[redacted]

AGENDA

MOL MANAGEMENT MEETING

February 15, 1967

	TAB
T-IIIM and Fat Core	1
Crew Safety (Cabin Atmosphere)	2
Gemini B Pad Abort System	3
Test Flow and Acoustic Testing	4
Contract Status	5
Financial Status	6
Orbit Escape	7
Aircraft Simulation	8
MM Access Door Status	9
NASA AGE Transfer Status	10
Electric Power Status	11
System Weight Status	12

OUTLINE

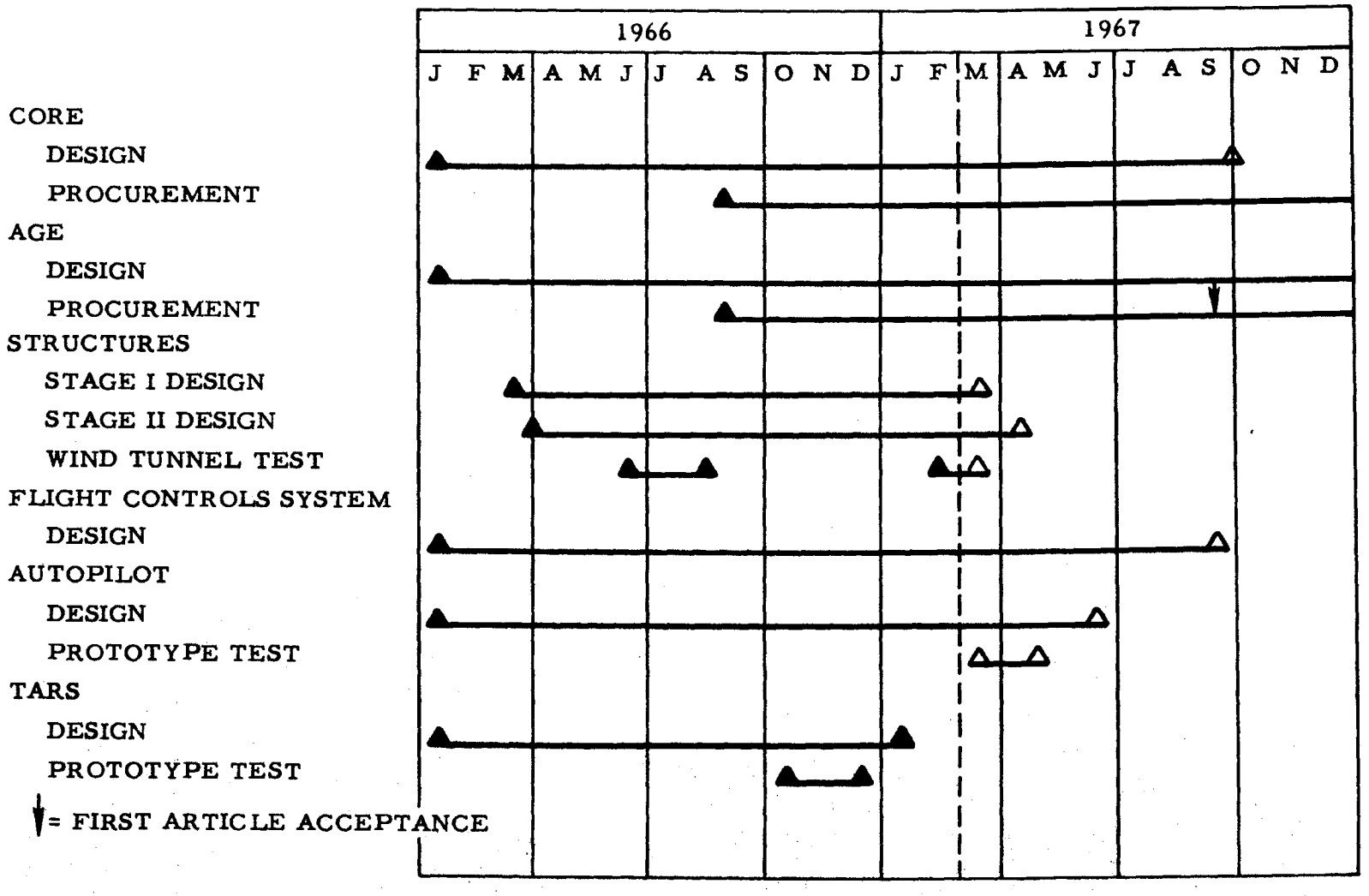
- TITAN IIIM TECHNICAL ACCOMPLISHMENTS TO DATE
- SCHEDULE AND COST DATA FOR "CASE I, II"
- TITAN IIIM BOOSTER OPTIONS
  - / 7 SEGMENT COMPETITION
  - / 156" SRM
  - / LDC/5
- TITAN IIIM "ROAD-MAP"
- CONCLUSIONS AND RECOMMENDATIONS

[redacted]

TITAN IIIM TECHNICAL ACCOMPLISHMENTS TO DATE

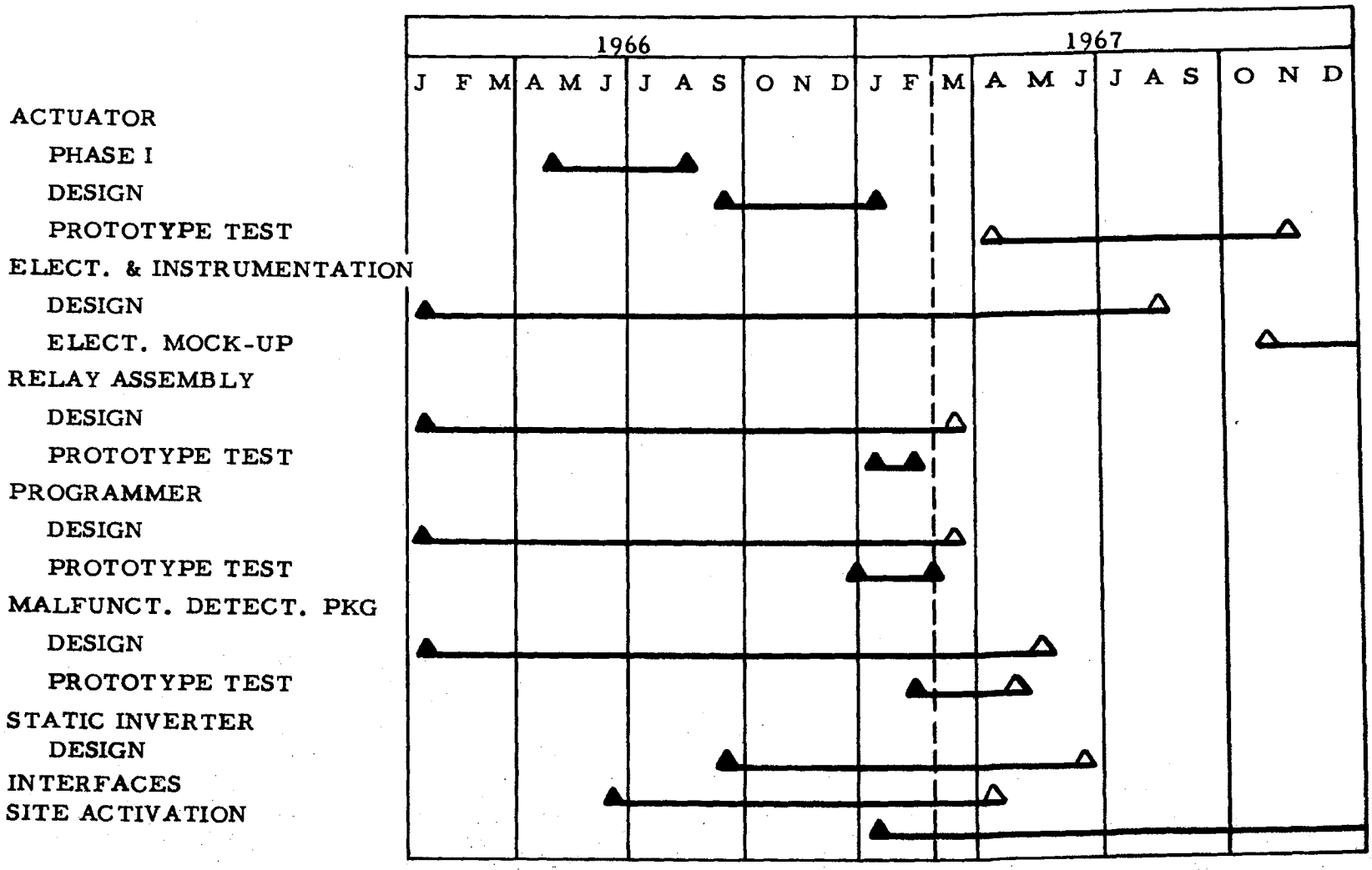
TECHNICAL ACCOMPLISHMENTS - MARTIN

STAGE I - STAGE II



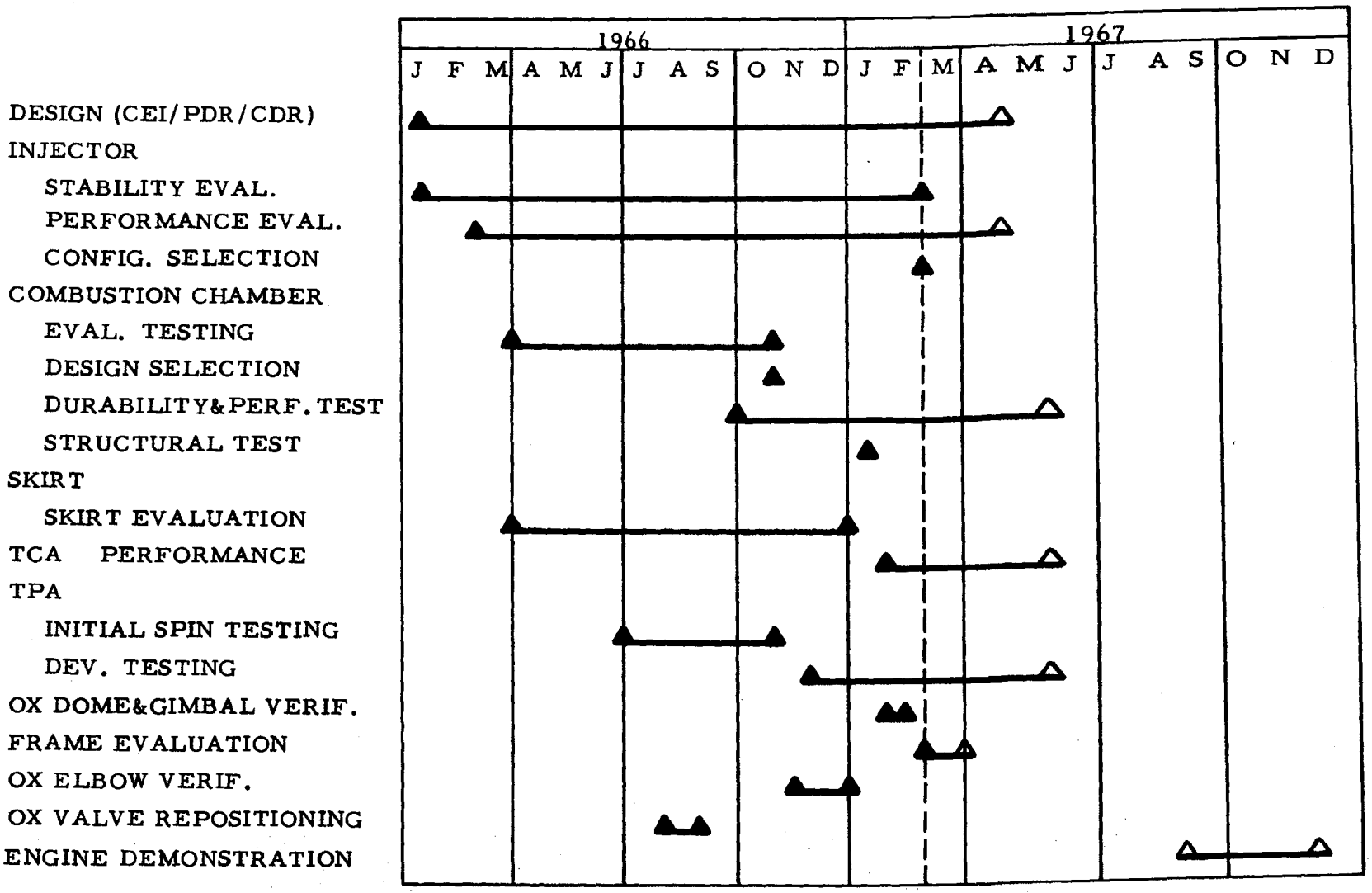
TECHNICAL ACCOMPLISHMENTS - MARTIN (CONTINUED)

STAGE I - STAGE II



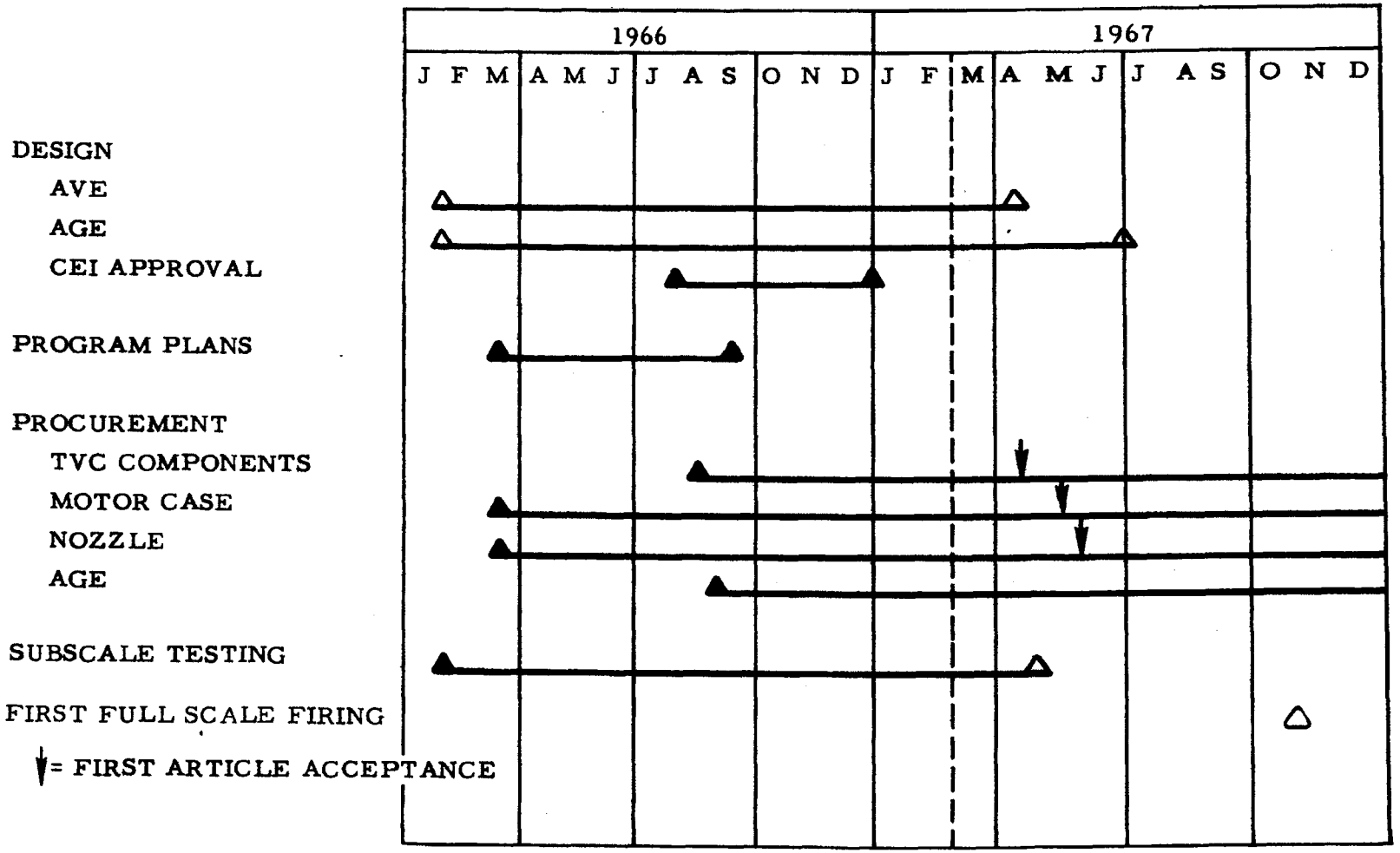
TECHNICAL ACCOMPLISHMENTS - AEROJET-GENERAL

STAGE I (15:1) LIQUID ENGINE



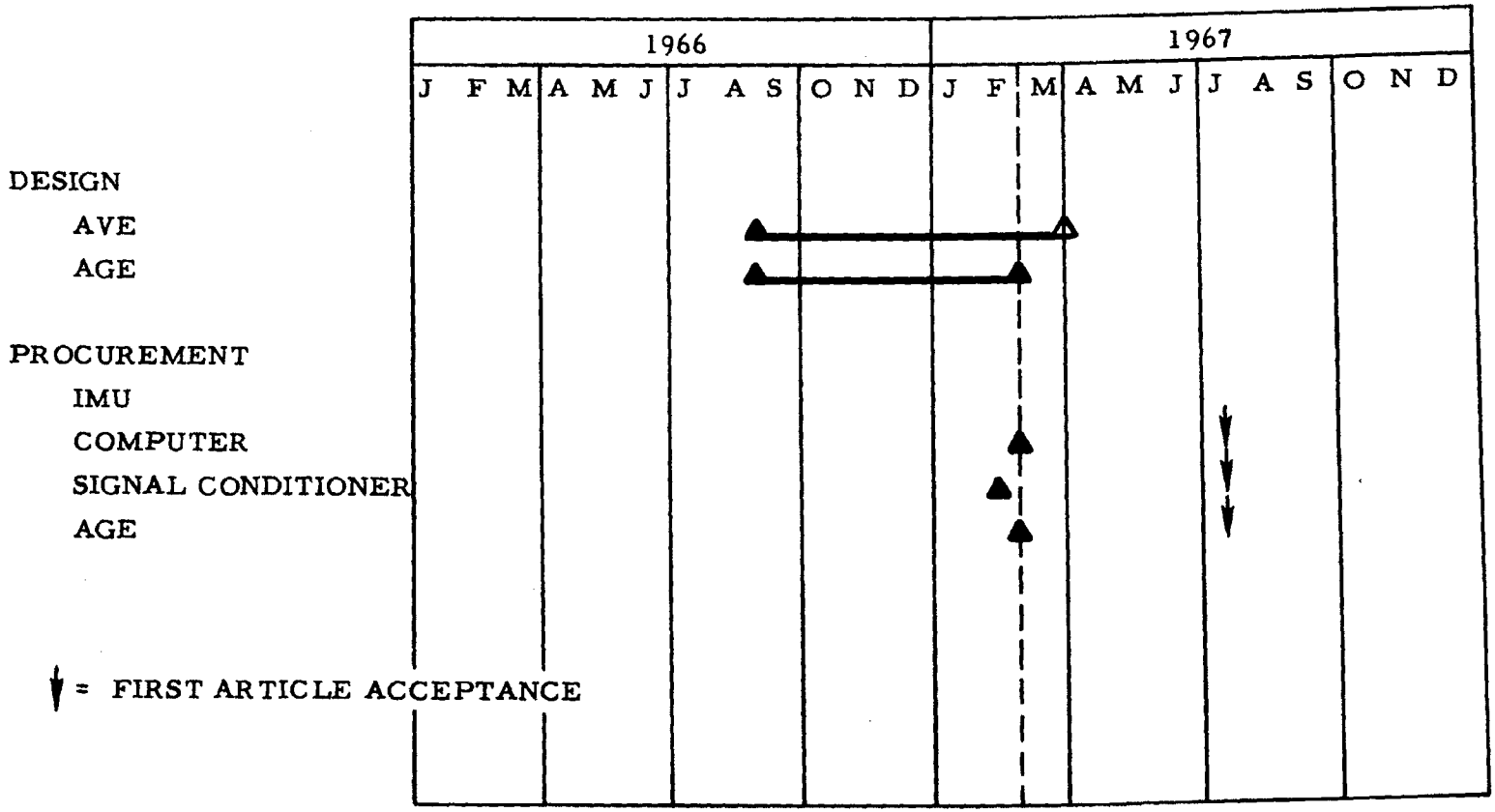
TECHNICAL ACCOMPLISHMENTS - UNITED TECHNOLOGY

7-SEGMENT SOLID ROCKET MOTORS



TECHNICAL ACCOMPLISHMENTS - AC ELECTRONICS

INERTIAL GUIDANCE SYSTEM



TITAN IIIM IMPACT ON OTHER TITAN III PROGRAMS

ITEM	TITAN III VEHICLE	DESCRIPTION OF IMPACT
15:1 STAGE I ENGINE	TITAN IIIB F/O TITAN IIIC F/O TITAN IIID	DELAY INCORPORATION OF UPRATED STAGE I ENGINE
STAGE I MAJORITY VOTE ACTUATOR	TITAN IIIC F/O TITAN IIID	REQUIRED FOR 15:1 ENGINE MAJORITY VOTE FEATURE MAY BE DELETED
UNIVAC 1824C COMPUTER AND SIGNAL CONDI-TIONER	TITAN IIIC-17, 18 TITAN IIIC F/O	THESE ITEMS PLANNED FOR TITAN IIIC-17 AND SUBSEQUENT
TARS	TITAN IIID	USE OF TITAN IIIM TARS ON TITAN IIID PERMITS DELETION OF ONE RATE GYRO SYSTEM
CAGE	TITAN IIID	DELAY IN TITAN IIIM DEVELOPMENT PRECLUDES CAGE AVAILABILITY FOR TITAN IIID
FLIGHT CONTROL COMPUTER	TITAN IIID	TITAN IIIM FIELD EFFECT TRANSISTOR AUTOPILOT PLANNED FOR TITAN IIID

SCHEDULE AND COST DATA FOR "CASE I, II"

PROGRAM SCHEDULE - FOUR YEAR

PRESENT SCHEDULE

MLC Construction Schedule

FY 67 | FY 68 | FY 69

CY 66 | CY 67 | CY 68 | CY 69

J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

1
2 DESIGN (PKG #2) — COMPLETE
3
4 Review 25, 26, 27 Oct. 66 — COMPLETE
5
6 Advertise & Award — COMPLETE
7
8 Construction
9
10 BOD's
11 Railroad
12 Propellant & Gas Holding Area
13 LOX Area
14 Communication Tunnel
15
16 LCC
17
18 AGE Bldg
19
20 UT & Launch Stand
21
22 A/C Shelter
23
24 Elec. Power
25
26 Theodolite Building
27
28 MST
29 LH Area
30 Complex Service Bldg
31
32
33
34
35
36 ■■■■■ ▲ 9 MONTH SLIP
37
38
39
40

J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

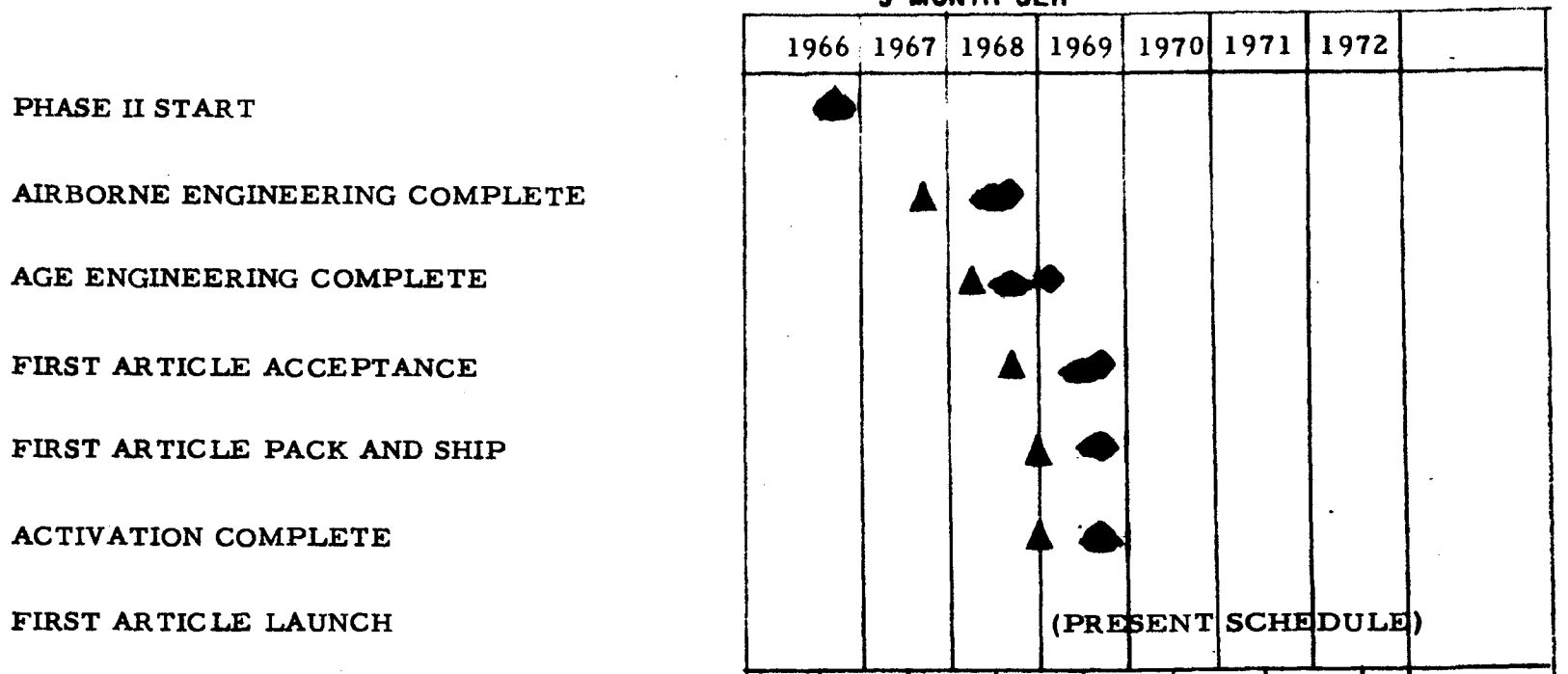
DCAS FORM 48A FEB 62 VELLUM FORM 489 BOND

DCASPP (L.A. Calif.) 62-3550

MARTIN COMPANY

PROGRAM PLAN

FUNDING LIMITATION PRESENT 9 MONTH SLIP

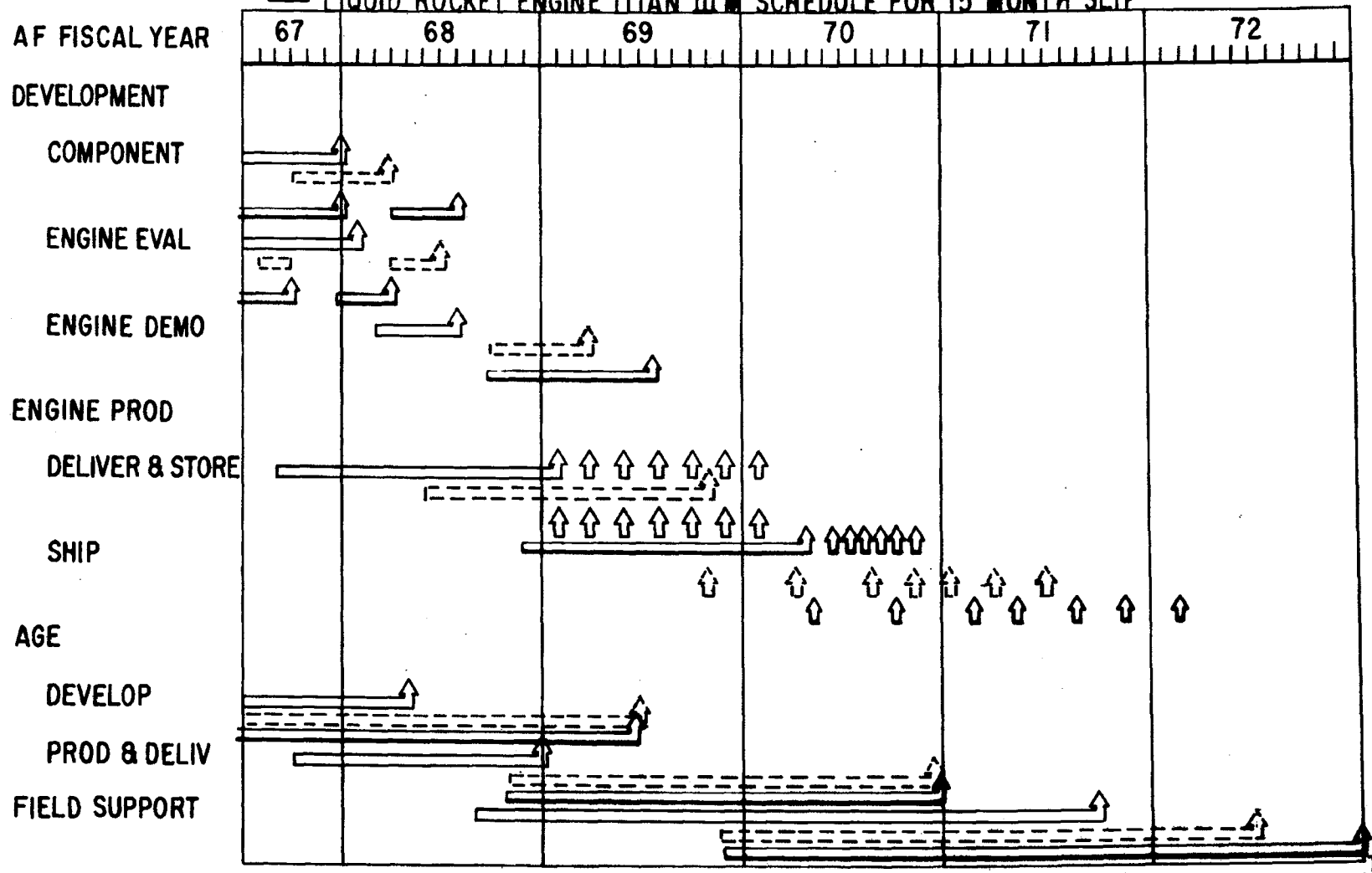


	FY67	FY68	FY69	FY70	FY71	FY72	TOTAL
REQUIRED FUNDING - PRESENT	39.8	52.9	35.6	21.1	7.4		156.8
9 - MONTH SLIP	38.0	36.5	38.0	29.5	17.3	4.5	163.8
			6.0 OVER LIMITATION				
FUNDING LIMITATION	38.0	30.5	38.0	32.0	19.5	6.8	164.8

◆ 11 MONTH SLIP
● 9 MONTH SLIP

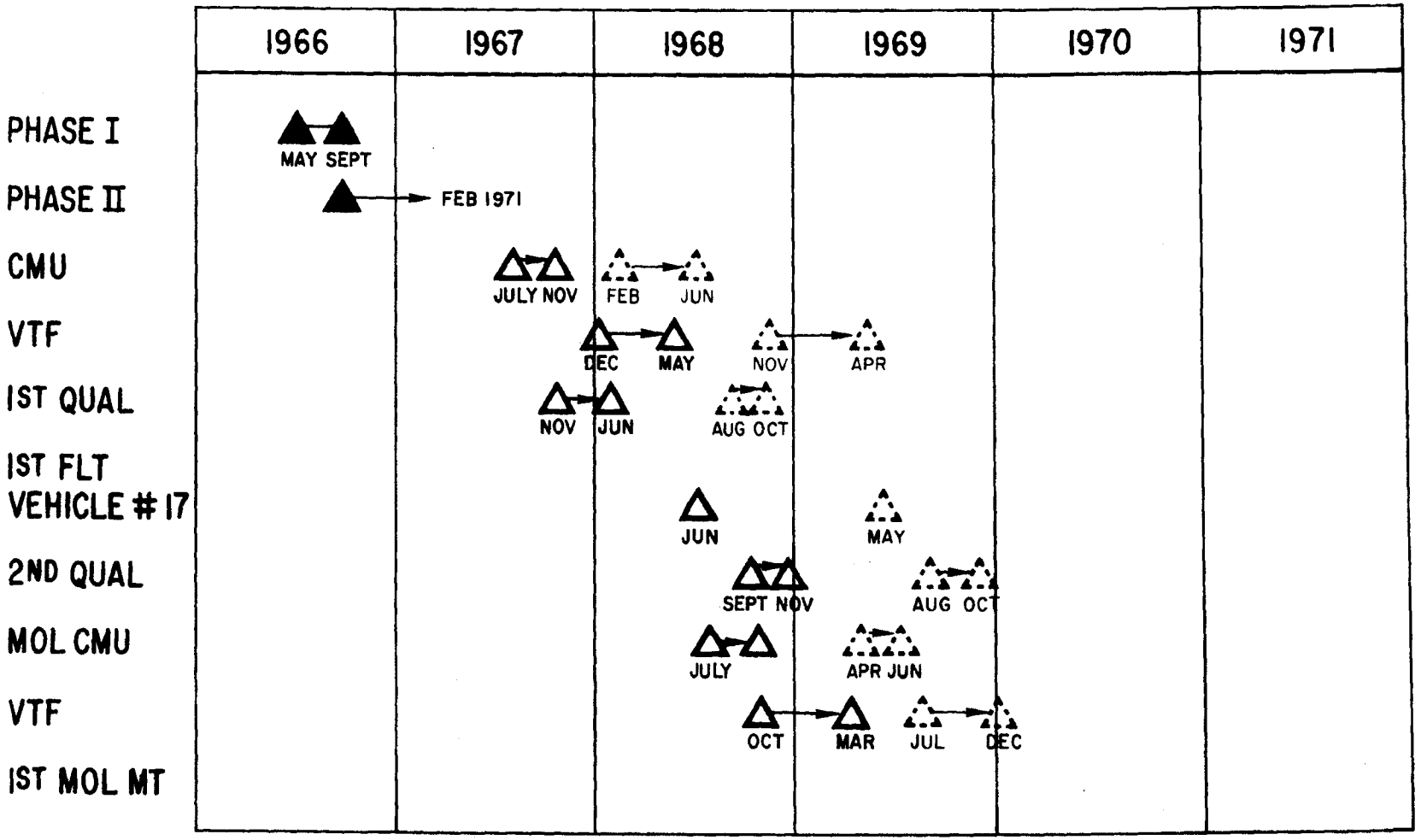
AEROJET-GENERAL CORP

— LIQUID ROCKET ENGINE TITAN III M SCHEDULE
--- LIQUID ROCKET ENGINE TITAN III M SCHEDULE FOR 9 MONTH SLIP
═══ LIQUID ROCKET ENGINE TITAN III M SCHEDULE FOR 15 MONTH SLIP



	67	68	69	70	71	72	TOTAL
— FY EXPENDITURES	19.8	17.0	9.1	3.9	1.7	0	52.5
-- FY EXPENDITURES	19.8	12.1	9.6	7.0	4.2	0.9	53.6
═ FY EXPENDITURES	17.0	9.5	9.2	9.1	6.7	3.3	54.8

AC ELECTRONICS DIVISION TITAN III M GUIDANCE PROGRAM PLAN



PRESENT	FY 66 & 67 7.8	FY 68 7.3	FY 69 3.9	FY 70 6.4	FY 71 2.0	FY 72 —
9 MOS SLIP	FY 66 & 67 5.7	FY 68 3.9	FY 69 6.6	FY 70 8.5	FY 71 4.4	FY 72 .60

△ PRESENT ⚠ 9 MOS SLIP

SUMMARY COST AND SCHEDULE IMPACT

(7 SEGMENT 120" SRM)

EXPENDITURES ($ in Millions)

	FY '66 & 67	68	69	70	71	72	TOTAL
● Present Program	80.8	131.1	94.9	50.0	31.5		388.3
● MOL Budget Limitation	80.8	75.0	105.0				
● Case I							
Impact: 11 Mos. Delay	✓	✓	✓	84.5	50.7	11.1	407.1
$18.8 M Total Cost Increase							
● Case II							
Impact: 9 Mos. Delay	85.7	87.1	95.5	71.5	48.0	18.4	406.2
$17.9 M Total Cost Increase							
FY '67, 68 Problem	4.9	12.1					

TITAN IIIM SLIP IMPACT ON TITAN III FAMILY

- 15:1 ENGINE INCORPORATION IN B, C, D
- STAGE I MAJORITY VOTE ACTUATOR IN C, D
- 1824 GUIDANCE COMPUTER IN C - SLIP #17 11 MOS.
- FLIGHT CONTROL COMPUTER (FET) INCORPORATION IN D
- TARS STANDARDIZATION WITH D
- CAGE INCORPORATION IN D

IMPACT OF MOL BUDGET CEILING ON TITAN III

- MOL BUDGET CEILING (CASE I)
  - / SLIPS FIRST MOL LAUNCH 11 MONTHS
  - / SLIPS C-17 LAUNCH 11 MONTHS
    - 1824 AVAILABILITY
  - / TOTAL PROGRAM COST INCREASE OF 18.8 M

- NINE (9) MONTH MOL SLIP (CASE II)
  - / INCREMENTAL COST ABOVE MOL BUDGET CEILING IN FY '67, 68 - 17 M
  - / TOTAL PROGRAM COST INCREASE OF 17.9 M

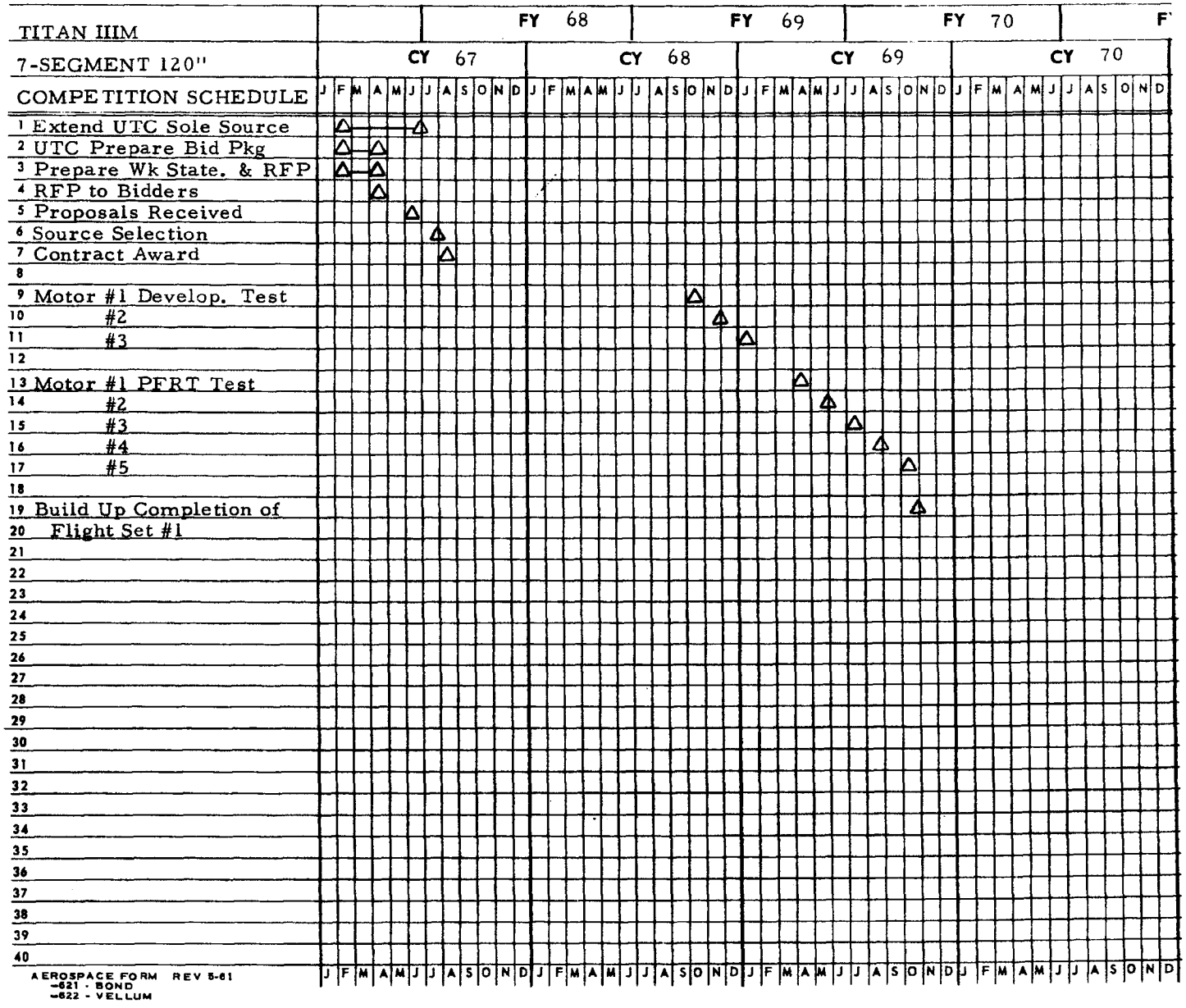
- INCREMENTAL COST ABOVE CASE II TO MAINTAIN 15:1 STAGE 1 ENGINE INCORPORATION IN "B" AND "D" PROGRAMS OF 4.2 M IN FY '67 AND 1.4 M IN FY '68

- INCREMENTAL COST ABOVE CASE II TO HOLD C-17 LAUNCH OF 2.3 M IN FY '67 AND 3.3 M IN FY '68

TITAN IIIM BOOSTER OPTIONS

7 SEGMENT COMPETITION

PROGRAM SCHEDULE - 6 Years



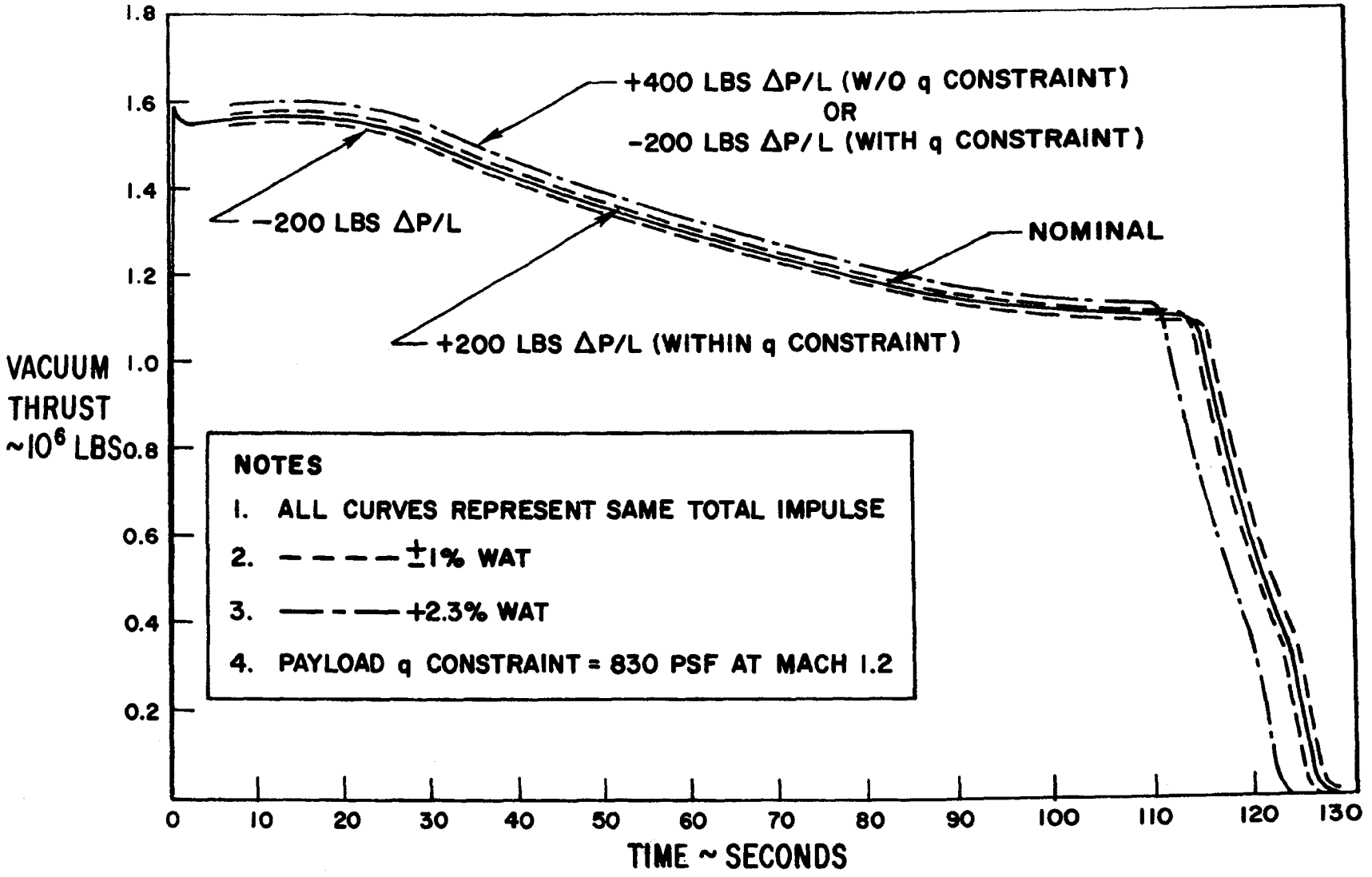
AEROSPACE FORM REV 5-61
-621 - BOND
-622 - VELLUM

PROGRAM RISKS DUE TO 7-SEGMENT COMPETITION

- POOR TECHNICAL DEFINITION OF MOTOR DUE TO SHORT TIME SPAN
- AFT SKIRT AND STRUCTURAL TESTS PRESENT PACING ITEMS
  - / DESIGN AND PROCUREMENT OF AFT SKIRT AND ATTACH STRUCTURE MUST START FROM BEGINNING (APPROXIMATELY 18 MONTHS TO BUILD)
    - CRITICAL ITEM BOTH FROM DESIGN AND WEIGHT STANDPOINT (3 MONTHS)
    - REQUIRE ADDITIONAL MARTIN COMPANY LOADS ANALYSIS
    - PROCUREMENT OF FORGING LONG LEAD ITEM (12 MONTHS)
  - / STRUCTURAL TESTING REQUIRED PRIOR TO FIRST LAUNCH (3 MONTH PROGRAM)
- PROPELLANT CHARACTERIZATION PROGRAM REQUIRED
  - / PAYLOAD PERFORMANCE CRITICAL ON SRM THRUST TIME CURVE
    - LOWER SRM PERFORMANCE MEANS LESS PAYLOAD
    - HIGHER SRM PERFORMANCE MEANS VIOLATION OF VEHICLE CONSTRAINTS

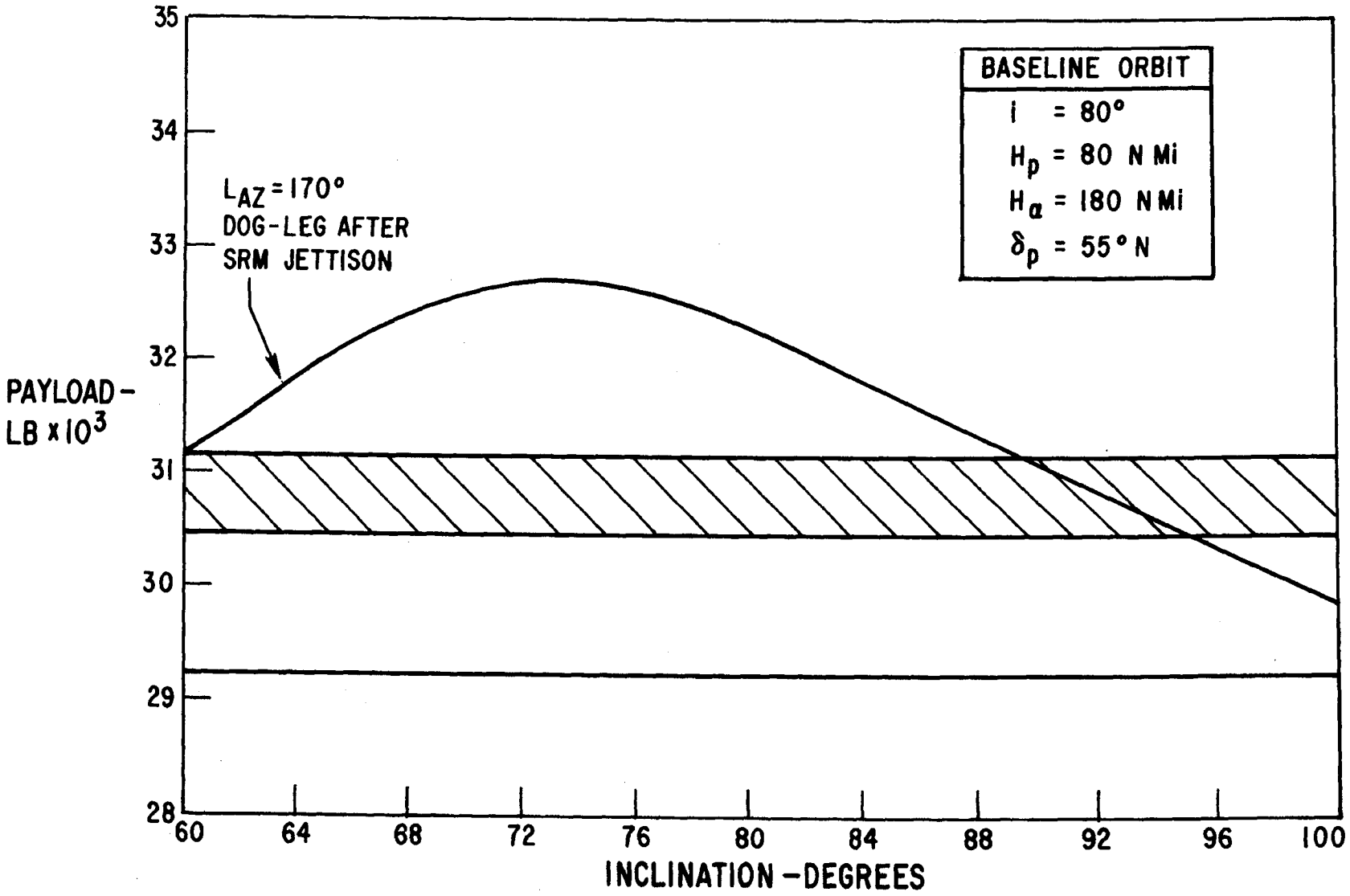
7 SEGMENT SRM THRUST VS TIME

PAYLOAD SENSITIVITY



~~CONFIDENTIAL~~

TITAN III M PERFORMANCE VS INCLINATION



~~CONFIDENTIAL~~

AEROSPACE CORPORATION
EL SEGUNDO, CALIF
FEB 14 - 67

SEVEN SEGMENT COSTS

- PRESENT (SOLE SOURCE - UTC)

/	EXPENDED THRU JUNE 1967	11.4 M
/	TOTAL TO COMPLETE (9 MONTHS SLIP)	
	WITH C&D BASE	107.0 M
	WITHOUT C&D BASE	114.0 M

- COMPETITION

/	EXPENDED ON SOLE SOURCE	11.4 M
/	COMPETITIVE PRICE	90.0 M
	TOTAL	101.4 M

Σ = POTENTIAL COST SAVINGS $\sim$ 6 - 13 M

SEVEN SEGMENT COMPETITION SUMMARY

- SRM COST PROBLEM CAN POTENTIALLY BE ALLEVIATED BY COMPETITION AFTER 5 SEGMENT SOURCE SELECTED

  / IF UTC WINS 5 SEGMENT COMPETION $\Longrightarrow$ STAY WITH UTC ON 7 SEGMENT (COST $\Delta \lesssim$ 6 M)

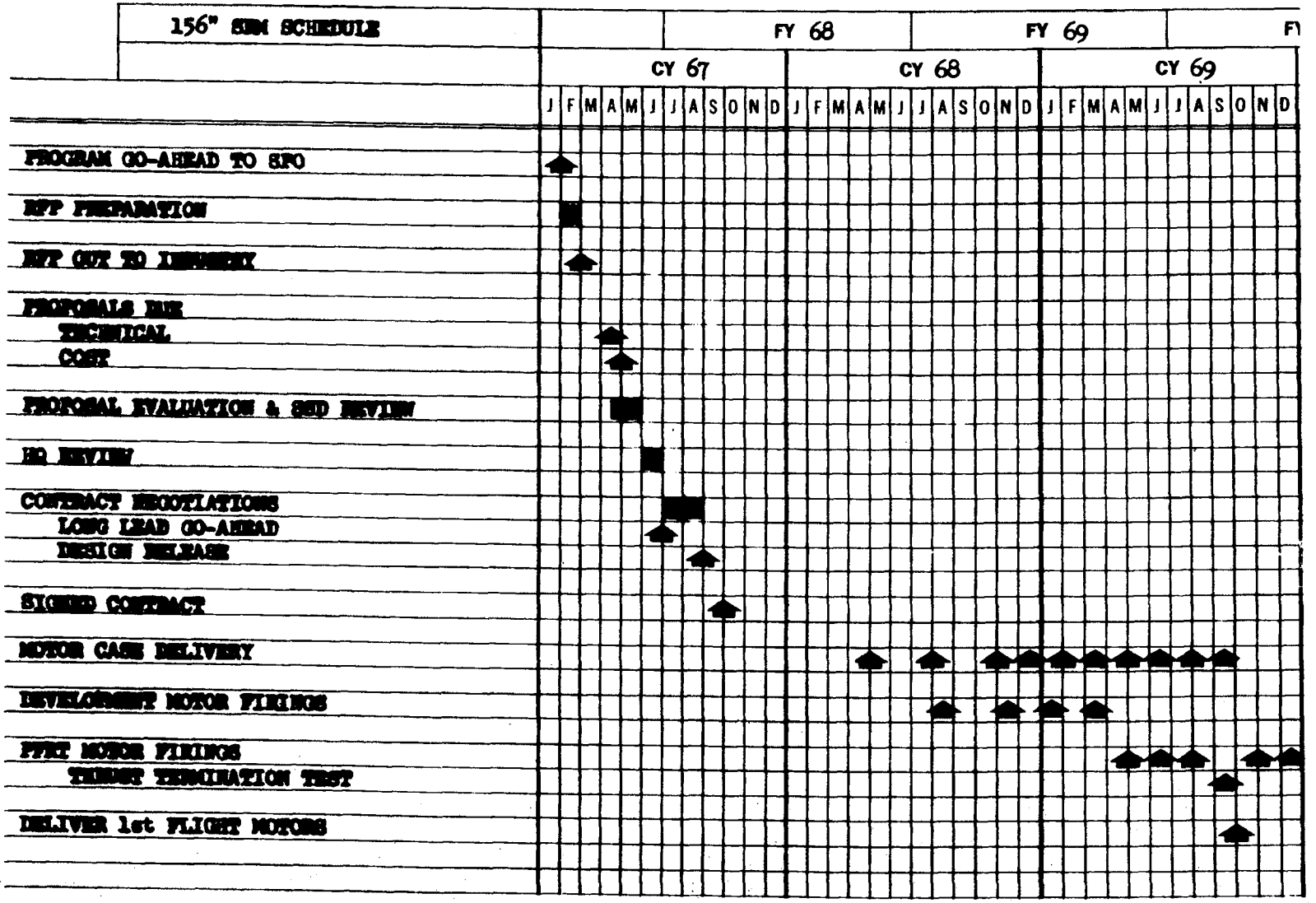
  / IF UTC LOSES 5 SEGMENT COMPETITION $\Longrightarrow$ COMPETE 7 SEGMENT TO MEET 9 MONTHS SLIP SCHEDULE

- ACTION REQUIRED:

  1. PREPARE 7 SEGMENT RFP TO MEET 9 MONTHS SLIP SCHEDULE (RFP AVAILABLE $\sim$ 15 APRIL)

  2. NEXT DECISION DATE $\sim$ 15 MARCH (5 SEGMENT SOURCE SELECTION)

156" SRM



MOL SRM COST ESTIMATES

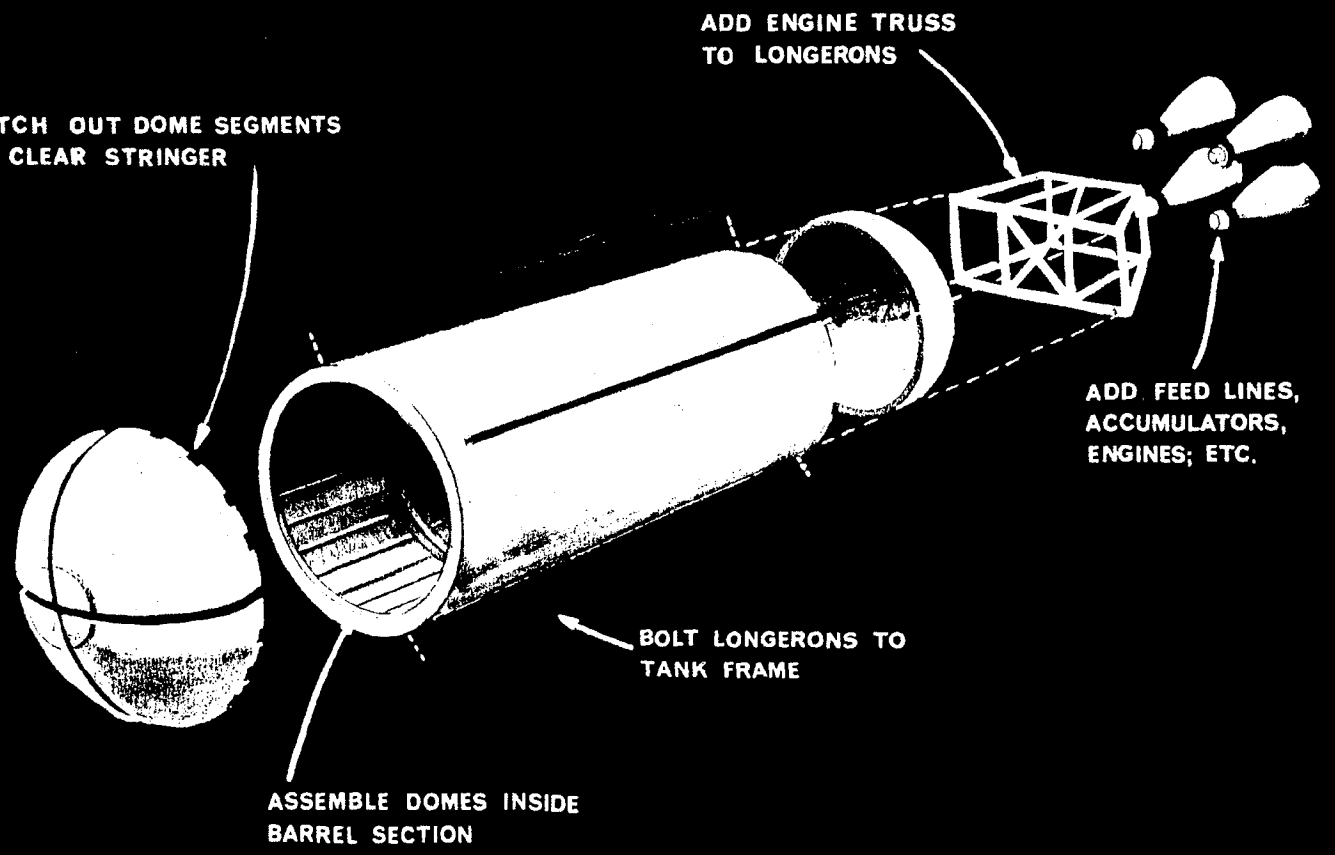
WORK STATEMENT BREAKDOWN	4 FEB 66 BASELINE NR	4 FEB 66 BASELINE REC	Δ NR	Δ REC	REVISED NR	REVISED REC
PROGRAM MANAGEMENT	8.22	2.92	1.70 (1)	0	9.92	2.92
SYSTEM ENGINEERING	4.62	1.51	.30 (1)	0	4.92	1.51
AIRBORNE DESIGN & NON-RECURRING TOOLING	44.93	0	.14 (2) .10 (3)	0	45.17	0
AIRBORNE PRODUCTION	0	54.53	0	0	0	54.53
GROUND DESIGN & NON-RECURRING TOOLING	8.15	0	0	0	8.15	0
AGE PRODUCTION & RECURRING TOOLING	13.91	0	0	0	13.91	0
ACTIVATION	4.97	0	0	0	4.97	0
LAUNCH OPERATIONS	0	8.17	0	0	0	8.17
LOGISTICS	1.86	2.75	0	0	1.86	2.75
FACILITY DESIGN	--	--	--	--	--	--
SUB-TOTAL	86.66	69.88	2.24	0	88.90	69.88
NATIONAL ECONOMY INCREASE			2.67 (4)	2.10 (4)	2.67	2.10
					91.57	71.98
					10.00 (5)	
TOTAL PROGRAM	156.54				173.55	

156" SRM CONSIDERATIONS

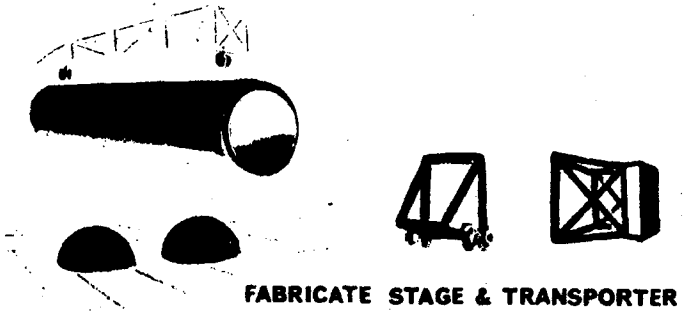
- PERFORMANCE CAPABILITY AT 44,000 LB. PAYLOAD
- REQUIRES 31 MONTHS FROM GO-AHEAD TO FIRST LAUNCH (PLUS 2 MONTHS LONG LEAD DURING NEGOTIATION WITH SELECTED SOURCE)
- COSTS ARE 60% - 70% HIGHER THAN 120" MOTOR PROGRAM

LARGE DIAMETER CORE

Final Assy - Fuel Tank

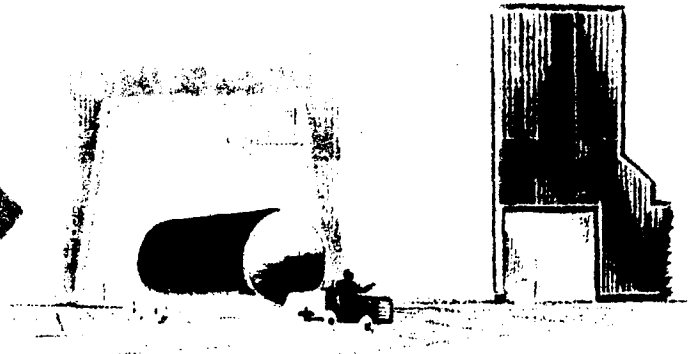


DEMONSTRATION PLAN



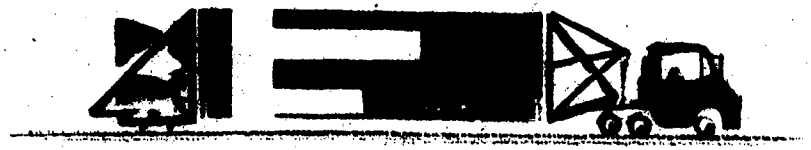
FABRICATE STAGE & TRANSPORTER

FACTORY CAPABILITY DEMO



MOVE THROUGH DENVER FACILITY

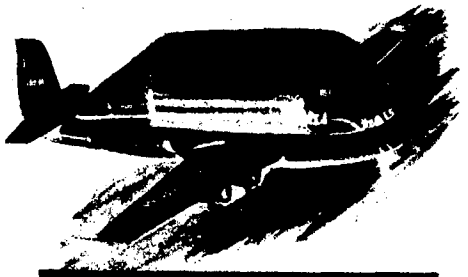
FACILITY CAPABILITY DEMO



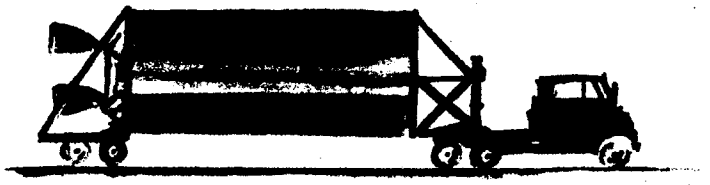
TRANSPORT TO WTR BY ROAD

GROUND TRANSPORTATION CAPABILITY DEMO

DEMONSTRATION PLAN (CONTINUED)



FLY FROM WTR TO BUCKLEY
AIR TRANSPORTATION



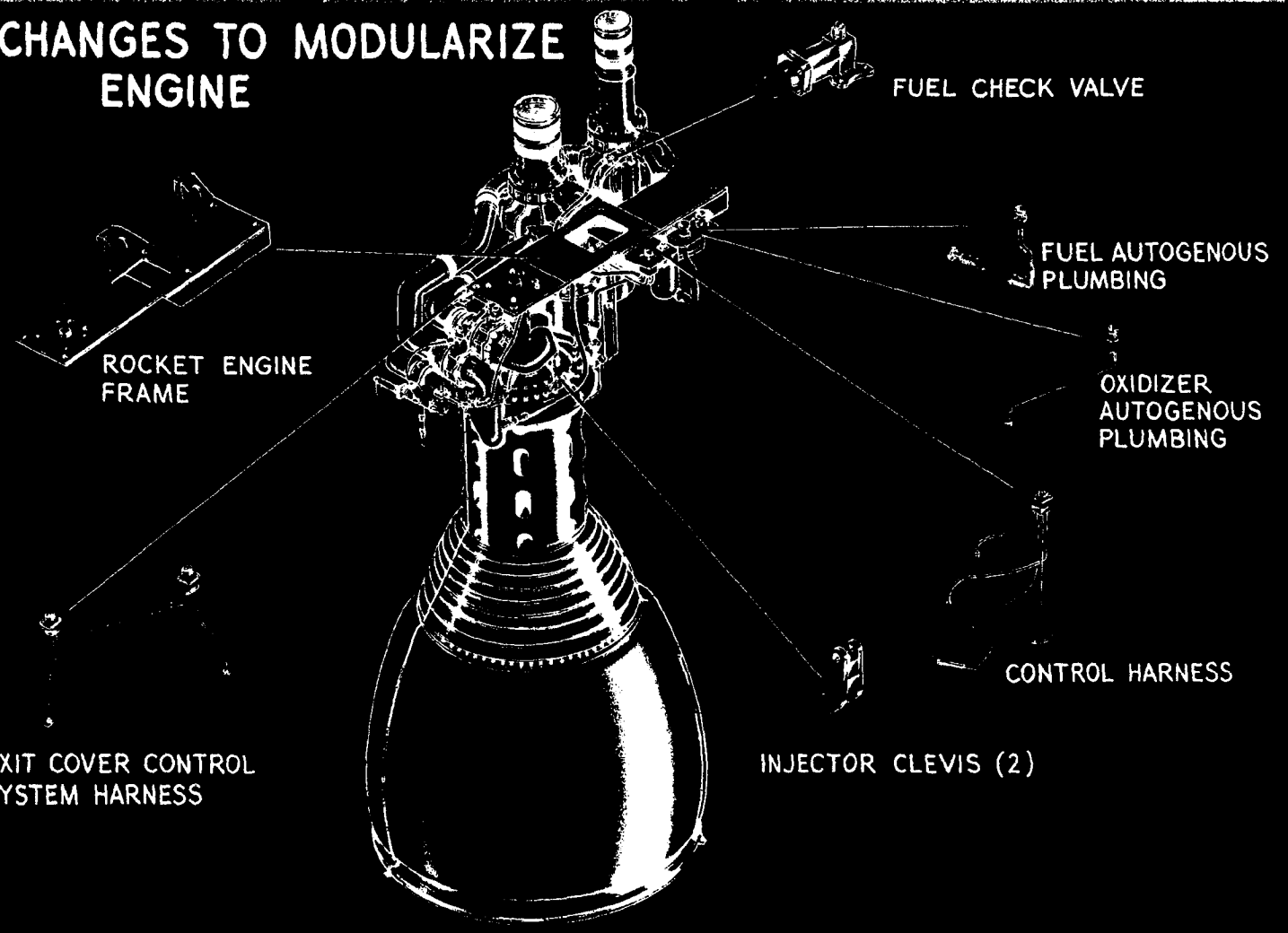
BUCKLEY TO MAIN PLANT
ROAD TRANSPORT

SHOWS DETAIL OF SUBSYSTEM

WE DID IT
DEMONSTATION

MODULAR ROCKET ENGINE

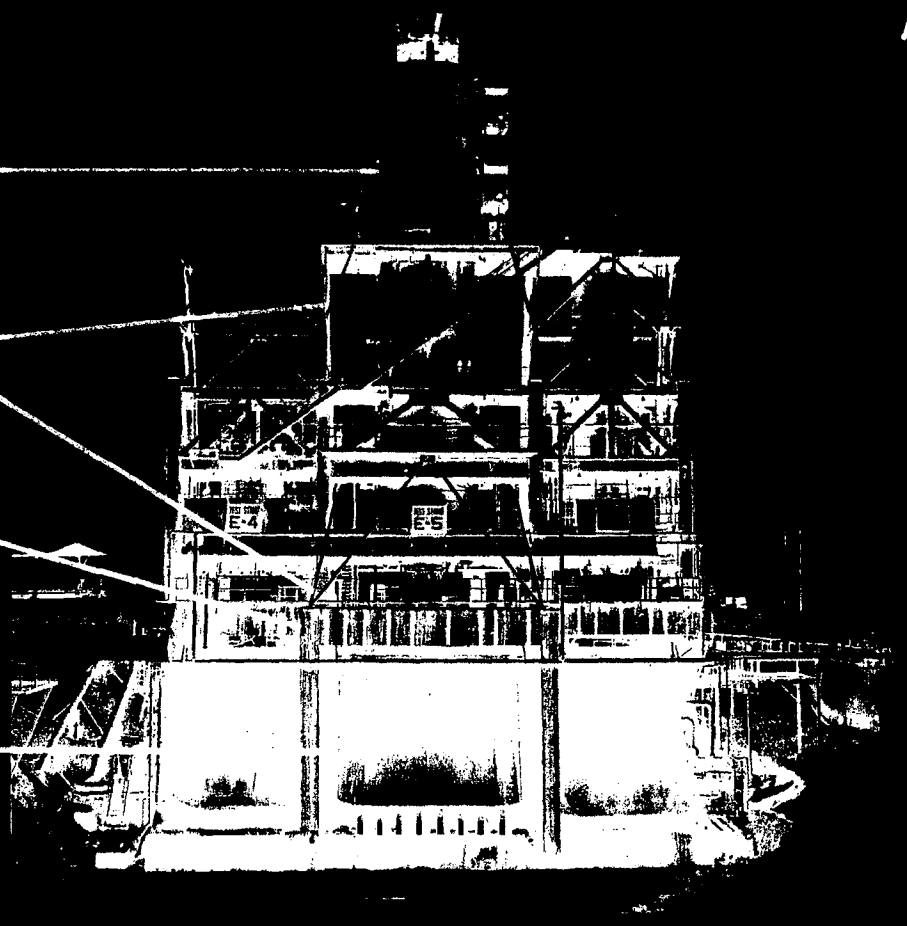
CHANGES TO MODULARIZE ENGINE



LARGE DIAMETER CORE

STEP 1
FEASIBILITY

- NEW BATTLESHIP TANKS
- ADDITIONAL FRAMING
- NEW CONCRETE (AGC CAPITAL)
- NEW DEFLECTOR PLATE AND 3 ADDITIONAL WATER PUMPS



STEP 2
AQUISITION PHASE

- ADDITIONAL DUMP TANK
- ADDITIONAL SUMP CAPACITY
- NEW WATER STORAGE TANK
- ADDITIONAL INSTRUMENTATION & CONTROLS CAPABILITY

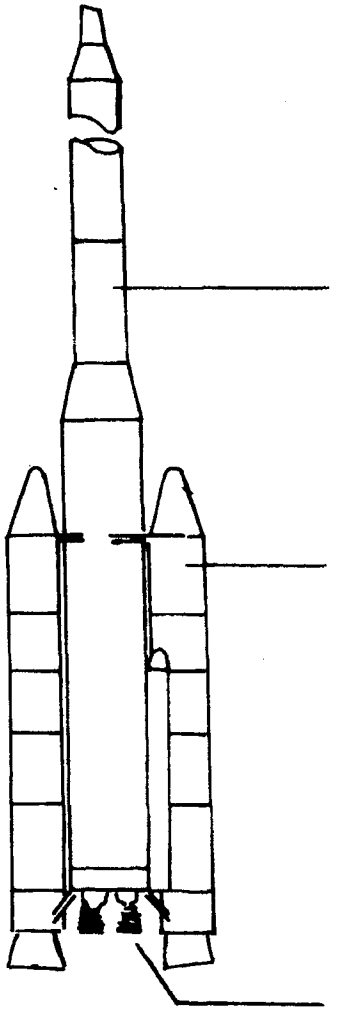
TITAN IIIM LDC/5 SUMMARY

- CONSIDERABLE CONTRACTOR SUPPORT EFFORT HAS BEEN UNDERWAY SINCE JULY 1966

  / WILL CULMINATE IN (JULY 1967)

  - MMC STAGE I LDC FABRICATION, INCLUDING FOUR 15:1 ENGINES MOUNTED AND PLUMBED, GROUND AND AIR TRANSPORTATION DEMONSTRATION
  - AGC MODULAR ENGINE FIRINGS

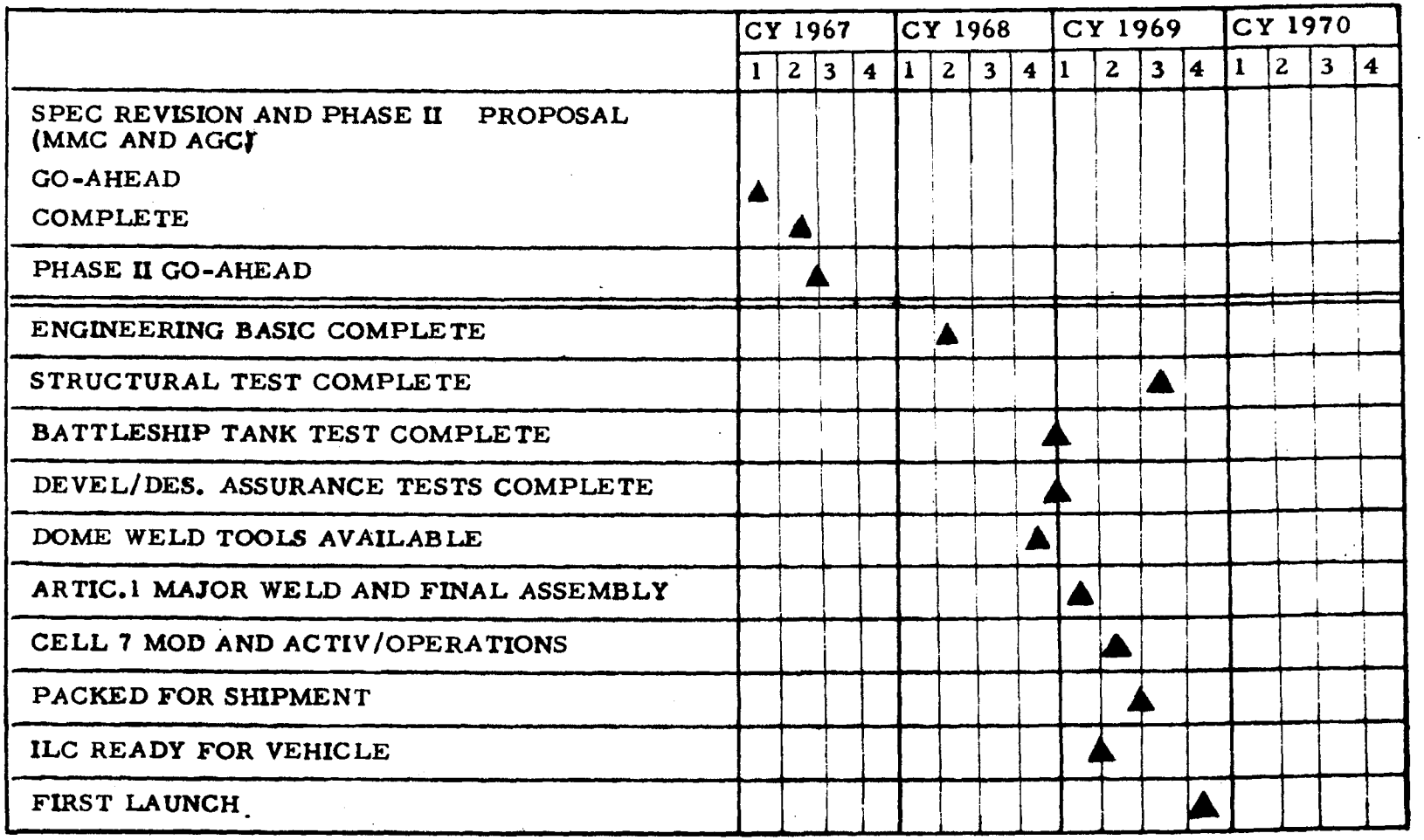
TITAN IIIM LDC/5 SUMMARY



- PERFORMANCE (80°, 80/130) $\approx$ 38,000 LBS.
- Q MAX $\leq$ 750

(1) HEREAFTER REFERRED TO AS TITAN IIIM-1

TITAN IIIM LDC/5 SUMMARY



LDC/5 SEGMENT SRM COSTS ($ in Millions)

EFFORT	FY 67	FY 68	FY 69	FY 70	FY 71	FY 72	TOTAL
AIRFRAME	39.5	57.5	52.6	33.5	19.7	5.7	208.5
LIQUID ENGINES	20.3	19.5	17.7	9.2	4.9	1.5	73.1
GUIDANCE	5.3	7.3	3.9	6.4	2.0	.6	25.5
SOLID MOTORS	15.0	6.5	13.5	9.8	7.3	.8	52.9
OTHER	5.5	11.3	16.9	8.2	3.5	.5	45.9
TOTAL	85.6	102.1	104.6	67.1	37.4	9.1	405.9

TITAN IIIM LDC/5 SUMMARY

- COST △ BETWEEN SEVEN-SEGMENT MOL BOOSTER AND TITAN IIIM LDC/5 SEGMENT

  / + = COST INCREASE DUE TO TITAN IIIM LDC/5

  \- = COST DECREASE DUE TO TITAN IIIM LDC/5

CONTRACTOR	NON-RECURRING	RECURRING
MARTIN	$+ 30 \times 10^6$	$+ .7 \times 10^6$
7 SEGMENT SRM	$- 40 \times 10^6$	$- 3.0 \times 10^6$ (1)
AGC	$+ 15 \times 10^6$	$+ 0.9 \times 10^6$
TITAN IIIM LDC/5 SEGMENT NET SAVINGS OVER 7 SEGMENT BOOSTER	$+ 5 \times 10^6$	$- 9.8 \times 10^6$

/ ADDITIONAL LIQUID PROPELLANTS (OVER 15:1) REQUIREMENTS - 5.0×10^6

Σ = LDC/5 $\approx$ TITAN IIIM/7

(1) ASSUMES ADD-ON TO D/5 AND C FOLLOW-ON CONTRACT (AT 5.0×10^6/SET SRM'S)

TITAN IIIM LDC/5 SUMMARY

- PERFORMANCE $\approx$ 38,000 LBS (80°, 80/130), $q_{max} \lesssim 750$
- INCREASED TECHNICAL RISK OVER PRESENT CONFIGURATION
  - / CLUSTERED STAGE I ENGINE PROGRAM VS 7 SEGMENT DEVELOPMENT
- SCHEDULE - FIRST FLIGHT CAN MEET 9 MONTHS SLIP REQUIREMENT (PHASE II GO-AHEAD JULY 1967)
- COSTS - TITAN IIIM LDC/5 $\approx$ TITAN IIIM/7

SUMMARY OF TITAN IIIM OPTIONS

VEHICLE	T-IIIM/7	T-IIIM LDC/5	T-IIIM/156"
PERFORMANCE (80°, 80/130)	32,800 LBS	38,000 LBS	44,000 LBS
TECHNICAL RISK	—	INCREASED - CLUSTERED STAGE I VS 7 SEGMENT DEVELOPMENT	—
SCHEDULE	ALL CAN MEET 9 MONTHS SLIP REQUIREMENT		
COSTS (1)	0	~ 0	+ 60 M

(1) COSTS REFERENCED AS INCREASE OVER TITAN IIIM/7 WITH 9 MONTHS SLIP

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- ADDITIONAL FY '67, 68 FUNDS ARE REQUIRED TO:
  1. MAINTAIN 9 MONTHS FIRST FLIGHT SLIP - 17 M
  2. MAINTAIN TITAN III C-17 LAUNCH DATE - 5.6 M
  3. INCORPORATE 15:1 IN TITAN III B, C, D (FIRST STAGE ENGINE COMMONALITY) - 5.6 M

- SEVEN (7) SEGMENT COMPETITION
  - / POTENTIAL COST SAVING $\approx$ 6 - 13 M
  - / TECHNICAL RISK IF OTHER THAN UTC $\Longrightarrow$ PERFORMANCE, QUALITY

- 156" SOLIDS
  - / COST INCREASE $\approx$ 60 M OVER PRESENT PROGRAM

- LDC/5 SEGMENT
  - / COST $\approx$ TITAN IIIM/7
  - / PERFORMANCE $\approx$ 5000 LBS GREATER THAN TITAN IIIM/7
  - / LOWEST COST OPTION FOR MOL GROWTH

RECOMMENDATIONS

- PROVIDE ADDITIONAL FUNDS TO:
  1. MAINTAIN TITAN III C-17 LAUNCH DATE
  2. MAINTAIN PRESENT 15:1 ENGINE DEVELOPMENT PROGRAM

- IF TITAN IIIM LDC/5 CAN BE CONSIDERED SERIOUS CANDIDATE FOR MOL BOOSTER THEN:
  - / INITIATE PHASE I IMMEDIATELY AT MMC AND AGC (COST $\approx$ 2 M) - COMPLETION DATE 1 JUNE
  - / • CONCURRENT PAYLOAD/LDC/5 COMPATABILITY STUDIES
    • PROVIDES EFFECT OF 7 SEGMENT COMPETITION
  - / DECISION BETWEEN TITAN IIIM/7 AND TITAN III LDC/5 - JULY '67

- IF TITAN IIIM LDC/5 CAN <u>NOT</u> BE CONSIDERED SERIOUS CANDIDATE THEN:
  - / PREPARE RFP TO COMPETE 7 SEGMENT SRM's -DECISION DATE 15 MARCH
    • COMPETE ONLY IF UTC LOSES 5 SEGMENT COMPETITION

- DO <u>NOT</u> CONSIDER BOTH LDC/5 PHASE 1 AND SRM COMPETITION

Leonard.

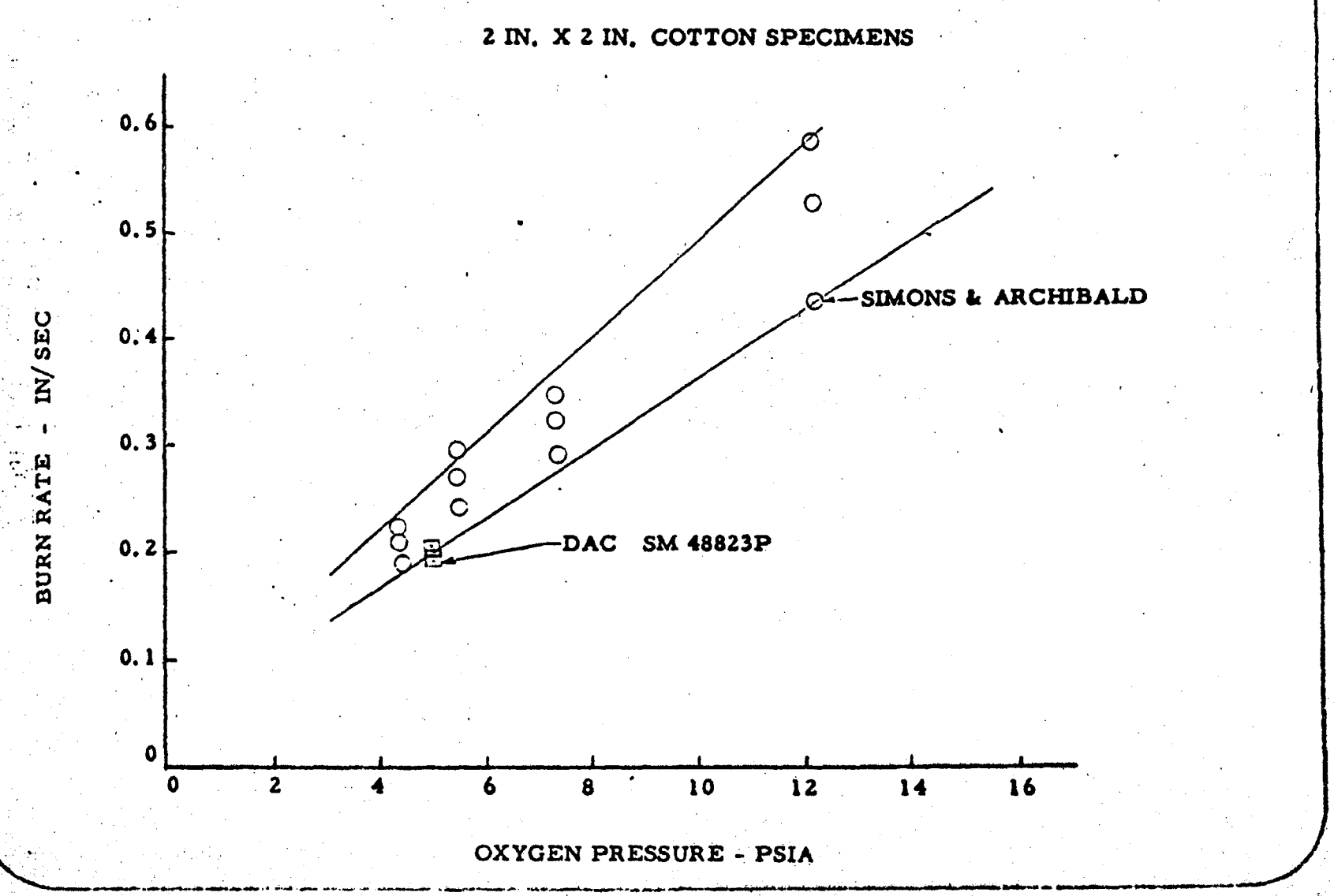
LVO-1430

MOL ATMOSPHERE

SELECTION - HAZARDS - PROCEDURES

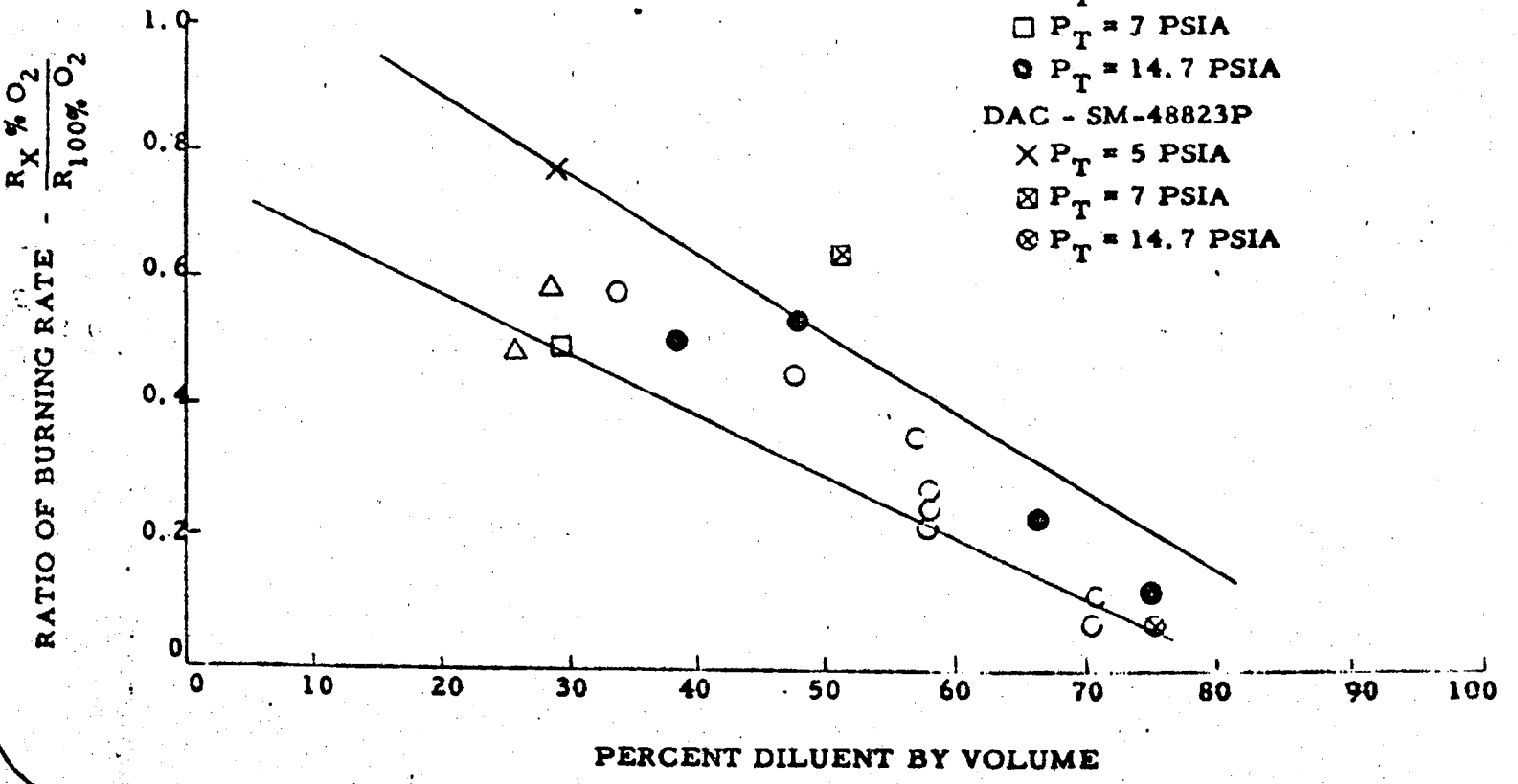
LVO-378

BURN RATE IN PURE OXYGEN



EFFECTS OF DILUENT ON BURN RATE

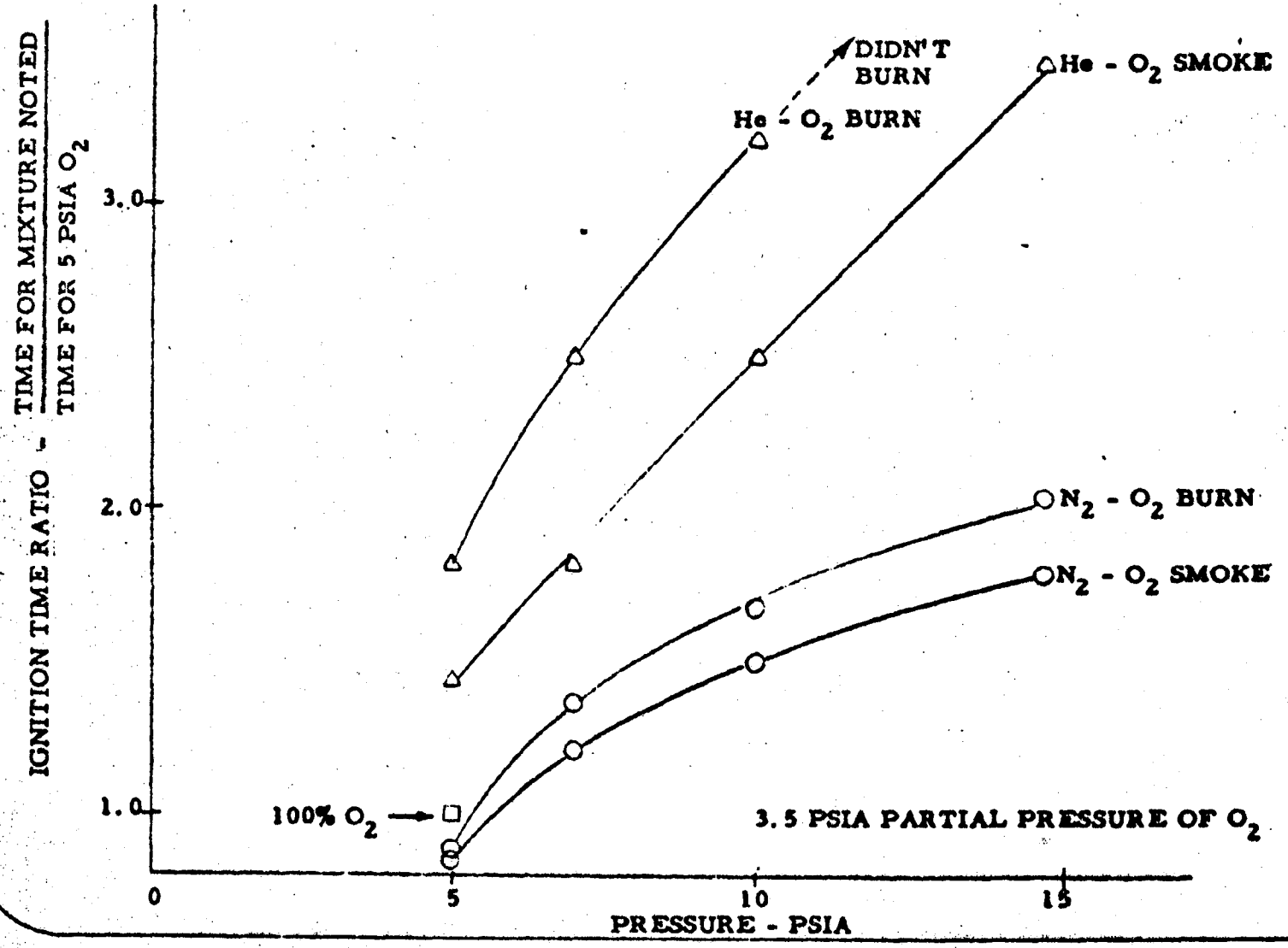
BURNING RATE RATIO OF COTTON CLOTH
2 IN. X 2 IN. SPECIMEN



LVO-1431

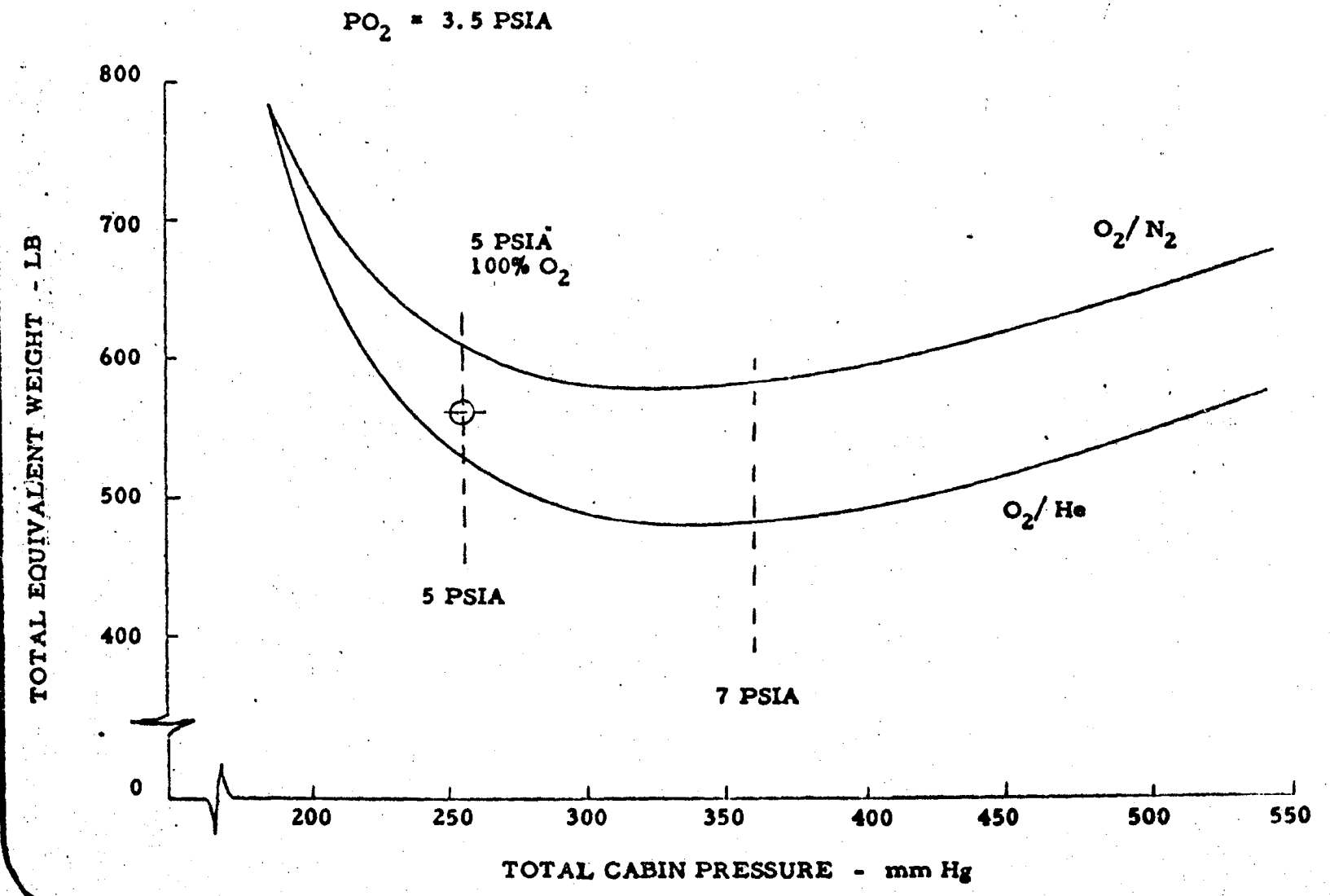
TIME TO SMOKING AND TO BURNING
ONE WIRE IN BUNDLE OF INSULATED WIRES

RAYCHEM 20 GAGE INSULATED WIRE



CURRENT BASELINE

ATMOSPHERE SELECTION COMPARISON



MOL ATMOSPHERE EFFECTS ON VOICE

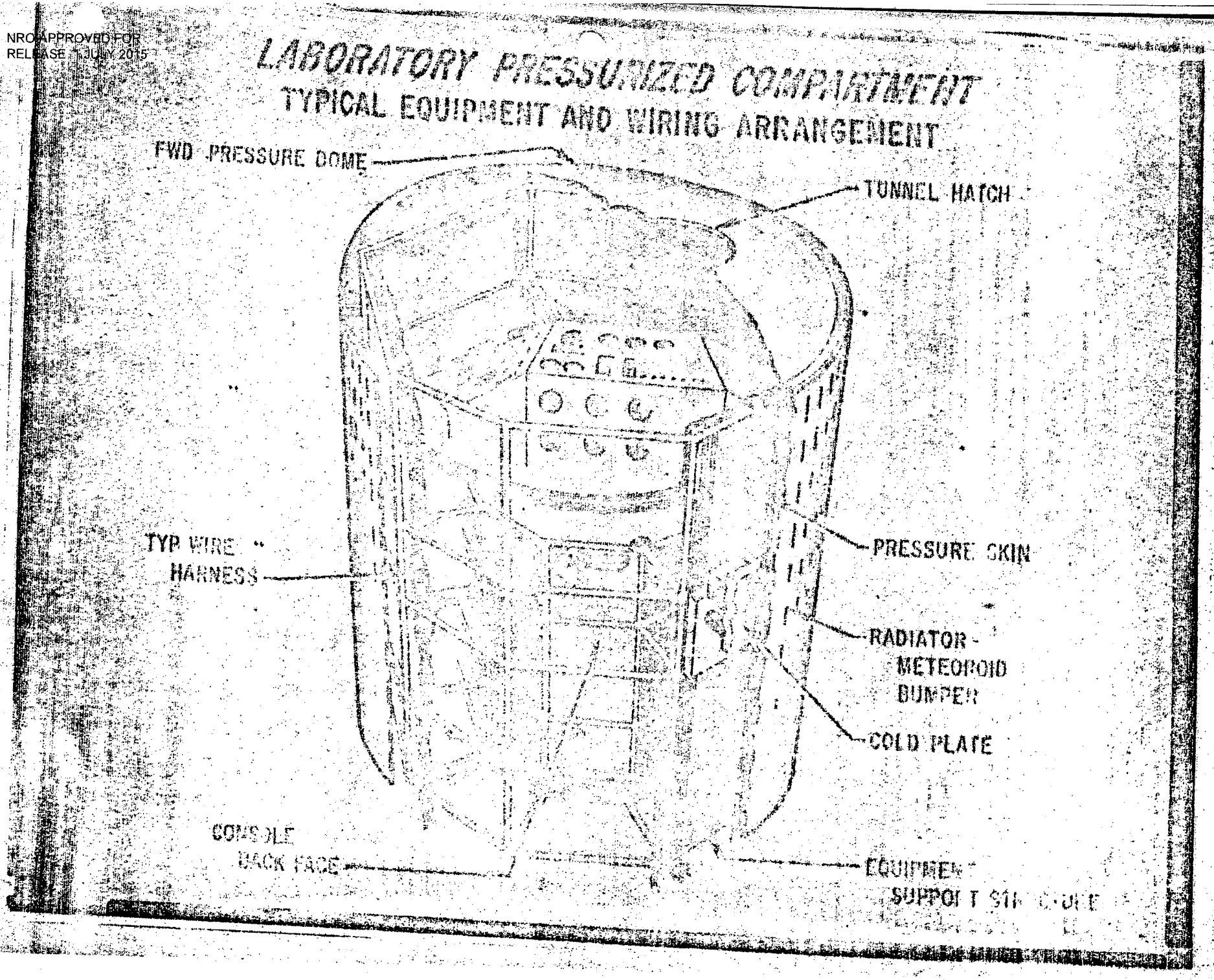
- TEST ATMOSPHERES
  - NORMAL AIR
  - 30% He, 70% O_2
  - 70% He, 30% O_2
- PRESSURES
  - SEA LEVEL
  - 27,000 FEET
- TEST MATERIAL
  - STANDARD SPEECH INTELLIGIBILITY SAMPLES & PHRASES
- FULL VEHICLE/REMOTE STATION/CONTROL CENTER LINKS SIMULATED
- TWO VEHICLE EQUIPMENT CONFIGURATIONS
  - VOCODER (2.4 KBPS)
  - WIDEBAND VOICE (20 - 38.4 KBPS)
- VARYING ERROR RATES INSERTED BETWEEN ENCRYPTION DEVICES
- LIVE VOICE TESTS CONDUCTED BY CREW
- VOICE INTELLIGIBILITY NOT APPRECIABLY DEGRADED BY HELIUM ATMOSPHERES TESTED

MOL

COMPARISON OF VARIOUS LABORATORY ATMOSPHERES

	PURE OXYGEN AT 5 PSI	70% OXYGEN 30% HELIUM AT 5 PSI	70% OXYGEN 30% NITROGEN 5 PSI	AIR AT 15 PSI
PHYSIOLOGICAL	OK UP TO 30 DAYS	MATCHES SEA LEVEL O_2 DEMONSTRATED FOR 56 DAYS	OK	NORMAL
FIRE HAZARD	LEAST DESIRABLE	LESS THAN 5 PSI O_2	LESS THAN 5 PSI O_2	MINIMUM
WEIGHT	40 LB HEAVIER THAN 70/30 HELIUM	LIGHTEST	90 LB HEAVIER THAN 70/30 HELIUM	HEAVIEST
CREW COMFORT (SHIRTSLEEVE ENVIRONMENT)	OK	SUPERIOR TO O_2 OR N_2	OK	NORMAL
SUIT COMPATIBILITY	OK	OK	OK	NOT COMPATIBLE WITH 3.7 PSI SUIT
SYSTEM COMPATIBILITY	OK	OK	OK	NOT COMPATIBLE WITH 5 PSI GEMINI
RELIABILITY	SIMPLEST SYSTEM	MORE COMPLEX THAN SINGLE GAS SYSTEM (EXTRA TANK, PARTIAL PRESSURE SENSOR)		
VOICE	OK	OK	OK	NORMAL

LABORATORY PRESSURIZED COMPARTMENT
TYPICAL EQUIPMENT AND WIRING ARRANGEMENT



MOL

EMERGENCY OXYGEN MASK ASSEMBLY

LOCATION:

- 2 IN GEMINI B TUNNEL
- 2 IN LABORATORY MODULE

PURPOSE:

- PROVIDE SHIRT SLEEVE CREW WITH SAFE ATMOSPHERE AND EYE PROTECTION IN EVENT CONTAMINATION OR PARTIAL LOSS OF ATMOSPHERE

OPERATING CHARACTERISTICS:

- 100 PERCENT O_2 FOR TEN MINUTES - SELF CONTAINED
- CAPABLE OF USING LM 100 PSI O_2 SUPPLY FOR LONGER PERIODS
- DEMAND REGULATOR HAS MANUAL OVERRIDE FOR FLUSH FLOW

MOL

SPECIFICATIONS

- MATERIALS FLAMMABILITY ACCEPTABILITY CRITERIA (MOL EXHIBIT)

  - FLASH POINT - 400°F MINIMUM
  - FIRE POINT - 450° MINIMUM
  - COMBUSTION RATE - 0.5 IN/SEC MAXIMUM

- ELECTRICAL DESIGN SPECIFICATION REQUIREMENTS (LM CEI)

  - ALL SWITCHING ASSEMBLIES + CIRCUIT PROTECTORS SHALL BE HERMETICALLY SEALED

  - ELECTRICAL COMPONENTS SHALL NOT PROVIDE AN IGNITION SOURCE FOR ANY EXPLOSIVE MIXTURE SURROUNDING THE VEHICLE EQUIPMENT

- SAFETY ENGINEERING (MOL EXHIBIT)

  - INSURE ANALYSIS OF POTENTIAL FAILURE/HAZARD

    . SOURCES OF COMBUSTION
    . FUEL SPILLS AND LEAKS POTENTIAL
    . FIRE WARNING DEVICES
    . FIRE EXTINGUISHING EQUIPMENT AND PROCEDURES
    . STORAGE AND HANDLING OF COMBUSTIBLES

  - ACTIONS TO ALLEVIATE HAZARD

MOL

LABORATORY GROUND TEST PROCEDURES

- IN PLANT CHECKOUT AND TESTING
  - CABIN PRESSURE CHECKS USING NITROGEN
  - SIMULATED ON-ORBIT OPERATION (WITH CREW) IN THERMAL VACUUM CHAMBER
- COUNTDOWN ACTIVITY
  - SECURE LABORATORY MODULE FOR FLIGHT (T-315 TO T-245)
    - CLEAN AIR, CLASS 100,000
  - ESTABLISH CABIN LAUNCH ATMOSPHERE (T-245 TO T-180)/ NO PERSONNEL IN LABORATORY
    - 16 PSI OXYGEN PURGE (20 MIN.)
    - 15 PSI (70% O_2 AND 30% He) (T-225)
    - CREW ENTER GEMINI (T-120)

MOL

GEMINI B GROUND TEST PROCEDURES

- IN-PLANT CHECKOUT AND TESTING
  - CABIN PRESSURE CHECKS USING NITROGEN
  - SIMULATED FLIGHT (WITH CREW) IN CHAMBER AT 5-15 PSI OXYGEN
- PRE-LAUNCH ACTIVITY
  - SIMULATED FLIGHT
    - 15 PSI OXYGEN
    - MANNED WITH EQUIPMENT OPERATING
  - CREW ENTERS FOR LAUNCH AT T-2 HOURS
    - PRESSURE CHECK AT 20 PSI OXYGEN AND PURGE
    - REMAIN AT 15 PSI OXYGEN UNTIL LAUNCH

ON PAD CREW EMERGENCY ESCAPE

- THROUGH GEMINI MAIN HATCHES TO TOWER PLATFORM
  - HATCHES MANUALLY OPENED FROM OUTSIDE IN 5-10 SECONDS
  - HATCHES MANUALLY OPENED FROM INSIDE IN 9 SECONDS
  - CREWMAN, UNASSISTED, CAN BE CLEAR OF SPACECRAFT IN 20 SECONDS
- USING ABORT MODE AFTER TOWER REMOVED
  - RE-ENTRY MODULE ESCAPE FOLLOWED BY SEAT EJECTION
  - CREWMEN CAN BE CLEAR OF SPACECRAFT IN 6-10 SECONDS

MOL

ON-ORBIT CREW SAFETY PROCEDURES

- **FIRE**
  - DON FACE MASKS
  - REPRESSURIZE GEMINI (15 SECONDS, MANUAL)
  - OPEN HATCH
  - ENTER GEMINI
  - DEPRESSURIZE LAB
  - CREW DECISIONS
    - ABORT IN SHIRTSLEEVES
    - LABORATORY INSPECTION AND ABORT

      TURN OFF LAB POWER
      INSPECT VIA TUNNEL HATCH WINDOW
    - REPRESSURIZE WITH HELIUM TO 3.7 PSI

      RE-ENTER LAB WITH FACE MASK
      DON SUIT/ INSPECT LAB
      REPAIR IF POSSIBLE
      CONTINUE MISSION/ ABORT

GEMINI

CREW PROCEDURES ON-ORBIT

- MANUALLY VENT CABIN TO VACUUM
- CREWMEN ARE IN PRESSURIZED SUITS
- AFTER FIRE IS EXTINGUISHED, CREW CAN TAKE CORRECTIVE ACTION TO ELIMINATE SOURCE
  - EITHER RE-PRESSURIZE CABIN
  - OR RE-ENTER IN A VENTED CABIN CONDITION

SPECIFIC ACTIONS UNDERWAY

- IN-HOUSE TEAMS REVIEWING COMBUSTION SOURCES AND CONTROL, DESIGN AND OPERATIONAL PROCEDURES
- ACCELERATING PRESENTLY CONTRACTED SAFETY STUDIES
- EXTABLISHING NASA CONTACT TO SECURE DATA AND CONSULTATION
- CONTACTING ALL KNOWN SOURCES OF RELEVANT TEST DATA

MOL

CONTRACTOR/IN-HOUSE STUDIES - LABORATORY

- ELIMINATE PURE OXYGEN ATMOSPHERE TESTING - USE 80 He/20 O_2 (BLEED DOWN DURING ASCENT THEN ACTIVATE TWO GAS CONTROLLER)
- INCREASE HELIUM PARTIAL PRESSURE DURING ON-ORBIT OPERATION
- ADJUST FLAMMABILITY CRITERIA TO MORE STRINGENT LEVELS

  INCREASE MINIMUM IGNITION TEMPERATURES, DECREASE ALLOWABLE BURNING RATE
- ACCELERATE OXYGEN DUMP WITH HELIUM PURGE
- DEVELOP FIRE EXTINGUISHING TECHNIQUES
- ISOLATE OR COMPARTMENTALIZE FIRE
- IMPROVE SENSING EQUIPMENT

CONTRACTOR IN-HOUSE STUDIES - GEMINI

- o ELIMINATE PURE OXYGEN ATMOSPHERE TESTING
- o COMPLETE TWO GAS SYSTEM
  - ESSENTIALLY SAME AS LABORATORY SYSTEM
- o SIMPLIFIED TWO GAS SYSTEM
  - PRELAUNCH
    - . OXYGEN TO SUIT LOOP FROM GROUND SOURCE
    - . HELIUM TO CABIN FROM GROUND SOURCE
  - ASCENT
    - . VENT CABIN AND PROVIDE ADDITIONAL OXYGEN TO MAINTAIN HABITABLE CABIN
  - ON-ORBIT
    - . CABIN RE-PRESSURIZATION USING LABORATORY SYSTEM
  - RE-ENTRY
    - . OXYGEN TO SUIT LOOP FROM GEMINI SYSTEM

MOL

SUMMARY

- PRESENT LABORATORY BASELINE ATMOSPHERE IS CONSIDERED OPTIMUM FOR MOL PROGRAM.
- OPERATIONAL PROCEDURES TO MINIMIZE EVENTS USING HIGH PRESSURE/ CONCENTRATION OXYGEN BEING EVALUATED.
- DESIGN AND PROCEDURAL CHANGES UNDER STUDY TO REDUCE ON-ORBIT/ GROUND HAZARD.
- NASA/ MOL DATA EXCHANGE ACCELERATED.

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GEMINI B PAD ABORT

CONTROL SYSTEM

(PACS)

15 FEBRUARY 1967

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GEMINI B PAD ABORT CONTROL SYSTEM

- PURPOSE OF BRIEFING
  - / SUMMARIZE THE PAD ESCAPE PROBLEM
  - / PRESENT STATUS TO DATE
- CONTENTS OF BRIEFING
  - / DEFINITION OF ESCAPE MODES
  - / DETAILS OF PAD ESCAPE PROBLEM
  - / PROPOSED PACS SYSTEM DESCRIPTION
  - / PRESENT MAC COST QUOTE FOR PACS
- BACKGROUND
  - / MOL ASCENT CREW SAFETY SYSTEM HAS EVOLVED TO THE PRESENT BASELINE DURING ALMOST THREE YEARS OF DETAILED STUDY FROM THE BASIC NASA GEMINI SYSTEM AND THE TITAN IIIC LAUNCH VEHICLE.
  - / THE PHASE IB BASELINE CONSISTED OF:
    - TITAN III WITH REDUNDANT GUIDANCE AND CONTROL SYSTEM AND MALFUNCTION DETECTION SYSTEM
    - GEMINI B SPACECRAFT ESCAPE SYSTEM
      - / SPACECRAFT ESCAPE UTILIZING SALVO FIRED RETRO MOTORS
      - / EJECTION SEATS FOR SUBSEQUENT USE IF LAND LANDING IS EMINENT OR INSUFFICIENT ALTITUDE IS ATTAINED

CREW SAFETY BASELINE ASCENT ESCAPE MODES

- ESCAPE MODES
  - / MODE "A" - ON THE PAD TO 30 SEC IN FLIGHT, AFTER WHICH TIME WATER IMPACT IS IMMINENT
    - THRUST TERMINATE LAUNCH VEHICLE
    - SALVO FIRE 6 RETROGRADE ROCKETS
    - SEAT EJECTION FROM SPACECRAFT
  - / MODE "B" - FROM 30 SEC IN FLIGHT TO 24,000 FPS VELOCITY
    - THRUST TERMINATE AND RIDEOUT AS REQUIRED
    - SALVO FIRE RETROS 6, 4, OR 2 AS REQUIRED
    - JETTISON ADAPTER SECTION
    - RE-ENTER AND DEPLOY RECOVERY SYSTEM
  - / MODE "C" - 24,000 FPS TO 488 SEC FLIGHT TIME ($\approx$20 SEC) (40° SOUTH LATITUDE IMPACT AT ZERO LIFT)
    - SEPARATE SPACECRAFT - FIRE STAGING ROCKETS
    - TIME RETRO FIRE TO ACHIEVE DESIRED TOUCHDOWN
    - RETROGRADE, RE-ENTER (FULL OR ZERO LIFT) AND RECOVERY
  - / MODE "D" - ABORT INTO ORBIT FOR MINIMUM LIFE OF TWO ORBITS
    - SEPARATE ORBITING VEHICLE FROM TITAN IIIM (MANUALLY)
    - ACCELERATE TO ORBIT VELOCITY WITH ACTS (MANUAL)
    - PERFORM DEGRADED MISSION TO EXTENT POSSIBLE

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CREW FATALITY SUMMARY
BASELINE CONFIGURATION

ABORT MODE		T-IIIM FAILURE RATE (PPM)	AVERAGE ESCAPE PROB*	ESTIMATED CREW LOSS (PPM)
A	0-5 SEC	217	.055	205
	5-30 SEC	427	.527	202
B	30-80 SEC	806	.314	553
	80-124 SEC	7000	.873	894
	124-468 SEC	20291	.972	566
C	468-495 SEC	1190	.986	17
D	495- SSECO	69	1.000	0
TOTALS FOR ASCENT		30,000	.918	2437 PPM

*INCLUDES UNRELIABILITY OF GEMINI B

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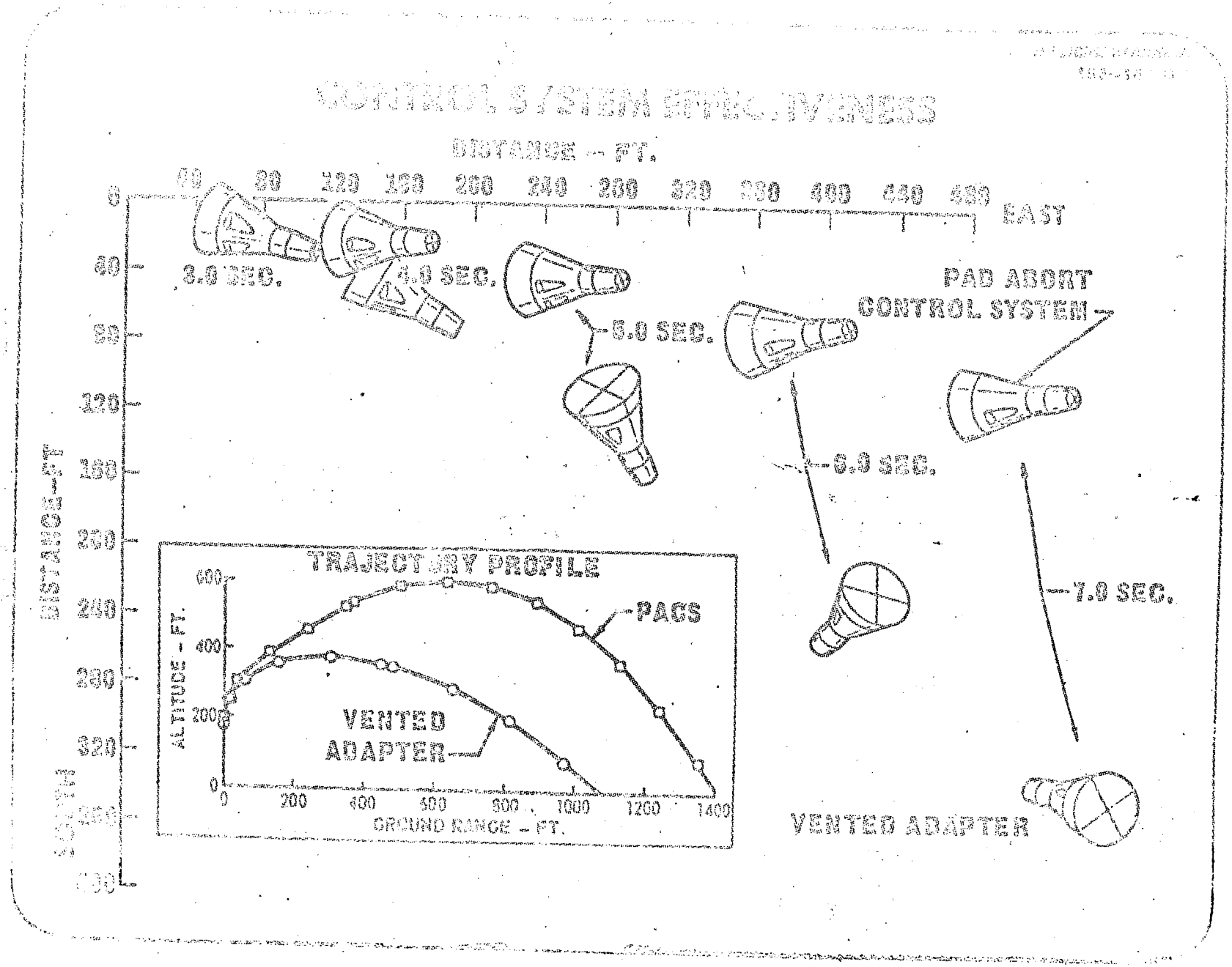
CONTRIBUTIONS TO PAD ESCAPE PROBLEM

- CRITERIA FOR CREW SURVIVAL
  - / MINIMUM SEPARATION DISTANCE FROM PAD $\geq$ 900 FEET
    - THERMAL LIMITATION OF PERSONEL CHUTE
  - / MINIMUM STABILIZED CHUTE ALTITUDE $\geq$ 75 FEET
    - STABILIZED SINK RATE 24 FPS
    - DEPLOYMENT ALTITUDE APPROXIMATELY 600 FEET

- DISTURBANCE FACTORS FOR ESCAPE ANALYSIS
  - / LAUNCH SITE WINDS
    - AFFECTS SPACECRAFT MOTION
    - AFFECTS CHUTE DRIFT
  - / LAUNCH VEHICLE TIP OFF MOTION
  - / RETRO ROCKET MISALIGNMENT WITH SPACECRAFT C.G.
  - / ADAPTER COMPARTMENT PRESSURES - "POP-GUN"
  - / POWER-ON DRAG RISE
  - / RETRO-ROCKET PERFORMANCE

- ALL FACTORS CONTRIBUTE TO THE UNCERTAINTY IN SPACECRAFT ALTITUDE AND ATTITUDE AT SEAT EJECTION

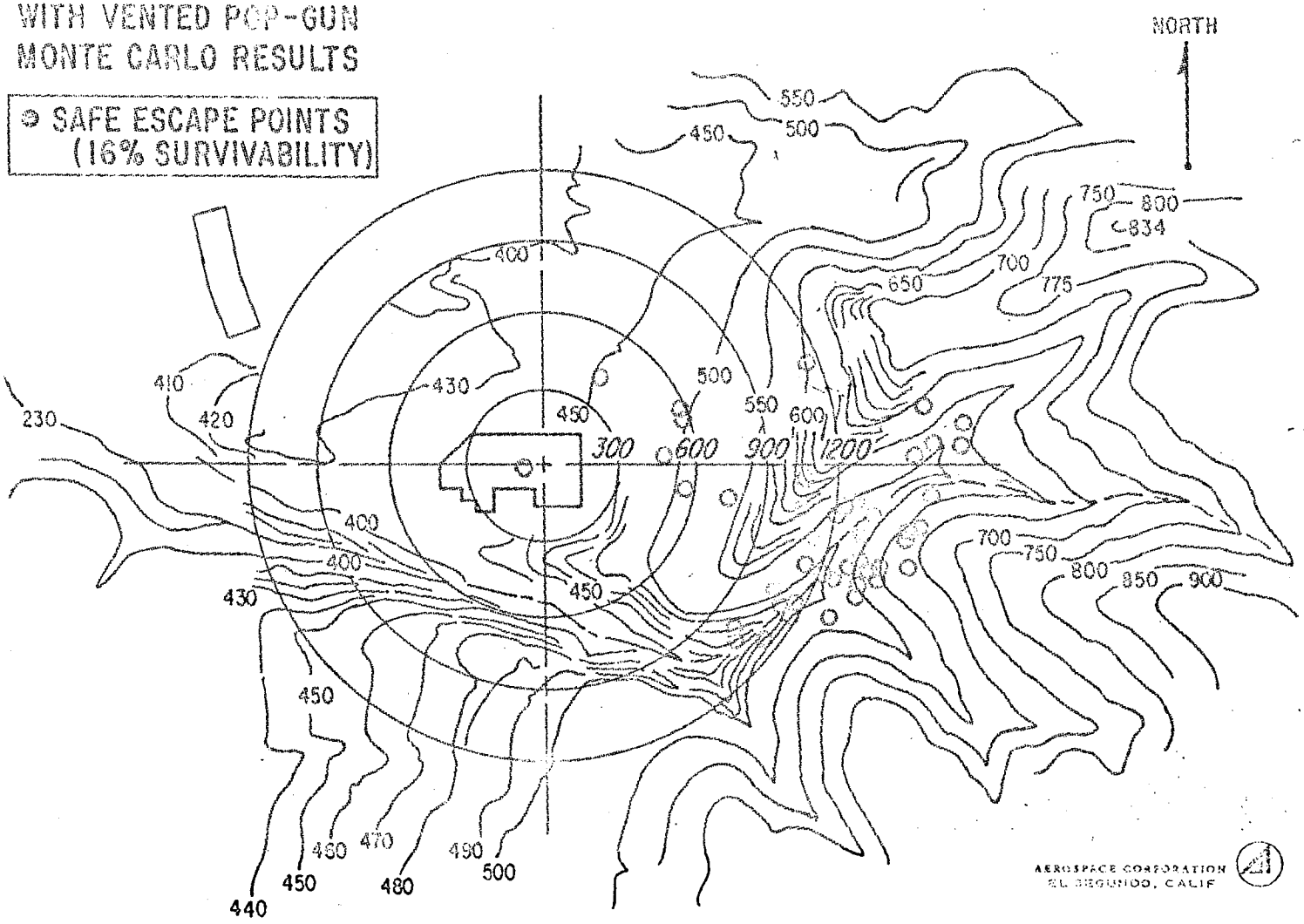
- ESCAPE PROBLEM IS APPLICABLE TO FIRST FIVE SECONDS OF FLIGHT



PAD ABORT - LOCUS OF IMPACT POINTS
UNCONTROLLED

— EASTERLY ESCAPE
— WITH VENTED POP-GUN
— MONTE CARLO RESULTS

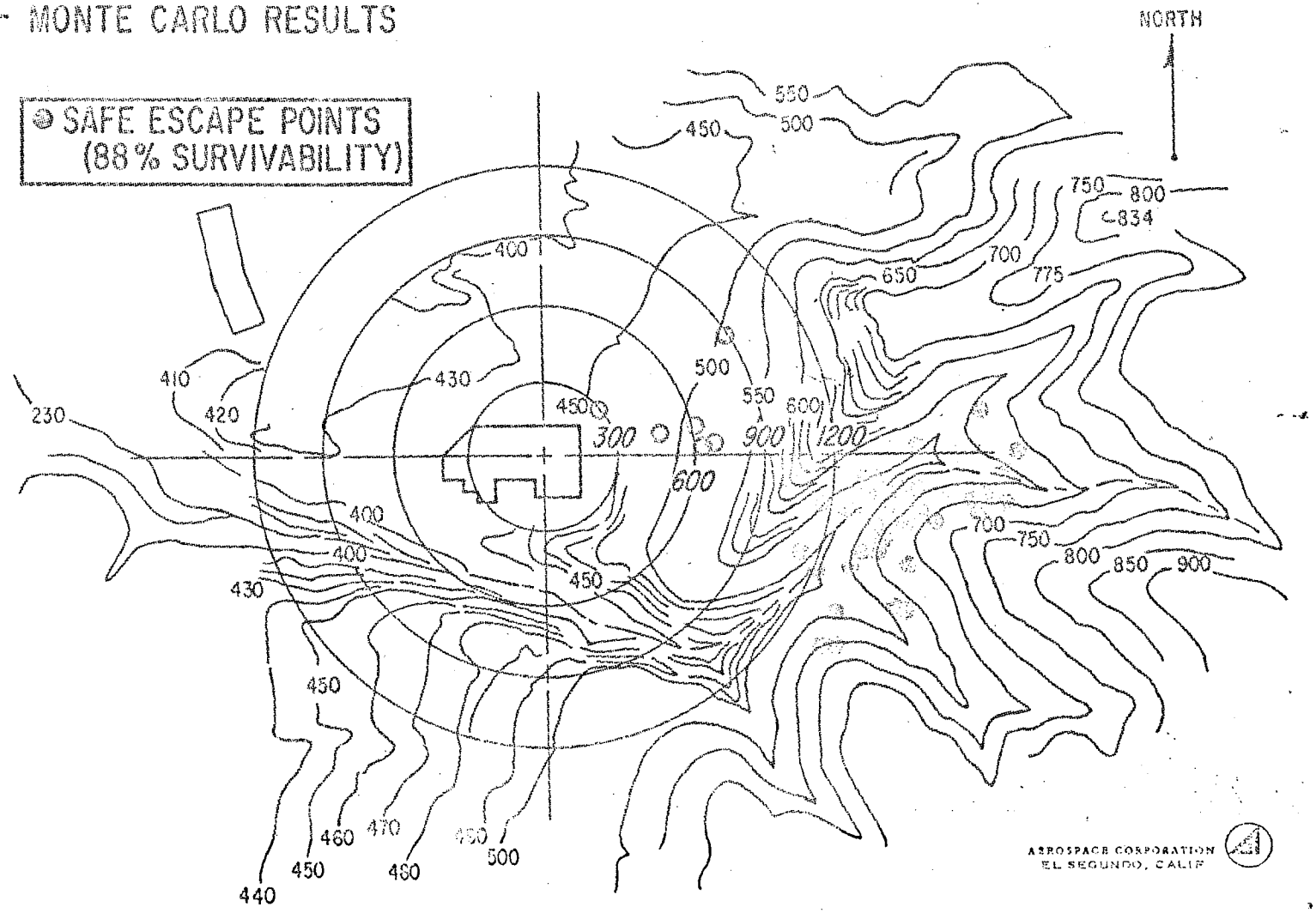
● SAFE ESCAPE POINTS
(16% SURVIVABILITY)



AEROSPACE CORPORATION
EL SEGUNDO, CALIF

PAD ABORT – LOCUS OF IMPACT POINTS
WITH THRUST VECTOR CONTROL

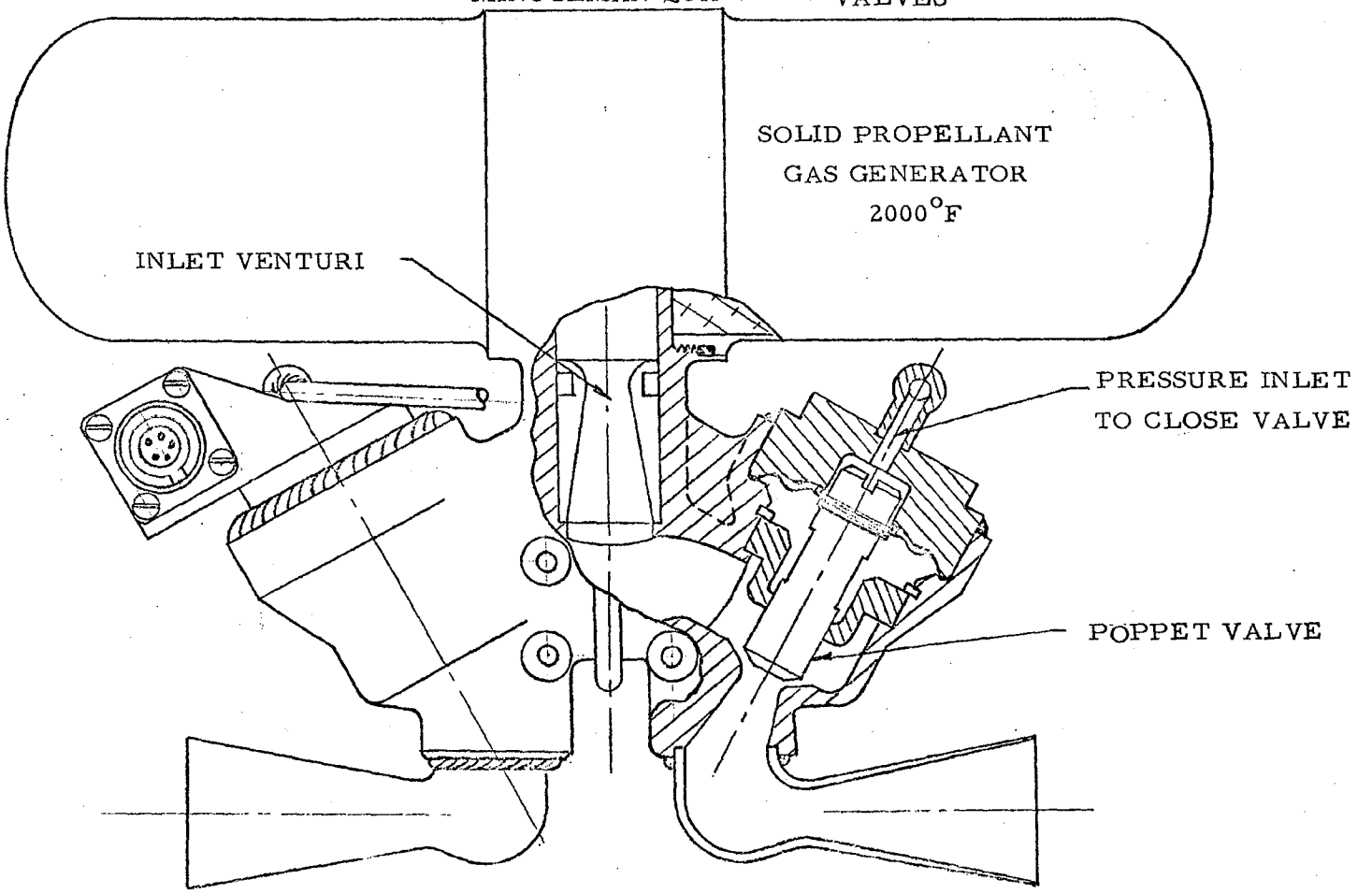
— EASTERLY ESCAPE
-- MONTE CARLO RESULTS



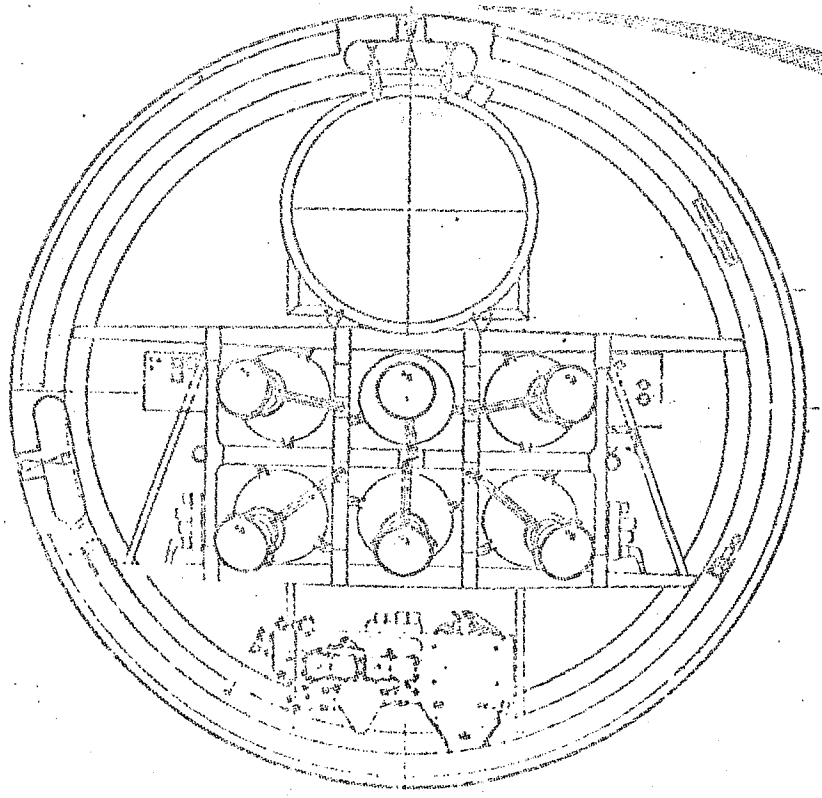
AERONUTRONIC WARM GAS GENERATOR PROPOSAL

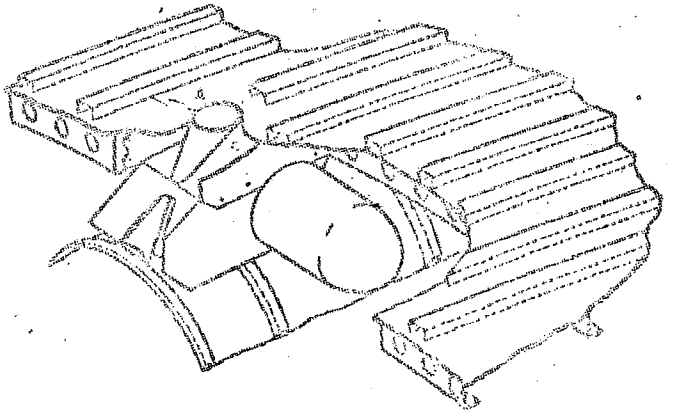
BASIC WEIGHT 12.5 LBS

MINUTEMAN QUALIFIED VALVES



ABORT MIRROR - PACS INSTALLATION





STATUS OF DEVELOPMENT AT

McDONNELL

- McDONNELL PRICING BASED ON THE FOLLOWING
  - / AERONUTRONIC BID FOR THRUSTERS
  - / HONEYWELL FOR ELECTRONICS USING RCS DRIVER CIRCUITS
    - COMPETITIVE THRUSTER BIDS BEING EVALUATED

- MAC WITHOLDING PLACEMENT OF PATE AND THRUSTER CONTRACTS ONLY
  - / ADAPTER INSTALLATION DRAWINGS PROCEEDING
  - / PROCUREMENT OF MINOR ITEMS PROCEEDING

- DETAIL TEST PLAN IN PREPARATION
  - / MOL SPO APPROVAL REQUIRED

Gemini B Offl.
RRW 2/14/67

12

PAD ABORT SYSTEM

McDONNELL FIRM COST QUOTATION

	AVE	AGE		TOTAL
o MAC EFFORT				
/ ENGINEERING	$ 332,092	$ 31,671		$ 363,763
/ MFG (Q.A. ETC.)	72,586	48,153		120,739
o PROCUREMENT				
/ MATERIAL	14,478	17,640	$ 32,118	
o PATE(6 UNITS)	247,239	--	247,239	
o THRUSTERS (12 UNITS)	1,066,369	--	1,066,369	
o RCS MOD.	4,025	--	4,025	
o MISC.	772	--	772	
o AGE	--	52,640	52,640	
TOTAL CFE				1,403,163
PROCUREMENT EXPENSE (4.7%)				65,949
TOTAL COST				1,953,614
G&A (8.9%)				173,915
AUTOMATION CENTER				66,896
TOTAL ESTIMATED COST				2,194,425
EARNINGS (12%)				263,331
RENT				485
TOTAL PACS COST				2,458,241
DEFERRED BUDGETARY ALLOCATION				$ 2,500,000

CONCLUSIONS

- BASELINE ESCAPE CONCEPT FOR NEAR PAD FAILURES PROVIDES ESSENTIALLY NO SURVIVABILITY (5%)
- ADDITION OF PACS WILL INCREASE THE SPACECRAFT WEIGHT AND COST
  - / MAC PROPOSAL
    - 46 POUNDS
    - $2.46 M
- PACS IMPROVES PAD ESCAPE TO APPROXIMATELY 95% SURVIVABILITY
- REQUEST APPROVAL TO PROCEED WITH PACS IMPLEMENTATION

BACK UP CHARTS

NASA GEMINI ABORT MODE I

- MODE I (SEAT EJECTION) APPLYS FROM IGNITION TO 15,000 FEET ALTITUDE
  - / PAD ESCAPE
    - SURFACE WINDS RESTRICTED TO LESS THAN 10.5 KNOTS
    - MINIMUM DISTANCE FROM PAD APPROXIMATELY 600 FEET
    - GLV HOLD-DOWN FOR 2 SECONDS
      - / 2 SECOND WARNING TIME - AVOIDS FLAME FRONT
      - / 12 SECOND WARNING TIME - AVOIDS OVERPRESSURE ON CHUTES
  - / AFTER LIFT-OFF
    - NO THRUST TERMINATION EXCEPT BY RSO
    - NO ESCAPE FOR 2 TO 4 SECONDS FOR SINGLE OR DUAL ENGINE FAILURES
    - 5.5 SECONDS WARNING TIME REQUIRED TO AVOID FLAME FRONT AT 10,000 FEET

- SURVIVABILITY IS HEAVILY DEPENDENT UPON CREW C.G. POSITIONS, GLV MOTION, AND WINDS

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NASA GEMINI COMPARISON
ESTIMATED CREW FATALITIES

ABORT MODE	GT-4 FAILURES PPM	GT-4 ESCAPE PROB. *	GT-4 CREW LOSS PPM	GT-12 FAILURES PPM	GT-12 ESCAPE PROB. *	GT-12 CREW LOSS PPM
I. 0-2 SECONDS(HOLD DOWN)	NO DATA			9,570	.999	3
2-50 SECONDS	13,480	.718	3720	5,680	.734	1520
II. 50-100 SECONDS	13,430	.696	4080	5,680	.703	1690
III. 100 SECONDS-21,000 fps	52,770	.990	520	48,420	.994	320
IV. 21000 fps-INSERT	5,220	.987	70	6,610	.995	24
TOTAL ASCENT	84,900	.901	8390	75,960	.954	3557
TOTAL MISSION			12,920			4,280

* AVERAGE ESCAPE PROBABILITY

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BYE-6[illegible]

(D) ~~SECRET~~ SPECIAL HANDLING

WHS - 223
cy 172
15 Feb 1967
1 27 Pages

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(C)

REVIEW OF MOL/DORIAN

GROUND TEST PLANNING

Bye 66246

(D) ~~SECRET~~ SPECIAL HANDLING

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~~SECRET~~ ~~SECRET~~ SPE AL HANDLING SPECIAL HANDLING

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INTEGRATED TEST FLOW PLAN

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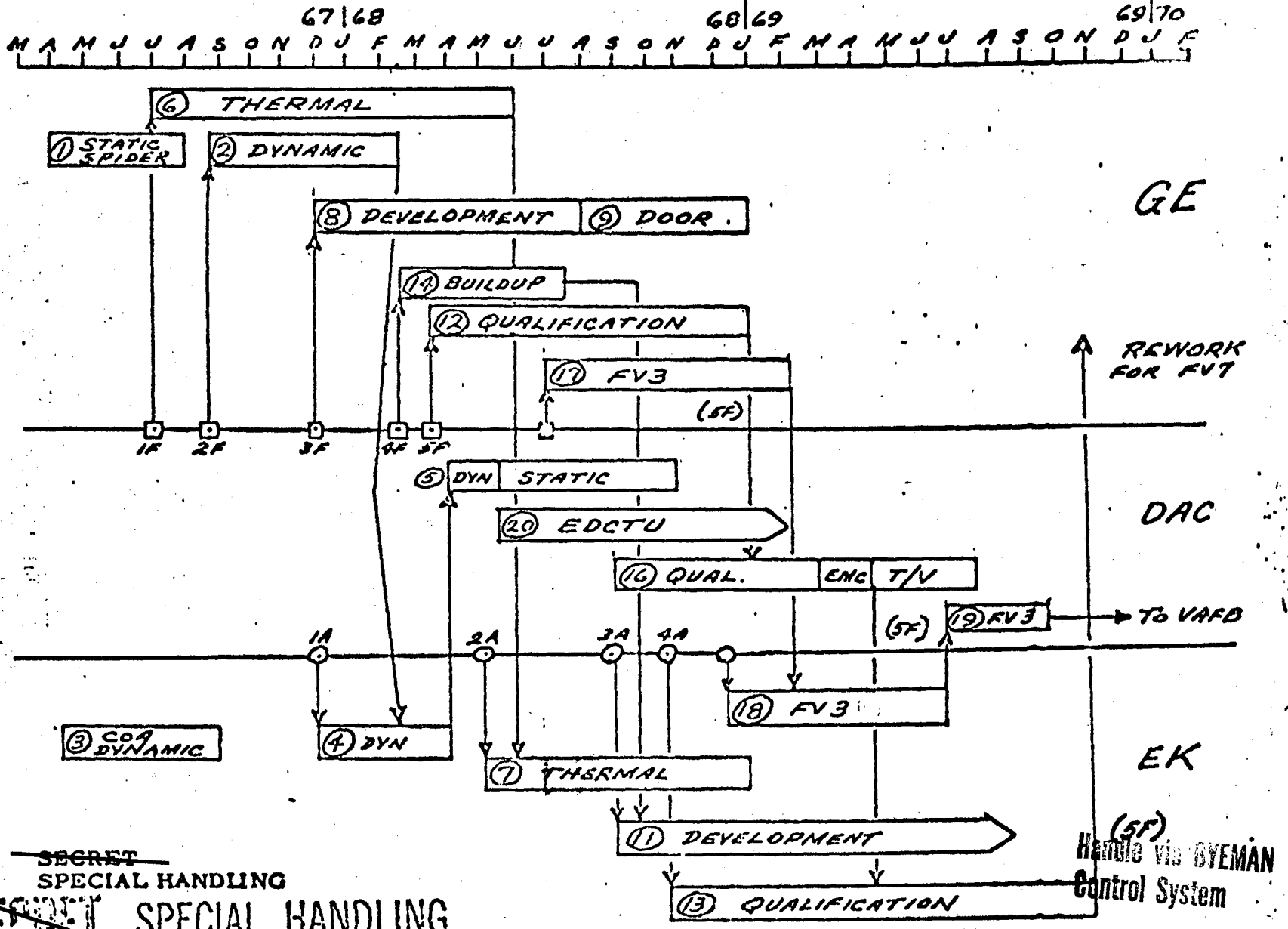

~~SECRET~~
SPECIAL HANDLING

~~SECRET~~ SPECIAL HANDLING

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OBJECTIVES

RE-EXAMINE MOL/DORIAN SYSTEM TEST PLANNING TO:

- O ENSURE WELL INTEGRATED CONSISTENT TEST PROGRAM
- O REDUCE NEED FOR NEW FACILITIES AND OTHER COSTS CONSISTENT WITH THE OBJECTIVES OF THE PROGRAM
- O RESULT IN LEAST IMPACT ON PRESENT ROLES

AREAS OF PARTICULAR CONCERN:

- O THERMAL VACUUM TESTING
- O ACOUSTIC TESTING
- O VIBRATION TESTING FOR MODES
- O OPERATIONAL DYNAMICS TESTING
- O TEST TIME PRIOR TO FLIGHT
- O IMPACT OF FLOW ON AGE/FACILITIES

PARTICIPANTS AND RESPONSIBILITIES

TEAM CHAIRMAN - J. KENT
CO-CHAIRMAN - N. NIEDERMAN

CATEGORY CHAIRMEN	PARTICIPANTS
DEVELOPMENT TESTING - (F. W. BELINA)	THERMAL - (R. D. LONG)
QUALIFICATION TESTING - (F. P. KIEFER/R. J. KREJCI)	ACOUSTIC - (D. L. VAN ERT/S. D. ZINN)
ACCEPTANCE TESTING - (W. C. HAYDEN/F. W. MACNAB)	DYNAMICS - (J. E. ANDERSON/R. W. DEZELAN)
	EMC - (W. J. BALDAU)
	FACILITIES/AGE - (D. E. WILKINS) (R. E. FINNEY/E. F. SCHMIDT)

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IMPLEMENTATION

	RECOMMENDATION	ACTION REQUIRED
DEVELOPMENT TESTING		
1	DIRECT GE TO CONDUCT INDIVIDUAL COMPONENT ACOUSTIC DEVELOPMENT TESTING, ONLY ON A SELECTIVE BASIS, AND RETAIN COMPONENT VIBRATION TESTING.	ECP
2.	DIRECT DAC TO CONDUCT THE MM DOOR JETTISON SHOCK TEST IN LV CONFIGURATION.	IN SCOPE
3.	DIRECT DAC TO CONDUCT SUPERSONIC, AS WELL AS TRANSONIC, METEROID SHIELD FLUTTER TEST.	ECP
4.	DIRECT DAC TO CONDUCT BOOST PHASE MODAL SURVEY WITH STV BASE SUPPORTED BY A STRUCTURE SIMULATING TITAN ADAPTOR.	IN SCOPE
5.	DIRECT DAC TO CONDUCT ORBITAL PHASE MODAL SURVEY ON STV, SUSPENDED VERTICALLY IN FREE-FREE CONDITION, WITH MM DOOR REMOVED AND WITHOUT DOOR TRUSS.	IN SCOPE

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IMPLEMENTATION

RECOMMENDATION		ACTION REQUIRED
DEVELOPMENT TESTING (CONT'D)		
6.	REVIEW THE EK COMPONENT DEVELOPMENT TEST PROGRAM TO ENSURE THAT CRITICAL DEVELOPMENTAL COMPONENTS ARE SUBJECTED TO THERMAL, THERMAL-VACUUM AND DYNAMIC EXPOSURES TO PROVIDE A MINIMUM RISK COMPONENT QUALIFICATION PROGRAM.	NORMAL WORK
7	DIRECT EK TO LIMIT PLANNED GROUND CONDITIONING TESTS (TEMPERATURE, HUMIDITY, ETC.) OF MM THERMAL MODEL.	ECP
8.	DIRECT EK TO PERFORM THE COA MODAL SURVEY WITH THE BARREL ATTACHED TO FIXED SUPPORTS AT THE THREE MOUNTING POINTS INSTEAD OF SUSPENDED IN A FREE-FREE CONDITION.	IN SCOPE
◇9	DIRECT EK TO PERFORM MM ACOUSTIC DEVELOPMENT TEST AT AN OFF SITE FACILITY.	ECP

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IMPLEMENTATION

RECOMMENDATION		ACTION REQUIRED
QUALIFICATION TESTING		
1.	DIRECT GE TO CONDUCT INDIVIDUAL COMPONENT ACOUSTIC QUAL TESTING ONLY ON A SELECTIVE BASIS. (RETAIN COMPONENT VIBRATION QUAL TESTING.)	ECP
◇2	DIRECT GE TO DELETE THE PLANNED TM BAY VIBRATION QUAL TEST, BUT CONDUCT A PRE-QUAL VIBRATION TEST.	ECP
◇3	DIRECT EK AND GE TO PERFORM THE TM BAY DYNAMIC QUAL TEST USING 114E.	ECP
4.	DIRECT DAC TO PERFORM THE MM SHELL STRENGTH QUAL TEST COMBINING DIFFERENTIAL PRESSURES WITH BENDING MOMENTS.	ECP
◇5	FOR UNIFORMITY THROUGHOUT THE PROGRAM, LIMIT ACOUSTIC QUAL TESTING TO FLIGHT LEVELS AND FLIGHT DURATION TO PERMIT QUAL VEHICLE USE FOR FLIGHT.	ECP
6.	RETAIN COA 30-DAY T/V TESTS. REDUCE OR CONSIDER FOR DELETION 60 MM T/V TEST	APPROVAL
◇7	DIRECT DAC TO PERFORM A LIMITED LM ACOUSTIC QUALIFICATION TEST AT THE SAME FACILITY USED FOR THE ACOUSTIC DEVELOPMENT TEST.	ECP

Handle via BYEMAN Control System

BYE

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IMPLEMENTATION

RECOMMENDATION		ACTION REQUIRED
ACCEPTANCE TESTING		
◇1	DIRECT DAC TO PERFORM A T/V ACCEPTANCE TEST ON EACH LM; DELETE T/V ACCEPTANCE TEST OF LV.	ECP
◇2	DIRECT GE TO PERFORM AN MMFS MODE VERIFICATION ACCEPTANCE TEST ON EACH FLIGHT VEHICLE	ECP
◇3	DIRECT EK TO PERFORM A COA MODE VERIFICATION ACCEPTANCE TEST ON EACH FLIGHT ARTICLE.	ECP
4.	DELETE ORBITAL PHASE SURVEY ON FV'S 3 AND 6.	(APPROVAL)
5.	DIRECT EK AND GE TO CONDUCT JOINT MM EMC ACCEPTANCE TEST AT ROCHESTER.	ECP
◇6	LOW LEVEL VIBRATION ACCEPTANCE TEST FOR LV, LM, AND MM.	ECP

Handle via BYEMAN
Control System

BYE-6[illegible]

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(D) ~~SECRET~~ SPECIAL HANDLING

PROPOSED SYSTEM-SEGMENT ACOUSTIC TESTS

(STEERING COMMITTEE RECOMMENDATION)

TEST PHASE	System LV = LM + MM	System Segments		
		LM	MM*	
			TM Bay	COA Bay
DEVELOPMENT		Acoustic	Acoustic	
QUALIFICATION		Limited** Acoustic	Limited** Acoustic	
ACCEPTANCE	Local Excitation at Interface Hard Points (Workmanship)	None Low Level Vibration	Low Level Vibration	

*MM = TM Bay + COA Bay

(D) ~~SECRET~~ SPECIAL HANDLING

Handle via BYEMAN Control System

BYE 8

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(D) ~~SECRET~~ SPECIAL HANDLING

SYSTEM-SEGMENT ACOUSTIC TESTS

ALTERNATE PLAN

	SYSTEM LV = LM + MM	SYSTEM SEGMENTS		
		LM	MM	
			TM BAY	COA BAY
DEVELOPMENT		ACOUSTIC*	ACOUSTIC**	
QUALIFICATION		--	--	
ACCEPTANCE	LOCAL EXCITATION AT INTERFACE HARD POINTS	ACOUSTIC	ACOUSTIC	

* OFF SITE OR HUNTINGTON BEACH

** OFF SITE OR ROCHESTER

(D) ~~SECRET~~ SPECIAL HANDLING

Handle via BYEMAN
Control System

ST-2005

BYE-6[illegible]

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COST COMPARISON - DELTAS

	OFF SITE QUAL. & DEVELOP. (COLD)	ON SITE DEVELOP. & ACCEP. (HOT)
ROCHESTER FACILITY		2.50 M
PERSONNEL SUPPORT OF FACILITY (2 YEARS)		.60 M
HUNTINGTON BEACH FACILITY		2.75 M
PERSONNEL SUPPORT OF FACILITY (2 YEARS)		.60 M
DAC ADDITIONAL TEST SUPPORT	.75 M	1.75 M
GE AND EK ACCEPTANCE TEST CREDIT	(.50 M)	
TRANSPORTATION (LM & MM)	.20 M	
SHROUDS AND STE (LM & MM)	.50 M	
GE TEST SUPPORT	1.00 M	
EK TEST SUPPORT	1.00 M	
AGE	.50 M	2.10 M
NASA SUPPORT COSTS	?	
	4.45 M	10.35 M

Handle via BYEMAN
Control S[illegible]

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MAJOR RECOMMENDATIONS AFFECTING DAC

RECOMMENDATION	IMPACT	ROM COST FUNDED	ROM COST NEW FUNDS
o CONDUCT LM ACOUSTIC QUAL TEST (IN SAME FACILITY USED FOR STV ACOUSTIC TEST)	TRANSPORT.		+$50 K
	TEST INCREASE (PLANNING & SUPPORT)		+$750 K
	ADD'L REFURB. LMQTV		+$500 K
	FACILITY COST		+$250 K
o T/V ACCEPTANCE OF LM INSTEAD OF LV	ELIM. CONTAM. TEST		-$60 K
	ELIM. BUILD. MOD.		-$150K
o DELETE ONE MMAS SHELL FOR FM 4.		-$500 K	
		-$500 K	+$1.34 M

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MAJOR RECOMMENDATIONS AFFECTING GE

RECOMMENDATION	IMPACT	ROM COST FUNDED	ROM COST NEW FUNDS
o MODIFY TEST FLOW			
SUBJECT QUAL VEHICLE #115 TO T/V ONLY, THEN FLY.	ELIMINATE ONE SET GE-AVE	-$5 M	
TM BAY 114E TO BE USED BY EK FOR COA DRV AND QUAL TESTING.	REDUCE AGE	-$4.5 M	
	REDUCE TEST SUPPORT	-$500 K	
	REDUCE SPARES	-$200 K	
DELETION OF QUAL TEST AT GE	ELIMINATE FACILITIES OPERATIONAL PERSONNEL	-$200 K	
SUPPORT OF DEVELOP. & QUAL TEST AT HOUSTON	ADDITIONAL TIME, TRAVEL, ETC.		+$300 K
o DIRECT GE TO DELETE MOST COMPONENT DEVELOP. & QUAL ACOUSTIC TESTS	ELIMINATE TESTS	-$100K	
		-$10.5 M	+$300 K

(D) ~~SECRET~~ - SPECIAL HANDLING

MAJOR RECOMMENDATIONS AFFECTING EK

RECOMMENDATION	IMPACT	ROM COST FUNDED	ROM COST NEW FUNDS
o NO MM ACOUSTIC FACILITY AT ROCHESTER	ELIMINATE FACILITY	-$2.5 M	
	ELIMINATE TEST FACILITY OPERATIONAL PERSONNEL	-$600 K	
o DELETE GROUND CONDITIONING TEST	ELIMINATE TEST & FACILITY	-$182K	
o USE TM BAY 114E FOR DEVELOP. & QUAL.	TEST SUPPORT REDUCTION	-$50 K	
o PERFORM MM ACOUSTIC DEVELOP. TEST AT AN OFF-SITE FACILITY	TEST SHROUD		+$250 K
	TRANSPORT.		+$50 K
	TEST INCREASE		+$150 K
o SUBJECT EK QUAL VEHICLE TO LIMITED ACOUSTIC QUAL TEST, THEN FLY	DELETE FM 4	-$3.2 M	
	REFURB. QM		+$1.0 M
	OFF-SITE TEST SUPPORT INCR.		+$250 K
	TRANSPORT.		+$50 K
		-$6.53 M	+1.75 M

(D) ~~SECRET~~ - SPECIAL HANDLING

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IMPACT SUMMARY

	PRESENTLY FUNDED	NEW FUNDS
o MAJOR RECOMMENDATIONS AFFECTING DAC	-$500 K	+$1.34 M
o MAJOR RECOMMENDATIONS AFFECTING GE	-$10.5 M	+$300 K
o MAJOR RECOMMENDATIONS AFFECTING EK	-$6.53 M	+$1.75 M
	-$17.53 M	+$3.39 M

NET DIFFERENCE — $14.14 M

Handle via BYEMAN
Control System

D ~~SECRET~~ SPECIAL HANDLING

CONCLUSIONS

- THE RECOMMENDED PROGRAM IS LESS THAN DESIRABLE FROM A TECHNICAL STANDPOINT, BUT UNDER THE FUNDING RESTRICTION IS AN ACCEPTABLE RISK
- IT PROVIDES INCREASED CONFIDENCE OF MISSION SUCCESS AND CREW SAFETY OVER THE BASELINE PROGRAM
- IT REQUIRES NO NEW FUNDS AND SHOULD RESULT IN REDUCTIONS
- THE ALTERNATE APPROACH PROVIDES INCREASED CONFIDENCE AND SHOULD BE ACHIEVABLE WITHIN PRESENT FUNDING

D ~~SECRET~~ SPECIAL HANDLING

BYE-[illegible]
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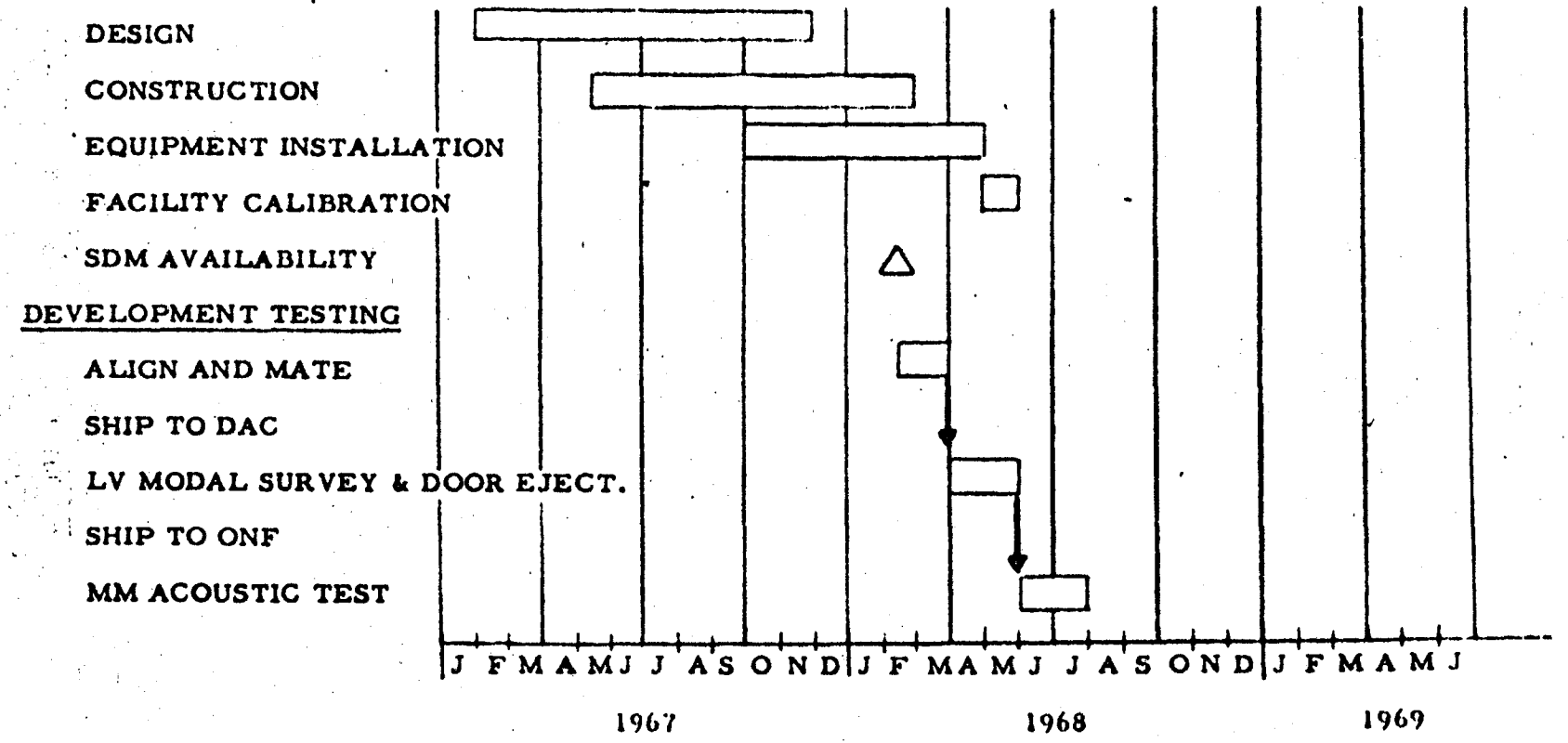
(D) ~~SECRET-SP~~ECIAL HANDLING

PROPOSED MM ACOUSTIC TEST SCHEDULING



(D) ~~SECRET~~-SPECIAL HANDLING

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Control System

ST-1096

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(D) ~~SECRET~~ SPECIAL HANDLING

TM BAY VIBRATION QUALIFICATION TEST

BASELINE:

- SINUSOIDAL VIBRATION TEST ONLY.
- RANDOM VIBRATION MAY BE ADDED BASED ON DATA FROM MM ACOUSTIC DEVELOPMENT TEST.

RECOMMENDATION:

- DELETE TM BAY VIBRATION QUALIFICATION TEST.
- REPLACE WITH TM BAY ACOUSTIC QUALIFICATION TEST (114E)
- CONDUCT LOW LEVEL VIBRATION (PRE-QUAL) TEST.

STEERING COMMITTEE ACTION:

- APPROVED.

(D) ~~SECRET~~ SPECIAL HANDLING

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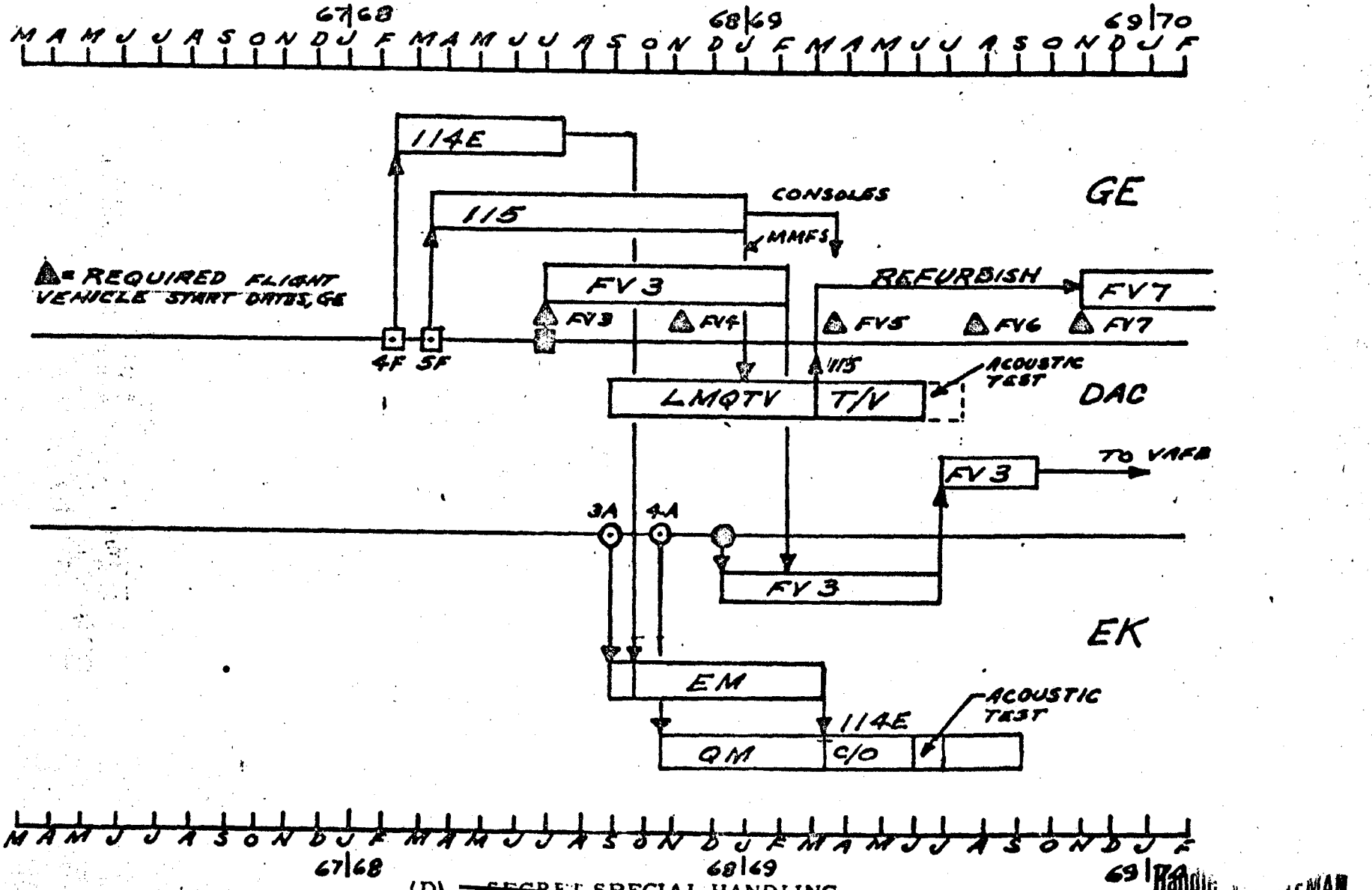
RECOMMENDED TEST FLOW REVISIONS



Handle via BYEMAN
Control System

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p920

ACOUSTIC QUALIFICATION TEST RECOMMENDATIONS

- SUBJECT LM AND MM TO AN ACOUSTIC TEST AT QUAL LEVELS FOR A DURATION IN EXCESS OF THAT EXPECTED DURING FLIGHT.
- PROVIDE ACOUSTIC FACILITY AT ROCHESTER FOR MM TESTING.
- MODIFY SANTA MONICA FACILITY FOR LM TESTING.

STEERING COMMITTEE ACTION:

- SUBJECT LM AND MM QUAL VEHICLES TO AN ACOUSTIC TEST AT FLIGHT LEVELS FOR FLIGHT DURATION.
- PERFORM LIMITED QUAL ACOUSTIC TEST IN SAME FACILITY AS USED FOR DEVELOPMENT TEST (TEST CONDUCTED WITH POWER OFF -- CHECK AT H.B. AND ROCHESTER BEFORE AND AFTER).
- FLY QUAL VEHICLES ON FLIGHT 7.

BYE-682

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LM QUALIFICATION COSTS

	OFF SITE	HUNTINGTON BEACH
LM HARDWARE (LIKE NO. 6)	$19.44 M	$19.44 M
ENGINEERING AND TEST SUPPORT	.69 M	.69 M
LMQTV REFURBISHMENT CREDIT	(2.81 M)	(2.81 M)
	$17.32 M	$17.32 M
ADDITIONAL AGE STATION	4.37 M	2.10 M
	$21.69 M	$19.42 M
THREE-MONTH PROGRAM EXTENSION	21.85 M	21.85 M
	$43.54 M	$41.27 M

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(D) ~~SECRET~~ SPECIAL HANDLING

LV THERMAL VACUUM TESTING AT DAC

ALTERNATIVES	CONSIDERATIONS
BASELINE: LAB VEHICLE THERMAL/VAC TEST	POSSIBLE HIGHER CONFIDENCE IN THERMAL INTERFACE POSSIBLE CONTAMINATION HANDLING PROBLEMS SCHEDULE DELAY DUE TO FINDING LM PROBLEMS IN LV CONFIGURATION
ALTERNATE: LM THERMAL/VAC TEST	SAVES 280 HOURS OF MM REDUNDANT TESTING AVOIDS POSSIBLE MM CONTAMINATION AVOIDS HANDLING PROBLEMS FINDS PROBLEMS IN SIMPLER CONFIGURATION FIVE-WEEK LAUNCH SLIP UNLESS DELETE PRE-QUAL EMC AND IMPROVE ECLS TEST SCHEDULE

RECOMMENDATION: T/V TEST LM INSTEAD OF LV. REVISE TEST FLOW TO ALLEVIATE SCHEDULE PROBLEM.

STEERING COMMITTEE ACTION: APPROVED PENDING SCHEDULE EVALUATION.

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MMFS MODE VERIFICATION TEST
ACCEPTANCE

ALTERNATIVES	CONSIDERATIONS
1. NO ACCEPTANCE MODAL VERIFICATION IS PRESENTLY PLANNED IN BASELINE	o A STATIC DEFLECTION MEASUREMENT IS TO BE PERFORMED ON THE SPIDER STRUCTURE ONLY
2. PERFORM A MMFS MODE VERIFICATION MEASUREMENT ON EACH ASSEMBLY AS A PART OF ACCEPTANCE PROCEDURE	o TM DYNAMIC CHARACTERISTICS ARE ONE OF MOST CRITICAL STRUCTURAL CONSIDERATIONS o MODE MEASUREMENTS OF MMFS ASSEMBLY IS BEST METHOD OF VERIFICATION o FIXTURE REQUIRED FOR HARD SUPPORT AT MMFS/LM INTERFACE STATION

RECOMMENDATION:

A MODE VERIFICATION TEST OF THE MMFS BE INCORPORATED INTO THE GE ACCEPTANCE TEST PROGRAM.

STEERING COMMITTEE ACTION:

CONDUCT ON FV 3 THEN CONSIDER ELIMINATION.

(D) ~~SECRET~~ SPECIAL HANDLING

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P 9 24

COA MODE SURVEY TEST
(ACCEPTANCE)

ALTERNATIVES	CONSIDERATIONS
BASELINE MODE SURVEY OF COA NOT PLANNED ON EACH ARTICLE	
ALTERNATIVE CONDUCT MODE SURVEY SIMILAR TO DM TEST	o THE RESULTS WILL VERIFY THAT DYNAMIC PROPERTIES OF COA ARE AS PREDICTED o WILL PROVIDE MINIMUM SHAKE-OUT OF WORKMANSHIP

RECOMMENDATION:

A MODE SURVEY TEST SHOULD BE CONDUCTED ON EACH FLIGHT ARTICLE. THIS TEST SHOULD UTILIZE HARD-POINT SUPPORT FIXTURE AS DESCRIBED FOR DM TEST

STEERING COMMITTEE ACTION:

CONDUCT ON FV 3 THEN CONSIDER ELIMINATION.

AT

BYE-

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(D) ~~SECRET~~ SPECIAL HANDLING

ACOUSTIC ACCEPTANCE TEST RECOMMENDATIONS

- SUBJECT LM AND MM TO AN ACOUSTIC ACCEPTANCE TEST.
- SUBJECT LV TO LOCAL EXCITATION AT INTERFACE HARD POINTS TO CHECK INTERFACE CONNECTIONS.

STEERING COMMITTEE ACTION:

- CONDUCT MM LOW LEVEL VIBRATION ACCEPTANCE TEST AT ROCHESTER.
- CONDUCT LV AND LM ACCEPTANCE TEST AT HB (LOW LEVEL EXCITATION).

(D) ~~SECRET~~ SPECIAL HANDLING

BYE-6

(D) ~~SECRET~~ SPECIAL HANDLING

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DAC FACILITY COSTS

BUILDING	900 K
SOUND EQUIPMENT (HORN)	180 K
COMPRESSOR, MOTOR, ELECTRIC DISTRIBUTION SUBSTATION	650 K
TAPE TRANSPORT	225 K
ACCELEROMETERS	31 K
SIGNAL CONDITIONING	127 K
MISCELLANEOUS	15 K
ANE COSTS	127 K
TOTAL	2.255 M
ENGINEERING AND PLANNING	.500 M
	2.750 M

Handle via BYEMAN Control System

(D) ~~SECRET~~ SPECIAL HANDLING

ST-2004

SECRET SPECIAL HANDLING

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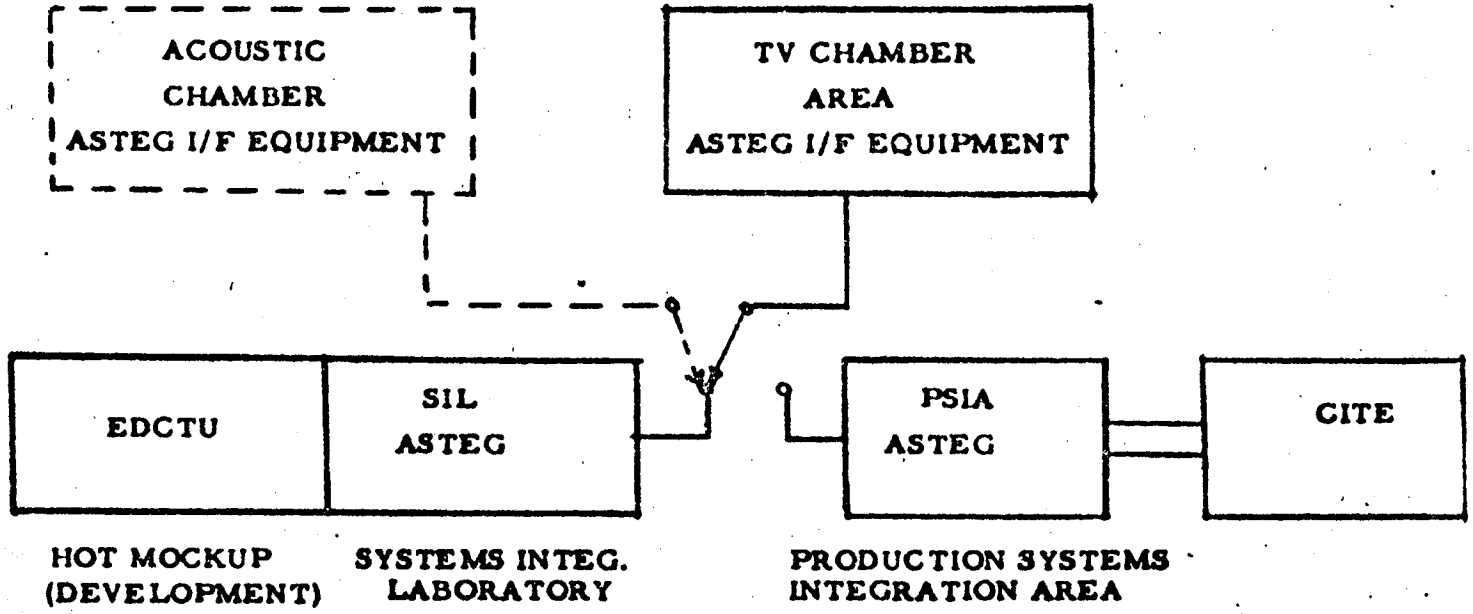
p927

AGE CONSIDERATIONS



Col. Dietrich

SUBJECT

DX RATING

- DX IS STILL A MOL PROGRAM REQUIREMENT.
- MR. FINK BRIEFED ON PROBLEM 6 FEB.
- TALKING PAPER FOR SEC. FLAX BEING PREPARED BY GEN EVANS' OFFICE.
- CONTRACTORS REQUESTED TO PROVIDE IMPACT IN CONJUNCTION WITH SCHEDULE AND FY LIMIT EXERCISE.

DOUGLAS - DEFERRED ITEMS

DEFINITIZATION PLAN

	RECEIVE PROPOSAL	COMPLETE NEGOTIATIONS
VAFB TEST EFFORT	1 MAR 67	9 JUN 67
SUPPORT MODULE	17 MAR 67	5 MAY 67
ATS INTEGRATION	17 MAR 67	14 APR 67
W/B AND INTEGRATION	17 MAR 67	9 JUN 67
NSA	15 MAR 67	15 JUN 67

CONTRACT STATUS

PHASE II CONTRACTS

- DAC
- MAC
- GE
- SUIT
- FOOD

- MARTIN
- AC ELECTRONICS DIV
- AEROJET
- UNITED TECHNOLOGY CORP

DEFERRED ITEMS

- DAC
- MAC
- GE

- MARTIN
- AC ELECTRONICS DIV

McDONNELL - DEFERRED ITEMS

DEFINITIZATION PLAN

	RECEIVE PROPOSAL	COMPLETE NEGOTIATIONS
SPARES	15 MAR 67	9 JUN 67
REMOTE SITE OPS	1 APR 67	31 MAY 67
VIBRATION TESTS	1 MAY 67	15 JUN 67
SIMULATOR O AND M	1 APR 67	30 MAY 67
PACS	29 FEB 67	30 APR 67
CPCS	8 MAR 67	7 APR 67

GENERAL ELECTRIC - DEFERRED ITEMS

DEFINITIZATION PLAN

	RECEIVE PROPOSAL	COMPLETE NEGOTIATIONS
ATS	15 JAN 67	15 MAR 67
FIELD TEST PROGRAM	13 MAR 67	10 MAY 67
EXCHANGE HARDWARE	15 MAR 67	15 MAY 67
LOGISTIC SPARES	1 MAY 67	1 JUN 67
ALIGNMENT EQUIPMENT	1 MAY 67	1 JUN 67
V/R	20 APR 67	20 JUN 67
DRV	15 MAY 67	15 JUL 67

ONF - DEFERRED ITEMS

DEFINITIZATION PLAN

	RECEIVE PROPOSAL	COMPLETE NEGOTIATIONS
MPS LEVEL TESTING ACOUSTIC TESTING LIQUID NITRO GEN PLANT	23 FEB 67	1 APR 67

MARTIN - DEFERRED ITEMS

DEFINITIZATION PLAN

	RECEIVE PROPOSAL	COMPLETE NEGOTIATIONS
GERTS	7 DEC 66	15 JUNE 67

AC ELECTRONICS DIV - DEFERRED ITEMS

DEFINITIZATION PLAN

	RECEIVE PROPOSAL	COMPLETE NEGOTIATIONS
GOLD PASTE DIODES	3 MAR 67	26 MAR 67
VAL SOFTWARE AND FIRST FLIGHT	15 AUG 67	30 AUG 67
REHAB SC AND MGC QUAL	15 MAY 68	30 MAY 68
CMU COMPUTER	1 OCT 67	30 OCT 67

MOL

FUNDING

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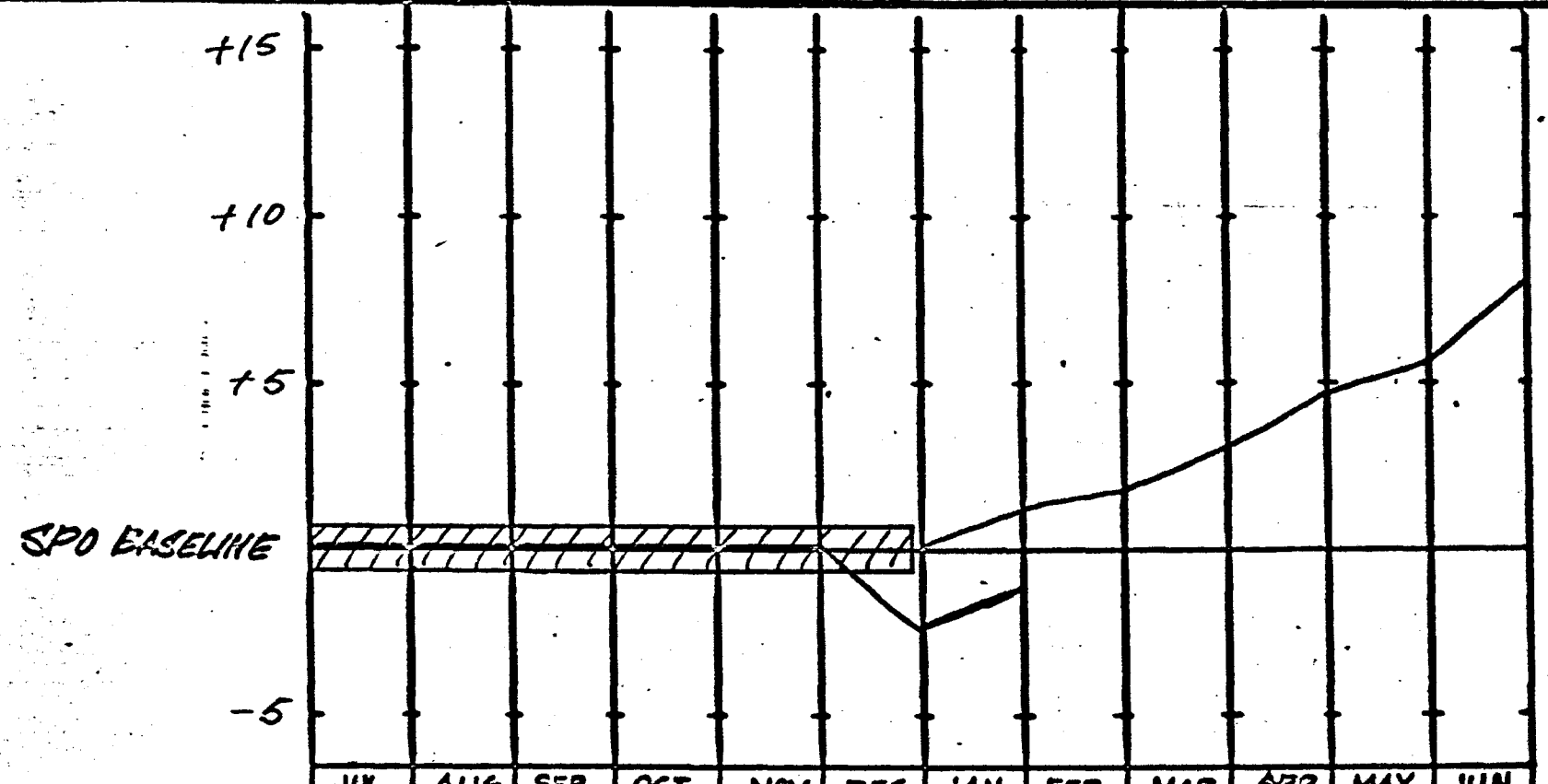
FINANCIAL STATUS FY67

SYSTEM SEGMENT LAB VEHICLE CONTRACTOR DOUGLAS



	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
CONTRACTOR BUDGET			4.2	9.5	18.9	26.6	37.0	51.0	66.0	85.0	104.0	124.9
SPO BUDGET			4.2	9.5	18.9	26.6	36.2	49.3	63.0	80.6	98.5	117.0
CONTR. EXPEND.			4.2	9.5	18.9	24.2	35.1					
GOVT OBLIG.			12.0	12.0	12.0	26.1	26.1					

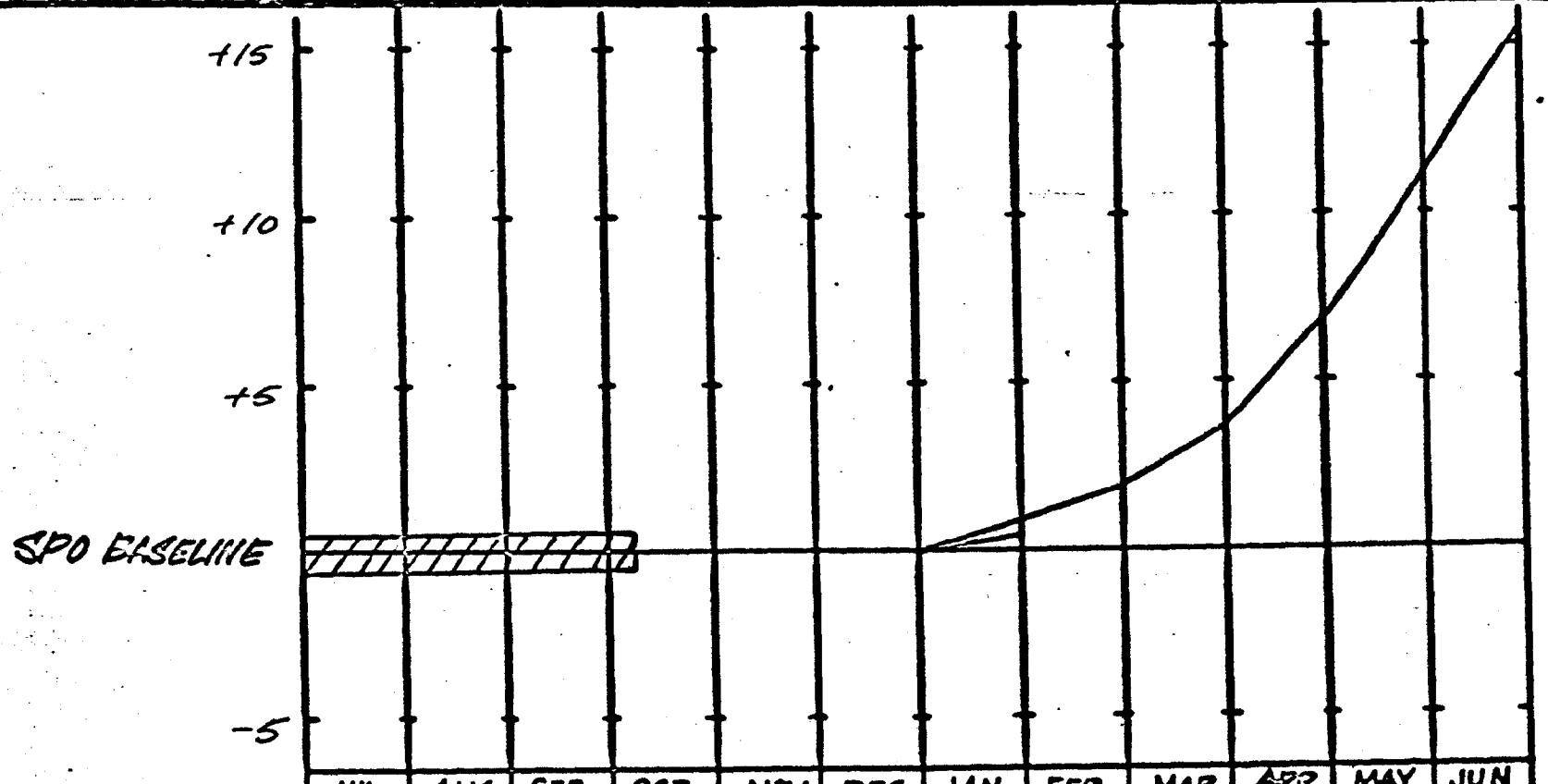
GROUP 4
Downgraded at 3 year intervals; declassified after 12 years

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

FINANCIAL STATUS FY67

SYSTEM SEGMENT MISSION MODULE CONTRACTOR GENERAL ELECTRIC



	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
CONTRACTOR BUDGET			1.2	3.2	5.9	8.8	12.9	17.7	23.1	30.1	38.1	47.1
SPO BUDGET			1.2	3.2	5.9	8.8	12.1	15.7	19.5	23.4	27.5	32.0
CONTR. EXPEND.			1.2	3.2	5.9	8.8	12.7					
GOVT OBLIG.			0	0	1.7	1.7	1.7					

Downgraded at 3 year intervals; declassified after 12 years

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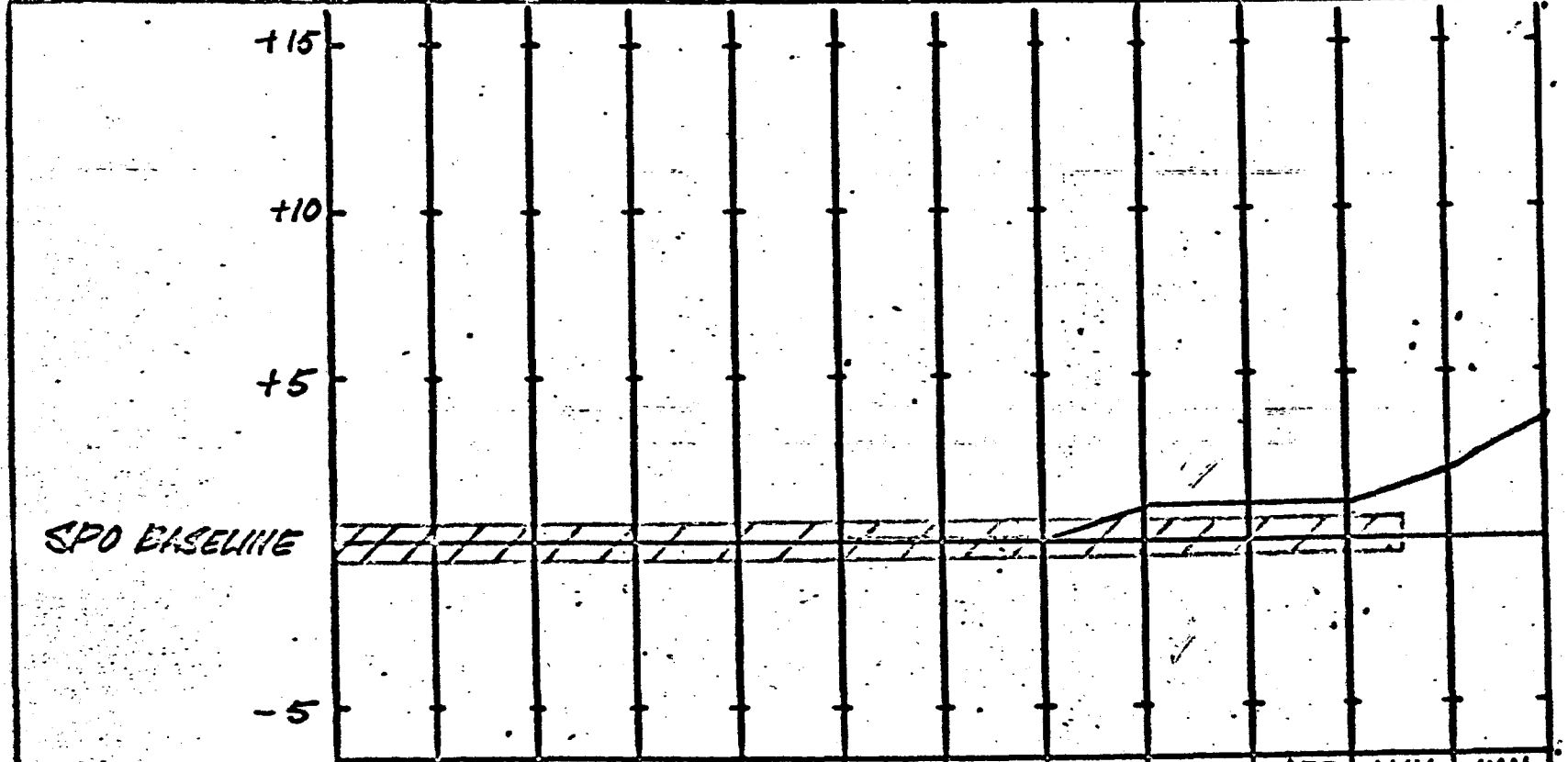
FINANCIAL STATUS FY67

SYSTEM SEGMENT EXPERIMENTS CONTRACTOR



	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
CONTRACTOR BUDGET						.6	6.6	19.6	27.6	30.6	39.6	49.2
SPO BUDGET						.6	6.6	13.6	21.6	29.6	37.6	45.7
CONTR. EXPEND.						.6	6.6					
GOVT OBLIG.				9.4	9.4	14.4	33.5					

GROUP 4
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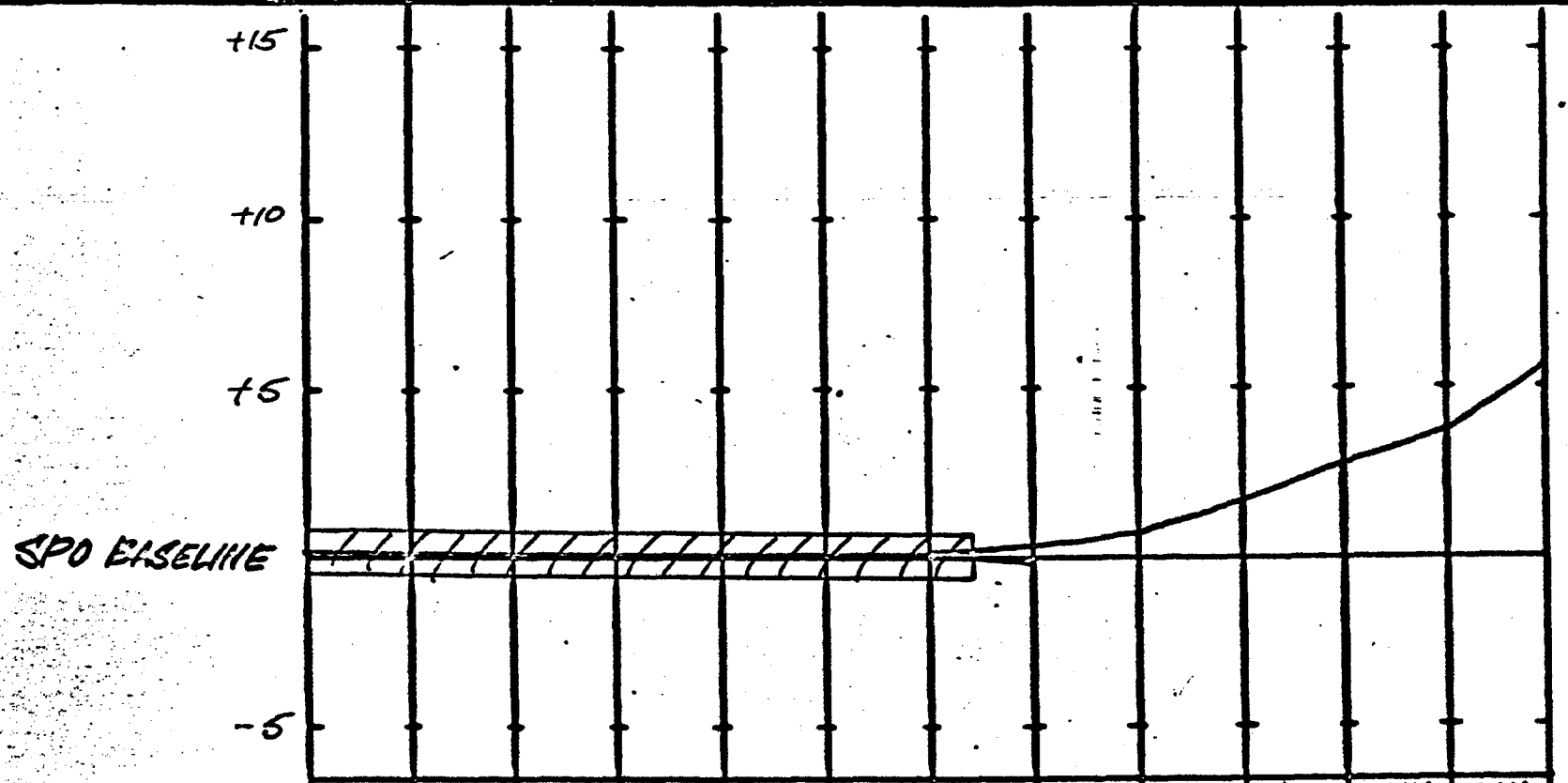
FINANCIAL STATUS FY 67

SYSTEM SEGMENT GEMINI 'B' CONTRACTOR McDONNELL



	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
CONTRACTOR BUDGET			.9	2.2	3.8	6.3	10.6	14.5	20.4	26.6	32.9	40.7
SPO BUDGET			.9	2.2	3.8	6.3	9.8	13.8	18.8	23.8	29.3	35.0
CONTR. EXPEND.			.9	2.2	3.8	6.3	9.6					
GOVT OBLIG.			0	6.0	6.0	6.0	7.4					

GROUP 4
Downgraded at 3 year intervals; declassified after 12 years

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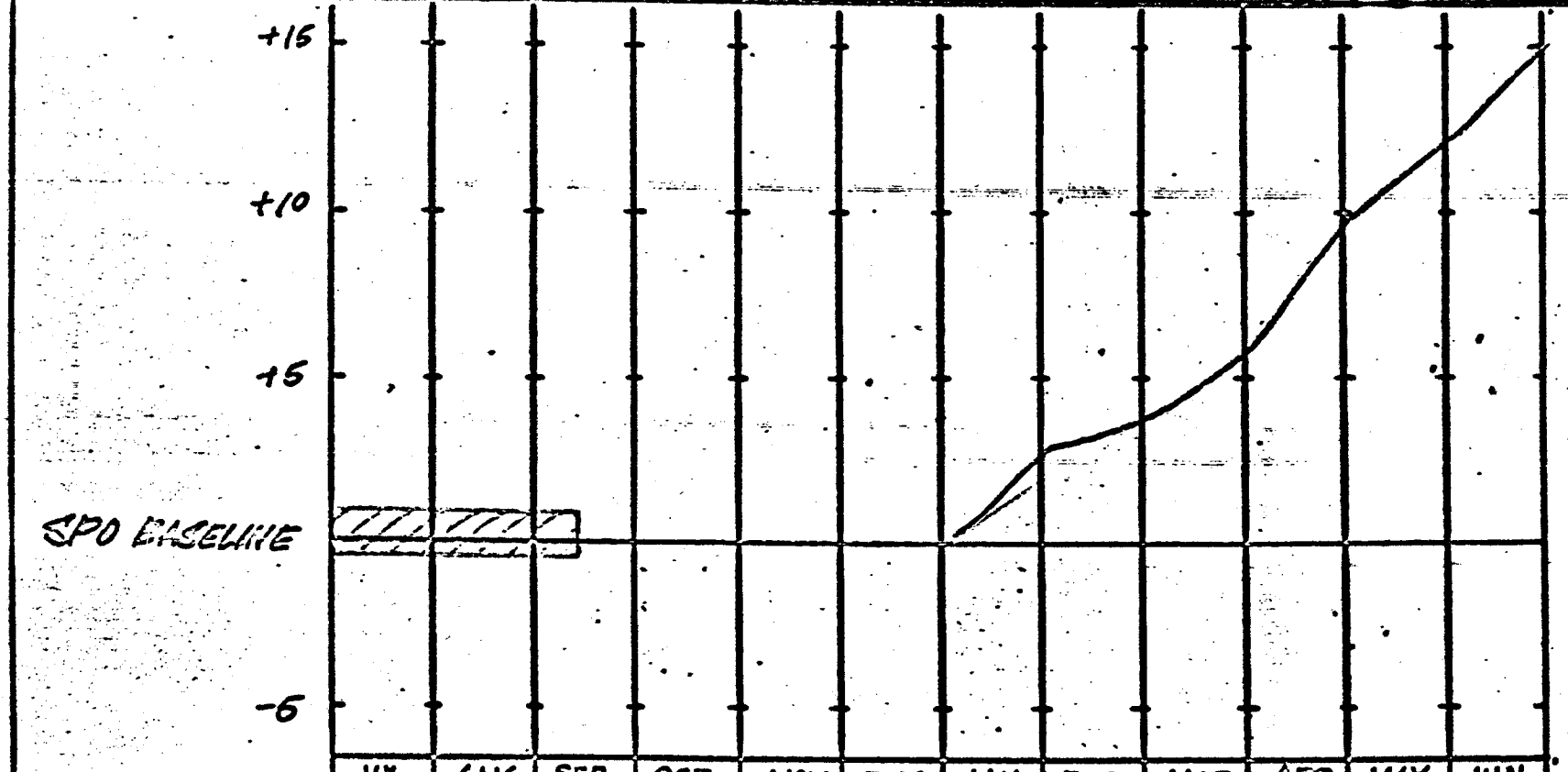
FINANCIAL STATUS FY67

SYSTEM SEGMENT T-III CONTRACTOR VARIOUS



	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
CONTRACTOR BUDGET	.2	.4	.6	.8	1.0	1.9	10.3	19.5	26.9	34.5	42.2	50.2
SPO BUDGET	.2	.4	.6	.8	1.0	1.9	7.5	14.7	19.9	24.7	29.8	35.0
CONTR. EXPEND.	.2	.4	.6	.8	1.0	1.9	9.6					
GOVT OBLIG.							.5					

Downgraded at [illegible] intervals; [illegible] after 12 years

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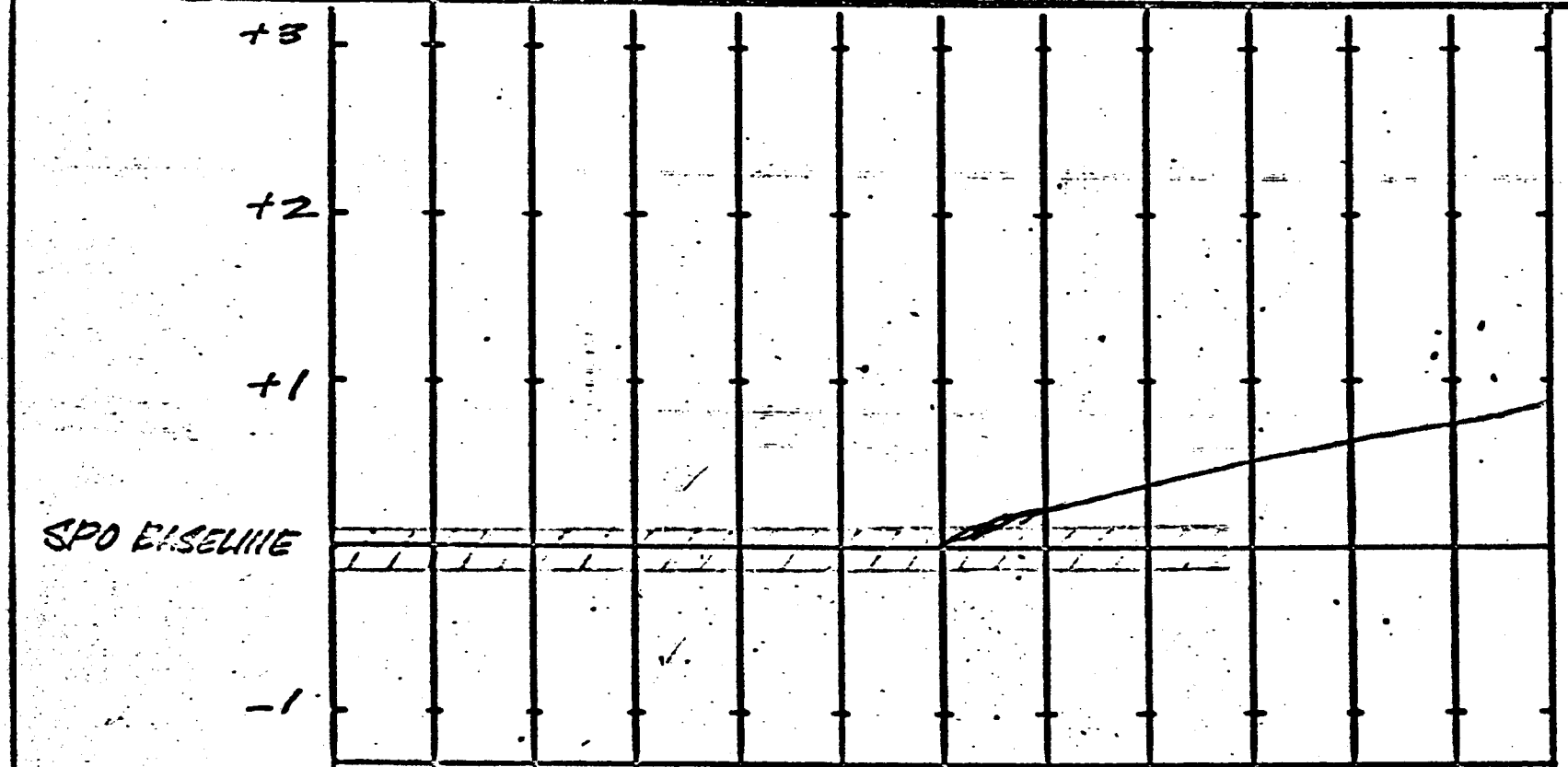
FINANCIAL STATUS FY67

SYSTEM SEGMENT GSE/TD CONTRACTOR AEROSPACE CORP.



	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
CONTRACTOR BUDGET	.1	.2	.3	.5	.6	1.2	2.1	3.0	3.9	4.9	5.9	6.9
SPO BUDGET	.1	.2	.3	.5	.6	1.2	1.9	2.7	3.5	4.3	6.2	6.1
CONTR. EXPEND.	.1	.2	.3	.5	.6	1.2	1.9					
GOVT OBLIG.	0	0	0	0	.0	1.0	3.3					

GROUP 4
Downgraded at 3 year intervals; declassified after 12 years

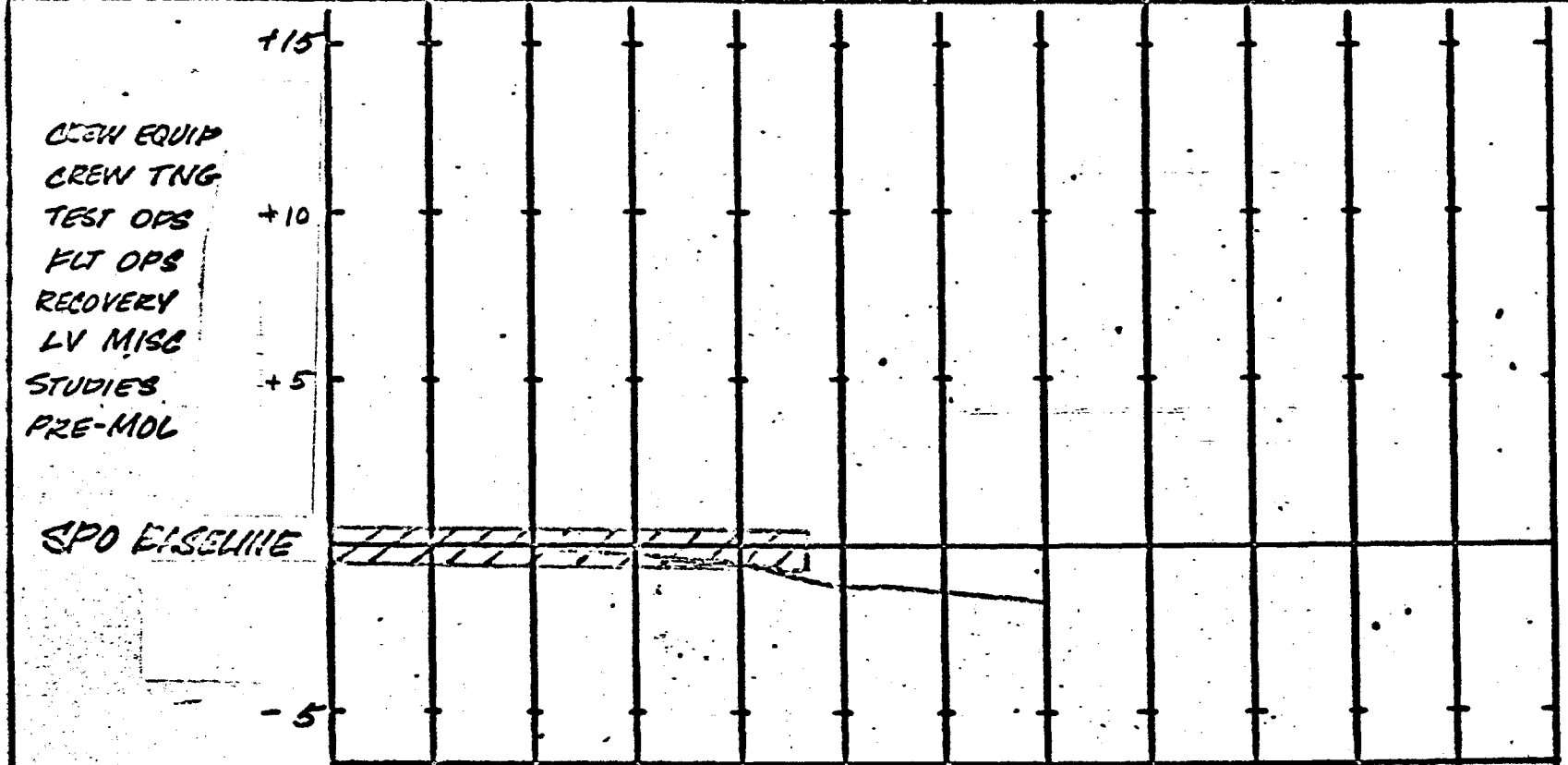
~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

MOL

FINANCIAL STATUS FY67

SYSTEM SEGMENT OTHER CONTRACTOR VARIOUS



	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
CONTRACTOR BUDGET		.2	.4	.6	2.6	3.0	3.5	5.0	8.2	10.0	13.8	15.6
SPO BUDGET		.2	.4	.6	2.6	3.0	3.5	5.0	8.2	10.0	13.8	16.6
CONTR. EXPEND.		.2	.2	.2	1.5	1.8	2.0					
GOV'T OBLIG.		.2	.2	.2	1.5	1.8	2.0					

GROUP 4
Downgraded at 3 year intervals; declassified after 12 years

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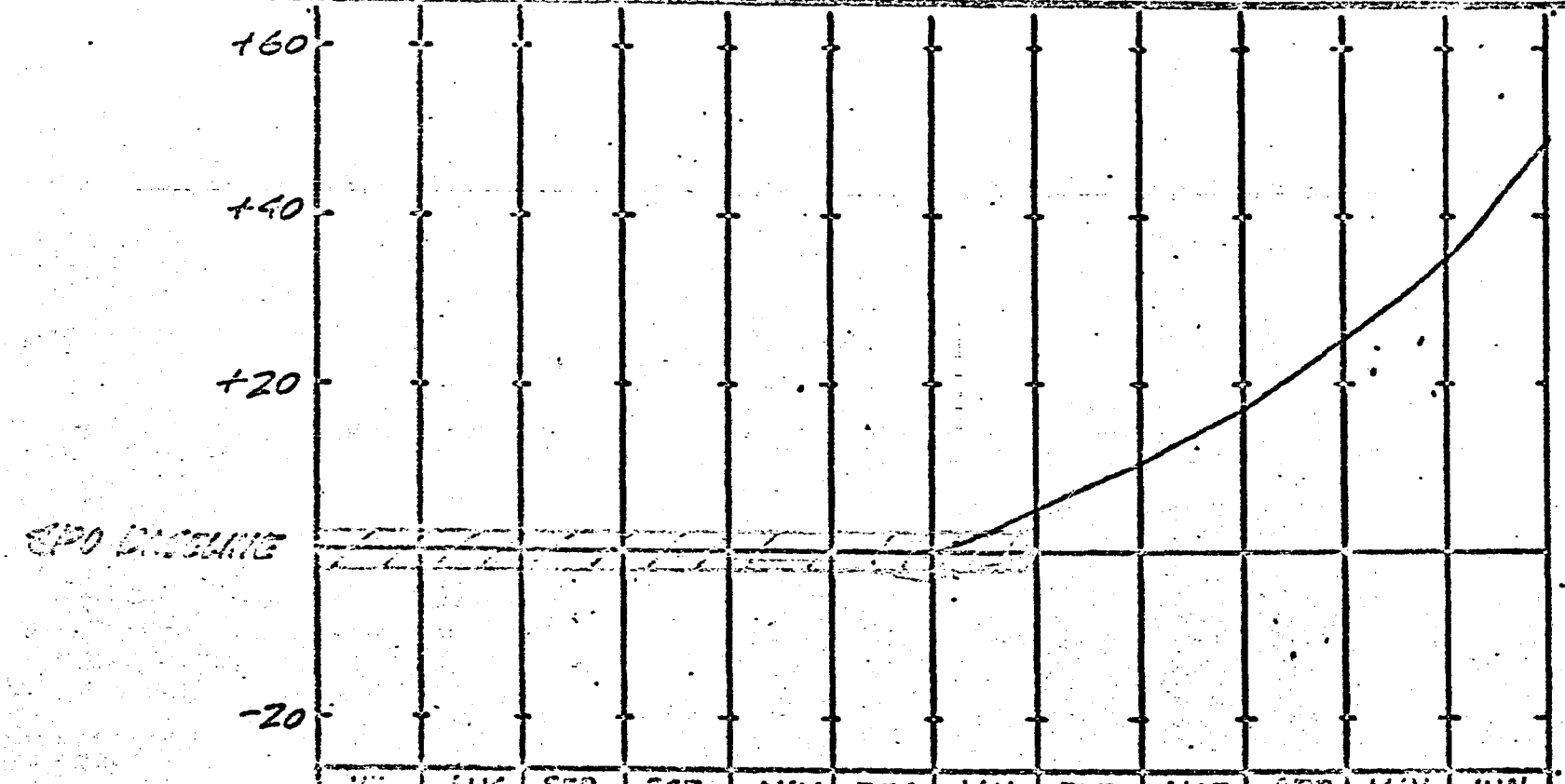
FINANCIAL STATUS FY67

SYSTEM SEGMENT TOTAL MOL CONTRACTOR VARIOUS



	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
CONTRACTOR CURRENT	3	8	7.6	16.8	32.8	48.4	83.0	126.5	171.1	221.7	276.5	331.6
SPO CURRENT	3	8	7.6	16.8	32.8	48.4	77.6	114.8	154.5	196.9	241.7	286.5
CONTR. EXPEND.	3	8	7.4	16.4	31.7	44.8	77.5					
GOVT CURR.	0	2	12.2	27.6	30.6	51.0	74.5					

Downgraded at 3 year intervals; declassified after 12 years

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MOL

SUMMARY - SPO/CONTRACTOR MEETING - 2 FEB 67

- TWO PROBLEMS:
  - DX: FULL DX IN WORK, DOLLAR LIMITED DX POSSIBLE
  - FUNDING: 40% BELOW CONTRACTORS REQUIREMENTS
- DIRECTION TO CONTRACTORS:
  - ANALYZE SCHEDULE/COST IMPACT OF FUNDING LIMITS (CASE 1)
  - ESTIMATE FUNDING REQUIREMENTS FOR 9 MONTH SLIP (CASE 2)
  - EXAMINE "SOFT" AREAS AND OPTIMIZE WORK SEQUENCE
  - SUBMIT PROPOSALS FOR CASES 1 AND 2 ON 14 FEB 67
- CONTRACTOR VICE PRESIDENTS PRESENT TOP MANAGEMENT VIEWS - 15 FEB 67
- CAUTIONS

1 of 6

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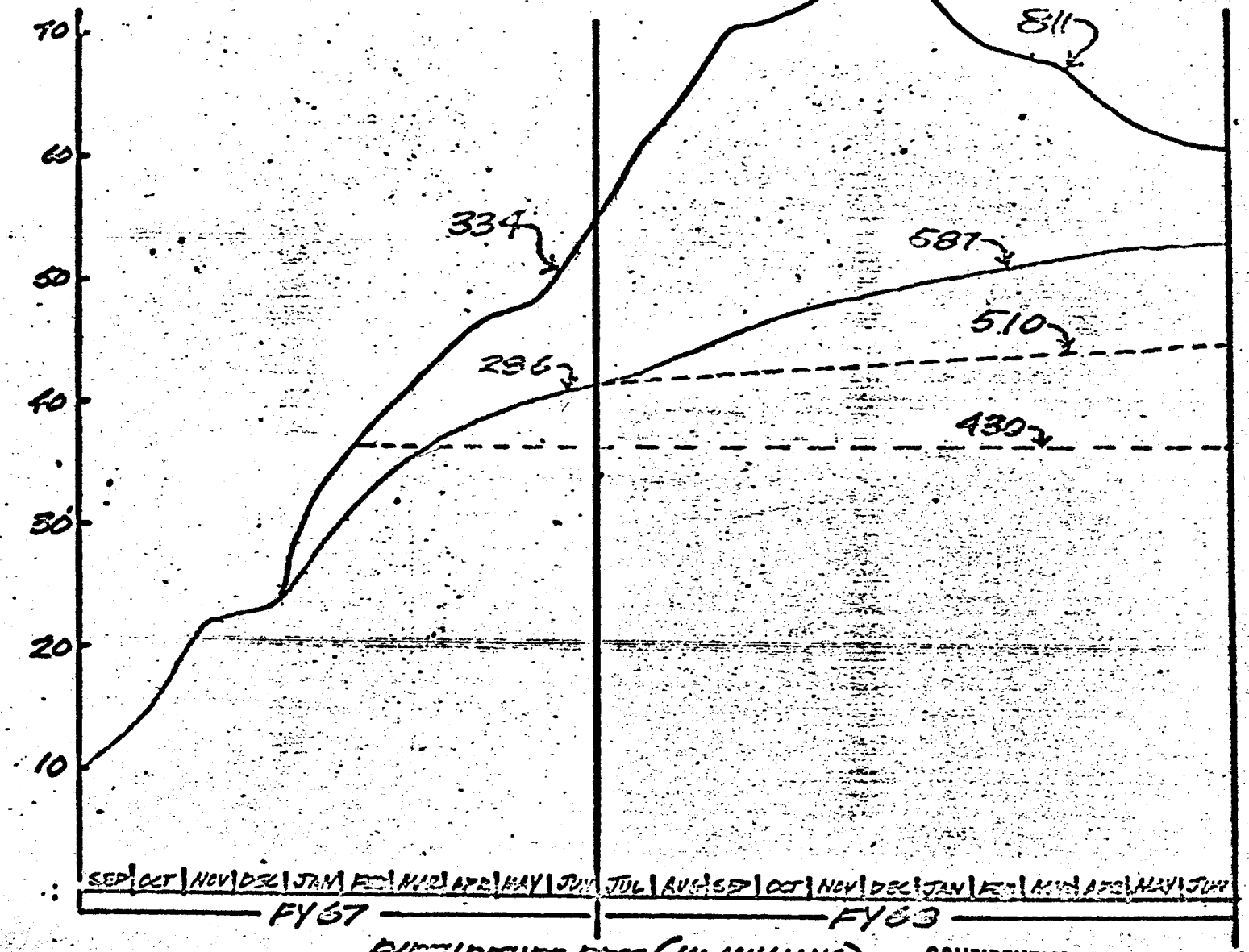
MONTHLY FUNDING REQUIREMENTS
(EXPENDITURES + FEE ONLY)



EXPENDITURE RATE (IN MILLIONS)

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MOL

DX PRIORITY

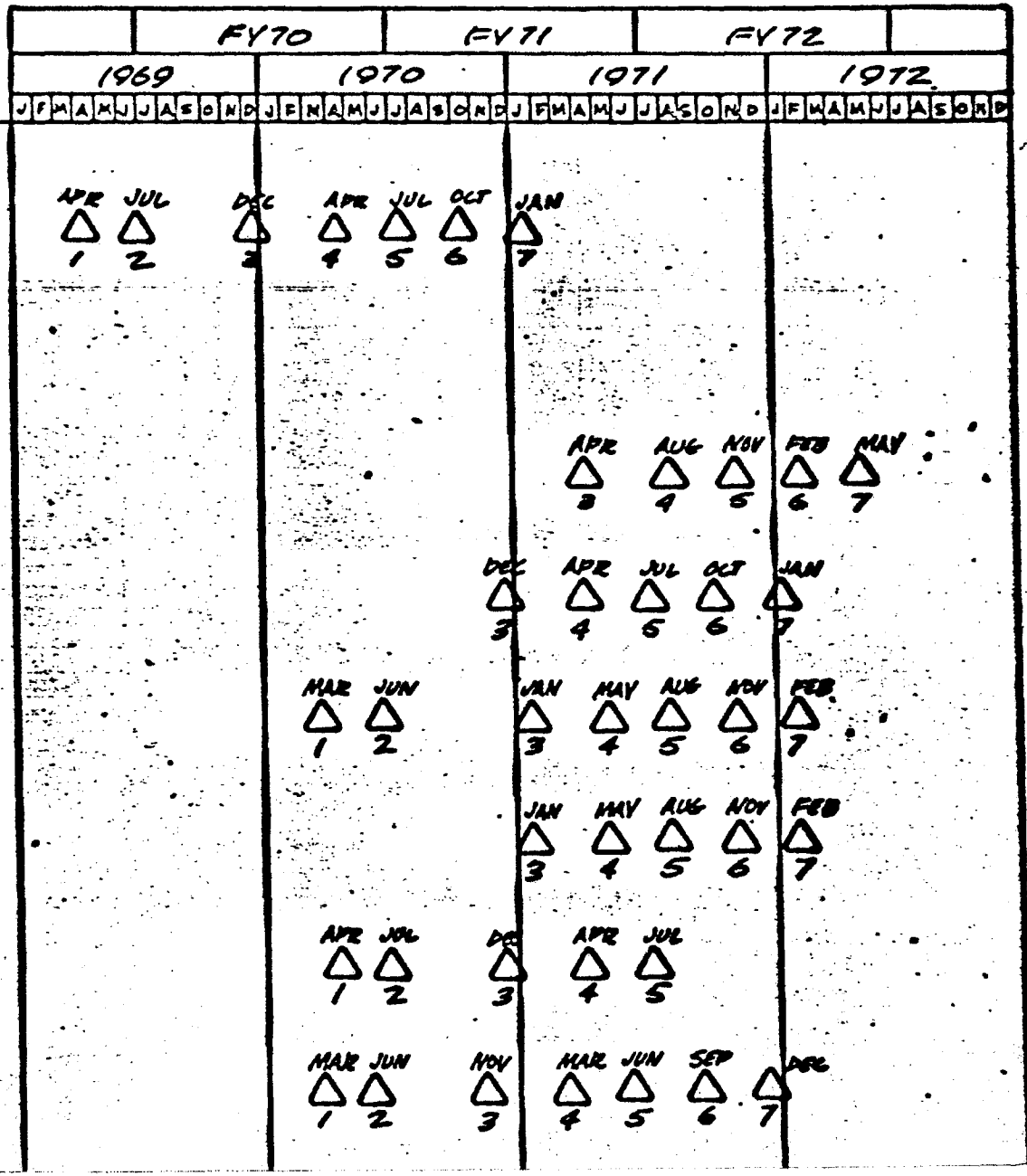
- CANNOT GUARANTEE SCHEDULE WITHOUT DX
- LIMITED DOLLAR DX SATISFACTORY
- TYPICAL CRITICAL ITEMS:
  - BERYLLIUM STRUCTURE
  - HI-REL PARTS
  - PRECISION BEARINGS
  - MICRO ELECTRONICS
  - PYROTECHNICS
  - ARM & DISARM DEVISE
  - FORGINGS
  - HONEYCOMB

MOL

FY 67/68/69 PLANNING BUDGETS

	FY 67		FY 68		FY 69	
	CONTR	BUDGET	CONTR	BUDGET	CONTR	BUDGET
DAC	124.9	117.0	298.7	170	225.4	220
G.E.	47.1	32.0	122.7	70	62.3	90
EXP	49.2	45.7	118.7	90	60.0	90
MAC	40.7	35.0	95.1	55	52.4	70
T-III	49.7	35.0	140.9	75	87.6	105
OTHER	(A) - 7.1 St. 4.3 Opn - 2.6 Prom. 3.0 Lv - 1.0 Rec. 4.8 22.8	(A) 6.1 St 4.3 Opn 2.6 ProM 3.0 Lv 1.0 Res 4.7 21.7	(A) - 13.2 St. 9.0 Opn - 11.4 Lv - 1.3 34.9	(A) 10.0 Opn 5.0 St. 4.0 40 (Res. 20.0) LUMISS - 1.0	(A) - 15.7 St. 5.0 Opn - 8.2 Lv - .5 29.4	(A) - Opn 25
TOTAL	334.4	286.4	811.0	500	517.1	600

MOL LAUNCH SCHEDULE FUNDING ENVELOPE



MCL

"FUNDS LIMITED" REQUIREMENTS

No Slip.	FY67	FY68	FY69	FY70	FY71	FY72	FY73	TOTAL	Δ from B. Book
DAC 13	101.8	185.6	219.6	200.0	130.2	44.7		881.9	68.7
G.E. 13	32.0	70.0	90.0	58.2	32.8	14.0	.4	297.4	57.6
EXP 12	45.7	90.0	90.0	62.2	32.7	19.5	1.0	341.1	59.8
MAC 12	26.8	62.4	70.8	60.2	23.8	4.2		248.2	13.5
T-IIIM 11	35.0	75.0	105.0	84.5	50.7	26.7		376.9	42.2
OTHER	17.3	17.5	26.3	24.8	22.4	20.6	3.0	131.9	55.9
TOTAL	258.6	500.5	601.7	469.9	292.6	129.7	4.4	2277.4	297.7

MCL

FUNDING REQUIREMENTS FOR 9 MO. SLIP

	FY67	FY68	FY69	FY70	FY71	FY72	TOTAL	Δ from B.B.
LV Optimum Sched	113.6	229.6	240.4	166.6	73.6	19.2	843.0	29.8
MM	39.7	95.3	82.2	45.0	20.2	7.9	290.3	50.5
EXP	47.4	130.0	80.0	45.2	22.5	6.6	331.7	50.4
GEM 'B'	30.0	68.4	77.3	47.8	17.1	.6	241.2	6.5
T-III M	37.8	83.7	98.2	84.0	50.4	20.2	374.3	39.6
OTHER	17.3	19.0	25.7	23.7	22.1	16.4	124.2	48.2
TOTAL	285.8	626.0	603.8	412.3	205.9	70.9	2204.7	225.0

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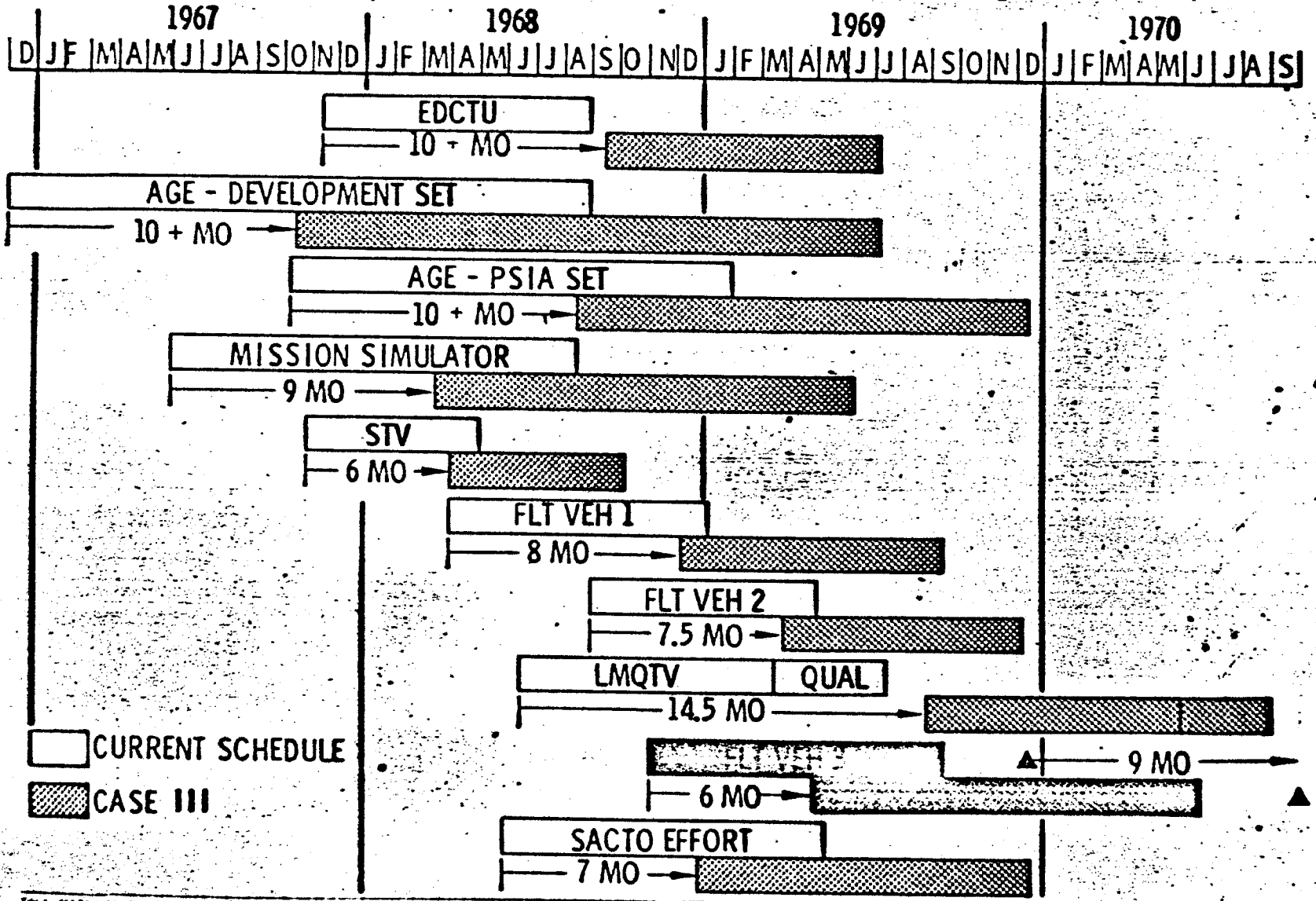
F00114

V979-6A

CASE I

ALTERNATE SCHEDULE APPROACH



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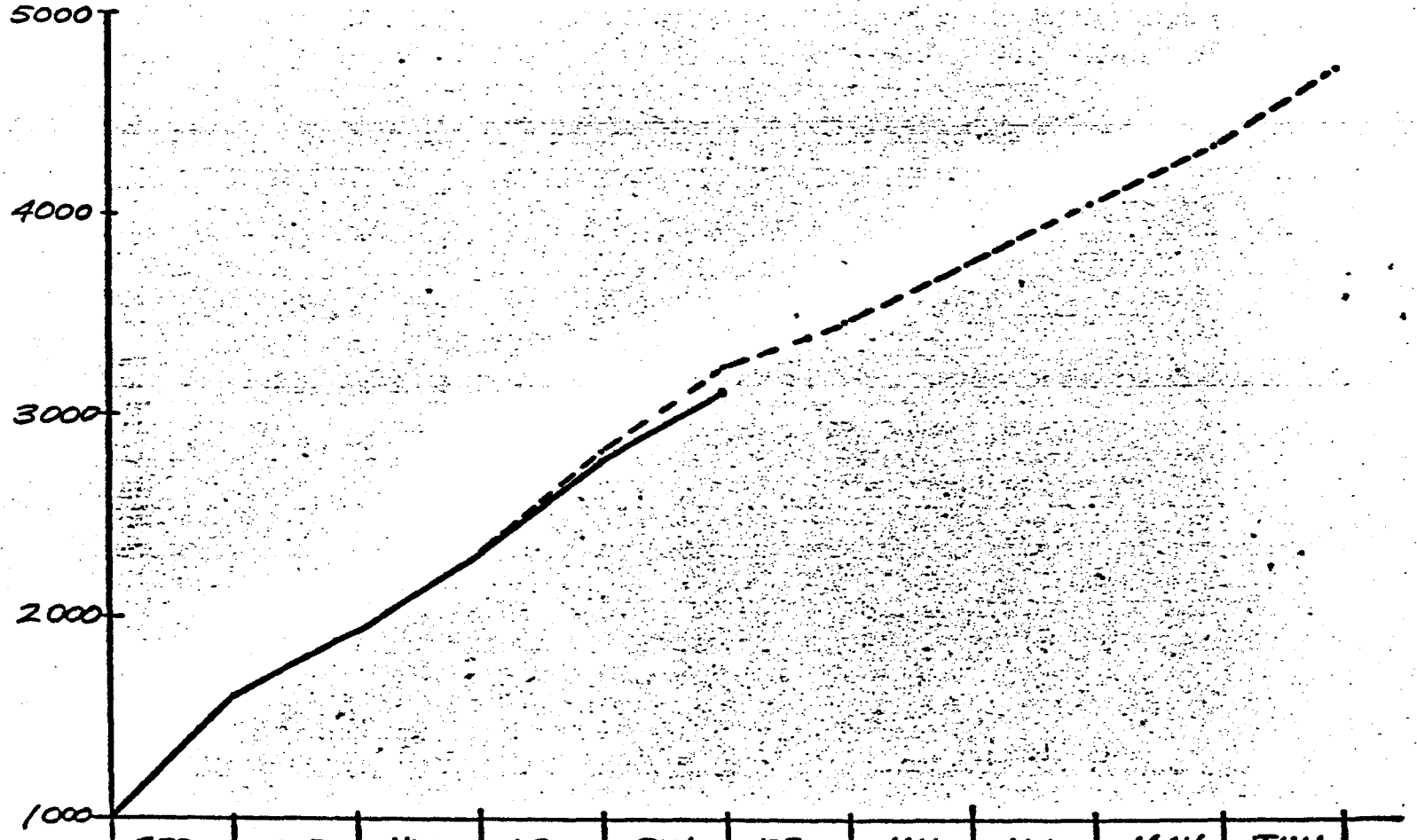
MOL

FUNDING REQUIREMENTS FOR 12 MO. SLIP

	FY67	FY68	FY69	FY70	FY71	FY72	TOTAL	Δ from B. Book
LV Rise schedule	105.8	170 197.7	240.3	201.3	94.1	26.1	865.3	52.1
MM	39.7	70 95.3	82.2	45.0	20.2	7.9	290.3	50.5
EXP.	47.4	130.0	80.0	45.2	22.5	6.6	331.7	50.4
GEM 'B'	30.0	68.4	77.3	47.8	17.1	.6	241.2	6.5
T-III M	37.8	83.7	98.2	84.0	50.4	20.2	374.3	39.6
OTHER	17.3	19.0	25.7	23.7	22.1	16.4	124.2	48.2
TOTAL	278.0	594.1	603.7	447.0	226.4	77.8	2227.0	247.3

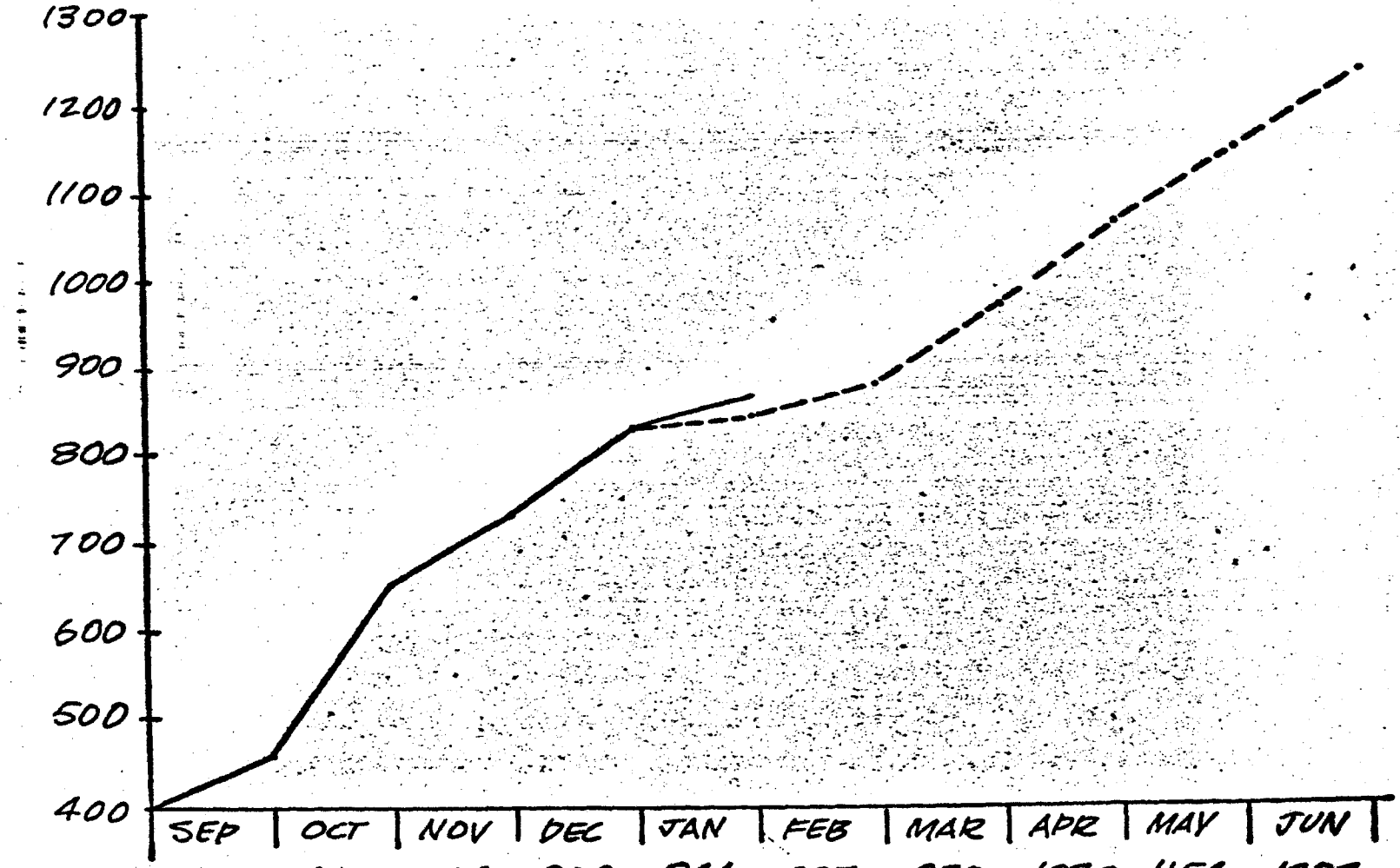
MOL

DOUGLAS MOL MANPOWER
ACTUALS vs FORECAST
FY 67



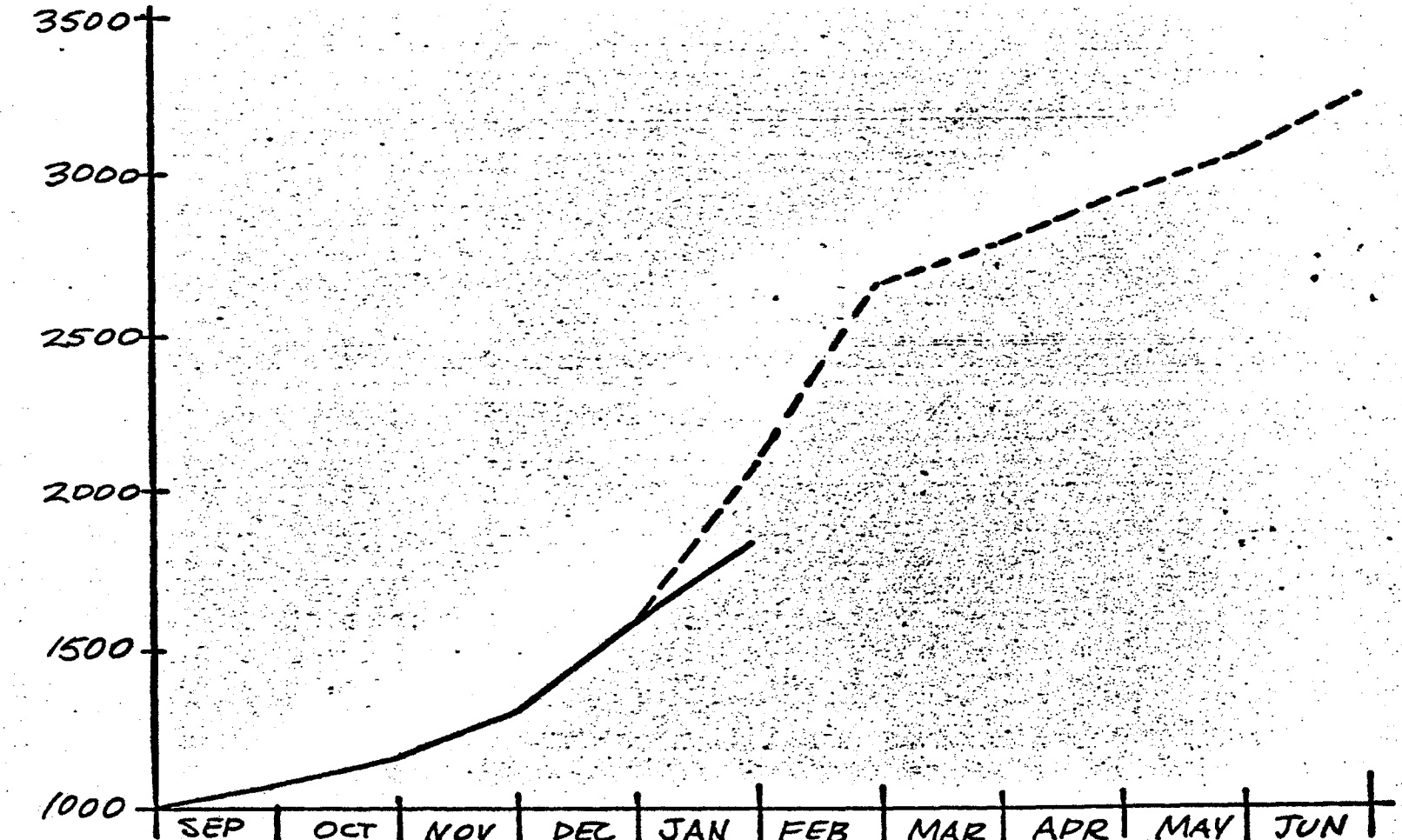
	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
FORECAST	1364	1929	2350	2783	3218	3454	3733	4064	4380	4758
ACTUALS	1369	1929	2350	2777	3154					

G.E. MOL MANPOWER
ACTUALS vs. FORECAST
FY 67



	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
FORECAST	458	653	729	828	844	887	973	1070	1154	1237
ACTUAL	458	653	729	828	866					

MAC MOL MANPOWER
ACTUALS VS FORECAST
FY67



	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
FORECAST	1074	1119	1303	1588	2074	2630	2769	2908	3046	3231
ACTUAL	1074	1119	1303	1588	1834					

BLUE BOOK BUDGET

	FY67	FY68	FY69	FY70	FY71	TOTAL
LV	118.3	240.0	265.0	145.3	44.6	813.2
MM	31.0	80.0	80.0	40.0	8.8	239.8
EXP	55.0	70.9	87.7	44.3	23.4	281.3
GEM 'B'	35.0	70.7	76.1	48.1	4.8	234.7
T-IIIM	35.0	105.0	120.0	50.0	24.7	334.7
OTHER	12.1	20.4	17.7	15.8	10.4	76.0
TOTAL	286.4	587.0	646.5	343.5	116.7	1979.7

MOL

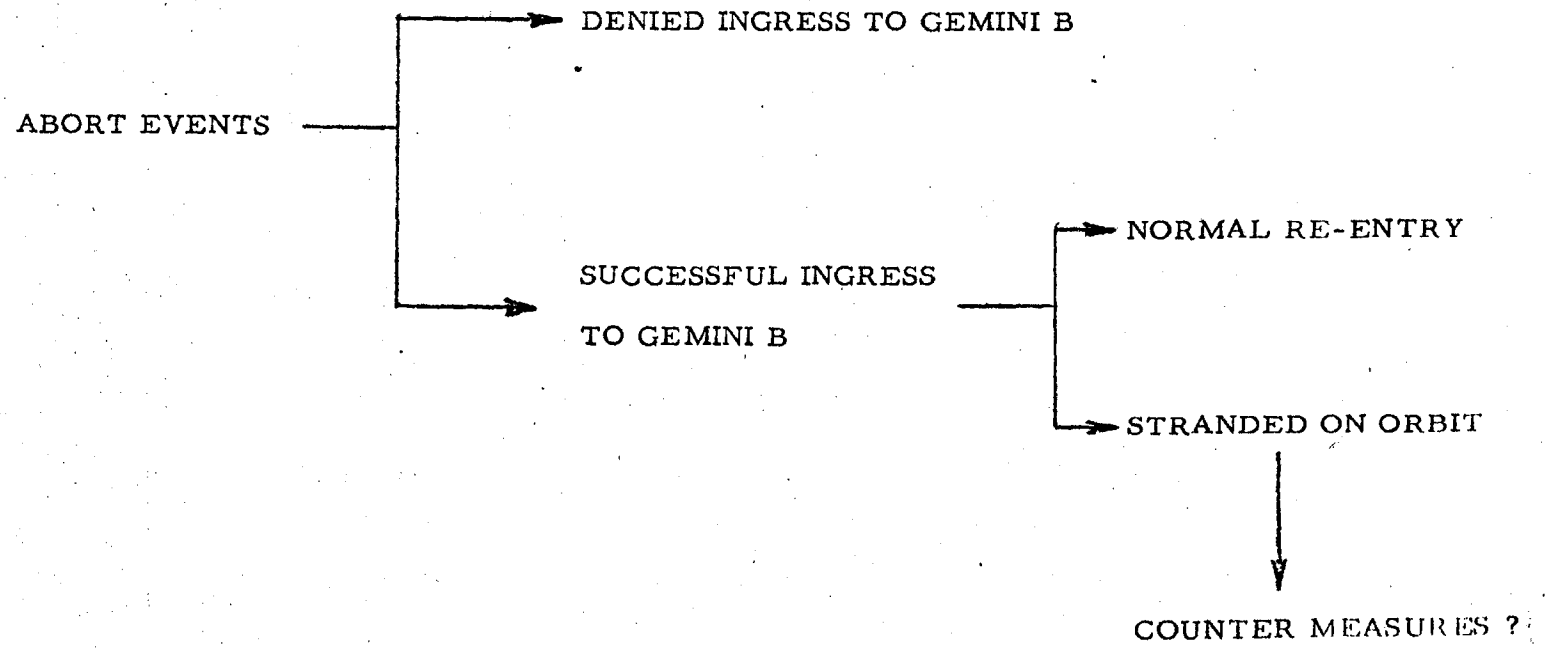
FUNDING REQUIREMENTS FOR 9 MO. SLIP

	FY 67	FY 68	FY 69	FY 70	FY 71	FY 72	TOTAL
REQUIRED	285.8	626.0	603.8	412.3	205.9	70.9	2204.7
AVAILABLE	286.4	500.0	600.0				

ORBIT PHASE RESCUE/ESCAPE CONSIDERATIONS FOR THE MOL

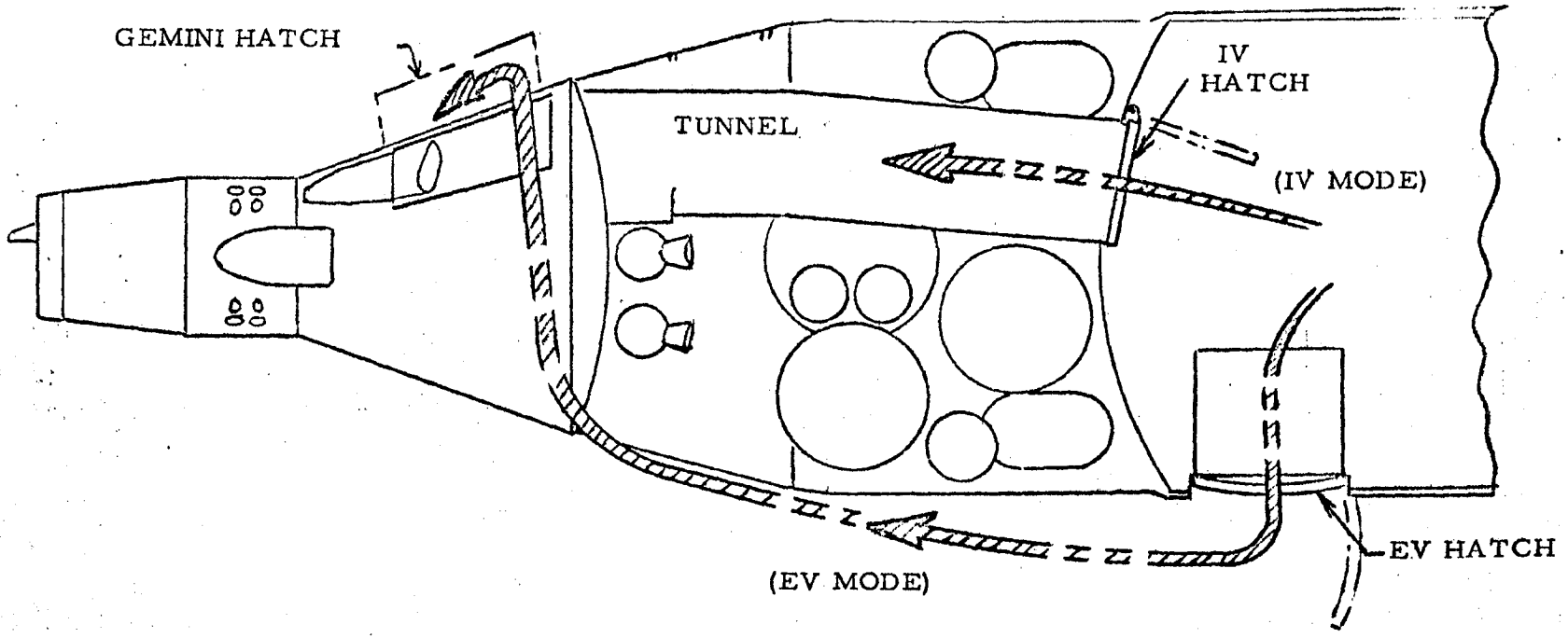
- RESPONSE TO HOUSE COMMITTEE ON SCIENCE & ASTRONAUTICS QUESTIONNAIRE: "SPACE FLIGHT EMERGENCIES"
  - ✓ ESTIMATE CREW ORBITAL STRANDING RISK
  - ✓ REVIEW EFFECTIVENESS OF POSSIBLE COUNTERMEASURES

APPROACH TO ON-ORBIT STRANDING ESTIMATE



ACCESS ROUTE PROBABILITIES

(LABORATORY TO GEMINI B)



INTRA-VEHICULAR MODE (IV)

EVENT	PROBABILITY*
⊙ HATCH INOPERATIVE	3.0×10^{-6}
⊙ CRUSHED TUNNEL	$.3 \times 10^{-6}$

EXTRA-VEHICULAR MODE (EV)

EVENT	PROBABILITY*
● DRV TUBE HATCH INOPERATIVE	3.0×10^{-6}
● PRESSURE SUIT ASSEMBLY INOPERATIVE	$.03 \times 10^{-6}$
● GEMINI B HATCH INOPERATIVE (OPEN)	6×10^{-6}

* PROBABILITY OF OCCURRENCE FOR 30 DAY IN-ORBIT

PROBABILITY OF DENIED INGRESS TO GEMINI B

ABORT FAILURE OR HAZARD	COMPARTMENT LOCATION OF FAILURE/HAZARD	PATH OF INGRESS TO GEM. B	PROBABILITY OF DENIED INGRESS TO GEM. B
FIRE	U.C.	I.V. WITH E.V. BACKUP	50×10^{-12}
		E.V. IF TUNNEL DAMAGE	15×10^{-6}
	P.C.	I.V. ONLY	3×10^{-6}
EXPLOSION	U.C.	CRUSHED TUNNEL, USE E.V.	15×10^{-6}
	P.C.	I.V.	3×10^{-6}
DEPRESSURIZATION	P.C.	GENERALLY I.V. WITH E.V. BACKUP	50×10^{-12}
NOXIOUS GASES	P.C.	I.V. OR E.V.	50×10^{-12}
SUBSYSTEM ANOMOLIES	U.C.	I.V. OR E.V. DEPENDING ON EFFECT ON SYSTEM (POWER LOSS, 0_2 LOSS)	15×10^{-6} TO 50×10^{-12}
	P.C.	I.V. OR E.V. DEPENDING ON EFFECT ON SYSTEM	

PROBABILITY OF DENIED INGRESS TO GEMINI B IS VERY REMOTE

POSSIBLE CAUSES OF FAILURE OF GEMINI B TO INITIATE NORMAL RE-ENTRY

SYSTEM	TYPE OF EVENT (RE-ENTRY PRECLUDING FAILURES)	PROBABILITY OF OCCURRENCE FOR 30 DAYS IN-ORBIT
GUIDANCE & CONTROL	HAND CONTROLLER INOPERATIVE OR FAILURE IN BOTH DIRECT AND RATE COMMAND MODE.	0.001×10^{-5}
PROPULSION	LEAKAGE OF BOTH RCS RINGS OR BURST OF PRESSURE TANK DAMAGING BOTH RINGS.	9.686×10^{-5}
	SHORT OR OPEN CIRCUIT - BOTH RINGS INOPERATIVE. FAILURE OF MORE THAN FOUR RETRO-ROCKETS	0.200×10^{-5}
ENVIRON. CONTROL SYSTEM	BURSTING OF 0_2 TANKS CAUSING 0_2 LOSS OR RETRO-ROCKET DAMAGE	7.200×10^{-5}
ELECTRICAL POWER	SHORT TO GROUND OF COMMON BUS CAUSING LOSS OF ALL FUNCTIONS. MULTIPLE BATTERY LOSS.	7.475×10^{-5}
CREW TRANSFER (I.V.)	HEAT SHIELD/PRESSURE HATCH FAILURE OR FAILURE TO SEPARATE GEMINI FROM LAB	0.400×10^{-5}
	TOTAL PROBABILITY OF A GEMINI B EQUIPMENT FAILURE WHICH WOULD PRECLUDE INITIATION OF RE-ENTRY	24.962×10^{-5}

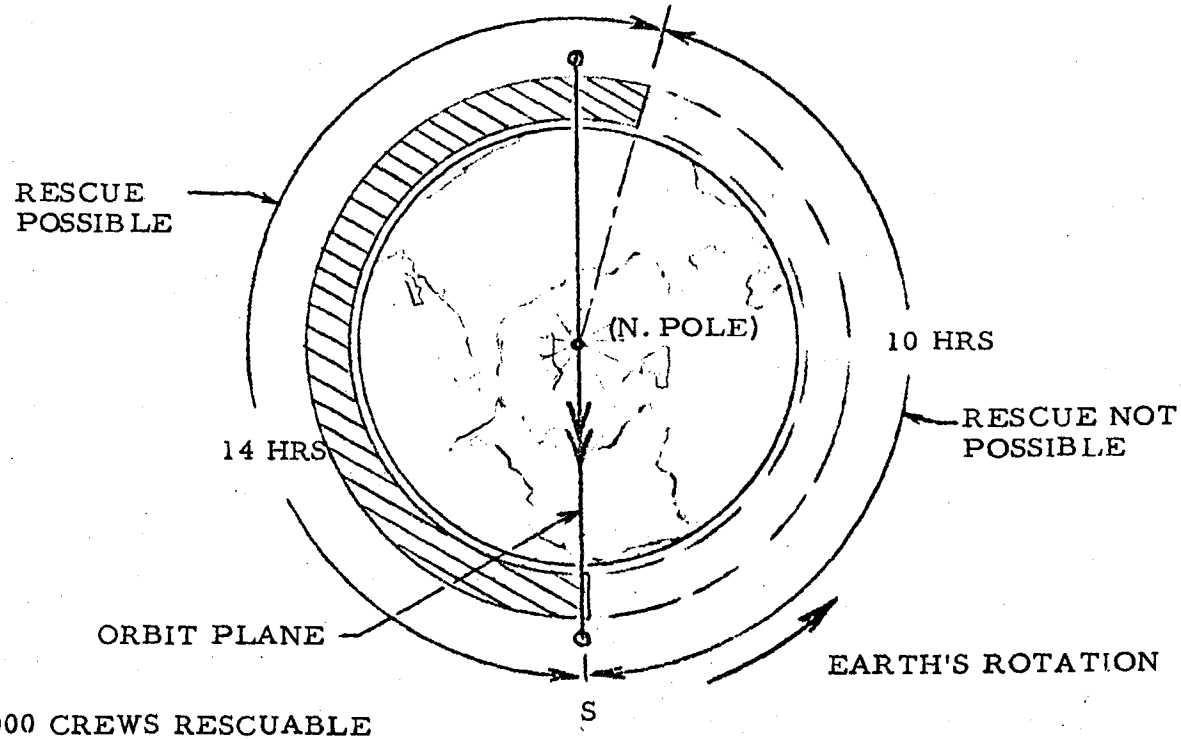
~2 1/2 per 10,000 missions

PROBABLE RESCUE OR ESCAPE ESTIMATE SUMMARY

	EVENT	PROBABLE EVENTS PER 10,000 MISSIONS
❶	OCCURRENCE PRECLUDING INGRESS TO GEMINI B FROM LAB	MUCH LESS THAN 1
❷	OCCURRENCE PRECLUDING RE-ENTRY OF GEMINI B	AT MOST 3
❸	ESTIMATED EVENTS PRECLUDING RESCUE OR ESCAPE (CREW FATALTIES, VEHICLE DYNAMICS)	AT LEAST 1
❹	ESTIMATED RESCUE OR ESCAPE OPPORTUNITIES	AT MOST 2

EARTH BASED RESCUE CONSIDERATIONS

- WITH NO CONSTRAINTS ON GEMINI B OR LAUNCH VEHICLE CAPABILITY
  - √ SYSTEM USED TWICE IN 10,000 MISSIONS
- CURRENT GEMINI B LOITER AND LAUNCH VEHICLE PAYLOAD CONSTRAINTS FURTHER REDUCE EFFECTIVENESS.



< 1/10,000 CREWS RESCUABLE

ON-BOARD ESCAPE SYSTEM CONSIDERATIONS

- TECHNOLOGY GENERALLY AVAILABLE
- SYSTEM COMPATIBILITY REQUIRES EARLY DESIGN INTEGRATION
  (TOTAL SYSTEM DESIGN)
- LIMITED UTILITY, CONSIDERING ALL CAUSES OF ORBITAL STRANDING
  (DEVICES DISABLED OR NOT AVAILABLE)
- RE-ENTRY, RECOVERY, RETRIEVAL HAZARDS.
  (UNSOPHISTICATED SUBSYSTEMS, LARGE DISPERSIONS)

COMPARISON OF ORBITAL STRANDING RISK WITH

RISKS OF SOME FAMILIAR ACTIVITIES

ACTIVITY	100,000 MAN DAYS
❶ DOMESTIC PASSENGER AIR CARRIERS	4.0
❷ ESTIMATED MOL CREW STRANDING	.7
❸ ACCIDENT FATALITY RATE, U.S. POPULATION	.2

SUMMARY

MOL BASELINE PROGRAM ORBITAL RESCUE/ESCAPE

- MOL SYSTEM DEVELOPMENT APPROACH
  - ✓ RELIABILITY
  - ✓ BLOCK AND FUNCTIONAL REDUNDANCY
  - ✓ TESTING
  - ✓ SYSTEMS MONITORING
  - ✓ EMERGENCY PROCEEDURES AND TRAINING
- REMOTE POSSIBILITY OF ORBITAL STRANDING (.9998 PER MISSION)

NO SUBSTANTIAL REQUIREMENT FOR RESCUE OR ESCAPE SYSTEMS IN THE MOL DEVELOPMENT PROGRAM.

FOLLOW-ON PROGRAM CONSIDERATIONS

- MOL MAY HAVE RENDEZVOUS/RESUPPLY CAPABILITY IN EARLY SEVENTIES -
- NASA AAP PLANS RENDEZVOUS/RESUPPLY OPERATIONS STARTING IN LATE SIXTIES -
- ELEMENTS OF THESE TWO SYSTEMS MIGHT BE COMBINED TO PERMIT AN EARLY SPACE RESCUE SYSTEM

5 Feb 1967
WFS-115
Cy 1 of 1
Sheets: 17

ACTIVE TARGET SIMULATION
VALIDATION EXPERIMENT

Handle via BYEMAN
Control System

BACKGROUND

⊙ 5 JANUARY 1967 SIMULATION PRESENTATION

- MAINSTREAM OF SIMULATION TO UTILIZE TWO-DIMENSIONAL STIMULUS MATERIAL OBTAINED FROM G/G^3 FLIGHTS
- USE OF AIRCRAFT, 3-D MODELS NOT ADVOCATED AS A PART OF MAINSTREAM SIMULATION
  - ∞ STIMULUS REALISM
  - ∞ SCALING PROBLEMS
  - ∞ SAMPLE SIZE
  - ∞ FACILITY REQUIREMENTS
  - ∞ COST & SCHEDULES

⊙ QUESTION POSED

- CAN A LIMITED AIRCRAFT SIMULATION BE PERFORMED TO VALIDATE THE MAINSTREAM 2-D SIMULATION?
  - ∞ TARGET CONTRAST
  - ∞ RESOLUTION LIMITS OF 2-D STIMULUS
  - ∞ EFFECTS OF COLOR
    ETC.

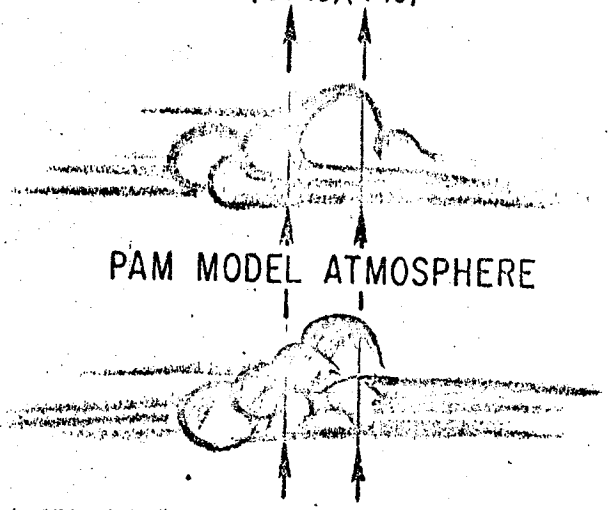
BRIEFING OUTLINE

- PRESENT APPROACH TO SIMULATION FIDELITY
  - CONTRAST SETTING
- OTHER RELATED ACTIVITIES
  - SCENE CONTRAST
- LIMITED AIRCRAFT VALIDATION PROGRAM
  - ANALYSIS
  - RECOMMENDATION

CONTRAST

PREDICTED BRIGHTNESS

(37%)(4%)



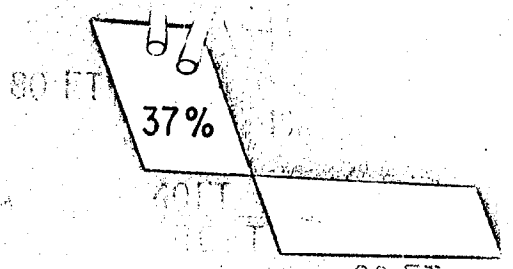
PAM MODEL ATMOSPHERE

CONTRAST

BYE-66[illegible]-67

(37%)(4%) DENSITY OF NEGATIVE

MEASURED BRIGHTNESS [illegible] (37%)(4%)
PHOTOMETER CAMERA



Handle Via BYEMAN
Control System

D G ~~SECRET~~ SPECIAL HANDLING

(D, G) ~~SECRET~~ SPECIAL HANDLING

SIMULATOR ILLUMINATION/CONTRAST PARAMETERS

ILLUMINATION LEVEL ≈ 3 TO 25 FT LAMBERTS

CONTRAST CALIBRATION (37%/4% TARGETS)

TARGET NO.	BRIGHTNESS RATIO						
	GROUND		ORBITAL			SIMULATOR	
	Photometer	Camera	PAM Predicted* (Photometer Input)	"G" Camera Contractor	"G" Camera SPPF	Primary	Secondary
1	6.2	7.8	3.1	2.4	3.0	1.8	2.5
2	6.0	8.2	3.1	2.8	3.1	1.6	1.8
3	6.9	10.7	3.4	2.7	2.8	2.7	2.9
4	---	16.6	---	2.5	2.7	2.0	2.6
AVAILABLE DATA POINTS							
	11	41	11	45	77	15	15

* CONSIDERS ONLY VERY LIGHT HAZE

Handle via BYEMAN Control System

PREVIOUS STUDIES/PROGRAMS

- PROJECT BLACKBIRD
  - SIMULTANEOUS AIRCRAFT AND GAMBIT PHOTOS OF ZI SCENES
- BALLOON PROGRAM
- TERRAIN RADIANCE EXPERIMENT
- NEUTRALLY PROCESSED GAMBIT MATERIAL

Handle via BYEMAN
Control System

AIRCRAFT SIMULATION PHILOSOPHY

- LIMITED PROGRAM ORIENTED TO INSURING REALISTIC GROUND SIMULATION
- CAPABLE OF BEING PERFORMED IN REASONABLE TIME COMPATIBLE WITH GROUND SIMULATION PROGRAM SCHEDULE
- MINIMUM IMPACT ON GROUND SIMULATION EQUIPMENT/PROGRAM SCHEDULES

Handle via BYEMAN Control System

POSSIBLE COMPONENTS OF AIRCRAFT SIMULATION

PART I

O OBJECTIVE

TO OBTAIN PHOTOMETRIC MEASUREMENTS FROM AN AIRCRAFT TO BE USED IN SETTING THE HAZE LEVELS IN THE GROUND SIMULATOR

O APPROACH

- SIMULTANEOUS AIRCRAFT PHOTOMETRIC MEASUREMENTS AND PHOTOS (BLACK/WHITE AND COLOR)
- PHOTOS PROCESSED LIKE G/G^3
- PHOTOS DISPLAYED IN SIMULATOR
- REQUIRE: SIMULATOR CONTRAST = MEASURED CONTRAST

O EQUIPMENT REQUIREMENTS

- AIRCRAFT, TELESCOPE, PHOTOMETER, CAMERA, RECORDERS

POSSIBLE COMPONENTS OF AIRCRAFT SIMULATION (CONT'D)

PART II

- OBJECTIVE

  TO COMPARE AIRCRAFT AND G/G^3 VIEWING CONDITIONS

- APPROACH

  - SIMULTANEOUS AIRCRAFT AND SATELLITE PHOTOS OF SAME ZI SCENE
  - PROCESS PHOTOS IDENTICALLY
  - COMPARE CONTRAST RATIOS/BRIGHTNESS

- EQUIPMENT REQUIREMENTS

  - PART I EQUIPMENTS SUFFICIENT

POSSIBLE COMPONENTS OF AIRCRAFT SIMULATION (CONCL'D)

PART III

- OBJECTIVE

  TO COMPARE HUMAN PERFORMANCE IN AN AIRCRAFT WITH THAT OBTAINED BY GROUND SIMULATION

- APPROACHES

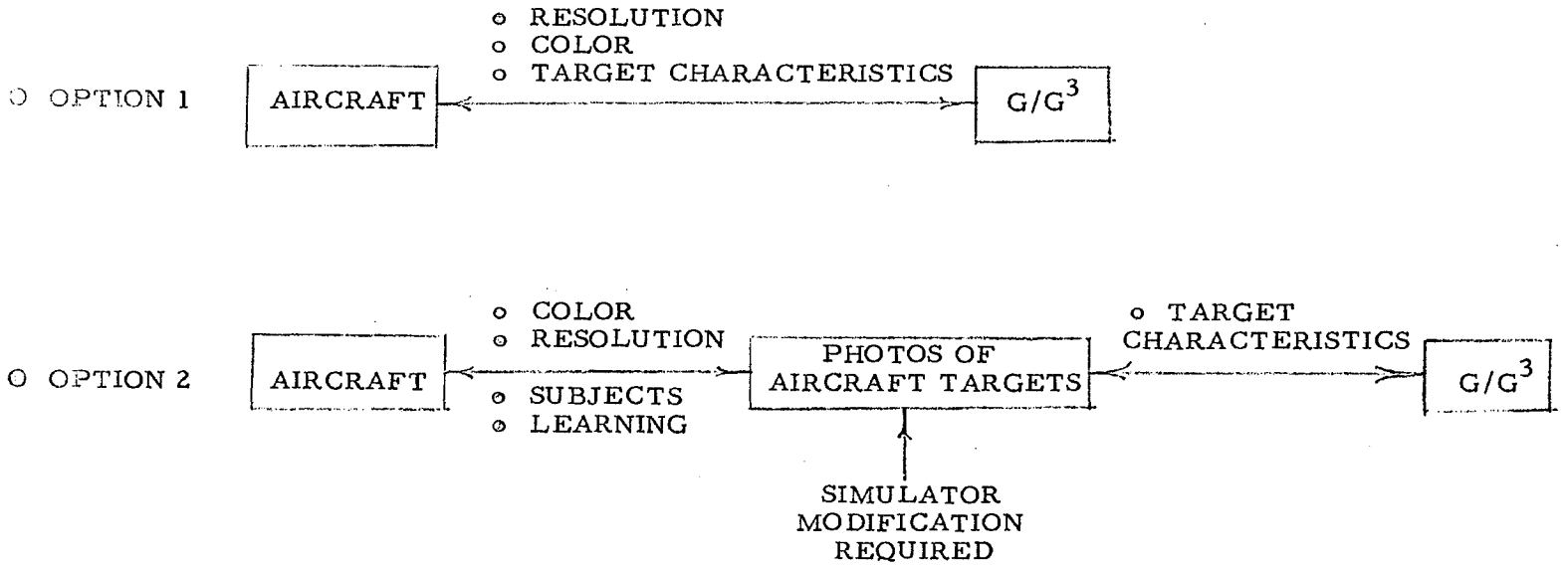
  - COMPARE AIRCRAFT PERFORMANCE WITH PERFORMANCE IN SIMULATOR USING G/G^3 STIMULUS
    - AIRCRAFT PHOTOS FOR AIRCRAFT PERFORMANCE SCORING ONLY
  - COMPARE AIRCRAFT PERFORMANCE WITH SIMULATOR PERFORMANCE AGAINST G/G^3 QUALITY PHOTOS OF SAME SCENES
    - AIRCRAFT PHOTOS PROCESSED LIKE G/G^3 AND OF SAME LIMIT RESOLUTION

- EQUIPMENT

  - PART I REQUIREMENTS PLUS POSSIBLY AN ADDITIONAL TELESCOPE
  - REQUIRES SIGNIFICANT ASTRONAUT PARTICIPATION

[illegible] DYEMAN
Control System

PART III ANALYSIS



BYE-

AIRCRAFT SIMULATION APPROACH SUMMARY

- PROGRAM OF SIMULTANEOUS PHOTOMETRIC MEASUREMENTS AND PHOTOGRAPHY FROM AIRCRAFT WOULD INSURE PRESENTATION OF SIMULATOR STIMULUS AT REALISTIC CONTRAST LEVELS
  - SIMULTANEOUS PHOTOGRAPHY BY SATELLITE (G OR G^3) WOULD BE DESIRABLE, THOUGH NOT MANDATORY

- DEVELOPMENT OF STATISTICS ON ACTIVE TARGET DETECTION CAPABILITIES FROM AIRCRAFT AND COMPARISON WITH SIMULATOR STATISTICS NOT A RECOMMENDED APPROACH FOR VALIDATION
  - CORRELATION OF AIRCRAFT STATISTICS WITH SIMULATOR DATA DIFFICULT AND QUESTIONABLE
  - TARGET TYPES/INDICATOR DEFINITION - SELECTION MORE CRITICAL
  - SIGNIFICANT IMPACT ON GE SIMULATOR DESIGN/SCHEDULE OF OPERATIONS

- USE OF TELESCOPE EQUIPPED AIRCRAFT MAY BE DESIRABLE AS A PART OF CREW INDOCTRINATION/TRAINING PROCEDURES

[illegible] BYEMAN
Control System

EQUIPMENT REQUIREMENTS

⊙ TELESCOPE

	ORBITAL	AIRCRAFT	AIRCRAFT
- ALTITUDE	480,000 FT.	30,000 FT.	40,000 FT.
- GROUND SPEED	25,000 FPS	400 FPS	400 FPS
- MAGNIFICATION	60-120X	3.75-7.5X	5-10X
- FOV	1°-.5°	16°-8°	12°-6°
- IMAGE DRIFT	.025°/SEC (1% V/H)	.05°/SEC (100% V/H)	.0375°/SEC (100% V/H)

⊙ PHOTOMETER

- 50-5000 FT-LAMBERT SOURCES
- 10-20 FT MINIMUM GROUND TARGET DIMENSION

⊙ CAMERA

- FOV - 10-20°
- LIMIT RESOLUTION - [redacted]

⊙ AIRCRAFT

- 30,000-40,000 FEET ALTITUDE
- KC-135, C-130 WOULD SUFFICE

Handle via BYEMAN
Control System

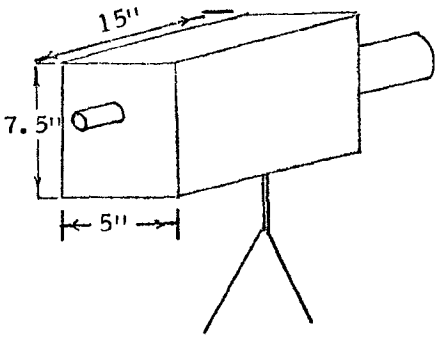
REPRESENTATIVE TELEPHOTOMETER

- GAMMA SCIENTIFIC MODEL 2000

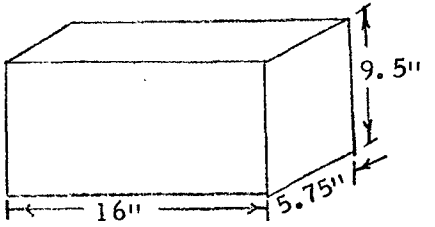
BYE-6[illegible]

- CHARACTERISTICS
  - SENSITIVE APERTURE OF 2 MIN - 3 DEGREES REAL FIELD WITH 5-15X MAGNIFICATION
  - MAXIMUM FULL-SCALE SENSITIVITY OF .3 TO $3X10^{-5}$ FT-LAMBERTS; ACCURACY 4% FULL SCALE
  - 3:1 EYEPIECE ZOOM, INTERCHANGEABLE OBJECTIVE LENSES
  - 45° APPARENT FIELD
  - COST ~ $3000

- CONFIGURATION



OPTICAL HEAD



CONTROL UNIT

Handle via BYEMAN Control System

BYE-68

CONCLUSIONS/RECOMMENDATION

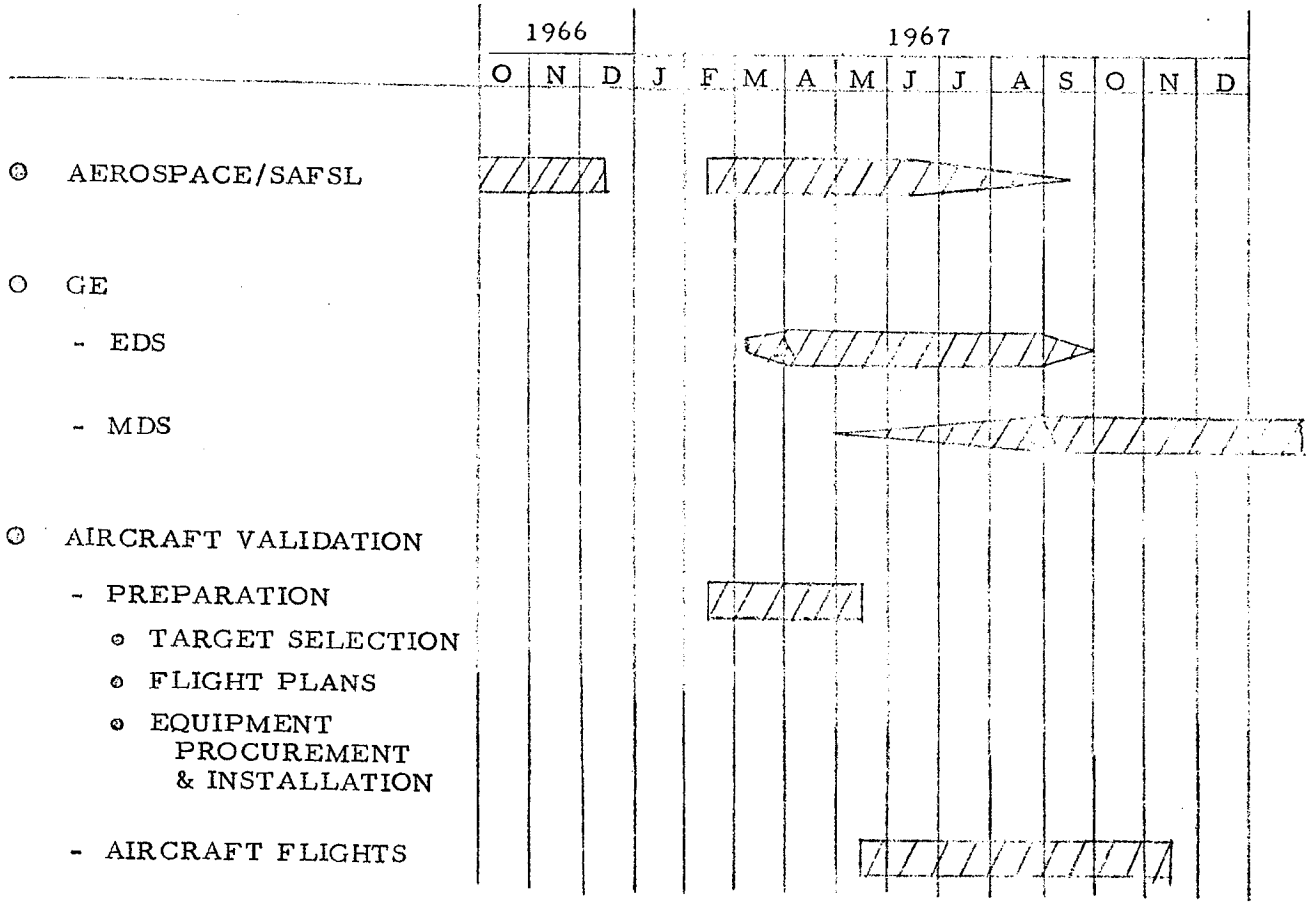
- ANALYSES INDICATE PRESENT APPROACH TO SIMULATOR CONTRAST SETTINGS REALISTIC, SOMEWHAT CONSERVATIVE

- PROGRAM INCLUDING PHOTOMETRIC MEASUREMENTS AND PHOTOGRAPHY FROM AIRCRAFT COULD INCREASE OUR CONFIDENCE IN THE GROUND SIMULATOR CONTRAST FIDELITY--BUT NOT SIGNIFICANTLY

- RECOMMEND THAT AIRCRAFT SIMULATION-VALIDATION PROGRAM NOT BE UNDERTAKEN

Handle via BYEMAN Control System

SCHEDULE



REPRESENTATIVE AIRCRAFT CAMERA

HR-262 CAMERA
(KS-72A)

O SPECIFICATIONS

- LENS	18" FOCAL LENGTH, f/5.6 12" FOCAL LENGTH, f/4.0 6" FOCAL LENGTH, f/4.5 3" FOCAL LENGTH, f/4.5
- FORMAT	4.5" X 4.5"
- SHUTTER	FOCAL PLANE DAY, 1/1000 TO 1/3000 INTRA-LENS NIGHT, 1/25, 1/50, 1/100
- IMC	MOVING FILM
- RESOLUTION	85 1/mm AWAR, 18" LENS, PLUS-X FILM
- CYCLE	6 CYCLES PER SEC MAX
- FILM	500', 250' WITH PROCESSING
- WEIGHT	70 LBS WITH FILM & 18" LENS
- DATA	ALPHA NUMERIC FROM AIRCRAFT
- POWER	28VDC, 200 WATTS

Handle via BYEMAN
Control System

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SSS-353
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14 Pages

BYE-68[illegible]-67

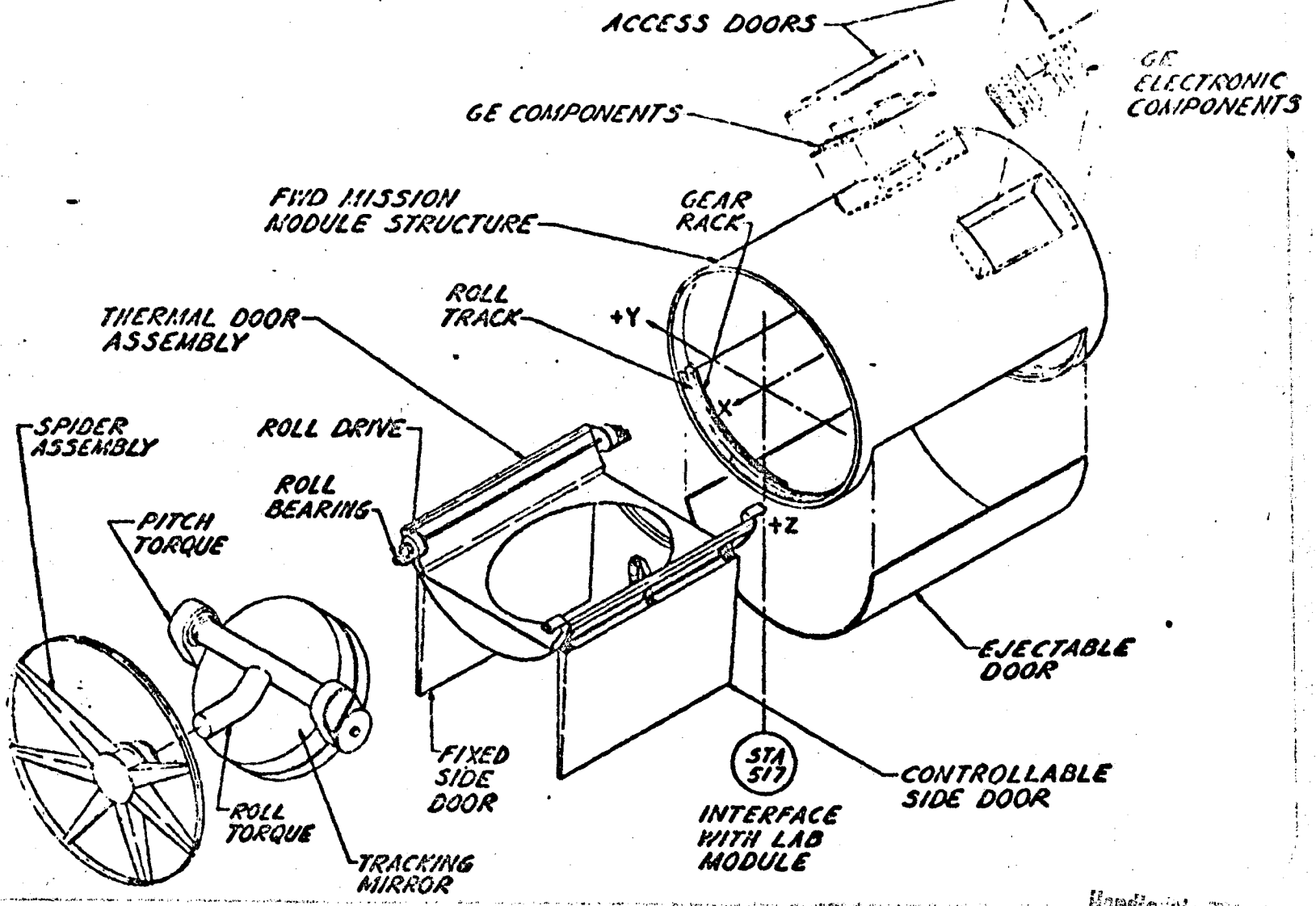
STATUS OF MISSION MODULE DOOR

5 FEBRUARY 1967

~~SECRET~~ SPECIAL HANDLING

MISSION MODULE
FORWARD STRUCTURE ASSEMBLY

BYE-68[illegible]-67



Handle Via BYEMAN
Control System

10 JANUARY TECHNICAL REVIEW

- EASTMAN KODAK
  - LOUVERS FEASIBLE
  - 3 PERCENT OBSCURATION
  - APPROXIMATELY 80 POUNDS WEIGHT INCREASE
  - UP TO 3 MONTHS SCHEDULE

- GENERAL ELECTRIC
  - SLIDING MASK INSIDE MISSION MODULE STRUCTURE
  - INTERFERED WITH AGREED-TO SPACE ENVELOPES
  - SOME SCHEDULE SLIP

- DOUGLAS AIRCRAFT COMPANY
  - SLIDING MASK EXTERNAL TO MISSION MODULE

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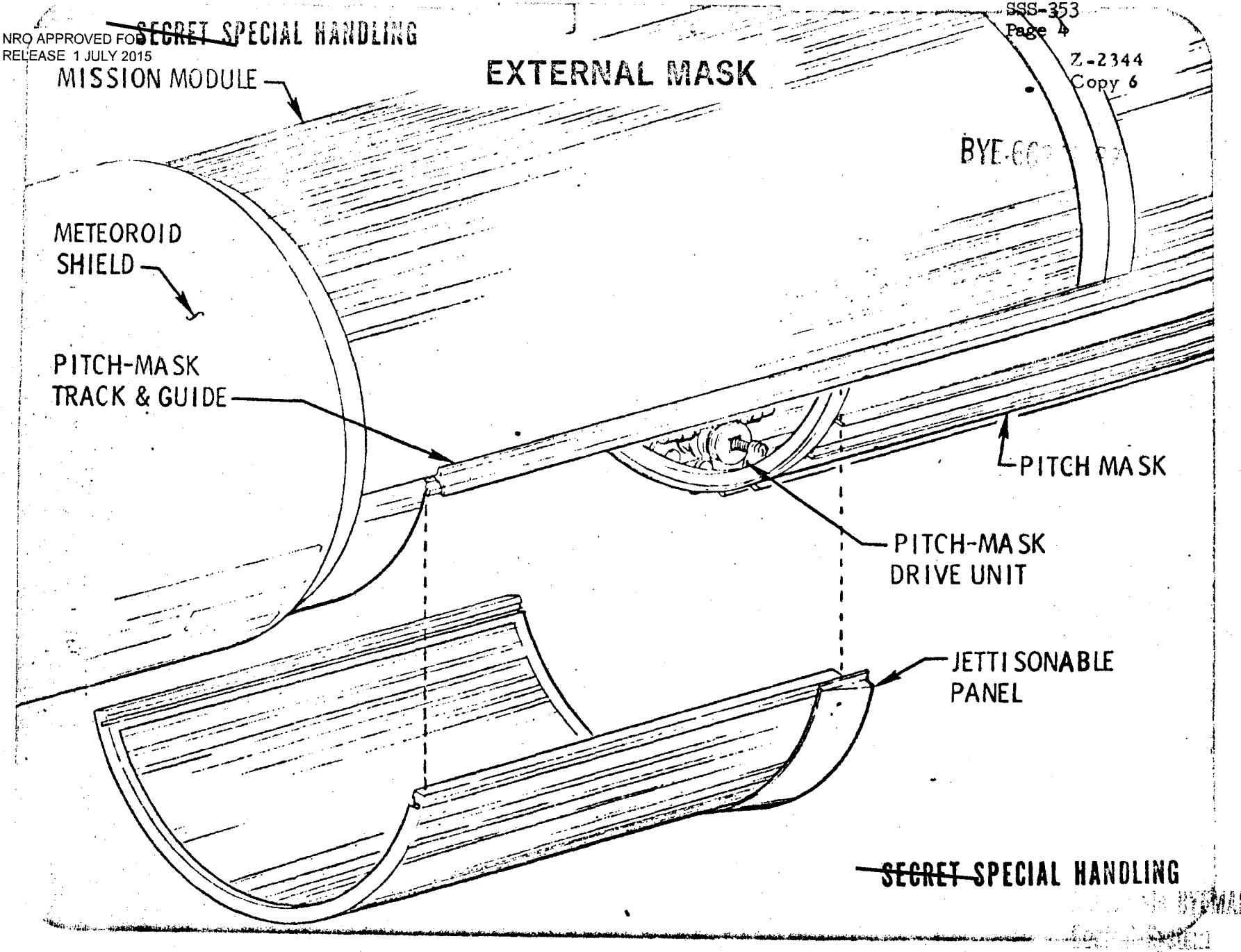
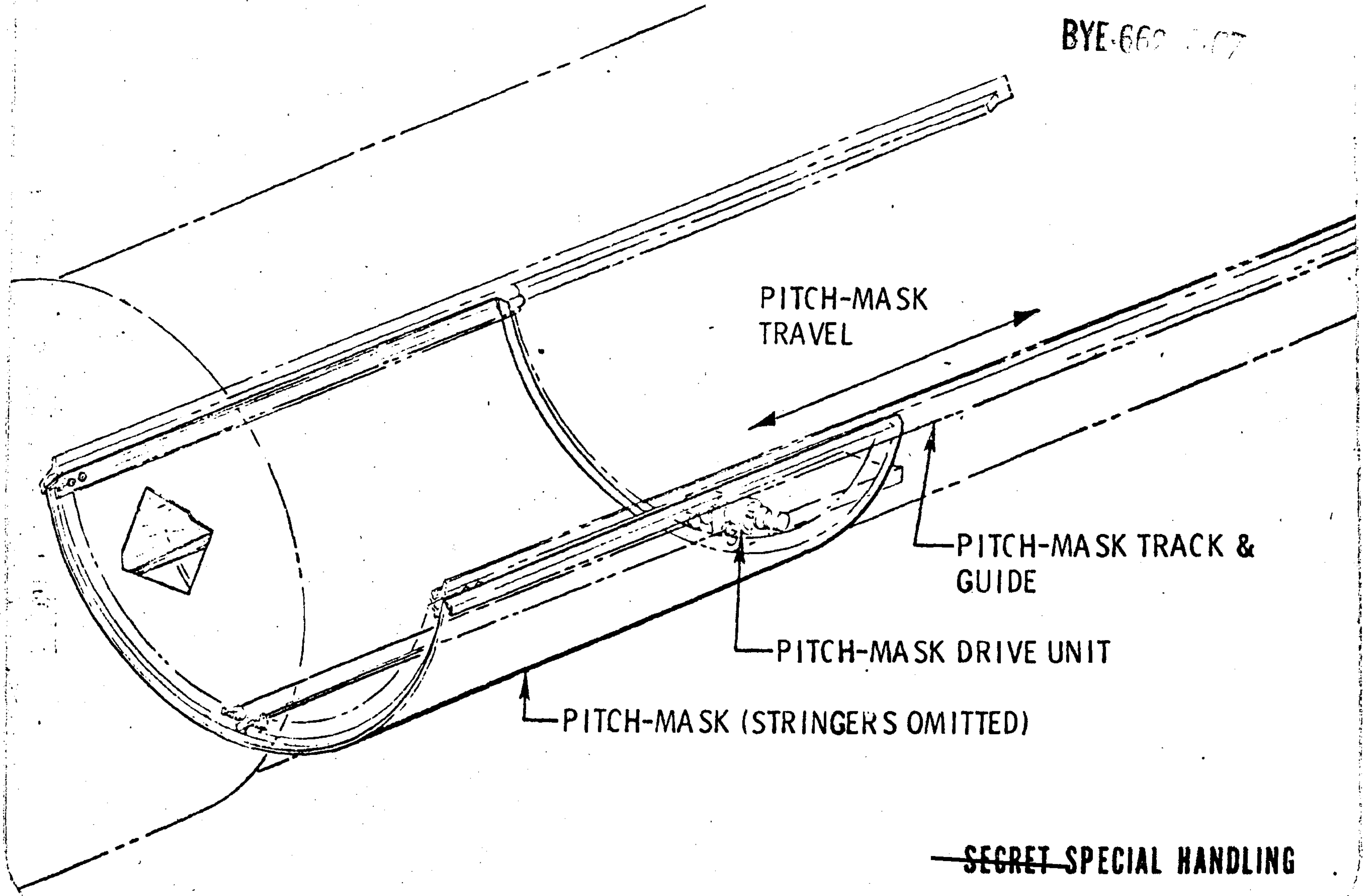
EXTERNAL MASK



~~SECRET SPECIAL HANDLING~~

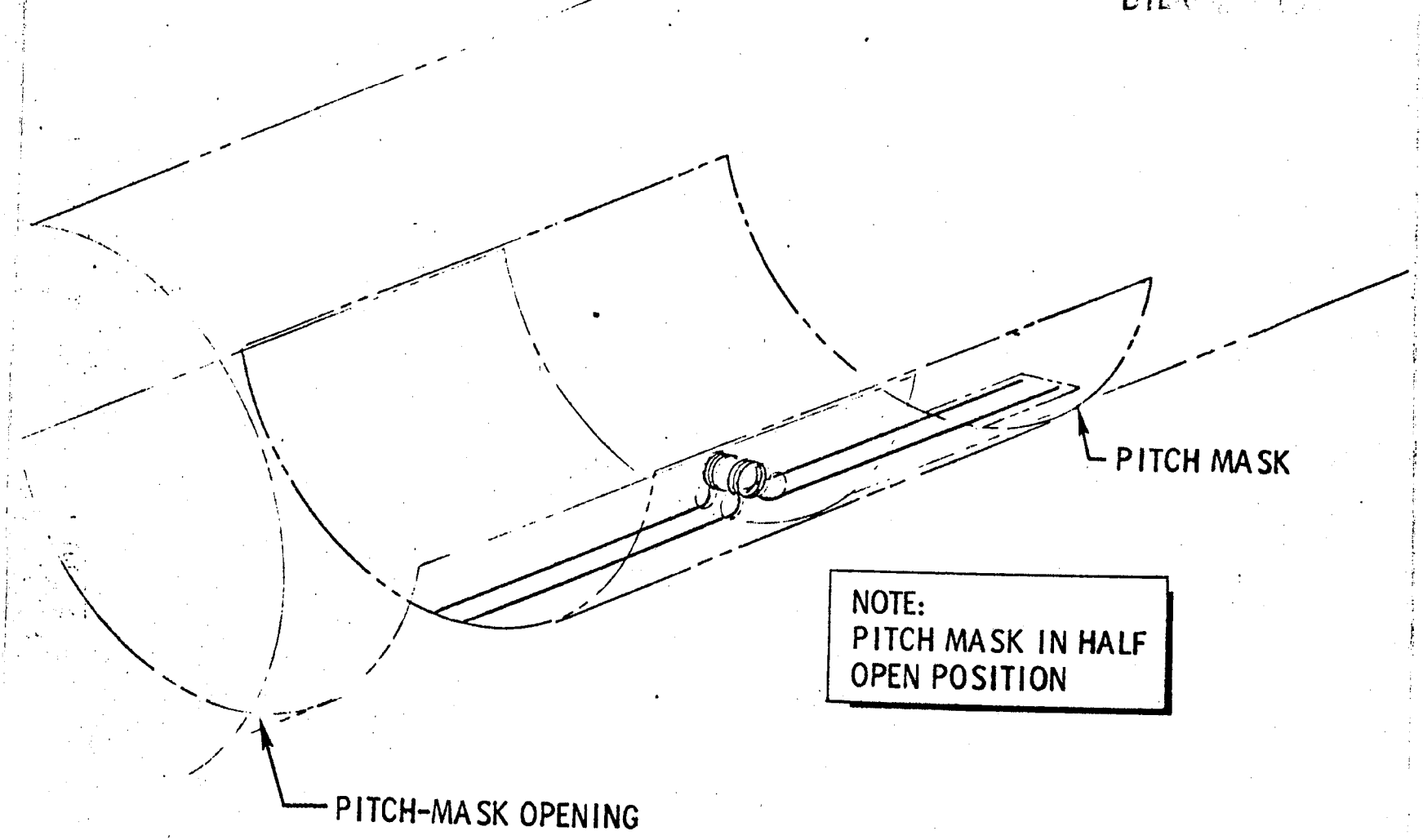
PITCH MASK
(EXTERNAL CONFIGURATION)

BYE-66[illegible]



EXTERNAL PITCH MASK SCHEMATIC-CABLE NETWORK
(AUTOMATIC REDUNDANT SYSTEM)

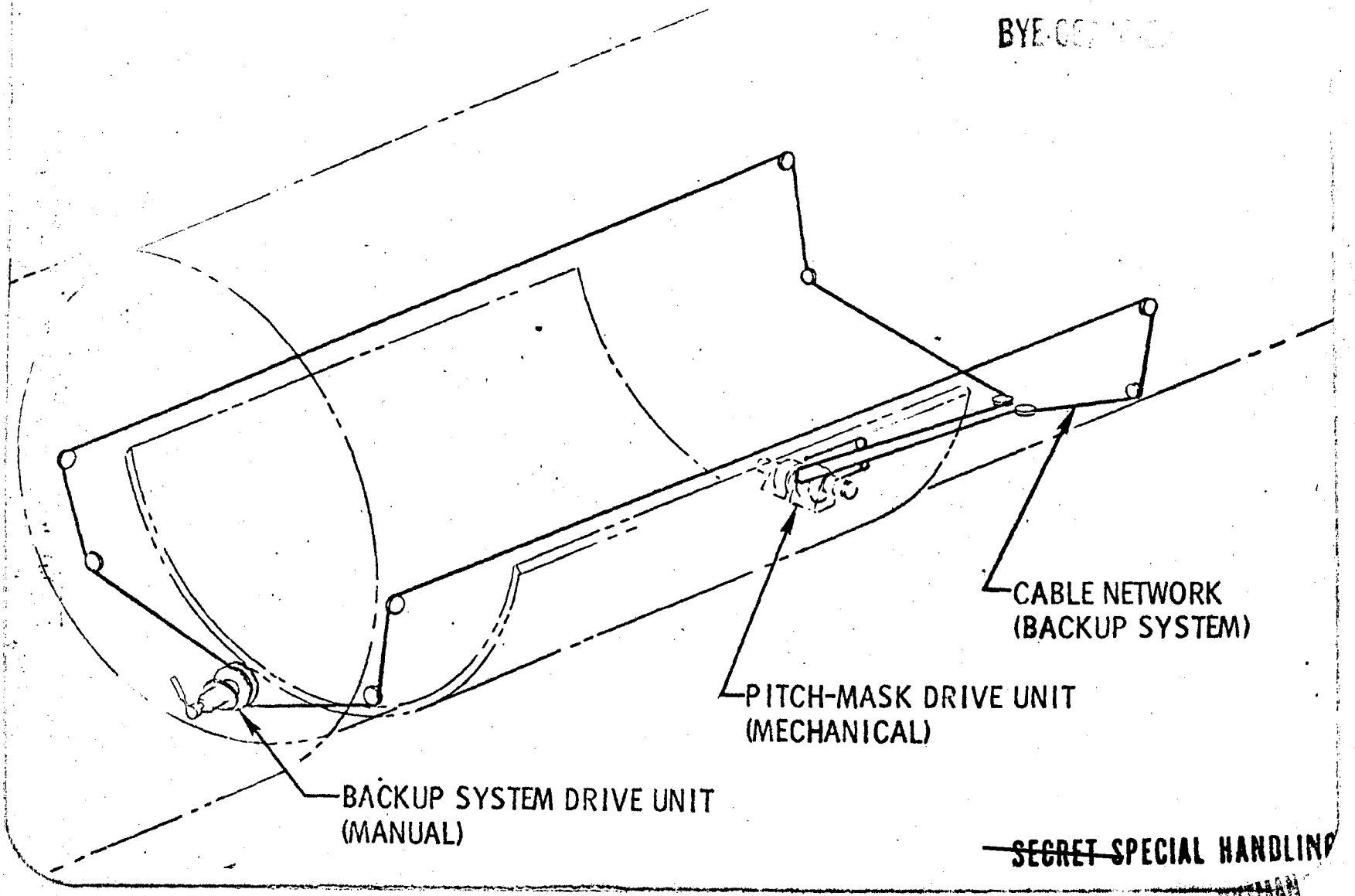
BYE-[illegible]



NOTE:
PITCH MASK IN HALF OPEN POSITION

PITCH MASK BACK UP CABLE SYSTEM

(INTERNAL & EXTERNAL CONFIGURATIONS)



DOOR CONFIGURATION WEIGHTS COMPARISON

	GE PHASE II ROLLING DOOR (LB)	DAC EXTERNAL SLIDING MASK (LB)
STRUCTURE (TRACK & SUPPT; RACK ASSY; ASCENT LOCKOUT DEV.; FAIRING, STRUCT. PROV.)	52.0	31.0
MASK (DOOR) (PRIMARY STRUCTURE - SKIN, STRINGERS, ATTACH; INSULATION AND HEATERS)	107.0	83.0
MECHANICAL (ROLLERS; DRIVE + ATTACH., MANUAL BACKUP)	54.0	25.0
ELECTRICAL (CONTROL, LOGIC, ASSY, INVERTERS, WIRES, CIRCUITRY & DISPLAYS)	15.0	15.0
ORBITAL DOOR	77.0	----
DOOR ACTUATOR	16.5	----
DOOR D DRIVE	1.5	----
ROLL THERMAL SHIELD	65.0	----
CONTINGENCY (10%)	----	16.0
TOTAL	388.0	170.0

Control System

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SPO DIRECTION (10 JANUARY 1967)

REALIGN TRACKING MIRROR GIMBAL AXIS

INSTALL LOUVERS ON TRACKING MIRROR

GE TO PROVIDE EXTERNAL SLIDING DOOR

EK AND GE TO SUBMIT ECP'S

~~SECRET~~ SPECIAL HANDLING

~~SECRET~~ SPECIAL HANDLING

BYE-

STATUS

- o CERVIT
  - UNDERWAY

- o REALIGNMENT
  - UNDERWAY

- o LOUVERS
  - EK TO SUBMIT PROPOSAL 15 MARCH 1967

- o DOORS
  - GE STOPPED WORK ON PHASE II DOORS
  - PRELIMINARY DISCUSSIONS WITH DAC 24 JANUARY 1967
  - SPECIFICATIONS TO DAC 2 FEBRUARY 1967

TECHNICAL RECOMMENDATIONS

BYE-

- ALIGN MIRROR GIMBAL TO COA
- INSTITUTE EK LOUVER DESIGN
- INSTITUTE GE PITCH MASK DESIGN
- INSTITUTE ACTION REQUIRED TO ENSURE THAT CERVIT AND ULE ARE SUITABLE BACKUPS TO FUSED SILICA
- RE-DIRECT DAC TO PROVIDE SHORTENED STRUCTURAL BLOW-OFF DOOR

CERVIT

BYE-66[illegible]

- CONTRACTED WITH OWENS-ILLINOIS FOR ONE SATISFACTORY BLANK (20 POURS MAXIMUM)
  - FIRST CASTING 21 FEBRUARY 1967
  - 7 - 10 DAYS BETWEEN POURS

- PROJECTED SCHEDULE WITH OWENS-ILLINOIS CALLS FOR TEN TRACKING MIRRORS AND TEN PRIMARY MIRRORS OVER NEXT TWO YEARS

- FIRST SATISFACTORY BLANK TO MYNEL

- PERKIN-ELMER FACILITY NOT READY UNTIL OCTOBER '67

- INVESTIGATE OTHER POLISHING AND GRINDING FACILITIES

Handle via BYEMAN
Control System

SPECIAL HANDLING
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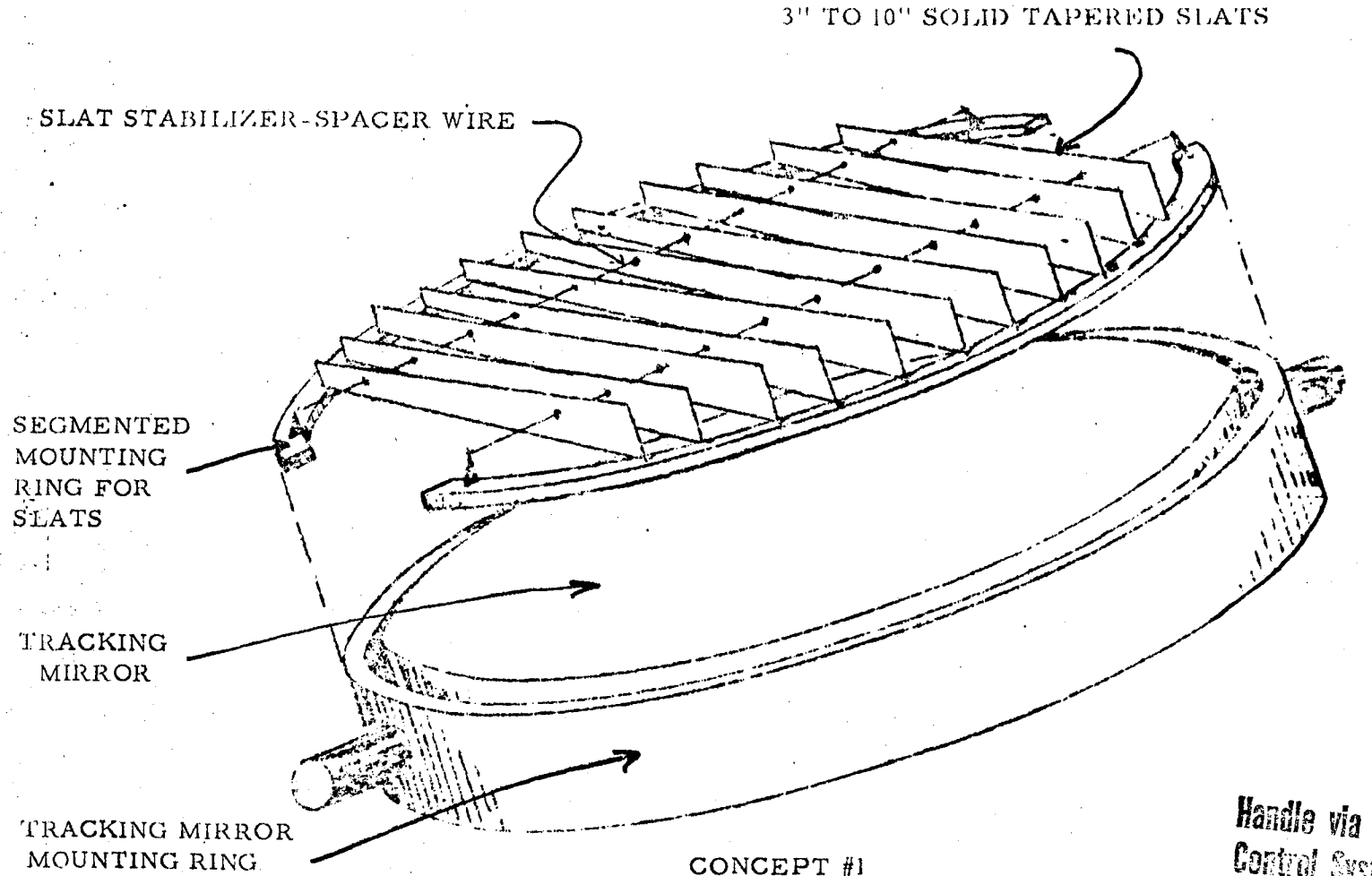
SLAT ASSEMBLY

SLAT CONCEPT: SOLID SLATS - SEGMENTED RING



CONCEPT #1
(BASELINE)

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Control System

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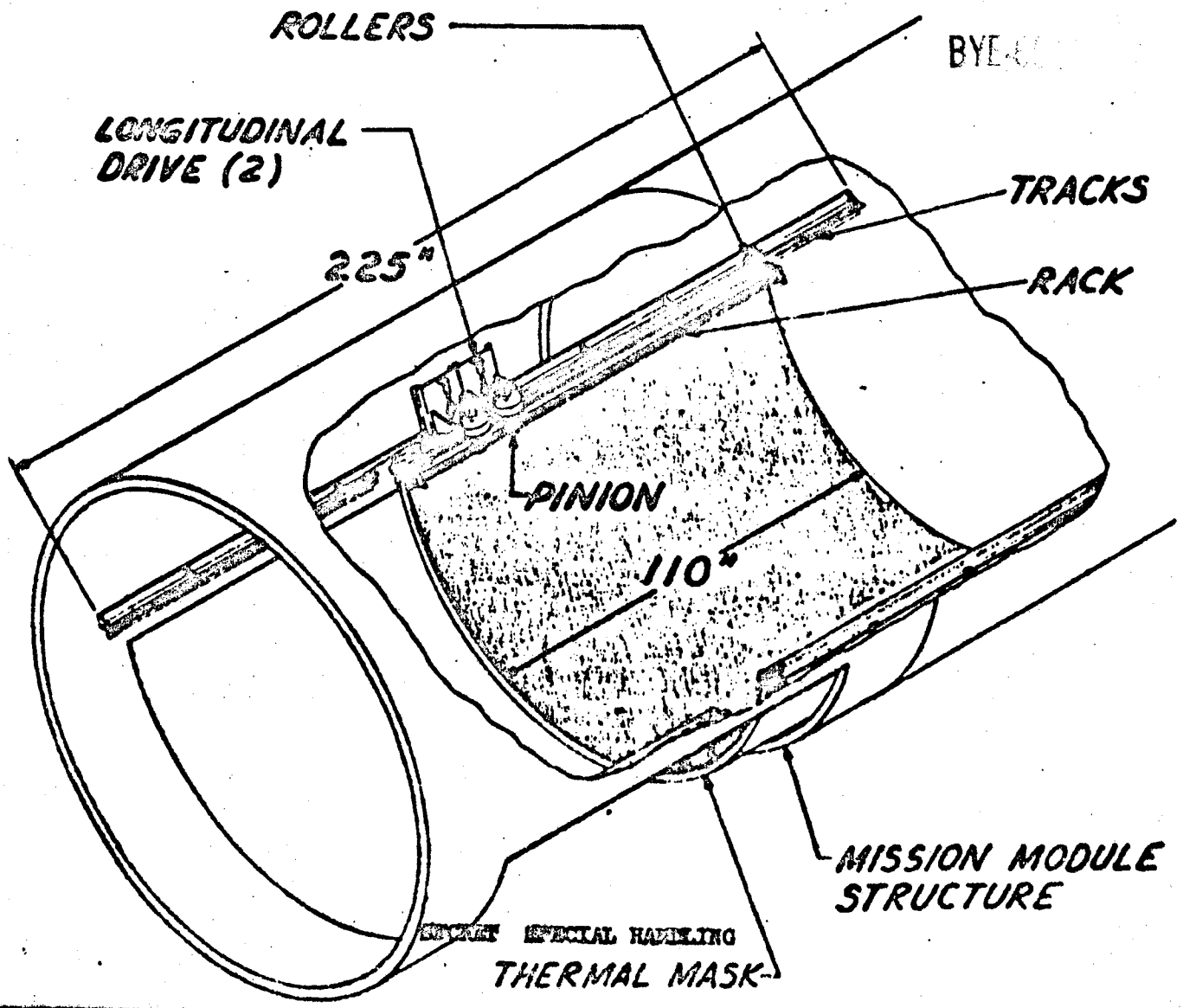
THERMAL MASK ASSEMBLY & INSTL



File No. L/C Hanson

8

MOL

HISTORY

- EARLY RECOGNITION OF POTENTIAL USE OF NASA EQUIPMENT
- NASA/MOL MEMO OF UNDERSTANDING - SCHRIEVER/MUELLER
- HST SUPPORT
- NASA GEMINI HARDWARE IDENTIFICATION

SERIES NO.

- MOL SPO/MSC TRANSFER AGREEMENT
  - / ST LOUIS AGE, FACTORY TEST EQUIPMENT, TOOLING
  - / KSC AGE, TEST EQUIPMENT
  - / VENDOR EQUIPMENT
  - / MOCKUPS, BOILERPLATES, STATIC ARTICLES
  - / GEMINI MISSION SIMULATORS
  - / RECOVERY EQUIPMENT
  - / FLOWN SPACECRAFT
  - / SPARES
- MOL SPO/MSC/MAC MEETINGS
- 64 POTENTIAL AGE CONFLICT ITEMS

SERIES NO.
1 2 3 4 5 6 0 1 2 3 4 5 6 7 8 9

STATUS

- 16 ACTUAL AGE CONFLICT ITEMS
- NEW PROCUREMENT COSTS
- TRANSFER AGREEMENT CONFLICT
- 4 LONG-LEAD PROCUREMENT ITEMS
- PRESENT ACTIONS
  - / AGE - COMPLETED
  - / AVE SPARES - OUTSTANDING

SERIES NO. 1 2 3 4 5 0 1 2 3 4 5 6 7 8 9

MOL

STATUS

	QUANTITY	COST	
CONFLICT ITEMS (KSC)			
TOOL KIT-OPTIC ALIGN	1*	$ 18.0K	
COLD TRAP	1	2.5	
CART-GOX	1	60.0	
KIT-GOX ANALYZER	1	5.0	
LEAK RATE TESTER-ECS (COOLANT SYSTEM)	1	22.0	
COMPUTER-MEMORY LOADER	1	188.0	
CALIBRATION KIT-G&C AGE	1*	27.0	
ATM-LOAD VERIFIER	1*	180.0	
FILTER CARTS (FLUSH & FUEL)	3	20.0	
TESTER PRINTED CIRCUIT CARD	1	23.0	
CHECKOUT BOX THERMOCOUPLE	1	3.0	
			$548.5
CONFLICT ITEMS (ST. LOUIS)			
HOSE-GOX CART TO HARDLINE	3	3.5	
POWER SUPPLY-AUXILIARY PORTABLE	1	8.0	
REFLECTOMETER-TIME DOMAIN	1*	6.0	
BOOSTER PUMP-HELIUM	1	5.0	
CHAMBER ASSEMBLY-VACUUM	1	9.0	
			$ 31.5
			$580.0K

*LONG-LEAD PROCUREMENT

SUMMARY

- MAXIMUM USE OF NASA EQUIPMENT
- APPROXIMATELY $50 MILLION SAVING
- TRANSFER AGREEMENT
- $580 THOUSAND NEW PROCUREMENT REQUIRED

SERIES NO.
1 2 3 4 5
0 1 2 3 4 5 6 7 8 9

MOL

SATURN AGE

- AVAILABLE ITEMS REVIEWED
- DEVELOPMENT FLIGHTS BEST APPLICATION
- EXACT IDENTIFICATION PROVIDED BY DAC
- FORMAL REQUEST TO NASA BY USAF
- ALLOCATION TO MOL DEPENDENT UPON PRIORITY
  - OTHER PROGRAMS HAVE ALSO REQUESTED SOME ITEMS

SATURN AGE

IDENTIFICATION

- 15 TYPES OF ITEMS IDENTIFIED
- CATEGORIES:
  - PCM GROUND STATIONS
  - FM/FM GROUND STATIONS
  - GROUND POWER
  - CONTROL & DISPLAY
- MAJORITY FROM SATURN IV-B SIL SET
- ESTIMATED COST: $2.4 MILLION

USAGE

- FACTORY CHECKOUT OF LABORATORY VEHICLES FOR DEVELOPMENTAL LAUNCHES - 1 SET
- VAFB CHECKOUT - 1 SET

MOL

APOLLO AGE

ACCOMPLISHMENTS

- LIST OF NAA/APOLLO AGE ITEMS AVAILABLE IN MOL TIME SPAN OBTAINED
- PRELIMINARY SCREENING AT SHORT-TITLE LEVEL ACCOMPLISHED BY DAC/AFPRO/MOL SPO/AEROSPACE
- COORDINATED LIST OF ITEMS OF INTEREST SENT TO NASA, WHO WILL ASSEMBLE TECHNICAL DATA
- MEETING ON 8 FEBRUARY -- NASA, DAC, MOL SPO, AEROSPACE
  - REVIEW ITEM-OF-INTEREST LIST
  - EXAMINE TECHNICAL DATA ON THESE ITEMS
  - IDENTIFY AGE UNITS SUITABLE FOR MOL
  - IDENTIFY ANY ADDITIONAL ITEMS FOR TECHNICAL REVIEW VIA DISCUSSION OF MOL REQUIREMENTS WITH NASA/NAA PERSONNEL

APOLLO AGE

PRELIMINARY AGE IDENTIFICATION

- **11 ITEMS IDENTIFIED**
- **CATEGORIES:** PROPELLANT HANDLING
  CRYOGENIC HANDLING
  PYROTECHNICS CHECKOUT
  DATA RECORDING/CALIBRATING
  ENVIRONMENTAL & MECHANICAL SUPPORT
- **APPROXIMATE VALUE (ORIGINAL)**
  $ 1.4 MILLION

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15 February 1967

STATUS REPORT

ELECTRIC POWER SYSTEM

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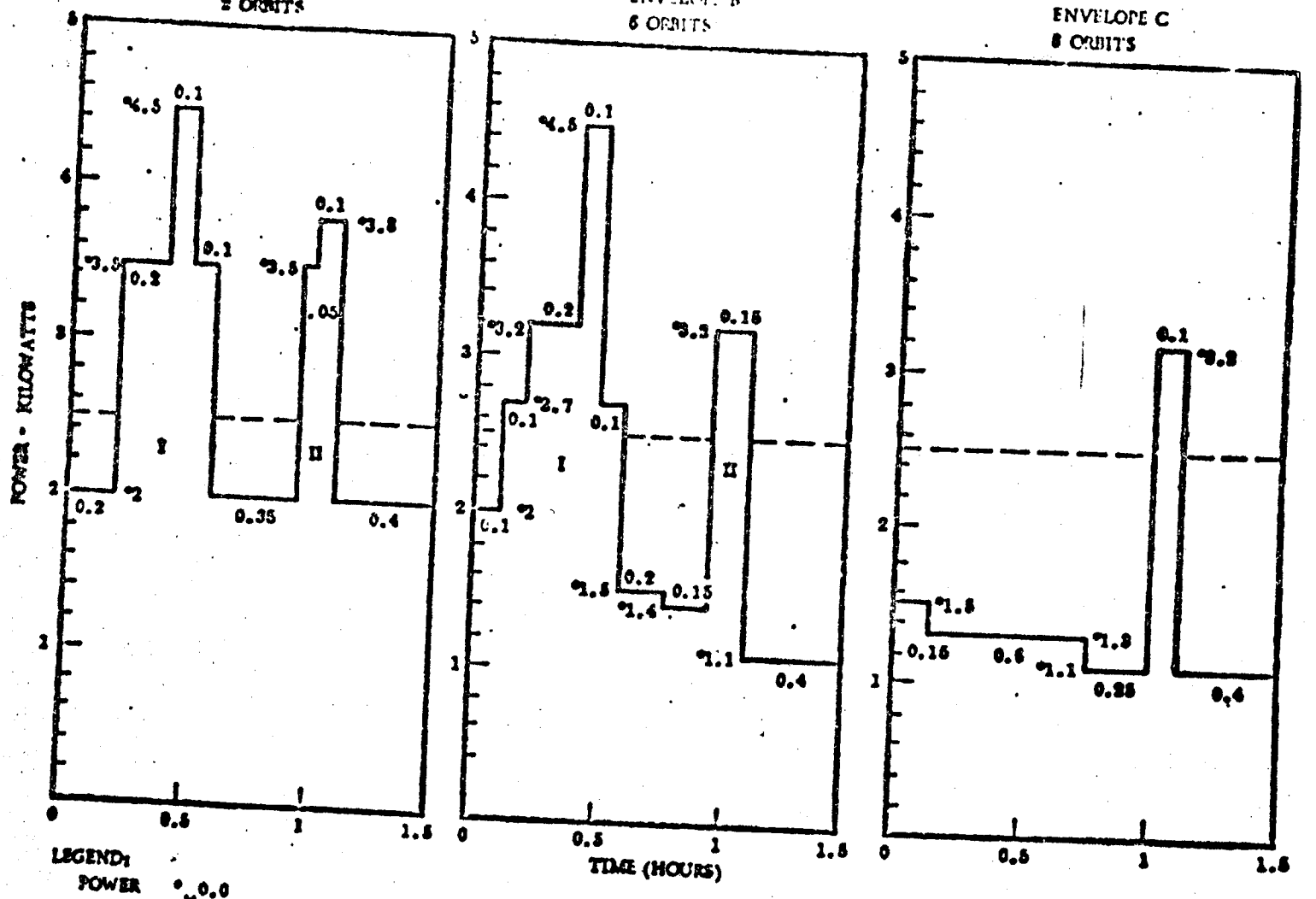
Page 2



LEGEND:
POWER [redacted] 0.0
DURATION 0.0
AVERAGE POWER 1.825 KW

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WH.-222
pg 3

BYE

AVERAGE POWER

CONTRACTOR	AVE POWER (WATTS)
MC DONNELL (GEMINI B)	100
DAC	1006
GENERAL ELECTRIC	308
ATS	45
IVS	3
EKC	277
W/B	13
OTHER	73
TOTAL	1825

REACTANT REQUIREMENTS	TANK CAPACITY
OXYGEN - 1140#	1182#
HYDROGEN - 147#	153#

MAXIMUM AVERAGE POWER GROWTH HAS A FIXED CEILING OF 3.7%

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BYE 6?

PEAK POWER

	MPSS OPERATION				COMM. OPERATION			OTHER
	TMS	P.O.	SGLS + MPSS	ALL OTHER	SGLS STA PASS	W/B R'DOUT	SGLS + W/B	ALL OTHERS
GEMINI B	145	145	190	145	190	190	190	190
DAC	1362	1362	1428	1645	1870	1740	2040	2800
GENERAL ELECTRIC	1405	995	995	848	604	604	604	604
ATS	460	460	460	460	0	0	0	0
IVS	53	53	53	53	0	0	0	0
EKC	801	1250	1250	801	536	266	266	600
W/B						700	700	0
TOTAL	4226	4265	4374	3952	3200	3500	3800	4194

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PEAK POWER CONTRACTUAL STATUS

SPDR	- CONFIGURATION MGT. CONTROL GROUP IN PROCESS OF INCORPORATING PEAK POWER ALLOCATIONS INTO SPDR
MC DONNELL	- ECP IN PREPARATION WITH TARGET SUBMITTAL DATE OF 27 FEBRUARY 1967
DOUGLAS	- WAITING FOR RFECP TO SPDR CHANGES
GENERAL ELECTRIC	- INCORPORATED IN WORK STATEMENT
EK	- PREPARING RESPONSE TO TWX RECOMMENDING REVISION TO WORK STATEMENT INCORPORATING PEAK POWER ALLOCATIONS

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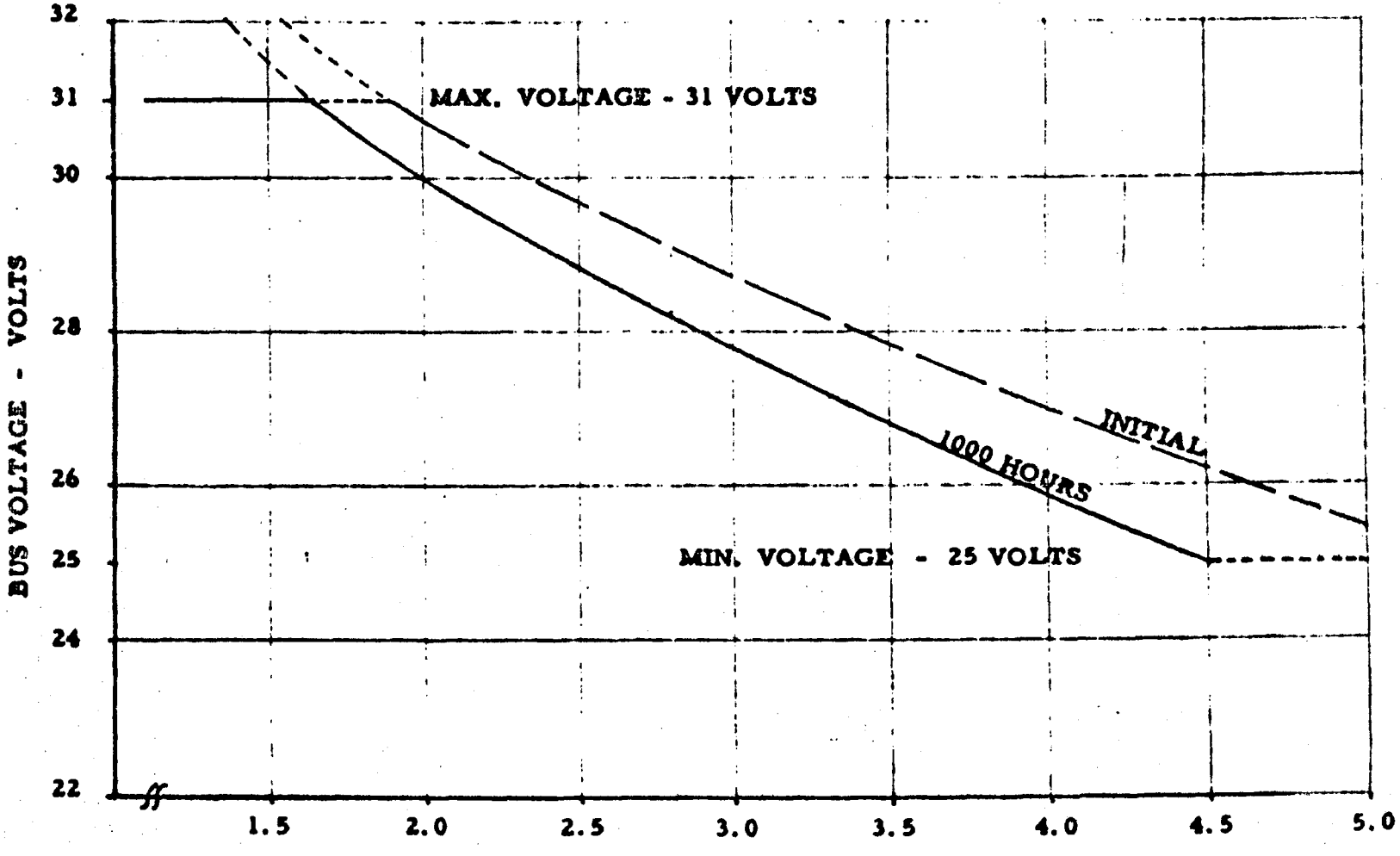
P1 6

MOL FUEL CELL ELECTRICAL PERFORMANCE

(INCLUDING TRANSIENTS)



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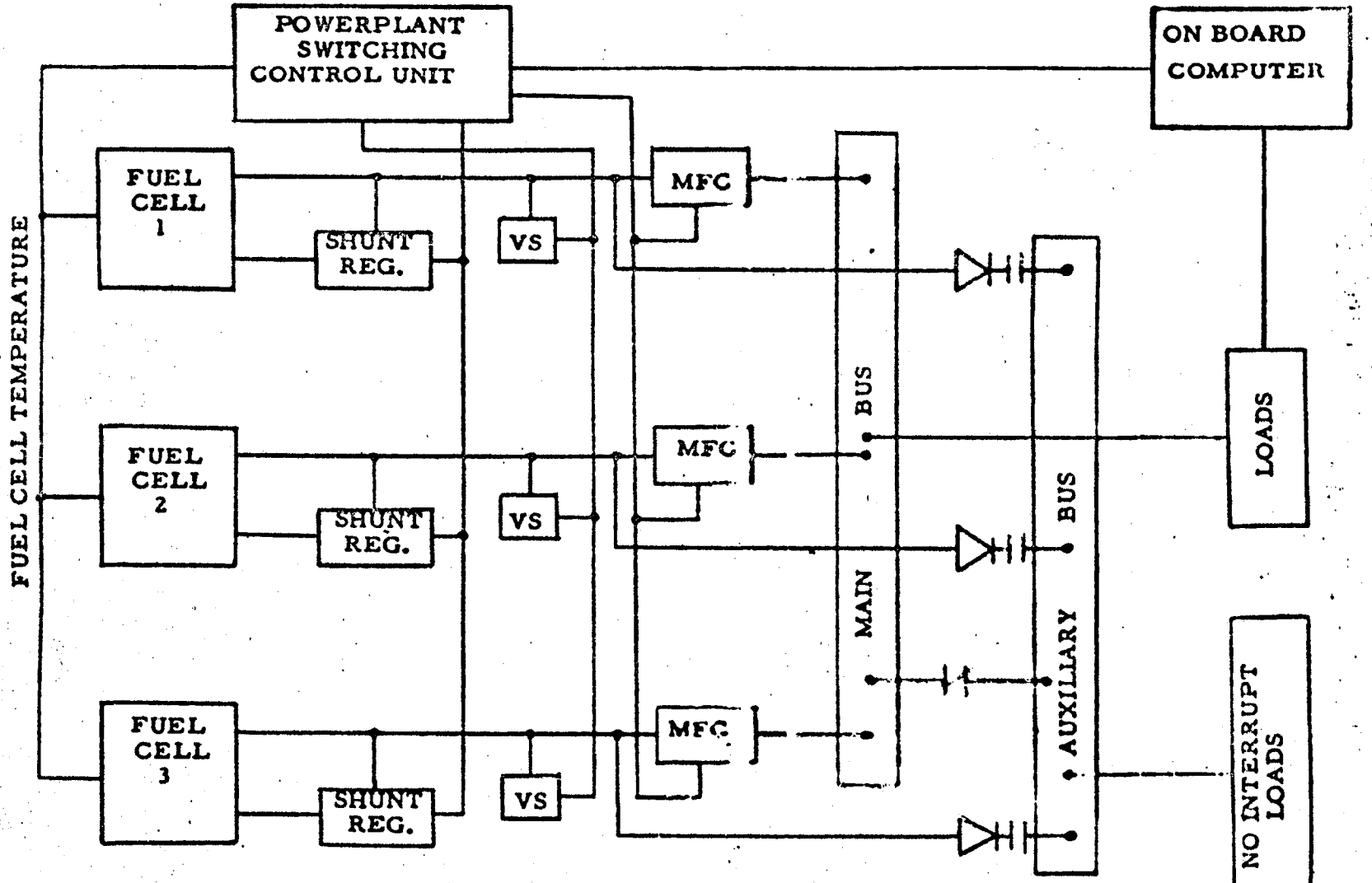
DAC BASELINE SWITCHING CONFIGURATION



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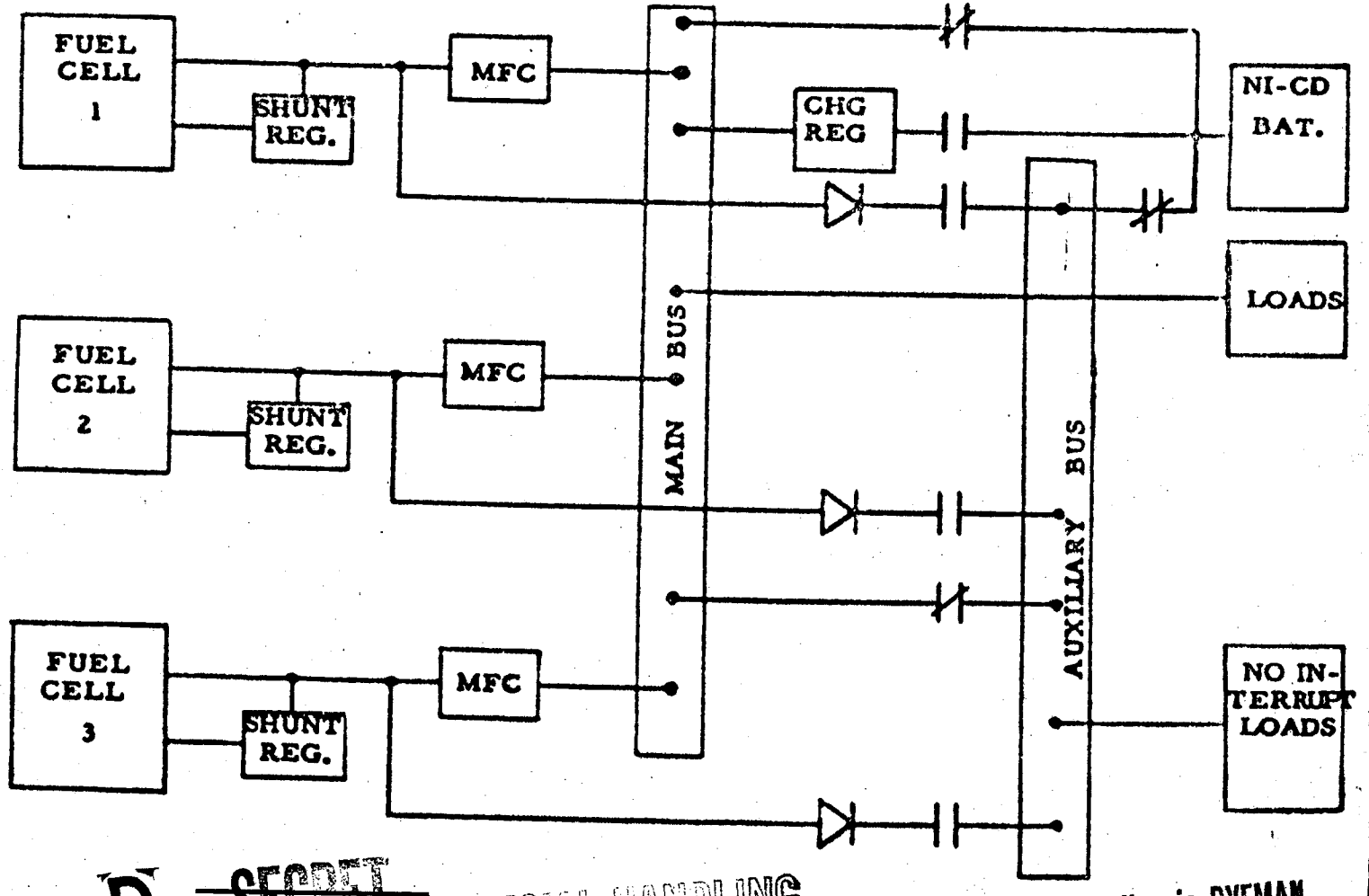
EPS CONFIGURATION
BASELINE FUEL CELL PLUS BATTERY/CHARGE REGULATOR



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MOL

FUEL CELL CONFIGURATION STU
WEIGHT SUMMARY

	POWER SYSTEM WEIGHTS (LBS)	
	29 CELL/SWITCHING	28 CELL/BATTERIES
FUEL CELLS	641	629
REACTANTS (INCL. RESERVES & RESIDUALS)	1331	1377
TANKS INCL. SUPPORTS	827	827
POWER SOURCE MISC	23	23
POWER CONVERSION	38	38
POWER DISTRIBUTION	522	522
POWER SWITCHING CONTROL UNIT	15	---
POWER PEAKING BATTERY SYSTEM	---	108
PLUMBING	70	70
SUPPORT	76	75
TOTAL	3543	3669
NET Δ WEIGHT DIFFERENCE		+126

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Control System

POWER SYSTEM DEVELOPMENT MILEST

- IDENTIFICATION OF IMPROVED FUEL CELL PARAMETERS — OCTOBER 1967
- IMPROVED FUEL CELL PERFORMANCE VERIFICATION — DECEMBER 1967
- POWER SWITCHING DEVELOPMENT TEST EVALUATION (EDCTU) — MAY 1968
- FUEL CELL POWERPLANT QUALIFICATION — JULY 1968
- ELECTRICAL POWER SYSTEM QUALIFICATION (LMQTV) — JUNE 1969

SYSTEM WEIGHT STATUS SUMMARY

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REQUIREMENTS CHANGES

	ESTIMATED CONTRACTUAL WEIGHT CHANGE	
o PAD ABORT CONTROL SYSTEM		+ 46
o ENVIRONMENTAL REQUIREMENTS CHANGE		+ 20
o BLAST PROTECTION FOR ABORT		+ 90 TO 268
o ACQUISITION SUBSYSTEM		
ADD 10" SYSTEM (2)	+496	
DELETE 5" SYSTEM	-320	
		+176
o WIDEBAND READOUT SYSTEM		
ADD ANTENNA SYSTEM & ELECTRONICS - BTL	+173	
ADD OPTICAL SYSTEM - CBS	+127	
ADD STRUCTUAL PROV. & COLD PLATES - DAC	+131	
ALLOCATION IN SP/DR FOR WIDEBAND SYSTEM	-163	
		+268
o THERMAL DOORS		
DELETE CURRENT THERMAL DOOR SYSTEM	-388	
ADD PITCH MASK - STRUCTURE, MASK, MECHANICAL DRIVES AND ELECTRONICS	+174	
ADD MIRROR LOUVERS AND MOUNTS	+ 97	
o TOTAL REQUIREMENT CHANGES		-117
		+483 TO 661

Handle via BYEMAN Control System

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WH3-136 R1
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ORBITING VEHICLE SYSTEM SEGMENT
WEIGHT SUMMARY - FEB. 1, 1967

	CONTR.	SP/DR WEIGHT	CURRENT WEIGHT	PROJ. CHG'S.	PREDICTED WEIGHT
GEMINI-B		6,120	6,108	+ 66	6,174
GEMINI-B SYSTEM SEGMENT	MAC	5,680	5,668	+ 66	5,734
FLIGHT CREW SYSTEM SEG.	SPO	360	360	0	360
PRESS SUIT ASSY. SEG.	SPO	80	80	0	80
LABORATORY VEHICLE SYSTEM SEGMENT (AVE)	DAC	14,449	14,519	+268	14,787
MISSION PAYLOAD SYSTEM SEG.		8,656	8,426	+490	8,916
G. E.	GE	2,435	2,486	-117	2,369
E. K.	EK	5,617	5,521	0	5,521
GFE	SPO	441	419	0	419
WIDEBAND READOUT SYS.	---	163	0	+431	431
BIG EYE	---	-----	-----	+176	176
TOTAL		29,225	29,053	+824	29,877

LAUNCH VEHICLE CAPABILITY 32,200 (80° INCL., 80/180 N. M., LAT_p 55° N. WTR, NO YAW STEERING)

PAYLOAD MARGIN: 2,323

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2 pages

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ORBITING VEHICLE CONTRACTUAL WEIGHT STATUS

	SP/DR WEIGHT	CONTRACTUAL MAX. Δ WT.	MAXIMUM WEIGHT (SP/DR + MAX Δ)
o CURRENT SP/DR WEIGHTS			
MAC (INCLUDING CREW & PSA)	6,120	120	6,240
DAC	14,449	750	15,199
E.K.	5,617	---	5,617
G.E.	2,435	390	2,825
OTHER (DRV, V/R, COMPUTER, CUES, WIDEBAND)	604	---	604
o MAXIMUM CONTRACTUAL WEIGHT	29,225	1,260	30,485
(CONTRACTOR REPORTED WEIGHT, FEB. 1, 1967 = 29,053)			
o REQUIREMENTS CHANGES			+683 TO 661
o MAXIMUM PREDICTED WEIGHT			30,968 TO 31,146
o T-III M NOMINAL PAYLOAD CAPABILITY (80° INCL., 80/180 N.M., $LAT_p = 55^\circ$ N.)			32,200
o RESERVE FOR OPERATIONAL FLEXIBILITY			1054 TO 1,232

~~SECRET~~ SPECIAL HANDLING

...LEMAN
Control System

MOL

ORBITING VEHICLE SYSTEM SEGMENT

WEIGHT HISTORY