TOP SECRET [redacted]

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file 1021

PRELIMINARY

PERFORMANCE EVALUATION

MISSIONS 1021-1 and 1021-2

30 June 1965

Approved [redacted]
Manager
Advanced Projects

Approved [redacted]
Program Manager

TOP SECRET [redacted]

I EVALUATION TEAM

The original negative and duplicate positive material from Mission 1021-1 and 1021-2 were examined at customer facilities during the period of 2 through 9 June 1965. The evaluation team was comprised of [redacted] of [redacted] Messers. [redacted] and [redacted] of ITEK and [redacted] of LMSC.

II FLIGHT SUMMARY

Mission 1021 (J-21) was launched at 1803Z (1103 PDT) hours on 18 May 1965 from Vandenberg Air Force Base. The prime objective of the mission was to acquire cartographic photography of the near equitorial land masses. The mission was launched in the late morning to avoid the normal cloud coverage that prevails in these areas in the afternoon. In order to obtain suitable Stellar Camera photography it was necessary to fly the mission nose first.

The satellite was launched into a 75° inclined orbit having an initial period of 89.81 minutes and an eccentricity of 0.00988. Initial perigee was 109.17 nautical miles at 24.3° North latitude, descending.

The SRV from Mission 1021-1 was successfully air recovered during pass 81 and the second recovery, Mission 1021-2 was caught in the air during pass 161. The impact of both recovery systems was within tolerance.

III MASTER PANORAMIC CAMERA #166.

The Master camera was the AFT looking system during this mission. The camera produced 2841 frames of photography during Mission 1021-1 and 842 frames during Mission 1021-2.

The photographic quality and information content of the Mission 1021-1 photography was considered to be somewhat lower than observed from recent

missions. The cause of lower quality is attributed to attenuation of contrast in the earths haze layer. The cloud cover encountered during the missions was quite low, 35% and 20% respectively, however examination of the Index camera photography showed that almost all of the terrain was covered by haze.

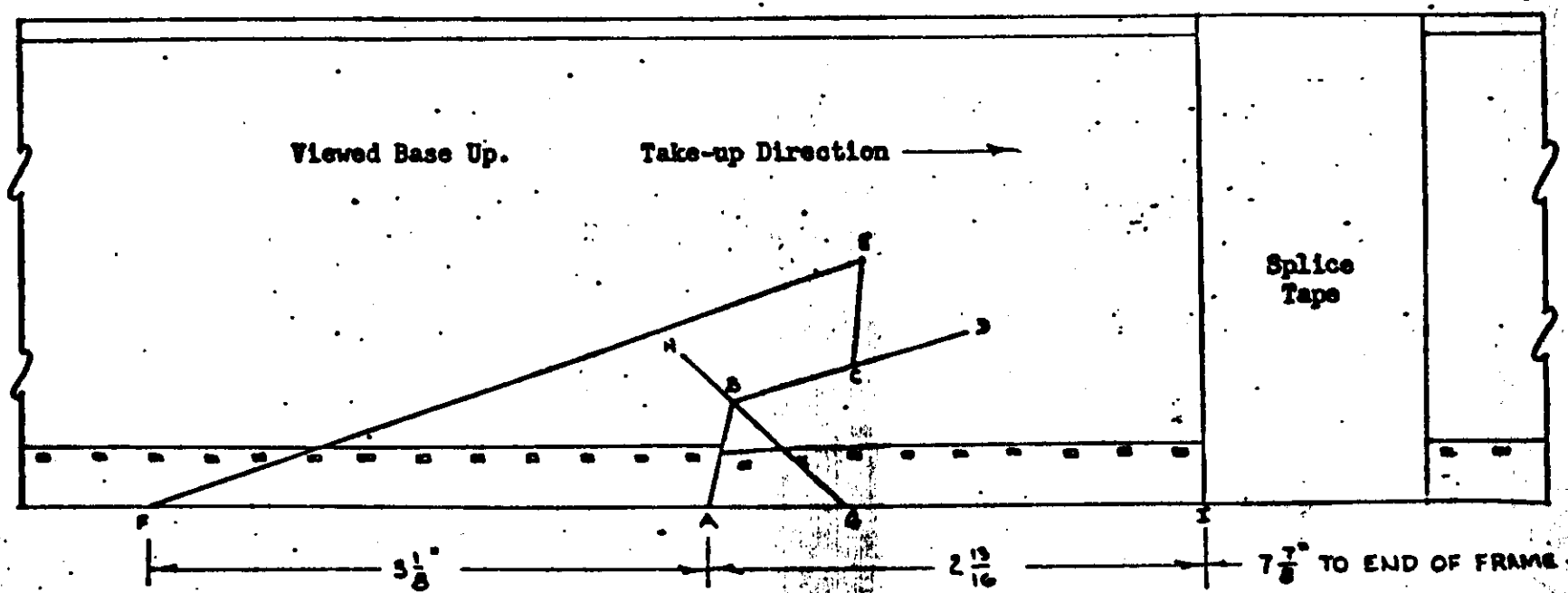
The quality of the Master camera photography from Mission 1021-2 was very poor as the film pulled out of the camera rails in frame 11 of the first programmed operation of the mission, pass D85. The subsequent frames contained approximately 25% to 30% of detectable ground scenes of poor quality while the remaining frame area was badly smeared and unusable.

The film came out of the rails as a result of a manufacturing defect in the film supply. Figure 1 shows this defect and the resulting film damage. During the initial inspection of the coated and slit film defective areas are noted by manually folding the film and cutting the edge with scissors. The film was folded along line G-H, as shown in Figure 1, and cut from B to A and C simultaneously. The scissors scratched the emulsion from point C to point D. This film cut is used as the indicator to the individual splicing the film that a splice is required at that point. Unfortunately the splice was made on the wrong side of the indicator cut.

Examination of frame 11 showed that the entire frame was properly metered into the camera platen as the rail scratch could be followed from frame 10 through frame 11 but was absent in frame 12. The character of the take-up end of frame 11 showed that the film was in the platen at the start of scan as the end was sharp and straight and the first two time track bits were normal. The third and all subsequent time track bits were abnormal in both position and size.

MISSION 1021-2

MASTER CAMERA; PASS 085, FRAME 11.



SEGMENT	CONDITION	LENGTH
A-B	Film Cut; Smooth edges.	0.620"
B-C	Film Cut; Smooth edges.	0.720"
C-D	Heavy emulsion scratch.	0.675"
C-E	Film Tear; Rough edges.	0.570"
E-F	Heavy film crease; Base to base.	4.312"
G-H	Light film crease; Emulsion to emulsion.	1.275"

ANGLE	DEGREES
GAB	78
ABC	118
ABG	58
GBC	59
DCE	85
AFE	19
IGB	137

FIGURE 4

It was not possible to ascertain when the film was torn along line C-E however it is obvious that the film was not creased along line E-F until after the exposure of that area. It is most probable that the E-F crease occurred when the film passed through the film metering roller.

The Master camera continued to function properly up to frame 9 of pass D102 at which time the metering drive pin sheared and film transport ceased. The camera continued to cycle normally throughout the remainder of Mission 1021-2 as evidenced by the presence of Stellar-Index photography which is programmed from the Master camera center-of-format switch.

A film crease was also observed in frames 74 and 75 of pass D41. The crease started 9 3/8" after a manufacturing splice, in frame 73, and extended for 49" along the time track side of the format, approximately 0.025" in from the film edge. The crease was a very narrow line with no indication of emulsion fractures from the crease to the film edge. It is concluded that the film started to mistrack after the splice on an un-flanged roller and that the roller edge produced the crease. The crease stopped 6 1/8" before the end of frame 75.

The Horizon camera photography was satisfactory up to pass D85, frame 11. Following that point the starboard (supply) horizon camera imagery was badly smeared as the film was in motion during exposure. The film moved approximately 0.175" during all subsequent exposures. The port horizon camera was normal throughout all photographic operations.

The binary data block operated normally to pass D85 frame 10. The data lamps were obscured by the camera rails after the failure in frame 11. Several data lamps were intermittently faint throughout the missions although no lamp failures were noted. It is postulated that the low lamp density

resulted from Primary processing. The Processing Summary shows a high degree of correlation between the material processed at the Primary level and low intensity lamps.

Minor light leaks fogged the panoramic camera film in the next to last frame of most operations. The position of the fog places the affected film between the last roller in the Master camera and the first roller in the IR assembly hence the leak apparently came from the stove-drum joint in the Master camera. Additional paint was applied to the Mission 1021-1 ablative shell interior following the light leak analysis of Mission 1019. No leaks were observed in the area of the fifth or sixth frame from the end of operates hence the additional paint has cured this problem. It must be recognized that it is not possible to reach some of the exposed surfaces on all recovery systems hence it is possible that some light leaks may be experienced in this area during future missions. Steps are being taken to achieve permanent corrective action for this problem.

IV SLAVE PANORAMIC CAMERA #167

The Slave camera was the FWD looking system during this mission. The camera produced 2772 frames of photography during Mission 1021-1 and 3177 frames during Mission 1021-2. The camera supply spool was fully depleted in frame 21 of pass D158. The diameter of the film on the take-up spool was approximately 1/2 inch larger than the flange diameter.

The photographic quality and information content of the Slave camera photography for both Mission 1021-1 and 1021-2 was comparable to the Master camera photography of Mission 1021-1. The camera operated normally throughout both missions and no anomalies were observed in the

binary data block, time track, end of pass mark and horizon cameras. The port horizon camera imagery appeared somewhat soft however further examination showed that the ground detail was sharp. The port camera was looking toward the sun side of the orbit plane therefore it is expected that the softness was due to the solar reflection from the earth haze.

Some minor emulsion scratches were present in the active format of most frames under the camera serial number and near the take-up end of the frame. A heavy emulsion scratch was intermittently from D25 through D30. This scratch was often severe and in many instances was continuously through several frames.

A distinct light leak fog pattern was present in the third from the last frame of most passes. The position of this fog was approximately 80 [redacted] from the start-of-pass mark which places the affected film between the Slave camera plate and the intermediate roller assembly. It is most probable that the light leak was located at the Slave camera stove and drum interface. This fog pattern has been present in essentially all Corona M and J missions although recent painting modifications have reduced the fog intensity. It does not appear possible to completely eliminate the residual leak due to its existance at a sensitive, moving interface therefore consideration should be given to the incorporation of a light weight opaque film chute between the Slave camera and the intermediate roller assembly.

V STELLAR-INDEX CAMERA #D63/69/69; MISSION 1021-1

The Stellar and Index cameras both produced 380 frames of photography during the mission. Both cameras produced nine frames of multiple exposure starting with frame 360. Frames 360, 361, 362 and 364 contained three

exposures, frames 371 and 378 were double exposures, frames 374 and 379 had six exposures, and frame 380 had four exposures. All intervening frames were properly exposed. It is most probable that an intermittent failure of the metering solenoid created this problem.

A continuous narrow band of fog was present near the correlation lamp during the first 75% of the Stellar film. The band appeared to be the result of a pressure mark rather than a light leak. The band had a slight waver. Subsequent investigation has not revealed the cause of this problem. A similar pattern was also present in the Index film near the camera serial number.

Newton rings were common throughout the Stellar photography. Foreign matter, probably flakes of emulsion, were adhered to both surfaces of the Index camera original negative and many small obstructions, some in focus and some not, were noted throughout the mission. It may be possible that these anomalies and the pressure markings are related and that more care must be exercised in cleaning the cameras before flight.

The quality of the Stellar camera photography was quite good with approximately 45 stellar images in most formats. The extended baffle produced an anticipated flare and vignetting of approximately 35%. Some star images were detectable within the flared area. The Index photography was considered fair as the overall contrast was lower than usual.

VI STELLAR-INDEX CAMERA #D25/27/25; MISSION 1021-2

The Stellar camera produced 421 photographic frames and the Index camera produced 423 frames during the mission. Both cameras depleted their supply spools during pass D152. The electro-mechanical operation of the cameras was normal throughout the mission. The Stellar photography

was excellent while the Index photography was fair to good.

The flare in the Stellar formats was the lowest seen to date. Generally no flare was present from the extended baffle and the only flare was from the baffle side curtains. A narrow, fog streak was present throughout the mission approximately 0.1 inches from the correlation lamp film edge. It was not possible to ascertain whether the streak was the result of a pressure mark or static discharge and whether it was camera associated. Some static discharge was observed intermittently during the mission from frame 220 to the mission end. Frame 387 was completely obliterated by a static burst.

The resolution in all corners of the Index photography was noticeably lower than near the center of format. This occurs in all Index cameras to a certain extent however the particular lens used in this camera did display a greater degree of astigmatism at the edge of the field than normally observed. The pre-flight camera resolution was within specification.

VII PANORAMIC CAMERA EXPOSURE

The Master camera operated with a 0.175 inch wide slit and a Wratten 21 filter while the Slave camera operated with a 0.250 inch slit and a Wratten 25 filter. Both cameras contained Eastman Type 3404 emulsion. The nominal exposure curves for passes 25, 57, 105 and 136 for the Slave camera are shown in Figures 2 through 5. The Master camera nominal exposures are essentially the same.

The predicted and reported processing level percentages are shown below. It should be noted that the abnormal operation of the Master camera

EXPOSURE POINTS

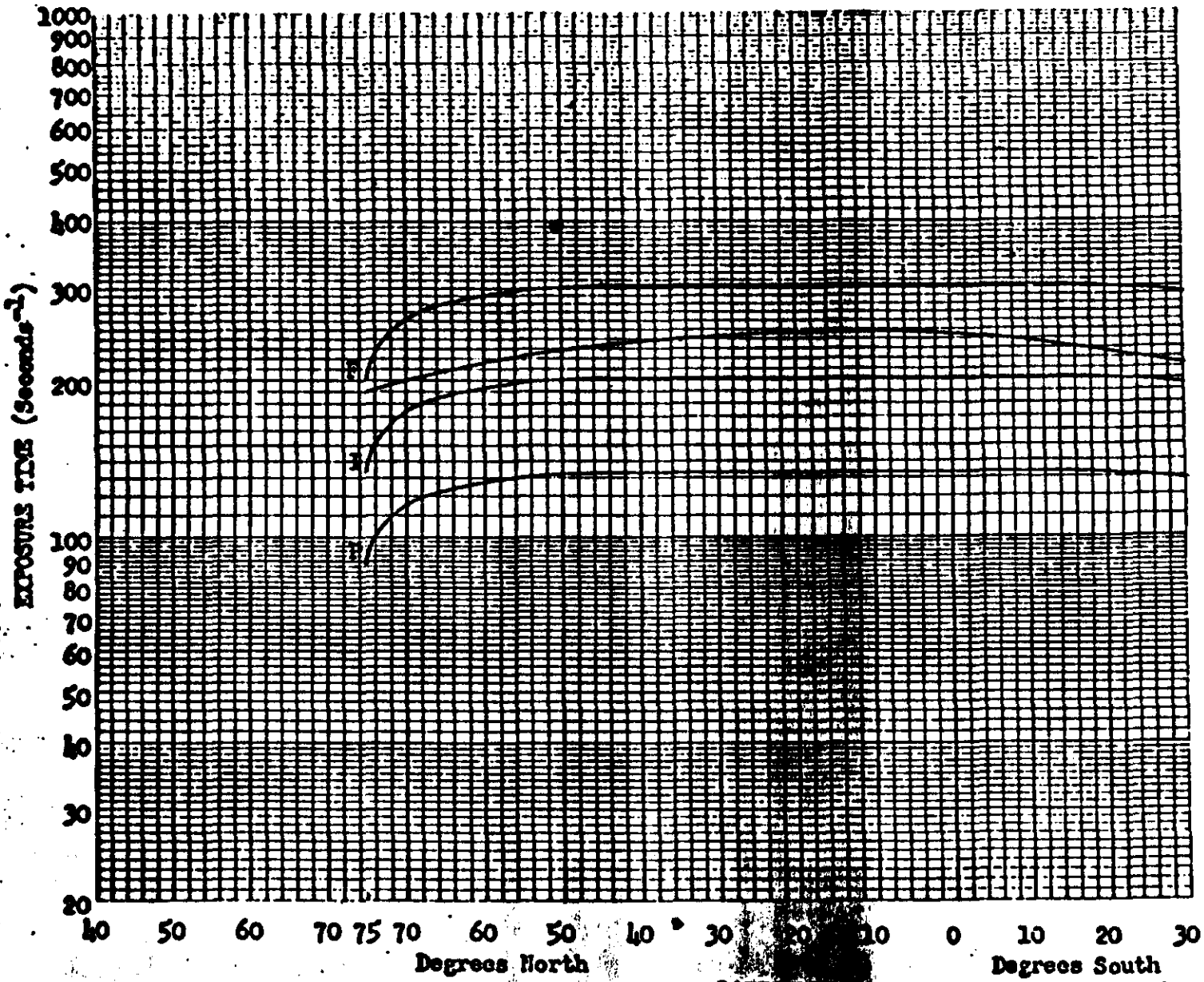


FIGURE [redacted]

Mission No: 1021-1

Payload No: J-21

Camera No: 167

Pass No: 25

Launch Date: 5/18/65

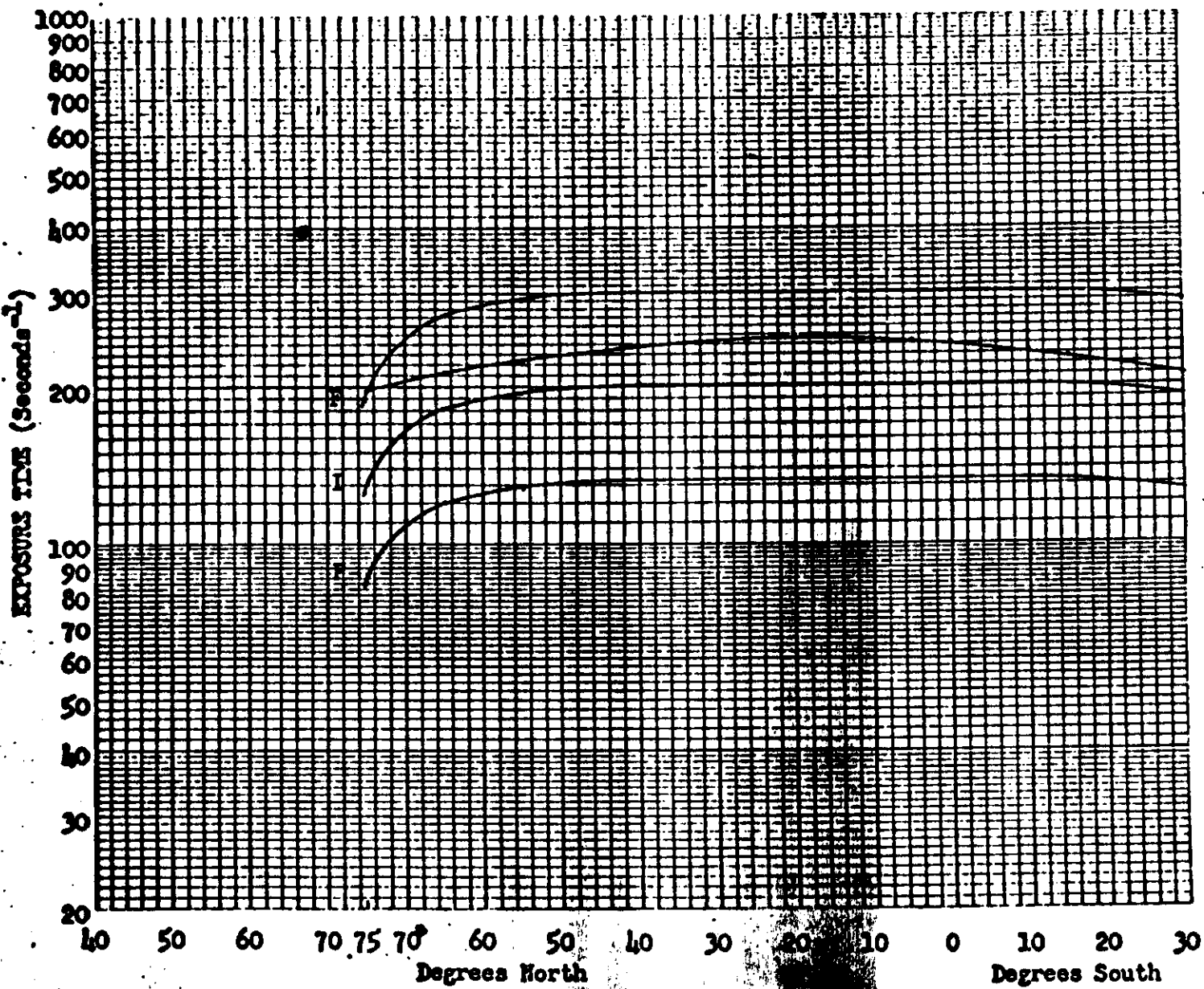
Launch Time: 1803 Z

Slit Width: .250

Filter Type: Wratten [redacted]

Film Type: 3404

EXPOSURE POINTS



Mission No: 1021-1

Payload No: J-21

Camera No: 167

Pass No: 57

Launch Date: 5/28/65

Launch Time: 1803 Z

Slit Width: .250

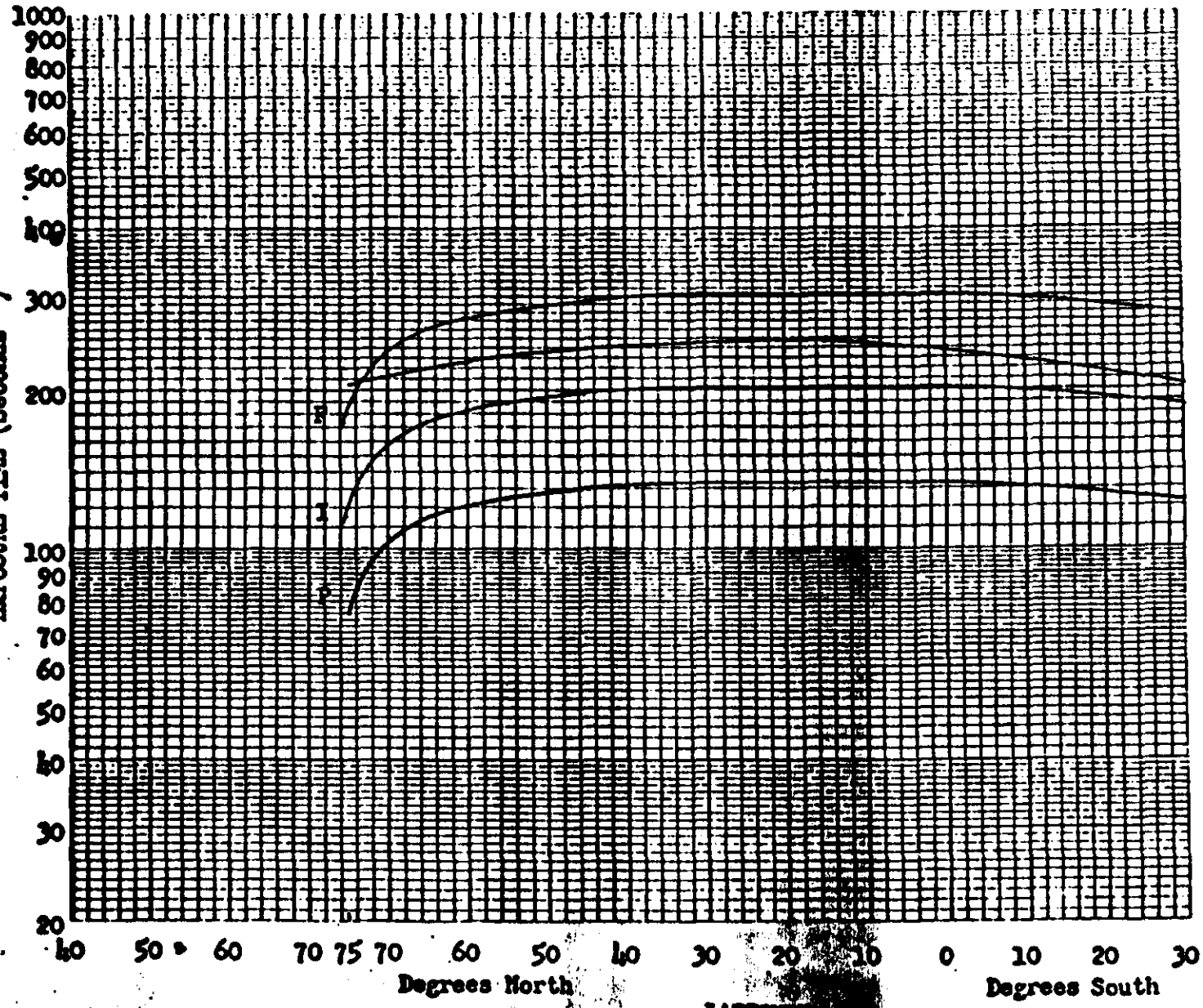
Filter Type: Wratten 2

Film Type: 3404

LATITUDE

FIGURE

EXPOSURE POINTS



LATITU[redacted]

FIGURE

Mission No: 1021-2

Payload No: J-21

Camera No: 167

Pass No: 105

Launch Date: 5/18/65

Launch Time: 1803 Z

Slit Width: .250

Filter Type: Wratten 25

Film Type: 3404

EXPOSURE POINTS

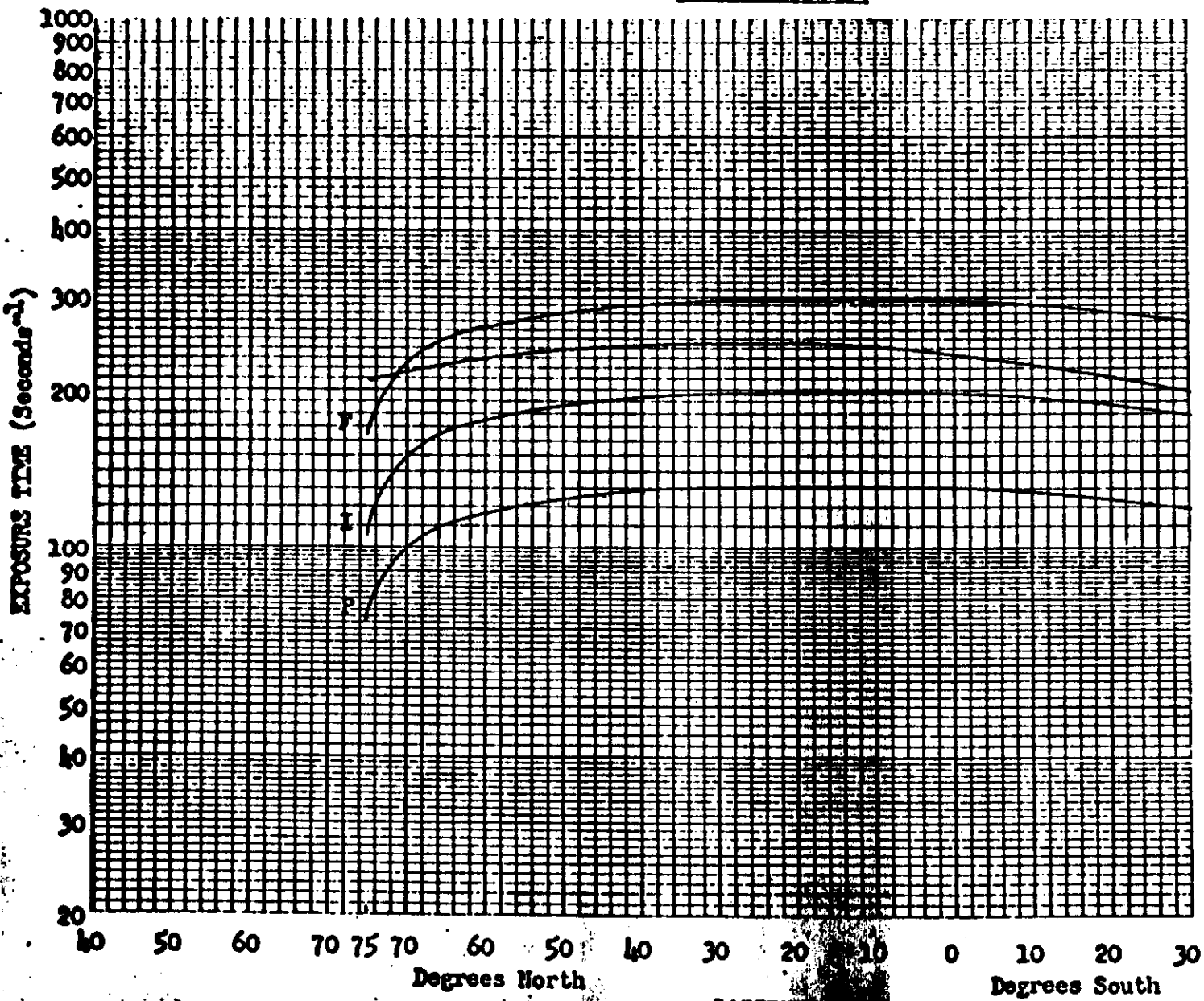


FIGURE 5

Mission No: 1021-2

Payload No: J-21

Camera No: 167

Pass No: 136

Launch Date: 5/18/65

Launch Time: 1803 Z

Slit Width: .250

Filter Type: Wratten 25

Film Type: 3404

during Mission 1021-2 negates any comparison between the predicted and reported processing.

Mission	Camera	Source	Primary	Intermediate	Full
1021-1	Slave	Predicted	0	68	32
		Reported	14	39	47
1021-1	Master	Predicted	0	99	1
		Reported	15	38	47
1021-2	Slave	Predicted	0	34	66
		Reported	46	41	13
1021-2	Master	Predicted	0	100	0
		Reported	22	25	53

The duplicate positives were considered to be somewhat darker than usual however this was attributed to the significant reduction in snow covered terrain. This darkness was not bothersome for the extraction of information. It was specifically determined that there was no loss of information content in shadow areas.

VIII RADIATION DOSAGE

The film dosimeter packets flown in and recovered from the capsules of Mission 1021-1 and 1021-2 have been processed and evaluated at A/P. The table below shows the base plus fog density measurements for the dosimeter samples and the corresponding radiation levels:

	Royal X Pan		3401	
Mission	Base + Fog	Radiation	Base + Fog	Radiation
1021-1	0.17 D	0.2 R	0.18 D	0.6 R
1021-2	0.18 D	0.2 R	0.15 D	0.4 R

The radiation encountered is somewhat lower than the levels experienced during recent missions and is well below the dosage required to fog Eastman Type 3404 emulsion.

IX VEHICLE ATTITUDE

The vehicle attitude data for both Missions 1021-1 and 1021-2 is not presently available at this facility.

X PERFORMANCE VALUES

A. Observed Targets

Objects that could be detected by the Evaluation Team were generally in the same category as Mission 1019.

B. Ground Targets

The photographic operations conducted over the United States and the targets acquired are:

Pass	Target
D-62	No targets observed; all clouds and haze.
D-79	Fort Huachuca, Arizona.
D-95	Fort Huachuca, Arizona.
D-111	Indian Springs and Parumph, Nevada
D-127	Edwards AFB, California
D-143	No targets; California area. MIP target in frame 14.

The engineering photography over Fort Huachuca during pass D-79 produced a 10 foot ground resolution with the Slave camera and a 12.5 foot resolution with the Master. The coverage of this same target during pass D-95 placed the target in the bonus area at the frame end.

The ground resolution at the Indian Springs and Parumph targets was greater than the displayed bars.

The Edwards AFB medium contrast target, available only in the Slave camera photography, resolved 12.7 feet along track and 9 feet in the cross track direction.

XI CONCLUSIONS

A. Summary

The missions produced good photographic coverage and information content of the desired target areas. Enlargements were normally made to 30X which is somewhat below recent experience.

B. Recommended Action

1. The splicing techniques and procedures used by the film manufacturer should be reviewed to preclude the re-occurrance of the encountered failure mode.
2. A film chute should be added to the Corona system between the Slave camera main-plate and the intermediate roller assembly. It does not appear possible to eliminate the camera drum light leak hence a protective chute merits consideration.
3. The slur pulse now presented on the Master camera film to denote Stellar-Index camera operation should also be displayed on the Slave camera film. It is recognized that the pulse would not always be present due to the lack of camera synchronization however this modification would permit partial time correlation of the S/I camera when the Master camera time track is inoperative.

4. The binary data lamps should be adjusted to permit automatic readout at all processing levels. Primary processing has been used to a much greater degree during recent missions.
5. Develop a painting and light leak specification for the ablative shells.
6. Investigate the abrasion pattern on the Stellar and Index film.

Distribution:

[redacted]