20 October 1966

EARLY "DISCOVERER" HISTORY

The first of the Discoverer series, an agena with no payload, aborted on the pad on the day of launch. Due to a vehicle sneak circuit, the separation retro rockets and explosive bolts fired when a hydraulic motor was exercised at T-60 minutes, causing fireworks on the pad.

The second agena (Discoverer No. 1) made orbit February 28, 1959, although in radio silence. Speculation at the time was that the protective nose cone over the antennas was ejected just before the agena firing and the agena then rammed into the nose cone and damaged the antennas to the point where no radio contact was made. Orbit was confirmed by radar skin-track.

The first recoverable type Discoverer payload consisted of a bio-medical capsule containing four live mice. The capsule itself was similar to our present ones, although smaller. On the first try at launch, the mice were dead as indicated by telemetry. At first it was thought that they were asleep, so a cherrypicker was sent up and a technician banged on the side of the vehicle in an attempt to wake them up. Catcalls and meows were used to no avail. It was later found that the mouse cage had been sprayed with krylon to make it smooth; but the krylon had chipped off the screen, the mice found it tasty and that ended that.

The second try several days later was almost aborted when the capsule life-cell humidity sensor suddenly indicated 100% humidity, out-of-band on T/M. Panic prevailed until the humidity then gradually crept down to a normal level. On evaluating the trouble, it was found that the humidity sensor is located right under the cage when on the pad and that a mouse merely did what comes naturally, but when the moisture dried out, all was forgiven, and it was launched -- into the ocean.

At the insistence of the SPCA, it was decided not to use live mice again until the orbit and recovery systems had been perfected, so the next Discoverer had four "mechanical" mice, merely small transistorized multivibrators to give a T/M readout, with simulated life-support systems. This capsule made orbit, but due to an orbit timer problem, it was ejected over the North Pole and came down in the snow near Spitzenbergen, off Norway. It is felt that recovery functions occurred, but the capsule was never retrieved - by America.

This payload was also distinguished by a notable member of our A/P facility - Harvey Boissier. It was desired to develop a system whereby our doors could be hidden from inquisitive eyes during the time our payload was on the pad. The Fairing was covered with paper, under which were two pieces of piano wire with ping-pong balls attached, with the idea that hopefully the wind caused by liftoff and launch would blow the ping-pong balls to the rear and the wire would tear the paper off, exposing the Fairing.

To test this concept, a test Fairing with paper, ping-pong balls and all, was mounted on a sports car and was driven up and down Bayshore at 90 per. This was quite a spectacle and attracted the attention of the local Gendarmes, who ticketed the driver.

On launch day, Harvey had the honor of attaching the balls to the top of the payload. Can you imagine how silly he felt at 2 a.m. on a foggy cold morning, with searchlights blazing and blockhouse TV watching, as he attached the ping-pong balls on a million dollar satellite? While this was happening, the whole missile started to erect and Harvey, for a moment, had the uncanny feeling he was going into orbit.

Anyway, it was launched, without Harvey, and the paper never came off. For all we know, the two ping-pong balls are still in orbit.

Then came the era of disappointment -- our "C" instrument either did not work, did not go into orbit, or the capsule was not recovered. It is interesting to note the frustration that followed Discoverer ~~XI~~ 11 when the instrument worked all the way, but no recovery.

It was about this time in the course of "witch hunts" to locate our problems that it was felt the Fairing Interface was heating up during ascent. It became Frank Watson's chore to devise a Fairing cooler. Frank had a water receptacle installed around the leading edge of the Fairing, the idea being that the water would boil during ascent and the steam would carry away the heat.

In order to contain the water and prevent sloshing, Frank wanted something absorbent, soft and easy to work. Kotex fulfilled these requirements so Frank bribed Ethel Jackson to get some for him.

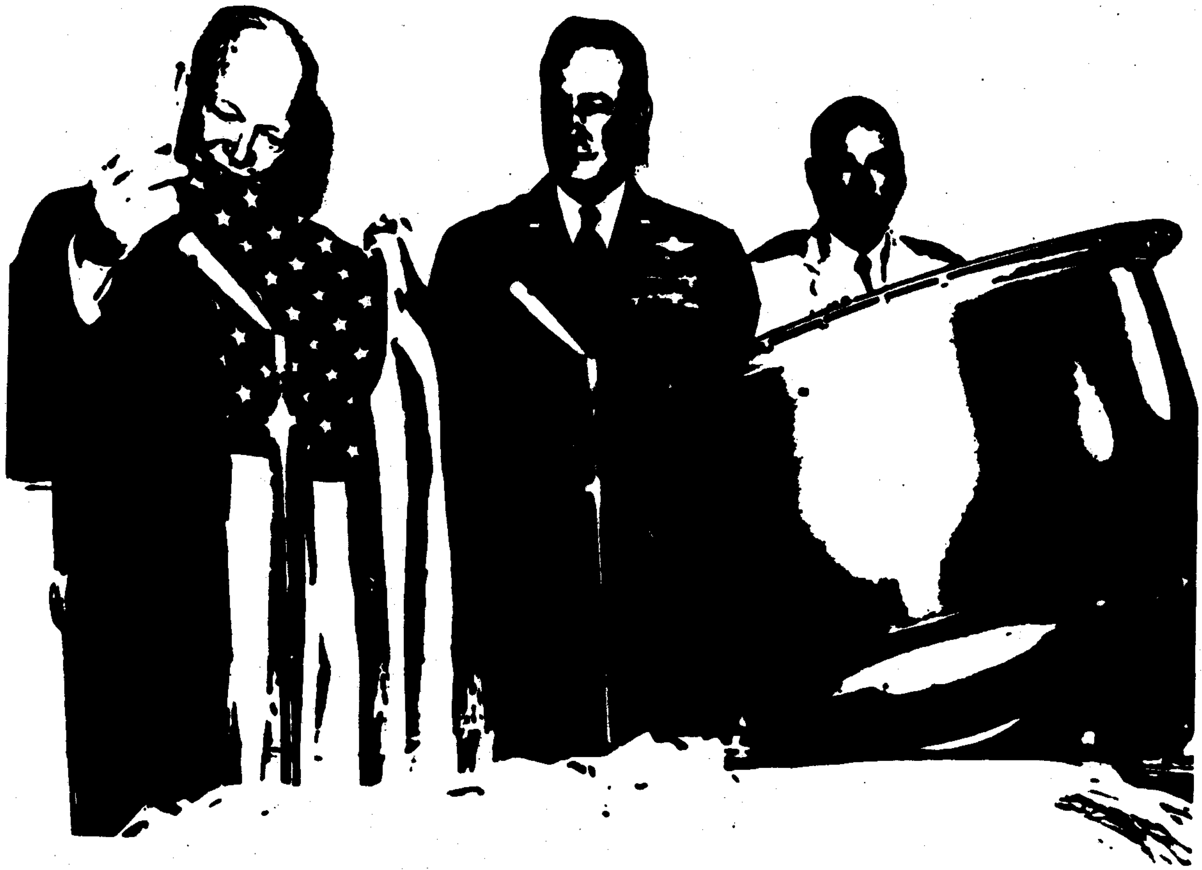
The reservoir was filled using a large hypodermic needle through the small external holes. Of course this led to tricks and Harvey Boissier again entered the picture. He rigged up a display for visiting VIP's, so that to satisfy their desire to touch the hardware they could use the hypodermic to squirt water in, but it squirted right out again through anoter hole, to the embarressment of a drenched VIP.

Remember 1054, Discoverer X, the first payload recovery? A perfect launch, but the Thor fishtailed and was destructed at 10,000 feet. The payload came down about a mile from Pad 5, and was located by helicopter, which landed payload people to guard it and render the pyrotechnics safe. Recovery was made by Jeep, rather an unauspicious ending for a reconnaissance payload.

It was decided that Discoverer XII was to be a "diagnostic" capsule, loaded with instrumentation and telemetry to tell us what was happening. It went into the ocean.

Discoverer XIII is famous. It was another diagnostic capsule and it worked all the way. Its capsule now reposes in the Smithsonian Institute, Washington, D.C., as the first object to be recovered from orbit. It was later determined that our capsules were being destroyed by explosions of small rockets used for spin and despin. Starting with Discoverer XII, our present cold-gas spin and despin system was inaugurated, and several successful recoveries ensued.

Discoverer XIV was a "C" instrument and the mission was completely successful, ending with 20 pounds of payload air-snatched on August 19, 1960. The spell had been broken; our project was on its way to the success it is today.



First Recovery from Space

Dwight D. Eisenhower

First Aerial Recovery

with best regards —

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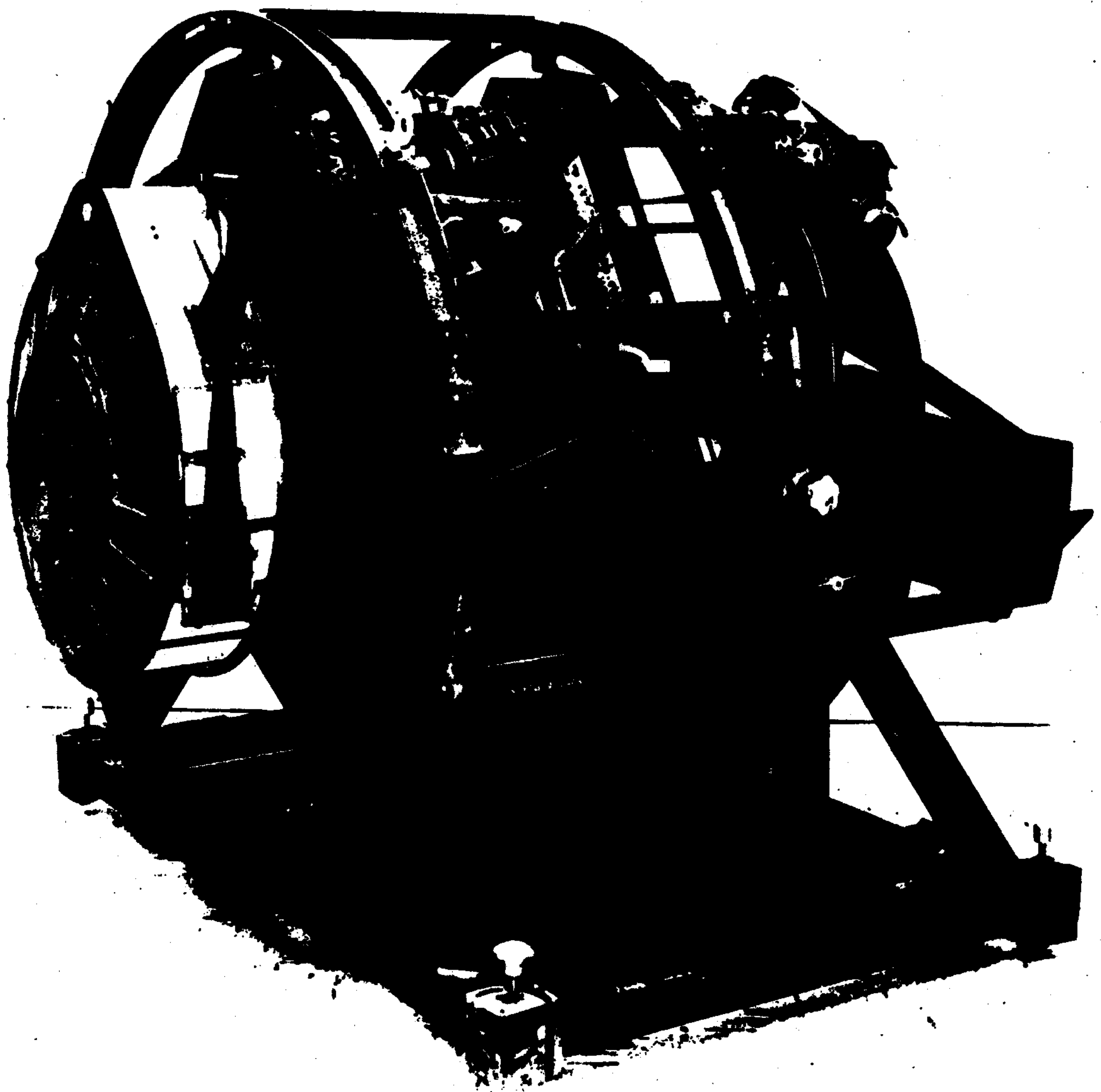
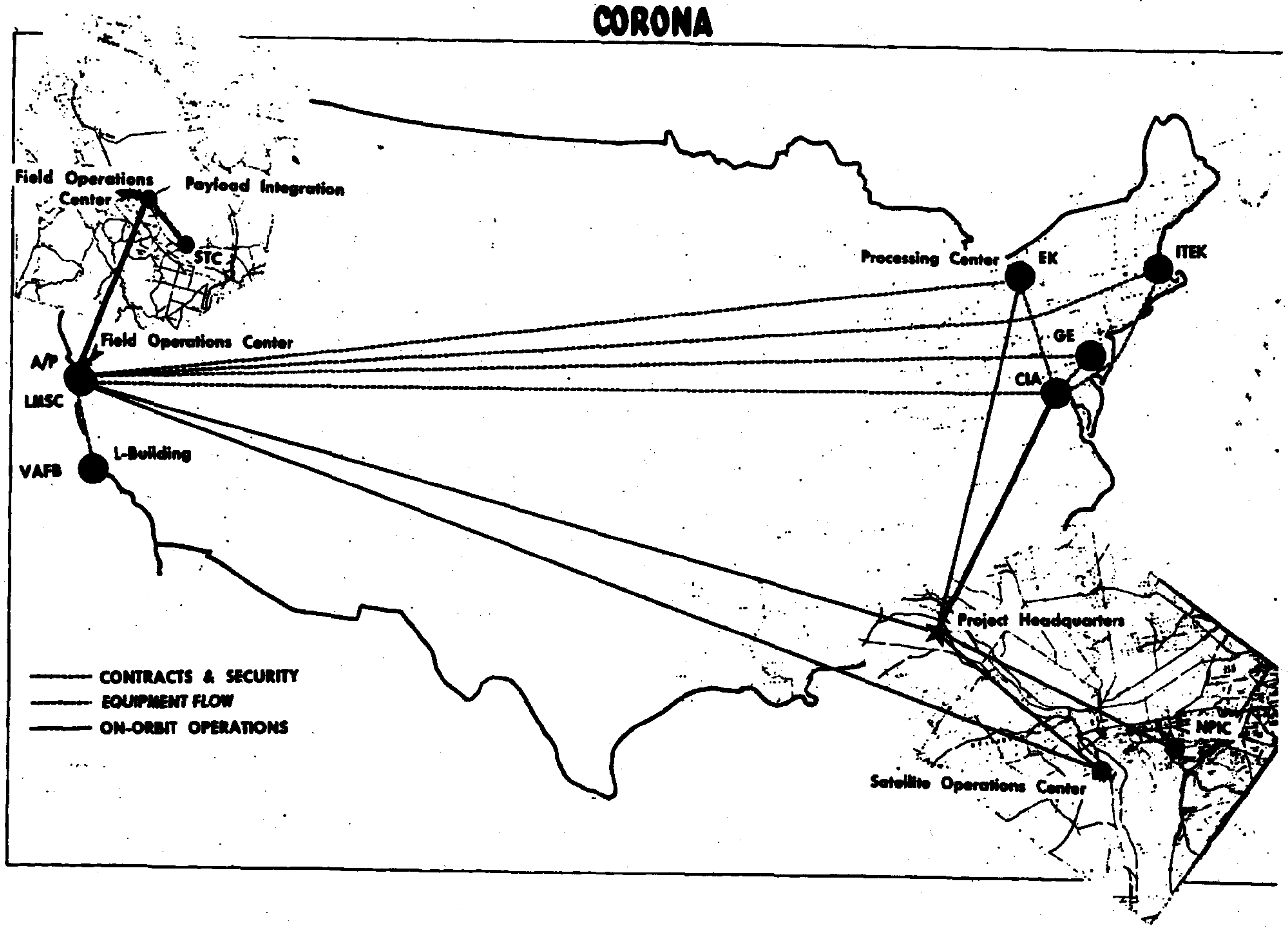


CORONA



Field Operations Center
Payload Integration
STC
Field Operations Center
A/P
LMSC
L-Building
VAFB
Processing Center
EK
ITEK
GE
CIA
Project Headquarters
NPIC
Satellite Operations Center
CONTRACTS & SECURITY
EQUIPMENT FLOW
ON-ORBIT OPERATIONS

SPECIAL HANDLING

162 PROGRAM PERFORMANCE

PROGRAM FLT. NO	VEH. NO	SRV NO	INSTR. TYPE	INSTR. NO	THOR NO	T/M NO	DRCS NO	S.I. NO	P/L WT. FLOWN	P/L WT. TRANSIT	REC. INSPECT AT A/P	SHIPPED FROM A/P	FLIGHT DATE	WKS AT A/P	TOTAL WEEKS TILL FLT.	RECOVERY DATE	SUMMARY
XXXVIII	1123	581	Cm-1	70/71	241	57	7	74	[illegible]	[illegible]	1-3-62	2-15-62	2-27-62	6 - 2	7 - 6	3-3-62	[illegible]
XXXIX	1124	584	Cm-2	72/73	331	53	1	NONE	[illegible]	45 LBS	1-5-62	4-5-62	4-17-62	12 - 6	14 - 4	4-20-62	[illegible]
XXXX	1125	586	Cm-3	74/75	333	52	6	70	[illegible]	[illegible]	1-26-62	4-11-62	4-28-62	10 - 5	13 - 1		[illegible]
XXXXI	1126	582	A-5	A	334	58	13	N/A	38.4	38.4	5-25-61	4-25-62	5-15-62	47 - 4	50 - 3	5-19-62	[illegible]
XLII	1128	585	Cm-4	76/77	336	55	9	82	[illegible]	79.2	2-15-62	5-13-62	5-29-62	12 - 2	14 - 4	6-1-62	[illegible]
XLIII	1127	583	Cm-5	78/79	335	44	8	76	[illegible]	81.1	3-1-62	5-21-62	6-1-62	11 - 4	13 - 1		[illegible]
XLIV	1129	591	Cm-6	80/81	339	48	10	88	[illegible]	80.3	3-21-62	5-30-62	6-22-62	10 - 0	13 - 2	6-25-62	[illegible]
XLV	1151	592	Cm-7	84/85	340	50	3	80	[illegible]	80	3-20-62	6-13-62	6-28-62	12 - 1	14 - 2	7-1-62	[illegible]
XLVI	1130	593	Cm-8	90/91	342	59	13	90	[illegible]	19.7	4-11-62	6-30-62	7-20-62	10 - 0	14 - 2	7-22-62	[illegible]
XLVII	1131	594	Cm-9	82/83	347	56	16	86	[illegible]	78.7	4-10-62	7-3-62	7-27-62	10 - 5	14 - 1	7-31-62	[illegible]
XLVIII	1152D	595	Cm-10	88/89	344	60	5	94	[illegible]	78.9	4-30-62	7-17-62	8-1-62	11 - 1	13 - 2	8-5-62	[illegible]
IL	1153	596	Cm-11	92/93	348	58	19	84	[illegible]	78.7	5-10-62	8-20-62	8-28-62	13 - 6	14 - 3	9-1-62	[illegible]
L	1132	600	A-10	A	349	63	202	N/A	36.3	36.3	5-22-62	8-6-62	9-1-62	6 - 3	10 - 1		[illegible]
LI	1133	597	Cm-12	94/95	350	65	4	100	[illegible]	44.2	5-16-62	9-1-62	9-17-62	15 - 3	17 - 5	9-19-62	[illegible]
LII	1154D	598	Cm-13	96/97	351	64	11	D-3	[illegible]	66	6-20-62	9-13-62	9-29-62	12 - 1	14 - 3	10-2-62	[illegible]
LIII	1134	603	A-9	A	352	66	10	N/A	38.3	38.3	3-31-62	9-20-62	10-9-62	26 - 1	27 - 3	10-13-62	[illegible]
LIV	1136D	599	Cm-14	98/99	367	54	24	D-5	[illegible]	79.4	6-25-62	10-23-62	11-5-62	17 - 1	19 - 0	11-9-62	[illegible]
LV	1135	601	Cm-15	100/101	353	62	23	D-7	[illegible]	78.8	7-10-62	11-12-62	11-24-62	17 - 6	19 - 4	11-29-62	[illegible]
LVI	1155	606	Cm-16	86/87	361	56	17	D-2	[illegible]	67	9-10-62	11-29-62	12-4-62	9 - 3	10 - 6		[illegible]
LVII	1156	607	Cm-17	102/103	368	70	18	D-4	[illegible]	79.3	8-13-62	12-7-62	12-14-62	16 - 4	17 - 4	12-18-62	[illegible]
LVIII	1157	608	Cm-18	104/105	369	69	21	D-8	[illegible]	78.1	10-13-62	12-20-62	1-7-63	8 - 2	10 - 6	1-11-63	[illegible]
LIX	1159	610	Cm-20	[illegible]	370	67	12	D-6	[illegible]	0	10-8-62	2-19-63	3-4-63	9 - 3	12 - 1		[illegible]
LX	1164	612	L-1	3	360	70	303	S-2	72.2	0	11-27-62	3-5-63	3-18-63	14 - 0	15 - 6		[illegible]
LXI	1160	609	Cm-19	[illegible]	376	60	22	D-10	[illegible]	66.7	9-11-62	3-25-63	4-1-63	22 - 3	27 - 2	4-4-63	[illegible]
LXII	1411	605	A-12	A	372	54	205	N/A	36.3	0	1-10-63	4-10-63	4-26-63	12 - 6	15 - 1		[illegible]
LXIII	1165	613	L-2	05	364	58	302	S3	72.9	0	2-2-63	4-11-63	5-18-63	6 - 5	11 - 4	5-21-63	[illegible]
LXIV	1161	616	M-21	[illegible]	362	68	26	D9	[illegible]	72.7	12-7-62	4-13-63	6-12-63	18 - 1	26 - 5	6-16-63	[redacted]
LXV	1166	611	M-22	[illegible]	381	62	20	D11	[illegible]	78.9	4-15-63	6-1-63	6-25-63	6 - 5	10 - 2	6-30-63	[redacted]
LXVI	1412	624	M-23	[illegible]	387	55	14	D12	[illegible]	78.2	5-1-63	6-10-63	7-12-63	6 - 4	11 - 2	7-22-63	[illegible]
LXVII	1167	614	L-3	01	382	66	304	D4	79.1	19.8	3-7-63	7-8-63	7-30-63	17 - 4	20 - 5	8-1-63	[illegible]
LXVIII	1162	615	J-1A	[illegible]	377	65	402	D-14	81.5	81.5	4-1-63	8-3-63	8-24-63	17 - 5	20 - 5	8-28-63	[illegible]
	1162	617	J-1B	[illegible]	377	01	402	D-16	81.5		4-1-63	8-3-63	8-24-63	17 - 5	20 - 5		
LXVIX	1169	604	A-11	A	394	64	203	N/A	38.9	38.9	9-3-62	8-2-63	8-29-63	47 - 5	51 - 4	9-2-63	[illegible]
LXX	1163	619	J-2A	[illegible]	383	69	404	D-18	81.7	81	[illegible]	8-27-63	9-23-63	17 - 6	21 - 5	9-26-63	[illegible]
	1163	620	J-2B	[illegible]	383	60	404	D-18	82.5		[illegible]	8-27-63	9-23-63	17 - 6	21 - 5		[illegible]
LXXI	1601	602	A-6	A	386	50	204	N/A	40.1	40.1	2-21-61	10-8-63	10-29-63	136 - 6	139 - 6	11-3-63	[illegible]
LXXII	1171	632	M-24	[illegible]	400	48	504	D27	78.7	0	[illegible]	10-30-63	11-9-63	11 - 4	13 - 0		[illegible]
LXXIII	1172	637	M-25	[illegible]	406	75	25	D26	[illegible]	75.7	9-27-63	11-15-63	11-27-63	7 - 4	8 - 5		[illegible]
LXXIV	1168	642	M-26	[illegible]	398	61	306	D-34	[illegible]	77	[illegible]	11-27-63	12-21-63	4 - 6	8 - 2	12-26-63	[illegible]

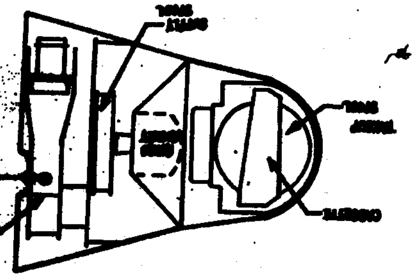
Table 1-1 — Operating Characteristics

Lens type	24-inch focal length, f/3.5 Petzval
Configuration of cameras	30-degree convergent stereo
Film	Type 3404 thin-base 70-millimeter film (former designation 4404)
Filter	Wratten 21 or 25
Lateral angular coverage	70 degrees (± 35 degrees)
Forward angular coverage	5 degrees 15 minutes (at format center)
Overlap	10 percent (at format center)
Format size	$2\frac{3}{16}$ by $29\frac{1}{4}$ inches
Film capacities	M System - 15,600 + feet J System - 31,200 + feet
Cycle rate	2.15 to 6.0 seconds/cycle
Maximum cycle rate at V/h = 0.043	2.15 seconds
Dynamic resolution	Exceeds 130 lines per millimeter at 2:1 target contrast
Relative humidity environment	60 percent maximum
Temperature environment (lens cell)	70 ± 10 °F
Pressure environment	1×10^{-1} to 1×10^{-8} mm Hg
Power consumption/camera	500 watts
System life	30 days

Table 1-1 — Summary of Physical Features and Operational Parameters

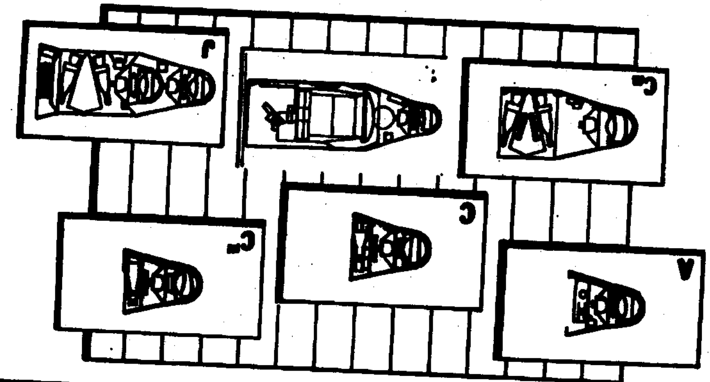
Physical Features	
Configuration	30-degree convergent stereo panoramic cameras
Lenses	24-inch focal length, f/3.5 Petzval design
Film capacity	15,750 feet of 70-millimeter, 3.0-mil, polyester-base film per camera
Film size	31.632 × 2.754 inches
Usable format	29.323 × 2.147 inches
Power	1620 watt-hours (24 vdc, unregulated, at 2.5 radians per second)
	270 watt-hours (115 vac, 400 cps, at 2.5 radians per second)
Weight (empty)	Approximately 437 pounds
Weight (with film)	Approximately 597 pounds
Cycle period	1.5 to 4.2 seconds per cycle
Exposure time	Variable
Overlap	Fixed at 7.6 percent
Filter	Variable (2 position)
Operational Parameters	
V/h range	0.0525 to 0.021 radians per second
Altitude	80 to 200 nautical miles
Cross-track coverage per frame	116 to 290 nautical miles
Along-track coverage per frame	7.73 to 19.33 nautical miles
Total along-track coverage	41,167 nautical miles at 80-nautical mile altitude
Total operating time	169 minutes at 80-nautical mile altitude

[redacted]



C, C' INBOARD PROFILE

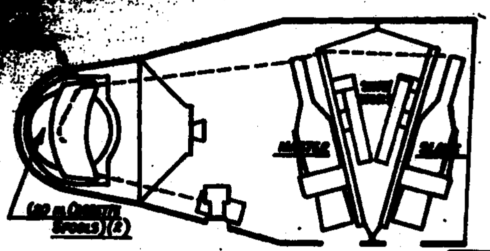
[redacted]



INBOARD PROFILES

[redacted]

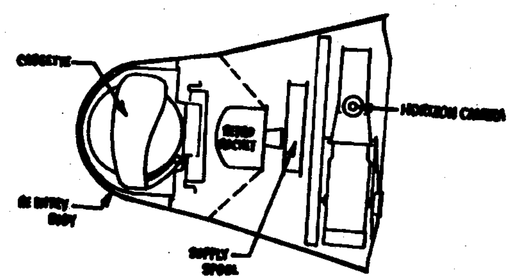
C_M INBOARD PROFILE



PERFORMANCE - 125mm
COVERAGE 6.8M nm²/FLT
STEREO

[redacted]

C''' INBOARD PROFILE



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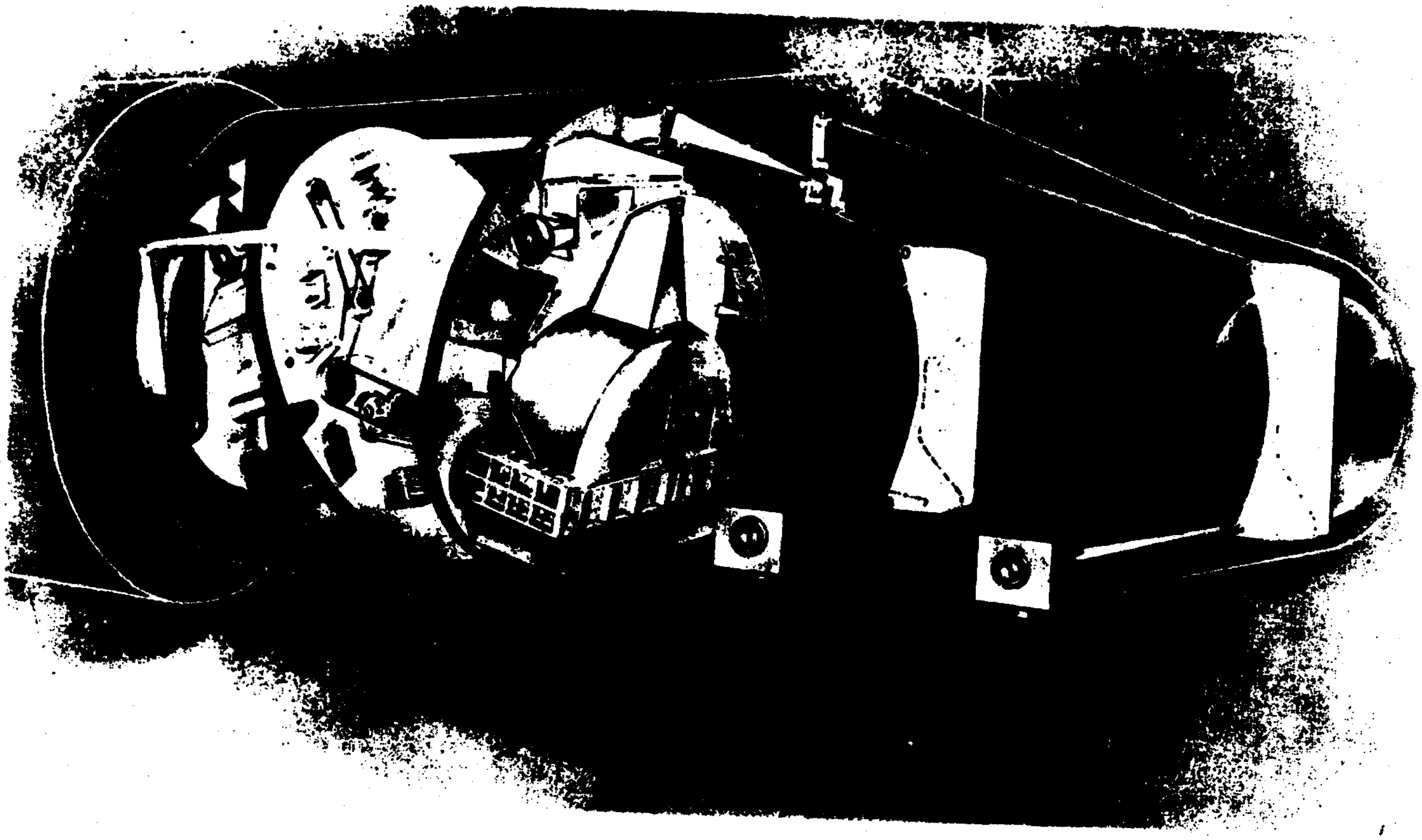
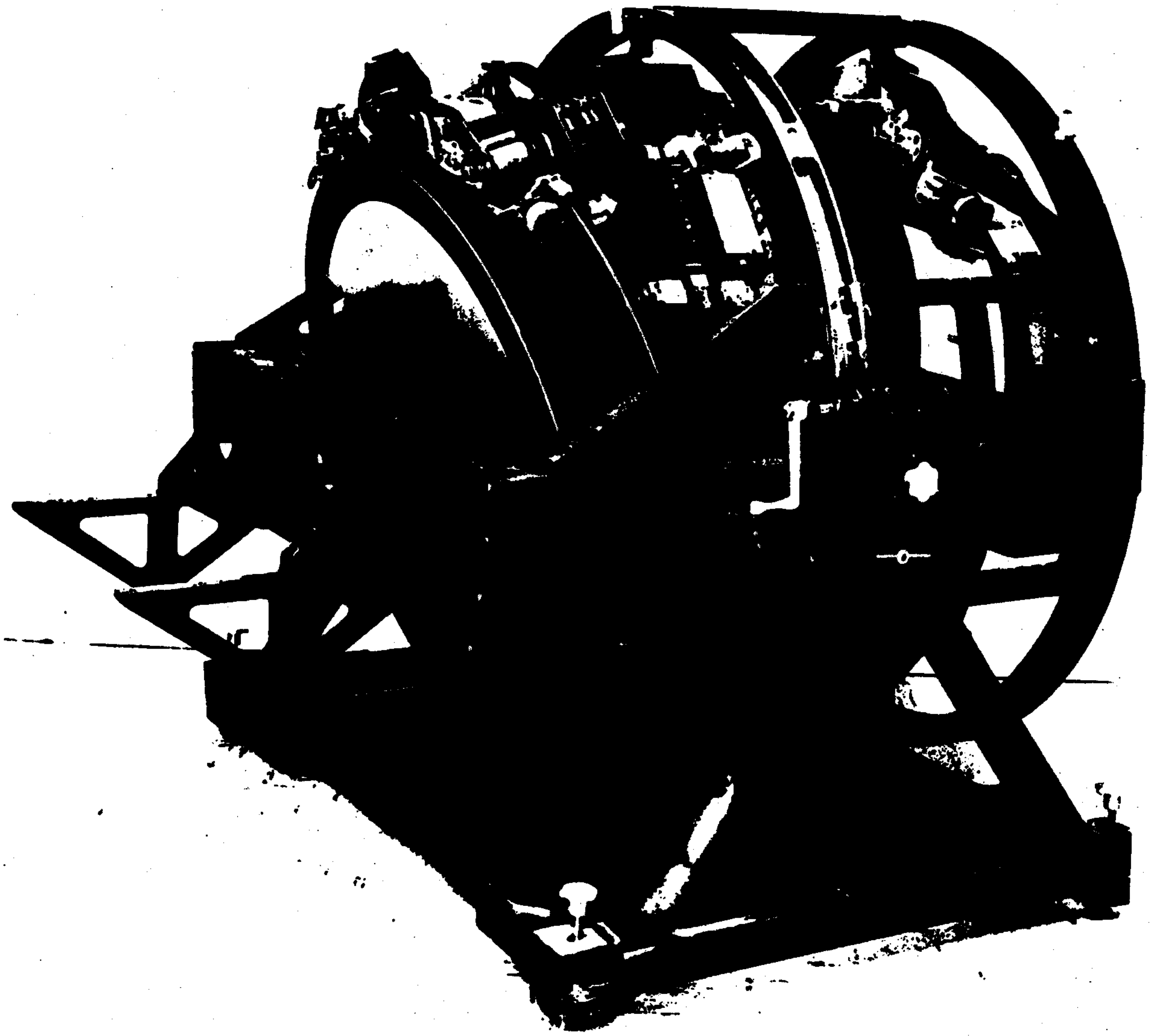
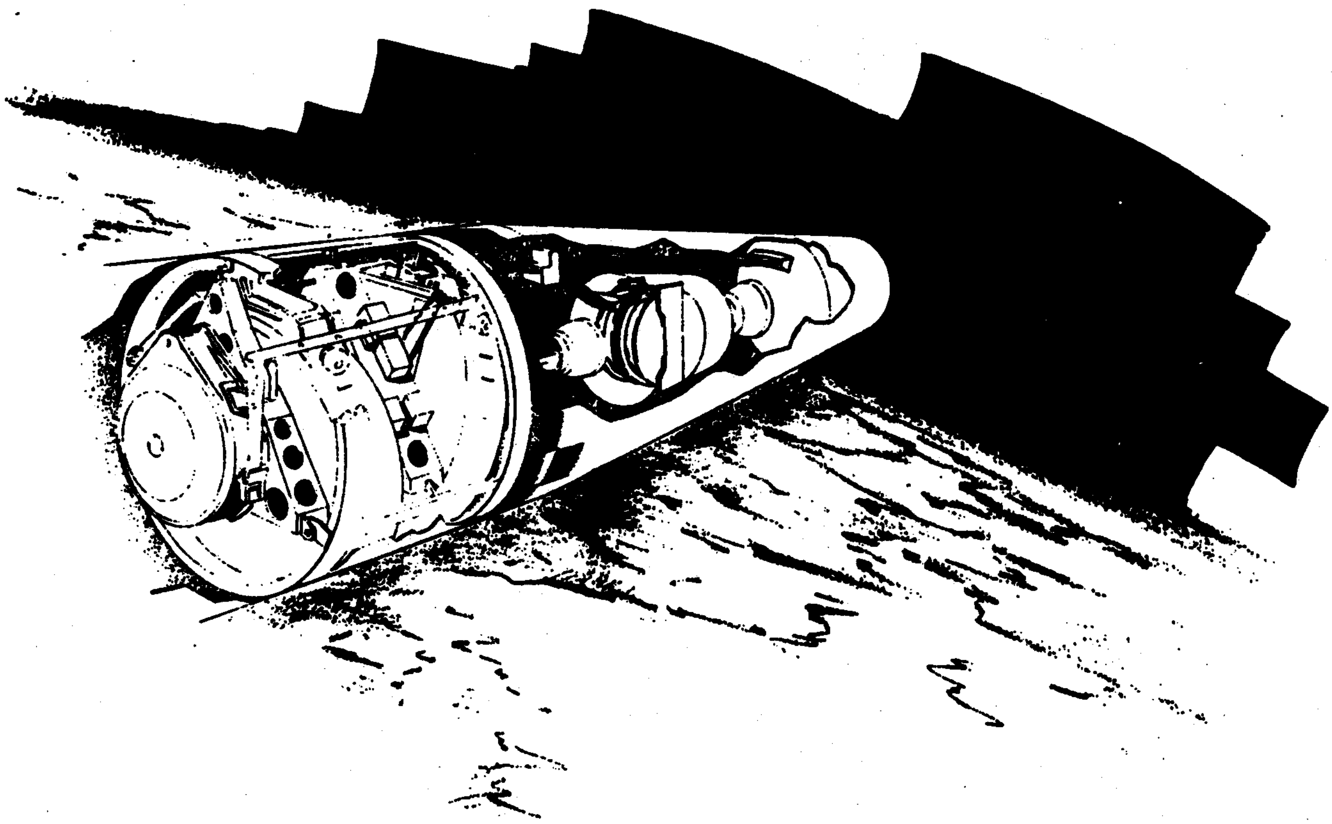






LAUNCH BY PROGRAM BY YEAR - 1959 - 1965

YEAR	DISC/ 162/241	MIDAS/ 461	101	NASA	102	201	[redacted]	SNAPSHOT	638/ VELA	TOTAL	[redacted]
59	8	0	0	0	0	0	[redacted]			8	[redacted]
60	11	2	1	0	0	0	[redacted]			14	
61	17	2	4	2	0	0	[redacted]			25	
62	22	2	1	6	2	3	[redacted]			39	1001 1001
63	16	3	0	0	0	0	[redacted]		1	27	[redacted]
64	16	0	0	7	0	0	[redacted]		1	41	[redacted]
65	12	0	0	4	0	0	[redacted]	1	1	29	[redacted]
TOTAL	102	9	6	19	2	3	[redacted]	1	3	183	[redacted]

RECOVERY BY PROGRAM BY YEAR

YEAR	241 CAPSULES LAUNCHED	241 CAPSULES RECOVERED AIR	241 CAPSULES RECOVERED SEA	[redacted]	101 CAPSULES LAUNCHED	101 REC.	[redacted]
59	8	0	0				
60	10	3	1				
61	16	4	3		2	0	
62	21	16	0	1001	1	0	[redacted]
63	18	10	2	[redacted]			
64	28	22	1	[redacted]			
65	22	21	0	[redacted]			
JB-TOTAL	123	86	7	[redacted]	3	0	[redacted]
ND TOTAL	123	93		[redacted]	3	0	[redacted]

L PROGRAM - KEY FEATURES

MARK I PAN CAMERA SYSTEM

1. **Characteristics**

   a. Operational ground resolution capability of 3 to 5 feet or better at high and 2:1 contrast, respectively, from 110 n. miles including degradation due to uncompensated image motion and vehicle stabilization residuals. Camera dynamic resolution test specification - 80 l/mm AWAR @ 2:1 contrast on SO-132 using MIL-STD-150A. Scale 1/120,000.

   b. Altitude - System specifications are for orbits in the altitude range over target from 90 to 175 nautical miles. The design readily accommodates elliptical orbits permitting versatile operational use. Design altitude - 110 n. miles.

   c. Orbit Life - 4 days - selected targets on command - ground selectivity of 5 alternate programs.

   d. Coverage - 42.3 nautical mile swath width at 110 nautical miles over 22° panoramic scan. Format 4.5 x 25 inches. About 3,600 photos each 7.5 x 42.3 nautical miles or approximately 1,000,000 square nautical miles vertical coverage at 110 n. miles.

   e. Lens, diffraction limited, 66" f/5. Lens-film resolution with SO-132 100 l/mm AWAR at 2:1 contrast. 175 l/mm AWAR at high contrast - 160 lbs.

   f. Mirror - 26½" diameter beryllium - 40 lbs.

   g. Film - Capacity - 75 lbs., corresponding to 8,000 feet of 5" 3-mil Estar film.

   h. Overlap - Minimum 10% nominal at nadir maintained for full V/h range.

   i. Stereo - ± 15° fore and aft. 30° convergence.

   j. Exposure - Exposure selectable by inserting one of ten fixed slits prior to launch providing 1/75 to 1/1500 second exposure at nominal

j. Slits available in ½ f-stop increments permitting the use of two films at any time of year.

k. Filter - Wratten 21.

l. Film Type - SO-130, SO-206, or SO-132 film may be used depending on mission requirements. SO-132 for ground illumination greater than 2,800 ft-candles corresponds to solar altitude greater than 22° or for noon launch corresponds to April 10 to September 5 for 35° to 75° north latitude. SO-206 will increase latitude to 88° or cover same latitudes as 132 for 9 additional weeks at a slight penalty in image quality. For solar altitude less than 22°, SO-206 for maximizing area of best resolution or SO-130 for maximizing northern-most latitude of operation.

m. IMC - IMC and cycling rate are variable proportional to V/h in the range of .0208 to .0458 rad/sec corresponding to cycling rate of 1-1/3 to 3 seconds per frame. IMC is accurate to within 1% of commanded value. The V/h rate is programmed internally to the camera as a function of time. Ten V/h functions and ten V/h generator start times can be selected by ground command. Each of the ten functions can be adjusted independently before launch for the best three-line segment approximation to the expected V/h over the full altitude range.

n. Environment - Unpressurized; temperature 70 ± 10°F. Passive thermal control for autofocus.

o. Weight - Pan Camera 610 lbs. - Cassette 15 lbs. Film - 75 lbs. Stellar/Index 20 lbs., Total photo system 720 lbs.

2. <u>Distinguishing Features</u>

The panoramic camera system incorporates the following features:

a. Roll Steering - The entire camera may be rolled up to 30° for specific objective targeting. This is an aid to more rapid attainment of target coverage, provides for targets not directly along the flight path and also afford a means of avoiding known adverse weather conditions. The IMC system is automatically adjusted during roll steering to prevent significant resolution loss. The roll steering is accomplished in 5 discrete angles of 0°, $\pm 15^\circ$, and $\pm 30^\circ$ offering a total available target swath width of 192 n. miles. The system permits 200 roll excursions per mission with a maximum response time of 30 seconds required for rolling from one 30° extreme to the other. Approximately 5 seconds are required for rolling a 15° increment.

b. Stereo - Stereo is provided as an aid to photo-interpretation. The direction the camera looks is controlled by rotating the mirror to the forward, vertical, or aft position and holding it stationary while panoramic scanning is accomplished. The camera accomplishes a stereo "burst" by exposing 8 frames with the camera looking forward 15°, then 8 frames with the camera looking back 15° over the same area. The camera will automatically shut off unless commanded to repeat an additional "burst" of 16 frames.

c. Film Transport - Unexposed film is intermittently supplied to the platen and is held stationary during photography. Transport is controlled to provide constant film tension with a straight through film path for highest reliability and minimum film damage. The spools are controlled such that they counter-rotate in the same plane each at a uniform speed thus minimizing vehicle disturbance and internal vibration and also requiring less power. The camera comes up to speed without wastage of film or loss of overlap synchronization upon receipt of start command for operational versatility.

d. Panoramic Scan - Scan is accomplished by rotation of the lens about its nodal point, thus offering maximum possible resolution and permitting image motion compensation by translation of the lens along its axis of rotation by a flat plate cam. A ruggedized bearing permits both rotation and translation. The lens drive employs energy-conserving techniques including extremely low friction to reduce the power required for panoramic scanning. To meet precise IMC, the scan velocity is controlled by a high performance drive using a precision AC tachometer and a DC torquer which eliminates direct mechanical coupling. The focal plane shutter driven by a high accuracy mechanism is coupled to the lens by a precision synchro.

e. Structure - The structure is semi-monocoque magnesium for maximum rigidity per unit weight incorporating titanium fittings for maximum strength to weight where required. The camera is mounted in the vehicle by a single mounting flange at the C.G. offering high resistance to vehicle structural and thermal stresses on the camera. The structure consists of three parts bolted together at the main mounting flange. The aft section contains the lens, mirror, and all electronics necessary for their operation. The inner-tube supports the platen and references it to the lens nodal point providing vibration and thermal isolation. The outer tube supports the film transport system and all electronics necessary for its operation. The three sections may bereadily and quickly disassembled to provide access to any part of the camera system. The structures are produced by use of special jigs and fixtures during manufacture such that a structural section is interchangeable with the mating section of any other structure. This feature facilitates ease and rapidity of both assembly and field operations.

f. Electronics Configuration - The amplifiers and control circuitry of the camera are built-in plug-in easily replaceable modules. Multiple usage of modules simplifies spares provisioning. Maximum reliability is achieved by use of silicon transistors screened by X-ray inspection and by conducting a 200-hour burn-in on all amplifiers prior to installation.

g. Auxiliary Data - Recorded on a digital data block on each frame. May be read by human or machine.

Time to 1/100 second - 29 bits

Scan Velocity Error, 10%

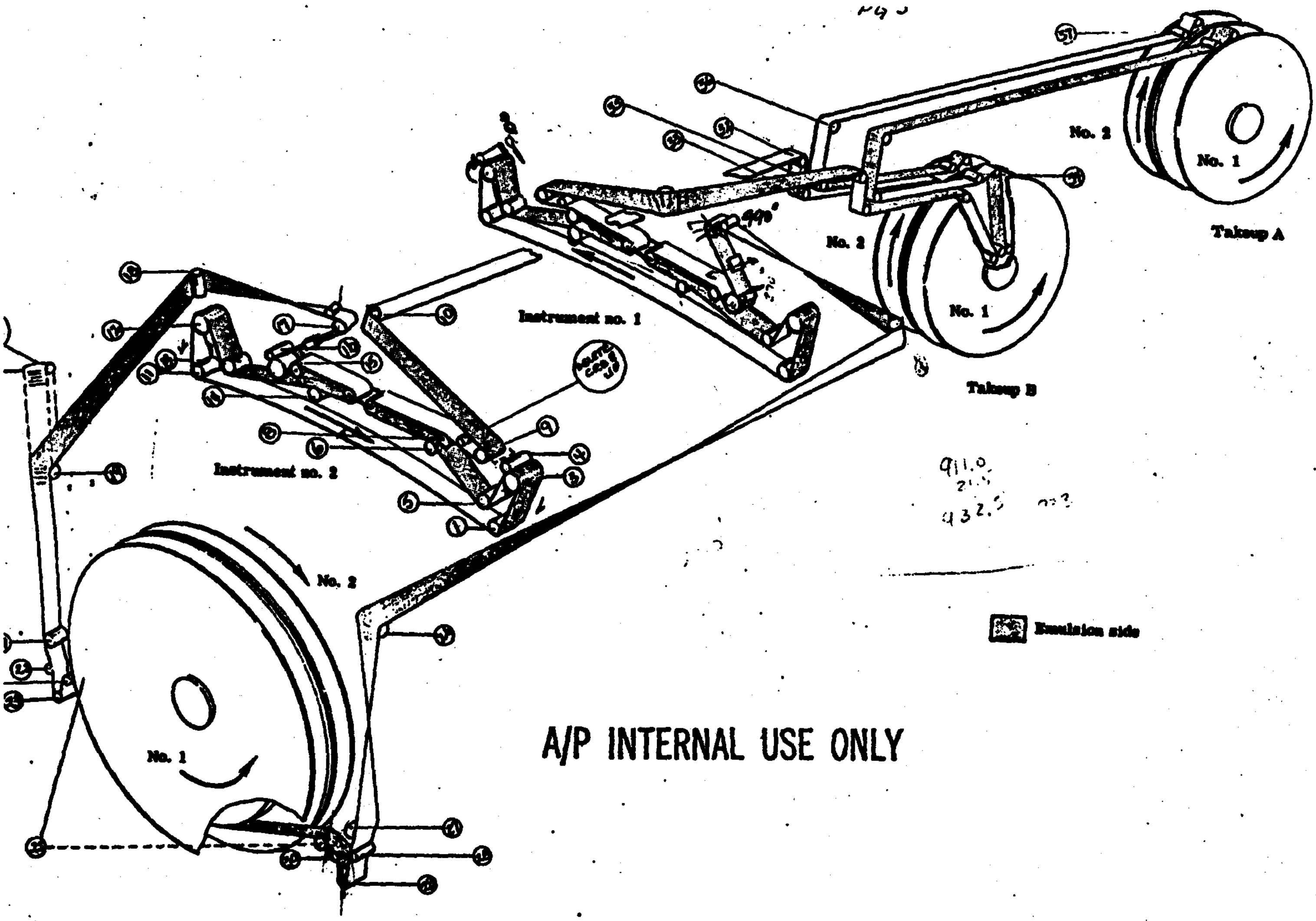
Stereo Mirror Position

Roll Steering Position   ATTITUDE INFORMATION

h. Stellar/Index Cameras - Stellar and index cameras are coordinated with Pan photography, to provide attitude, cartographic, and position information. The stellar and index cameras operate to expose 1 frame for every 10 panoramic frames providing 55% overlap. These may be operated independent of the panoramic, and both have 400 frame capacity.

Index Camera - 38 mm f/4.5 - 2¼ x 2¼ inch format on 70 mm film.

Stellar Camera - 85 mm f/1.9 approximately. 1-inch circular format on 35mm film.



A/P INTERNAL USE ONLY

Fig. 6-1 — Film threading diagram

History of Resolution Testing in the Field

The original concept for the C and C' program included dynamic resolution tests at A/P and VAFB using portable collimators. The VAFB tests were eliminated due to unstable dolly mounting of the system resulting in resolution data that was meaningless relative to system performance. The VAFB tests were eliminated prior to any successful recoveries.

Resolution test procedures for the C and C' cameras established a so called "figure of merit" approximately 20 percent below the values determined at Itek-Boston. With the exception of the last few C' units which required major mechanical maintenance in the field no adjustment of the optics was made at the A/P facility.

The C''' program continued the portable collimator concept with a change in procedure during the program to through focus tests instead of the "figure of merit" determination of performance. Because of inadequacies in the test system, determination and confirmation of focus provided more useful data than maximum resolution figures.

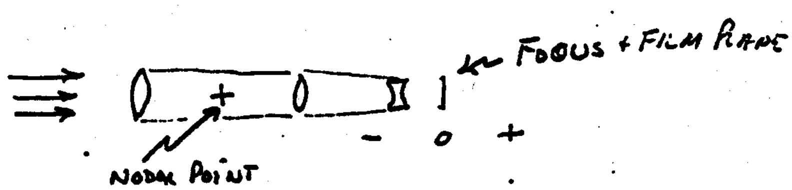
A change in test procedures was established for the M program based on the premise that unknown system effects due to interaction of two instruments may result in some quality degredation. A seismic block was installed in Waltham with the capability of installing and running both instruments simultaneously during resolution tests. A similar but inadequate installation was made at the A/P. facility to determine complete system effects.

Inadeqaucies of the test bed relative to vibration effects, precluded the use of "figure of merit" or maximum resolution data as a criteria for acceptance. Resulting data was inconsistent if an attempt was made to compare resolution values with that obtained at Waltham. Therefore a thorough focus procedure was established with maximum allowable deviation from Itek-Waltham data specified. It may be noted that all M systems were within the specified tolerances.

Absolute quality resolution data obtained has not been correlated with flight performance due to some known and/or unknown systems effects that cannot be simulated by any feasible type of testing at the A/P facility. The disharmony and time wasting discussion resulting from quality determination tests conducted in the field with inadequate simulation of systems effects and compromising test procedures and equipment are not needed in present or future programs.

If the integrity of an optical system is in doubt as a result of shipping and handling, it has not been properly qualified for flight. If the qualification program is assumed to be adequate then shipping, handling and test procedures should be modified to insure the camera is treated as an optical instrument not as a football.

OPTICAL TESTING



LEXINGTON - COLLIMATOR SET AT AMBIENT

FILM THROUGH FOCUS RUN FROM BACK TO FRONT

EXAMPLE 

EXP. # 1 AT + AND PROGRESSES TO -.

FILM IS MOVED THROUGH THE AERIAL IMAGE + TO -

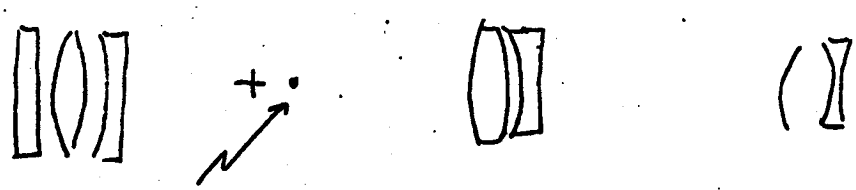
E.T.L.

COLLIMATOR SET FOR A SIMULATED VACUUM SHIFT OF THE BACK FOCUS (.016")

FILM PLANE IS HELD STATIONARY WHILE THE AERIAL IMAGE IS PULLED THROUGH.

EXAMPLE - 

EXP. # 1 IS - AND PROGRESSES TO +.



DUE TO POSITIVE BOW - NODE MOVES AFT SHORTING FOCAL LENGTH BUT NOT SIGNIFICANTLY CHANGING FOCUS. - SEE BFL DATA

		EFL	BFL
RADIUS -	96	-.0003"	0
CONCENTRIC RADII .005"	48	-.0009"	0
	24	-.0017"	0
	12	-.0034"	-.0001
	6	-.009"	-.0003
	3	-.0111"	-.0010

NOTE BOTH NEGATIVE QUANTITIES

FILTER, .005" INCREASE FL BY .0025"

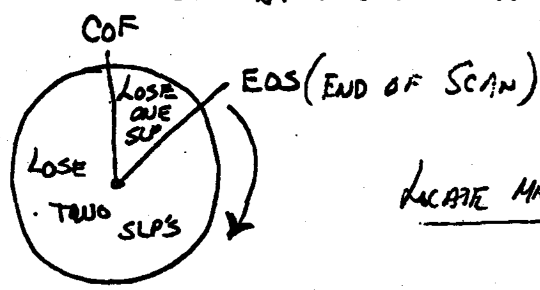
INITIAL EFL 24.0319

PLANE PARALLEL FILTER ADDED = 24.0344

LOSS OF SLP DUE TO SCAN POSITION ON SHUT DOWN

① ONE LOST SLP IF OPT. OFF AFTER COF AND BEFORE EOS

② TWO LOST SLP IF OPT. OFF AFTER EOS AND BEFORE COF



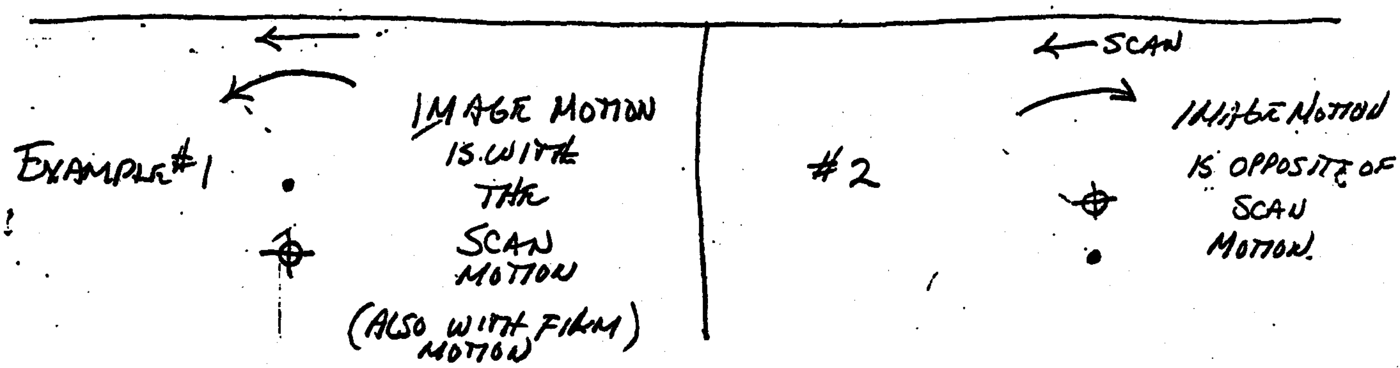
LOCATE MEMO FROM AL. SEE NOLH

IMAGE MOTION

⌖ MECHANICAL NODE

• OPTICAL NODE

← SCAN DIRECTION



FOGGING RUN

CR1 – WAS DONE BOTH WAYS SAMPLE DONE IN HORIZONTAL

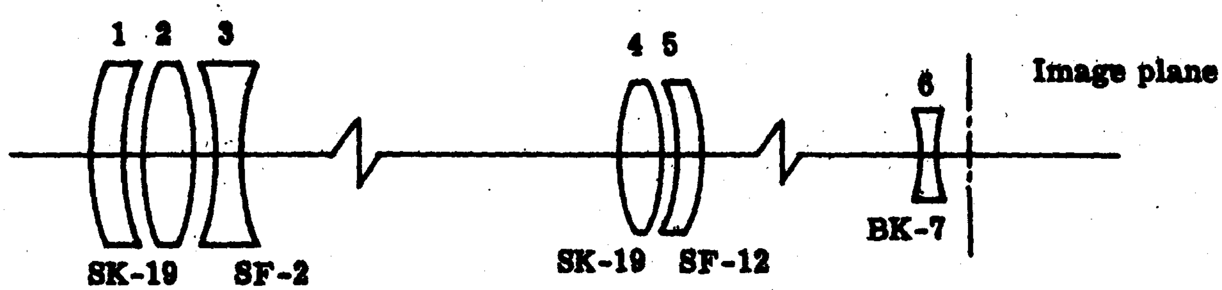
CR2 – " " " "

FREQUENCY PULSE

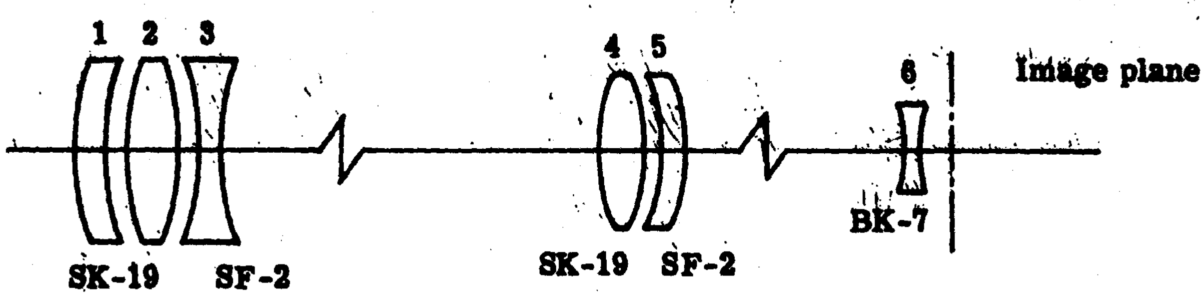
1 MARC DURATION SMEAR 4 MARC

PETZVAL LENS DIAGRAMS

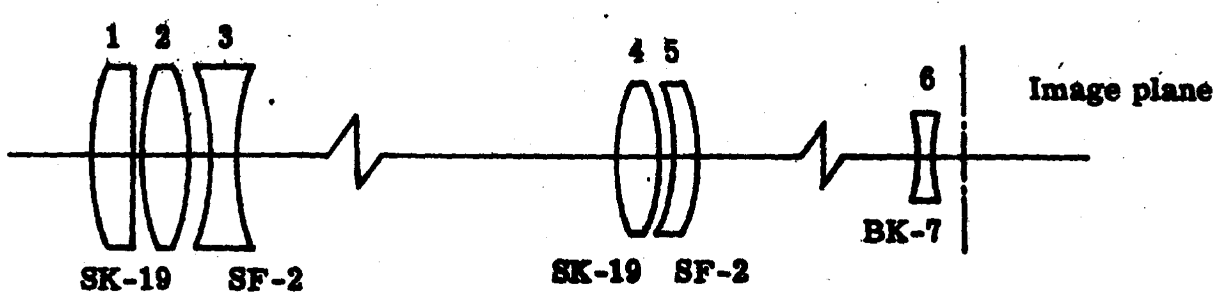
J-1, J-3, Type I



J-3, Type II



J-3, Type III, Type IV

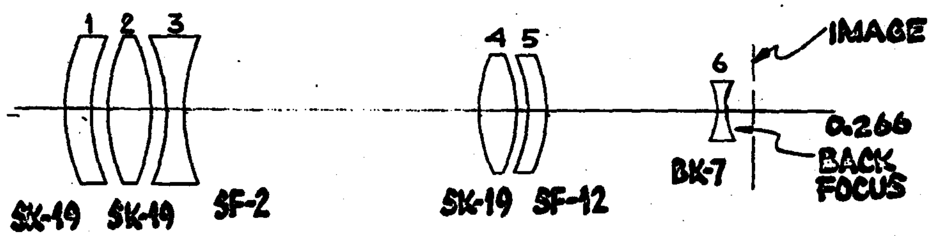


Dick M.

FIRST GENERATION OPTICAL DESIGN

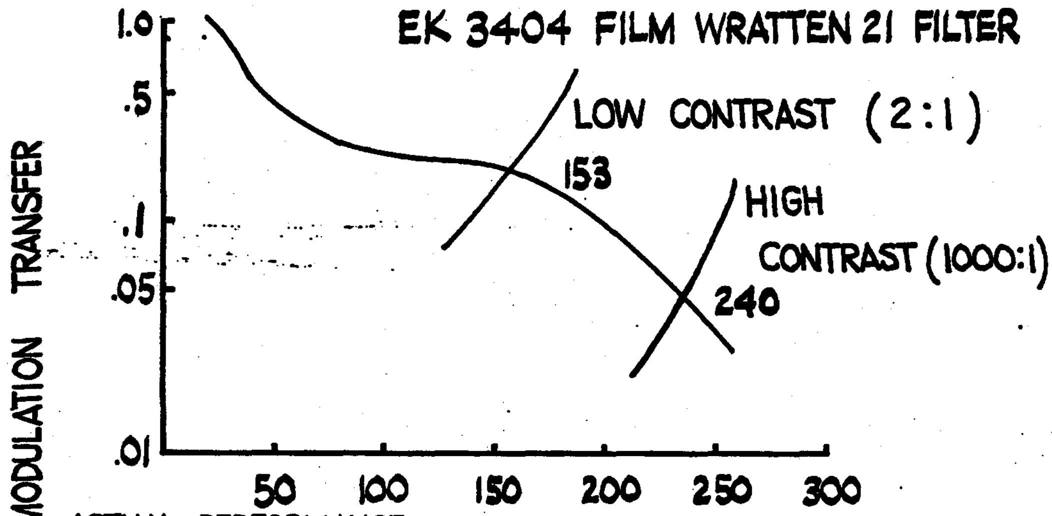
24 INCH FOCAL LENGTH
f/3.5
6° FIELD

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

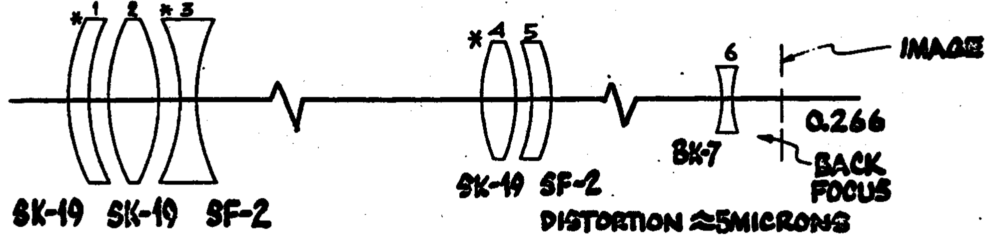
DISTORTION ≈ 5 MICRONS
RESOLUTION 140 ℓ/mm LOW CONTRAST MEASURED ON MANN BENCH WITH EK 3404 FILM

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



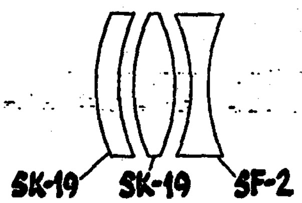
DISTORTION ≈ 5 MICRONS

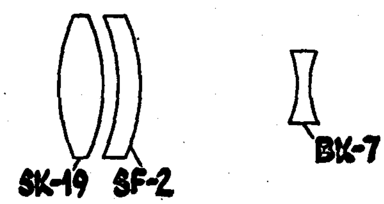
- FIRST THREE ELEMENTS SAME DIAMETER
- ASTRONOMICAL OBJECTIVE QUALITY GLASS
- SF-2 REPLACES SF-12 IN ELEMENT 5
- * INDICATES THICKENED ELEMENTS
- 21 LENSES (TOTAL 33 LENSES)

THIRD GENERATION OPTICAL DESIGN

24 INCH FOCAL LENGTH
f/3.5
6° FIELD

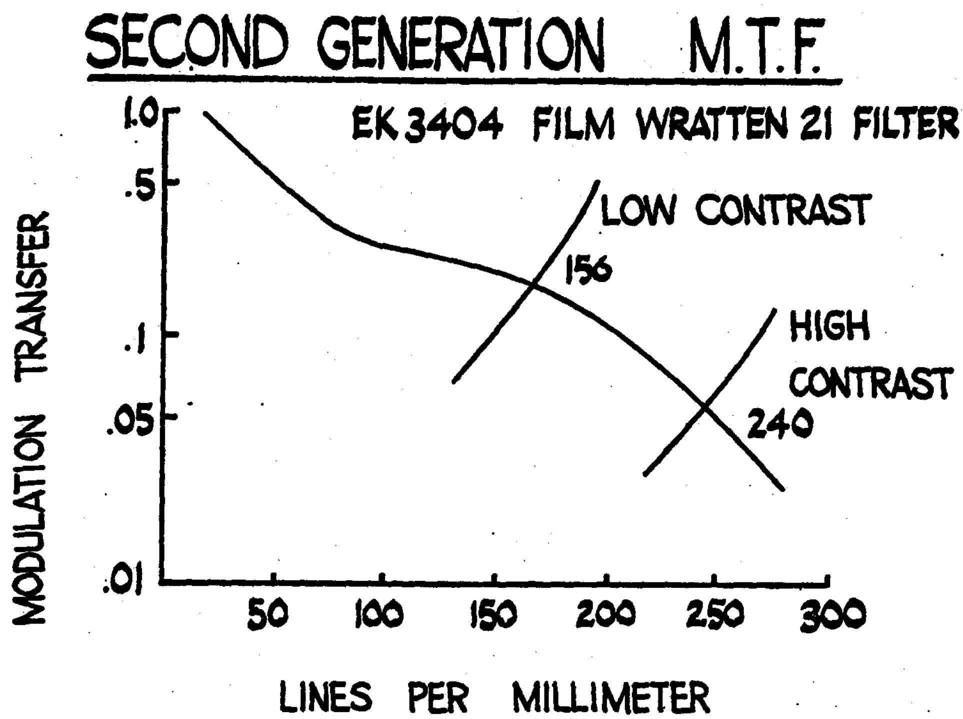
GLASS WEIGHT≈17
SPECTRAL RANGE 0.6000–0.7100
CENTRAL WAVE LENGTH – 0.6500



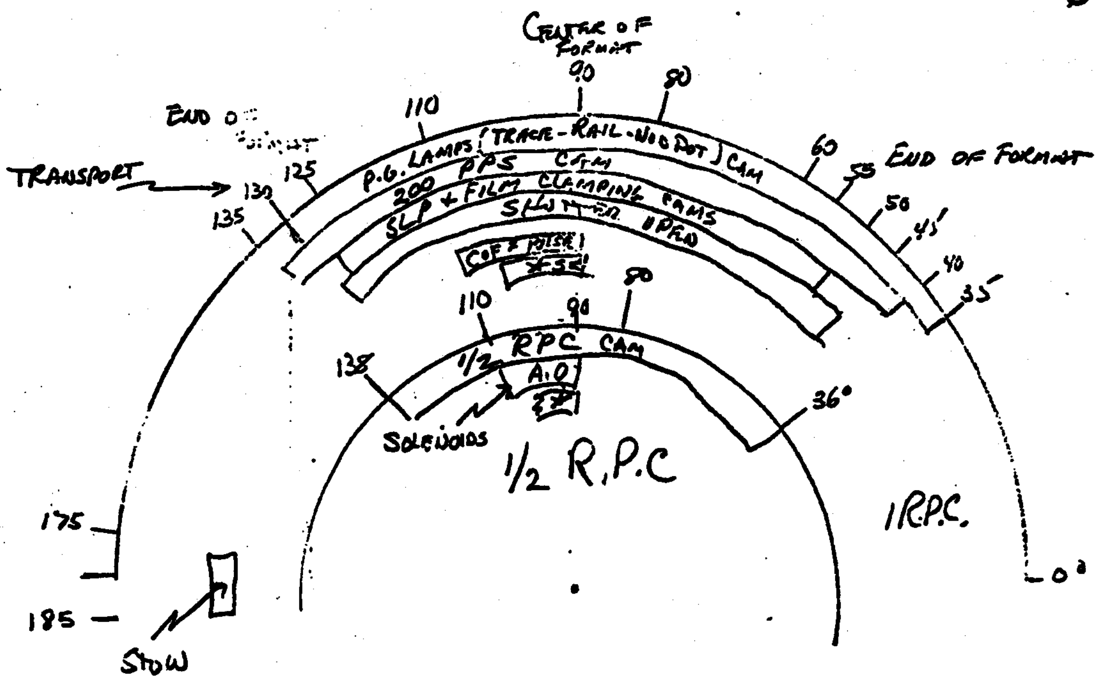


DISTORTION ≈ 5 MICRONS

- 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


SECOND GENERATION M.T.F.
EK 3404 FILM WRATTEN 21 FILTER
LOW CONTRAST
156
HIGH CONTRAST
240
MODULATION TRANSFER
1.0
.5
.1
.05
.01
50
100
150
200
250
300
LINES PER MILLIMETER

TIMING DIAGRAM DWG # D 85427



✱ - Serial lamp

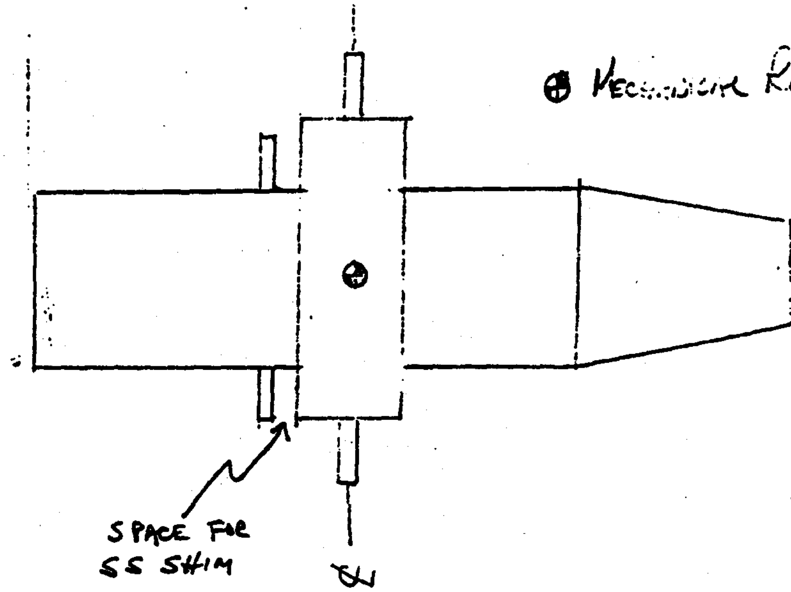
✱ - FIDUCAL LAMPS

COLLOMATORS - 120" USES A .400 SHIM ON AUTO COLLIMATING DEVICE - SINCE ACCEPTANCE OF .015 SHIFT OF BFL ALL 9232 COLLIMATORS WERE RESET FOR A .015" SHIFT.

10-12-67 - 120" USES A .375 SHIM OR .025" /.001 AT CAMERA

60" USES A .200 SHIM .00625"/.001 AT CAMERA

LENS



① WHEN THE SS SHIM IS REDUCED (THINNED) THE LENS CELL MOVES AFT, THE RAILS MAY NEED ADJUSTING TO HOLD THE CORRECT LIFT CONDITIONS. NORMAL LIFT RANGE IS +.006" TO +.008"

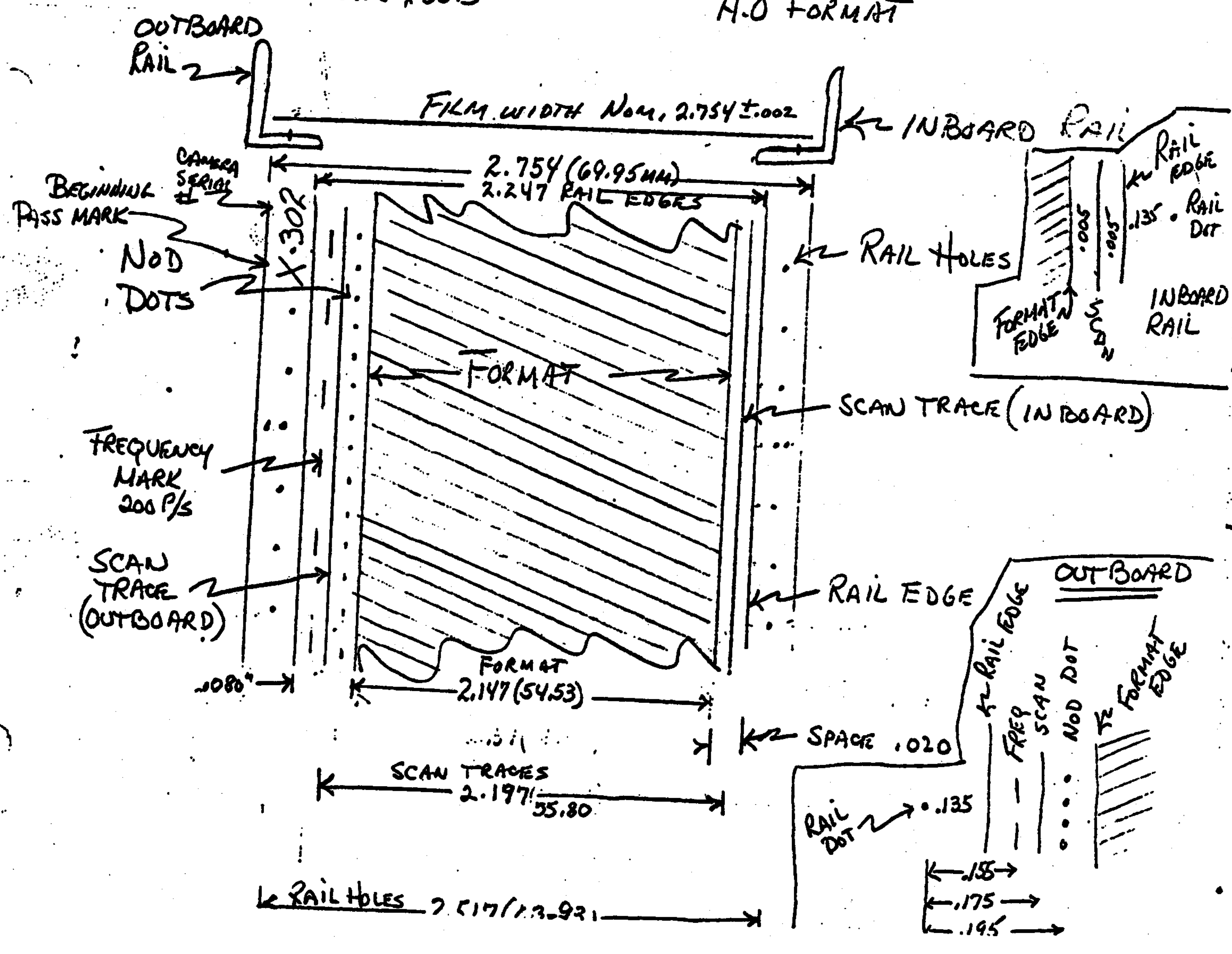
② WHEN THE VACUUM NODE IS AFT OF THE MECHANICAL POINT OF ROTATION AN IMAGE MOTION IS GENERATED, THIS MOTION IS IN THE DIRECTION OF SCAN DURING EXPOSURE, AND ALSO IS IN THE SAME DIRECTION AS THE FILM MOTION CAUSED BY THE SCANNING ARM DUE TO FILM LIFT.

③ FORMAT (INCREASE) LENGTH DUE TO ROLLER/DRUM DIAMETER INCREASE. $\frac{2\pi(.030")\times 70}{360} = .0367"$

④ COLD SYSTEM CAUSE AN INCREASE IN FILM LIFT.
−23°F = .005" GAIN IN LIFT.

⑤ ±30°F INCREASES FOCUS VS MECHANICAL DISTANCES APPART BY ROUGHLY .0002". LARGEST PROBLEM SEEM TO BE ④ FILM LIFT CHANGE

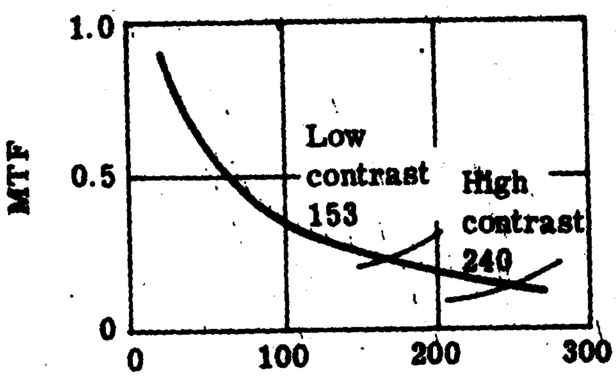
Actual FWD 303	Design Nominal	Actual AFT 302	All Measurements at Format ℄
54.3 MM	54.53	54.3	Format Width (Start of Normal Dro.)
—	724.80 29.323 (70°)		Format Lenght
63.5 MM	63.93	63.3	Rail Hole to Rail Hole
.50 MM	.51	.55	Frequency Mark to Scan Trace
55.6 MM	55.80	55.85	Scan Trace to Scan Trace
—	.51	—	Nod Dot to Scan Trace (Outboard)
4.23 MM	3.68	3.9	Outboard ℄ Rail Hole to Scantrace
3.65 MM	3.56	3.53	Inboard ℄ Rail Hole to Scan Trace
804.	797.97 31.416	804.	Metered Distance (
	52.8 X 53.3		A.O Format



PETZVAL LENS

Design MTF

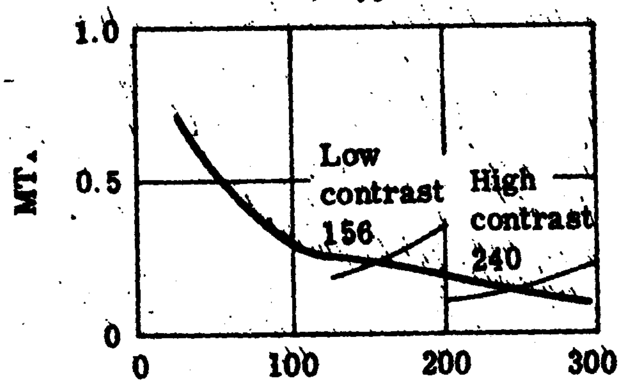
J-1, J-3, Type I



Static Resolution Specifications

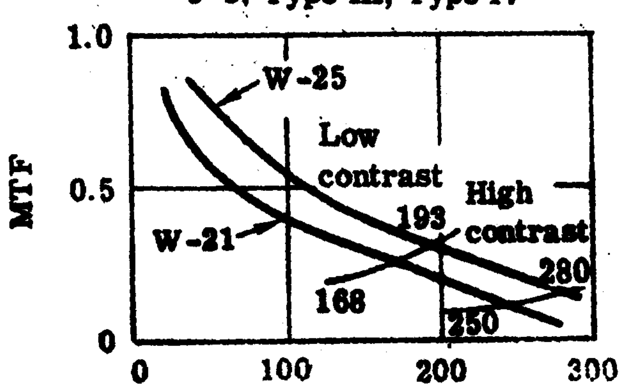
	Resolution	
Filter	EK 3404 at 2:1	EK 3404 at 1,000:1
W-21	140 1/mm	240 1/mm
W-25	None	None

J-3, Type II



	Resolution	
Filter	EK 3404 at 2:1	EK 3404 at 1,000:1
W-21	140 1/mm	240 1/mm
W-25	None	None

J-3, Type III, Type IV



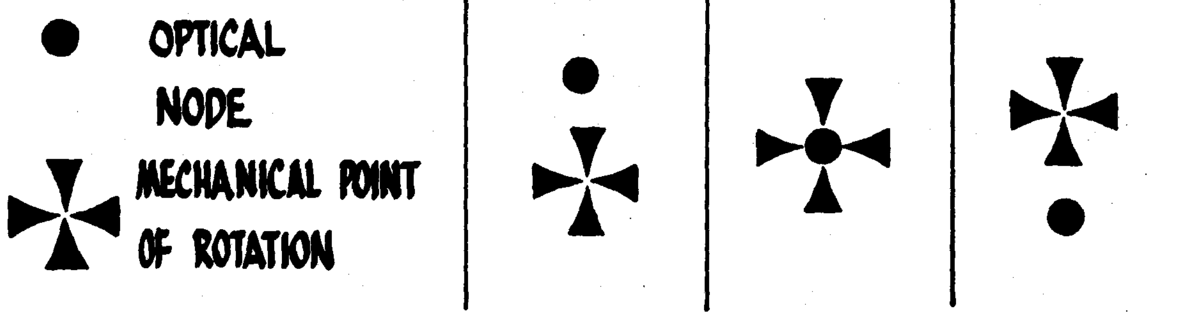
Resolution, cycles per millimeter

		Resolution	
	Filter	EK 3404 at 2:1	EK 3404 at 1,000:1
Type III	W-21	150 1/mm	240 1/mm
	W-25	175 1/mm	240 1/mm
Type IV	W-21	160 1/mm	240 1/mm
	W-25	185 1/mm	240 1/mm

I(U) IMAGE MOTION

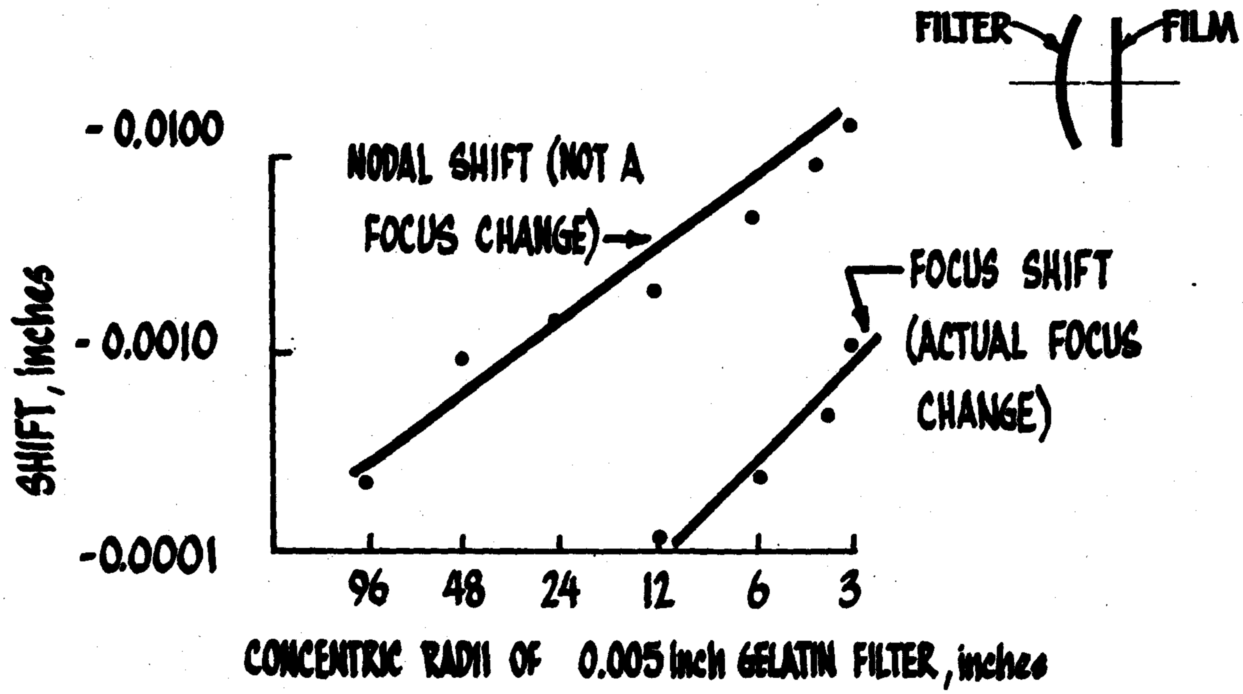
GENERATED BY ROTATING AT A POINT OTHER THAN THE NODE

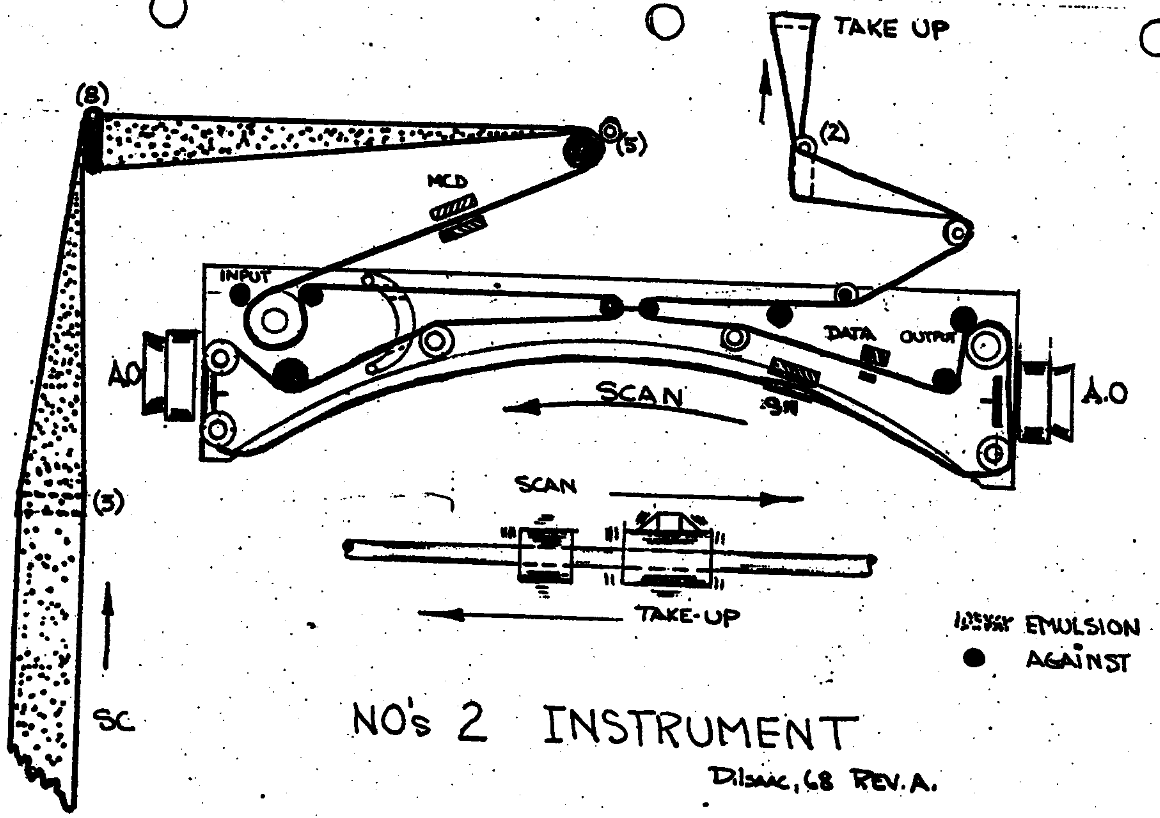
IMAGE SMEAR	←	NONE	→
SCAN DIRECTION	←	←	←



NODAL SHIFT AND BACK FOCUS CHANGE

AS A FUNCTION OF POSITIVE FILTER BOW

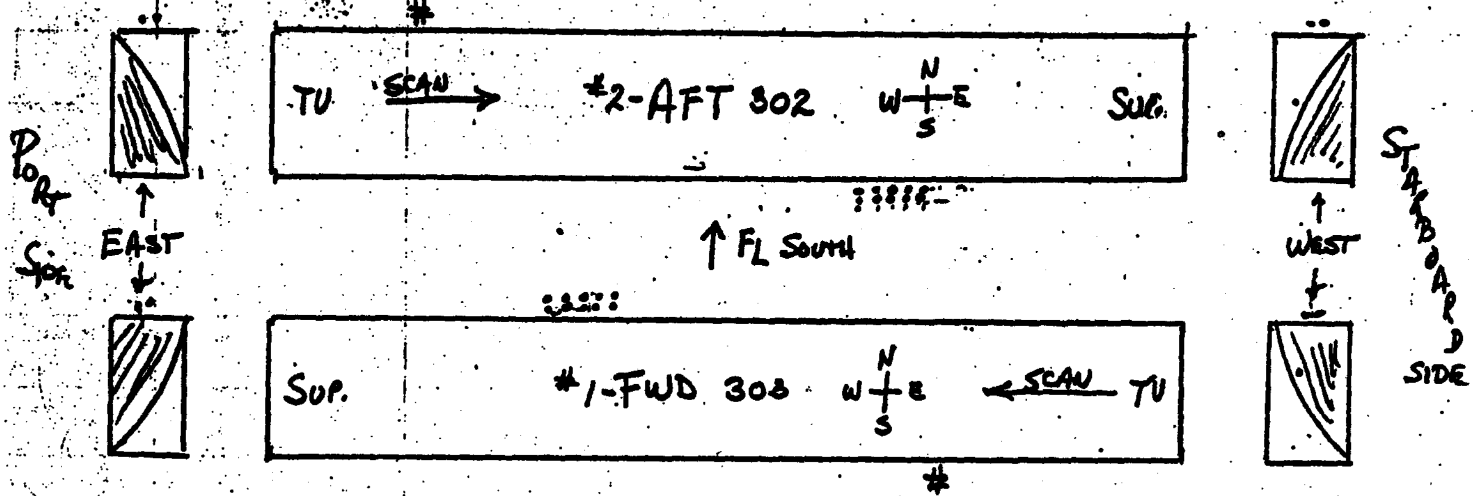




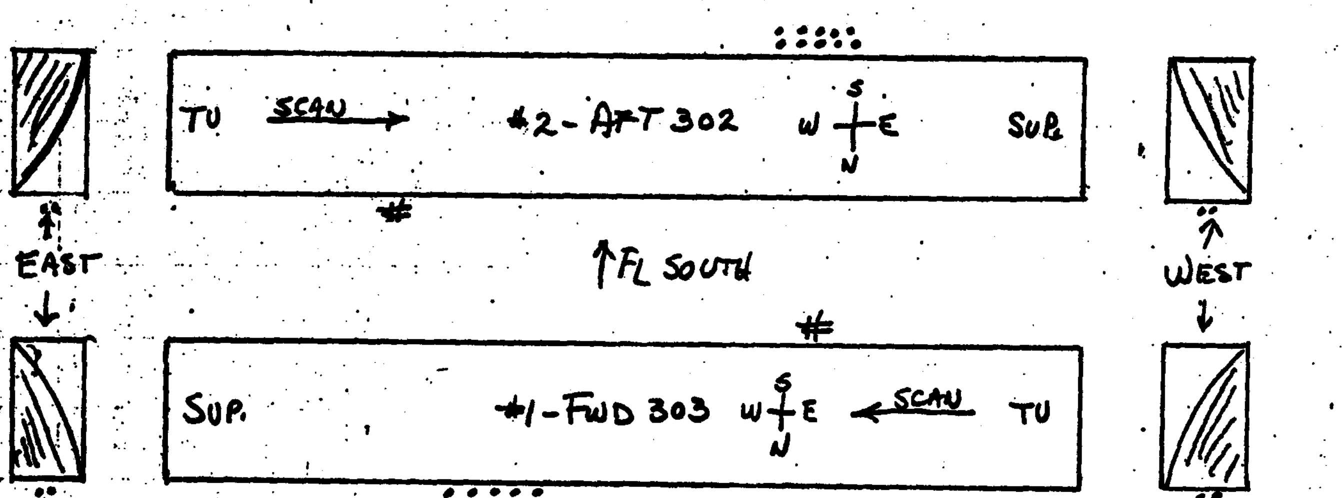
NO's 2 INSTRUMENT

Dilsaac, 68 REV. A.

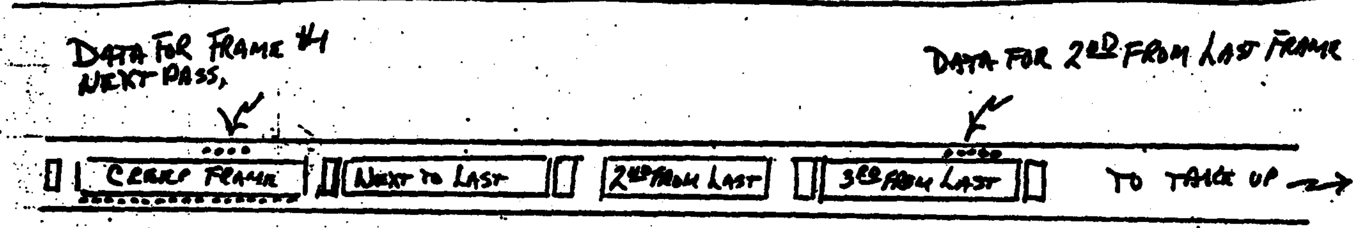
O.N. EMULSION DOWN OR D.P. EMULSION UP



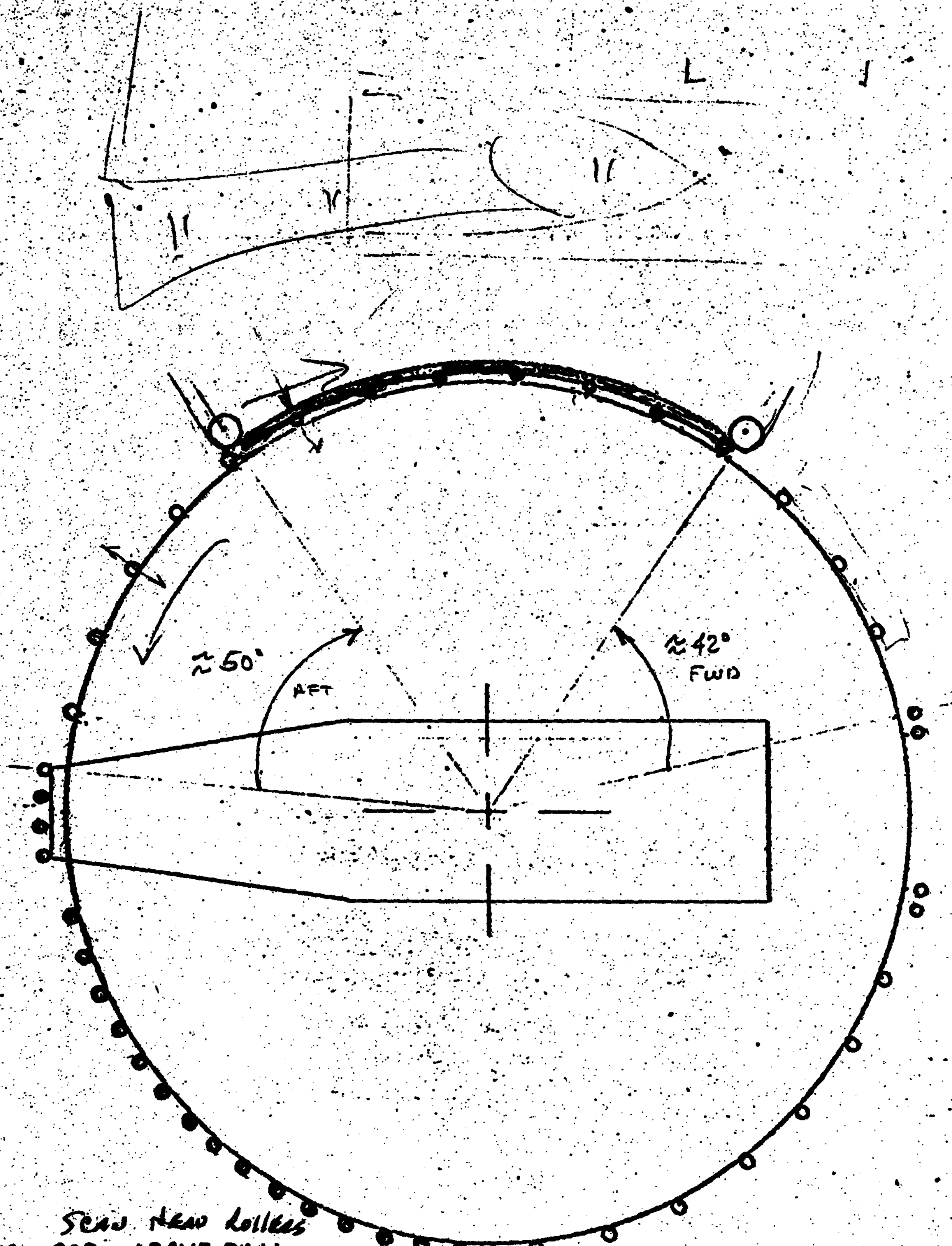
O.N EMULSION UP OR D.P. EMULSION DOWN



FILM TRANSPORTS IN OPPOSITE DIRECTION OF SCAN



DRUM ROLLER / RAIL RELATIONSHIPS



Scan New Rollers

- .006-.008 ABOVE RAIL
- .005-.007 BELOW
- .005-.010 BELOW
- .010-.015 BELOW
- .030-.050 BELOW
- SHORTER STOW ROLLERS

68-1067

DRUM ROLLER RELATIONSHIPS

ELC

FIG 1

FIG 2

FIG 3

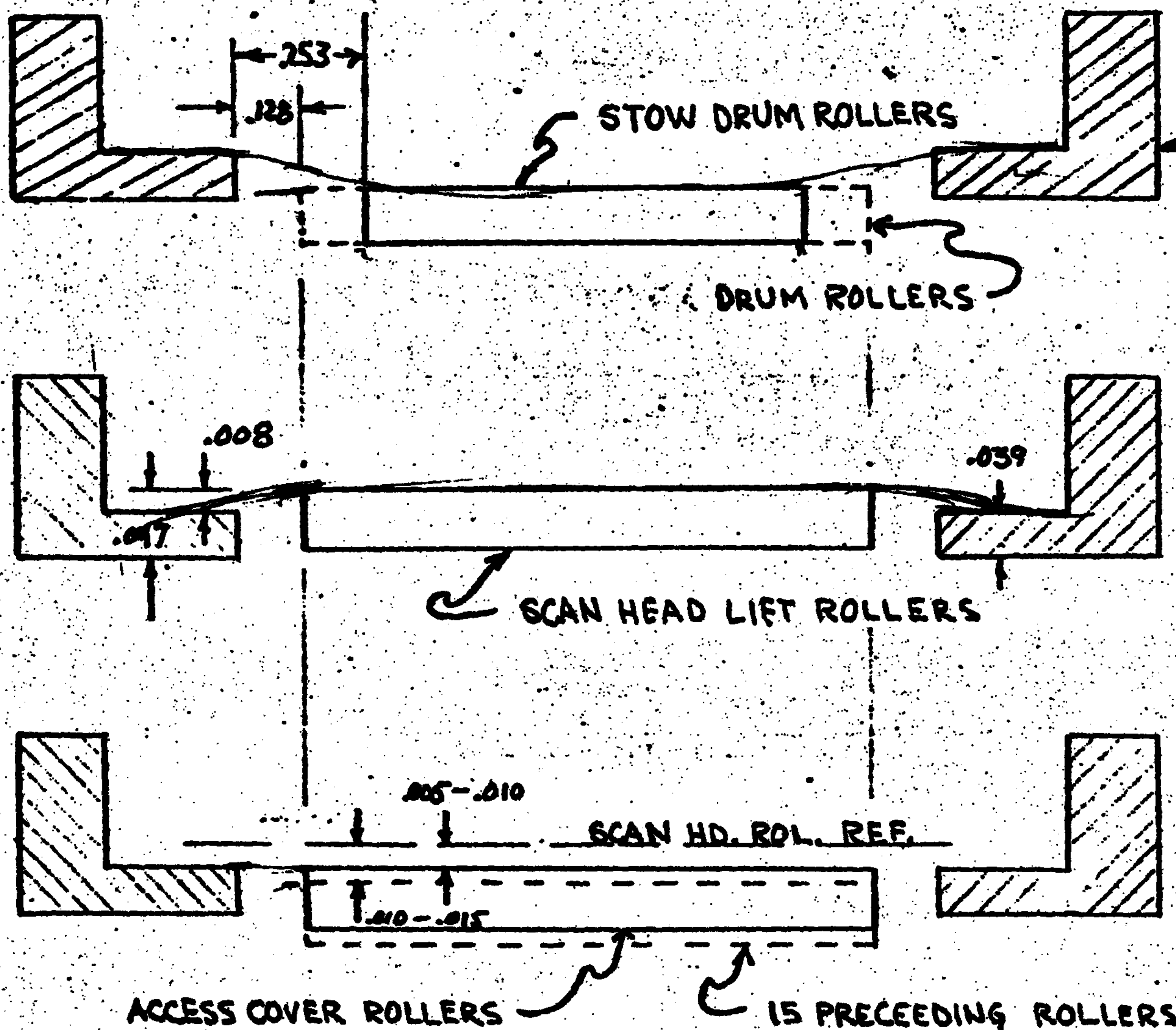


FIG 1. RELATIONSHIP OF NORMAL DRUM ROLLER TO RAIL. THESE ROLLERS ARE .030 - .060 BELOW THE LIFT ROLLERS.

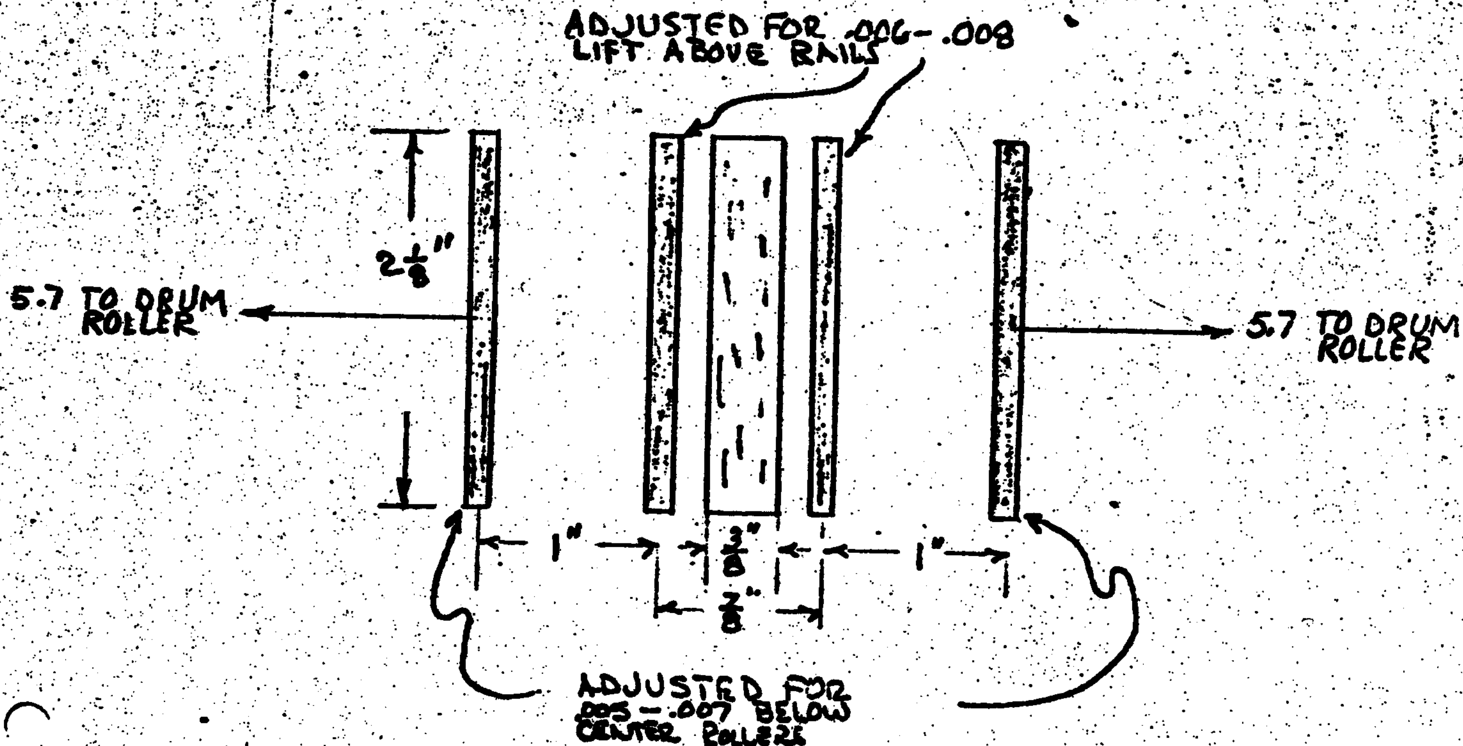
FIG 2. RELATIONSHIP OF SCAN HEAD LIFT ROLLER TO RAIL.

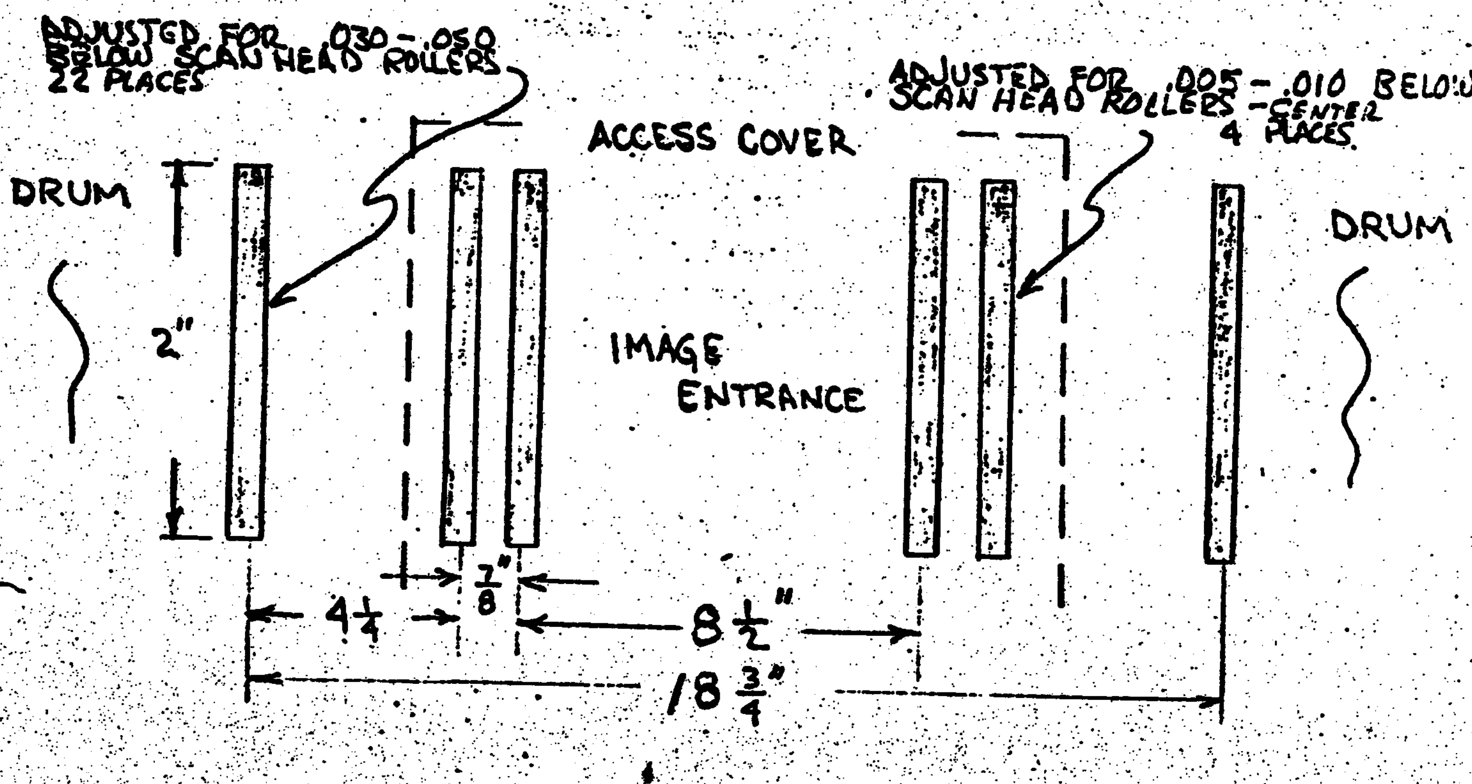
FIG 3. RELATIONSHIP OF THE ACCESS COVER AND THE 15 PRECEEDING DRUM ROLLERS TO THE RAIL AND THE SCAN HEAD LIFT ROLLER

NOTE: TOLERANCES .253 AVG .222 - .284
.128 AVG .097 - .159

SLC

SCAN HEAD / ACCESS COVER ROLLER





DRUM ROLLER / RAIL RELATIONSHIPS

1. MEASUREMENT DATA

DRUM DIAMETER 48 inches
DRUM CIRCUMFERENCE 150 inches

PLATEN ROLLERS — 29¼ inches
DISTANCE BETWEEN

1° = .417 inch at DRUM ROLLERS

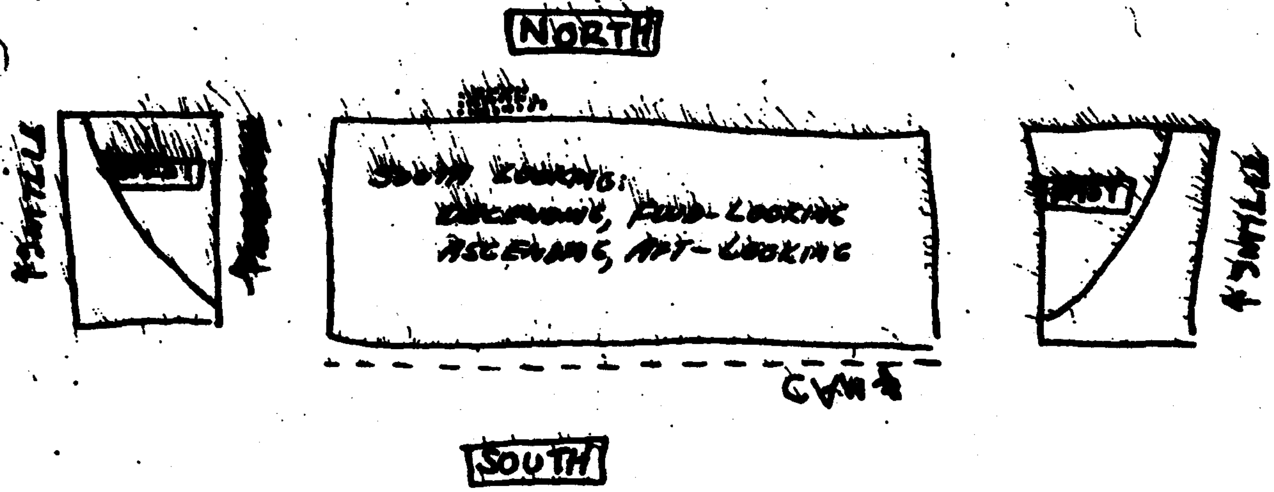
2. ROLLER / RAIL RELATIONSHIPS

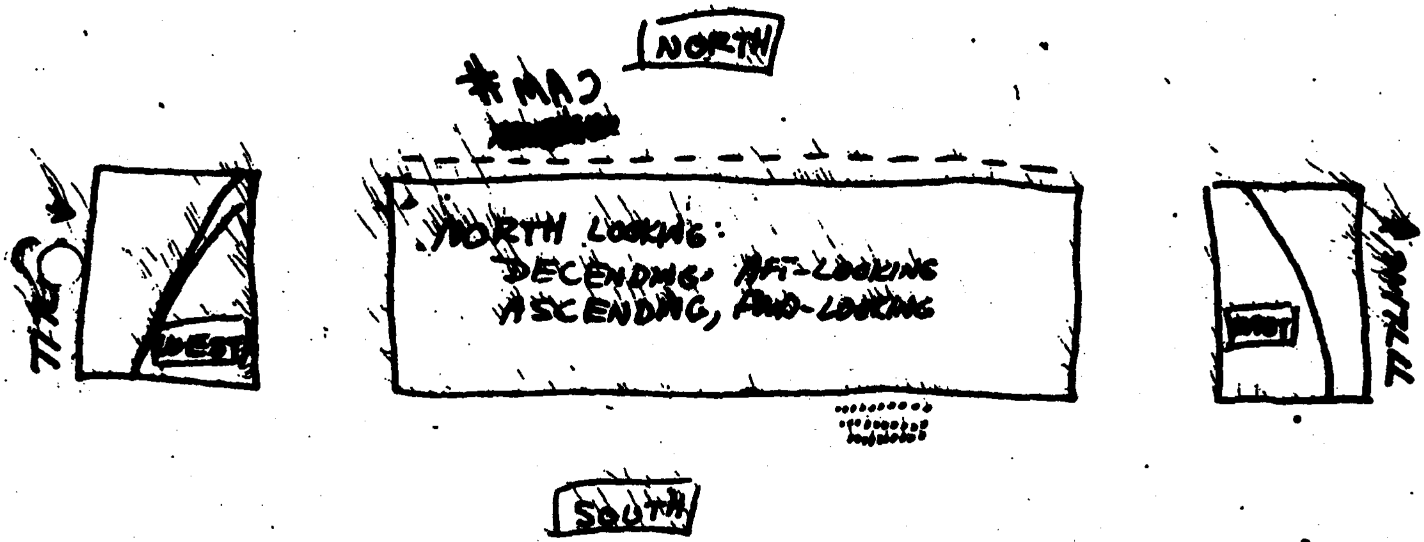
17½" FWD DRUM ROTATION OF 42° PLACES ACCESS COVER ROLLERS INTO RAILS

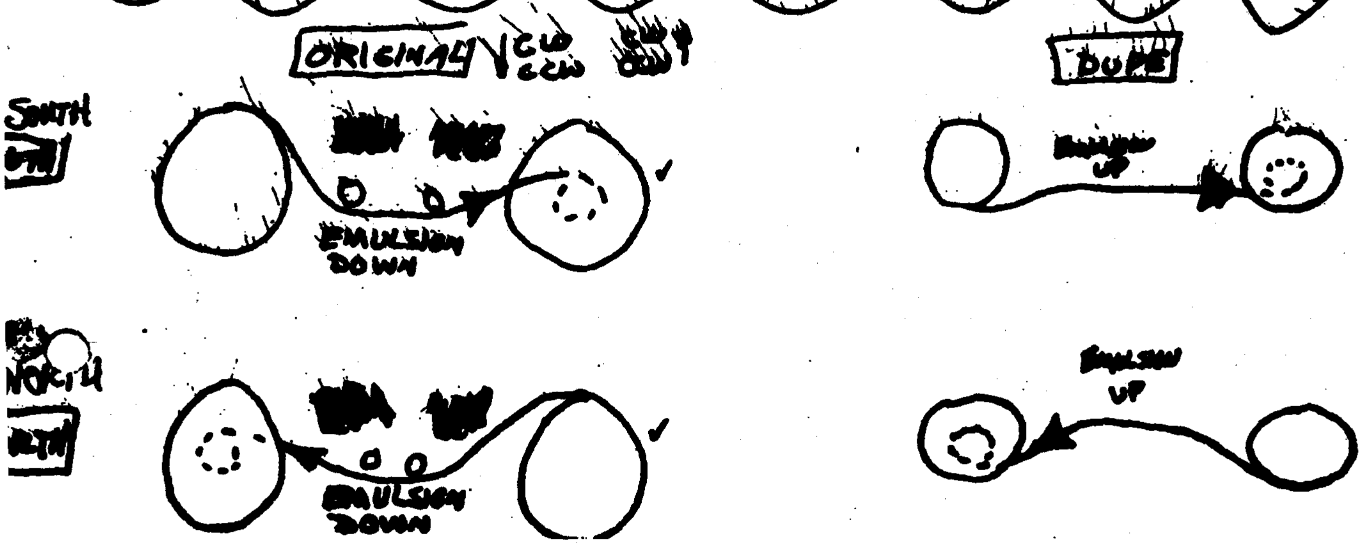
21" AFT DRUM ROTATION OF 50° PLACES SCAN HEAD ROLLERS INTO RAILS

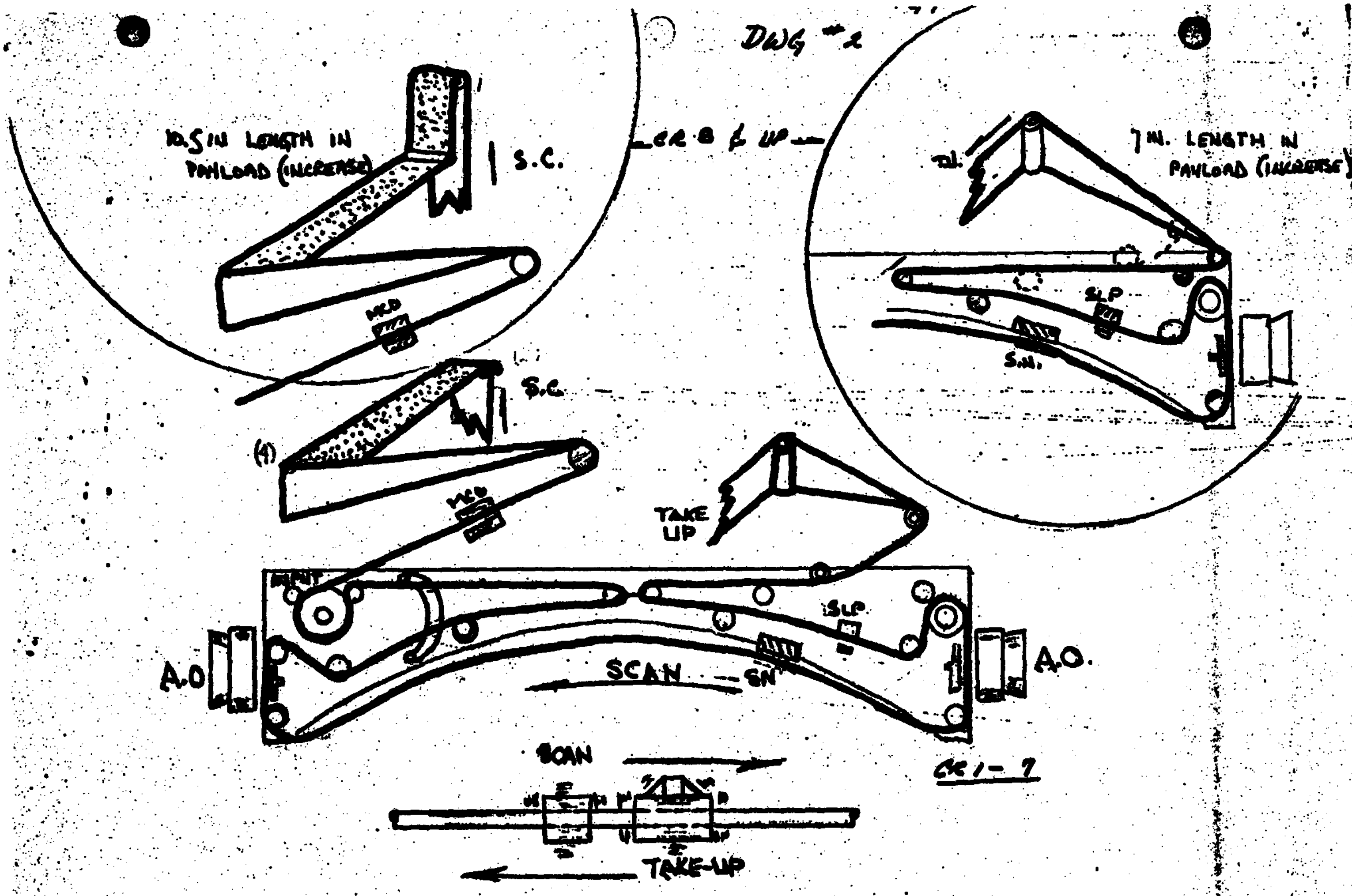
SEVEN DRUM ROLLERS IN RAILS AT STOW POSITION ARE SHORTENED BY .125 EACH END. TOLERANCE OF STOW POSITION IN THE FORWARD DIRECTION PLACES THE EIGHTH DRUM ROLLER (NOT SHORTENED) INTO THE RAILS.

J-3

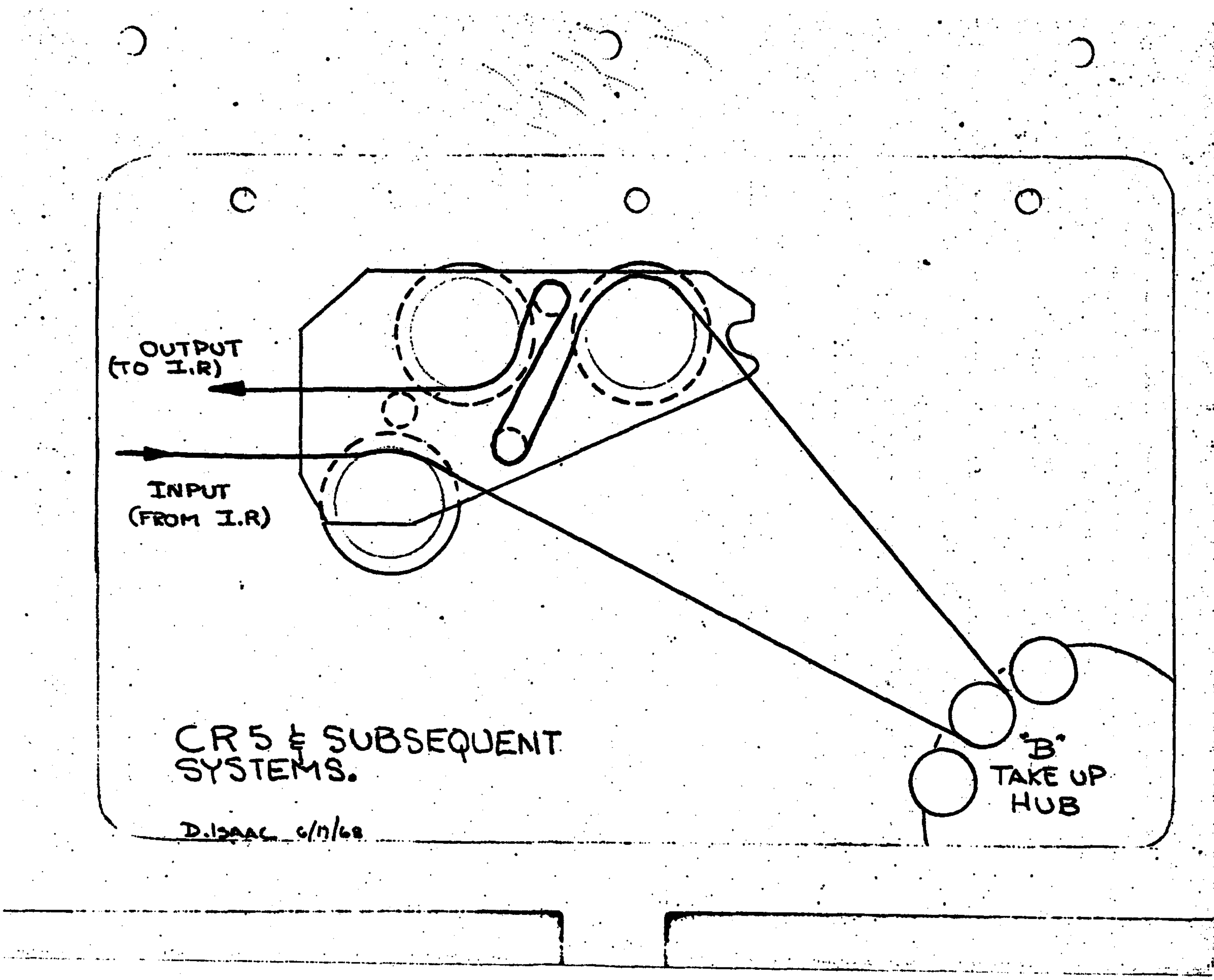

NORTH
SOUTH LOOKING:
ASCENDING, AFT-LOOKING
SOUTH

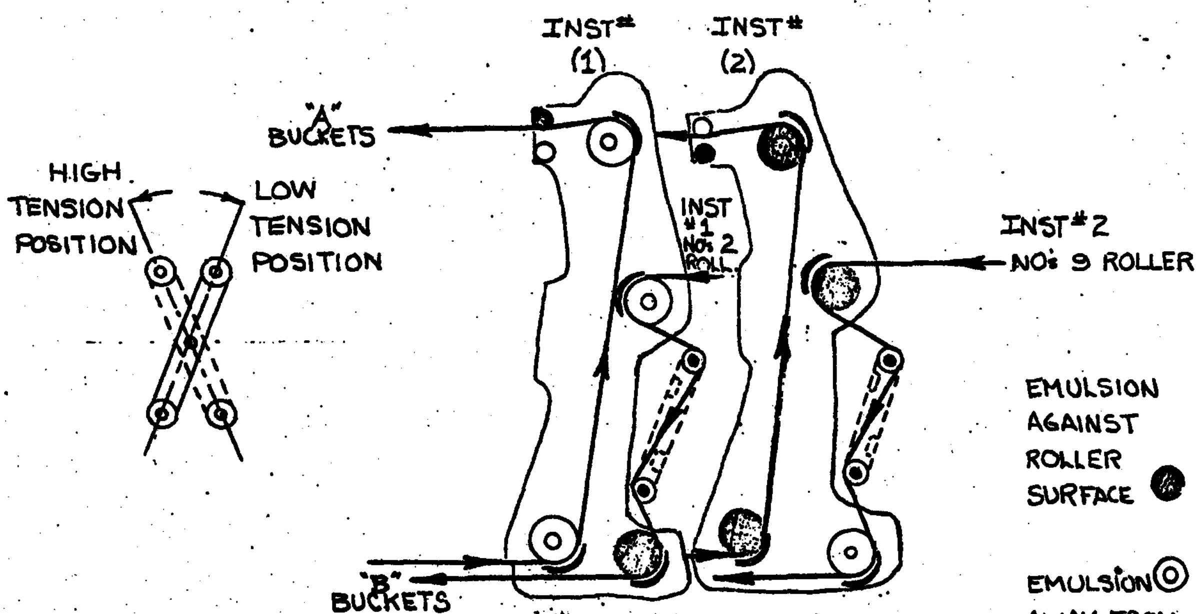

NORTH
NORTH LOOKING:
DECENDING, AFT-LOOKING
ASCENDING, FWD-LOOKING
WEST
SOUTH


ORIGINAL
CW
CCW
DUPE
SOUTH
EMULSION DOWN
EMULSION UP
NORTH
EMULSION UP
EMULSION DOWN



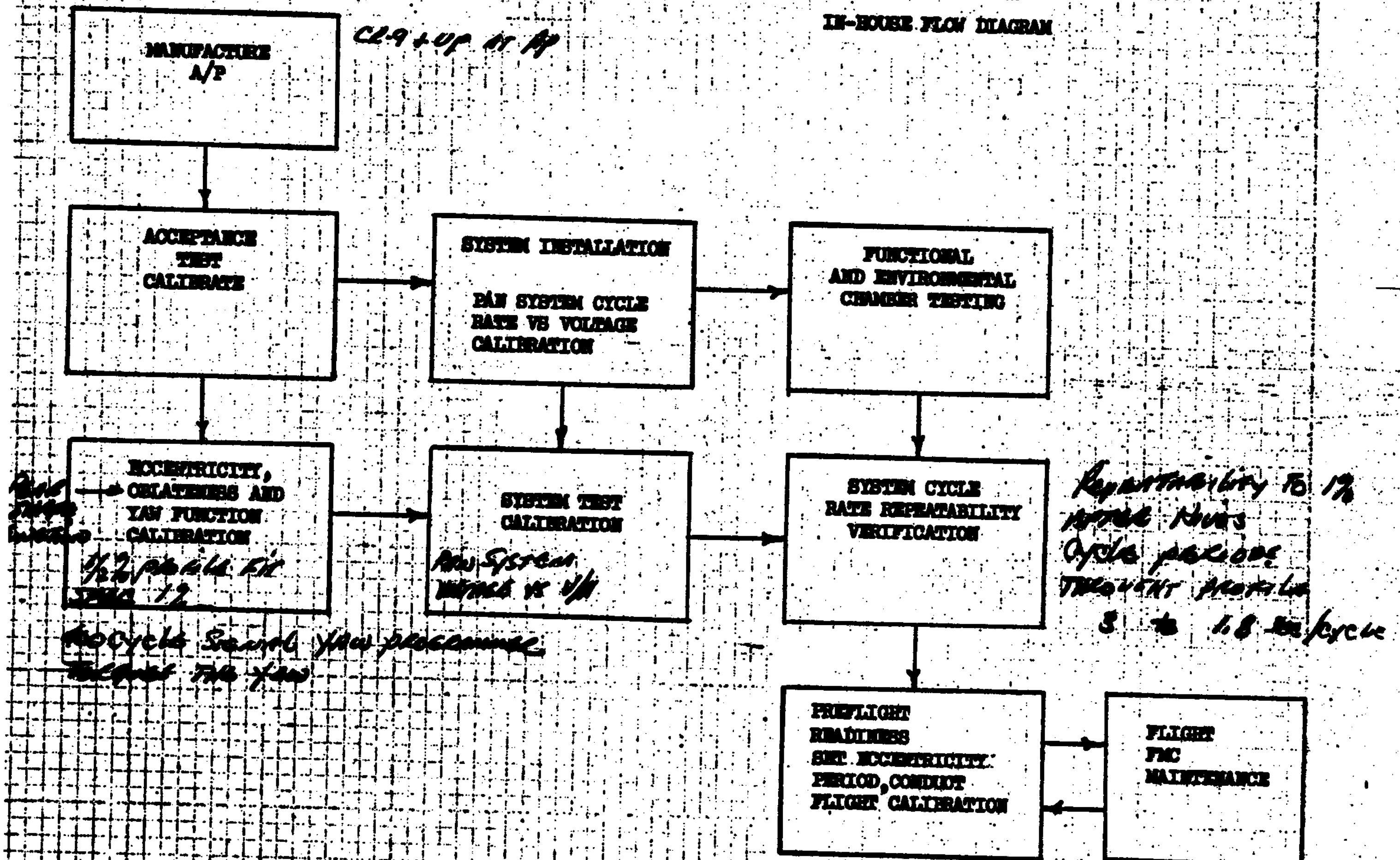
A/P INTERNAL USE ONLY


OUTPUT
(TO I.R)
INPUT
(FROM I.R)
CR5 & SUBSEQUENT
SYSTEMS.
"B"
TAKE UP
HUB
D.ISAAC 6/17/68

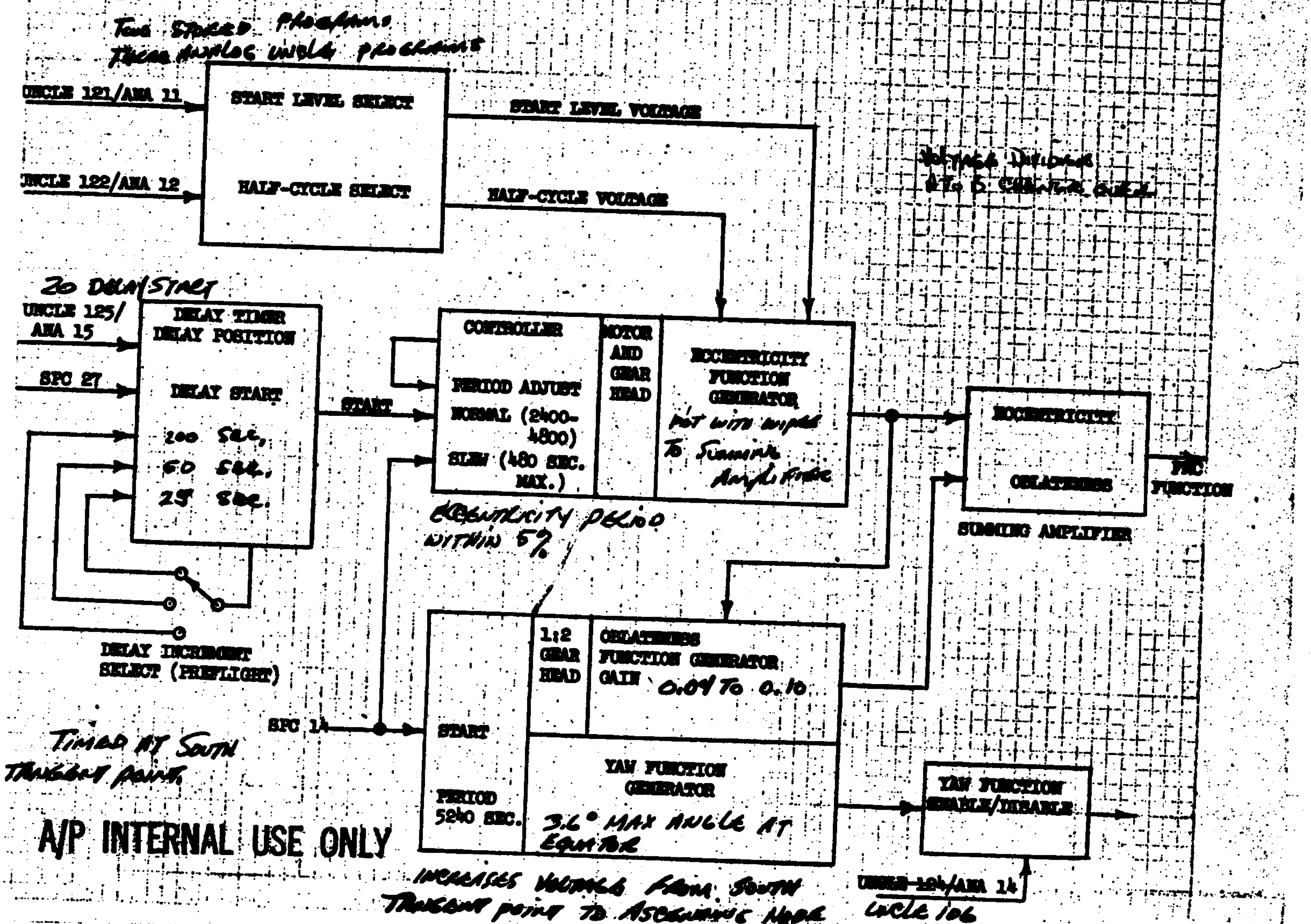


C.R.
INTERMEDIATE ROLLER
ASSEMBLY
CONSTANT TENSION MOD.

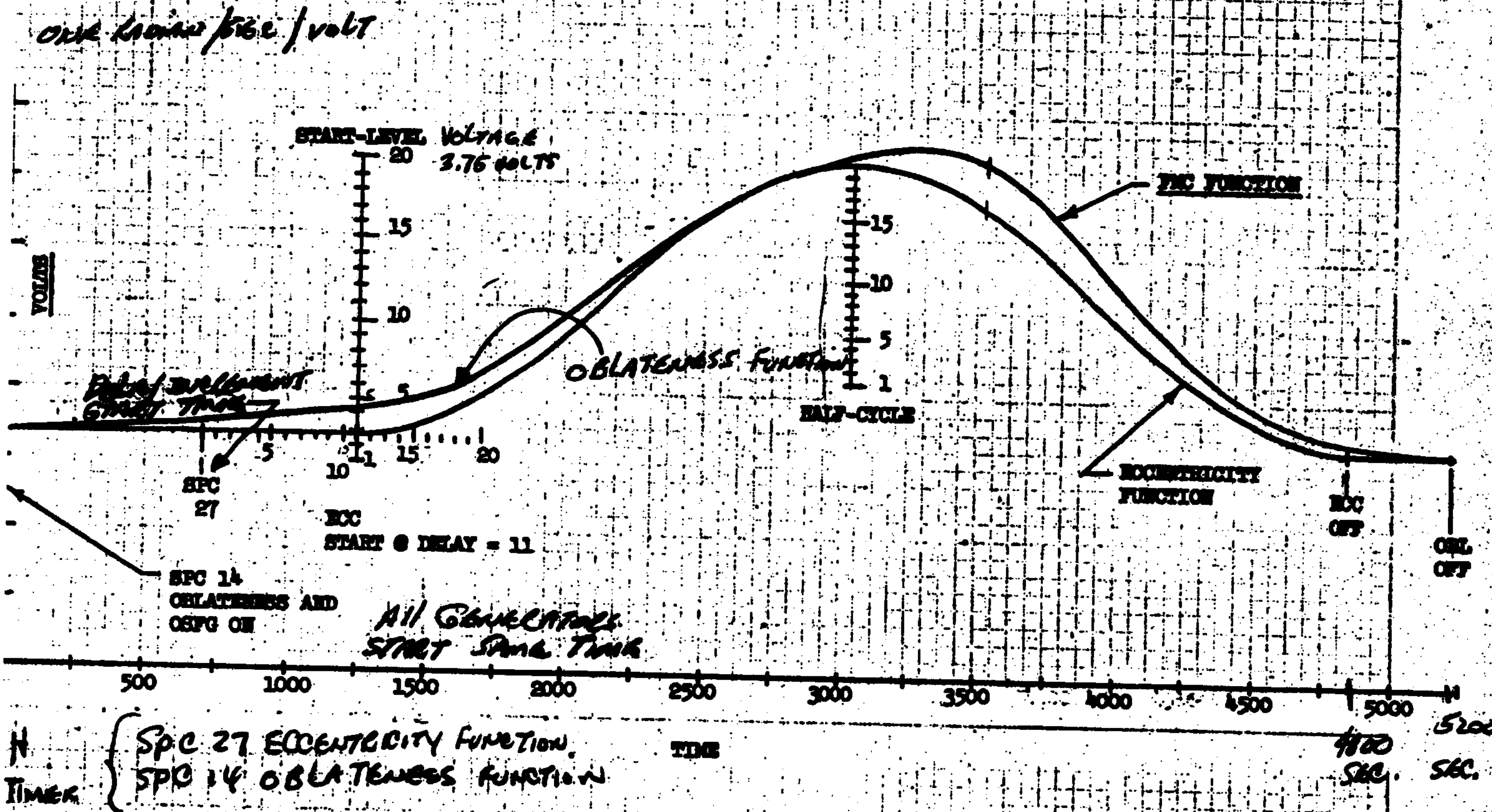
SLOPE PROGRAMMER
IN-HOUSE FLOW DIAGRAM



A/P INTERNAL USE ONLY

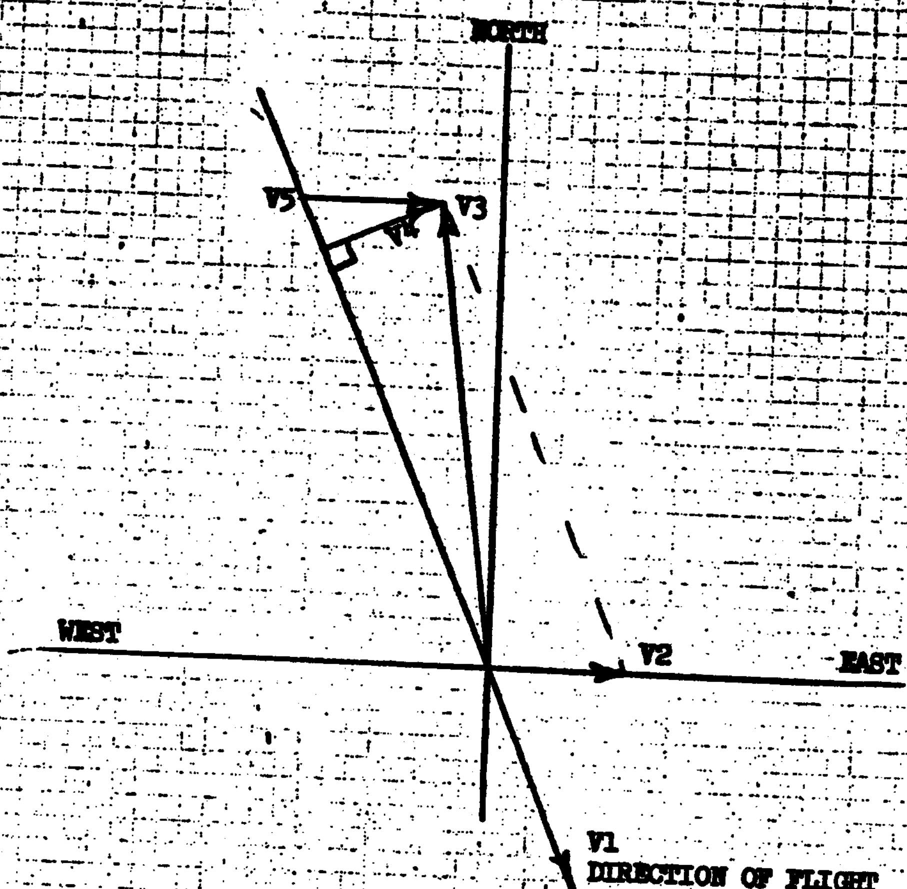


A/P INTERNAL USE ONLY



A/P INTERNAL USE ONLY

YAW COMPENSATION DIAGRAM



V1 - FMC component of IMC (ground track velocity).

V2 - Earth rotational velocity referred to the satellite.

V3 - Image motion velocity referred to the satellite (V1 + V2).

V4 - Cross track velocity component of V3 (Yaw compensation)

V5 - Forward ground track velocity referred to satellite.

Yaw compensation is about 3.6° max. Yaw angle, positioned at the descending node.

A/P INTERNAL USE ONLY

DISCOVERER PERFORMANCE

DISCOVERER NUMBER	VEHICLE NUMBER	CAPSULE NUMBER	INSTRUMENT NUMBER	INSTRUMENT TYPE	THOR NUMBER	PAYLOAD WEIGHT FLOWN	PAYLOAD WEIGHT RECOVERED	RECEIVED INSTRUMENT AT "A/P"	SHIPPED FROM "A/P"	FLIGHT DATE	WEEKS AT "A/P" — DAYS AT "A/P"	TOTAL WEEKS TILL FLIGHT	RECOVERED	SUMMARY
I	1022				163					2-28-59				NO CAPSULE FLOWN
II	1018			BIO.	170					4-13-59				CAPSULE EJECTED OVER SPITZBERGEN 4-13-59
III	1020			BIO.	174					6-3-59				AGENA FAILED TO ORBIT
IV	1023	102	4	C	179	16 LBS.	0	5-5-59	5-29-59	6-25-59	3 — 3	7 — 2	NO ORBIT	AGENA FAILED TO ORBIT
V	1029	111	7	C	192	20 LBS.	0.405	6-5-59	7-23-59	8-13-59	6 — 6	9 — 6		LOW TEMPERATURES – NOT RECOVERED INSTRUMENT FAILED ON REV(1)
VI	1028	105	6	C	200	16 LBS.	0.108	5-18-59	6-3-59	8-19-59	2 — 2	13 — 2		RETRO ROCKET MALFUNCTION – NOT RECOVERED INSTRUMENT FAILED ON REV(2)
VII	1051	109	10	C	206	10 LBS.	0	6-29-59	7-29-59	11-7-59	4 — 1	19 — 3	NO ORBIT	AGENA FAILURE – NO ORBIT
VIII	1050	107	9	C	212	10 LBS.	0	7-23-59	11-7-59	11-20-59	15 — 0	15 — 13		ECCENTRIC ORBIT – WRONG ATTITUDE [illegible]
IX	1052	113	8	C	218	10 LBS.	0	6 28-59	1-10-60	2-4-60	28 — 0	31 — 4	NO ORBIT	AGENA FAILED TO ORBIT
X	1054	110	13	C	223	10 LBS.	0	12-7-59	2-4-60	2-19-60	8 — 3	10 — 4	NO ORBIT	AGENA FAILED TO ORBIT
XI	1055	103	14	C	234	16 LBS.	16 LBS.	1-11-60	2-24-60	4-15-60	6 — 2	13 — 3		SPIN ROCKET FAILURE – NOT RECOVERED INSTRUMENT OPERATION O.K.
XII	1053	N/A 2	N/A	N/A	DIAGNOSTIC		0			6-29-60			NO ORBIT	AGENA FAILED TO ORBIT – DIAGNOSTIC
XIII	1057	N/A 2	N/A	N/A	DIAGNOSTIC		0			8-10-60			8-11-60	SUCCESSFUL [illegible] – DIAGNOSTIC
XIV	1056	101 [illegible] 2	3	C	237	20 LBS.	20 LBS.	1-28-60	3-28-60	8-18-60	8 — 3	21 — 6	8-19-60	SUCCESSFUL AIR CATCH INSTRUMENT OPERATION O.K.
XV	1058	107 [illegible] 2	11	C	246	20 LBS.	20 LBS.	2-22-60	8-25-60	9-13-60	26 — 2	29 — 0		[illegible] INSTRUMENT OPERATION O.K.
XVI	1061	506 4	15	C'	253	20 LBS.	0	6-6-60	9-17-60	10-26-60	14 — 5	20 — 2	NO ORBIT	5° THRUST MALFUNCTION – AGENA FAILED TO ORBIT
XVII	1062	507 4	17	C'	297	39 LBS.	1.7 [illegible]	9-12-60	10-17-60	11-20-60	5 — 0	9 — 6	11-22-60	SUCCESSFUL AIR CATCH – PAYLOAD [illegible]
XVIII	1103	508 4	19	C'	296	39 LBS.	39 LBS	10-9-60	10-29-60	12-7-60	2 — 6	8 — 3	12-10-60	SUCCESSFUL AIR CATCH INSTRUMENT OPERATION O.K.
XIX	1101	N/A 2	N/A	N/A	258		0			12-20-60				NO SRV INSTALLED – (RM-1 PAYLOAD)
XX	1104	520 5	3	A	298	39 LBS.	39 LBS.	10-18-60	12-21-60	2-17-61	9 — 4	17 — 3		[illegible] FAILED AT REV(32) INSTRUMENT FAILED – [illegible]
XXI	1102	N/A 2	N/A	N/A	261		0			2-18-61				NO SRV INSTALLED – (RM-2 PAYLOAD)
XXII	1105	509 4	18	C'	300	39 LBS.	0	2-21-61	3-28-61	3-30-61	5 — 0	5 — 2	NO ORBIT	AGENA FAILURE – NO ORBIT
XXIII	1106	521 5	4	A	307	39 LBS.	39 LBS	11-30-60	3-16-61	4-8-61	15 — 2	18 — 4		RECOVERY WAS ATTEMPTED ON REV(32) [illegible] INSTRUMENT OPERATION O.K.
XXIV	1108	541 5	8	A	302	39 LBS.	0	4-3-61	5-25-61	6-8-61	7 — 3	9 — 3	NO ORBIT	AGENA FAILURE – [illegible]
XXV	1107	510 4	16	C'	309	39 LBS.	39 LBS	3-7-61	4-17-61	6-16-61	5 — 6	14 — 3	6-18-61	SUCCESSFUL WATER PICK-UP
XXVI	1109	511 4	20	C'	308	39 LBS.	22.78 LBS.	10-18-61 2-21-61	2-14-61 5-18-61	7-7-61	16 — 0 12 — 6	1 — 0 4 — 4	7-9-61	SUCCESSFUL AIR CATCH INSTRUMENT FAILED ON REV(22)
XXVII	1110	524 5	7	A	322	39 LBS.	0	4-4-61	6-29-61	7-21-61	11 — 4	15 — 3	NO ORBIT	NO ORBIT – THOR GUIDANCE DESTRUCT
XXVIII	1111	512 4	21	C'	309	39 LBS.	0	11-13-60 4-17-61	3-4-61 3-[illegible]-61	8-2-61	16 — 6 4 — 5	6 — [illegible] 10 — [illegible]	NO ORBIT	AGENA GUIDANCE FAILURE
XXIX	1112	554 4	54	C'''	323	39 LBS.	39 LBS.	6-23-61	8-17-61	8-30-61	7 — 6	9 — 5	9-1-61	RECOVERY ON REV(33) INSTRUMENT O.K.
XXX	1113	551	53	C'''	310	39 LBS	39 LBS.	5-27-61	7-17-61	9-12-61	7 — 0	15 — 0	9-14-61	SUCCESSFUL AIR CATCH [illegible]
XXXI	1114	552	55	C'''	324	39 LBS.	20 LBS	5-22-61	8-23-61	9-16-61	13 — 2	16 — 6	NO SEPARATION	[illegible]
XXXII	1115	555	56	C'''	328	39 LBS	12.4 LBS.	8-9-61	9-14-61	10-13-61	5 — 1	9 — 2	10-14-61	SUCCESSFUL AIR CATCH – [illegible]
XXXIII	1116	513	22	C'	329	39.6 LBS.	0	3-16-61	7-20-61	10-23-61	19 — 0	31 — 4	NO ORBIT	[illegible]
XXXIV	1117	653	24	C'	330	32.0 LBS	39 LBS	5-22-61	9-26-61	11-5-61	16 - 2	24 - 0		[illegible]
XXXV	1118	523 B	25	C'	326	39.4 LBS	13 LBS	8-30-61	10-18-61	11-15-61	11 — 0	11 — 1	11-16-61	[illegible]
XXXVI	1119	525 B	52	C'''	325	38.2 LBS	38.2 LBS	11-10-61	11-27-61	12-12-61	2 — 3	4 — 4	12-16-61	[illegible]
XXXVII	1120	571	57	C'''	327	38.6 LBS	0	11-16-61	12-19-61	1-13-62	4 — 5	3 — 3	NO ORBIT	AGENA FAILURE – NO ORBIT
XXXVIII	1123	581	70 & 71	C/M-1	241	38.6 & 38.6	75.1 LBS	1-3-62	2-16-62	2-27-62	6 — 2	7 — 6	3-3-62	[illegible]
XXXIX	1124	584	72 & 73	C/M-2	331	38.4 & 38.8	45 LBS	1-5-62	4-5-62	4-17-62	12 — 6	14 — 4	4-20-62	[illegible]
XXXX	1125	586	74 & 75	C/M-3	333	39.1 & 39.1	[illegible] LBS	1-26-62	4-11-62	4-28-62	6 — 2	8 — 5		[illegible]

ERS Filter.	Film Types	MIP No. -1 & -2	Rev. No. Frame#	Temp.[1] F Instr.	Temp. F S.C.	Altitude Vert NM	SUN (DEG.) Elev.	SUN (DEG.) Azimuth	Latitude Degrees	Exp. Time SEC-1	SYSTEM TEST DATA AT LAUNCH Cycles	Days at Altitude	SCAN HEAD Removed	SCAN HEAD Shimed
-23A	3404			47		85					50185	22	0 Times	0 Times
				50							-			
-25	3404	85-1	56/108	46	47	85	37.1	-8.0	251	254	45997	22	0 Times	0 Times
				53	54									
F05[2]	3404/			69		87					60110	18	0	0
	SO230			53										
F09[3]	3404/	90-1	D16/22	65	60	87	24.0	44.2	233	233	57085	18	1	1
	SO230			55	55									
F05	3404/			76		88					57423	9	1	1
	SO230			63										
-21	3404/	90-1	D79/15	69	64	88	63.1	34.0	241	411	66220	9	0	0
	SO230			61	58									
F05	3404			75		87					62042	10	2	1
				65										
-15/ND	3404/	115-1	D16/6	68	62	87	63.7	58.8	234	387	67289	10	4	2
	SO180			61	58									
E+ND	380/3404	95-1	D16/20	80	72	85	35.3	37.3	233	273	92710	20	8	2
	SO-121			71	69									
-23A	SO-380			76		85					88955	20	8	1
				69										
E+20C	3404/			63		83					86317	9	7	1
.5ND	SO-121			62										
-25	3404	110-1	D32/8	61	59	83	34.6	33.9	236	498	83507	9	7	1
				61	61									
F05	3404	95-1	D122/30	59	55	99	39.8	84.2	258	338	62313	21	3	1
		95-2	D170/20	61	55		42.2	70.0	260	413				
V-21	3404/			55		99					74867	21	5	1
	SO-340			55										
W-28	3404/			66		62/100					65346	9	5	1
	SO-242			63										
W-25	3404	105-1	D30/20	67	62	82	20.8	32.1	243	-	74412	9	11	4
		100-2	D242/20	64	63	100	31.5	1.0	234	-				
W-25	3404			64		94					60229	13	4	3

MISSION SUMMARY

~~TOP SECRET C/SPECIAL HANDLING NO. A/P 67-06089~~

MISSION NUMBER	PAYLOAD NUMBER	VEHICLE NUMBER	LAUNCH DATE	LAUNCH TIME	ORBIT INCLINATION (°)	PERIGEE ALTITUDE (NM)	PERIGEE LOCATION (°N)	RECOVERY PASS	MASTER CAMERA NUMBER	MASTER SLIT (")	MASTER FILTER TYPE	SLAVE CAMERA NUMBER	SLAVE SLIT (")	SLAVE FILTER TYPE	STELLAR-INDEX CAMERA NUMBER
1029	J-27	1623	2/2/66	2132 Z	75.1	90.5	22.5	81 / 180	178	0.275	W-25	179	0.175	W-21	D73/94/91 / D76/78/94
1030	J-29	1622	3/9/66	2202 Z	75.0	97.5	18.7	81 / 180	182	0.275	W-25	183	0.175	W-21	D84/100/107 / D82/105/102
~~1031~~	~~J-30~~	~~1627~~	4/7/66	2202 Z	75.1	104.5	23.3	112 / 177	184	0.225	W-23A	185	0.150	W-21	D85/101/89 / D86/106/86
1032	J-28	1625	5/3/66	1925 Z	—	—	—	— / —	180	0.150	W-21	181	0.150	W-21	D81/97/101 / D80/73/100
1033	J-33	1630	5/24/66	0213 Z	86.1	102.0	60.7	82 / 178	194	0.200	W-21	195	0.200	W-21	D91/108/109 / D94/102/75
1034	J-31	1626	6/21/66	2131 Z	80.1	105.4	18.2	81 / 181	186	0.200	W-23A	187	0.150	W-21	D88/103/76 / D87/107/106
1035	J-36	1628	9/20/66	2114 Z	85.0	99.5	29.1	81 / 180	188	0.225	W-23A	189	0.175	W-21	D95/112/113 / D96/104/116
1036	J-32	1631	8/9/66	2046 Z	100.0	102.4	22.9	115 / 212	190	0.200	W-23A	191	0.150	W-21	D98/110/111 / D99/109/105
1037	J-38	1632	11/8/66	1957 Z	100.0	91.9	14.5	65 / 197	198	0.225	W-23A	199	0.175	W-21	D101/123/125 / D100/126/134
1038	J-34	1629	1/14/67	2120 Z	80.1	96.9	29.2	81 / 193	192	0.225	W-23A	193	0.175	W-21	D93/92/112 / D90/111/108
1039	J-39	1635	2/22/67	2202 Z	80.0	97.0	30.2	81 / 177	206	0.225	W-23A	207	0.175	W-21	[illegible] / D100/123/125
1040	J-35	1636	3/30/67	1954 Z	85.1	90.7	20.3	81 / 145	196	0.175	W-21	197	0.225	W-23A	D79/96/96 / D92/73/110
1041	J-40	1634	5/9/67	2152 Z	85.1	100.1	33.0	83 / 215	208	0.225	W-23A	209	0.175	W-21	D106/134/133 / D102/127/127
1042	J-37	1633	6/16/67	2135 Z	80.0	96.5	29.1	97 / 240	204	0.200	W-23A	205	0.150	W-21	D97/120/117 / D95/121/118
1043	J-42	1637	8/7/67	2144 Z	80.0	102.1	16.3	113 / 240	200	0.200	W-23A	201	0.150	W-21	D107/136/135 / D112/143/139
1101	CR-1	1641	9/15/67	1941 Z	80.0	84.8	5.7	97 / 206	302	*	W-21 / W-23A	303	*	W-23A / W-25	DISIC NO. 3
1044	J-41	1639	11/2/67	2131 Z	81.6	98.9	18.4	97 / 144	202	0.225	W-23A	203	0.175	W-21	D103/122/129 / D104/132/131
1102	CR-2	1642	12/9/67	2226 Z	81.6	85.4	19.0	83 / 212	304	*	W-21 / 3F06	305	*	W-25 / 3F09	DISIC NO. 4
1045	J-45	1640	1/24/68	2226 Z	81.5	96.8	7.0	112 / 223	214	0.225	W-23A	215	0.175	W-21	D109/137/130 / D108/138/141
1046	J-46	1638	3/14/68	2200 Z	83.0	99.9	30.0	113 / 240	220	0.140**	W-23A	221	0.110**	W-21	D110/151/157 / D120/152/156
1103	CR-3	1643	5/1/68	2131 Z	83.0	87.2	19.0	116 / 228	306	*	W-21 / 3F05	307	*	W-25 / W-12	DISIC NO. 5
1047	J-47	1645	6/20/68	2146 Z	85.0	100.6	15.7	129 / 240	218	0.160	W-23A	219	0.130	W-21	D117/148/146 / D116/150/154
1104	CR-4	1644	8/7/68	2136 Z	82.1	84.3	5.7	115 / 244	308	*	W-21 / 3F05	309	*	W-25 / [illegible]	DISIC NO. 7

** SO-230 FILM USED IN MISSION 1046.

* 300 SERIES INSTRUMENTS USE VARIABLE SLIT EXPOSURE CONTROL. REFER TO FINAL REPORT, SECTION 2.

[illegible] 1/68

~~TOP SECRET C/SPECIAL HANDLING~~

TABLE 10-1

PERFORMANCE SUMMARY

~~TOP SECRET C/SPECIAL HANDLING NO. A/P 67-0600g~~

MISSION NUMBER*	CAMERA	SERIAL NUMBER	M.I.P. VALUE	AFSPPF MTF/AWM AVERAGE	AFSPPF MTF/AWM SLIT (μ)	AFSPPF MTF/AWM AVERAGE	90% ATTITUDE ERROR (°) PITCH	90% ATTITUDE ERROR (°) ROLL	90% ATTITUDE ERROR (°) YAW	90% ATTITUDE RATES (°/HR.) PITCH	90% ATTITUDE RATES (°/HR.) ROLL	90% ATTITUDE RATES (°/HR.) YAW	90% V/H ERROR (%)	90% RESOLUTION LIMIT (FEET) ALONG TRACK	90% RESOLUTION LIMIT (FEET) CROSS TRACK	I.M.C. ERROR
1045-1	FWD	214	96	68	90	—	0.23	0.47	0.86	30.3	27.1	23.8	3.8	4.0	1.0	3.4
	AFT			72			0.25	0.40	0.86	21.0	24.9	24.3	3.5	3.4	0.7	3.0
1045-2	FWD	215	90	68			0.42	0.35	0.63	35.2	37.9	26.8	2.6	3.2	2.4	2.7
	AFT			72			0.46	0.25	0.60	36.5	28.3	29.0	4.0	4.2	1.1	4.4
1046-1	FWD	220	90	87	90	—	0.21	0.52	0.80	44.3	18.0	34.0	2.2	1.8	1.4	2.3
	AFT			86			0.23	0.54	0.80	44.8	15.4	21.2	1.7	1.1	0.9	1.9
1046-2	FWD	221	85	70			0.26	0.16	0.75	47.3	17.6	19.2	1.8	1.7	1.2	2.2
	AFT			84			0.29	0.15	0.76	40.4	14.9	16.0	1.7	1.1	0.8	1.8
1103-1	FWD	306	96	80	90	—	0.25	0.31	0.60	27.4	36.8	30.7	1.9	1.1	0.8	2.1
	AFT			79			0.24	0.31	0.60	27.5	30.8	32.8	2.0	1.3	0.9	2.1
1103-2	FWD	307	96	85			0.26	0.23	0.66	24.0	37.6	34.9	2.8	2.4	1.2	2.7
	AFT			80			0.25	0.23	0.65	24.0	37.8	27.2	2.7	1.9	0.8	2.9
1047-1	FWD	210	85	63	90	—	0.18	0.23	0.82	24.2	23.8	23.1	2.6	1.7	0.9	2.1
	AFT			75			0.16	0.22	0.82	25.4	30.6	22.8	1.6	1.3	0.6	1.8
1047-2	FWD	219	85	65			0.25	0.27	–	34.3	30.6	–	3.7	3.3	4.5	4.1
	AFT			75			0.23	0.27	–	34.8	27.7	–	2.9	2.1	3.8	3.0
1104-1	FWD	308	115	115	90	—	0.35	0.21	0.88	23.9	23.4	33.4	1.2	1.2	1.5	1.3
	AFT			98			0.33	0.22	0.80	23.9	23.6	35.6	1.2	0.9	1.0	1.3
1104-2	FWD	309	115	109			0.24	0.18	0.75	21.6	23.9	30.4	1.2	1.3	1.4	1.4
	AFT			105			0.24	0.18	0.73	22.3	24.1	31.2	1.3	0.8	0.9	1.2

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~~TOP SECRET C/SPECIAL HANDLING~~

TABLE 10-2

ESTIMATED RELIABILITY SUMMARY

~~TOP SECRET~~

~~C/SPECIAL HANDLING NO. A/P 67-06089~~

(AT 50% CONFIDENCE LEVEL)

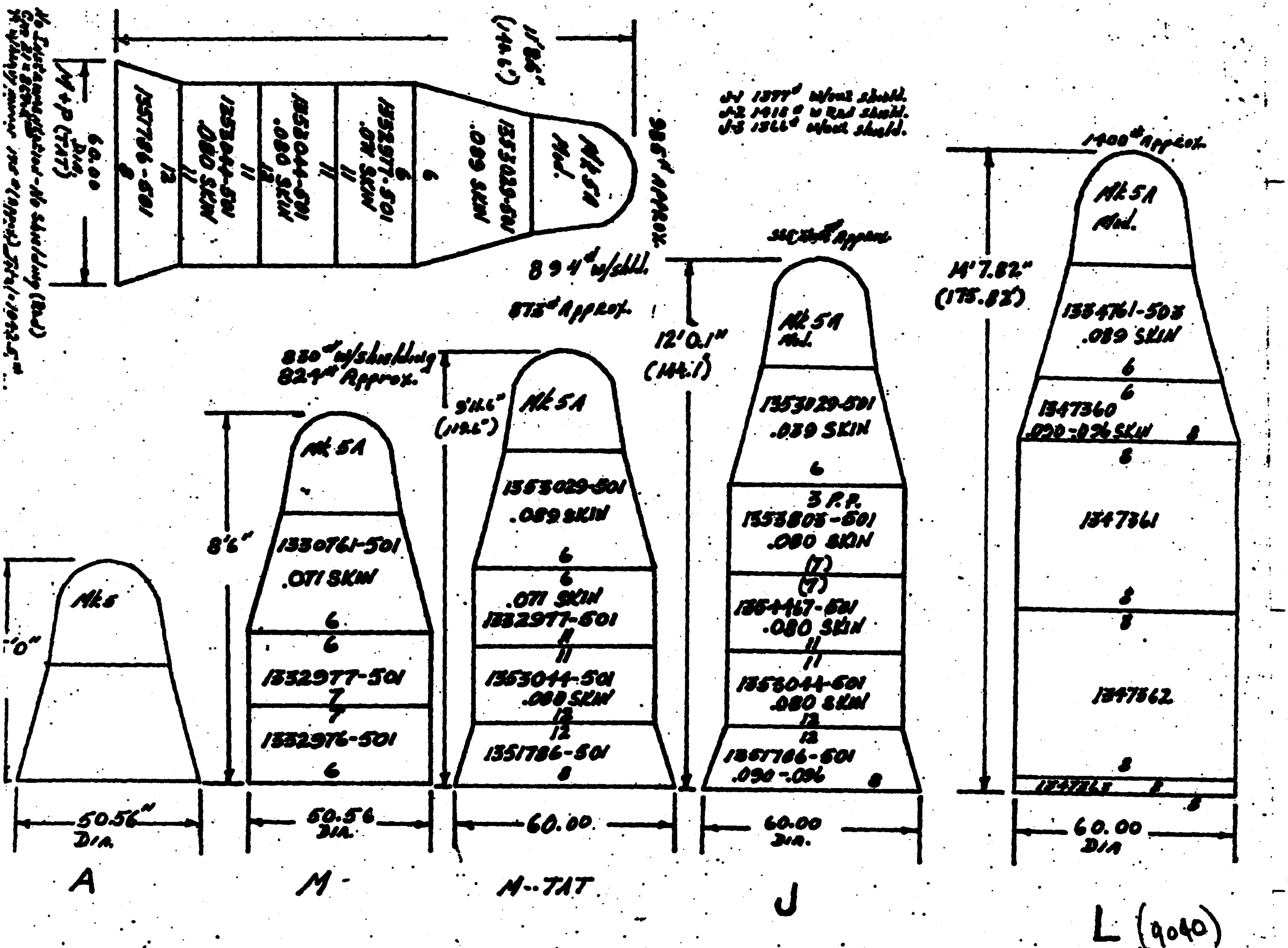
MISSION NUMBER	PRIMARY FUNCTIONS															SECONDARY FUNCTIONS					
	PANORAMIC CAMERA			PANORAMIC CAMERA DOORS			COMMAND & CONTROL SYSTEM			PAYLOAD CLOCK			ON-ORBIT FUNCTIONS	RECOVERY SYSTEM			STELLAR-INDEX CAMERAS			HORIZON CAMERAS		
	SAMPLE	FAILURES	RELIABILITY	SAMPLE	FAILURES	RELIABILITY	SAMPLE	FAILURES	RELIABILITY	SAMPLE	FAILURES	RELIABILITY	RELIABILITY	SAMPLE	FAILURES	RELIABILITY	SAMPLE	FAILURES	RELIABILITY	SAMPLE	FAILURES	RELIABILITY
1101	191	2	98.6	122	0	99.4	11,208	2	** 98.1	11,208	0	** 99.9	** 96.5	87	1	98.1	12,900	0	* 77.2	112,000	0	99.1
1044	195	2	98.6	124	0	99.5	11,484	2	98.1	11,484	0	99.9	96.5	89	1	98.1	20,400	4	98.3	116,000	0	99.1
1102	199	2	98.7	126	0	99.5	11,736	2	98.2	11,736	0	99.9	96.6	91	1	98.2	17,708	1	* 63.8	118,000	0	99.1
1045	203	2	98.7	128	0	99.5	12,072	2	98.3	12,072	0	99.9	96.8	93	1	98.2	29,330	4	95.8	121,000	0	99.1
1046	207	2	98.7	130	0	99.5	12,432	2	98.4	12,432	0	99.1	96.8	95	1	98.2	36,180	4	98.8	124,000	0	99.2
1103	211	2	98.7	132	0	99.6	12,768	2	98.5	12,768	0	99.1	96.9	97	1	98.3	22,365	1	* 90.9	127,000	0	99.2
1047	215	2	98.8	134	0	99.5	13,130	2	98.6	13,130	0	99.1	97.0	99	1	98.3	38,000	1	92.5	130,000	0	99.2
1104	219	2	98.8	136	0	99.5	13,490	2	98.7	13,490	0	99.1	97.0	101	1	98.3	27,365	1	* 74.4	133,000	0	99.2

** CALCULATIONS ADJUSTED TO NOMINAL 14-DAY MISSION STANDARD

* DISIC REPLACES S/I CAMERAS ON 1100 SERIES SYSTEMS

~~TOP SECRET C/SPECIAL HANDLING~~

TABLE 10-3



J-1 1377# w/out shield.
J-2 1415# w Rad shield.
J-3 1366# w/out shield.
1400# Approx.
Mk 5A
Mod.
14'7.82"
(175.82")
1354761-503
.089 SKIN
6
6
1347360
.090-.096 SKIN
8
8
1347361
8
8
1347362
8
1347363
8
8
60.00
DIA
L (9040)
Mk 5A
Mod.
12'0.1"
(144.1")
1353029-501
.039 SKIN
6
3 P.P.
1353805-501
.080 SKIN
(7)
(7)
1354467-501
.080 SKIN
11
11
1353044-501
.080 SKIN
12
12
1351786-501
.090-.096
8
60.00
DIA.
J
894# w/shld.
875# Approx.
9'11.6"
(119.6")
Mk 5A
1353029-501
.089 SKIN
6
6
.071 SKIN
1352977-501
11
11
1353044-501
.080 SKIN
12
12
1351786-501
8
60.00
M-TAT
830# w/shielding
824# Approx.
8'6"
Mk 5A
1330761-501
.071 SKIN
6
6
1352977-501
7
7
1352976-501
6
50.56
DIA.
M
Mk 5
50.56"
DIA.
A
11'8.6"
(140.6")
60.00
DIA
M+P (TAT)
1351786-501
8
12
1353044-501
.080 SKIN
11
1352977-501
.071 SKIN
6
.089 SKIN
1353029-501
Mk 5A
Mod.
985# Approx.

DISCOVERER PERFORMANCE

SPECIAL HANDLING

Program Flight Number	Vehicle Number	Thor Number	[illegible] Number	Mission Number	Instr. Type	Instr. Number	SRV Number	Date Received at A/P	Ship to Pad	[illegible]	Total [illegible] Flight	[illegible]	Flight Date	[illegible]	Recovery Date	Summary	
1	1022	163											2/28/59			NO CAPSULE FLOWN.	
2	1018	170			DIG.								4/13/59			CAPSULE EJECTED OVER SPITZBERGEN 4/13/59.	
3	1020	174			DIG.								6/3/59			AGENA FAILED TO ORBIT.	
4	1023	179	002	9001	C	4	102	5/5/59	5/28/59	3—3	7—2	16	6/25/59	0	NO ORBIT	AGENA FAILED TO ORBIT.	
5	1029	192	004	9003	C	7	111	6/2/59	7/22/59	6—6	9—6	20	8/13/59	0.465		LOW TEMPERATURES. NOT RECOVERED. INSTRUMENT FAILED ON REV. [illegible].	
6	1028	200	003	9002	C	6	105	5/19/59	6/3/59	2—2	13—2	16	8/19/59	0.165		RETRO-ROCKET MALFUNCTION. NOT RECOVERED. INSTRUMENT FAILED ON REV. [illegible].	
7	1051	206	006	9004	C	10	109	6/24/59	7/23/59	4—1	10—3	10	11/7/59	0	NO ORBIT	AGENA FAILURE. NO ORBIT.	
8	1050	212	007	9005	C	9	107	7/25/59	11/7/59	15—0	16—6	10	11/20/59	0		ECCENTRIC ORBIT. WRONG ALTITUDE. INSTRUMENT FAILURE. NOT RECOVERED.	
9	1052	218	008	9006	C	8	113	6/26/59	1/10/60	28—0	31—4	10	2/4/60	0	NO ORBIT	AGENA FAILED TO ORBIT.	
10	1054	223	009	9007	C	13	110	12/7/59	2/4/60	8—3	10—4	10	2/19/60	0	NO ORBIT	AGENA FAILED TO ORBIT.	
11	1055	234	010	9008	C	14	103	1/11/60	2/24/60	6—2	13—3	16	4/15/60	16		SPIN ROCKET FAILURE. NOT RECOVERED. INSTRUMENT OPERATION O.K.	
12	1053	DIAGNOSTIC	014	N/A	N/A	5							6/29/60	0	NO ORBIT	AGENA FAILED TO ORBIT, DIAGNOSTIC.	
13	1057	DIAGNOSTIC	012	N/A	N/A	12							8/10/60	0	8/11/60	SUCCESSFUL WATER PICK-UP, DIAGNOSTIC.	
14	1056	237	011	9009	C	3	101	1/28/60	3/28/60	8—4	23—0	20	8/18/60	20	8/19/60	SUCCESSFUL AIR CATCH. INSTRUMENT OPERATION O.K.	
15	1058	246	013	9010	C	11	106	2/28/60	6/28/60	25—3	29—1	20	9/13/60	20		CAPSULE PITCH ATTITUDE INCORRECT AT RE-ENTRY. CAPSULE SUNK BEFORE RECOVERY. INSTRUMENT OPERATION O.K.	
16	1061	253	015	9011	C'	15	506	6/6/60	9/17/60	14—5	20—2	20	10/26/60	0	NO ORBIT	[illegible] TIMER MALFUNCTION. AGENA FAILED TO ORBIT.	
17	1062	297	016	9012	C'	17	507	9/12/60	10/17/60	5—0	9—6	30	11/12/60	LT LEAKED	11/14/60	SUCCESSFUL AIR CATCH. PAYLOAD BROKE. T/M NO. 34	
18	1103	296	017	9013	C'	19	508	10/3/60	10/29/60	2—6	6—3	30	12/7/60	30	12/10/60	SUCCESSFUL AIR CATCH. INSTRUMENT OPERATION O.K. T/M NO. 37	
19	1101	250	N/A	N/A	N/A	N/A	N/A						12/20/60	0		NO SRV INSTALLED. (RM-1 PAYLOAD)	
20	1104	298	018	9014A	A	3	520	10/18/60	10/21/60	9—1	17—3	30	2/17/61	30		ORBITAL PROGRAMMER FAILED AT REV. [illegible]. INSTRUMENT FAILED. STILL IN ORBIT. NO RECOVERY PROGRAM.	
21	1102	261	N/A	N/A	N/A	N/A	N/A						2/18/61	0		NO SRV INSTALLED. (RM-2 PAYLOAD)	
22	1105	300	019	9015	C'	18	509	2/21/61	3/23/61	5—0	5—2	30	3/30/61	0	NO ORBIT	AGENA FAILURE. NO ORBIT. T/M NO. 39	
23	1106	307	020	9016A	A	4	521	11/28/60	3/16/61	15—1	18—3	30	4/8/61	30		RECOVERY WAS ATTEMPTED ON REV. [illegible] DUE TO LOSS OF CONTROL GAS. STILL IN ORBIT. INSTRUMENT OPERATION O.K.	
24	1108	302	022	9018A	A	8	541	4/3/61	5/25/61	7—3	9—3	30	6/8/61	0	NO ORBIT	AGENA FAILURE. POWER FAILURE AND GUIDANCE PROBLEM CAUSING [illegible].	
25	1107	306	021	9017	C'	16	510	3/7/61	4/17/61	5—6	14—3	30	6/16/61	30	6/18/61	SUCCESSFUL WATER PICK UP.	
26	1109	308	023	9019	C'	20	511	10/10/60	5/16/61	20—6	37—3	30	7/7/61	20.78	7/9/61	SUCCESSFUL AIR CATCH. INSTRUMENT FAILED ON REV. [illegible]	75%
27	1110	322	024	9020A	A	7	524	4/4/61	6/24/61	11—3	15—3	30	7/21/61	0	NO ORBIT	NO ORBIT. THOR GUIDANCE DESTRUCT.	0
28	1111	309	025	9021	C'	21	512	11/15/60	6/20/61	26—6	37—3	30	8/3/61	0	NO ORBIT	AGENA GUIDANCE FAILURE.	0
29	1112	323	027	9023	C'''	54	554	6/28/61	8/17/61	7—6	9—5	30	8/30/61	30	9/1/61	RECOVERY ON REV. (33). INSTRUMENT O.K.	100%
30	1113	319	026	9022	C'''	53	551	5/29/61	7/17/61	7—0	15—1	30	9/12/61	30	9/14/61	SUCCESSFUL AIR CATCH. RECOVERY ON REV. (33).	100
31	1114	324	029	9024	C'''	56	552	5/22/61	8/23/61	13—2	16—5	30	9/17/61	20	NO RECOVERY	SUCCESSFUL ORBIT. POWER FAILURE BEFORE RECOVERY PRECLUDED THE EVENT. INSTRUMENT O.K. [illegible]	0%
32	1115	320	032	9025	C'''	56	555	8/9/61	9/14/61	5—1	9—2	30	10/13/61	12.4	10/14/61	SUCCESSFUL AIR CATCH. SUSPECT AGENA POWER PROBLEMS. HAD TO ATTEMPT RECOVERY ON REV. [illegible]	25%
33	1116	329	028	9026	C'	22	513	3/10/61	7/20/61	10—0	31—4	30.5	10/23/61	0	NO ORBIT	SECOND STAGE (AGENA) FAILED. WENT INTO SEA AFTER TAKE-OFF.	0
34	1117	330	033	9027	C'	24	553	5/20/61	9/26/61	10—1	23—6	30	11/5/61	30		SUCCESSFUL ORBIT. DUE TO GAS VALVE FAILURE, NO RECOVERY MADE. STILL IN ORBIT. INSTRUMENT OPERATION O.K.	0
35	1118	326	037	9028	C'	25	523	8/30/61	10/10/61	7—0	11—0	30	11/15/61	13	11/16/61	ONE DAY OPERATION DUE TO SHORTAGE OF CONTROL GAS. INSTRUMENT OPERATION O.K. [illegible]	25%
36	1119	325	039	9029	C'''	52	525	11/10/61	11/27/61	2—3	4—4	39.2	12/12/61	39.2	12/16/61	SUCCESSFUL ORBIT. RECOVERED ON REV. (64). SUCCESSFUL WATER PICK-UP. INSTRUMENT OPERATION O.K.	100%
37	1120	327	040	9030	C'''	57	571	11/16/61	12/19/61	4—5	6—2	38.6	1/13/62	0	NO ORBIT	AGENA FAILURE. NO ORBIT.	0

[illegible]
Sept. [illegible]

241 PROGRAM PERFORMANCE

PROG. FLT. NO.	VEH. NO.	THOR NO.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	SUMMARY
38	1123	241	041	9031	Cm-1	70-71	301	37	74	N/A	N/A	70-71	7	1/2/62	2/10/62	6—2	7—6	37.6 - 37.8	2/27/62	78.1	66	3/2/62	[illegible]
39	1124	331	042	9032	Cm-2	72-73	304	55	NONE	N/A	N/A	72-73	1	1/5/62	4/3/62	12—5	14—4	38.4 - 37.5	4/17/62	48.9	33	4/20/62	[illegible]
40	1125	333	043	9033	Cm-3	74-75	306	82	76	N/A	N/A	74-75	6	1/20/62	4/11/62	10—5	13—1	38.1 - 38.1	4/28/62	68.5	84	—	[illegible]
41	1126	334	044	9034	A-5	A	302	38	N/A	N/A	N/A	N/A	13	2/28/61	4/20/62	47—4	50—5	39.4	5/15/62	39.4	63	5/18/62	[illegible]
42	1128	336	045	9035	Cm-4	76-77	305	30	82	N/A	N/A	76-77	9	2/10/62	5/15/62	12—2	14—4	38.7 - 38.5	5/29/62	79.2	40	6/1/62	[illegible]
43	1127	338	046	9036	Cm-5	78-79	303	44	79	N/A	N/A	78-79	8	3/1/62	5/30/62	11—4	13—1	40.6 - 40.5	6/1/62	81.1	0	—	[illegible]
44	1129	339	047	9037	Cm-6	80-81	301	46	88	N/A	N/A	84-85	10	3/22/62	6/20/62	10—0	13—2	40.1 - 40.2	6/22/62	80.3	89	6/26/62	[illegible]
45	1131	340	048	9038	Cm-7	84-85	302	90	90	N/A	N/A	86-87	3	3/30/62	6/15/62	12—1	14—2	40.1 - 39.9	6/27/62	80.0	63	7/1/62	[illegible]
46	1130	342	049	9039	Cm-8	90-91	303	30	90	N/A	N/A	88-89	13	4/11/62	6/30/62	10—9	14—2	40.2 - 40.2	7/20/62	19.7	33	7/25/62	[illegible]
47	1131	347	050	9040	Cm-9	92-93	304	38	86	N/A	N/A	86-87	16	4/19/62	7/2/62	10—5	14—1	38.4 - 38.3	7/27/62	78.7	66	7/31/62	[illegible]
48	1152	344	051	9014	Cm-10	88-89	305	60	94	N/A	N/A	94-95	5	4/30/62	7/10/62	11—1	13—2	38.5 - 38.4	8/1/62	78.9	66	8/3/62	[illegible]
49	1153	346	052	9044	Cm-11	92-93	306	38	84	N/A	N/A	100-105	19	5/19/62	8/24/62	15—6	14—3	38.4 - 38.3	8/28/62	78.7	68	9/1/62	[illegible]
50	1132	349	054	9042	A-10	A	300	63	N/A	N/A	N/A	N/A	202	5/22/62	9/5/62	6—3	10—1	38.3	9/1/62	38.3	66	—	[illegible]
51	1133	350	055	9043	Cm-12	94-95	307	68	100	N/A	N/A	98-99	4	5/15/62	9/1/62	15—3	17—5	40.2 - 40.2	9/17/62	44.2	17	9/18/62	[illegible]
52	1134	351	056	9046	Cm-13	96-97	308	64	9-3	N/A	N/A	104-105	11	6/20/62	9/5/62	12—1	14—3	38.6 - 38.5	9/29/62	80.0	49	10/2/62	[illegible]
53	1134	352	057	9046	A-9	A	603	66	N/A	N/A	N/A	N/A	10	3/31/62	9/20/62	26—1	27—3	38.3	10/9/62	38.3	65	10/12/62	[illegible]
54	1401				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10/26/62	N/A	N/A	—	[redacted]
55	1134	367	058	9047	Cm-14	98-99	300	34	9-5	N/A	N/A	106-107	24	6/29/62	10/23/62	17—1	19—0	38.8 - 38.6	11/5/62	79.4	66	11/9/62	[illegible]
56	1135	363	059	9048	Cm-15	100-101	301	62	9-7	N/A	N/A	100-101	23	7/10/62	11/10/62	17—5	19—4	38.4 - 38.4	11/24/62	78.8	81	11/28/62	[illegible]
57	1166	361	060	9049	Cm-16	86-87	306	36	9-2	N/A	N/A	116-117	17	8/10/62	11/20/62	9—3	10—6	38.6 - 38.9	12/4/62	67.9	0	—	[illegible]
58	1156	368	061	9050	Cm-17	102-103	307	70	9-4	N/A	N/A	114-115	18	8/15/62	12/7/62	16—4	17—4	38.7 - 38.8	12/14/62	79.3	64	12/18/62	[illegible]
59	1157	369	063	9051	Cm-18	104-105	308	60	9-5	N/A	N/A	108-109	21	10/25/62	12/20/62	8—2	10—6	38.1 - 38.0	1/7/63	78.1	84	1/11/63	[illegible]
60	1159	370	064	9052	Cm-20	108-109	310	67	9-6	N/A	N/A	120-121	12	12/6/62	2/15/63	3—3	12—1	38.3 - 38.5	2/28/63	0	0	—	[illegible]
61	1164	360	065	8001	L-1	63	612	70	5-2	T/L-1	N/A	8	300	11/27/62	3/2/63	14—0	15—5	72.2	3/18/63	0	0	—	[illegible]
62	1160	375	066	9055	Cm-19	106-107	309	80	9-10	N/A	N/A	118-119	22	3/21/62	2/28/63	25—3	27—2	38.9 - 38.8	4/1/63	86.7	49	4/4/63	[illegible]
63	1411	372	067	9085	A-12	A	605	54	N/A	N/A	N/A	N/A	205	1/10/63	4/10/63	12—6	15—1	38.3	4/26/63	0	0	—	[illegible]
64	1165	364	069	8002	L-2	68	613	86	3-3	T/L-2	N/A	4	302	2/28/63	4/14/63	8—5	11—4	72.9	5/18/63	0	33	5/20/63	[illegible]
65	1161	362	068	9054	M-21	112-113	616	68	9-9	N/A	N/A	110-111	26	12/7/62	4/15/63	18—1	20—3	38.5 - 38.2	5/12/63	78.7	65	6/16/63	[redacted]
66	1166	381	070	9085	M-22	110-111	611	62	9-11	N/A	N/A	130-131	20	4/18/63	6/1/63	6—5	10—2	38.5 - 38.4	6/26/63	78.9	65	6/30/63	
67	1412	388	071	9087	M-23	120-121	604	56	9-12	T/U-12	N/A	128-129	14	5/1/63	6/18/63	6—4	11—2	38.1 - 38.1	7/18/63	78.2	64	7/22/63	
68	1167	382	072	8003	L-3	91	614	96	3-4	T/L-6	N/A	7	304	3/7/63	7/8/63	17—4	20—5	73.1	7/30/63	19.8	32	8/1/63	[illegible]
69	1162	377	073	1001	J-1A	114-115	615	65	9-14	T/U-15	2/C-3	T-5	402	4/1/63	8/2/63	17—5	20—5	81.5	8/24/63	81.5	64	8/28/63	[illegible]
	1162	377	073	1001	J-1B	114-115	617	01	9-16	T/U-10	2/C-3	T-4	402	4/1/63	8/2/63	17—5	20—5	81.5	8/24/63	0	0	—	[illegible]
70	1169	394	074	9056	A-11	A	604	84	N/A	N/A	N/A	N/A	205	3/5/62	8/2/63	47—5	51—4	38.9	8/29/63	38.9	66	9/2/63	[illegible]
71	1163	383	075	1002	J-2A	116-117	619	66	9-18	T/J-4	2/C-4	T-3	404	4/24/63	8/27/63	17—6	21—5	81.7	9/23/63	81.9	40	9/26/63	[illegible]
[illegible]	1163	383	075	1002	J-2B	116-117	620	60	9-13	T/U-13	2/C-4	T-6	404	4/24/63	8/27/63	17—6	21—5	82.5	9/23/63	0	100	—	[illegible]
72	1407	396	079	9089	A-6	A	602	50	N/A	N/A	N/A	N/A	204	2/21/61	10/8/63	136—6	139—5	40.1	10/28/63	40.1	66	11/3/63	[illegible]
73	1171	400	078	9060	M-24	128-129	632	48	9-27	T/J-12	N/A	T-23	504	8/10/63	10/30/63	11—4	13—0	78.7	11/9/63	0	0	—	[illegible]
74	1172	406	080	9061	M-25	134-135	637	75	9-35	T/J-21	N/A	T-29	25	9/27/63	11/18/63	7—4	8—5	37.9 - 37.8	11/27/63	78.7	81	—	[illegible]
75	1168	398	081	9062	M-26	130-131	642	61	9-34	T/J-15	N/A	T-24	306	10/04/63	1/12/63	4—6	8—2	38.4 - 38.6	12/21/63	77.8	81	12/28/63	[illegible]
76	1174	389	084	1004	J-3A	124-125	629	64	9-29	T/U-20	2/C-7	T-30	505	6/28/63	2/1/64	31—4	35—4	79.0	2/15/64	79.0	49	2/18/64	[illegible]
	1174	389	084	1004	J-3B	124-125	628	65	9-42	T/J-6	2/C-7	T-10	505	6/25/63	2/1/64	31—4	35—4	79.2	2/15/64	79.2	112	2/22/64	[illegible]
77	1175	395	088	1003	J-6A	126-143	631	106	9-36	T/U-17	2/C-8	T-17	506	7/26/63	3/6/64	32—8	34—4	78.7	3/24/64	0	0	—	[illegible]
	1175	395	088	1003	J-6B	126-143	630	103	9-31	T/U-18	2/C-8	T-18	506	7/26/63	3/6/64	32—8	34—4	78.9	3/24/64	0	0	—	[illegible]

241 PROGRAM PERFORMANCE

PROG FLT NO.	VEH NO.	THOR NO.	[illegible]	MISSION NO.	INSTR. TYPE	INSTR. NO.	SRV NO.	T/M NO.	S/I NO.	S/I T/U GASKET	[illegible] CASE	MAIN T/U GASKET	[illegible]	INSTR. [illegible] A/P	SHIP TO BASE	[illegible] A/P	[illegible] FLT	[illegible] FLOWN	FLIGHT DATE	[illegible] TRANSF.	[illegible]	[illegible] DATE	SUMMARY
78	1004	393	093	1005	J-8A	[illegible]	018	120	D-39	T/J-30	2/C-10	T-13	513	1/15/64	4/10/64	12-0	14-3	78.4	4/27/64	0	0	—	[illegible] DUE TO PYRO [illegible] FAILURE [illegible] INSTR. FAILED DUE TO FILM MATERIAL BREAKAGE.
	1004	393	093	1005	J-8B	[illegible]	038	121	D-40	T/J 26	2/C-10	T-35	513	[illegible]	4/10/64	12-0	14-3	78.4	4/27/64	0	0	—	
79	1176	405	094	1006	J-9A	[illegible]	030	107	D-43	T/U-14	2/C-11	T-21	[illegible]	[illegible]	[illegible]	12-3	16-2	78.3	6/4/64	78.5	65	6/8/64	[illegible] AIR RECOVERY. [illegible] INSTRUMENT [illegible]
	1176	405	094	1006	J-9B	[illegible]	039	104	D-49	T/U-30	2/C-11	T-30	[illegible]	[illegible]	[illegible]	12-3	16-2	78.3	6/4/64	78.5	126	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION GOOD.
80	1000	400	096	9003	A-21	21	651	51	NA	NA	NA	NA	526	6/3/64	6/2/64	12-8	14-2	36.6	6/19/64	36.6	96	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION GOOD. CLOUD COVERAGE 60-70%.
81	1009	410	095	1007	J-7A	[illegible]	034	106	D-43	T/U-11	2/C-9	T-11	300	[illegible]	[illegible]	19-1	24-3	80.1	6/19/64	80.1	85	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION GOOD. RESOLUTION GOOD.
	1009	410	095	1007	J-7B	[illegible]	033	119	D-24	T/U-15	2/C-9	T-18	309	[illegible]	[illegible]	19-1	24-3	78.9	6/19/64	78.9	128	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION GOOD.
82	1177	404	097	1008	J-10A	[illegible]	040	109	D-45	T/U-15	2/C-12	T-31	514	2/27/64	[illegible]	11-4	19-0	80.1	7/10/64	80.1	49	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
	1177	404	097	1008	J-10B	[illegible]	041	112	D-35	T/U-9	2/C-12	T-14	514	[illegible]	[illegible]	11-4	19-0	80.2	7/10/64	80.2	112	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
83	1006	413	098	1009	J-12A	[illegible]	046	136	D-36	T/U-23	2/C-13	T-57	517	[illegible]	[illegible]	12-4	16-2	79.2	8/5/64	69.5	49	8/8/64	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible] PROBLEM.
	1006	413	098	1009	J-12B	[illegible]	047	116	D-36	T/U-34	2/C-13	T-34	517	[illegible]	[illegible]	12-4	16-2	79.4	8/5/64	79.4	128	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
84	1005	412	099	9006A	A-22	22	667	71	NA	NA	NA	NA	526	4/9/64	6/4/64	10-0	20-3	39.4	8/21/64	39.4	96	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible] CLOUD COVERAGE [illegible]%.
85	1176	405	100	1010	J-11A	[illegible]	044	113	D-41	T/U-27	2/C-[illegible]	T-27	510	3/12/64	7/14/64	17-5	26-3	80.5	9/14/64	80.5	65	9/18/64	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
	1176	405	100	1010	J-11B	[illegible]	[illegible]	118	D-44	T/U-30	2/C-[illegible]	T-44	510	3/12/64	7/14/64	17-5	26-3	81.5	9/14/64	81.5	144	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
86	1170	421	105	1011	J-[illegible]A	[illegible]	[illegible]	119	D-39	T/U-[illegible]	2/C-16	T-40	[illegible]	[illegible]	[illegible]	12-1	16-2	78.9	10/5/64	66.9	65	10/9/64	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible] FAILED.
	1170	421	105	1011	J-[illegible]B	[illegible]	054	131	D-37	T/J-8	2/C-16	T-20	[illegible]	[illegible]	[illegible]	12-1	16-2	72.7	10/5/64	66.3	—	—	[illegible] ATTEMPTED RECY. [illegible]
87	1179	416	107	1012	J-13A	[illegible]	051	117	D-51	T/U-[illegible]	2/C-5	T-43	507	3/30/64	[illegible]	17-3	26-5	79.7	[illegible]	66.3	49	[illegible]	[illegible]
	1179	416	107	1012	J-13B	[illegible]	048	114	D-46	T/U-32	2/C-5	T-32	507	[illegible]	[illegible]	17-3	26-5	79.7	[illegible]	36.5	81	[illegible]	[illegible]
88	1173	420	108	1013	J-15A	[illegible]	056	127	D-52	T/U-27	2/C-[illegible]	T-55	519	4/17/64	[illegible]	21-5	26-3	79.2	11/2/64	80.4	65	11/6/64	[illegible]
	1173	420	108	1013	J-15B	[illegible]	057	133	D-47	T/U-36	2/C-[illegible]	T-40	519	4/17/64	[illegible]	21-5	26-3	79.1	11/2/64	0	81	11/7/64	[illegible]
89	1180	416	110	1014	J-16A	162	[illegible]	129	D-53	T/J-2	2/C-21	T-7	520	6/4/64	[illegible]	20-4	23-6	79.1	11/18/64	80.0	81	11/22/64	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
	1180	416	110	1014	J-16B	130	[illegible]	132	D-30	T/U-33	2/C-21	T-12	520	6/14/64	11/4/64	11-5	13-5	79.4	11/18/64	72.9	145	11/27/64	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
90	1007	424	111	1015	J-17A	130	062	129	D-61	T/J-25	2/C-22	T-63	524	[illegible]	[illegible]	[illegible]-0	63-6	78.9	12/10/64	76.9	81	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
	1007	424	111	1015	J-17B	141	063	140	D-56	T/J-39	2/C-22	T-38	524	[illegible]/65	[illegible]	[illegible]-1	57-0	79.0	[illegible]	66.7	175	[illegible]	[illegible] AIR RECY. [illegible]
91	1606	414	112	1016	J-18A	132	065	136	D-55	T/U-21	2/C-23	T-47	523	9/6/63	[illegible]	65-3	70-6	78.7	1/15/65	77.7	81	1/20/65	[illegible]
	1606	414	112	1016	J-18B	133	066	106	D-59	T/U-28	2/C-23	T-29	523	9/6/63	[illegible]	65-3	70-6	72.5	1/15/65	72.5	150	[illegible]	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
92	1611	432	119	1017	J-14A	140	[illegible]	100	D-21	T/U-22	2/C 24	T-25	[illegible]	[illegible]/63	[illegible]	57-2	66-5	79-6	2/22/65	81.2	81	2/2/65	[illegible] AIR RECOVERY. INSTRUMENT OPERATION [illegible]
	1611	432	119	1017	J-14B	106	025	112	D-60	T/J-23	2/C 24	T-32	[illegible]	6/13/64	[illegible]	57-2	66-5	76.7	2/22/65	75.7	145	3/6/65	[illegible] AIR RECOVERY [illegible] INSTRUMENTAL [illegible]

[illegible]

DISCOVERER PERFORMANCE

DISCOVERER NUMBER	VEHICLE NUMBER	CAPSULE NUMBER	INSTRUMENT NUMBER	INSTRUMENT TYPE	THOR NUMBER	PAYLOAD WEIGHT FLOWN	PAYLOAD WEIGHT [illegible]	RECEIVING INSPECTION AT "A/P"	SHIPPED FROM "A/P"	FLIGHT DATE	WEEKS AT "A/P"	WEEKS AT "A/P"	TOTAL WEEKS TILL FLIGHT	RECOVERED	SUMMARY
I	1022				163					2-28-59					NO CAPSULE FLOWN
II	1018			BIO.	170					4-13-59					CAPSULE EJECTED OVER SPITZBERGEN 4-13-59
III	1020			BIO.	174					6-3-59					AGENA FAILED TO ORBIT
IV	1023	102	4	C	179	16 LBS.	0	5-5-59	5-29-59	6-25-59	3	3	7 — 2	NO ORBIT	AGENA FAILED TO ORBIT
V	1029	111	7	C	192	20 LBS.	0.405	6-5-59	7-23-59	8-13-59	6	6	9 — 6		LOW TEMPERATURES — NOT RECOVERED INSTRUMENT FAILED ON REV.(1)
VI	1028	105	6	C	200	16 LBS.	0.108	5-18-59	6-3-59	8-19-59	2	2	13 — 2		RETRO ROCKET [illegible] - NOT RECOVERED INSTRUMENT FAILED ON REV.(6)
VII	1051	109	10	C	206	10 LBS.	0	6-24-59	9-23-59	11-7-59	4	1	19 — 3	NO ORBIT	AGENA FAILURE — NO ORBIT
VIII	1050	107	9	C	212	10 LBS.	0	9-25-59	11-7-59	11-20-59	15	0	15 — 13		[illegible] ORBIT - [illegible] — NOT RECOVERED
IX	1052	113	8	C	218	10 LBS.	0	6-28-59	1-10-60	2-4-60	28	0	31 — 4	NO ORBIT	AGENA FAILED TO ORBIT
X	1054	110	13	C	223	10 LBS.	0	12-7-59	2-4-60	2-19-60	8	3	10 — 4	NO ORBIT.	AGENA FAILED TO ORBIT
XI	1055	103	14	C	234	16 LBS.	16 LBS.	1-11-60	2-29-60	4-15-60	6	2	13 — 3		SPIN ROCKET FAILURE — NOT RECOVERED INSTRUMENT OPERATION O.K.
XII	1053	104 2	N/A	N/A	DIAGNOSTIC		0			6-29-60				NO ORBIT	AGENA FAILED TO ORBIT — DIAGNOSTIC
XIII	1057	152 2	N/A	N/A	DIAGNOSTIC		0			8-10-60				8-11-60	SUCCESSFUL WATER PICK-UP — DIAGNOSTIC
XIV	1056	101 [illegible] 2	3	C	237	20 LBS.	20 LBS.	1-28-60	3-28-60	8-18-60	8	3	28 — 6	8-19-60	SUCCESSFUL AIR CATCH INSTRUMENT OPERATION O.K.
XV	1058	108 [illegible] 2	11	C	246	20 LBS.	20 LBS.	2-22-60	8-25-60	9-13-60	26	2	29 — 0		[illegible] — INSTRUMENT OPERATION O.K.
XVI	1061	506 4	15	C'	253	20 LBS.	0	6-6-60	9-17-60	10-26-60	14	5	20 — 2	NO ORBIT	"D" TIMER MALFUNCTION - AGENA FAILED TO ORBIT
XVII	1062	507 4	17	C'	297	39 LBS.	1.7 [illegible]	9-12-60	10-17-60	11-20-60	5	0	9 — 6	11-22-60	SUCCESSFUL AIR CATCH - PAYLOAD [illegible]
XVIII	1103	508 4	19	C'	296	39 LBS.	39 LBS	10-9-60	10-29-60	12-7-60	2	6	8 — 3	12-10-60	SUCCESSFUL AIR CATCH INSTRUMENT OPERATION O.K.
XIX	1101	N/A 2	N/A	N/A	258		0			12-20-60					NO SRV INSTALLED - (RM-1 PAYLOAD)
XX	1104	520 5	3	A	298	39 LBS.	39 LBS.	10-18-60	12-21-60	2-17-61	9	4	17 — 3		ORBITAL PROGRAMMER FAILED AT REV.(31) INSTRUMENT FAILED - [illegible]
XXI	1102	N/A 2	N/A	N/A	261		0			2-18-61					NO SRV INSTALLED - (RM - 2 PAYLOAD)
XXII	1105	509 4	18	C'	300	39 LBS.	0	2-21-61	3-28-61	3-30-61	5	0	5 — 2	NO ORBIT	AGENA FAILURE - NO ORBIT
XXIII	1106	521 5	4	A	307	39 LBS.	39 LBS	11-30-60	3-16-61	4-8-61	15	2	18 — 4		[illegible] — INSTRUMENT OPERATION O.K.
XXIV	1108	541 5	8	A	302	39 LBS.	0	4-3-61	5-25-61	6-8-61	7	3	9 — 3	NO ORBIT	AGENA FAILURE - POWER FAILURE AND GUIDANCE PROBLEM [illegible]
XXV	1107	510 4	16	C'	309	39 LBS.	39 LBS	3-7-61	4-17-61	6-16-61	5	6	14 — 3	6-18-61	SUCCESSFUL WATER PICK-UP
XXVI	1109	511 4	20	C'	308	39 LBS.	28.78 LBS.	10-18-61 2-21-61	2-14-61 5-18-61	7-7-61	16 / 12	0 / 6	1 — 0 / 7 — 4	7-9-61	SUCCESSFUL AIR CATCH INSTRUMENT FAILED ON REV.(22)
XXVII	1110	524 5	7	A	322	39 LBS.	0	4-4-61	6-24-61	7-21-61	11	4	15 — 3	NO ORBIT	NO ORBIT - THOR GUIDANCE [illegible]
XXVIII	1111	512 4	21	C'	309	39 LBS.	0	11-15-60 4-17-61	3-4-61 7-20-61	8-2-61	16 / 4	6 / 5	6 — 2 / 10 — 2	NO ORBIT	AGENA GUIDANCE FAILURE
XXIX	1112	559 4	54	C'''	323	39 LBS.	39 LBS.	6-23-61	8-17-61	8-30-61	7	6	9 — 5	9-1-61	RECOVERY ON REV.(32) INSTRUMENT O.K.
XXX	1113	551	53	C'''	310	39 LBS	39 LBS	5-29-61	7-17-61	9-12-61	7	0	15 — 0	9-14-61	SUCCESSFUL AIR CATCH [illegible] ON REV.(33)
XXXI	1114	552	55	C'''	324	39 LBS.	20 LBS	5-22-61	8-23-61	9-16-61	13	2	16 — 6	NO [illegible]	SUCCESSFUL ORBIT - POWER FAILURE [illegible]
XXXII	1115	555	56	C'''	328	39 LBS	12.4 LBS.	8-9-61	9-14-61	10-13-61	5	1	9 — 2	10-14-61	SUCCESSFUL AIR CATCH - [illegible]
XXXIII	1116	513	22	C'	329	39.5 LBS.	0	3-16-61	7-20-61	10-23-61	19	0	31 — 4	NO ORBIT	[illegible]
XXXIV	1117	653	24	C'	330	39.0 LBS	39 LBS	5-22-61	9-26-61	11-5-61	16	2	24 — 0		[illegible]
XXXV	1118	523 B	25	C'	326	39.4 LBS	13 LBS	8-30-61	10-18-61	11-15-61	11	0	11 — 1	11-16-61	[illegible]
XXXVI	1119	525 B	52	C'''	325	38.2 LBS	38.2 LBS	11-10-61	11-27-61	12-12-61	2	3	4 — 4	12-16-61	[illegible] INSTRUMENT OPERATION O.K.
XXXVII	1120	571	57	C'''	327	38.6 LBS	0	11-16-61	12-19-61	1-13-62	4	5	3 — 3	NO ORBIT	AGENA FAILURE - NO ORBIT
XXXVIII	1123	581	70 & 71	C/M-1	241	38.6 & 38.5	75.1 LBS	1-3-62	2-16-62	2-27-62	6	2	7 — 6	3-3-62	[illegible]
XXXIX	1124	584	72 & 73	C/M-2	331	38.4 & 38.8	45 LBS	1-5-62	4-5-62	4-17-62	12	6	14 — 4	4-20-62	[illegible]
XL	1125	586	74 & 75	C/M-3	333	39.1 & 39.1	68.8 LBS	1-26-62	4-11-62	4-28-62	6	2	8 — 5		[illegible]

W. C. COTTRELL
[illegible] HOLLYWOOD [illegible]

SPECIA' HANDLING

162 PROGRAM PERFORMANCE

PROGRAM FLT. No	VEH. No	SRV No	INSTR. TYPE	INSTR. No	THOR No	T/M No	DRCG No	S.I. No	PAY'D WT. FLOWN	PAY'D WT. TRANSF.	REC. INSPECT AT A/P	SHIPPED FROM A/P	FLIGHT DATE	WKS AT A/P	WKS AT A/P	TOTAL WEEKS TILL FLT.	RECOVERED DATE	SUMMARY
XXXVIII	1123	581	Cm-1	70/71	241	57	7	74	[illegible]	[illegible]	1-3-62	2-16-62	2-27-62	6	2	7-6	3-3-62	[illegible]
XXXIX	1124	584	Cm-2	72/73	331	53	1	NONE	[illegible]	45 LBS	1-5-62	4-5-62	4-17-62	12	6	14-4	4-20-62	[illegible]
XXXX	1125	586	Cm-3	74/75	333	52	6	70	[illegible]	[illegible]	1-28-62	4-11-62	4-28-62	10	5	13-1		[illegible]
XXXXI	1126	582	A-5	A	334	58	13	N/A	39.4	39.4	5-26-61	[illegible]	5-15-62	47	4	50-3	5-19-62	[illegible]
XLII	1128	585	Cm-4	76/77	336	55	9	82	[illegible]	79.2	2-16-62	5-13-62	5-29-62	[illegible]	[illegible]	[illegible]	6-1-62	[illegible]
XLIII	1127	583	Cm-5	78/79	335	44	8	76	[illegible]	81.1	3-1-62	5-21-62	6-1-62	11	4	13-1		[illegible]
XLIV	1129	591	Cm-6	80/81	339	48	10	[illegible]	[illegible]	80	3-21-62	5-30-62	6-22-62	[illegible]	0	13-2	6-25-62	[illegible]
XLV	1151	592	Cm-7	84/85	340	50	3	80	[illegible]	80	3-30-62	6-13-62	6-28-62	12	1	14-2	7-1-62	[illegible]
XLVI	1130	593	Cm-8	80/81	342	59	13	90	[illegible]	19.7	4-11-62	6-26-62	7-20-62	10	0	14-2	7-22-62	[illegible]
XLVII	1131	594	Cm-9	82/83	347	56	16	[illegible]	[illegible]	78.7	4-10-62	7-3-62	7-27-62	10	5	14-1	7-31-62	[illegible]
XLVIII	1152D	595	Cm-10	[illegible]	344	[illegible]	5	[illegible]	[illegible]	78.9	4-30-62	7-19-62	8-1-62	11	1	13-2	8-5-62	[illegible]
IL	1153	596	Cm-11	92/93	348	53	19	[illegible]	[illegible]	78.7	5-19-62	8-21-62	8-28-62	13	6	14-3	9-1-62	[illegible]
L	1132	600	A-10	A	349	63	202	N/A	36.3	36.3	5-22-62	8-6-62	9-1[illegible]	13	3	10-1		[illegible]
LI	1133	597	Cm-12	94/95	350	55	4	100	[illegible]	[illegible]	5-16-62	9-1-62	[illegible]	15	3	17-5	9-18-62	[illegible]
LII	1154D	598	Cm-13	96/97	351	64	11	D-3	[illegible]	66	6-20-62	9-13-62	9-23-62	12	1	14-3	10-2-62	[illegible]
LIII	1134	603	A-9	A	352	66	10	N/A	38.3	38.3	7-31-62	9-30-62	[illegible]-62	26	1	27-3	10-13-62	[illegible]
LIV	1136D	599	Cm-14	98/99	367	54	24	D-5	[illegible]	78.4	6-25-62	[illegible]	11-5-62	17	1	19-0	11-9-62	[illegible]
LV	1135	601	Cm-15	100/101	353	52	23	D-7	[illegible]	78.8	7-10-62	11-18-62	11-24-62	17	6	19-4	11-29-62	[illegible]
LVI	1155	606	Cm-16	86/87	361	56	17	D-2	[illegible]	67	8-16-62	[illegible]	12-4-62	9	3	10-6		[illegible]
LVII	1156	607	Cm-17	102/103	368	70	18	D-4	[illegible]	79.3	8-15-62	12-9-62	12-14-62	16	4	17-4	12-18-62	[illegible]
LVIII	1157	608	Cm-18	104/105	369	[illegible]	[illegible]	D-8	[illegible]	78.1	[illegible]	12-30-62	1-7-63	8	2	10-6	1-11-63	[illegible]
LIX	1159	610	Cm-20	108/109	370	67	[illegible]	D-6	[illegible]	0	[illegible]	2-19-63	3-4-63	9	3	12-1		[illegible]
LX	1164	612	L-1	3	360	70	[illegible]	S-2	72.2	0	11-21-62	3-5-63	3-18-63	14	0	15-6		[illegible]
LXI	1160	609	Cm-17	[illegible]	376	60	22	D-10	[illegible]	66.7	7-31-62	2-25-63	4-1-63	22	3	27-2	4-4-63	[illegible]
LXII	1411	605	A-12	A	372	54	205	N/A	38.3	0	1-10-63	4-10-63	4-26-63	12	6	15-1		[illegible]
LXIII	1165	613	L-2	05	364	58	302	S3	72.9	0	2-26-63	4-11-63	5-18-63	6	5	11-4	5-21-63	[illegible]
LXIV	1161	616	M-21	[illegible]	352	68	26	D9	[illegible]	78.7	12-7-62	4-13-63	6-12-63	18	1	26-5	6-16-63	[illegible]
LXV	1166	611	M-22	[illegible]	381	62	20	D11	[illegible]	78.9	4-15-63	6-1-63	6-26-63	6	5	10-2	6-30-63	[illegible]
LXVI	1412	624	M-23	[illegible]	382	55	14	D12	[illegible]	78.2	5-1-63	[illegible]	7-18-63	6	4	11-2	7-22-63	[illegible]
LXVII	1167	614	L-3	01	382	66	304	S4	77.1	77.3	3-7-63	7-3-63	7-30-63	17	4	20-5	8-1-63	[illegible]
LXVIII	1162	615	J-1A	[illegible]	377	65	402	D-14	81.5	81.5	4-1-63	8-3-63	8-24-63	17	5	20-5	8-28-63	[illegible]
	1162	617	J-1B	[illegible]	377	01	402	D-16	81.5		4-1-63	8-3-63	8-24-63	17	5	20-5		[illegible]
LXIX	1167	604	A-11	A	394	64	203	N/A	38.9	38.9	7-3-62	[illegible]-63	8-29-63	47	5	51-4	9-2-63	[illegible]
[illegible]	1163	619	J-2A	[illegible]	383	69	404	D-18	81.7	81	4-24-63	[illegible]	9-23-63	17	6	21-5	[illegible]	[illegible]
	1163	620	J-2B	[illegible]	383	60	404	D-13	82.5		4-24-63	[illegible]	9-23-63	17	4	21-5		[illegible]
LXXI	1601	402	A-6	A	386	50	204	N/A	40.1	40.1	2-21-61	10-8-63	10-29-63	136	6	139-6	11-3-63	[illegible]
LXXII	1171	632	M-24	[illegible]	460	48	504	D27	78.7	0	8-10-63	10-30-63	11-7-63	11	4	13-[illegible]		[illegible]
LXXIII	1172	637	M-25	[illegible]	406	75	25	D26	[illegible]	75.7	9-27-63	11-18-63	11-27-63	7	4	[illegible]		[illegible]
LXXIV	1168	642	M-26	[illegible]	398	61	306	D-34	[illegible]	77	10-19-63	11-27-63	12-21-63	4	6	8-2	12-25-63	[illegible]
LXXV	1174	629	J-5A	[illegible]	389	64	505	D-29	77.0	79	6-25-63	2-1-64	2-15-64	31	4	33-4	2-18-64	[illegible]
	1174	628	J-5B	[illegible]	389	65	505	D-42	79.2	79.2	6-25-63	2-1-64	2-15-64	31	4	33-4	2-22-64	[illegible]

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MISSION NO	SYSTEM	INST #	ZΦ	% A	% B		DFD -1	DFD -2	
	J1	114/115	8-24-63						
	J2	116/117	9-23-63						
1011	J3 x	160/161	10-4-64	100	0		D30	D57	
1019	J4 x	118/119	9-29-65	100	0		D39	D19	[illegible]
	J5	124/125	2-15-64	100	100				
	J6	126/143	3-2?-64	FAILED TO ORBIT					
1007	J7	144/145	6-19-64	100	100		D43	D54 *	S SHUTTER FAILURE
	J8	146/147	4-27-64	FAILED TO ORBIT					
1006	J9	148/149	6-4-64	100	100		D45 *	D49	"S" SHUTTER FAILURE 40%
1008	J10	150/151	7-10-64	100	100		D48 *	D33	"I" SHUTTER OPEN LAST 75%
1010	J11	152/153	9-14-64	100	100		D41	D44	
1009	J12	154/155	8-5-64	85	100		D56 *	D38 *	"S" SHUTTER DOUBLE 10% ; BEACON PROBLEM
1012	J13	156/157	10-17-64	86	50		D51 *	D46	NO DFC UNREG. ; ATTITUDE PROBLEM
1017	J14	140/165	2-25-65	100	100		D21	D60 *	"S&I" MULTIPLE EXPOSURES
1013	J15	158/159	11-2-64	80	0		D52	D47	MOMENTARY LOSS OF POWER - SHORTED PINS
1014	J16	162/139	11-18-64	100	100		D53	D50 *	INTERMITTENT METERING LAST 50%
1015	J17	138/141	12-19-64	98	88		D61	D58	
1016	J18	132/133	1-15-65	100	100		D55	D59 *	OVER EXPOSED "S"
1018	J19	122/123	3-26-65	100	100		D20 *	D22 *	DFC PROG. FAILURE
1020	J20	136/137	6-9-65	100	0		D67	D62	LOST VEHICLE REGULATOR
1027	Jx27	164/163	12-9-65	75	0		D71	D68	VEHICLE GAS PROBLEM
1025	Jx28	142/127	10-5-65	100	100		D73	D70	
1021	J21	166/167	5-18-65	100	20/100		D63 *	D25	METERING PROBLEM
1022	J22	168/169	7-19-65	100	100		D65	D24	
1023	J23	170/171	8-17-65	100	50/100		D17	D66	COMMAND RELAY FAILURE
1024	J24	172/173	9-22-65	100	100		D69	D64	
1026	J25	174/175	10-28-65	100	100		D75	D72	
1028	J26	176/177	12-24-65	100	100		D77	D74	
1029	J27	178/179	2-2-66	100	100		D79	D76	
1032	J28	180/181	5-3-66	FAILED TO ORBIT			D80	D32	
1030	J27	182/183	3-9-66	100	100		D94	D82	
1031	J30	184/185	4-7-66	100	50		D83	D86	# 2 FAILED TO WRAP

MISSION	SYSTEM	INST. #	RD	% A	% B		DFD -1	DFD -2					
1034	J31	186/187	6-21-66	100	100		D85	D87					
1036	J32	190/191	8-9-66	100	100		D89	D88					
1033	J33	194/195	5-23-66	100	100		D91	D84					
	J34	192/193											
	J35	196/197											
035 PG-1	J36	188/189		100	100		D95	D96					
	J37	204/205											
037 PG-2	J38	198/199		100	100		D101	D106					
	J39	206/207											
	J40	208/209											
	J41	202/203											
PG-3	J42	200/201											
	J43	210/211											
	J44												
	J45												
	J46												
	J47												
	J48												
	J49												
	J50												
	J51												

4 LMSC 833E

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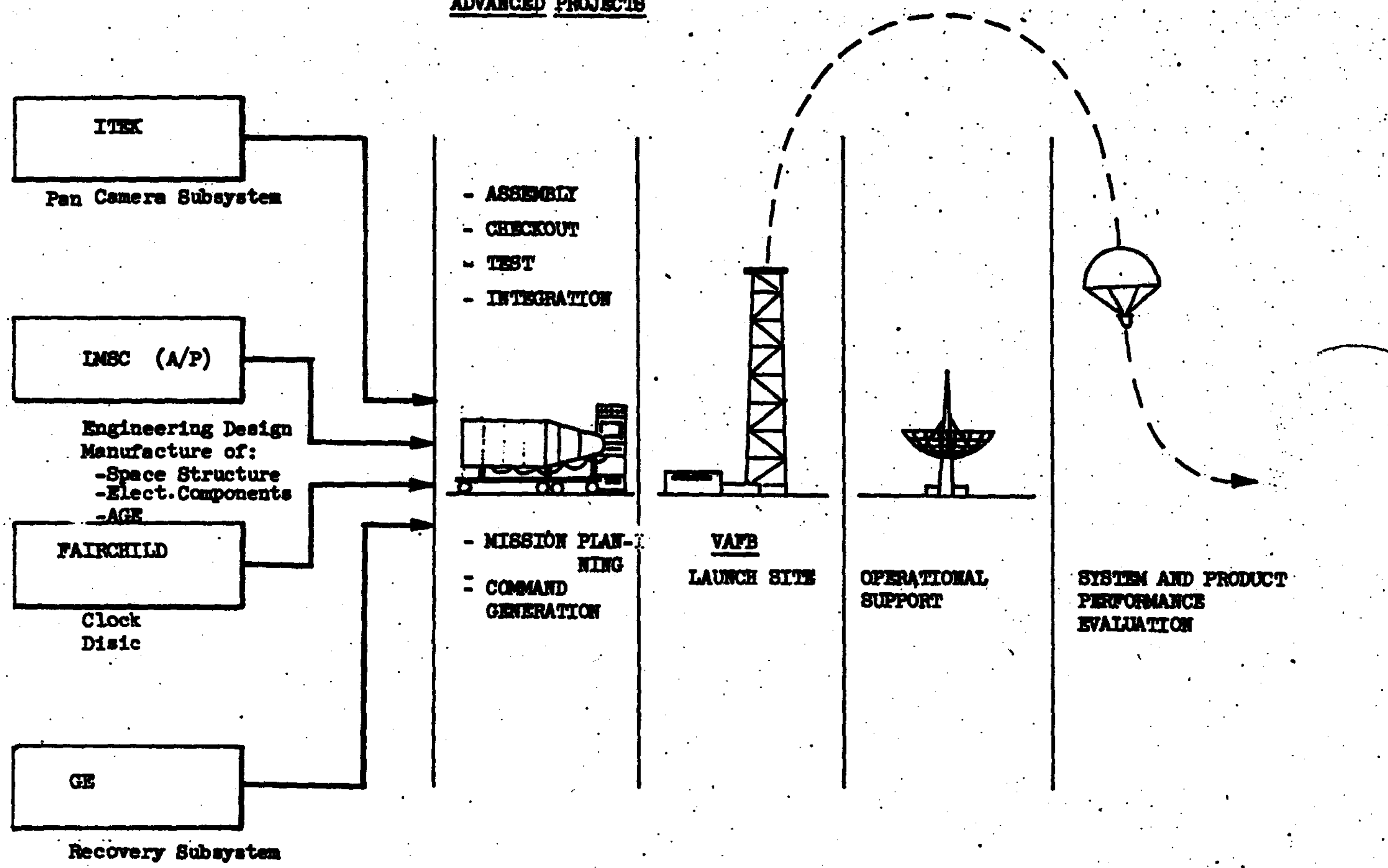
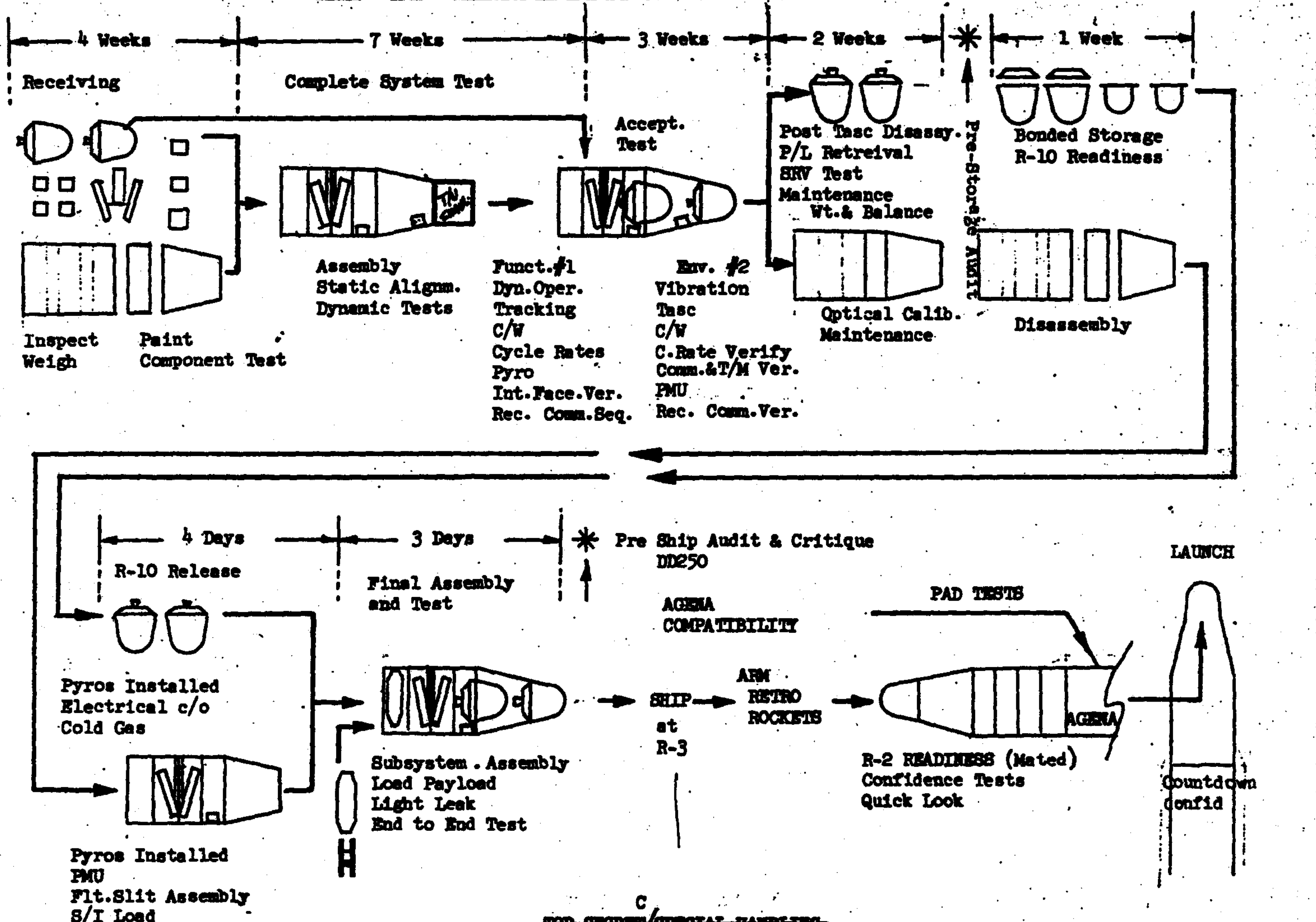
ADVANCED PROJECTS

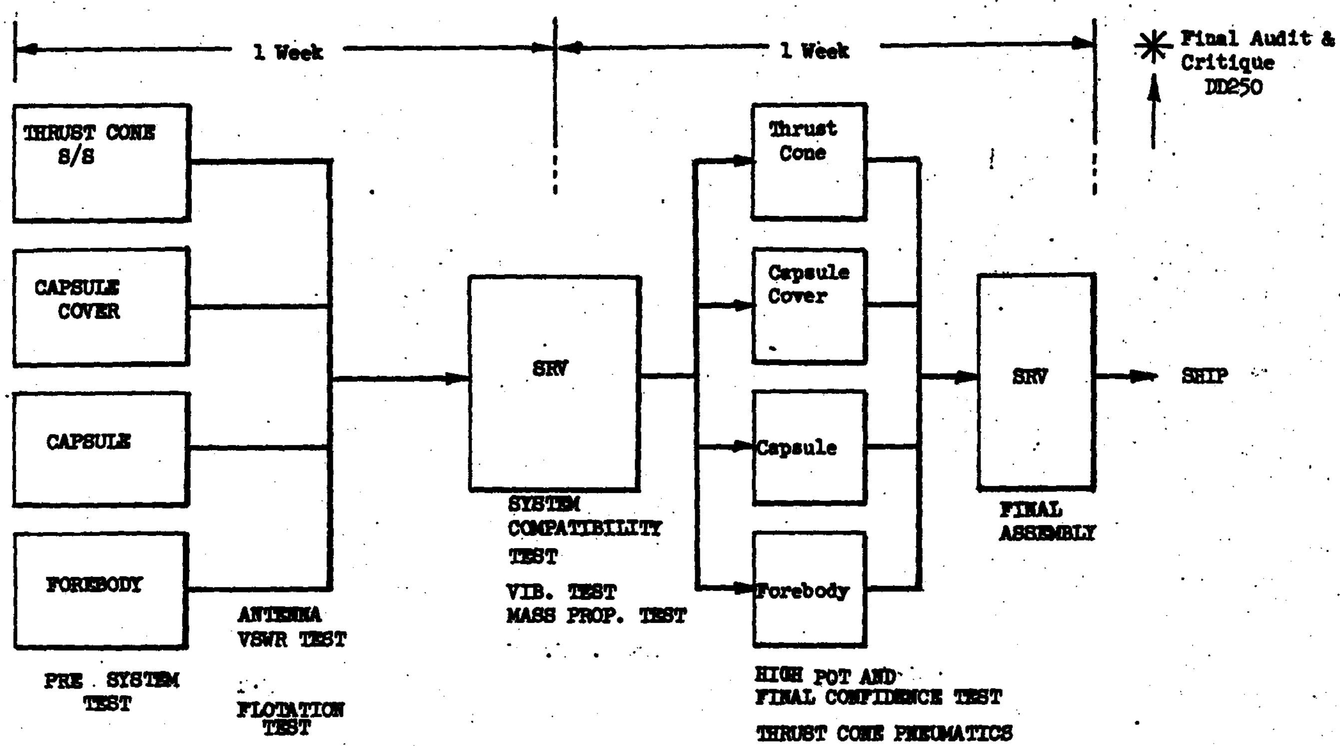


~~TOP SECRET C SPECIAL HANDLING~~

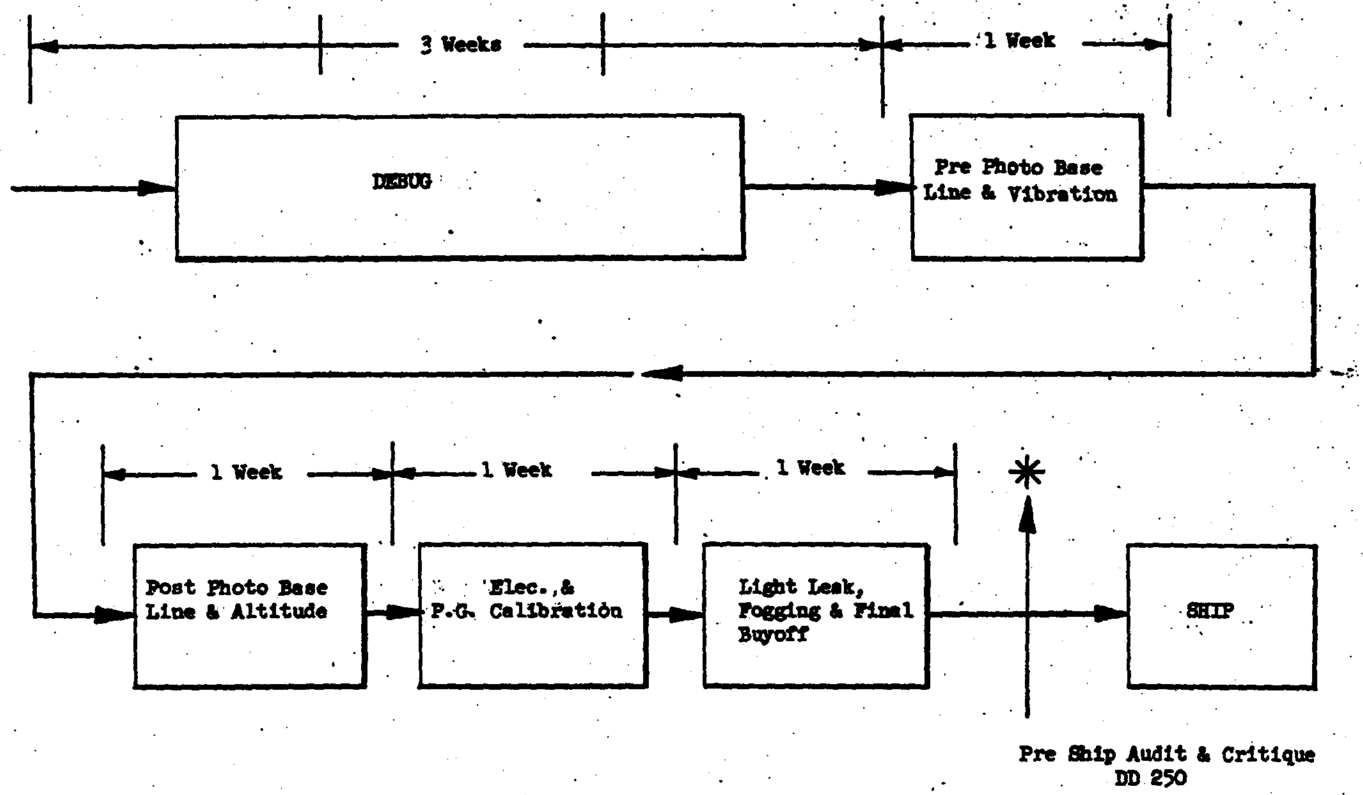
IMSC A/P FACTORY TO LAUNCH FLOW CHART - TYPICAL



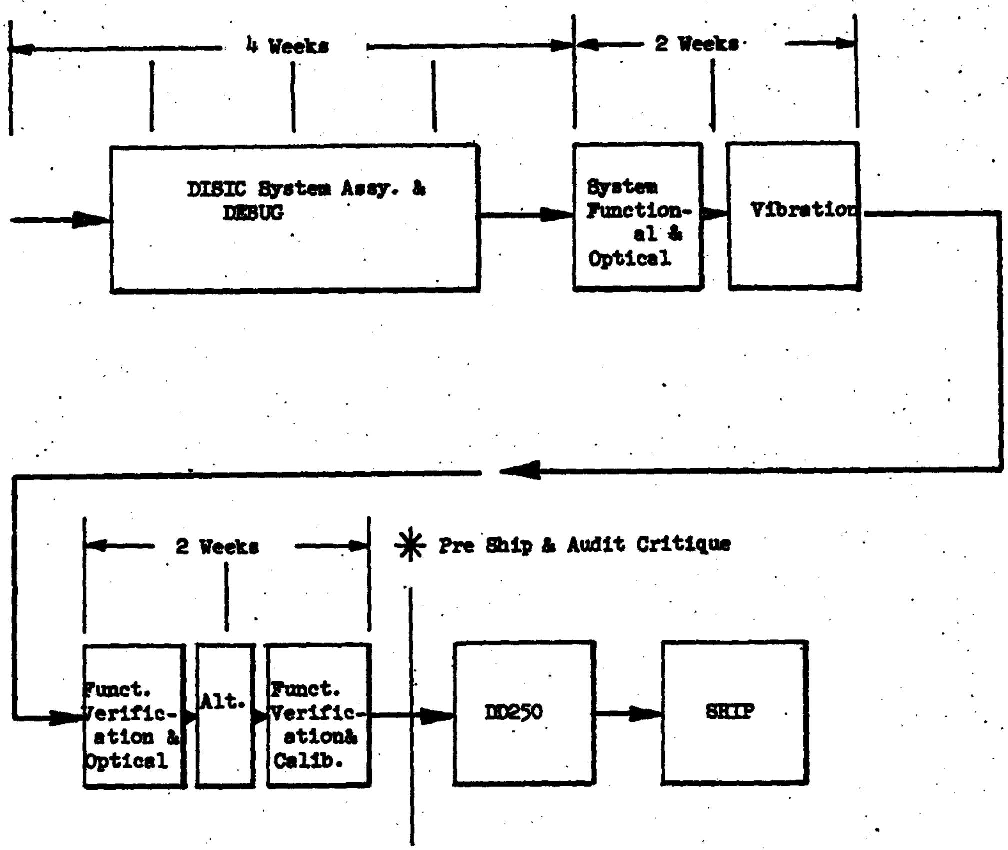
GE ACCEPTANCE TEST FLOW - TYPICAL - TYPICAL



ITEK ACCEPTANCE TEST - FLOW CHART - TYPICAL



FAIRCHILD ACCEPTANCE TEST FLOW CHART - TYPICAL



SYSTEM ENVIRONMENTAL TESTING

QUALIFICATION

- SINUSOIDAL VIBRATION

LONGITUDINAL AXIS

FREQUENCY	LEVEL
5-15	0.13 INCHES, P-P
15-20	2.1 g, 0-P
20-400	1.0 g, 0-P
400-2000	2.1 g, 0-P
LATERAL AXIS FREQUENCY	LEVEL
11-2000	0.7 g 0-P

- THERMAL ALTITUDE

CHAMBER PRESSURE 10^{-5} mm HG

SYSTEM INTERNAL PRESSURE 10^{-4} mm HG MAX

SIMULATION B= 0°, 40°, & 70°.

DURATION 14 DAYS

LOW TEMPERATURE TEST AT 50°F.

HIGH TEMPERATURE TEST AT 90°F.

SYSTEM OPERATIONAL AT HIGH & LOW TEMPS

ACCEPTANCE

- VIBRATION

SINUSOIDAL FREQUENCY	LONGITUDINAL ONLY LEVEL
15-400	0.50 g; 0-P
400-2000	1.0 g, 0-P

OR OPTIONALLY

RANDOM

FREQUENCY	DENSITY	LEVEL
20-600	.005G ^{2}/CPS	
600-2000	.01 G^2/CPS	4.1 g RMS

- THERMAL ALTITUDE

CHAMBER PRESSURE 10^{-5}mmHG

SIMULATION B°=0 B=65°

DURATION 6 DAYS

TEST OF REPRESENTATIVE FLIGHT PROGRAM

TESTING LEVELS OF SUB-SYSTEMS AND COMPONENTS ARE SHOWN IN T3-6-002 GENERAL SPECIFICATION

GOVERNING DOCUMENTS

LMSC 6117	General Environmental Specification for Agena Satellite Program
RO-J3-001	Requirement Specification "J3" Payload System, Corona J Program
T3-6-002	General Specification for Payload Qualification and Acceptance
T3-6-063	Test Specification for Acceptance and Qualification of J-3 Payload Systems
Exhibit SH-64-23	DISIC Performance Specification
DCS 397-1	Design Control Specification J-3 Panaramic Camera System
S0010-02-0022	SRV System . Design Specification

ENVIRONMENTAL TEST LEVELS

QUALIFICATION / **ACCEPTANCE**

Sinusoidal Vibration

Longitudinal Axis

Qualification Frequency (cps)	Qualification Level	Acceptance Frequency (cps)	Acceptance Level
5-15	0.38 Inches peak to peak	15-400	1.0 g's, 0 - peak
15-20	4.0 g's, 0-peak	400-2000	2.5 g's, 0 - peak
20-400	3.0 g's, 0-peak		
400-2000	3.5 g's, 0-peak		

Lateral Axes (cps)	Level (g's)
11-2000	2.0

Random Vibration

Frequency Range (cps)	Density (g^2/cps)	Overall Acceleration (g's RMS)	Frequency Range (cps)	Density (g^2/cps)	Overall Acceleration (g's RMS)
20-400	0.05		20-400	0.025	
400-2000	0.12	14.5	400-2000	0.09	13.0

Thermal Altitude

Vacuum	Temperature (Cyclematic)	Vacuum	Temperature (Cyclematic)
10^{-5}mm Hg	-120 to +250°	10^{-5}mm Hg	-120 to +250°

Shock

Longitudinal Axis

Level (g's)	Duration (ms)	Number (each)
15	6	3

Lateral Axes

Level (g's)	Duration (ms)	Number (each)
5	6	3

Acceleration

Longitudinal Axis (+ indicates ascent)

Level (g's)	Direction
11.0	+
15.0	-
22.0	

Lateral Axes

Level (g's)	Direction	
6.0	+	(Not to be performed concurrently)
8.0	-	

Load Testing (Structures)

0° to 100% load limit in 5% increments of 5 to 10 second duration.

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EXPOSURE ANALYSIS TECHNIQUE

FOR

[redacted]

PANORAMIC CAMERAS

21 JUNE 1968

E. G. Theobald

[redacted]/SPECIAL HANDLING

ABSTRACT

A simplified, graphic analysis technique has been developed for the selection and control of the variable exposure capabilites of the [redacted] CR-systems. The "XPAN" computer program produces printed plots which graphically relate ideal camera slit width to orbit time and geographic position. The technique provides directly observable indications of the requirements for, as well as the actual performance of, the panoramic camera exposure control system. The display concept is equally applicable to fixed slit systems or to continuously variable slit systems.

EXPOSURE ANALYSIS TECHNIQUE

for

[redacted]

PANORAMIC CAMERAS

Early in the history of the [redacted] Program LMSC recognized that a convenient means was needed to relate all of the variables influencing the exposure obtained by a panoramic camera in a non-circular orbit. It was necessary to consider the variations in exposure times produced by a fixed slit in a camera subjected to constantly changing panoramic scan rates as dictated by the image motion compensation requirements. It was also necessary to consider the corresponding variations in exposure time resulting from the profiles of image illuminance experienced. Pre-flight slit selection then became a matter of determining what slit size would produce the most desirable combination of maximum area-of-interest coverage (properly exposed) and minimum overexposure potential. Of course, no in-flight corrections or modifications to the exposure was possible.

This basic routine for the analysis of exposure for the panoramic cameras was developed by LMSC in mid-1963 as a computerized program with the identifying name "XPAN", and has been the basis for launch time and slit/filter recommendations on all subsequent missions. The output of this original program was limited to a simple tabulation of the required analytical data. By using the actual orbital characteristics experienced, the XPAN routine has provided a post-flight summary of the mission exposure performance.

The CR camera system introduced a multiple-slit variable exposure control capability. The control system consists of a series of four discrete slit widths which are stepped in a pre-flight established time sequence. The exposure control timer is activated by stored program commands from the Agena H-timer. Initiation of the slit-changing sequence trails the activation by a real-time controlled time delay, up to a maximum of 400 seconds. The only other real-time control of the exposure system is the ability to select any one of the four slits in a fixed mode. A failsafe slit is also provided to protect against system malfunction.

This variable exposure feature added an additional degree of complexity to mission planning and operations that was beyond the capability of the basic XPAN program to analyze efficiently. The selection of slits now involved the new considerations of time sequence selection and control, and of the dramatic impact on these factors created by dispersions in orbital parameters. For efficiency, a fully automated routine for slit and timing selections was devised, but was found to lack adequate flexibility for variations to accommodate special requirements, experiments, personal preferences and individual judgement and experience. In addition, the fully automated concept does not lend itself to mission operations support, nor to ready visualization of the expected performance and the relative compromises involved.

The first attempt to satisfy these inadequacies consisted of expanding the basic XPAN program to include a graphic presentation of an ideal slit width function for full, intermediate and primary processing levels, plotted against orbit time and corresponding latitude locations. The plots proved to be so convenient for analysis and planning, and the exposure performance so apparent from the visual representation, that further sophistication of the technique has not been pursued. It has also become evident that the graphic displays are of much value in J_1 systems planning.

It is this expanded, graphic, XPAN technique that is described in the following paragraphs.

CONTENT

The present XPAN program outputs two data forms for each condition analyzed. The basic orbit, camera and illumination data are summarized in listing form for use as reference and support information as required. This summary includes: A) Ground velocity and vehicle height with the resulting ground angular velocity (v/h) and corresponding values of nominal cycle rate, format ground coverage and exposure time achieved with various selected slits; B) Solar azimuth and elevation with corresponding ideal exposure times for each processing level; and C) The resulting ideal slit width required to attain the ideal exposure when subjected to the corresponding orbit dynamics. These data are all summarized as functions of latitude.

The second output form is a graphic representation of ideal slit width as a function of orbit time. As explained previously, these plots have become the "heart" of the XPAN analysis technique. The time scale is linear in seconds from the ascending node, with the corresponding latitude ground locations also indicated for ready reference. The slit width coordinate is expressed in terms of a "slit-value" (S_v), which is directly analogous to the concept of exposure value (E_v) such that a change of 1.0 in S_v represents a change of 1.0 in E_v, which is equal to a change of one "photographic stop".[1] The curves plotted in this output form may represent ideal slit width functions for one film/filter selection at each of three processing levels, or any three individual combinations of films, filters and processing.

An example of the content and format of these program output data forms is included as an appendix to this report.

CALCULATIONS

The calculations included in the total XPAN program are very extensive, and much too complex to discuss in a brief presentation. It should be sufficient to describe the program in terms of the nature of the various calculations that are performed. Figure 1 represents a simplified flow diagram of the XPAN program calculations.

---

1. An increase in exposure of one "photographic stop" represents a change of 100%, or twice the exposure. A decrease of one stop is one-half the original exposure. The concept is summarized by the expression $E = 2^{E_v}$, where E is exposure and E_v is exposure value.

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SIMPLIFIED FLOW DIAGRAM OF COMPLETE XPAN PROGRAM

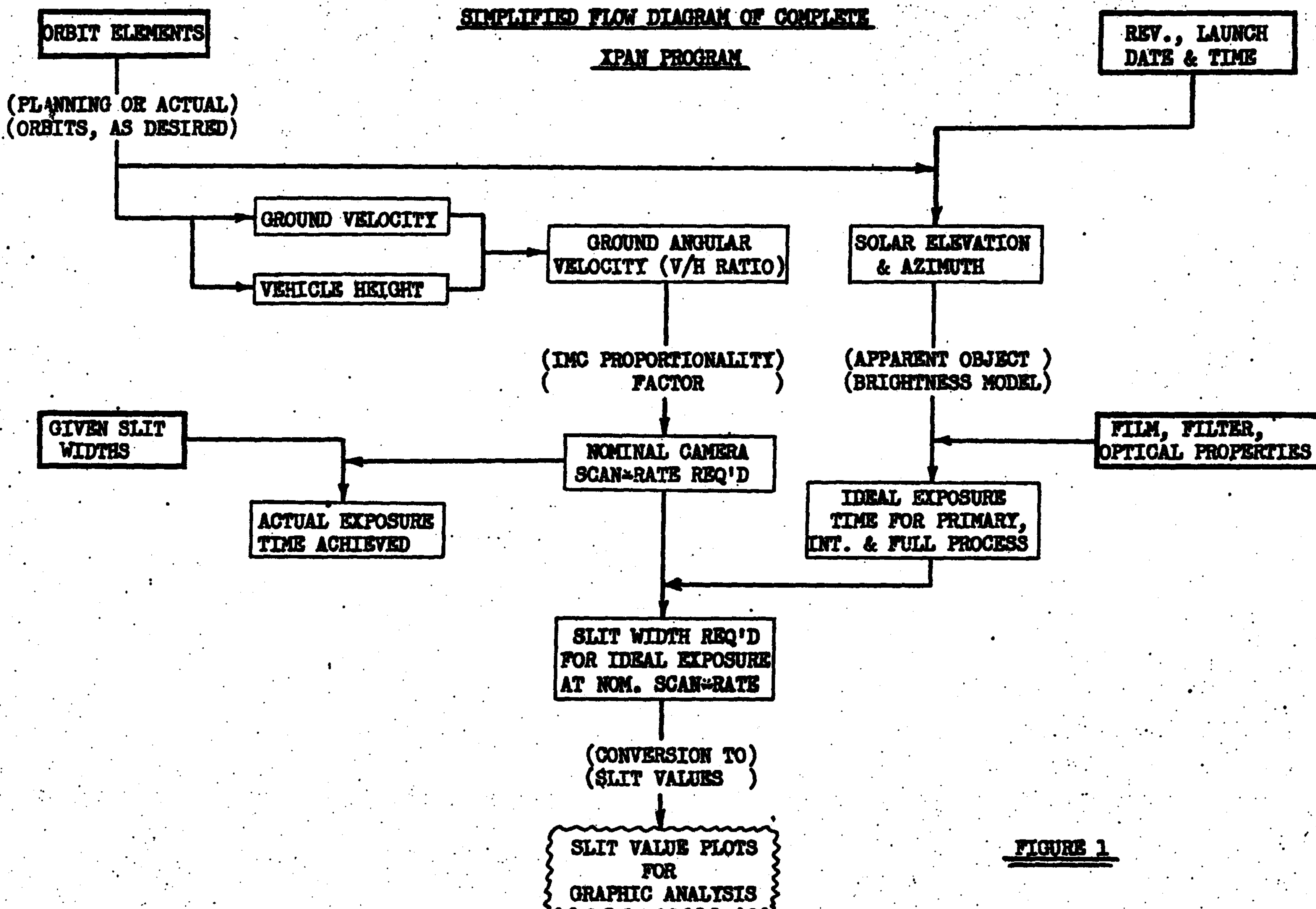

FIGURE 1

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Basically, the program calculates the time profiles of ground velocity, height, and solar elevation and azimuth for the selected orbit, pass, and launch time and date. The ground velocity and height are combined to produce the ground angular velocity (v/h) function, from which is calculated the corresponding cycle rate which will provide proper image motion compensation. Selected slit widths are then used to calculate the exposure times that will be achieved with this profile of computed cycle rates. The solar elevations are compared with the applicable object brightness model[2], and the resulting apparent luminance profile modified by the film, filter and camera characteristics to produce ideal exposure times for each processing level (primary, intermediate and full). The ideal slit widths are obtained by merely calculating the slit required to achieve the ideal exposure times when constrained by the corresponding computed nominal camera scan rates.

These calculations are all very straightforward computations. The utility of the results is dependent upon the form and format of the output data presentation. It was found that plots of the ideal slit width were inconvenient in that the photographic effects of deviations (over- and under-exposure) could not be quickly quantitized. Since the variations in slit width influence exposure in a logarithmic manner, it became very convenient to express the slit width profile as a logarithmic function. By maintaining the popular "photographic stop" concept, it is possible to express the slit width in a function such that an increase of 1.0 directly corresponds to an increase in E_v of 1.0, which is equal to one "stop". This function may be stated by:

$$1/s = 2^{S_v}$$

(or)

$$S_v = \frac{\text{Log } 1/s}{\text{Log } 2} ,$$

where s = slit width, inches
S_v = "slit value"

which is mathematically compatible with the familiar expressions

$$1/t = 2^{T_v}$$
$$E = 2^{E_v} \quad \text{, etc.}$$

At any given scan rate (inches per second) in a given camera configuration, the relationship $\Delta S_v = \Delta T_v = \Delta E_v$ may be applied. It is therefore possible to observe directly the magnitude of over- and under-exposure deviations that would be introduced by a given slit. It must be cautioned, however, that the difference in the ideal S_v function at two different times in the orbit (or at two different latitude locations) does not represent an equal change in E_v except in the occasional instances where the camera scan rate is unchanged. The awkwardness of transposing slit widths to S_v values is more than offset by the convenience and ease of evaluation. A given slit will have a constant S_v value, and will therefore be represented by a straight line on the plots.

2. The object brightness model is an empirical correlation of apparent object luminance as a function of solar elevation. The model currently in use is an overall average, and does not attempt to account for season variations, if any. The model is updated as sufficient support evidence is available.

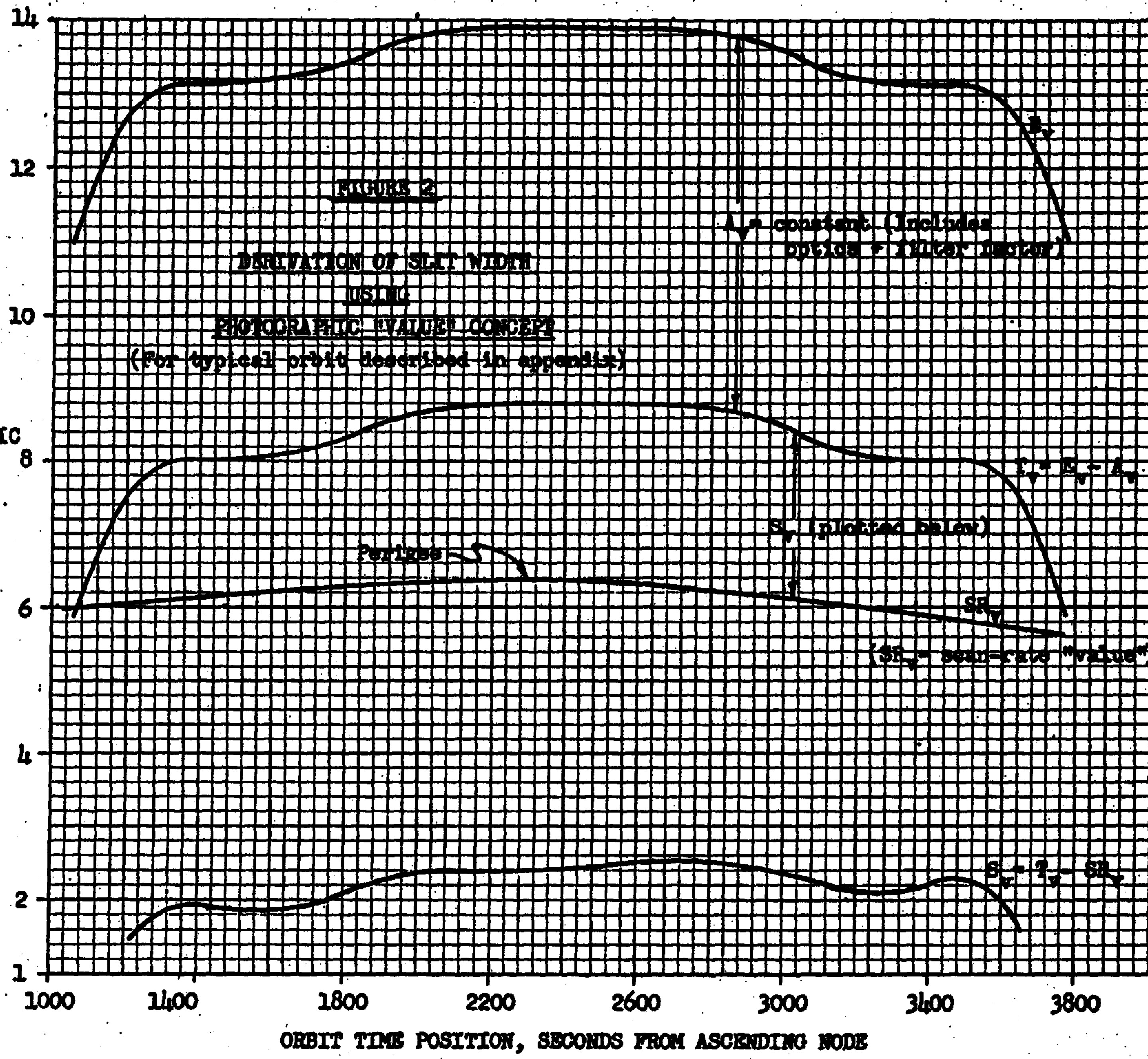
FIGURE 2
DERIVATION OF SLIT WIDTH
USING
PHOTOGRAPHIC "VALUE" CONCEPT
(For typical orbit described in appendix)
PHOTOGRAPHIC VALUE
ORBIT TIME POSITION, SECONDS FROM ASCENDING NODE
1000
1400
1800
2200
2600
3000
3400
3800
14
12
10
8
6
4
2
1
E_v
A_v = constant (Includes optics + filter factor)
$T_v = E_v - A_v$
S_v (plotted below)
Perigee
SR_v
(SR_v - scan-rate "value")
$S_v = T_v - SR_v$

The relationship of S_v to the exposure profile of E_v for an actual mission is illustrated in Figure 2. The data is taken from the XPAN examples presented in the appendix.

USING THE XPAN PLOTS

The XPAN technique of exposure analysis and evaluation can be applied to all stages of mission support; a) pre-flight planning and slit selection, b) in-flight operations evaluation and real-time control, and c) post-flight summary of photographic performance. The entire exposure control system flight requirements are established with this technique, including provisions for experiments and special considerations. Since the abscissa of the XPAN plots is linear in orbit time, it is possible to superimpose the exposure control system timing sequence directly on the slit function with freedom of movement along the horizontal axis. In practice, this flexibility is accomplished by plotting the selected slit values in their proper timing sequence on a transparent overlay, which can then be positioned along the abscissa as desired to obtain optimum exposure match. This is the technique employed to identify the requirements for Brush 51 and 52 H-timer punch locations (these are the stored program commands that activate the exposure control system timer).

A typical overlay is included in the appendix with the XPAN output examples. For ease in use, the overlay is indexed to the ordinate (slit value) scale when the heavy horizontal reference line near the lower edge of the overlay sheet is superimposed directly over the horizontal dotted line immediately adjacent to the time words on the XPAN plots. Horizontal movement of the overlay is acceptable; however, the reference lines must remain indexed at all times. A scale of the real-time controlled exposure sequence delay (Δt_1) is also included on the overlay for ease in selecting changes in delay settings, and for rapid identification of the exposure status with previous settings.

Two other points of significance must be emphasized in using these plots. First, it must be kept in mind that over- and under-exposure comparisons must be made only between the ideal slit at some point on the curve and the actual slit alternatives at that same point, for the reasons discussed previously. The area above the ideal slit curve represents exposure less than nominal (under-exposure with respect to the specific curve), and the area below greater than nominal (over-exposure). The second point to remember is that increasing slit values (S_v) represent decreasing slit widths. The chart shown in Figure 3 provides a convenient and rapid means of relating slit width and slit value. For a more precise conversion, the pertinent relationships are:

$$S_v = 1.443 \ln 1/s \quad \text{(Natural logarithm)}$$

$$= 3.322 \log 1/s \quad \text{(Base 10 logarithm)}$$

and

$$1/s = 2^{S_v}$$

$$= \ln^{-1}(0.693\, S_v) \quad \text{(Natural logarithm)}$$

$$= \log^{-1}(0.301\, S_v) \quad \text{(Base 10 logarithm)}$$

(or)

$$s = \ln^{-1}(-0.693\, S_v) = \log^{-1}(-0.301\, S_v)$$

where "s" is slit width in inches.

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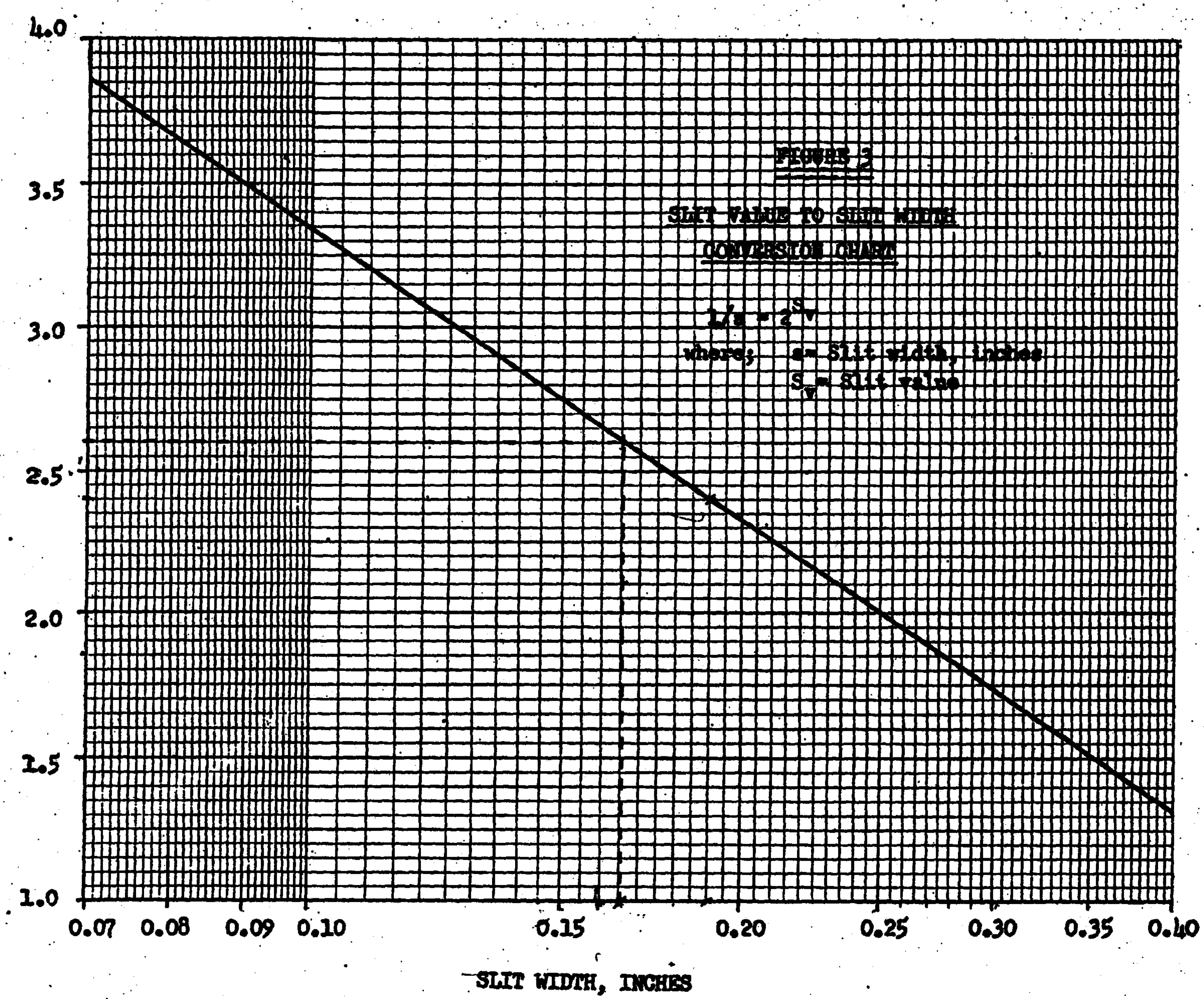

FIGURE 2

SLIT VALUE TO SLIT WIDTH CONVERSION CHART

$1/s = 2^{S_v}$

where; s = Slit width, inches

S_v = Slit value

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Inspection of the sample materials included in the appendix should make evident the uses of the XPAN technique. The more common applications may be briefly described as follows:

A) Pre-flight planning and slit selection is accomplished using nominal "planning orbits" for input parameters. Initial runs will cover a wide span of launch times, from which is eventually selected the desired time, date and orbital configuration. Normal selection of slit widths consists of selecting the 4 values that provide the optimum matching of the appropriate ideal slit width profile over the areas in which the instruments will be operated during the life of the mission. This selection must consider the timing limitations of the exposure control system, and the possible dispersions in launch date and time, and in actual orbit parameters, most significant of which is perigee location. The slit selection procedure must also consider provisions for special experiments, mixed film loads, or other extraordinary conditions, where applicable.

B) Requirements for stored-program commands and timing intervals for the exposure control system are determined by selecting the timing (within system limitations) of the chosen slit values so as to produce an optimum match with the ideal slit profile. The special provision situations previously mentioned must be kept in consideration. The Start commands (Brushes 51 and 52 on the H-timer) are then located appropriately, using an initial delay interval (Δt_1, which is real time commandable) which will accommodate all reasonable dispersions.

C) In-flight operations support utilizes real, updated orbit parameters to obtain XPAN plots for the actual conditions being encountered. By utilizing an overlay of the actual slit/time selections it is possible to make periodic evaluations of the exposure control performance throughout the mission and to update the control settings as required. This is achieved by indexing the overlay along the abscissa such that the Δt_1 position in effect at the time coincides with the time location of the SPC Brush 51. If a more optimum fit of the selected slits can be obtained by a different Δt_1 setting, the overlay is moved horizontally to the best fit, and the system commanded to the Δt_1 position now coinciding with the Brush 51 position. However, it must be remembered that these timing shifts are now restricted such that the Brush 51 position must always appear within the limits of the Δt_1 delay time range. Real time commanding of any of the slits to a fixed position for special considerations, or for optimum control at the time, can be evaluated by positioning the various slits on the overlay in the area of interest (irrespective of the Brush 51 orientation, but maintaining the base reference indexing). Fixed slit evaluation can also be evaluated by drawing a horizontal line corresponding to the appropriate slit value through the area of interest.

D) Post-flight performance evaluation of the exposure control system combines the actual orbit parameters and command history with the slit/time settings and stereo program to graphically depict the exposure history experienced.

SUMMARY

Though not highly sophisticated, the XPAN technique for exposure analysis for the CORONA system panoramic cameras is very effective in achieving a practical exposure control, largely as a result of its simplicity of application and the visual comprehension afforded by the graphic presentations. Perhaps the weakest part of the analysis is the uncertainties in the object brightness model, which is currently undergoing further revisions. The adequacy of this graphic analysis is well within the limitations of the brightness model and the mechanics of the exposure control system proper. The XPAN program and analytical technique is adaptable to virtually effortless revision as improvements are achieved in the model and/or the hardware. The technique is equally applicable to any application, ranging from single fixed slit to an infinitely variable exposure control.

APPENDIX

[redacted]

TYPICAL CR XPAN PLOT 21302 LAUNCH 4-15-68, DATA FOR 4-22 REV NO. 100

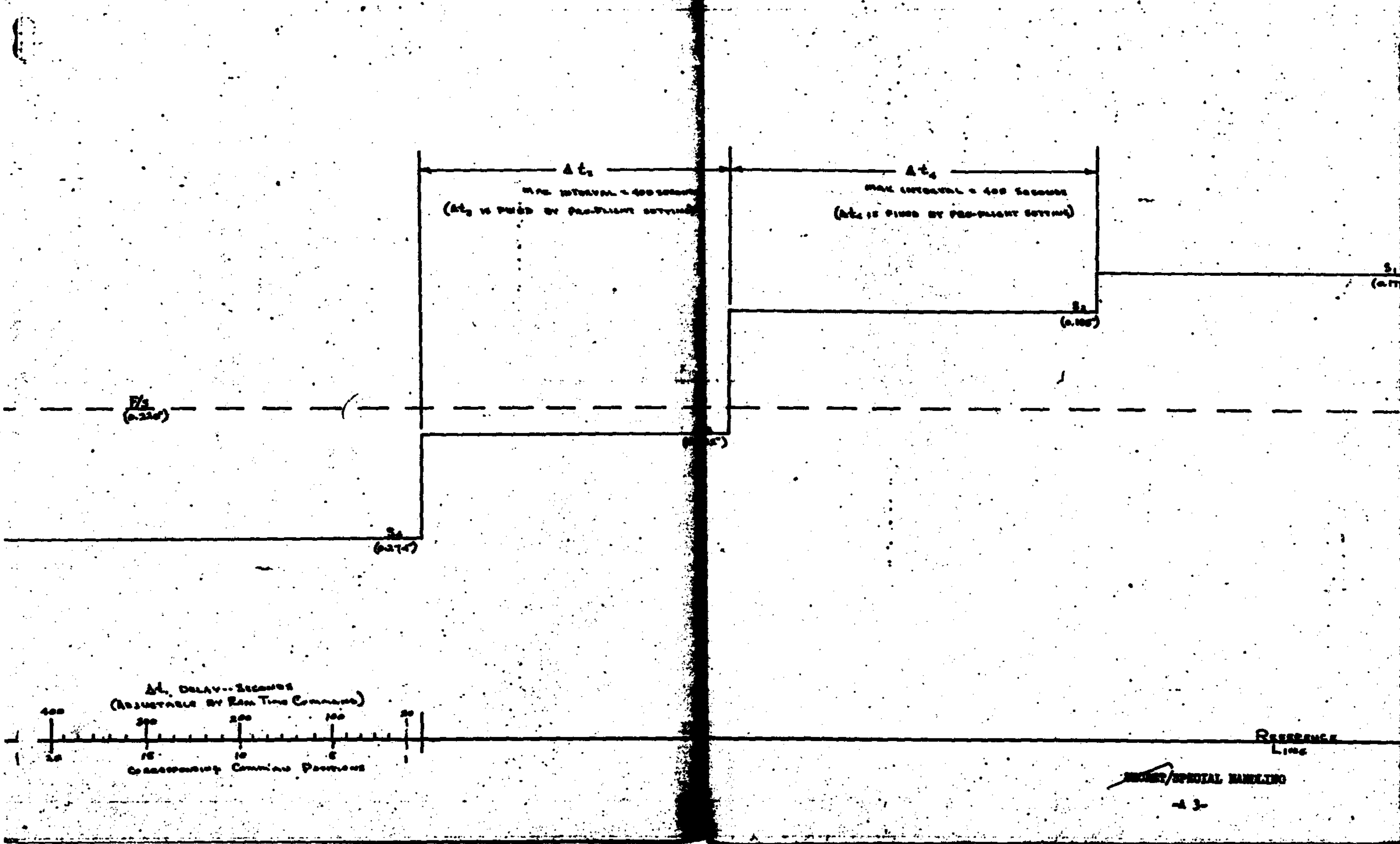
ORBIT - PERIOD = 88.58 MIN. PERIGEE = 85.00 NM AT 240.00 DEG. INCLINATION = 81.30 DEG. ECCENTRICITY = 0.00841

CAMERA = 24 IN FOCAL LENGTH, T/3.80, 7.95 PCT ENDLAP, MAXIMUM RATES = 596 CPS 3404 FILM, FILTER W23A

ASCENDING NODE = 5.59 DEG LONGITUDE AT 2181 SEC GMT. SOLAR DECLINATION = 12.13 DEG. EQUATION OF TIME = 87 SEC.

QUAD -LAT	SEC. FROM NODE	INERTIAL AZIMUTH - DEG.	YAW ANGLE (REQ)	GROUND VELOC. FT/SEC	HEIGHT - N.M.	GROUND ANG VEL RAD/SEC	ACP. CYCLE RATE	KP FORMAT COVERAGE WIDTH	LENGTH	SEC EXPOSURE SLIT= 0.340	SLIT= 0.134	IDEAL SLIT, FULL	EXPOS TOLERANCE -SECONDS (DENOM) FULL	INT	PRI	SOLAR ELEV.	AZIMUTH	QUAD -LAT
150	752	13.24	-2.16	24477	115.99	0.03473	0.3896	168.1	11.4	173	438					-24.1	13.9	150
155	828	14.86	-1.52	24509	114.13	0.03534	0.3964	165.4	11.2	176	446					-19.1	13.4	155
160	904	17.11	-1.65	24541	112.22	0.03599	0.4037	162.6	11.0	179	454					-14.0	13.1	160
165	982	20.35	-1.37	24573	110.25	0.03668	0.4115	159.7	10.8	182	463					-8.9	12.8	165
170	1062	25.44	-1.07	24606	108.18	0.03743	0.4199	156.8	10.6	186 U	473 U	1.0731	59	39	26	-3.6	12.7	170
175	1147	34.58	-0.74	24640	105.96	0.03827	0.4293	153.5	10.4	190 U	483 U	0.6295	103	68	45	2.0	12.7	175
180	1251	57.74	-0.32	24682	103.18	0.03937	0.4416	149.5	10.1	196	497 U	0.3156	211	139	92	8.9	12.8	180
182	1325	90.00	-0.00	24712	101.07	0.04024	0.4513	146.5	9.9	200	508 U	0.2712	251	166	109	14.1	12.8	182
280	1409	122.26	0.32	24742	98.93	0.04116	0.4617	143.4	9.7	205	520 U	0.2678	260	172	113	19.4	13.5	280
275	1513	145.42	0.73	24778	96.19	0.04240	0.4756	139.4	9.5	211	535 U	0.2758	260	172	113	26.3	14.2	275
270	1597	154.56	1.06	24806	94.02	0.04342	0.4870	136.2	9.2	216	548 U	0.2751	267	176	116	31.8	15.0	270
265	1676	159.65	1.36	24825	92.08	0.04438	0.4978	133.4	9.0	221	560 U	0.2643	284	188	124	37.1	16.0	265
260	1753	162.89	1.64	24849	90.31	0.04529	0.5080	130.9	8.9	225	572 U	0.2463	311	205	135	42.1	17.2	260
255	1829	165.14	1.90	24867	88.71	0.04613	0.5175	128.5	8.7	230	582 U	0.2275	343	226	149	47.1	18.8	255
250	1904	166.76	2.15	24881	87.30	0.04691	0.5261	126.5	8.6	233	592 U	0.2105	377	249	164	51.9	20.9	250
245	1978	167.98	2.37	24892	86.10	0.04758	0.5337	124.8	8.5	237	601 U	0.1977	407	268	177	56.7	23.6	245
240	2052	168.91	2.58	24900	85.14	0.04813	0.5399	123.4	8.4	239	608 U	0.1898	429	283	187	61.3	27.2	240
235	2126	169.63	2.76	24905	84.43	0.04855	0.5445	122.3	8.3	242	613 U	0.1866	440	290	192	65.7	32.2	235
230	2200	170.19	2.92	24905	84.01	0.04879	0.5473	121.7	8.3	243	616 U	0.1859	444	293	193	69.8	39.5	230
225	2273	170.62	3.06	24902	83.89	0.04886	0.5480	121.6	8.2	243	617 U	0.1870	442	292	192	73.4	50.3	225
220	2346	170.96	3.18	24895	84.08	0.04873	0.5466	121.8	8.3	242	615 U	0.1879	440	290	192	76.1	66.2	220
215	2419	171.20	3.27	24885	84.59	0.04842	0.5431	122.6	8.3	241	611 U	0.1865	435	290	191	77.3	87.2	215
210	2493	171.37	3.34	24870	85.44	0.04791	0.5373	123.8	8.4	238	605 U	0.1842	440	290	191	76.6	109.0	210
205	2566	171.47	3.38	24852	86.62	0.04722	0.5296	125.5	8.5	235	596 U	0.1807	442	291	192	74.2	125.3	205
200	2639	171.50	3.39	24830	88.13	0.04637	0.5201	127.7	8.7	231	585 U	0.1766	444	293	193	70.8	139.2	200
305	2712	171.47	3.38	24805	89.97	0.04538	0.5090	130.4	8.8	226	573 U	0.1726	442	291	192	66.8	146.3	305
310	2785	171.37	3.34	24776	92.10	0.04427	0.4966	133.5	9.0	220	559 U	0.1729	433	285	188	62.5	151.8	310
315	2859	171.20	3.28	24744	94.53	0.04308	0.4832	137.0	9.3	214	544 U	0.1760	414	273	180	57.9	155.7	315
320	2933	170.96	3.19	24705	97.22	0.04183	0.4692	140.9	9.6	208	528 U	0.1833	386	255	168	53.3	158.6	320
325	3006	170.62	3.08	24672	100.14	0.04055	0.4548	145.1	9.8	202	512 U	0.1943	353	233	154	48.5	160.8	325
330	3080	170.19	2.94	24633	103.26	0.03926	0.4404	149.6	10.1	195	496 U	0.2069	321	212	140	43.7	162.4	330
335	3155	169.63	2.78	24593	106.54	0.03799	0.4261	154.4	10.5	189	480 U	0.2193	292	193	127	38.9	163.7	335
340	3230	168.91	2.60	24550	109.94	0.03675	0.4122	159.3	10.8	183	464 U	0.2277	273	180	119	34.0	164.7	340
345	3305	167.98	2.39	24508	113.43	0.03556	0.3989	164.4	11.1	177	449 U	0.2296	262	173	114	29.0	165.6	345
350	3380	166.76	2.17	24464	116.94	0.03443	0.3862	169.4	11.5	171	435 U	0.2240	260	171	113	24.1	166.2	350
355	3457	165.14	1.92	24421	120.46	0.03337	0.3743	174.5	11.8	166	421 U	0.2171	260	172	113	19.1	166.7	355
360	3534	162.89	1.66	24378	123.92	0.03238	0.3632	179.6	12.2	161	409 U	0.2182	251	165	109	14.0	167.0	360
365	3612	159.65	1.38	24336	127.31	0.03146	0.3529	184.5	12.5	157	397 U	0.2534	210	139	92	8.9	167.2	365
370	3693	154.56	1.07	24296	130.61	0.03061	0.3435	189.3	12.8	152 U	386 U	0.4014	129	85	56	3.4	167.4	370
375	3779	145.42	0.74	24259	133.85	0.02982	0.3345	194.0	13.2	148 U	376 U	0.8549	59	39	26	-2.0	167.4	375
380	3885	122.26	0.32	24207	137.41	0.02899	0.3252	199.1	13.5	144	366					-8.9	167.2	380
382	3965	90.00	-0.00	24176	139.73	0.02848	0.3194	202.5	13.7	142	359					-14.1	167.3	382
480	4047	57.74	-0.32	24147	141.75	0.02804	0.3145	205.4	13.9	139	354					-19.4	166.6	480
475	4153	34.58	-0.74	24117	143.83	0.02759	0.3095	208.4	14.1	137	348					-26.3	165.9	475
470	4239	25.44	-1.08	24057	145.07	0.02734	0.3066	210.2	14.3	136	345					-31.8	165.1	470

Sample X-SCAN Overlay



SECRET SPECIAL HANDLING

NO. BOS-66-12074

SHC66-X64

Copy no 2

Copy #2 Copy no 3

Assume one dual unit rebuilt for operational

1 2 3 4 5 6 7 8 9 10 11 12 13 14

11 instruments

13 inst. Recovered 11 flown

C Summary 1 through 14 8 + 13 recovered

PROGRAM SUMMARY

C' Summary 10/26/60 - 11/15/61

11 systems #15 - 25 (23 not flown)
5 recoveries from 10 flights

24" ; 5" not Petz High contrast 90 l/mm

1961

C''' Summary 8/30/61 - 1/13/62 24" Petz. - 9129

6 systems #52 - 57 3404
4 recoveries from 6 flights

"M" Summary 2/27/62 - 12/21/63 24" Petz. f3.5.

26 systems #1 - 26
20 recoveries from 26 flights

Sign. improvements in "J"
Modular star wheel
Four collet scan head
N.D. 65m nd.
New V/H circuitry
New temp sensors
Improved temp insensitivity

"J" History 54 recoveries out of 62 possible from 31 flights

System	S/N	R-O	A	B
1	114/115	8/24/63	8/28	
2	116/117	9/23/63	9/26	
5	124/125	2/15/64	2/18	2/22
6	126/143	3/24/64	No Orbit	
8	146/147	4/27/64	Power Prob. No Rec.	
9	143/149	6/4/64	6/8	6/13
7	144/145	6/19/64	6/23	6/27
10	150/157	7/10/64	7/13	7/17
12	154/155	8/5/64	8/8	8/13
11	152/153	9/14/64	9/18	9/23
3	160/161	10/5/64	10/9	
13	156/157	10/17/64	10/20	10/22 (Veh.)
15	158/159	11/2/64	11/6	11/7 (Sheared Pins)
16	162/139	11/18/64	11/23	11/28
17	138/141	12/19/64	12/24	12/30
18	132/133	1/15/65	1/20	1/25
14	140/165	2/25/65	3/2	3/6 (S Shutter)
19	122/123	3/26/65	3/29	3/31
4X	118/119	4/29/65	5/4	
21	166/167	5/18/65	5/23	5/28 (S Only)
20	136/137	6/9/65	6/15	6/16 (Partial)
22	168/169	7/19/65	7/23	7/28
23	170/171	8/17/65	8/22	8/26
24	172/173	9/22/65	9/27	10/2

C-[illegible] 1966

SECRET SPECIAL HANDLING

NO. BOS-66-12074

System	S/N	R-0	A	B
JX28	142/127	10/5/65	10/10	10/15
25	174/175	10/28/65	11/2	11/7
JX27	164/163	12/9/65	12/10 (80%)	12/11 (Empty)
26	176/177	12/24/65	12/29	1/2
27	178/179	2/2/66	2/7	2/12
29	182/183	3/9/66	3/14	3/19
30	184/185	4/7/66	4/14	4/18

31

28 NOTHING

33 VV

31 VV

~~32 VV~~

36 VV

38

THE "C" PROGRAM HARDWARE WAS BUILT BY FAIRCHILD USING AN ITEK PANORAMIC DESIGN CONCEPT THIS EQUIPMENT WAS BUILT ON A SUB CONTRACT TO FAIRCHILD BECAUSE ITEK HAD NO HARDWARE CAPABILITY

Special Handling

PREPARED BY Roy Anderson
DATE
CHECKED BY

PAGE
MODEL
REPORT NO

MASTER INSTRUMENT

System No.	Serial No.	Film Type	Filter Type	Slit Width (inches)	Take Up Horizon Aperture	Take Up Horizon Exposure Time	Take Up Horizon Filter	Supply Horizon Aperture	Supply Horizon Exposure Time	Supply Horizon Filter
M1	70	SO132	21	.200	F6.8	1/100	25	F6.8	1/50	25
M2	72	SO132	21	.200	F6.8	1/50	25	F6.8	1/50	25
* M3	74	SO132	21	.200	F8.0	1/50	25	F8.0	1/50	25
M4	76	SO132	21	.200	F8.0	1/50	25	F6.8	1/50	25
* M5	78	SO132	21	.200	F6.8	1/25	None	F6.8	1/25	None
M6	80	SO132	21	.200	F8.0	1/50	25	F8.0	1/50	25
M7	84	SO132	21	.200	F6.8	1/25	None	F6.8	1/25	None
M8	90	SO132	21	.200	F8.0	1/50	25	F8.0	1/50	25
M9	82	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M10	88	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M11	92	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M12	94	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M13	96	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M14	98	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M15	100	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
* M16	86	SO132	21	.250	F6.8	1/100	25	F6.8	1/100	25
M17	102	SO132	21	.250	F8.0	1/100	25	F8.0	1/100	25
M18	104	SO132	21	.250	F6.8	1/100	25	F6.8	1/100	25
* M20	108	SO132	21	.250	F6.8	1/100	25	F6.8	1/100	25
M19	106	SO132	21	.250	F6.8	1/100	25	F6.8	1/100	25
1121	112	SO132	21	.200	F6.5	1/100	25	F6.5	1/100	25
1122	110	SO132	21	.200	F6.5	1/100	25	F6.5	1/100	25
** J1	114	SO132	21	.200	F6.5	1/100	25	F6.5	1/100	25
1123	120	SO132	21	.200	F6.5	1/100	25	F6.5	1/100	25
J12	116	SO132	21	.250	F6.5	1/100	25	F6.5	1/100	25
J13	118									
L1	03	SO132	12	.296						
L2	05	SO132	12	.296						
L3	01	SO132	12	.310						
J4	172									

SLAVE INSTRUMENT

System No.	Serial No.	Film Type	Filter Type	Slit Width (inches)	Take Up Horizon Aperture	Take Up Horizon Exposure Time	Take Up Horizon Filter	Supply Horizon Aperture	Supply Horizon Exposure Time	Supply Horizon Filter
M1	71	SO132	21	.200	F6.8	1/100	25	F6.8	1/50	25
M2	73	SO132	21	.200	F6.8	1/50	25	F6.8	1/50	25
M3	75	SO132	21	.200	F6.8	1/50	25	F6.8	1/50	25
M4	77	SO132	21	.200	F8.0	1/50	25	F6.8	1/50	25
M5	79	SO132	21	.200	F8.0	1/50	25	F6.8	1/50	25
M6	81	SO132	21	.200	F6.8	1/25	None	F6.8	1/25	None
M7	85	SO132	21	.200	F8.0	1/50	25	F8.0	1/50	25
M8	91	SO132	21	.200	F8.0	1/100	None	F6.8	1/100	25
M9	83	SO132	21	.200	F8.0	1/100	None	F8.0	1/100	None
M10	89	SO132	21	.200	F8.0	1/100	12	F8.0	1/100	12
M11	93	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M12	95	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M13	97	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M14	99	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M15	101	SO132	21	.200	F6.8	1/100	25	F6.8	1/100	25
M16	87	SO132	21	.250	F6.8	1/100	25	F6.8	1/100	25
M17	103	SO132	12	.250	F6.8	1/100	25	F6.8	1/100	25
M18	105	SO132	21	.250	F6.8	1/100	25	F6.8	1/100	25
M20	109	SO132	21	.250	F6.8	1/100	25	F6.8	1/100	25
M19	107	SO132	21	.250	F6.8	1/100	25	F6.8	1/100	25
1121	112	SO132	21	.200	F6.5	1/100	25	F6.5	1/100	25
1122	111	SO132	21	.200	F6.5	1/100	25	F6.5	1/100	25
J1	115	SO132	21	.200	F6.5	1/100	25	F6.5	1/100	25
1123	114	SO132	21	.200	F6.5	1/100	25	F6.5	1/100	25
J12	117	SO132	21	.250	F6.5	1/100	25	F6.5	1/100	25
J13	119									
	123									

STELLAR AND INDEX (FRAMING)

System No.	Stellar Serial No.	Stellar Film Type	Stellar Aperture	Stellar Exposure	Stellar Filter Type	Index Film Type	Index Aperture	Index Exposure	Index Filter Type	Launch Date
M1	74					SO130	F6.3	1/250	21	2/27/62
M2	None									[illegible]
M3	70					SO130	F6.3	1/250	21	[illegible]
M4	82					SO130	F6.3	1/250	21	[illegible]
M5	26					SO130	F6.3	1/250	21	[illegible]
M6	[illegible]					SO130	F6.3	1/250	21	[illegible]
M7	[illegible]					SO130	F6.3	1/250	21	[illegible]
M8	[illegible]					SO130	F6.3	1/250	E1	[illegible]
M9	[illegible]					SO130	F6.3	1/250	21	[illegible]
M10	[illegible]					SO130	F6.3	1/250	21	[illegible]
M11	[illegible]					SO130	F6.3	1/250	21	[illegible]
M12	100					SO130	F6.3	1/250	21	[illegible]
M13	103	SO130	F1.9	1/2	None	SO136	F4.5	1/125	21	[illegible]
M14	05	SO130	F1.9	1/2	None	SO136	F4.5	1/125	21	[illegible]
M15	07	SO130	F1.9	1/2	None	SO136	F4.5	1/125	21	[illegible]
M16	[illegible]	SO130	F1.9	1/2	None	SO136	F4.5	1/125	21	[illegible]
M17	[illegible]	SO130	F1.9	1/2	None	SO136	F4.5	1/125	21	[illegible]
M18	[illegible]	SO130	F1.9	1/2	None	SO136	F4.5	1/125	21	[illegible]
M20	[illegible]	SO130	F1.9	1/2	None	SO136	F6.5	1/125	21	[illegible]
M19	D10	SO130	F1.9	1/2	None	SO136	F6.5	1/125	21	4/1/63
1121	D9	[illegible]	F1.9	2	None	SO136	F4.5	1/500	21	[illegible]
1122	D11	[illegible]	F1.9	2.5	None	SO136	F4.5	1/500	21	[illegible]
J1	[illegible]	[illegible]	F1.9	2	None	130	F4.5	1/500	21	[illegible]
1123	D12	130	F1.9	2.5	None	130	F4.5	1/500	21	[illegible]
J12	D13	130	F1.9	2	None	130	F4.5	1/500	21	[illegible]
J13										
L1										
L2										
L3	S2	[illegible]	F1.9	1/2	None	SO136	F4.5	1/125	21	3/18/63
J4	S3	[illegible]	F1.9	2	None	SO136	F4.5	1/125	21	[illegible]
	S4	130	F1.9	2.5	None	130	F4.5	1/500	21	[illegible]

* = Not Recovered
** = 2nd Rec. p.6.