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APOLLO STATUS REPORT [redacted] JAN-FEB 1962

24 February 1962

4.5.4.2

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NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

[redacted]

APOLLO

STATUS REPORT

JAN-FEB 1962

S&ID

2-62 AP 10136
①

SCOPE OF BRIEFING

- SUGGESTED GROUND RULES FOR NAA APOLLO STATUS REPORTS
- APOLLO MANAGER STATUS REPORT
- NAA SUBCONTRACTOR EVALUATION PROCEDURE
- POWER SYSTEMS & GSE
- FLIGHT, LIFE & ELECTRONIC SYSTEMS
- STRUCTURES, INTEGRATION & RELIABILITY
- FACILITIES

GROUND RULES-NAA STATUS REPORT

- OVERALL PROGRAM REPORT
  - MANAGEMENT
    - ORGANIZATIONAL CHANGES
    - MAJOR EVENTS, MEETINGS, AGREEMENTS
    - SCHEDULE STATUS (MAJOR MILESTONES)
    - CHANGES IN SCOPE OR WORK STATEMENT
  - SELECTED SUBJECTS BY ACTIVITY
  - MAJOR FUTURE ACTIVITIES
  - RECOMMEND QUARTERLY STATUS REPORT

2-62 AP 10138

APOLLO MANAGER STATUS REPORT

- ORGANIZATION
- RESPONSIBILITIES
- MAJOR EVENTS & MILESTONES
- SELECTED SUBJECTS
  - MANPOWER
  - PROGRAM CONTROL
  - ENGINEERING ORG PLANS & STUDIES
  - PROPOSAL STATUS
  - INTEGRATION
  - OPERATIONS
- MAJOR FUTURE ACTIVITIES

S&ID ORGANIZATION

ORGANIZATION BACKGROUND

- OCT 61 PROPOSAL

  PROJECT/FUNCTIONAL BACK-UP

  POST PROPOSAL STUDIES

- JAN 62 S&ID REORGANIZATION

  CENTRAL FUNCTIONS & GEN. ADMIN.

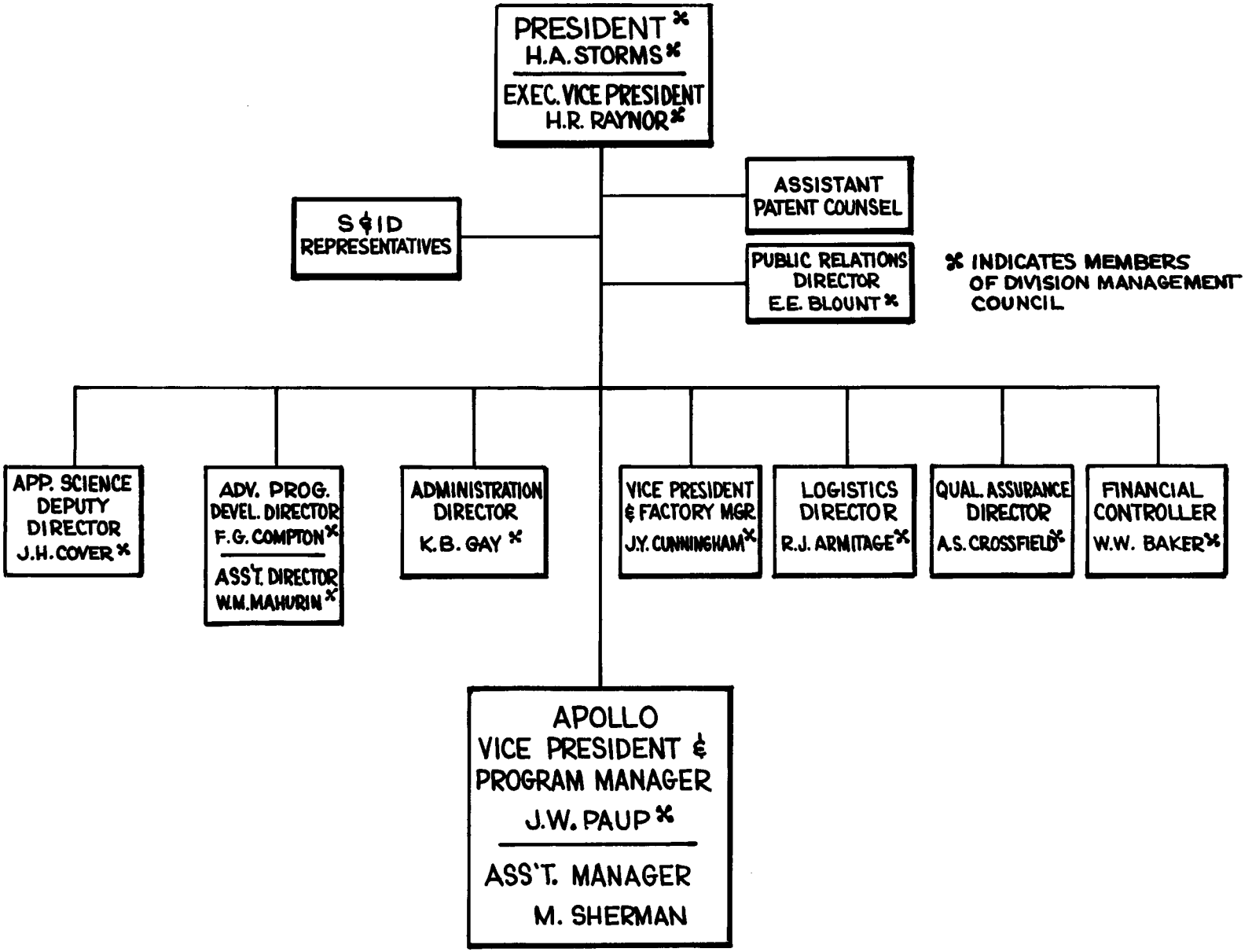
  PROGRAM SUB DIVISIONS

  PHASED DEVELOPMENT

PHASES OF ORG DEVELOPMENT

	APOLLO DIV	FUNCT DIV
PHASE I (JAN-MAR)	ENG., PROG. CONT., MAT., MFG. A/C, LOG	C.A., FACIL., ADMIN APP. SCI., MFG DETAIL Q.A.
PHASE II (APR-JUN)	PHASE I & C.A., FAC., ADM. SERV.	APP SCI., MFG DETAIL Q.A.
PHASE III (POST 62)	STUDY ADDITIONAL MFG ADMINISTRATION, RELIABILITY & SYSTEM TEST PROJECT RESPONSIBILITY	

S&ID ORGANIZATION



2-62 AP 10143
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S & ID RESPONSIBILITIES

FUNCTIONAL RESPONSIBILITY

- APP. SCI.
  - LABS
  - ADV. DES.
  - OPS ANAL.
- ADMIN
  - HOUSEKEEPING
  - GEN. PURCH.
  - BUILD UP FACIL ORG
  - BUILD UP C.A. ORG
- MFG
  - DETAIL FAB
  - TOOLING
  - MFG PLANNING
- LOGISTICS
  - PUBLICATIONS & GRAPHICS
- FINANCIAL
  - ACCOUNTING
  - FIN. DATA PROC.
- PUBLIC REL.
  - DIV. AREA REPS
  - PATENT COUNSEL

POLICY GUIDANCE PLUS SPECIFIC SUPPORT

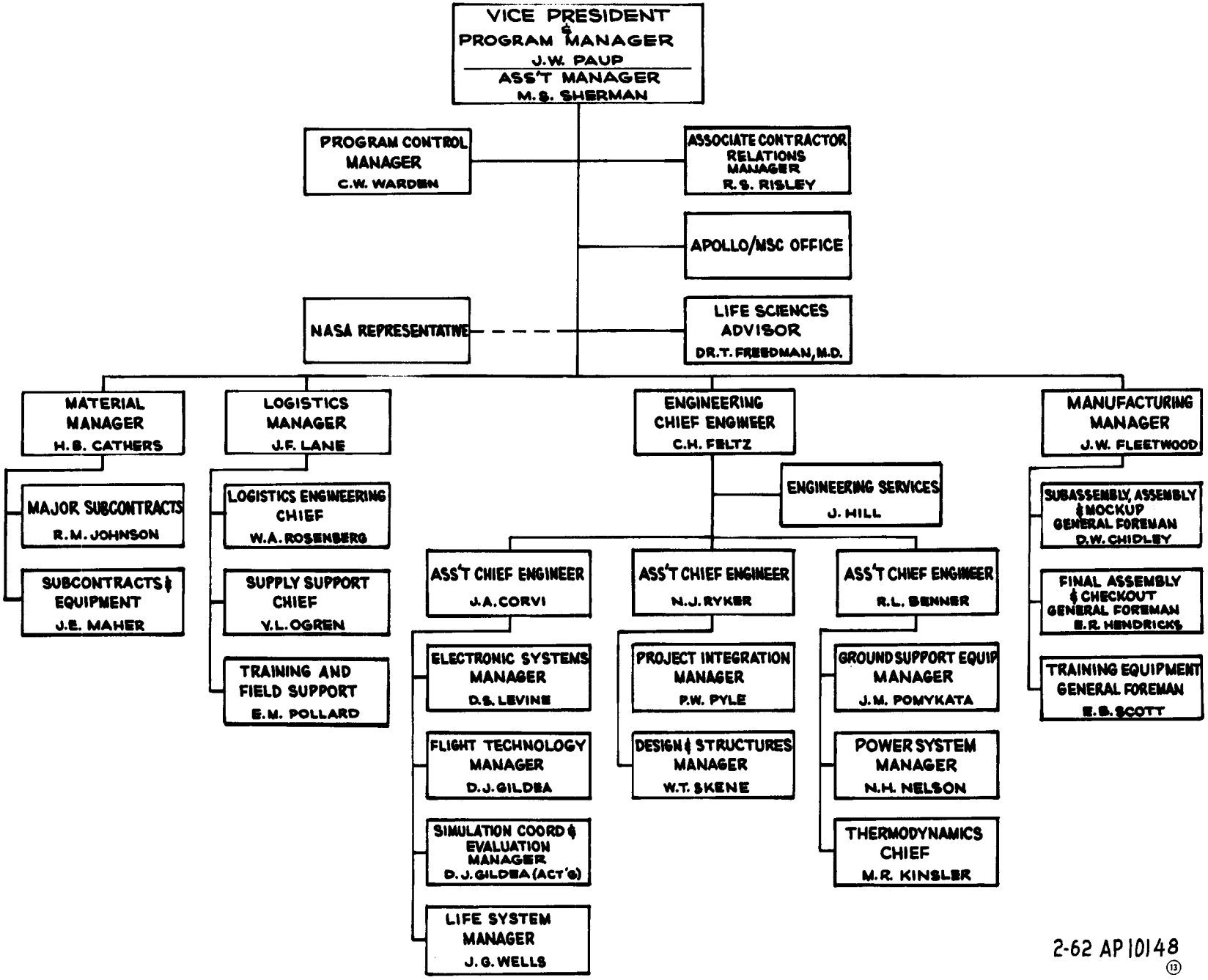
2-62 AP 10145

QUALITY ASSURANCE

- SYSTEM TEST
  - FIELD SUPPORT OPERATIONS
  - CONDUCT SYS TESTS
- RELIABILITY
  - STAT. DATA
  - METHODS
  - PROGRAM
    - ANALYSE
    - APPORTION
    - ASSESS
- QUAL CONTROL
  - INDEPENDENT QUALITY SURVEIL.
  - ADVISORY TO PROGRAM

APOLLO ORGANIZATION

APOLLO DIVISION



2-62 AP 10148
(13)

APOLLO RESPONSIBILITIES

PROGRAM RESPONSIBILITIES

- ENGINEERING
  - FULL TECHNICAL RESPONSIBILITY
- PROGRAM CONTROL
  - PERT
  - CHANGE CONTROL COORD.
  - PROGRESS REPORTS
  - BURDEN ADMIN.
  - MANPOWER FORECAST
  - CONTROL ROOM
  - STANDUP BRIEFING
- LOGISTICS
  - LOG. ENGINEERING
  - SUPPLY SUPPORT
  - TRNG & FLD SUPPORT

PROGRAM RESPONSIBILITIES

- MANUFACTURING
  - ASSEMBLY
  - SUBASSEMBLY
  - MOCK-UP
  - FINAL ASSEMBLY
  - CHECK OUT
  - TRNG. EQUIP.
- MATERIAL
  - MAJOR SUBCONTRACTORS
  - SUB-CONTRACTS & EQUIP
  - ANALYSIS & CONTROL
- ASSOC. CONTR REL.
  - REPRESENTATION
  - NEGOTIATION & ADMIN OF AGREEMENTS
  - COORD., APOLLO/ASSOC EFFORT

2-62 AP 10151 (18)

MAJOR EVENTS

MAJOR EVENTS

- PROPOSAL
- AWARD
- WILLIAMSBURGH (CONTRACT)
- APPROVAL OF BIG 4
- THOUSANDS OF SUPPLIERS
- REORGANIZATION FOR SUB-DIV.
- NASA OFFICE AT NAA
- COST PROPOSAL RE-SCHEDULING
- FIRST STAND-UP BRIEFING
- NASA/NAA PERT CONFERENCE
- NASA/NAA MIT CONFERENCE

MAJOR EVENTS (CONT)

- JANUARY DOCUMENTATION DELIV.
- HEAT SHIELD & FUEL CELL SURVEY
- ONE VS. FOUR S/M PROPULSION
- STATIC FIRING FACILITY SURVEY (M^cG)
- NASA/NAA PLANNING DOCUMENT REVIEW
- LOCKHEED AWARD ANNOUNCED
- LEWIS LAB LUNAR LANDING MOD. MEETING
- G.E. ANNOUNCEMENT
- NAA HOUSTON REPS. OFFICE
- LITTLE JOE I OUT
- LITTLE JOE II PLAN ESTABLISHED

MAJOR MILESTONES

APOLLO MAJOR MILESTONES
(THRU 19 FEB)

MILESTONES	SCHED.	REV. SCHED.	COMP.
MAKE OR BUY LIST, PRELIM	1-19		1-19
HUMAN FACTORS SIMUL.	1-17	2-19	
LIFE SYSTEM TEST PLAN	1-16		1-16
WIND TUNNEL SCHED. DEFINED	1-11		1-11
MICROMETEROID IMPACT STUDY	1-31	2-20	
C/M BASIC LINES	1-17		1-17
LITTLE JOE II BOOSTER REQ'S	1-19		1-19
MISSION PROPULSION SPEC.	1-30	2-13	2-13
S/M BASIC LINES	1-18	2-20	

2-62 AP 10156

APOLLO MAJOR MILESTONES
(THRU 19 FEB) (CONT)

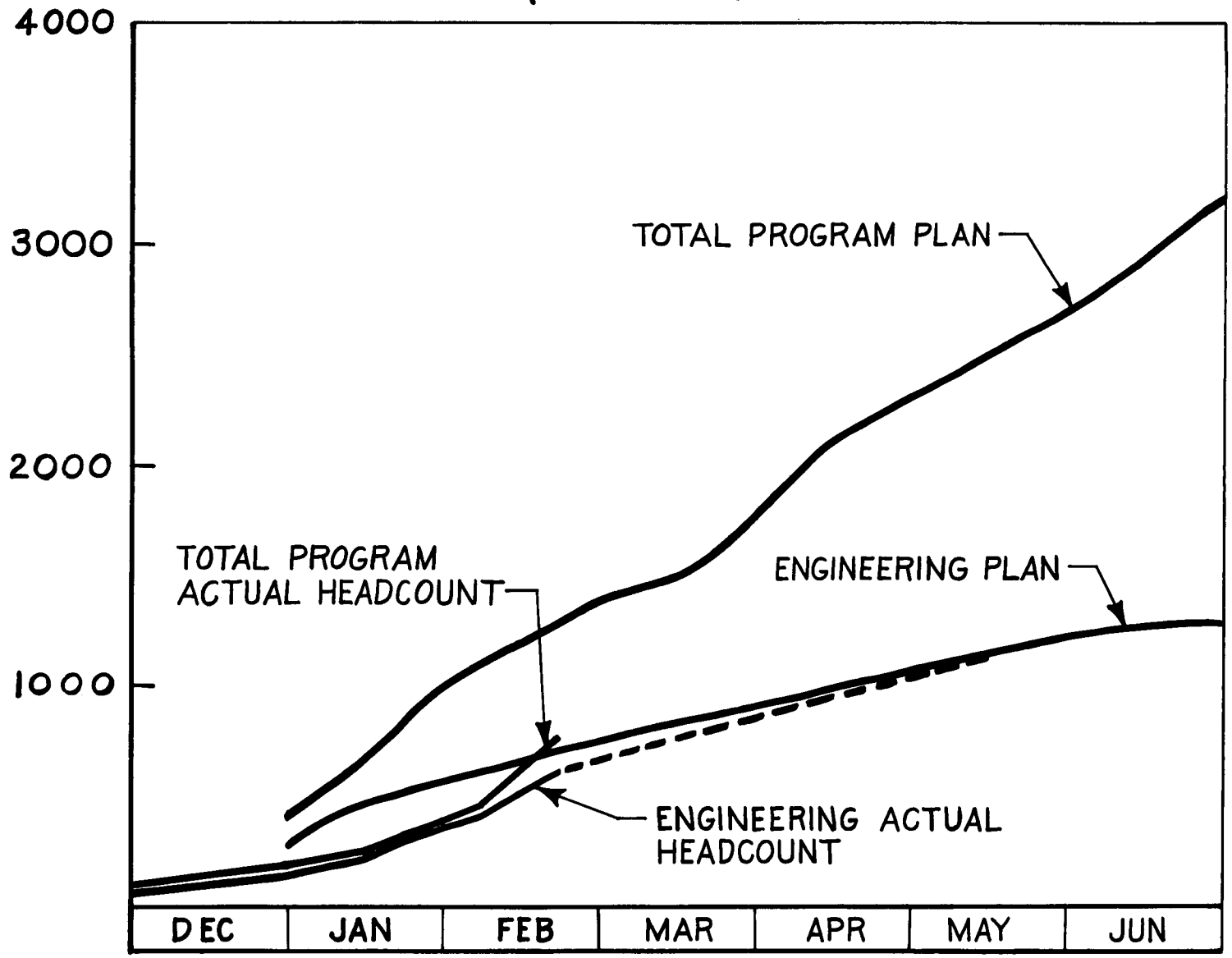
MILESTONES	SCHED	REV. SCHED	COMP
FUEL CELL VENDOR SEL.	1-2	2-28	
SURVEY OF ABLATION FACILTIES	1-9		1-9
PRELIM. MFG. PLAN	1-15		1-15
PRELIM. TEST, RELIAB. & FACILITIES PLAN	1-30		1-30
S/C PERFORMANCE SPEC.	2-15	2-20	
PRELIM. L.E.S. DESIGN	2-16	2-19	
PRELIM. MASTER MEAS.	2-19		

2-62 AP 10157

SELECTED SUBJECTS

MANPOWER

APOLLO PROGRAM MANPOWER LOAD
(DIRECT)



2-62 AP10160

PROGRAM CONTROL

2-62 AP 10161

PROGRAM CONTROL

- PERT TEAM & NETWORK PRIORITY EST.
- 9 OF 22 NETWORKS IN WORK
- PERT/COST STUDY INITIATED
- CONTROL ROOM-ON LINE RECOMP
- NETWORK-GENERAL ORDER RELATION
- DEVELOPMENT PLAN NEARING COMPLETION

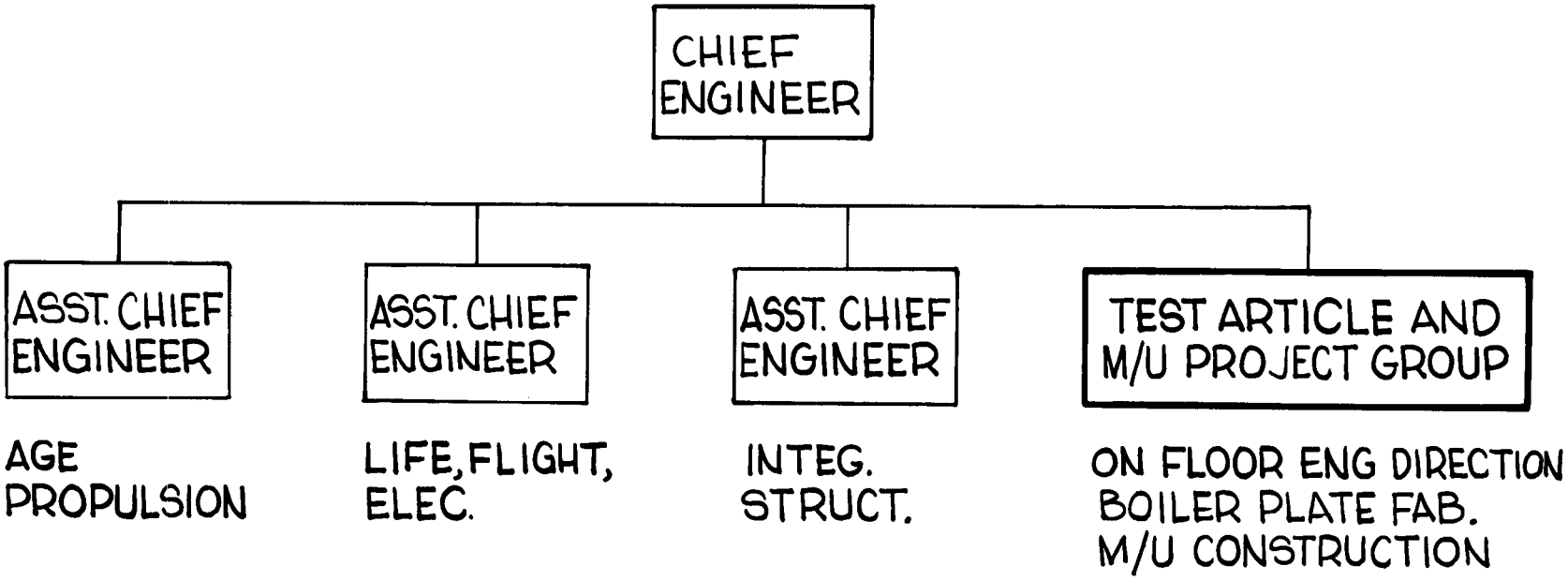
ENGINEERING ORGANIZATION PLANS AND STUDIES

ENGINEERING ORGANIZATION
PLANS & STUDIES

TEST ARTICLE & MOCKUP PROJECT GROUP

CO-LOCATED WITH MFG

EXPEDITE TEST HARDWARE



2-62 AP10164

PROPOSAL STATUS

PROPOSAL STATUS

• ORIGINAL SUBMITTAL DATE	17 FEB
• REVISED DATE	31 MAR
• SUBCONTRACTOR ESTIMATES PACING	
• LITTLE JOE II EFFECTS	
• SUPPLEMENTAL SUBMITTAL	9 APR
• OBJECTIVE:	
DEFINITIVE CONTRACT	JUNE 62

INTEGRATION

SYSTEMS INTEGRATION

- STATUS:

  FUNCTIONAL APOLLO ENG UNIT

  ENGINEERING MANAGER LEVEL

  FULFILLS CURRENT REQUIREMENTS

- STUDY:

  DETERMINE FUTURE REQUIREMENTS
  FNL/PROJECT ORG:
  REPORTING LEVEL

OPERATIONS

2-62 AP10169

NAA AMR OPERATIONS

- CURRENT STATUS
  - EXECUTIVE RESP.—QUAL. ASSURANCE
  - SUPPORTING RESP.—PROG. ENGINEERING
    PROG. LOGISTICS
- PLANS
  - STUDY REQUIREMENTS (POD, LOD, FOD)
  - DESCRIBE QUALITY ASSURANCE & PROG. RELATIONS
  - RECOMMEND ORG. RESPONSIBILITY TASKS

ACTIONS REQUIRED

APOLLO SCHEDULE REQUIREMENTS

- DESIGN FREEZE, S/M, 1 APR. 1962
  SINGLE ENGINE COMPATIBILITY
  DEPENDENT UPON: LLPM VS L.E.V.
  DECISION NOW

- SA-7 LAUNCH SCHEDULE
  DEPENDENT UPON: MIT GUIDANCE
  SYSTEM HDWRE TO S&ID APOLLO
  BY 1 APR. 1963

MAJOR FUTURE ACTIVITIES

MAJOR FUTURE ACTIVITIES

- GOSS PERFORMANCE SPECIFICATION
- SEMI-HARD MOCK-UPS-MFG COMPLETE
- CABIN INTERIOR MOCK-UPS-MFG COMPLETE
- 100% DESIGN RELEASE - INITIAL BOILERPLATES
- AERODYNAMIC FREEZE
- BASIC MASTER LINES - C/M & S/M
- 1ST PROGRAM RELIABILITY REVIEW
- MODULE & ADAPTER INTERFACE MOCK-UP-MFG COMPLETE
- 100% FABRICATION & PARTS RELEASE - GSE FOR B/P
- CABIN EXTERIOR MOCK-UP - MFG COMPLETE
- 100% INITIAL SPEC DELIVERED
- S/M MOCK-UP - MFG COMPLETE
- 100% DESIGN RELEASE - MAINT. TRAINERS
- RELIABILITY MEETING FEASIBILITY

2-62 AP10174

PROGRAM ACCOMPLISHMENTS

POWER SYSTEMS & GSE

- ORG. ESTABLISHED
- TOP TWO SUP. LEVELS EST.
- ECS NEG. COMPLETE
- LAUNCH ESCAPE MOTOR CONTR
- LAUNCH ESCAPE TOWER RFP
- SINGLE ENGINE
- PROPELLANT FEED
- AERODYN. HEAT. WIND TUNNEL
- G.S.E. TRAINING & EQUIP LIST

INTEGRATION AND STRUCTURES

- ORG. ESTABLISHED
- NON-FLYABLE B/P CONFIG. FREEZE
- PRELIM S/M CONFIG.
- PRELIM C/M CONFIG.
- EARTH RECOVERY SYS. DEV.
- HEAT SHIELD PROP. IN EVAL.
- PRELIM. TECH. DEV. PLAN
- REPORTS ON SCHED.

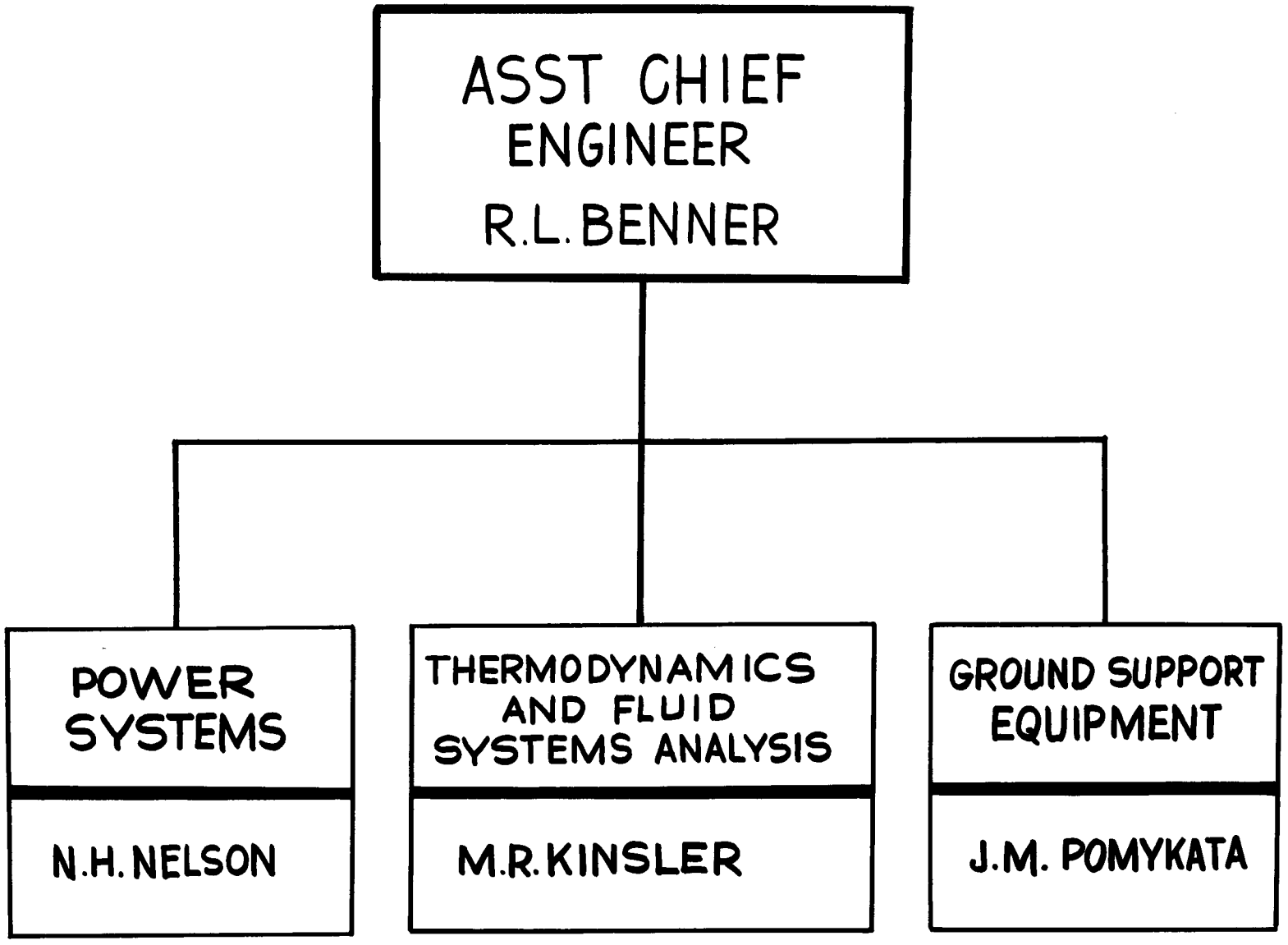
FLIGHT, LIFE AND ELECTRONICS

- ORG. ESTABLISHED
- TOP TWO SUP. LEVELS EST.
- WIND TUNNEL PROGRAM
- COMM. CONTR. NEG.
- STAB. & CONTROL CONTR. NEG.
- GOSS REQMNT. STUDY
- PRELIM ELEC. LAYOUT DES.
- SIMULATOR SEMI-HARD MOCK-UP
- SENSITIVITY FUNCTIONS
- LITTLE JOE II

FACILITIES

- ORG. ESTABLISHED
- FACILITY PLAN EST.
- PHASE A AREA 10% COMPL.

POWER SYSTEMS & GSE


ASST CHIEF ENGINEER
R.L. BENNER
POWER SYSTEMS
N.H. NELSON
THERMODYNAMICS AND FLUID SYSTEMS ANALYSIS
M.R. KINSLER
GROUND SUPPORT EQUIPMENT
J.M. POMYKATA

2-62 AP10177

RESPONSIBILITIES

POWER SYSTEMS

- ENGINE PROCUREMENT & INSTALLATION DESIGN
- PROPELLANT FEED & PRESSURIZATION SYSTEMS
- ELECTRICAL POWER & DISTRIBUTION SYSTEMS
- ENVIRONMENTAL CONTROL SYSTEM

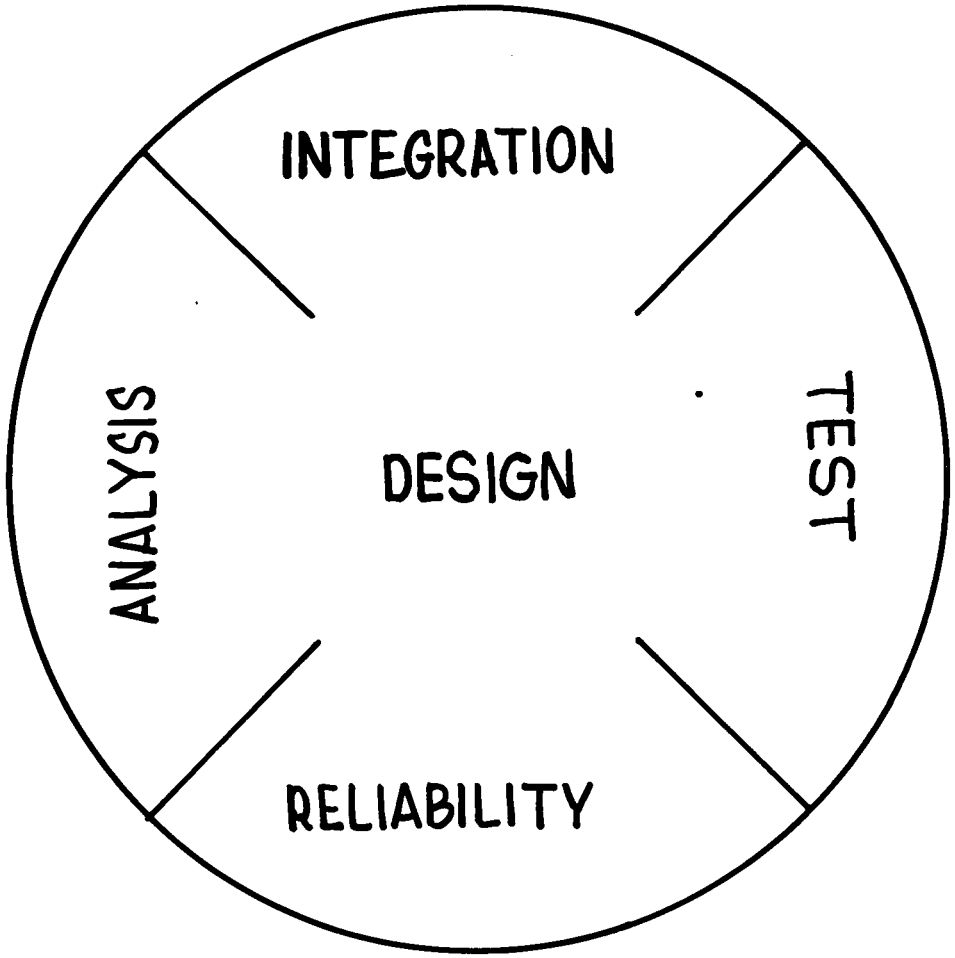
THERMODYNAMICS

- AERO-THERMO-DYNAMICS
- HEAT TRANSFER
- FLUID SYSTEMS ANALYSIS
- ENVIRONMENTAL CONTROL SYSTEM ANALYSIS
- NUCLEAR SHIELDING

GROUND SUPPORT EQUIP

- GSE SYSTEMS REQUIREMENTS & DESIGN
- TRAINING EQUIPMENT REQUIREMENTS & DESIGN

DESIGN PRACTICE



2-62 AP 10179
(44)

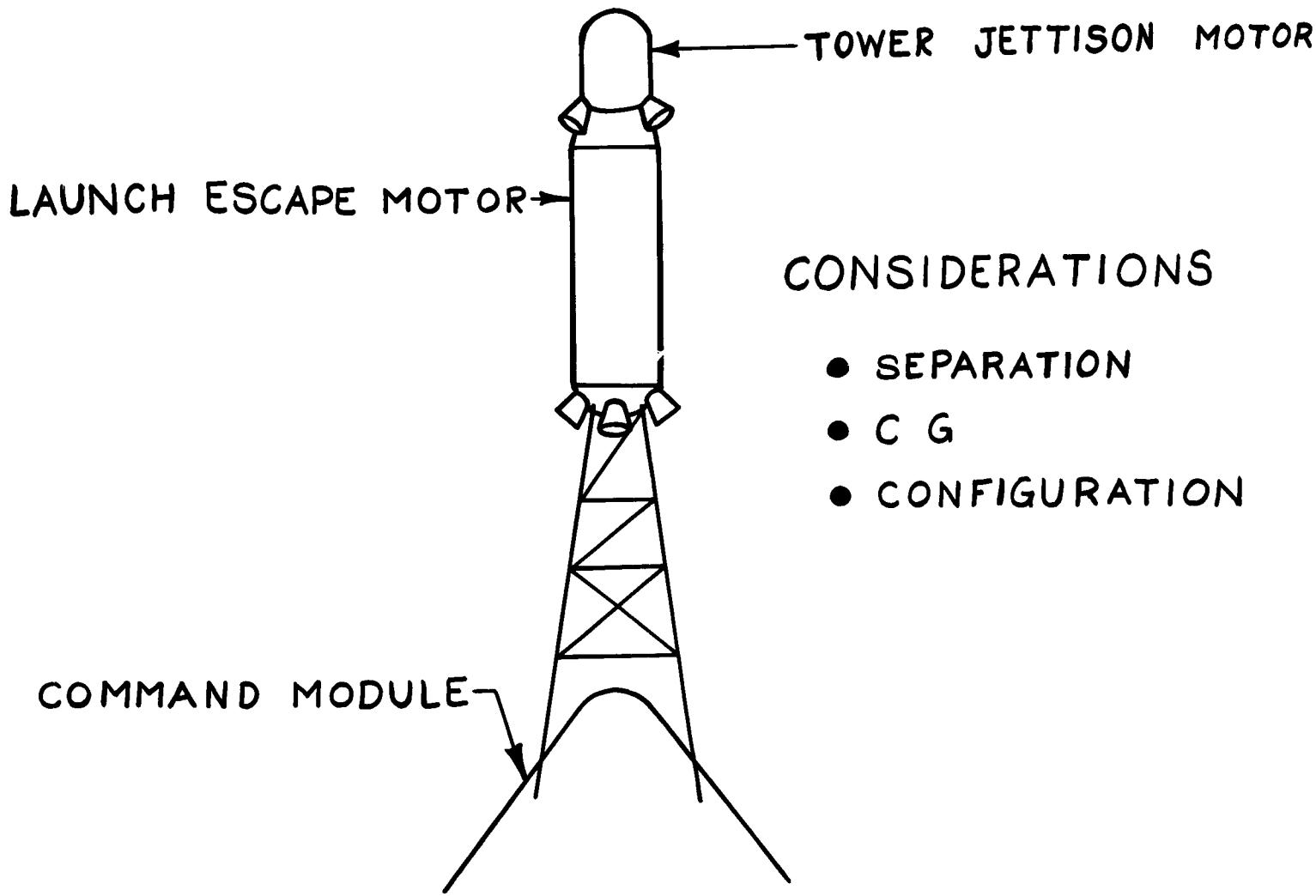
MAJOR EVENTS

PERIOD ENDING 19 FEB. 1962

- ORGANIZATION ESTABLISHED
- ECS CONTRACT NEGOTIATED WITH AIRESEARCH, SYSTEM SPEC. COMPLETED
- LAUNCH ESCAPE MOTOR CONTRACTOR SELECTED - LOCKHEED
- LAUNCH ESCAPE TOWER JETTISON MOTOR RFP ISSUED
- SERVICE MODULE PROPULSION MEETING AT MSC, HOUSTON 2-7-62
  - SINGLE VS MULTIPLE ENGINE
  - PROPELLANT FEED SYSTEM CONFIGURATION
- AERODYNAMIC HEATING WIND TUNNEL PROGRAM SCHEDULE ESTABLISHED
- GSE & TRAINING EQUIPMENT LIST

2-62 AP10180

LAUNCH ESCAPE SYSTEM ARRANGEMENT



CONSIDERATIONS

- SEPARATION
- C G
- CONFIGURATION

2-62 AP10181

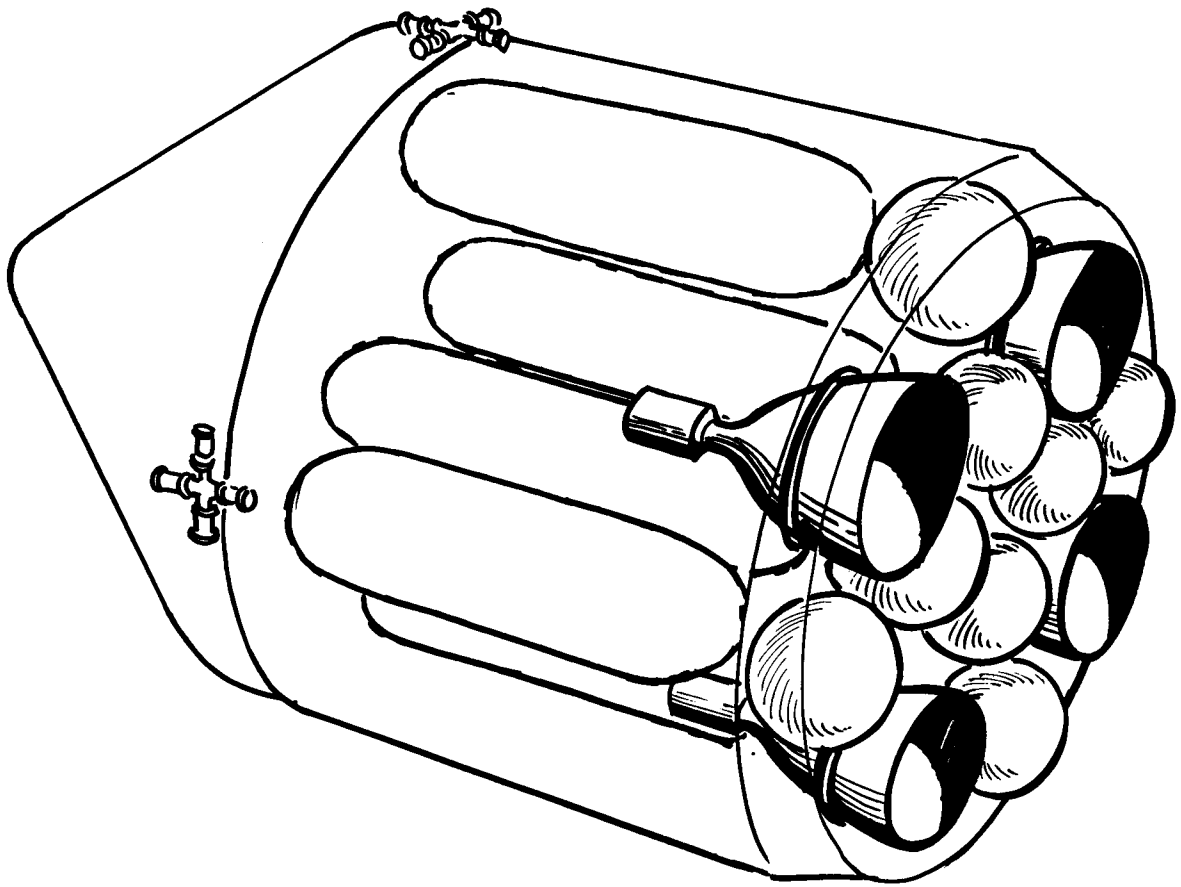
GSE & TRAINING EQUIPMENT SUMMARY

- BENCH MAINTENANCE — 23 ITEMS
  DETAIL FAULT ISOLATION & REPAIR
- CHECKOUT — 34 ITEMS
  FUNCTIONAL INTEGRITY - MAJOR MALFUNCTIONS
- HANDLING — 38 ITEMS
  TRANSPORT & POSITION
- MONITORING — 21 ITEMS
  VISUAL - TESTS/COUNTDOWN
- SERVICING — 33 ITEMS
  TRANSFER LIQUIDS, GASES, POWER, ETC
- AUXILIARY — 19 ITEMS
  SUPPLEMENT MAJOR EQUIPMENT
- TRAINERS — 20 ITEMS
  FLIGHT & GROUND CREWS - TEST PERSONNEL

SERVICE MODULE PROPULSION

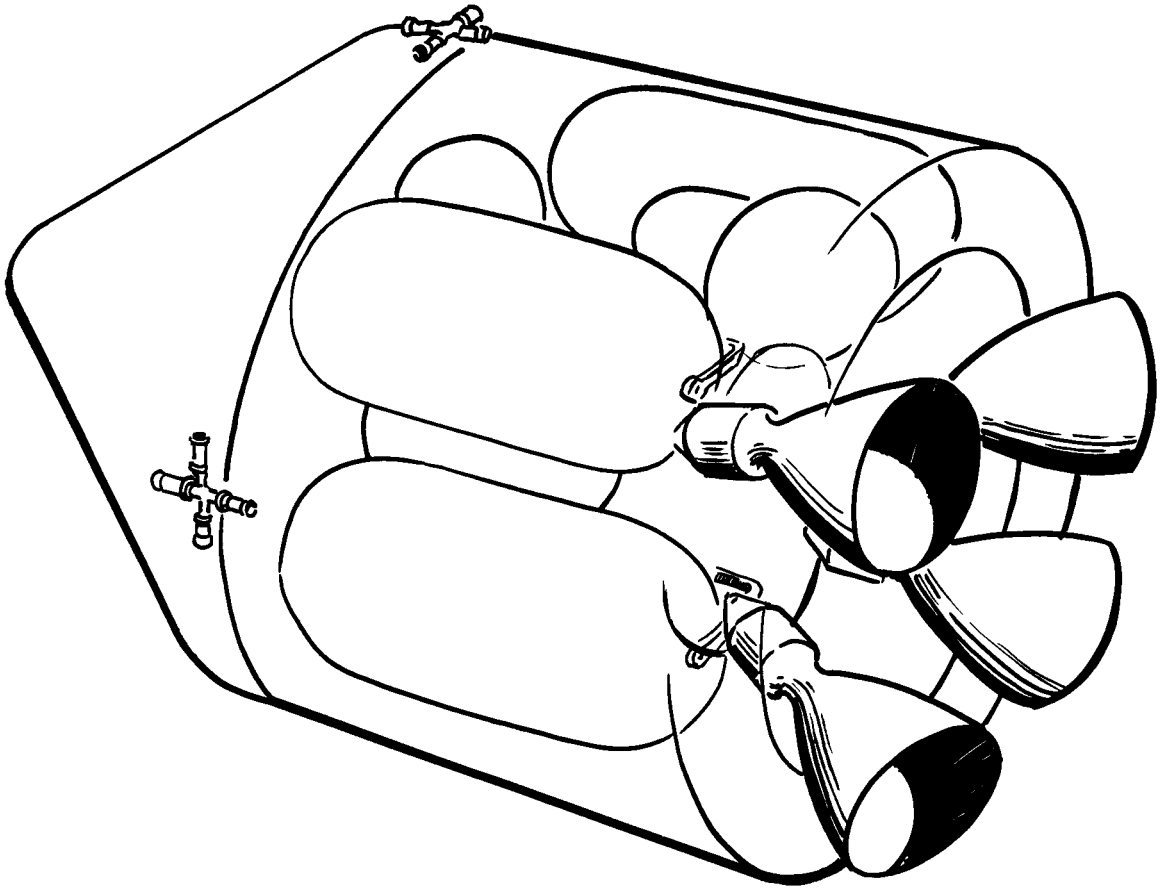
2-62 AP 10183

SERVICE MODULE PROPULSION
MULTIPLE ENGINES - MULTIPLE TANKS



2-62 AP10184

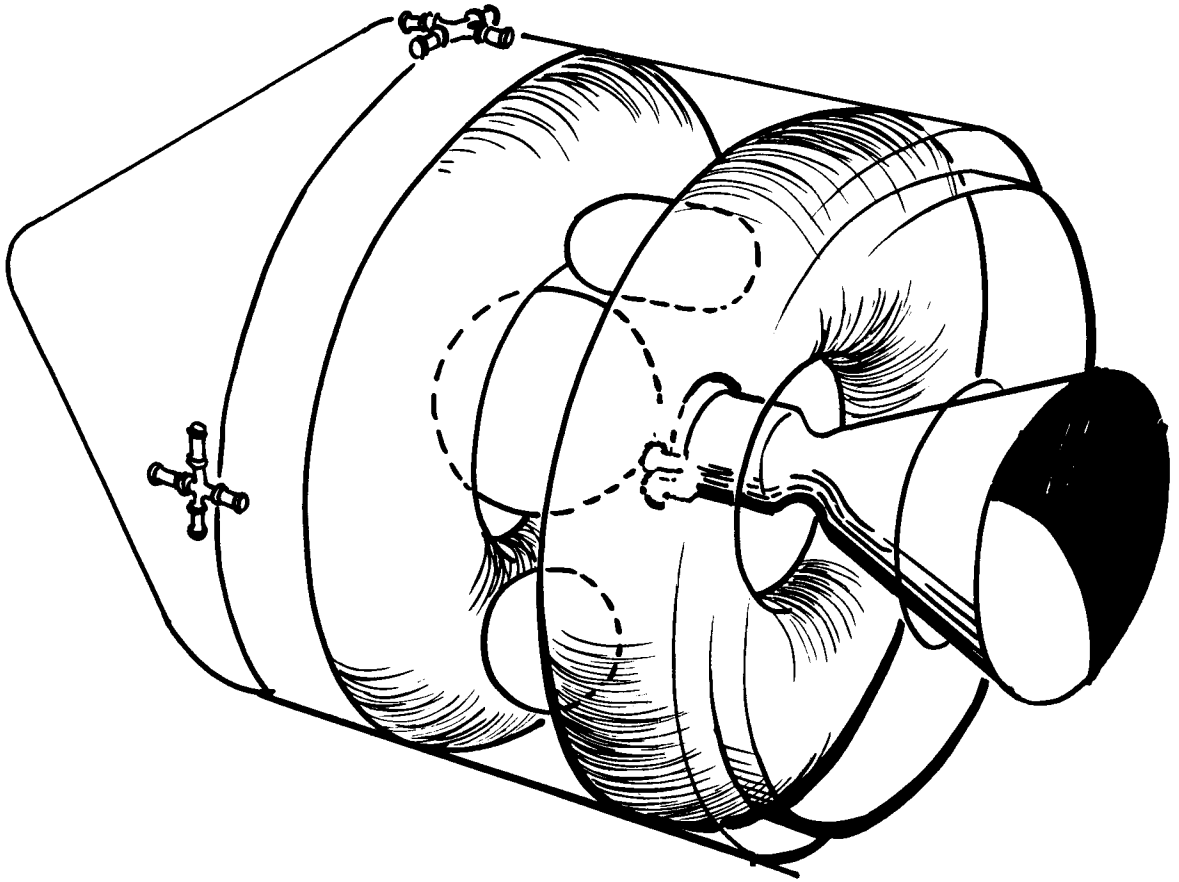
SERVICE MODULE PROPULSION
MULTIPLE ENGINES - MULTIPLE TANKS



2-62 AP10185

SERVICE MODULE PROPULSION

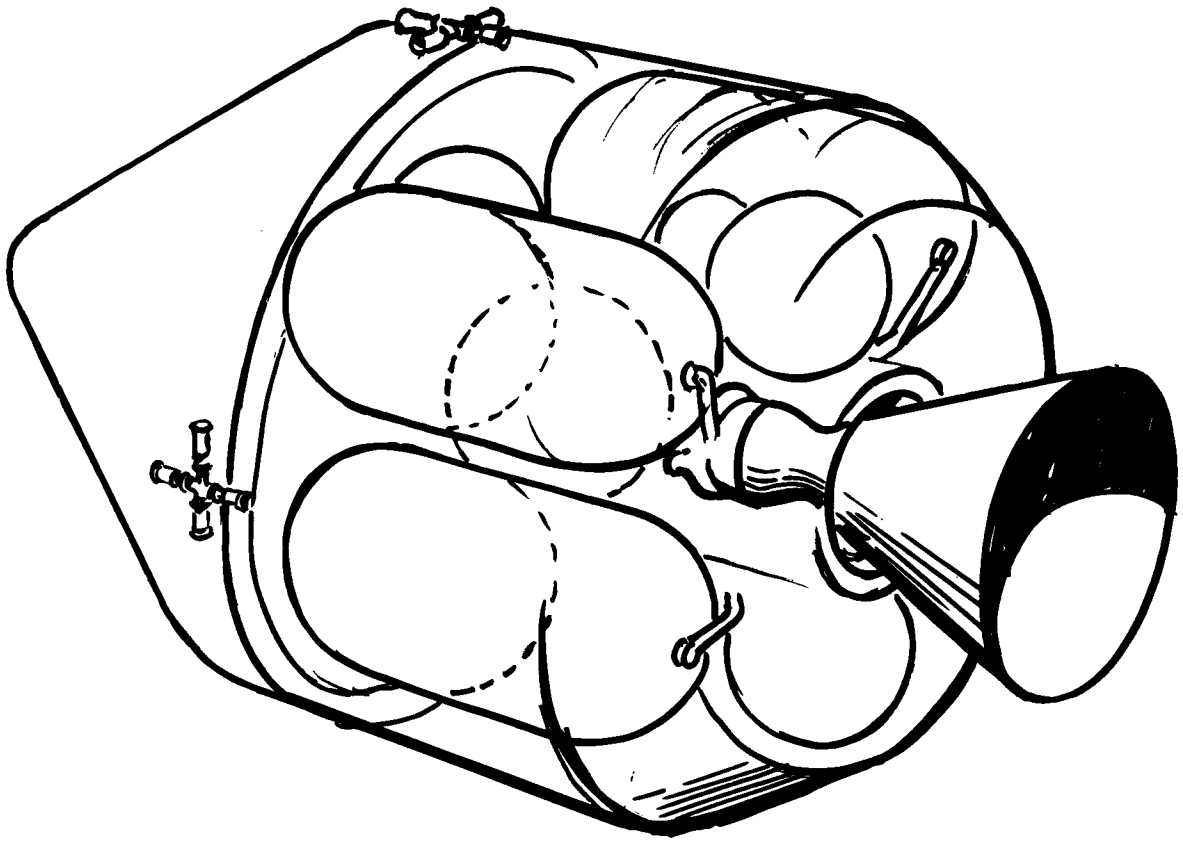
SINGLE ENGINE - TOROIDAL TANKS



2-62 AP10186

(51)

SERVICE MODULE PROPULSION
SINGLE ENGINE - MULTIPLE TANKS



2-62 AP10187

SERVICE MODULE PROPULSION

SINGLE ENGINE vs MULTIPLE ENGINES

CONSIDERATIONS

- ENGINE DEVELOPMENT EFFORT
- ENGINE PERFORMANCE
- GUIDANCE & CONTROL
- VEHICLE CONSIDERATIONS
- RELIABILITY
- WEIGHT

SERVICE MODULE PROPULSION

SINGLE ENGINE vs MULTIPLE ENGINES

DECISIVE FACTORS

- SIMPLICITY

  COMPONENTS, RELIABILITY, MAINTENANCE, CREW CONTROL

- WEIGHT

SINGLE ENGINE SELECTED

[redacted]

SERVICE MODULE PROPULSION
ENGINE REQUIREMENTS ESTABLISHED

- THRUST RATING - 20,000 LBS
- SPECIFIC IMPULSE - 315 SEC
- HYPERGOLIC PROPELLANTS
- NOZZLE - 40:1 EXPANSION RATIO
- ENGINE MOUNTING - GIMBAL
- ENGINE WEIGHT - 320 LBS
- RELIABILITY - .99991

[redacted]

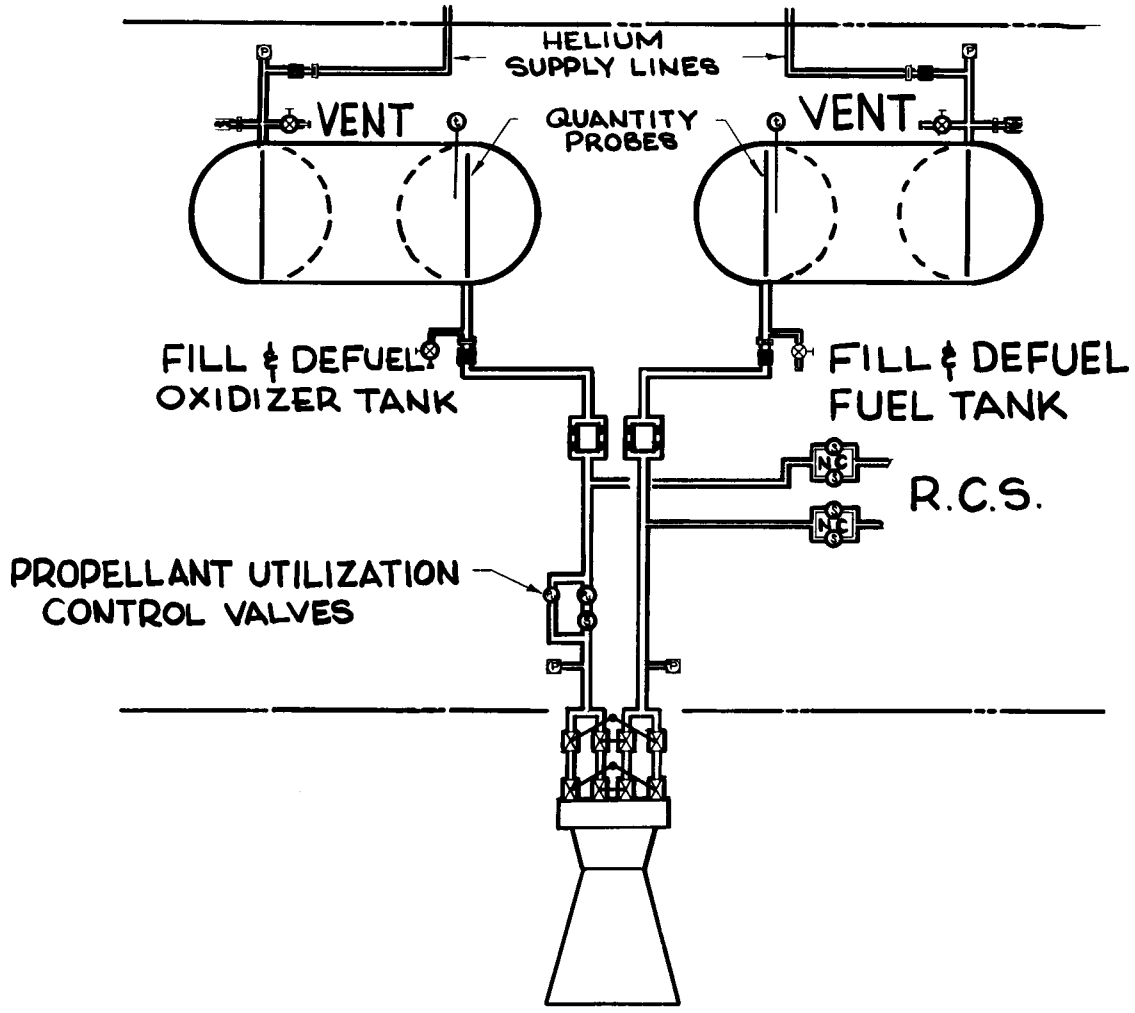
2-62 AP10190
(95)

MAJOR STUDIES UNDERWAY

[redacted]

SERVICE MODULE PROPULSION SYSTEM

SINGLE ENGINE – SINGLE TANK



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2-62 AP10192

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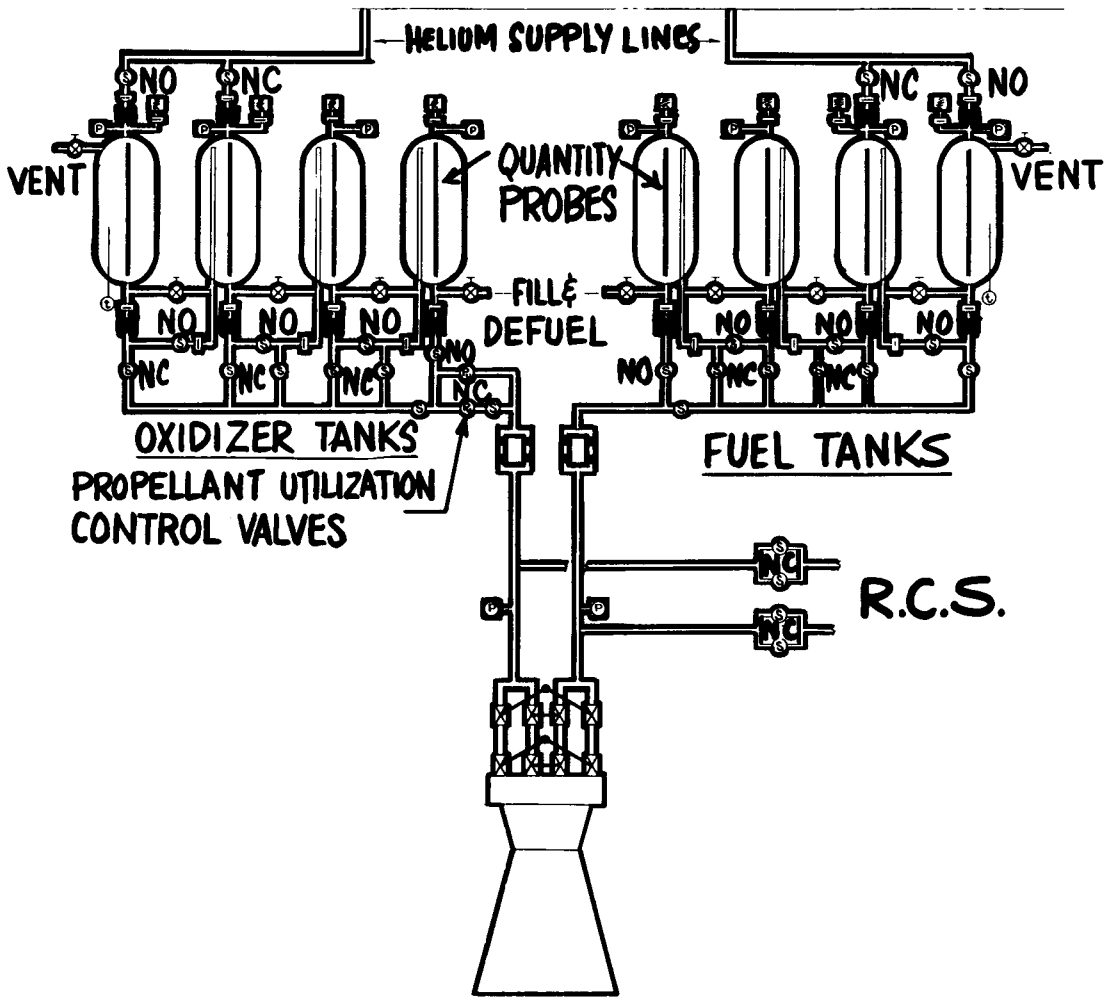
SERVICE MODULE PROPULSION SYSTEM

MULTIPLE TANKS-ISOLATION CAPABILITIES



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2-62 AP10193

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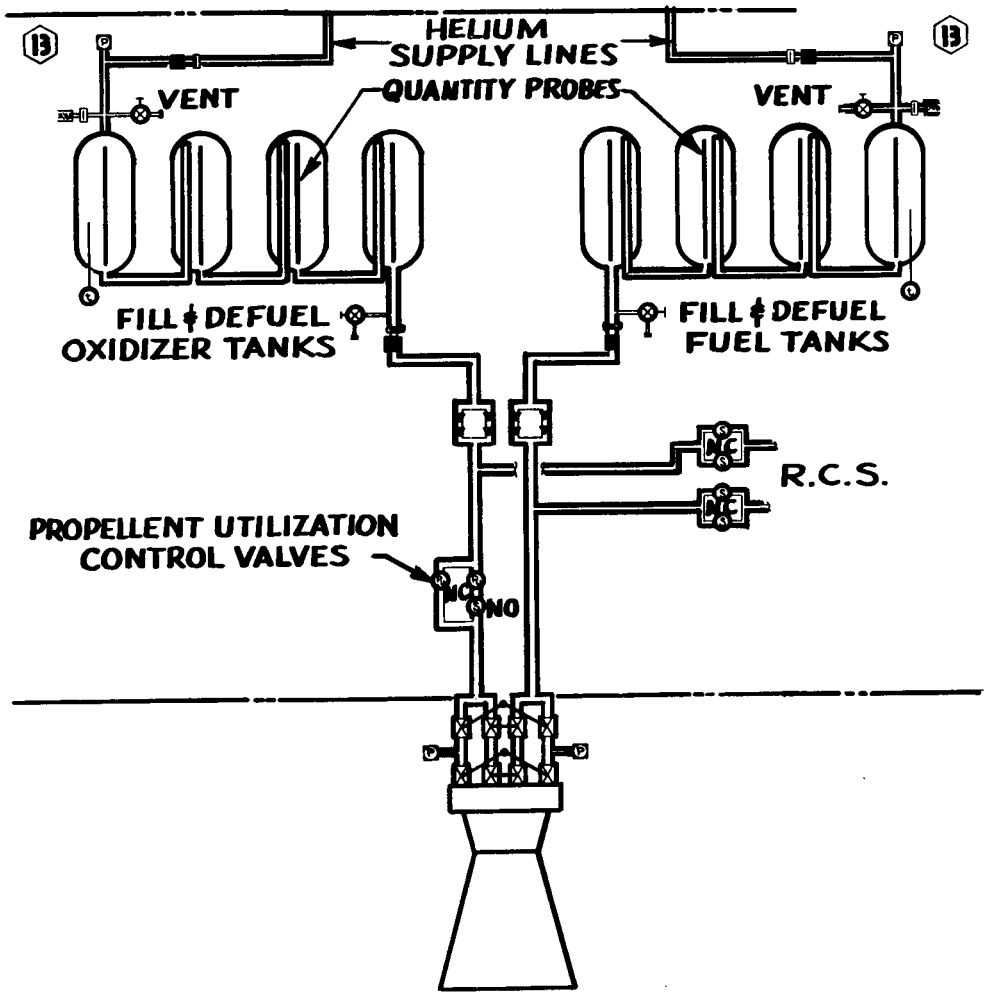
SERVICE MODULE PROPULSION SYSTEM

QUADRUPLE TANKS · SIMPLIFIED



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2-62 AP 10194

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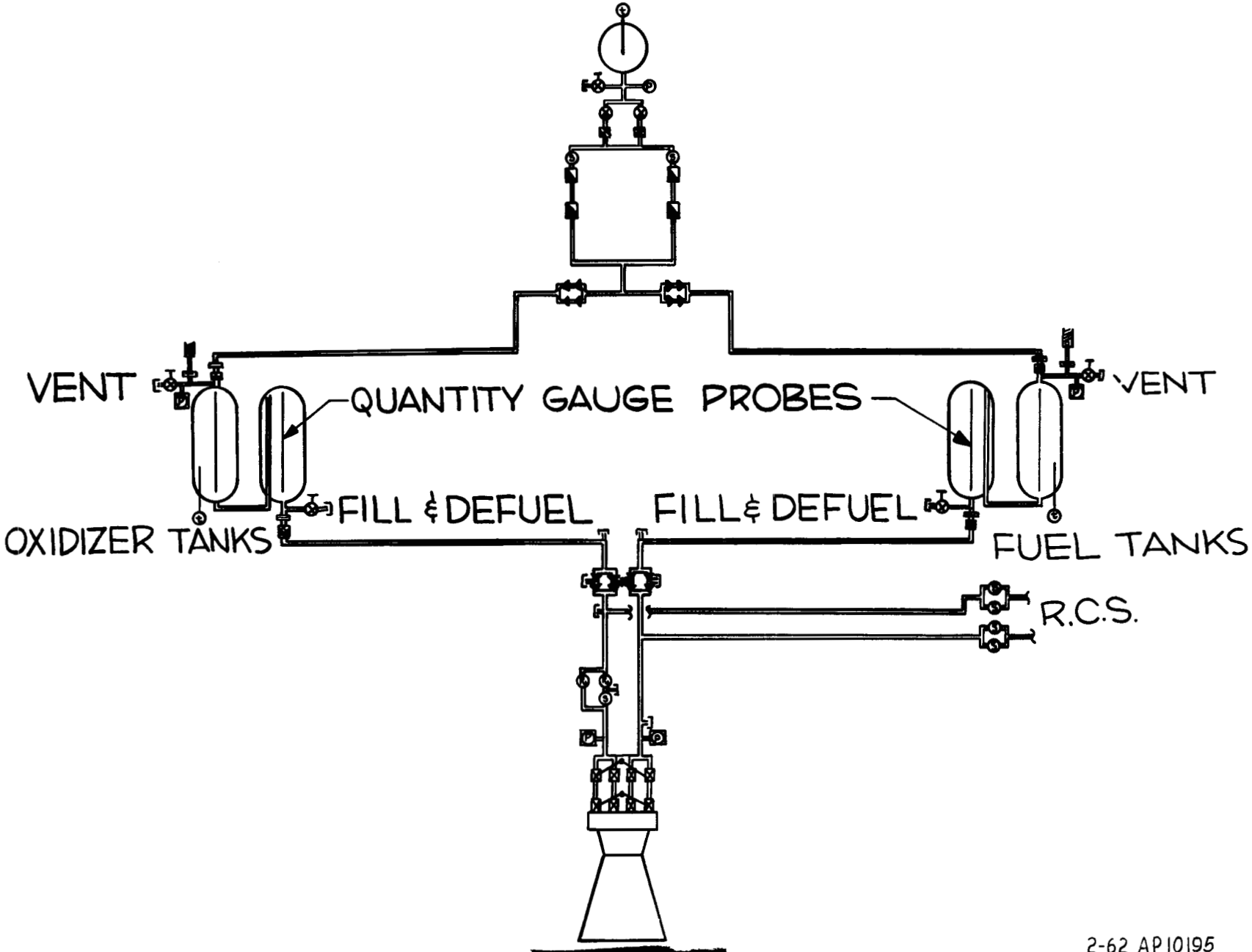
SERVICE MODULE PROPULSION SYSTEM
DUAL TANKS-SIMPLIFIED



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2-62 AP10195

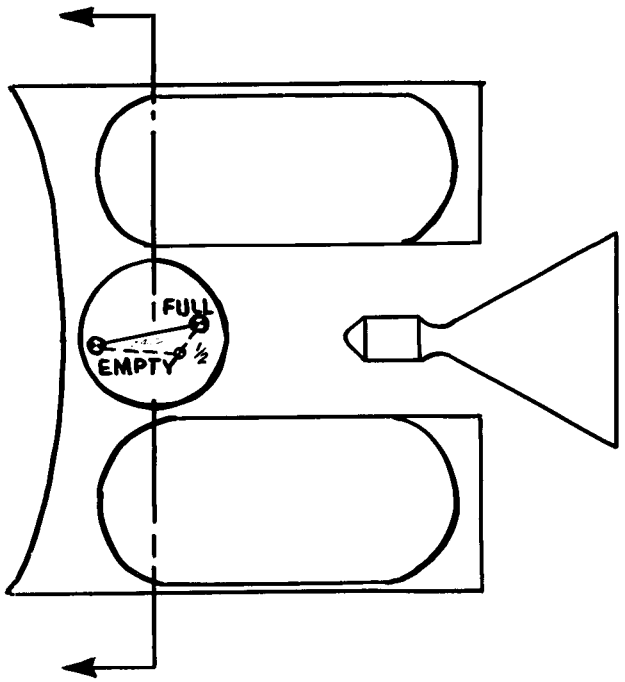
S/M TANK CONFIGURATION STUDY SUMMARY

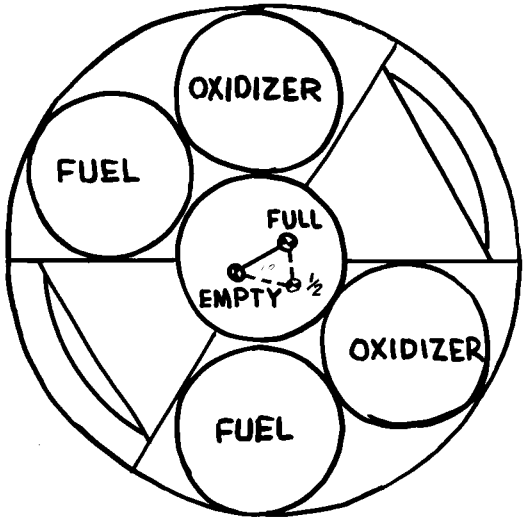
CONSIDERATIONS	TANKAGE CONFIGURATIONS				
	TOROID	DOUBLE CYLINDRICAL	QUADRUPLE CYLINDRICAL		
			SIMPLIFIED	WITH ISOLATION PROVISIONS	
				VALVES EXPOSED	VALVES PROTECTED
COMPONENTS	33	29	31	81	89
INSTRUMENTATION & TEST POINTS	16	16	16	36	29
TANK PIERCE POINTS	14	14	26	32	32
LEAK POINTS	54	56	64	156	176
TANK DESIGN & FABRICATION	MAY LIMIT TO LOWER STRENGTH MATLS	POSSIBLE FROM HI-STRENGTH MATERIALS			
SLOSH BAFFLES	COMPLEX	SIMPLE IF REQD	SIMPLE IF REQD	SIMPLE IF REQD	SIMPLE IF REQD
RESIDUAL FUEL	POSSIBLE PROBLEM	GOOD	GOOD	GOOD	GOOD
C G CONTROL	DIFFICULT	GOOD	GOOD	GOOD	GOOD
SERVICE AND MAINTENANCE	FAIR	GOOD	FAIR	DIFFICULT	DIFFICULT
CREW DISPLAY & CONTROL	GOOD	GOOD	GOOD	COMPLEX	COMPLEX

2-62 AP10196

SERVICE MODULE PROPULSION

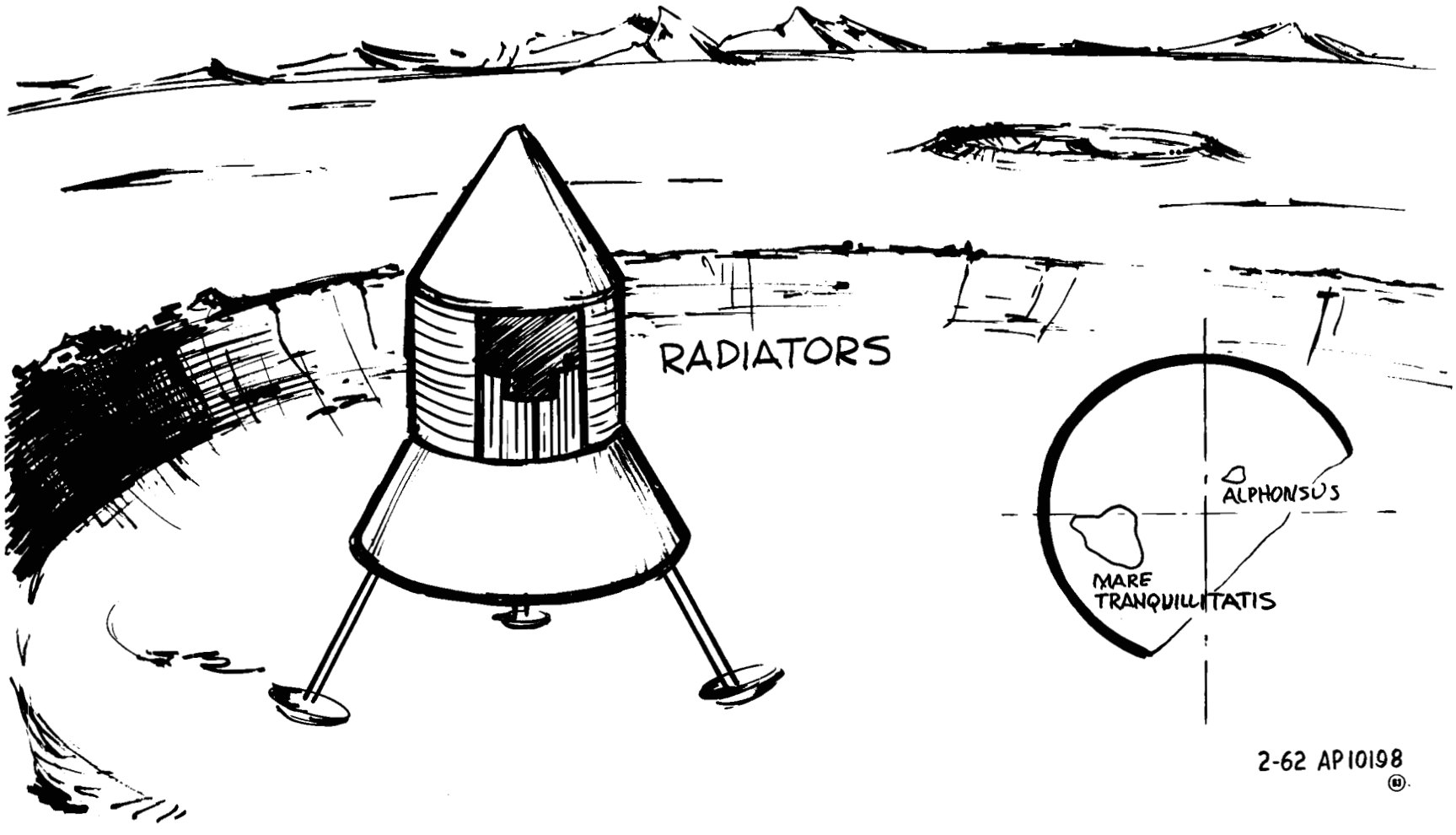
MULTIPLE TANKS - 2 OXIDIZER - 2 FUEL





2-62 AP 10197

SPACE RADIATOR STUDIES
LUNAR OPERATIONS



2-62 AP10198

HEAT REJECTION STUDIES

RADIATOR POSITION	HEAT PUMP	WATER EVAPORATION
VERTICAL	YES	NONE
VERTICAL	YES	50 LB
VERTICAL	YES	150 LB
VERTICAL	YES	250 LB
HORIZONTAL	NO	250 LB

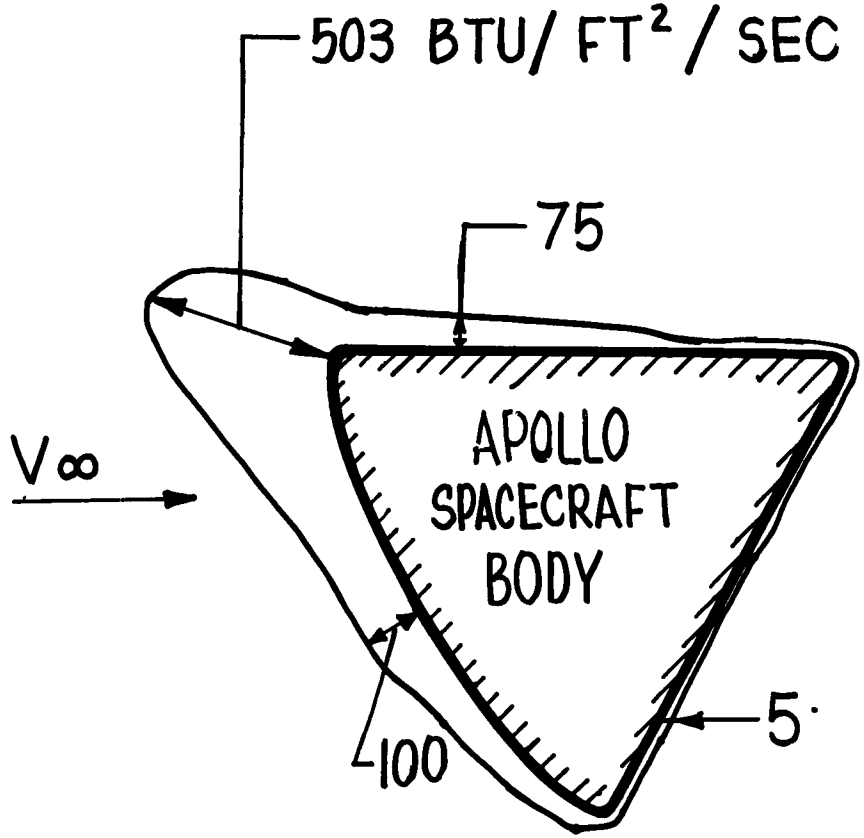
RADIATOR AREAS : 100; 200; 300 SQ FT

[redacted]

APOLLO REENTRY AERODYNAMIC HEATING RATE DISTRIBUTION

PEAK HEATING RATE:

503 BTU/FT^2/SEC



HEAT SHIELD & INSULATION REQUIREMENTS

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2-62 AP10200

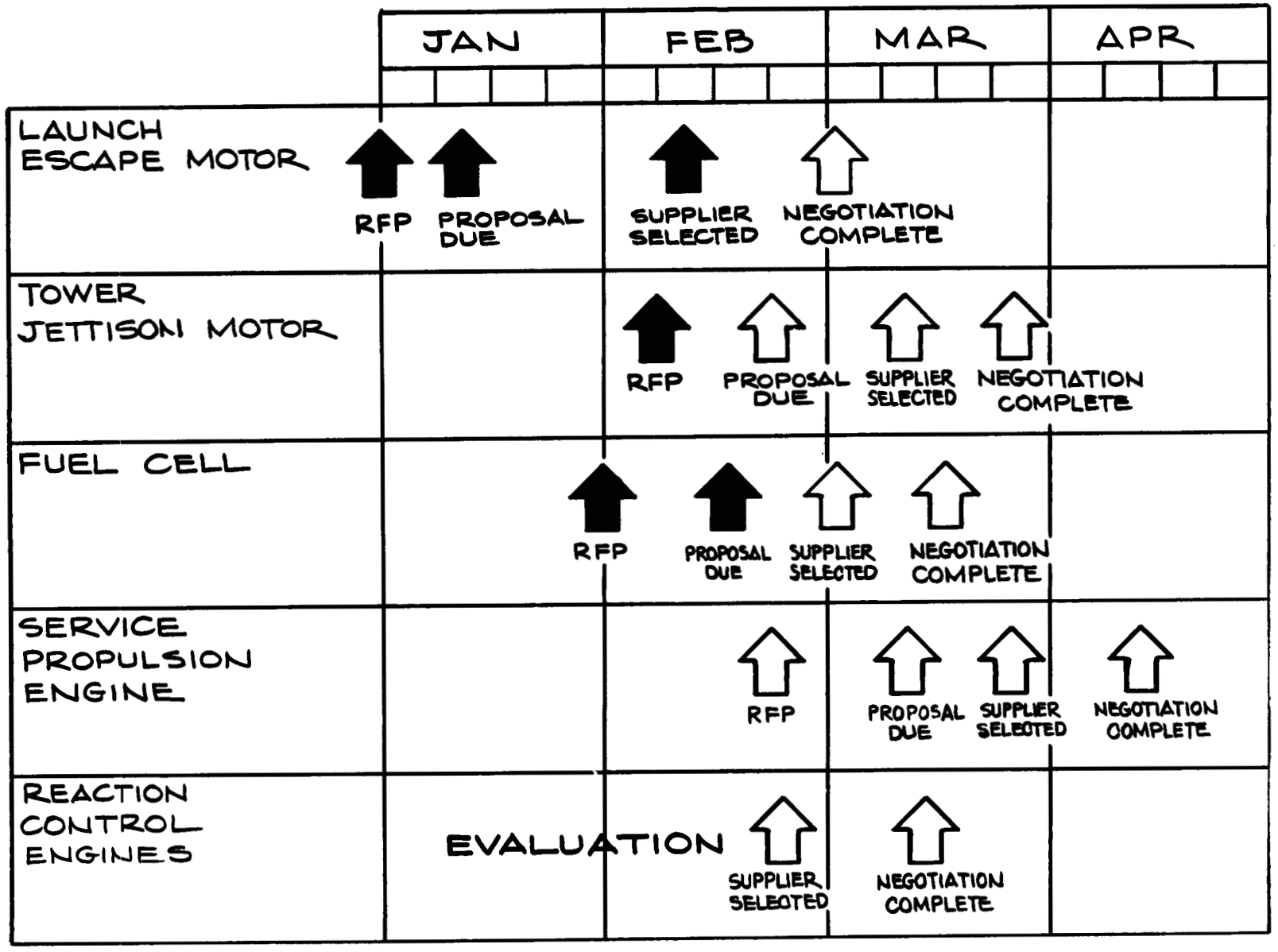
MAJOR EVENTS

IMMEDIATE FUTURE

- SERVICE MODULE PROPELLANT TANKAGE SELECTION
- ELECTRICAL POWER FUEL CELL SUPPLIER SELECTION
- LAUNCH ESCAPE TOWER JETTISON MOTOR SUPPLIER SELECTION
- SERVICE MODULE PROPULSION ENGINE SUPPLIER SELECTION
- REACTION CONTROL ENGINES SUPPLIER SELECTION
- ECS & FUEL CELL HEAT REJECTION SYSTEM CONCEPT ESTABLISHED

2-62 AP10201

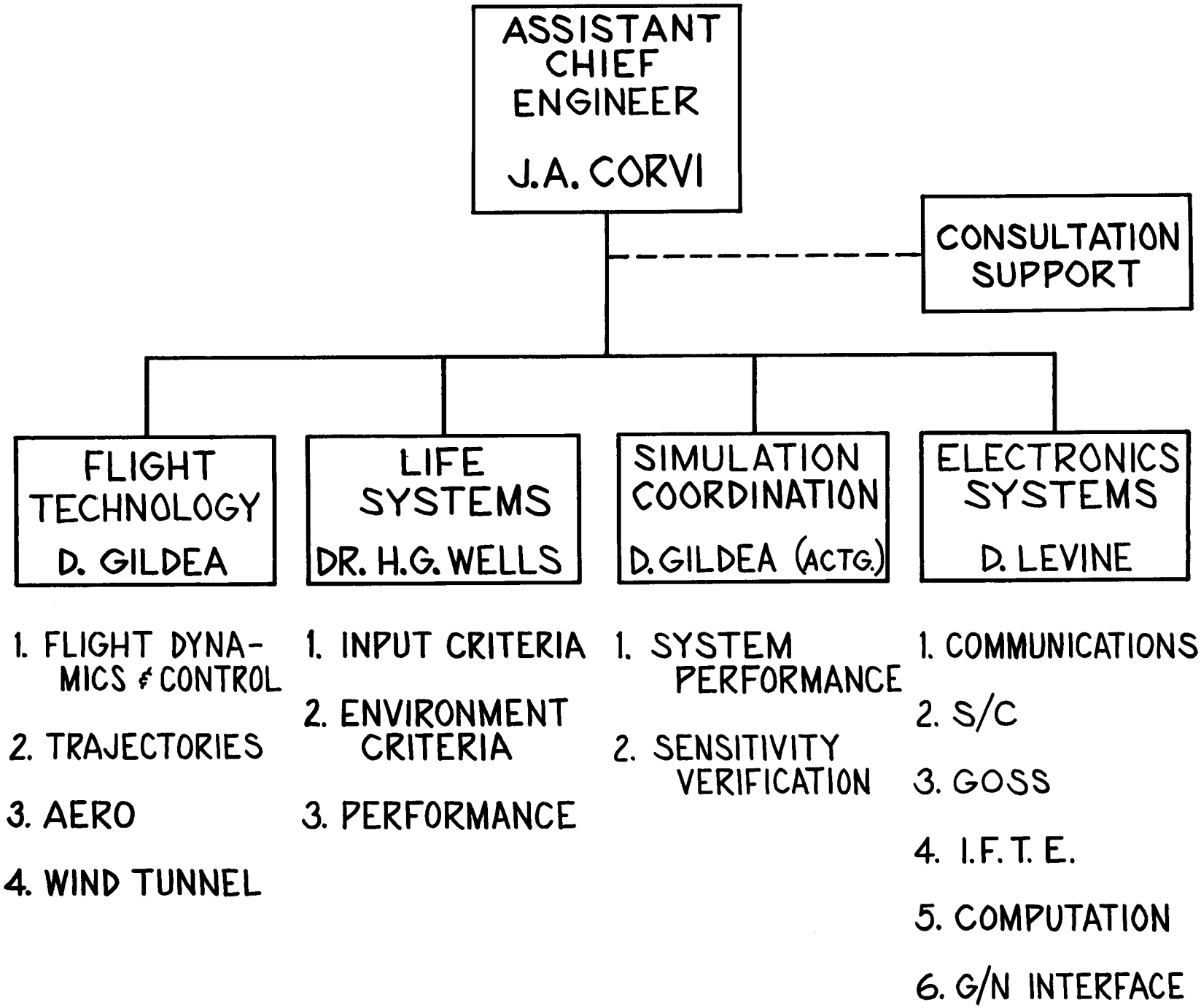
PROCUREMENT SCHEDULE
MAJOR ITEMS



2-62 AP10202

FLIGHT, LIFE & ELECTRONIC SYSTEMS

2-62 AP10203

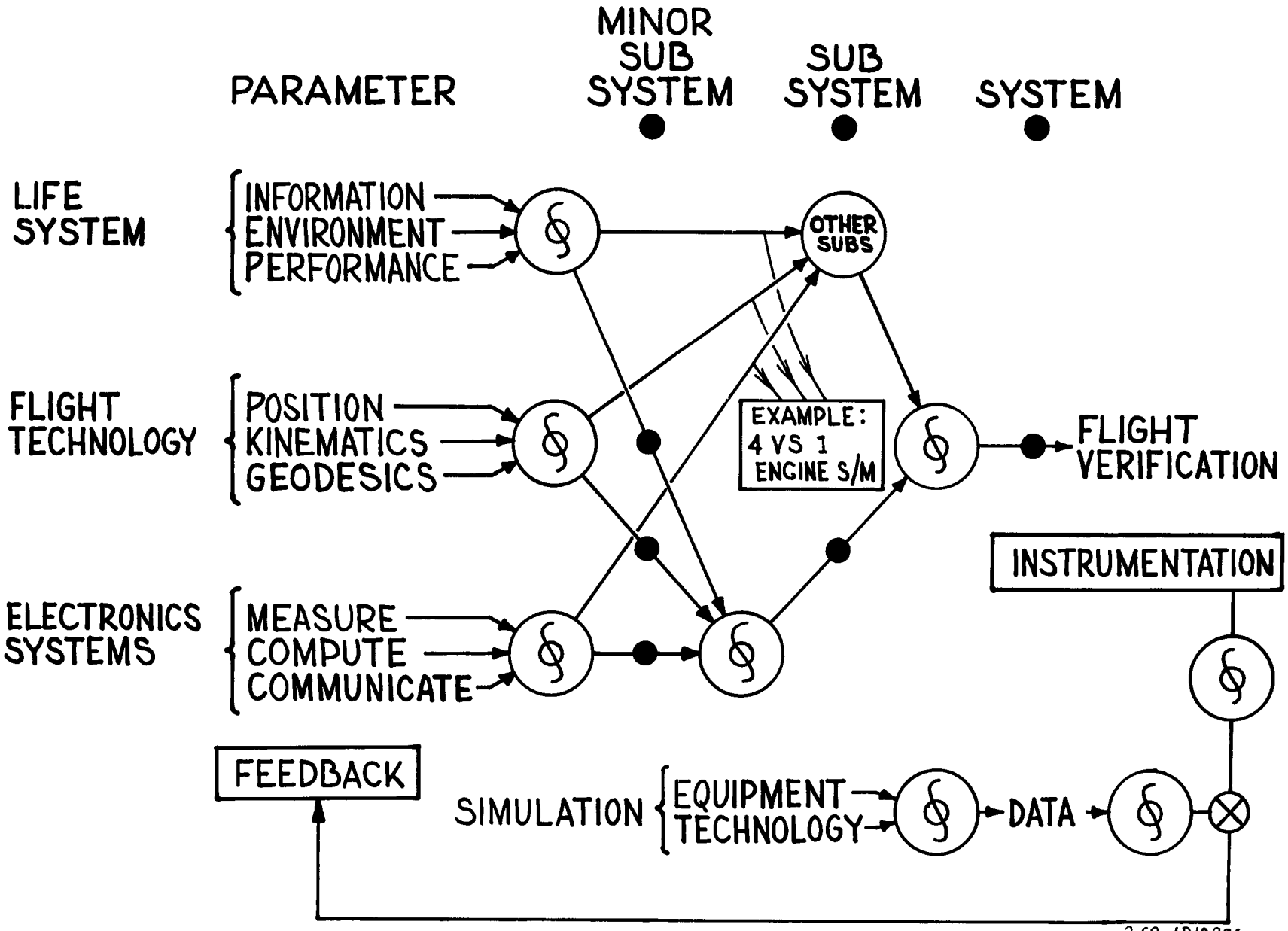

ASSISTANT CHIEF ENGINEER
J.A. CORVI
CONSULTATION SUPPORT
FLIGHT TECHNOLOGY
D. GILDEA
1. FLIGHT DYNAMICS & CONTROL
2. TRAJECTORIES
3. AERO
4. WIND TUNNEL
LIFE SYSTEMS
DR. H.G. WELLS
1. INPUT CRITERIA
2. ENVIRONMENT CRITERIA
3. PERFORMANCE
SIMULATION COORDINATION
D. GILDEA (ACTG.)
1. SYSTEM PERFORMANCE
2. SENSITIVITY VERIFICATION
ELECTRONICS SYSTEMS
D. LEVINE
1. COMMUNICATIONS
2. S/C
3. GOSS
4. I.F.T.E.
5. COMPUTATION
6. G/N INTERFACE

2-62 AP 10204

COMPLETED OR PARTIALLY COMPLETED TASKS

- ORGANIZATION AND MAJOR SUPERVISION
- WIND TUNNEL PROGRAM (SAME AS NASA)
- COMMUNICATIONS SUB-CONTRACT NEGOTIATED WITH COLLINS
- S/C SUB-CONTRACT NEGOTIATED WITH M/H
- GOSS REQUIREMENTS 80%
- ELECTRONIC RACKS DEFINED
- SIMULATION "MOCKUP" CAPSULE COMPLETE
- SOME SENSITIVITY FUNCTIONS DEFINED
- DESIGN CRITERIA 80% COMPLETE
- "IN FLIGHT" TEST LOGIC

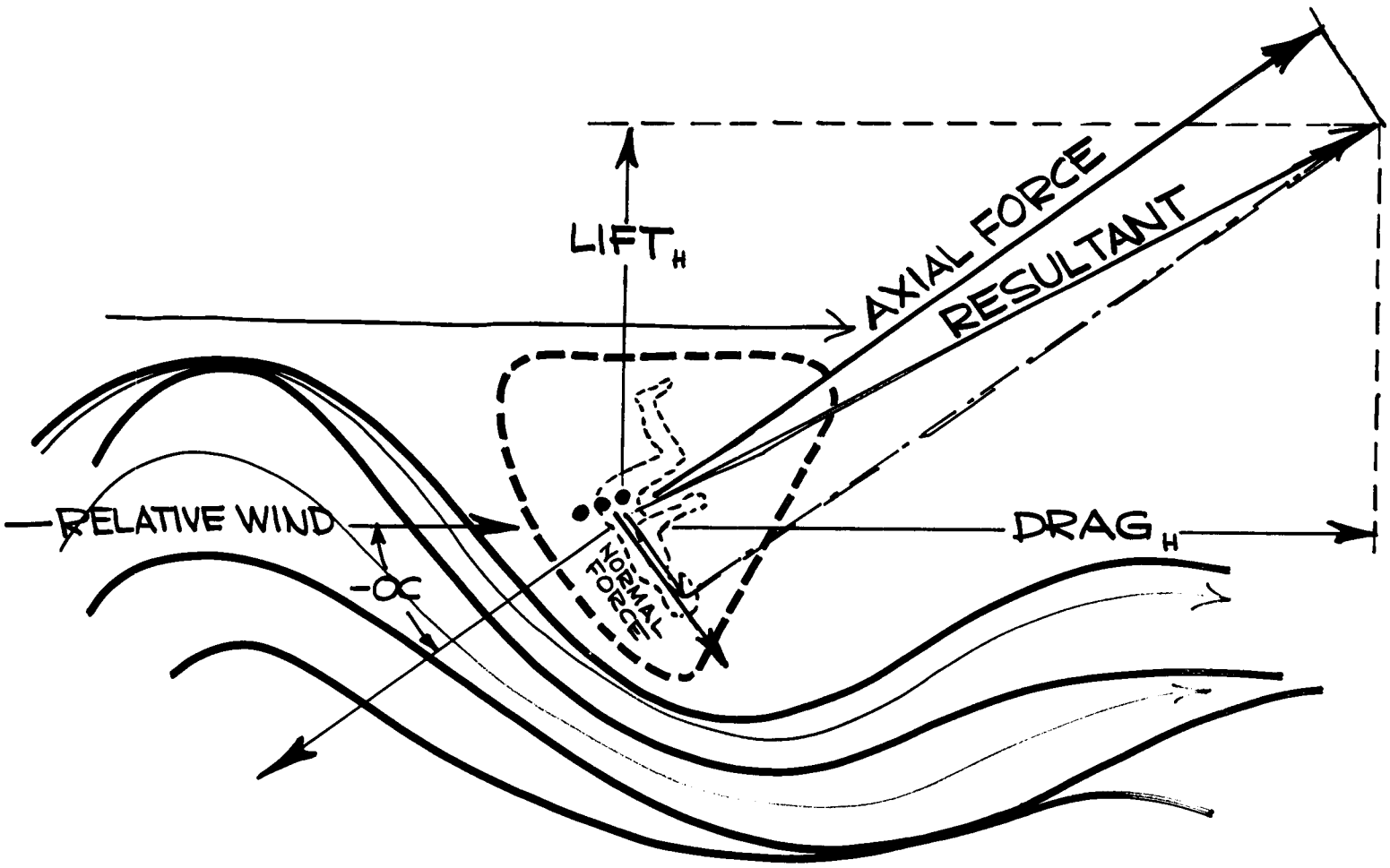
EXAMPLE OF INTEGRATION WITHIN F.L.E.S.



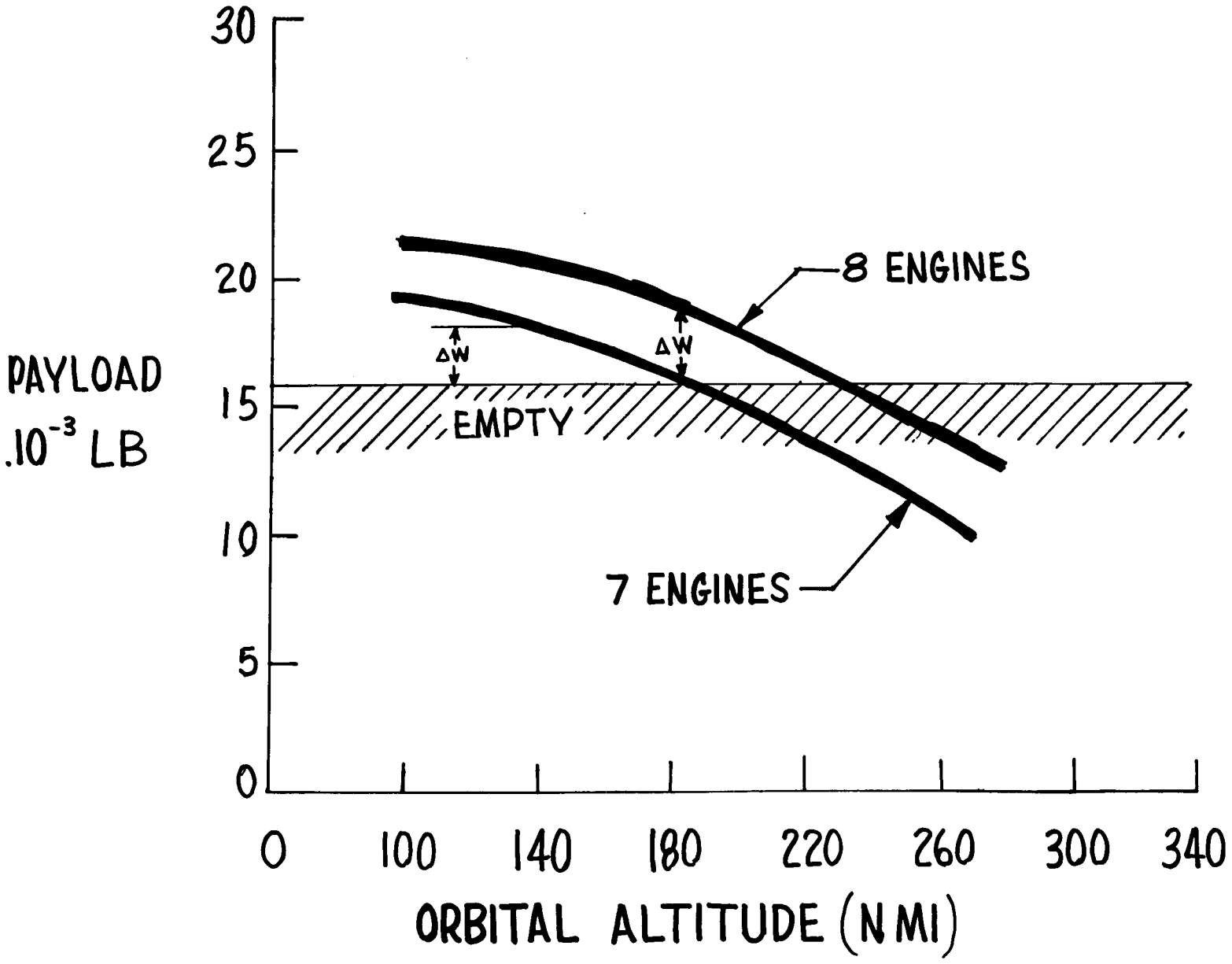
2-62 AP10206
(11)

STATUS OF SOME FLIGHT TECHNOLOGY TASKS

"POSITIVE LIFT WITH NEGATIVE α VEHICLE"



2-62 AP10207



2-62 AP10208
(73)

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SENSITIVITY PARAMETERS

PERFORMANCE TRADE FACTORS	S-I STAGE	S-IV STAGE
$\frac{\text{PAYLOAD WEIGHT}}{\text{STAGE WEIGHT (DRY)}}$	$-0.12 \frac{lb}{lb}$	$-1.0 \frac{lb}{lb}$
$\frac{\text{PAYLOAD WEIGHT}}{\text{THRUST}}$	$+0.006 \frac{lb}{lb}$	$+0.26 \frac{lb}{lb}$
$\frac{\text{PAYLOAD WEIGHT}}{\text{SPECIFIC IMPULSE}}$	$+180 \frac{lb}{sec}$	$+100 \frac{lb}{sec}$

BASED ON MARSHALL C-I TRAJECTORY DATA

PAYLOAD AT 100 N MI CIRCULAR ORBIT

2-62 AP10209 (14)

[redacted]

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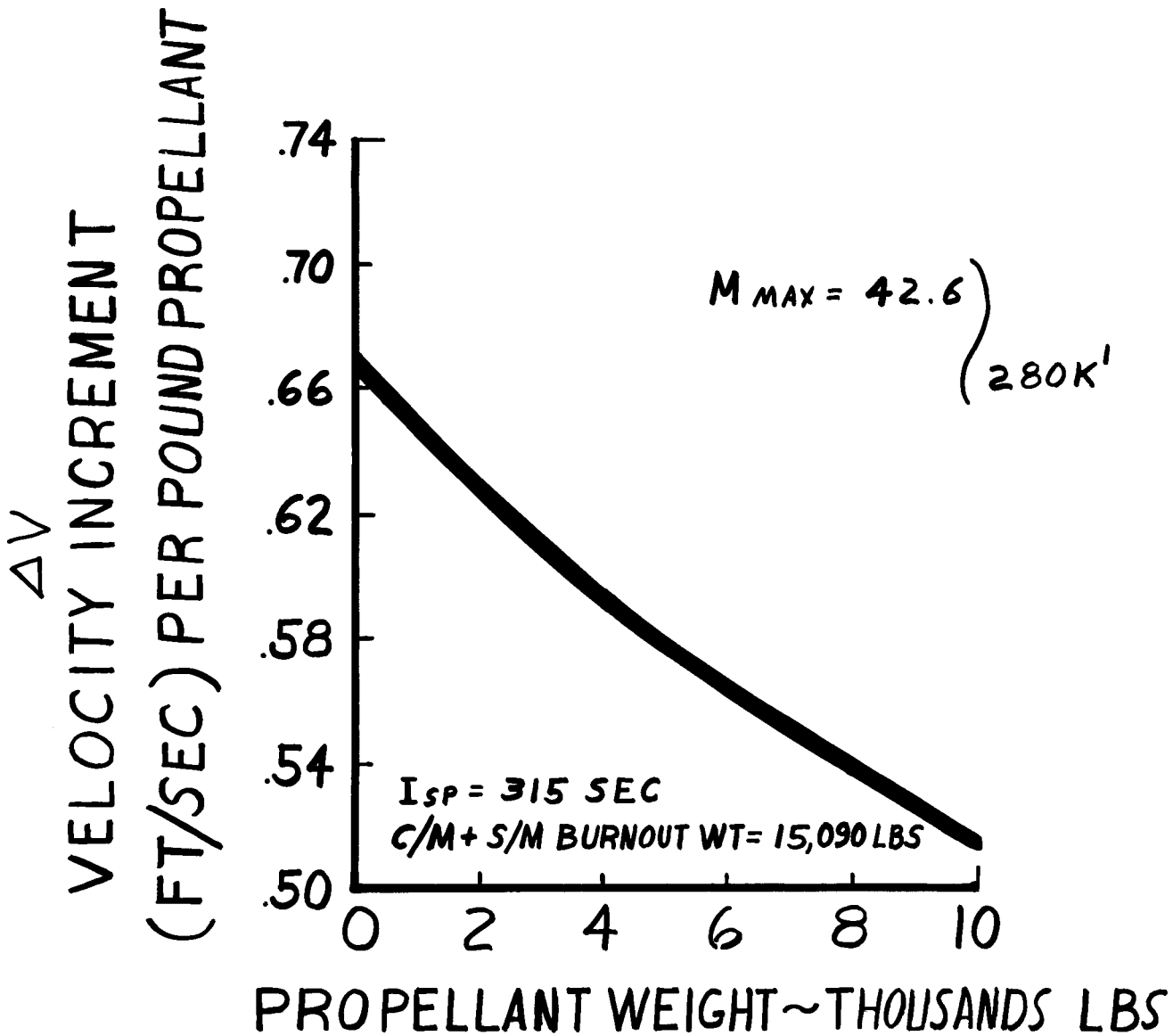
APOLLO C/M & S/M PERFORMANCE IN EARTH ORBIT



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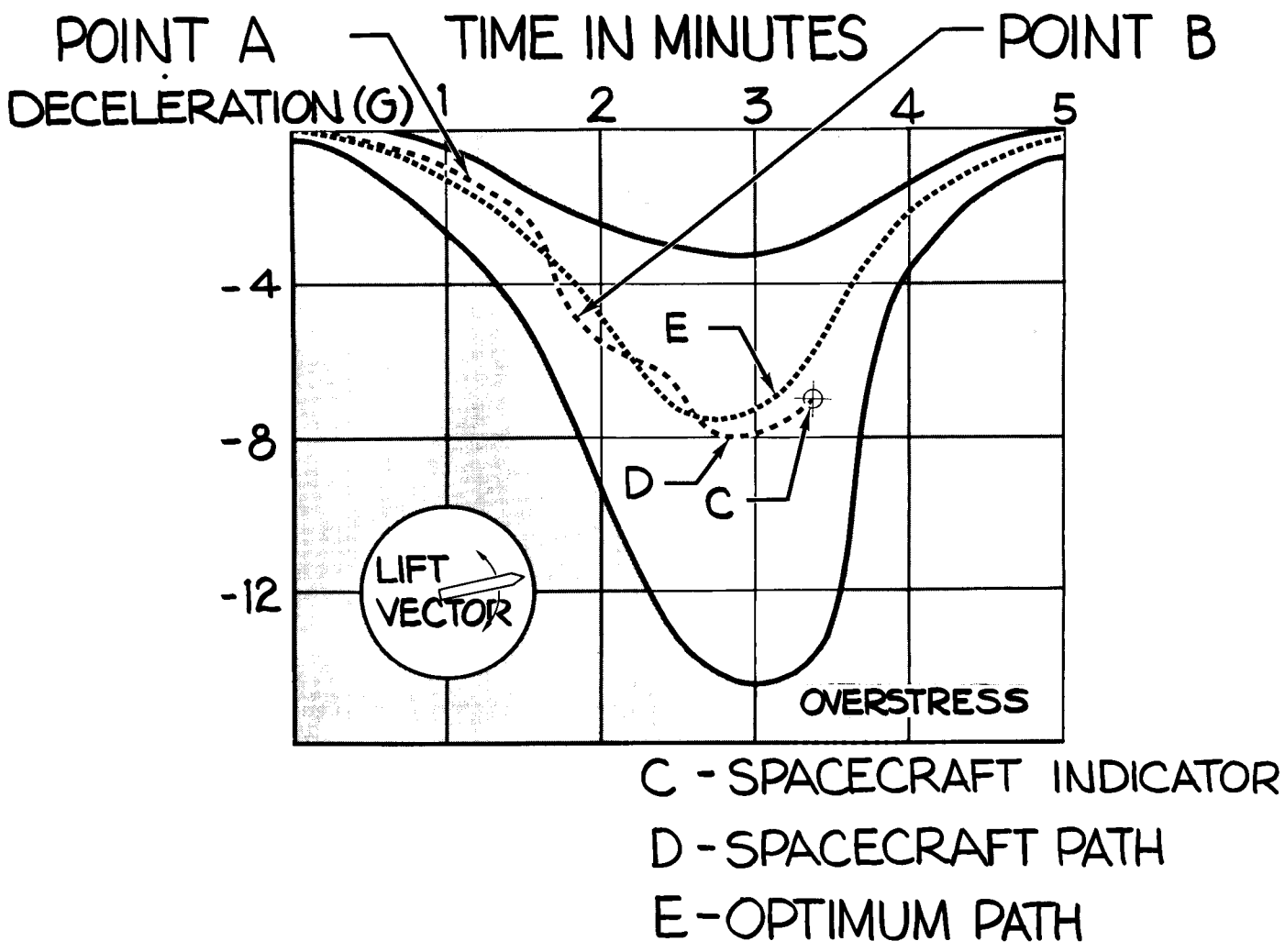
2-62 AP10210
®

NASA / NAA SUPER ORBIT

	NASA	NAA	REMARKS
WEIGHT	C/M 8500 800 TOTAL = 9300	C/M 8150 S/M 3718 ADAP 660 TOTAL = 12,528	SERVICE MODULE REQUIRED
C-1 DRAG	BLOCK I CONFIGURATION	BLOCK II CONFIGURATION	
BOOST	NO HOLD DOWN	3 SEC C-1 HOLD DOWN W_p = 17,714 prop.	
S IV I_{sp}	420	412	NAA CONSERVATIVE
RESULTS	31,000 fps	29,000 fps	BOTH FOR 6 G's ENTRY

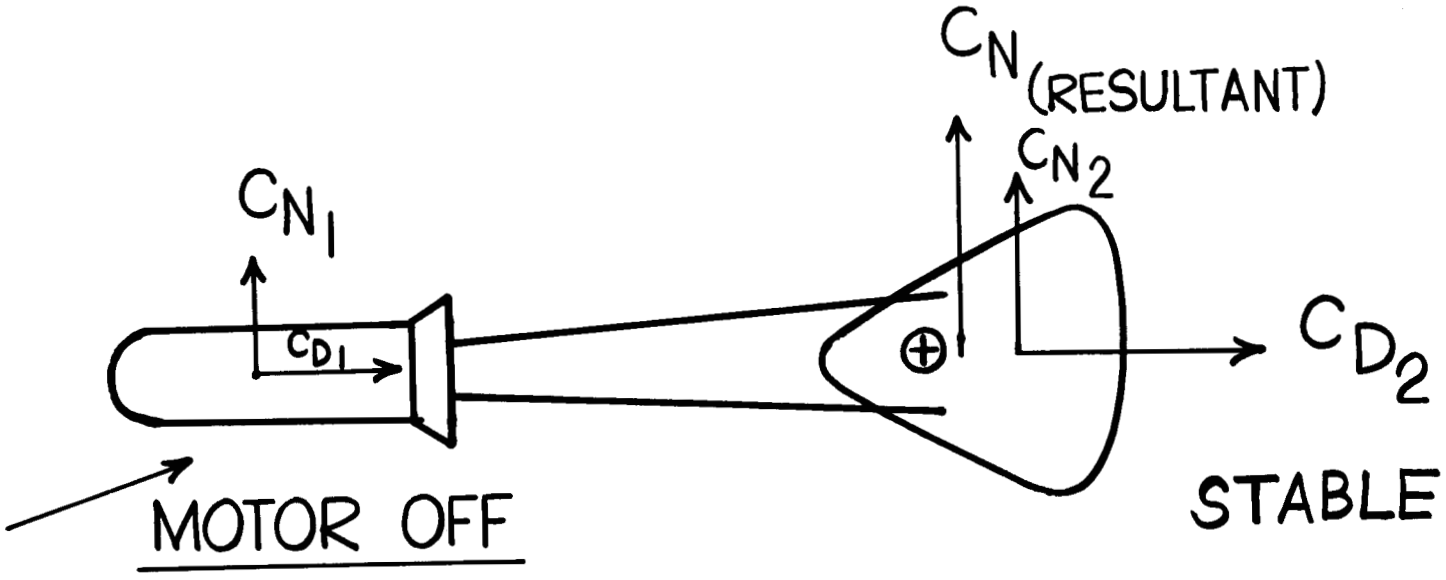
2-62 AP 10211

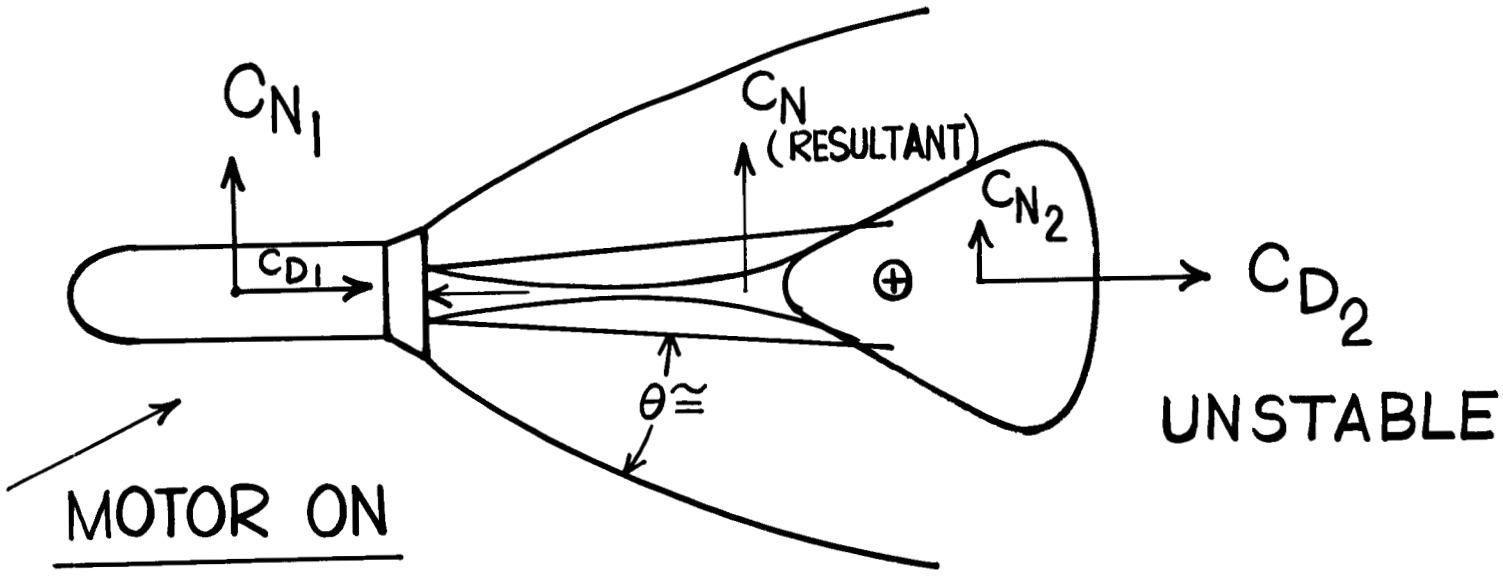
"BACK-UP" ENTRY INSTRUMENT



2-62 AP 10212

AERODYNAMIC FORCES





2-62 AP 10213

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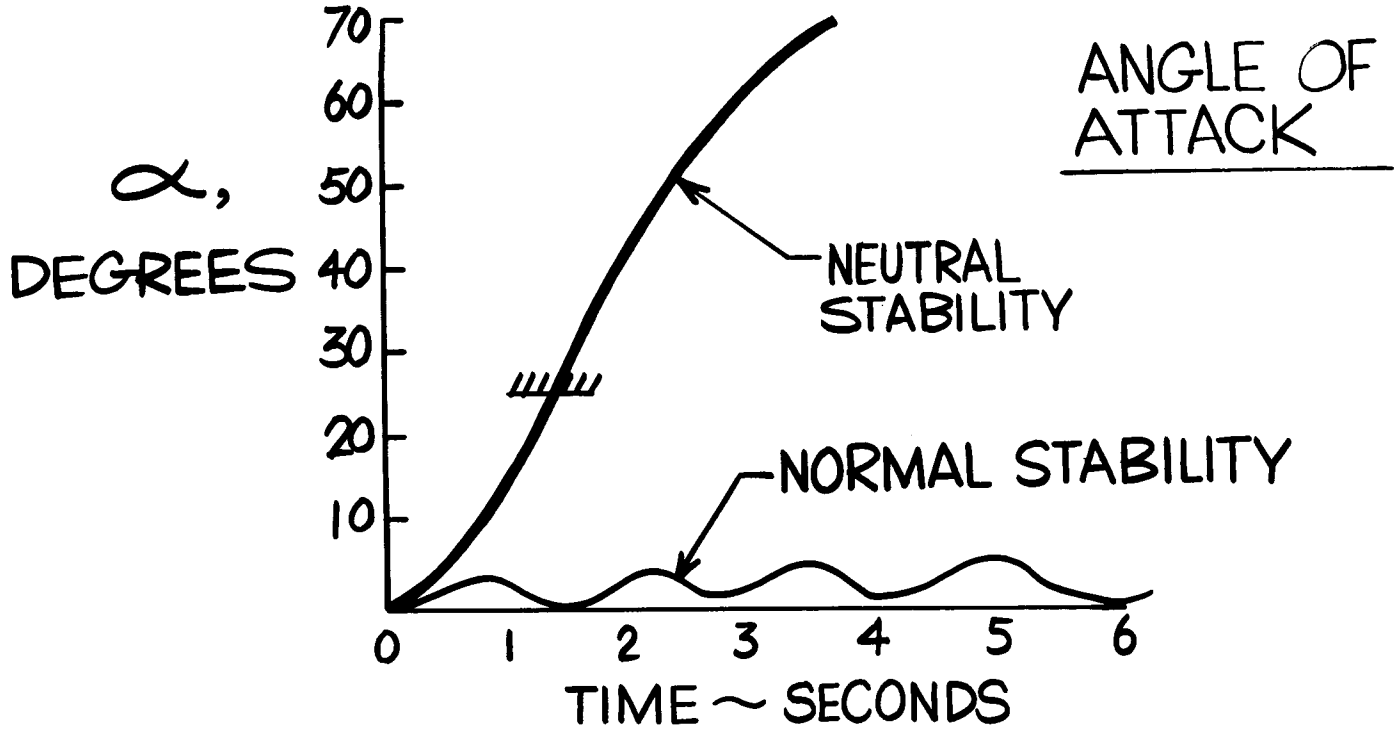
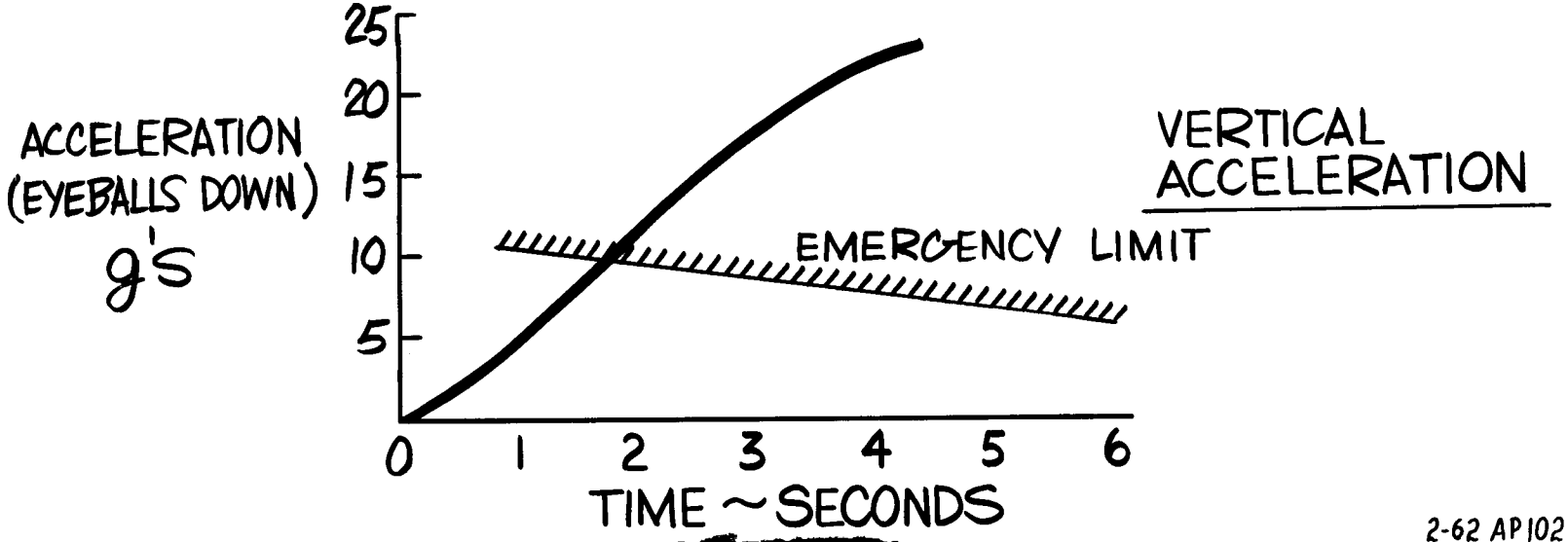
JET EFFECT STABILITY PROBLEM





2-62 AP10214

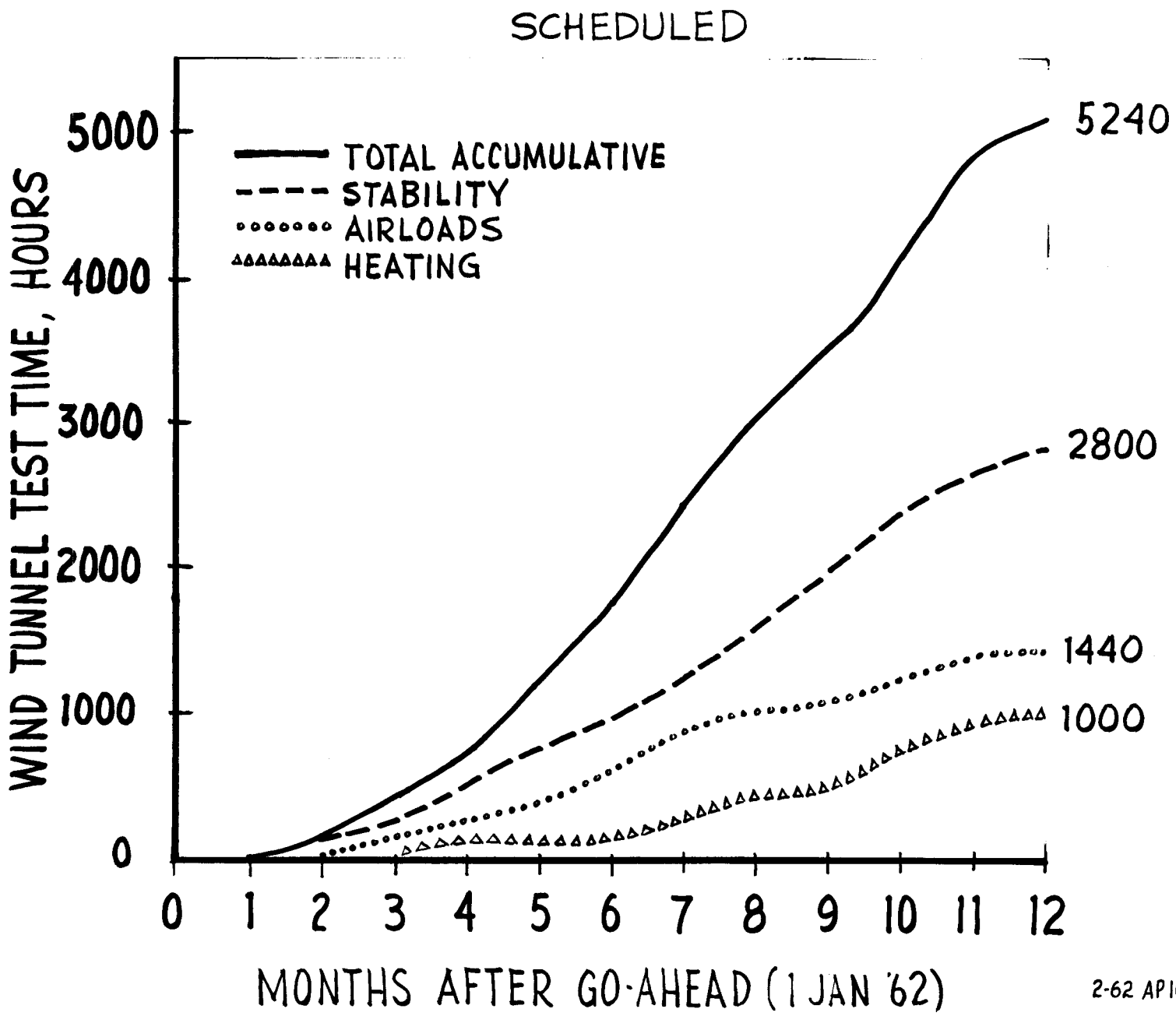
[redacted]

PROGRAMS FOR DATA ON C/M & ABORT SYS

	MAX g DATA	HIGHER g HIGH ALT	EXCERCISE OF S/M	HIGH g	TIME TO DATE	RECOM-MENDATION
LITTLE JOE I	MARGINAL WITH PROGRAM	NO	NO	NO	LATE	DIS-CONTINUE
LITTLE JOE II	AVAIL-ABLE	YES	YES	YES	LATER	YES
WIND TUNNEL PROGRAM	YES	JET EFFECT DIFFERENT	NO	NO	EARLY	YES

2-62 AP 10215

WIND TUNNEL TESTS



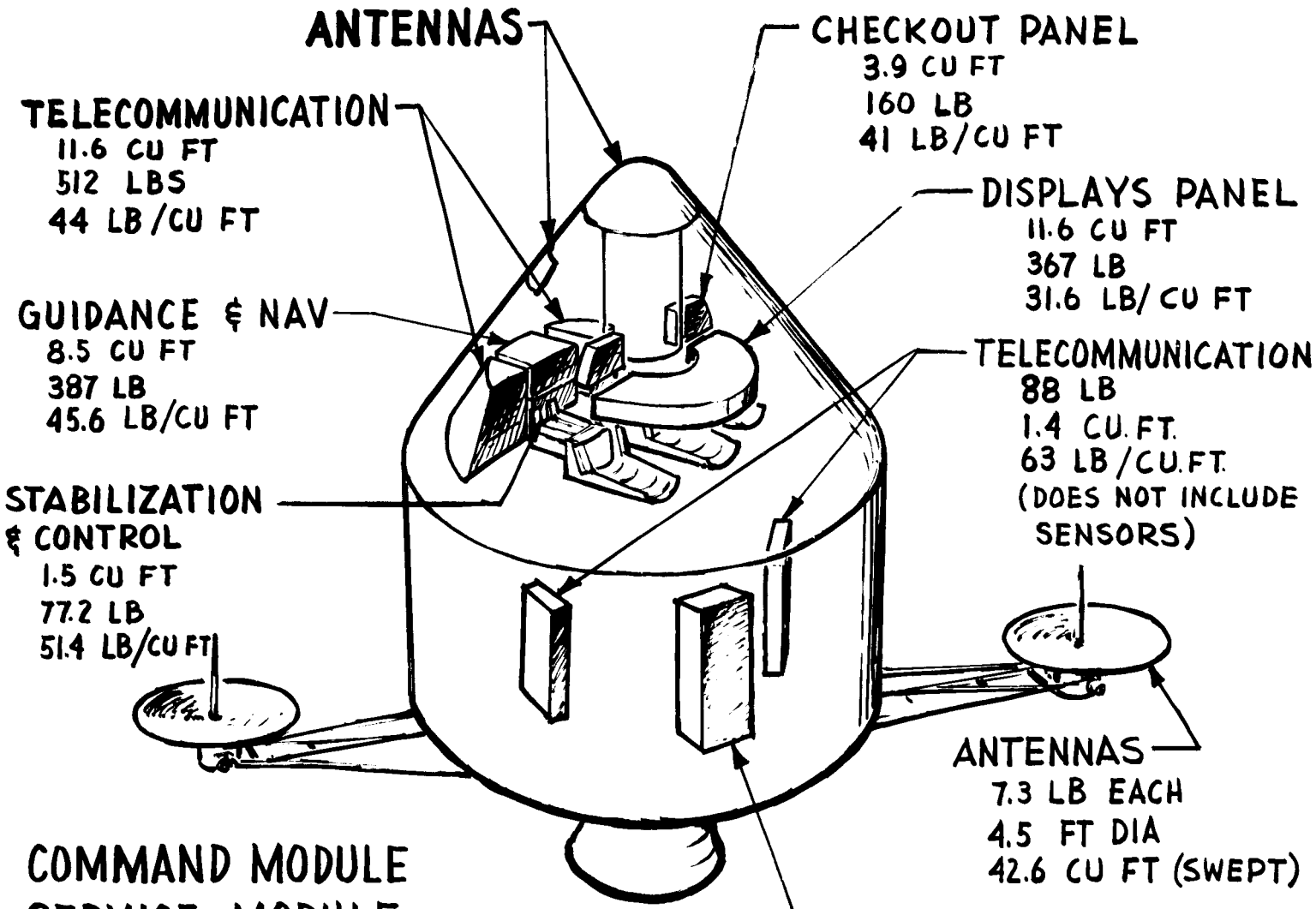
2-62 AP 10216

ELECTRONIC SYSTEMS

2-62 AP10217

[redacted]

ELECTRONIC SYSTEMS



COMMAND MODULE
SERVICE MODULE

TOTAL WEIGHT = 1754

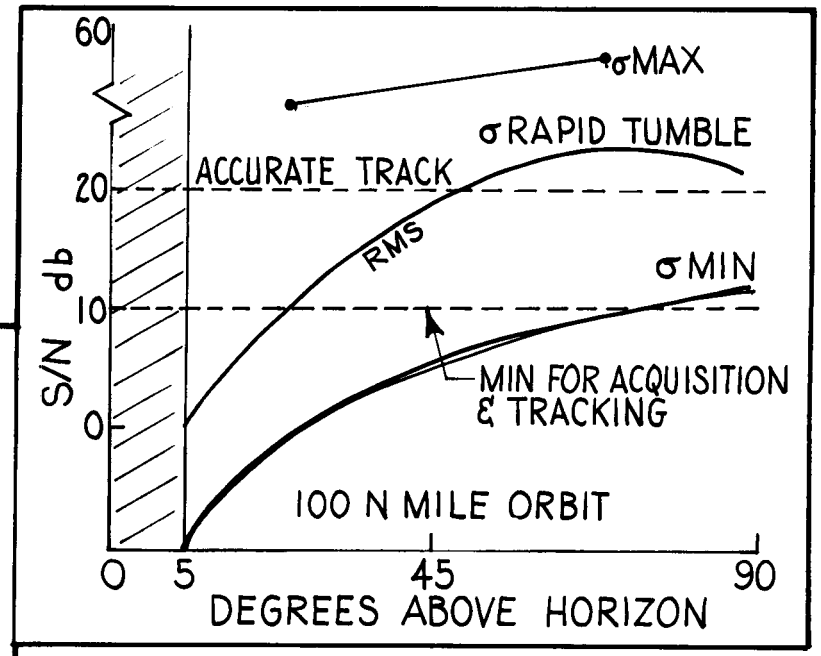
TOTAL VOLUME = 84.6 - 42.6

2-62 AP10218

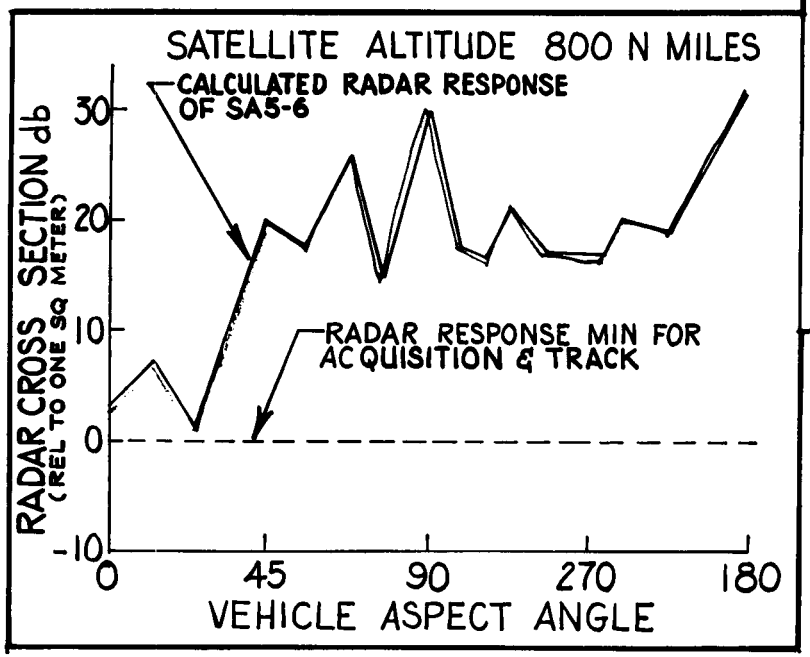
[redacted]

"NO-BEACON" ANALYSIS

AN/FPS-16 RADAR 5 kmc



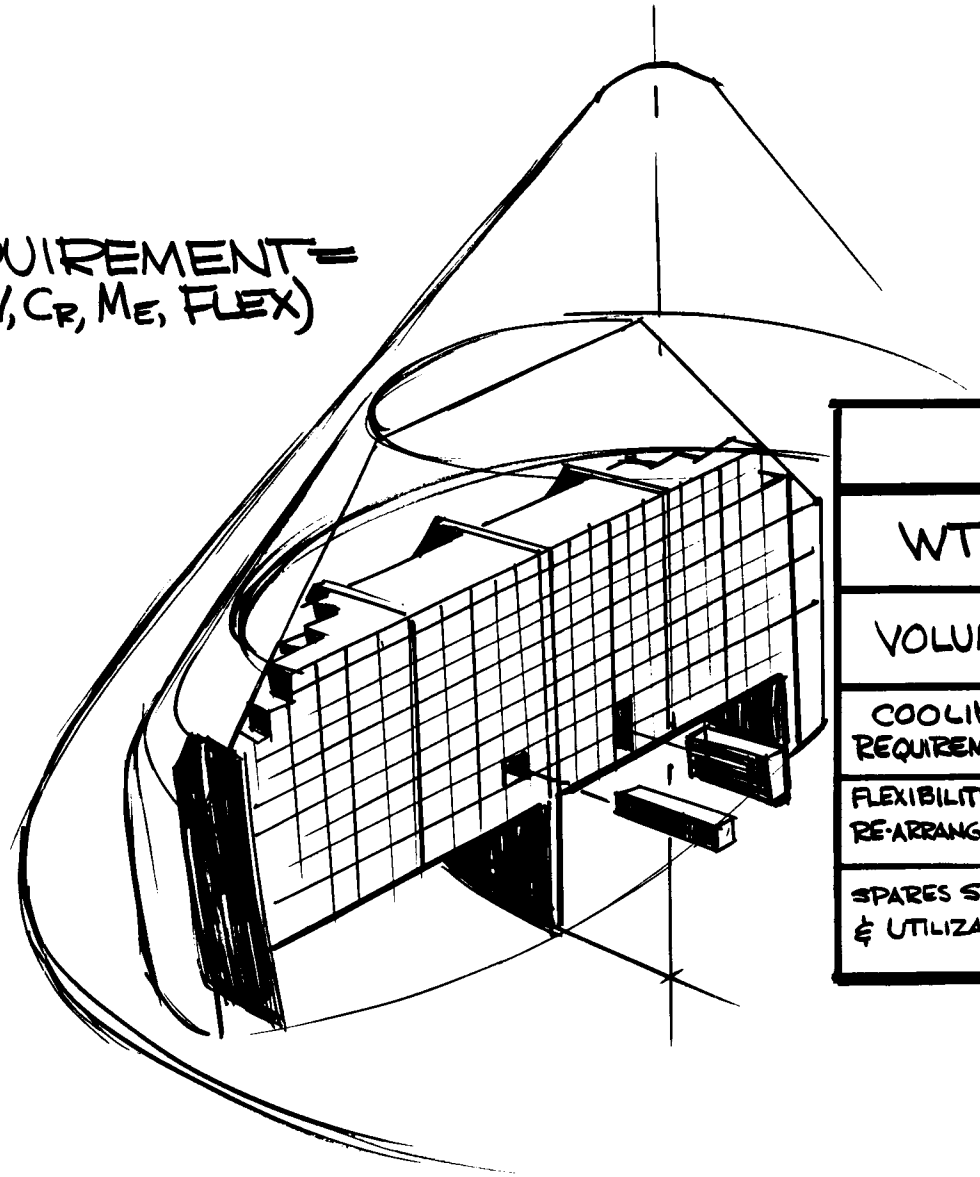
SPASEUR RADAR - 107mc



2-62 AP10219

MODULAR ELECTRONICS INST RACK

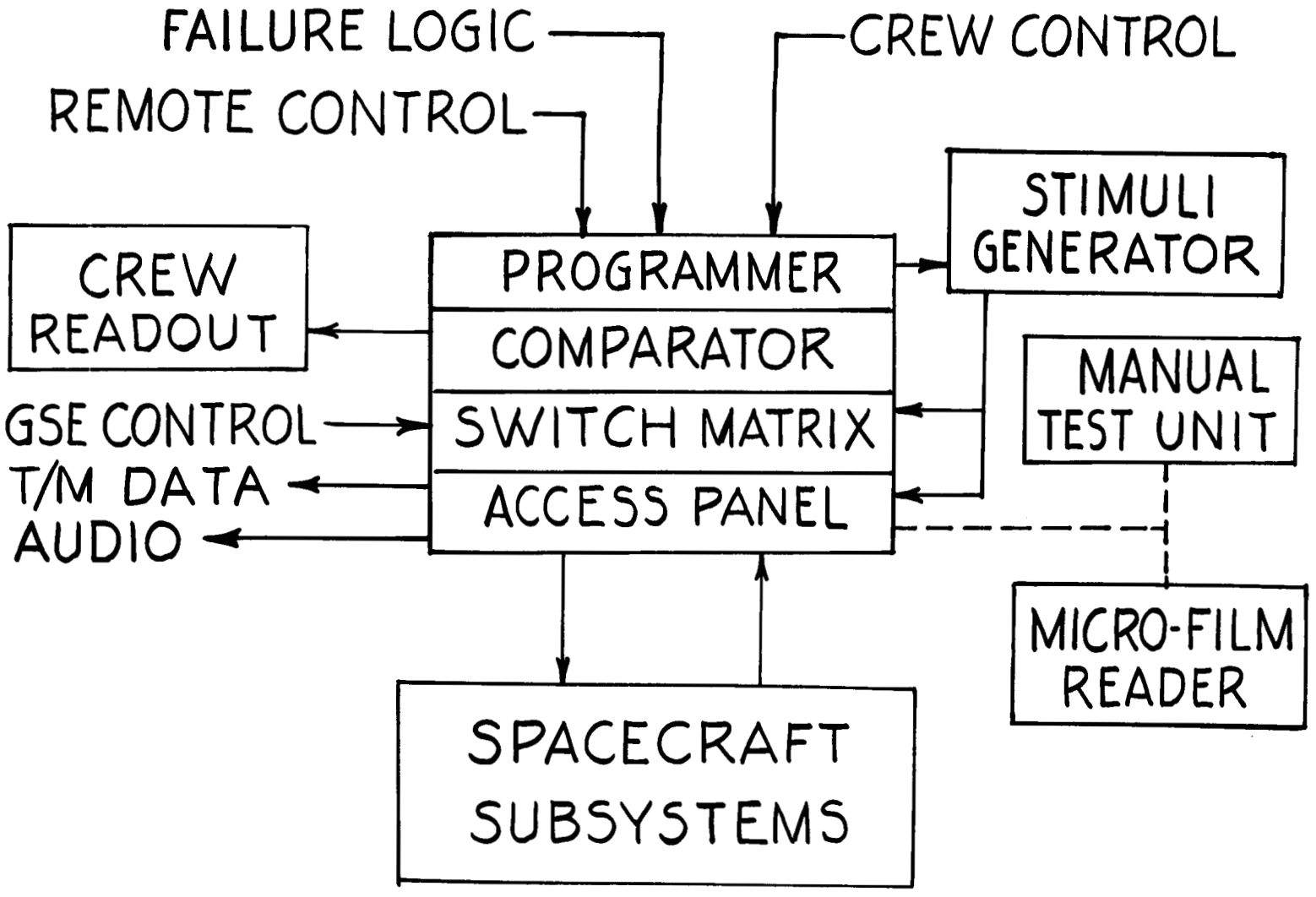
REQUIREMENT =
+ (W, V, C_R, M_E, FLEX)



	MODULAR CELL	SOME OTHERS
WT	LOWER	HIGHER
VOLUME	LOWER	HIGHER
COOLING REQUIREMENTS	LOWER	HIGHER
FLEXIBILITY FOR RE-ARRANGEMENT	GOOD	POOR
SPARES STORAGE & UTILIZATION	EFFICIENT	RESTRICTED

2-62 AP 10220

IN-FLIGHT TEST SYSTEM



2-62 AP10221

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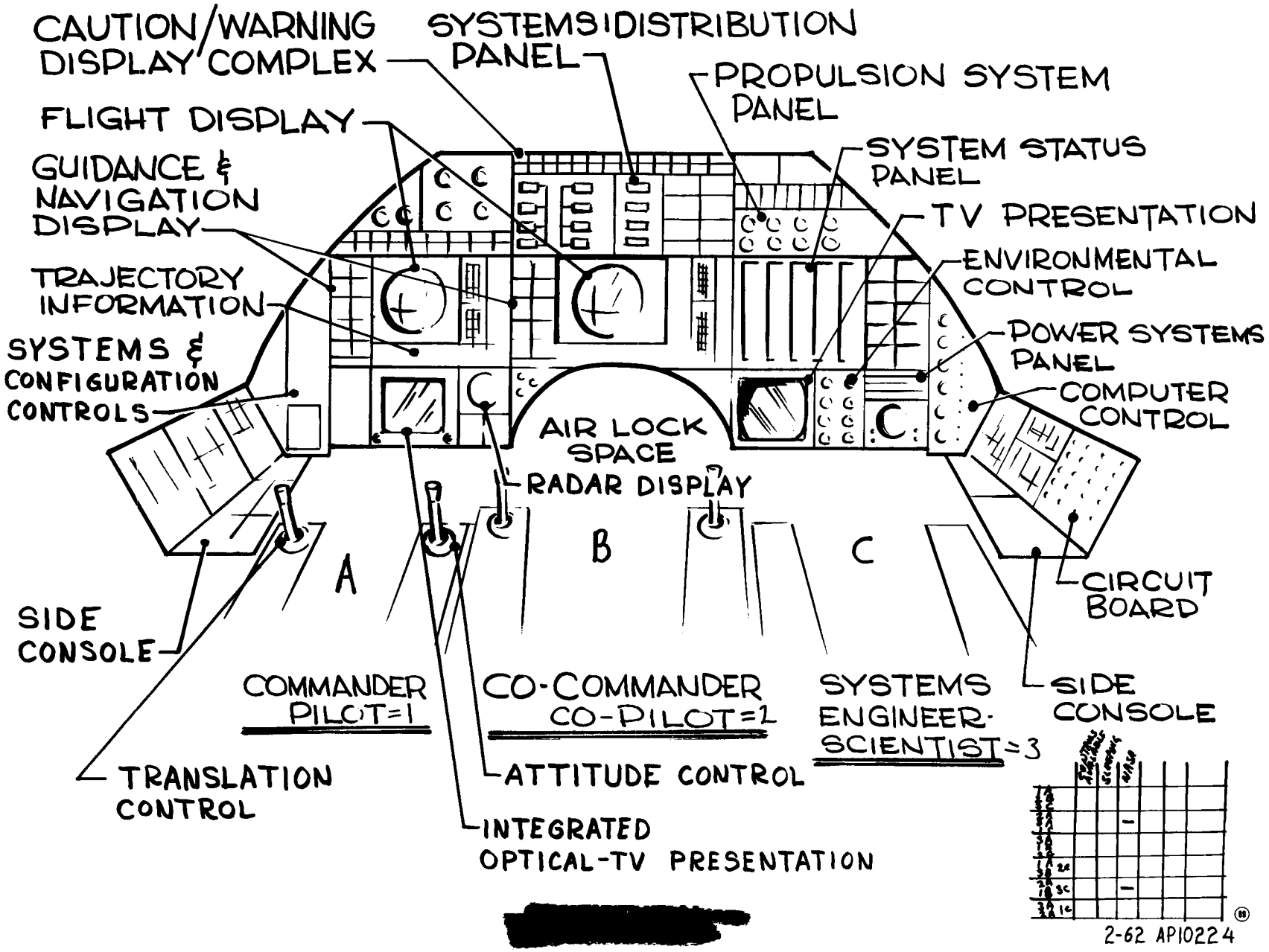
APOLLO – LIFE SYSTEMS C/M CONTROL-DISPLAY LAYOUT



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2-62 AP10224

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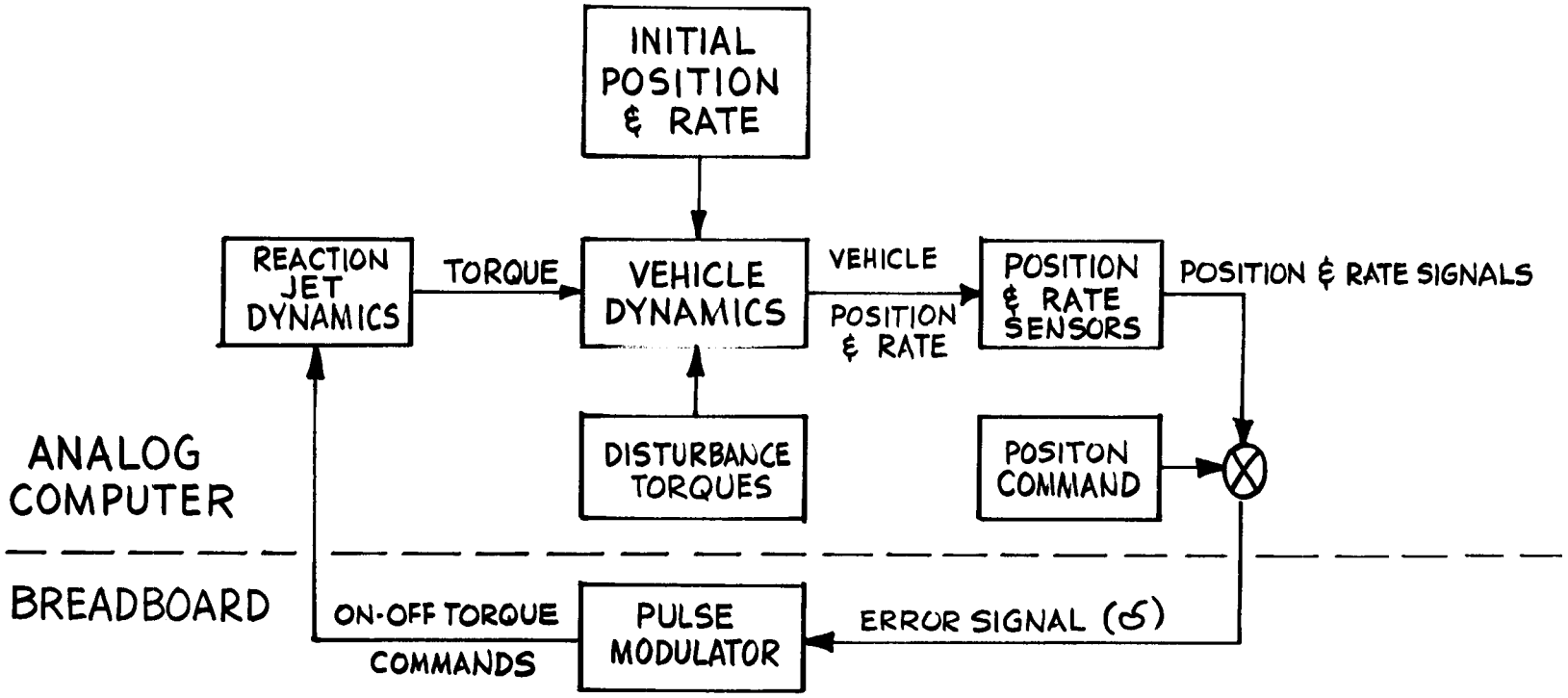
STABILIZATION & CONTROL PULSE MODULATION



PREPROGRAMMED PULSE TECHNIQUE

- PULSE COMMAND ARE ON-OFF PULSES
- PULSES OF PREDETERMINED WIDTH
- PULSES OCCUR AT SELECTED VALUES OF ERROR SIGNAL

PULSE WIDTH & FREQ MODULATION TECHNIQUE

- TORQUE COMMANDS ARE ON-OFF PULSES
- PULSE WIDTH & FREQ ARE A FUNCTION OF ERROR SIGNAL
- THE FUNCTION IS: $(t) \times (F) = (K) \times (\sigma)$

t PULSE DURATION F PULSE FREQ
K PROPORTIONALITY FACTOR σ ERROR SIGNAL

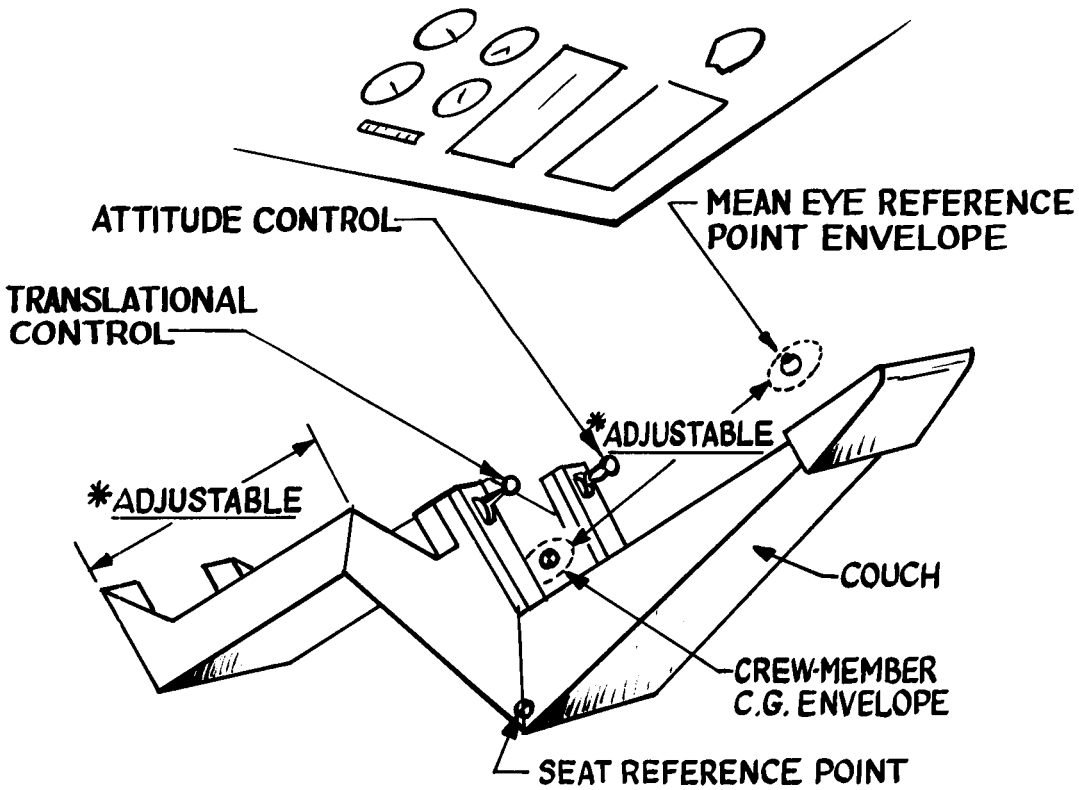
2-62 AP10222

[redacted]

LIFE SYSTEMS

[redacted]

APOLLO LIFE SYSTEMS ANTHROPOMETRIC STUDIES



CABIN

$V = 336\ ft.^3$

$h_{max} = 76''$

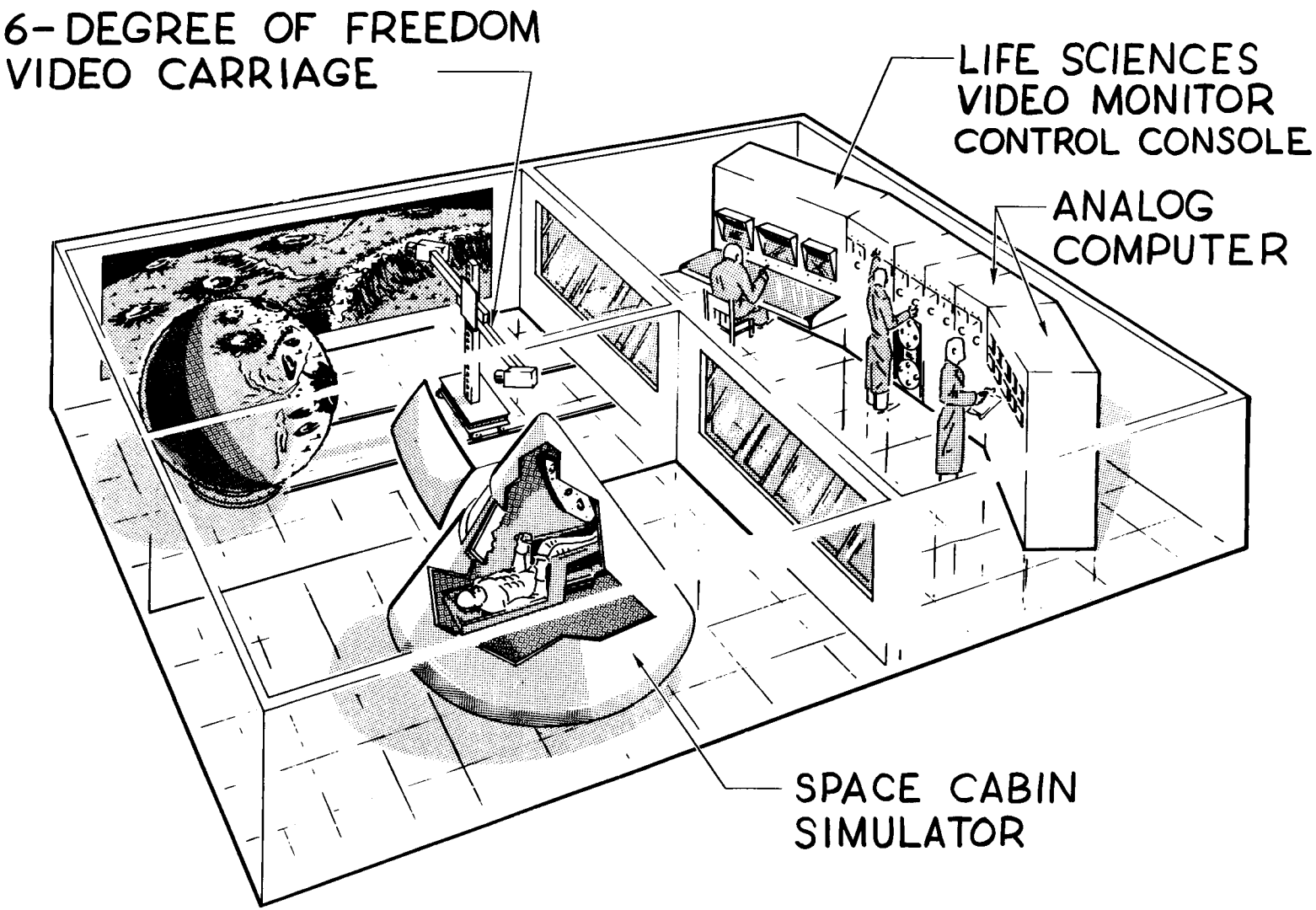
MINIMUM EYE TO PANEL DISTANCE $= 24.5''$

* TO ACCOMODATE 10-90 PERCENTILE CREW MEMBER FOR 90% (72.2") P & C

[redacted]

2-62 AP10225

COMPUTER SIMULATION FACILITY



2-62 AP10226
(81)

TASKS TO BE REPORTED ON AT NEXT MEETING

1. DESIGN CRITERA
2. GOSS PRELIMINARY REQUIREMENTS
3. ANTENNAS CONCEPT
4. $\Delta V = f(W, P, \cdots)$
5. LJ II PROGRAM
6. SA→10 PRELIMINARY INSTRUMENTATION
7. RENDEZVOUS DATA (GEODESICS)
8. TELESCOPE REQUIREMENTS
9. RADAR ALT REQ
10. COUCH & DISPLAYS DESIGN
11. WINDOW REQ
12. IN-FLIGHT TEST LOGIC

[redacted]

CIRCUMLUNAR SENSITIVITIES

LAUNCH TIME & INJECTION TIME EFFECTS

PARAMETER	Δ LAUNCH TIME = 1 SEC	Δ INJECTION TIME = 1 SEC
PERILUNE RADIUS – Δr_p	7.4 N. MILE	90 N. MILE
PERIGEE RADIUS – Δr_p	-108 N. MILE	-3055 N. MILE
TOTAL TRANSIT TIME – ΔT_t	.0783 HR	-.221 HR
EARTH CONIC INCLINATION – Δi_E	.41 DEG	-11.5 DEG

[redacted]

2-62 AP10228

93

[redacted]

GROSS WEIGHT-COMMAND MODULE WEIGHT SENSITIVITIES

MISSION	$\frac{\Delta W_G \text{ LB}}{\Delta W_{CM} \text{ LB}}$
LUNAR LANDING	12.0
LUNAR TAKE-OFF (SPACE CRAFT)	5.0
LUNAR ORBIT	1.8
EARTH ORBIT	1.2

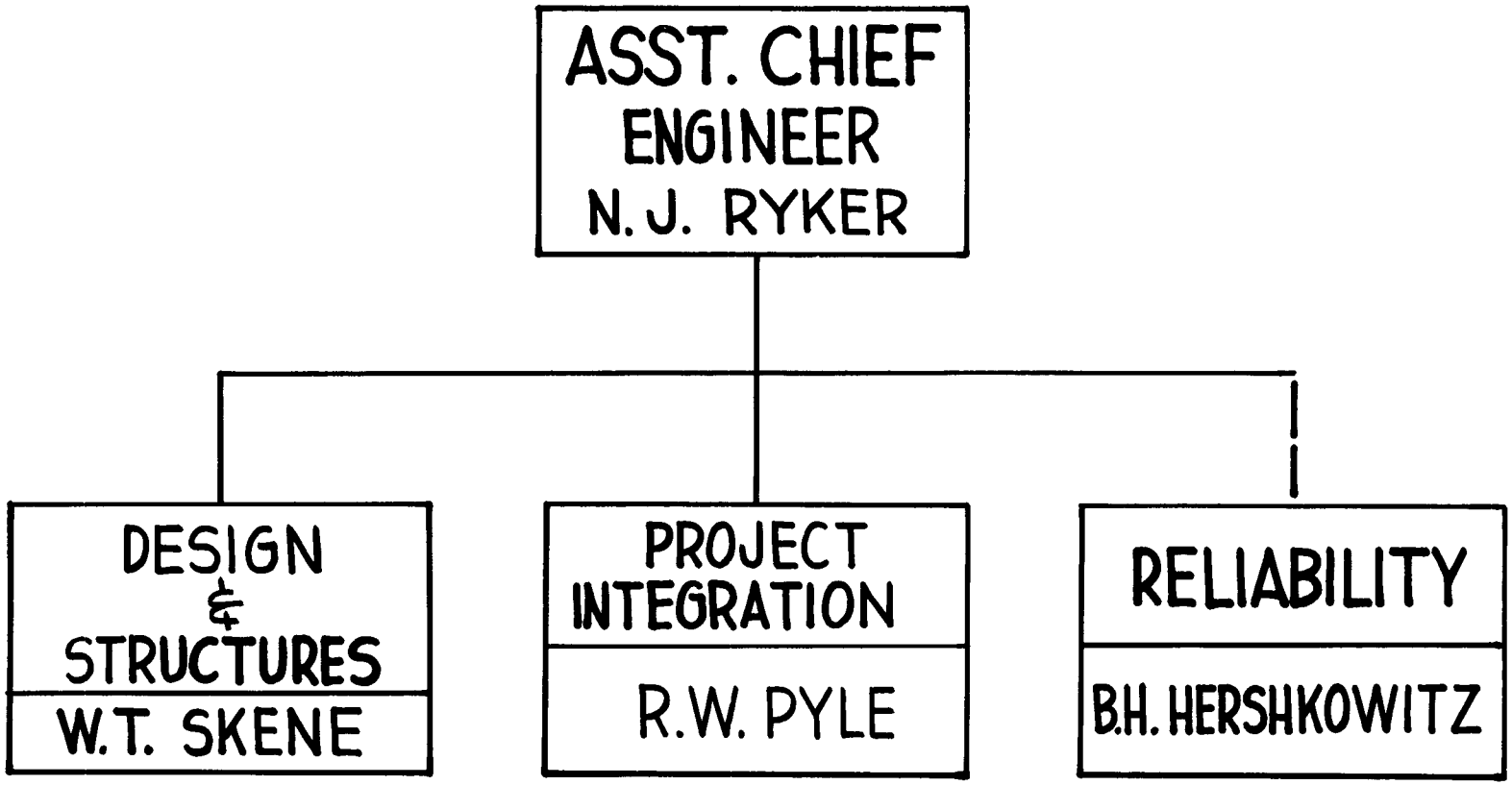
FOR EARTH ORBIT C-1 GROSS WEIGHT

LIMIT $\frac{\Delta(\Delta V)}{\Delta W_{CM}} = .671$ ft/sec/lb

2-62 AP10229

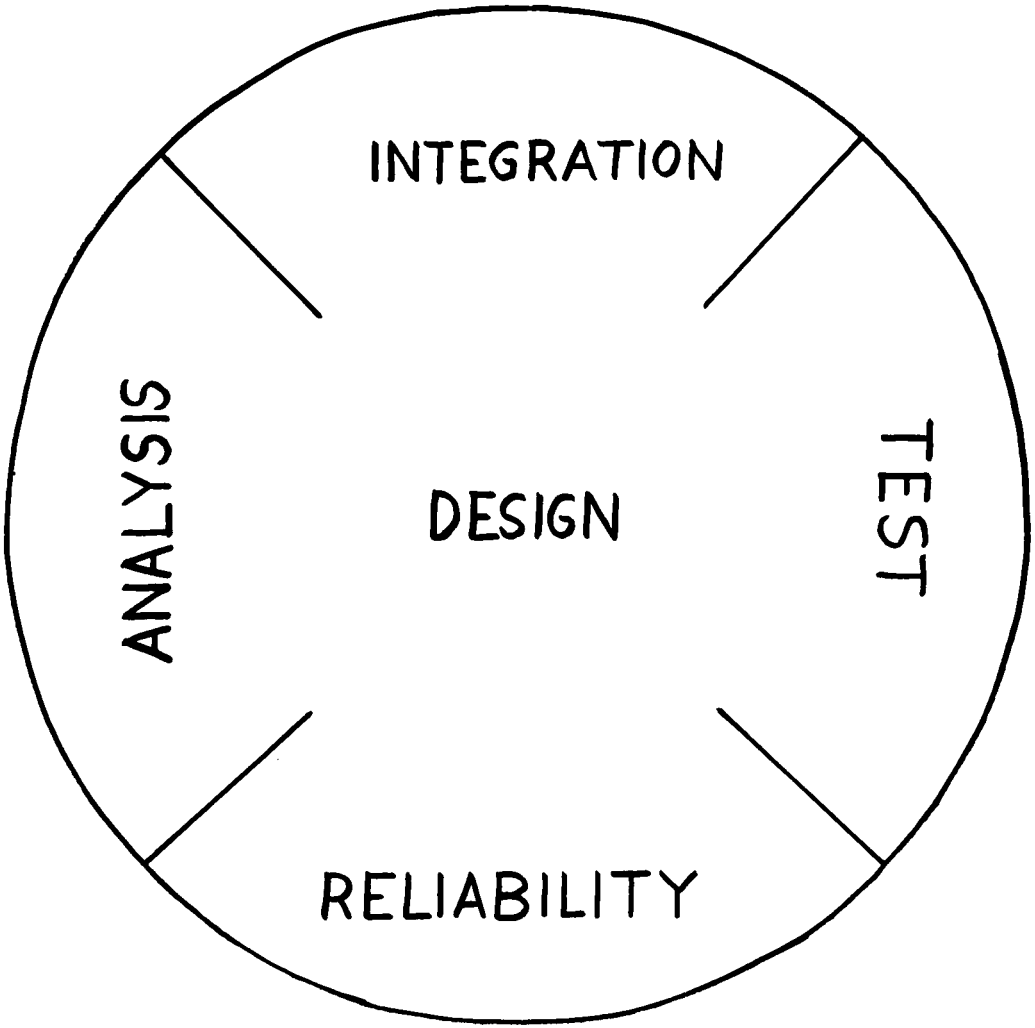
[redacted]

STRUCTURES, INTEGRATION & RELIABILITY


ASST. CHIEF ENGINEER
N. J. RYKER
DESIGN & STRUCTURES
W.T. SKENE
PROJECT INTEGRATION
R.W. PYLE
RELIABILITY
B.H. HERSHKOWITZ

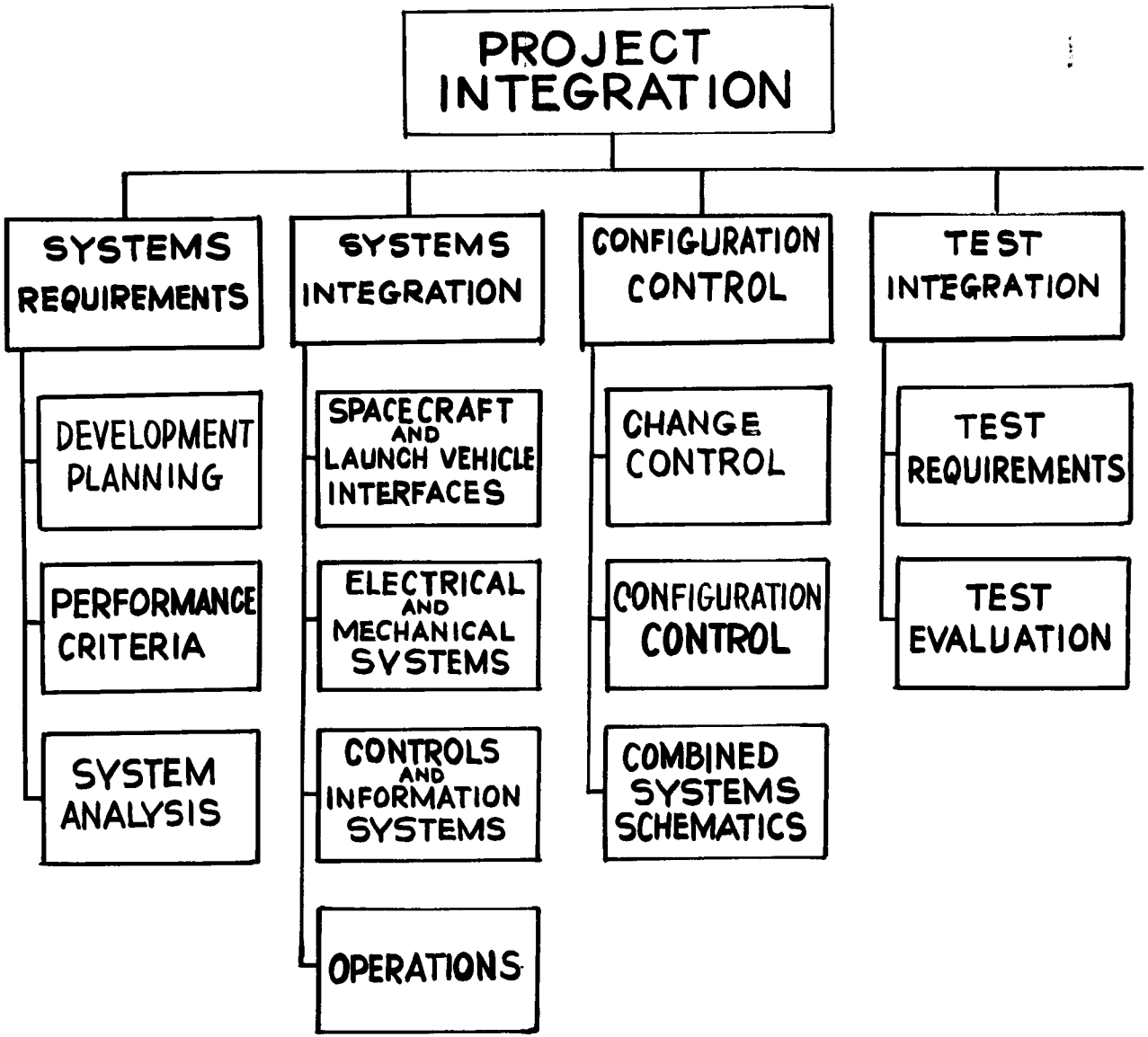
2-62 AP 10231

DESIGN PRACTICE



2-62 AP10232

APOLLO SYSTEM INTEGRATION


PROJECT INTEGRATION
SYSTEMS REQUIREMENTS
DEVELOPMENT PLANNING
PERFORMANCE CRITERIA
SYSTEM ANALYSIS
SYSTEMS INTEGRATION
SPACECRAFT AND LAUNCH VEHICLE INTERFACES
ELECTRICAL AND MECHANICAL SYSTEMS
CONTROLS AND INFORMATION SYSTEMS
OPERATIONS
CONFIGURATION CONTROL
CHANGE CONTROL
CONFIGURATION CONTROL
COMBINED SYSTEMS SCHEMATICS
TEST INTEGRATION
TEST REQUIREMENTS
TEST EVALUATION

2-62 AP10234

PROJECT INTEGRATION

- SYSTEM ANALYSIS
- SYSTEM REQMTS
- TECH DEVELOPMENT PLAN
- COMBINED SYSTEM TEST
- INTEGRATED TEST PLAN
- CONFIG CONTROL
- C/O & LAUNCH PROCEDURES INTEG
- SYSTEM DESIGN REVIEW
- INTERFACE DEFINITION & CONTROL

LUNAR LANDING TECHNIQUES

- LUNAR ORBITAL RENDEZVOUS SYSTEM (LOR) USING A LUNAR EXCURSION VEHICLE (LEV)

- LUNAR LANDING MODULE
  - DIRECT LAUNCH
  - EARTH ORBITAL RENDEZVOUS

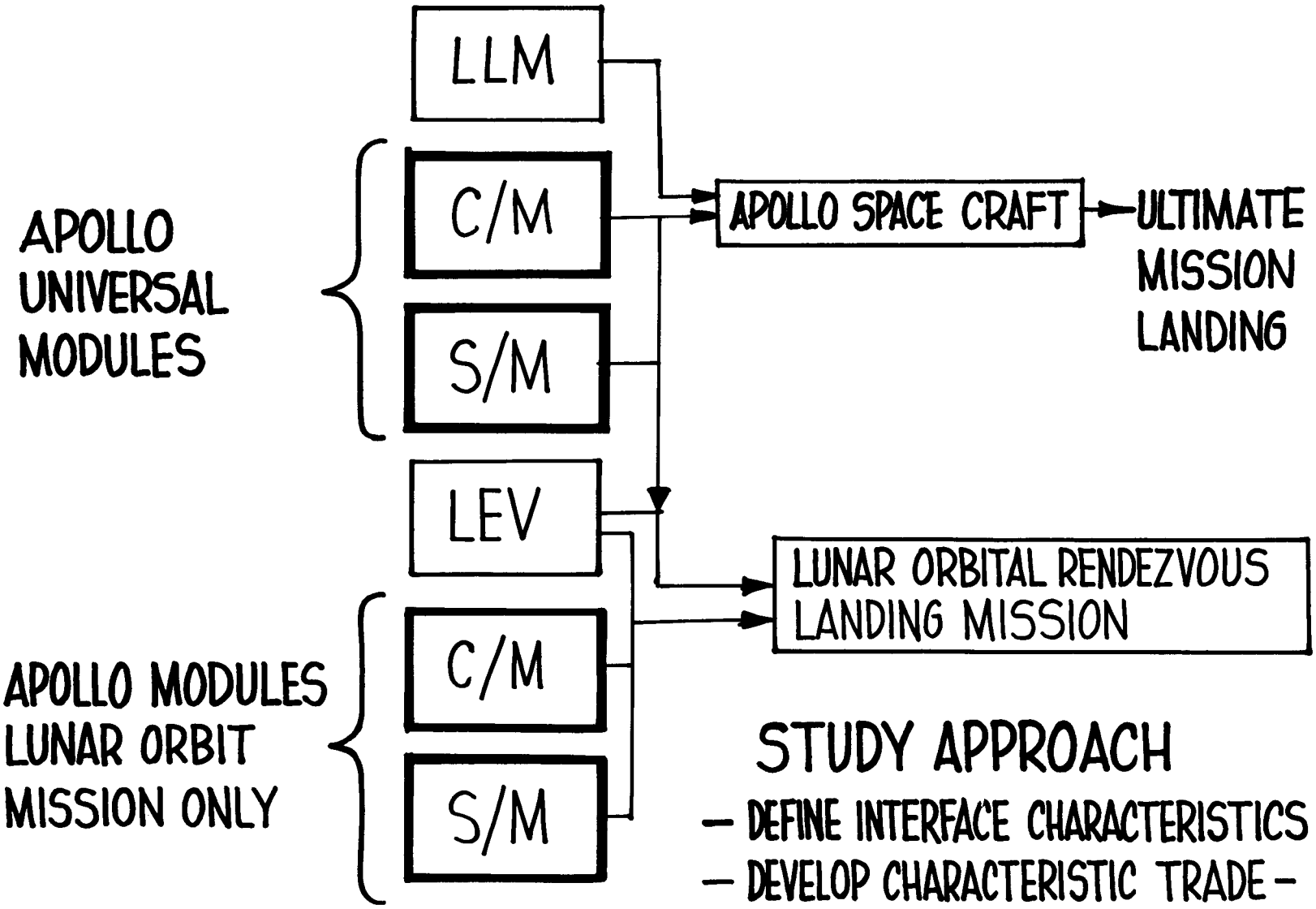
LUNAR ORBITAL RENDEZVOUS

ALTERNATE METHOD OF LUNAR LANDING

GROUND RULES

- LAND MAN ON MOON AT THE EARLIEST TIME, CONSISTANT WITH HIGH PROBABILITY OF SURVIVAL
- MAINTAIN ULTIMATE MISSION CAPABILITY
- MINIMIZE LUNAR EXCURSION VEHICLE(LEV) INTERFACES WITH APOLLO MODULES
- DEVELOP SYSTEM COMPATIBLE WITH PLANNED LAUNCH VEHICLE

SYSTEM APPROACH

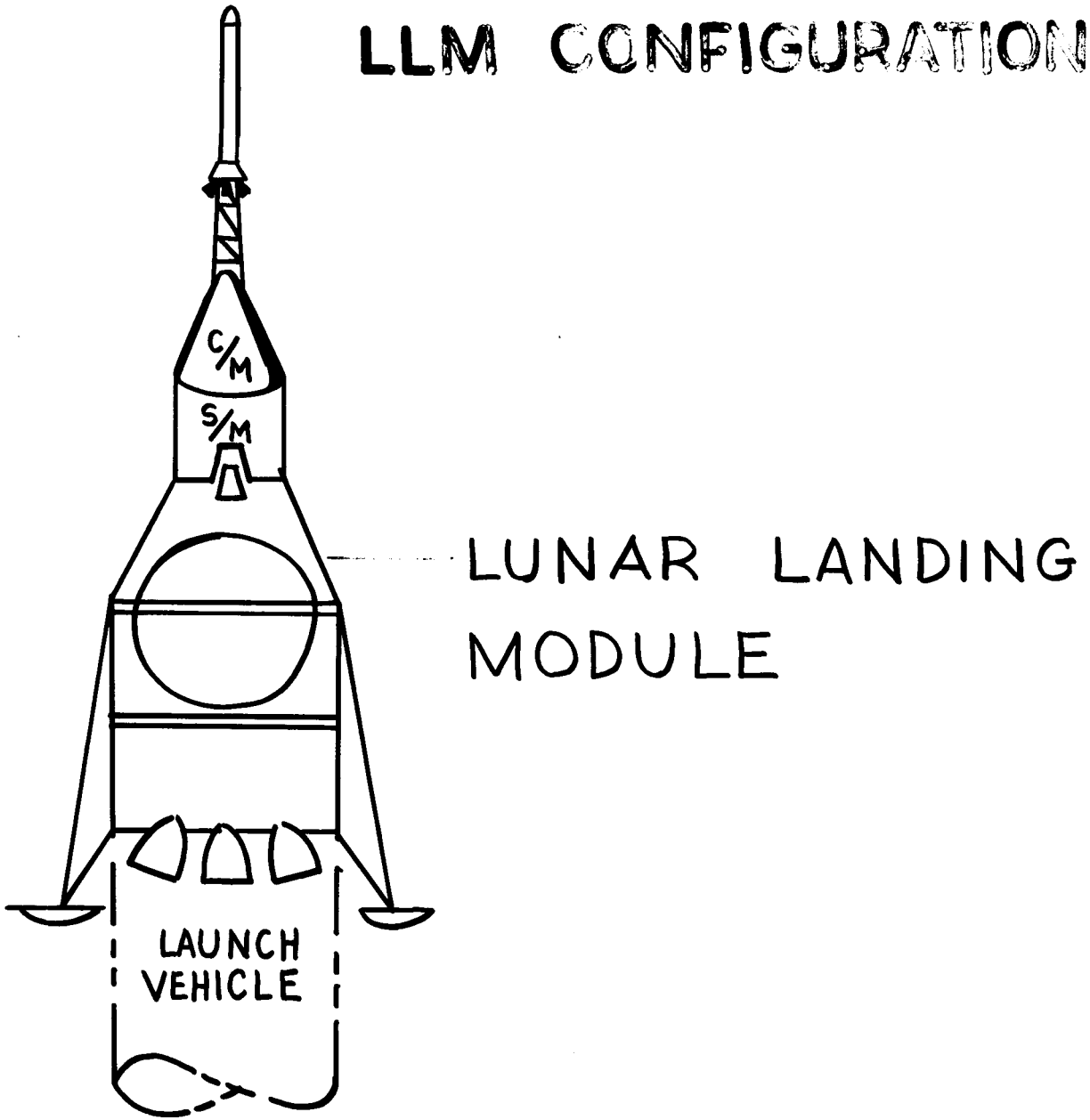


STUDY APPROACH

- DEFINE INTERFACE CHARACTERISTICS
- DEVELOP CHARACTERISTIC TRADE-OFF DATA
- DEVELOP SYSTEM DESIGN CRITERIA

2-62 AP10238

LLM CONFIGURATION



2-62 AP10239

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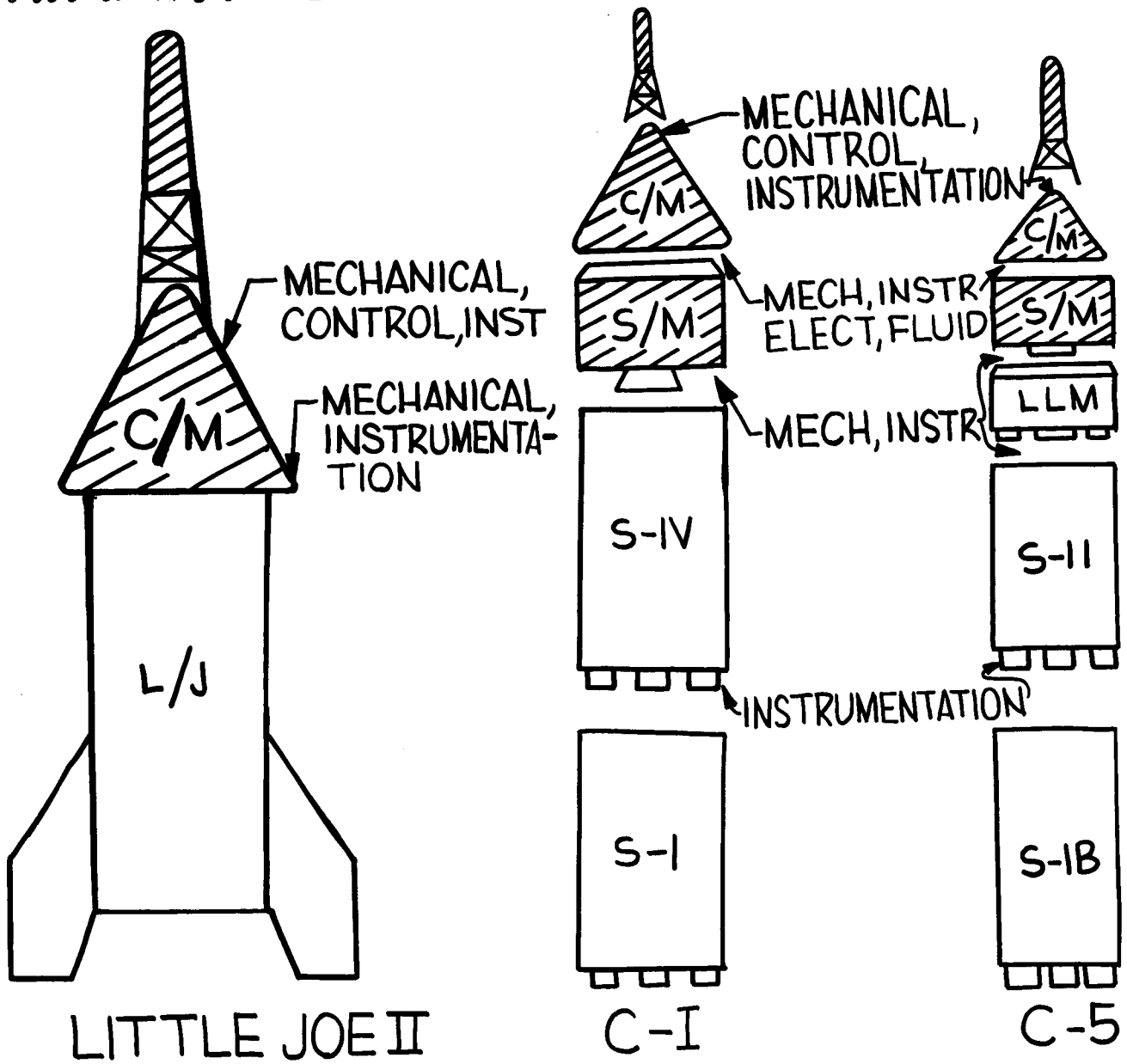
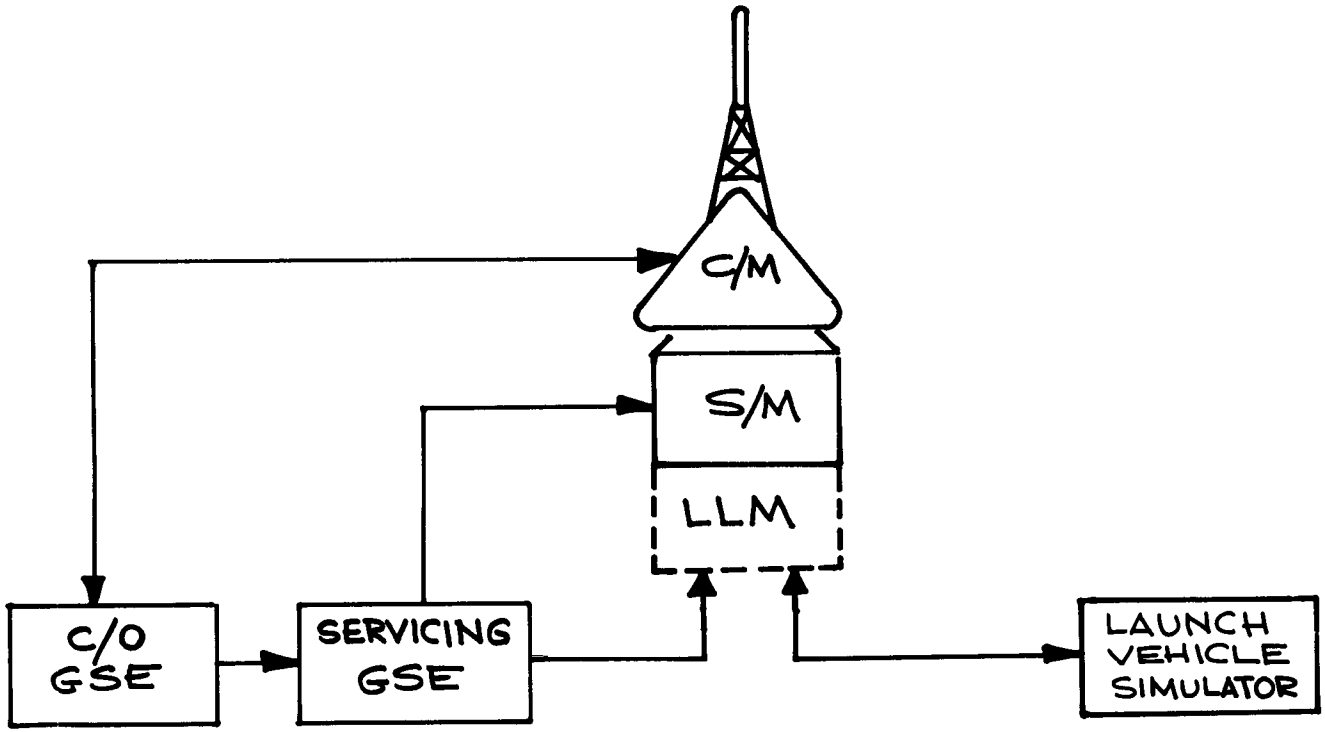
PRIMARY SPACE VEHICLE INTERFACES



NOTE - SHADED MODULES TO BE BUILT BY S & I D

2-62 AP10240

HOUSE SPACE CRAFT



RESOLVE INTERFACE PROBLEMS & PERFORM SYSTEM C/O SEPARATION TESTS

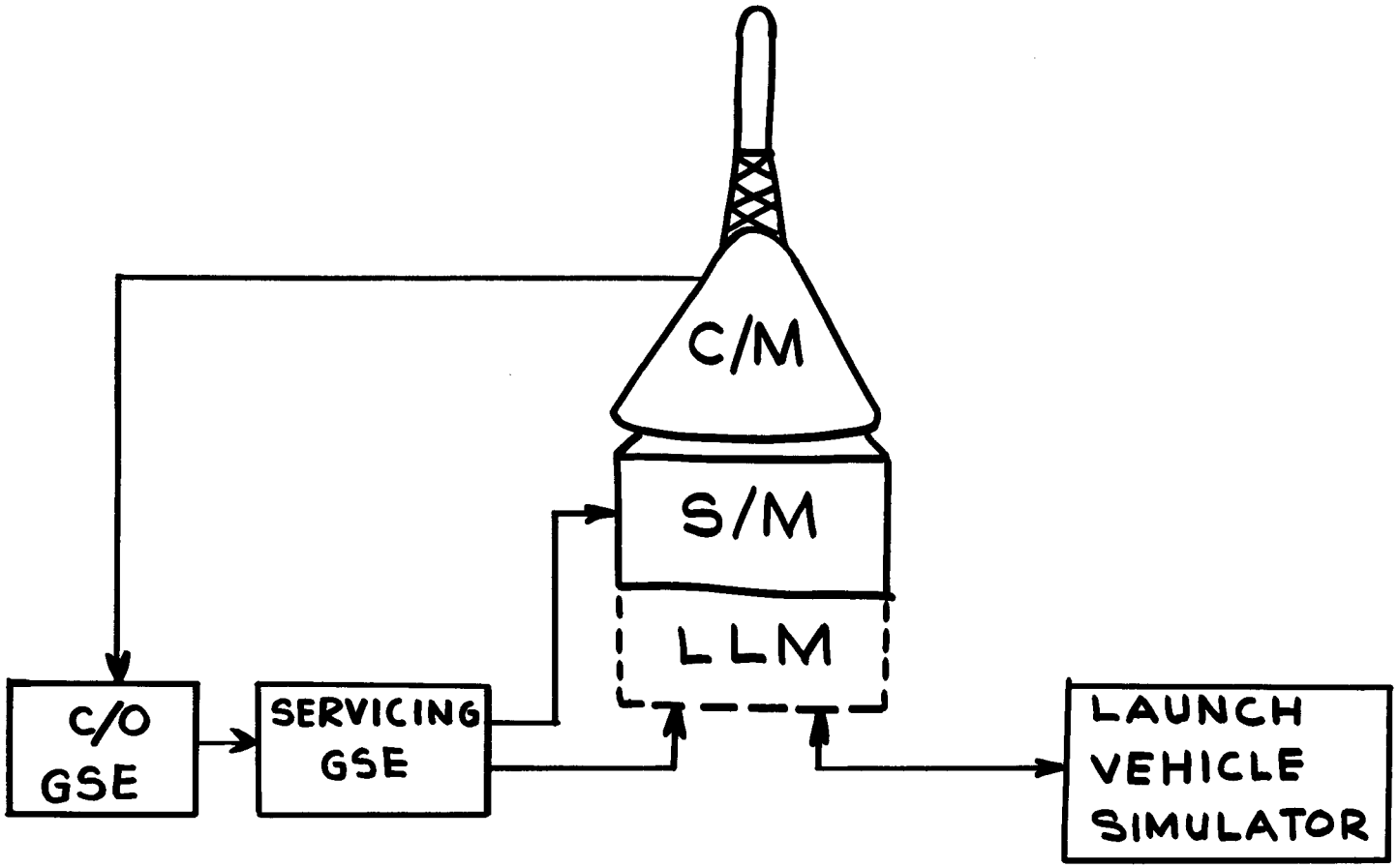
ELECTRO-INTERFACE EVALUATION TESTS

SPECIAL INTEGRATION & COMPATIBILITY C/O TESTS

PERFORM TRAINING OF FLIGHT TEST PERSONNEL

DEVELOP C/O PROCEDURES

ACCEPTANCE TESTING



VERIFY SYSTEM COMPATIBILITY
PERFORM ELECTRICAL INTERFACE TEST
PERFORM COMBINED SYSTEMS TEST
VERIFY SPACECRAFT READY FOR SHIPMENT TO AMR

2-62 AP 10242
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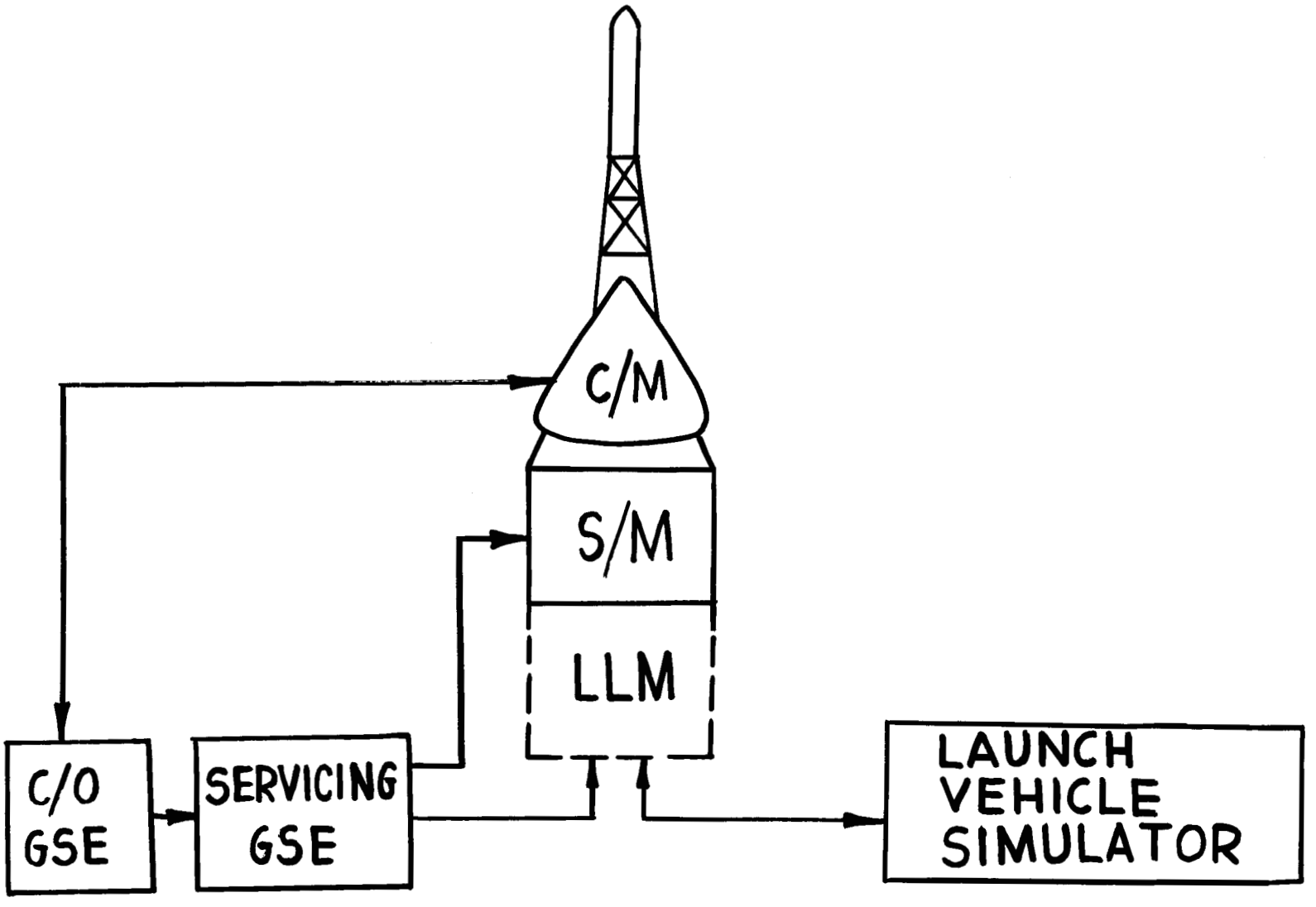
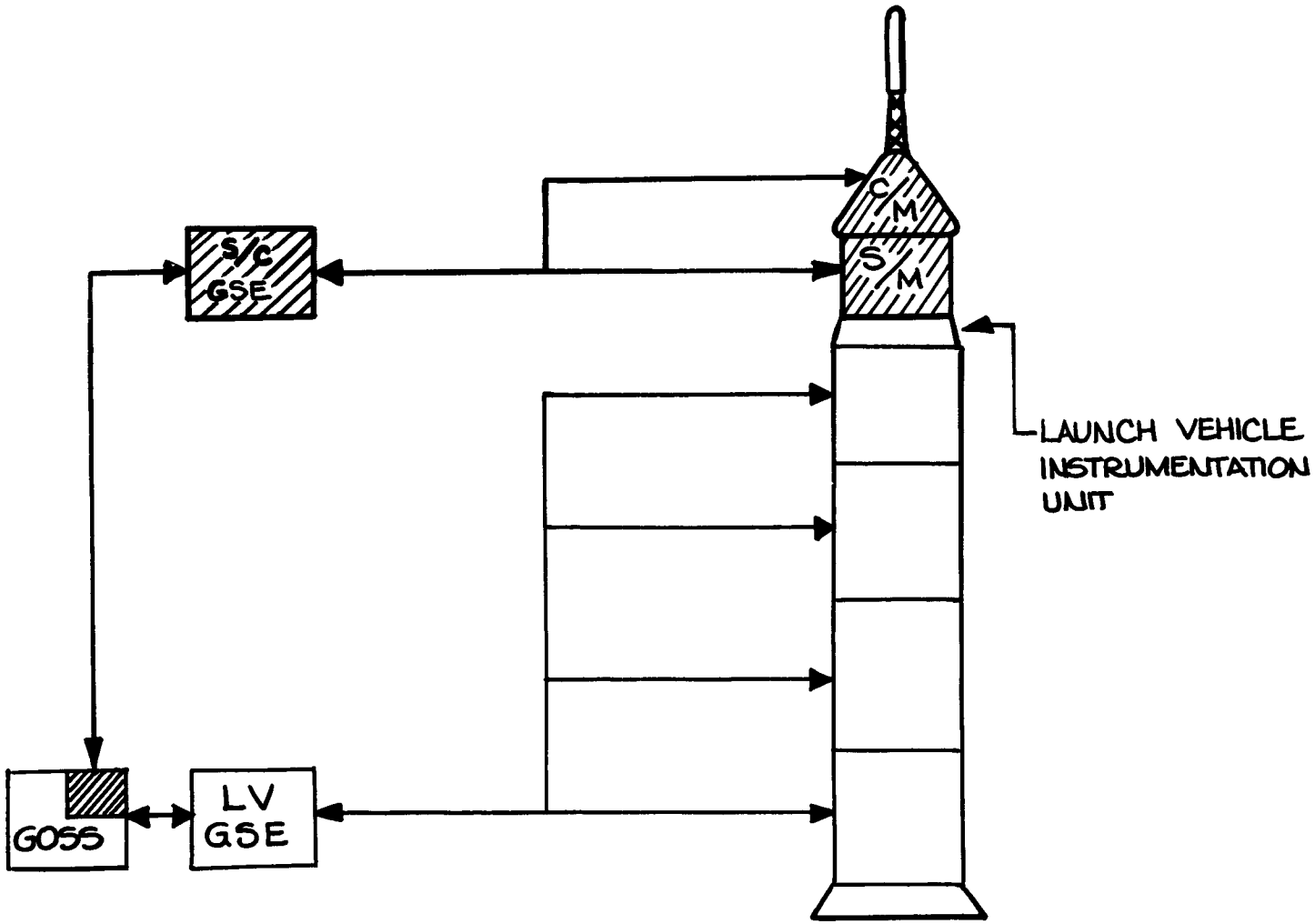
AMR C/O AREA



PERFORM COMBINED SYSTEMS TEST
VERIFY INTERFACE COMPATIBILITY

2-62 AP10243

AMR LAUNCH PAD



EVALUATE S/C SYSTEMS FOR INTERFACE COMPATIBILITY
PERFORM COMPATIBILITY TEST
VERIFY S/C SYSTEMS READY FOR FLIGHT

▨ NAA RESPONSIBILITY

2-62 AP 10244

SYSTEM INTEGRATION MILESTONES

JAN 31 REQUIREMENT

TEST PLAN	SUBMITTED
LAUNCH VEHICLE INTEGRATION REPORT	SUBMITTED

FEB 28 REQUIREMENT

INITIAL RELEASE 19 FEB
PERCENT ENGRG COMPLETION

21	MOCKUP SPECS	95%
17	BOILER PLATE VEHICLE SPECS	95%
1	PROGRAM PLAN (ENGRG PORTION)	95%
1	MOCKUP INSP PLAN	90%
1	SPACECRAFT PERFOR SPEC	100%
1	COMM MOD PERFOR & INTERFACE SPEC	100%
1	ADAPTER PERFOR & INTERFACE SPEC	100%
1	LUNAR LAND MOD PERFOR & INTERFACE SPEC	100%
1	DESIGN CRITERIA	100%

2-62 AP10245

DESIGN & STRUCTURES

- DESIGN
  - STRUCT & MECH SYST DESIGN
  - SYST INSTALLATION
  - VOLUME ALLOCATION
  - FUNCTIONAL TESTING
  - LAUNCH–ESCAPE TOWER & ERS
  - HEAT SHIELD

DESIGN & STRUCTURES

- STRUCTURAL ANALYSIS
  - STRESS & DEFLECTION ANALYSIS
  - WEIGHT CONTROL
  - MATERIAL & PRODUCTION
  - STATIC TESTING
- STRUCTURAL DYNAMICS
  - DYNAMICS RESPONSE ANALYSIS
  - SHOCK VIBRATION & ACOUSTIC ANALYSIS
  - STRUCT LOADS & CRITERIA
  - DYNAMIC TESTING

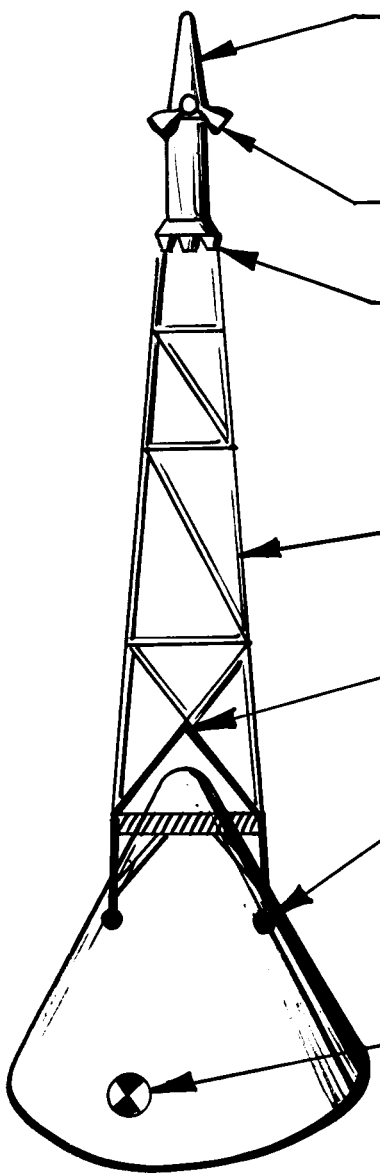
DESIGN MILESTONES

- NON-FLY BP CONFIG FREEZE
- PREL S/M CONFIG DECISION
- PREL 6/M CONFIG
- EARTH REC SYST DEVEL STARTED
- HEAT SHIELD PROPOSALS IN EVAL
- PRIMARY ORG STRUCT EST

DESIGN INVESTIGATIONS

- ESCAPE TOWER CONFIGURATION
- CREW COMPARTMENT VOLUME
- LANDING SHOCK ATTENUATION
  - COUCH
  - COMMAND MODULE
- ABLATIVE SUBSTRUCTURE

LES CONFIGURATION



UNSYMMETRICAL DRAG FOR STABILITY

JETTISON MOTOR

THRUST VECTOR CONTROL
INJECTION
SWIVEL NOZZLE

FOUR-LEGGED TOWER

SINGLE DISCONNECT ACTUATION

FOUR SHACKLES
SPRING LOADED
LOAD RELEASE

OFFSET CG

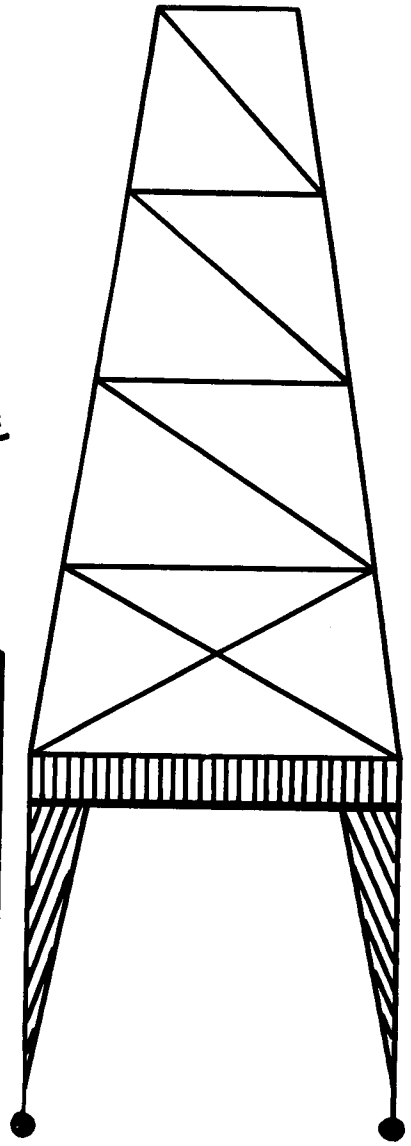
2-62 AP 10250

TOWER-DESIGN STUDY

- CRITICAL LOAD CONDITION
  - ABORT AT MAXIMUM DYNAMIC PRESSURE
- CONSTRUCTION CONSIDERED
  - CLOSED - MONOCOQUE OR SKIN
    - STRINGER NOT A SERIOUS CANDIDATE
  - WELDED TRUSS PROMISING
- CANDIDATE MATERIALS

	F_{tu}/ρ in	TRUSS WT	FABRICATION
H 11	750,000	150	VERY DIFFICULT
TITANIUM 5AI-2.5 SA	510,000	190	AVG DIFFICULTY
4130	300,000	360	SIMPLE

- SPECIAL PROBLEMS
  - INSULATION AGAINST FLAME IMPINGEMENT
  - NATURAL FREQUENCY



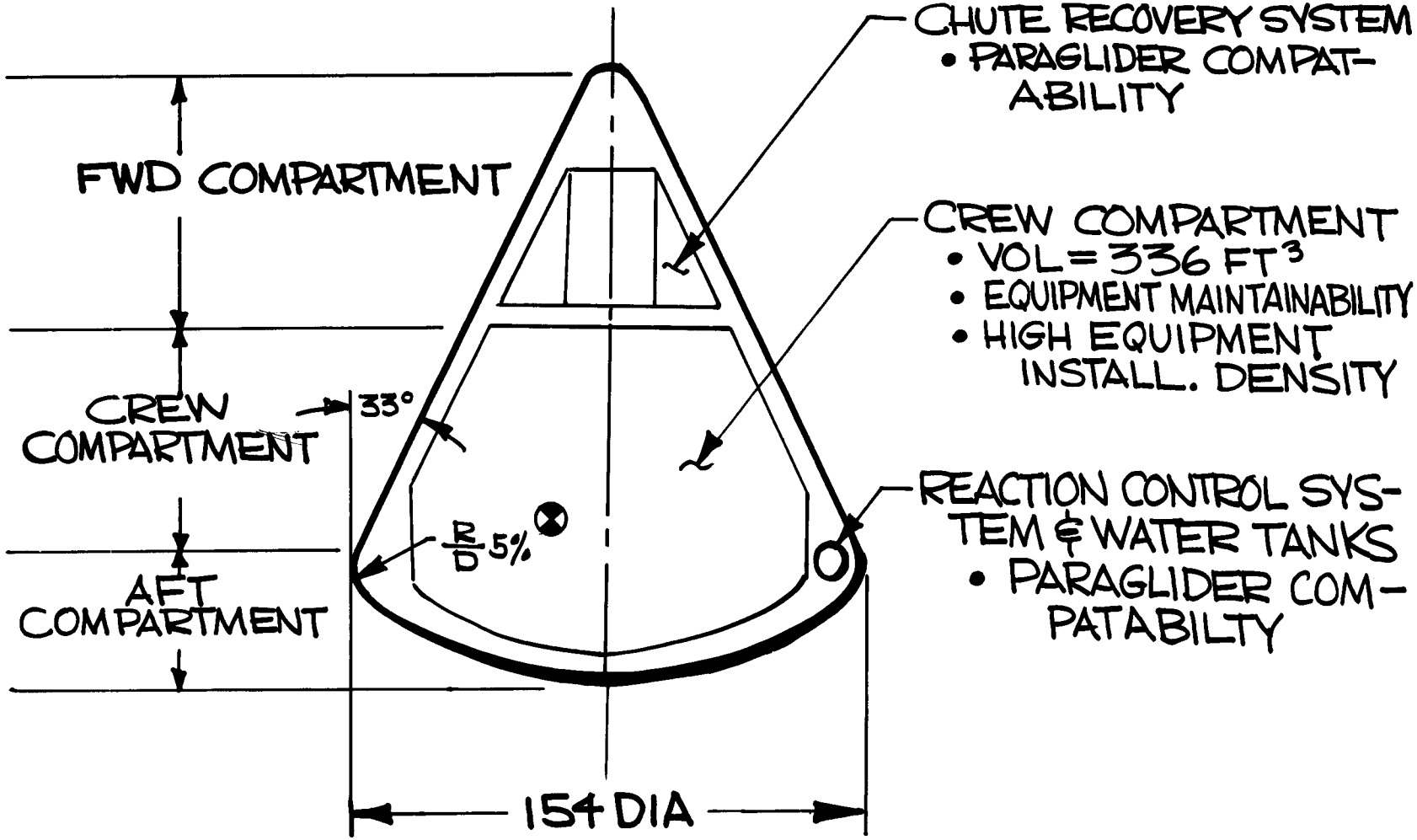
2-62 AP10251

C/M SHAPE & VOLUME

2-62 AP10252

[redacted]

C/M ARRANGEMENT

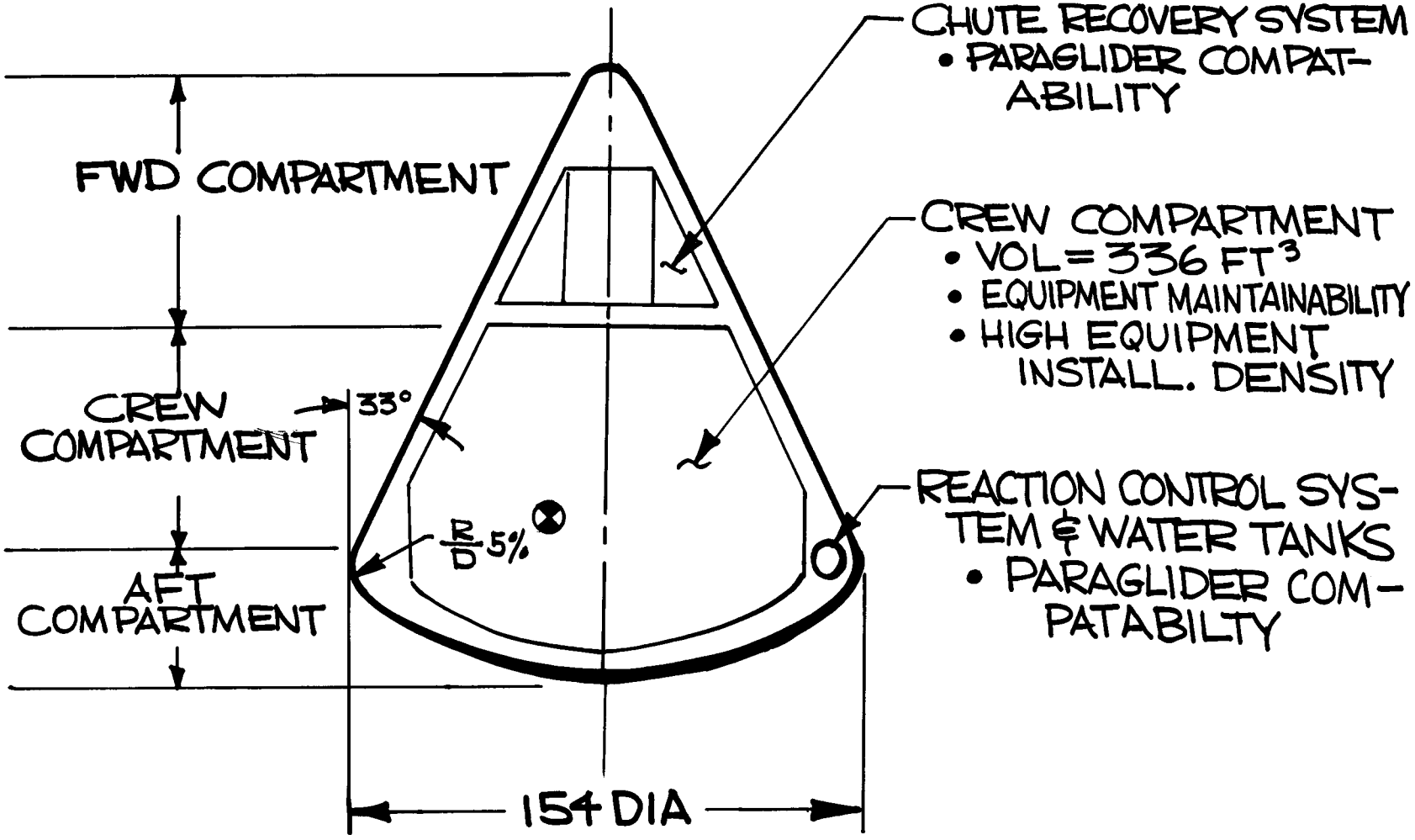


[redacted]

2-62 AP 10253

[redacted]

C/M ARRANGEMENT

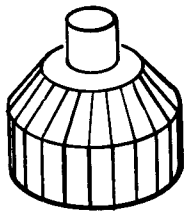
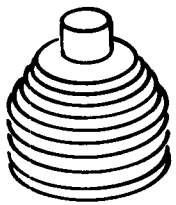
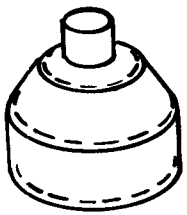


[redacted]

2-62 AP 10253

C/M PRESSURE SHELL

WEIGHT-TRADE OFFS

	UNIT WT #/FT^2	SCAR WT CUTOUTS #/FT^2	TOTAL UNIT WT #/FT^2	CRITICAL LOADING
 SKIN STRINGER	1.88	0.43	2.31	INTERNAL PRESS: 30 PSI FOR SKINS
 RING-REINFORCED	1.29	0.43	1.72	EXTERNAL PRESS: 18.6 PSI FOR STRINGERS
 ALUM-HONEYCOMB	0.81	0.25	1.06	EXTERNAL PRESS: 12.5 PSI FOR RINGS

2-62 AP 10254

[redacted]

COMMAND MODULE VOLUME STUDY

PROBLEM	STUDIES
• CREW COMPARTMENT VOL = 336 FT^3	INCREASE VOLUME INCREASE CORNER RADIUS DECREASE CONE ANGLE INCREASE OUTER DIAMETER
• EQUIPMENT DENSITY 27-36 FT^3	
• SHOCK ATTENUATION COUCH SWEPT VOLUME FOR $\dot{g}$ = 250 g/SEC STROKE REQUIRED 15"	INCREASE ONSET RATE ($\dot{g}$)
C/M ATTENUATION SYSTEM	MINIMIZE VOLUME REQUIREMENTS COMPATIBLE WITH SYSTEM

[redacted]

2-62 AP10255

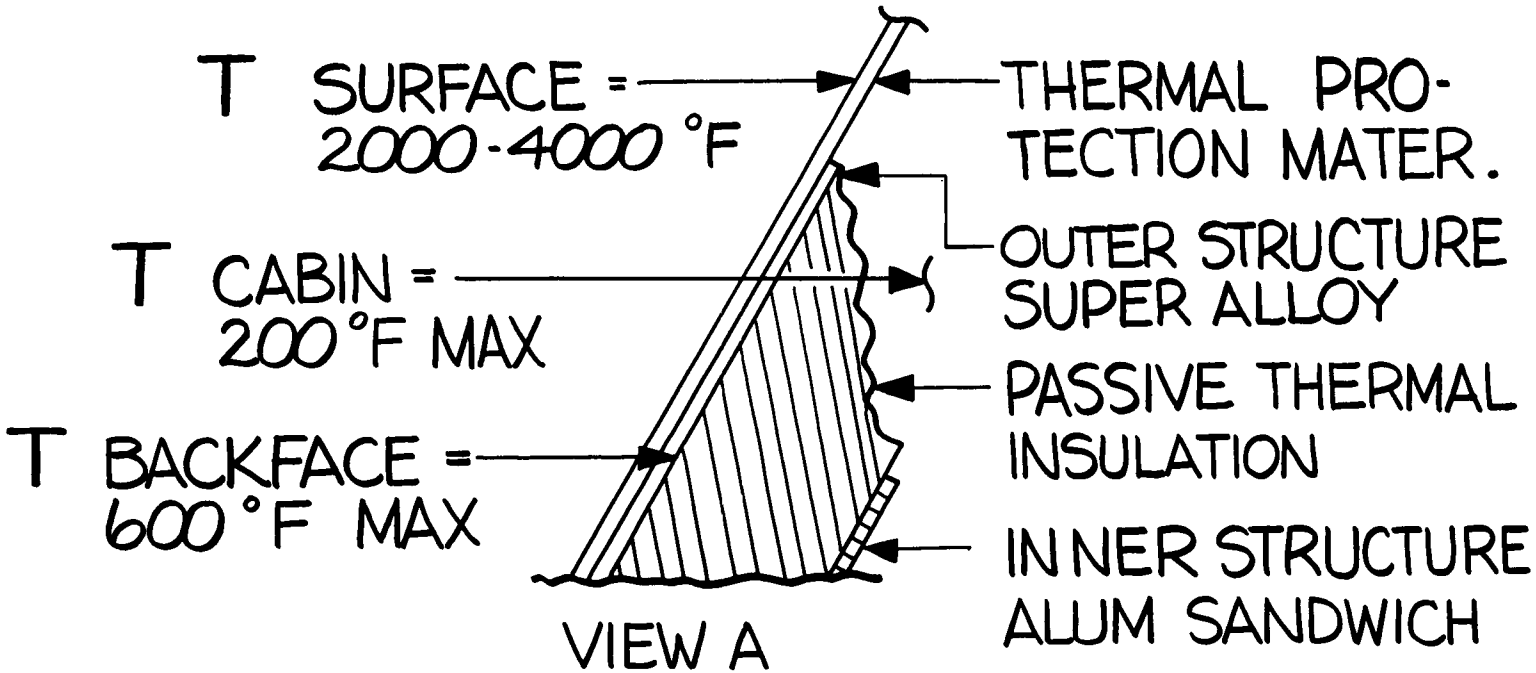
ABLATIVE SUBSTRUCTURE SELECTION

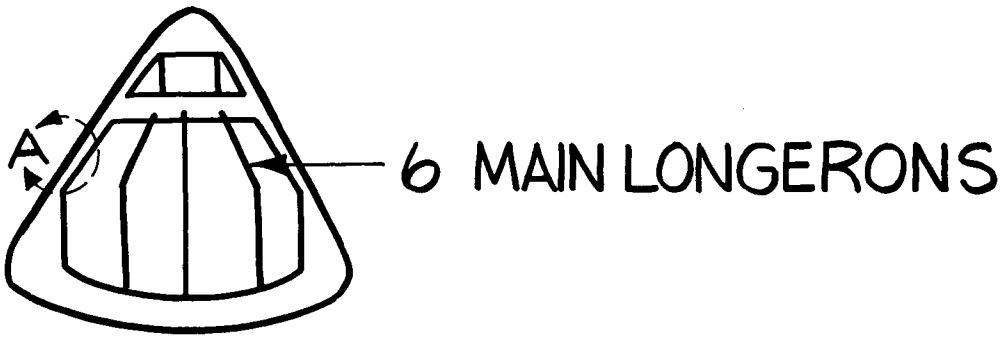
2-62 AP10256

(121)

[redacted]

C/M STRUCTURAL ARRANGEMENT





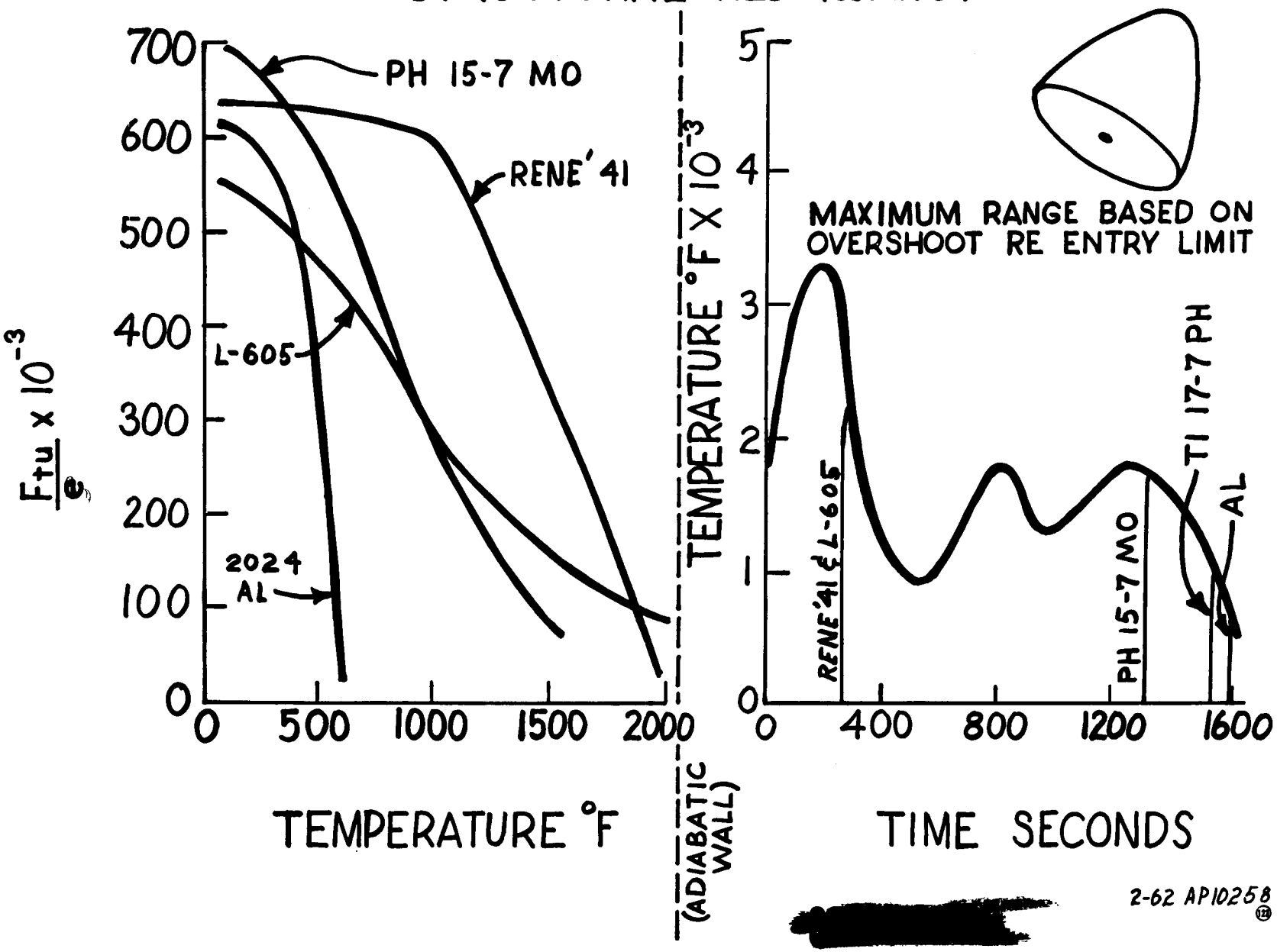
[redacted]

2-62 AP10257

[redacted]

ABLATIVE SUBSTRUCTURE TEMPERATURE

PREDICTING A FAILURE OF ABLATION MATERIAL STRUCTURAL REDUNDANCY

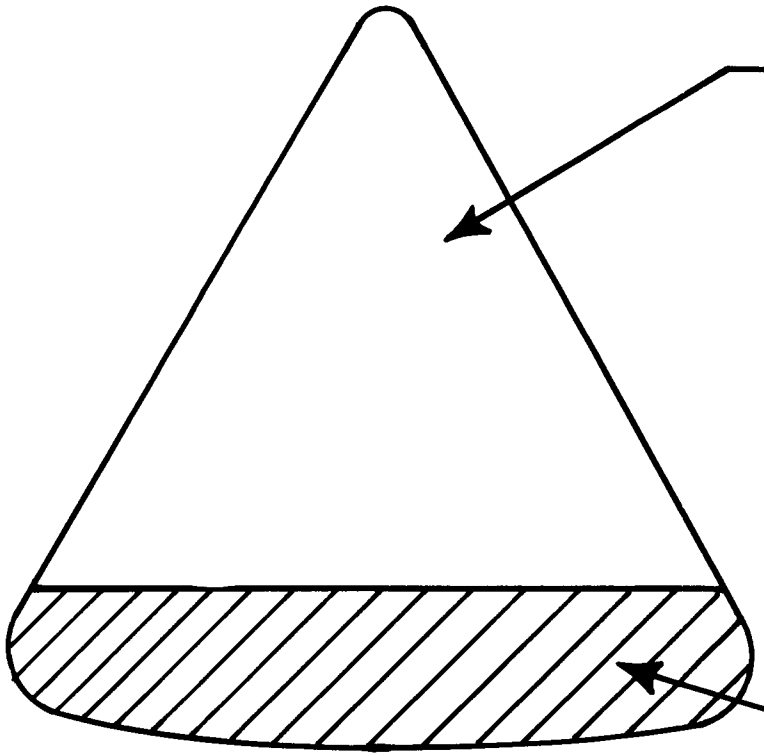


2-62 AP10258

[redacted]

[redacted]

STRUCTURAL SELECTION



L-605
MIN GUAGE
SIMPLIFIED MANUFACT-
URING
10% WT PENALTY

RENE 41
STRUCTURAL REQTS
1800° F TEMP

[redacted]

BRAZED VS WELDED SANDWICH

SUBSTRUCTURE

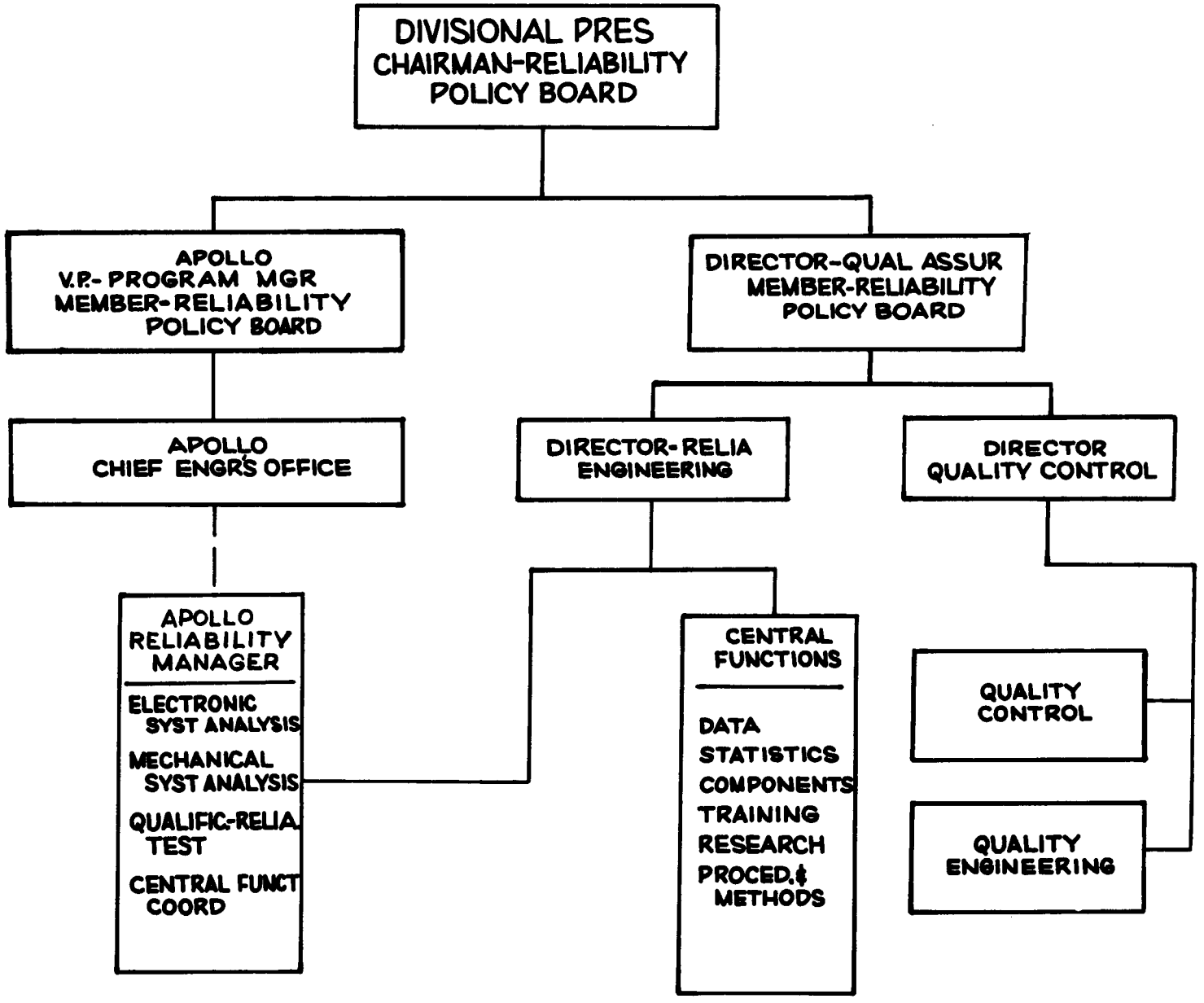
	BRAZED	WELDED
PRODUCI-BILITY	NEEDS COMPLEX TOOLING - CLOSE TOL. - CLEANLINESS LONG LEAD TIME	CAN BE STRETCH FORMED SHORT LEAD TIME
AVAILA-BILITY	MULTIPLE SOURCE	SINGLE SOURCE

2-62 AP10260

RELIABILITY AND CREW SAFETY

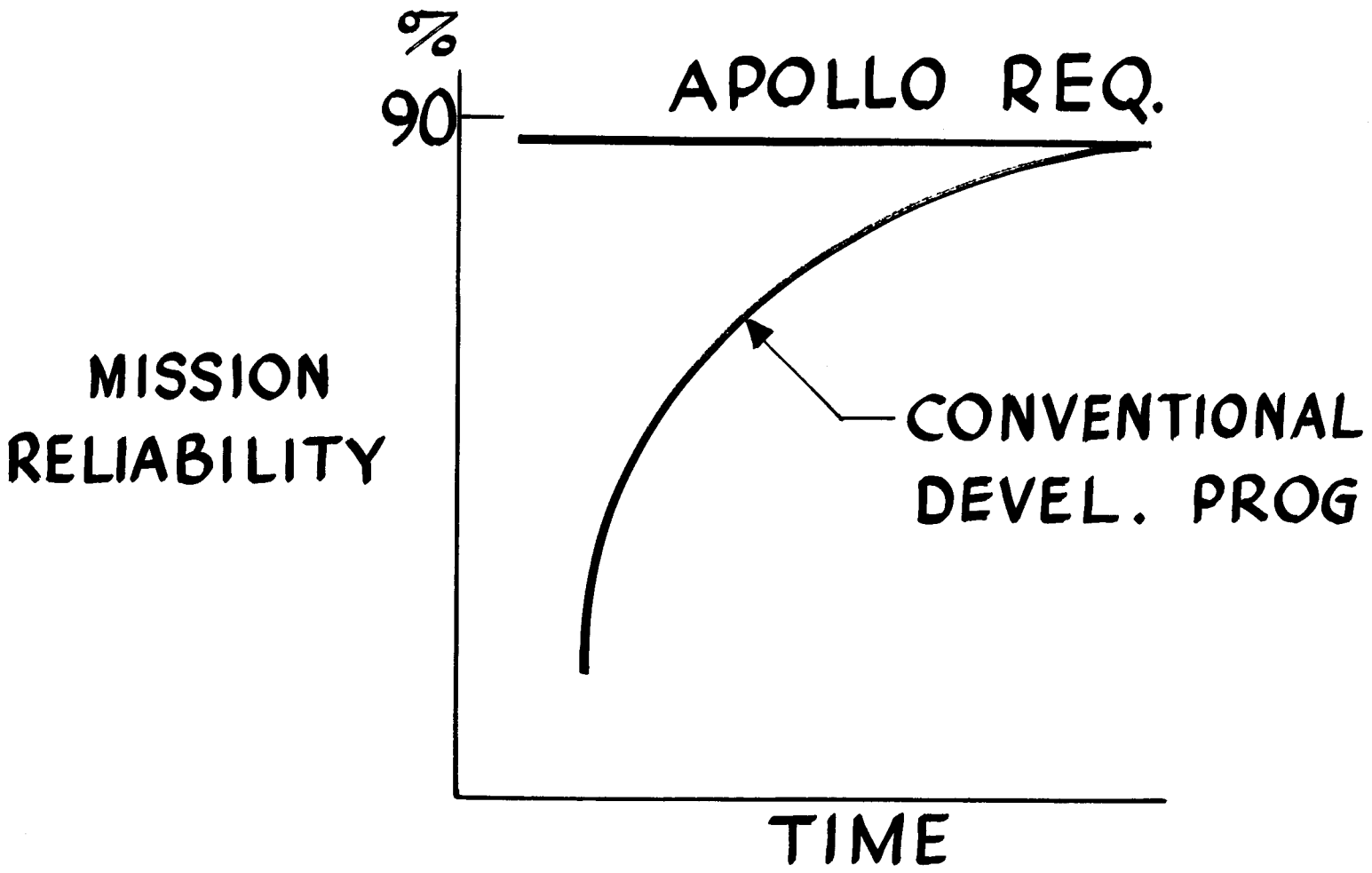
2-62 AP 10261

DIVISIONAL RELIA / QUALITY ORG



2-62 AP10262

RELIABILITY GROWTH



2-62 AP10263

APOLLO RELIABILITY PROGRAM

CONCENTRATION ON PREVENTIVE MEASURES

MINIMIZES NEED FOR LATER CURATIVE ACTIONS

DESIGN CRITERIA

RELIABILITY
PERFORMANCE
MAINTAINABILITY
WEIGHT-VOL
COST
SCHEDULE

RELIABILITY PROGRAM FEATURES

- HIGH INTEGRITY DESIGN
- STRINGENT CONTROLS
- PERSONNEL MOTIVATION
- CONTINUOUS ANALYSIS AND FREQUENT REVIEWS
- STATISTICALLY DESIGNED TESTS
- INTEGRATION OF ALL PROGRAM ELEMENTS

2-62 AP10265

RELIABILITY-CREW SAFETY-DESIGN PARAMETERS

DESIGNER IS GIVEN QUANTITATIVE FAILURE RATE "BUDGET" TO MEET

FIRST STEP IN THIS PROCESS IS

RELIABILITY-CREW SAFETY

APPORTIONMENTS

MISSION PHASE APPORTIONMENTS

(COMMAND & SERVICE MODS)

PHASE	RELIA.	CREW SAFETY
GROUND OPERATIONS	0.99966	0.99999
LAUNCH - TRANSLUNAR	0.99995	0.99999
TRANSLUNAR	0.9825	0.99965
LUNAR APPROACH & LANDING	0.9988	0.99997
LUNAR OPERATIONS	0.99687	0.99993
LUNAR LAUNCH - TRANSEARTH	0.99994	0.99999
TRANSEARTH	0.9824	0.99965
EARTH APPROACH & ENTRY	0.99992	0.99999
EARTH LANDING & RECOVERY	0.99995	0.99999
MISSION RELIABILITY	0.960	

MISSION CREW SURVIVAL PROBABILITY 0.9992

2-62 AP10267

RELIABILITY APPORTIONMENT

	RELIABILITY	CREW SAFETY
LUNAR LANDING-EARTH RETURN	.90	.999
COMMAND & SERVICE MODULES	.96	.9992
NAV & GUIDANCE	.994	.99992
LUNAR LANDING MODULE	.988	.99990
LAUNCH VEHICLE	.95	.99994
GOSS COMPLEX	.999	.99999
G. S. E.	.9999	.99999

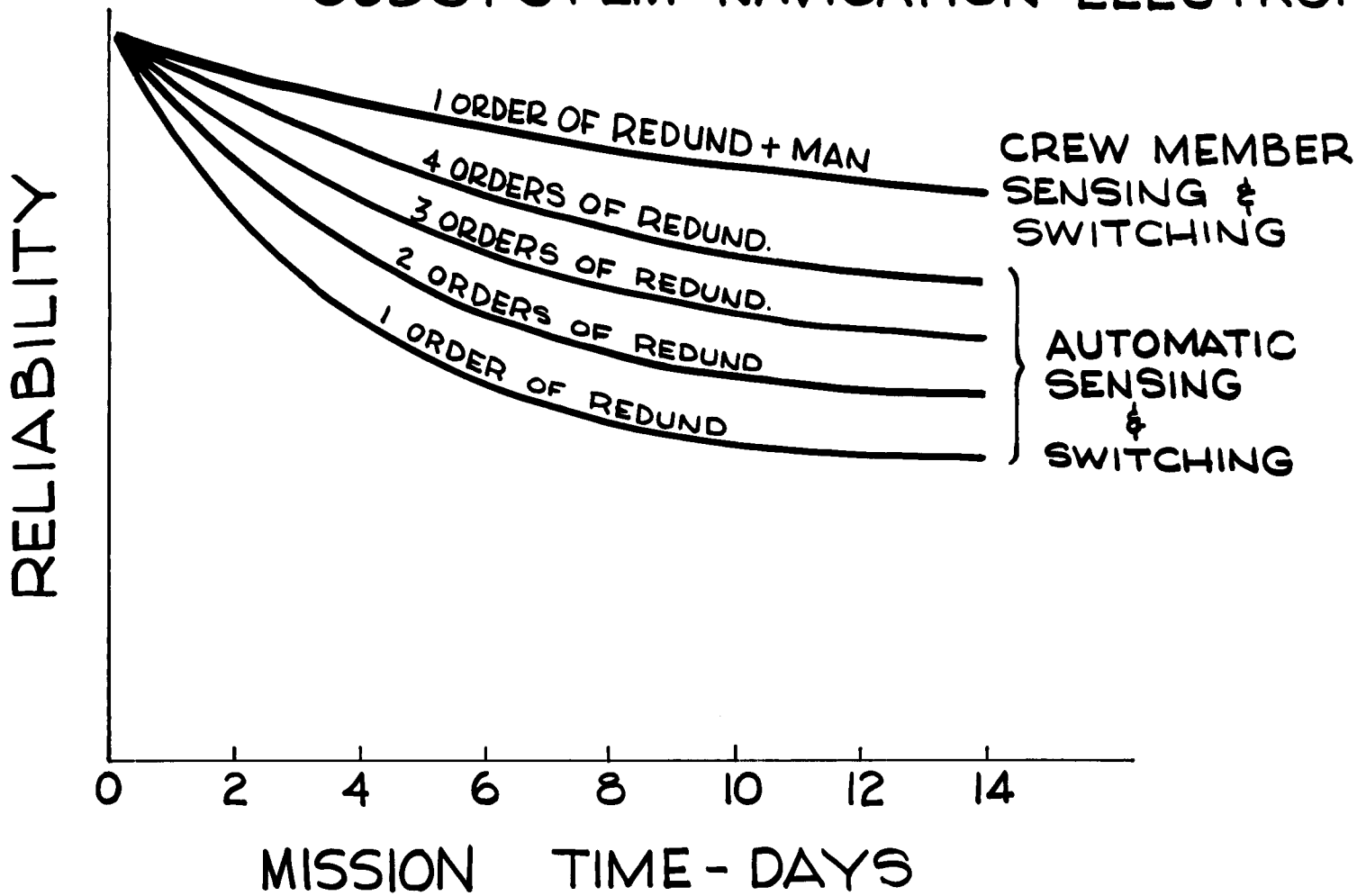
SUBSYSTEM APPORTIONMENTS
(COMMAND & SERVICE MODS)

SUBSYSTEM	RELIA.	CREW SAFETY
NAVIG.-GUIDANCE	0.994	0.9999
STAB.-CONTROL	0.995	0.99992
TELECOMMUNICATIONS	0.9925	———
MISSION PROPULSION	0.99977	0.99997
REACTION CONTROL C/M	0.99996	0.99996
REACTION CONTROL S/M	0.996	0.99997
EARTH LANDING SYST.	0.99994	0.99994
MISC. MECHANICAL DEVICES	0.993	0.99997
STRUCTURES & HEAT SHIELD	0.997	0.99995
ENVIRONMENTAL CONTROL	0.9935	0.9997
ELECTRICAL POWER	0.9955	0.99997
INSTRUMENTATION	0.9955	———
LAUNCH ESCAPE	0.9978	0.99995
COMMAND & SERVICE MOD. MISSION RELIABILITY	0.960	———
CREW SURVIVAL PROBABILITY		0.9992

2-62 AP10269

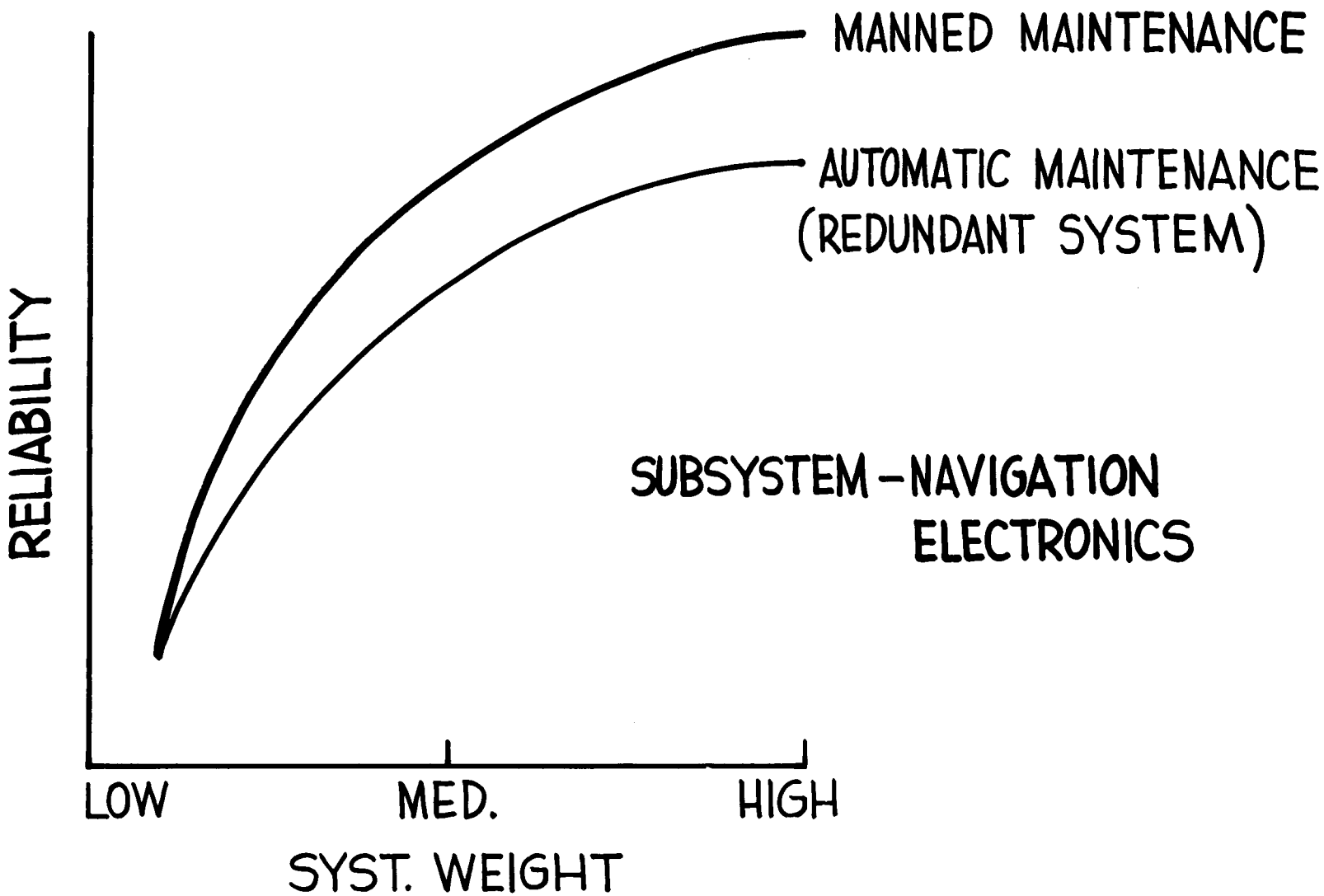
MAN'S CONTRIBUTION TO RELIA.– MISSION TIME

SUBSYSTEM-NAVIGATION ELECTRONICS



2-62 AP10270
(135)

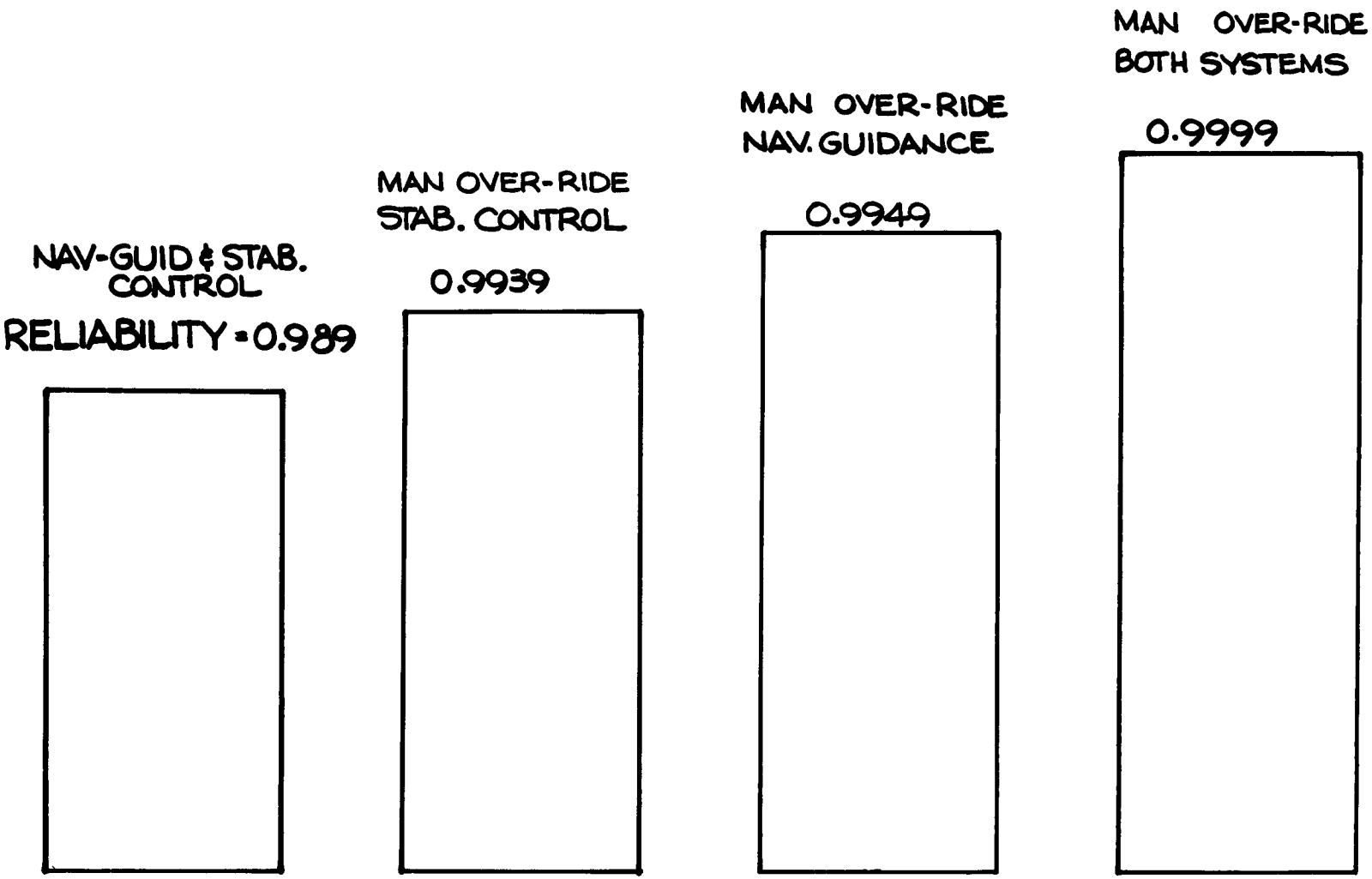
MAN'S CONTRIBUTION TO RELIA.— MAINT. & SYST. WEIGHT



2-62 AP102 71

MAN'S CONTRIBUTION TO RELIA.

-0.995 RELIA. MAN.



RELIABILITY MILESTONE

JAN.	NASA WORK STATEMENT NEGOTIATED
	SUBCONTRACTOR-SUPPLIER RELIA. ADMINIST. INITIATED
	MISSION PHASE RELIA. APPORTIONMENTS COMPLETE
	SUBSYSTEM RELIA. APPORTIONMENTS COMPLETE
	RELIA. PROGRAM PLAN SUBMITTED TO NASA/MSC
FEB.	RELIA. PROGRAM PLAN REVIEWED WITH NASA/MSC
	RELIA.-CREW SAFETY DESIGN CRITERIA DOCUMENTED

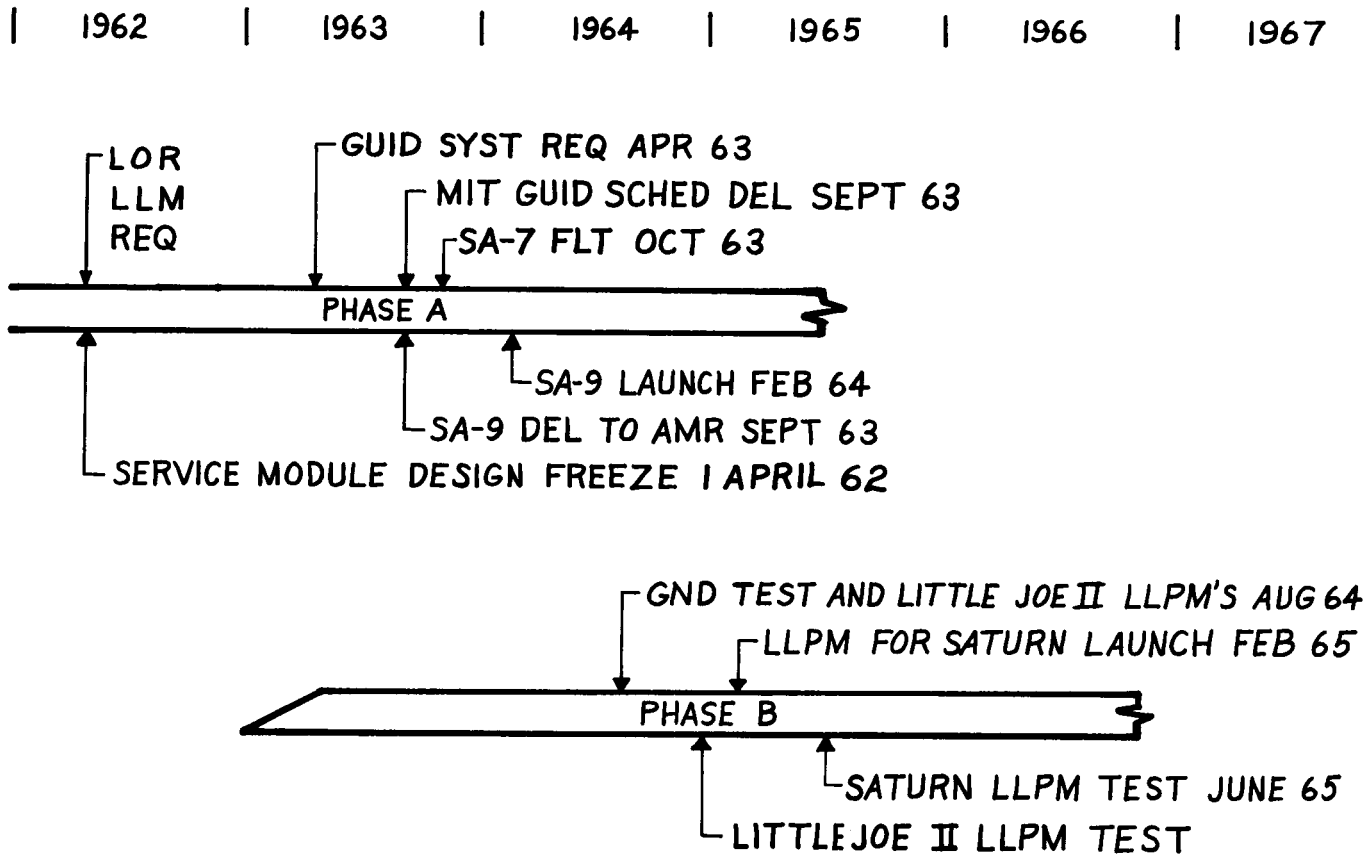
FUTURE PLANS

- DESIGN
  - BASIC MASTER LINE
  - C/M CONFIG FREEZE
  - PRELIM DETAILS C/M INNER STRUCTURE
  - S/M CONFIG FREEZE
  - MOCK-UP #1 COMPLETE
  - SELECT HEAT SHIELD SUPPLIER
- PROJECT INTEGRATION
  - TEST PLAN REVISION
  - REQMTS, CRITERIA & M.V. SPECS -
    - EARLY BP SPECS
- RELIABILITY
  - QUALIFICATION-RELIA. TEST PLAN DUE-NASA
  - FIRST RELIA.-PROGRAM REVIEW

2-62 AP10274

[redacted]

CRITICAL ASSOCIATE CONTRACTOR REQUIREMENTS



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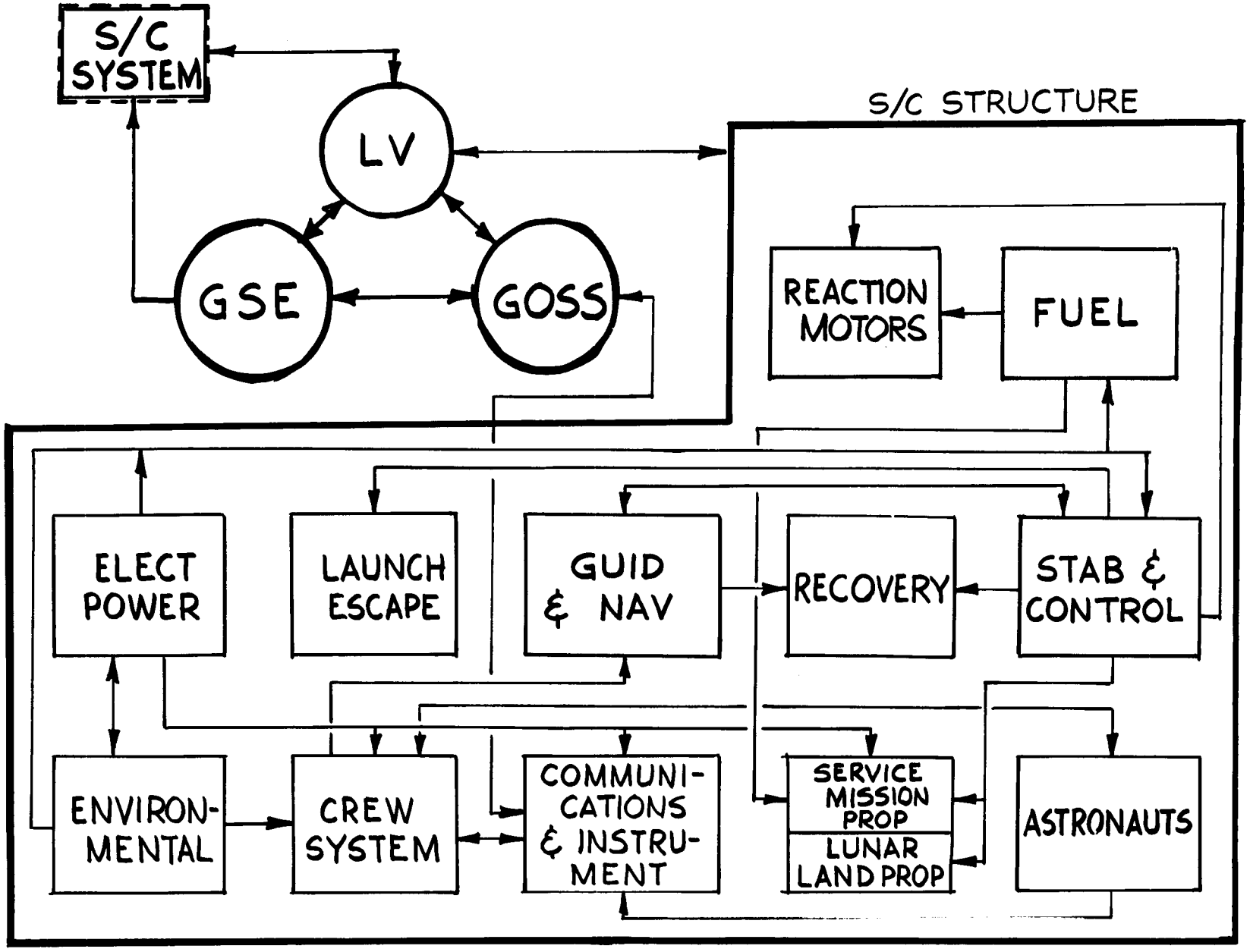
2-62 AP10275

APOLLO SYSTEM SCHEMATIC



2-62 AP10276

NAA SUBCONTRACTOR EVALUATION PROCEDURE

2-62 AP10277

MAKE OR BUY

- COMMITTEE
- DECISIONS
- MAJOR POLICY ITEMS

MAKE OR BUY COMMITTEE

- VICE PRESIDENT–PROGRAM MANAGER
- VICE PRESIDENT–MANUFACTURING
- DIRECTOR–MATERIAL
- DIRECTOR–QUALITY ASSURANCE
- DIRECTOR–ADMINISTRATION

PRELIMINARY SPECS

COMPILE LIST OF PROSPECTIVE SUBCONTRACTORS

- ENGINEERING
- PURCHASING
- OTHERS

SELECTION OF SOURCES

CONSIDERATIONS

- KNOW-HOW
- SPACE
- EQUIPMENT
- MANPOWER
- WORKING CAPITAL
- QUALITY STANDARDS
- AID REQUIRED FROM NAA

COMPILE LIST OF QUALIFIED BIDDERS

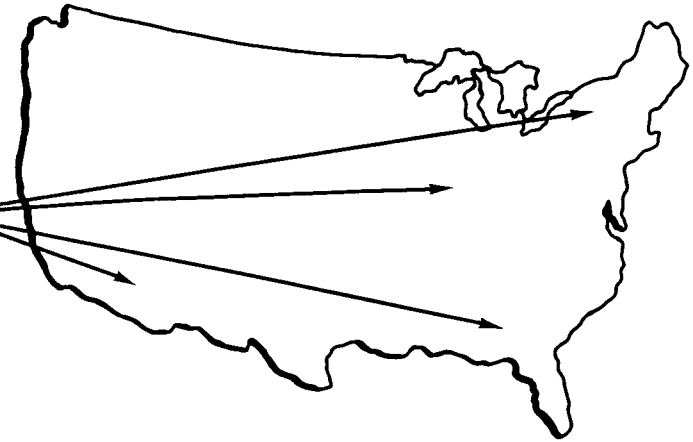
- EXPERIENCE
- SUPPLIERS DATA
- SURVEYS

SURVEY TEAM
PROCEDURE

SPECIALISTS REPRESENTING

- ENGINEERING
- MANUFACTURING
- TOOLING
- PURCHASING
- CONTRACTS
- QUALITY CONTROL
- FINANCIAL
- LOGISTICS

NAA TEAMS



SURVEY TEAMS WILL EVALUATE THE POTENTIAL SUBCONTRACTORS ABILITIES & FACILITIES TO ACCOMPLISH ANY GIVEN SUBCONTRACT

- FUEL CELLS
- MISSION PROPULSION
- ESCAPE TOWER
- ABLATIVE HEAT SHIELD
- ETC

SOURCE SELECTION BOARD COMPLIES

QUALIFIED BIDDERS LIST

(1)

(2)

(3)

TO NASA FOR CONCURRENCE

2-62 AP10284

S & ID SOURCE SELECTION BOARD

PRESIDENT

EXECUTIVE VICE PRESIDENT

DIRECTOR OF MATERIAL

DIRECTOR OF APPLIED SCIENCE

VP-PROGRAM MANAGER

DIRECTOR OF QUALITY ASSURANCE

VICE PRESIDENT—MANUFACTURING

DIRECTOR OF LOGISTICS

COMPTROLLER

DIRECTOR OF ADMINISTRATION

2-62 AP 10285

BIDDER EVALUATION

- PROPOSALS & SURVEYS RECEIVED IN PROGRAM PURCHASING DEPARTMENT

- PROPOSALS & SURVEYS DISTRIBUTED
  - PURCHASING
  - ENGINEERING
  - QUALITY ASSURANCE
  - MANUFACTURING
  - APPLIED SCIENCE

- PROPOSALS, SURVEYS & PAST PERFORMANCE EVALUATED
  - MAJOR AREAS OF CONSIDERATION
    - TECHNICAL DESIGN
    - TECHNICAL CAPABILITIES
    - ABILITY TO PRODUCE
    - PROBABLE COST
    - PROGRAM MANAGEMENT

TYPICAL EVALUATION TEAMS

- **ENGINEERING**
  - PROJECT ENGINEER
  - DESIGN SUPERVISION
  - R & D SUPERVISION
  - SYSTEM ENGINEERS
  - ENGINEERING OPERATION REPRESENTATIVES
- **MANUFACTURING**
  - GENERAL FOREMEN
  - TECHNICAL SPECIALISTS
  - METHODS ANALYSTS
  - TEST ENGINEERS
  - MANUFACTURING ENGINEERS
  - STATISTICIANS
  - PROJECT COORDINATORS
  - CHANGE ANALYSTS
- **QUALITY ASSURANCE**
  - CHIEF, Q.C. SUBSYSTEM
  - CHIEF, Q.C. SUBCONTRACTING
  - FOREMAN, ELECTRONIC INSPECTION
  - SUPERVISOR P.D.L.
  - HYDRAULIC SPECIALIST
  - GENERAL FOREMAN
  - FOREMAN
  - RELIABILITY SPECIALIST
- **PURCHASING**
  - GENERAL SUPERVISOR
  - ADMINISTRATIVE BUYER
  - PURCH. REPRESENTATIVE
  - COST ANALYSTS

BIDDERS TECHNICAL BRIEFING

- BIDDERS GIVE VERBAL PRESENTATION COVERING THE DATA SUPPLIED TO NAA IN THEIR PROPOSALS

- QUESTIONS ARE ASKED BY NAA PERSONNEL TO OBTAIN ADDITIONAL SUPPORTING DATA & CLARIFICATION

ENGINEERING EVALUATION COMMITTEE

SELECTION AND FUNCTIONS

- TECHNICAL PROPOSALS RECEIVED IN ENGINEERING
- PROGRAM MANAGER & DIRECTOR OF APPLIED SCIENCE APPOINT EVALUATION COMMITTEE & TECHNICAL SUBCOMMITTEE
- EVALUATION COMMITTEE & TECHNICAL SUB-COMMITTEE EVALUATE TECHNICAL APPROACH
- COMMITTEE MEETS FOR FINAL EVALUATION
- DECISION PRESENTED TO PROGRAM MANAGER & DIRECTOR OF APPLIED SCIENCE
- RECOMMENDATIONS FORWARDED TO PURCHASING

ENGINEERING EVALUATION SUMMARY SHEET

PROJECT _____ DATE _____

SUBSYSTEM _____ PREPARED BY _____

CATEGORY	MAX POINTS	COMPANY		COMPANY		COMPANY		COMPANY	
		POINTS	STANDING	POINTS	STANDING	POINTS	STANDING	POINTS	STANDING
TECHNICAL DESIGN									
TECHNICAL CONCEPT									
SUPPORT									
FLIGHT TEST									
WEIGHT & VOLUME									
SUBTOTAL									
POSITION									
TECHNICAL CAPABILITIES									
ENGRG MGMT CONCEPT									
ENGRG DEV CAPABILITY									
ENGRG SCHED COMPAT									
ENGRG FACILITIES									
SUBTOTAL									
POSITION									
TOTAL FINAL POSITION									

2-62 AP 10290

TECHNICAL DESIGN

PROJECT_____
SUBSYSTEM_____

DATE_____
PREPARED BY_____

CATEGORY	WEIGHT FACTOR	COMPANY		COMPANY		COMPANY		COMPANY	
		POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS
TECHNICAL CONCEPT									
PERFORMANCE (DESIGN)									
RELIABILITY									
COMPATABILITY WITH A/V									
SIMPLICITY OF OPERATION									
INTEGRATION									
MAINTAINABILITY									
PACKAGING									
SUBTOTAL									
SUPPORT									
GROUND SUPPORT EQUIP									
TRAINING EQUIP									
TECH SERVICE PERSONNEL									
PERSONNEL TRAINING									
TECHNICAL DATA									
MAINTENANCE ENG									
LOGISTICS (SPARES)									
SUBTOTAL									
FLIGHT TEST									
SCOPE									
TIMELINESS									
SUBTOTAL									
WEIGHT & VOLUME									
TOTAL									
POSITION									

2-62 AP10291

PROJECT_____
SUBSYSTEM_____

TECHNICAL CAPABILITIES

DATE_____
PREPARED BY_____

CATEGORY	WEIGHT FACTOR	COMPANY		COMPANY		COMPANY		COMPANY	
		POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS
ENGRG MGM'T CONCEPT									
MANAGEMENT APPROACH									
RELATIVE IMPORTANCE OF SUBCONTRACT IN CO									
SUBTOTAL									
ENGRG DEVEL CAPABILITIES									
PAST RECORD									
EXPERIENCE									
SUBTOTAL									
ENGRG SCHED COMPAT									
ABILITY TO MEET SCHEDULE									
WORK LOAD									
SUBTOTAL									
ENGRG FACILITIES									
FACILITY REQUIREMENTS									
SUBTOTAL									
TOTAL POSITION									

2-62 AP10292

TITLE DESIGN PERFORMANCE

PROJECT _____ DATE _____
SUBSYSTEM _____ PREPARED BY _____

CONSIDER:

- RESERVE PERFORMANCE CAPABILITIES
- APPROACH TO PROBLEM AREAS
- POWER CONSUMPTION
- STABILITY
- RANGE
- ACCURACY
- DESIGN CONCEPTS
- ENVIRONMENTAL COMPATIBILITY
- UTILIZATION OF SOLID STATE DEVICES
- SELF TEST FEATURES
- UTILIZATION OF PREFERRED SOURCES

	POINTS
(SAMPLE WORK SHEET)	

PROJECT _____ SUBSYSTEM _____

PURCHASING EVALUATION

DATE _____ PREPARED BY _____

SUMMARY–INCLUDING MANUFACTURING AND QUALITY

CATEGORY	MAX POINTS	COMPANY		COMPANY		COMPANY		COMPANY	
		POINTS	STANDING	POINTS	STANDING	POINTS	STANDING	POINTS	STANDING
ABILITY TO PRODUCE									
CAPACITY									
CAPABILITY									
PAST PERFORMANCE									
SUBTOTAL									
POSITION									
PROBABLE COST									
INTERNAL COST COMPARISON									
EQUITY OF COST DISTRIBUTION									
SUBCONTRACT COST COMPARISON									
COMPARISON OF ADDITIONAL FAC REQ									
BID COMPARISON									
TRANSPORTATION, TRAVEL & COMMUNICATION									
PREPRODUCTION COST									
BUDGETARY CONTROL									
COST REDUCTION EXPERIENCE									
SUBTOTAL									
POSITION									
PROGRAM MANAGEMENT									
TERMS & CONDITIONS									
COOPERATION & ENTHUSIASM									
REPORTING									
PROGRAM CONTROL									
PURCHASING & SUBCONTRACTING									
SUBTOTAL									
POSITION									
TOTAL									
FINAL POSITION									

2-62 AP10294

PROJECT _____
SUBSYSTEM _____

ABILITY TO PRODUCE

DATE _____
PREPARED BY _____

CATEGORY	WEIGHT FACTOR	COMPANY		COMPANY		COMPANY		COMPANY	
		POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS
CAPACITY									
PERSONNEL									
FACILITIES (AREA)									
FACILITIES (EQUIP.)									
FINANCIAL									
CAPABILITY									
DESIGN									
MANUFACTURING									
QUALITY CONTROL									
PAST PERFORMANCE									
DELIVERY									
QUALITY									
TOTAL POSITION									

2-62 AP10295

PROJECT_____
SUBSYSTEM_____

PROBABLE COST

DATE_____
PREPARED BY_____

CATEGORY	WEIGHT FACTOR	COMPANY		COMPANY		COMPANY		COMPANY	
		POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS
INTERNAL COST COMPARISON RATE PER/HOUR BURDEN G & E G & A FEE OR PROFIT									
EQUITY ALLOCATION OF COSTS									
SUBCONTRACT COST COMPARISON PERCENTAGE OF SUBCONTRACT G & A & OTHER COSTS FEE OR PROFIT									
FACILITIES REQUIRED REQUIRED FROM GOVERNMENT TO BE SUPPLIED FROM SUBCONTRACTOR BAILMENT									
BID COMPARISON ADJ TO COMPATIBLE ELEMENTS									
TRANSPORTATION, TRAVEL & COMM. SHIPPING COSTS TRAVEL COSTS COMMUNICATION COSTS									
PREPRODUCTION COSTS RELOCATION OF MACH & EQUIP MANUFACTURING DEVELOPMENT COSTS									
BUDGETARY CONTROL ADEQUACY OF CONTROL									
COST REDUCTION EXPERIENCE									
TOTAL POSITION									

2-62 AP10296

PROJECT _____
SUBSYSTEM _____

PROGRAM MANAGEMENT

DATE _____
PREPARED BY _____

CATEGORY	WEIGHT FACTOR	COMPANY		COMPANY		COMPANY		COMPANY	
		POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS
TERMS & CONDITIONS EXPERIENCE WITH CPFF CONTRS SUPPLIERS EXCEPTIONS									
COOPERATION & ENTHUSIASM AGGRESSIVENESS COOPERATION INTEREST									
REPORTING INTERNAL REPORTS REPORTS TO NAA									
PROGRAM CONTROL PROGRAM PLANNING PROGRAM IMPLEMENTATION ABILITY TO RECOGNIZE NEED FOR CORRECTIVE ACTION									
PURCHASING & SUBCONTR CONTROL OF SUBCONTRACTS PERFORMANCE CONTROL									
TOTAL POSITION									

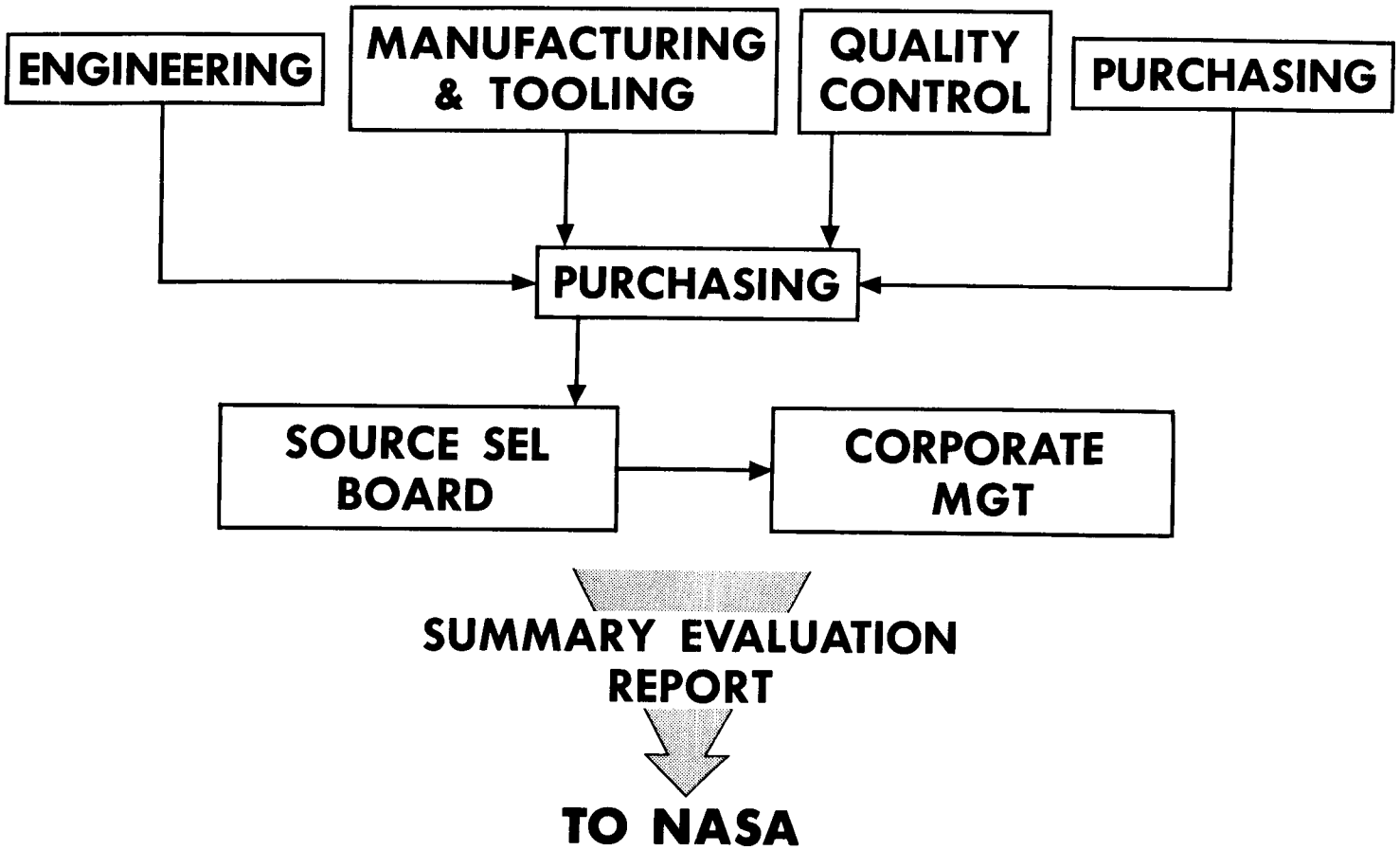
PROJECT _____
SUBSYSTEM _____

EVALUATION SUMMARY

DATE _____
PREPARED BY _____

MAX POINTS	CATEGORY	COMPANY	COMPANY	COMPANY
750	TECHNICAL DESIGN			
250	TECHNICAL CAPABILITIES			
500	ABILITY TO PRODUCE			
300	PROBABLE COST			
200	PROGRAM MANAGEMENT			

SELECTION OF SOURCE

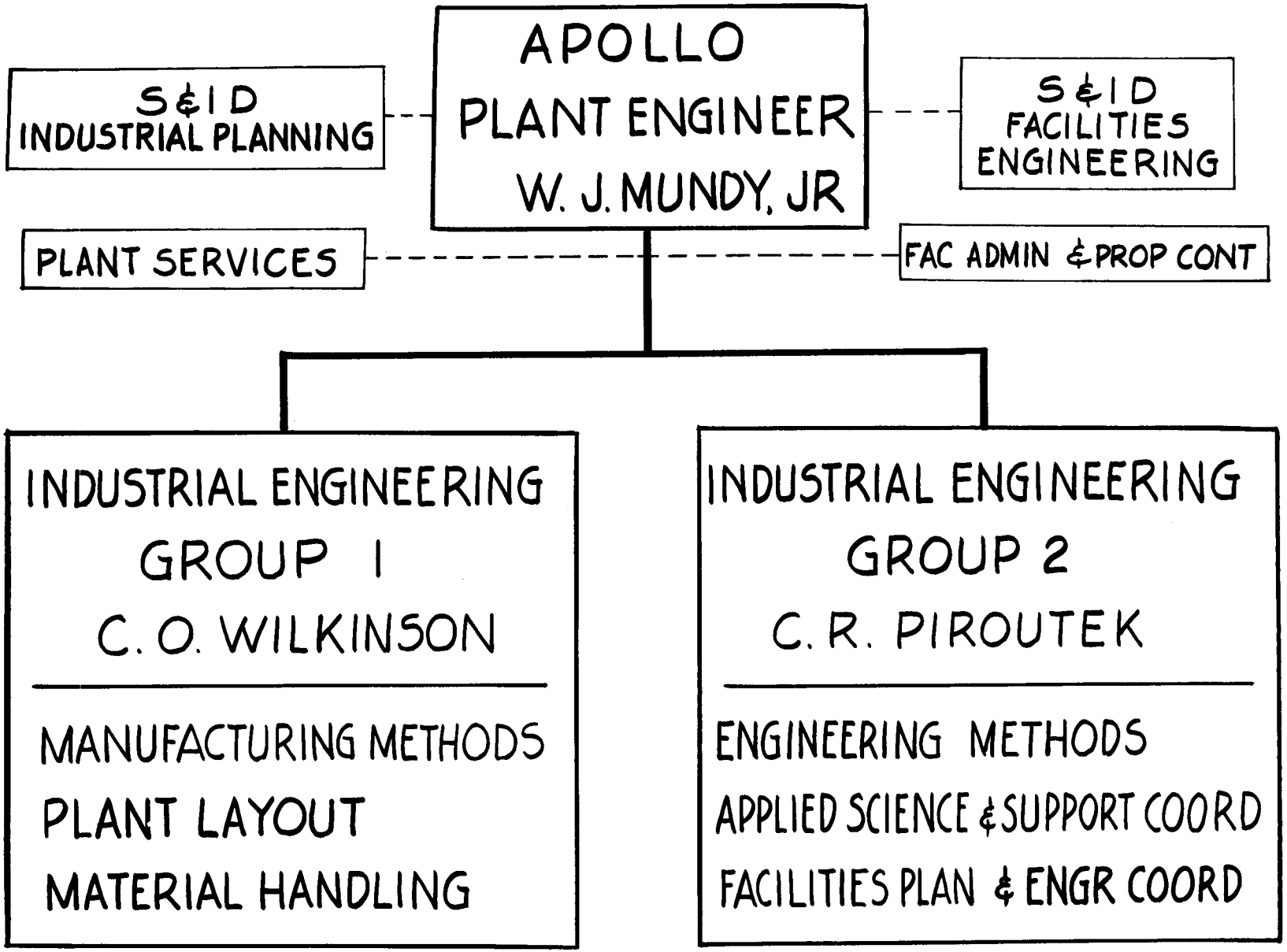


2-62 AP10299

FACILITIES

2-62 AP10300

APOLLO PLANT ENGINEERING



2-62 AP10301

APOLLO FACILITIES RESPONSIBILITIES SUMMARY

1. PLAN PROCURE & ADMINISTER ALL S&ID APOLLO PROGRAM FACILITIES
2. REVIEW & APPROVE SUB-CONTRACTORS APOLLO PROGRAM FACILITIES REQUIREMENTS
3. REVIEW & FURNISH SYSTEMS INTEGRATION FACILITIES CRITERIA TO ASSOCIATE CONTRACTORS
4. REVIEW & FURNISH SYSTEMS INTEGRATION & TEST FACILITIES CRITERIA TO THE NASA
5. ADMINISTER COMPANY CAPITAL AND GOVERNMENT FACILITIES CONTRACT FUNDS FOR S&ID

2-62 AP 10302

FACILITIES ACTIONS TO DATE

- APOLLO PLANT ENGINEERING DEPARTMENT ORGANIZED
- PRELIMINARY FACILITIES PLAN SUBMITTED 1-31-62
- PHASE A FACILITIES REQUIREMENTS ESTABLISHED
- INTERIM FACILITIES CURRENTLY PROVIDED FOR:
  - PROGRAM MANAGEMENT
  - ENGINEERING
  - LOGISTICS
  - MATERIAL
  - MOCK-UP FABRICATION
  - TOOLING

APOLLO FACILITIES PLAN
S&ID DOWNEY PLANT

- PROGRAM MANAGEMENT, ENGINEERING, SPACECRAFT MANUFACTURING & SYSTEMS INTEGRATION TO BE CENTERED AT THE DOWNEY PLANT

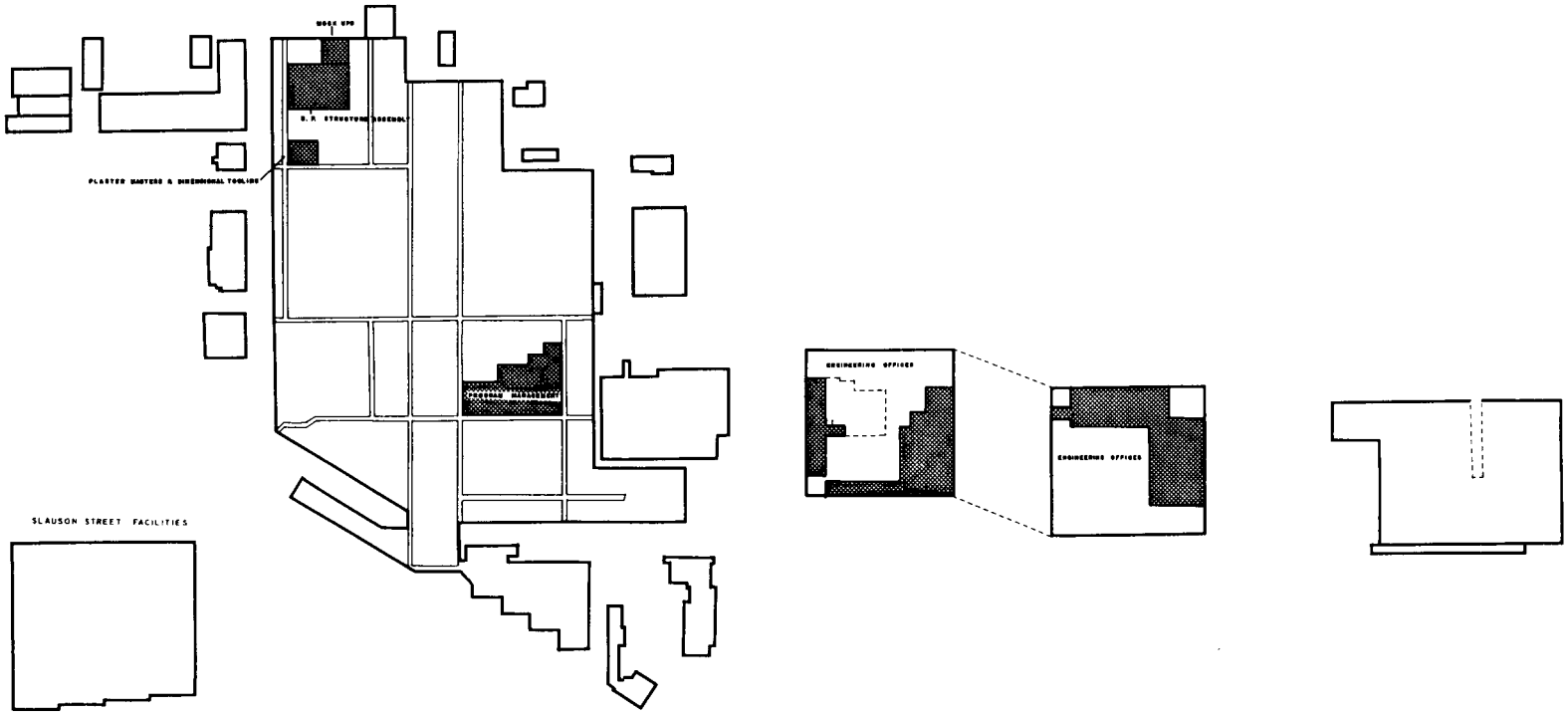
- ADDITIONAL DOWNEY PLANT FACILITIES REQUIRED
  - FINAL ASSEMBLY – SYSTEMS INTEGRATION & CHECKOUT – ADDITION TO BUILDING 6
  - ALUMINUM HONEYCOMB BONDING & TEST FACILITY
  - SPACE SYSTEMS DEVELOPMENT FACILITY
    CRYOGENICS, ELECTRIC POWER SYSTEMS, RCS, ECS, VIBRATION
  - ADDITION TO RADIOGRAPHIC FACILITY
  - DATA GROUND STATION TO BE LOCATED IN BUILDING 6
  - LAND & WATER IMPACT TEST FACILITY
  - TOOLING MASTER STORAGE / MODIFICATION FACILITY

2-62 AP10304

APOLLO AREA REQUIREMENTS FEB 1962

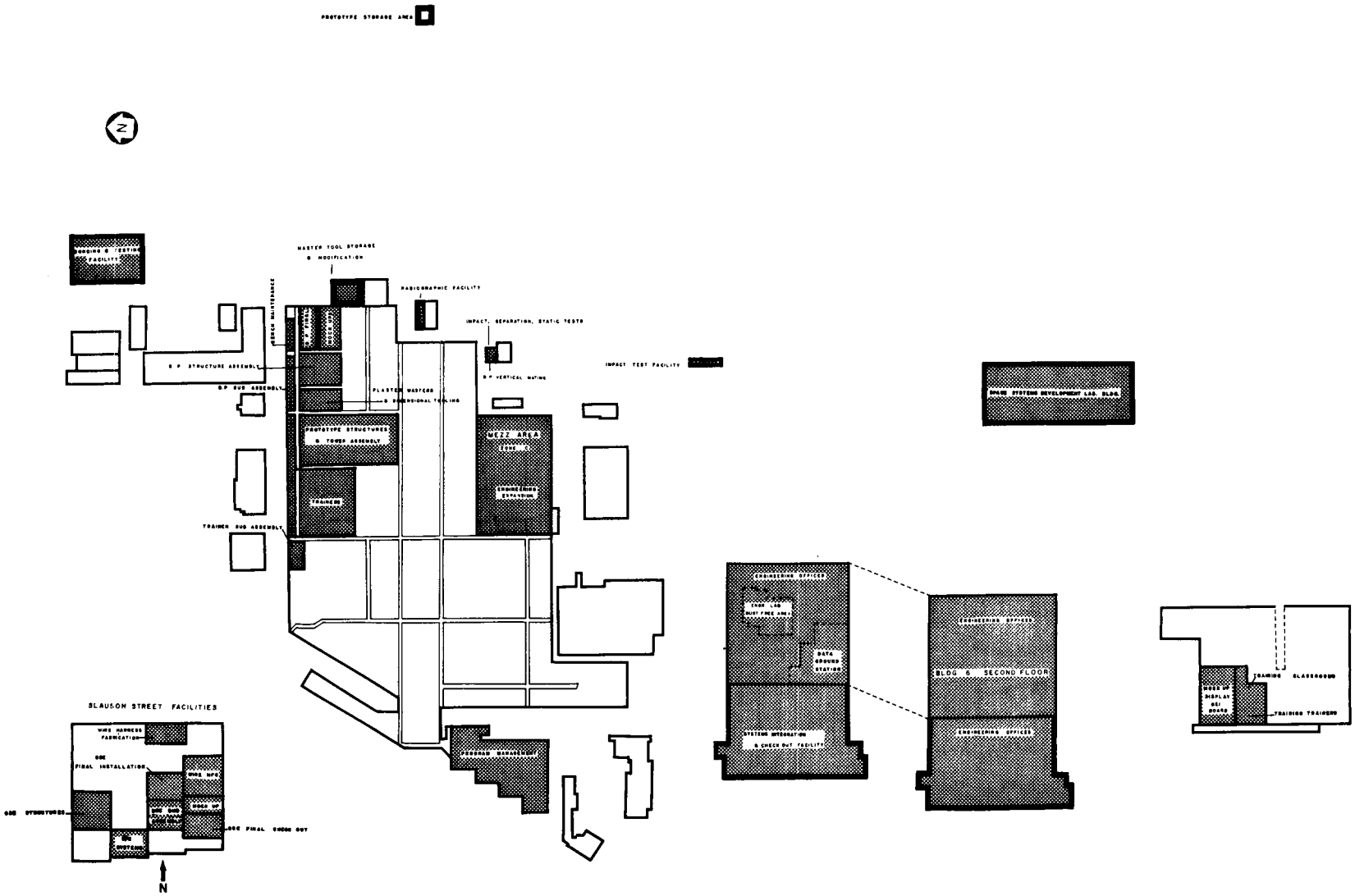
2-62 AP10305

APOLLO AREA REQUIREMENTS APRIL 1962



2-62 AP 10306

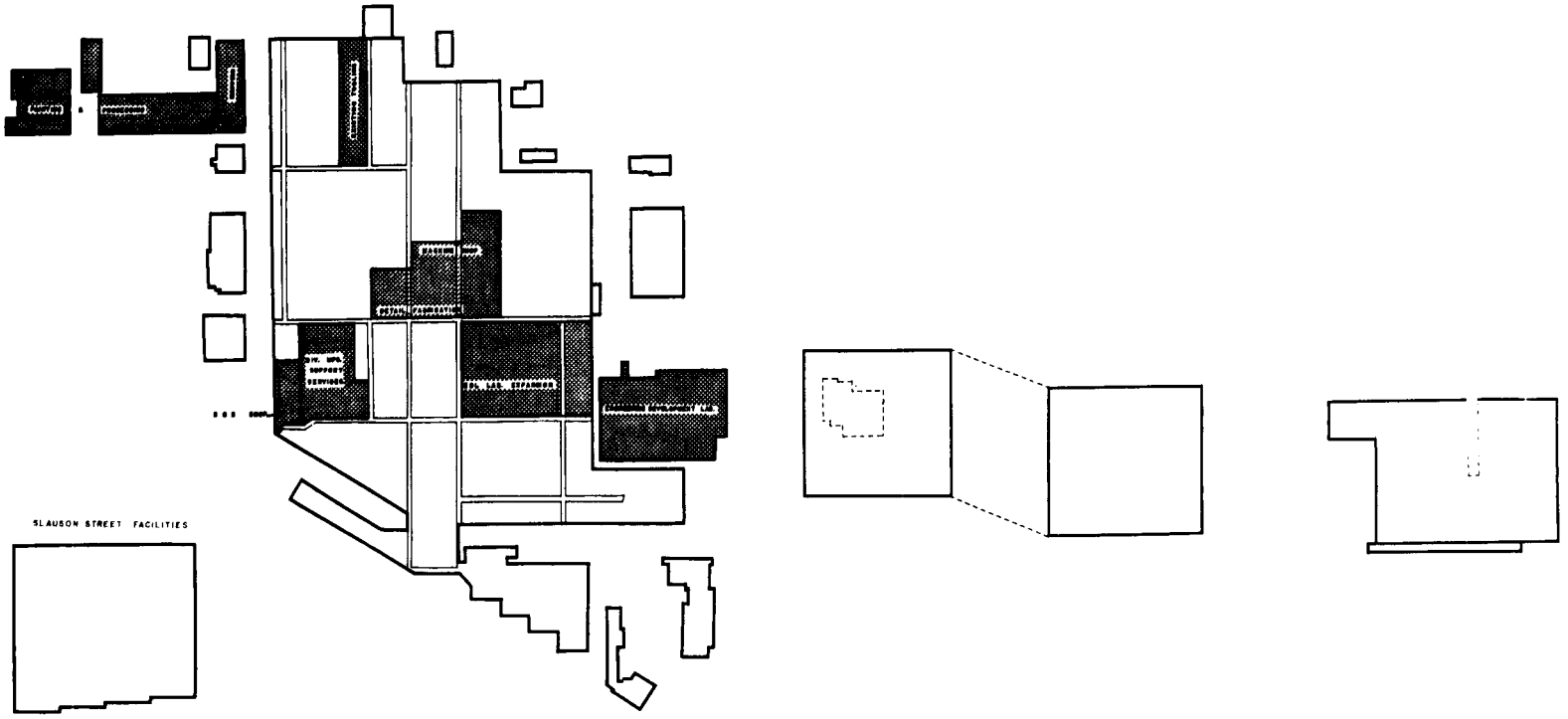
APOLLO AREA REQUIREMENTS DEC. 1962



2-62 AP10307

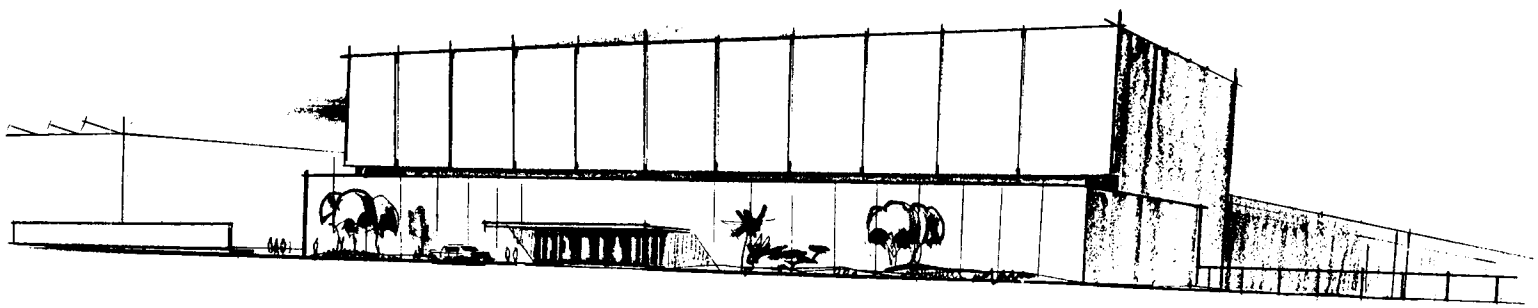
(112)

APOLLO SUPPORT ACTIVITIES DEC 1962



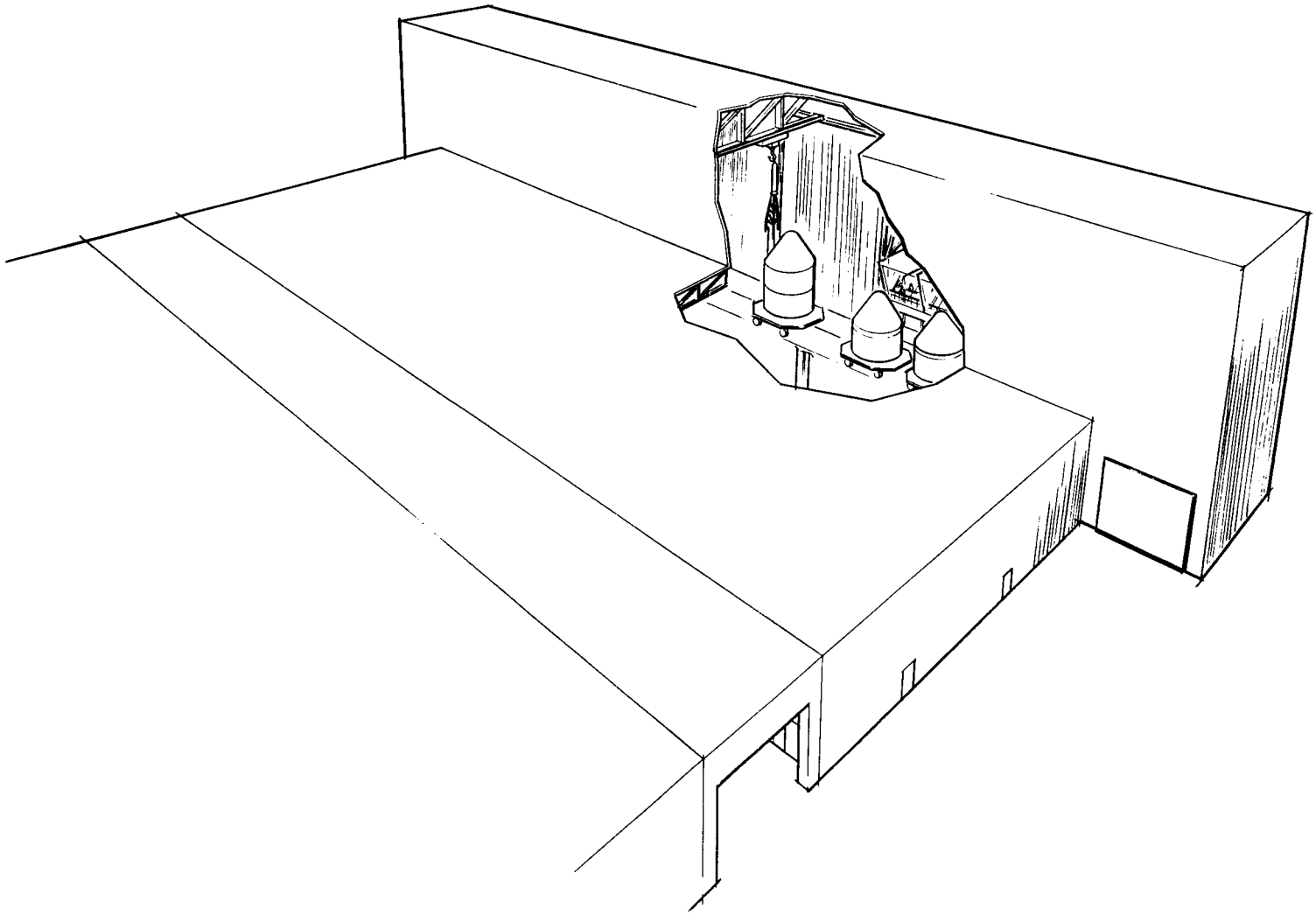
2-62 AP1030B

SYSTEMS INTEGRATION & CHECKOUT FACILITY



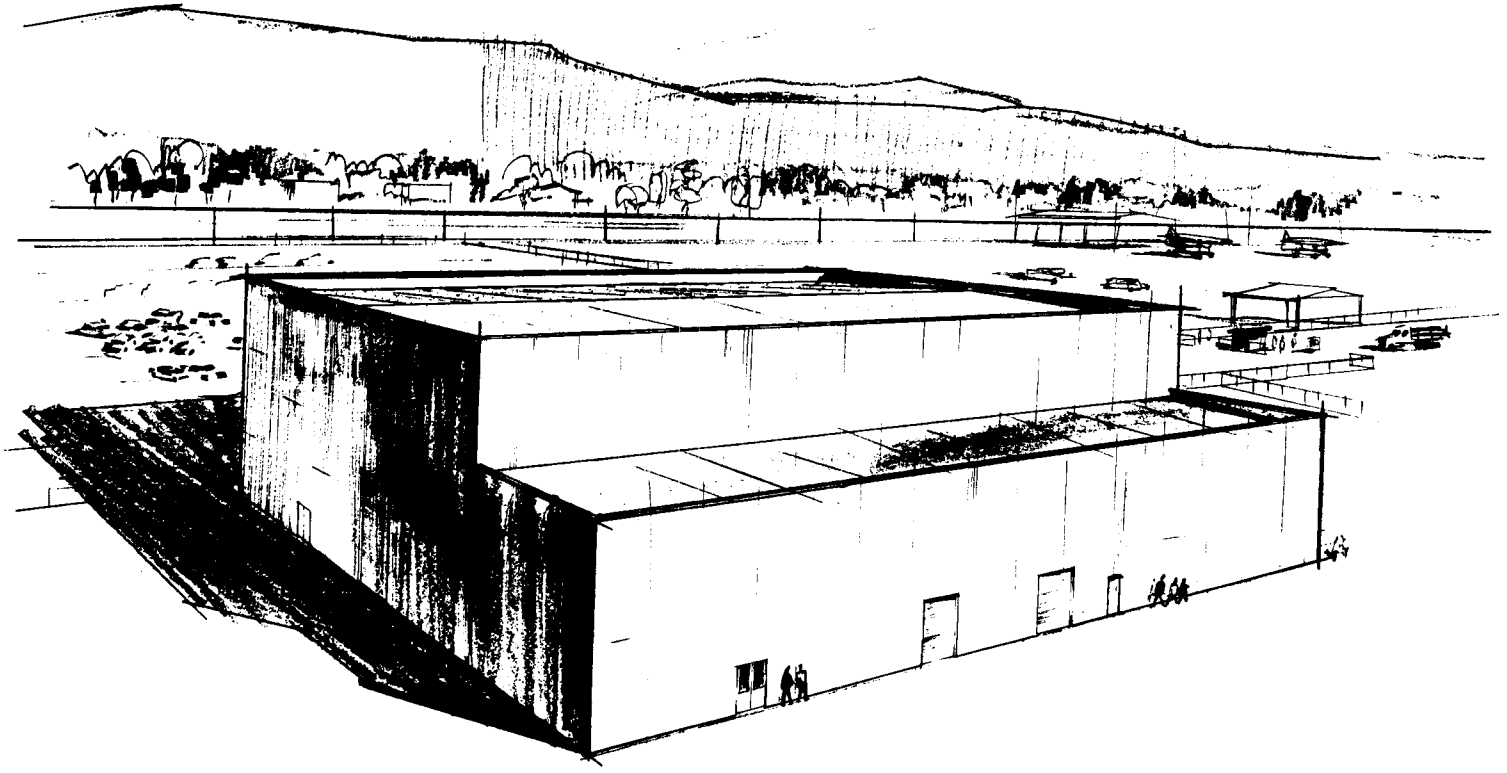
2-62 AP10309

SYSTEMS INTEGRATION & CHECKOUT FACILITY



2-62 AP10310

MANUFACTURING BONDING & TEST FACILITY



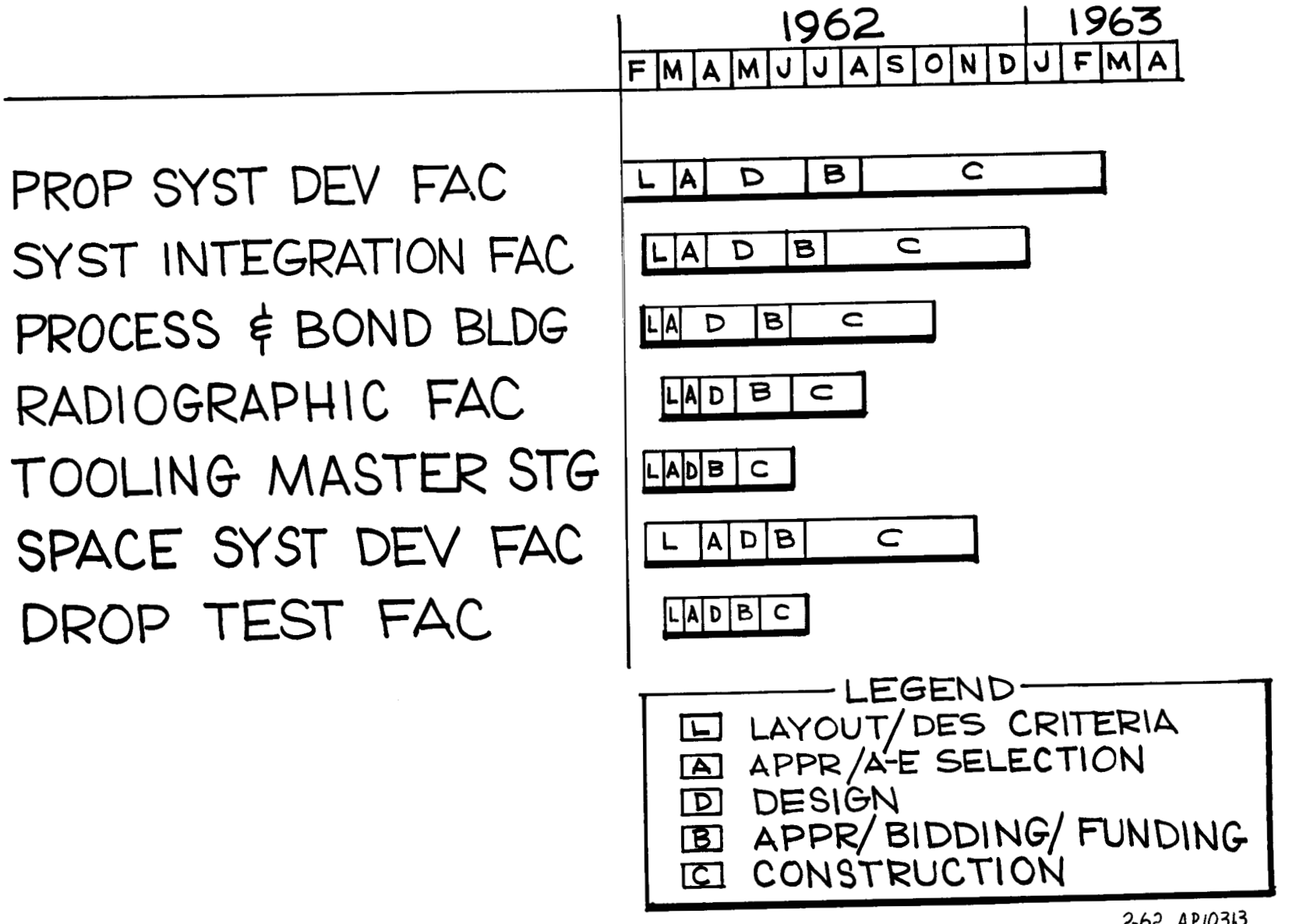
2-62 APIC311

S&ID TEST FACILITIES

- PROPULSION SYSTEMS DEVELOPMENT FACILITY PLANNED TO BE LOCATED AT AF PLANT 66 McGREGOR, TEXAS - S&ID FACILITY

- NAA AEROSPACE LABORATORIES, LOS ANGELES, CALIFORNIA
  - WIND TUNNEL
  - ACCOUSTIC CHAMBER
  - SPACE CHAMBER

APOLLO
FACILITIES PREPARATION SCHEDULE



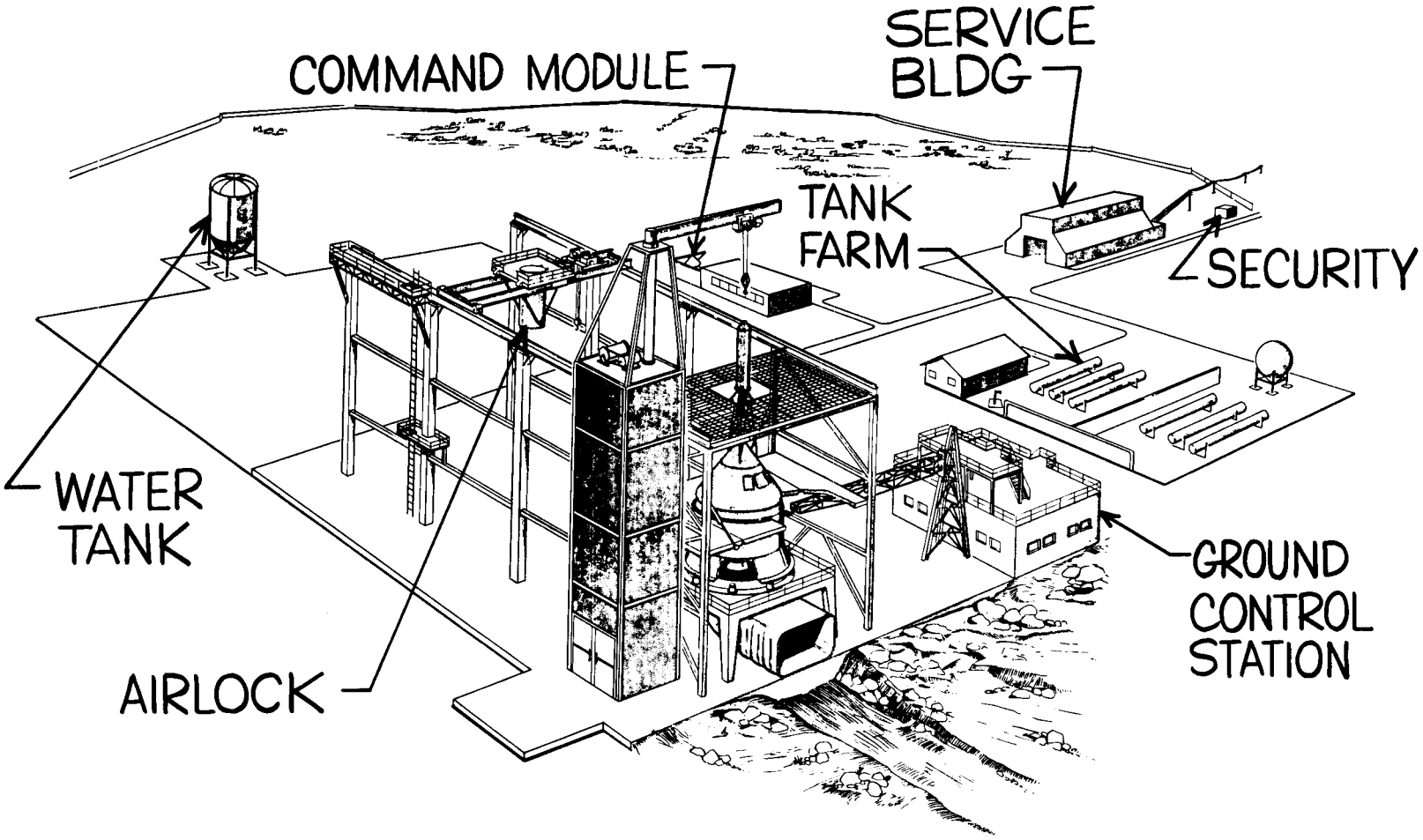
2-62 AP10313

GOVERNMENT FACILITIES

- THE NASA APOLLO MANNED SPACECRAFT CENTER FACILITIES AT AMR & HOUSTON
- A.E.D.C. TULLAHOMA- WIND TUNNEL & ENVIRONMENTAL TEST FACILITIES
- AMES · LEWIS · GODDARD · LANGLEY · JPL · BRL TEST FACILITIES
- ESCAPE & RECOVERY RANGES
- ANTENNA TEST RANGE
- GOSS NETWORK & NAVAL SUPPORT

2-62 AP 10314
(178)

PROPULSION SYSTEMS DEVELOPMENT FACILITY—APOLLO



2-62 AP 10315

FACILITIES LOCATIONS

2-62 AP 10316

ITEMS TO BE ACCOMPLISHED IN IMMEDIATE FUTURE

- MASTER FACILITIES SCHEDULE
- SET UP COMMAND MODULE-BOILERPLATE STRUCTURE ASSEMBLY AREA
- COMPLETE DESIGN CRITERIA FOR NEW FACILITIES
- EXPAND PROGRAM MANAGEMENT-ENGINEERING APOLLO SUPPORT DEPARTMENT AREAS TO SUPPORT PLANNED GROWTH
- RELOCATE WAREHOUSE TO L.A. TO PROVIDE APOLLO MANUFACTURING AREA
- START AQUISITION OF LONG LEAD FACILITY ITEMS

ACTIONS REQUIRED

1962

ITEM	FEB	MAR	APR	MAY	JUNE	JULY
MASTER FAC SCHEDULE	S/D					
PLANT 16 USE AGREEMENT		NASA				
PLANT 66 USE AGREEMENT		NASA				
REVISED PRELIM FAC PLAN		S/D				
FACILITIES CONTRACTS						
APPENDIX A FY 62			NASA S/D			
FY 63				NASA S/D		
FUNDING FY 62			NASA			
FY 63						NASA

2-62 AP10318

SCHEDULE REQUIREMENTS

AMR FACILITIES AVAILABILITY

• LITTLE JOE II LAUNCH PAD	NOV 1962
• SATURN LAUNCH DUMMY	MAR 1963
• R.C.S. FACILITY	JULY 1963
• ECS FACILITY	JULY 1963
• PYROTECHNIC FACILITY	JULY 1963
• SYSTEMS CHECKOUT M.S.C. BLDG. AT AMR	SEPT 1963