SECRET G [redacted] (b)(3)

BIF-008- W-C-001175-OH-73 - 002

Sheet 1 of 61

12 October 1973

ADVANCED GAMBIT PRESENTATION

BIF-008-001175/73 2 B

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SECRET G

Handle via BYEMAN
Control System Only

AGENDA

INTRODUCTION	-	BACKGROUND, OBJECTIVES, GOALS
PHASE I	-	BASELINE SELECTION STUDY
PHASE II	-	SYSTEM EVALUATION
		° DESIGN CONFIGURATION
		° PERFORMANCE EVALUATION
		° IMPLEMENTATION
SUMMARY		

OBJECTIVE

- AN EVOLUTION OF THE GAMBIT PROGRAM WHICH WILL PROVIDE A SUBSTANTIAL PERFORMANCE IMPROVEMENT WITH A MINIMUM IMPACT ON COST, SCHEDULE, VEHICLE, AND FACILITIES.

GOALS

- TO PROVIDE A SYSTEM WHICH CAN:
  1) PRODUCE A MAJORITY OF ITS PHOTOGRAPHS AT A GROUND RESOLVED DISTANCE (GRD) [redacted] OR BETTER, AND WITH THE BEST PHOTOGRAPH [redacted] GRD OR BETTER. (b)(1) (b)(3)
  2) PROVIDE COST EFFECTIVENESS BY A MAXIMUM ULITIZATION OF PRESENT GAMBIT TECHNOLOGY AND FACILITIES.
  3) BE OPERATIONAL EFFECTIVE FLIGHT #55 (MIDDLE 1978)

Approved for Release: 2022/02/09 C05137151

PPS MAJOR IMPROVEMENTS SUMMARY

- ULTRA - THIN BASE FILMS	EARLY	1967
- SINGLE SRV TO DUAL SRVS	MID	1969
- USE OF LOW COEF. OPTICAL MATERIALS	MID	1970
- DRM ASSEMBLY AT ONF	LATE	1970
- ORBITAL LIFE INCREASED (30 DAYS)	EARLY	1971
- LENS FORMULA CHANGE (R-5)	MID	1971
- EXPOSURE SLIT CHANGE	EARLY	1972
- INCREASED FILM CAPACITY (10,800)	MID	1973
- IMPROVED OPTICAL QUALITY	MID	1973
- ORBITAL LIFE INCREASED (45 DAYS)	MID	1975
- 9 X 5 (DUAL PLATEN) DESIGN	EARLY	1976

SCS MAJOR IMPROVEMENTS SUMMARY

IMPROVEMENT	YEAR
INCREASE NUMBER OF ROLLS TO 1250	1967
INCREASE NUMBER OF ROLLS TO 2250	1968
REDUNDANT ATTITUDE CONTROL SYS.	1968
INCREASE NUMBER OF ROLLS TO 7000	1969
NINE I-K BATTERIES	1969
TEN I-K BATTERIES	1971
MIX OF I-K AND MAGNUM BATTERIES	1971
TEN MAGNUM BATTERIES	1972
INCREASE NUMBER OF ROLLS TO 18,000	1972
TEN SUPER MAGNUM BATTERIES	1974
INTEGRAL SECONDARY PROPULSION SYSTEM	1974
HYDRAZINE REACTION CONTROL SYSTEM	1974
BOOSTER 2ND STAGE LEVEL SENSOR SHUTDOWN	1974
SOLAR ARRAY POWER SYSTEM	1975

BASELINE SELECTION STUDY

° STUDY AREAS

1) LENS SELECTION

2) PHYSICAL LIMITATIONS

3) ASCENT/ORBITAL SYSTEM OPTIMIZATION

LENS SELECTION

- LENS TYPE: ROSS VERSUS RITCHEY - CHRETIEN

(b)(1)
(b)(3)

CONDITIONS

NADIR, ON-AXIS, IN-FOCUS

65 NMI

1σ SMEAR

2/1 CONTRAST

SO 124 FILM, AEI = 2.0

80% OQF

* SELECT ROSS LENS BECAUSE

1) BETTER RESOLUTION FOR GIVEN SYSTEM WEIGHT
2) MUCH EASIER FOCUS, ALIGNMENT TOLERANCES
3) NO NEW TECHNOLOGY

o ROSS LENS f-NUMBER SELECTION

(b)(1)
(b)(3)

CONDITIONS

NADIR, ON-AXIS, IN-FOCUS
65 RMI
Iσ SMEAR
2/1 CONTRAST
SO-124 FILM, AEI = 2.0
80% OQF

* f/4 LENS GIVES BEST PERFORMANCE DUE TO SMEAR SENSITIVITY OF LONGER FOCAL LENGTHS.

* ALSO, f/4 LENS GIVES:

1) SHORTER VEHICLE LENGTH, LESS WEIGHT, BETTER DYNAMICS
2) BETTER COVERAGE, MORE TARGETS
3) COMPATIBLE WITH PRESENT FILM AND TREND TOWARDS SLOWER FINER GRAINED FILMS

** SELECT ROSS f/4 LENS FOR FURTHER STUDY

PHYSICAL LIMITATIONS

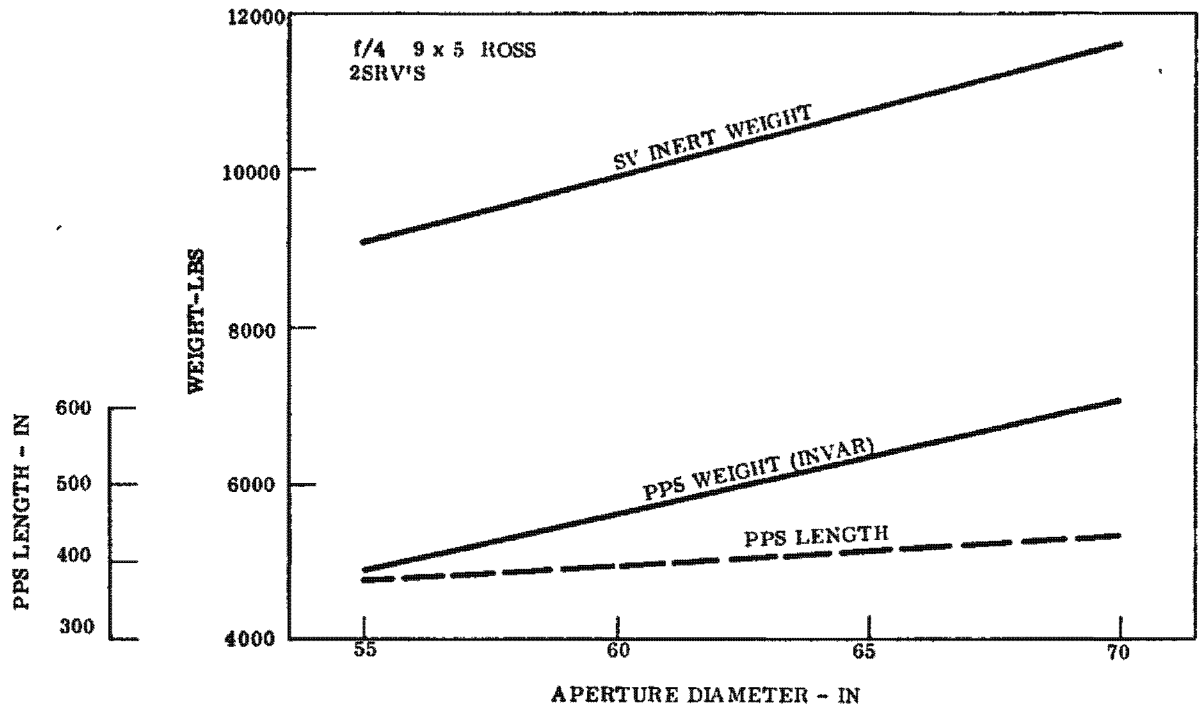
- ITEMS CONSIDERED
  1) MANUFACTURING & TEST FACILITIES
  2) LAUNCH PAD CONSTRAINTS
  3) LAUNCH VEHICLE CAPABILITIES
  4) TRANSPORTATION

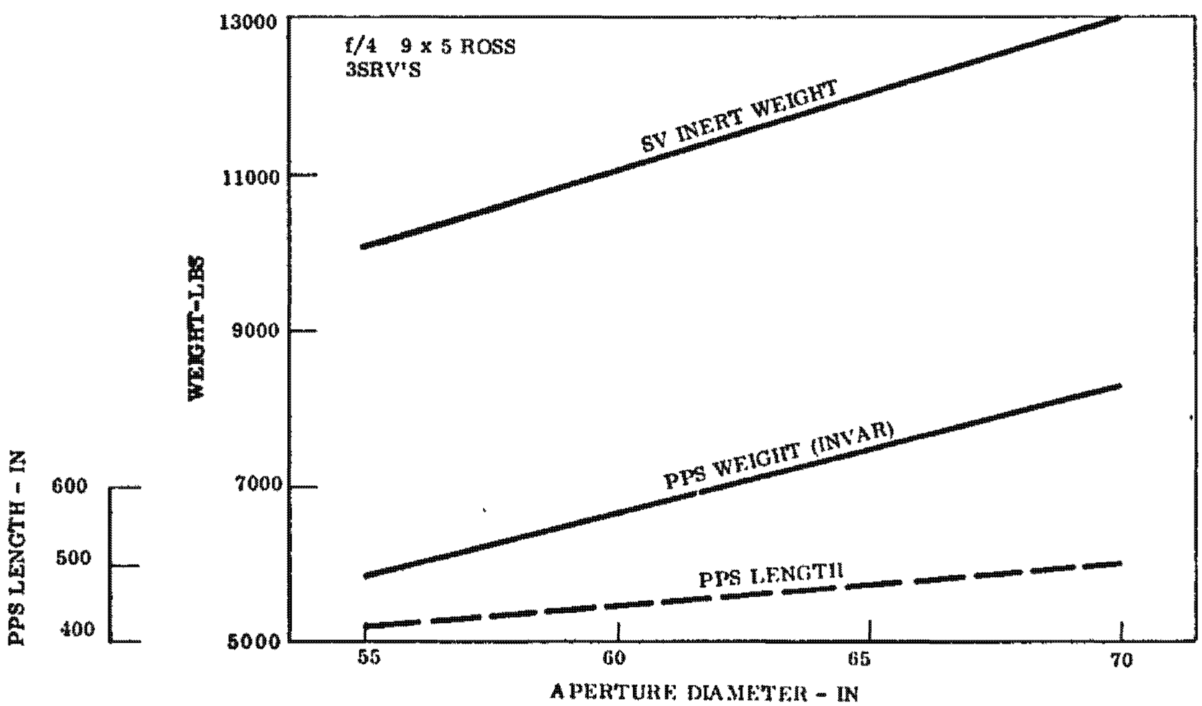
PHYSICAL LIMITATIONS (CONTINUED)

- EXISTING FACILITIES CAN MANUFACTURE 90" OPTICS WITHOUT MODIFICATION.
- MAXIMUM OPTICAL DIMENSION IS STEREO MIRROR MAJOR AXIS.
- STANDARD STEREO MIRROR SIZING METHODS RESULTS IN 90" X 70".

** 70" IS AN APERTURE SIZE THAT IS COMPATIBLE WITH EXISTING FACILITIES.

BEGIN ORBIT INERT WEIGHT



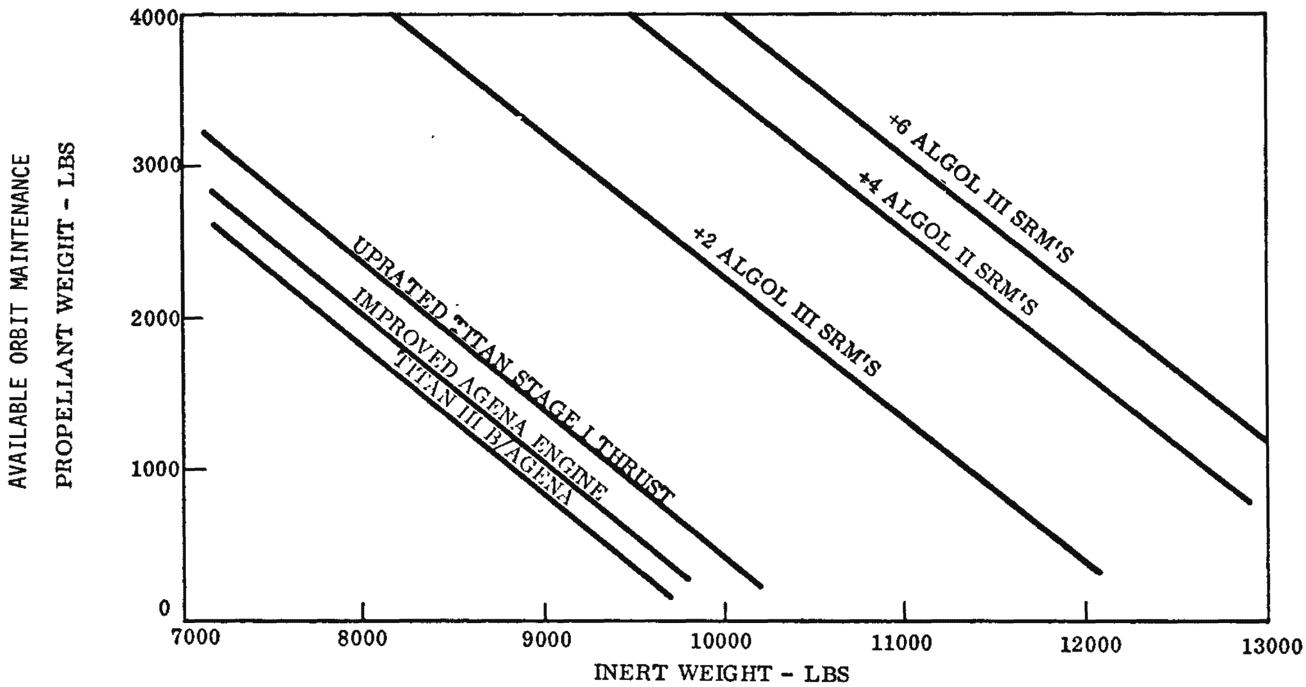


ASCENT CAPABILITY

ASSUMPTIONS:

- RETAIN BASIC T IIIB LAUNCH VEHICLE AND COMPLEX.
- UPRATE ASCENT CAPABILITY
  FIVE PERCENT STAGE I THRUST INCREASE
  HIGH PERFORMANCE INJECTOR IN SCS
- ADD 2, 4, OR 6 ALGOL III SRM'S (REF. MMC BRIEFING OF 22 FEBRUARY 1973)

ASCENT CAPABILITY SUN SYNCHRONOUS INCLINATION



OPTIMIZATION METHOD

PROBLEM STATEMENT:

GIVEN AN ELEMENT OF WEIGHT (BOOSTER PERFORMANCE), HOW SHOULD IT BE ALLOCATED BETWEEN OPTICS, ALTITUDE AND LIFETIME, TO SATISFY OBJECTIVES.

PROBLEM APPROACH:

SEEK AN OPTIMUM WEIGHT BALANCE BETWEEN OPTICS SIZE AND ORBIT MAINTENANCE PROPELLANTS PARAMETRICALLY WITH FILM SUPPLY AND LIFETIME.

SYSTEM EQUATIONS:

$$GRD = K_1 \frac{h}{D}$$

$$LIFE_{FILM} = K_2 \frac{Q}{f} \frac{h}{D}$$

$$LIFE_{VEHICLE} = g\ (h,\ D)$$

WHERE: Q = FILM QUANTITY
h = PERIGEE ALTITUDE
D = APERTURE DIAMETER
f = FRAME RATE
K_i = PROPORTIONALITY CONSTANTS

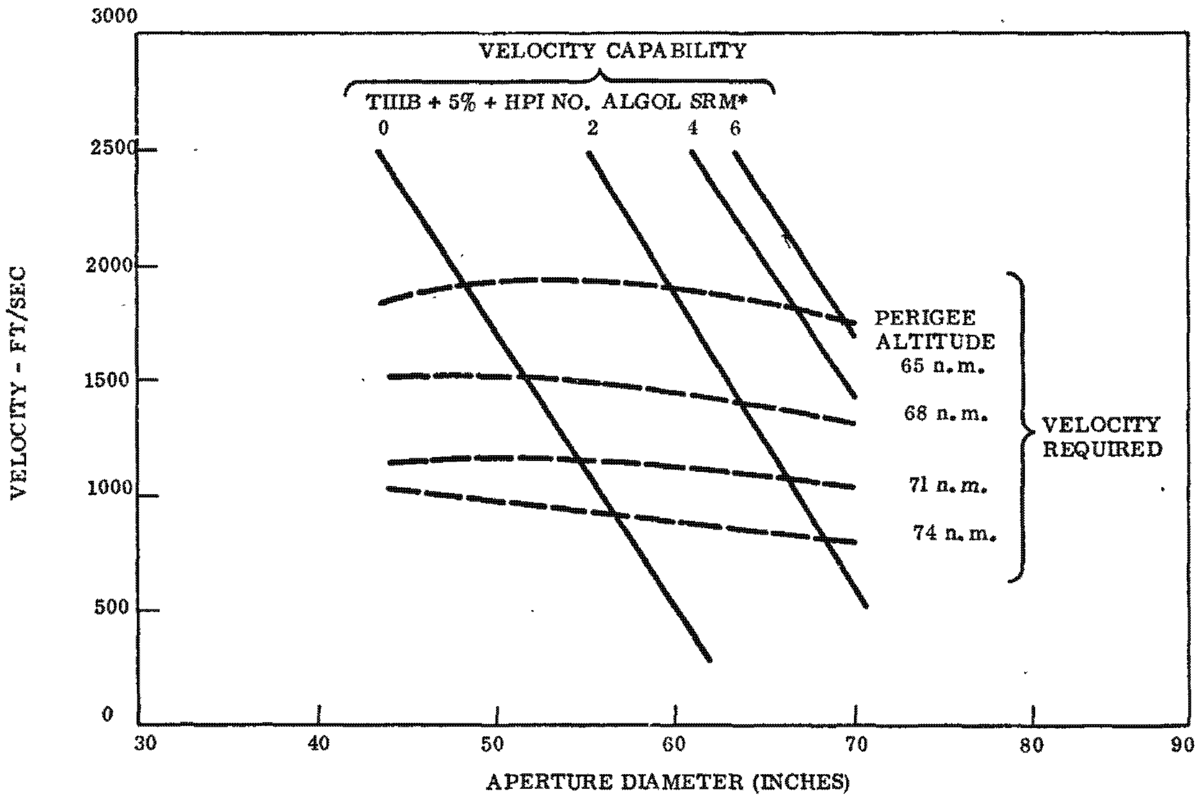
AND g(h,D)= SOME NON-LINEAR FUNCTION WHICH IS THE COMBINATION OF ASCENT CAPABILITY AND ORBIT MAINTENANCE REQUIREMENTS

OPTIMIZATION EXAMPLE

STEP		
1	SETTING $L_{VEHICLE} = L_{FILM}$ CONSTITUTES A BALANCED COMBINATION SUCH THAT THE PROPELLANT AND FILM SUPPLIES ARE DEPLETED SIMULTANEOUSLY.	$LIFE_{FILM} = LIFE_{VEHICLE}$ $K_2 \frac{Q}{f} \frac{h}{D} = g\,(h, D)$
2	SINCE h AND D UNIQUELY DEFINE THE GRD FOR A GIVEN OPTICAL CONFIGURATION, AN APPROACH CAN BE ESTABLISHED TO SOLVE FOR GRD WITH A GIVEN FRAME RATE FILM QUANTITY AND BOOSTER UNDER THE CONDITIONS OF BALANCE IN STEP 1.	$\frac{h}{D} = \frac{f}{K_2 Q}\, g\,(h, D)$
3	THESE VALUES CAN BE PLOTTED TO DETERMINE TRENDS WITH THE OPTIMUM CONFIGURATION BEING AT THE MINIMUM POINT.	

ESTIMATED MISSION ORBITAL MAINTENANCE

(300 FRAMES PER DAY)



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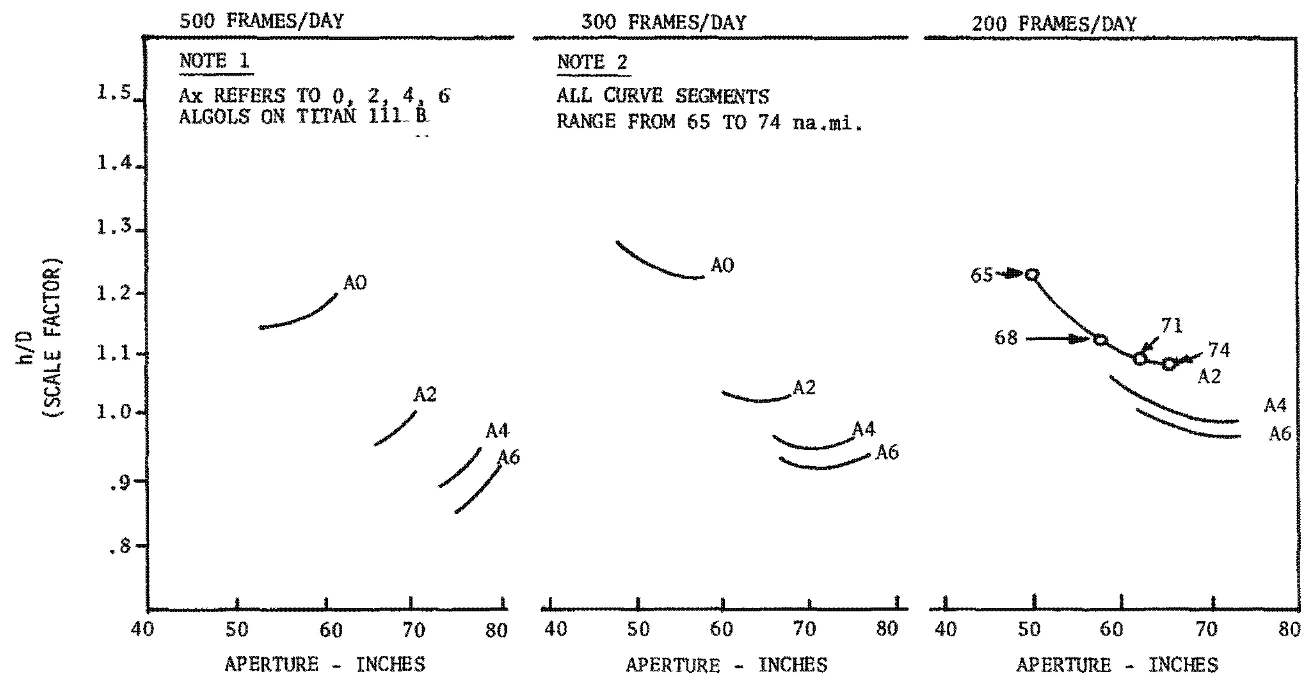
OPTIMUM CONFIGURATIONS

TWO SRV'S



17

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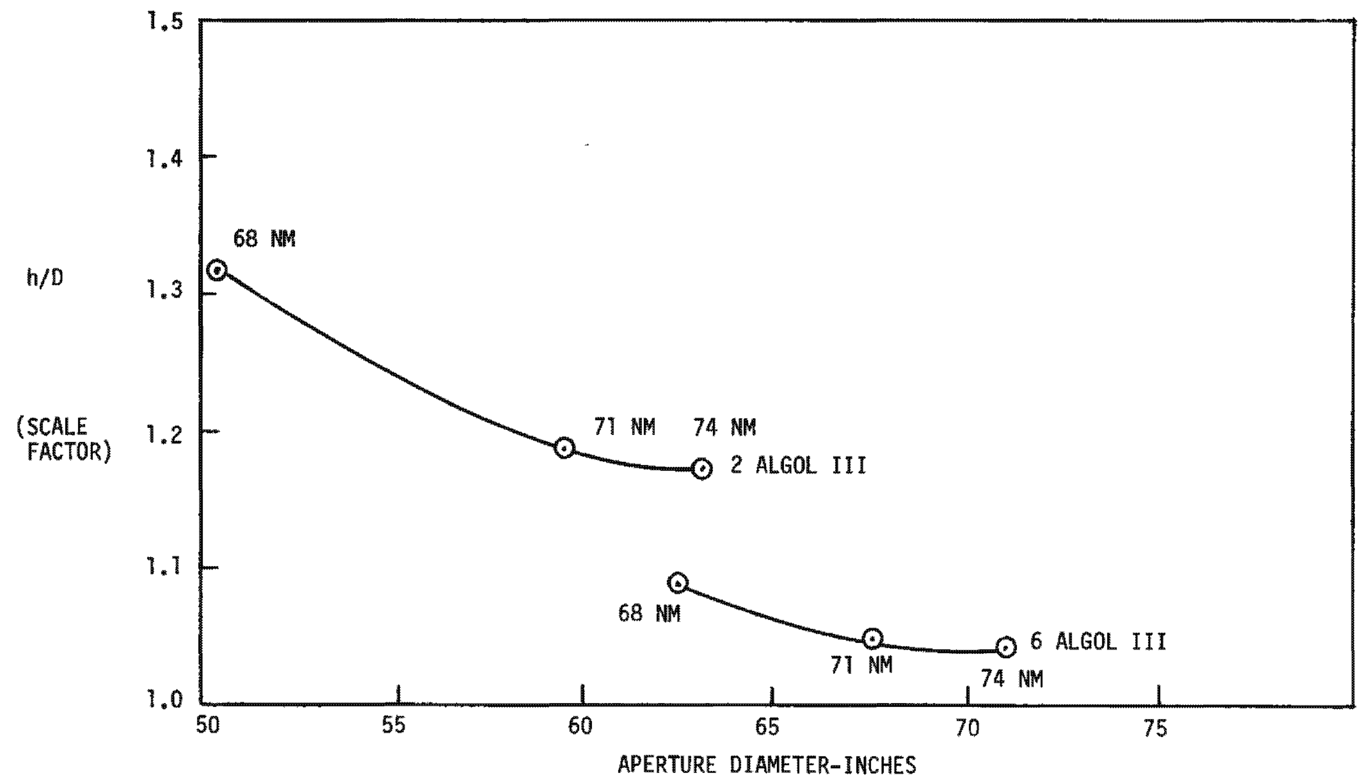
MISSION LIFE = 60 DAYS 2 SRV's



(b)(1)
(b)(3)

2 SRV'S
NEAR OPTIMUM PROPELLANTS/OPTICS CONFIGURATIONS

NO. SRVs	APPROX. FRAMES PER DAY (9 INCH PLATEN)	BOOSTER NUMBER OF ALGOLS	APERTURE DIAMETER INCHES	PERIGEE ALT. NA. MI.		APPROX. NO. OF FRAMES (9 INCH PLATEN)	NUMBER OF DAYS LIFE AT PERIGEE ALTITUDE
2	200	6	70	70.5		8800	44 (51) *
2	300	6	70	66		8100	27 (31) *
PRESENT GAMBIT SATELLITE							
2	300	0	43.5	65		13,200	44
2	200	0	43.5	71		14,200	71 **

*PARENTHETICAL NUMBERS GENERATED SUBSEQUENT TO CFD ANALYSIS.
** PRESENT PSV NOT QUALIFIED FOR 71 DAYS.

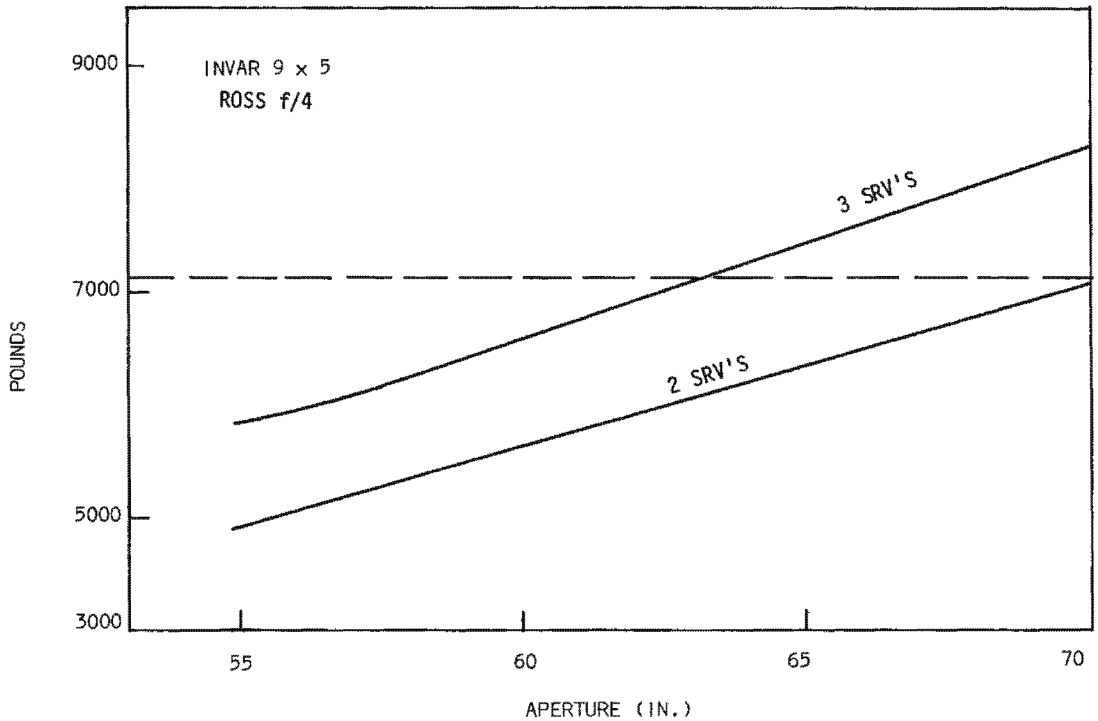
FRAMES VS RESOLUTION TRADE OFFS

° - ADD 3RD SRV

  * - 50% FILM LOAD INCREASE
  * - ABOUT 1000 LB. WEIGHT PENALTY

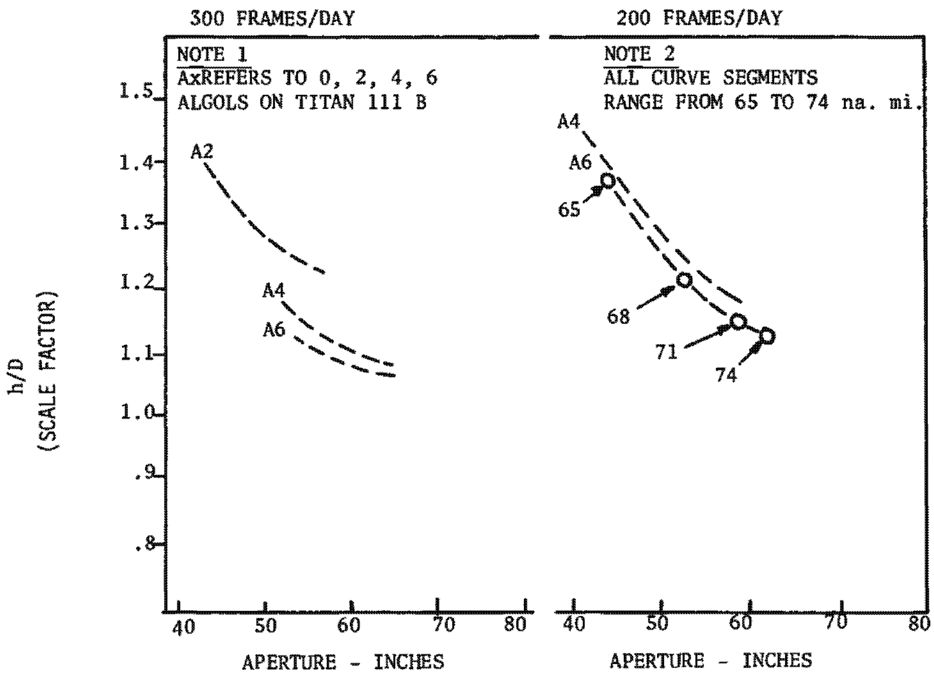
POSSIBLE TRADE-OFFS	PRICE
° - SAME APERTURE, FLY HIGHER	RESOLUTION
° - SAME APERTURE, SAME ALTITUDE	LIFE
° - SMALLER APERTURE, SAME ALTITUDE	RESOLUTION
° - WEIGHT SAVING MEASURES	$, TIME
° - COMBINATION OF ABOVE	

3 SRV'S VS. 2 SRV'S PAYLOAD WEIGHT



OPTIMUM CONFIGURATIONS

3 SRV'S



3 SRV'S VERSUS 2 SRV'S

NEAR OPTIMUM PROPELLANTS/OPTICS CONFIGURATIONS

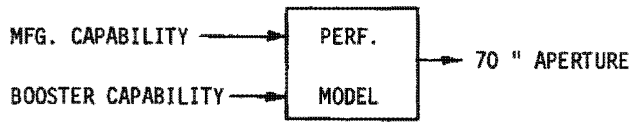
(b)(1)
(b)(3)

NO. SRVs	APPROX. FRAMES PER DAY (9 INCH PLATEN)	BOOSTER NUMBER OF ALGOLS	APERTURE DIAMETER INCHES	PERIGEE ALT. NA. MI.	[redacted]	APPROX. NUMBER OF FRAMES (9 INCH PLATEN)	NUMBER OF DAYS LIFE AT PERIGEE ALTITUDE
2	200	6	70	70.5		8800	44 (51) *
3	300	6	65	72		14,700	49 (54) *
			PRESENT GAMBIT SATELLITE				
2	300	0	43.5	65		13,200	44
2	200	0	43.5	71		14,200	71 **

*PARENTHETICAL NUMBERS GENERATED SUBSEQUENT TO CFD ANALYSIS.
** PRESENT PSV NOT QUALIFIED FOR 71 DAYS.

BASELINE SELECTION STUDY CONCLUSIONS

- LENS TYPE: ROSS f/4
- LENS SIZE FOR 2 SRV'S



- WITH THE P/L APERTURE AND BOOSTER CAPABILITY OPERATING JUST SHORT OF MAJOR COST THRESHOLDS, THE PSV IS OPTIMUM
- PRICE PAID VERSUS PRESENT GAMBIT PSV: TOTAL FRAMES
- GAMBIT FRAME QUANTITY CAN BE MAINTAINED BY SRV OPTIONS.

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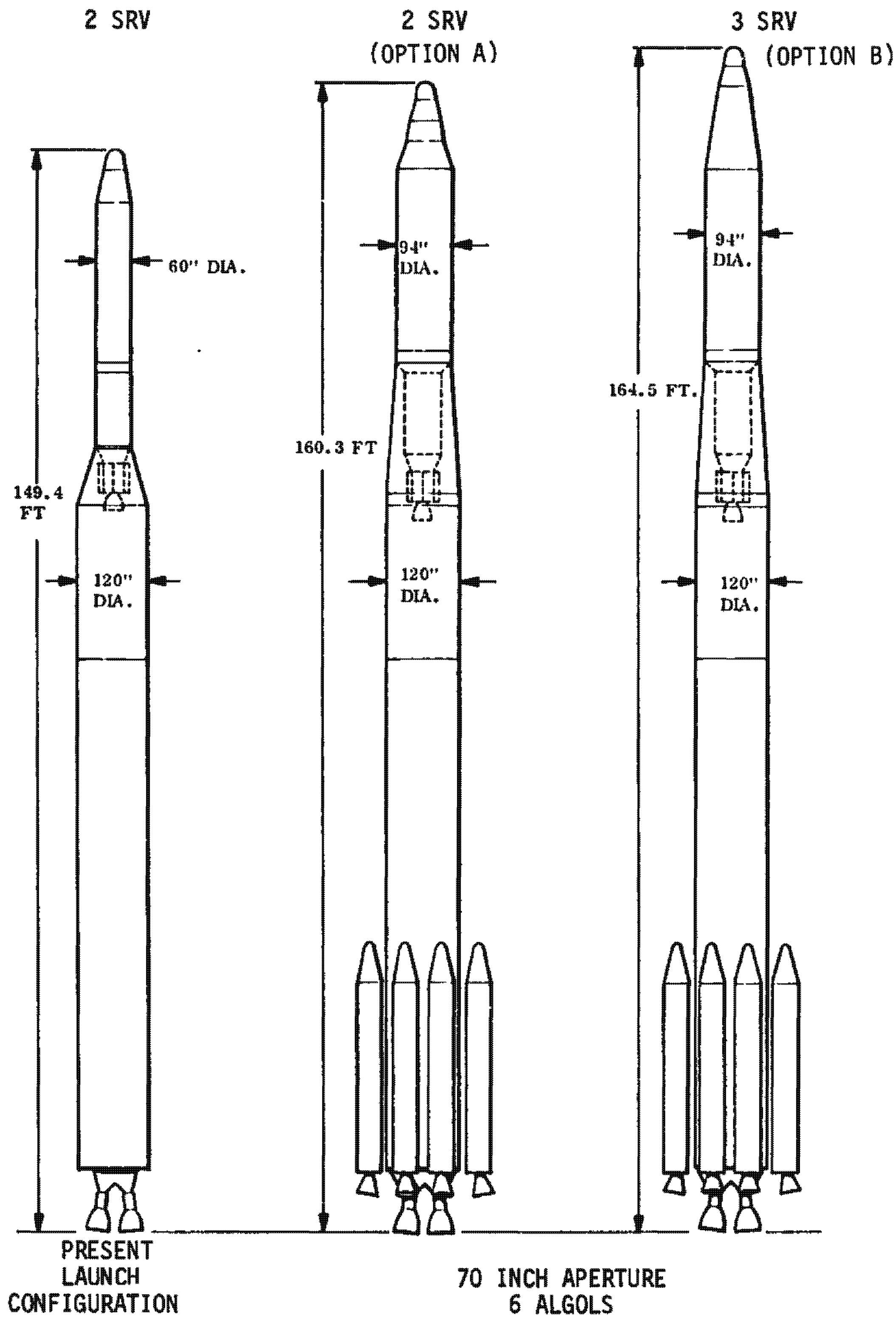
BIF-008- W-C-001175-OH-73



LAUNCH VEHICLE PROFILE

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IMPACT ON SCS

SUBSYSTEM	ADVANCED G^3 OPTION A	ADVANCED G^3 OPTION B
STRUCTURE	MINOR	MINOR
PROPULSION	MINOR	MAJOR
GUIDANCE	MINOR	MINOR
ELECTRICAL POWER	MINOR	MINOR
TT & C	MINOR	MINOR
THERMAL	MINOR	MINOR
ROLL JOINT	MAJOR	MAJOR
BOOSTER/SCS ADAPTOR	MAJOR	MAJOR
AGE/FACILITIES	MAJOR	MAJOR

MAJOR ROLL JOINT IMPACTS

MAJOR CHANGE

HARMONIC DRIVE

MOTOR DRIVE

STRUCTURE

OVER TRAVEL

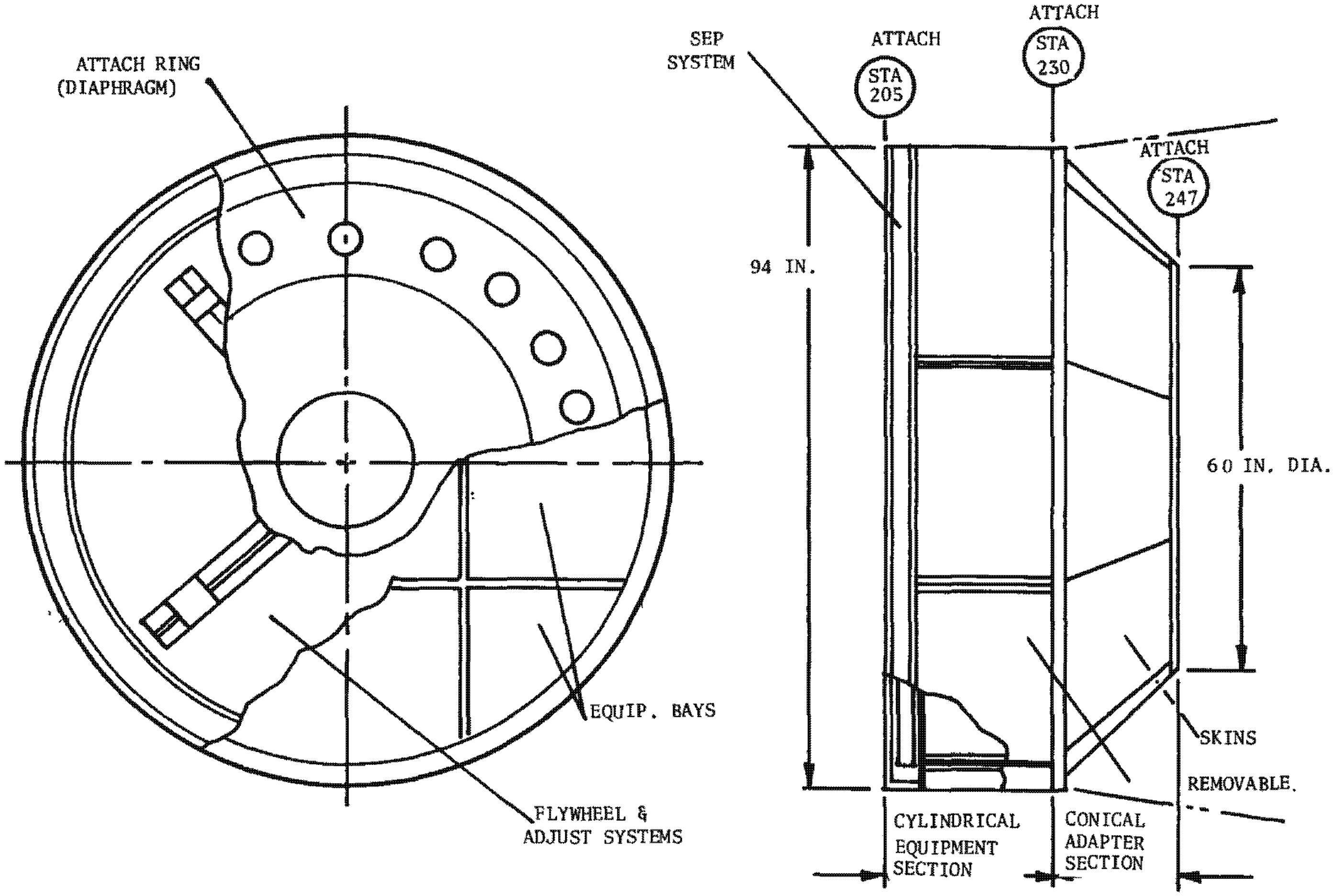
SERVO ELECTRONICS

POSITION TRANSDUCER

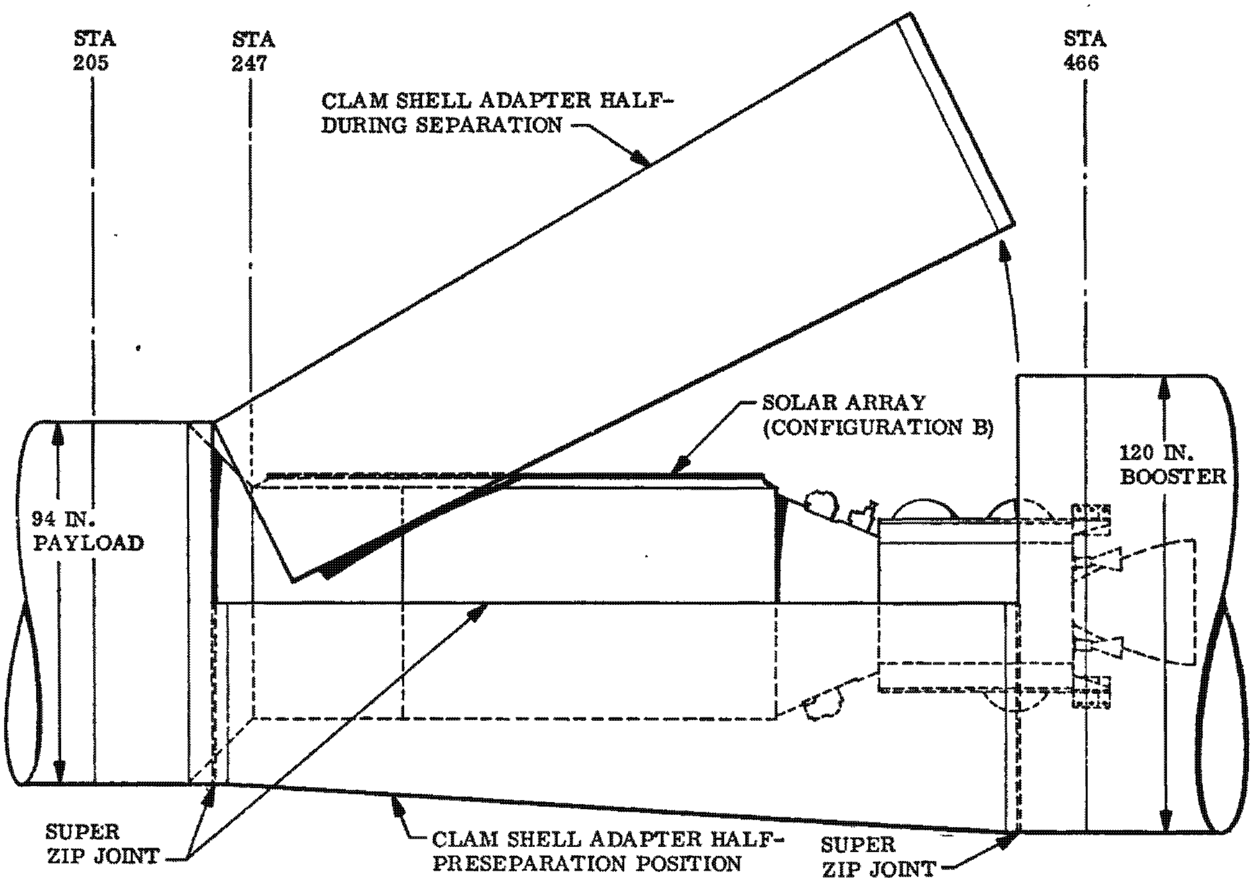
VERNIER REACTION WHEEL

POWER ELECTRONICS

- PRELIMINARY SIZING OF COMPONENTS HAS SHOWN THAT THE MAJOR COMPONENTS FOR A SCALED ROLL JOINT (MOTORS, HARMONIC DRIVE), ARE WELL WITHIN THE STATE-OF-THE-ART.
- PRELIMINARY DESIGN CONCEPTS FOR A VERNIER REACTION WHEEL HAS BEEN ESTABLISHED, HOWEVER, SIZING HAS NOT BEEN COMPLETED.



ROLL JOINT CONFIGURATION



CLAMSHELL ADAPTER

MAJOR FACILITIES IMPACTS

SUNNYVALE

THERMAL ALTITUDE SIMULATION CHAMBER

ACOUSTIC CHAMBER

HANDLING EQUIPMENT

TOOLING

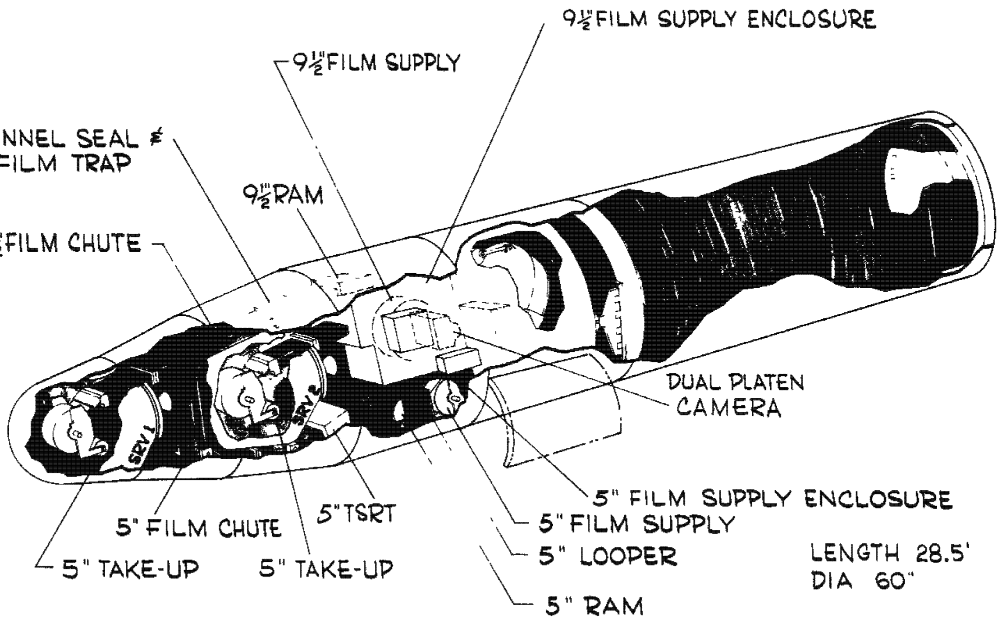
VAFB

GANTRY STATION INSERTS

UMBILICAL RETRACTABLE BOOM

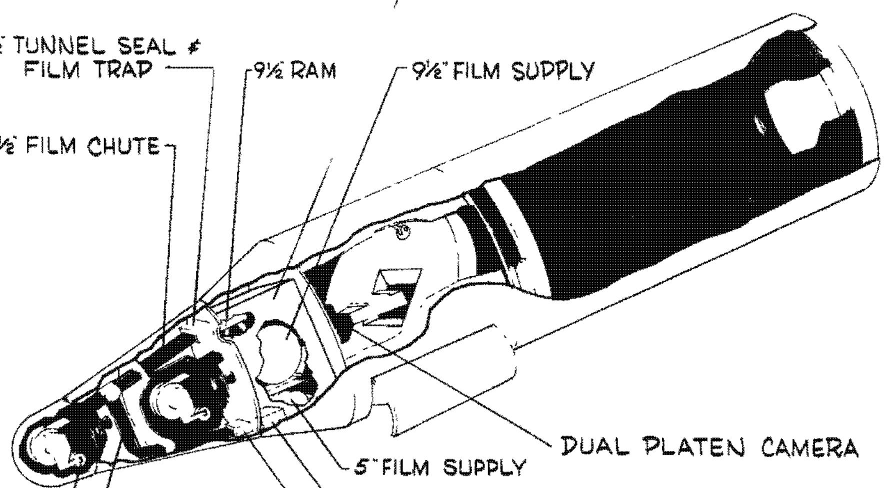
HANDLING EQUIPMENT

9 X 5 SYSTEM PPS



ADVANCED G³ PPS

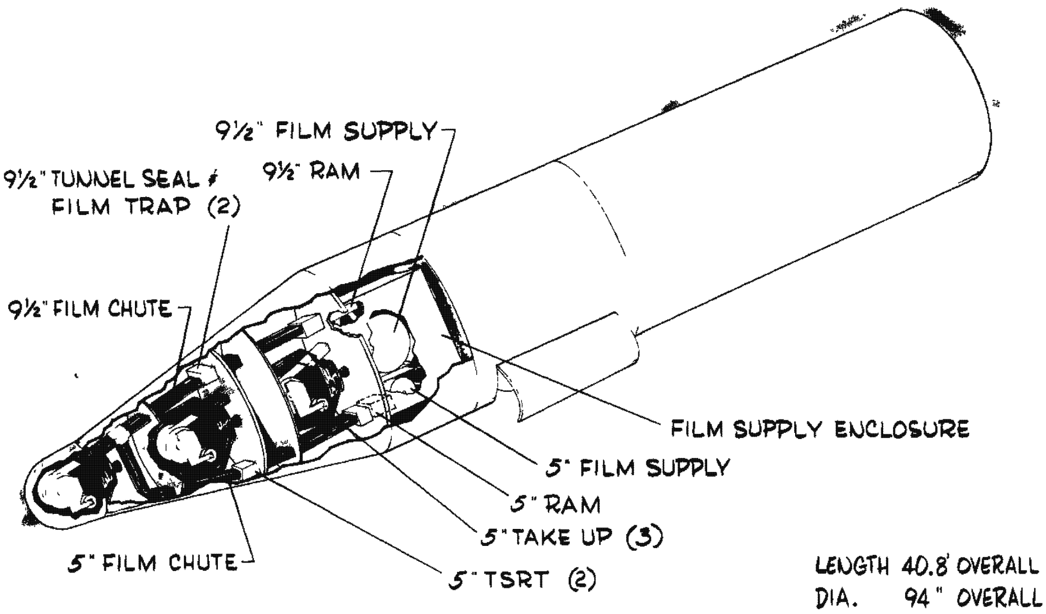
OPTION A



LENGTH 36.9' OVERALL
DIA. 94" "

ADVANCED G^3 PPS

OPTION B



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ADVANCED G³

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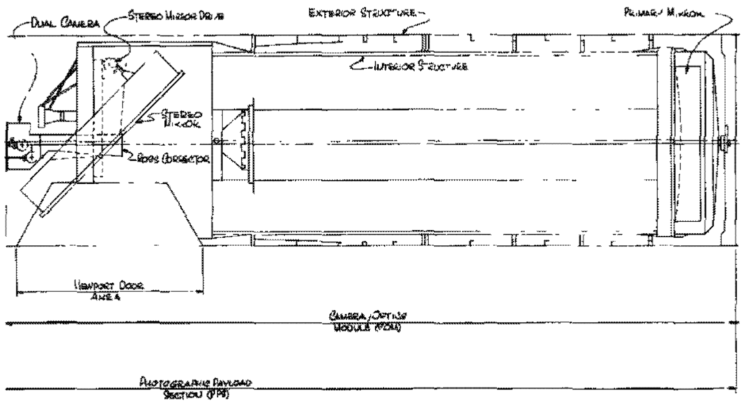
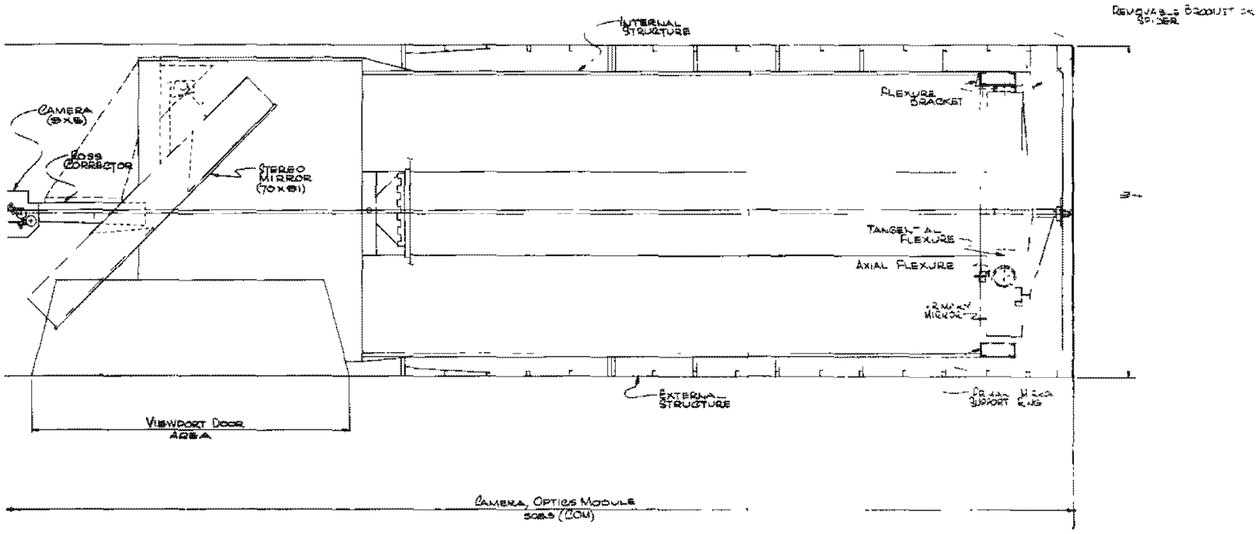


COM 9x5



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COM OPTION A
OPTION B

~~SECRET G~~

34

9 × 5 – ADVANCED G^3 COMPARISON

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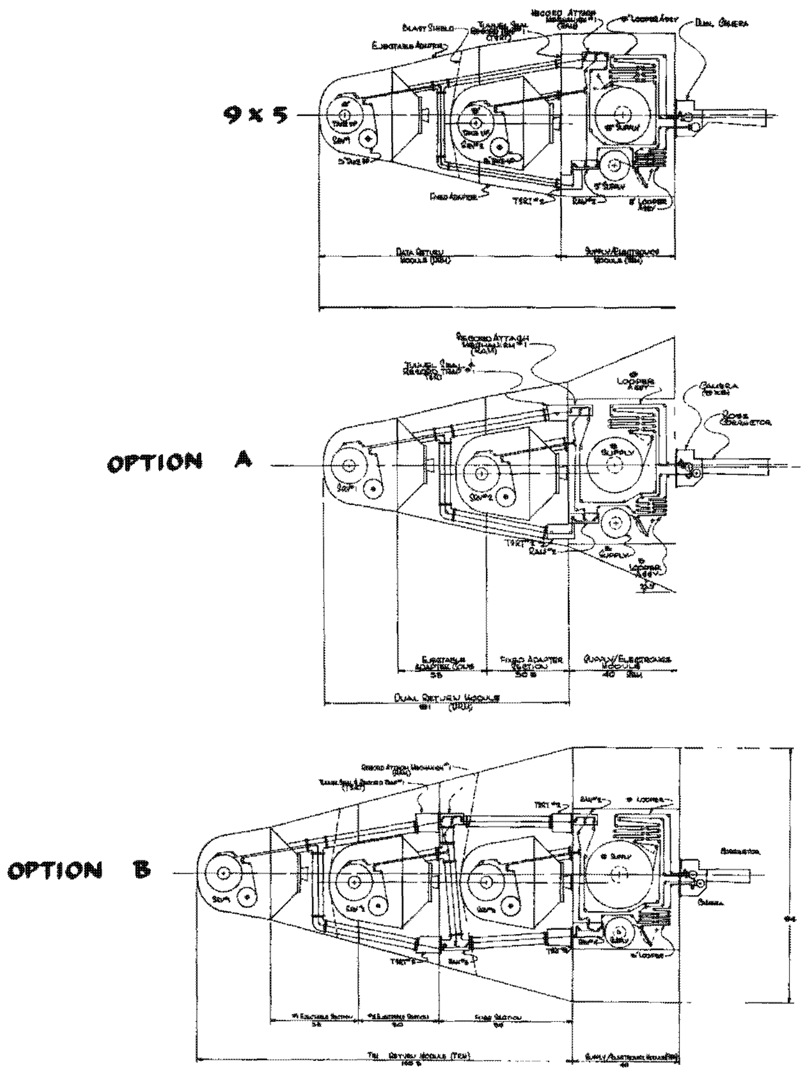
SECRET G



SECRET G

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Control System Only

IMPACT ON PRIME PRL ITEMS

	ADVANCED G^3	
PRL ITEM	OPTION A	OPTION B
CAMERA	MINOR	MINOR
FILM HANDLING	NONE	MAJOR
OPTICS ASSEMBLY (OA)	MAJOR	MAJOR
ROSS CORRECTOR	MINOR	MINOR
SERVO'S	MAJOR	MAJOR
EXTERNAL STRUCTURE	MAJOR	MAJOR
SEM	MINOR	MAJOR
SRV'S	NONE	NONE
DRM	NONE	MAJOR
ELECTRICAL BOXES	MINOR	MINOR

MECHANICAL CHARACTERISTICS

PARAMETER	9 X 5	ADVANCED G[3] OPT. A	ADVANCED G[3] OPT. B
MARK V SRV'S	2	2	3
PPS DIA.	60"	94"	94"
PPS LENGTH (FT.)	28.6	36.9	40.9
PRIMARY MIRROR SIZE (INCH)	43.5	70	
PRIMARY MIRROR WEIGHT (LBS)	260	630	
STEREO MIRROR SIZE (INCH)	46 X 58	70 x 91	
STEREO MIRROR WEIGHT (LBS)	400	980	

BASIC CONDITIONS FOR PERFORMANCE COMPARISONS

1. LENS PARAMETERS: 280-INCH LENS PARAMETERS BASED ON DIRECT SCALE-UP OF 175-INCH R-5. 80% OQF.

2. NADIR SMEAR RATE AT 65 NM (1σ): 72 μ RAD/SEC, IN-TRACK; 120 μ RAD/SEC, CROSS-TRACK.

3. FILM: FINE GRAIN, UTB

   AEI 2.0 ASSUMED

   $TM = 0.01 + 1.08 \times 10^{-6} f^2$

4. MISSION SIMULATION:

   LAUNCH: 25 JUNE, 1136 PST

   INCLINATION: SUN SYNCHRONOUS (96.4°)

   INITIAL ORBIT: 66 NM PERIGEE AT 48° N. LAT.

   191 NM APOGEE

   TARGET OVERLAP INTERVAL: 5 DAYS

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IMPLEMENTATION

DEFINITION PHASE AND PROPOSAL

DEFINITION PHASE (FIRST FIVE (5) MONTHS)

- DETERMINE OPTICAL FORMULA AND SYSTEM PERFORMANCE.
- DETERMINE CONFIGURATION, WEIGHT, MECHANICAL DESIGN CONCEPT.
- DETERMINE MANUFACTURING AND TESTING FLOWS AND SCHEDULES.
- DETERMINE FACILITY REQUIREMENTS.

RESULTS: TECHNICAL BASELINE FOR COST PROPOSAL

DEFINITION PHASE (LAST THREE (3) MONTHS)

- DETERMINE SYSTEM PERFORMANCE, OPERATION PROFILES.
- COMPLETE MECHANICAL, THERMAL AND ELECTRICAL ANALYSES.
- DEVELOP SPECIFICATIONS, LONG LEAD HARDWARE REQUIREMENTS.
- PREPARE FINAL EVALUATION REPORTS.

DEVELOPMENT PROGRAM ONF

OPTICAL DEVELOPMENT

OPTICAL COMPONENT: STRUCTURALLY PRIME; HANDLING, VIB & ACCELERATION

OPTICAL ENGINEERING MODEL. FULLY PRIME. COMPLETE OPTICAL TESTS

RELIABILITY MODEL COMPONENTS. FULLY PRIME. FULL QUALITY TESTS (FOR USE IN RM)

DEVELOPMENT MODELS, OPTICAL A OR B

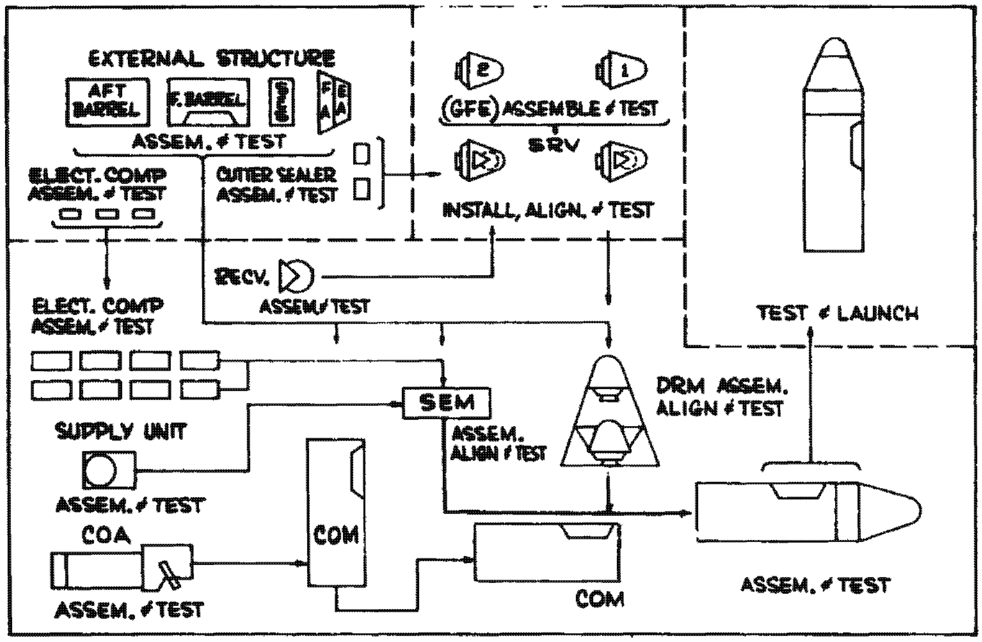
MOCK-UP

STRUCTURAL DEVELOPMENT MODEL

ENGINEERING MODEL

RELIABILITY MODEL

ASSEMBLY FLOW PLAN



ADVANCED G^3 FACILITIES SUMMARY

COMPONENTS	AVAILABLE FACILITY	MODIFICATION
OPTICAL		
•RCFLA ELEMENTS	HE (ROML)	---
•PRIMARY	601 (1EM)	NULL COMP. & PERSONNEL SUPPORT PLATFORMS
•STEREO	601 (2EM)	---
•COATING	101 (120" COATER)	---
ELECTRICAL/MECHANICAL	LP (2ND FLOOR)	ADDITIONAL RECEPTACLES
OPTICS ASSEMBLY (THM, VAC)		
•VERTICAL ROSS MATCH	101 (CHM. I)	INCREASED CAPACITY HOIST
•COA ASSEMBLY & TEST	101 (CHM. B, II, IIG)	---
MODULES		
• SEM & DRM (MRM)	LP (CLEAN ROOM)	18' X 18' TEST ROOM, CABLE TRAYS, SPIN BOTTLE PLUMBING.
•COM	101 (HVAS)	(SEE PAYLOAD).
•VIBRATION	102	LENGTHEN TOWER.
PAYLOAD		
•ASSEMBLY	101 (HVAS)	REMOVE EXISTING ROSS MATCH. CLEAN ROOM ENCLOSURE. CABLE TRAYS PIT FOR I_{XX} MACH. LIGHTING, AIR CONDITIONING
•TEST (THM, VAC)	101 (CHM. B)	---
•TEST/ASSY. SUPPORT	101 (HIGH BAY) 101 (HIGH BAY) 101G	TEST CONSOLE ROOM, LIGHTING, OUTLETS VERTICAL STORAGE PADS OFFICE FACILITIES

IMPACT ON SUPPORT PRL ITEMS

TYPE	EXISTING QTY.	9 X 5		ADVANCED G^3			
				OPT. A		OPT. B	
		MOD	NEW	MOD	NEW	MOD	NEW
OPTICAL	80	2	9	13	59	13	59
MECHANICAL	160	18	10	15	37	19	51
ELECTRICAL	84	20	25	11	4	25	6
		40	44	39	100	57	116
TOTAL	324	84		139		173	

CHANGES IN EQUIPMENT REQUIREMENTS MAINLY DUE TO:

OPTICAL - IMPACT OF LARGER SIZE MIRRORS, CHAMBER EQUIP., AND NEW TEST GLASSES.

MECHANICAL - IMPACT OF LARGER SIZE UPON: ROAD TRANSPORTER, INTERPLANT VAN, ERECTOR TRUCK AND HANDLING EQUIP.

ELECTRICAL - ADDITIONAL REQUIRED FOR BUILDING 101 OPERATIONS, NEW SERVOS, AND ADDITIONAL SRV.

FIELD SOUTH CONSIDERATIONS

1. SERVICE ROOM WILL REQUIRE MODIFICATION.
2. AIR CONDITIONING EQUIPMENT FOR UNIT MAY HAVE TO BE ENLARGED.
3. E-ROOM ENVIRONMENTAL CONTROL MAY HAVE TO CHANGE AND BE PART OF INTERFACE.
4. STANDBY HEATER SYSTEM MAY REQUIRE A CHANGE.
5. THE "L" PRESET SUPPLY CAPACITY MAY HAVE TO BE CHANGED.
6. AIR CONDITIONING ALARM IN L-ROOM FOR UNIT AIR (2 ABOVE).
7. CHANGE IN DECKS AT WORKING LEVELS; ADJUSTABLE OR RETRACTABLE.
8. ELEVATOR MODIFICATION OR OTHER CHANGE TO REACH NEW WORKING LEVELS.
9. "A" ROOM RELOCATION.
10. LARGER STORAGE AREA AT WORK LOCATION MAY BE REQUIRED.
11. WILL REQUIRE LIFTING GUIDEWIRE SYSTEM FOR LIFTING OR HANDLING.
12. LARGER UNIT MAY REQUIRE ROAD OR FACILITY MODIFICATIONS.
13. UNIT SIZE/WEIGHT PLUS HANDLING EQUIPMENT MAY REQUIRE FACILITY CRANE MODIFICATION.
14. NEW GAS LOADING FACILITY REQUIRED DUE TO NEW LOCATION AND/OR OPTION B.
15. MODIFICATION OF (OR NEED FOR) BEACON REPEATER ANTENNA SYSTEM.

CLAMSHELL ADAPTER DEVELOPMENT

- ENGINEERING MOCK-UP
  - SPACE ALLOCATION
  - ACCESSABILITY TO SCS DETERMINATION
  - CHUTING FOR VEHICLE/AGE DISCONNECTS
- SEPARATION DEVELOPMENT UNIT

  6 REPLACEMENT SETS OF "SUPER-ZIP" SEPARATION JOINT HARDWARE

  7 DEVELOPMENT TESTS - CONFIRM DESIGN SEPARATION SEQUENCE - MALFUNCTION TESTS OF REDUNDANT PYROS - CENTER OF GRAVITY EXCURSION - SEPARATION SPRING FORCE VARIATIONS
- SEPARATION QUALIFICATION UNIT
  - HEATED SEPARATION TEST
- STRUCTURAL TEST - 2 UNITS
  - QUAL TEST FOR ASCENT LOADS
  - QUAL TEST FOR INTERNAL INERTIAL LOADS AND TESTS OF AGE PULL-A-WAY CHUTING

ROLL JOINT DEVELOPMENT

- ELECTRO-MECHANICAL BREADBOARD
- WOODEN MOCK-UP FOR SPACE ALLOCATION
- STRUCTURAL TEST VEHICLE (ROLL JOINT ONLY)
- INTEGRATED STRUCTURAL TEST VEHICLE
- FUNCTIONAL MOCK-UP
- QUAL/LIFE TEST VEHICLE

FACILITIES MODIFICATIONS, JP

BLD. 102

- PROVIDE A BOOM RETRACT SIMULATION FOR AGENA UMBILICAL CHUTES DESIGN VERIFICATION TEST
- PREPARE PRESENT FACILITIES FOR SHROUD SEPARATION TEST

AREA 40

- REWORK VERTICAL SLACK FIXTURE

SCOC-14 AREA

- ENLARGE THERMAL ALTITUDE SIMULATION CHAMBER
- ENLARGE ACOUSTIC CHAMBER

VAFB

- NEW GANTRY STATION PLATFORM INSERTS
- STUDY THE LIFT OFF CHARACTERISTICS OF AN ALGOL CONFIGURATION WITH RESPECT TO AGENA BOOM RETRACT SYSTEM
- STUDY SSVS REQUIREMENT

GROUNDRULES AND ASSUMPTIONS

1. ONF 0001 SCHEDULE TO BE AS NEGOTIATED (3/YR).
2. START DEFINITION PHASE ON 1 DECEMBER 1973.
3. START DEVELOPMENT PROGRAM ON 1 DECEMBER 1974
4. NEW DESIGN EFFECTIVITY - FLIGHT 55 (FIRST USE - SEPT. 1978, LAST USE SEPT. 1980).
5. DIFFERENCES BETWEEN OPTIONS:

	OPTION A	OPTION B
BUCKETS	2	3
RATE/YEAR	3	2
ORDER QTY.	7 + 1 AME SET	5 + 1 AME SET

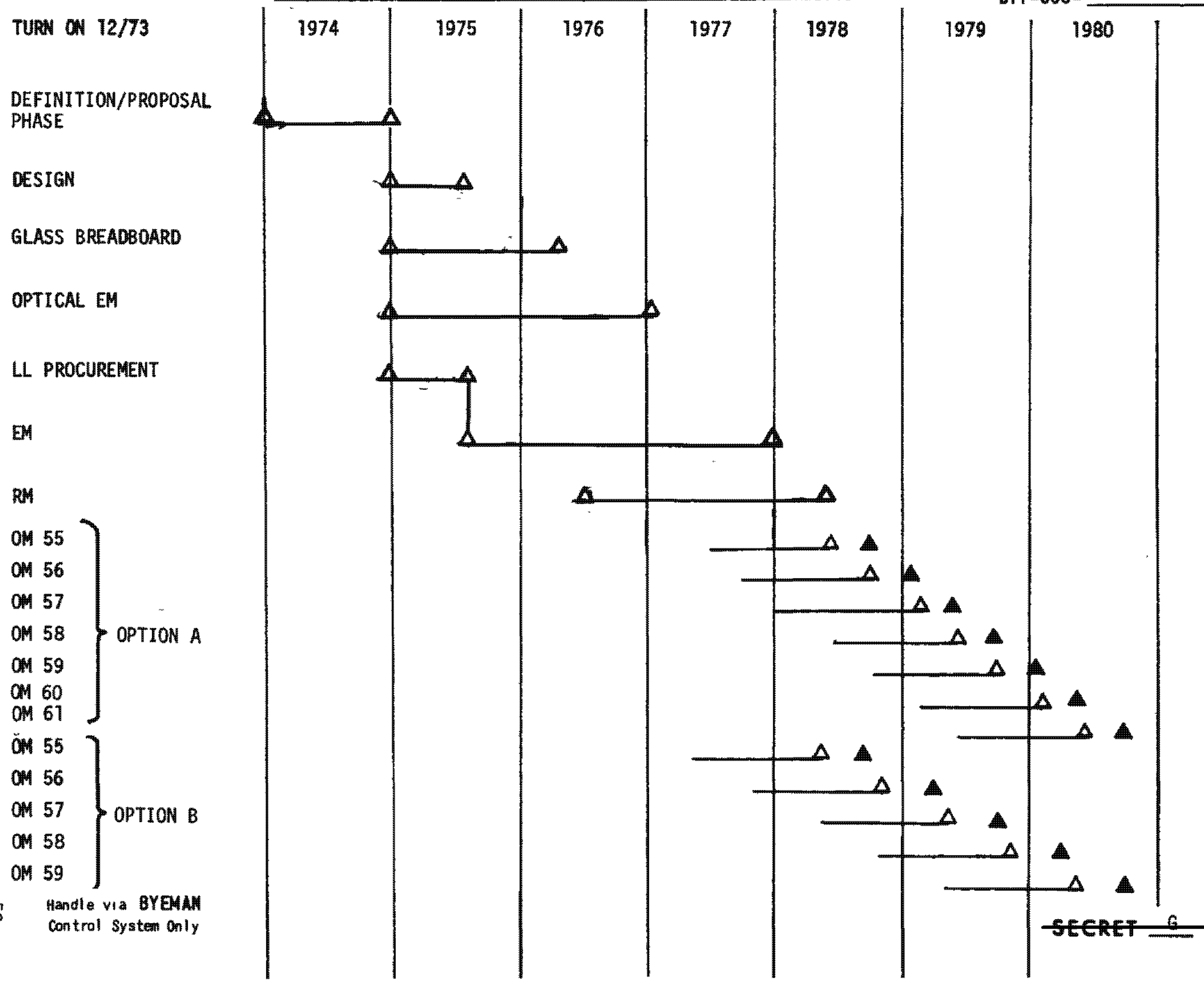
6. DEVELOPMENT MODELS

ONF: MOCK-UP, GLASS BB, SDM, OPT. EM, EM, RM (NO TM)

JP: DTV, 5 AFT SHROUDS, 3 ROLL JOINTS

OVERALL PROGRAM SCHEDULE - OPTION A & OPTION B EFFECTIVITY OM-55

BIF-008-W-C-001175-OH-73



Handle via BYEMAN
Control System Only

SUMMARY

GOALS

- ° IMPROVED PERFORMANCE
- ° MAXIMUM UTILIZATION OF PRESENT FACILITIES AND DESIGN
- ° FIRST USE FLIGHT #55 (MIDDLE 1978)

RECOMMENDED CONFIGURATION

- ° TITAN III B = 6 ALGOLS
- ° 280 FL, F/4, ROSS LENS, 2SRV'S

PERFORMANCE

[redacted] (b)(1) (b)(3)

- ° SYSTEM FLEXIBILITY: RESOLUTION VS LIFE

EFFECTIVITY: #55, 1978

APPENDIX

SYSTEM SMEAR RATE SOURCES AT NADIR
(μ Rad/Sec)

	Value σ_B	Value σ_R
IN TRACK CONTRIBUTORS		
SATELLITE CONTROL SECTION		
Adaptive bias decay and gas valve impulse bit granularity	10	15
PHOTOGRAPHIC PAYLOAD SECTION		
Film drive speed granularity		24
Knowledge of focal length		26
Film drive speed drift		31
OTHER		
Knowledge of altitude		51
TOTAL SYSTEM IN TRACK SMEAR RATE (67 percentile, 1-σ)	72	
CROSS TRACK CONTRIBUTORS		
SATELLITE CONTROL SECTION		
Yaw static and dynamic offset	57	64
Adaptive bias and vernier reaction wheel errors		30
Gas valve impulse bit granularity		21
PHOTOGRAPHIC PAYLOAD SECTION		
Alignments	16	
Crab granularity		40
Crab reproducibility		57
Hotdogging		12
TOTAL SYSTEM CROSS TRACK SMEAR RATE (67 percentile, 1-σ)	118	

1 All values at 65 nm, (v/h = 1145 μ rad/sec/o) includes software modelling and compensation of adaptive bias and orbit dependent offsets with 75% accuracy, does not include contingencies.

PITCH AXIS POINTING ERROR SOURCES[1]
(Degrees)

	Value σ_B	Value σ_R
SATELLITE CONTROL SECTION SOURCES		
1. Pitch gyro random drift	0.0013	
2. Pitch deadband bias	0.0032	
3. Horizon sensor noise		0.0169
4. Horizon sensor null	0.0210	
5. Horizon sensor alignment to guidance module	0.0074	
6. Guidance module alignment to roll joint	0.0084	
7. Payload alignment to roll joint	0.0056	
8. Program rate error		0.0132
9. Eccentricity of orbit and earth oblateness		0.0100
10. Horizon uncertainty	0.0160	0.0500
11. Pitch external torque offset		0.0138
12. Adaptive bias dynamic offset		0.0345
SATELLITE CONTROL SECTION SUBTOTAL	0.0294	0.0666
PHOTOGRAPHIC PAYLOAD SECTION SOURCES		
1. Line of sight to mirror alignment	0.0060	
2. Mirror to payload alignment	0.0140	
3. Line of sight reproducibility		0.0500
4. Pitch hotdogging		0.0100
PHOTOGRAPHIC PAYLOAD SECTION SUBTOTAL	0.0152	0.0510
PHOTOGRAPHIC SATELLITE VEHICLE TOTAL	0.0331	0.0839
PHOTOGRAPHIC SATELLITE VEHICLE (95th Percentile)	0.2033	

1 Includes software modelling and compensation of adaptive bias and orbit dependent offsets with 75% accuracy, does not include contingencies.

ROLL AXIS POINTING ERROR SOURCES[1]
(Degrees)

	Value σ_B	σ_R
SATELLITE CONTROL SECTION SOURCES		
1. Yaw gyro random drift	0.0014	
2. Yaw gyro alignment	0.0016	
3. Roll deadband bias	0.0030	
4. Horizon sensor noise		0.0120
5. Horizon sensor null	0.0190	
6. Horizon sensor alignment to guidance module	0.0083	
7. Guidance module alignment to roll joint	0.0193	
8. Roll joint alignment to payload	0.0056	
9. Roll joint granularity		0.0505
10. Roll joint deadband uncertainty		0.0500
11. Horizon uncertainty	0.0150	0.0300
12. Roll external torque offset		0.0138
13. Adaptive bias dynamic offset		0.0250
SATELLITE CONTROL SECTION SUBTOTAL	0.0327	0.0831
PHOTOGRAPHIC PAYLOAD SECTION SOURCES		
1. Line of sight to payload alignment	0.0140	
2. Crab line of sight reproducibility		0.0125
PHOTOGRAPHIC PAYLOAD SECTION SUBTOTAL	0.0140	0.0125
PHOTOGRAPHIC SATELLITE VEHICLE TOTAL	0.0356	0.0840
PHOTOGRAPHIC SATELLITE VEHICLE (95th Percentile)	0.2080	

1 Includes software modelling and compensation of orbit dependent offsets with 75% accuracy, does not include contingencies.

(b)(1)
(b)(3)

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POINTING AND SMEAR ESTIMATES
(BEST ENGINEERING ESTIMATES)

THE FOLLOWING EFFECTS HAVE BEEN CONSIDERED IN THE ESTIMATES OF POINTING AND SMEAR:

- SOFTWARE COMPENSATION OF ORBIT DEPENDENT AND ADAPTIVE BIAS OFFSETS. (SOFTWARE MODELLING ASSUMED 75% ACCURATE)
- INCREASE IN INERTIAS AND SLEWING MOMENTA OF PAYLOAD AND STEREO MIRROR.
- ASYMMETRIC PAYLOAD INERTIAS AROUND THE PAYLOAD SLEW AXIS.
- DECREASE IN CRAB (.12°) AND ROLL JOINT (.175°) GRANULARITIES.
- ADDITION OF VERNIER REACTION WHEEL.

NUMERICAL SUMMARY

PARAMETER	175-INCH	280-INCH OPT. A	280-INCH OPT. B
MARK V SRV'S	2	2	3
FOCAL LENGTH (INCHES)	175	280	
EFFECTIVE F-NUMBER FOR EXPOSURES	4.32	4.20	
CENTRAL OBSTRUCTION (%)	8.5	4.0	
PRIMARY FILM LOAD (9 1/2 INCHES)	10,800	10,800	16,200
TYPICAL FRAME CAPACITY	12,700	7,900	11,800
SWATH WIDTH AT 65 NM, NADIR	3.3	2.1	
SECONDARY FILM LOAD (5 INCHES)	3,000	3,000	4,500
TYPICAL FRAME CAPACITY	3,500	2,180	3,260
SWATH WIDTH AT 65 NM, NADIR	1.7	1.1	
FILM DRIVE SPEED RANGE (IPS)	3.4-11.8	5.4-18.9	

[redacted]

(b)(1)
(b)(3)

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