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Copy No. [redacted]
24 April 1967

INTEROFFICE MEMORANDUM

TO: Distribution

FROM: [redacted]

SUBJECT: Changes to 9232 Design Status Briefing Books

The briefing books issued at the April design status briefing contained the following errors:

1. The enclosed page was omitted
2. The book contained two weight summaries, the correct one having a right-hand column total of 443.3.

We request that you delete the incorrect weight summary and then insert the enclosed page so that the order of pages is as follows:

Camera Module
J-1, J-3 Comparison
Equipment Status
Completed Qualification Tests
Remaining Qualification Tests
Weight Summary
Estimated Power Requirements
Camera Dynamic Resolution
Camera Dynamic Performance
Improved Petzval Design
Improved Petzval Performance
Thermal Analysis Philosophy and Approach
Thermal Math Model
High Efficiency Servo Amplifier
Amplifier Comparison
Slit Width Control
Slit Width vs. Scanning Speed

Material Change Detector
Auxiliary Optics Filter Changer
Nod to Scan Calibration
Rail Hole Calibration
Film Path - UTB
Shutdown Sequence
Film Format
SLP Block
Problem Areas
Flight Readiness

[redacted]

[redacted]

Enc.

CAMERA DYNAMIC RESOLUTION

LOW CONTRAST

CAMERA NUMBER	AVERAGE IMC/SCAN
300	126
301 *	119
302	122
303	130
304	128
305	132

* LENS HAS NODAL POINT ANOMALY

1 A. Corona

(3)

TOP SECRET [redacted] [redacted]

DESIGN REVIEW

J-3 CAMERA SYSTEM

23-24 AUGUST 1966

TOP SECRET [redacted]

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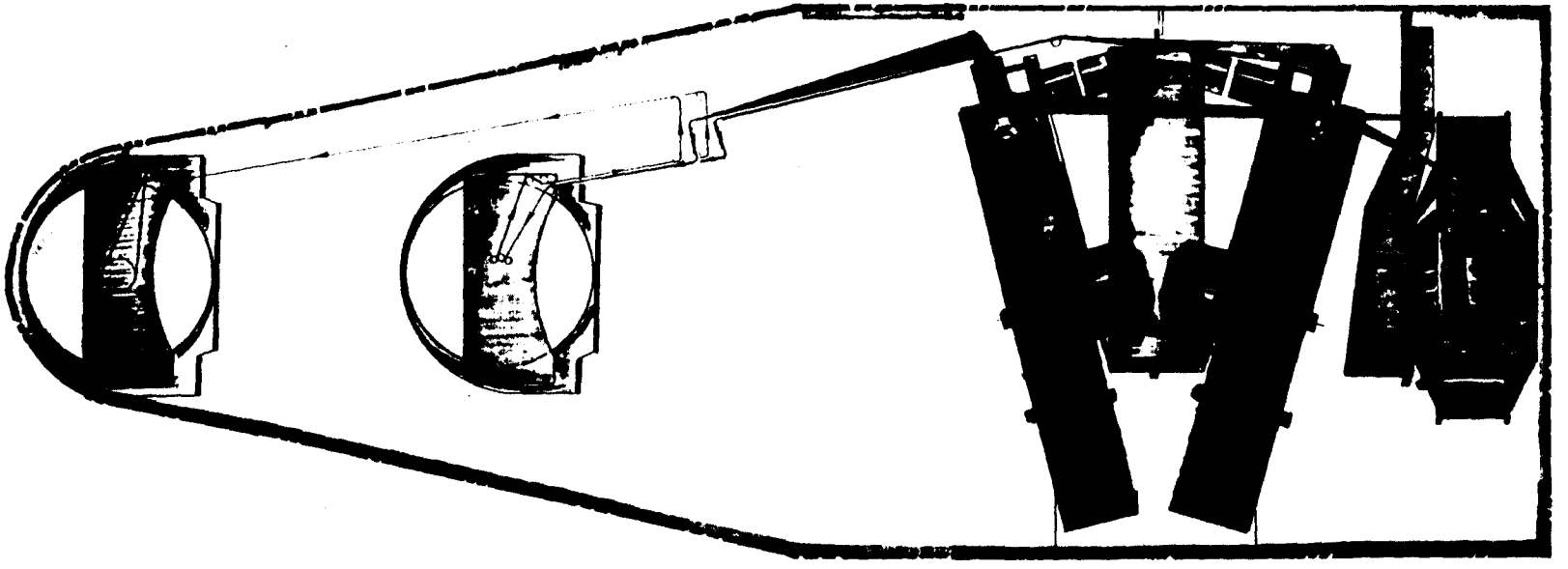
DESIGN REVIEW
J-3 CAMERA SYSTEM

23-24 AUGUST 1966

J-3 CAMERA SYSTEM

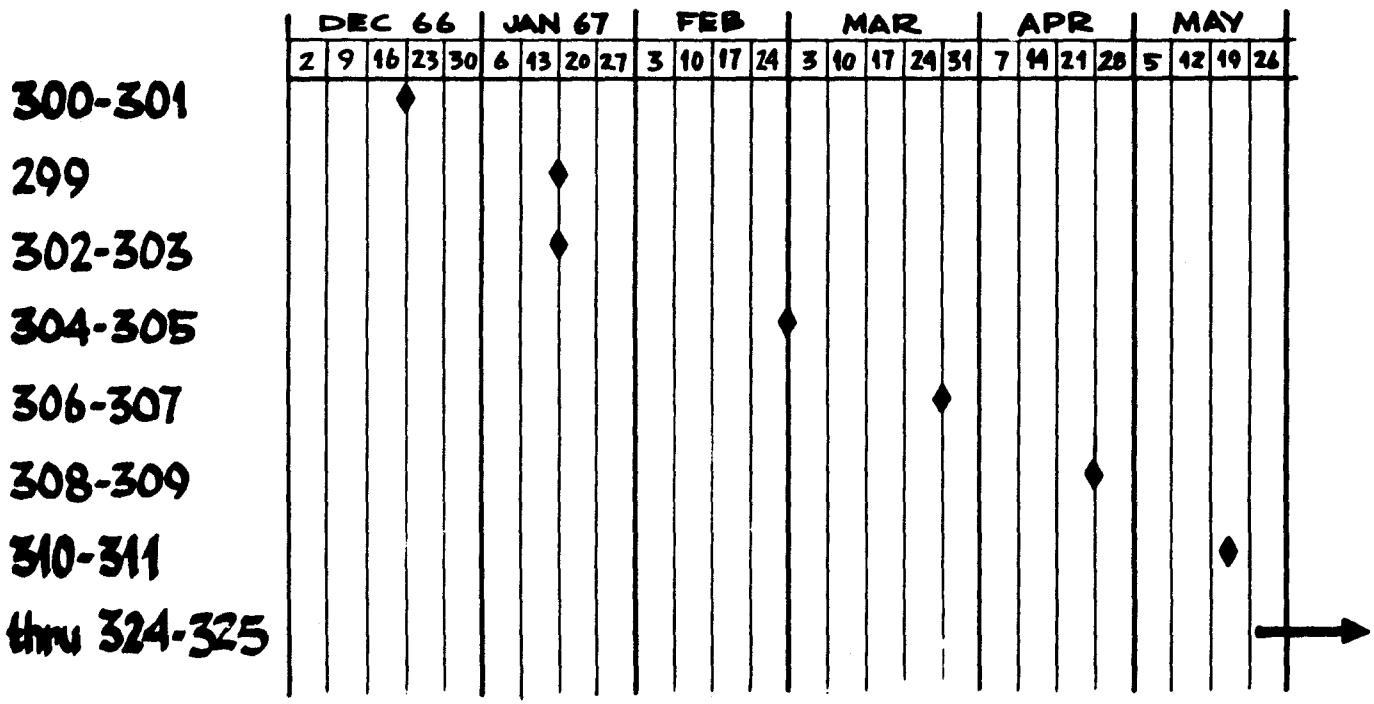


SYSTEM SPECIFICATION SUMMARY

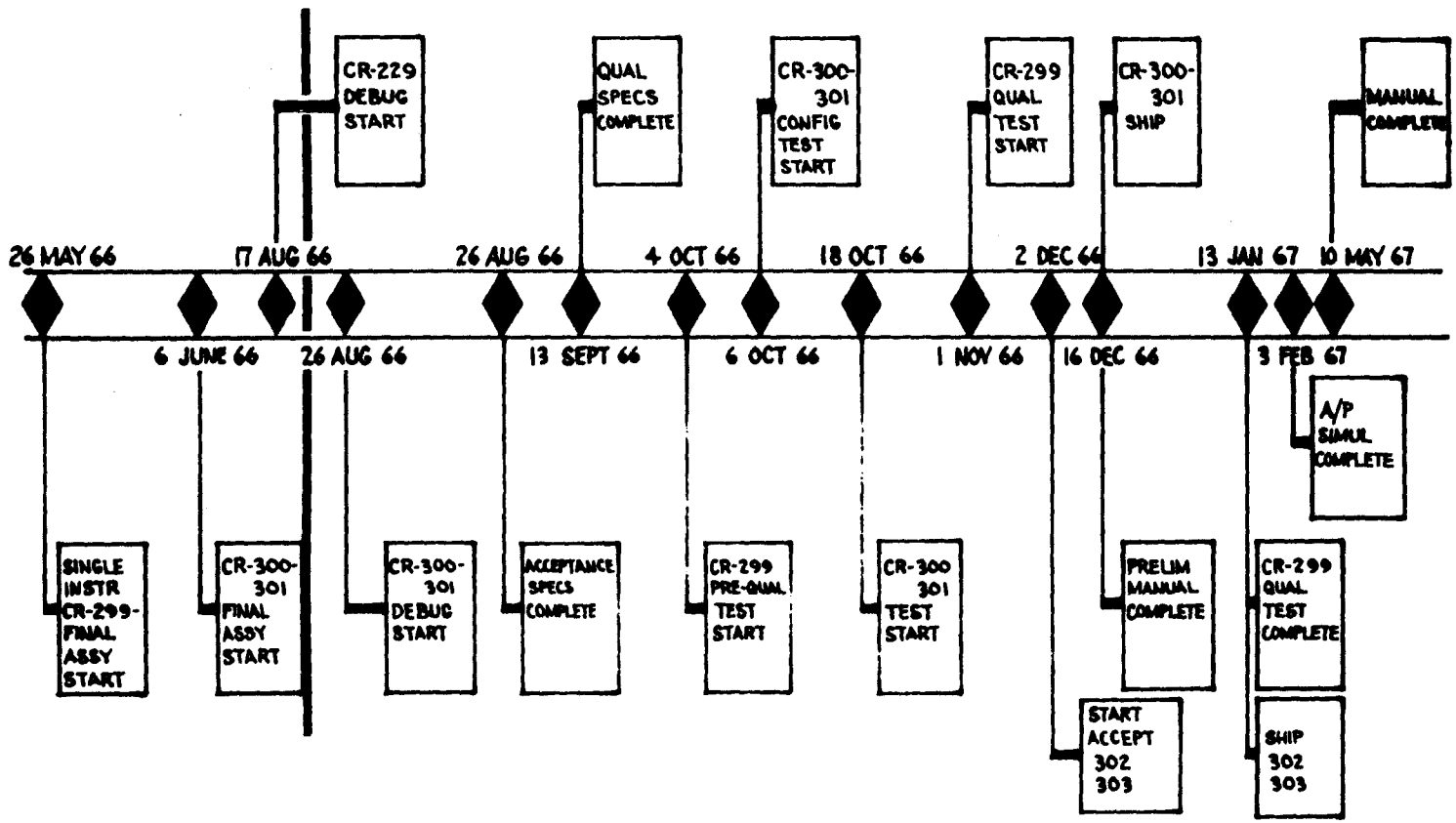
CONFIGURATION	30° CONV. STEREO PANORAMIC
LENS	24-INCH, f/3.5 PETZVAL
FILMS	3404, 180*, 380*, 362*, 121
SUPPLY CAPACITY	15,600 ft/CAMERA
FORMAT SIZE	2.147 X 29.323 INCHES USEABLE
ALTITUDE	80-200N.M.
SWATH WIDTH	116-290 N.M
TOTAL FORWARD COVER	7.73-19.33 N.M. (7.6% OVERLAP)
CYCLE RATE	3.74-1.47 RAD/SEC
SYSTEM PERFORMANCE	110 L/mm (2:1 CONTRAST)

* DESIGN GOAL

TOTAL PROGRAM DEL. SCHEDULE



MAJOR MILESTONE DEVELOPMENT SCHEDULE



DRAWING STATUS AS OF 8/15

	DESIGN	DET & CHECK	RELEASED
MAIN INST	46	58	611
SUPPLY ASSY			101
SUPPLY SPOOL			8
T/UA			130
T/UB			134
I.R			16
GSE	31	30	224
ETL		30	202
AUX STRUCT			33
TOTALS	77	118	1459

REMAINING MAIN INST DRAWING

AS OF 8/15/66

	DESIGN	DETAIL	CHECK
MAIN ELEC BOX			16
AUX ELEC BOX	46	2	
LIGHT SEAL			1
KAPLAN DRIVE		1	14
AUX OPTICS EXP COMP		19	
LIST MATERIALS		1	
ASSEMBLY		1	1
FAMILY TREES		2	
	46	26	32

GATING ITEMS

AS OF 8/15/'66

MAIN STRUCTURE	UNIT 302 - 8/17, UNIT 303 - 8/22
THEODOSYN BEARINGS	DUE 10/7
THEODOSYN	1ST BERYLLIUM DUE 11/11
	1/WK AFTER
CAPACITOR	DUE 8/22
AUXILIARY STRUCTURE	1ST - 8/15, 2ND - 8/19, 3RD - 8/23

SYSTEM ANALYSIS

ALONGTRACK IMAGE BLUR - MICRONS

VEHICLE AND INTERFACE	TYPE	BLUR	BASIS
ORBIT MATCH ERROR	R	2.23 COS θ	3 %
V/h COMMAND VOLTAGE	R	2.23 COS θ	3 %
ROLL ATTITUDE ALIGNMENT	R F	0.72 SIN θ	34.3 MIN
PITCH ATTITUDE ALIGNMENT	R F	0.49 COS θ	43.4 MIN
PITCH RATE	R	0.10 COS θ	0.004°/SEC
YAW RATE	R	0.10 SIN θ	0.004°/SEC
TERRAIN HGT VAR	R	0.36	3,000 FT.

NOTES: 80 N.M. - 2.44 M SEC EXP. - 3σ

ALONGTRACK IMAGE BLUR - MICRONS

CAMERA	TYPE	BLUR	BASIS
VIBRATION	R	2.0	ASSUMPTION
SERVO ERROR	R	2.23 COS θ	3 %
IMC ERROR (CAM)	F	2.23 COS θ	3 %
UNCOMPENSATED IMC	S	1.85 *	FORMAT WIDTH
LENS DISTORTION	S	0.013 COS θ*	5 μ @ EDGE

* AT EDGE OF FORMAT

NOTE: 80 N.M. - 2.44 M SEC EXP. - 3 σ

CROSSTRACK IMAGE BLUR - MICRONS

VEHICLE & INTERFACE	TYPE	BLUR	BASIS
ROLL ATTITUDE AND ALIGNMENT	R, F	0.18 $\sin^2\theta$	34.3 MIN.
YAW ATTITUDE AND ALIGNMENT	R, F	1.14 $\cos^2\theta$	51.6 MIN
PITCH ATTITUDE AND ALIGNMENT	R, F	0.43 $\sin 2\theta$	43.4 MIN.
ROLL RATE	R	0.12	0.005°/SEC
YAW RATE	R	0.03 $\cos 2\theta$	0.004°/SEC

NOTES: 80 n.mi, 2.44 MSEC EXPOSURE, 3σ.

CROSSTRACK IMAGE BLUR, MICRONS

CAMERA	TYPE	BLUR	BASIS
VIBRATION	R	2.0	ASSUMPTION
NODAL POINT LOC.	F	0.22	±0.001"
I.M.C. CROSS-COUPLING	F	0.11	5 MIN. MISALIGNMENT
CROSSTRACK I.M.	S	$9.8 \sin 2\theta$	UNCOMPENSATED
LENS DISTORTION	S	0.83 *	5 MICRONS AT EDGE
FILM LIFT	S	1.11	0.005" FILM LIFT

* AT EDGE OF FORMAT

NOTE: 80 N.M.-2.44 M/SEC EXP.-3σ

BLUR AND GROUND RESOLUTION

ALONG PRINCIPAL AXIS

	ALONGTRACK		ACROSSTRACK	
	0°	30°	0°	30°
80 NAUTICAL MILES				
BLUR MICRONS	3.28	3.01	2.64	11.0
GROUND RESOLUTION FT.	6.3	7.2	6.1	12.9
100 NAUTICAL MILES				
BLUR MICRONS	2.52	2.23	1.79	8.57
GROUND RESOLUTION FT.	7.6	8.7	7.3	14.2

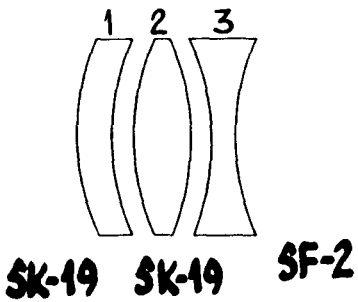
NOTE: 2.44 M/SEC. EXP.-3404-2:1 CON-2 σ

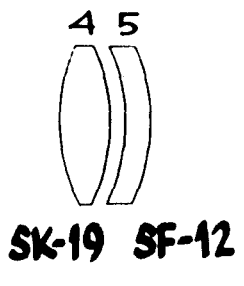
OPTICS

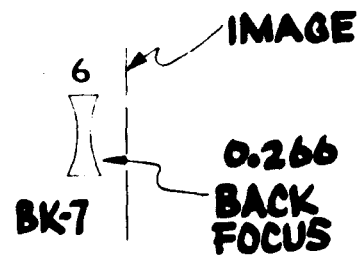
FIRST GENERATION OPTICAL DESIGN

24 INCH FOCAL LENGTH
f/3.5
6° FIELD

GLASS WEIGHT ≈ 15 POUNDS
SPECTRAL RANGE 0.5461-0.6900

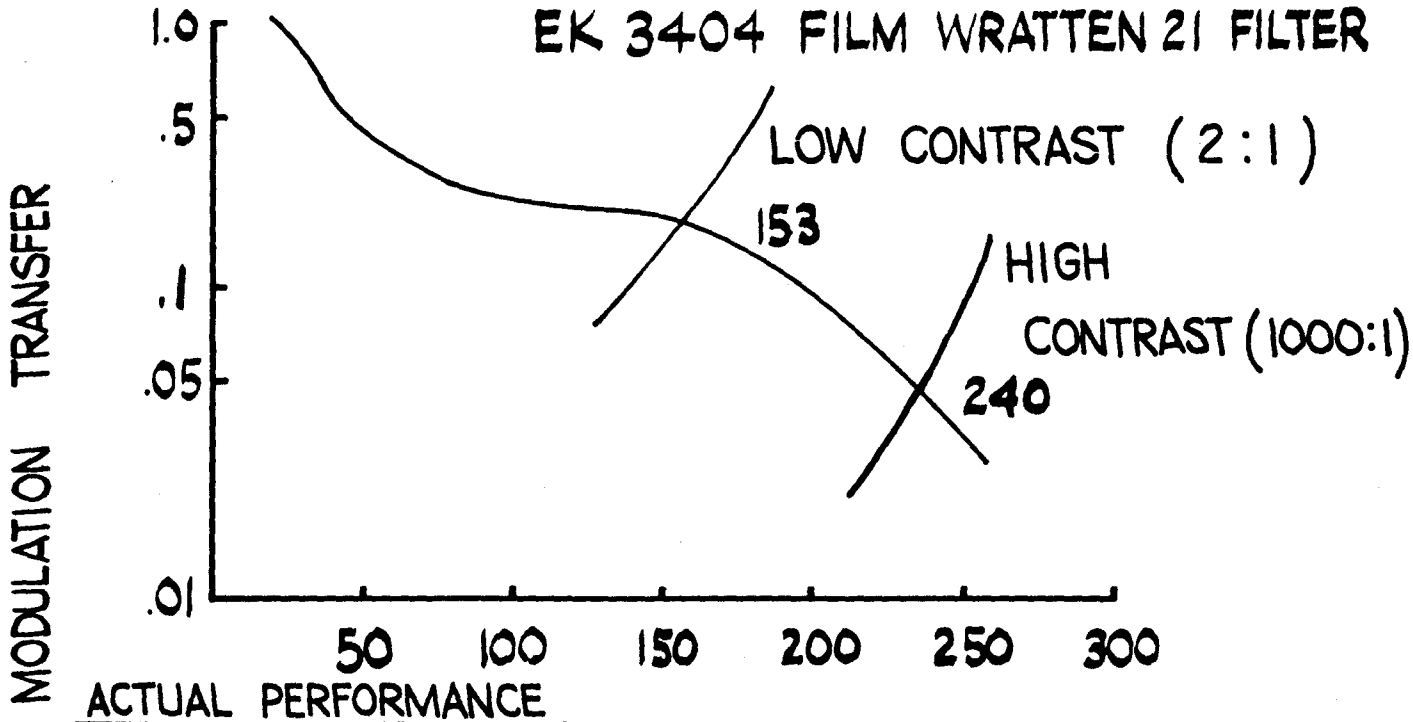






- ELEMENTS 1 AND 3 RELATIVELY THIN
- ELEMENT 3 SMALL DIAMETER
- R.Q. QUALITY GLASS
- 1ST 12 LENSES (INCLUDES QUAL UNIT)

FIRST GENERATION M.T.F.



ACTUAL PERFORMANCE

DISTORTION ≈ 5 MICRONS

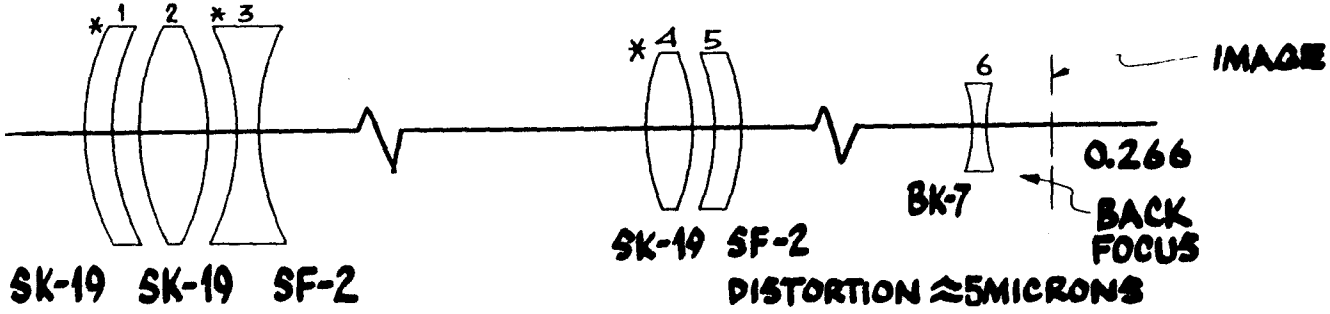
RESOLUTION 140 ℓ/mm LOW CONTRAST MEASURED ON MANN BENCH WITH EK 3404 FILM

SECOND GENERATION OPTICAL DESIGN

DESIGN NO. 65-020-03-D3

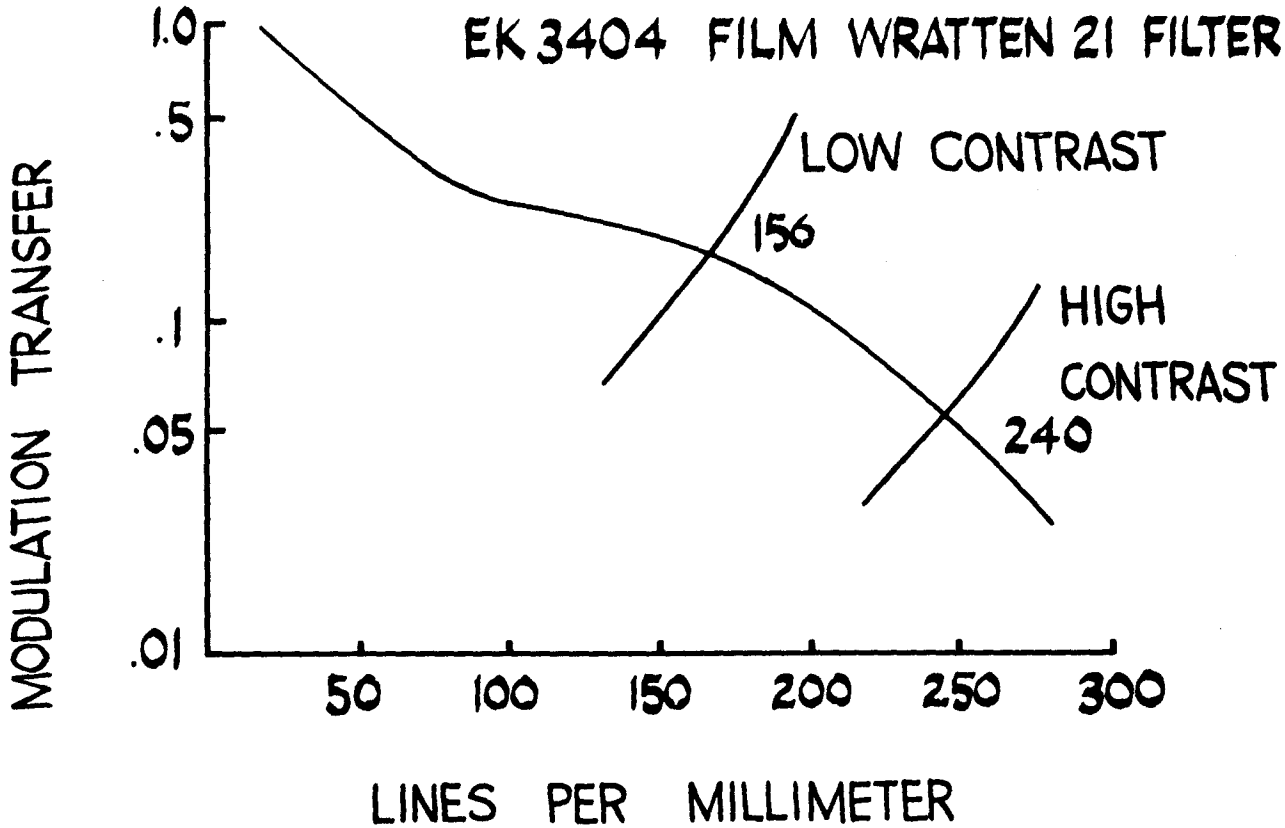
24 INCH FOCAL LENGTH
f/3.5
6° FIELD

GLASS WEIGHT ≈ 17 POUNDS
SPECTRAL RANGE 0.5461 - 0.6900
CENTRAL WAVELENGTH - 0.6200



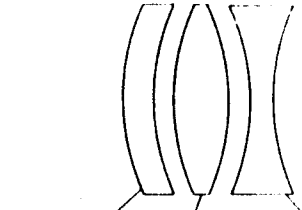
- FIRST THREE ELEMENTS SAME DIAMETER
- ASTRONOMICAL OBJECTIVE QUALITY GLASS
- SF-2 REPLACES SF-12 IN ELEMENT 5
- * INDICATES THICKENED ELEMENTS
- 21 LENSES (TOTAL 33 LENSES)

SECOND GENERATION M.T.F.



THIRD GENERATION OPTICAL DESIGN

24 INCH FOCAL LENGTH
f/3.5
6° FIELD

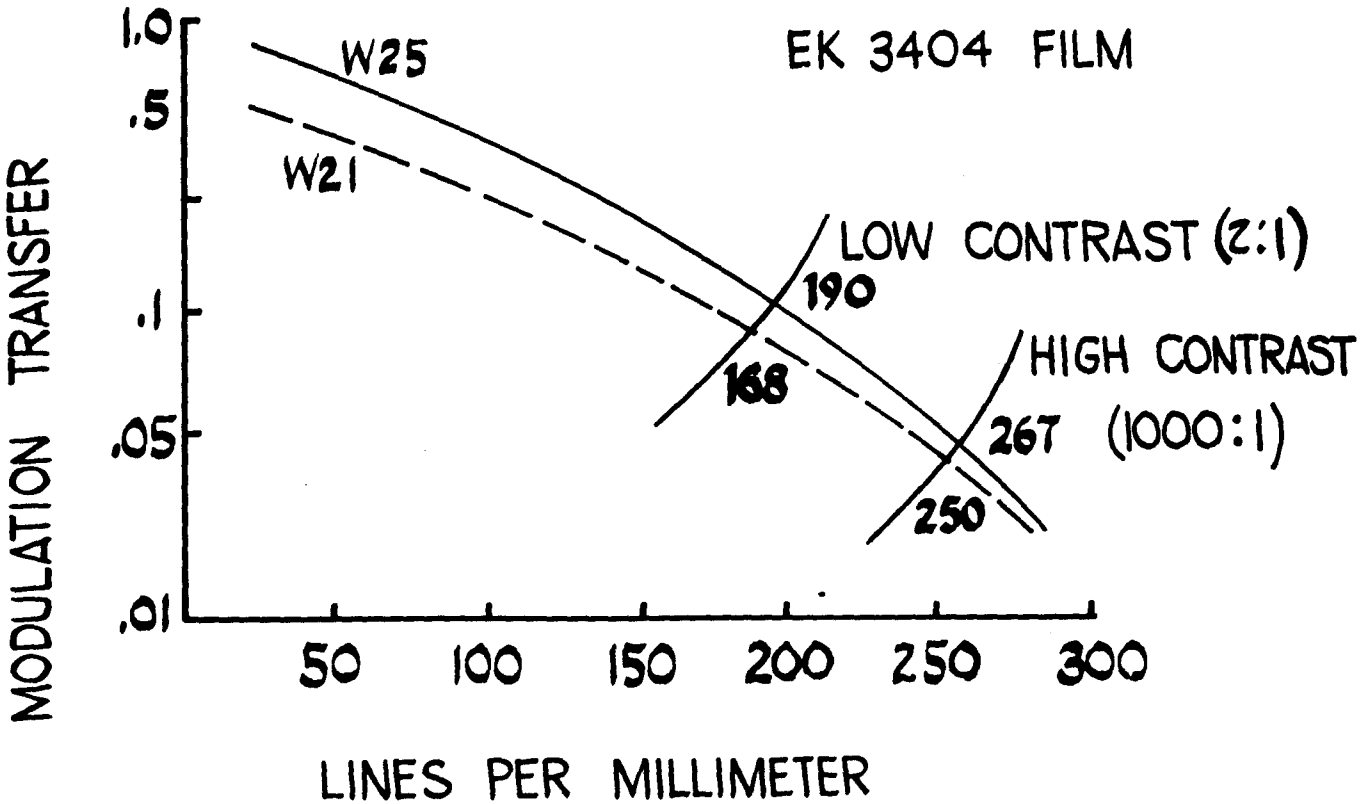


GLASS WEIGHT ≈ 17
SPECTRAL RANGE 0.6000 - 0.7100
CENTRAL WAVE LENGTH - 0.6500

DISTORTION ≈ 5 MICRONS

- SAME GLASS TYPES AND QUALITY AS SECOND GENERATION DESIGN
- SAME ELEMENT THICKNESS
- SLIGHTLY DIFFERENT RADII, AIRSPACES
- CENTRAL WAVELENGTH RAISED TO 0.6500, TO MATCH WRATTEN 25 FILTER RESPONSE

THIRD GENERATION M.T.F.



RESOLUTION, I-162, I-164

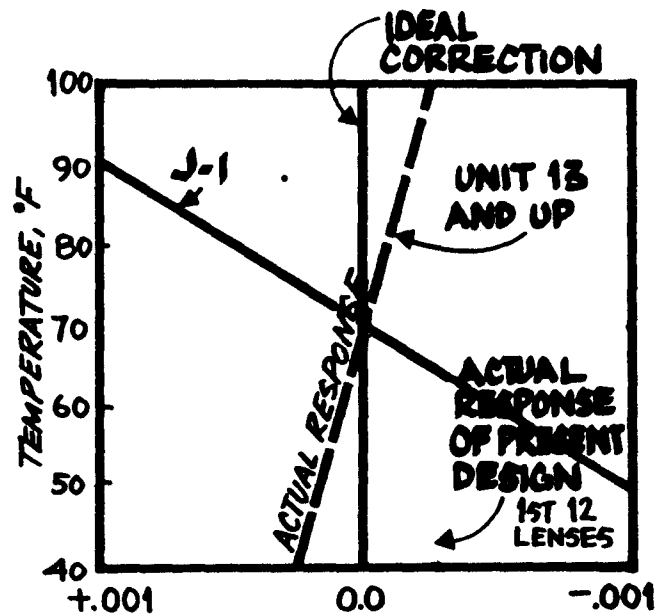
	I-162	I-164
LOW CONTRAST RESOLUTION	146 ℓ/mm	150 ℓ/mm
DISTORTION	3 μ	2 μ
VACUUM FOCAL SHIFT	0.016* INCH	0.016* INCH
VACUUM NODAL SHIFT	0.016** INCH	0.016** INCH

* EMPIRICALLY CONFIRMED ** NOT CONFIRMED

THERMAL SENSITIVITY (UNIFORM EXCURSIONS)

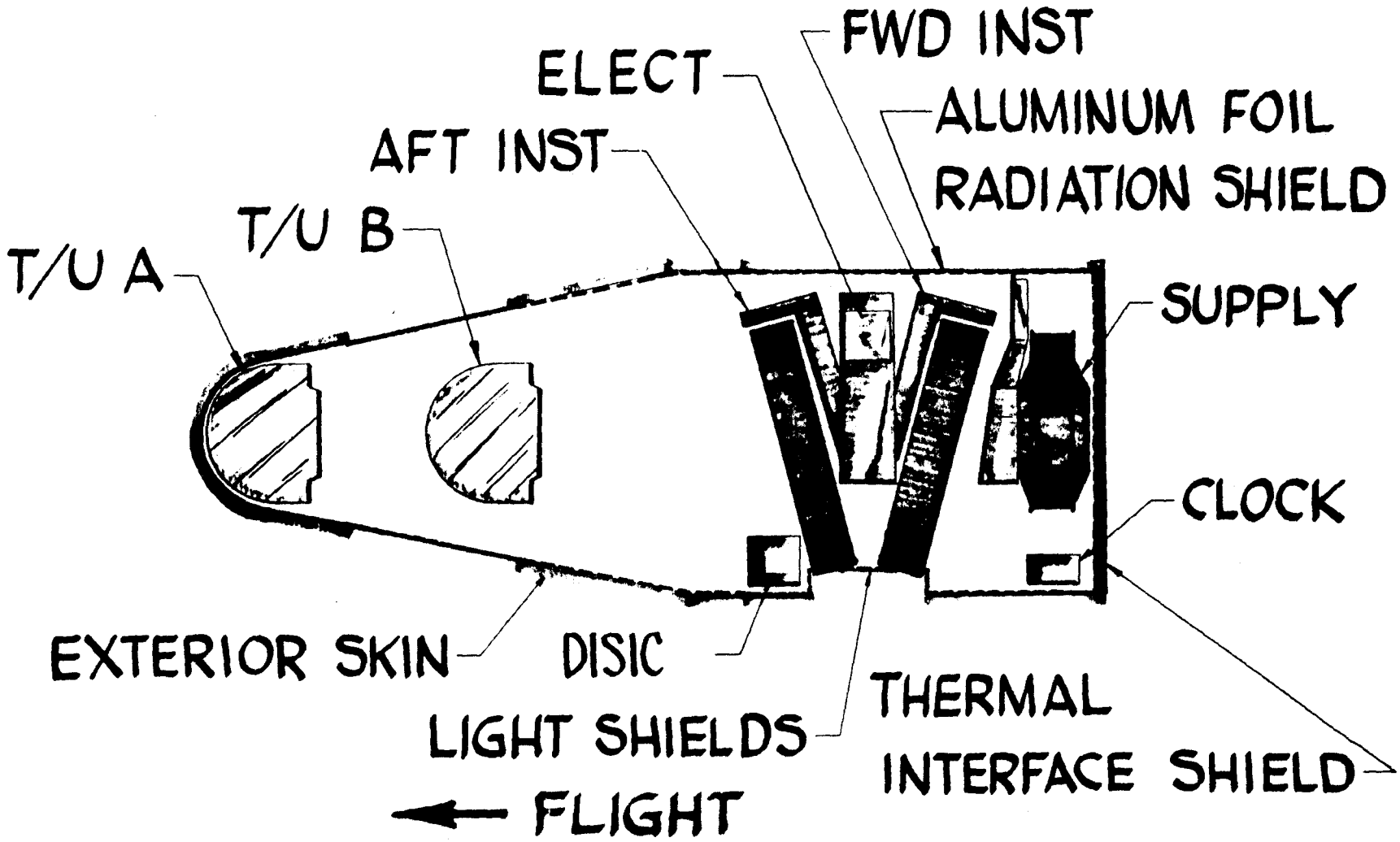
DESIGN NO. 65-020-03-D3

- MAGNESIUM PETZVAL CELL WITH TITANIUM TAIL CONE MOUNTED AT NODAL POINT
  - DESIGNS EXHIBIT SAME DEPARTURE FROM IDEAL
  - TOLERANCE OF ± 0.060" BETWEEN POSITION OF NODAL POINT AND JUNCTION
  - ELEMENT THICKNESS, AIRSPACE CHANGES, CURVATURE CHANGES, AND INDEX CHANGES CONSIDERED



THERMAL ANALYSIS

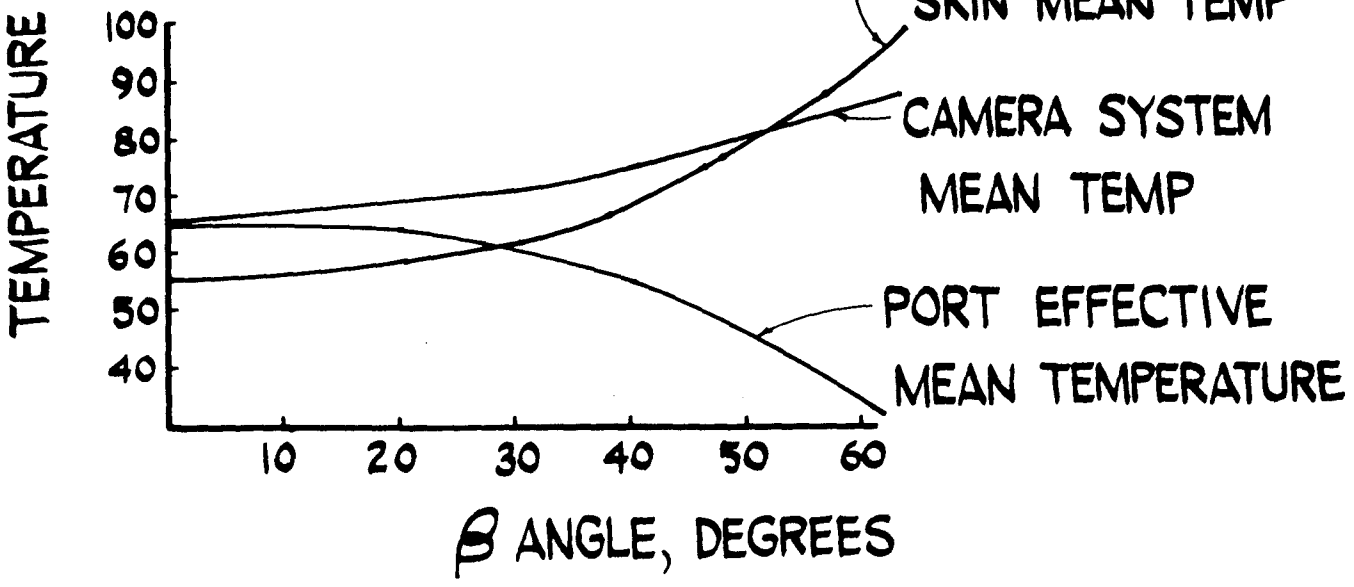
THERMAL DESIGN SUMMARY



THERMAL ANALYSIS PHILOSOPHY & APPROACH

VARIATION OF TEMPERATURE WITH β ANGLE

$$T_{mean} = \left[\int_{0}^{Period} \frac{[T(Time)]^4}{Period} dt \right]^{1/4}$$



THERMAL MATH MODEL

- THERMAL MATH MODEL DEVELOPED
  USES STANDARD NODAL HEAT BALANCE TECHNIQUES FOR DIGITAL COMPUTER SOLUTION
- SYSTEM REPRESENTED BY 180 NODES; LENS CELL BY 14 NODES
- TEMPERATURE-TIME RESPONSE PREDICTED FOR ORBITAL CONDITIONS
- PREDICTED LENS TEMPERATURES WITHIN ±10°F OF NOMINAL

DETAILED COMPONENT THERMAL DESIGN

- MAIN DRIVE SYSTEM
  ISOLATED FROM LENS CELL

- SERVO ELECTRONICS
  REMOVE HEAT FROM DIODES

THERMAL TESTING

	°F
ELECTRONIC COMPONENTS	0 & 250 (NON OPERATE)
ELECTRONIC SUBSYSTEMS	
NON RECOVERABLE	40 & 100 *
RECOVERABLE	40 & 100 *
OPTICAL SUBSYSTEMS	60 & 80 *
MECHANICAL ASSEMBLIES	
NON RECOVERABLE	40 & 100 *
RECOVERABLE	40 & 100 *

* ENG EVAL TO BE RUN AT GREATER LIMITS

FLIGHT DATA THERMAL ANALYSIS

- ANALYZE 6 FLIGHTS

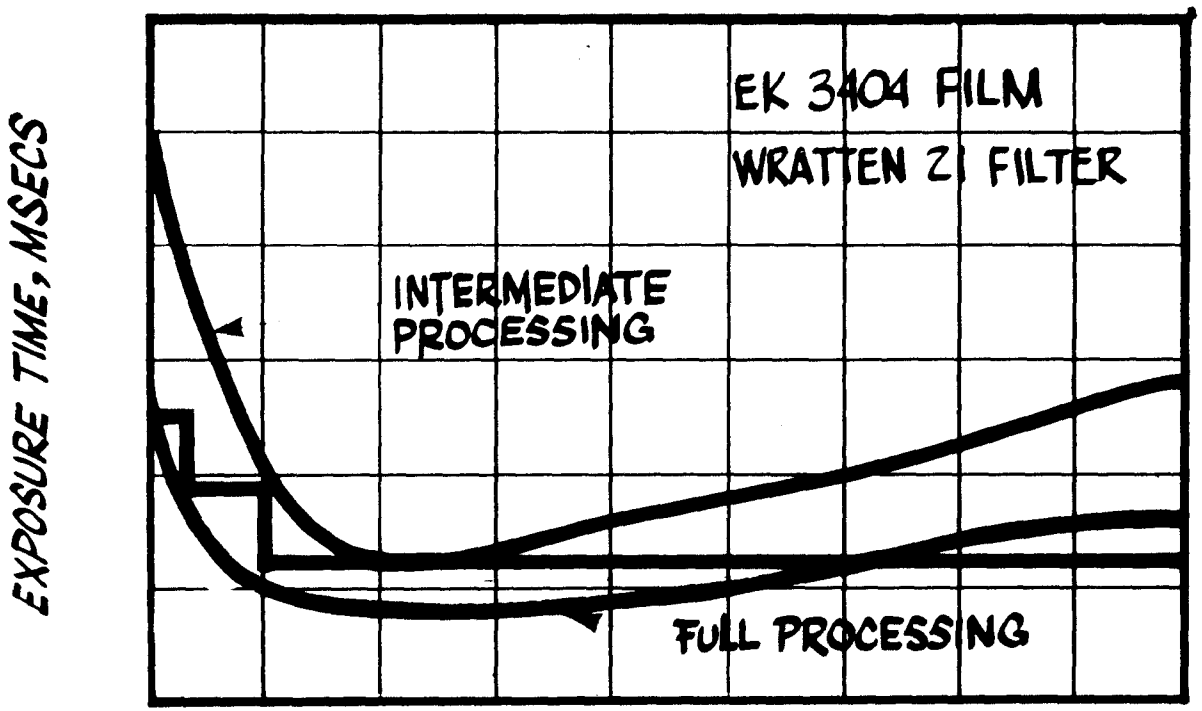
- FLIGHT SELECTION BASIS
  - FIRST TWO FLIGHTS
  - FLIGHTS WITH TEMPERATURE ANOMALIES
  - FLIGHTS WITH ERRATIC PERFORMANCE
  - FLIGHTS LOGICALLY SPACED THROUGH PROGRAM DURATION

- COMPREHENSIVE ANALYSIS REQUIRES TEMPERATURE/TIME HISTORY DATA

EXPOSURE CONTROL ANALYSIS

~~TOP SECRET~~ [redacted]

EXPOSURE vs SOLAR ALTITUDE B & W



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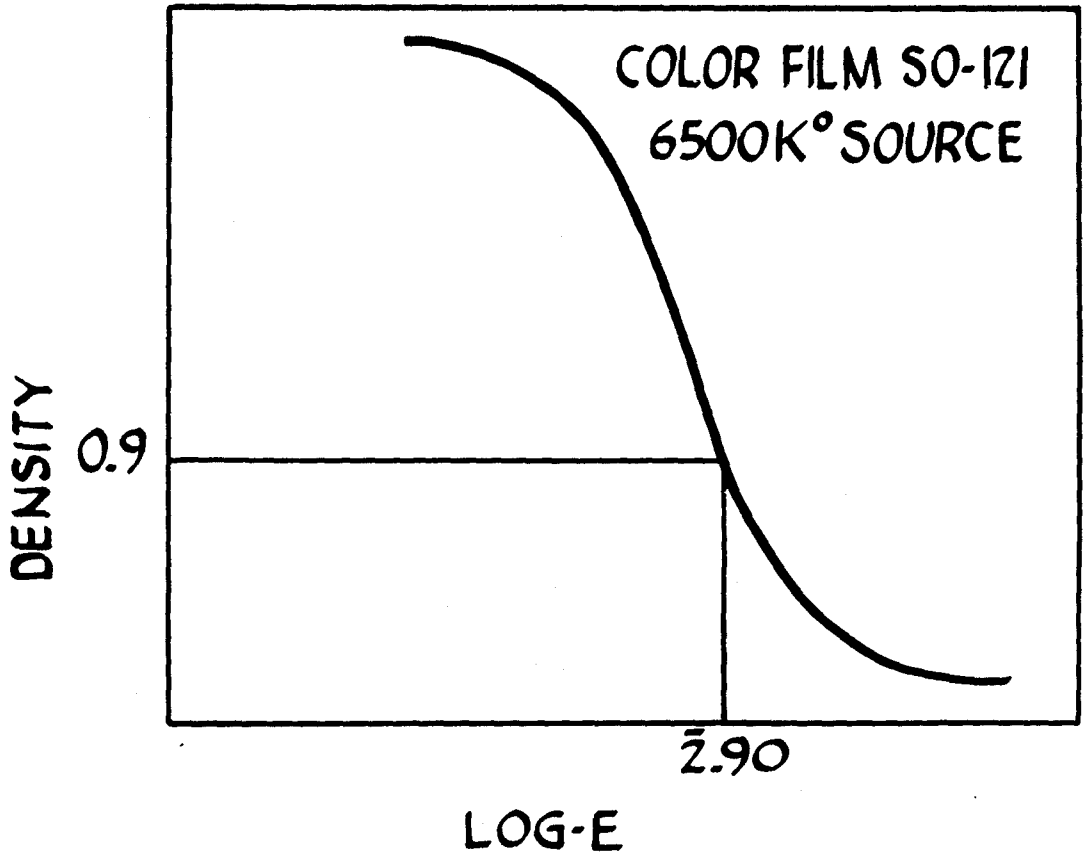
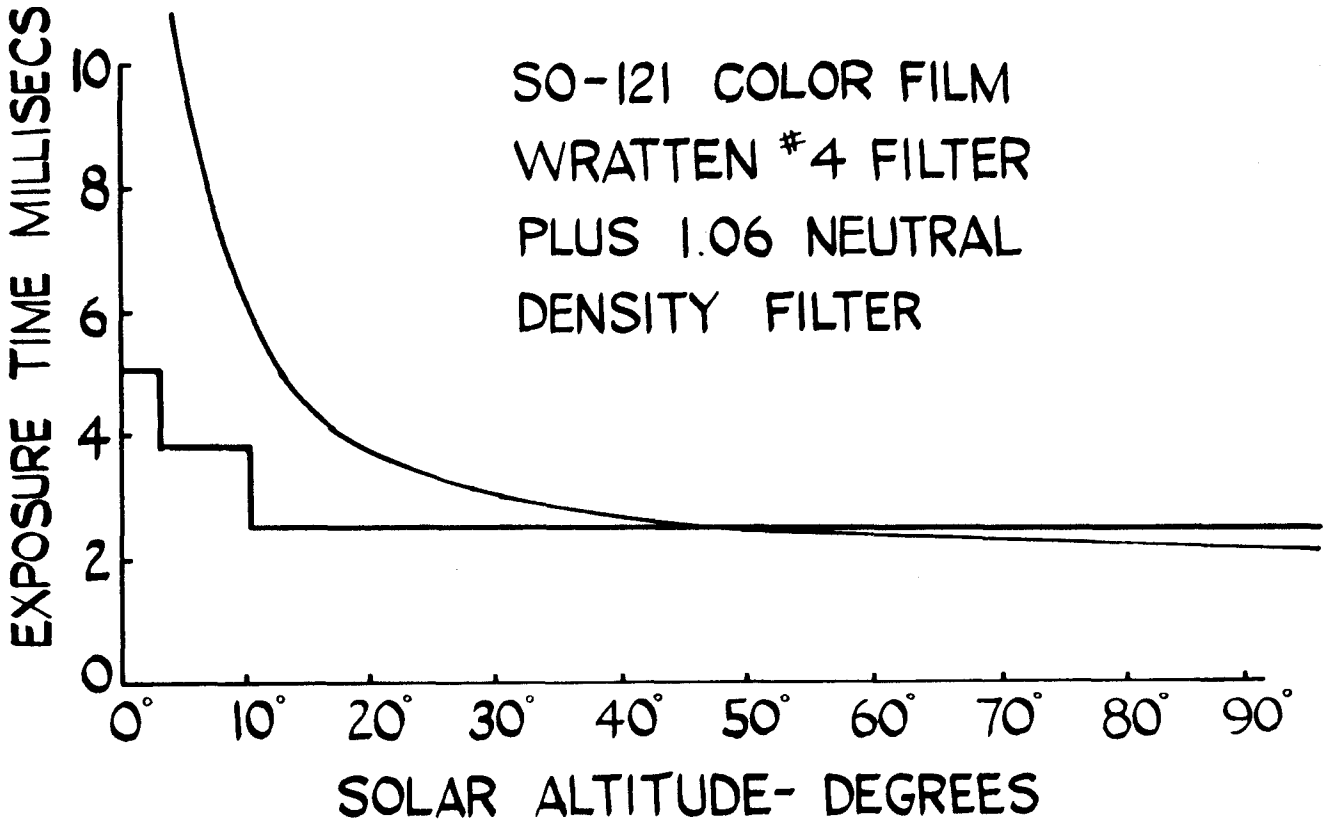
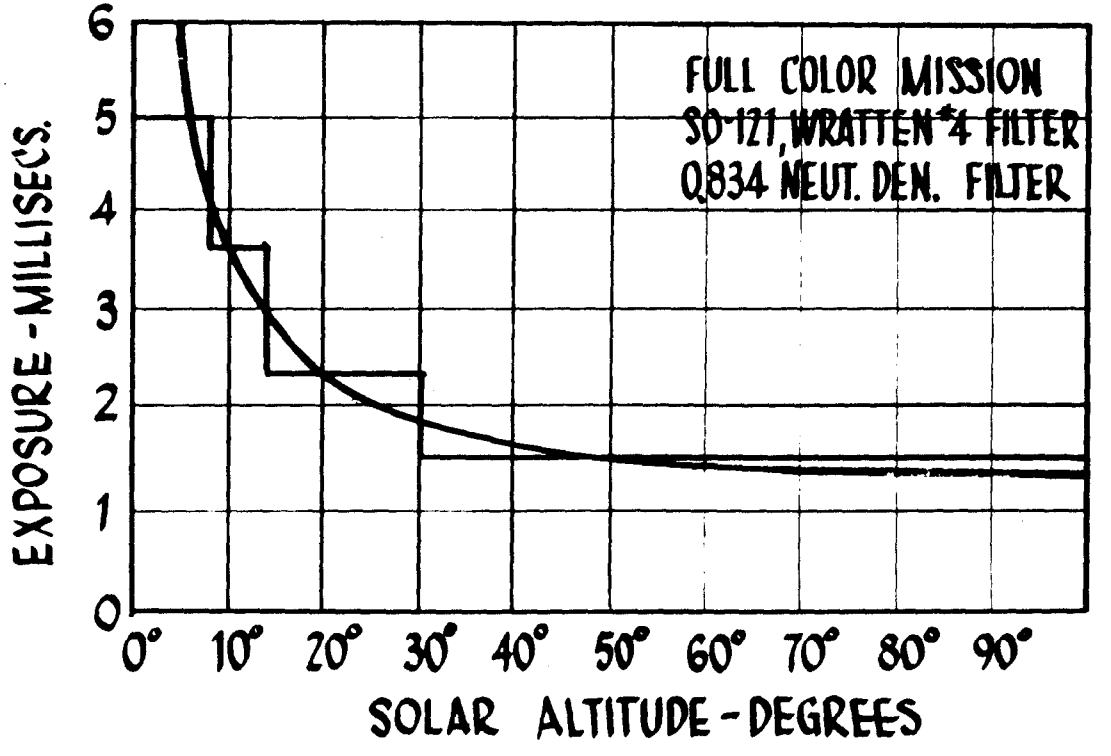
LUMINOUS DENSITY VS LOG-E



EXPOSURE TIME VS SOLAR ALTITUDE

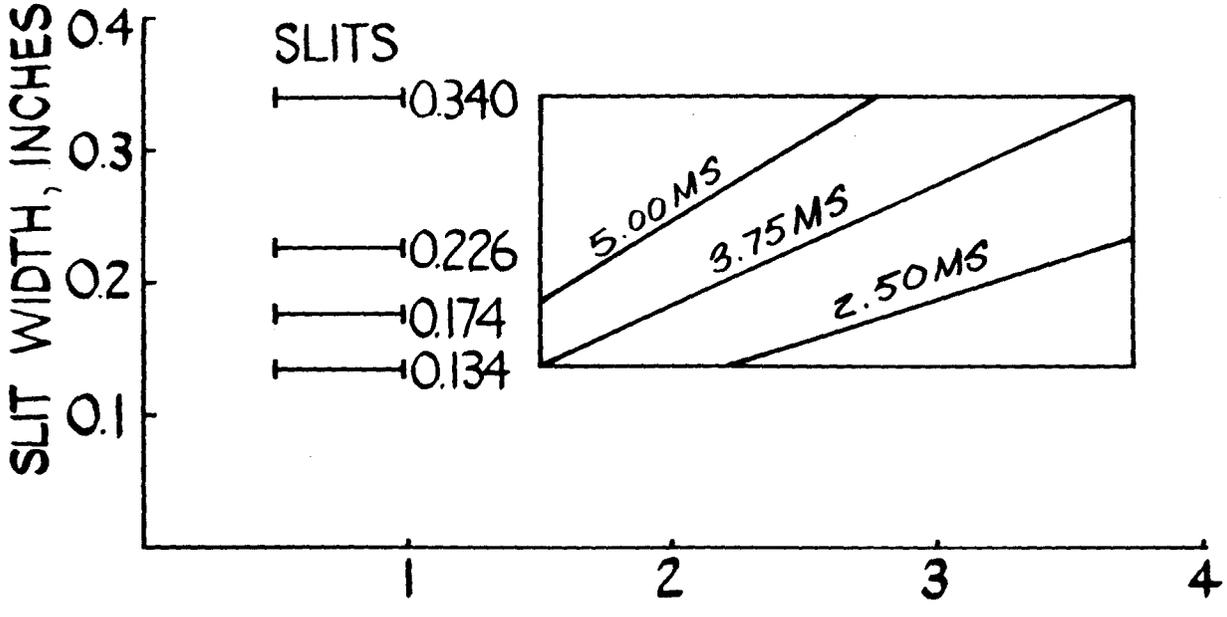


EXPOSURE VS. SOLAR ALTITUDE



SLIT WIDTH VS SCANNING SPEED

FOR VARIOUS EXPOSURE TIMES



FLIGHT TEST PROGRAM

EKIT FLIGHT TEST PROGRAM

BASIC PURPOSE

TO USE SIMILAR CAMERA SYSTEM IN A HIGH FLYING AIRCRAFT TO EVALUATE TECHNIQUES THAT WILL ENABLE USE OF FLEXIBILITY INHERENT IN J-3

MODEL TESTS

USING MODEL TO COMPARE FILMS UNDER CONTROLLED CONDITIONS

1. SO-362 VS. 3404

2. SO-121 VS. KODACHROME II VS. ANSCOCHROME D50

FLIGHT TESTS

LOW SOLAR ANGLE WITH SO-121
BI COLOR
SO-362 VS. 3404
NIGHT CONTROL
NIGHT DETECTION
FILM / FILTER COMPARISON
EXPOSURE LEVEL WITH 3404
COLOR COMPARISON
INDEX
POLARIZATION
M LAUNCH DETECTION
METRIC TESTS
LOW GAMMA

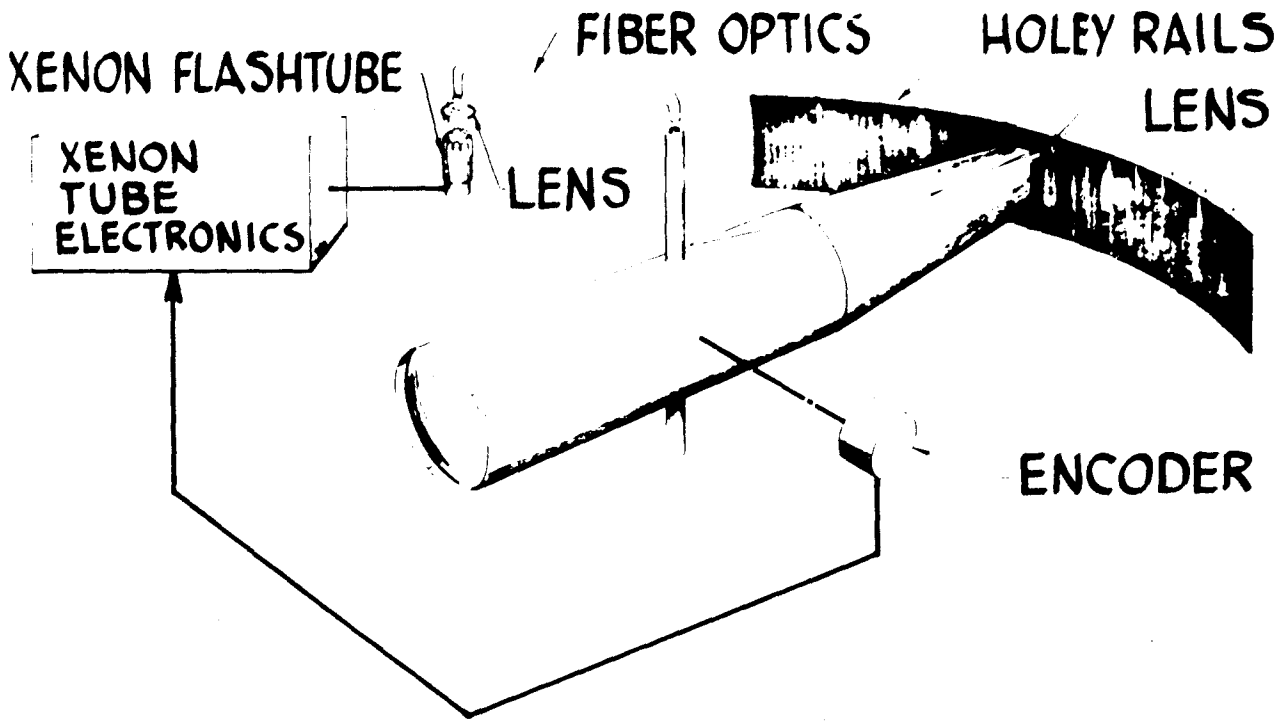
EKIT SCHEDULE

	FLIGHT TEST	ANALYSIS REPORT
1. SO-121	COMPLETE	7 SEPT
2. BI-COLOR	COMPLETE	20 SEPT
3. 362 VS 3404	COMPLETE	
4. NIGHT CONTROL		
5. NIGHT DETECTION		
6. FILM/FILTER		
7. INDEX		
8. EXPOSURE LEVEL	COMPLETE	
9. COLOR COMPARISON		
10. POLARIZATION	COMPLETE	
11. M LAUNCH DETECTION		
12. METRIC TEST	16 AUG	
13. LOW GAMMA	18 AUG	

P.G. CALIBRATION

NOD TO SCAN CALIBRATION

PRIMARY TECHNIQUE (RAIL)



3σ DISTORTION (ACROSS TRACK)

CALIBRATION OF RAIL HOLES	9 MICRONS
FILM FLATNESS	NEGLIGIBLE
RANDOM FILM SHRINKAGE	6.6
RAIL HOLE IMAGE MEASUREMENT	5
CAMERA RESOLUTION	1
FILM LIFT	5
THERMAL DRIFT (±10°F)	28
VIBRATION	NEGLIGIBLE
IMAGE POINT MEASUREMENT	5
LENS DISTORTION	NEGLIGIBLE
FOCAL LENGTH ERROR	4.3
RSS	31.7

ALLOWABLE ERROR 36 MICRONS

3σ DISTORTION (ALONG TRACK)

CALIBRATION OF RAIL HOLES	9 MICRONS
FILM FLATNESS	1
RANDOM FILM SHRINKAGE	6.6
RAIL HOLE IMAGE MEASUREMENT	5
CAMERA RESOLUTION	1
FILM LIFT	5
SCAN SHAFT BEARINGS	4
THERMAL DRIFT (±10°F)	9
VIBRATION	3
MEASUREMENT	5
LENS DISTORTION	3
RSS	17.8
ALLOWABLE ERROR	36 MICRONS

CHARACTERISTICS OF DATA

- NOD DOTS - 0.001 - 0.002 DIA
- SOLID LINE - 0.002 WIDE
- DASHES (TIME MARKS) -0.007 × 0.045
- SIZE IDENTICAL FOR ALL FILMS (3404- S0380-S0362 -S0180 - S0121)

WASHINGTON DATA CENTER

WASH. DATA CENTER DATA REDUCTION

- MEASUREMENT OF ALL IMAGES - RESEAU, HOLES, TRACES, NOD PULSES, ETC.
- TRANSFORMATION OF MEASUREMENT TO COMMON SYSTEM CORRECTED FOR FILM SHRINKAGE
- CAMERA AXES ORTHOGONALITY DETERMINATION
- SCAN-NOD ANGLE RELATIONSHIP DETERMINATIONS
- FINAL FORMULATION OF RESULTS

ACTIVITIES WASH. DATA CENTER

A.O.

- ANALYSIS PROGRESSING ON CAMERA CALIBRATION TECHNIQUES FOR PRINCIPAL POINT DETERMINATION

P.G.

- MENSURATION FORMAT ESTABLISHED
- TRANSFORMATION METHODOLOGIES FORMULATED AND PARTIALLY PROGRAMMED
- PRELIMINARY ANALYSIS FOR DETERMINATION OF CAMERA AXES ORTHOGONALITY COMPLETED
- CUSTOMER REQUIREMENTS CURRENTLY BEING INVESTIGATED

A.O.- P.G.

- ANALYSIS COMPLETED AND RESULTS PARTIALLY PROGRAMMED FOR DETERMINATION OF SYSTEM RELATIVE ORIENTATIONS

TYPE AND SCHEDULE OF REPORTS

QUALIFICATION TEST DATA REDUCTION

- INTERIM P.G. CAPABILITY EVALUATION (30 OCT 1966)
- FINAL QUAL. DATA EVALUATION (15 FEB 1967)

ACCEPTANCE TEST DATA REDUCTION

- (30 DAYS AFTER ACCEPT. TEST)

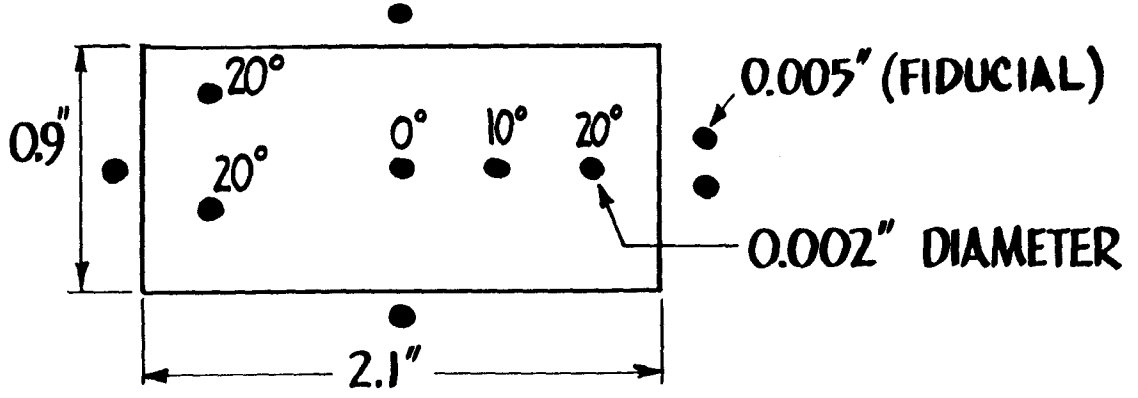
OPERATIONAL MATERIAL DATA REDUCTION

- (30 DAYS AFTER RECEIPT OF MATERIAL)

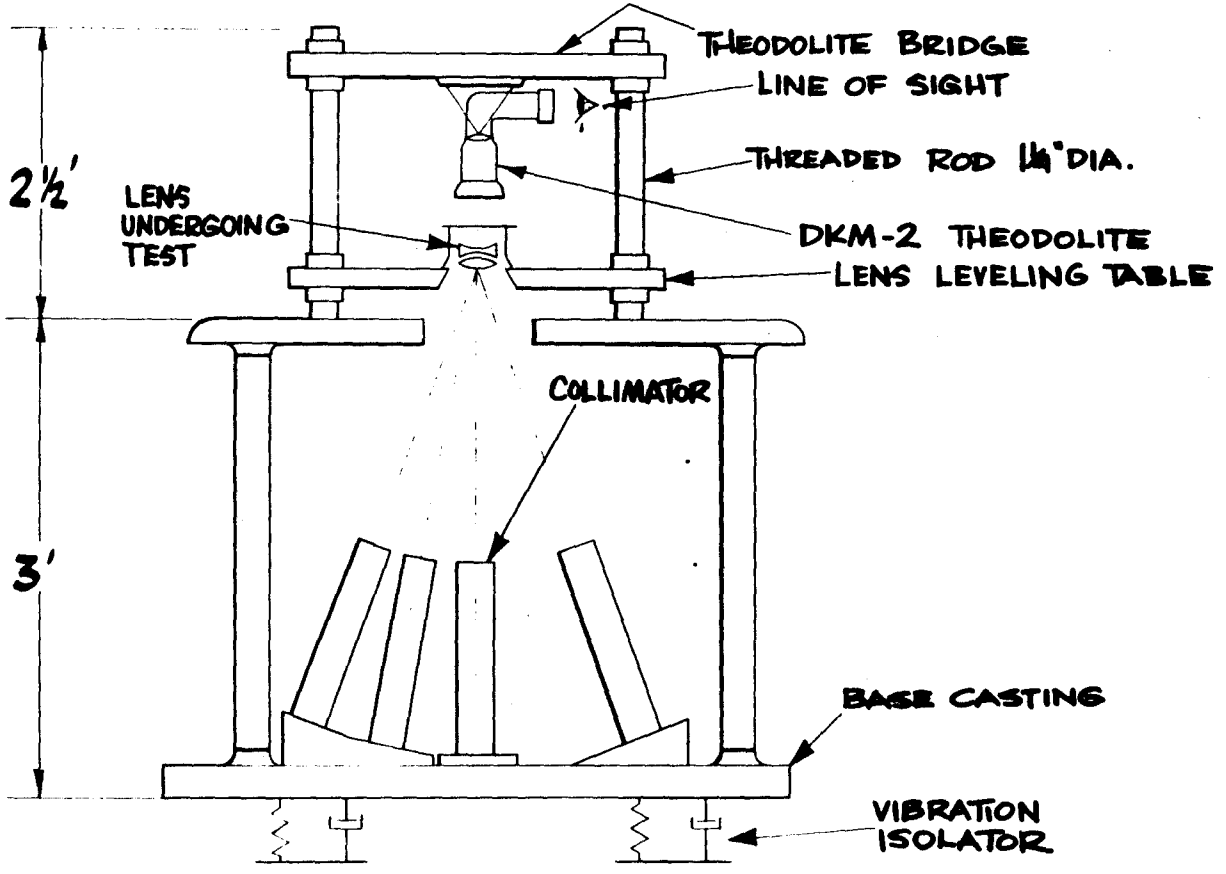
A.O. CALIBRATION

HORIZON OPTICS CALIBRATION (55mm, f/6.3)

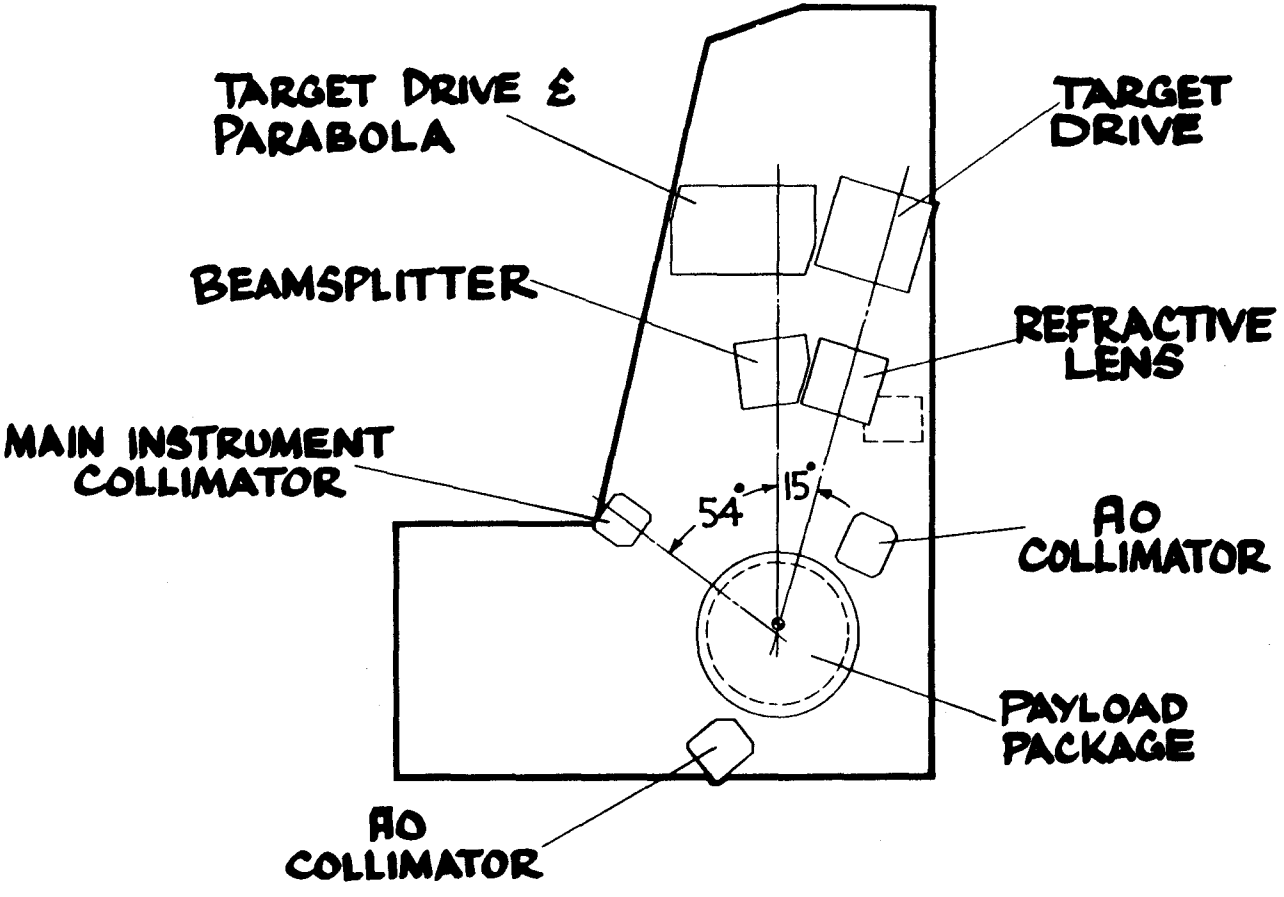
DETERMINE EQUIVALENT FOCAL LENGTH	25 μ
DETERMINE PRINCIPAL POINT AUTOCOLLIMATION	10
DISTORTION CHECK (3 POINTS)	10



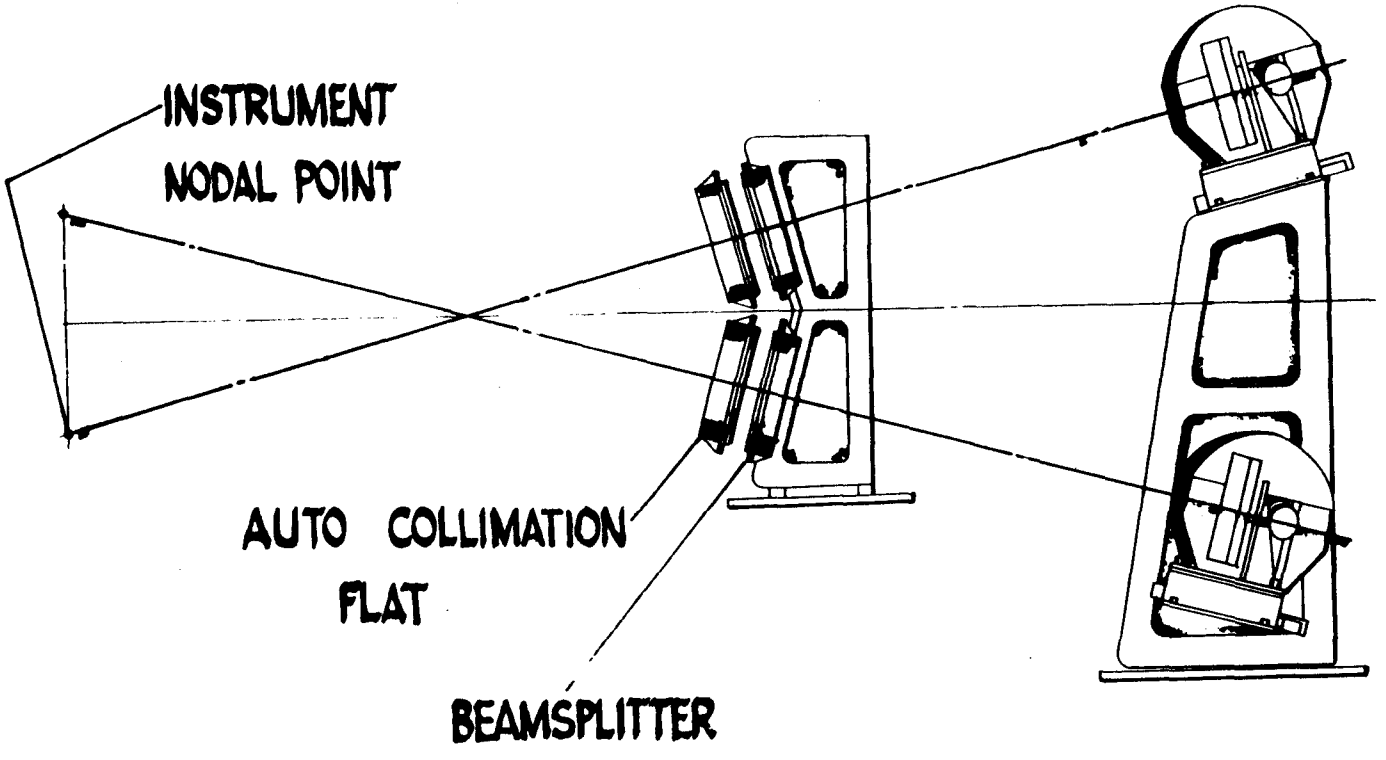
A.O. CALIBRATION DEVICE



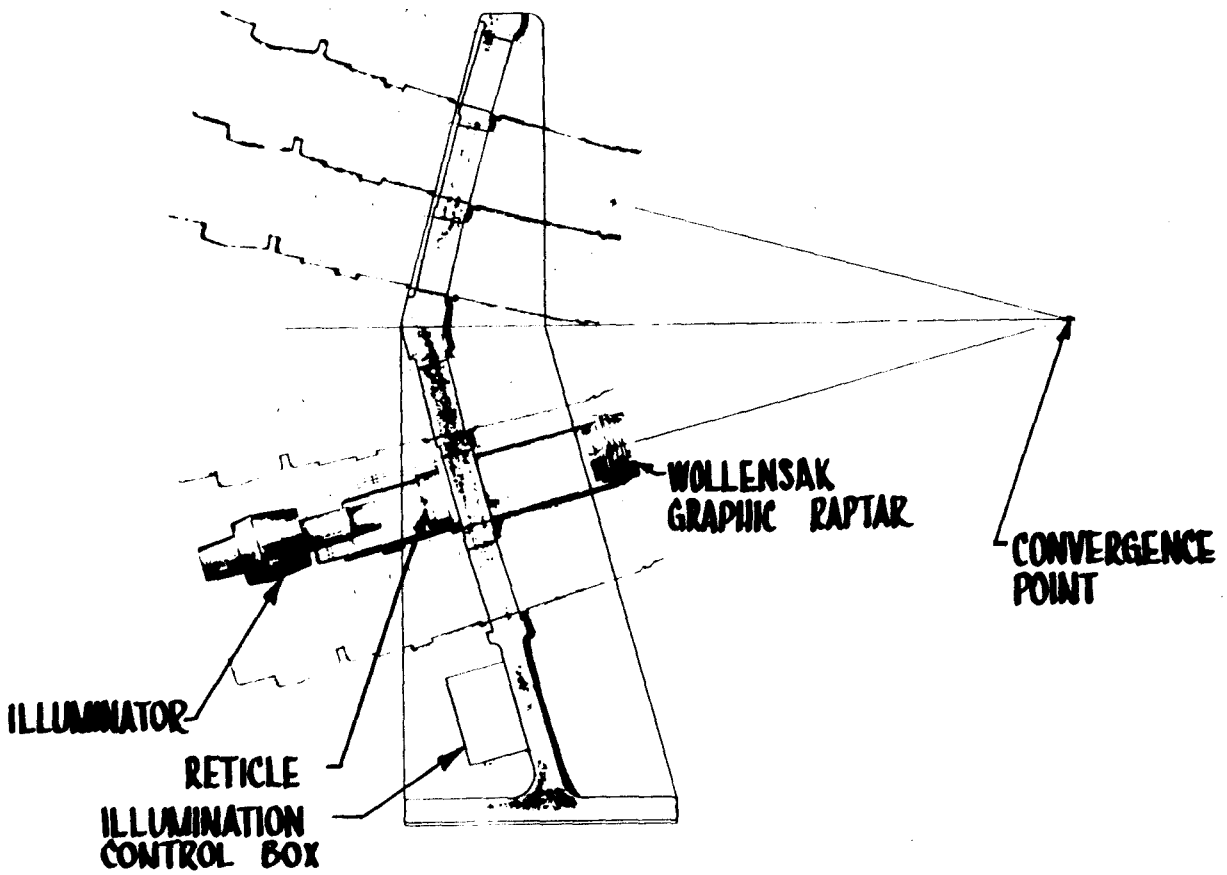
A/P SIMULATOR PLAN VIEW



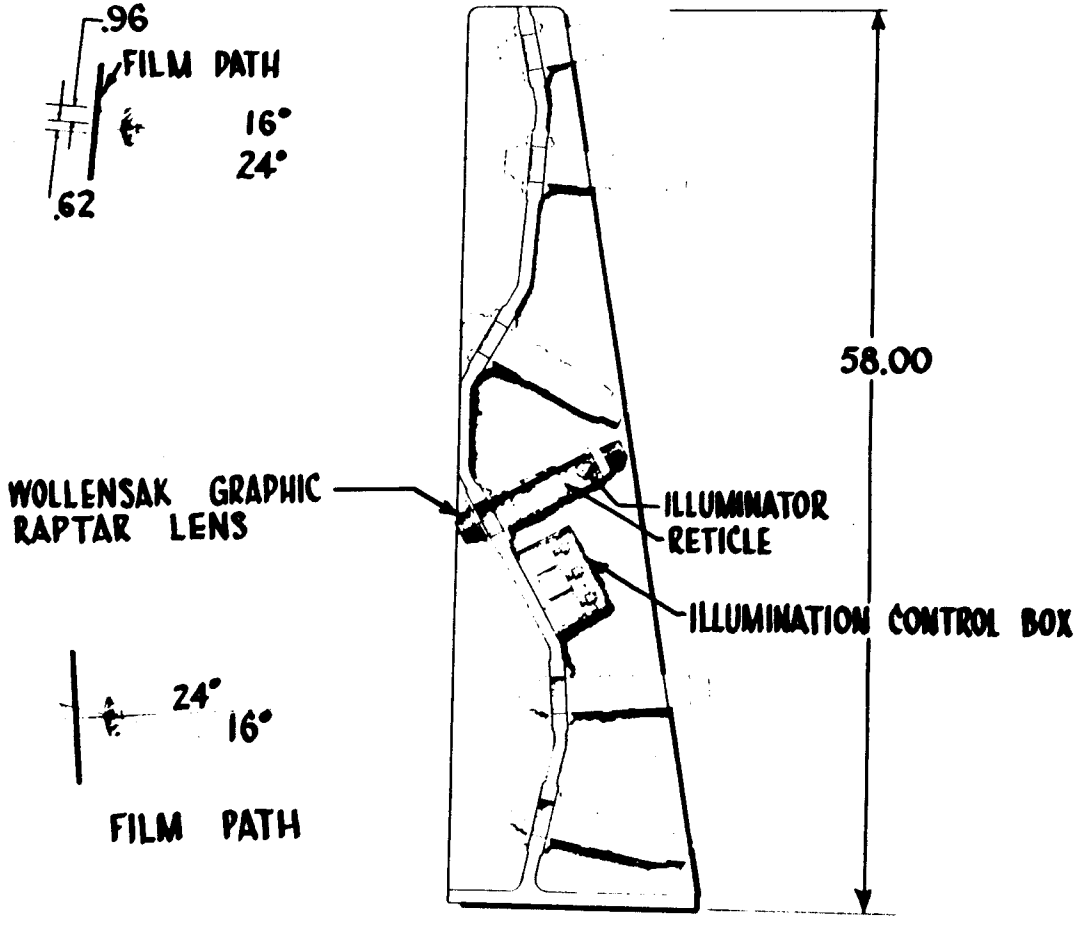
RESOLUTION COLLIMATOR SYSTEM



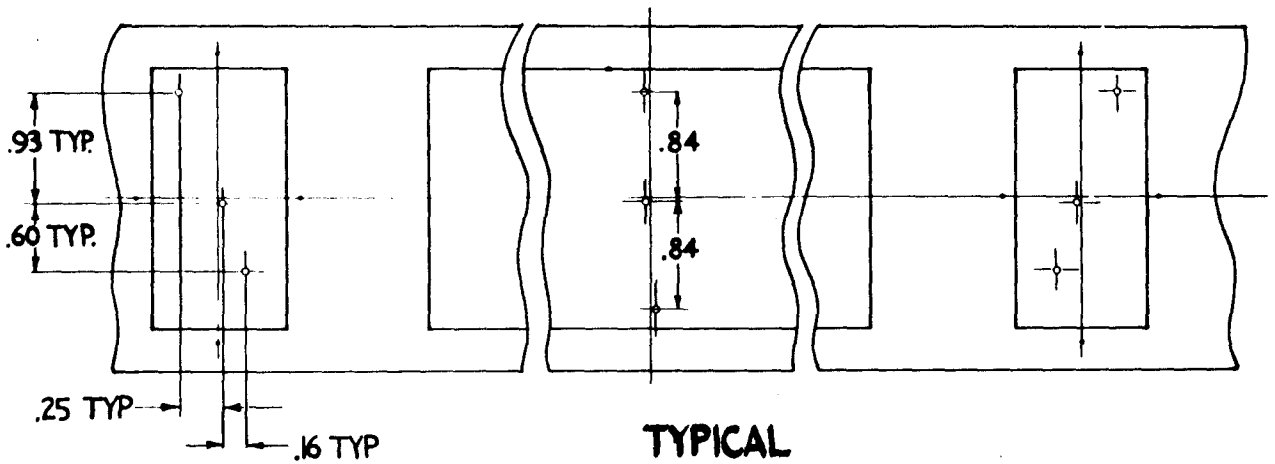
MAIN INSTRUMENT CALIBRATION SYSTEM



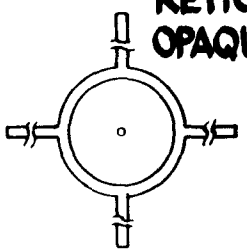
A.O. CALIBRATION SYSTEM



CALIBRATION FORMAT

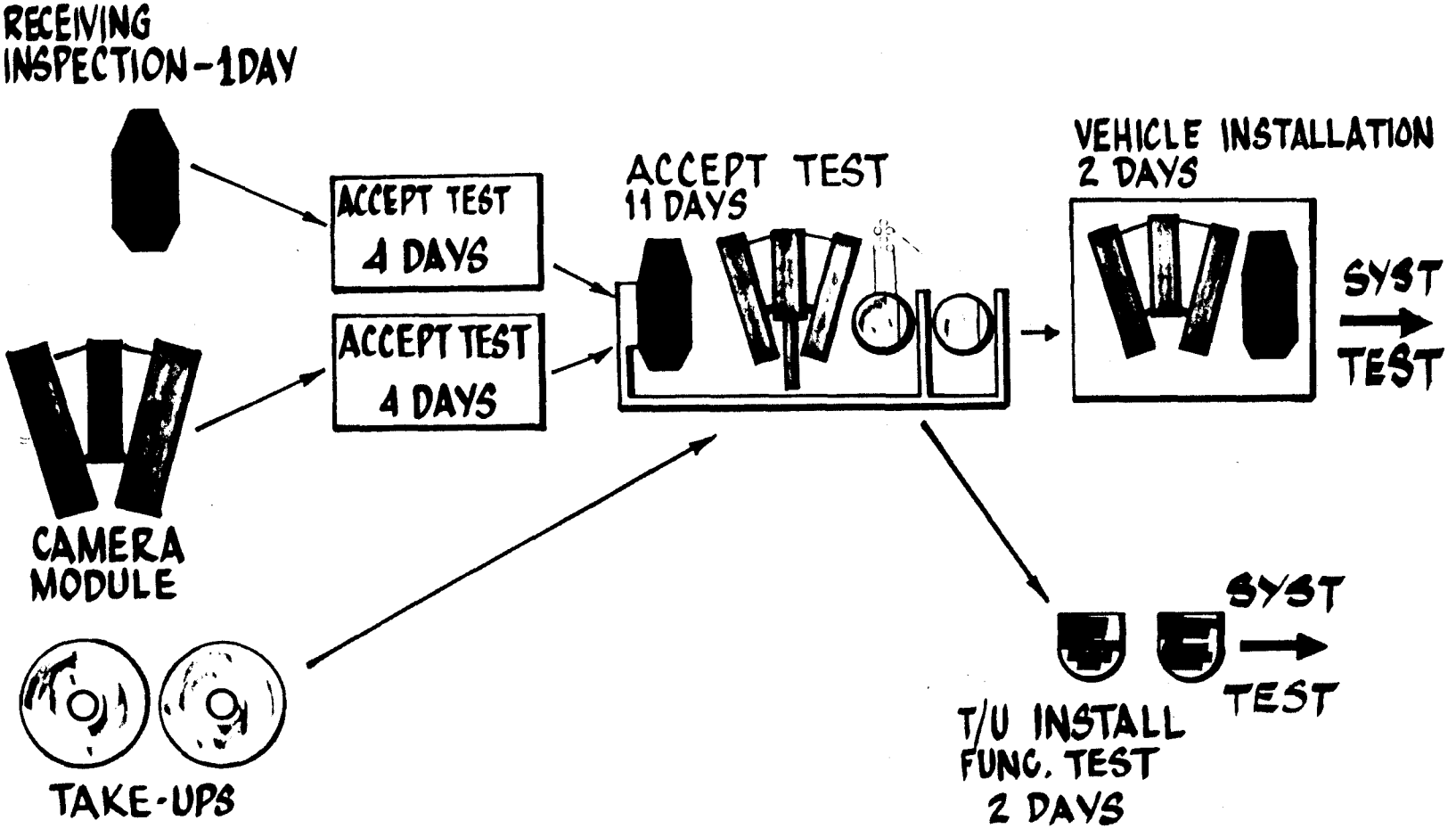


TYPICAL
RETICLE PATTERN
OPAQUE BACKGROUND



A/P TEST PROGRAM

COMPONENT TEST FLOW THRU A/P



QUALIFICATION TESTING

SINUSOIDAL VIBRATION

SUPPLY AND STRUCTURE

X 5-15 cps	0.18 IN (DA)		LIMITED TO 4.0g AT LOADED
15-20	2.0g	(0-PEAK)	SPOOLS EXCEPT IN 15-20 cps
20-400	1.5g	"	RANGE
400-2000	3.0g	"	
Y,Z 11-2000 cps	1.0g	"	

ENGR. EVALUATION AT 0.38 in (DA), 4.0, 3.0, 3.5 g's ON X AXIS AND 2.0g's ON Y,Z AXES

SINUSOIDAL VIBRATION

CAMERA MODULE W/DUMMY

X	5-15 cps	0.18 in (DA)	LIMIT TO 4.0g AT CELLS
	15-20	3.0g (0-peak)	EXCEPT 15-20 Cps RANGE
	20-400	2.0g "	
	400-2000	3.0g "	
Y,Z	11-400	1.0g "	
	400-2000	3.0g "	

T/U SINUSOIDAL VIBRATION

EMPTY

X	5-15 cps	0.5 IN (DA)	
	15-20	7.0 g	(0-PEAK)
	20-400	5.0 g	"
	400-2000	7.5 g	"
Y,Z	11-2000	3.0 g	"

RANDOM VIBRATION

	CPS	G^2/CPS	g's RMS
SUBSYSTEMS < 250#	20-400	0.05	14.5
& MAJOR SUBASSEMBLIES	400-2000	0.12	
MINOR SUBASSEMBLIES	20-400	0.05	17.5
	400-2000	0.18	

SHOCK AND ACCELERATION

		SHOCK. (6-8 MS)	ACCEL.**		
MAIN INST		NOT REQD.	-X	11.0g	COMB.
			+Z	2.0	
* FULL T/U	X	-20 g	X	11.5	
	Y,Z	± 5	+Z	2.5	
EMPTY	X	±20	-X	11.0	COMB.
	Y,Z	±10	-Z	2.0	
FULL SUPPLY	X	±15	-X	11.0	COMB.
	Y,Z	±10	±Z	2.0	

* NO FILM OR OFF-SPOOLING DAMAGE ALLOWABLE

** 3 MIN EACH DIRECTION AT C.G., CONTINGENT ON AVAILABILITY OF OUTSIDE FACILITY

QUAL. LEVELS FOR STRUCTURES

		SINE VIBRATION		ACCELERATION		
AUX STRUCT & SUP STRUCT	X	5-15 cps	0.5 IN (DA	-X	11.0g	COMBINED
		15-400	5.0g			
		400-2000	10.0g			
	YZ	15-2000	3.0g	+Z	2.0g	
MAIN INST STRUCT				-X	11.0g *	BY STATIC LOADING
				+Y	3.0g	
				+Z	3.0g	

*TEST COMPLETED-RESULTS FACTORED INTO DESIGN

QUALIFICATION TEMP TEST LEVELS (°F)

	HIGH SOAK	LOW SOAK	HIGH OPER	LOW OPER
CAMERA MOD*			100**	40**
T/U 2			100	40***
SUPPLY			100	40
LENS & CELL	100 (4 hr)	40 (4 hr)	80	60
ELECT ASSY'S			100	40
MECH ASSY'S			100	40

* ENG EVAL AT 105 AND 35

** IN TOLERANCE 70 ± 10°F ONLY

*** ACCEPTANCE TEST - ALL FLIGHT UNITS

VIBRATION SPECIFICATION WAIVERS

			PLANNED	T3-6002A *
SUPPLY	LONG	5-15 cps	0.18" (P-P)	0.38 (P-P)
		15-20	2.0 g (0-P)	4.0 g (0-P)
		20-400	1.5 g (0-P)	3.0 g (0-P)
		400-2000	3.0 g (0-P)	3.5 g (0-P)
	LAT	15-2000	1.0 g	2.0 g

* ENG EVAL TO BE PERFORMED AFTER QUAL.

ACCELERATION SPECIFICATION WAIVERS

	PLANNED TEST	T3-6-002A REQUIREMENT
LOADED T/U	LONG +11.5 g	LONG -15 g
	LAT ±2.5 g	LAT ±6.5 g
	3.0 MIN.	10 MIN
NON-RECOVERABLE STRUCTURE	+11	+20
	± 2	± 3

ENG. EVAL. TO BE PERFORMED AFTER QUAL.

ITEMS VIBRATION AND SHOCK QUALIFIED

RESISTORS/CAPACITORS/RELAYS/POTS	19 OF 156
INLAND TORQUE MOTOR	1
THEODOSYN ENCODER	1
GLOBE GEARHEAD MOTOR	1
CLUTCH	1
SPINDLE	1
ROLLERS	2
INTERMEDIATE ROLLER ASSEMBLY	1
T/U ASSEMBLY	1
SUPPLY ASSEMBLY	1

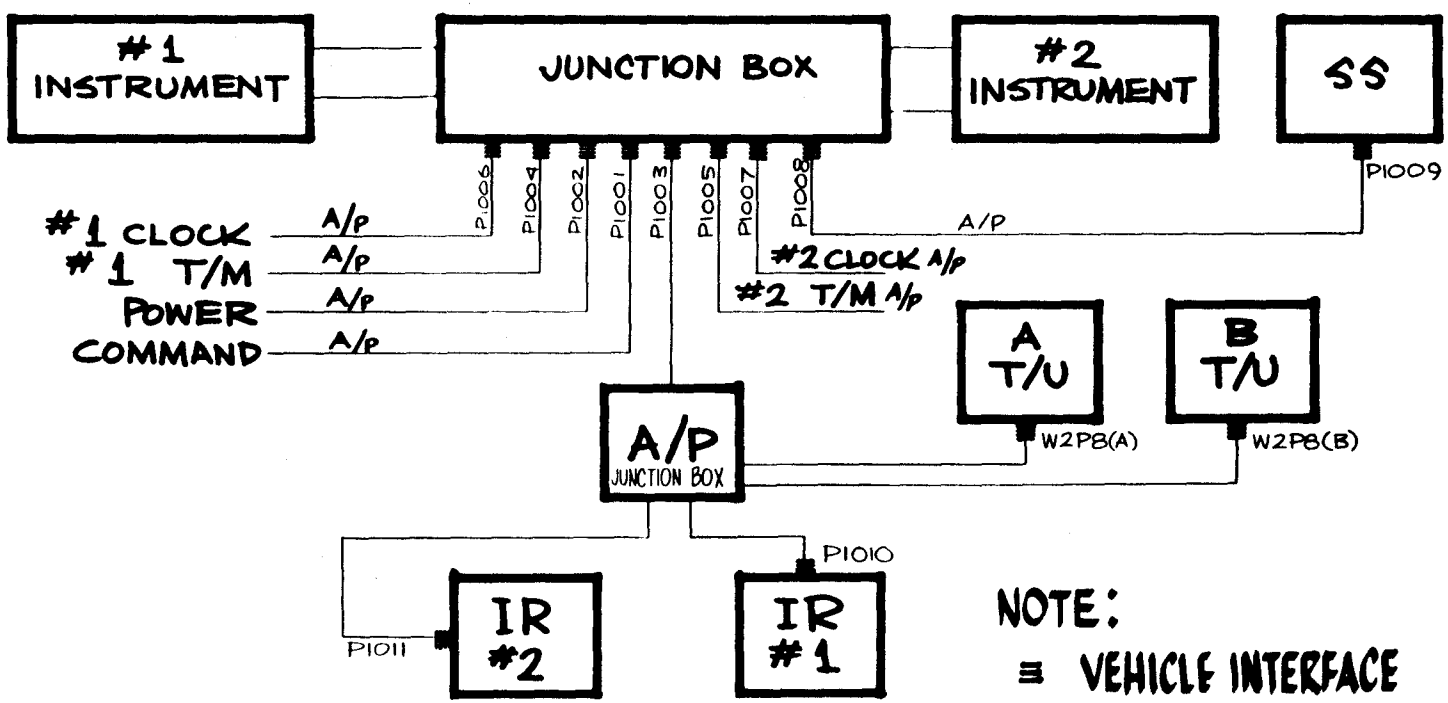
INTERFACE

INTERFACE DOCUMENT STATUS

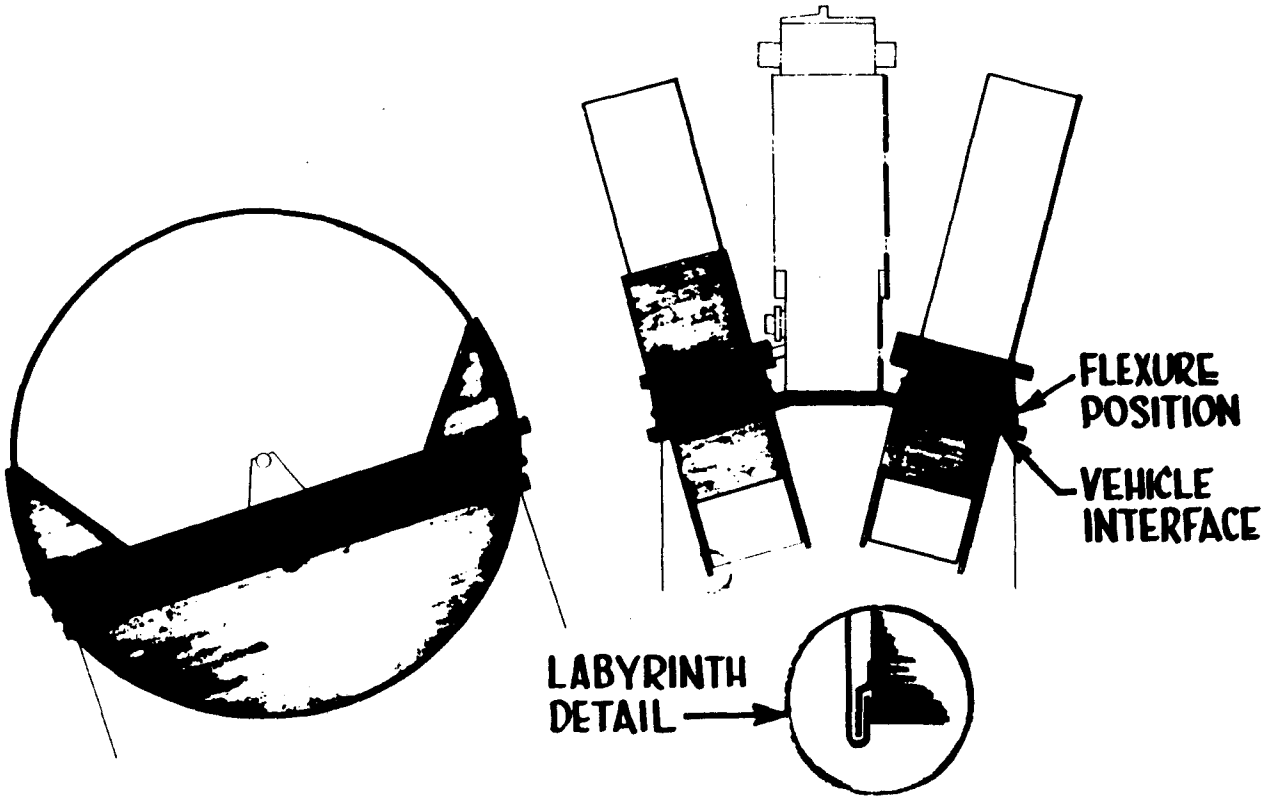
T3-5-019B	ELECTRICAL	APPROVED
T33-100	PAYLOAD COMP	NOT RECEIVED
T33-101B	N/C STA 0-86	* APPROVED
T33-102D	N/C STA 86 AFT	BEING REVIEWED
T33-112	EXIT T/U & IR	NOT RECEIVED
T33-113A	MAIN DOOR BOOT	* APPROVED
T33-114A	M.I. ELECT CONN	* APPROVED
ITEK 78900	T/U	* APPROVED
6K636	T/U (A/P X D02)	* APPROVED

* REQUIRE SIGNATURES

ELECTRICAL INTERFACE



LIGHT SHIELDING



THERMAL INTERFACE

- OPTICAL TRAIN DESIGN GOAL 70 ± 10°F
- STRUCTURAL COMPONENTS 70 ± 30
  (BASED ON COMMON TEMP. GROUND RULES)

WEIGHT SUMMARY AS OF 8/15

MAIN INSTRUMENT		329
UNIT 1	128	
UNIT 2	128	
STRUCTURE	26	
ELECTRONICS	47	
SUPPLY		74
TAKE-UPS		36
MISC. (I.R.)		3
TOTAL		442

POSSIBLE WEIGHT SAVINGS

- MAIN INSTRUMENT STRUCTURE
- RE-DESIGN ALL FIXTURES
- RE-EVALUATE AUXILIARY STRUCTURE

BRASSBOARD TESTING

BRASSBOARD TESTING RESULTS TO DATE

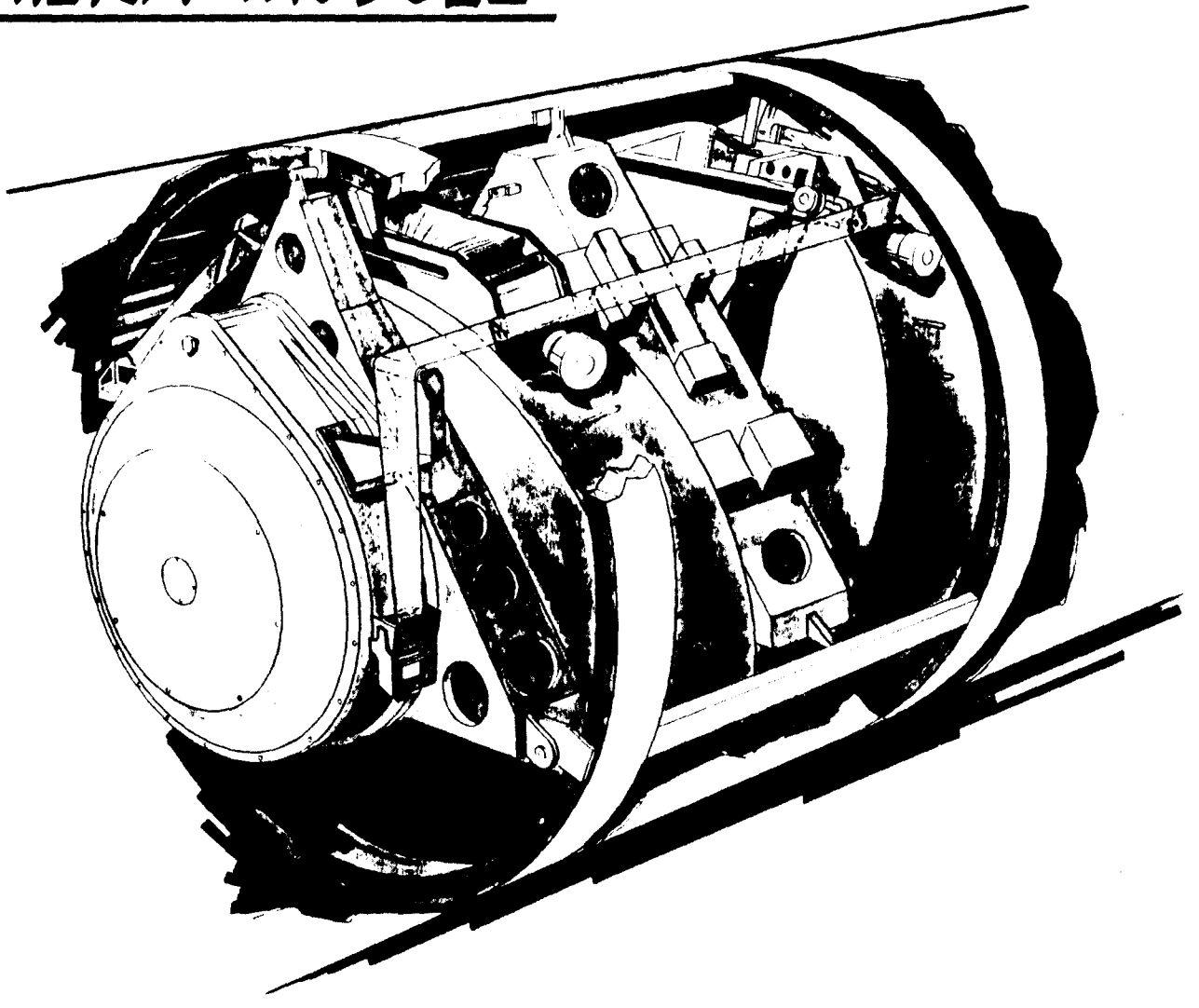
- SERVO DRIVE SYSTEM PARAMETERS ESTABLISHED
- ECCENTRIC GEAR INPUT METERING SYSTEM TESTING
- FILM FRAMING MECHANISMS TESTING
- FILM TRACKING INTEGRITY ESTABLISHED
- TESTING OF I.M.C. MECHANISMS
- INVESTIGATION OF SYSTEM DYNAMIC EFFECTS

BRASSBOARD TESTING FUTURE PLAN

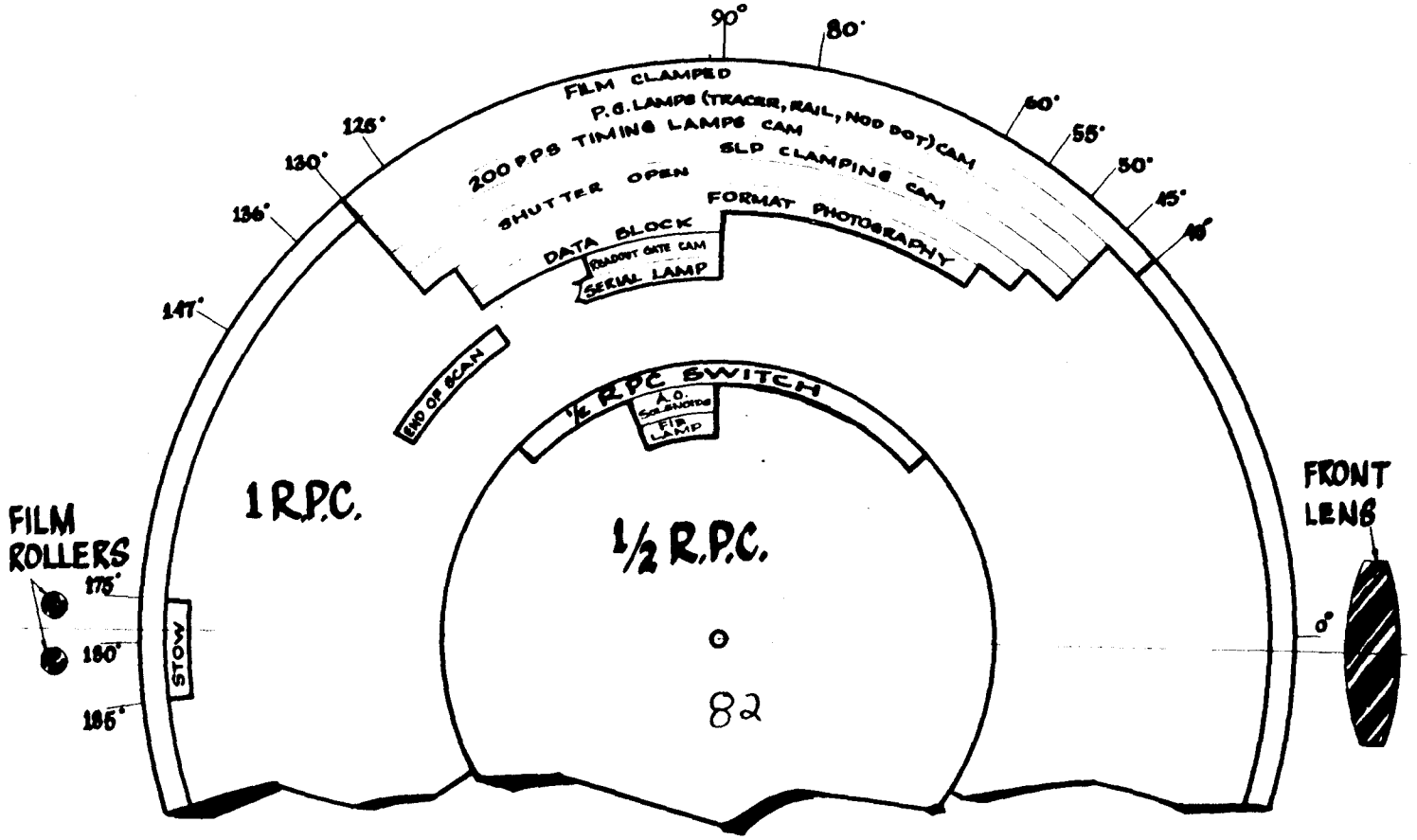
- FILM FLATNESS INVESTIGATIONS
- PAN GEOMETRY AND DATA READOUT INVESTIGATIONS
- ELECTRICAL CONTROL SYSTEM CHARACTERISTICS

MAIN INSTRUMENT

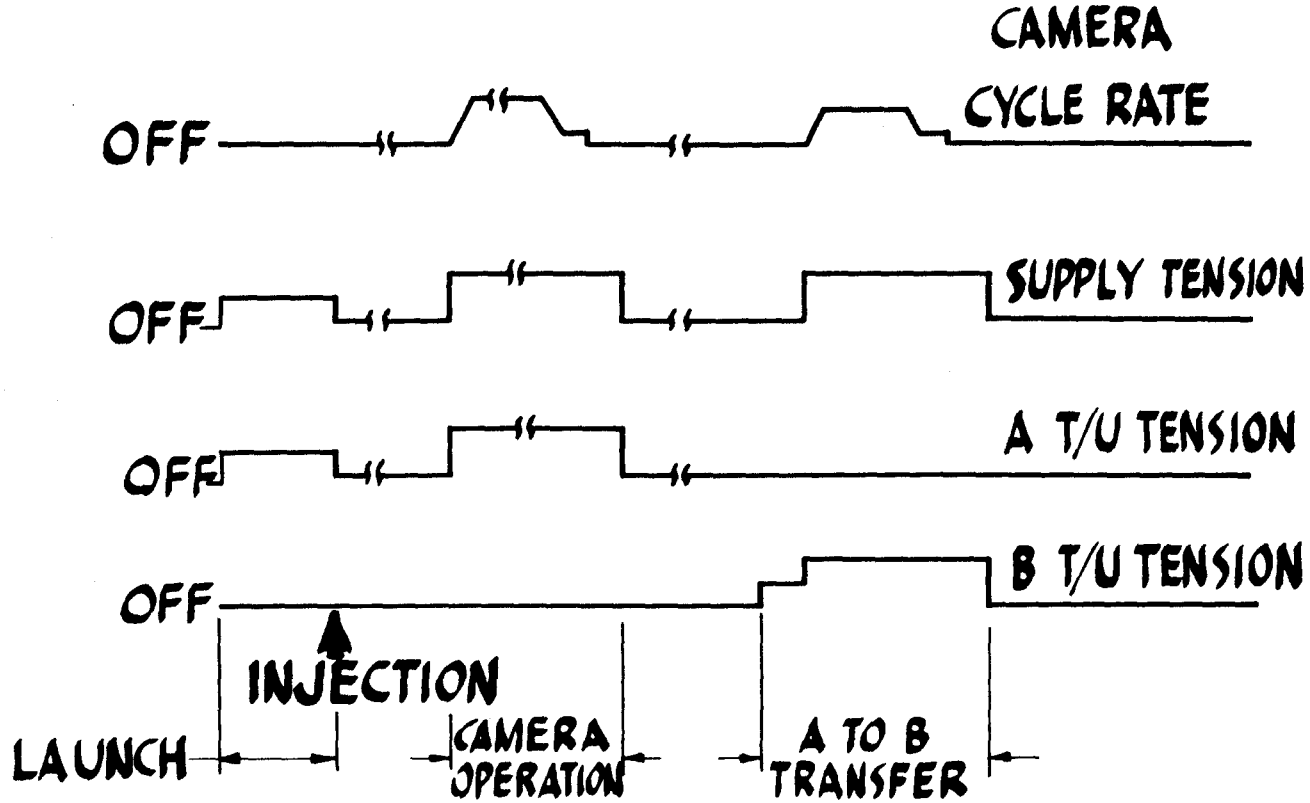
CAMERA MODULE



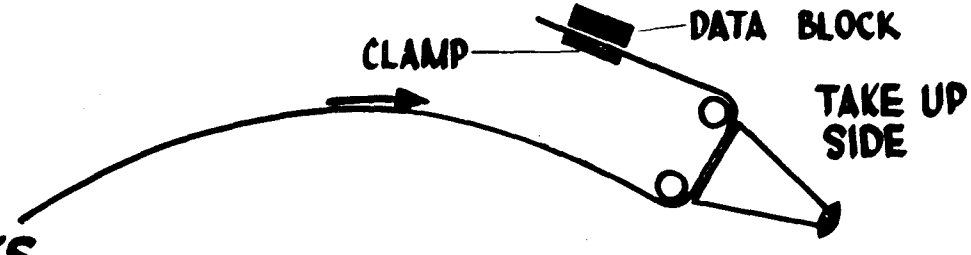
CAMERA EVENTS



SYSTEM SEQUENCE



TIME RECORDING



FEATURES

- UTILIZES SILICON LIGHT PULSE BLOCK (SLP)
- PRINTS TIME ON PRECEEDING FRAME
- MOUNT AND CABLE INTERFACE ONLY

PROBLEMS

EMULSION DUST SENSITIVITY

DISIC CORRELATION

NONE PROVIDED

EXPOSURE CONTROL

DESIGN FEATURES

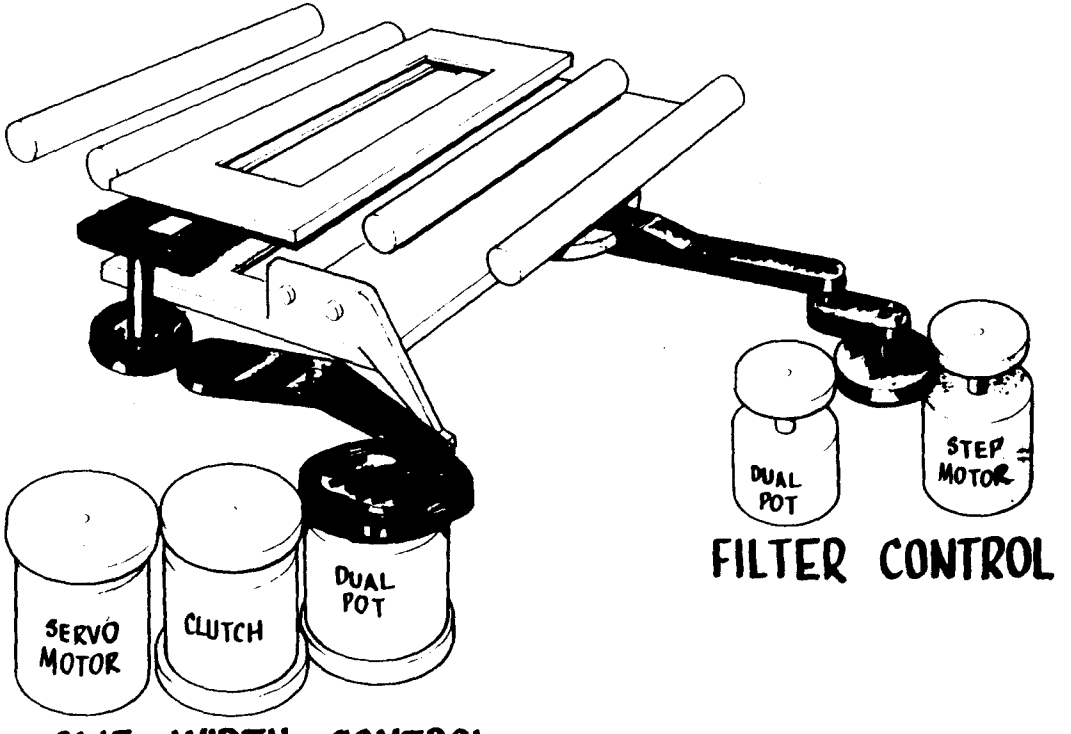
SLIT WIDTH

- PREDETERMINED FAILURE WIDTH (MID RANGE)
- FOUR SELECTABLE SLITS PLUS FAILURE WIDTH
- INTERCHANGEABLE CAMS ON INSTALLED SYSTEM
- RTC REQUIRED FOR FAILSAFE
- CAPABILITY OF RTC RESET AFTER FAILSAFE SIGNAL

FILTER SELECTOR

- REMOTE CHOICE OF 2 FILTERS
- INTERCHANGEABLE FILTER CARRIERS ON INSTALLED SYSTEM
- FILTER PLUS NEUTRAL DENSITY ELEMENT AT SAME STATION

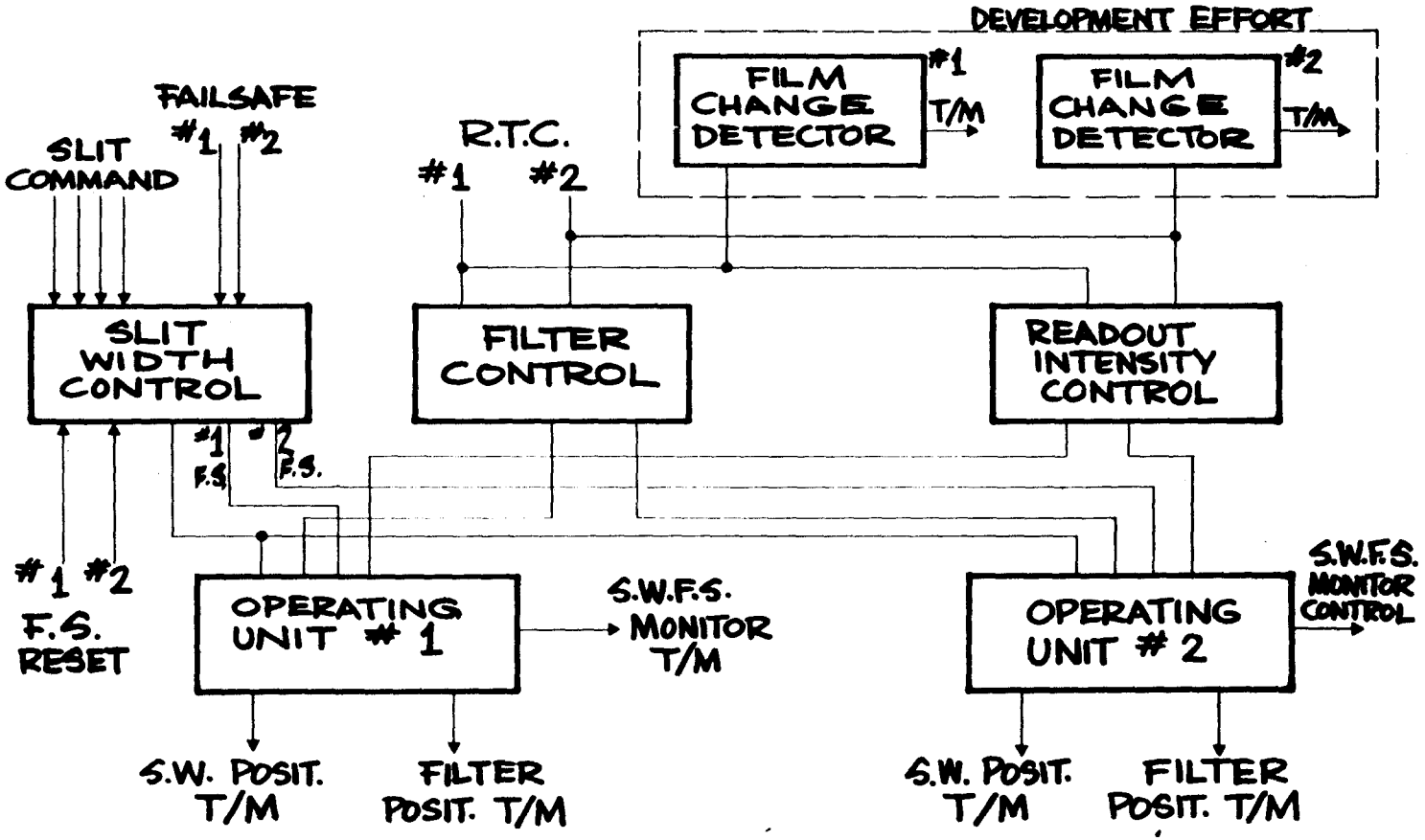
SLIT WIDTH CONTROL



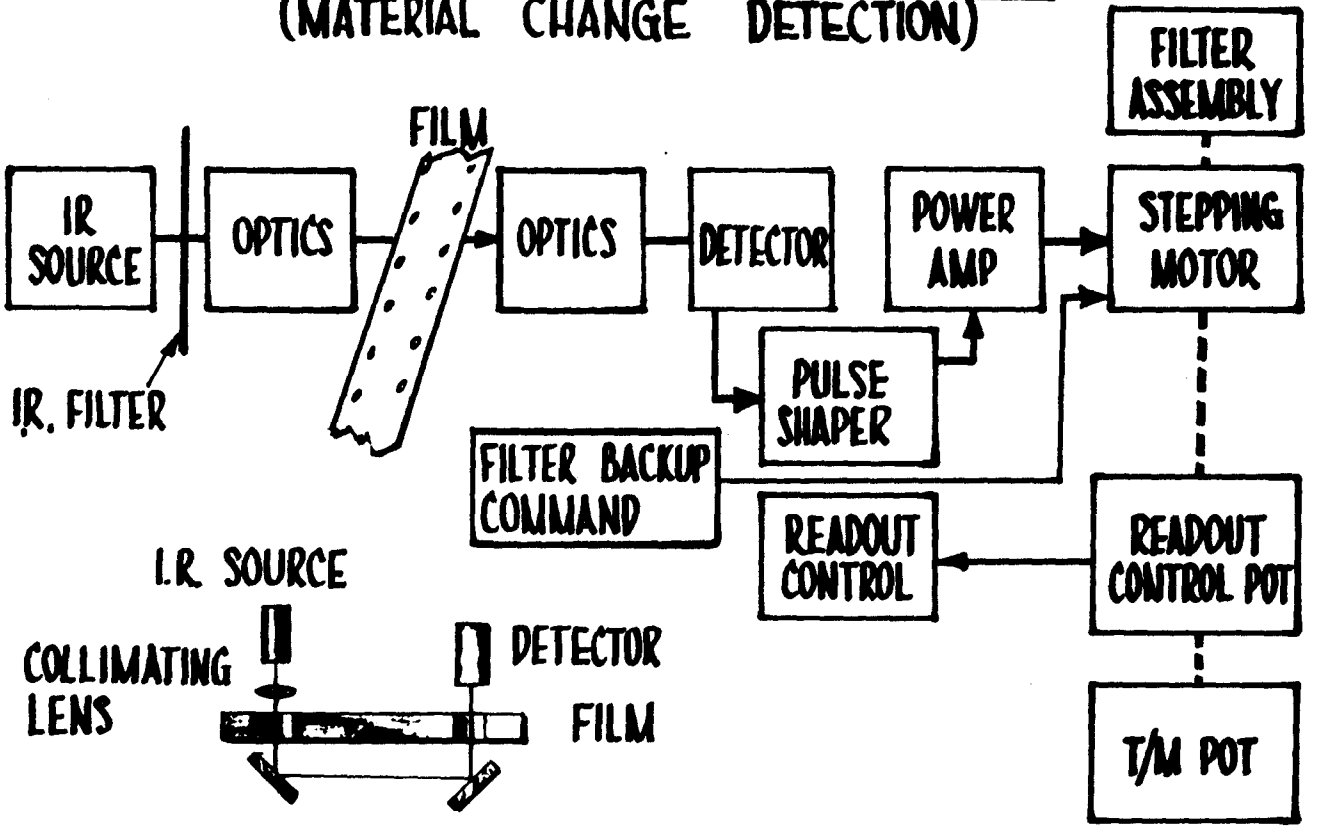
EXTERNAL COMMANDS

- FOUR LINE SLIT WIDTH COMMAND
  (ONE OF FOUR ENERGIZED CONTINUOUSLY)
- TWO LINE - SLIT WIDTH FAIL SAFE
- TWO LINE - S.W.F.S. RESET
- TWO LINE - FILTER, A.O., + READOUT CHG.

EXPOSURE AND READOUT CONTROL BLOCK DIAGRAM



FILTER CONTROL SYSTEM
(MATERIAL CHANGE DETECTION)



ADDITIONAL CONSIDERATIONS

- COMPENSATE HOR. OPTICS EXPOSURE FOR FILM TYPES
- ADJUST DATA EXPOSURE FOR FILM TYPES
  - HOR. OPTICS FIDUCIALS
  - P.G CALIBRATION(XENON FLASH & INCANDESANT)
  - TIME MARKS
  - SLP BLOCK
  - BEGIN PASS, SERIAL,

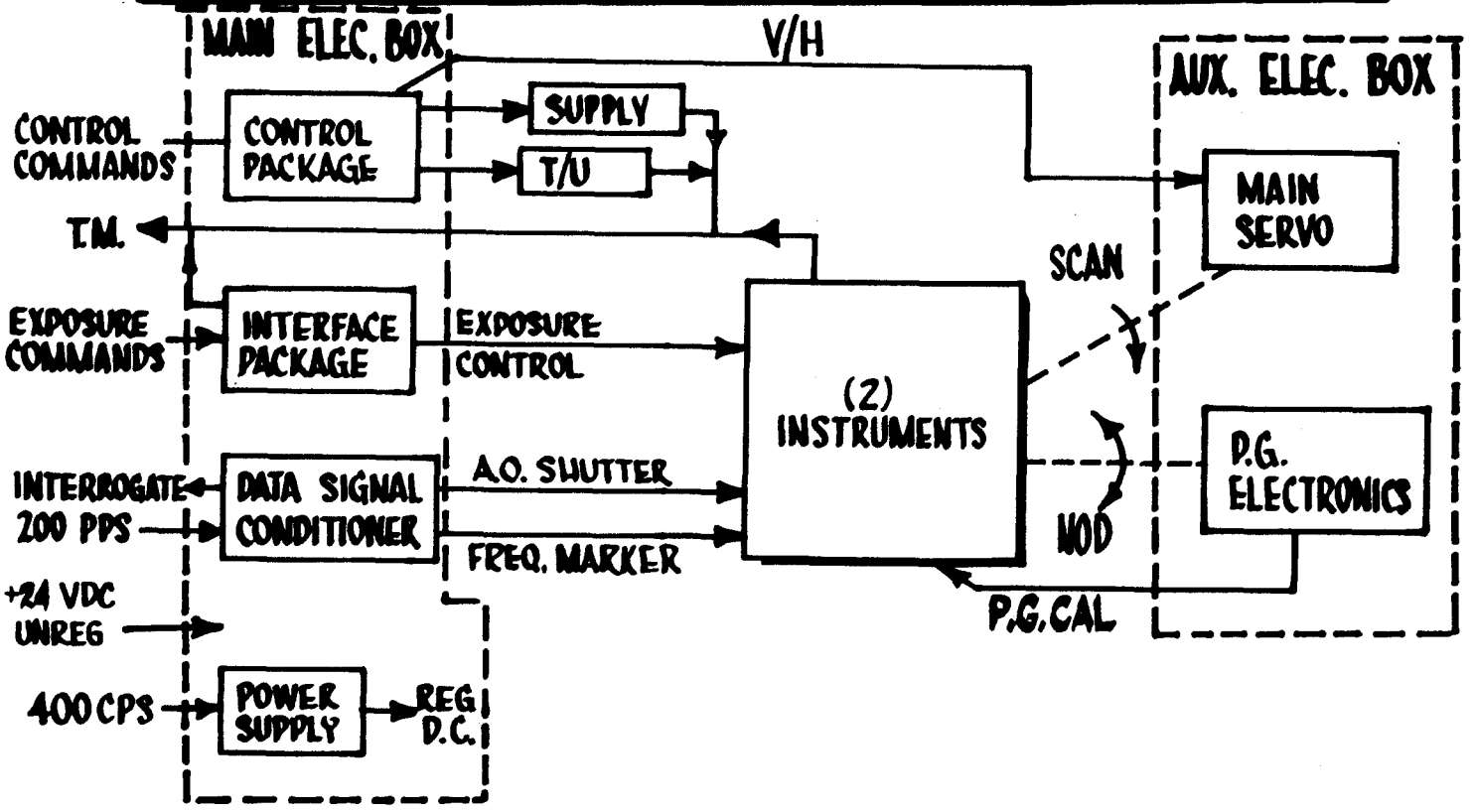
SUMMARY-FAILURE RECOVERY MODE

- SLIT WIDTH DRIVE TRAIN ELECTRONICS
  R.T.C. TO NOMINAL SLIT WIDTH

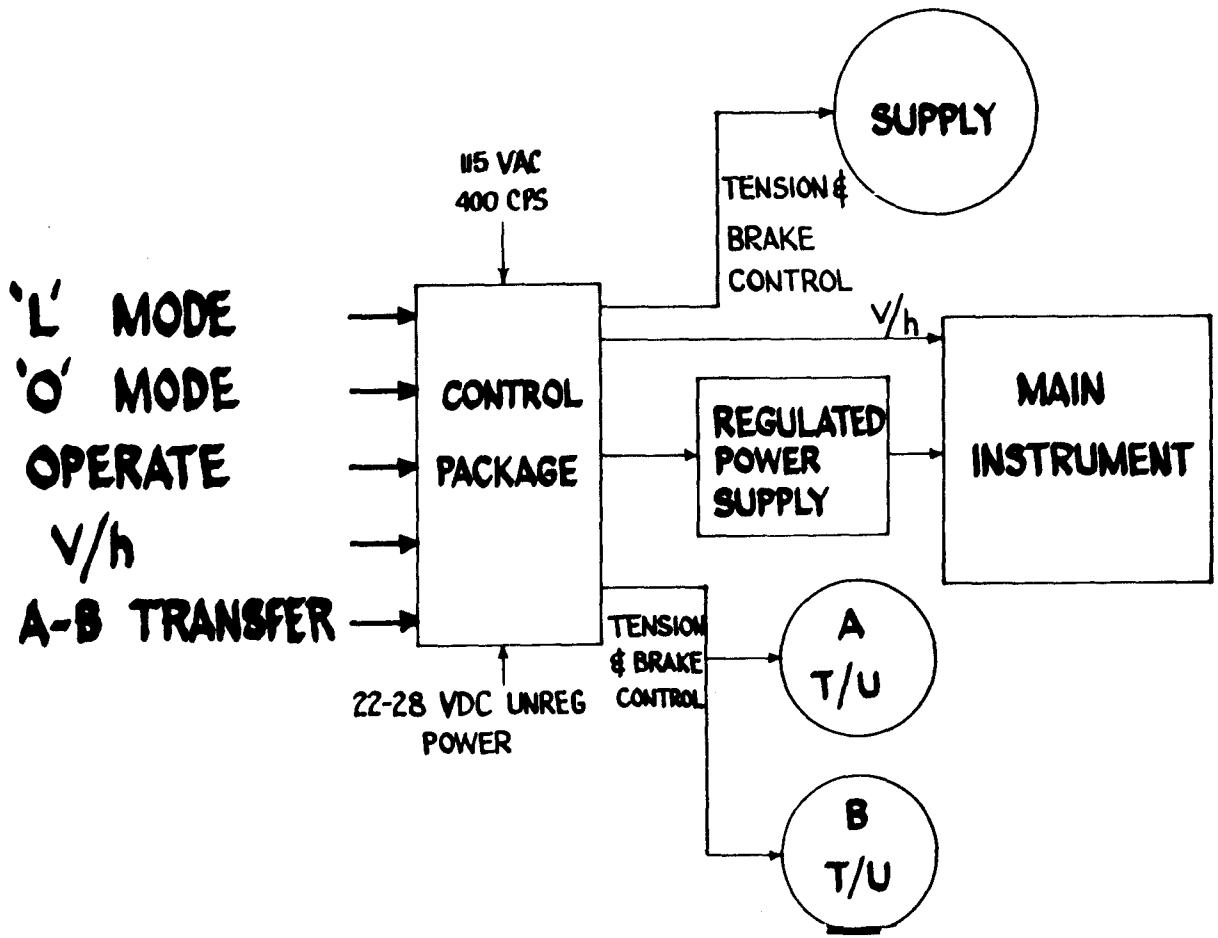
- MATERIAL CHANGE DETECTOR
  R.T.C. TO STEPPING MOTOR

CAMERA ELECTRICAL SYSTEM

ELECTRICAL SYSTEM BLOCK DIAGRAM



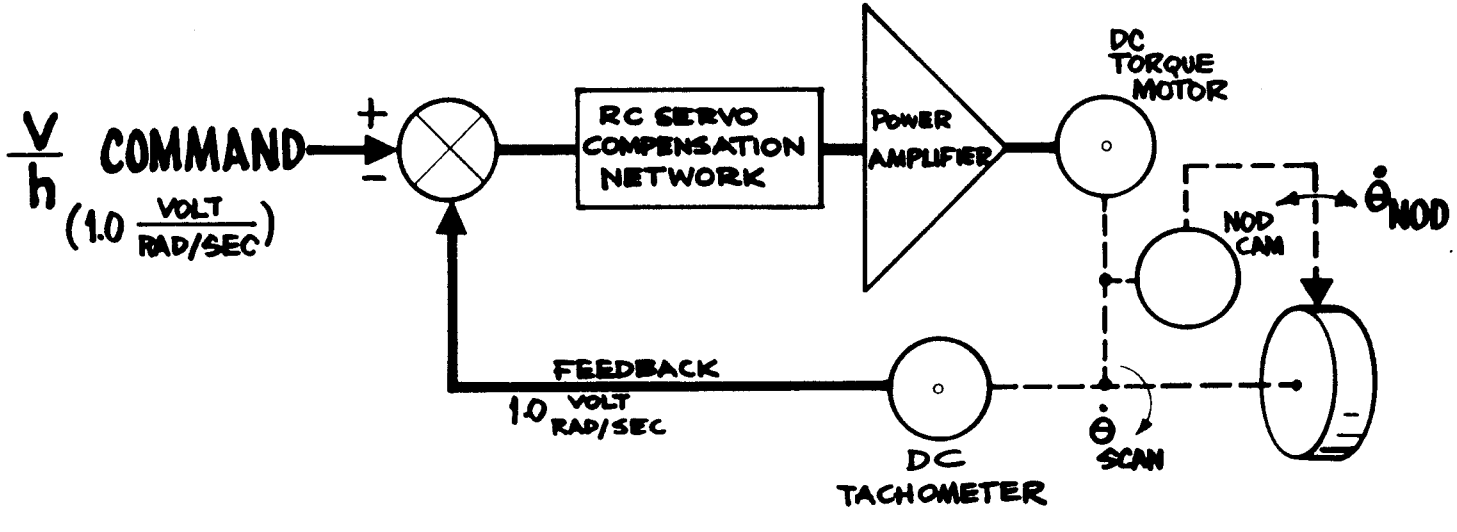
ELECTRICAL SYSTEM CONTROL



MAIN SERVO CHARACTERISTICS

REQUIREMENTS: (SCAN PERIOD)

$$\frac{V}{h} \rightarrow \dot{\theta}_{SCAN} \rightarrow 1\%\ \text{SERVO ERROR}\ (1\sigma)$$



MAIN SERVO DESIGN STATUS

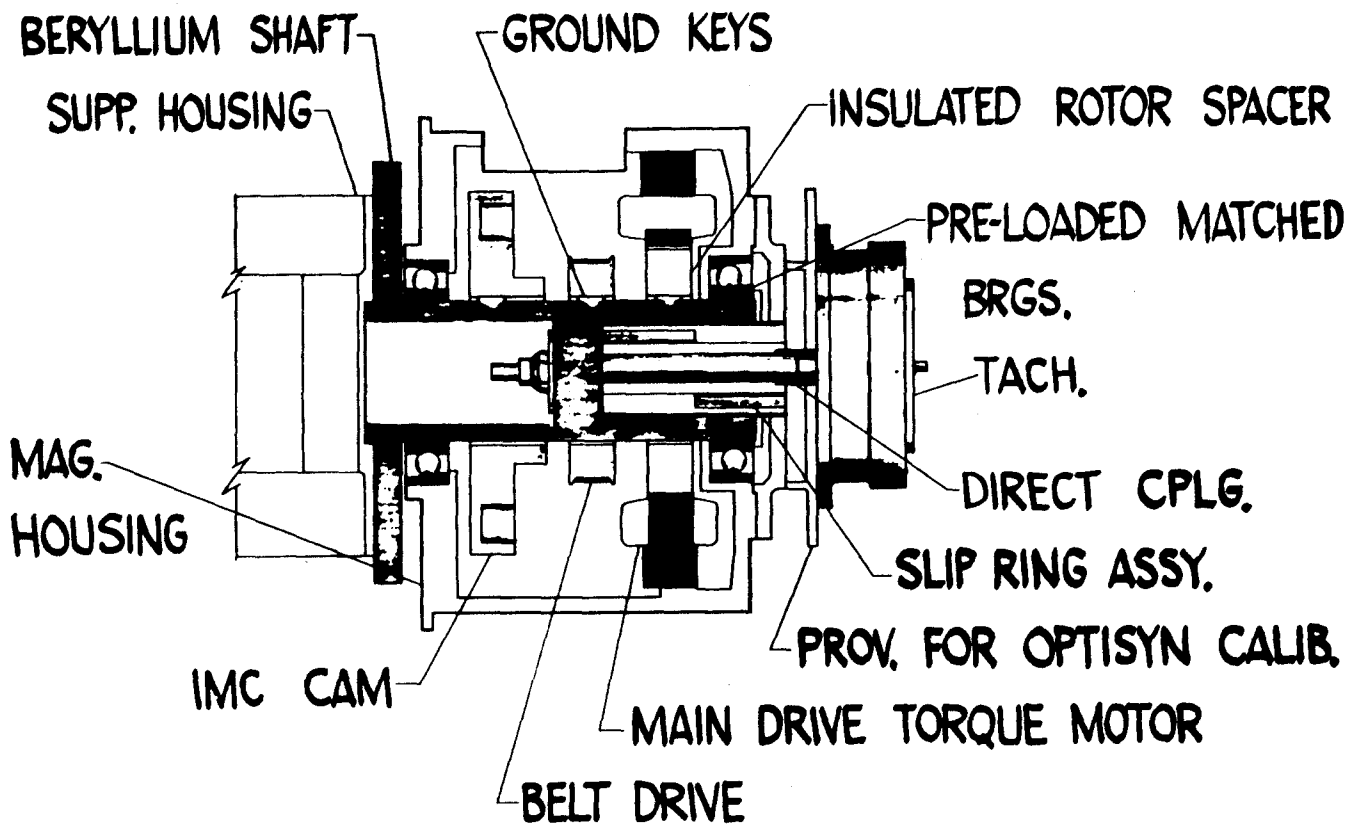
- BRASSBOARD AND ENVIRONMENTAL TESTS → $\Delta\dot{\theta}_{SCAN} < 1\%$
- CONVENTIONAL AMPLIFIER INEFFICIENT → THERMAL UNCERTAINTIES AND POWER LOSSES
- HIGH EFFICIENCY AMPLIFIER DESIGNED → UNDER EVALUATION

ESTIMATED POWER REQUIREMENTS

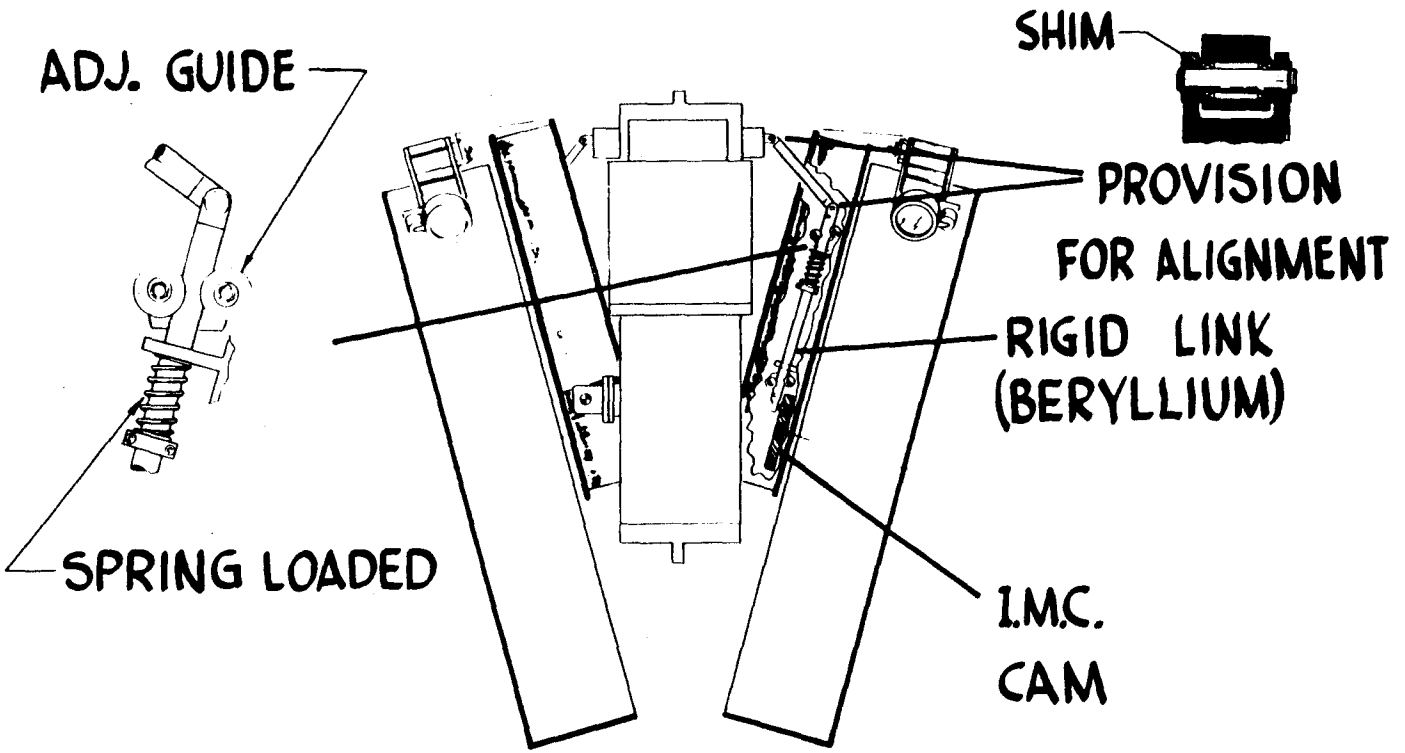
	WATT-HRS @ 3.75 rad/sec	WATT-HRS @ 2.5 rad/sec	WATT-HRS @ 1.4 rad/sec
24 VDC UNREG	1140	1700	3040
115 VAC 400 CPS	134	200	357
	1274	1900	3397
BUDGET	1957	1957	1957

CAMERA MECHANICAL DESIGN

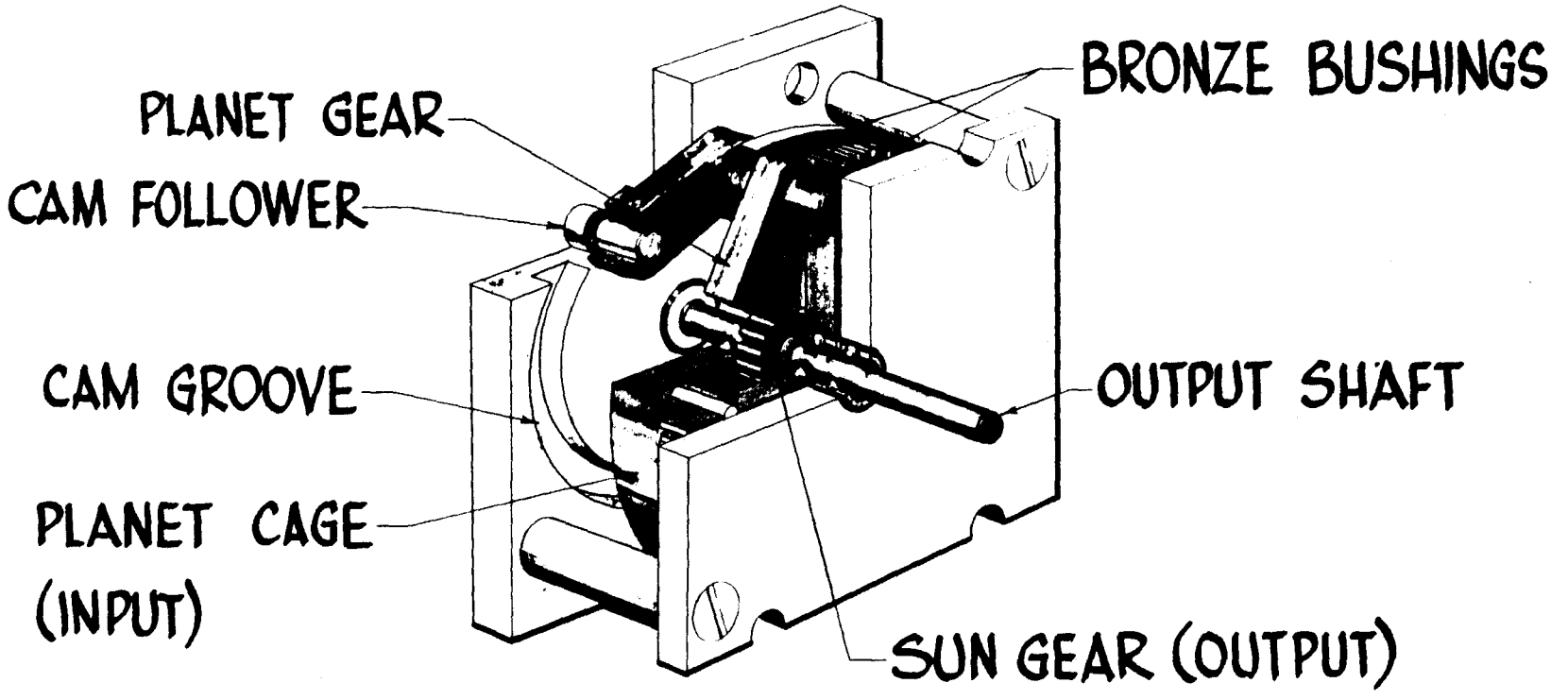
MAIN DRIVE ASS'Y.



I.M.C. MECHANISM



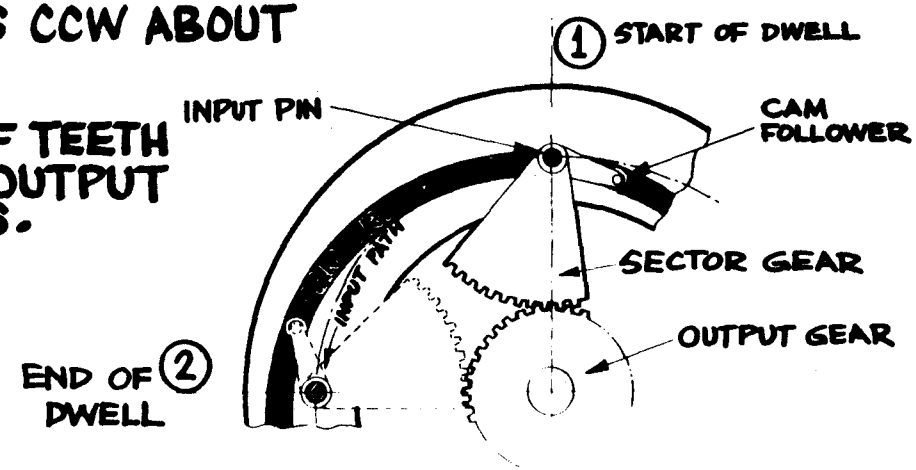
KAPLAN DRIVE



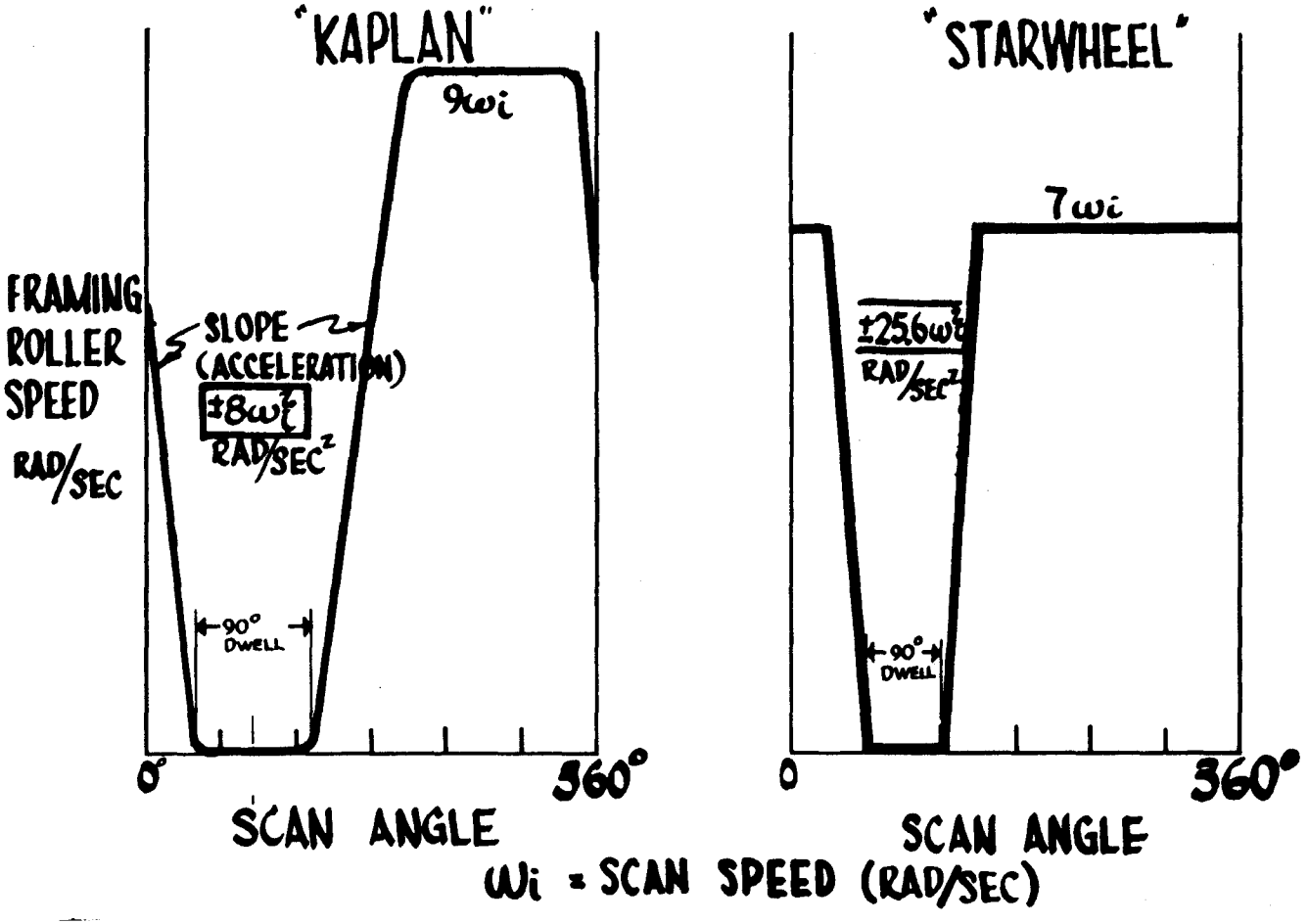
DWELL GENERATING PRINCIPLE

DURING DWELL (POSITION ① TO POSITION ②)

- INPUT PIN IS DRIVEN CCW AT INPUT SPEED AROUND CIRCULAR PATH CONCENTRIC WITH INPUT SHAFT;
- CAM FOLLOWER MOVES RADIALLY OUTWARD AT CONSTANT RATE;
- SECTOR ROTATES CCW ABOUT INPUT PIN;
- NET ADVANCE OF TEETH IN MESH WITH OUTPUT GEAR CANCELS.



FRAMING ROLLER DRIVES



ωi = SCAN SPEED (RAD/SEC)

SUPPLY

~~TOP SECRET~~/[redacted]

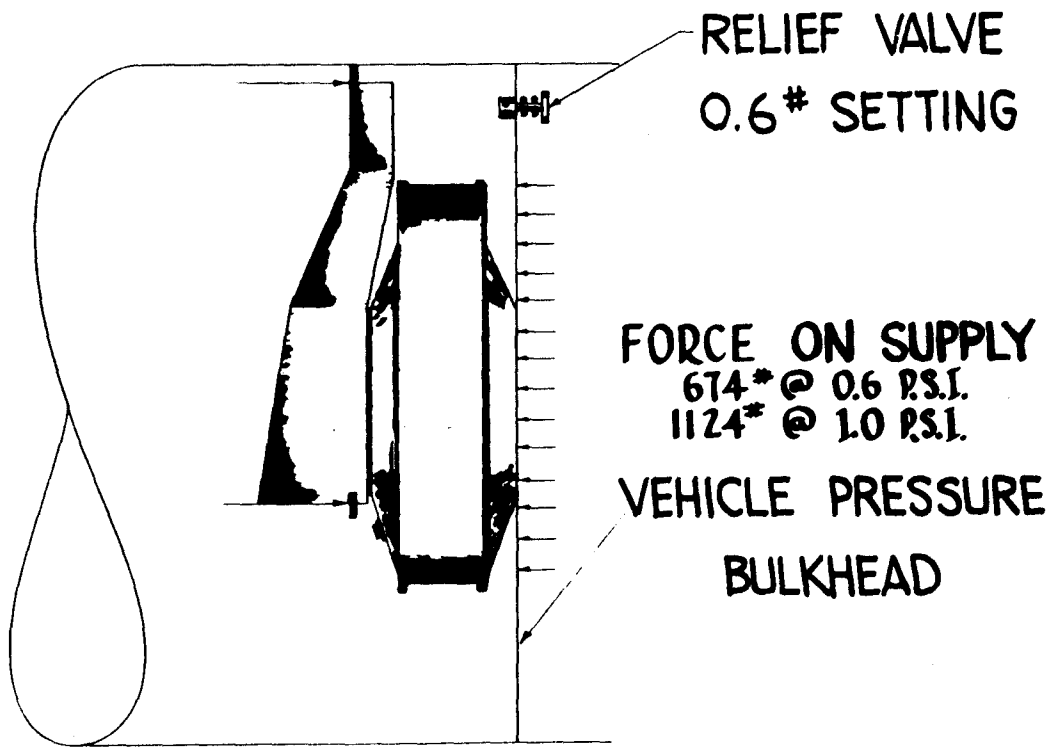
SUPPLY REDESIGN

CORE ASSEMBLY (LIGHTENED)
FLANGE ASSEMBLY (SINGLE TAPE ADHESIVE)
COVERS (CHEMICALLY MILLED)
CENTER SECTION (CHEMICALLY MILLED)
WING BRACKETS REDESIGNED
ROLLER BRACKETS RESIGNED
CONNECTOR RELOCATED

TOTAL WEIGHT SAVINGS = 9#/ASS'Y

~~TOP SECRET~~/[redacted]

PURGE PRESSURE LOADS



TAKE-UPS

TAKE-UP DESIGN IMPROVEMENTS

- SPOOL SEPARATION INCREASED BY 0.06
- ROLLER SHAFTS STIFFENED
- MECHANICAL LOCKS SECURE SPOOL BEARING RETAINING RINGS
- RUBBER HUB ROLLER REPLACED WITH METALLIC ROLLER
- HUB ROLLER CLEARANCE INCREASED TO 0.008/0.011
- ROTORS AND DRIVE GEARS HAVE IMPROVED BEARING SUPPORT
- CO-AXIAL RATCHET USED IN ANTI-BACK-UP SYSTEM
- COMPONENTS RELOCATED PER SYSTEM REQUIREMENTS

SENSOR ARM ASSEMBLY IMPROVEMENTS

- SENSOR ARMS REDESIGNED
- FILM TYPE POTENTIOMETERS USED
- ANTI-BACKLASH GEARING INSTALLED
- RADIUS READ-OUT TO BE LIMITED TO TM SENSITIVITY

T/U THERMAL REQUIREMENTS

MECHANICAL ANALYSIS

- GEAR PITCH LINE LIMIT 0 - 140°F
- BEARING PACKAGING LIMIT 55-105°F

REQUIRED SPEEDS FOR 1.5 SEC/CYCLE

- EMPTY "A" SPOOL 110 RPM
- 0.175 RADIUS BUILDUP 100 RPM
- 0.300 RADIUS BUILDUP 95 RPM
- 0.425 RADIUS BUILDUP 90 RPM

T/U THERMAL TESTS

A/P TESTS		F°
• LOW LIMIT (J-30)		13-15
• HIGH LIMIT (J-31)		95-100
ETL TESTS (RPM AFTER 3 SEC)		
LUB-NYE 180	LUB ASTRO OIL	
• 19-25	52-73	20
• 40-50	107-109	30
• 60-80	123-120	40
• 80-100	125-125	50
• 120-(UP TO SPEED)	125-123	70

INTERMEDIATE ROLLER ASSEMBLY

INTER.ROLLER ASSEMBLY REDESIGN

- SIMPLIFIED FILM PATH
- INDIVIDUAL ASSEMBLIES
- ROTATION POTS MONITOR T/U FUNCTION
- SHORT CHUTE SECTION ELIMINATED
- INSIGNIFICANT WEIGHT INCREASE (3 OZ.)

Δ TENSION SENSING DEVICE

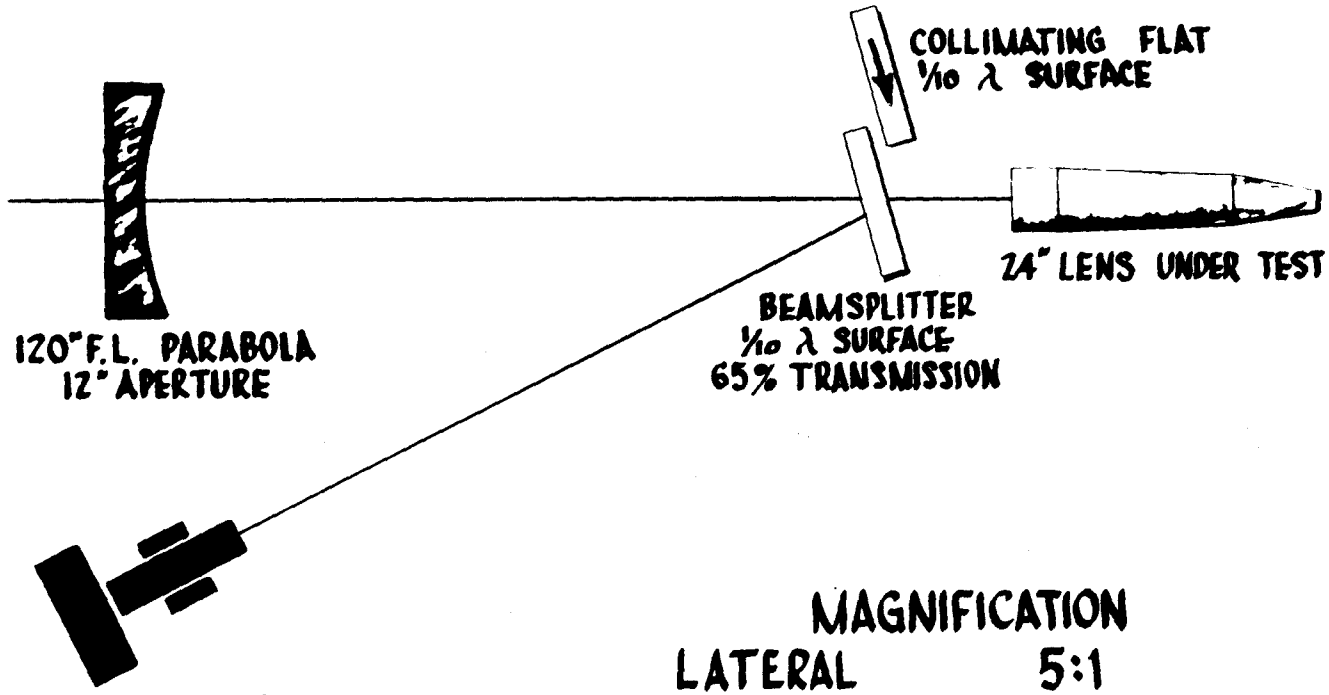
TEST & CHECK CONSOLE

T&C CHARACTERISTICS

- SIMULATES VEHICLE ELECTRICAL INTERFACE
- PROVIDES READOUT OF ALL T/M AND SELECTED CAMERA ELECTRICAL FUNCTIONS
- READOUTS VIA 367 POINT PATCH PANEL TO DIGITAL VOLTMETER, VISICORDER OR DIGITAL PRINTER
- PROVIDES READOUT OF SCAN OR NOD VELOCITIES 0.07%

DYNAMIC TEST FACILITY

DYNAMIC OPTICAL TEST SYSTEM



MAGNIFICATION	
LATERAL	5:1
AXIAL	25:1