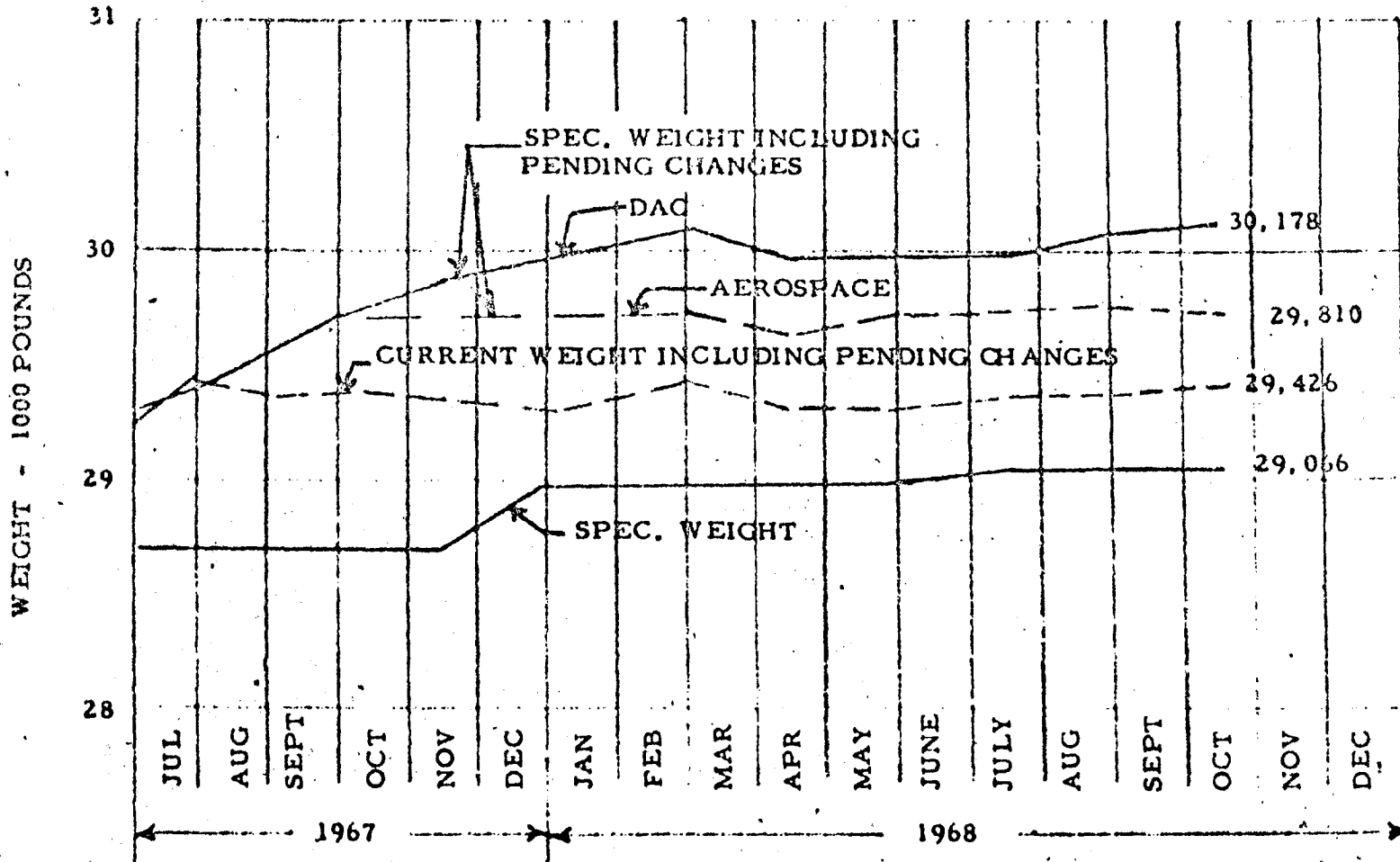


~~SECRET/DORIAN~~

ORBITING VEHICLE WEIGHT HISTORY

HANDLE VIA BYEMAN SYSTEM ONLY



HANDLE VIA BYEMAN
CONTROL SYSTEM ONLY

EXCLUDED FROM AUTOMATIC
REGRADE: DOD DIR 5200.10
DOES NOT APPLY

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Cp 2 6/1/68
AEROSPACE
INPUT

ORBITING VEHICLE SYSTEM SEGMENT WEIGHT SUMMARY - 15 OCTOBER 1968

SYSTEM SEGMENT AVE (INCLUDING GFE)	SPEC.	CURRENT	PERCENT OF CURRENT WEIGHT		
			EST.	CALC.	ACT.
MAC AVE & GFE	5,997	5,952	23.0	66.0	11.0
DAC AVE & GFE	14,617	14,254	42.8	47.1	10.1
GE AVE & GFE	2,800	2,865	45.0	54.0	1.0
EK AVE	5,792	5,751	8.0	29.0	63.0
HS PSA AVE	142	142	100	0	0
WHIRLPOOL - FOOD	102	102	0	100	0
FLIGHT CREW	360	360	100	0	0
ORBITING VEHICLE & CREW	29,810	29,426	33.0	47.4	19.6
THIM CAPABILITY - 90° INCL, 80/187 NM, LAT _p 45° N			30,889		
PAYLOAD MARGIN			1,463		
RESERVE PAYLOAD DELTA					
I MARK V DRV			475		
WIDEBAND SCAN SYSTEM			485		
			<u>960</u>		

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POTENTIAL WEIGHT CHANGES

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ESTIMATED
WEIGHT CHANGE

- o AWG 24 WIRE CATEGORY OF USE REFINEMENT + 20
- o DELETE STRUCTURAL STIFFNESS REQUIREMENT FOR ACQUISITION TRACKING SCOPE - 59
- o ATTITUDE GYRO REQUIREMENTS ON VEHICLE STIFFNESS + 15
- o MISSION MODULE VENT FILTERS + 15
- o EMI TEST WIRING + 5
- o DELETE POWER SYSTEM CONTROL UNIT - 10
- o FUEL CELL SYSTEM CHANGE -150
- o ADD OVERBOARD DUMP INHIBITS + 10
- o ADD CONTAMINATION SHROUDS + 10
- o STRENGTHEN CAMERA OPTICAL ASSEMBLY + 40
- o STRENGTHEN ACQUISITION TRACKING SCOPE FOR HIGHER LOADS AND ACOUSTICS + 25
- o ADD GEMINI-B SUN SHAFTING PROTECTION + 2
- o INCREASE GEMINI-B MODE B ABORT SIDE LOADS + 6

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POTENTIAL WEIGHT CHANGES
(CONTINUED)

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o	STRENGTHEN MISSION MODULE FRAMES	+ 25
o	RECENT INTERFACE CHANGES	
/	ADD MISSION MODULE ACCESS	+ 10
/	REVISE WIRE HARNESS DESIGN	+ 25
/	REVISE PLUMBING INSTALLATION	+ 5
/	SUPPORT FOR ADDED EQUIPMENT (PERIPHERAL DISPLAY AND VIBRATION AMPLIFIER ELECTRONICS)	+ 5
/	ADD CAPTIVE FASTENERS	+ 5
/	ADD COOLANT SYSTEM FILTERS	+ 2
/	ADD CLEARANCE FOR HAND CONTROLLERS	+ 2
/	ADD FIXTURES FOR HANDLING OF FILM ON-ORBIT	+ 5
	TOTAL	+ 23

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15 OCTOBER 1968

OV PEAK AND AVERAGE POWER

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	<u>ALLOCATION</u>	<u>CURRENT REPORT</u>	<u>VARIANCE WITH ALLOCATION</u>
AVERAGE POWER (WATTS)	1822	1609	- 213
PEAK POWER (WATTS)			
A) TRACKING MIRROR SLEW	4326	3954	- 372
B) PHOTOGRAPHIC OPERATIONS	4426	4160	- 266
C) MISSION PAYLOAD CHECKOUT	4370	4102	- 268
D ₁) MISSION PAYLOAD ACTIVATION/ PREPARATION	4301	4105	- 196
D ₂) OTHER MISSION PAYLOAD OPERATION	4209	3697	- 512
E) SGLS STATION	3342	3129	- 213
F) WIDEBAND STATION	3851	3339	- 512
G) SGLS & WIDEBAND STATIONS	3937	3727	- 210
H) ALL OTHER ORBITAL	4196	3857	- 339
I) EARLY OR LATE ORBIT	4439	4102	- 337
J) LAUNCH AND ASCENT	2791	2260	- 530

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REACTANT CONSUMPTION COMPARISON

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<u>FUEL CELL</u>	<u>PC-3A4 (BASELINE)</u>	<u>PC-8B</u>	<u>A-C</u>
BASELINE REACTANTS (LBS)	1293		
REACTANT CONSUMPTION RATE (#/KWH)	.948	.985	.936
AVERAGE POWER CAPABILITY (WATTS) WITH BASELINE REACTANTS*	1825	1800	1892
Δ WATTS	0	-25	+67
Δ REACTANT	0	18	-46

* EXCLUDING 10% RESERVE FOR CELL CHARACTERISTICS, LOAD UNCERTAINTIES, AND TIMELINE EFFECTS.

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TRACKING MIRROR MATERIALS

24 October 1968

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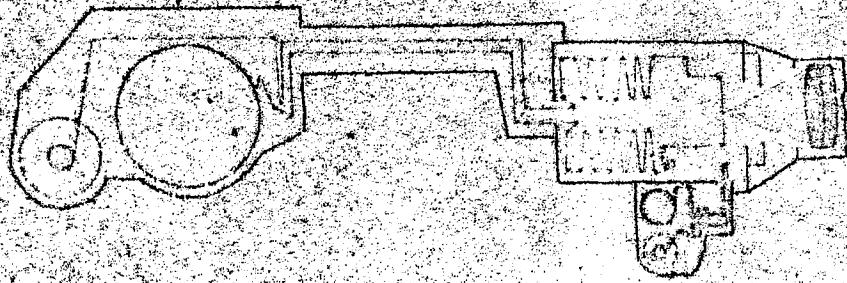
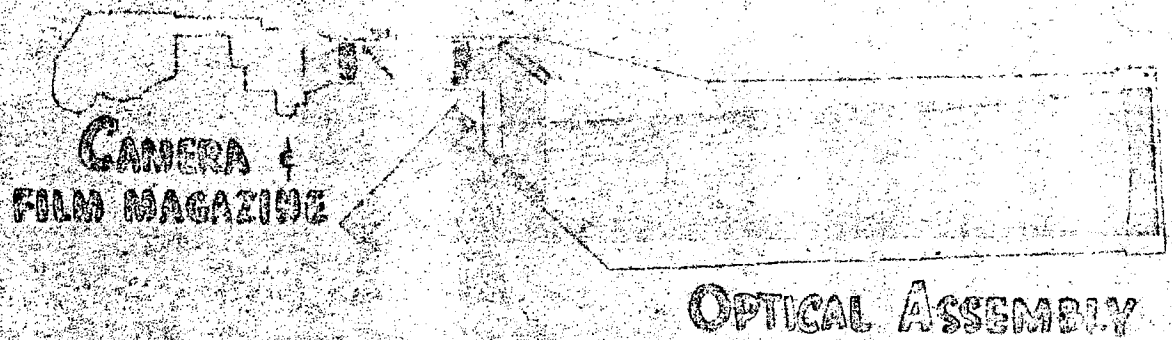
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CAMERA OPTICAL ASSEMBLY (COA)

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CF 1243



Handle via BYEMAN
Control System Only

~~SECRET~~ D

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CF 1243

FIG 1

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ULE/CERVIT

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BACKGROUND

- o BASELINE CHANGE TO LOW COEFFICIENT MATERIAL
- o RELATED TRACKING MIRROR SLAT DELETION AND THERMAL DOOR SIMPLIFICATION
- o EK WORK SPECIFICATION REVISIONS:

PRIMARY MIRROR - ULE - FLIGHTS 5 AND SUBS

FLIGHTS 3 AND 4 SCHEDULE PERMITTING

NEWTONIAN AND ROSS FOLDING MIRRORS - ULE

ALL FLIGHTS

TRACKING MIRROR - LOW COEFFICIENT MATERIAL - ALL FLIGHTS

CERVIT/ULE CHOICE TO BE MADE WHEN SCHEDULE REQUIRES

72-INCH CERVIT (MACHINED) IN GRIND (10" THICK)

72-INCH ULE IN POLISH (10" THICK) ~ .9 A PEAK-TO-PEAK

72-INCH CERVIT (12 INCH THICK) BEING MACHINED AT OWENS ILLINOIS

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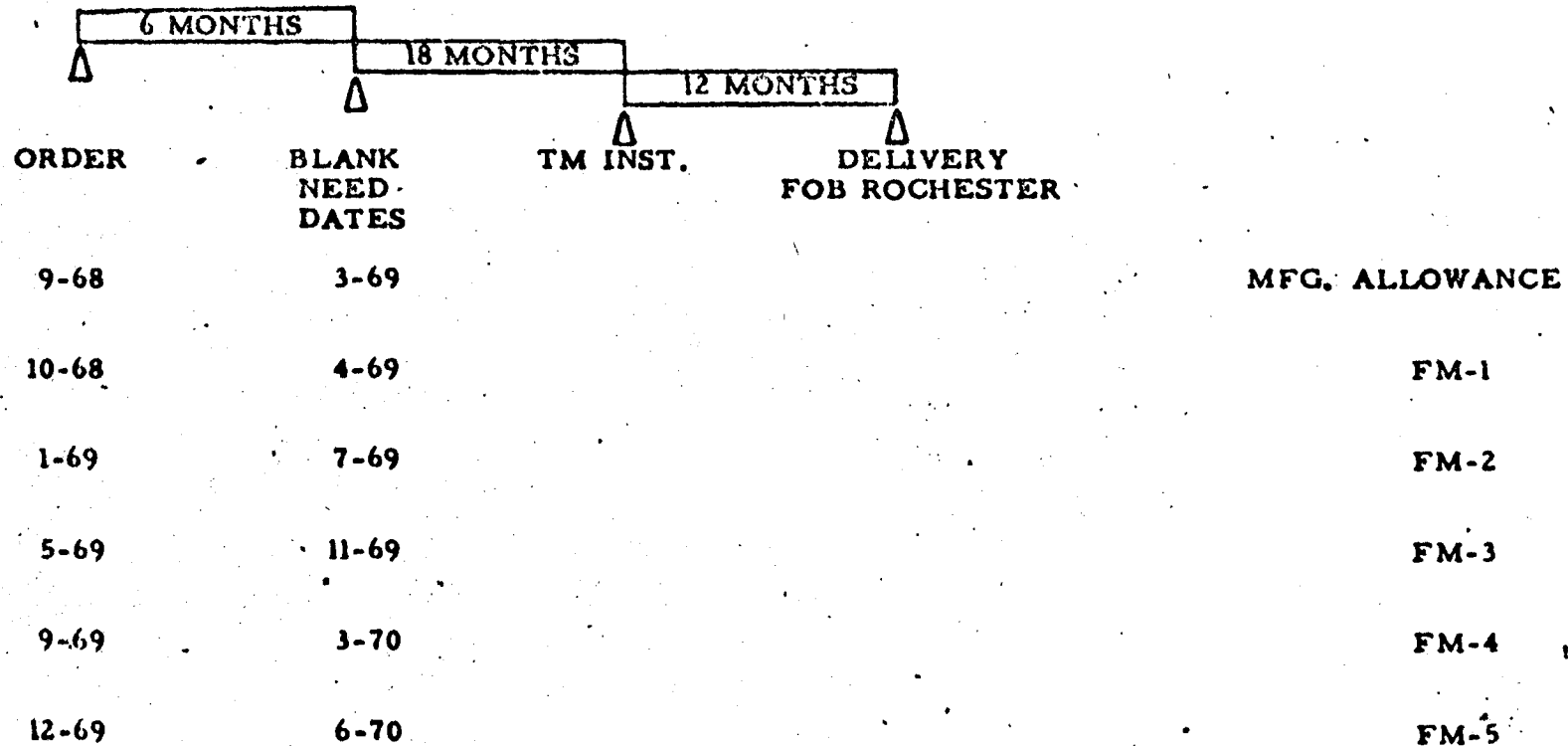
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CURRENT MOL PROGRAM SCHEDULE

TRACKING MIRRORS



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TRACKING MIRROR PROPERTIES

	FUSED SILICA	CER-VIT	ULE
o CORE CONSTRUCTION	SLOTTED	MACHINED	WELDED
o WEIGHT (12" THICK)			
NOMINAL	980	940	900
MAXIMUM	1000	990	930
o RIGIDITY	4λ	2-1/2 λ	3 λ
o THERMAL EXPANSION COEFFICIENT, ($\times 10^{-6}/^{\circ}\text{C}$)			
SP/DR REQUIREMENT	--	+ .05	+ .05
RECENT NOMINAL AT 20°C	+ .54	- .08	- .04
o STRESS CONCENTRATION	CORNERS, SLOTS	FILLETS	CORNERS
o MANUFACTURABILITY	GOOD	EXCELLENT	EXCELLENT

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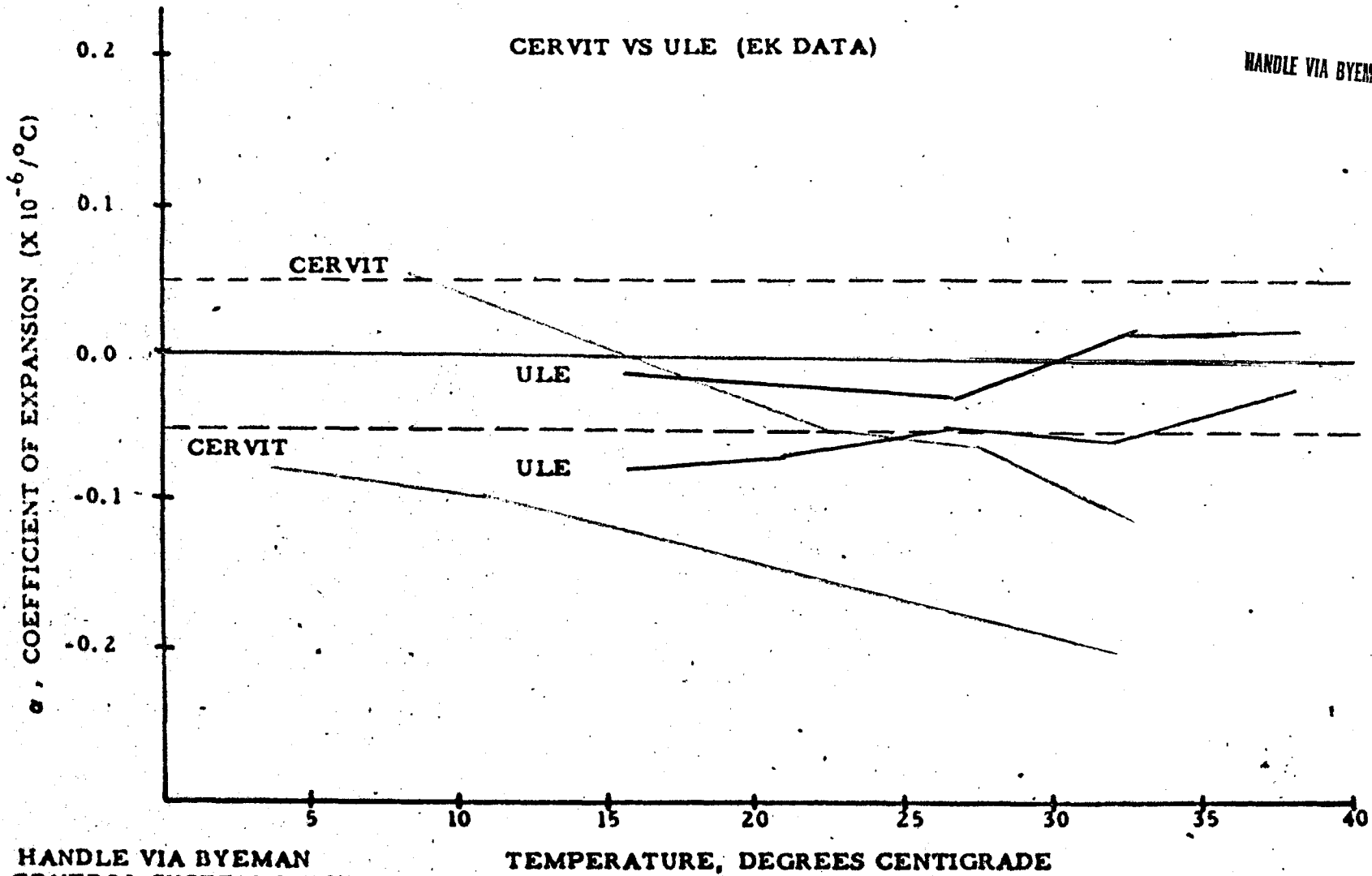
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COEFFICIENT OF EXPANSION MEASUREMENTS

CERVIT VS ULE (EK DATA)

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TEMPERATURE, DEGREES CENTIGRADE

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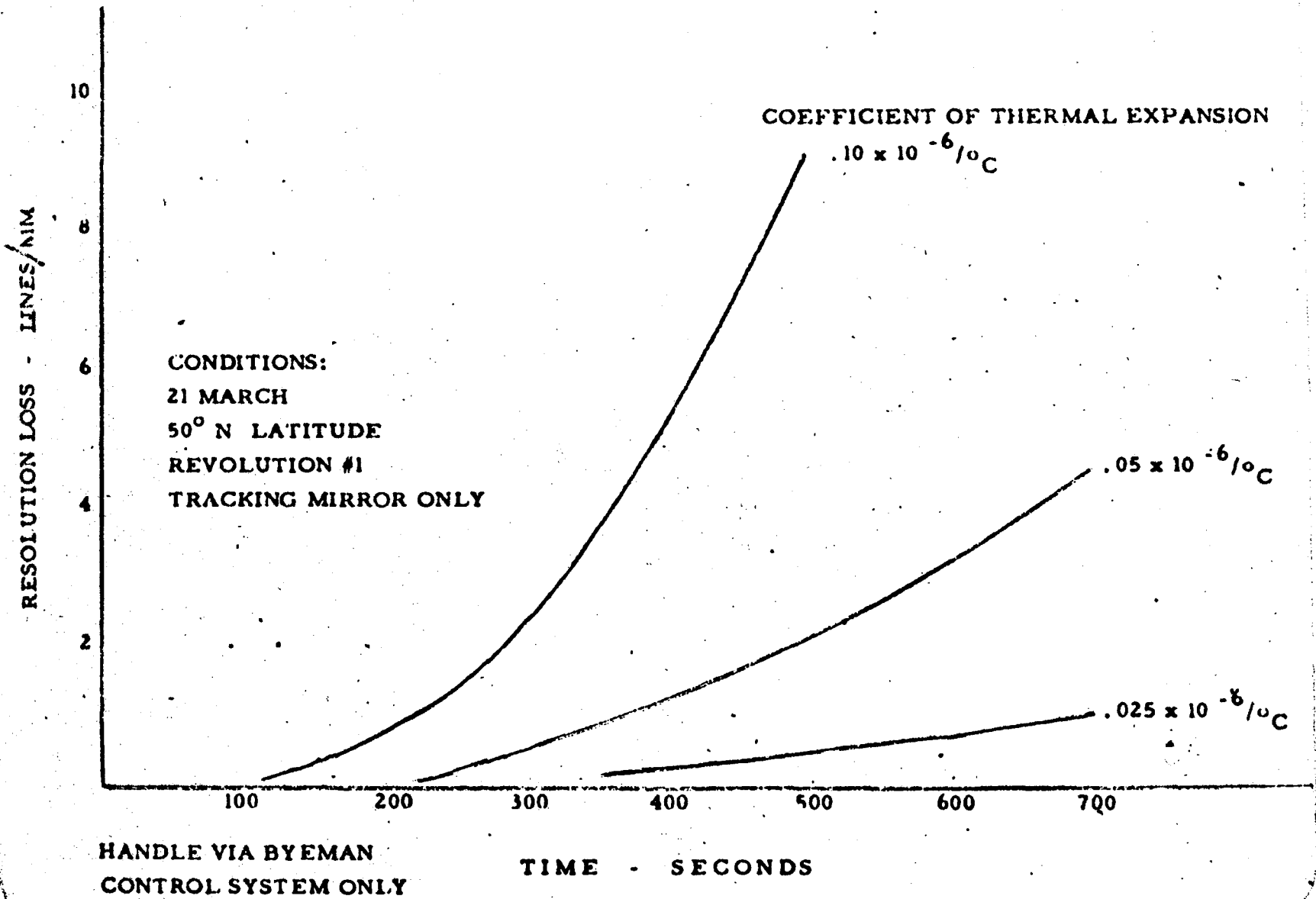
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RESOLUTION LOSS VS. DOOR OPEN TIME

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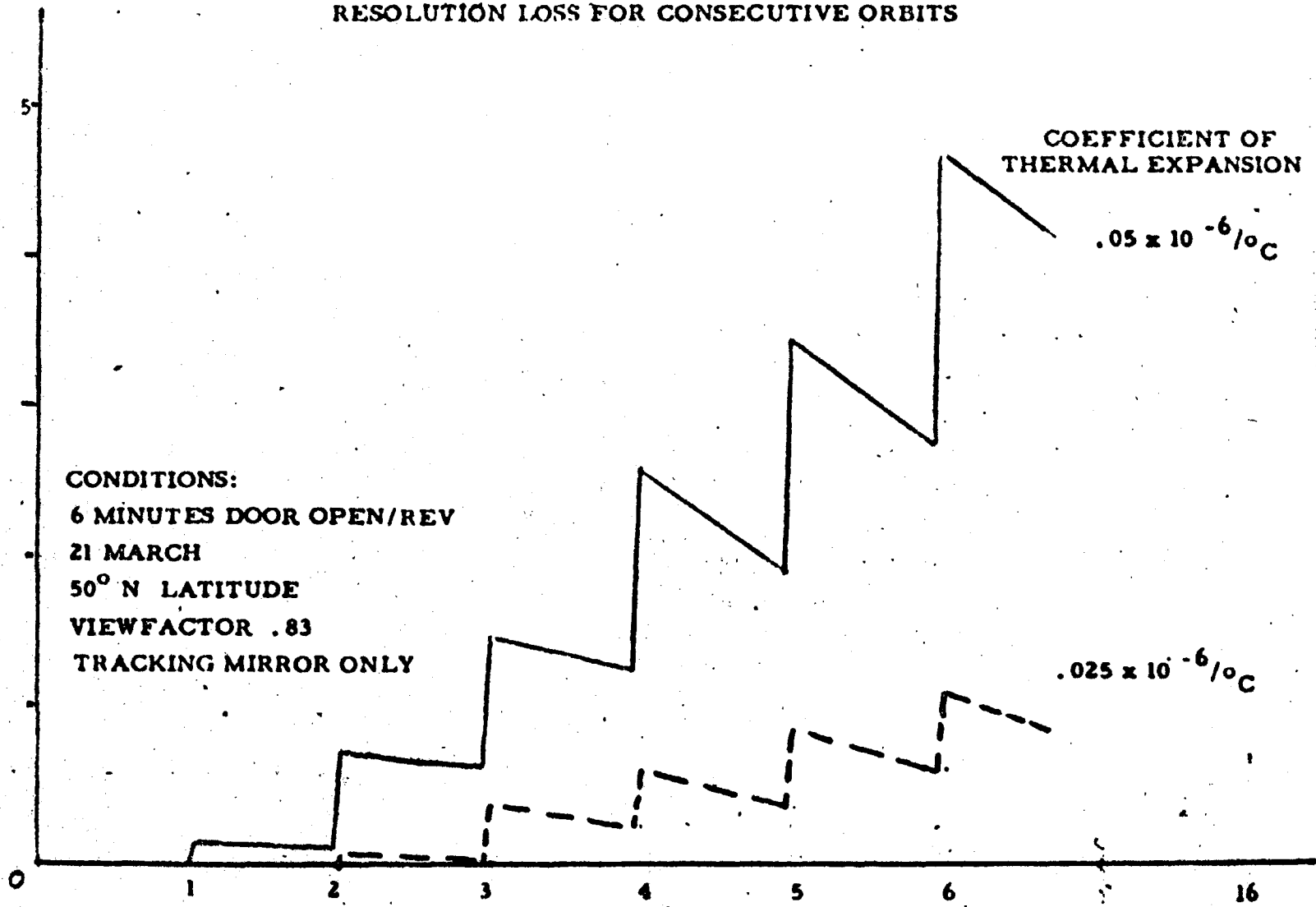
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RESOLUTION LOSS FOR CONSECUTIVE ORBITS

PERFORMANCE LOSS - LINES/MM



CONDITIONS:
6 MINUTES DOOR OPEN/REV
21 MARCH
50° N LATITUDE
VIEWFACTOR .83
TRACKING MIRROR ONLY

COEFFICIENT OF
THERMAL EXPANSION

$.05 \times 10^{-6}/^{\circ}\text{C}$

$.025 \times 10^{-6}/^{\circ}\text{C}$

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REVOLUTION NUMBER

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SUMMARY

- o BOTH CERVIT AND ULE ACCEPTABLE FROM WEIGHT, STRUCTURAL, AND PROCESSING STANDPOINTS
- o CONTROL OF COEFFICIENT OF EXPANSION MORE FAVORABLE FOR ULE - WILL SIGN UP FOR $.03 \times 10^{-6}/^{\circ}\text{C}$ FOR LATER BLANKS
- o LOW COEFFICIENT OF EXPANSION VITAL TO MISSION SUCCESS
- o RECOMMEND SELECTION OF $.03 \times 10^{-6}/^{\circ}\text{C}$ COEFFICIENT OF EXPANSION ULE FOR TRACKING MIRROR MATERIAL

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IMPLEMENTATION PLAN

- o AUTHORIZE EKC TO PROCURE SIX 72-INCH ULE TRACKING MIRROR BLANKS
- o ULE BOULES TO BE SUPPLIED GFE
- o REDIRECT CERVIT CONTRACT WITHIN PRESENT FUNDS FROM SIX LIGHTWEIGHT MACHINED BLANKS TO:

3 SOLID MASTER BLANKS

1 - 82-INCH MASTER SPHERE CHAMBER IIG

1 - 72-INCH MASTER PLANO CHAMBER IIIA

1 - 72-INCH MASTER PLANO CHAMBER IIIB

~ 3 LIGHTWEIGHT 72-INCH MACHINED BLANKS ($.03 \times 10^{-6}/^{\circ}\text{C}$
COEFFICIENT GOAL)

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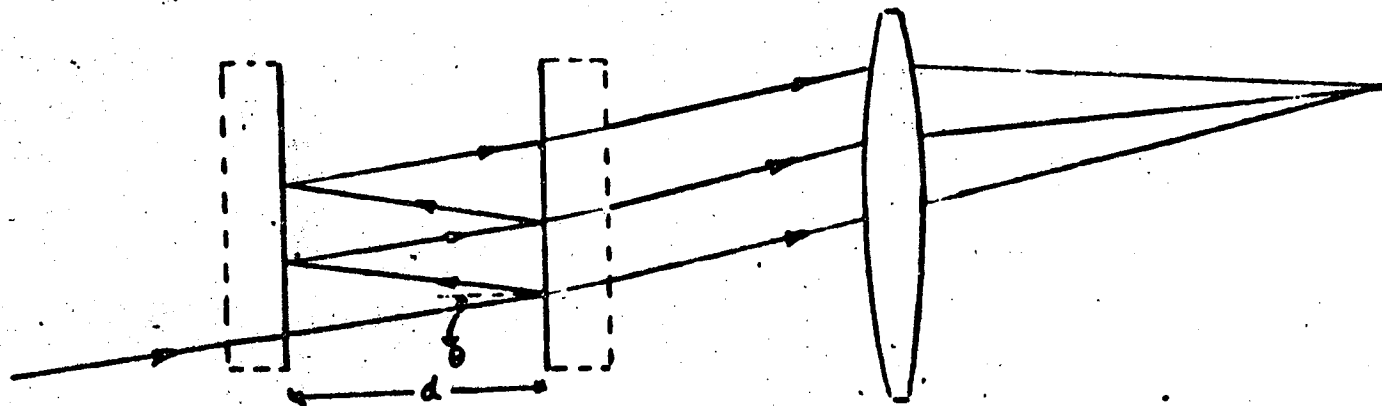
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PRINCIPLE OF FABRY-PEROT INTERFEROMETER

(PATH LENGTH DIFFERENCE $2nd \cos \theta$)



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STRUCTURES

LOADS STATUS/SYSTEM DESIGN IMPACT

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HANDLE VIA BYEMAN SYSTEM 01

BRIEFING CONTENT

- o LOADING CONDITIONS
- o TYPICAL TRANSIENT LOADS ANALYSIS FLOW
- o OV MODEL DESCRIPTION
- o LOADS CONTRACT STATUS
- o CAMERA OPTICS ASSY BARREL STRUCT DEV TEST FAILURE
- o BARREL TEST RESULTS
- o BARREL STRUCTURAL FIX
- o TRACKING MIRROR ASSY STATUS
- o LAB VEHICLE STATUS
- o OVERALL LOADS APPROACH SUMMARY

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HISTORY OF LOAD CYCLES TO DATE

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- **LOAD CYCLE 1 (APRIL 1966)**
 - STATIC ELASTIC
 - 8 MASS OV MODEL COUPLED TO BOOSTER
 - 50 MASS OV MODEL BASE EXCITED
 - ALL TRANSIENT LOADING CONDITIONS EXAMINED

- **LOAD CYCLE 2 (NOVEMBER 1966)**
 - STATIC ELASTIC
 - DISTRIBUTED SHELL METHOD
 - 12 SPRUNG MASSES IN FORWARD UNPRESSURIZED COMPARTMENT
 - 2 SPRUNG MASSES IN MM (OBSOLETE ORIENTATION)
 - ALL TRANSIENT LOADING CONDITIONS EXAMINED

- **LOAD CYCLE 3 (FEBRUARY 1967)**
 - STATIC ELASTIC - ACQUISITION-TRACKING SCOPE PROTUBERANCE ADDITIONS
 - OV SHELL STIFFNESS REDUCED
 - CORRECTED ORIENTATION OF MM MASS - VARIED STIFFNESS
 - SINGLE SPRUNG MASS BIRD CAGE (6 DOF)
 - 3 STAGE I SHUTDOWN
 - 2 THRUST TERMINATION CASES

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LOADING CONDITIONS
FLIGHT LOADS ANALYSIS

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o **TRANSIENT CONDITIONS**

SRM THRUST BUILDUP (LAUNCH)

STAGE I IGNITION

STAGE I SHUTDOWN

STAGE II IGNITION

STAGE II SHUTDOWN

THRUST TERMINATION (STAGE 0)

o **STEADY STATE FLIGHT LOADS**

MAX BUFFET

MAX $Q_{\alpha\beta}$

MAX ACCELERATION (STAGE 0, I, & II)

LOAD RELIEF SWITCH IN AND OUT

SEVERAL INTERMEDIATE STAGE 0 POINTS

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DYNAMIC DATA REQUIREMENTS

● ASCENT

- STRUCTURAL LOADS FOR VEHICLE AND SUBSYSTEMS
- EQUIPMENT ACCELERATIONS
- DYNAMIC CLEARANCES
- MOUNT LOADS

● ORBIT

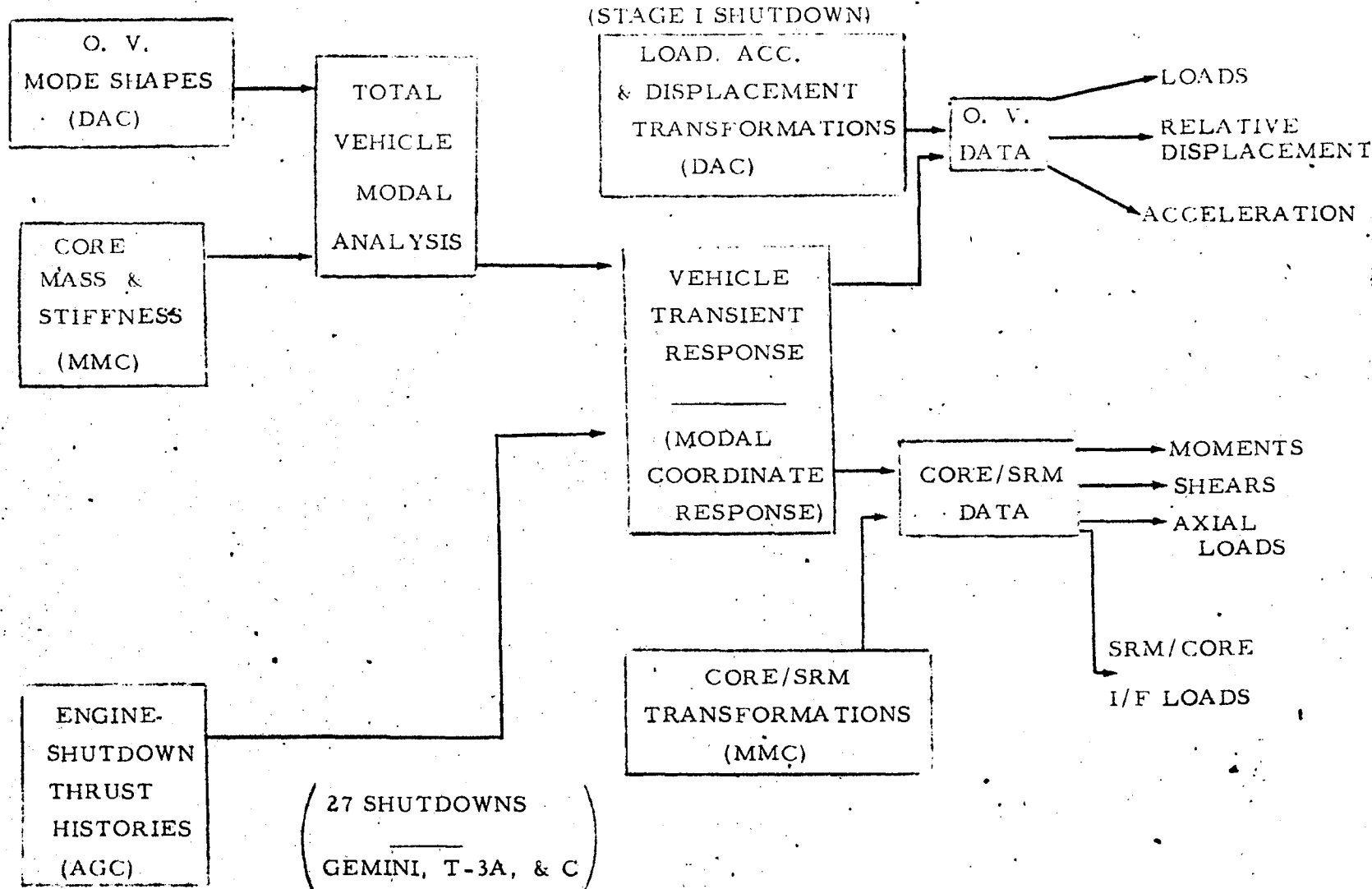
- DYNAMIC PERFORMANCE

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TYPICAL TRANSIENT LOADS ANALYSIS FLOW CHART

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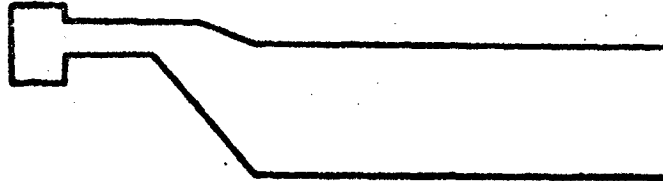
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LOADS CYCLE 4 DYNAMIC MODEL

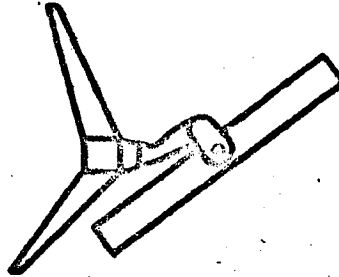
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CAMERA OPTICAL
ASSEMBLY (COA)



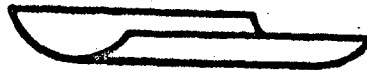
24 MASSES
144 DEGREES OF
FREEDOM

TRACK MIRROR ASSEMBLY



12 MASSES
72 DEGREES OF
FREEDOM

THERMAL COVER
(SLIDING MASK)



3 MASSES
9 DEGREES OF
FREEDOM

SUMMARY

110 MASSES
613 DEGREES OF FREEDOM

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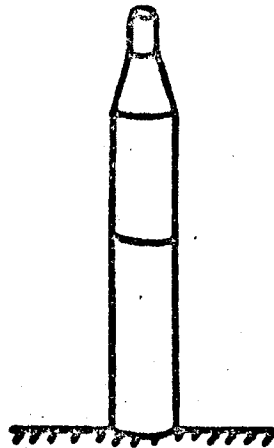
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LOADS CYCLE 4 DYNAMIC MODEL

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OV CANTILEVER MODES

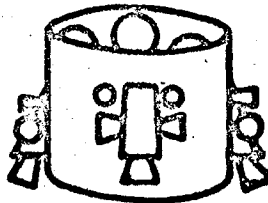


12 MASSES - GEMINI B

23 MASSES - LV SHELL

205 DEGREES OF FREEDOM

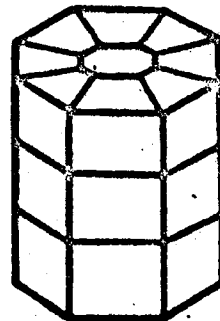
**FORWARD UNPRESSURIZED
COMPARTMENT**



11 MASSES

33 DEGREES OF FREEDOM

**EQUIPMENT SUPPORT STRUCTURE
(BIRDCAGE)**



25 MASSES

150 DEGREES OF FREEDOM

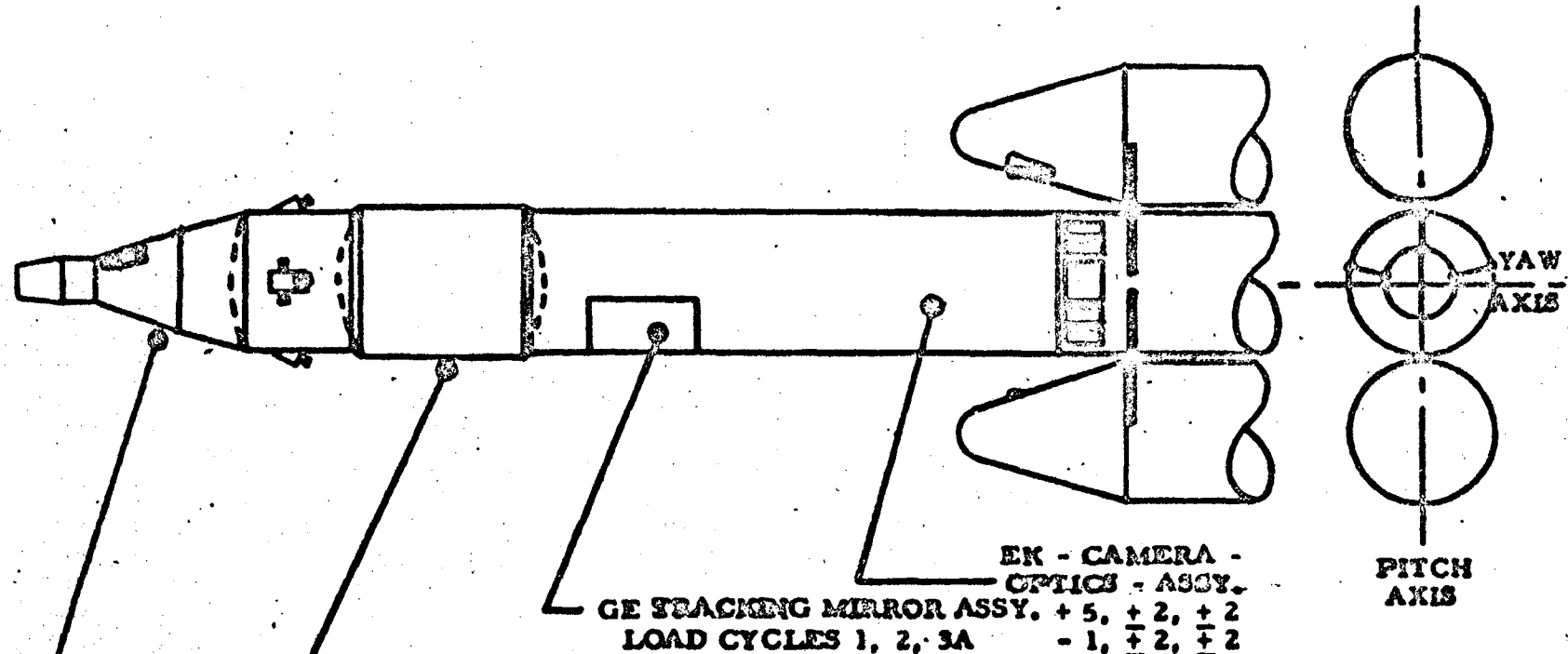
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CONTRACT STATUS OF LOADS



EK - CAMERA -
OPTICS - ASSY.
GE TRACKING MIRROR ASSY. + 5, + 2, + 2
LOAD CYCLES 1, 2, 3A - 1, ± 2 , ± 2

MDAC-WD - LABORATORY VEHICLE
-(STUFFED LM + 2MPS)

/ LOADS CYCLE 3A + DYN 1, 2, 3A

MDAC-ED
GEMINI B

/ NASA GEMINI STRUCT CAPABILITY

+ LOADS CYCLE 3A STAGE I SHUTDOWN EST FOR STRAPS

+ LOCAL POP GUN ENVIR

/ ON CONTRACT TO PROVIDE STRUCT ANAL FOR FINAL DESIGN LOADS (L. C. 4)

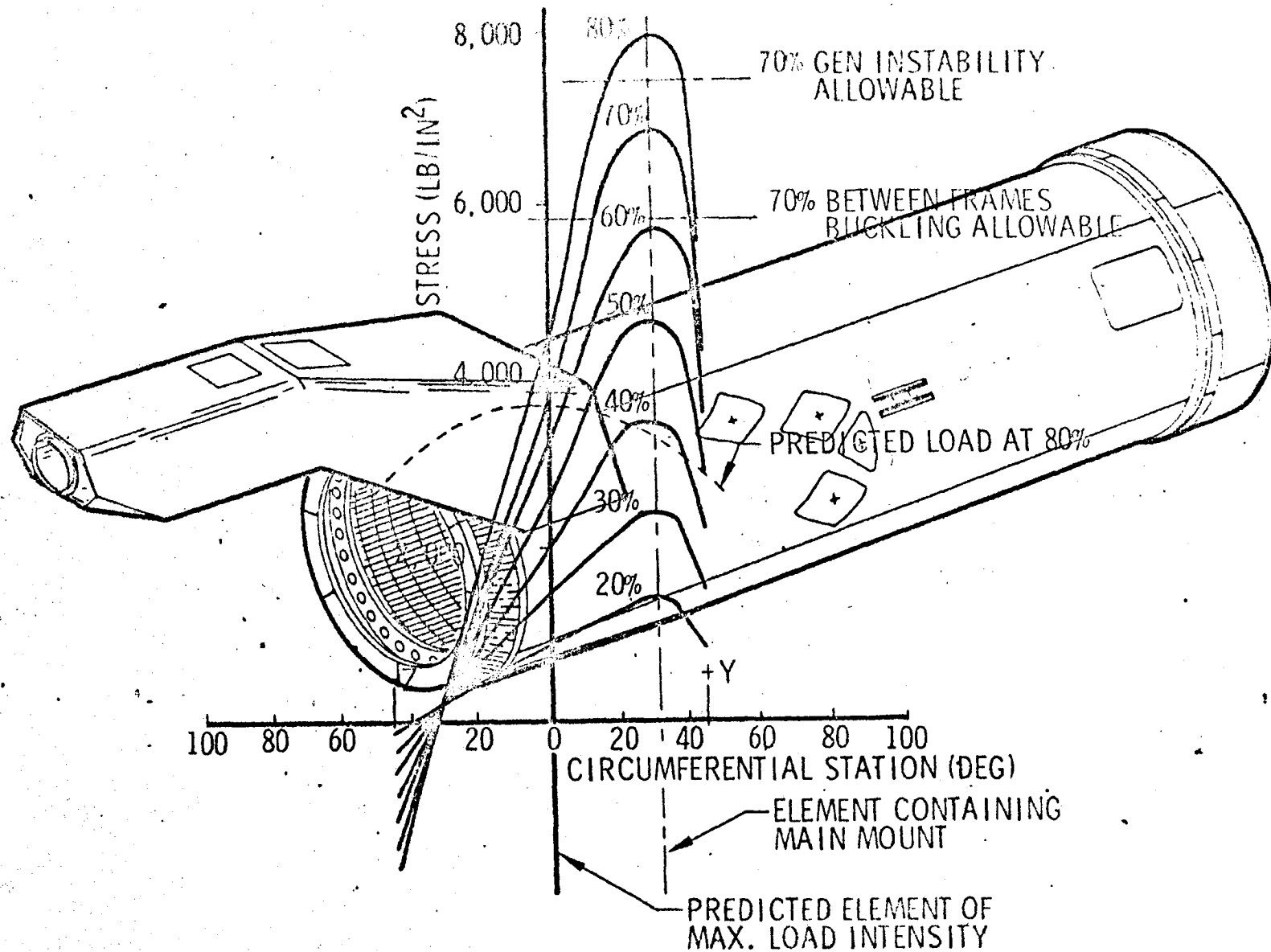
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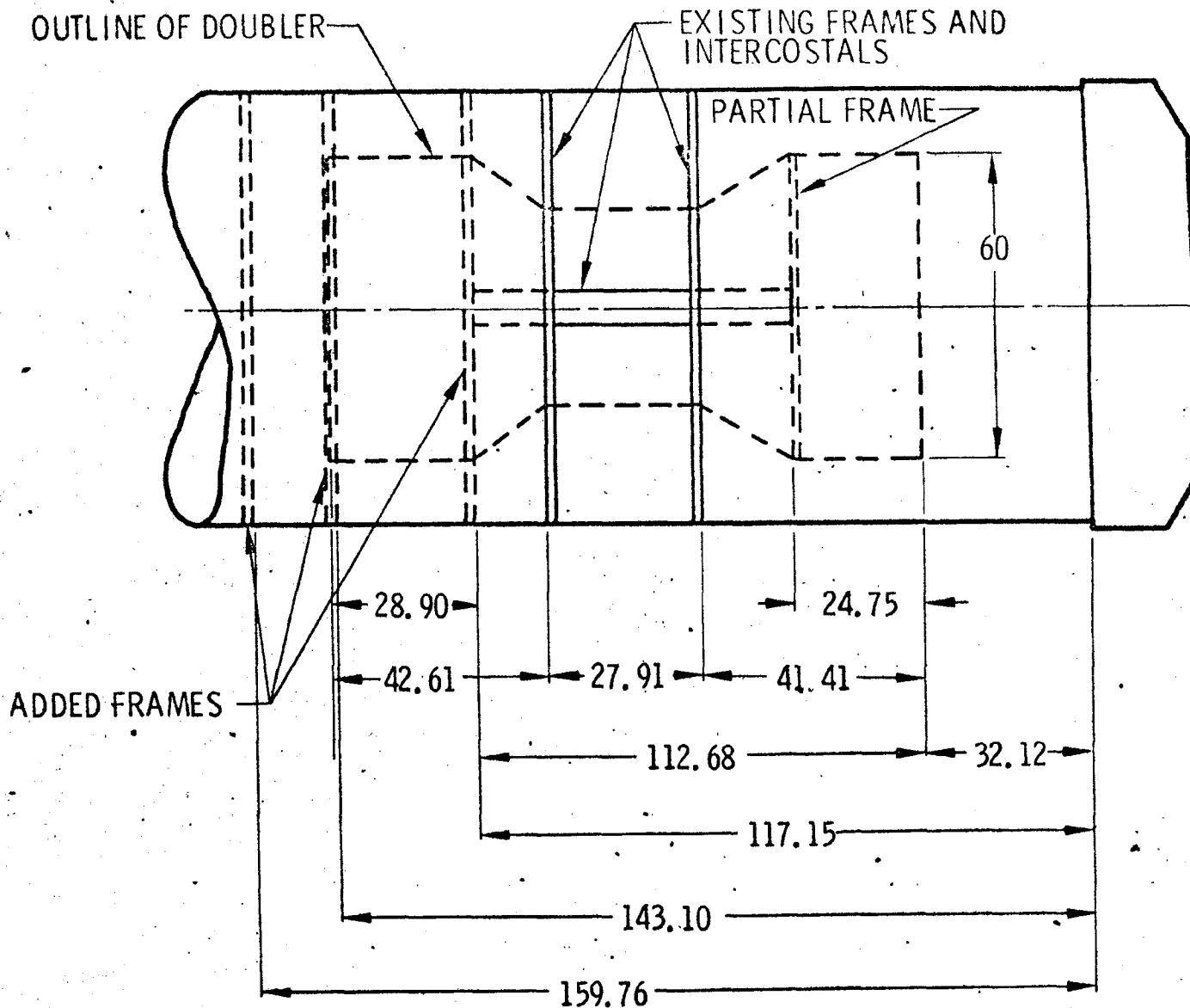
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CIRCUMFERENTIAL STRESS DISTRIBUTION JUST FORWARD OF MAIN MOUNT



PROPOSED GEOMETRY OF FIX
(VIEW LOOKING INTO Q OF SUPPORT FITTING)

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CAMERA OPTICS ASSY-STATUS/ CURRENT ACTIVITIES

- o IMPLEMENT FIX AND RETEST TO +5, +2, +2 LIMIT

- o EVALUATE DESIGN FOR CYCLE 4 LOADS
 - / PRELIMINARY RESULTS (STAGE I SHUTDOWN) INDICATE LOCALIZED MARGINAL CAPABILITY (FWD 40 INCHES)

- o RECONFIGURE TEST SET-UP FOR CYCLE 4 LOADS
 - / TEST TO FAILURE

- o MODIFICATION ACTION, IF REQUIRED
 - / SMALL NEG MARGINS - LOCAL MOD OR REASSESSMENT OF DESIGN CRITERIA (FACTORS OF SAFETY)
 - MINIMAL SCHEDULE/COST IMPACT
 - / LARGE NEG MARGINS - REQUIRES REDESIGN

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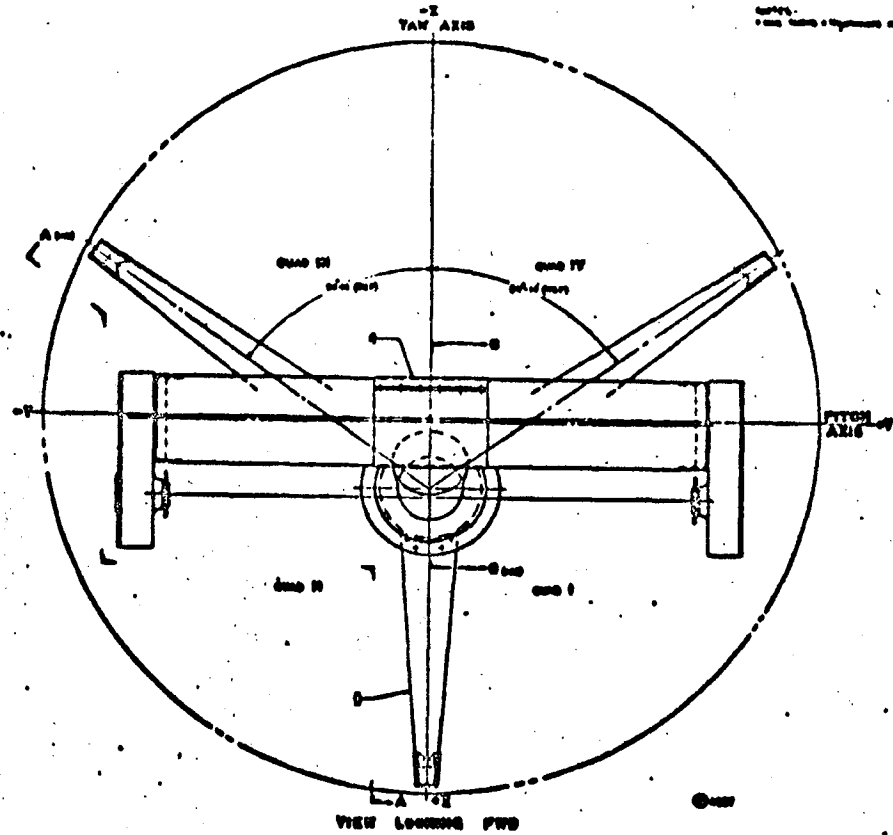
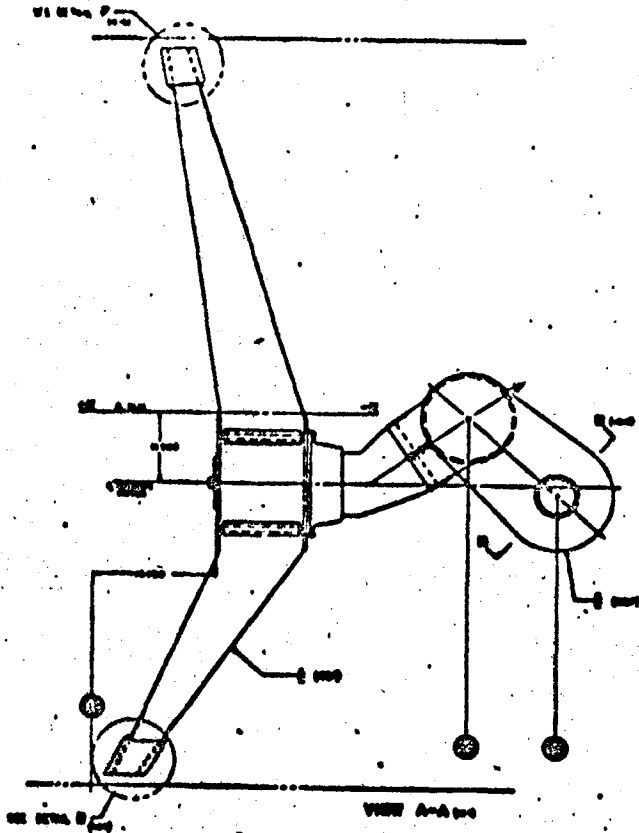
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~~SECRET~~ SPECIAL HANDLING

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~~SECRET~~ SPECIAL HANDLING

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TRACKING MIRROR ASSY STRUCTURE

- BACKGROUND
 - / PRELIMINARY FOURTH LOAD CYCLE RESULTS INDICATED NEGATIVE STRUCTURAL MARGIN AT TWO GENERAL LOCATIONS ON THE TRIPOD/GIMBAL STRUCTURE

- IMPACT
 - / "PATCH-TYPE" FIX TO BE IMPLEMENTED IN AREA OF SHAFT/TUBE TRANSITION

 - / POSSIBLE CHANGE IN BOLT/TORQUE ARRANGEMENT AT ATTACHMENT OF 9" BEARING HOUSING

 - / IMPACT CONSIDERED MINOR BY GE

- STATUS
 - / GE WISHES TO KEEP MAC IN HOLD MODE UNTIL FOURTH LOAD CYCLE RESULTS ARE OFFICIAL

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TRACKING MIRROR ASSY BEARINGS

○ **BACKGROUND**

/ PRELIMINARY FOURTH LOAD CYCLE RESULTS INDICATE
CRITICAL BALL LOADS ON 2.4" (PITCH) BEARINGS

○ **IMPACT**

/ POSSIBLE PERFORMANCE DEGRADATION RESULTING
FROM EXTREME BRINELLING INDUCED BY HIGH
OSCILLATORY LOADING

○ **STATUS**

/ GE HAS CONFIGURED CYCLIC LOAD TEST OF PITCH
BEARINGS USING PREDICTED BALL LOAD TIME-HISTORIES
AS INPUT. "BEFORE AND AFTER" VALUES OF TORQUE
RIPPLE WILL BE COMPARED

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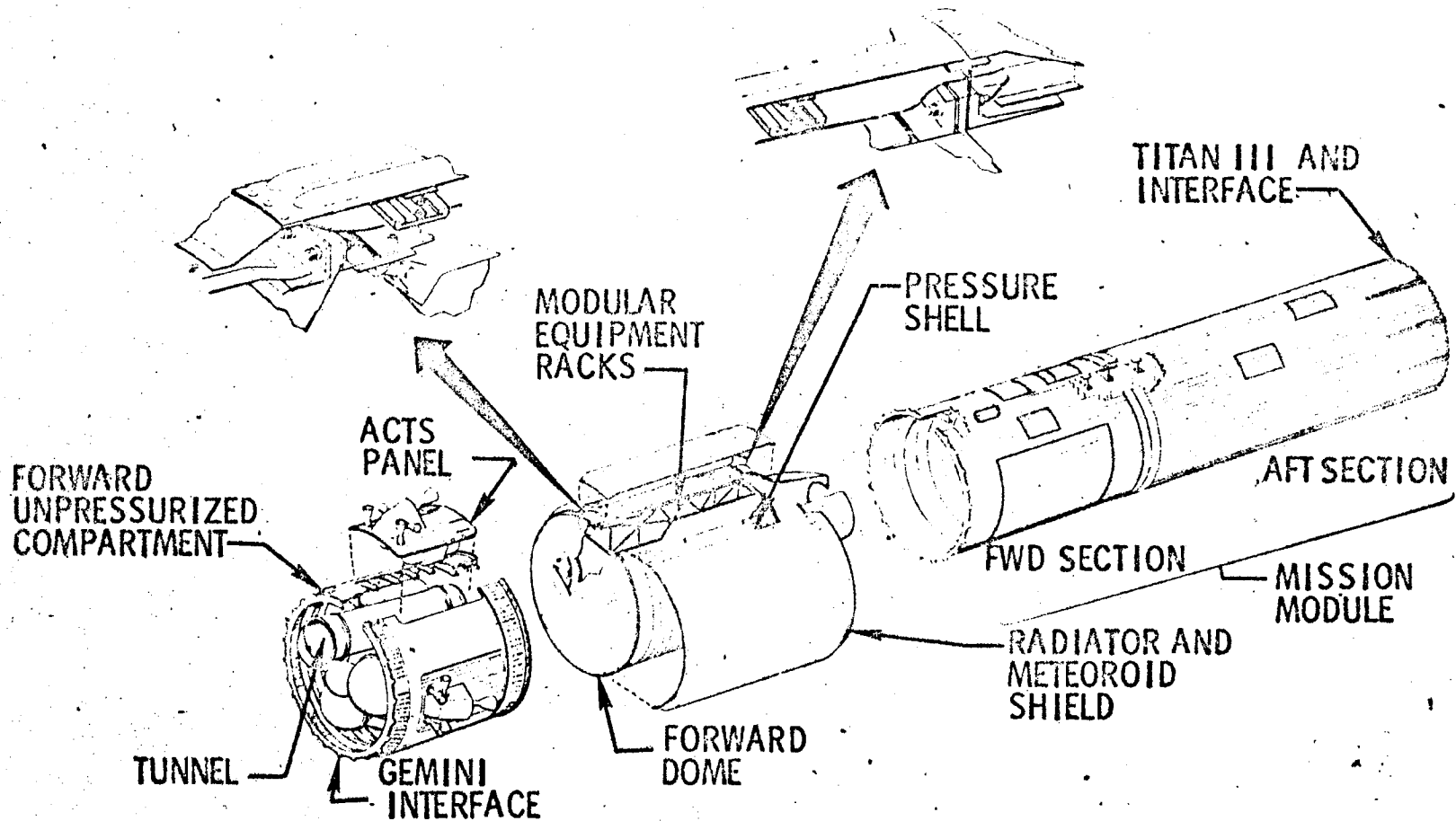
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MOL MAJOR ASSEMBLY BREAKDOWN

V529-7A
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○

LAB MODULE

NRO APPROVED FOR
RELEASE 1 JULY 2015

HANDLE VIA BYEMAN SYSTEM ONLY

- o PRIMARY STRUCTURE - FUPC, PC, MMPS
 - / NO PROBLEM - DESIGN TO STATIC ELASTIC (MAX *gda*)
- o FUPC - TANKS, FUEL CELL SUPPORTS, ETC.
 - / TO DATE - NO PROBLEM
 - / WILL BE REVIEWED FOR ALL TRANSIENT CONDITIONS
- o BIRDCAGE
 - / UPR BAY 6 LOADS (STAGE 1 SHUTDOWN) > CURRENT DESIGN CAPABILITY
 - / L. C. 4 MASS IN BAY 6 EXCESSIVE (300⁺ LB GE HARNESS, LATER WT APPROX 200⁺ LB)
 - PRELIM ANALYSIS INDICATES REDUCED LOADS < DESIGN CAPABILITY
 - / ADD'L LATERAL SUPPORTS IN UPR PC ADJ TO BAY 6 FEASIBLE
 - PRELIM ANAL INDICATES REDUCED LOADS < DESIGN CAPABILITY
 - / NEWER MODEL WITH ABOVE FIXES TO BE DRIVEN WITH L. C. 4 TRANSIENTS
 - DETERMINE STRUCTURE/MASS LOADS

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LOAD CYCLE 4 TRANSIENT LOADS SCHEDULE

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<u>CONDITION</u>	<u>ANALYSIS COMPLETE</u>	<u>REVIEW COMPLETE</u>	<u>DATA TRANSMITTAL</u>
A. STAGE I SHUTDOWN LOADS	9/9 (ACTUAL)	9/23 (ACTUAL)	10/7
B. PRE-LAUNCH	8/26 (ACTUAL)	9/9 (ACTUAL)	9/13
C. LAUNCH	10/14	10/28	11/1
D. STAGE II IGNITION	10/14	10/28	11/1
E. STAGE II SHUTDOWN	10/28	11/11	11/15
F. STAGE I IGNITION	10/28	11/11	11/15
G. THRUST TERMINATION (CRITICAL CASES)	10/28	11/11	11/15
H. THRUST TERMINATION (REMAINING CASES)	12/11	12/25	12/28

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SUMMARY

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- o PRELIMINARY CYCLE 4 LOADS EVALUATION
 - / STATIC ELASTIC - PRIMARY STRUCTURE - NO PROBLEM
 - / TRANSIENT - STAGE I SHUTDOWN (TRADITIONALLY MOST CRITICAL)
 - TRACING MIRROR ASSY
 - / TRIPOD/GMBAL - MINOR IMPACT
 - / 2.4" BEARINGS - CYCLICAL TEST PERFORMED USING ACTUAL LOAD-TIME HISTORIES
 - . PRELIMINARY RESULTS LOOK GOOD
 - CAMERA OPTICS ASSY
 - / BARREL (POST-FIX) - MARGINAL LOCALIZED CAPABILITY
 - LAB VEHICLE
 - / EQUIPMENT SUPPORT RACK - MINOR IMPACT
 - / FWD UNPRESS COMPT - NO PROBLEM
- o ALL CONDITIONS TO BE EVALUATED FOLLOWING RECEIPT OF TOTAL PACKAGE 15 NOVEMBER 1968

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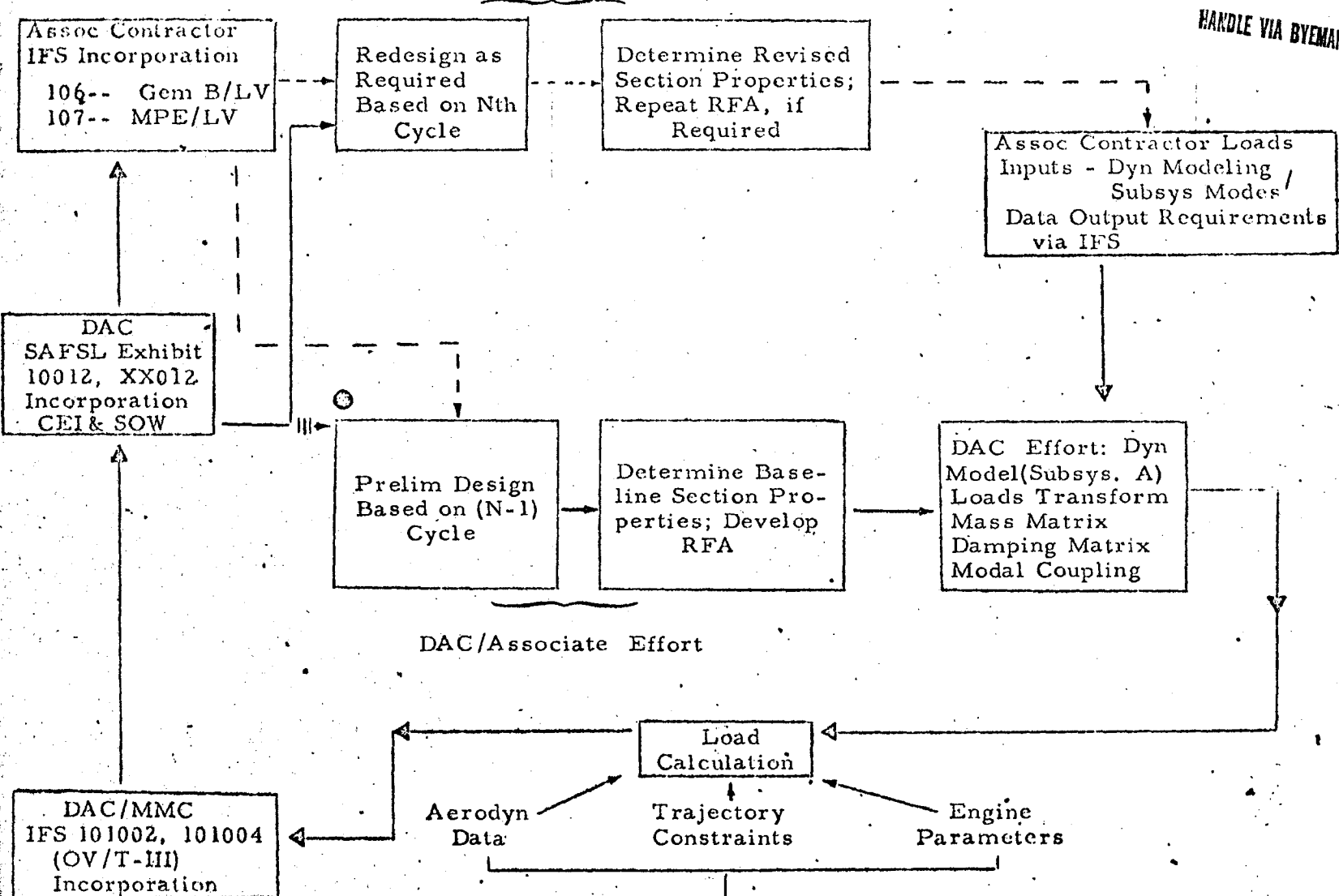
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FLOW OF LOAD DATA

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DAC/Associate Effort



DAC/Associate Effort

Martin Effort

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MOL CONTAMINATION

HANDLE VIA BYEMAN SYSTEM ONLY

- o SOURCES & CRITICAL EQUIPMENT
- o NON-MOL PROPULSION TEST RESULTS
- o ACTS PROPULSION CONTAMINATION
 - STEADY STATE
 - PULSING
- o RELATED EFFORT
- o SUMMARY

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POTENTIAL ORBITING VEHICLE CONTAMINATION SOURCES

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- o ASSEMBLY & CHECKOUT
- o TRANSPORTATION & PRE-LAUNCH
- o LAUNCH & ASCENT
 - STAGE "O" SEPARATION
 - STAGE II IGNITION
 - STAGE II RETROS
- o ON ORBIT
 - MATERIAL OUTGASSING
 - VARIOUS DUMPS, I. E., MOLECULAR SIEVE, URINE, ETC.
 - ATTITUDE CONTROL & TRANSLATION SYSTEM (ACTS)
 - o ORBIT ADJUST
 - o ATTITUDE CONTROL

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ON-ORBIT CONFIGURATION

ORBIT ADJUST OPERATION

- o 100# THRUST FOR 120 - 200 SECONDS EVERY 3 - 5 DAYS
- o SLIDING MASK - CLOSED
- o STAR TRACKER - TUCKED POSITION
- o HORIZON SENSOR OPERATING
- o ATS FAIRING CLOSED

MISSION PAYLOAD OPERATION

- o ATTITUDE ENGINES (22# THRUST) ENABLED FOR .7 SEC AT AN AVERAGE OF 40 SEC INTERVALS
- o HORIZON SENSOR OPERATING
- o SLIDING MASK OPEN
- o STAR TRACKER OPERATING
- o ATS OPEN & OPERATING

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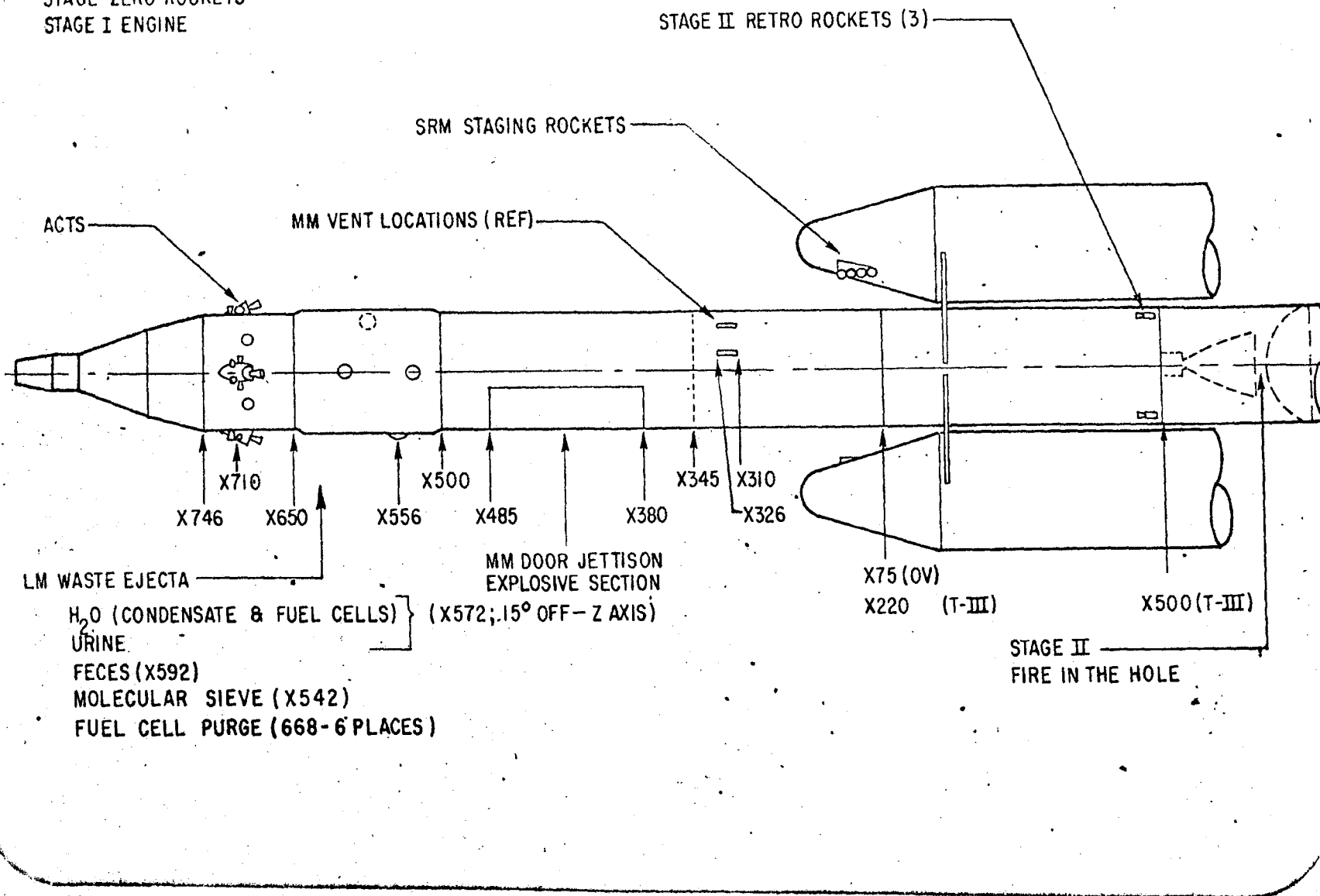
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POTENTIAL EXTERNAL CONTAMINATION SOURCES

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SOURCES NOT SHOWN:

- ASCENT ATMOSPHERE
- STAGE ZERO ROCKETS
- STAGE I ENGINE



LM WASTE EJECTA

- H₂O (CONDENSATE & FUEL CELLS)
- URINE
- FECES (X592)
- MOLECULAR SIEVE (X542)
- FUEL CELL PURGE (668-6 PLACES)

MM DOOR JETTISON
EXPLOSIVE SECTION

STAGE II
FIRE IN THE HOLE

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INTRODUCTORY CONTAMINATION MOVIE

- o TWO FILM CLIPS
 - BELL 23 LB MINUTEMAN THRUSTOR
 - MARQUARDT 22 LB THRUSTOR
- o YELLOWISH/BROWN VISCOUS LIQUID PRODUCED DURING PULSE MODE OPERATION OF BOTH THRUSTORS
- o CONTAMINATION FOUND INSIDE AND OUTSIDE OF PLUME BOUNDARY

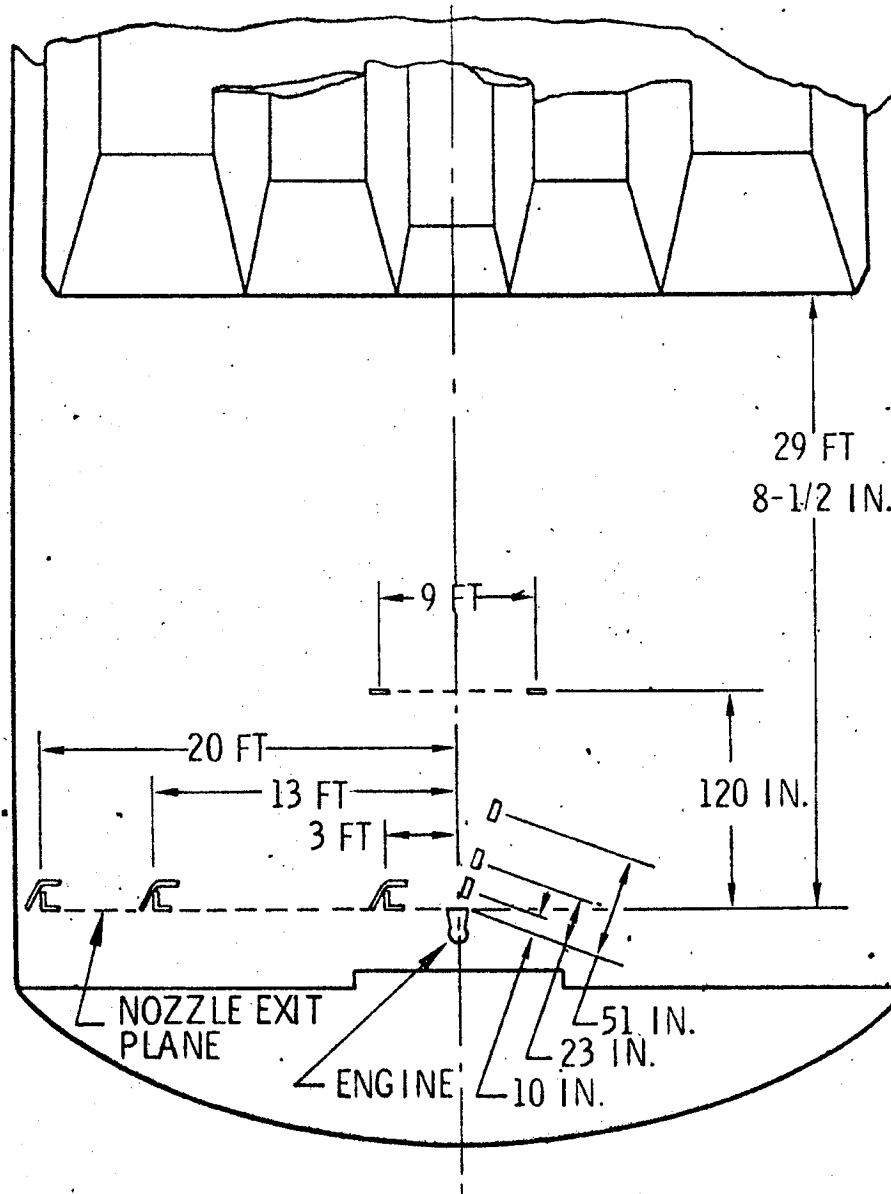
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AEDC MINUTEMAN PIGGYBACK TEST
SAMPLE LOCATION SCHEMATIC AEDC MARK I CHAMBER
AEROSPACE ENVIRONMENTAL FACILITY

V1785-1A

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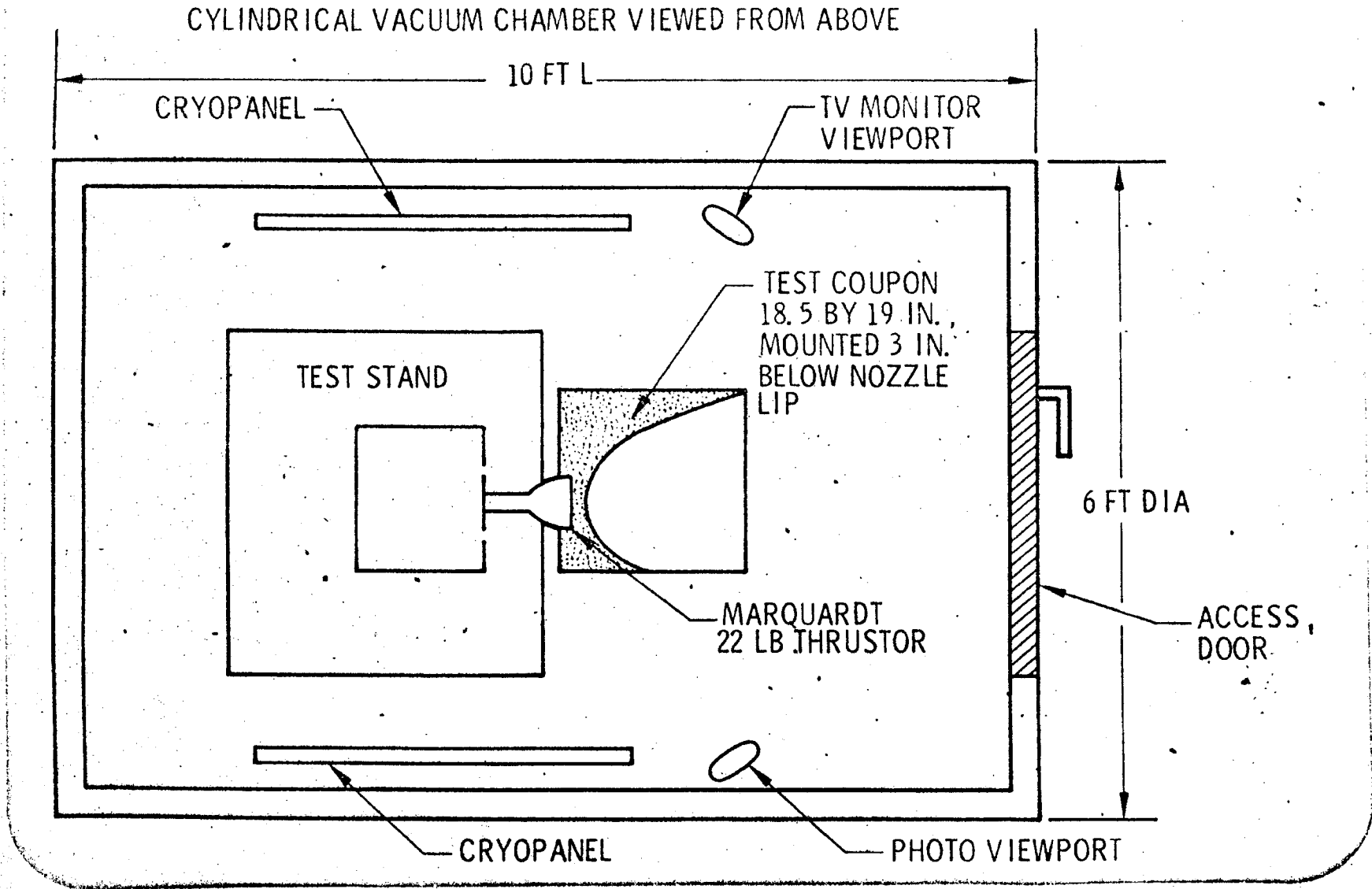


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EDWARDS RTF PIGGYBACK TEST FACILITY AND TEST CONFIGURATION

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NON-MOL TESTING MOVIE

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DESCRIPTION OF BASELINE MOL PLUME TEST AT AEDC

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OBJECTIVES

MEASURE STEADY STATE AND PULSE MODE PLUME CONTAMINATION
MEASURE PLUME IMPINGEMENT HEATING RATES AND PRESSURES
EVALUATE UNSTEADY PRESSURES WITHIN THE PLUME AT POINTS OF
IMPINGEMENT
TEST POTENTIAL CONTAMINATION FIXES

TEST FACILITY

CELL 8V OF THE AEROSPACE ENVIRONMENTAL FACILITY AT AEDC
LIQUID HELIUM CRYO-LINERS MAINTAIN ALTITUDE 400,000
FT DURING STEADY STATE FIRING

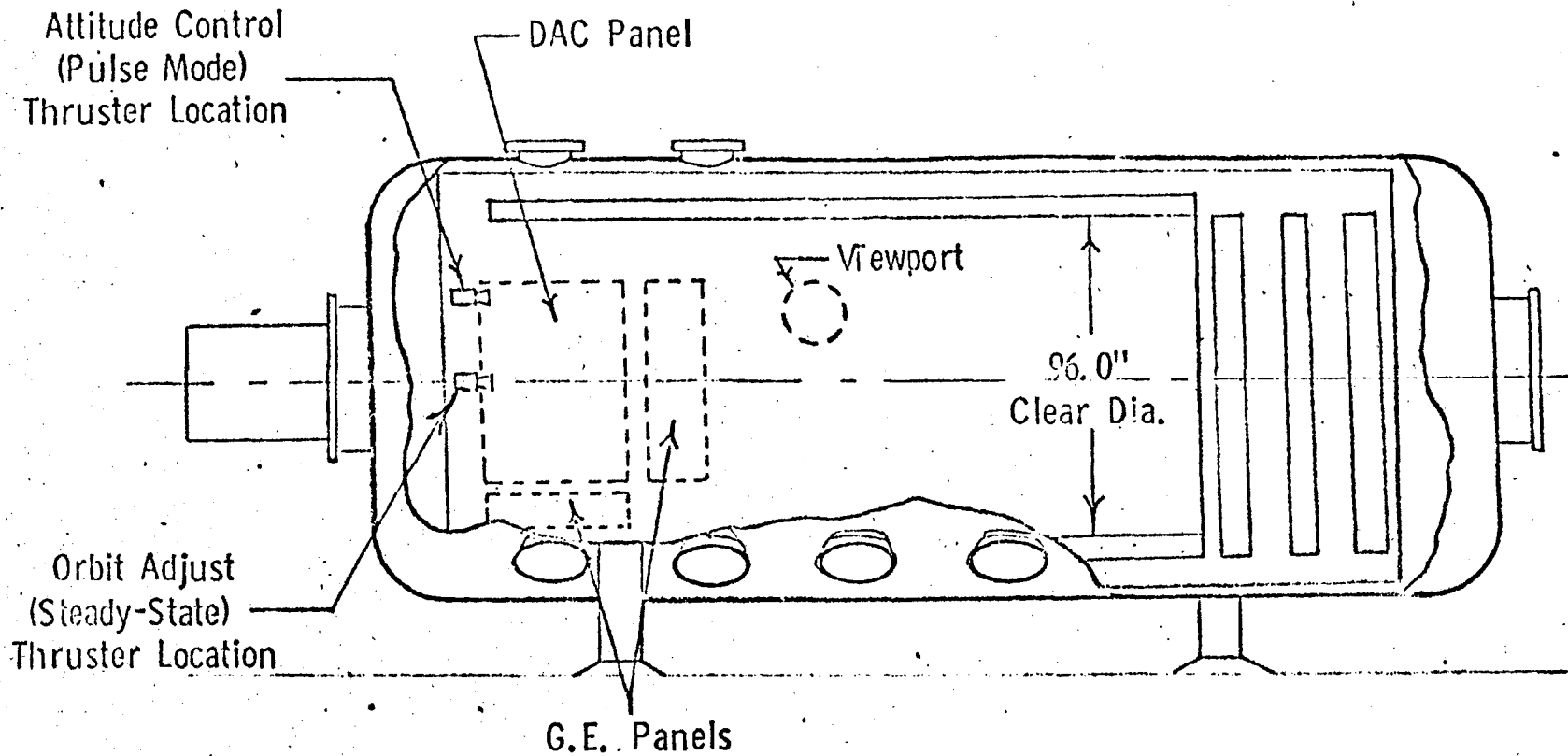
TEST HARDWARE

1 LB THRUST (VACUUM) THRUSTOR MANUFACTURED BY MARQUARDT
TWO TEST PANELS ORIENTED VERTICALLY TO ASSESS EFFECTS OF GRAVITY
TEMPERATURE - PRESSURE PANEL
CONTAMINATION PANEL

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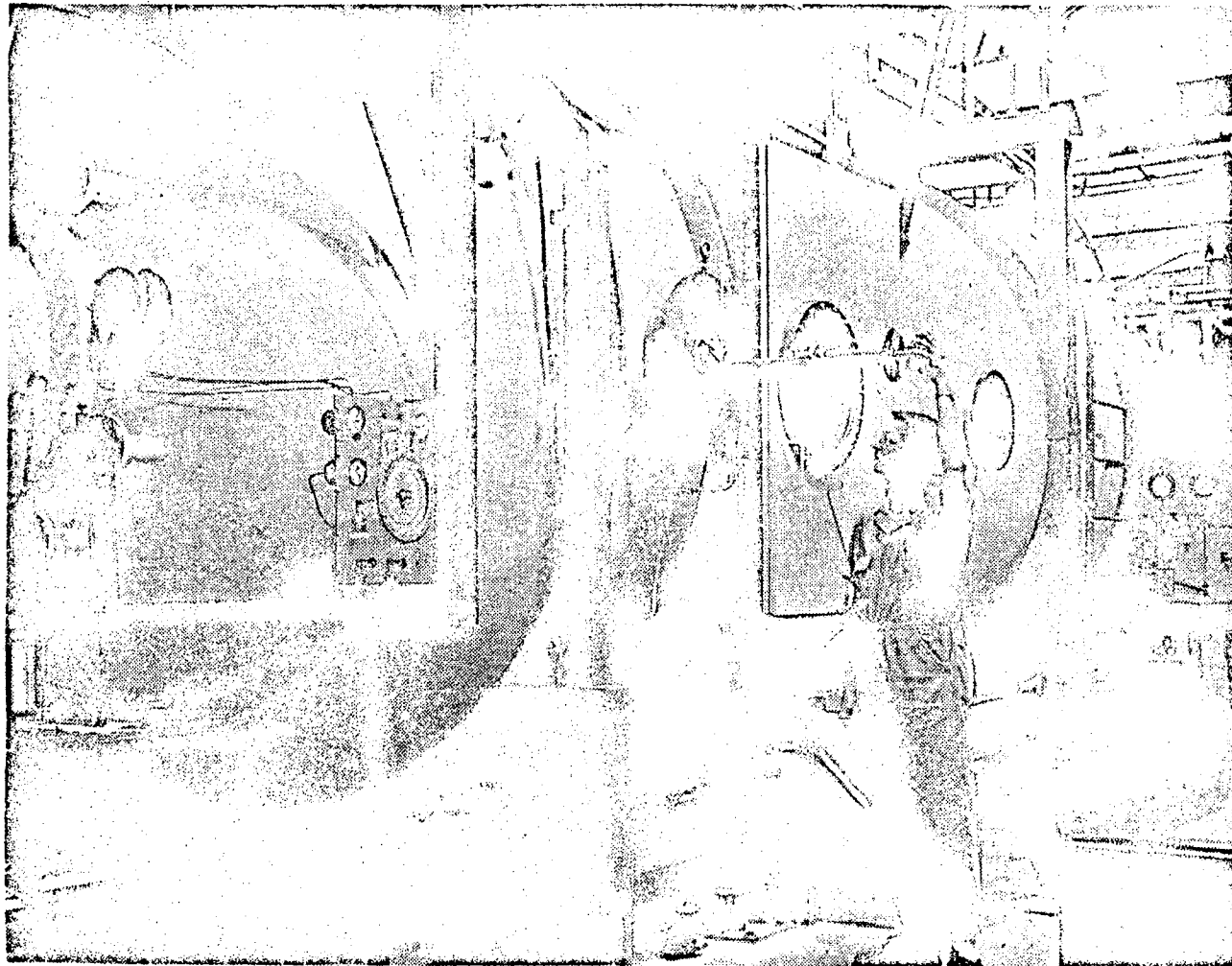
8V CHAMBER TEST INSTALLATION

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AEDC AEROSPACE ENVIRONMENTAL FACILITY

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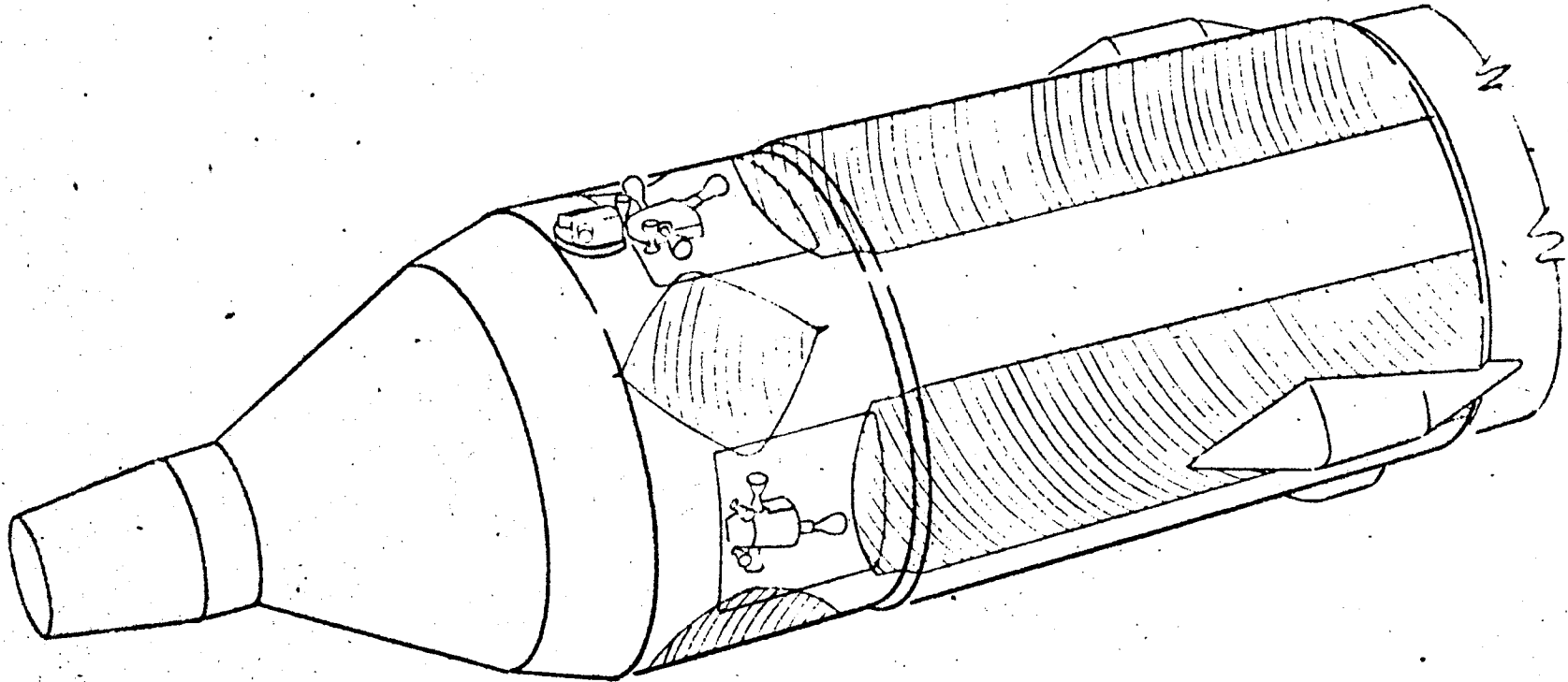


8V

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PLUME IMPINGEMENT REGIONS

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STEADY STATE CONTAMINATION MOVIE

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- o PRE-FIRE COLD PANEL (-60°F MINIMUM)
 - THERMAL CONTROL SAMPLES ARE CLEAN
 - GLASS SAMPLES ARE CLEAR

- o POST-FIRE COLD PANEL (AFTER 6 205 SEC FIRINGS)
 - THERMAL CONTROL SAMPLES HAVE YELLOWED
 - GLASS SAMPLES ARE OPAQUE

- o POST-FIRE HEATED PANEL (AFTER 6 205 SEC FIRINGS)
 - THERMAL CONTROL SAMPLES HAVE NOT DISCOLORED
 - GLASS SAMPLES HAVE NOT BECOME OPAQUE

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STEADY STATE MOVIE

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STEADY STATE
THRUSTOR PLUME IMPINGEMENT CONTAMINATION TEST RESULTS TO DATE
SUBSCALE AEDC 8V CHAMBER

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- UNHEATED TEST PANEL ($\sim - 60^{\circ}\text{F}$)
/ CONTAMINANT DEPOSITED ON TEST PANEL AND SPECIMENS
- UNHEATED TEST PANEL WITH LINE-OF-SIGHT BARRIER (FENCE)
AT SCALED VIEWPORT LOCATION
/ NO SIGNIFICANT REDUCTION IN AMOUNT OF CONTAMINANT
- UNHEATED TEST PANEL WITH LINE-OF-SIGHT BARRIER AT SCALED
LM/MM INTERFACE LOCATION
/ AMOUNT OF CONTAMINANT DEPOSITED AFT OF FENCE
SIGNIFICANTLY REDUCED
- HEATED TEST PANEL WITH FENCE AT SCALED LM/MM INTERFACE
LOCATION ($\sim + 70$ TO $+ 120^{\circ}\text{F}$)
/ AMOUNT OF CONTAMINANT DEPOSITED ON PANEL BOTH FWD AND
AFT OF FENCE SIGNIFICANTLY REDUCED

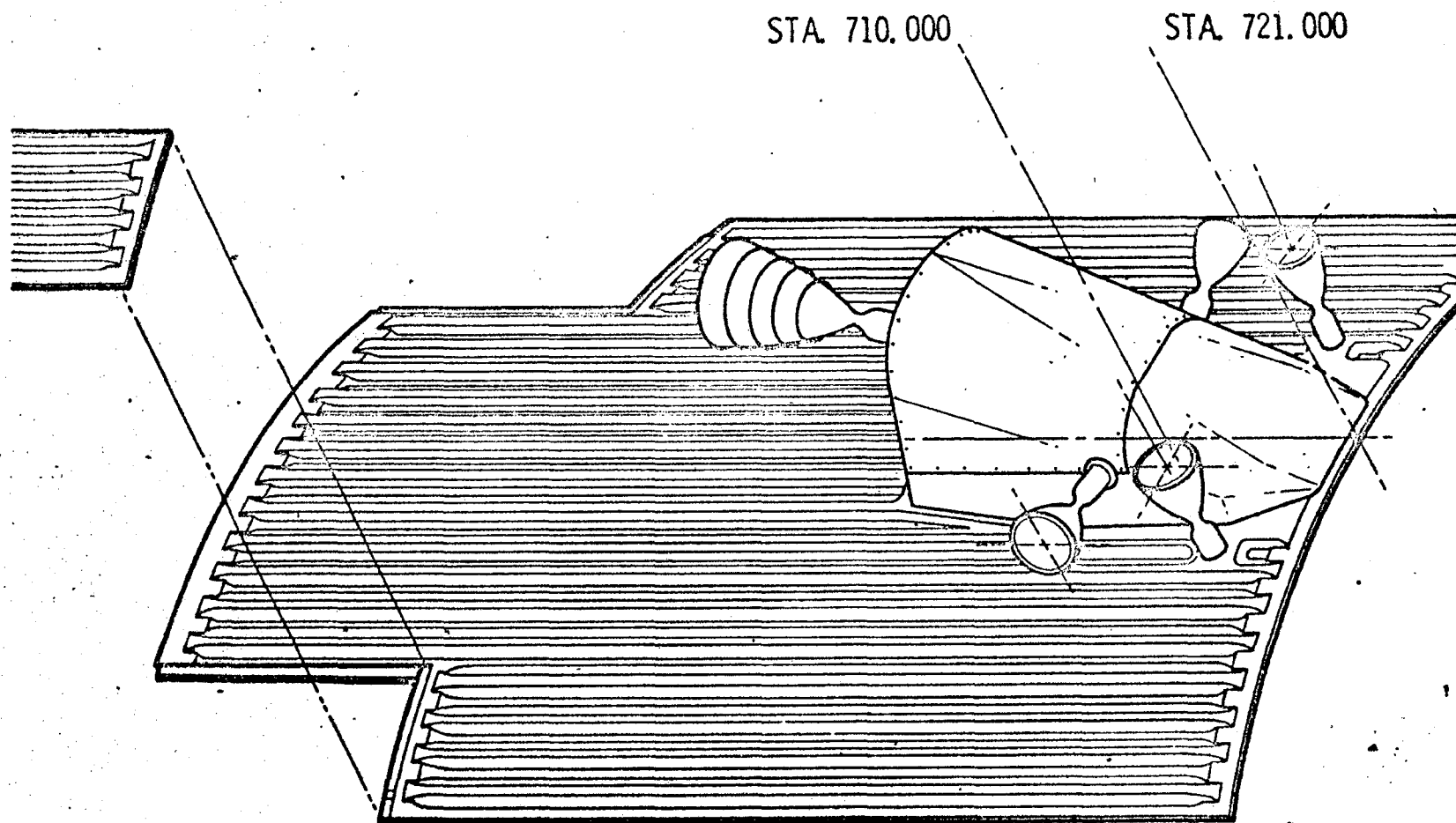
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ACTS MODULE CONFIGURATION

V2102-3

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PULSE MODE CONTAMINATION MOVIE

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- o BASELINE THRUSTOR CONFIGURATION
 - PRE-FIRE
 - AFTER 3000 PULSES (20 MS ON, 1 SEC OFF)
 - AFTER 8000 PULSES (20 MS ON, 1 SEC OFF)

- o BASELINE THRUSTOR WITH PANEL FENCE FIX
 - PRE-FIRE
 - AFTER 3000 PULSES (20 MS ON, 1 SEC OFF)

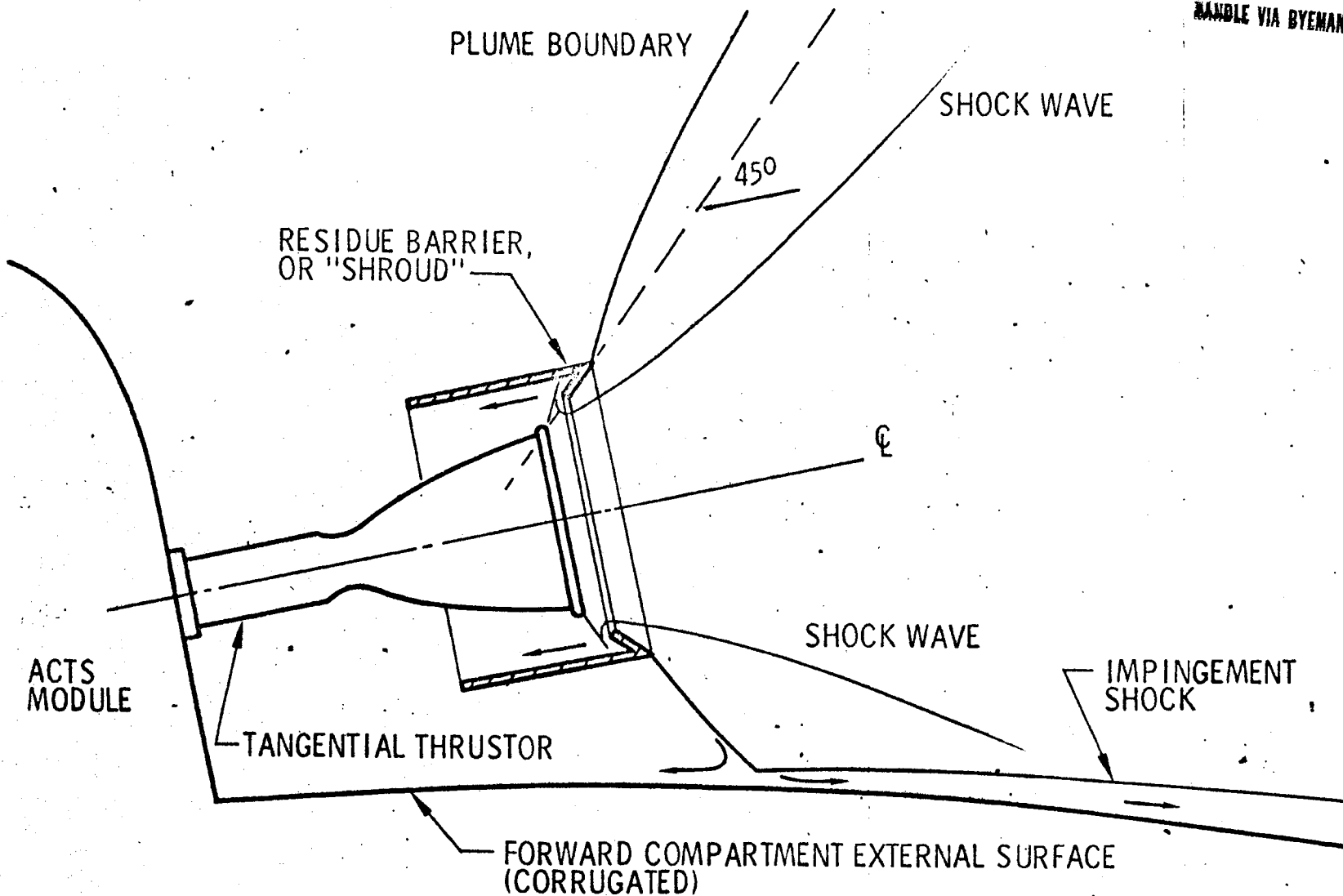
- o THRUSTOR WITH SHROUD FIX
 - FIRST 10 PULSES (20 MS ON, 1 SEC OFF)
 - AFTER 1000 PULSES (20 MS ON, 1 SEC OFF)

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TANGENTIAL THRUSTOR FLOWFIELD IN PRESENCE OF SHROUD

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PULSING MOVIE

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PULSE MODE CONTAMINATION TEST RESULTS TO DATE

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o SIGNIFICANT CONTAMINATION

- BASELINE TEST WITH NO CORRECTIVE FIXES
- HEATED NOZZLE (200°F)
- HEATED PROPELLANTS (>100°F)
- MIXTURE RATIO CHANGE (1.0 TO 2.0)
- HEATED AND UNHEATED SHROUD WITH CONTAMINANT RETENTION DEVICE

o LITTLE OR NO DISCERNIBLE CONTAMINATION

- PROTECTIVE FENCE AT FORWARD RADIATOR LOCATION
- UNHEATED SHROUD AROUND NOZZLE WITH COLLECTOR
- HEATED SHROUD AROUND NOZZLE - CONTAMINATION DECOMPOSED

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AEDC PLUME CONTAMINATION TESTS

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	1968												1969			
	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J
<u>8-V TEST CELL</u>																
CHECKOUT	█															
PLUME MAPPING	█	█	█													
STEADY STATE CONTAMINATION			█	█												
PULSE CONTAMINATION (TANGENTIAL)				█	█	█										
STEADY STATE (GE EQUIP:)						█										
CELL MAINTENANCE						█										
PULSE CONTAM: RADIAL							█									
MISC. TESTS								█	█							
<u>MARK I CELL</u>																
PLANNING								█	█							
SET-UP CHECKOUT								█	█	█						
FULL SCALE TESTS												█	█	█		

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ADDITIONAL PLUME CONTAMINATION EFFORT

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- o AEROSPACE CORPORATION LABORATORIES
 - THERMO CHEMISTRY & PROPERTIES OF CONTAMINATION
 - TRANSPORT TESTS/ANALYSES OF CONTAMINATION

- o NASA - MSC
 - EVA RETRIEVAL OF THERMAL CONTROL SAMPLES - 3RD MANNED FLIGHT

- o NASA - LEWIS
 - PLUME TESTS OF 5 LB HYPERGOLIC THRUSTOR - EARLY 1969

- o NASA - HUNTSVILLE
 - ANALYSES IN SUPPORT OF APOLLO APPLICATION PROGRAM (AAP) CURRENT EFFORT
 - PLANS/DOCUMENTATION FOR AAP EXPERIMENTS -23 (LAUNCH CONTAMINATION) AND -27 (ON-ORBIT CONTAMINATION)

- o AFRPL
 - PLANS FOR PULSE MODE CONTAMINATION TESTS OF MOL THRUSTOR IN EARLY 1969

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SUMMARY

HANDLE VIA BYEMAN SYSTEM ONLY

- o TEST RESULTS NEARING COMPLETION
 - SIGNIFICANT CONTAMINATION PRODUCED
 - CONTROL APPEARS FEASIBLE
- o ANALYTICAL EFFORTS IN PROCESS
 - TEST DATA REDUCTION
 - VEHICLE TEMPERATURE PROFILES
 - THERMAL CONTROL COATING SENSITIVITY
- o FUTURE TESTING PLANNED
 - 22 LB MOL ENGINE IN MARK I
 - INVESTIGATE PULSING FIXES
- o IMPACT
 - STEADY STATE
 - IF DEGRADATION EXCEEDS ALLOWABLE REVERSE THRUSTORS
OR SEAL EQUIPMENT
 - PULSING
 - DEGRADATION APPEARS EXCESSIVE
 - SHROUDS PROVIDE EFFECTIVE CONTROL
 - CONTAINMENT REMAINS PROBLEM

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APOLLO 7 DISCREPANCY LIST/MOL RELATED

- o EXCESSIVE CABIN FAN NOISE
- o LOSS OF AC BUSS #1
- o WATER CONDENSATE IN CABIN & SUIT HOSE
- o BIOMEDICAL INSTRUMENTATION SENSOR OVERHEATED
- o WINDOW CONTAMINATION
- o SEXTANT CONTAMINATION

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