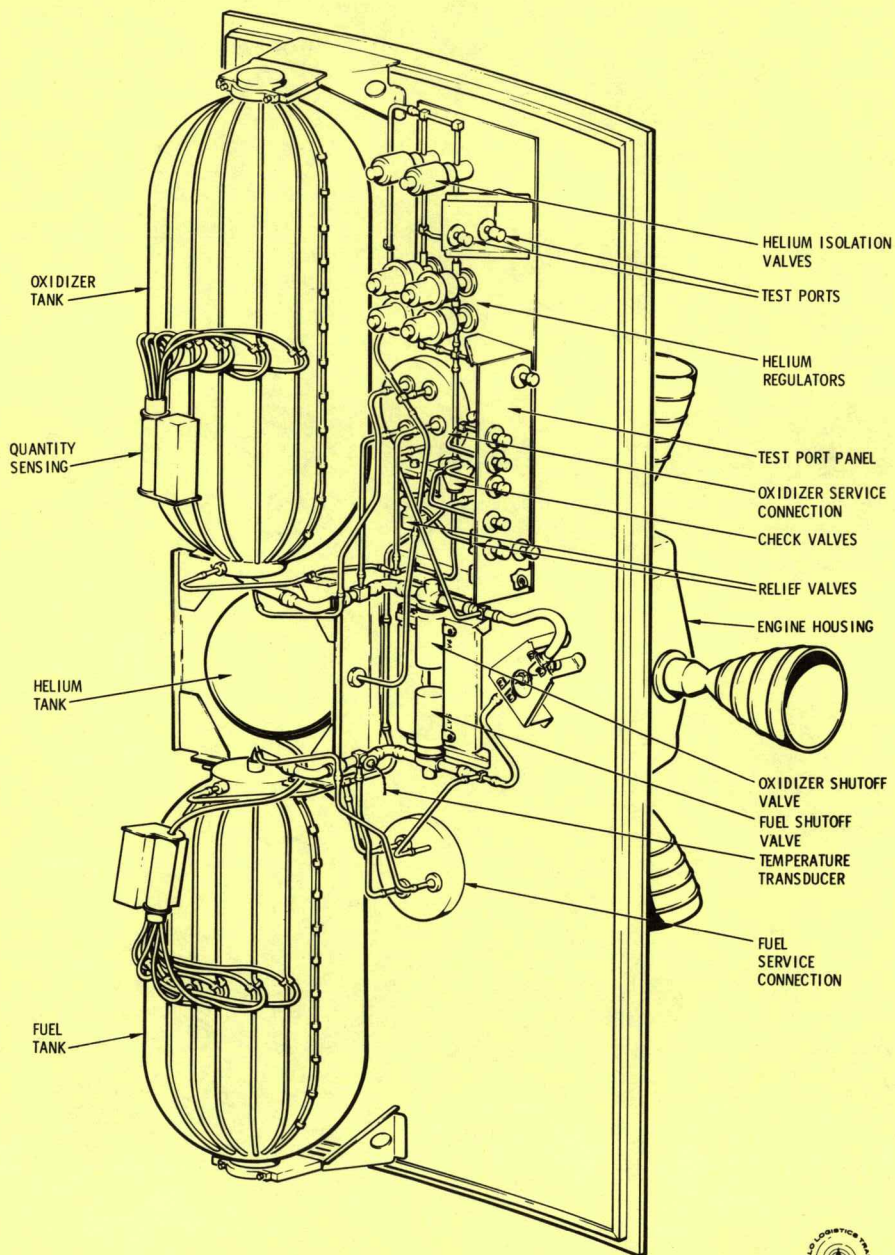


S/M REACTION CONTROL SYSTEM QUADS

2



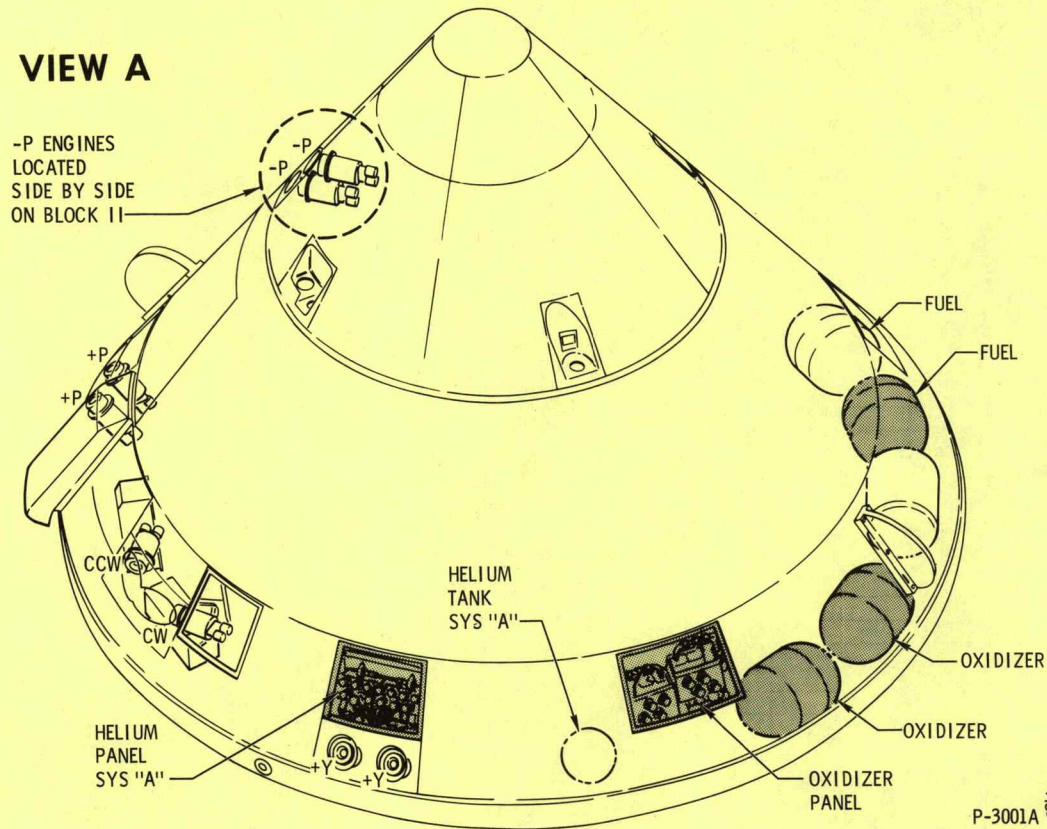
SM RCS PANEL ASSEMBLY



C/M REACTION CONTROL COMPONENT LOCATION

2

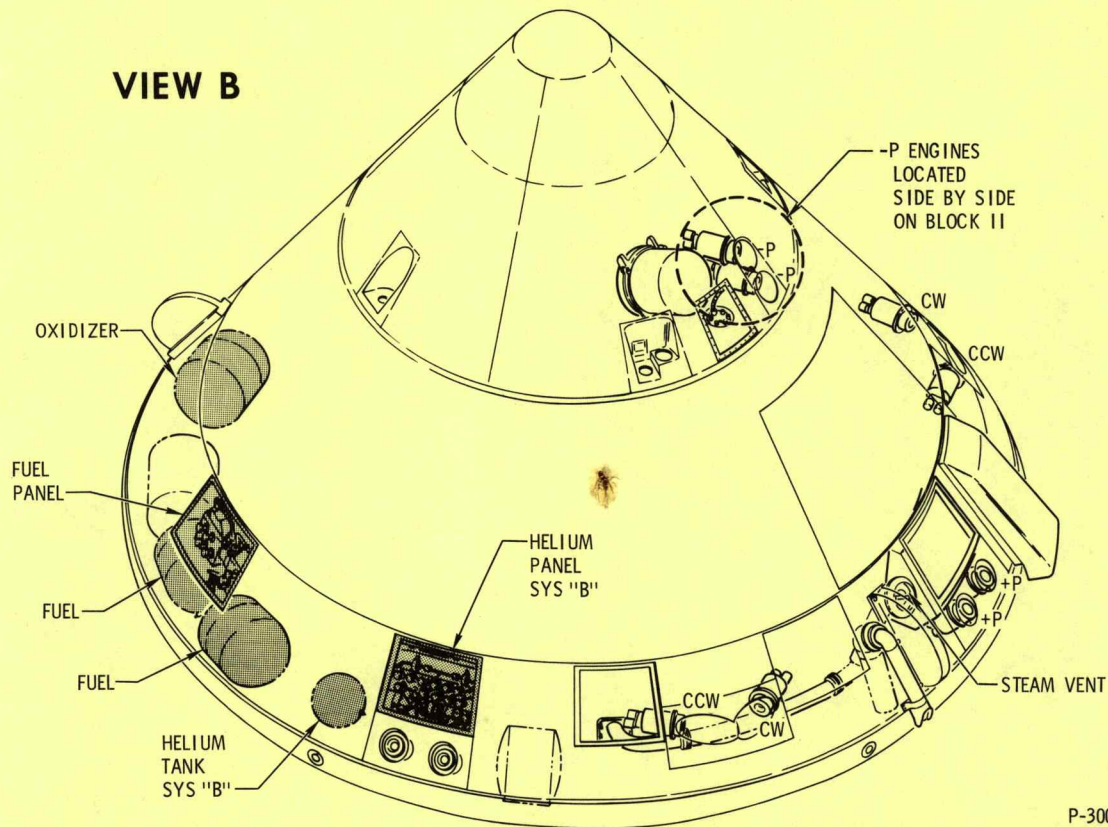
VIEW A



C/M REACTION CONTROL COMPONENT LOCATION

2

VIEW B

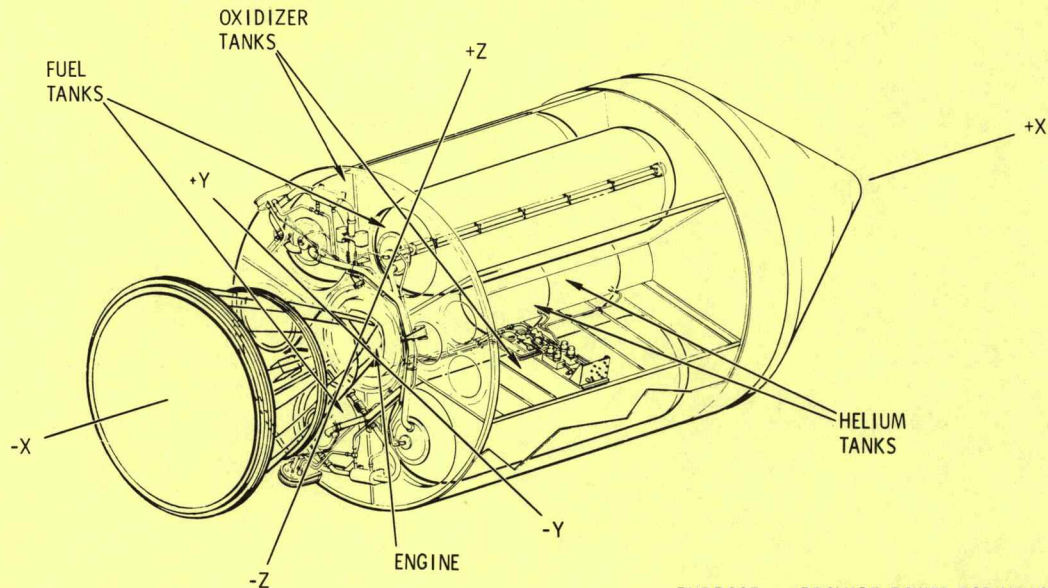


P-3002C



SERVICE PROPULSION SYSTEM

2



TYPE OF SYSTEM: NON-THROTTLEABLE, PRESSURE FEED SYSTEM, HYPERGOLIC PROPELLANTS AND ABLATIVE CHAMBER WITH RADIANT COOLED NOZZLE EXTENSION.

SYSTEM DESCRIPTION: ONE SYSTEM CONSISTING OF A PROPELLANT FEED SYSTEM AND ONE ENGINE

PROPELLANTS - NITROGEN TETROXIDE AND BLENDED HYDRAZINE (50% UDMH & 50% HYDRAZINE)

SYSTEM CONTROLLED BY G&N AND/OR SCS WITH A MANUAL OVERRIDE CAPABILITY

PURPOSE: PROVIDE POWER FOR MAJOR VELOCITY CHANGES AFTER BOOSTER SEPARATION UNTIL C/M S/M SEPARATION. IN ADDITION SUPPORTS S/M ABORT CRITERIA AFTER THE LAUNCH ESCAPE TOWER HAS BEEN JETTISONED

P-1078



COMMUNICATIONS SYSTEM

MISSION REQUIREMENTS

2

- DATA COLLECTION

CREW STATUS

SYSTEM STATUS

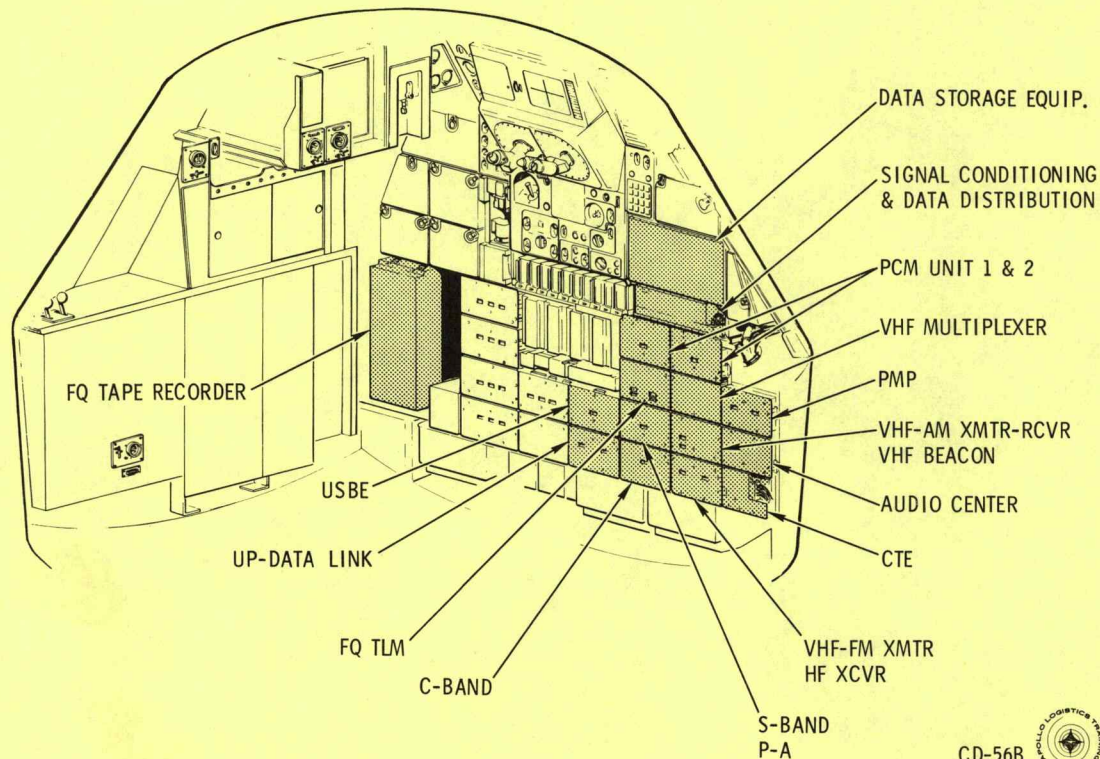
- VOICE
- TV
- TRACKING
- RECOVERY BEACON
- UP DATA
- TAPE RECORDER



LOWER EQUIPMENT BAY

COMMUNICATIONS

2

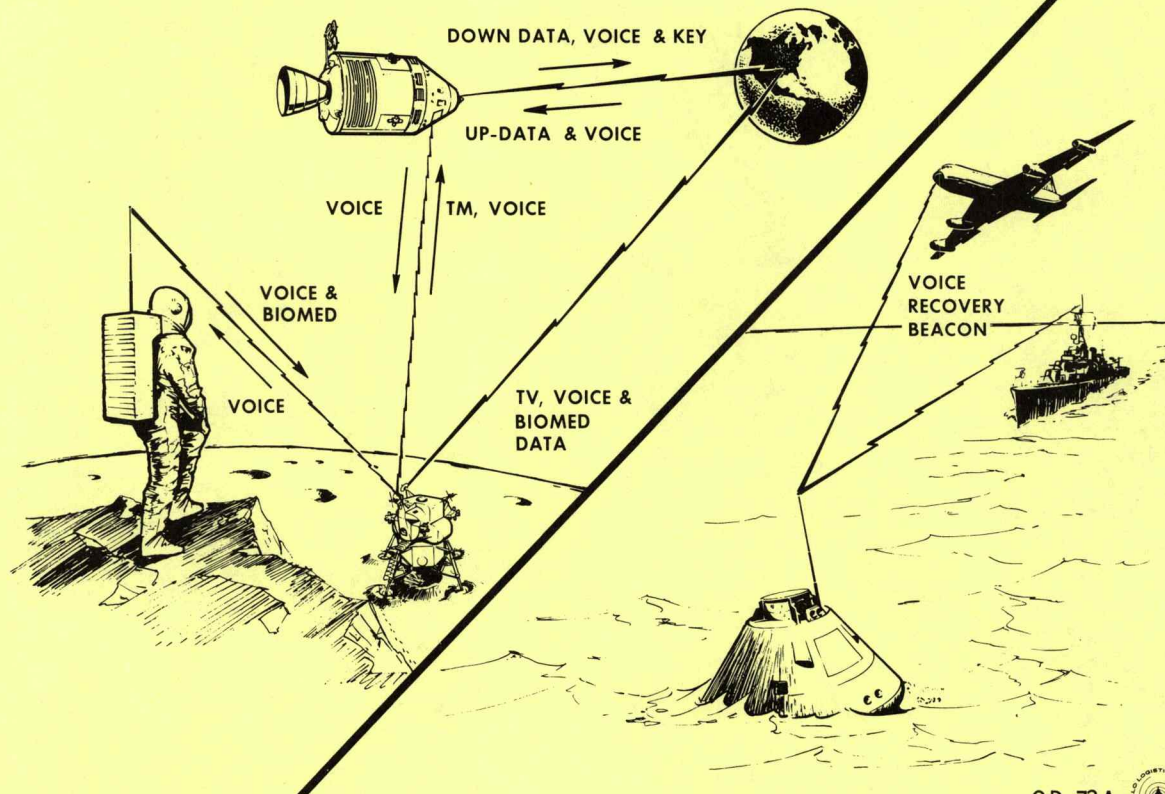


CD-56B



COMMUNICATIONS MODES

2

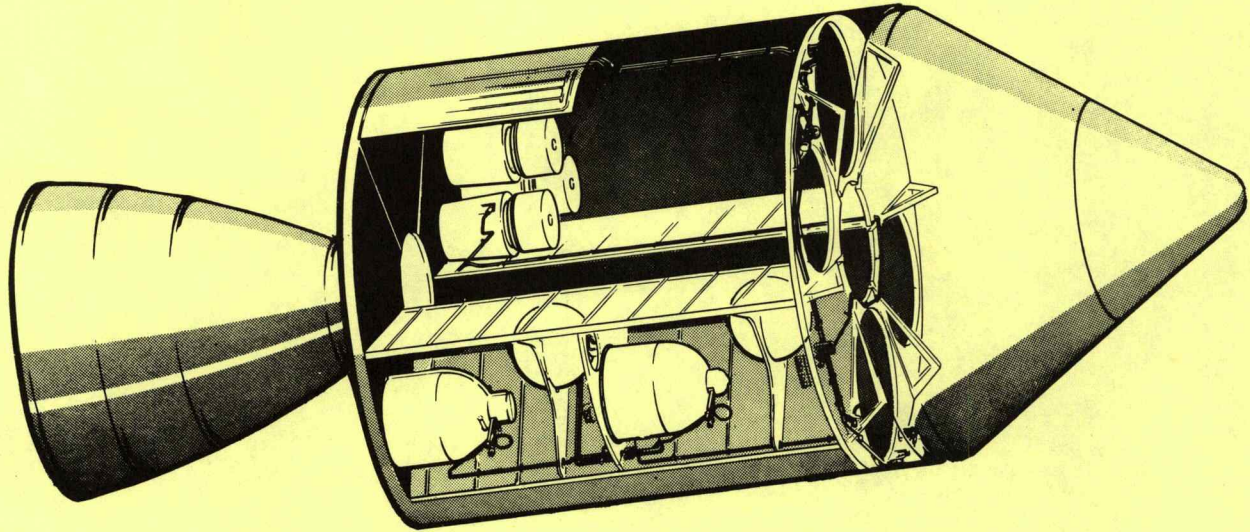


CD-73A



ELECTRICAL POWER SYSTEM

2



ELECTRICAL POWER SYSTEM

FUNCTIONAL DIVISION

POWER SOURCES

- D.C. SYSTEM

FUEL CELL MODULES (3)

BATTERIES (3)

- A.C. SYSTEM

INVERTERS (3)

POWER DISTRIBUTION

- D.C. BUSSES

- A.C. BUSSES

SPECIAL CIRCUITS

- BATTERY CHARGER

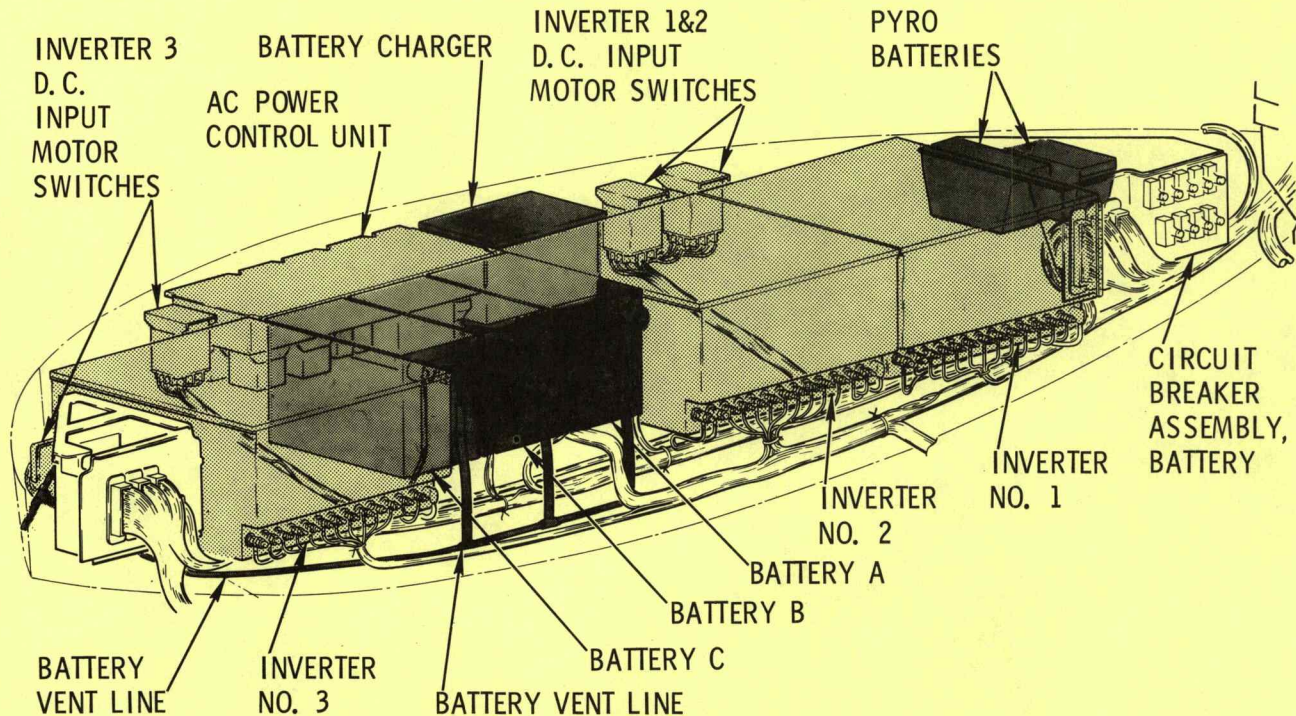
- PYROTECHNIC BATTERIES (2)

- S/M JETTISON CONTROL BATTERIES (2)



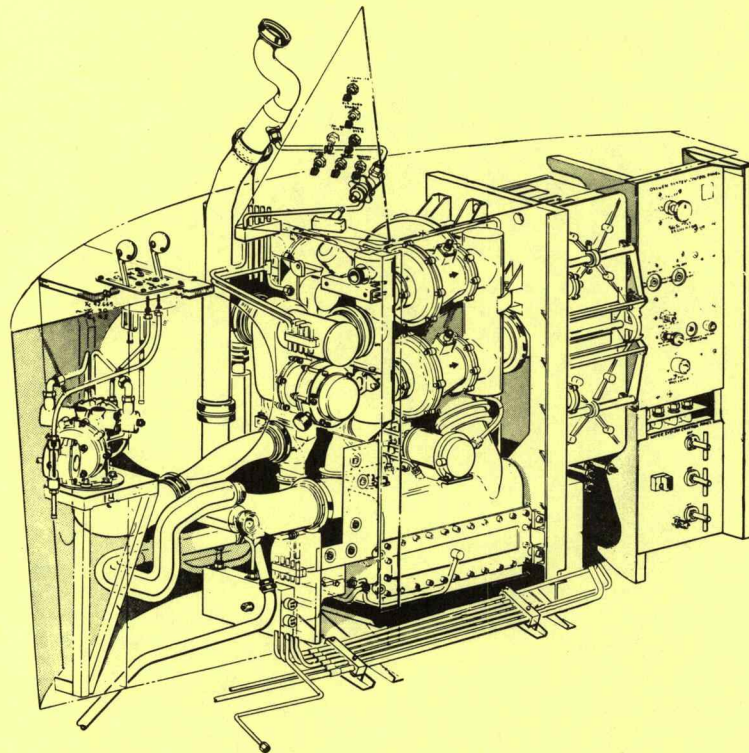
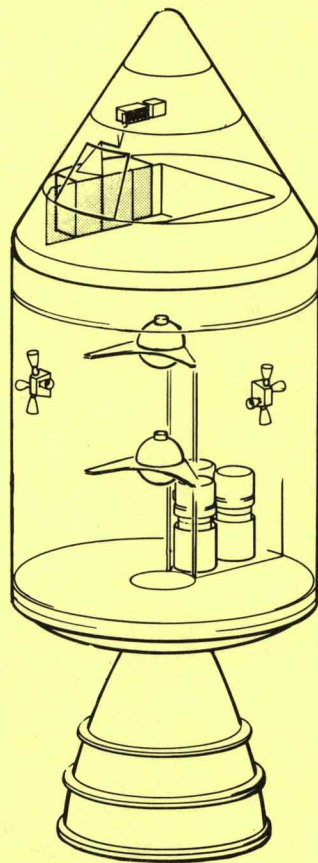
EPS COMPONENTS

LOWER EQUIPMENT BAY



ENVIRONMENTAL CONTROL SYSTEM

2



ECS FUNCTIONAL REQUIREMENTS

CONTROL SPACECRAFT ATMOSPHERE

- PRESSURE-TEMPERATURE-HUMIDITY-CONTAMINATION

PROVIDE COOLING FOR SPACECRAFT EQUIPMENT

- GUIDANCE & NAVIGATION-STABILIZATION & CONTROL
- COMMUNICATIONS-AC POWER SUPPLY-OTHER

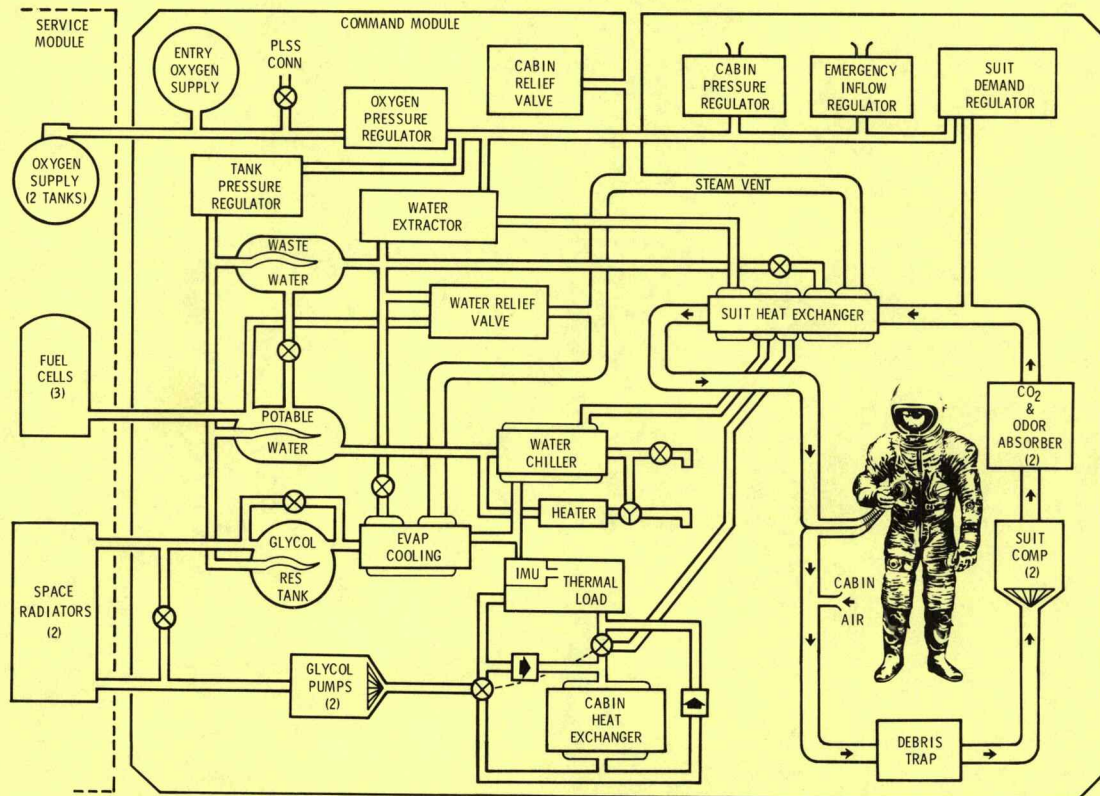
CONTROL COLLECTION, STORAGE & DISTRIBUTION OF WATER

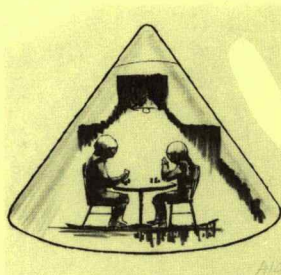
- POTABLE WATER FOR CREW USE
- WASTE WATER FOR SUPPLEMENTAL COOLING



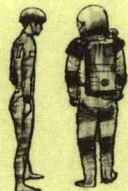
ENVIRONMENTAL CONTROL

FUNCTIONAL BLOCK DIAGRAM

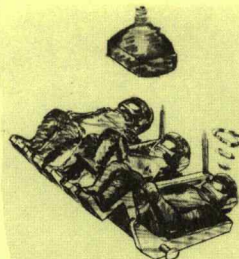




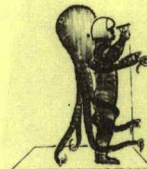
LIGHT AND SIGHT



SPACE SUIT ASSY



CREW COUCHES

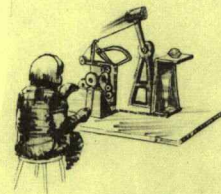


RESTRAINTS

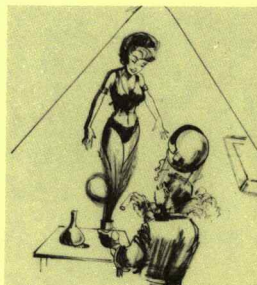


SURVIVAL

CREW EQUIPMENT



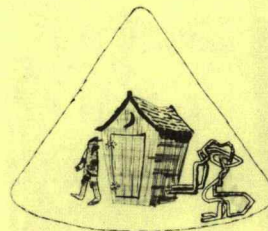
INFLIGHT TOOLSET



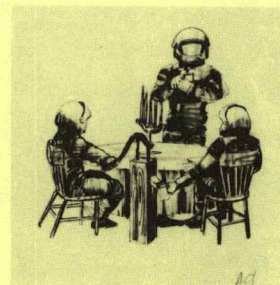
MISSION EXPERIMENTS



MEDICAL



WASTE CONTROL



WATER AND FOOD

MAR 66

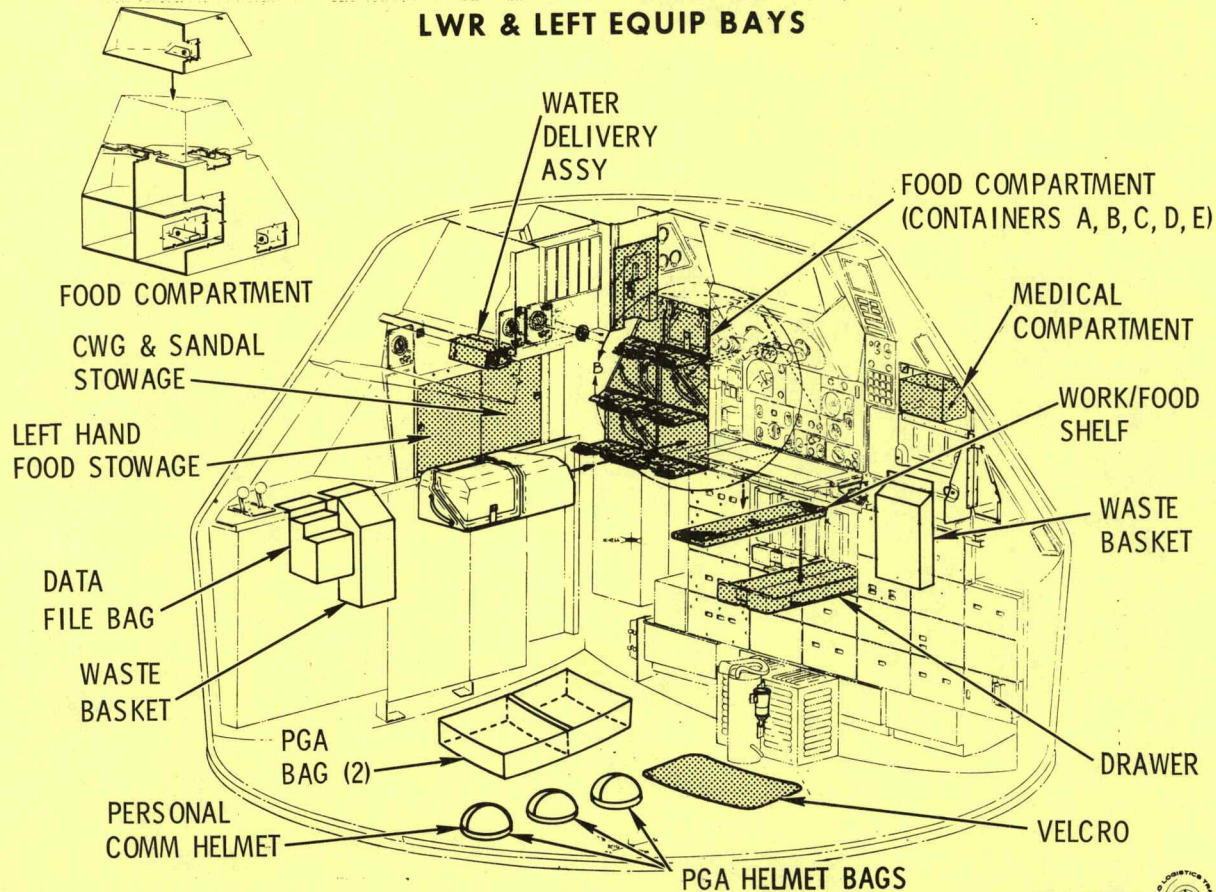
FAM-5402 A



APOLLO CREW EQUIPMENT INSTL, BLOCK I

LWR & LEFT EQUIP BAYS

2



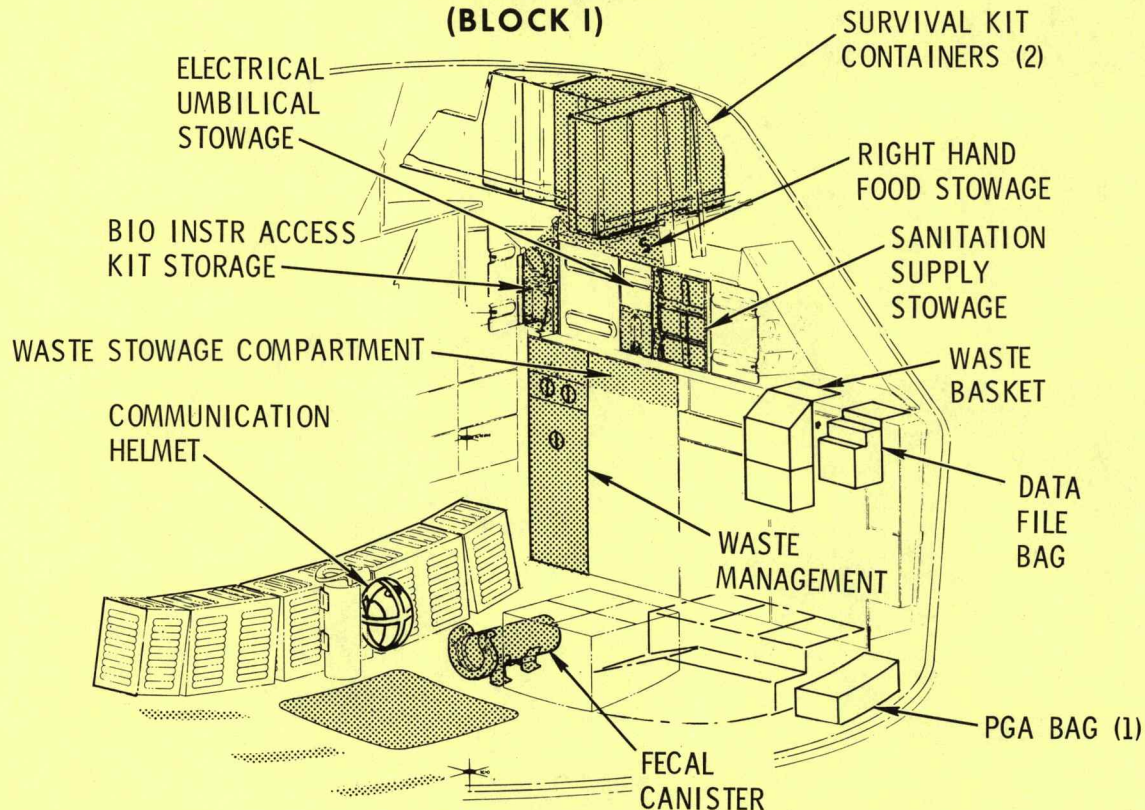
MAR 66

CS-0003B



APOLLO CREW EQUIPMENT INSTL.

RT EQUIP BAY (BLOCK 1)

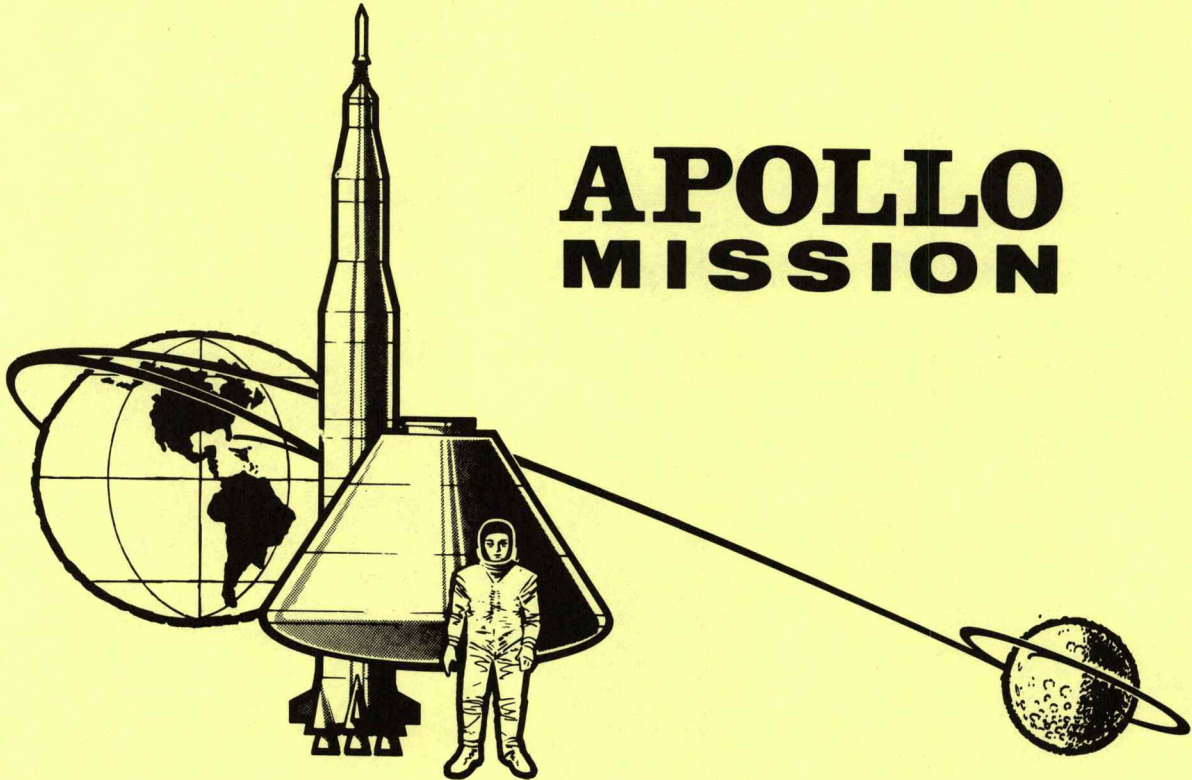


MAR 66

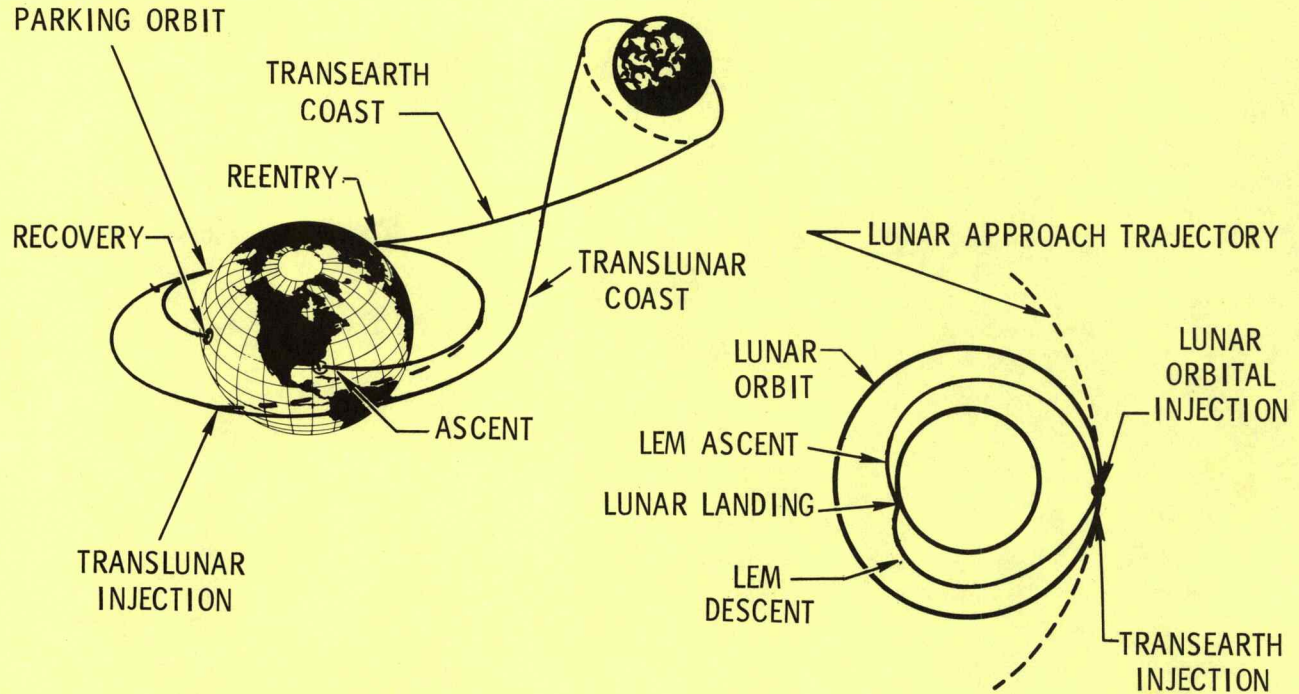
CS-0004C



APOLLO MISSION

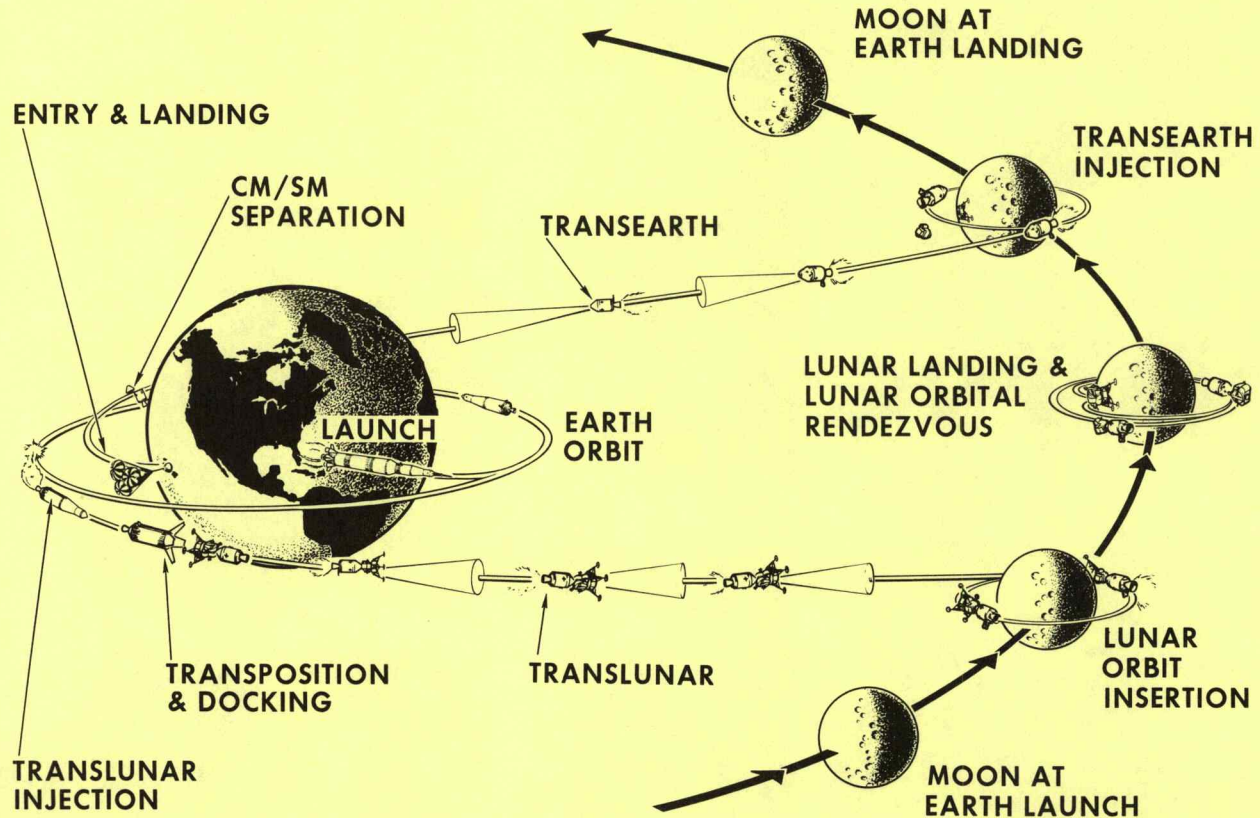


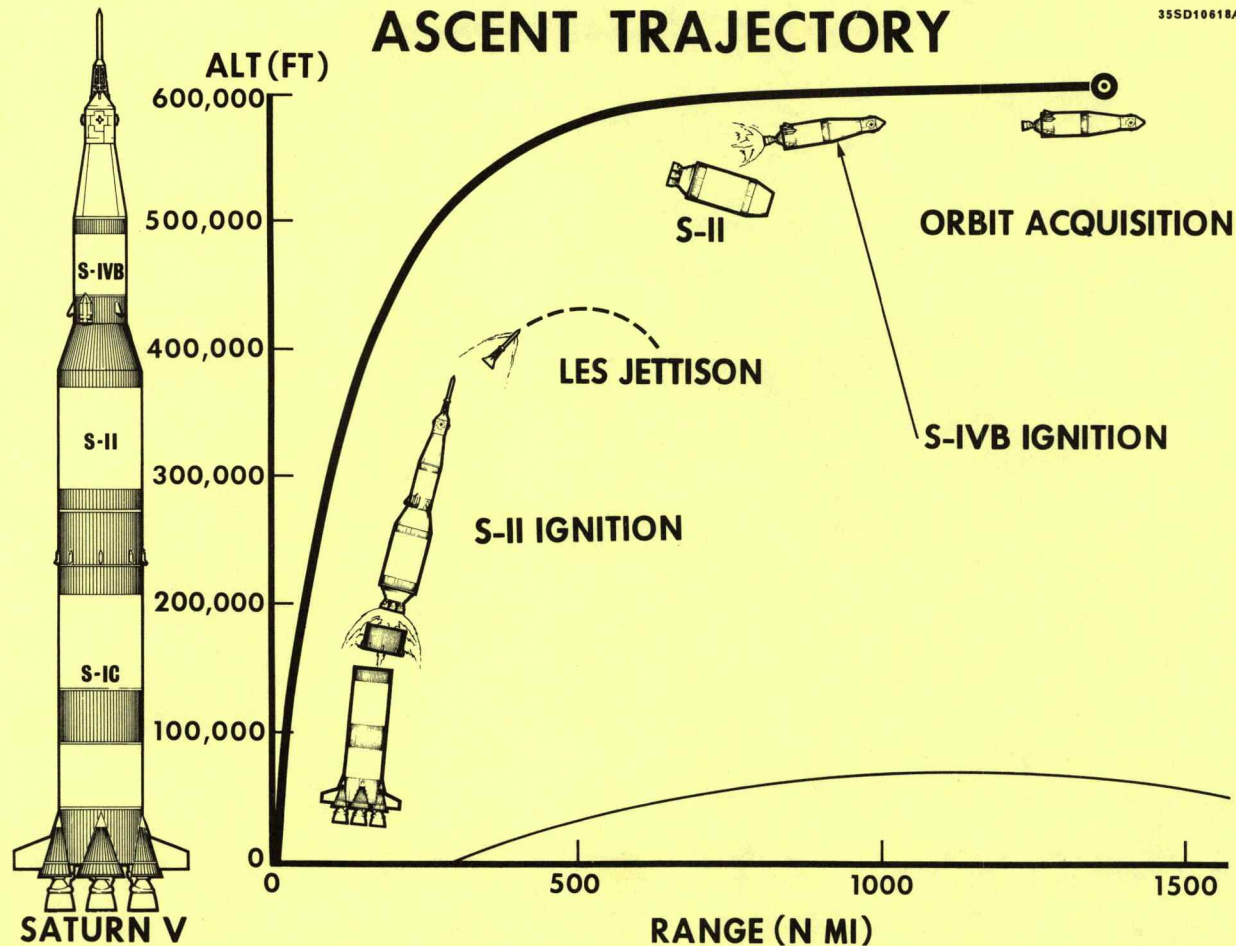
LUNAR MISSION



APOLLO MISSION PLAN

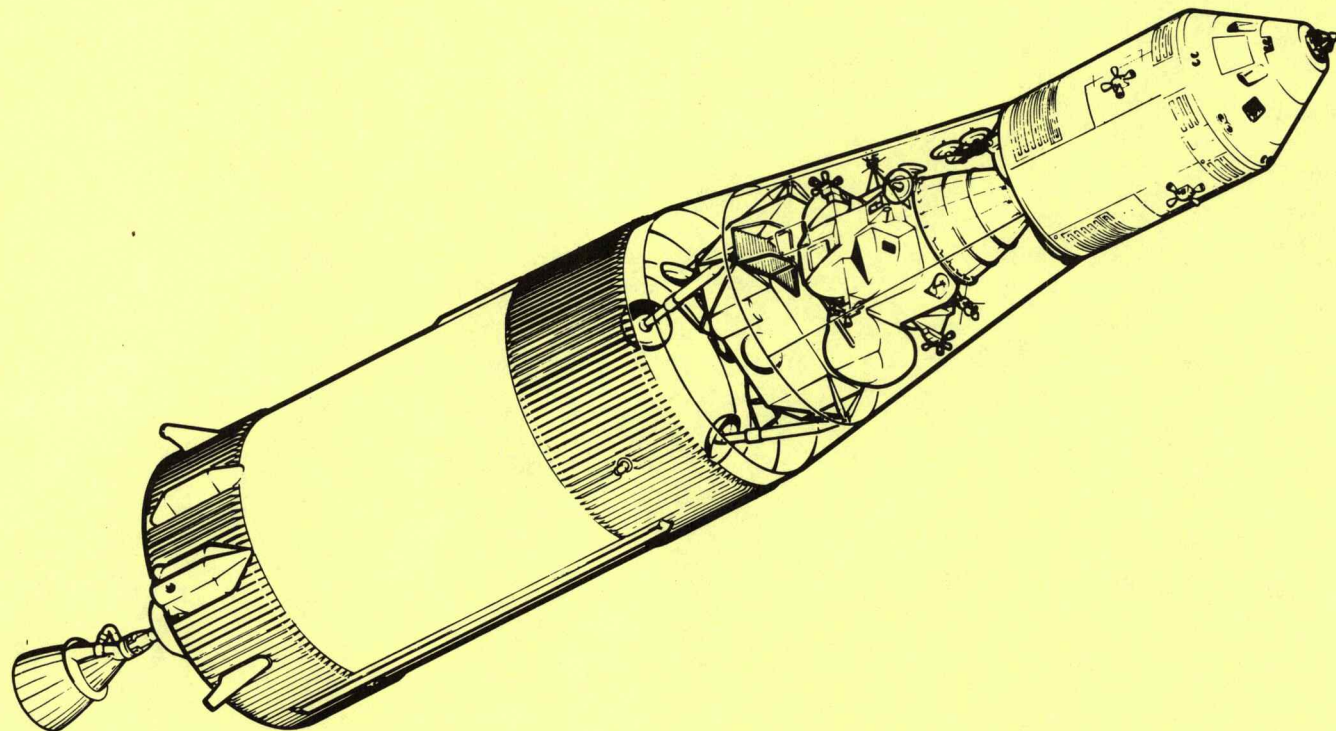
55SD10885





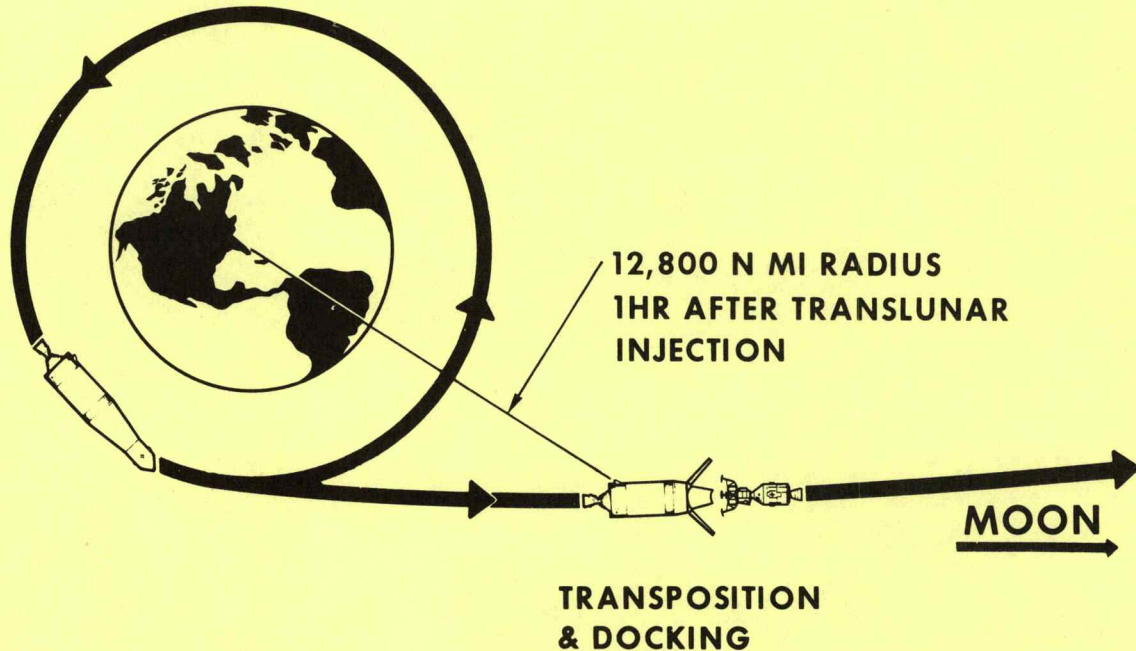
APOLLO SPACECRAFT/S-IVB EARTH ORBITAL CONFIGURATION

S125AP84510



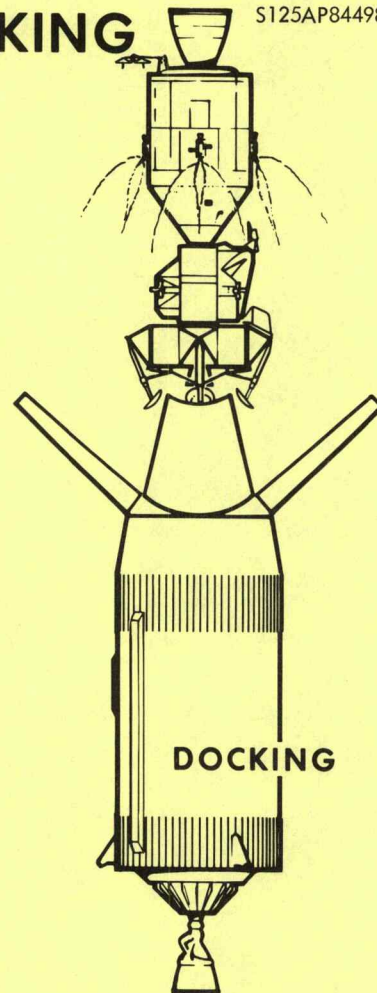
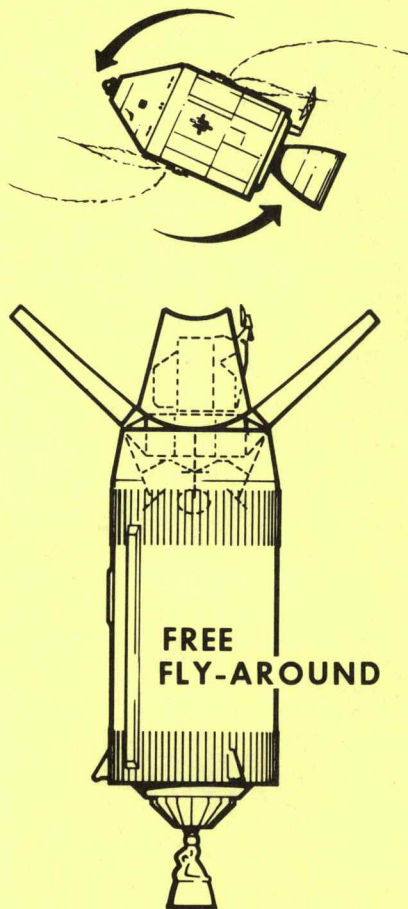
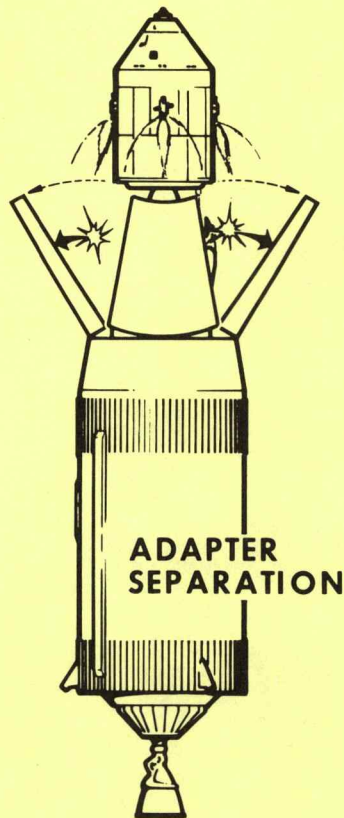
TRANSLUNAR INJECTION & COAST

3

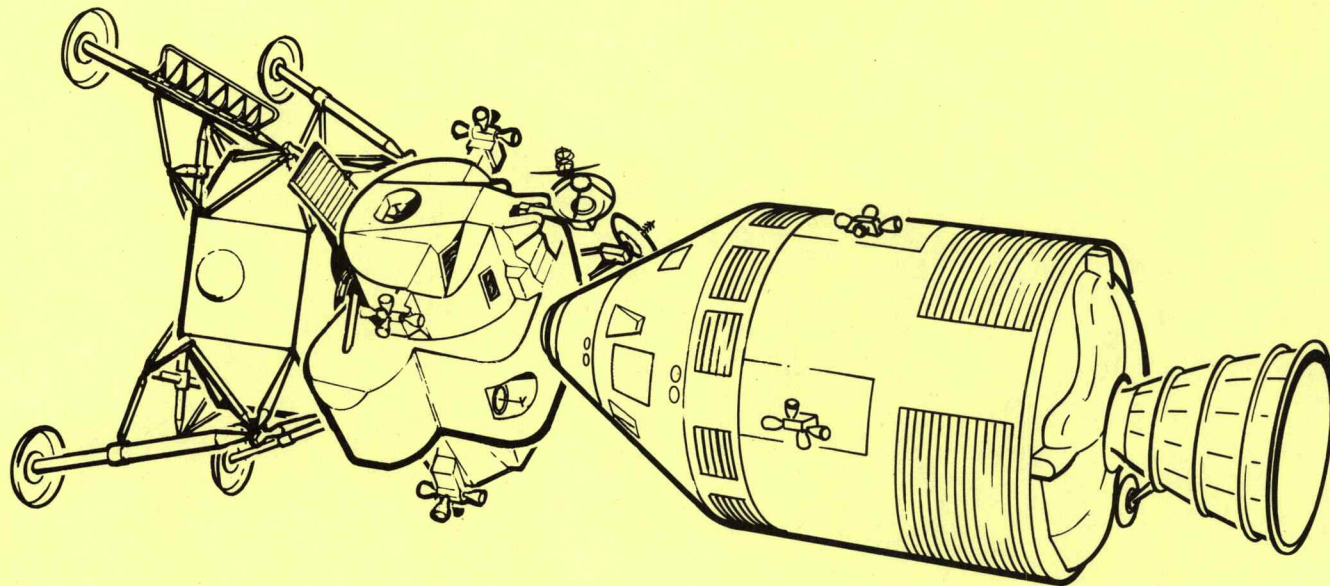


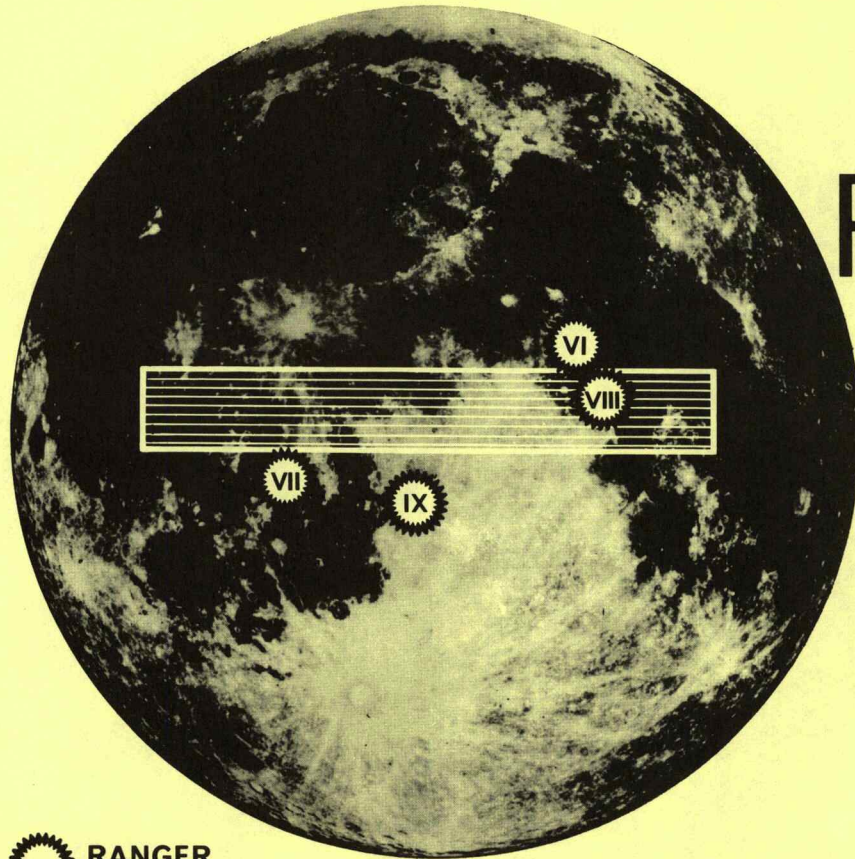
TRANSPOSITION & DOCKING

S125AP84498



APOLLO SPACECRAFT TRANSLUNAR CONFIGURATION

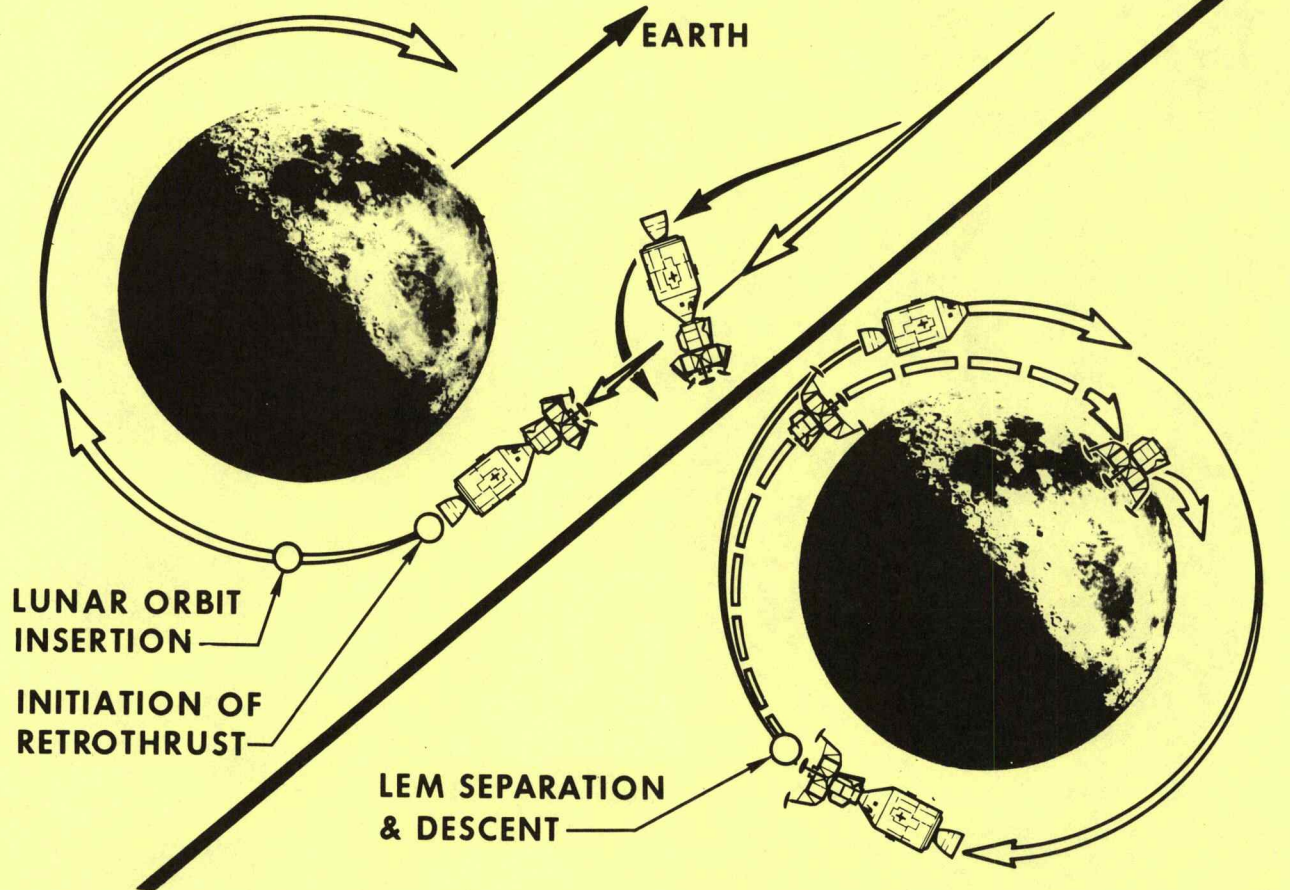




PROPOSED LUNAR LANDING

LUNAR ORBIT & LEM DESCENT

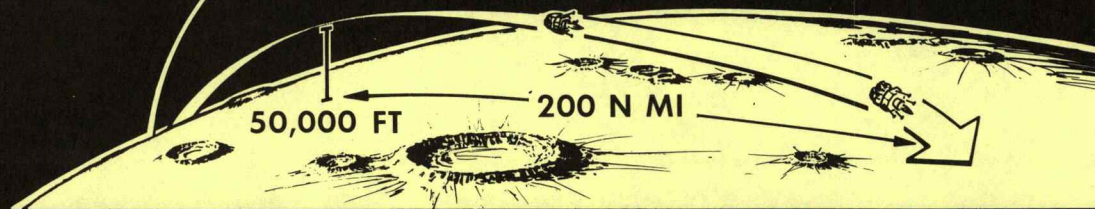
S125AP84505



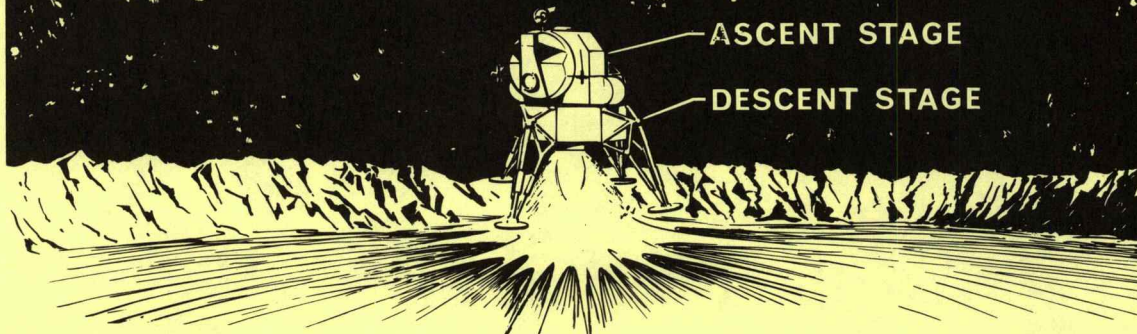
LEM DESCENT AND LANDING

84AP77521

LUNAR PARKING
ORBIT (80 N MI)

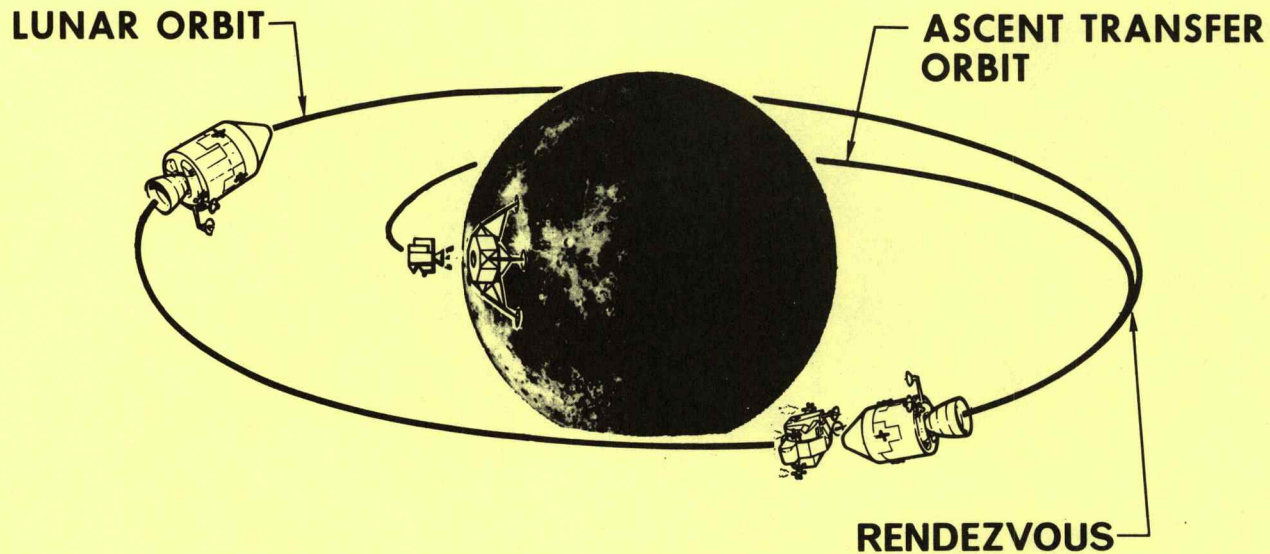


LANDING CONFIGURATION



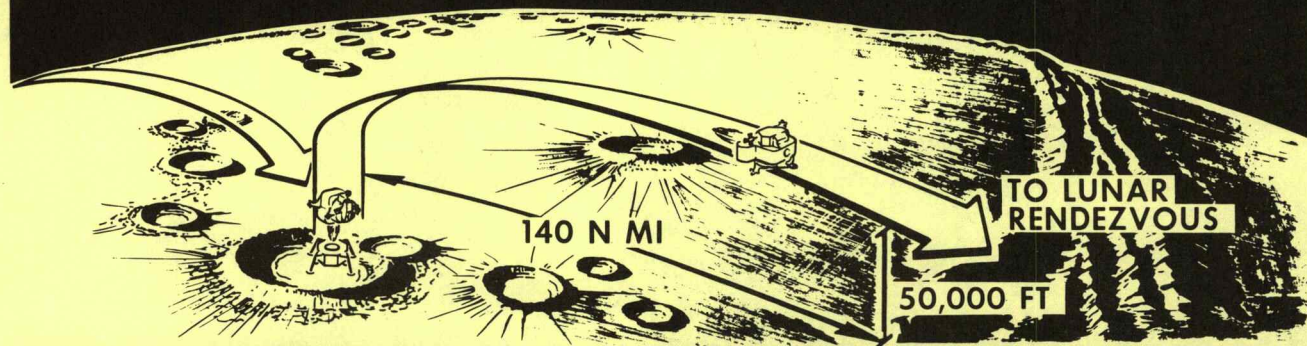
LEM ASCENT & LUNAR ORBITAL RENDEZVOUS

3

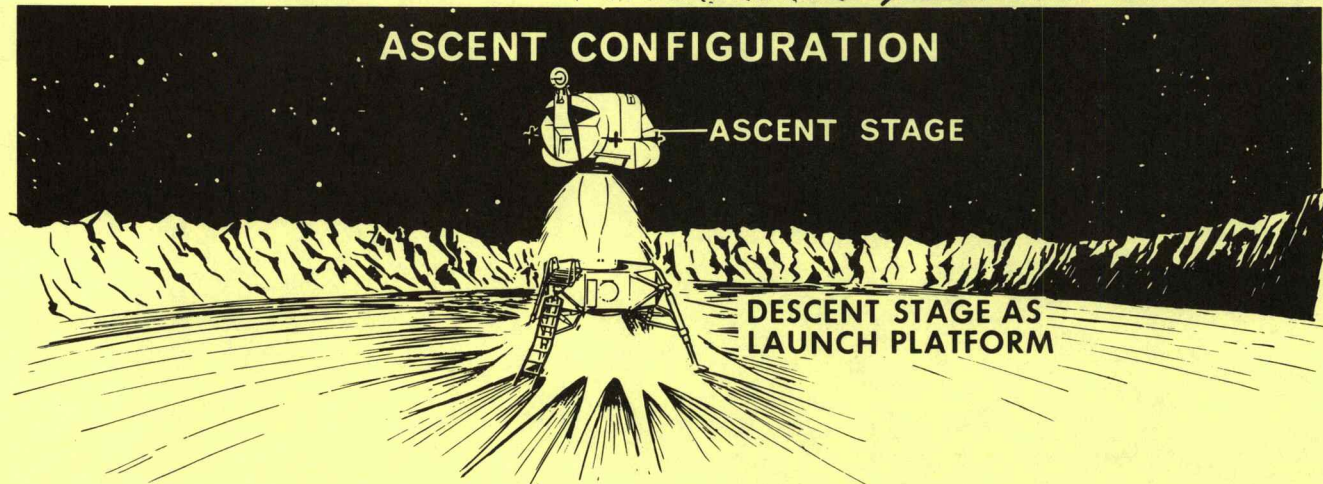


LEM ASCENT

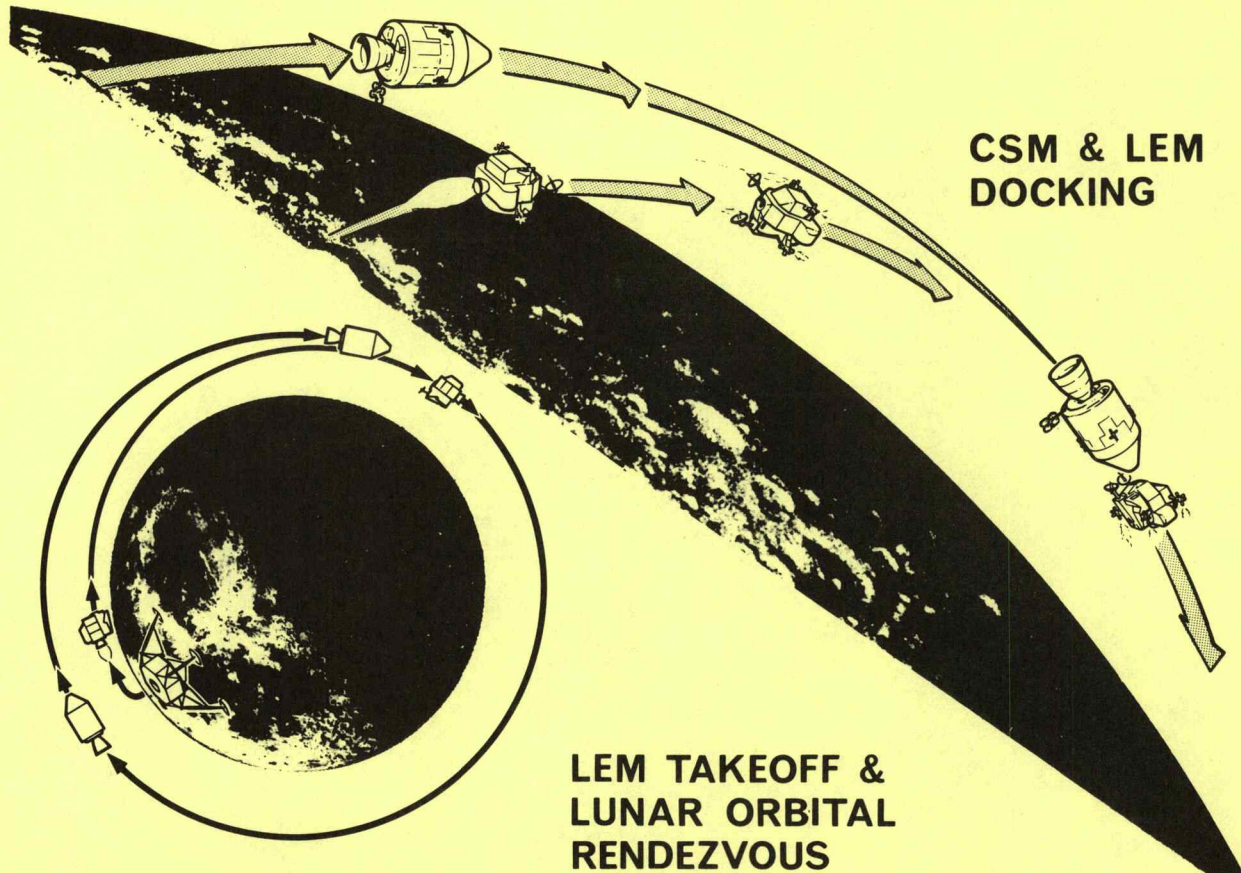
S125AP84502



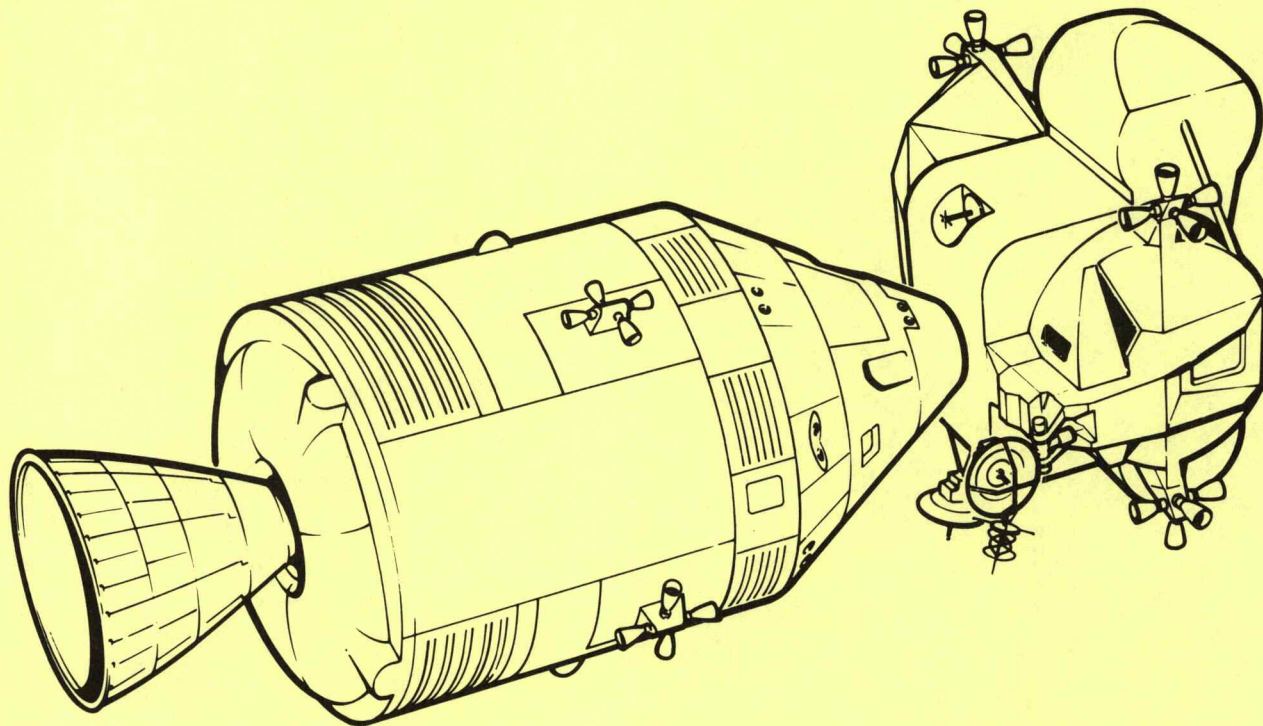
ASCENT CONFIGURATION



LUNAR ORBITAL RENDEZVOUS & DOCKING

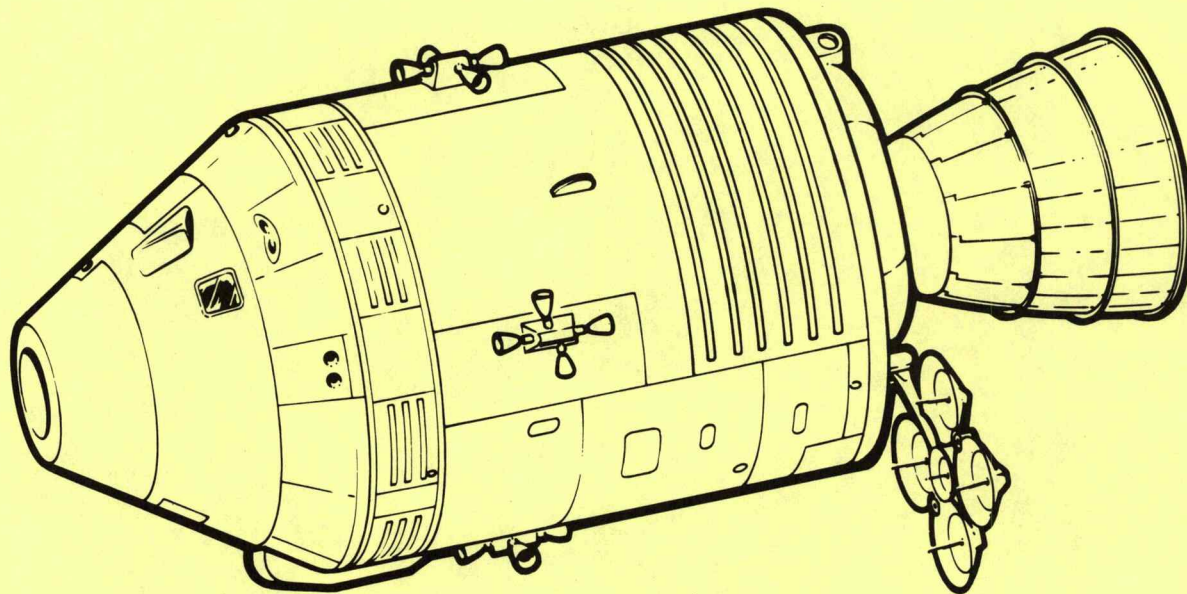


APOLLO SPACECRAFT LOR CONFIGURATION

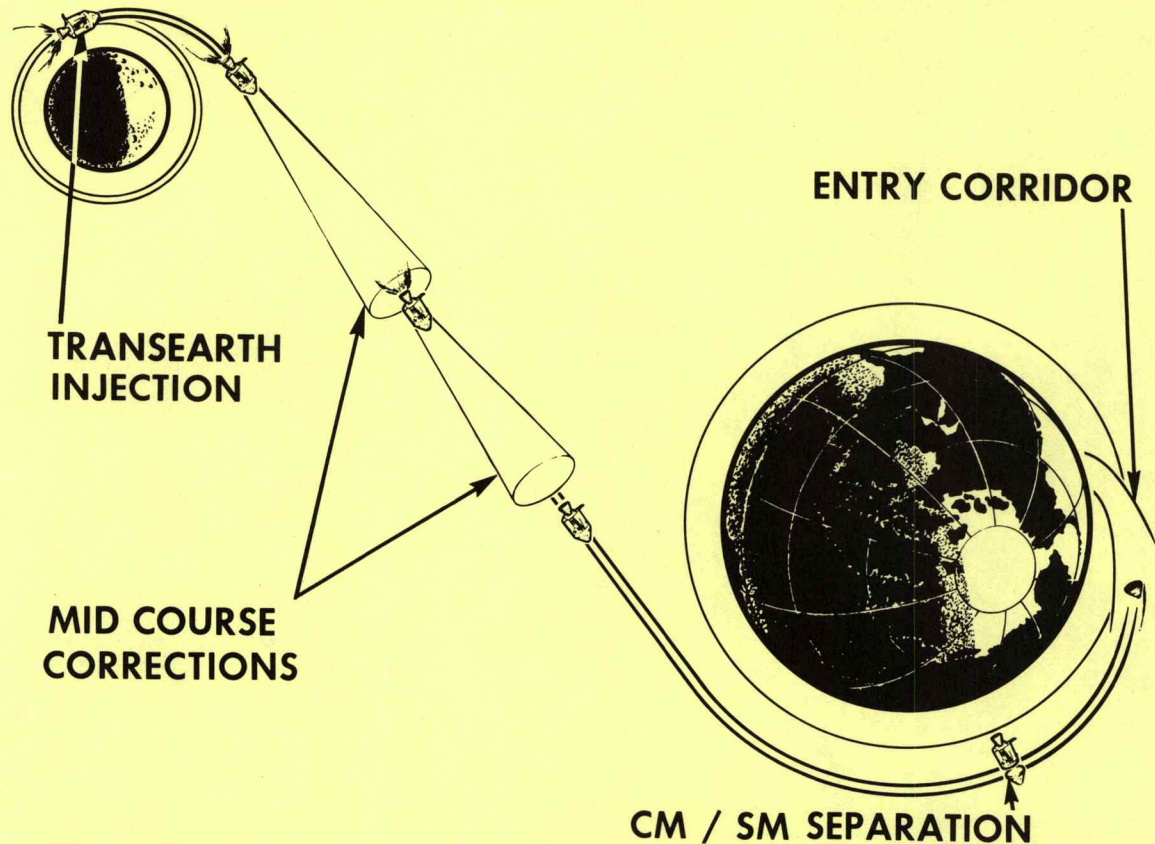


APOLLO TRANSEARTH CONFIGURATION

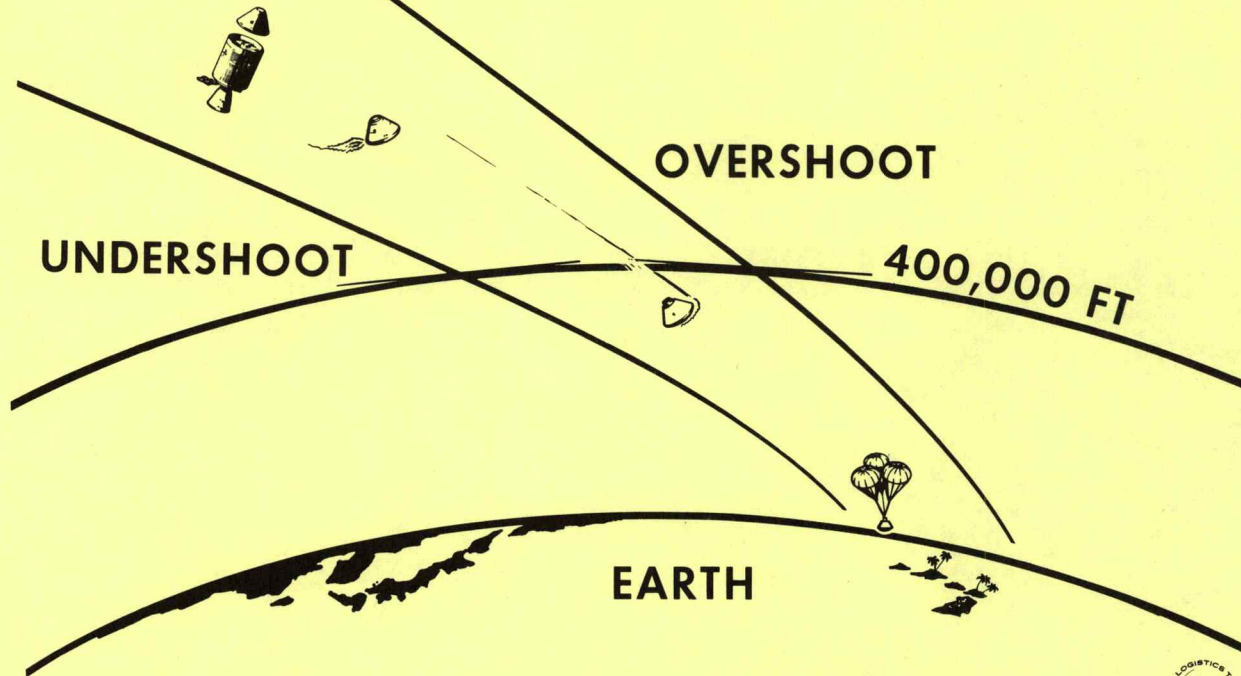
3



TRANSEARTH & ENTRY



ENTRY CORRIDOR

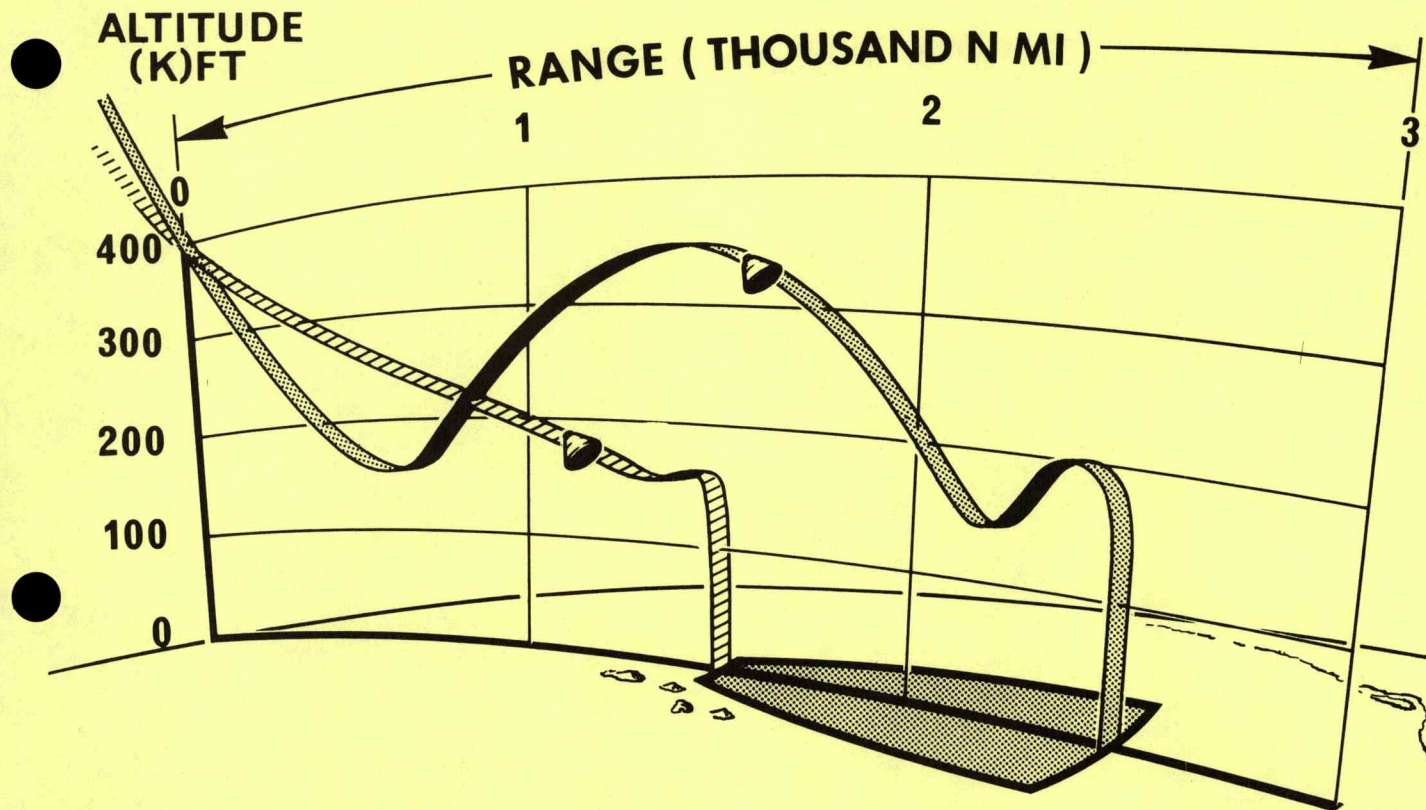


FAM-1017



TYPICAL RE-ENTRY RANGES

65ASD10884A



HEAT SHIELD
JETTISONED
BY 24,000 FEET

RECOVERY MODES

AFTER 1.6-SEC
TIME DELAY
DROGUE CHUTES
DEPLOYED-REEFED FOR 8 SEC

DROGUE CHUTES RELEASED
AND MAIN CHUTES DEPLOYED
REEFED BY 10,000 FT

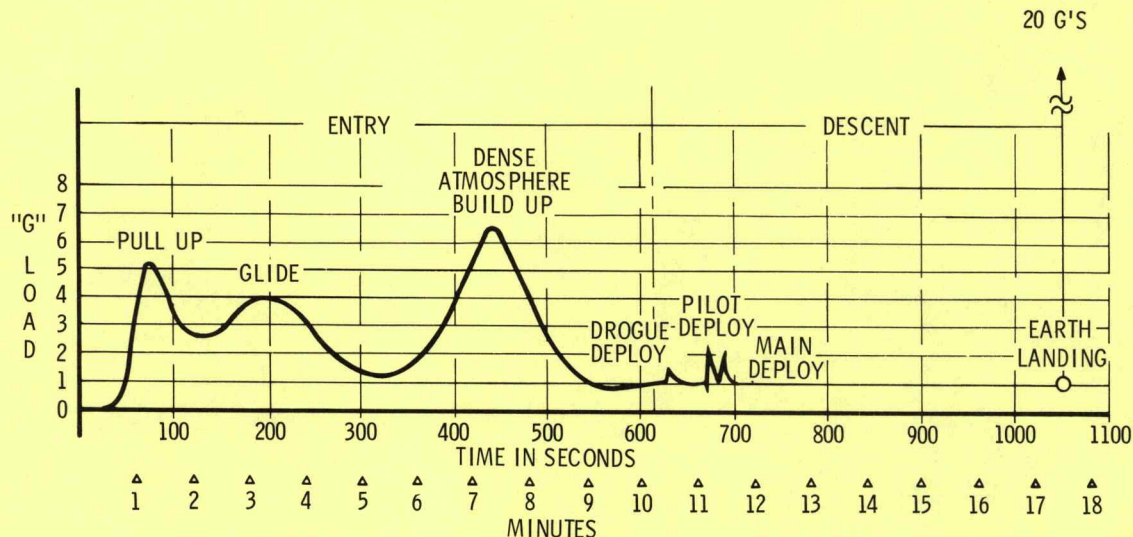
MAIN CHUTES FULLY
OPENED AFTER BEING
REEFED FOR 8 SEC

MAIN CHUTES RELEASED AT IMPACT



"G" FORCES, LUNAR MISSION, BLOCK II

ASTRONAUT SENSED



REF DESIGN REFERENCE MISSION, LED-540-12 dtd OCT 64



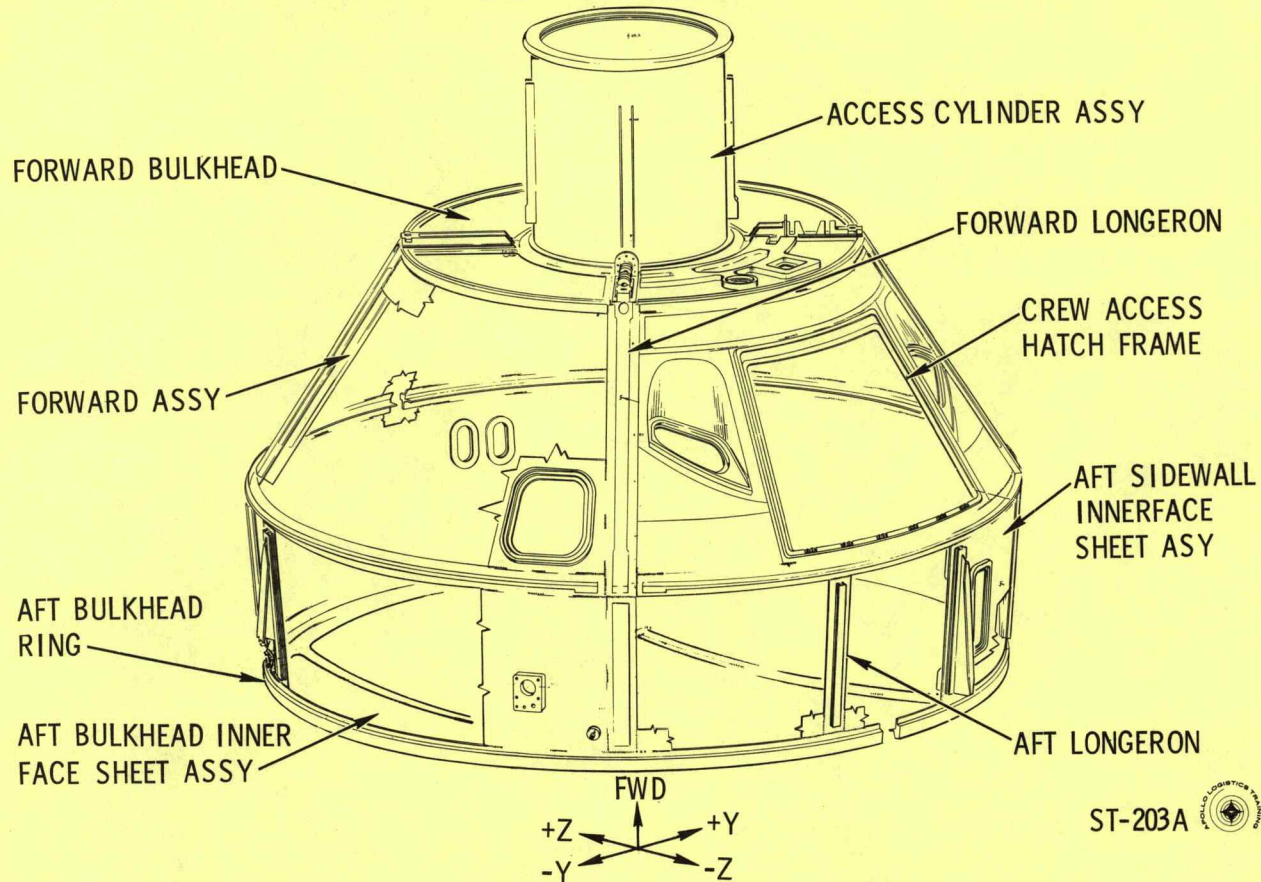
STRUCTURES

FAM-1515



INNER STRUCTURE

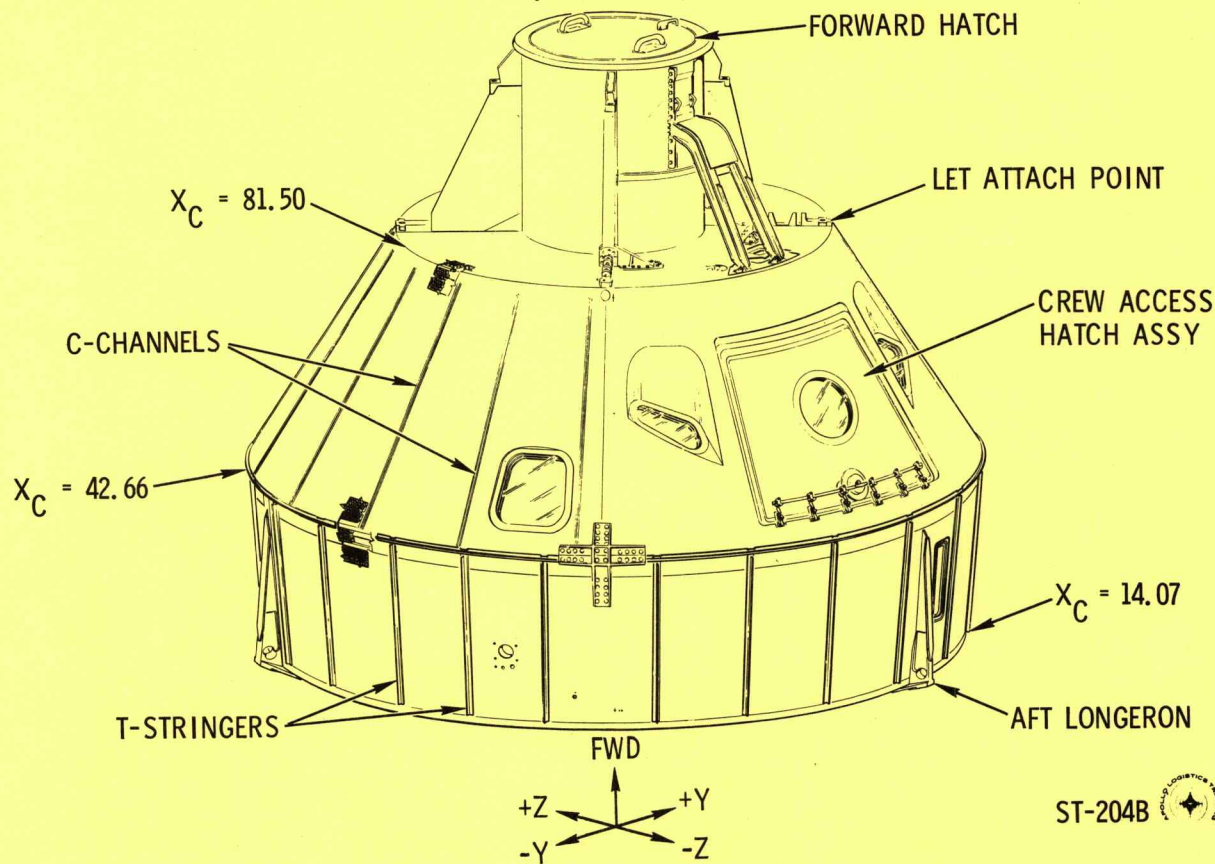
INNER SHELL (BLOCK I)



ST-203A

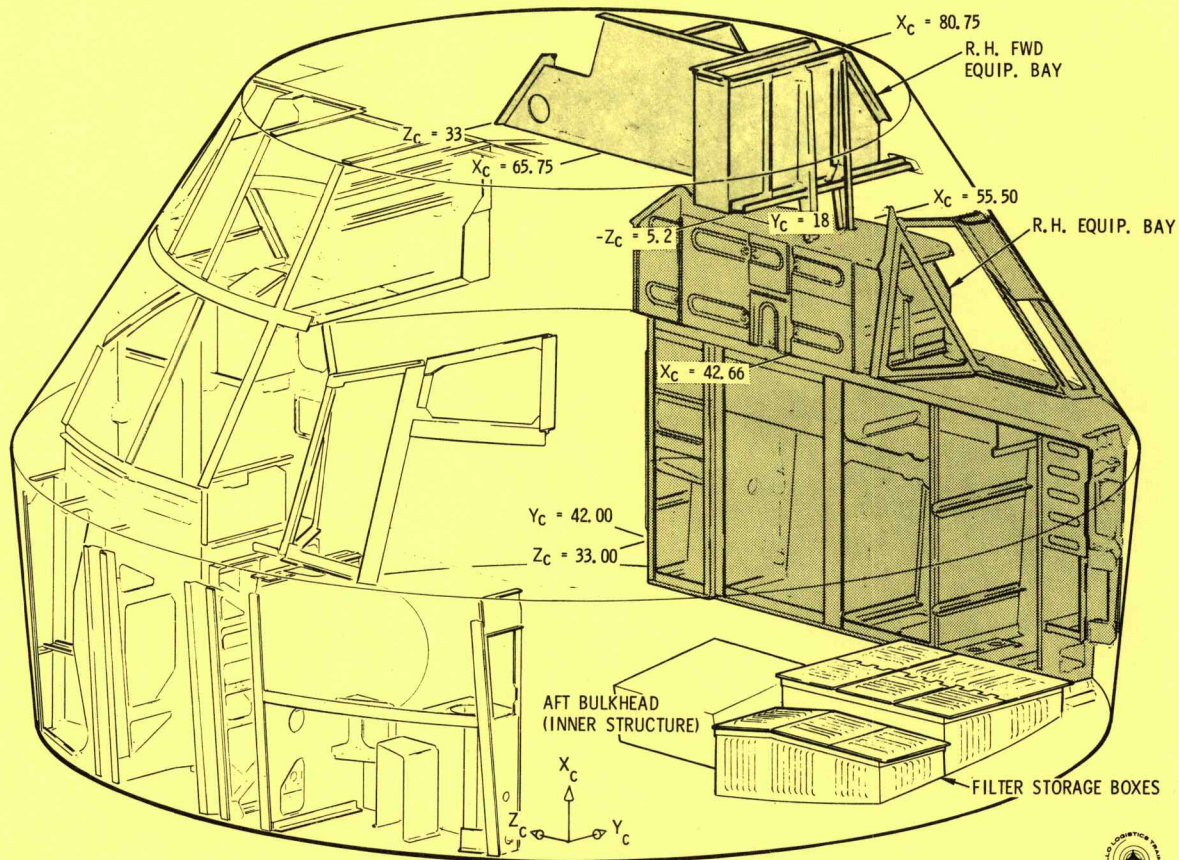


COMMAND MODULE INNER STRUCTURE (BLOCK I)



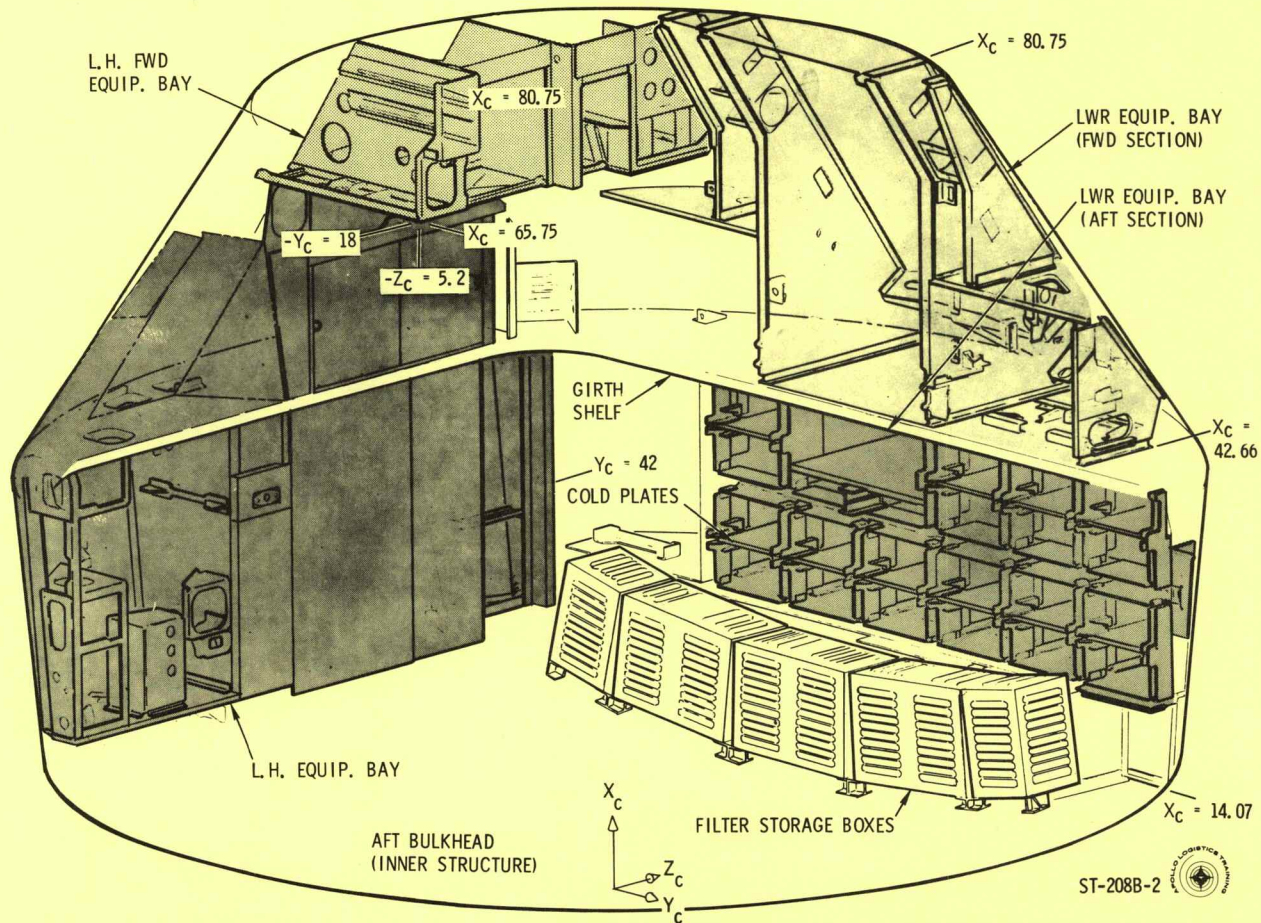
C/M SECONDARY STRUCTURE

BLOCK I



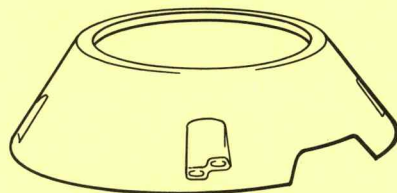
C/M SECONDARY STRUCTURE

BLOCK I

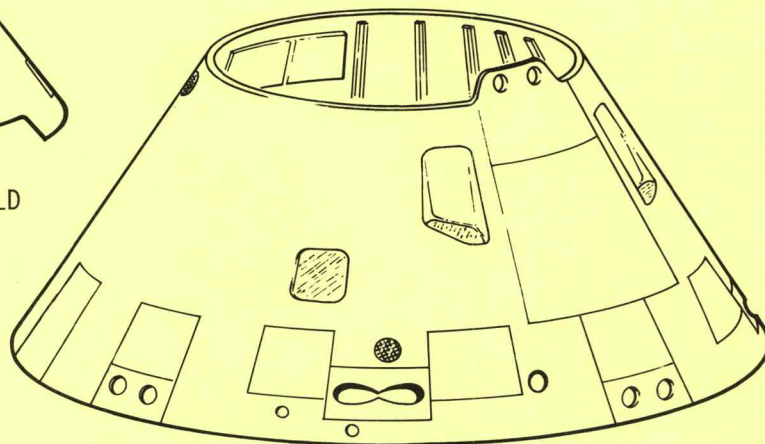


COMMAND MODULE HEAT SHIELDS

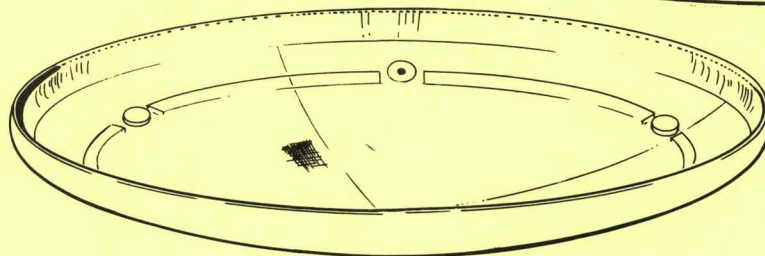
BLOCK II



FORWARD HEAT SHIELD



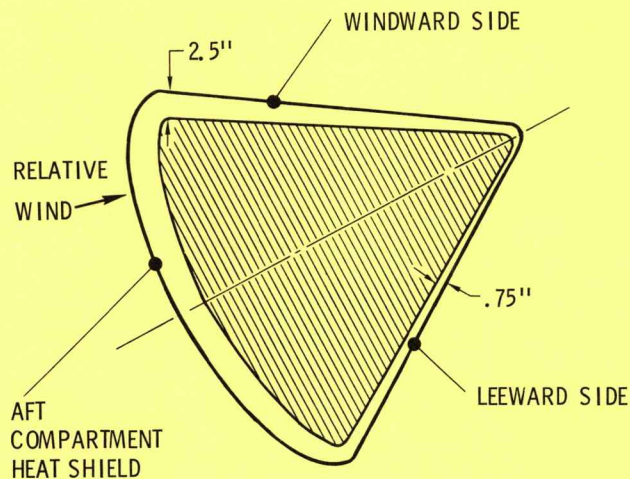
AFT HEAT SHIELD



CREW COMPARTMENT
HEAT SHIELD

ABLATOR THICKNESS

BLOCK I



AVCO 5026-39 HC

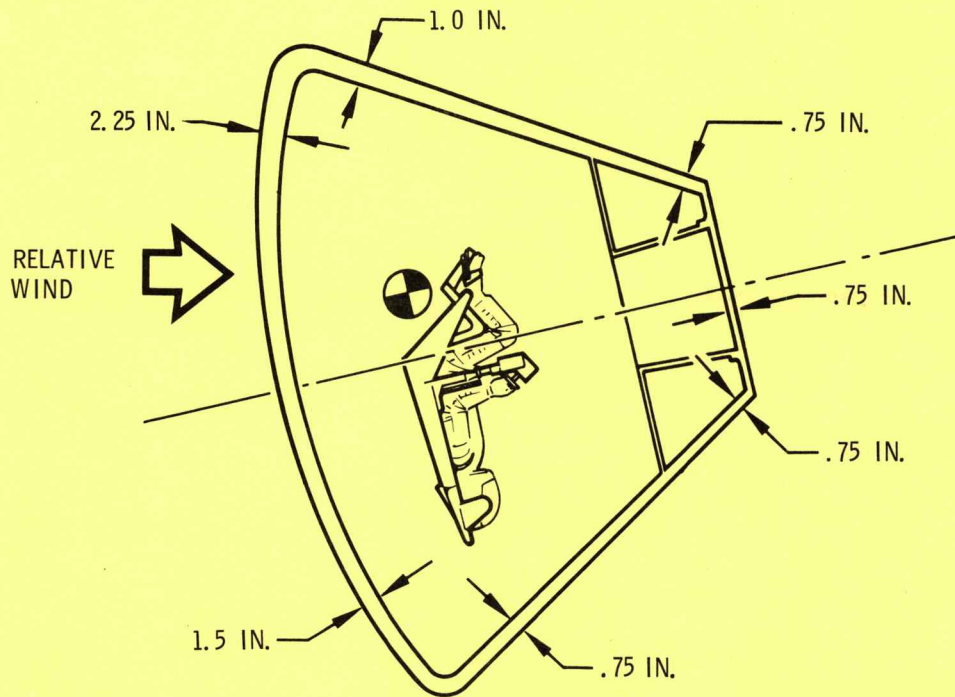
- 30 LB/FT³
- EPOXY PHENOLIC MATERIAL
- GLASS FIBERS
- SILICA FIBERS
- PHENOLIC MICROBALLOON

FAM-1506 B



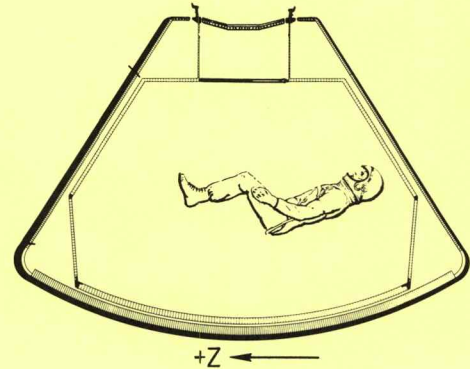
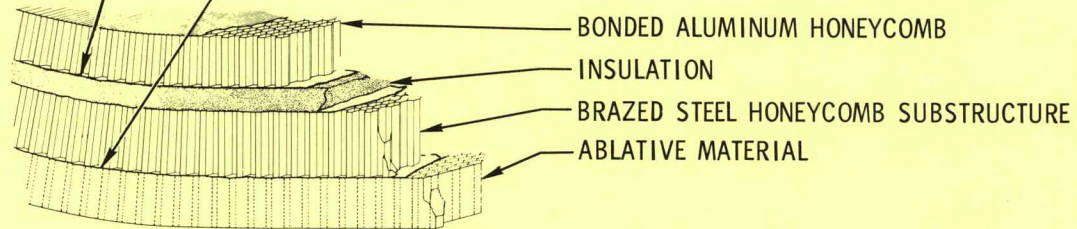
COMMAND MODULE ABLATIVE MATERIAL THICKNESS

BLOCK II



APOLLO SKIN CONFIGURATION

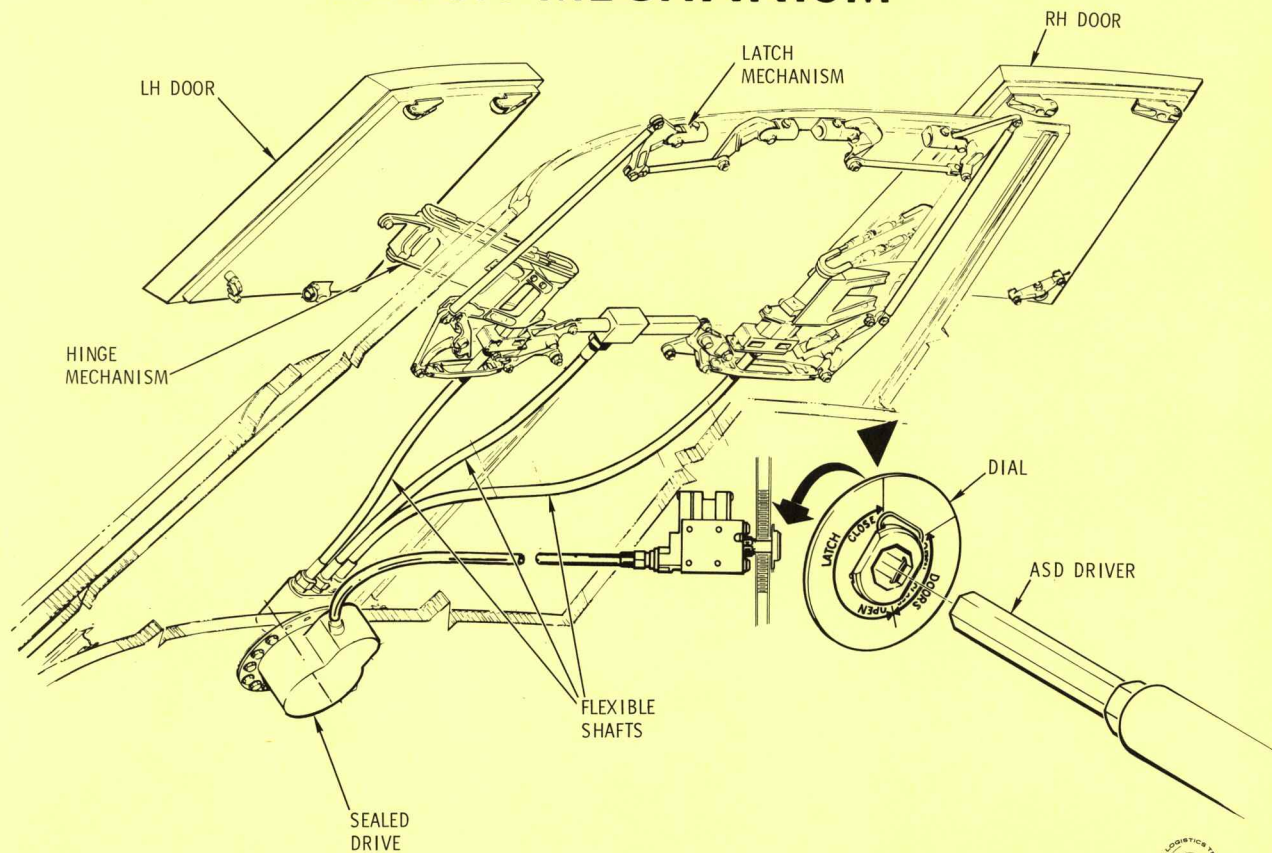
MAX AT MAIN CHUTE DEPLOYMENT
200°F 600°F



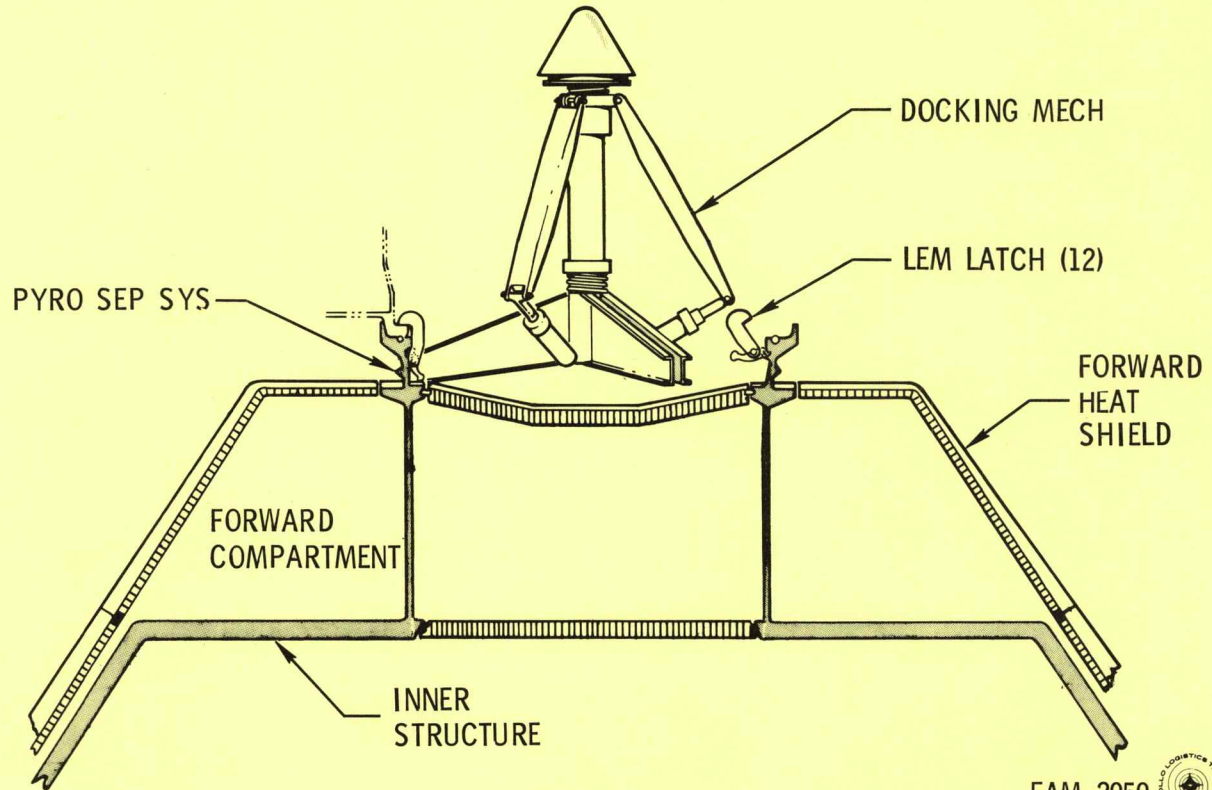
ST-206F



ASTRO-SEXTANT DOOR LATCH MECHANISM



CM FORWARD SECTION



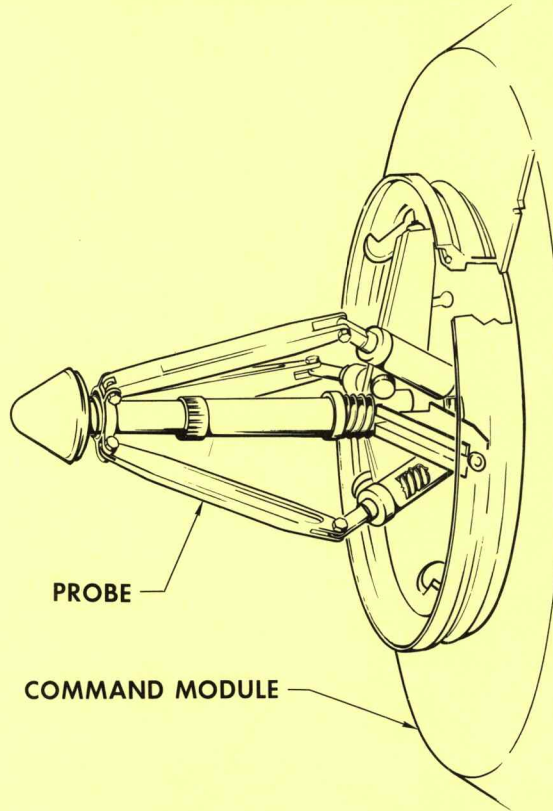
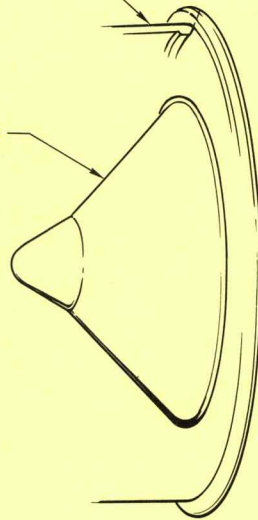
FAM-2050



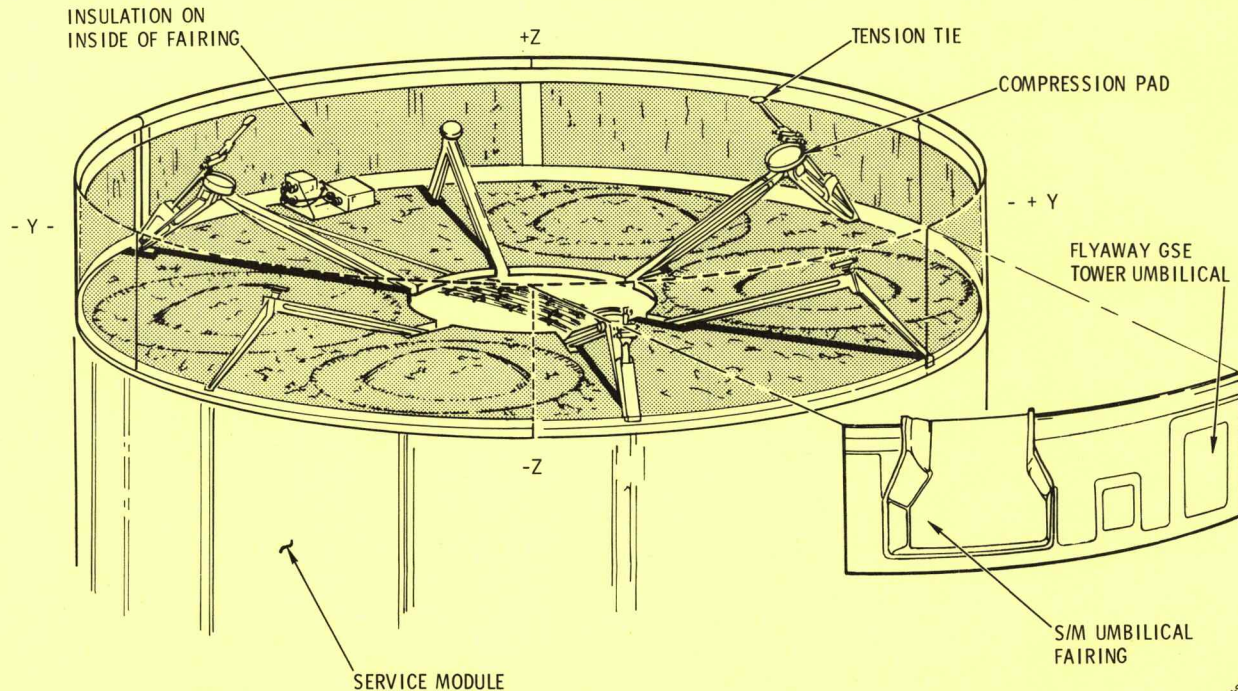
LEM DOCKING MECHANISM

LUNAR EXCURSION
MODULE

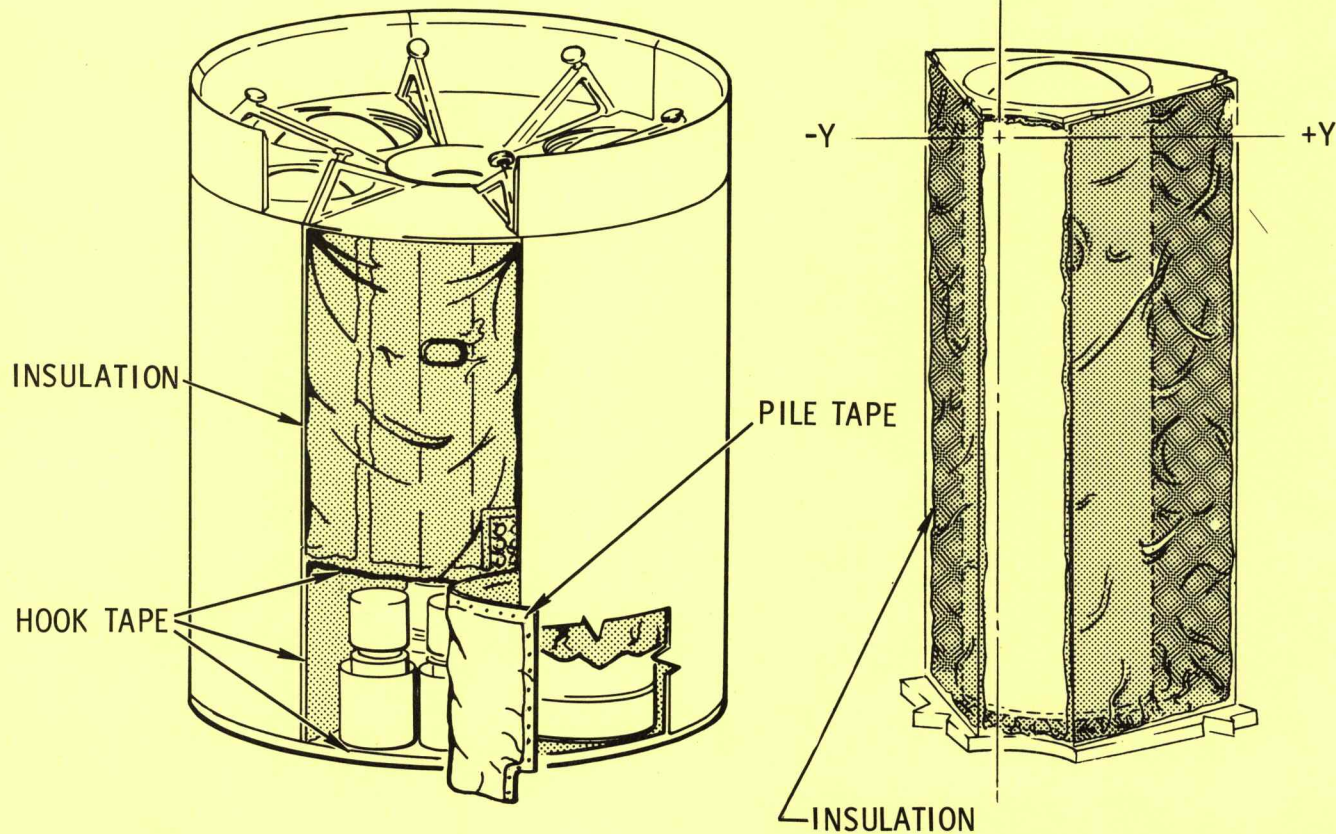
DROGUE



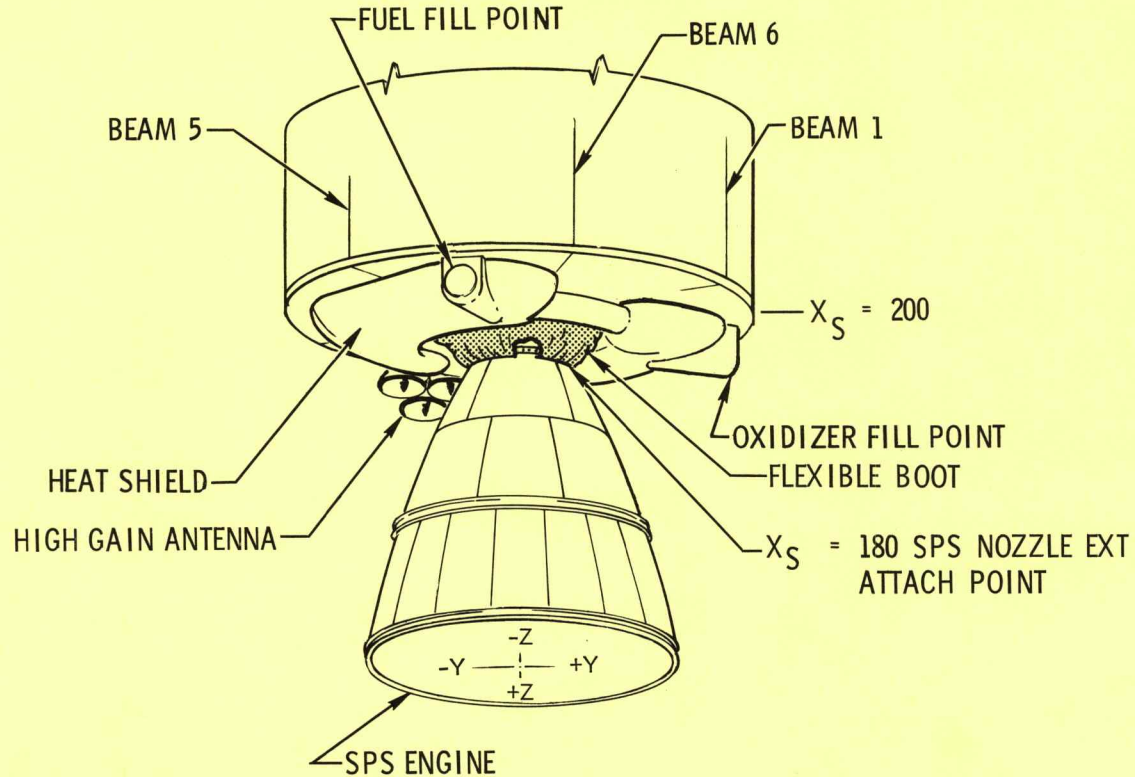
FORWARD BULKHEAD INSULATION



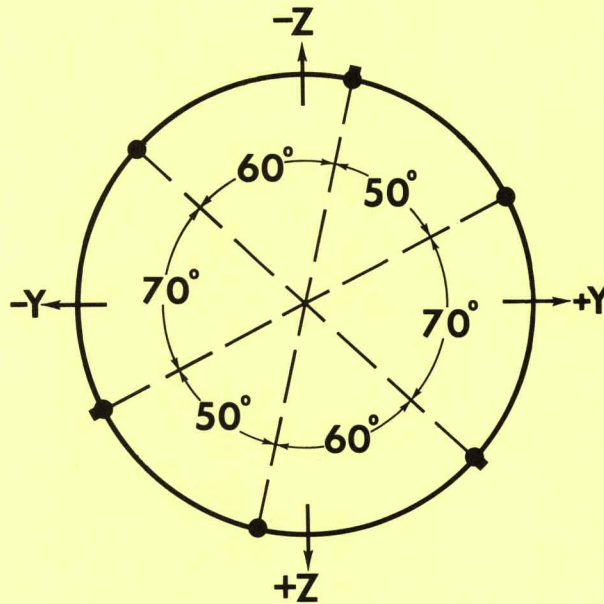
S/M INSULATION



S/M SPS NOZZLE AND HEAT SHIELD



CM/SM STRUCTURAL INTERFACE

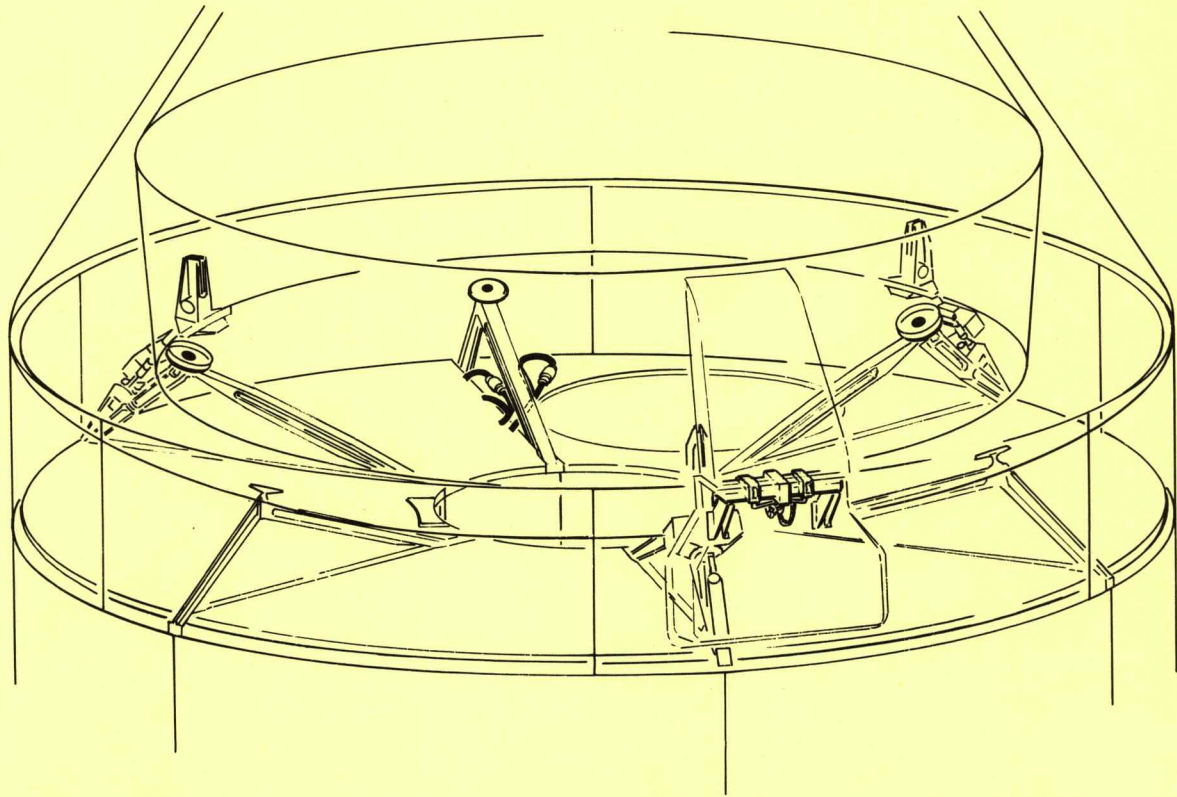


VIEW
LOOKING FORWARD

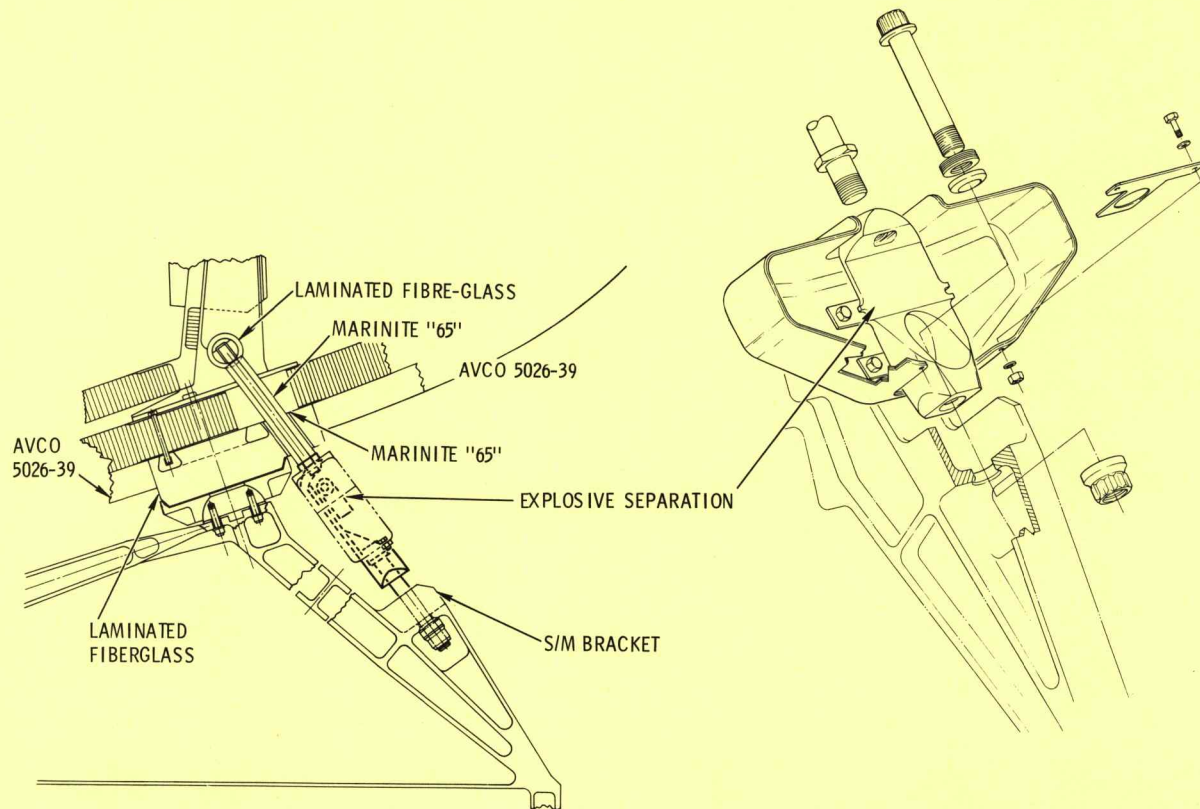
- COMPRESSION PAD
- COMPRESSION PAD/TENSION TIE COMBINATION



C/M - S/M SEPARATION SYSTEM

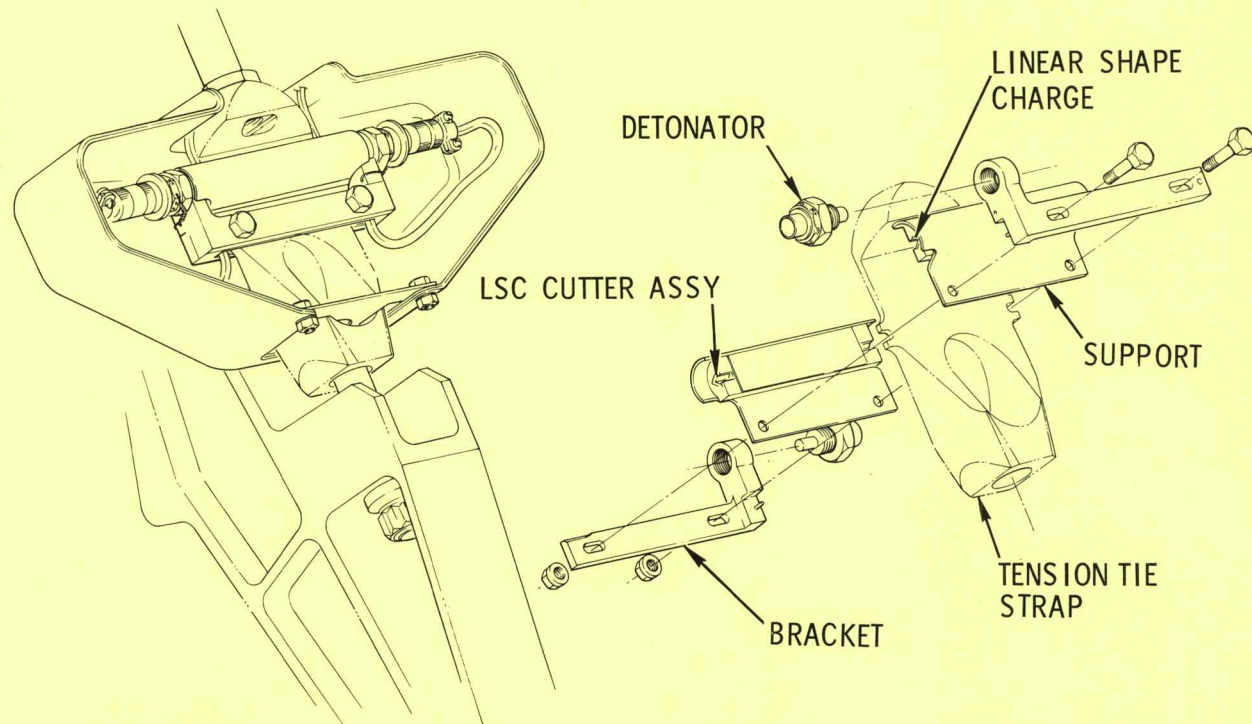


AFT TENSION-TIE

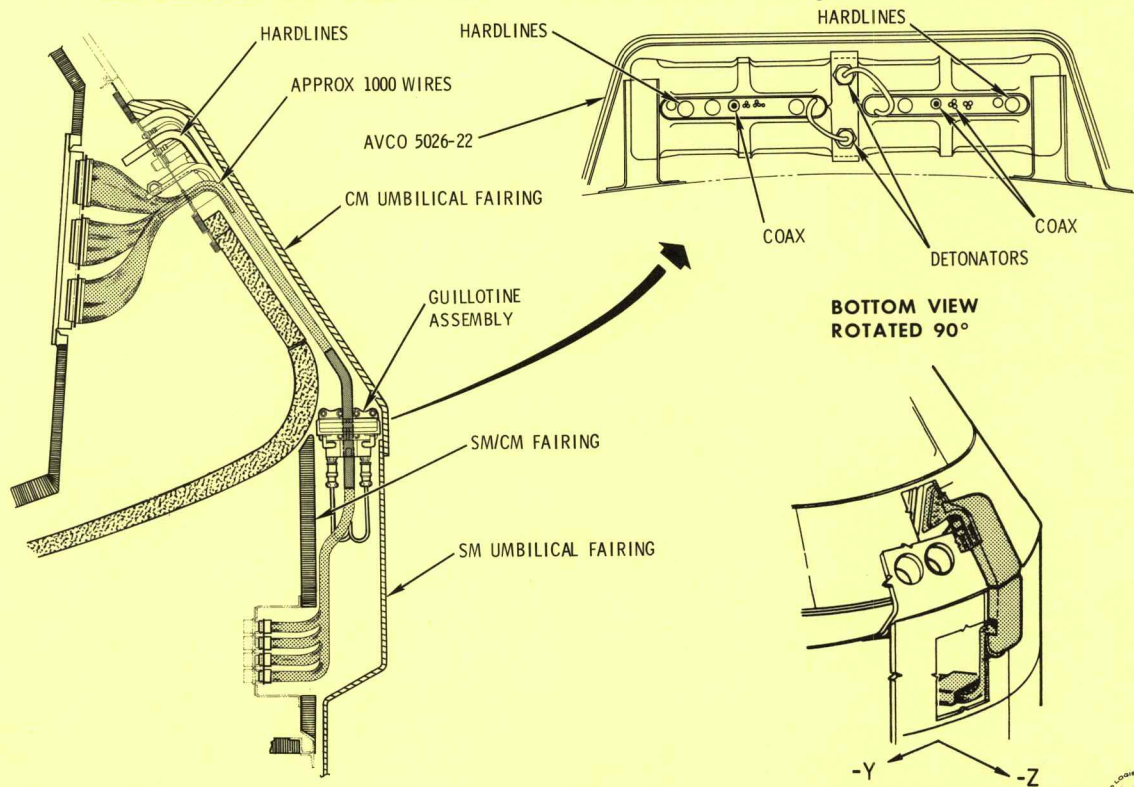


C/M-S/M SEPARATION SYSTEM

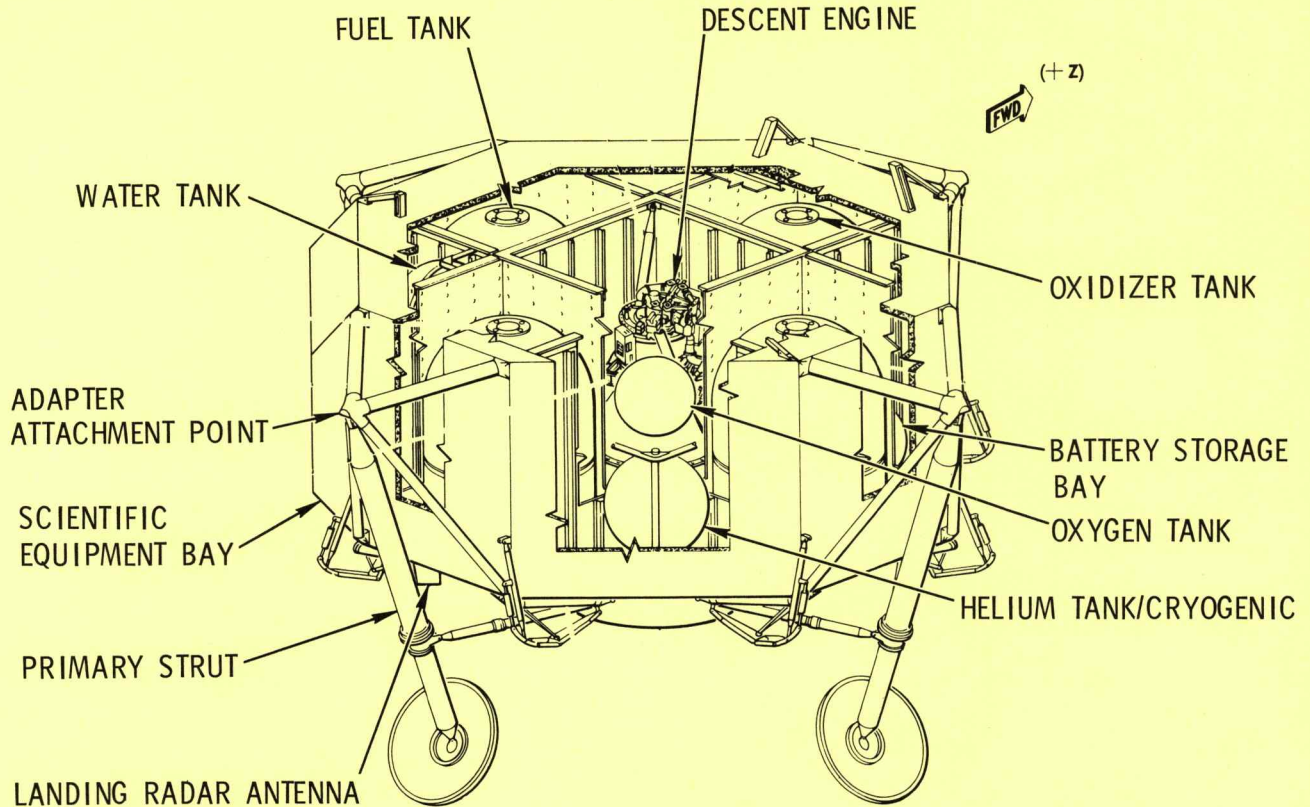
ORDNANCE INSTALLATION



C/M TO S/M ELECTRICAL CABLE & HARD LINE ASSY (BLOCK I)

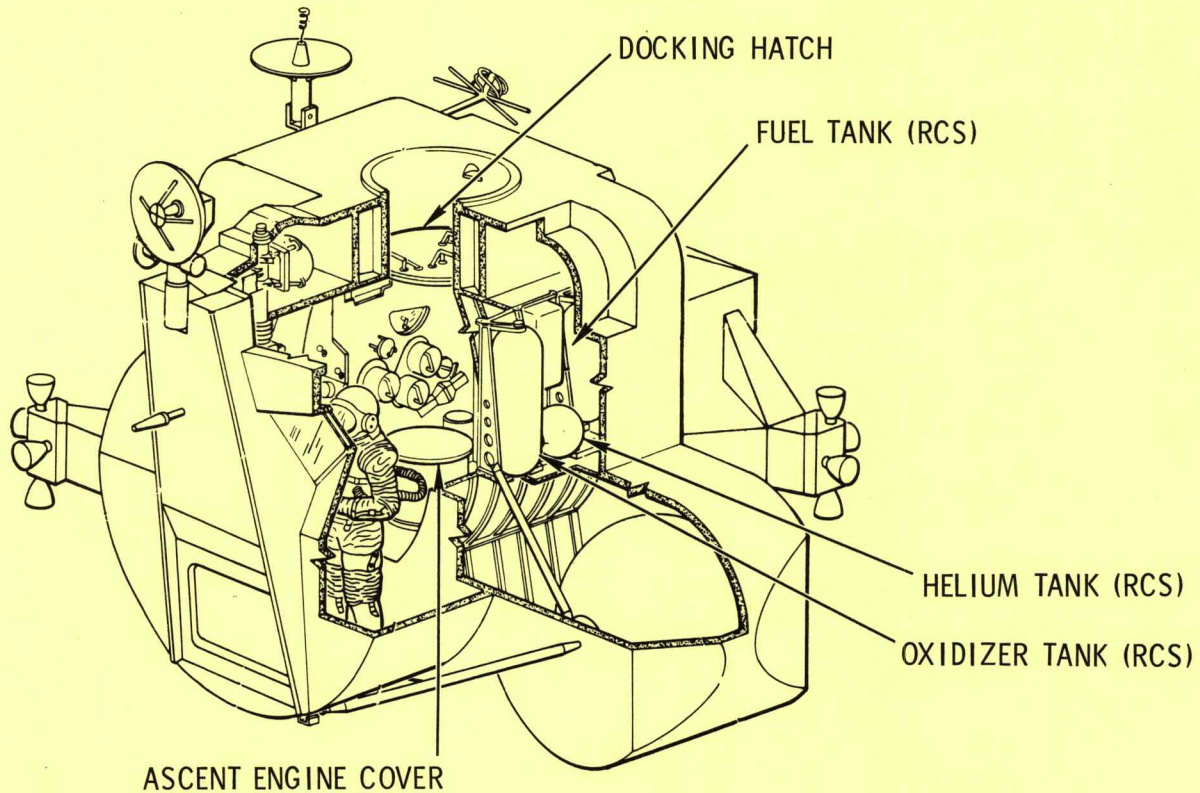


LEM DESCENT STAGE



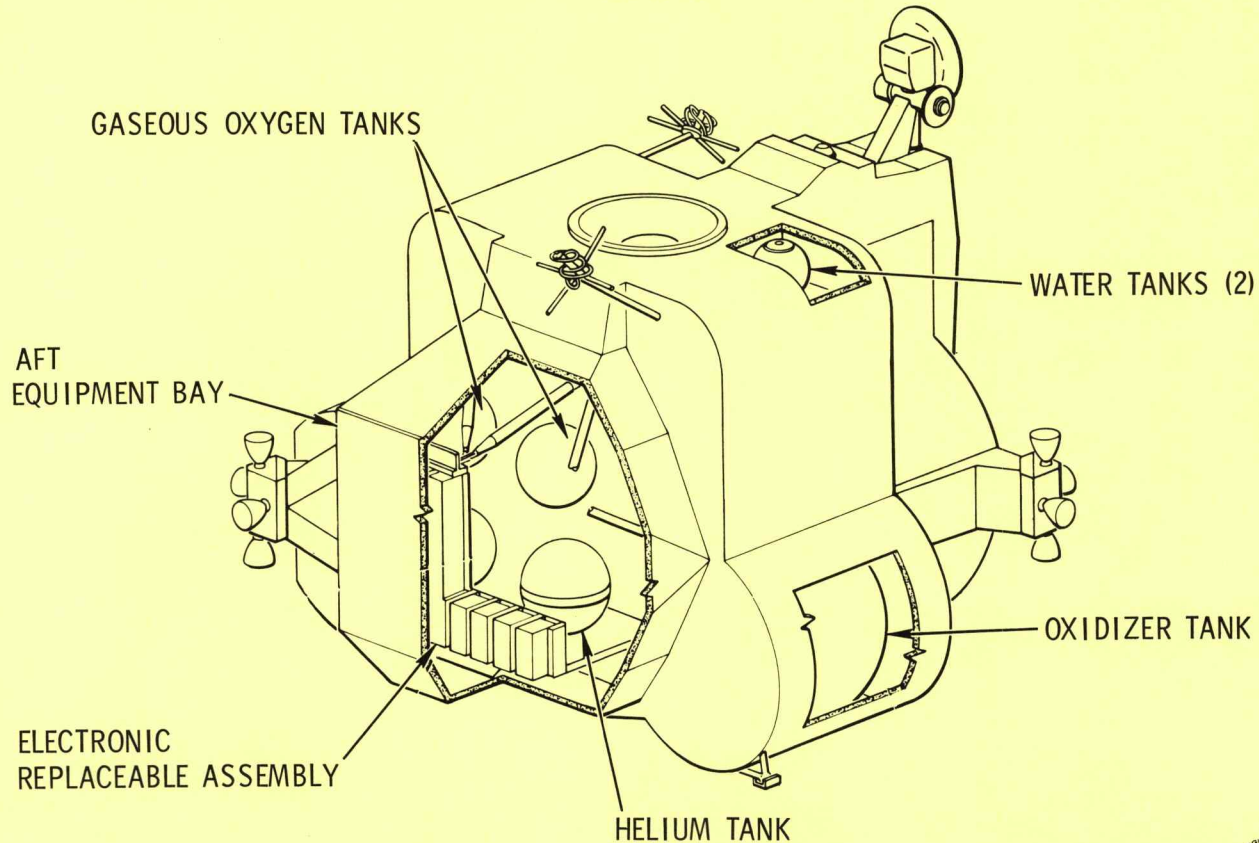
LEM ASCENT STAGE

VIEW A

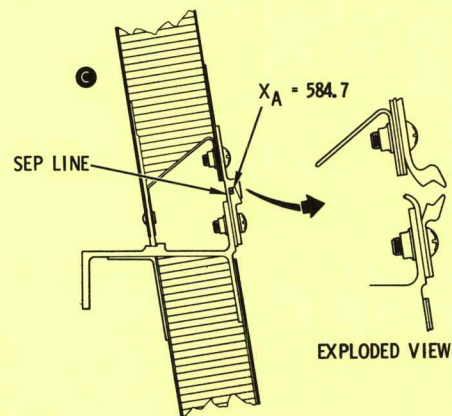
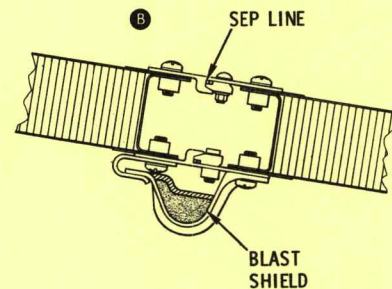
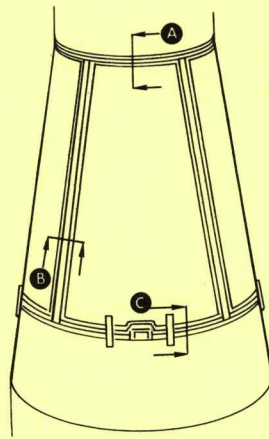
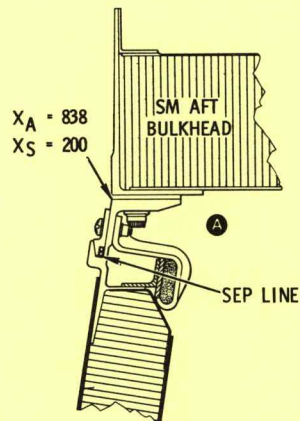


LEM ASCENT STAGE

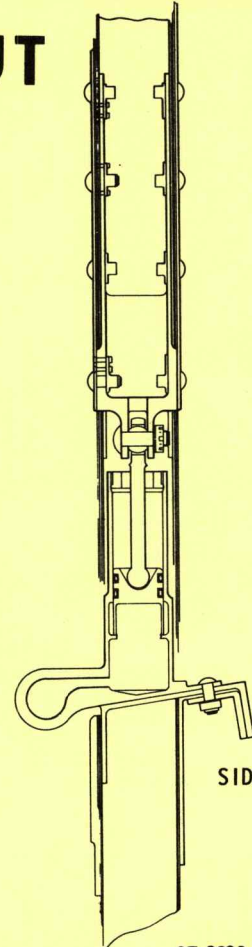
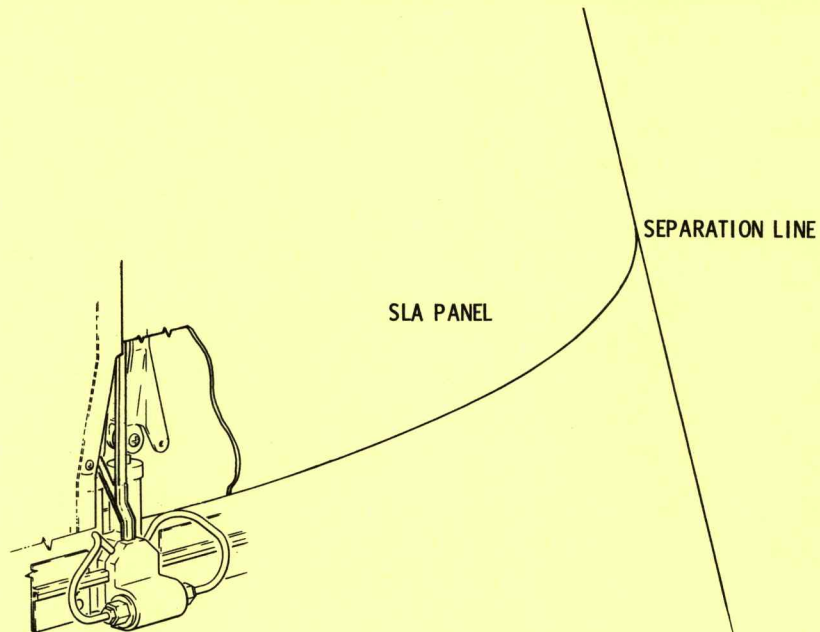
VIEW B



ADAPTER PANEL SEPARATION LINE

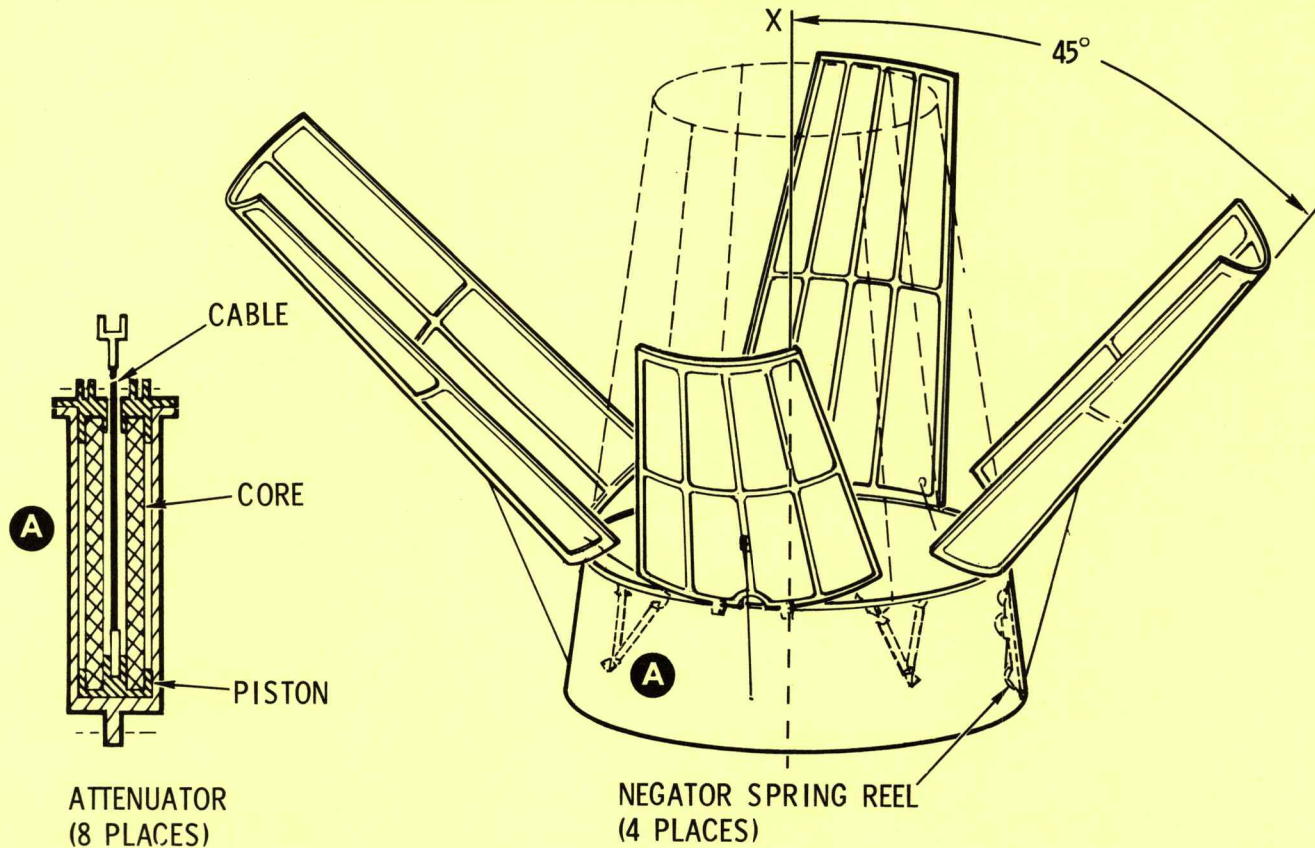


SLA THRUSTER LAYOUT

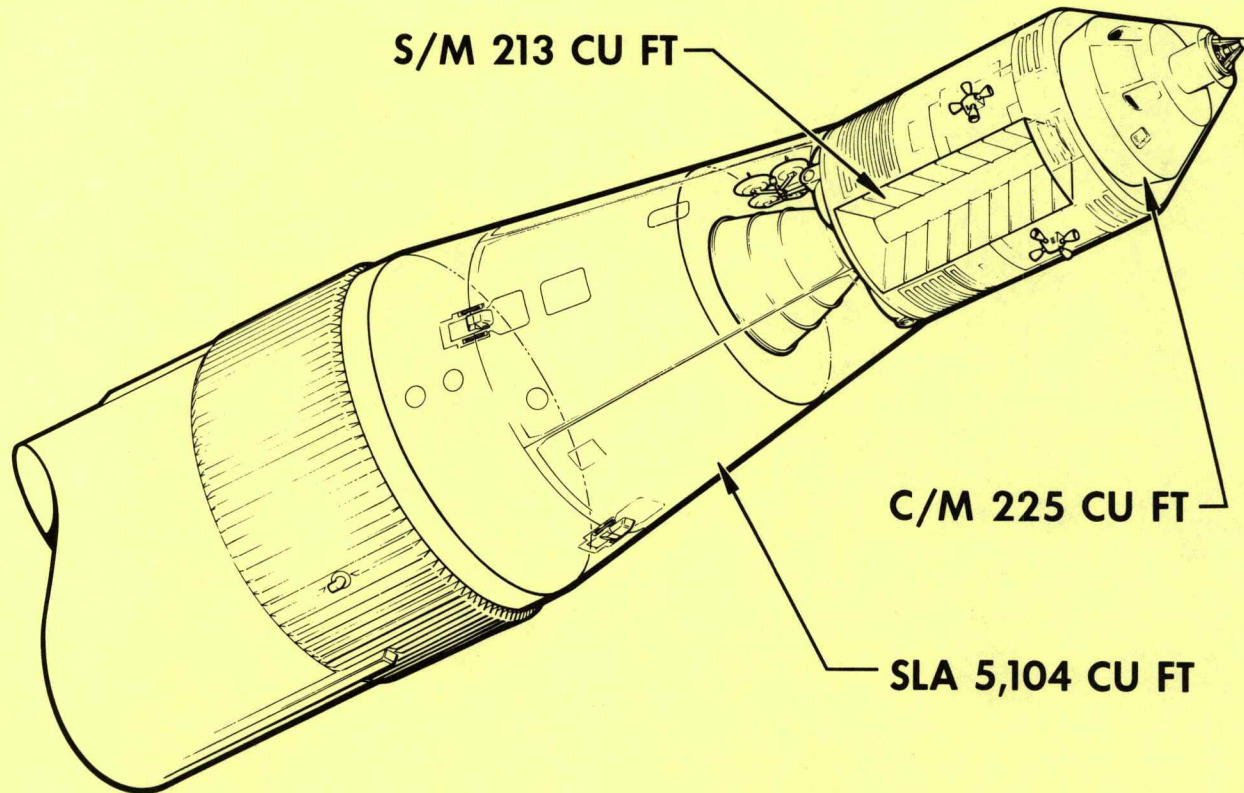


SIDE VIEW

SLA PANEL DEPLOYMENT



APOLLO SPACECRAFT USEABLE VOLUME



SEQUENCING

FAM-3005B



LAUNCH ESCAPE SYSTEM

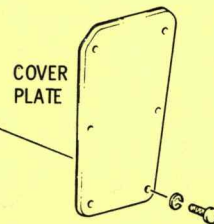
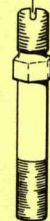
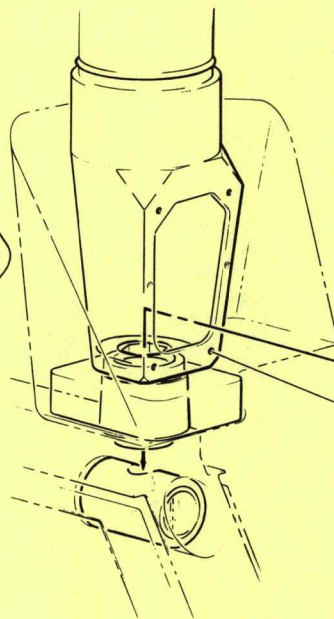
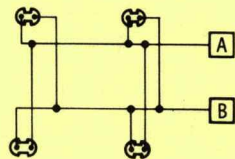
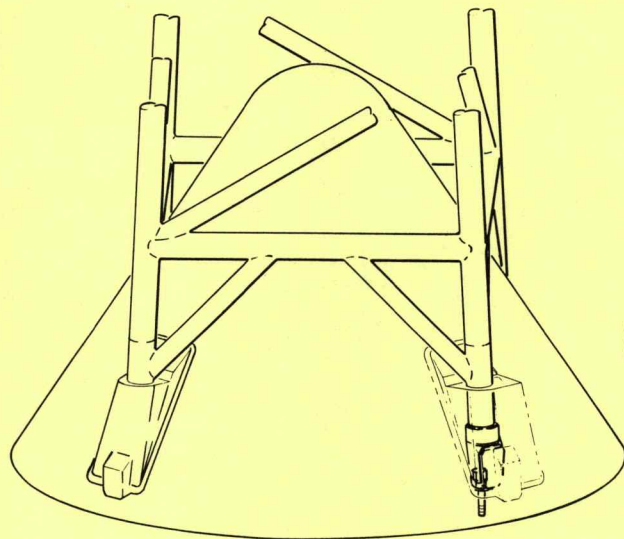
MAJOR COMPONENTS

- TOWER STRUCTURE
- ROCKET MOTORS
 - LAUNCH ESCAPE MOTOR
 - PITCH CONTROL MOTOR
 - TOWER JETTISON MOTOR
- BALLAST
- CANARDS
- TOWER SEPARATION MECHANISM
- BOOST PROTECTIVE COVER



LAUNCH ESCAPE SUBSYSTEM

FRANGIBLE NUT INTALLATION

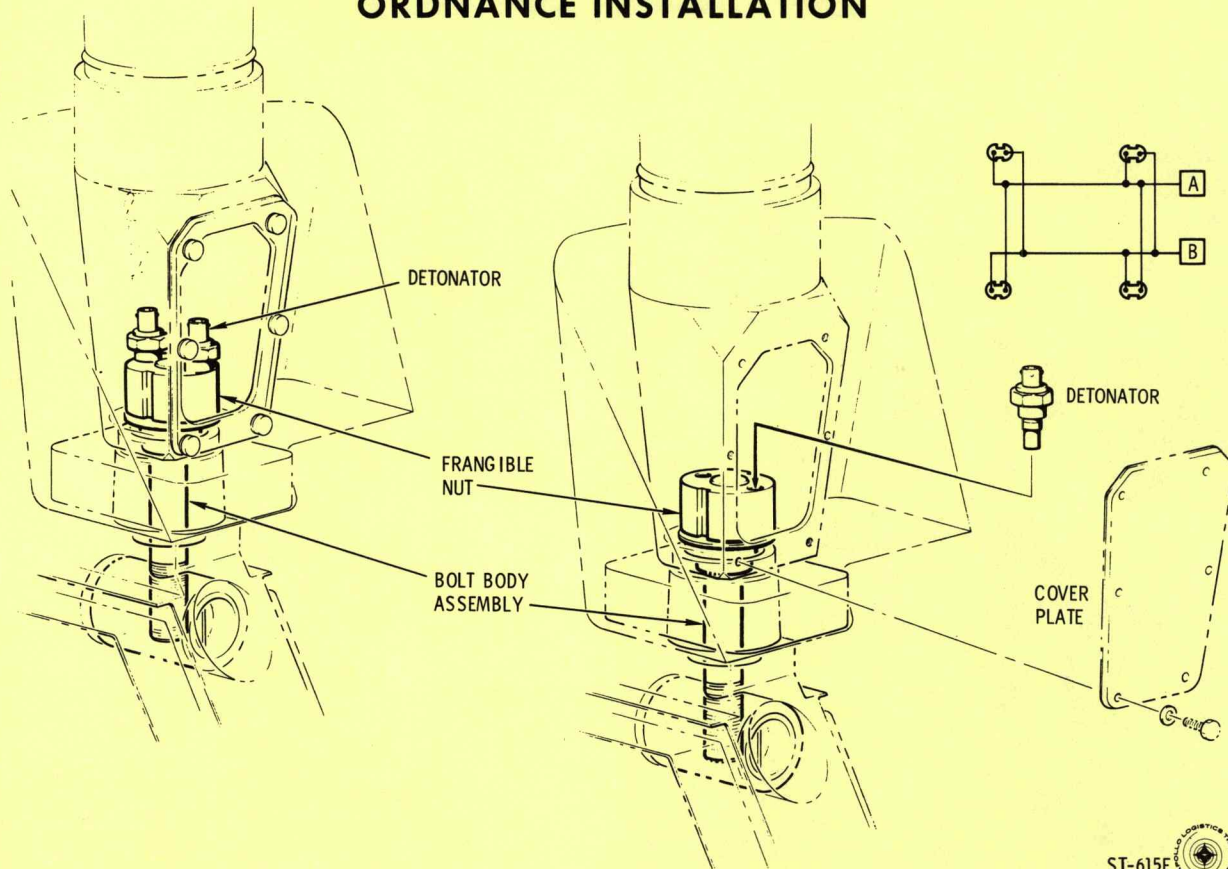


ST-175A



TOWER SEPARATION MECHANISM

ORDNANCE INSTALLATION



ST-615E



EARTH LANDING SUBSYSTEM

MAJOR COMPONENTS

- FWD HEAT SHIELD SEPARATION
MECHANISM
- PARACHUTE SUBSYSTEM
 - DROGUE PARACHUTES
 - PILOT PARACHUTES
 - MAIN LANDING PARACHUTES
- RECOVERY AIDS
 - POST LANDING VENTILATION
 - FLOTATION BAGS
 - SEA PICKUP SLING
 - SEA MARKER
 - SWIMMER UMBILICAL
 - RECOVERY ANTENNAS (HF & VHF)



EARTH LANDING SYSTEM

35SD10794

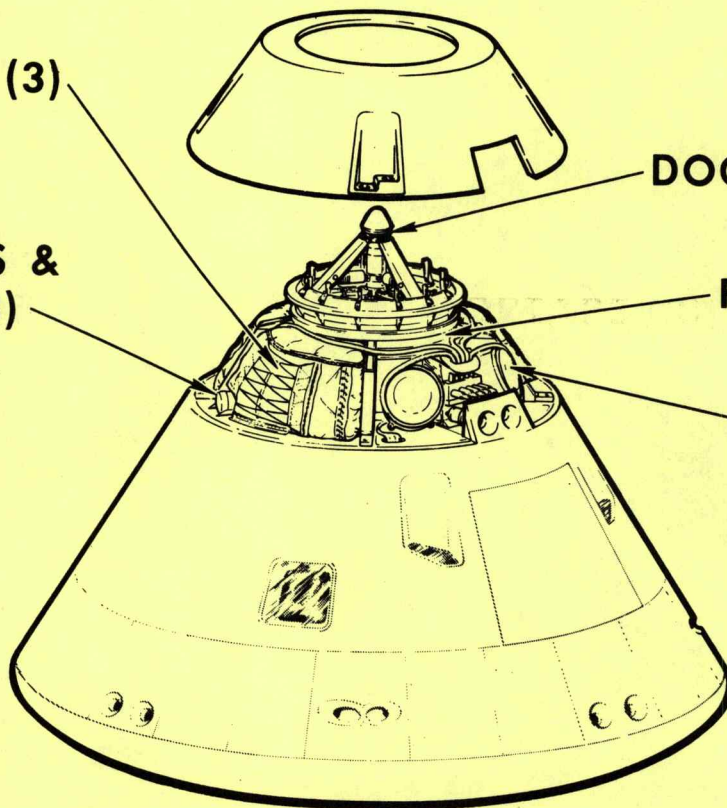
MAIN &
PARACHUTE (3)

PILOT
PARACHUTES &
MORTARS (3)

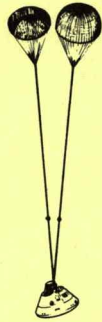
DOCKING PROBE

FWD TUNNEL

DROGUE
PARACHUTES
& MORTARS

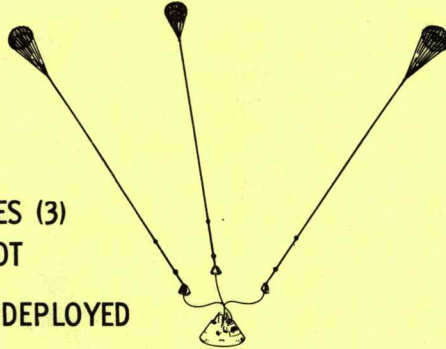


EARTH LANDING SYSTEM PARACHUTES



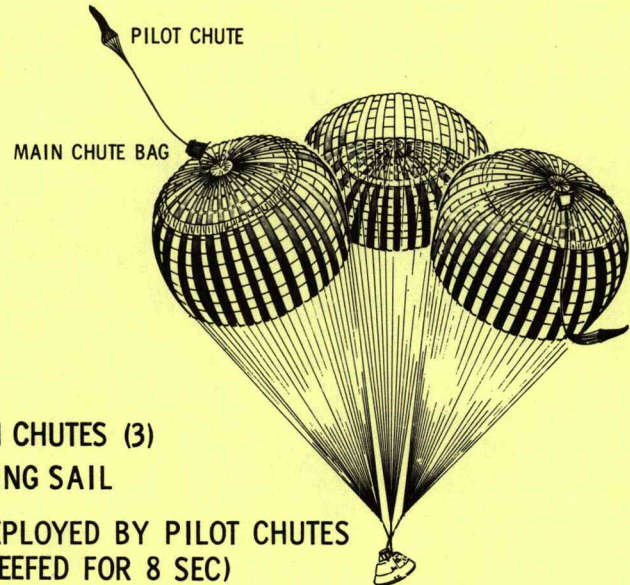
DROGUE CHUTES (2)

- FIST RIBBON TYPE
- MORTAR DEPLOYED (REEFED FOR 8 SEC)
- 13.7 FT DIAMETER



PILOT CHUTES (3)

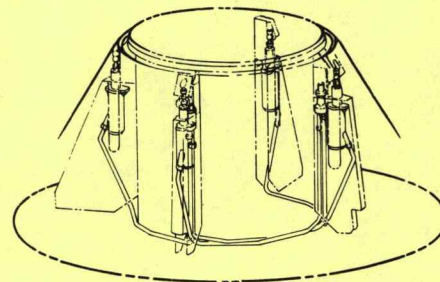
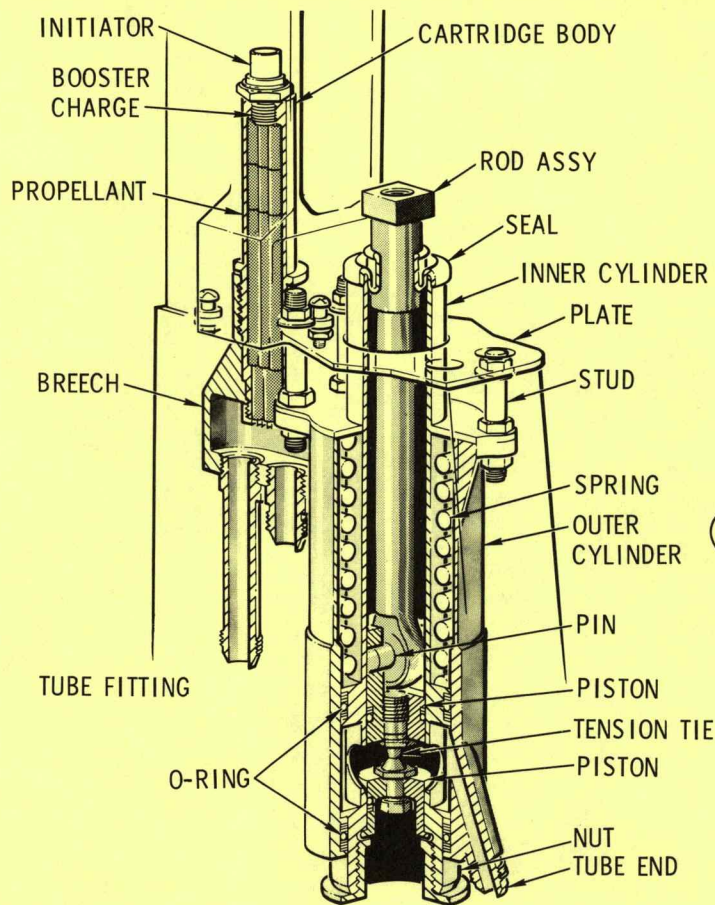
- RING SLOT
- MORTAR DEPLOYED
- 7.2 FT DIAMETER



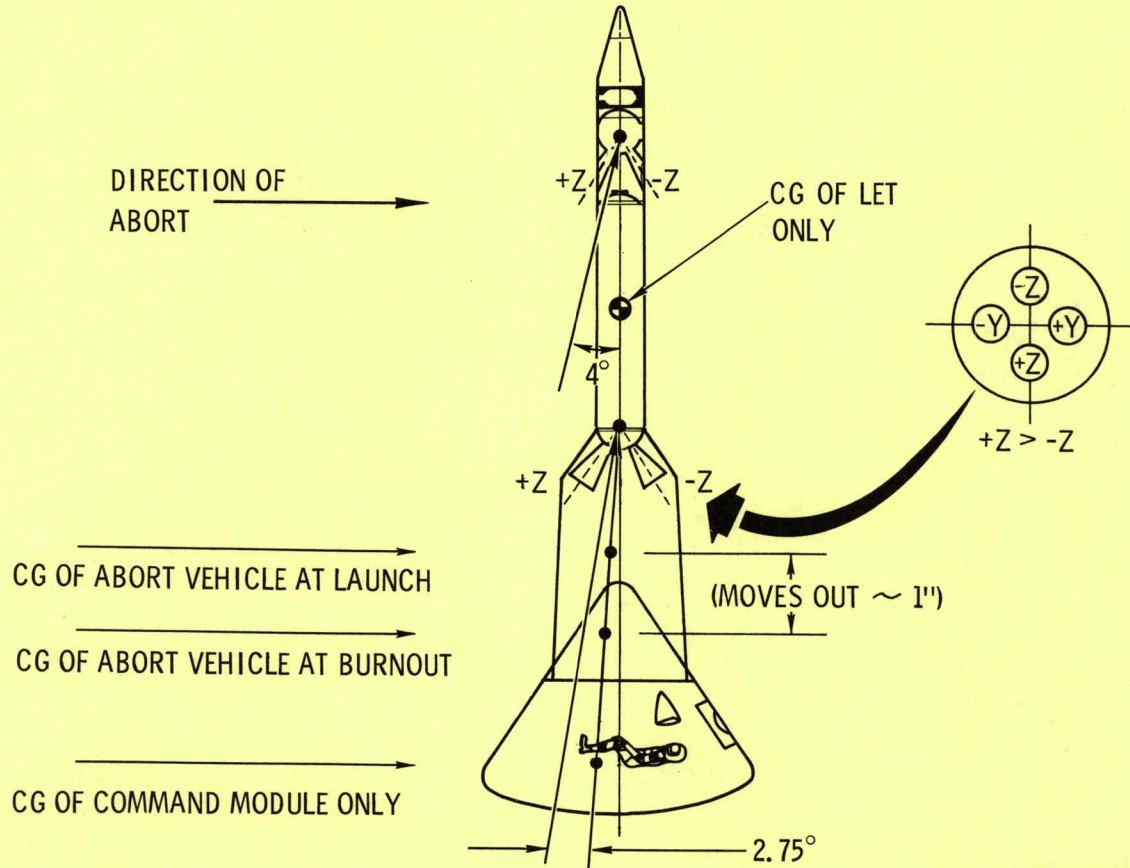
MAIN CHUTES (3)

- RING SAIL
- DEPLOYED BY PILOT CHUTES (REEFED FOR 8 SEC)
- 83.5 FT DIAMETER

FORWARD HEAT SHIELD SEPARATION SYSTEM

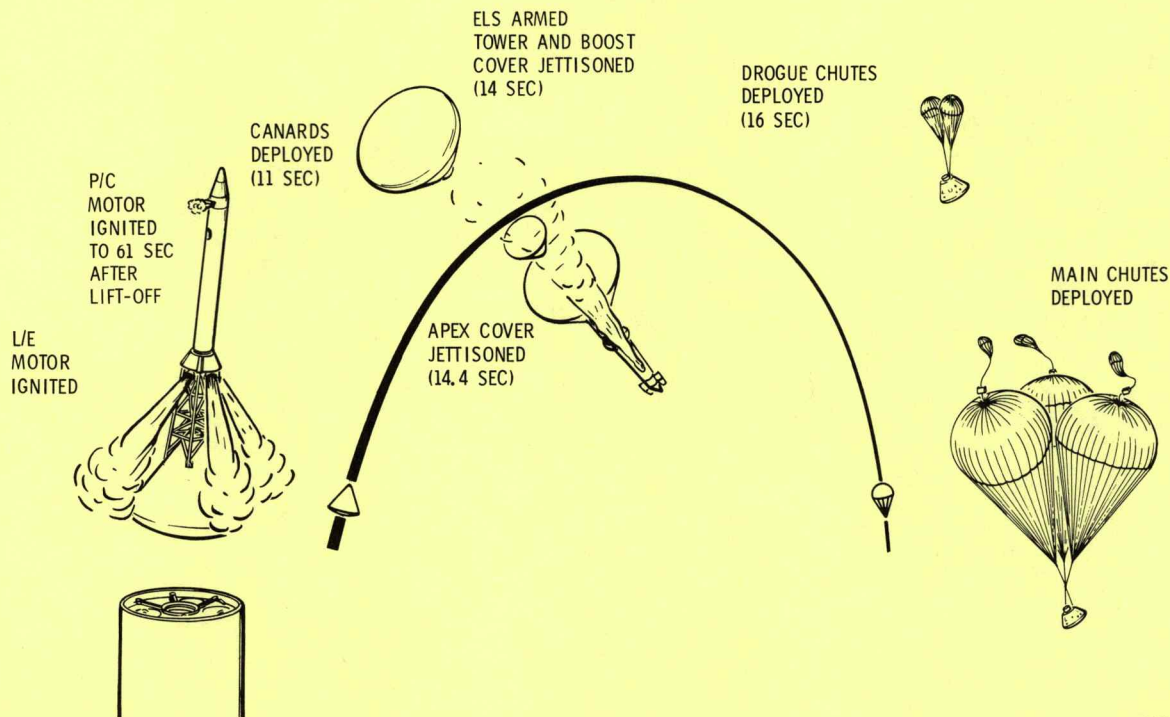


ABORT VEHICLE MECHANICS



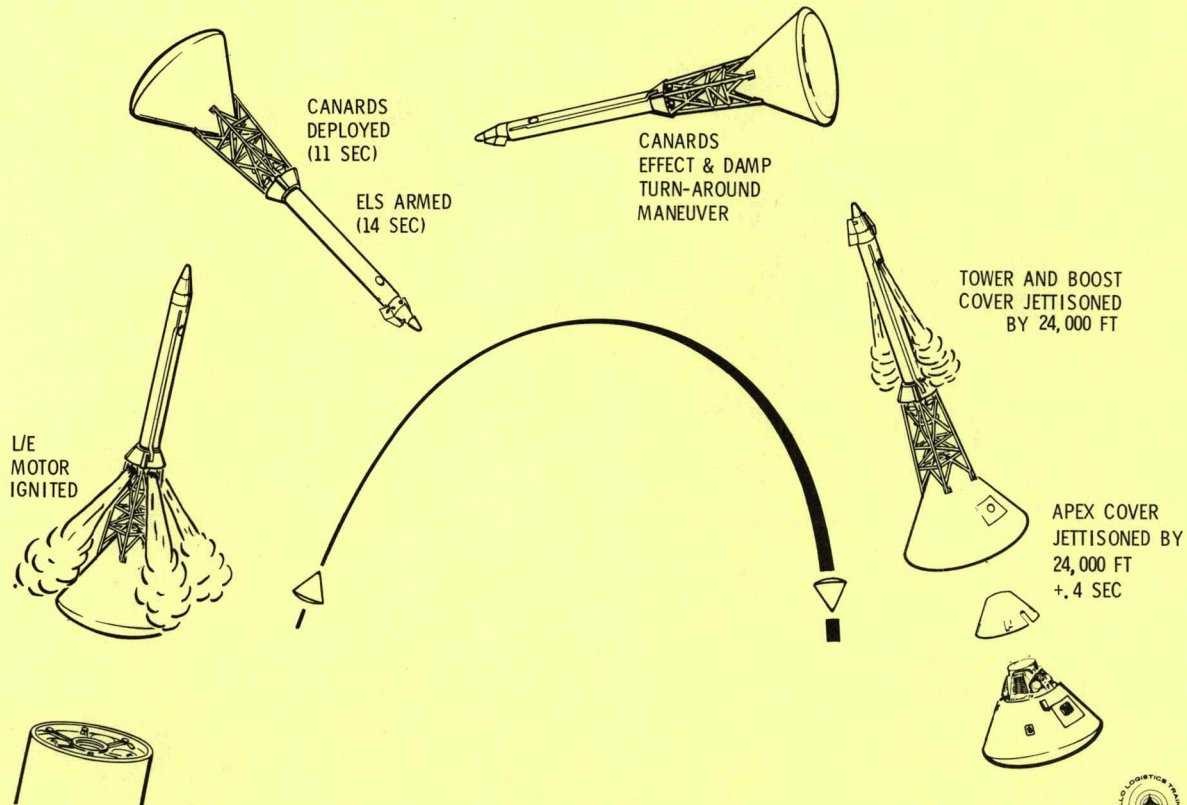
LOW ALTITUDE LES ABORT

(PAD TO <30,000 FT.)



MEDIUM ALTITUDE LES ABORT

(30,000 TO 120,000 FT.)

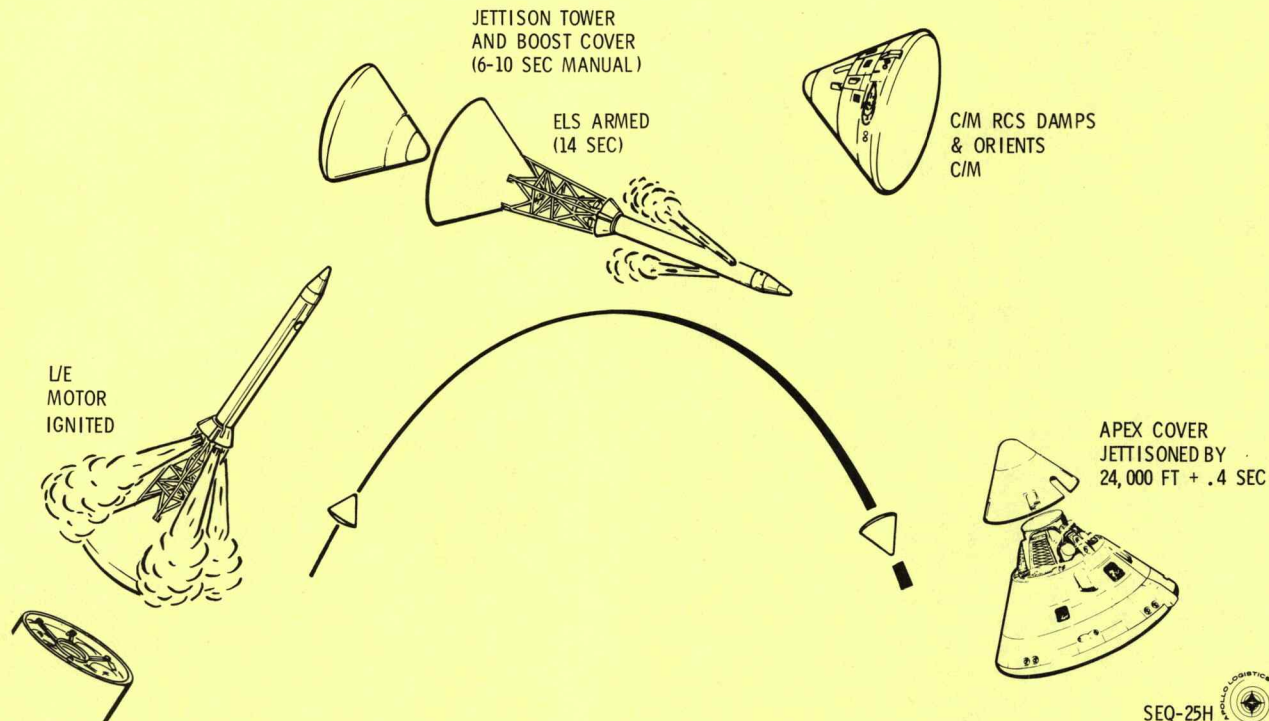


SEQ-44E



HIGH ALTITUDE LES ABORT

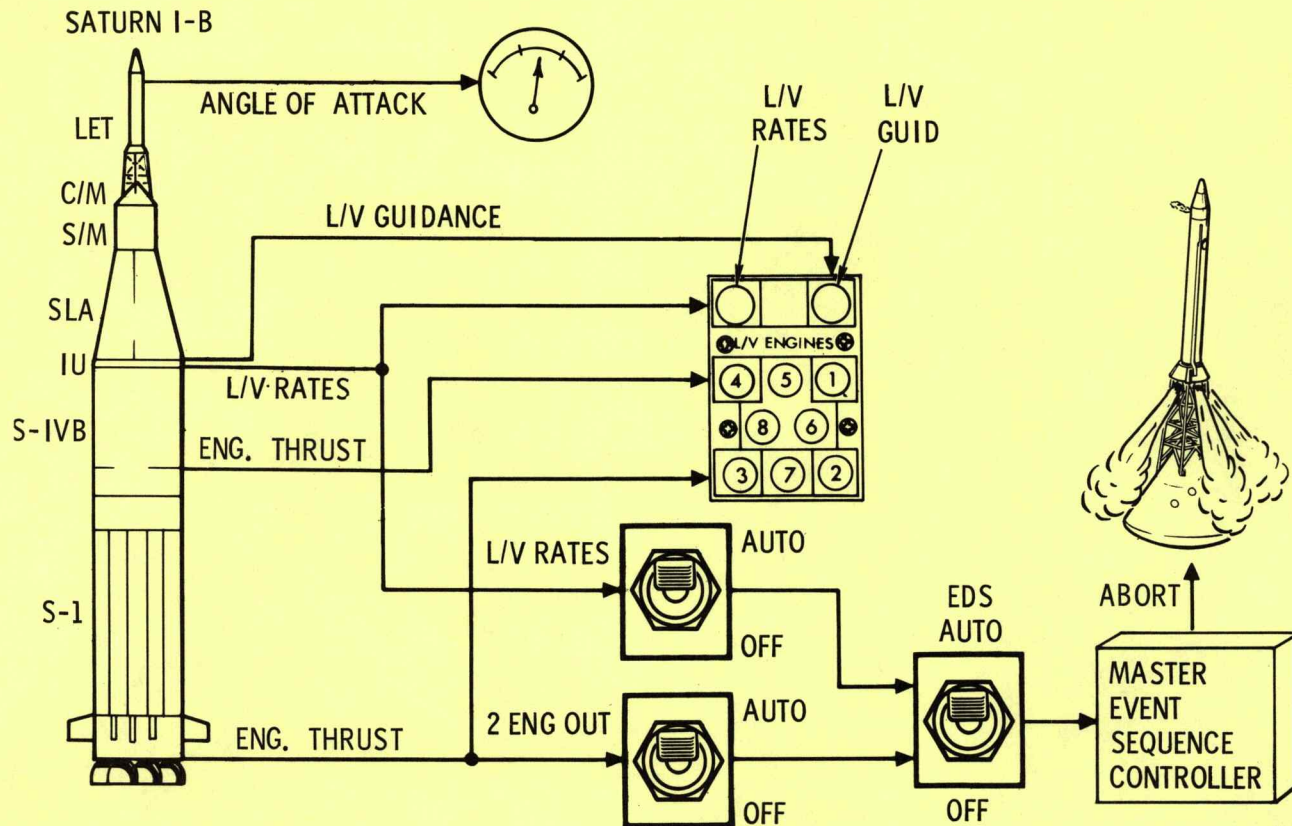
(120,000 FT TO TWR JETT)



SEQ-25H

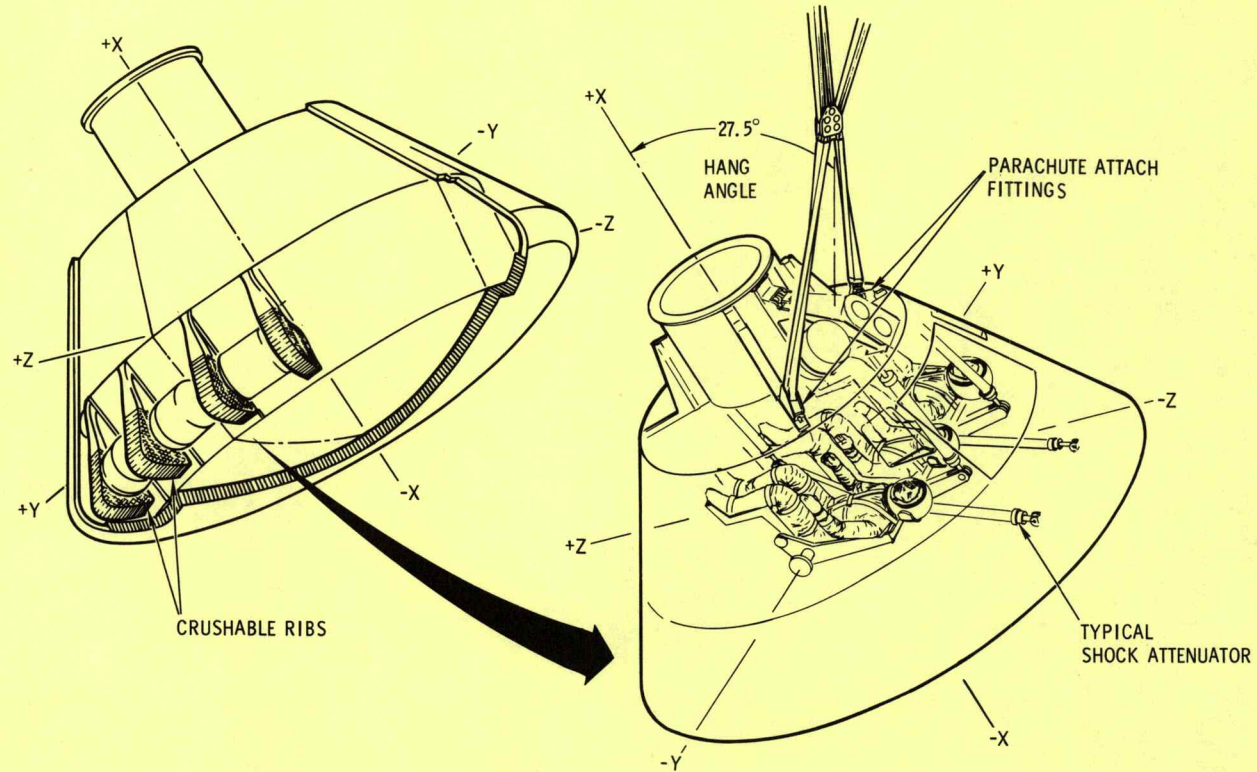


EMERGENCY DETECTION SYSTEM



EARTH IMPACT SYSTEM

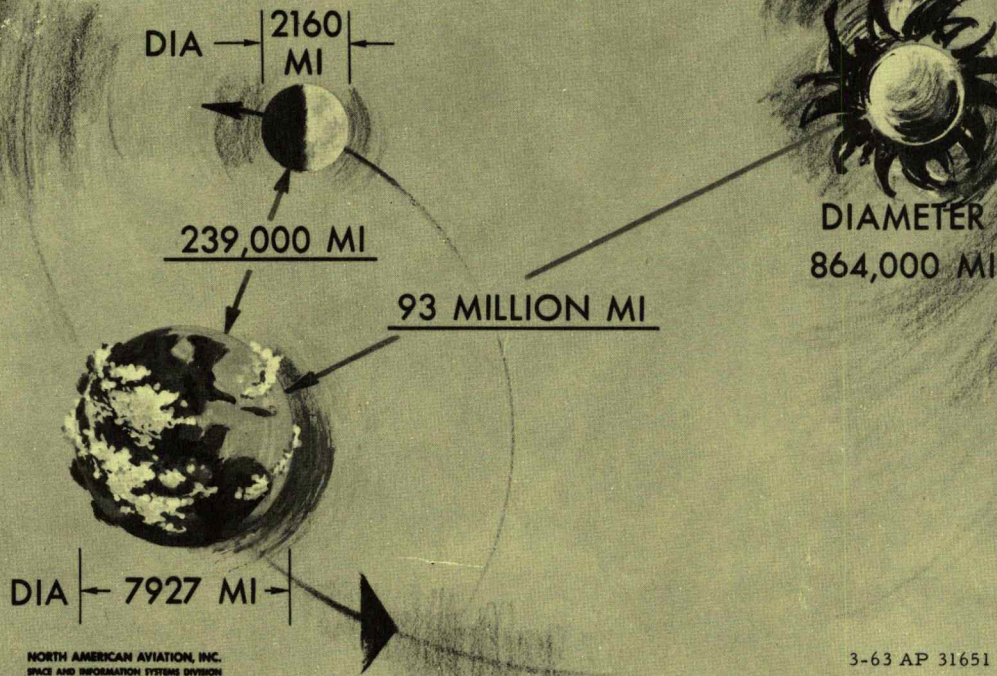
BLOCK I



GUIDANCE & CONTROL



BASIC CONSIDERATIONS



VELOCITY REQUIREMENTS

ESCAPE VELOCITY

36,700 FT/SEC

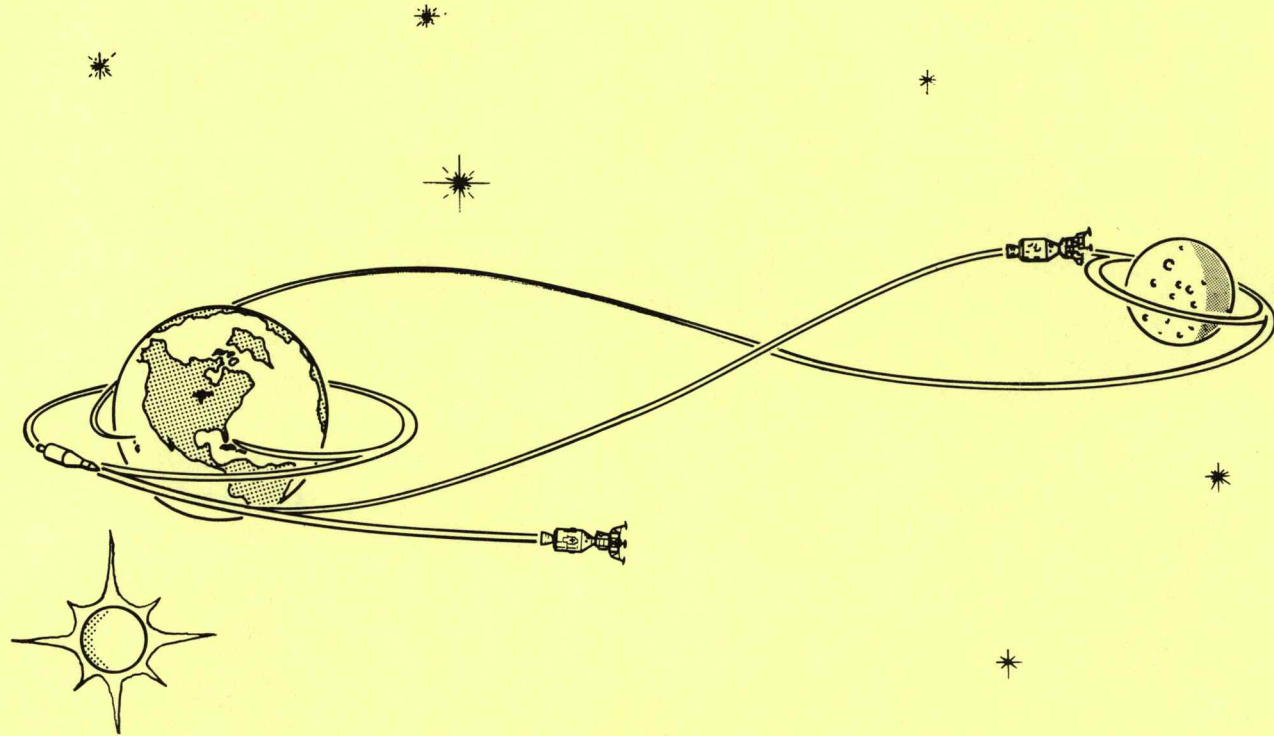


8,400 FT/SEC

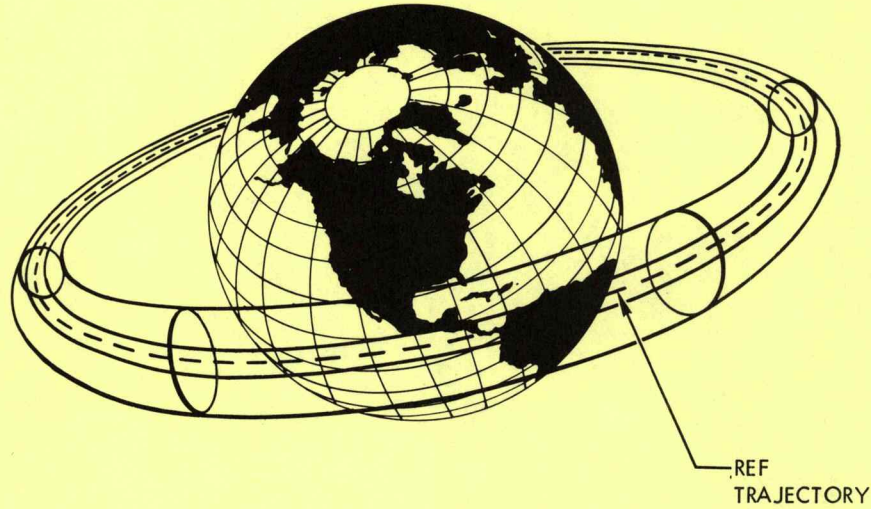
25,000 FT/SEC - ORBIT - 5280 FT/SEC

6 - RELATIVE GRAVITY - 1

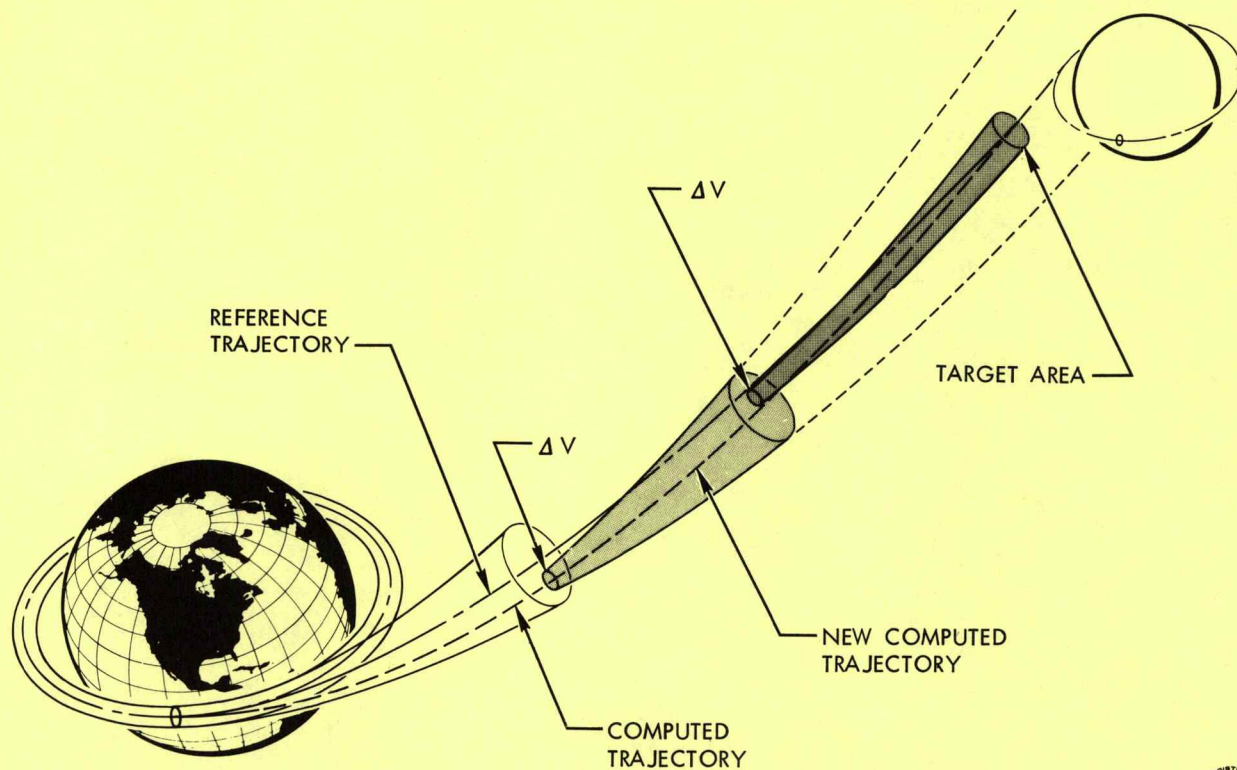
GUIDANCE & NAVIGATION REFERENCE TRAJECTORIES



EARTH ORBIT POSITION & TRAJECTORY DETERMINATION



MIDCOURSE POSITION & TRAJECTORY DETERMINATION



GN-182



GUIDANCE & CONTROL FUNCTIONS

G&N

- POSITION
- TRAJECTORY
- VELOCITY
- ATTITUDE

SCS

- STABILIZATION
- ROTATION
- TRANSLATION
- THRUST VECTOR

RCS

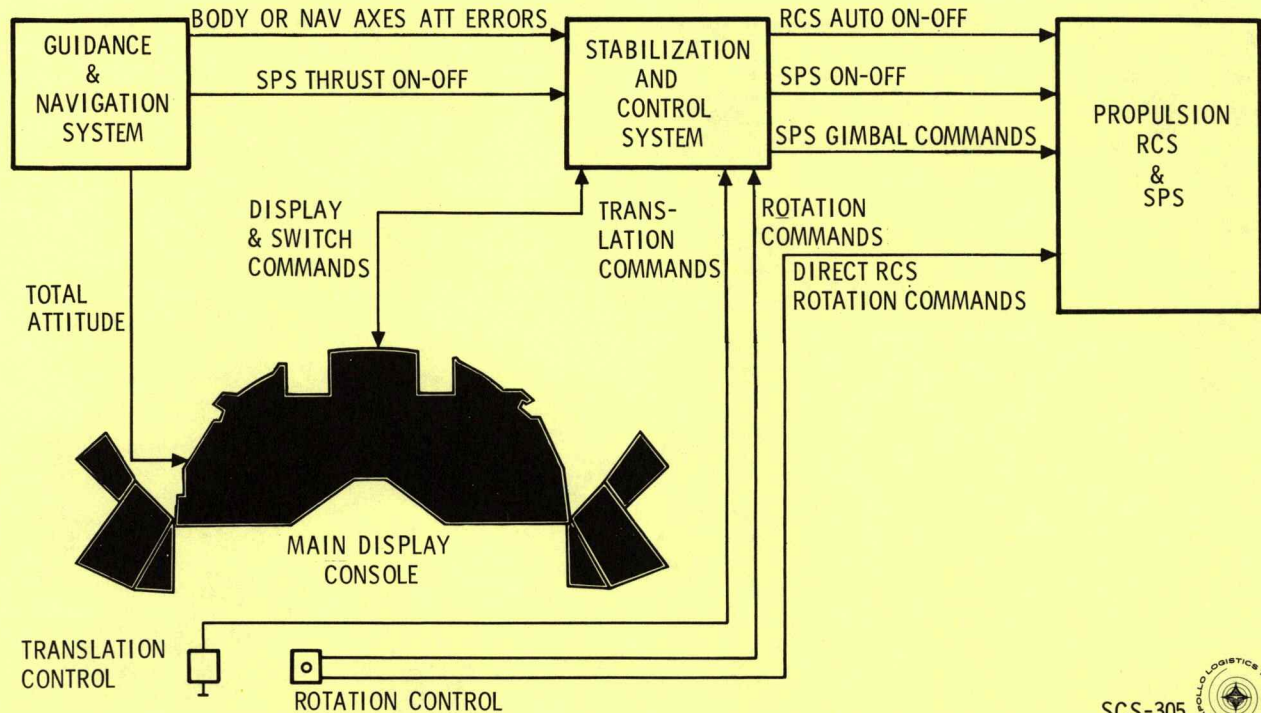
- ROTATION
- TRANSLATION

SPS

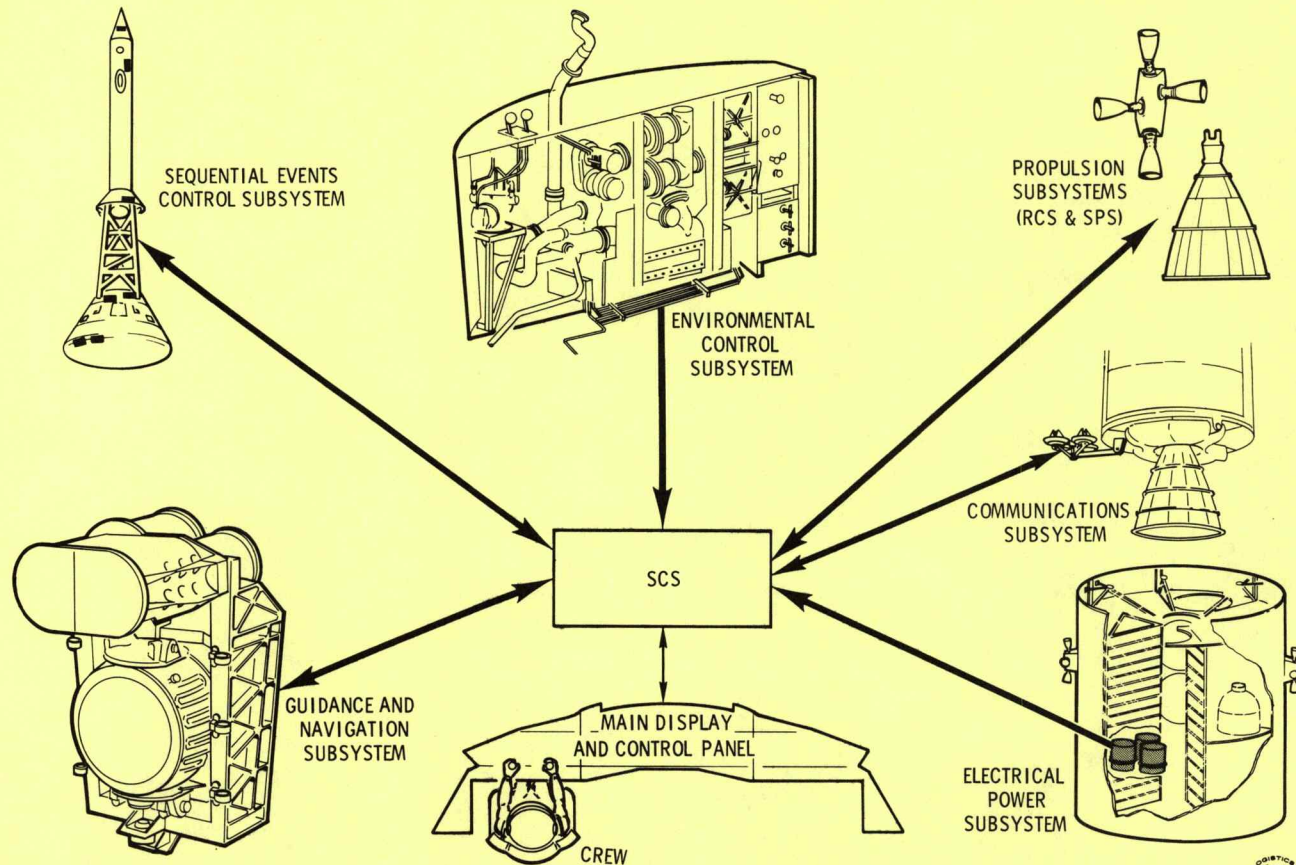
- MID-COURSE CORRECTIONS
- PLANE CHANGES
- LUNAR ORBIT INSERTION
- TRANS-EARTH INJECTION



G&C FUNCTIONAL CONTROL LOOPS



SCS AND APOLLO SUBSYSTEM INTERFACES

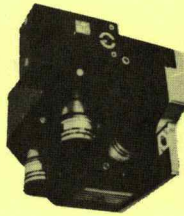


SCS-303A

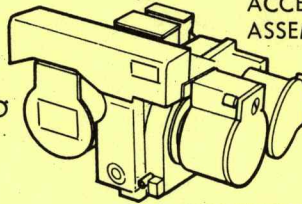


SCS HARDWARE

SENSORS



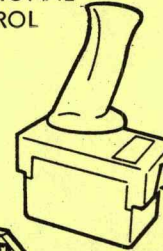
RATE GYRO
ASSEMBLY



ATTITUDE
GYRO
ACCELEROMETER
ASSEMBLY

MANUAL CONTROLS

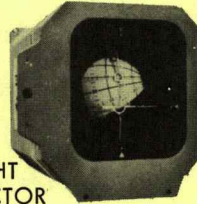
3 AXIS
ROTATIONAL
CONTROL



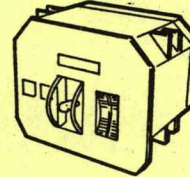
TRANSLATION CONTROL



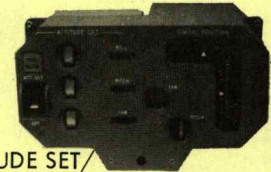
CONTROLS & DISPLAYS



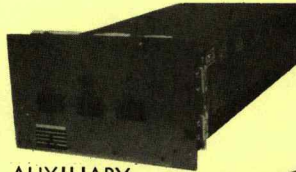
FLIGHT
DIRECTOR
ATTITUDE INDICATOR



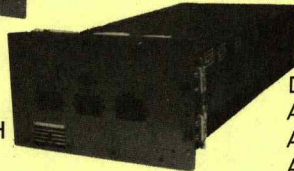
DELTA V
INDICATOR



ATTITUDE SET/
GIMBAL POSITION
INDICATOR

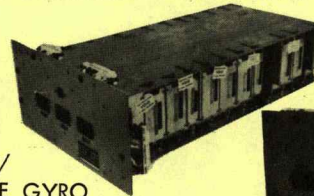


AUXILIARY
ECA

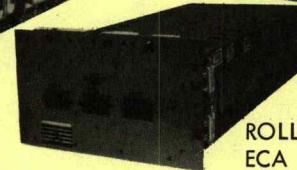


PITCH
ECA

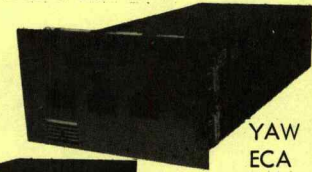
ELECTRONIC CONTROL ASSEMBLIES



DISPLAY/
ATTITUDE GYRO
ACCELEROMETER
ASSEMBLY ECA



ROLL
ECA

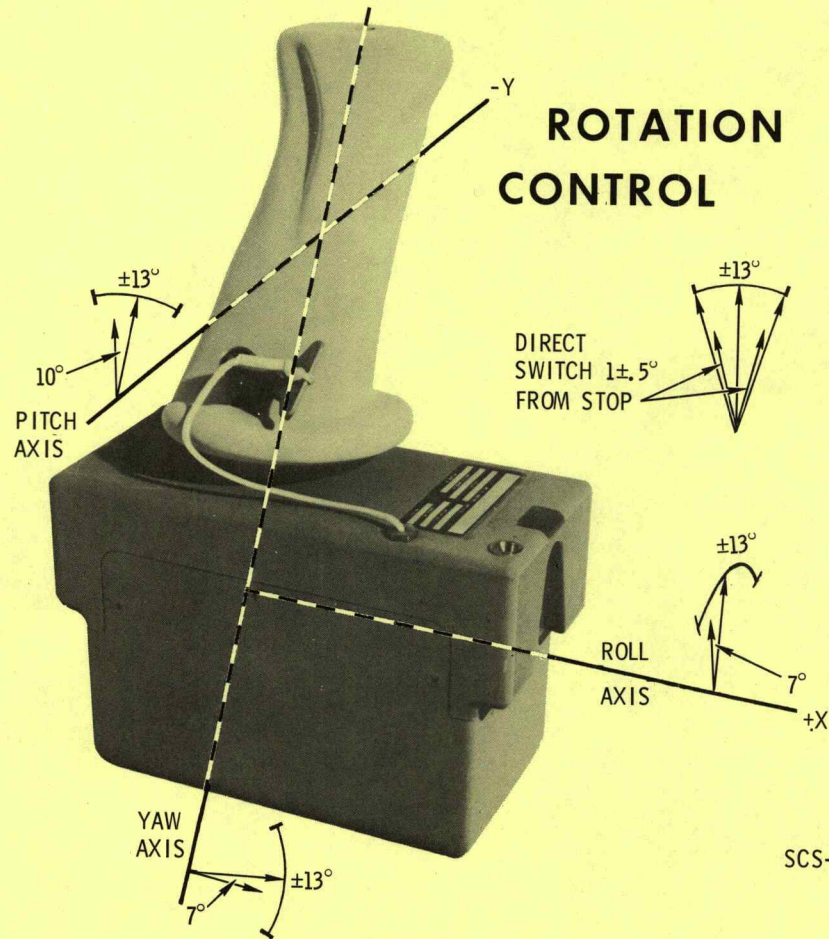


YAW
ECA

SCS-019D



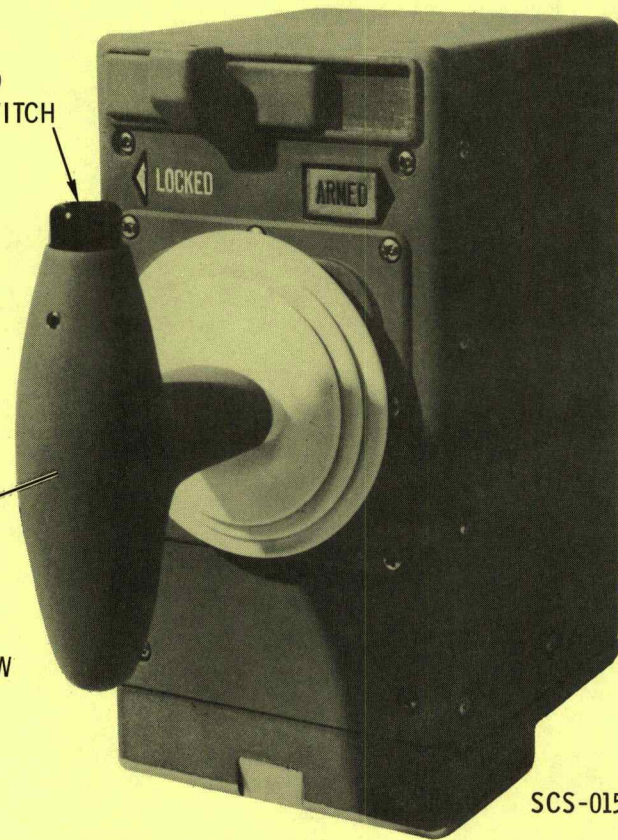
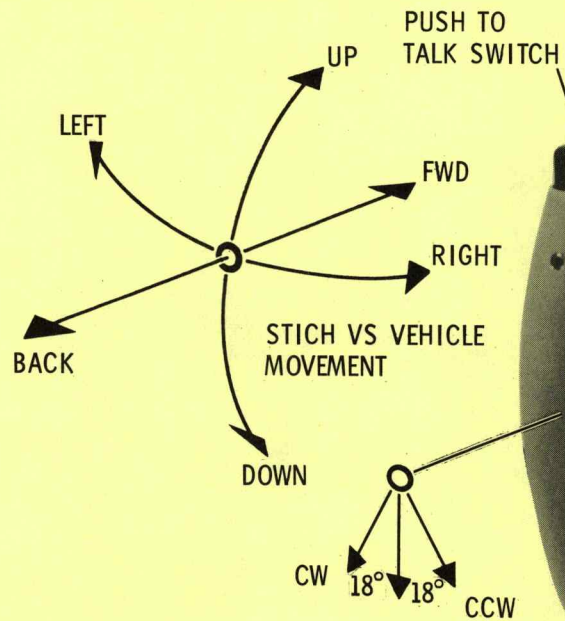
ROTATION CONTROL



SCS-016B



TRANSLATION CONTROL



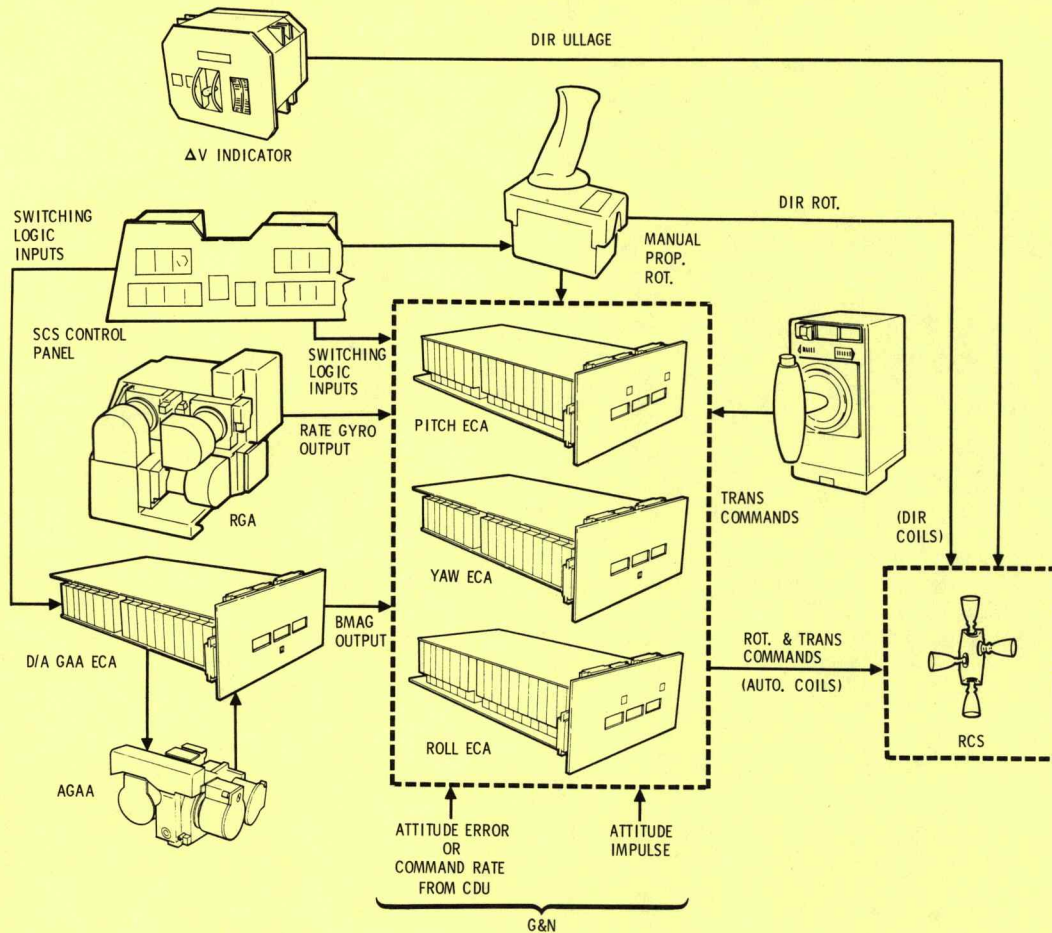
SCS-015C



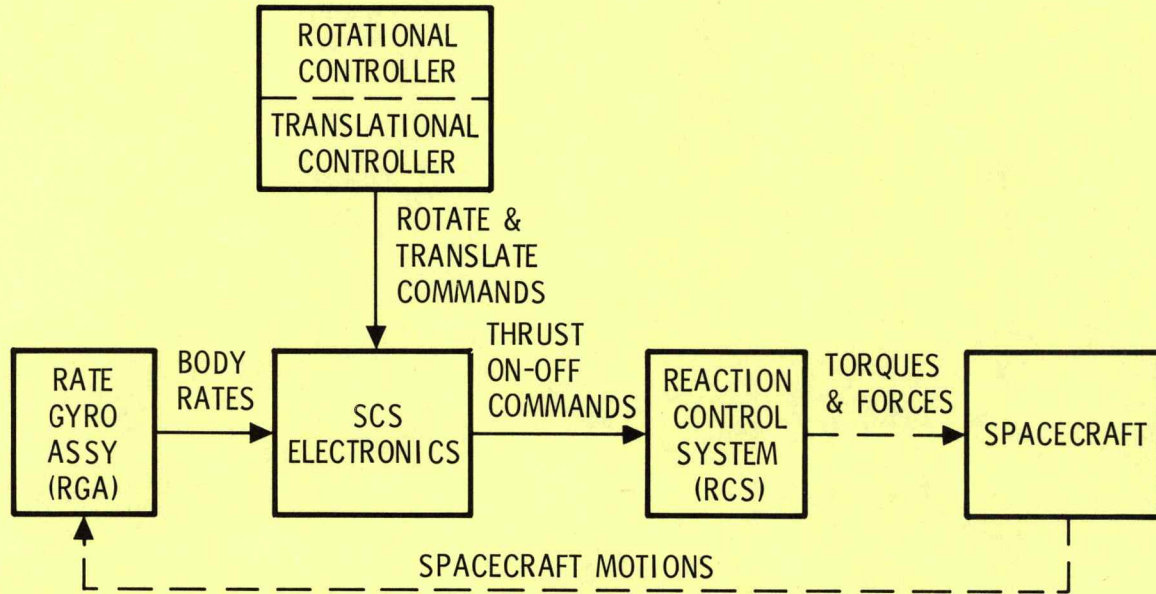
6



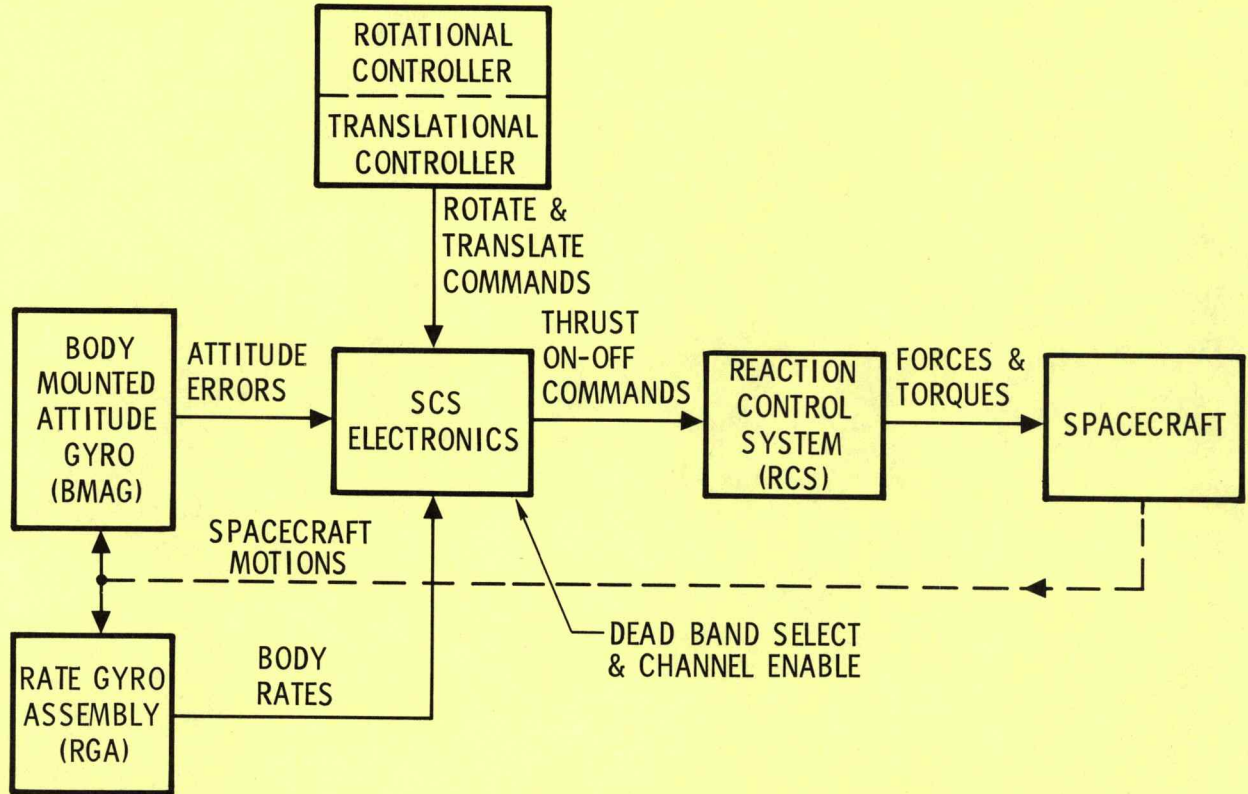
ATTITUDE CONTROL SUBSYSTEM



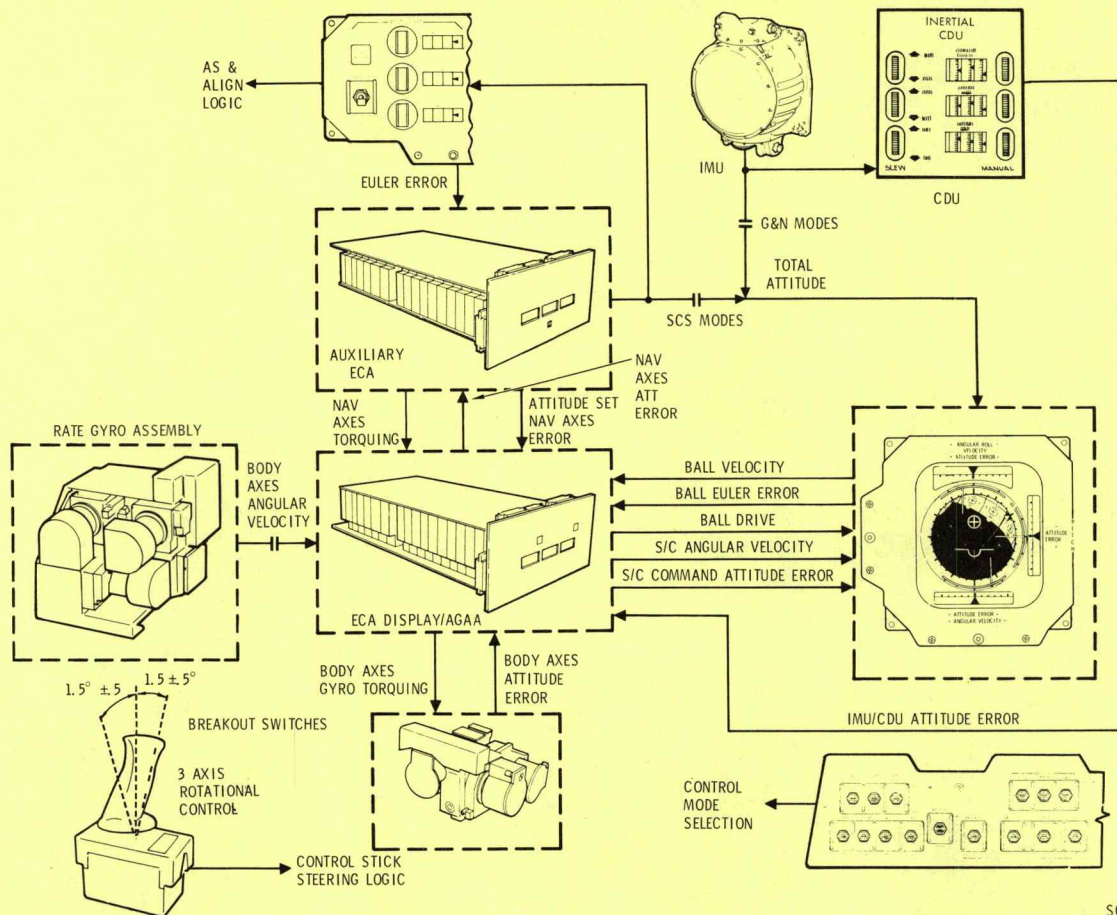
RATE STABILIZATION



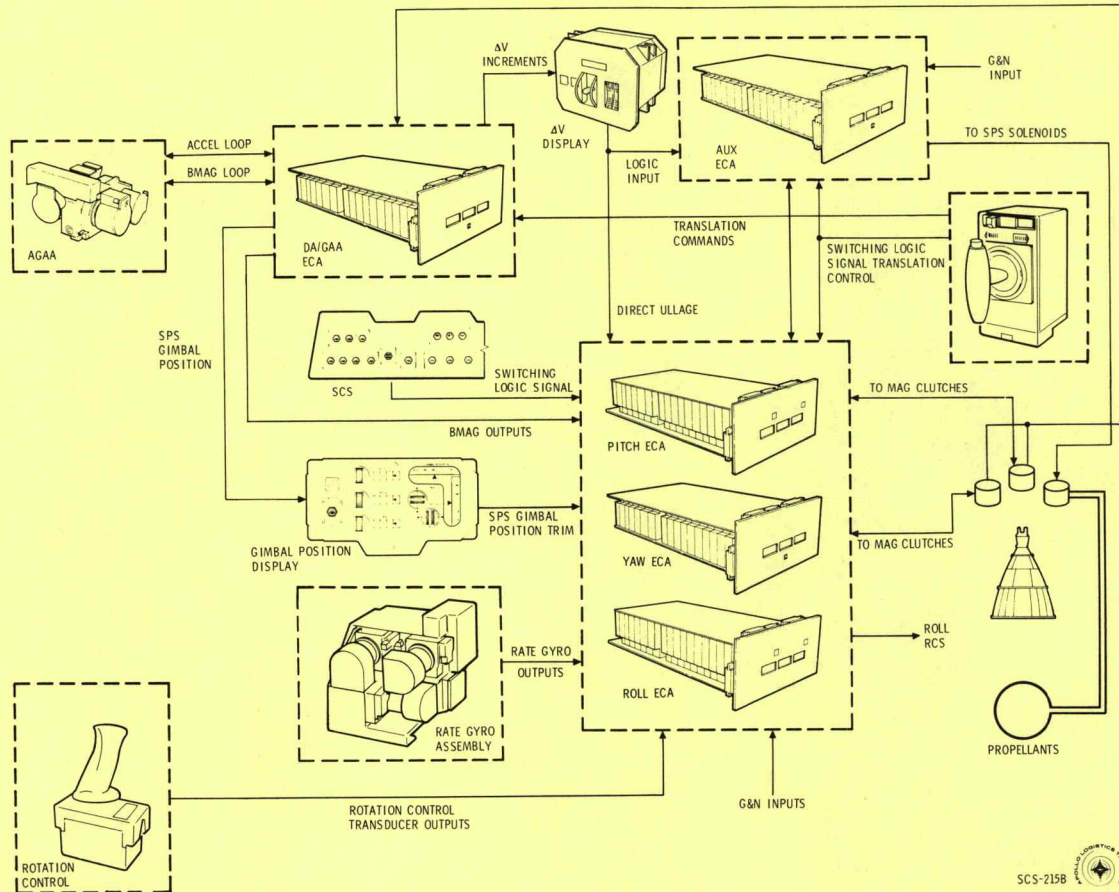
ATTITUDE HOLD (SCS)



ATTITUDE REFERENCE SUBSYSTEM

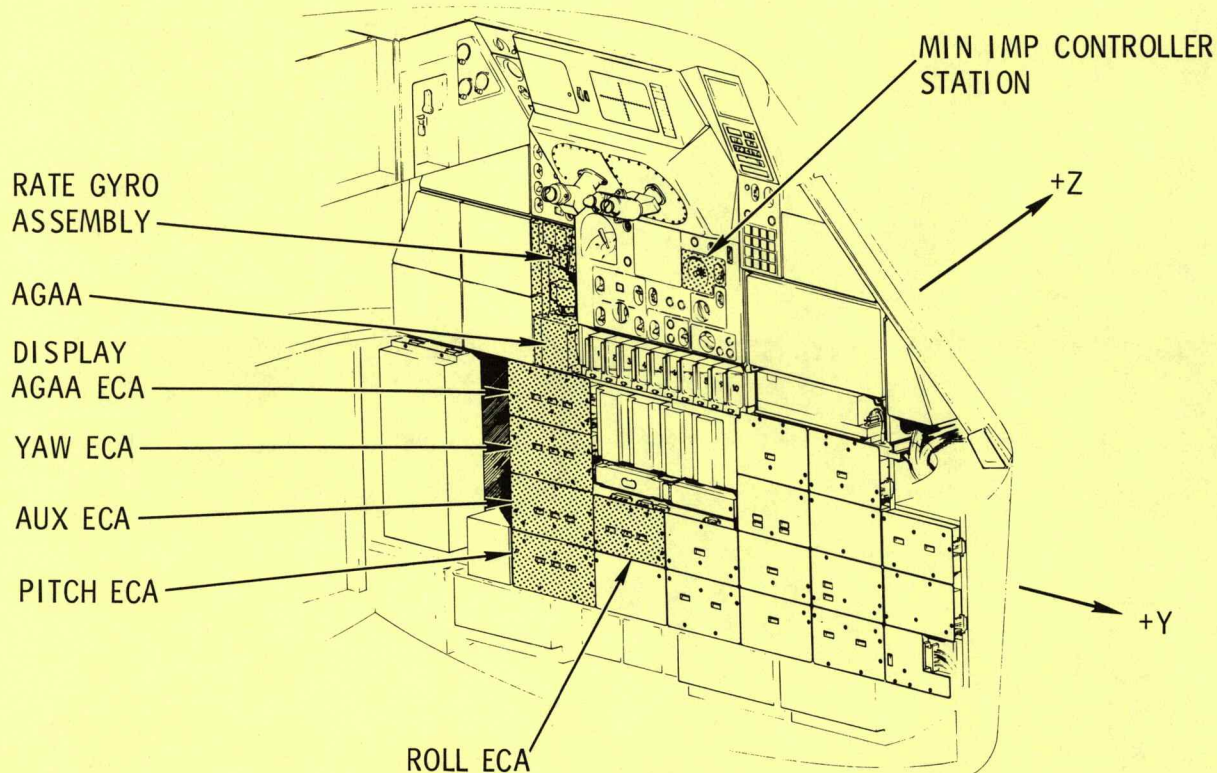


THRUST VECTOR CONTROL



LOWER EQUIPMENT BAY

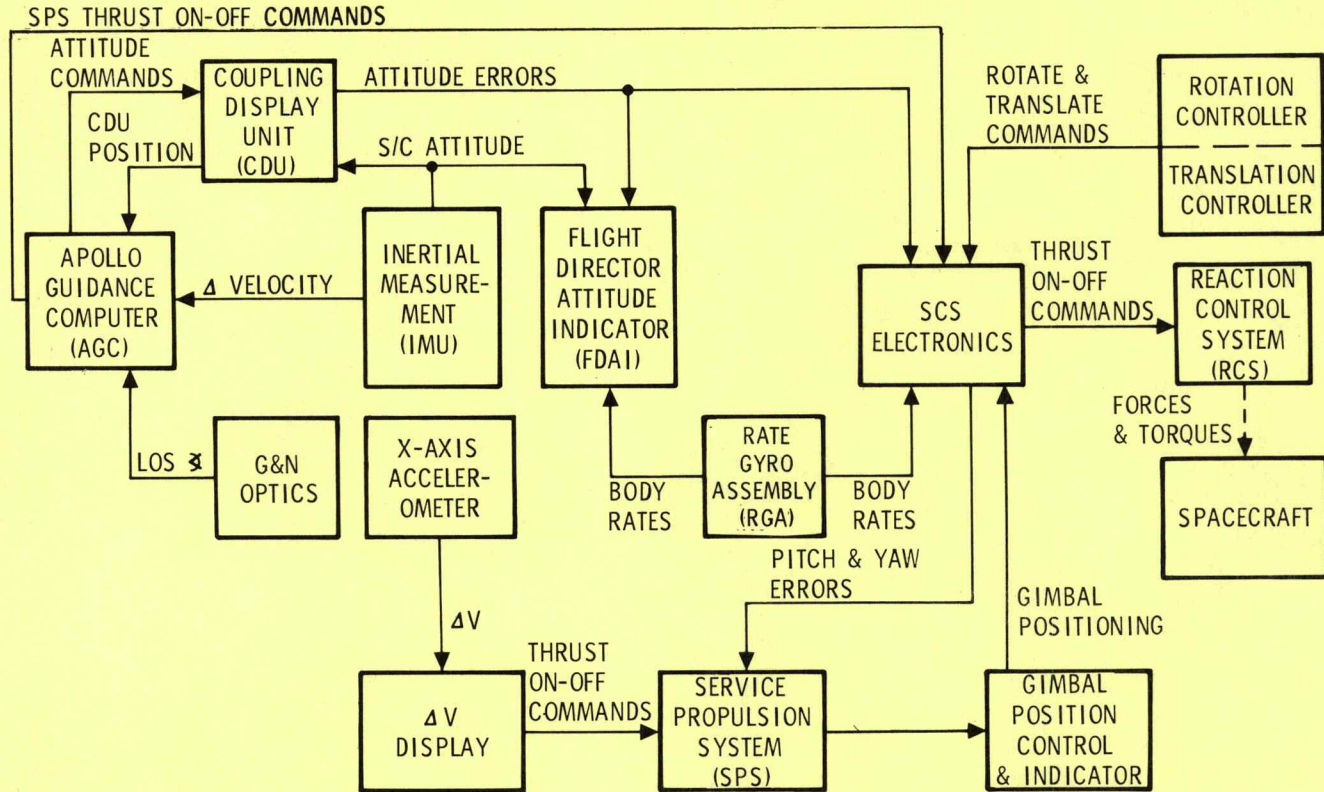
SCS FUNCTIONS



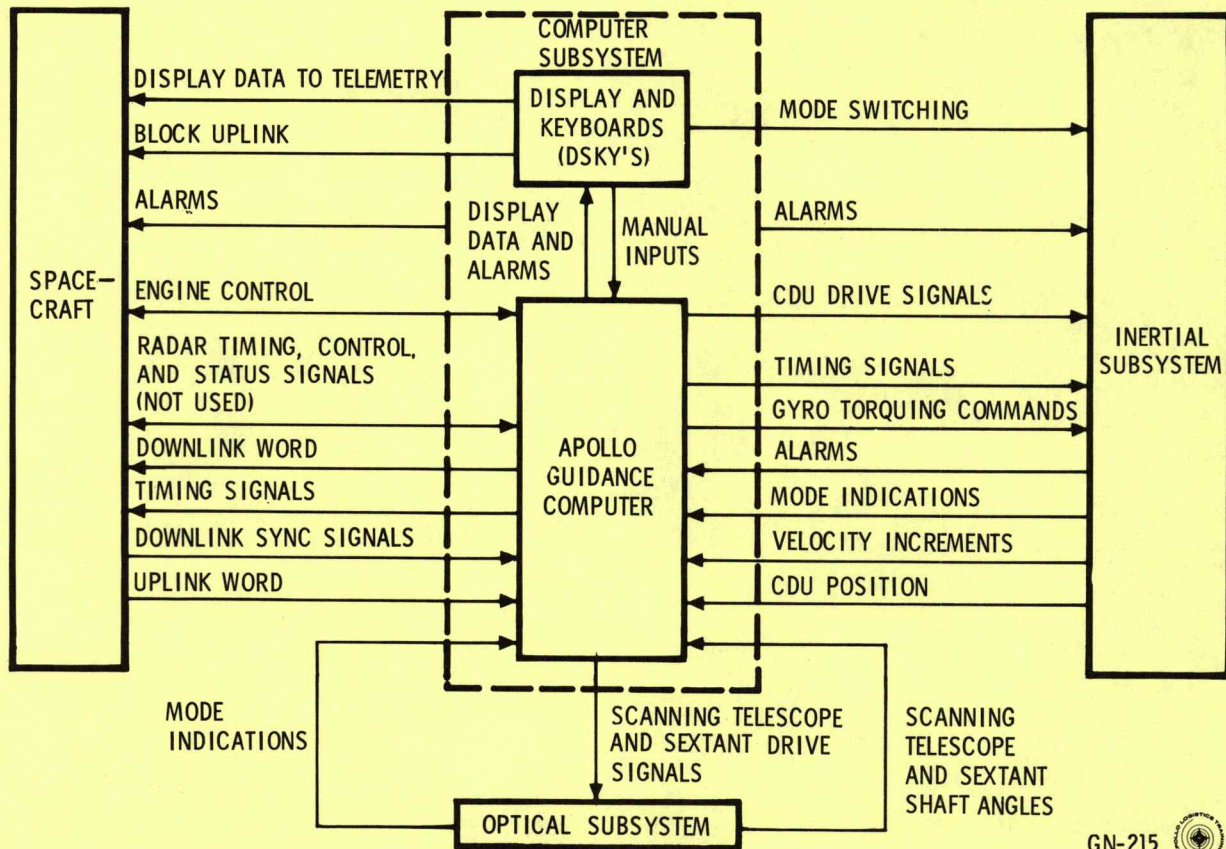
6



G&N-SCS INTERFACE



COMPUTER SUBSYSTEM, GENERAL INTERFACE



PROPULSION

7

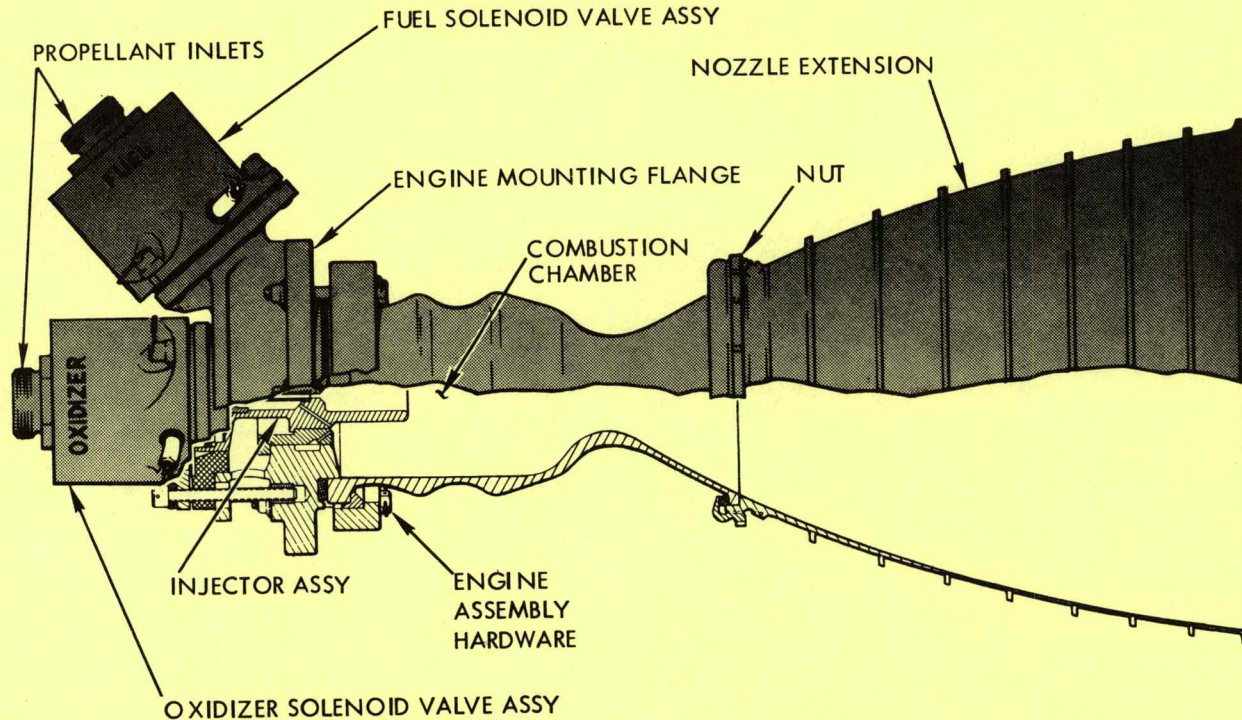
FAM-4000A



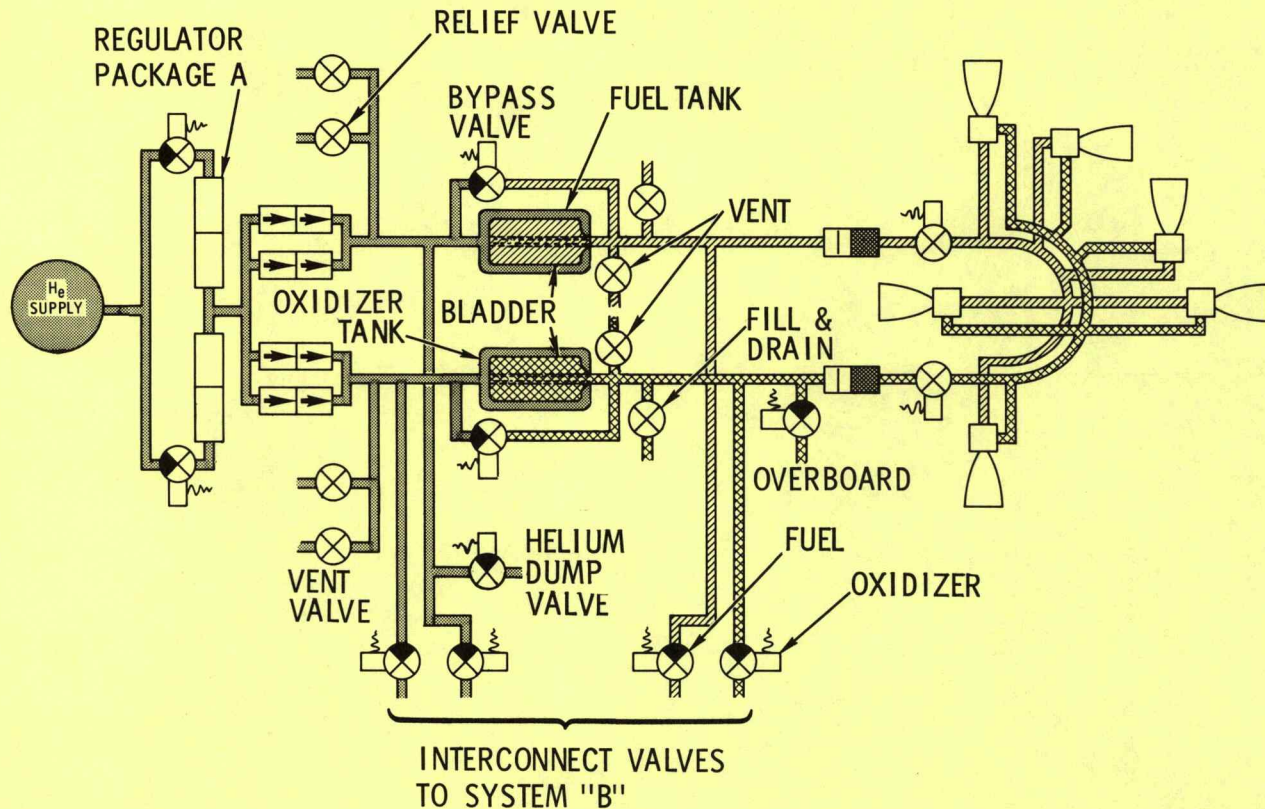
7



S/M RCS ENGINE CUTAWAY

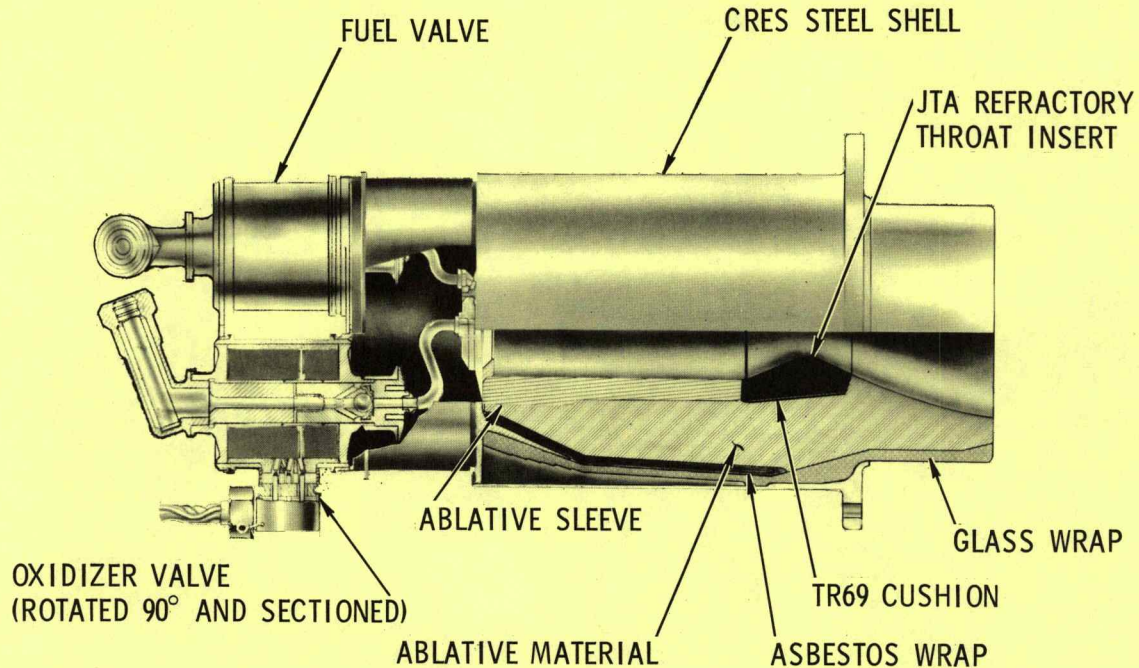


C/M REACTION CONTROL SYSTEM



C/M RCS ENGINE

SE 8-5

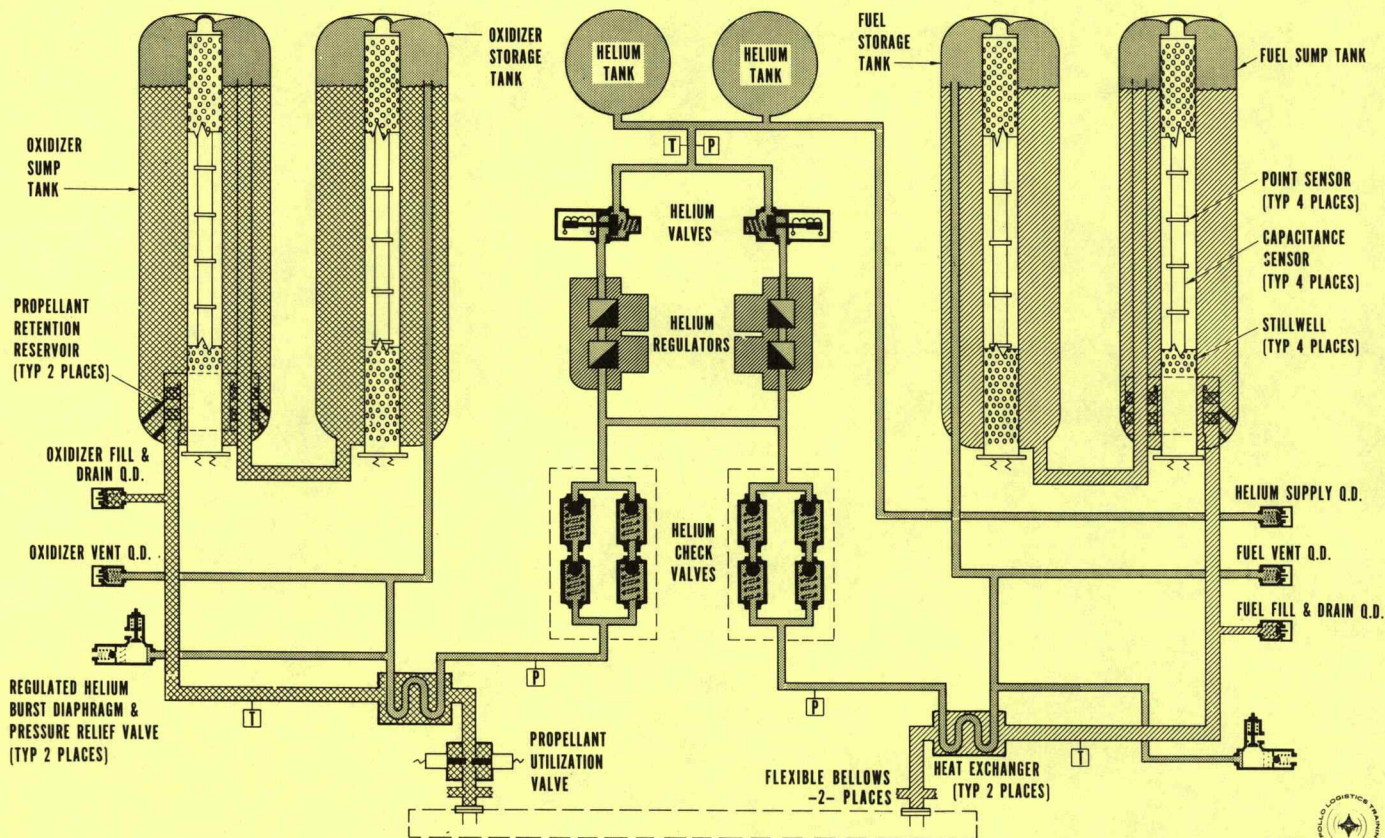


P-3005B

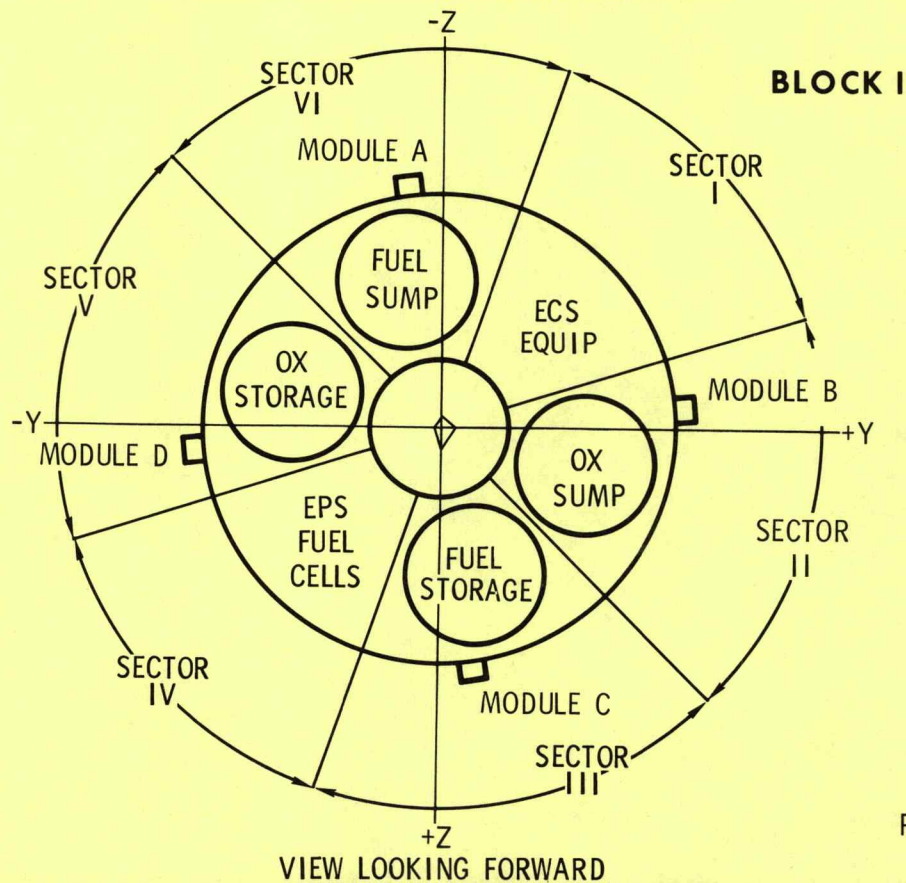


SERVICE PROPULSION SYSTEM

PROPELLANT FEED



SERVICE MODULE SECTORS AND CENTER OF MASS SHIFT

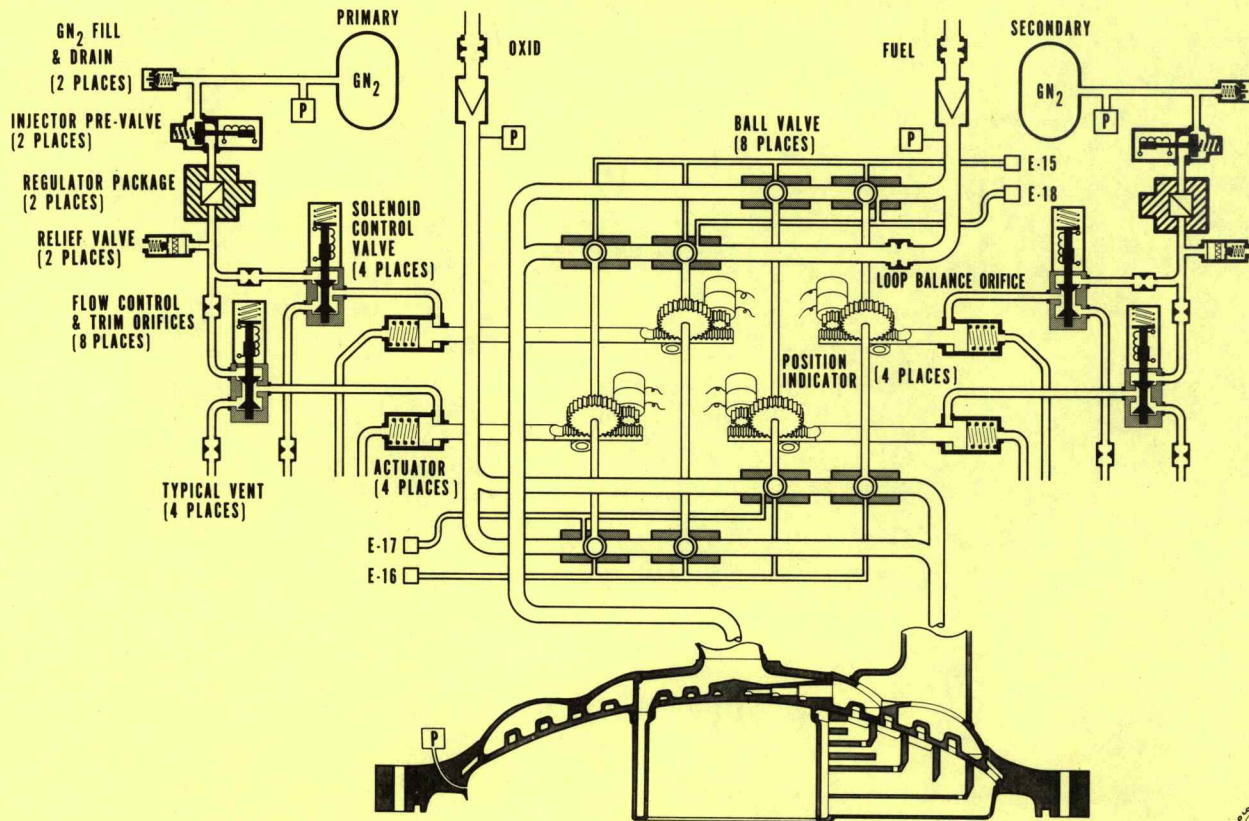


P-0004C



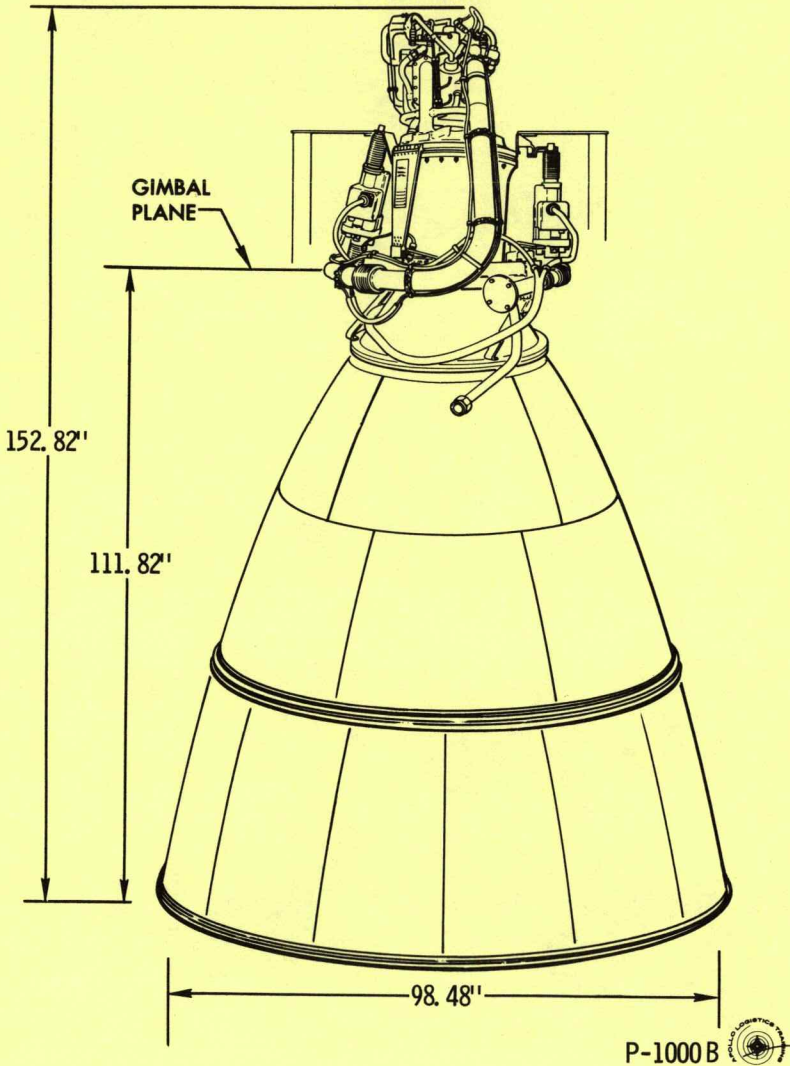
PROPELLANT FLOW SCHEMATIC

SERVICE PROPULSION SYSTEM



SPS ROCKET ENGINE

AJ10-137



7

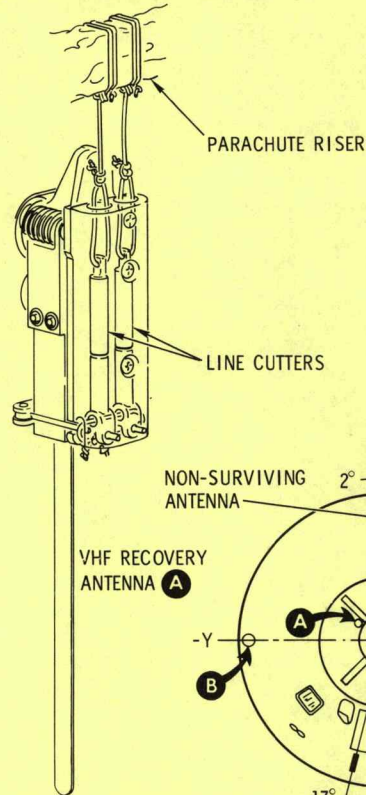
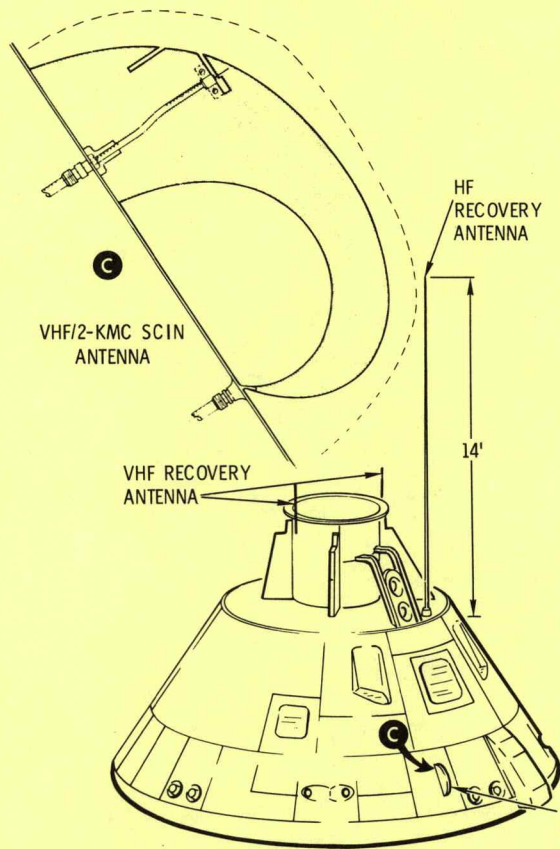


TELECOMMUNICATIONS

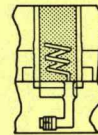


COMMUNICATIONS SYSTEM

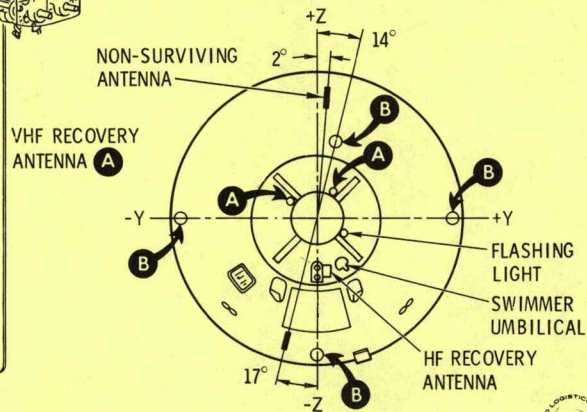
ANTENNA EQUIPMENT GROUP



C-BAND ANTENNA



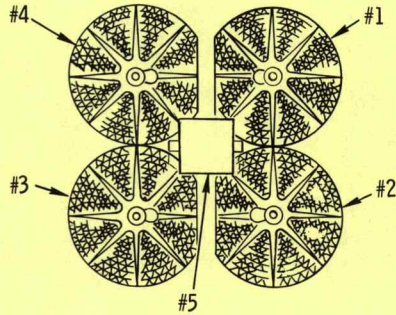
B



CD-17C

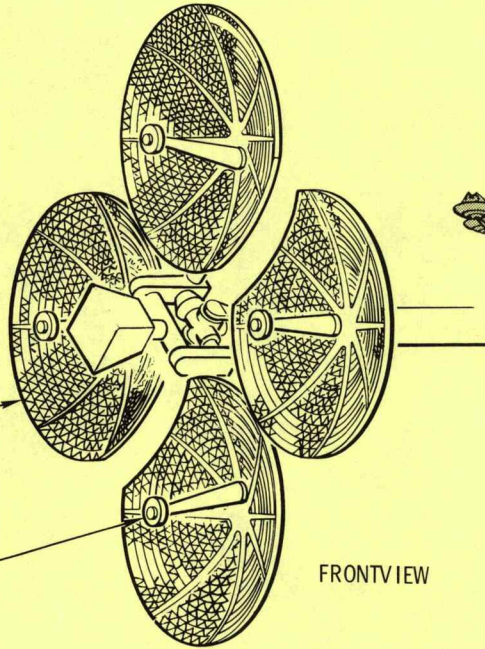


BLOCK II S-BAND HI GAIN ANTENNA

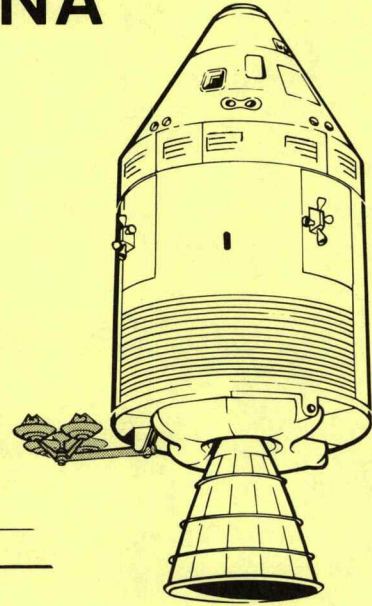


SOLAR RIB
REFLECTORS
≈31" DIA

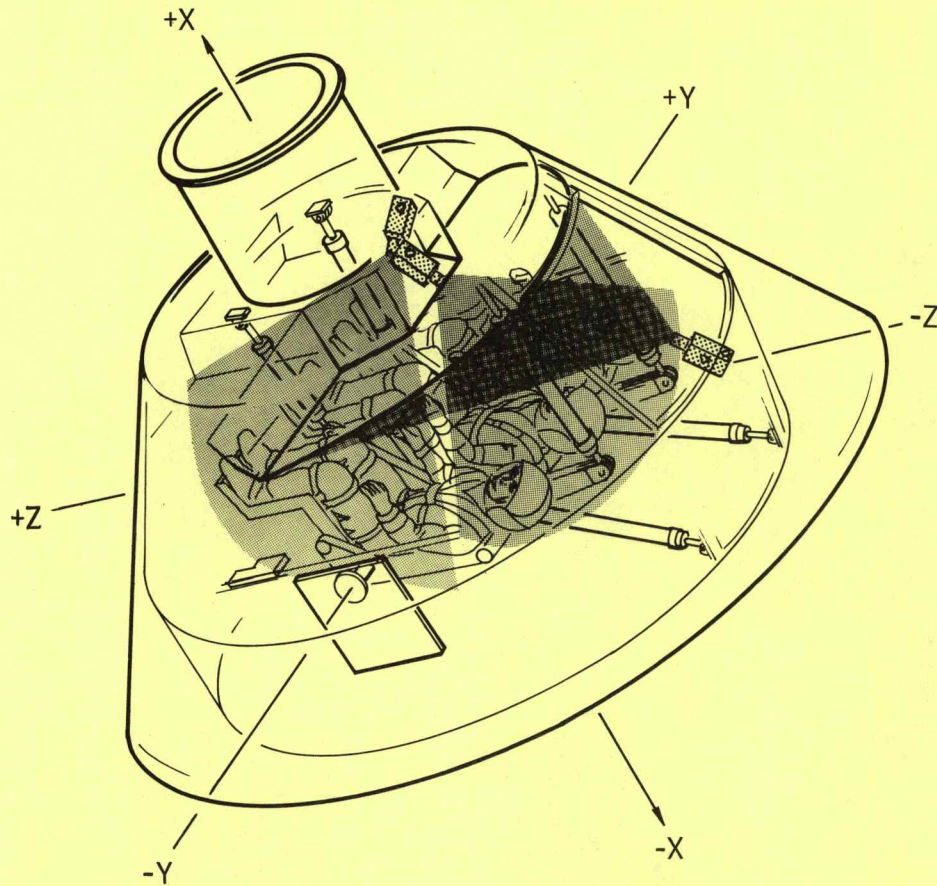
FEEDHORNS
10° OFFSET



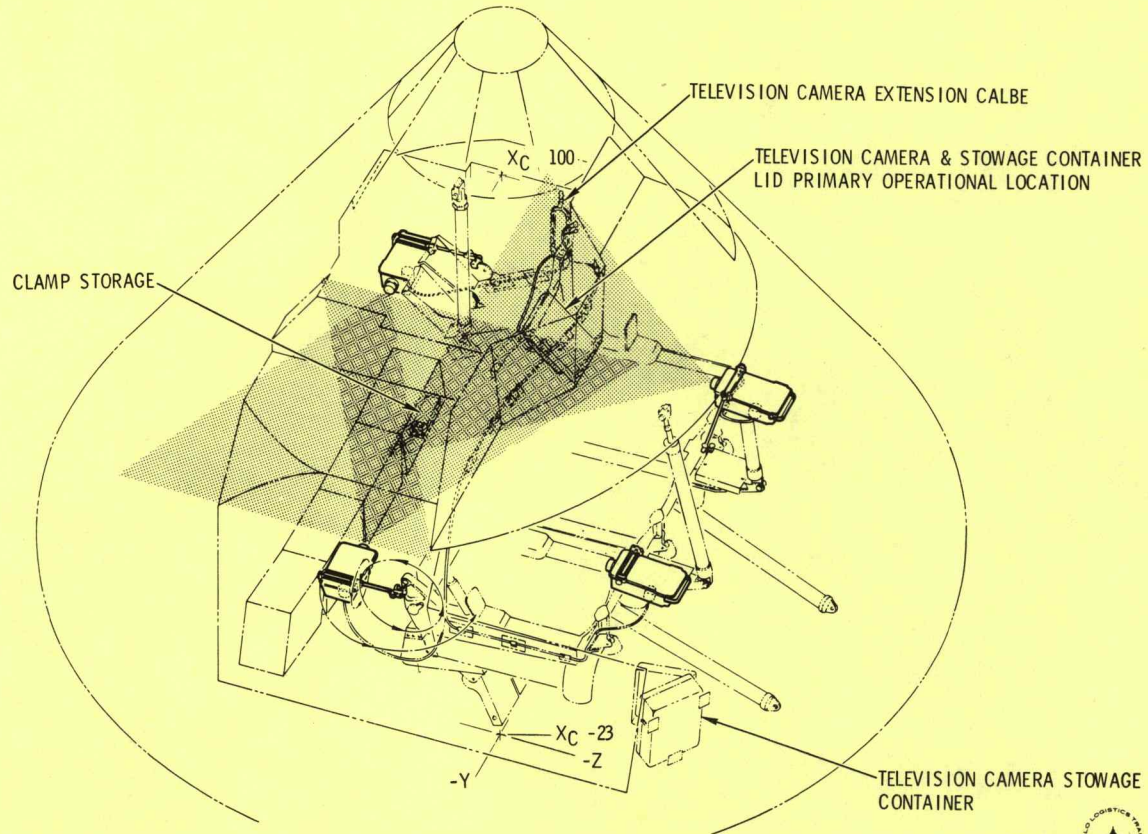
FRONTVIEW



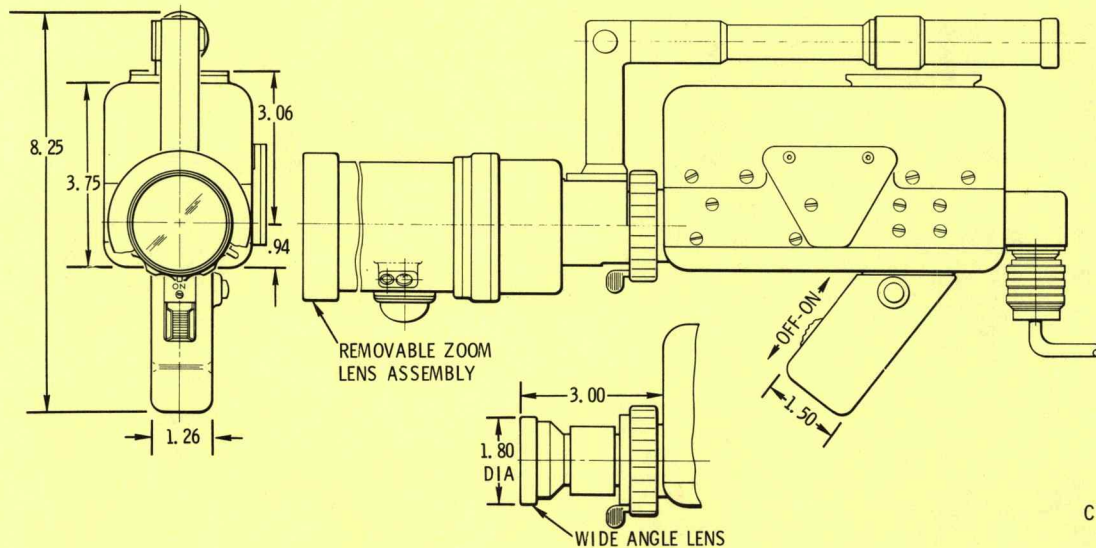
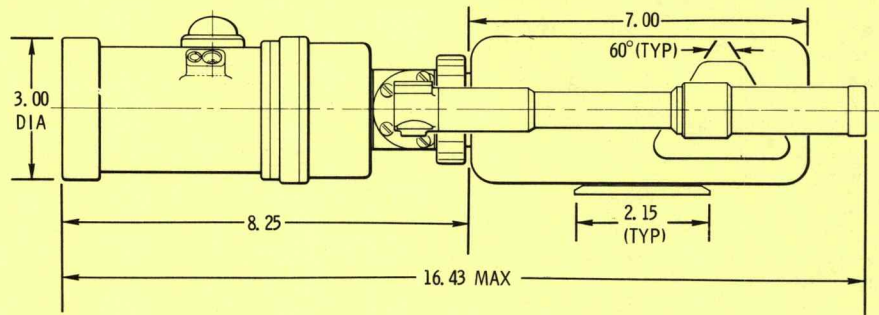
TV CAMERA LOCATIONS



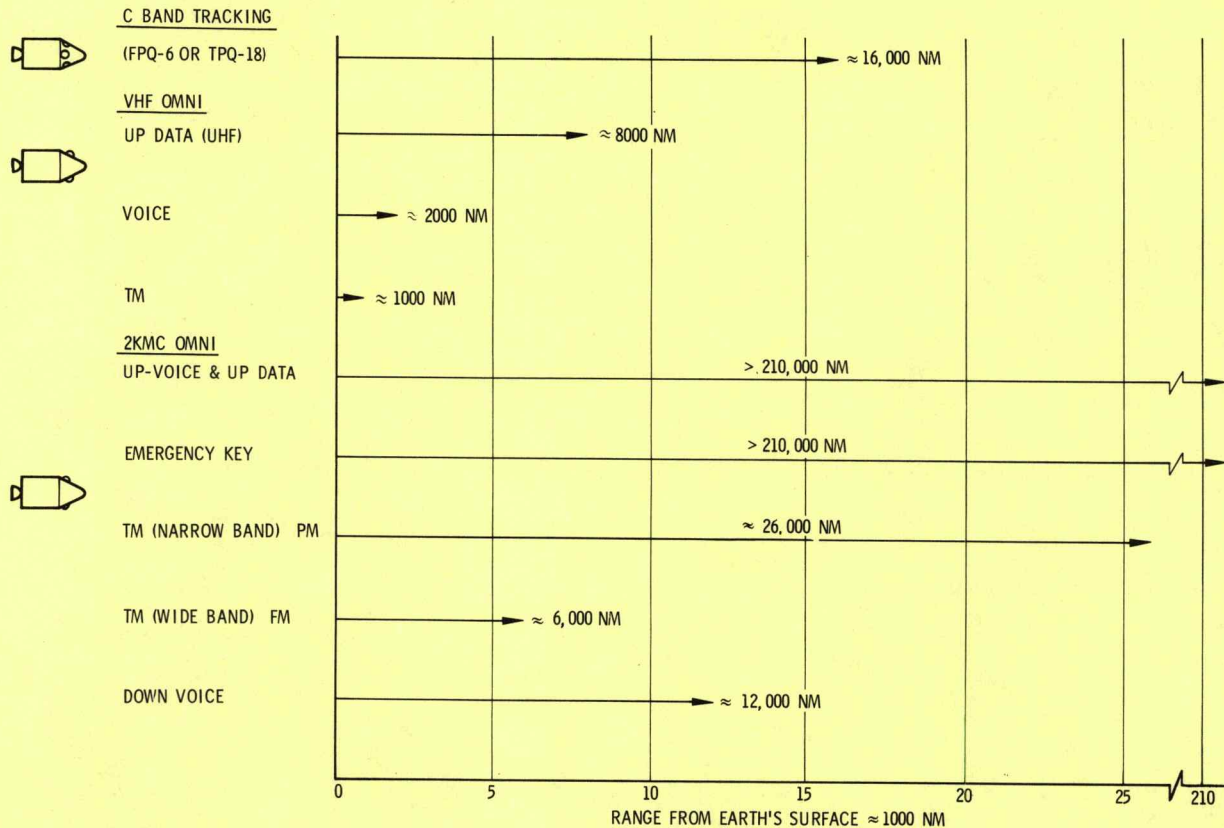
BLOCK II TV CAMERA LOCATIONS



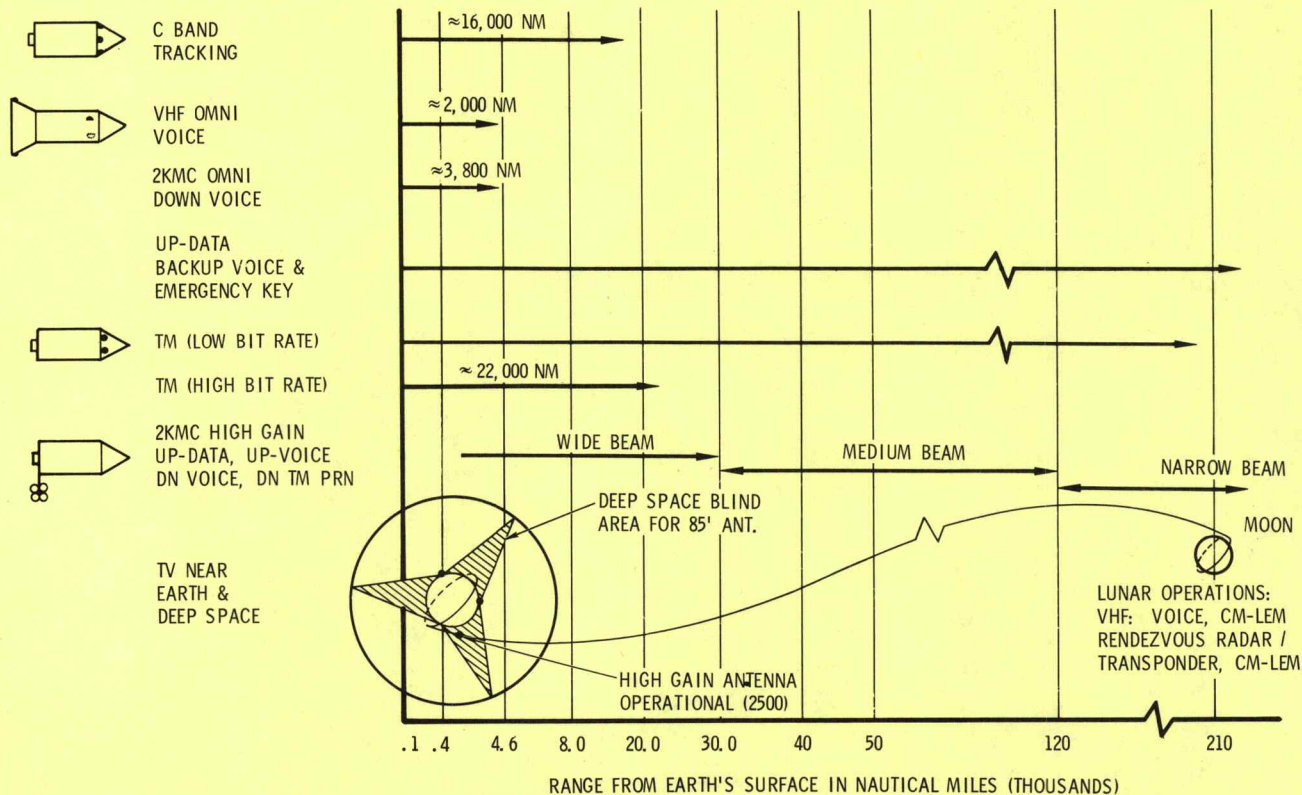
APOLLO TV CAMERA



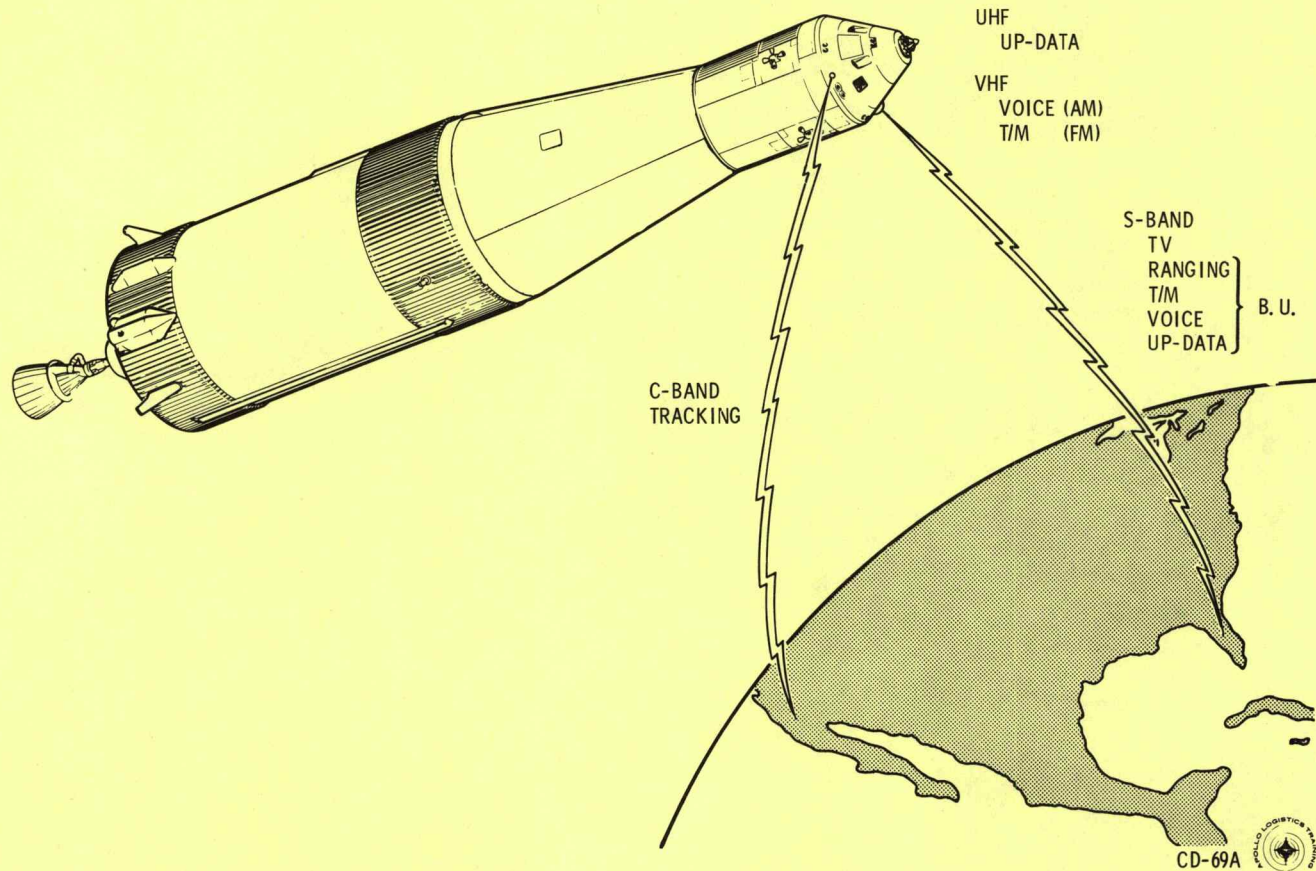
BLOCK I COMMUNICATIONS RANGES



CSM BLOCK II COMMUNICATIONS RANGES



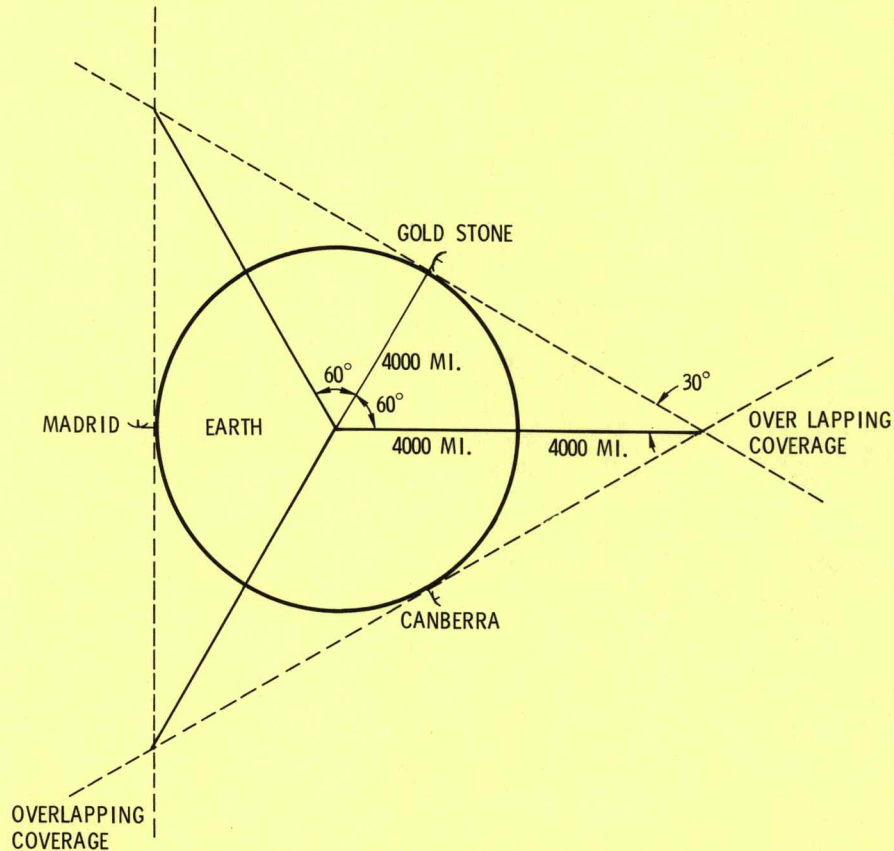
NEAR EARTH COMMUNICATION MODES



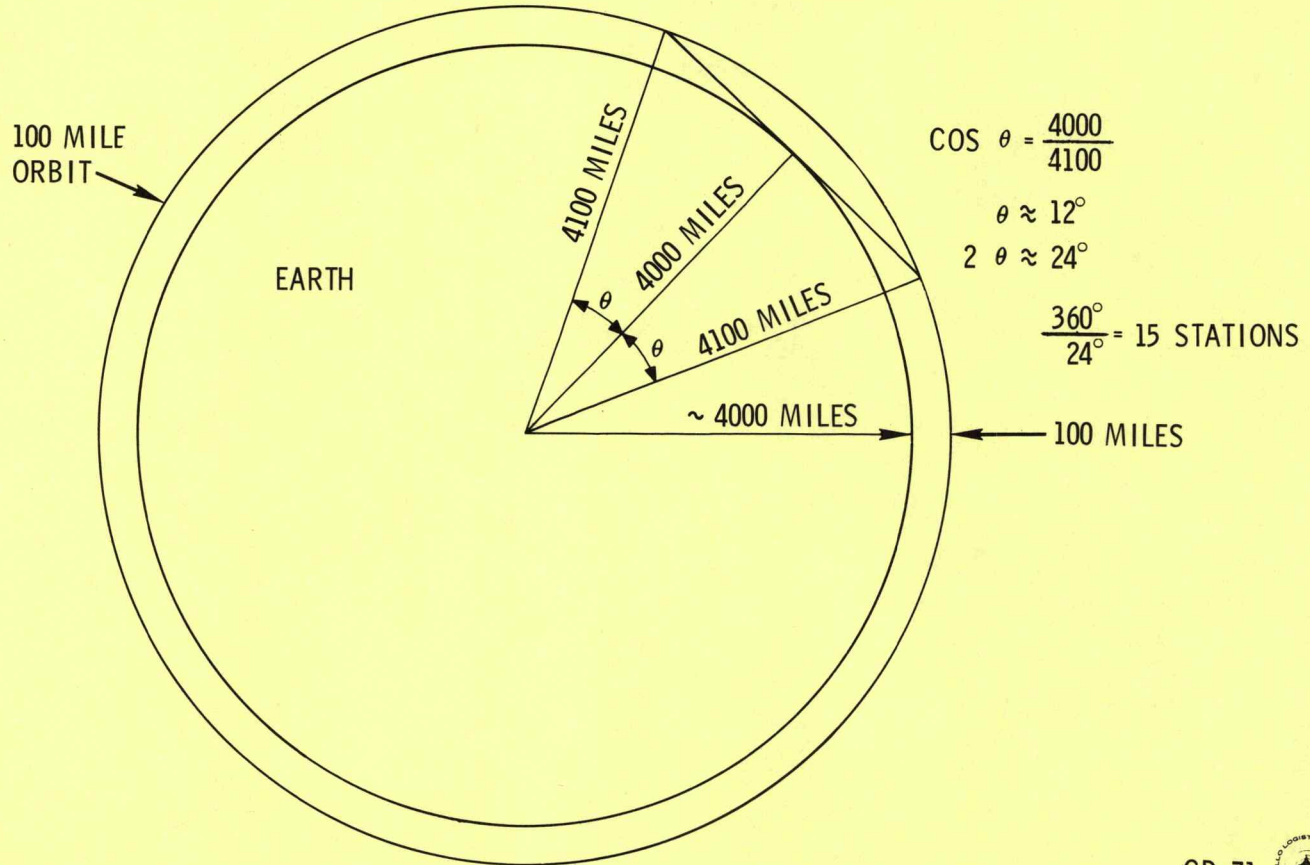
CD-69A



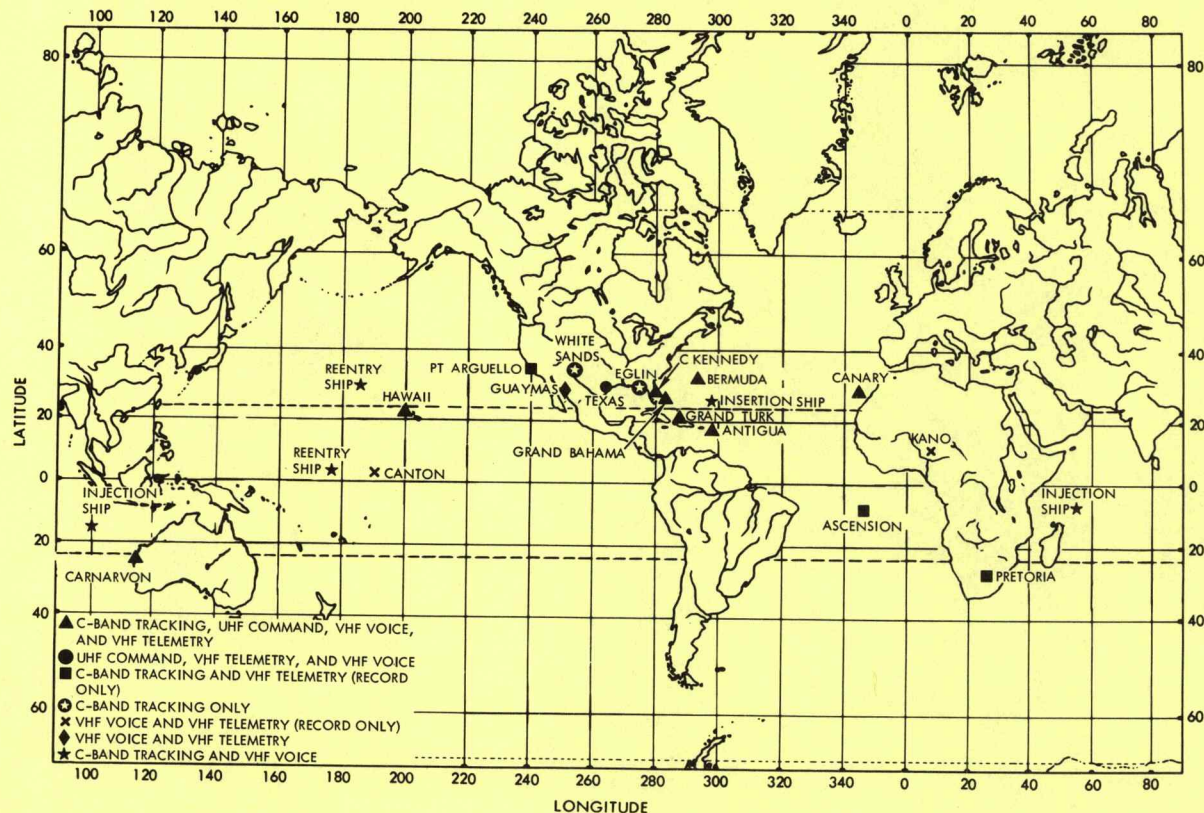
S-BAND GROUND STATION GEOMETRY



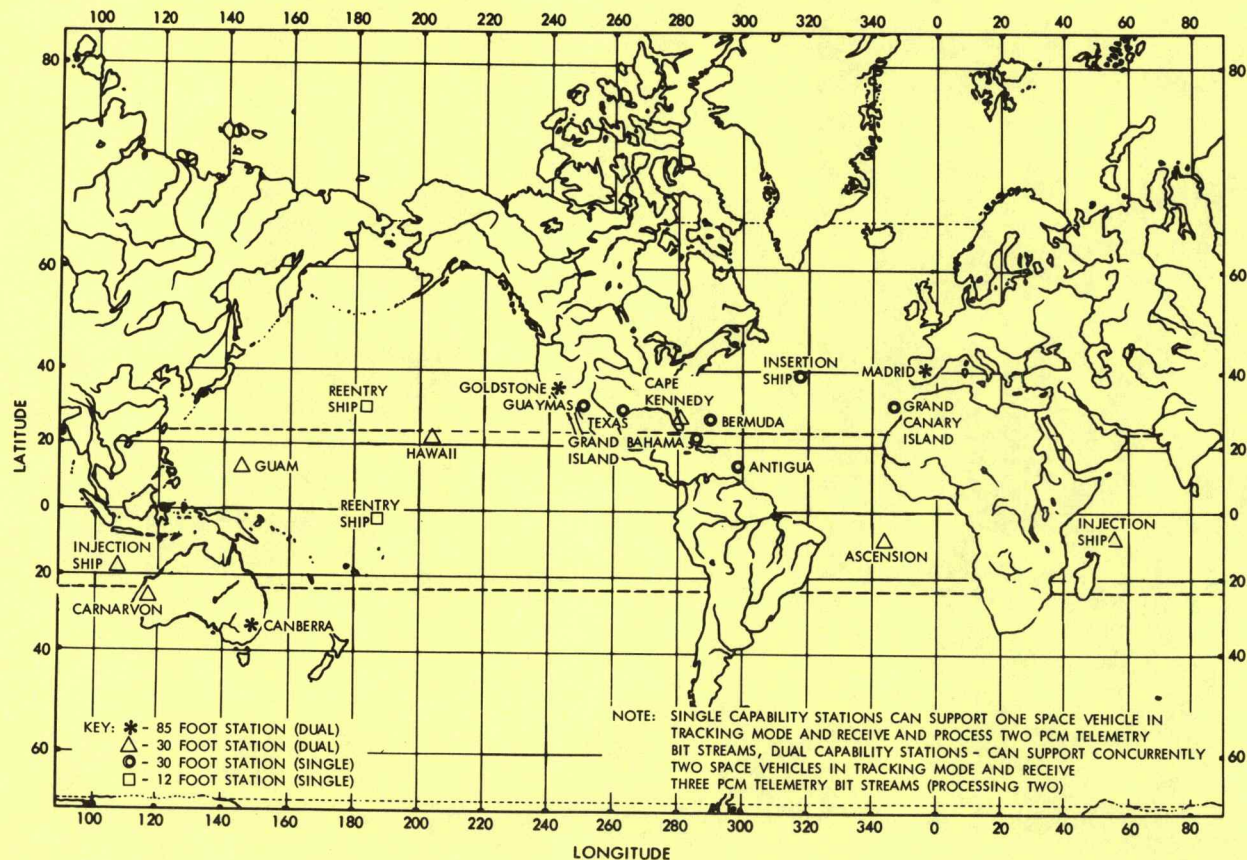
S-BAND GROUND STATION REQ



BLOCK I MSFN NEAR EARTH VHF/UHF/ C-BAND STATION LOCATIONS



BLOCK I & II MSFN S-BAND STATION LOCATIONS



MSFN S-BAND IMPLEMENTATION SCHEDULE

STATION	DUAL C SINGLE CAPABILITY	ANTENNA SIZE (FT)	1966												1967											
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
CARNARVON	D	30						▲						■												
BERMUDA	S	30							▲					■												
HAWAII	D	30							▲					■												
KENNEDY	D	30								▲					■											
TEXAS	S	30										▲							■							
GUAYMAS	S	30										▲						■								
GUAM	D	30						▲						■												
ASCENSION	D	30											▲						■							
ANTIGUA	S	30																▲						■		
CANARY	S	30															▲						■			
GRAND BAHAMA	S	30												▲						■						
GOLDSTONE	D	85										▲						■								
CANBERRA	D	85												▲						■						
MADRID	D	85																▲					■			
INSERTION SHIP	S	30							■																	
INJECTION SHIP	D	30										■														
INJECTION SHIP	D	30												■												
REENTRY SHIP	S	12													■											
REENTRY SHIP	S	12																■								
8 INSTRUMENT- ATION AIRCRAFT																										■

COMPLETE INSTALLATION AND CHECKOUT 

COMPLETE SYSTEM SIMULATION 

COMM EQUIPMENT/MISSION PHASE

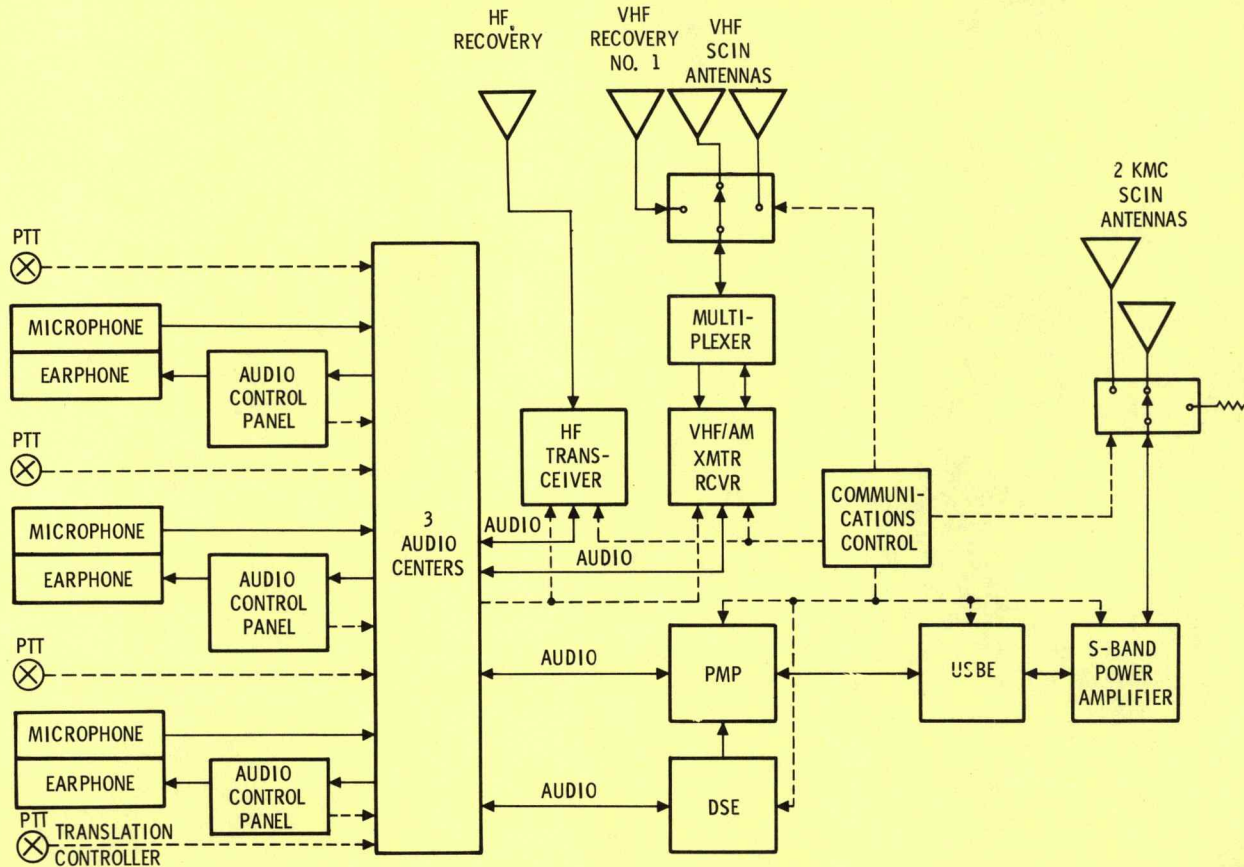
	PRE- LAUNCH	LAUNCH EARTH ORBIT TRANS- LUNAR INJECT.	TRANS- LUNAR FLIGHT 4000 MI	LUNAR ORBIT	LEM DESCENT LUNAR EXPLORE LEM ASCENT	TRANS- EARTH INJECT TRANS EARTH FLIGHT	DESCENT LANDING RECOVERY
VOICE	HARDLINE VHF/AM*	VHF/AM S-BAND*	S-BAND	S-BAND	S-BAND VHF/AM+	S-BAND	HF VHF/AM
TV	N/A	S-BAND	S-BAND	S-BAND	S-BAND	S-BAND	
BIO MED	HARDLINE VHF/FM*	VHF/FM S-BAND*	S-BAND VHF/AM+	S-BAND	S-BAND VHF/AM+	S-BAND	
UP-DATA	HARDLINE UHF/FM*	UHF/FM S-BAND*	S-BAND	S-BAND	S-BAND	S-BAND	
DWN- DATA	HARDLINE VHF/FM*	VHF/FM S-BAND*	S-BAND	S-BAND	S-BAND	S-BAND	
RANGING		C-BAND S-BAND*	S-BAND	S-BAND	S-BAND	S-BAND	
BEACON							HF VHF-BCN

* BACKUP MODE

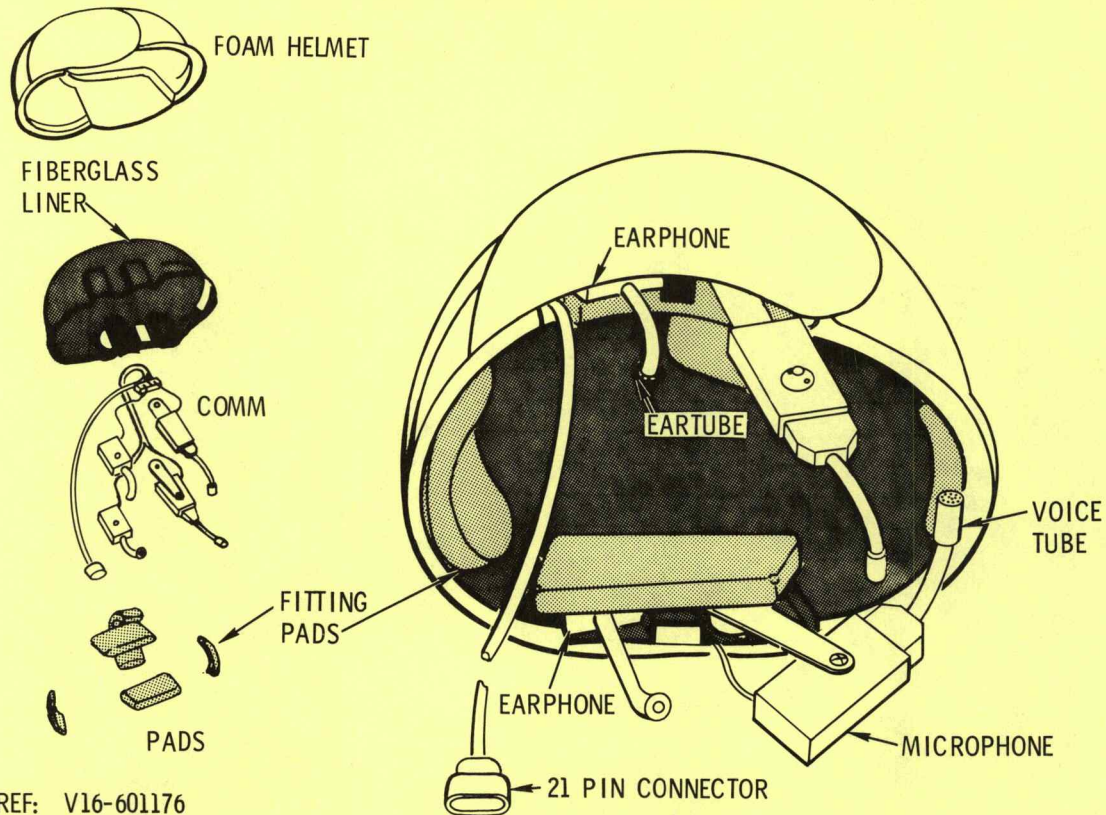
+ LEM-E. V. A. COMMUNICATIONS



AUDIO EQUIPMENT INTERFACES



PERSONAL COMMUNICATIONS ASSEMBLY MK II



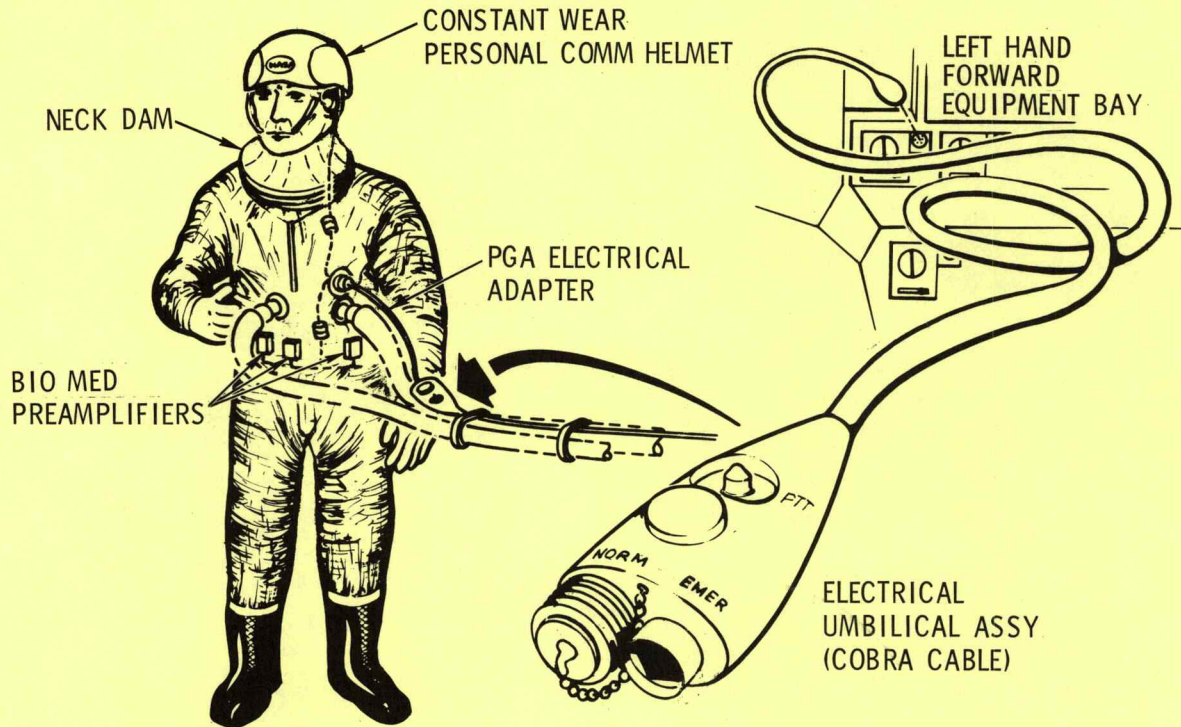
REF: V16-601176

NOV 65

CS-1018



PERSONAL COMMUNICATIONS EQUIPMENT CONNECTIONS, BLK I PGA

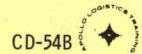


MAR 66

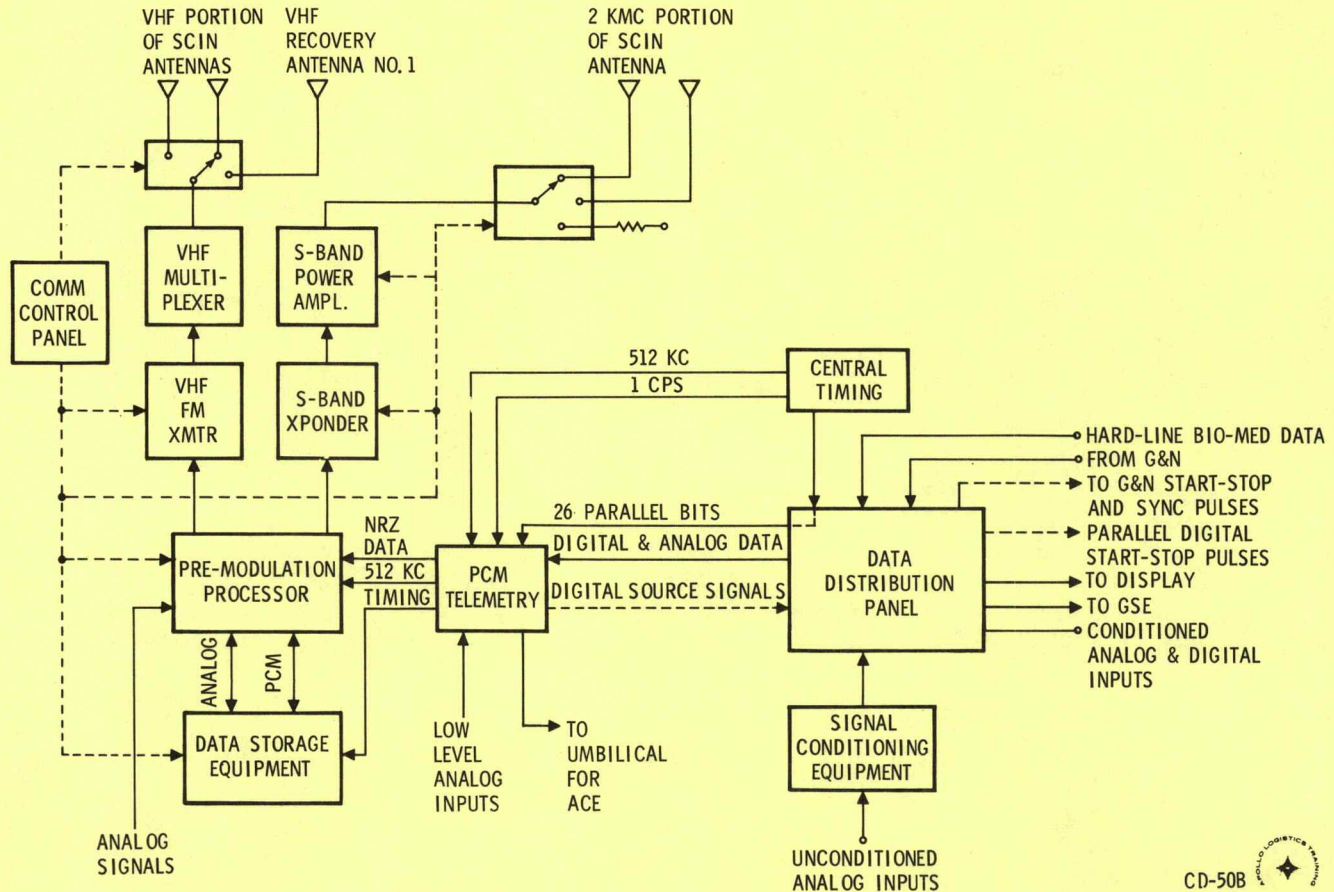
CS-1016C



8



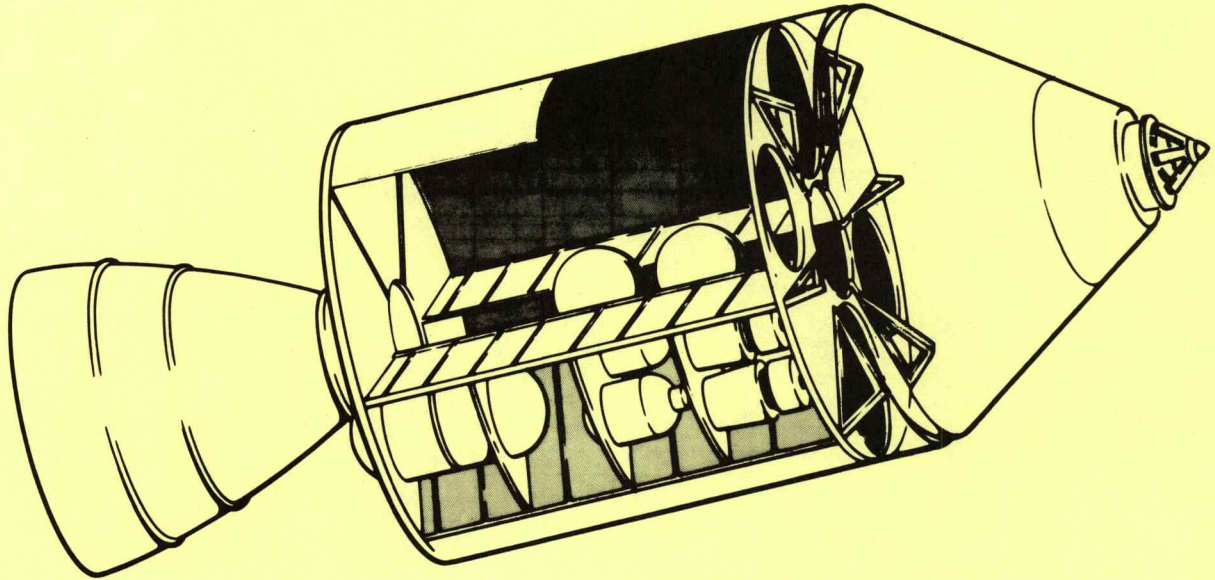
DATA SYSTEM INTERFACES



ELECTRICAL POWER

ELECTRICAL POWER SYSTEM

BLOCK II



H₂ & O₂ CRYOGENIC STORAGE

- STORAGE VESSELS
- CONTROL VALVES
- PRESSURE
- TEMPERATURE



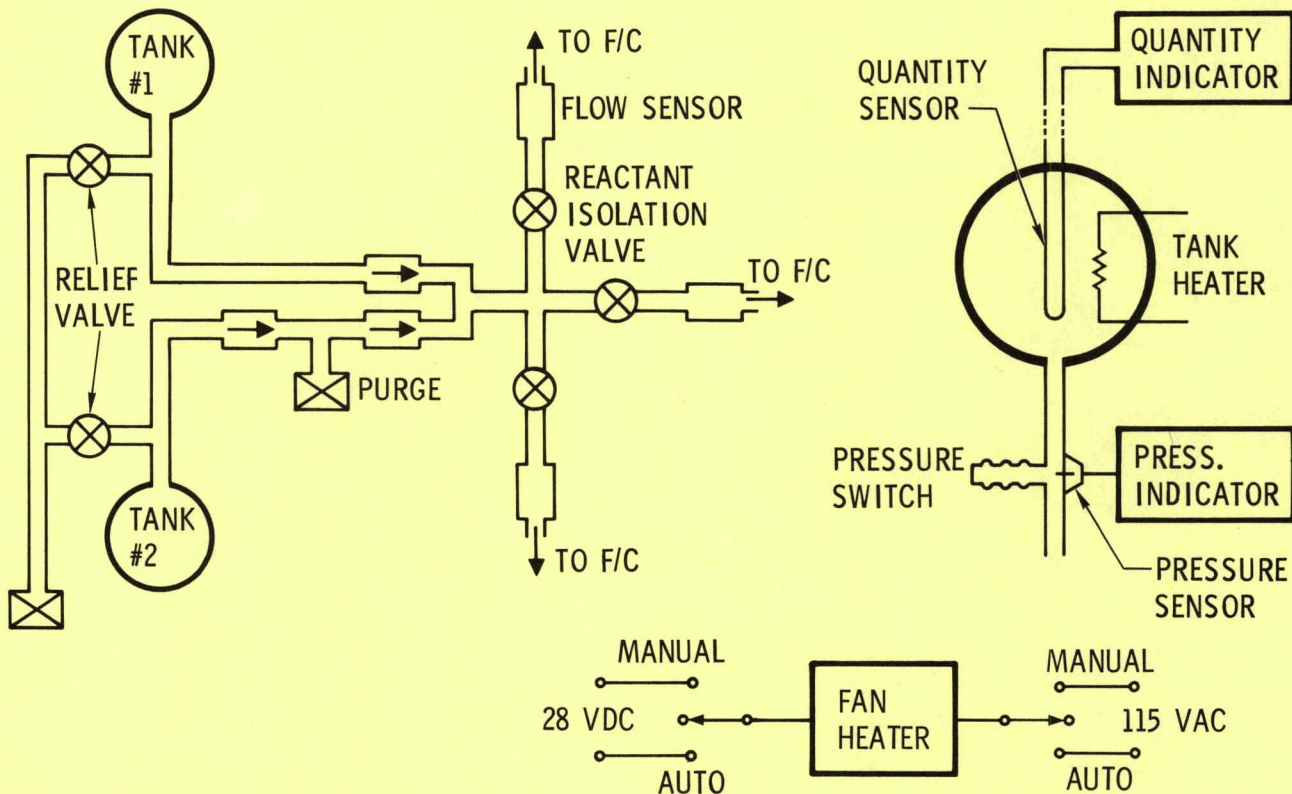
CRYOGENIC STORAGE SYSTEM

GAS	CONTAINER	CAPACITY	TOTAL CAPACITY
O ₂	INCONEL (2)	320 LBS (EA)	640 LBS
H ₂	TITANIUM (2)	28 LBS (EA)	56 LBS

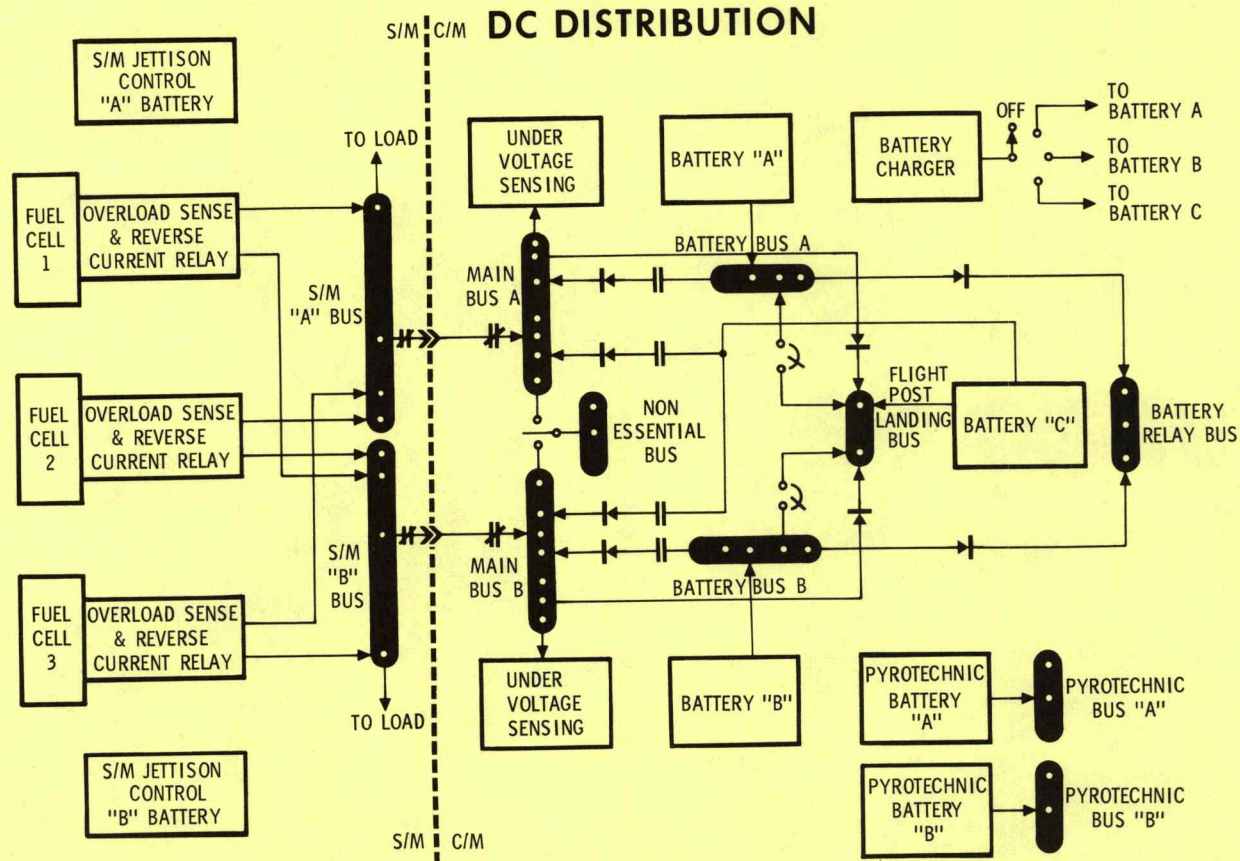
GAS	INPUT TEMP.	SETTLED TEMP.	STORED PRESSURE	SYSTEM ALLOCATION
O ₂	-297° F	-284° F	900 ± 35 PSIA	EPS - 410 #
				ECS - 230 #
H ₂	-423° F	-417° F	245 ± 15 PSIA	FUEL CELLS ONLY



CRYOGENIC STORAGE SYSTEM

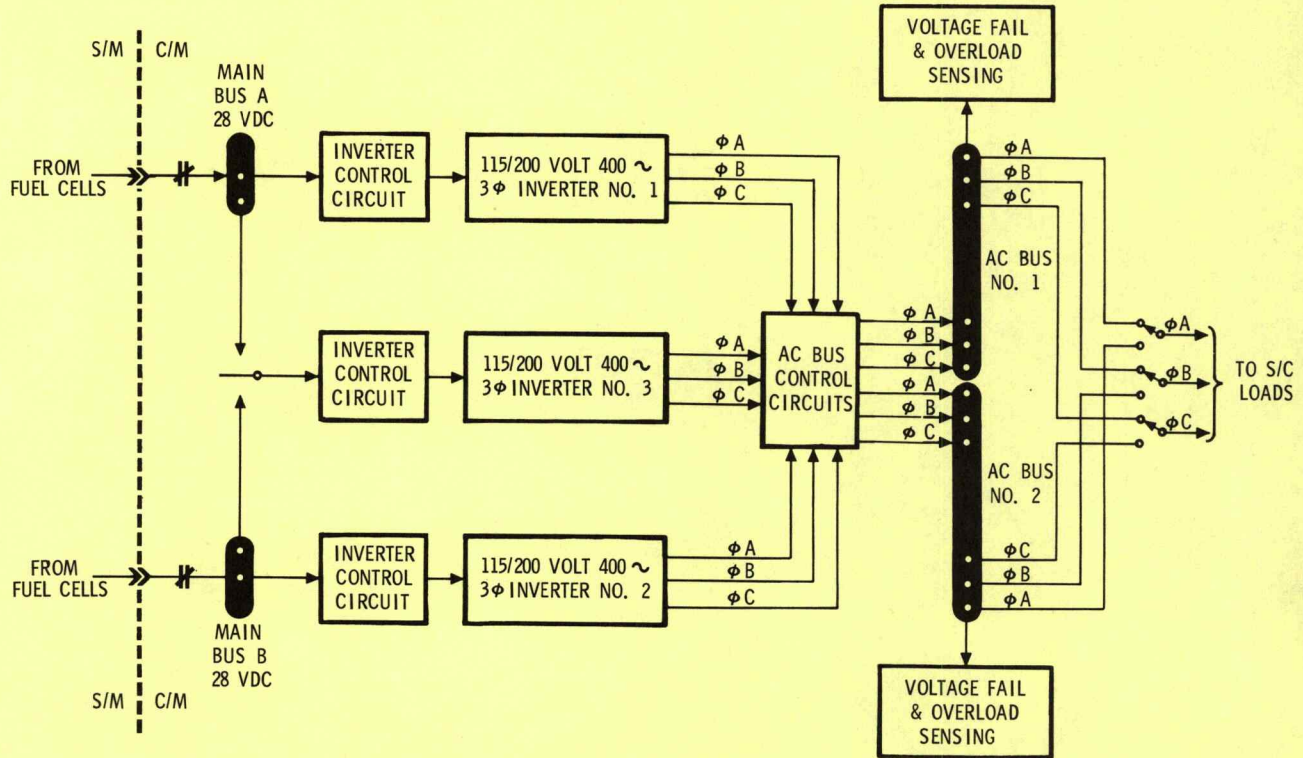


ELECTRICAL POWER SYSTEM

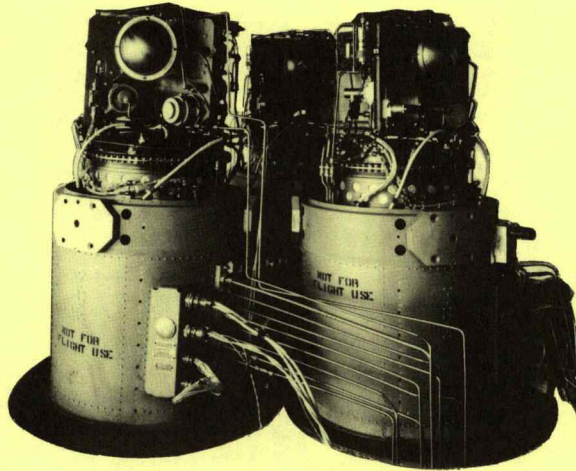


ELECTRICAL POWER SYSTEM

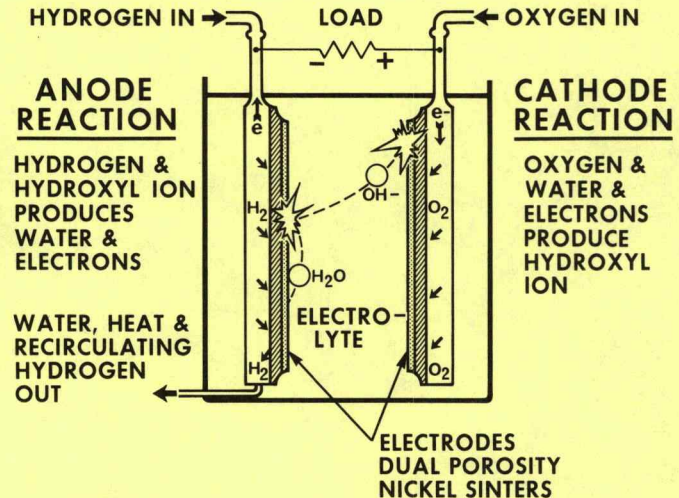
AC DISTRIBUTION



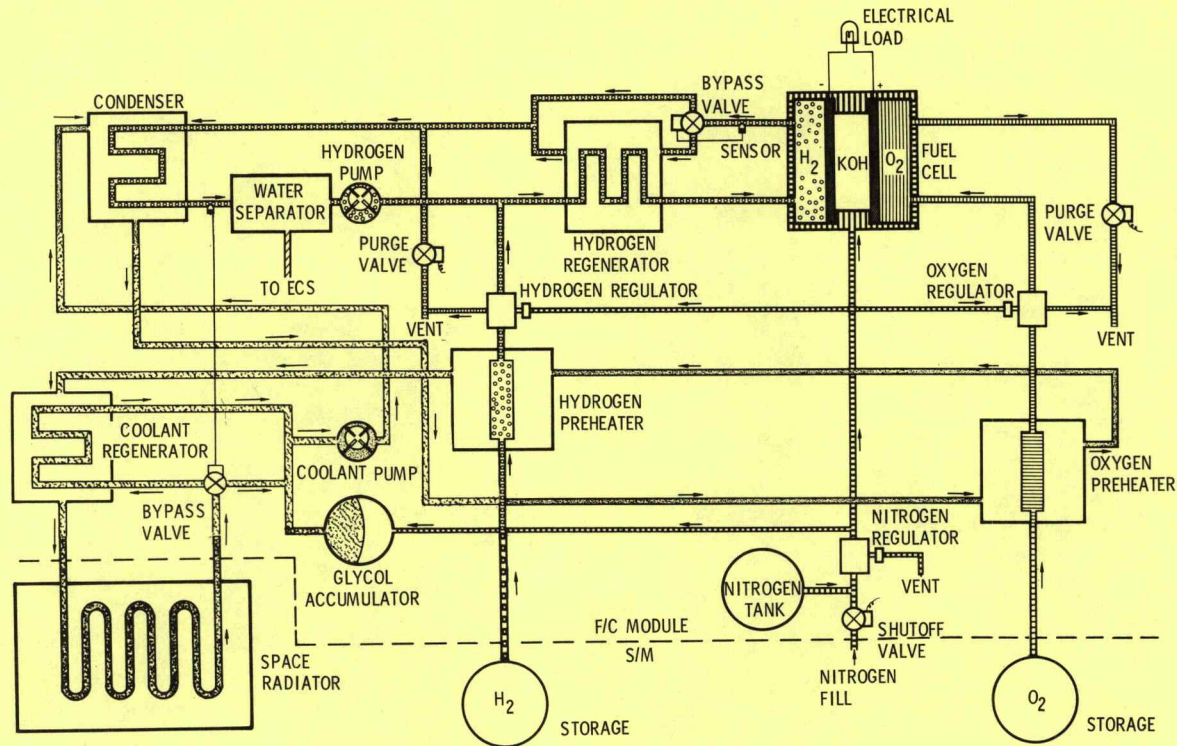
APOLLO FUEL CELL POWERPLANT



HEIGHT = 44 IN.
 DIAM = 22 IN.
 WEIGHT = 245 LB EACH

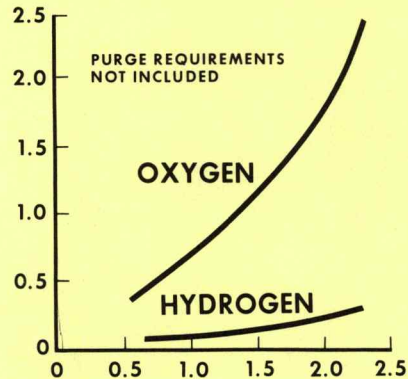


EPS FUEL CELL DIAGRAM

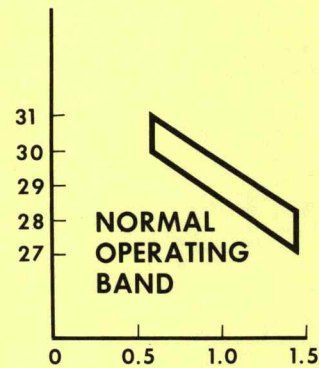


FUEL CELL REACTION

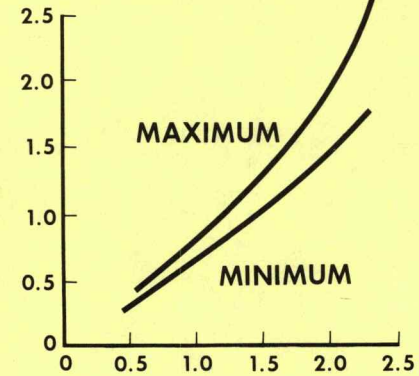
MAXIMUM REACTANT
CONSUMPTION-
POUNDS PER HOUR



VOLTAGE



WATER GENERATION RATE-
POUNDS PER HOUR-
PURGING NOT INCLUDED



GROSS POWER PER POWERPLANT - KILOWATTS

ENVIRONMENTAL CONTROL

FAM-2505 A



ENVIRONMENTAL CONTROL

SUBSYSTEM FUNCTIONS

OXYGEN SUPPLY SUBSYSTEM

- NORMAL OXYGEN SUPPLY
- ENTRY OXYGEN SUPPLY
- CABIN PRESSURE CONTROL
- FLUID TANK PRESSURIZATION

PRESSURE SUIT SUBSYSTEM

- WATER & CONTAMINANT REMOVAL FROM SUIT & CABIN
- SUIT PRESSURE & TEMPERATURE CONTROL

WATER SUBSYSTEM

- STORES & DISTRIBUTES

POTABLE WATER (DRINKING & FOOD RECONSTITUTION)

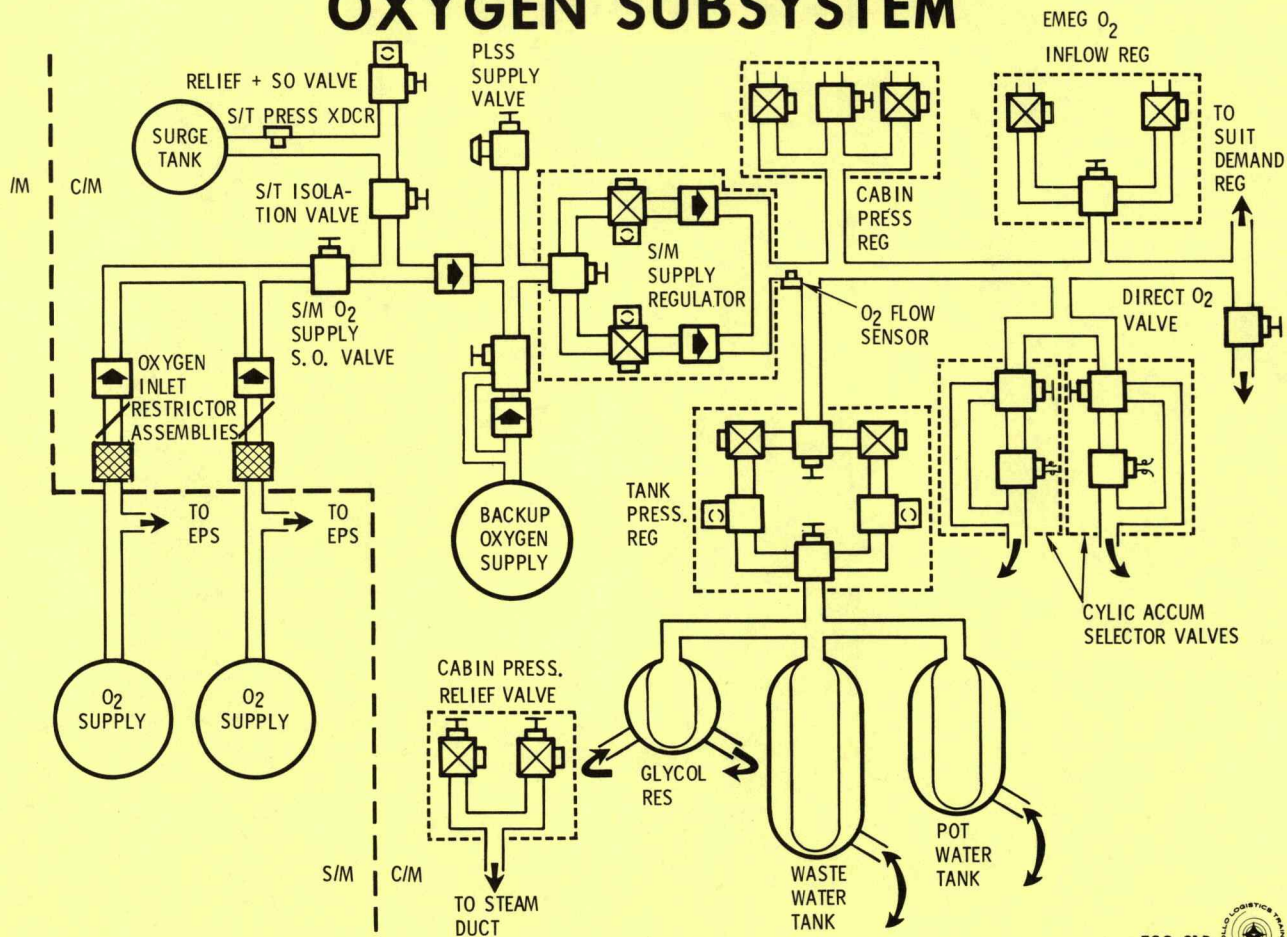
WASTE WATER (SUPPLEMENTAL COOLING)

WATER GLYCOL SUBSYSTEM

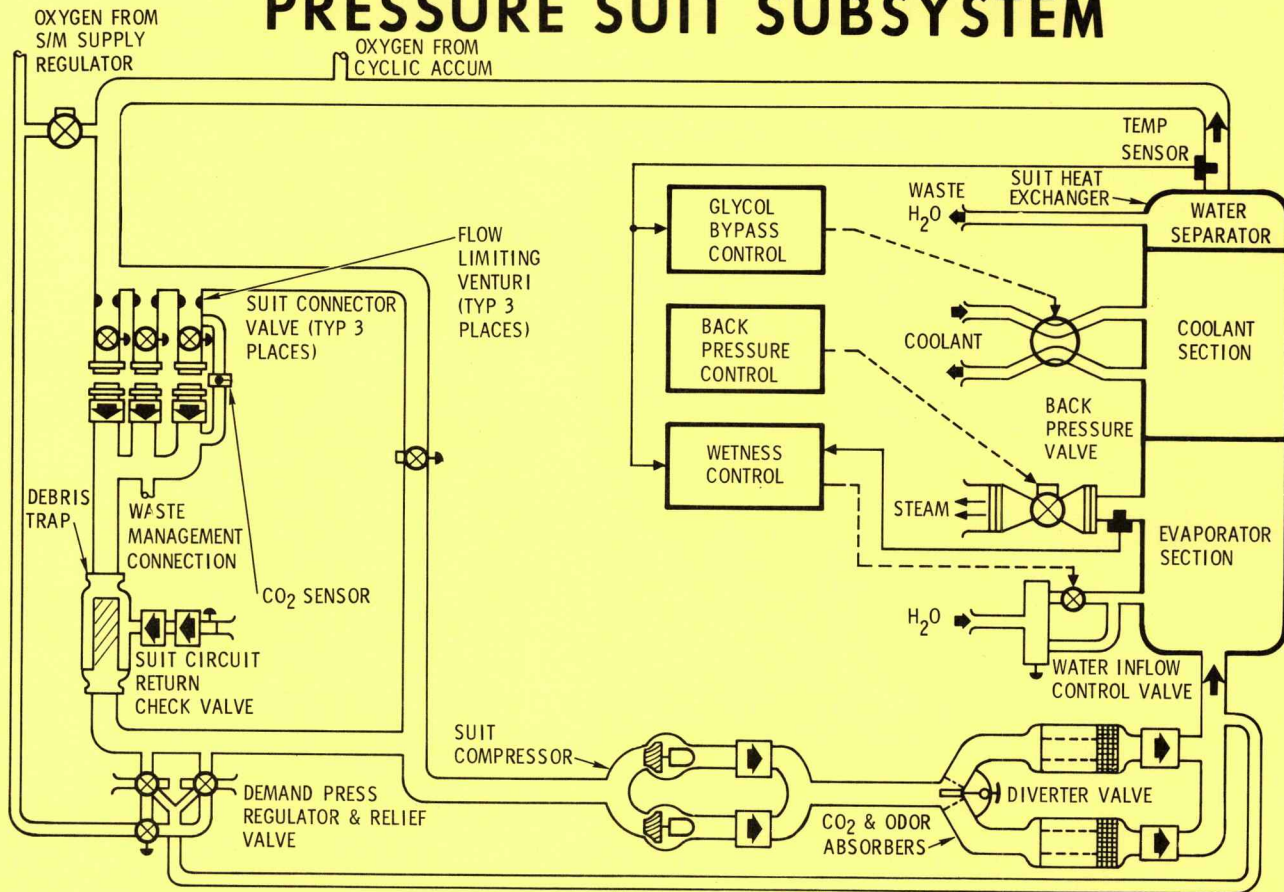
- PRIMARY HEAT TRANSFER
- COOLING FOR SUIT & ELECTRONICS
- HEATING OR COOLING FOR CABIN
- REJECTS EXCESS HEAT TO SPACE



OXYGEN SUBSYSTEM

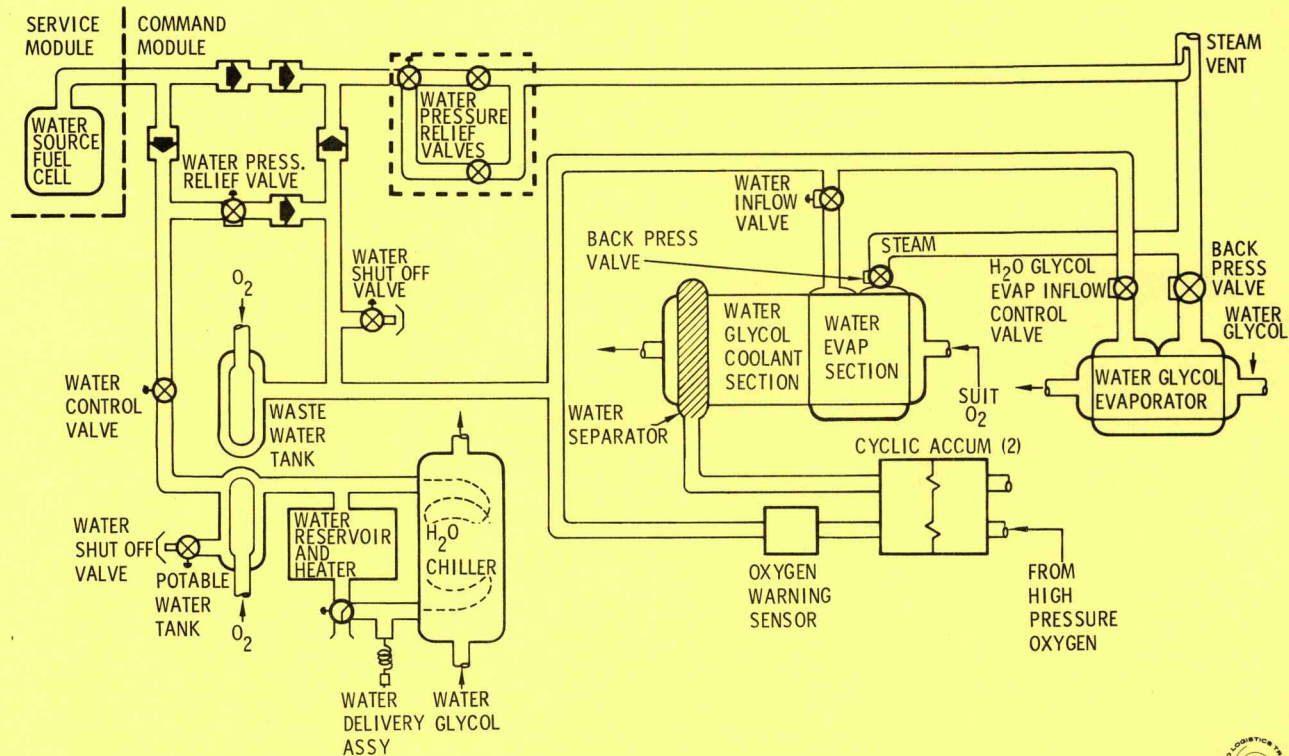


PRESSURE SUIT SUBSYSTEM

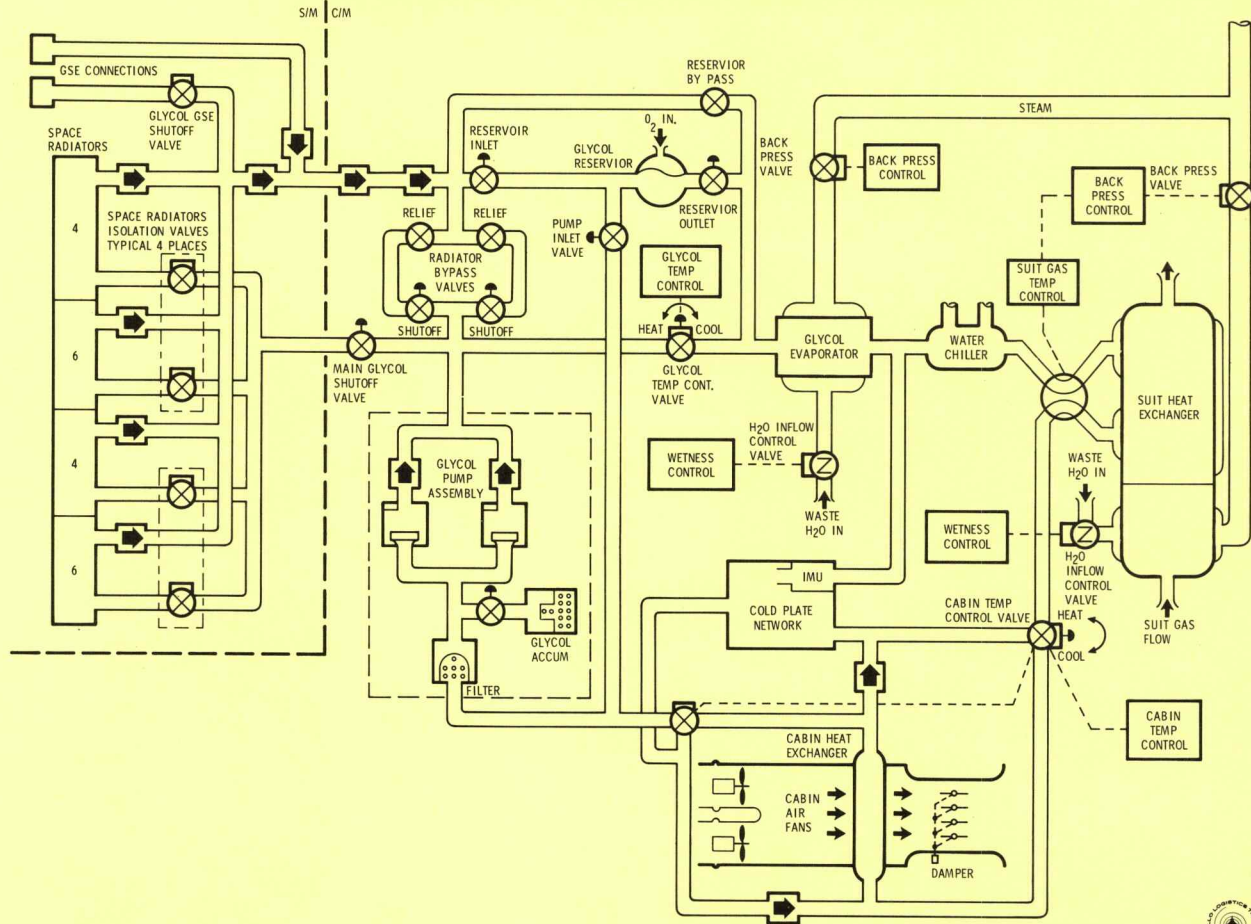


ENVIRONMENTAL CONTROL

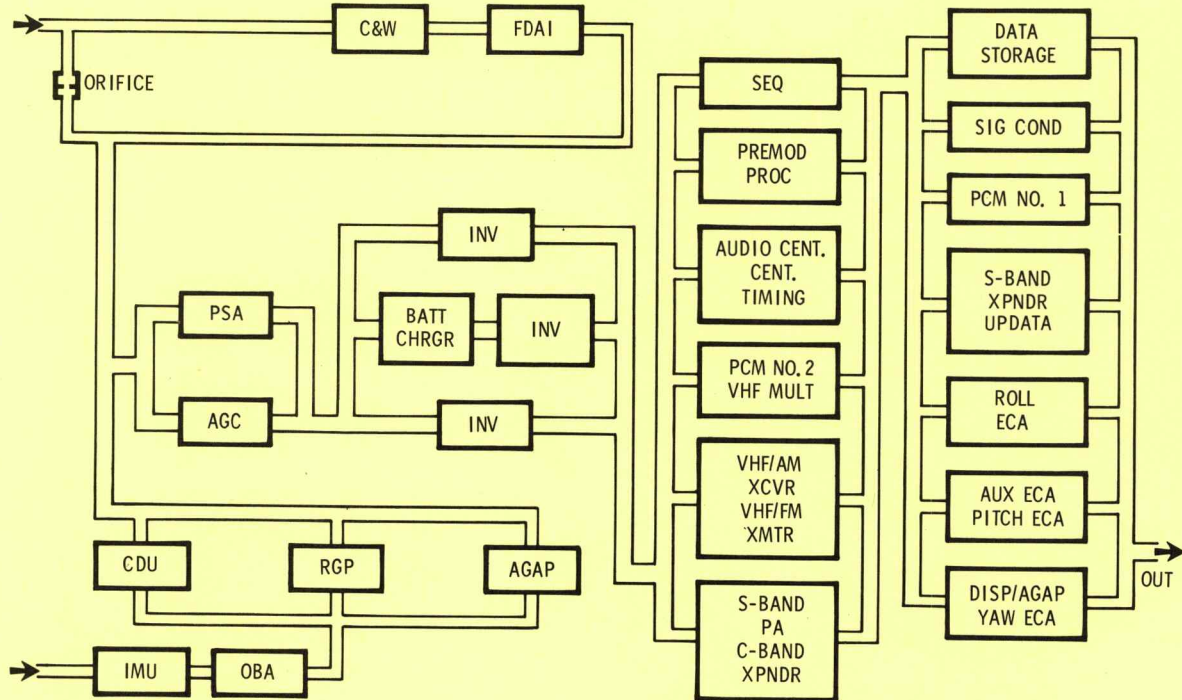
WATER SUBSYSTEM



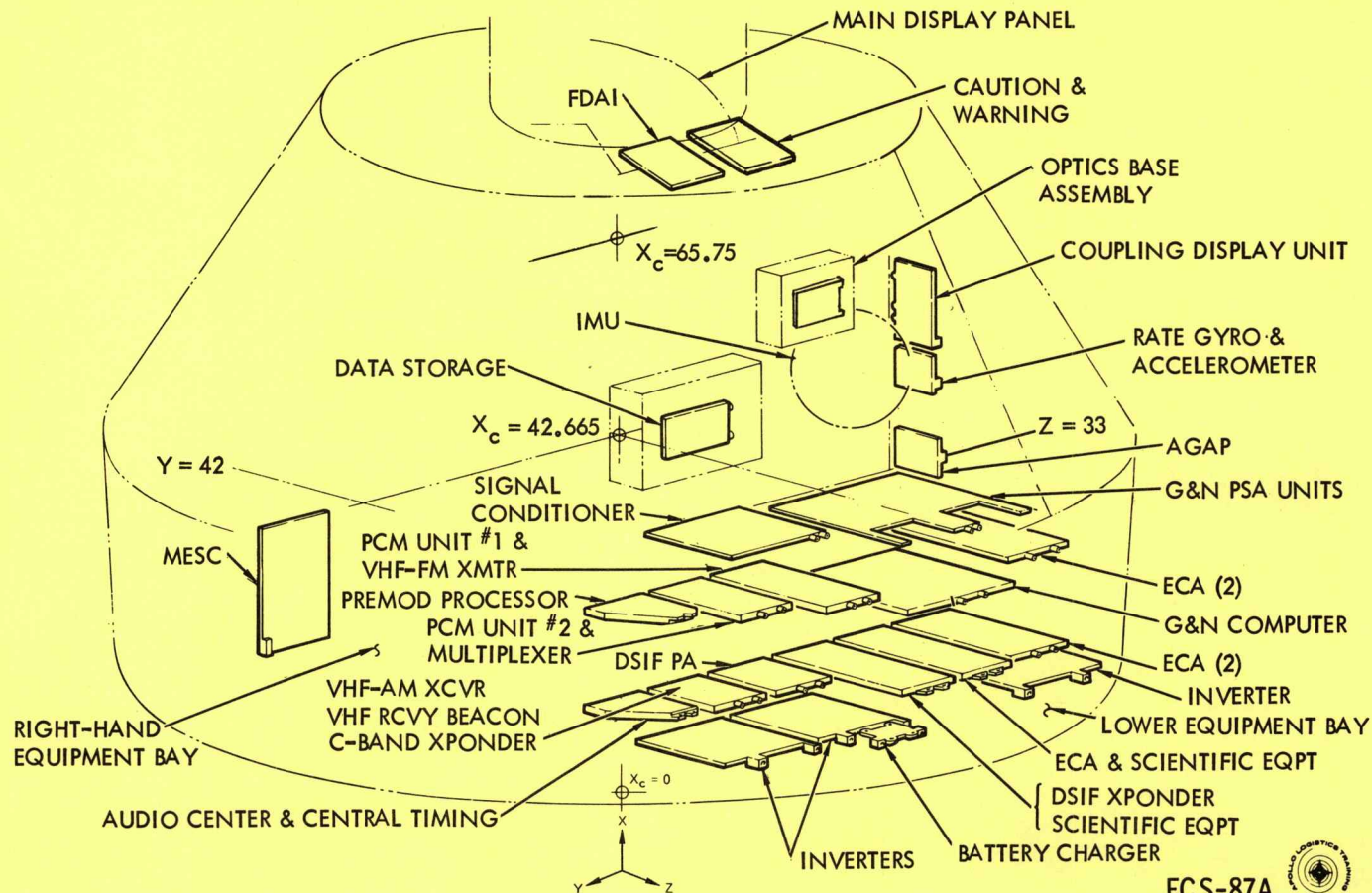
WATER GLYCOL SUBSYSTEM



COLDPLATE NETWORK



COMMAND MODULE COLDPLATE PROVISIONS



FCS-87A



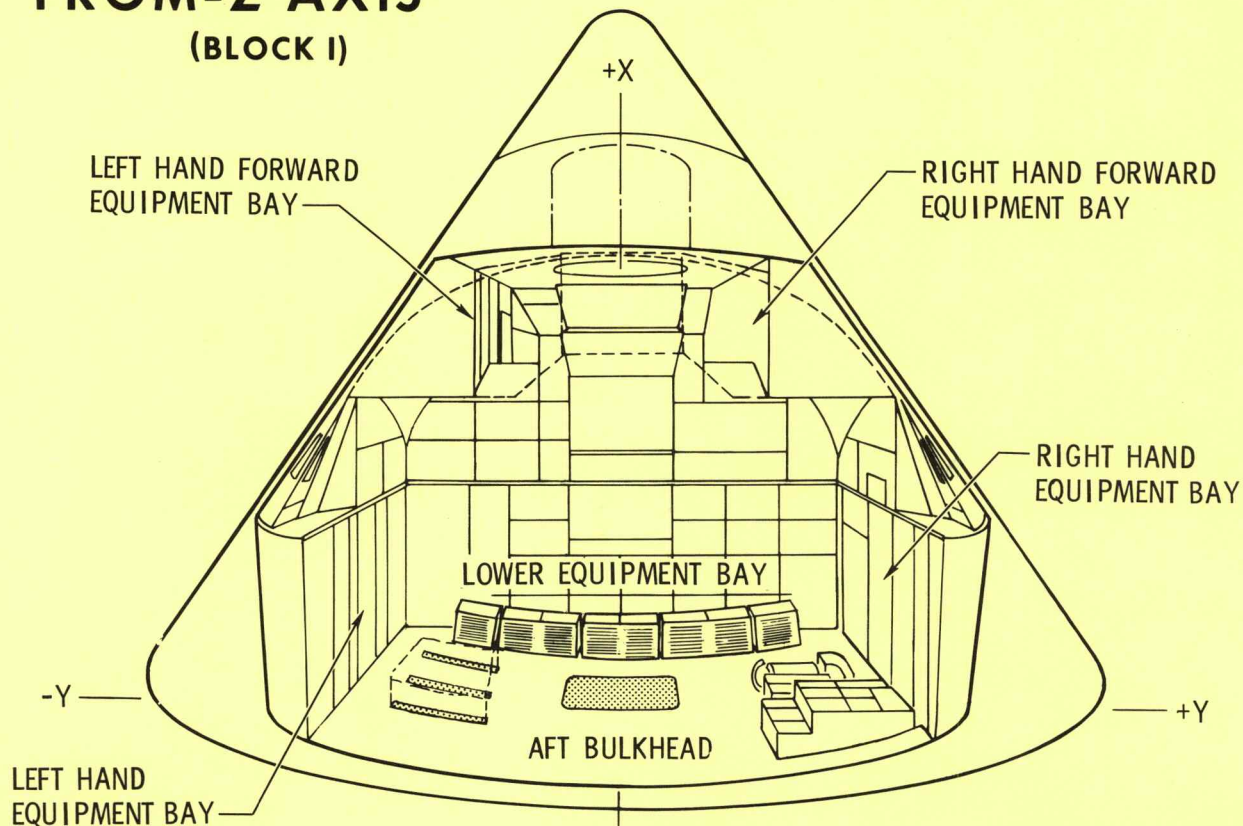
CREW EQUIPMENT

FAM-5015

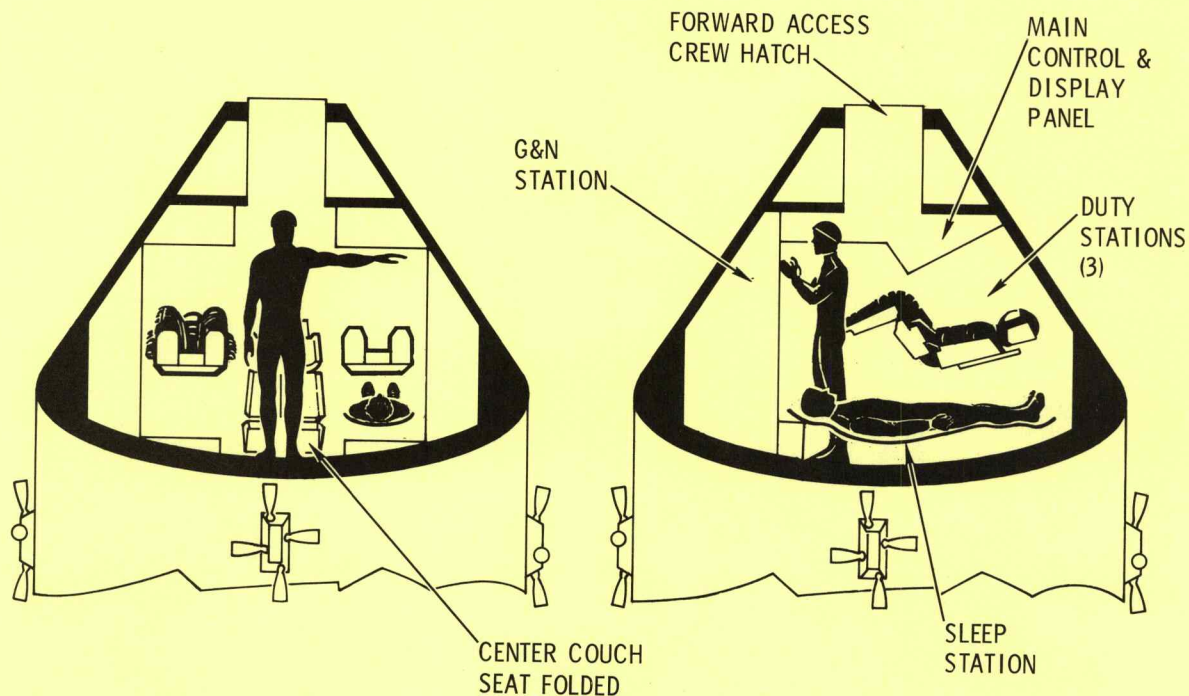


APOLLO CREW COMPARTMENT, INT VIEW, FROM-Z AXIS

(BLOCK I)



APOLLO CREW STATIONS

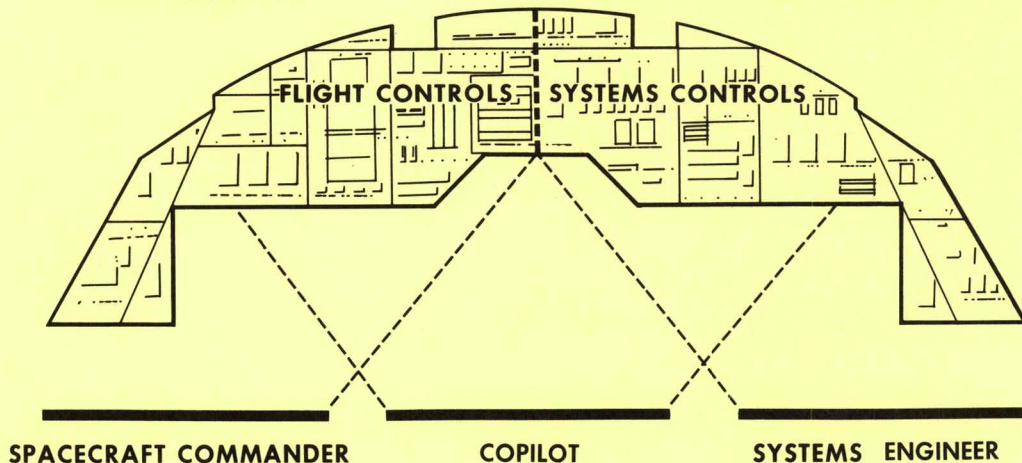


FAM-5008 A



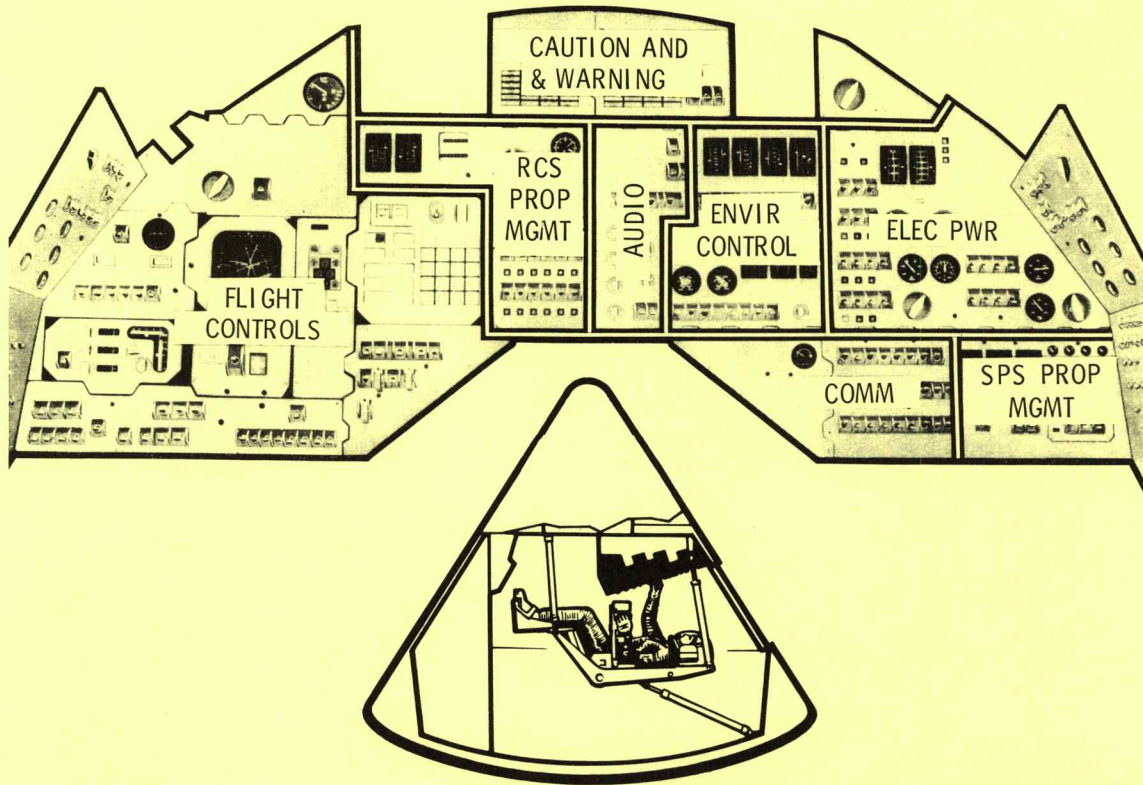
MAIN PANEL FUNCTIONS

- LV EMERGENCY DETECTION
- FLIGHT ATTITUDE
- MISSION SEQUENCE
- ΔV MONITOR
- ENTRY MONITOR
- PROPELLANT GAGING
- ENVIRONMENT CONTROL
- COMMUNICATIONS CONTROL
- POWER DISTRIBUTION
- MALFUNCTION DETECTION



MAIN PANEL

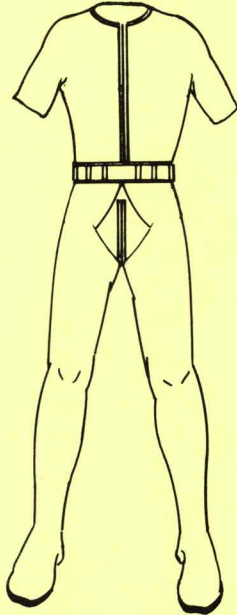
(BLOCK I)



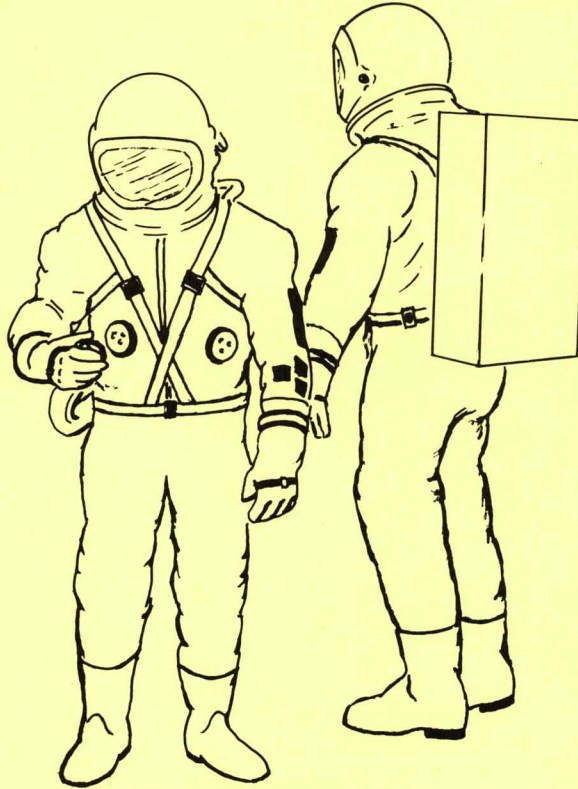
FAM-5403



CREWMAN CLOTHING



CONSTANT
WEAR
GARMENT

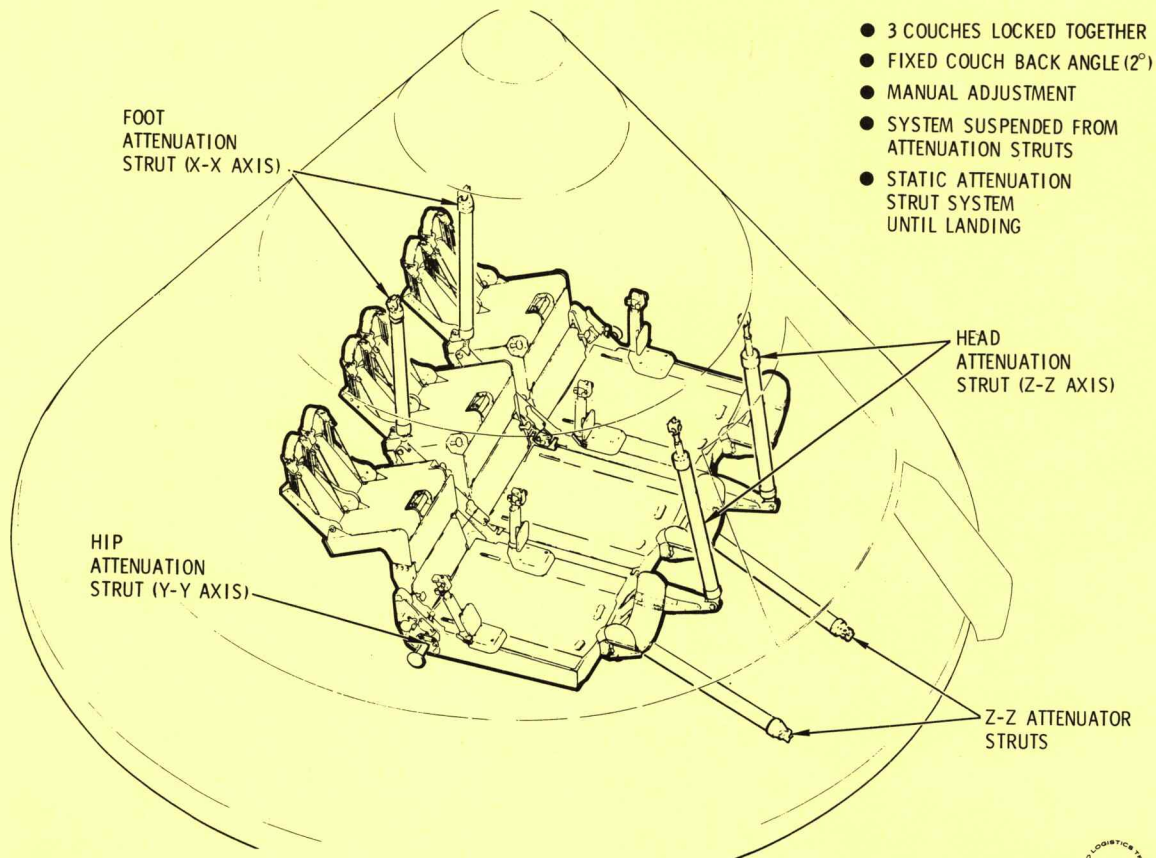


APOLLO PRESSURE SUIT &
PORTABLE LIFE SUPPORT SYSTEM



THERMAL
GARMENT

CREW COUCH INSTALLATION



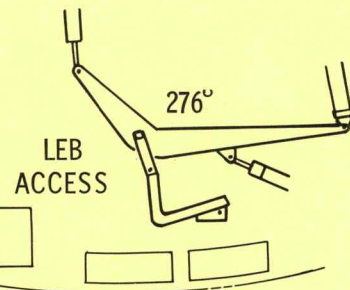
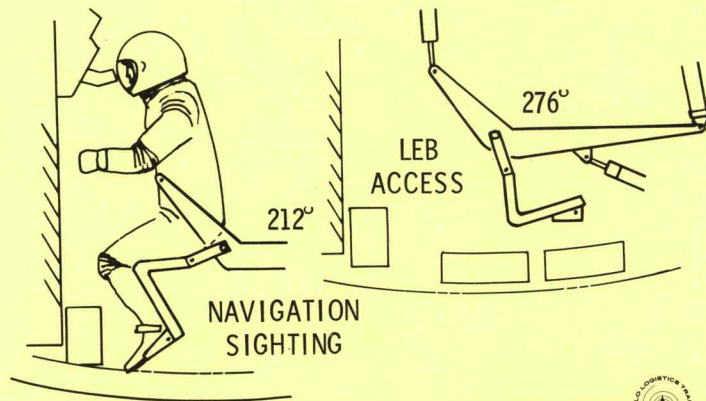
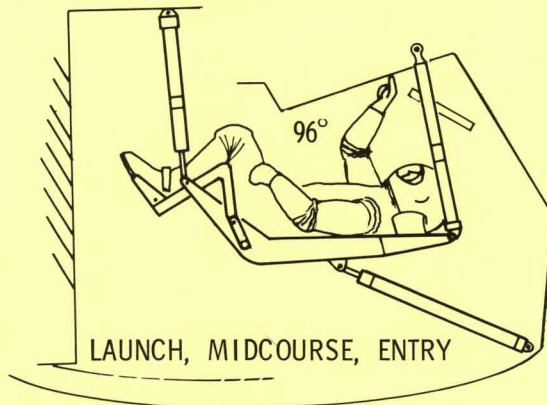
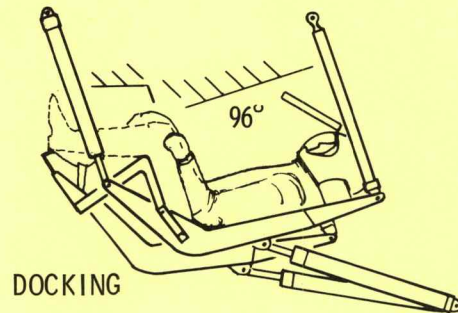
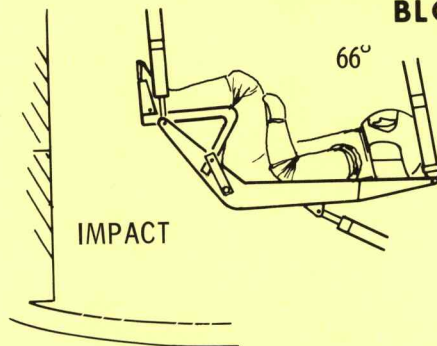
REF: V16-531501

FEB 66

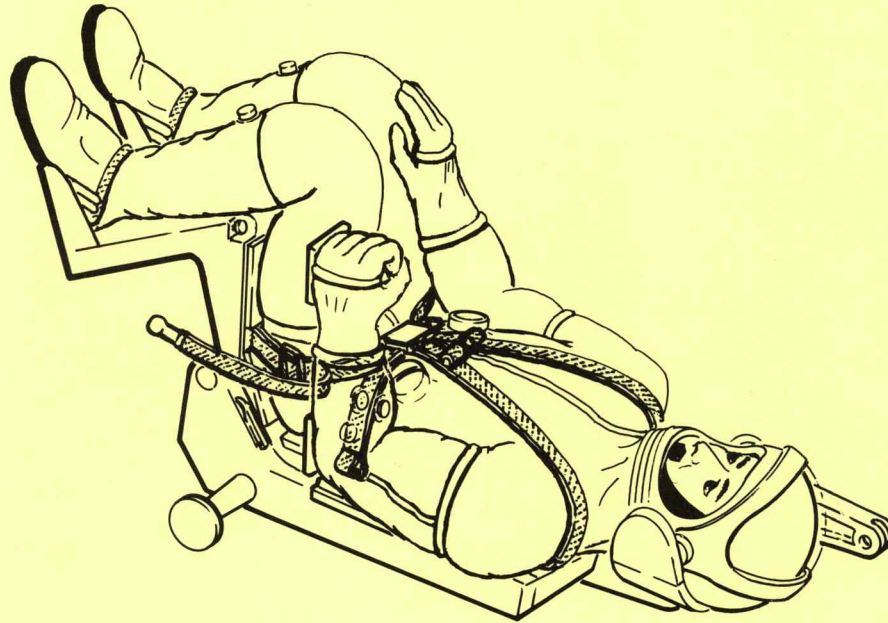
CS-2001B 

CREW COUCH POSITIONS

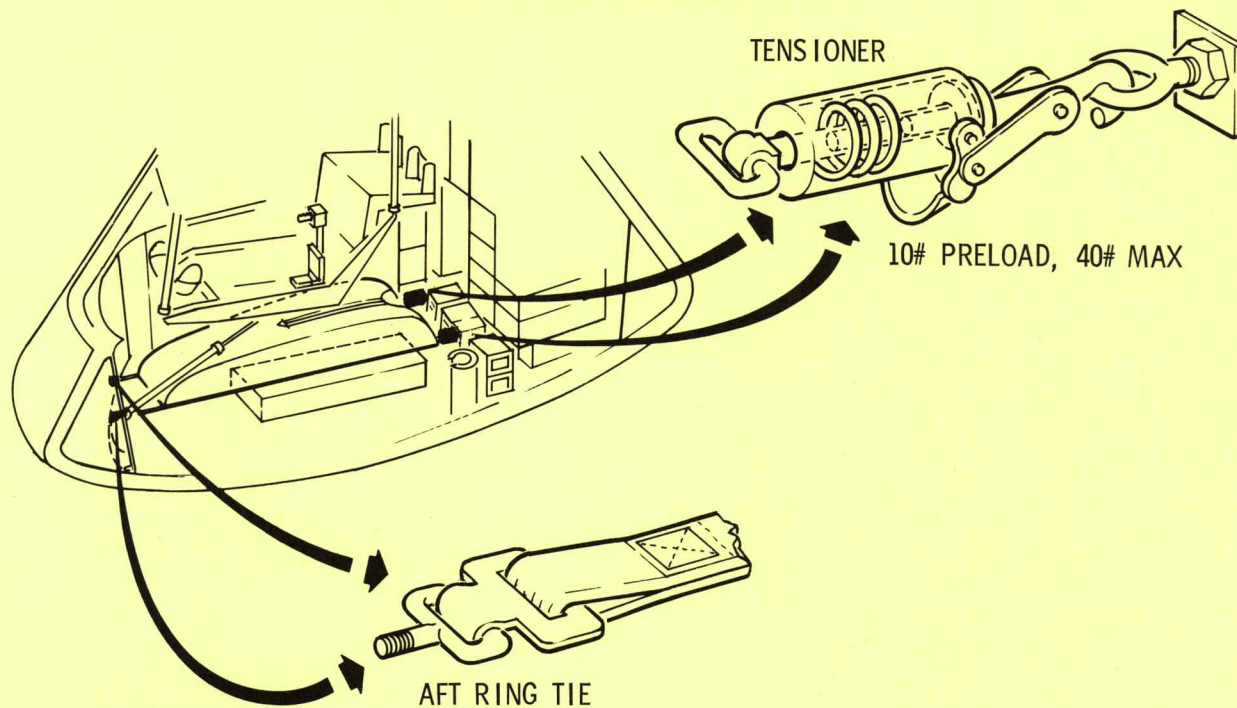
BLOCK I & BLOCK II



APOLLO CREWMAN RESTRAINT HARNESS ASSEMBLY



SLEEPING POSITION RESTRAINT CONFIGURATION

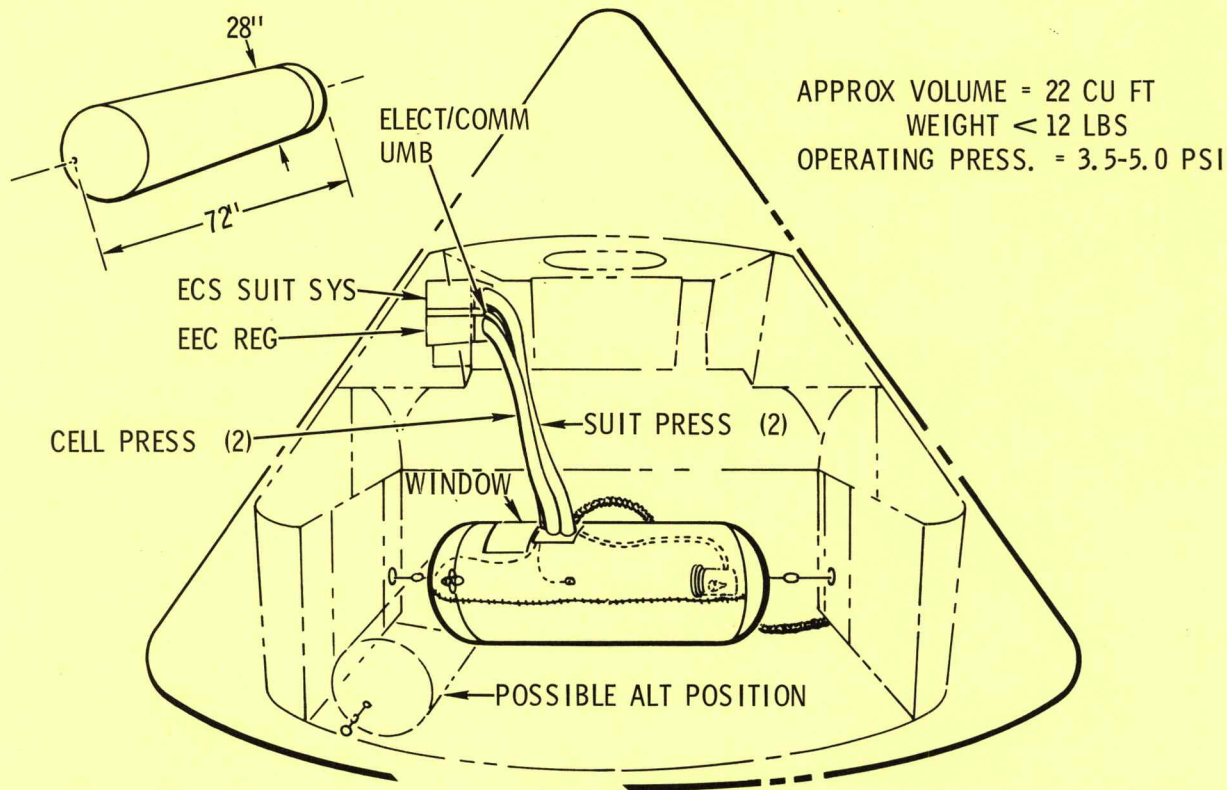


JUN 65

CS-2330



EMERGENCY ENVIRONMENTAL CHAMBER (EEC)



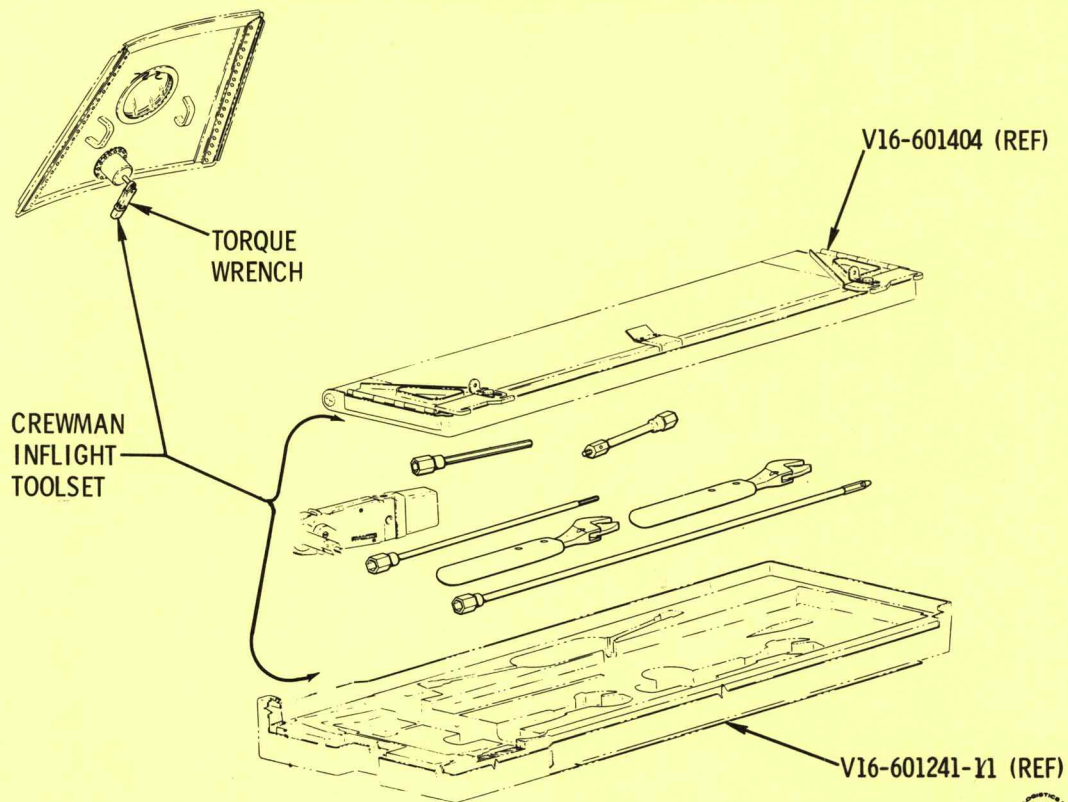
MAR 65

CS-5475



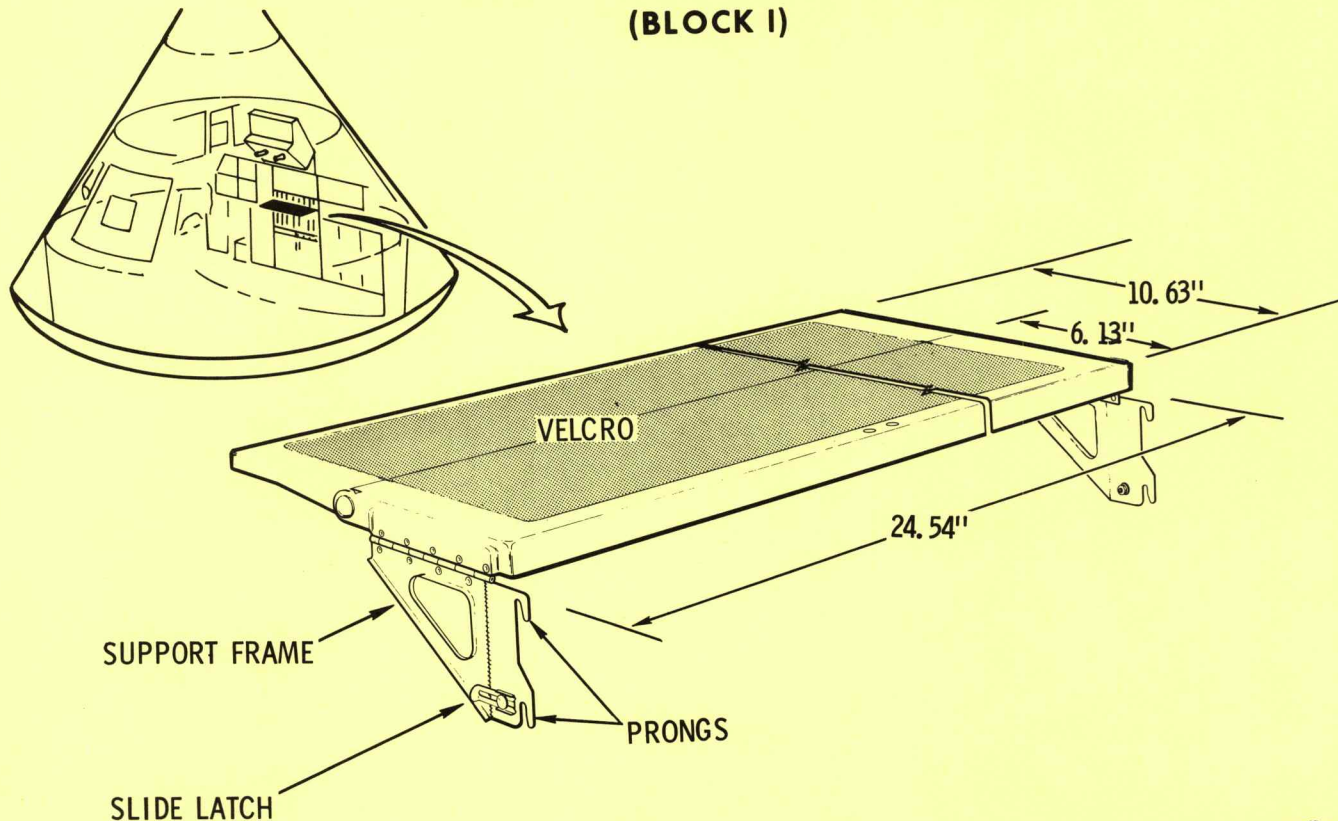
FIELD INSTALLATIONS

CREWMAN INFLIGHT TOOLSET

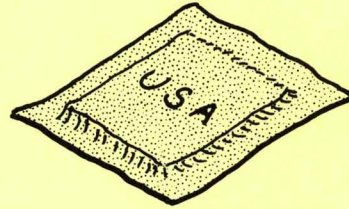
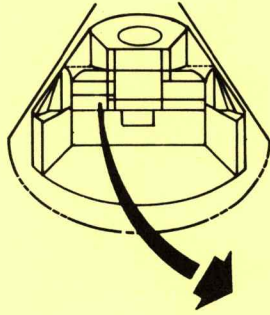


WORK/FOOD SHELF

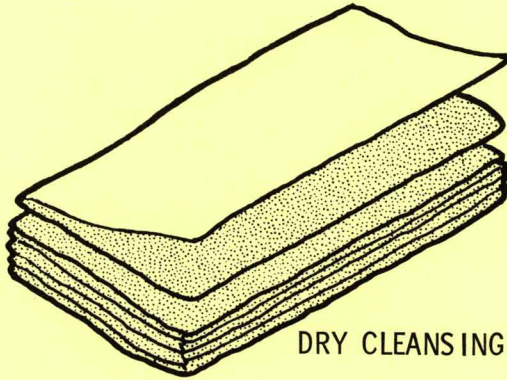
(BLOCK I)



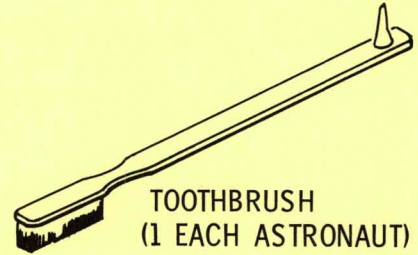
PERSONAL HYGIENE ITEMS



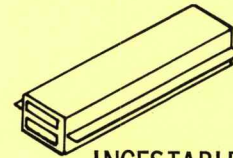
WET CLEANSING CLOTH



DRY CLEANSING CLOTH

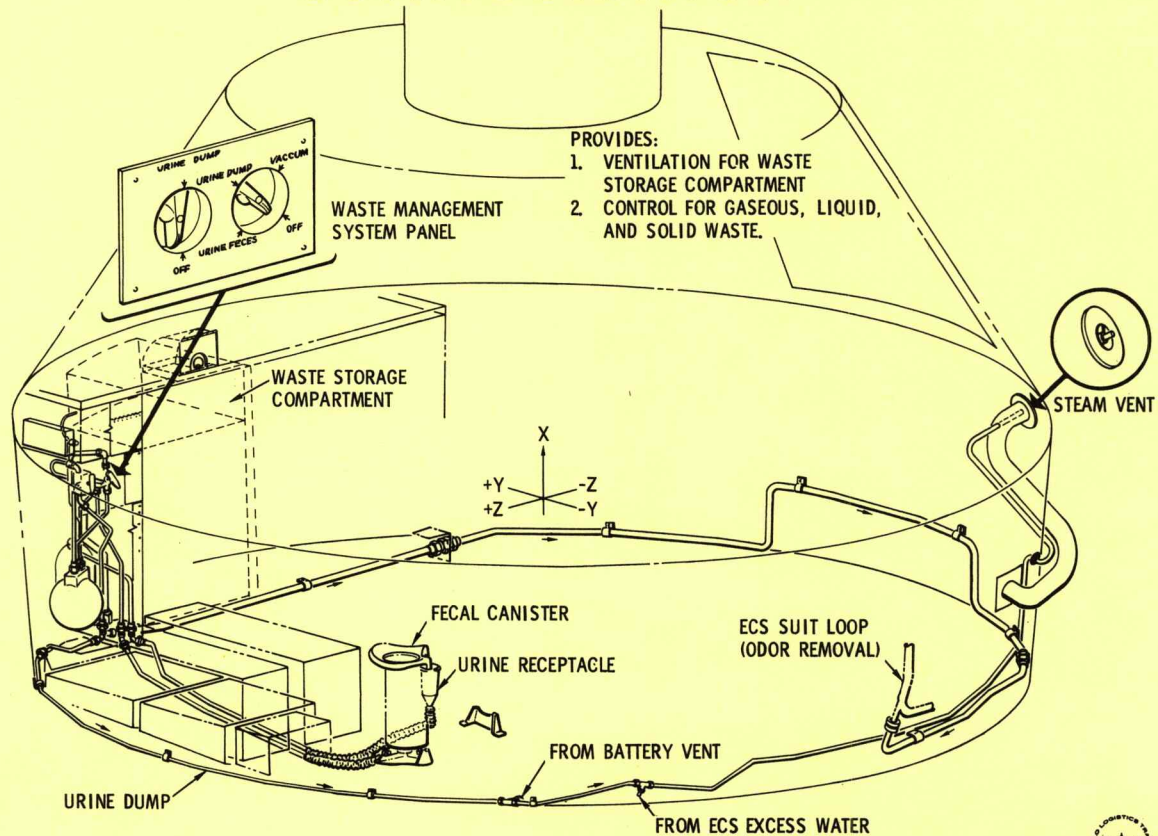


TOOTHBRUSH
(1 EACH ASTRONAUT)

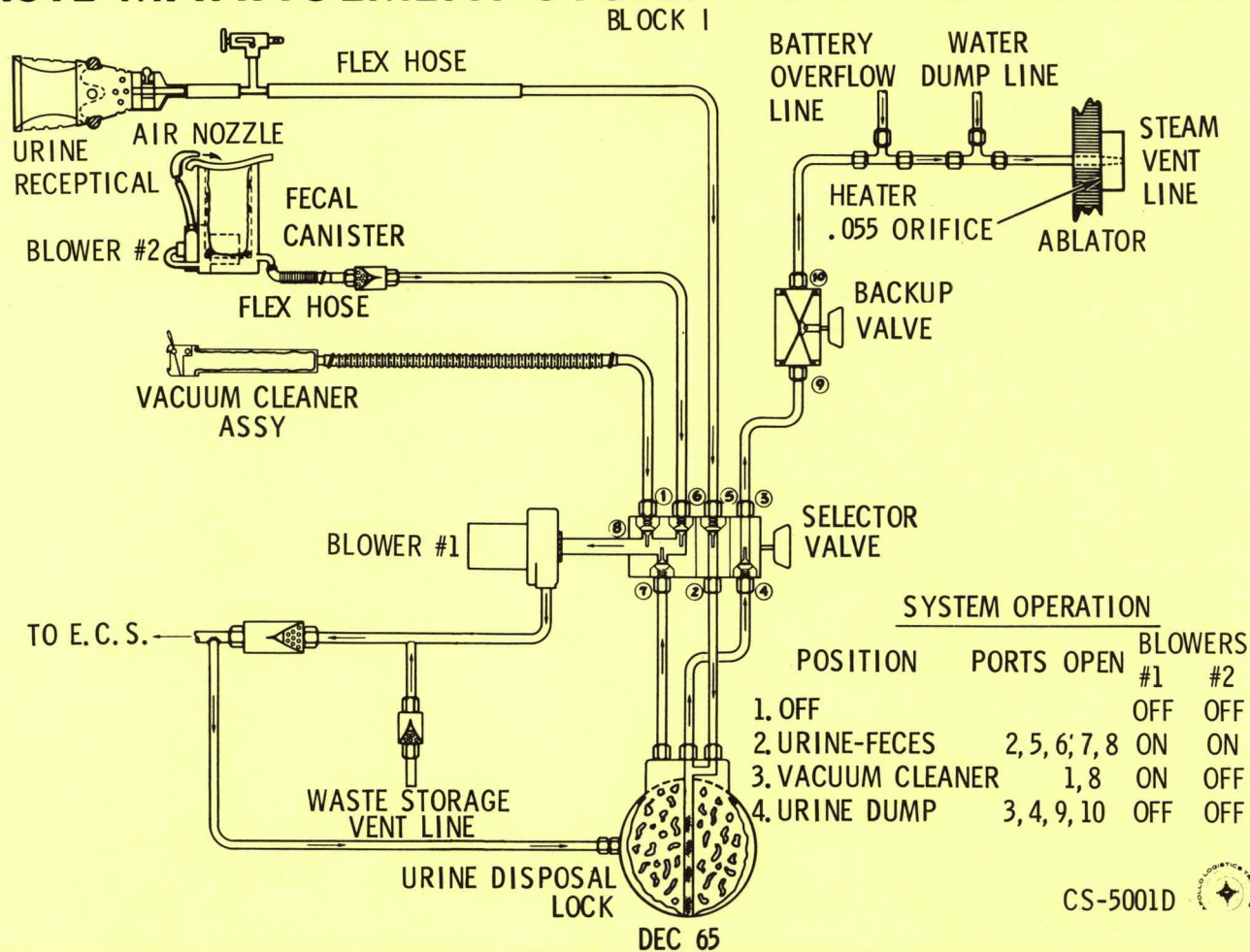


INGESTABLE GUM PACK
(2 STICKS PER PACK)

WASTE MANAGEMENT SYSTEM CONFIGURATION



WASTE MANAGEMENT SYSTEM FUNCTIONAL FLOW

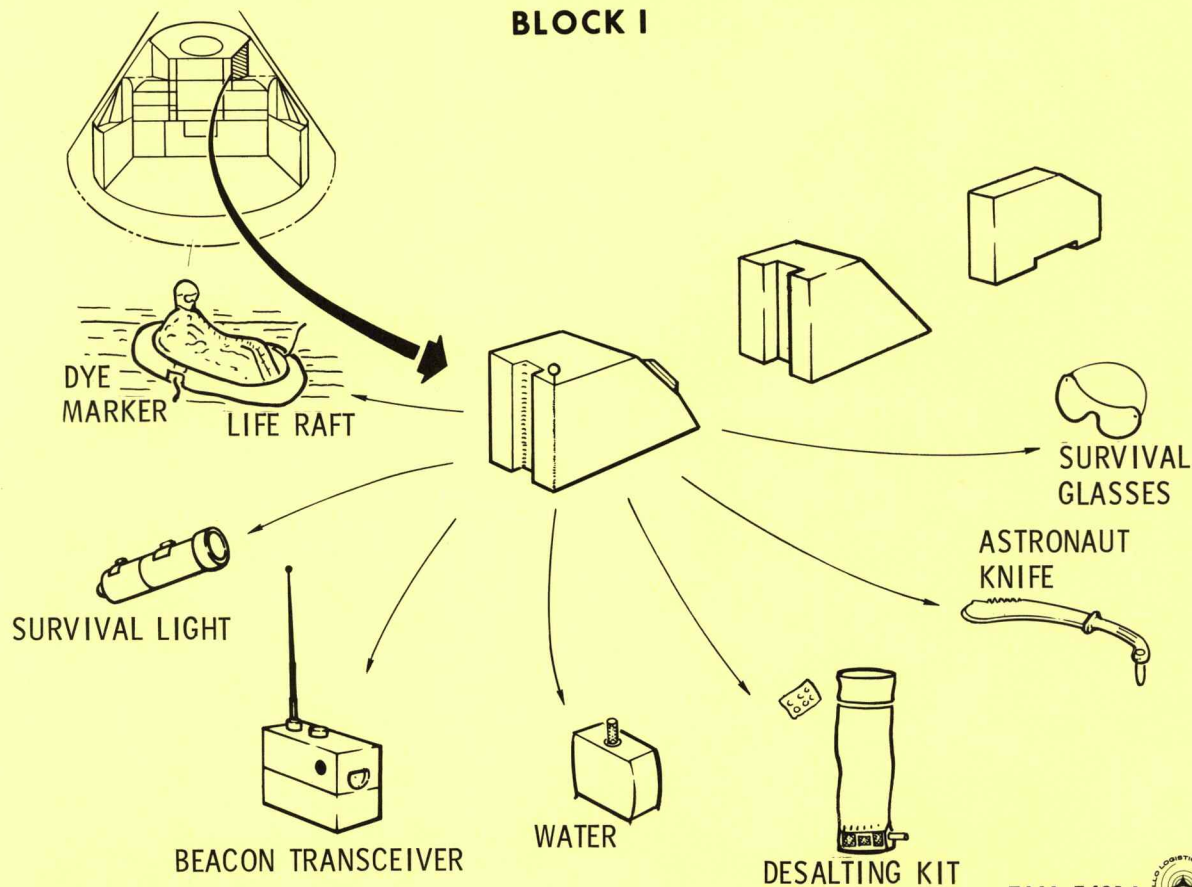


CS-5001D



APOLLO SURVIVAL KIT AND COMPONENTS

BLOCK I



FAM-5401A



APOLLO ABBREVIATIONS

ACE	ACCEPTANCE CHECKOUT EQUIP.	LEM	LUNAR EXCURSION MODULE
AGAA	ATTITUDE GYRO ACCELEROMETER ASSEMBLY (SCS)	LES	LAUNCH ESCAPE SUBSYSTEM (SECS)
AGC	APOLLO GUIDANCE COMPUTER (G&N)	LET	LAUNCH ESCAPE TOWER (SECS)
AGCU	ATTITUDE GYRO COUPLING UNIT (SCS)	L/O	LIFT-OFF
APS	APOLLO PRESSURE SUIT	LOR	LUNAR ORBITAL RENDEZVOUS
ARS	ATTITUDE REFERENCE SUBSYSTEM (SCS)	LOS	LINE OF SIGHT (G&N)
AM	AMPLITUDE MODULATION (COMM)	LSC	LINEAR SHAPE CHARGE (SECS)
AMS	APOLLO MISSION SIMULATOR	LV	LAUNCH VEHICLE
BMAG	BODY MOUNTED ATTITUDE GYRO (SCS)	MC	MEGACYCLES
BPC	BOOST PROTECTIVE COVER (SECS)	MESC	MASTER EVENTS SEQUENCE CONTROLLER (SECS)
B/P	BOILERPLATE	MSC	MANNED SPACECRAFT CENTER (HOUSTON)
CG	CENTER OF GRAVITY	MSFN	MANNED SPACE FLIGHT NETWORK (COMM)
C/M	COMMAND MODULE	MTVC	MANUAL THRUST VECTOR CONTROL (SCS)
COMM	COMMUNICATIONS SUBSYSTEM	PCM	PULSE CODE MODULATION (COMM)
CSM	COMMAND SERVICE MODULE	PGA	PRESSURE GARMENT ASSEMBLY (CREW)
CTE	CENTRAL TIMING EQUIP. (COMM)	PLSS	PORTABLE LIFE SUPPORT SYSTEM (CREW)
CWG	CONSTANT WEAR GARMENT (CREW)	PM	PHASE MODULATION (COMM)
DSE	DATA STORAGE EQUIP. (COMM)	PMP	PREMODULATION PROCESSOR (COMM)
DSIF	DEEP SPACE INSTRUMENTATION FACILITY (COMM)	PRN	PSEUDO-RANDOM NOISE (COMM)
ΔV	DIFFERENTIAL VELOCITY (G&C)	PROP	PROPULSION
ECA	ELECTRONIC CONTROL ASSEMBLY (SCS)	Q	DYNAMIC PRESSURE
ECS	ENVIRONMENTAL CONTROL SUBSYSTEM	RCS	REACTION CONTROL SUBSYSTEM
EDS	EMERGENCY DETECTION SUBSYSTEM (SECS)	RGA	RATE GYRO ASSEMBLY (SCS)
ELS	EARTH LANDING SUBSYSTEM (SECS)	S/C	SPACECRAFT
EPS	ELECTRICAL POWER SUBSYSTEM	SCS	STABILIZATION & CONTROL SUBSYSTEM
EVA	EXTRA-VEHICULAR ACTIVITY (CREW)	SCT	SCANNING TELESCOPE (G&N)
FC	FUEL CELL (EPS)	SECS	SEQUENTIAL EVENTS CONTROL SUBSYSTEM
FDAI	FLIGHT DIRECTOR ATTITUDE INDICATOR (SCS)	SLA	SPACECRAFT LEM ADAPTER
FHS	FORWARD HEAT SHIELD	SM	SERVICE MODULE
FM	FREQUENCY MODULATION (COMM)	SPS	SERVICE PROPULSION SUBSYSTEM
G&C	GUIDANCE & CONTROL	SSA	SPACE SUIT ASSEMBLY (CREW)
G&N	GUIDANCE & NAVIGATION	SXT	SEXTANT (G&N)
GOSS	GROUND OPERATION SUPPORT SYSTEM (COMM)	TCA	THRUST CHAMBER ASSEMBLY (PROP)
GSE	GROUND SUPPORT EQUIP.	TLM	TELEMETRY (COMM)
HF	HIGH FREQUENCY (3-30MC)	TVC	THRUST VECTOR CONTROL (SPS)
IMU	INERTIAL MEASUREMENT UNIT (G&N)	UDL	UP DATA LINK (COMM)
IU	INSTRUMENT UNIT (LV)	UDMH	UNSYMMETRICAL DIMETHYL HYDRAZINE (PROP)
KMC	KILOMEGA CYCLES (2 KMC = S BAND)(5KMC = C BAND)	UHF	ULTRA HIGH FREQUENCY (300-3000 MC)
KOH	POTASSIUM HYDROXIDE (EPS)	USBE	UNIFIED S-BAND EQUIP. (COMM)
KSC	KENNEDY SPACE CENTER (FLORIDA)	VHF	VERY HIGH FREQUENCY (30-300MC)
		WMS	WASTE MANAGEMENT SUBSYSTEM (CREW)

