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Classified Supplement to

QUARTERLY REPORT

Second Quarter FY-67

(10 Sept 1966 through 9 Dec 1966)

PAR 24-6-5S Contract [redacted] Task B
PAR 24-7-5S Contract [redacted] Task E
PAR 24-7-6S Contract [redacted], Task E

9 December 1966

Prepared by:

for [redacted]

Approved by:

[redacted]

for E. L. Green

Date: 30 December 1966

Prepared at Contractor's Facility
as Specified by
Contract [redacted]

[redacted]

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INTRODUCTION

The classification of PAR 24-6-5S, PAR 24-7-5S, and PAR 24-7-6S quarterly reports, require that they be bound separately from other PAR reports making up the Quarterly Report, Contracts [redacted] and [redacted] Second Quarter FY-67 dated 9 December [redacted].

9 Dec 66

TABLE OF CONTENTS

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~~TOP SECRET~~

Contract [redacted] Task B
Second Quarter FY-67

PAR 24-6-5S
9 Dec 66

SUBJECT: Exposure Criteria for Acquisition Films

TASK/PROBLEM

1. Modify and refine the criteria for exposure of acquisition films through analysis of data from operational missions, controlled flight tests, laboratory tests, and scientific literature. Integrate into the Exposure Criteria Studies data on geographical location, sun direction, and air masses, and evaluate their effect on exposure. As significant results are determined, disseminate updated exposure recommendations to the reconnaissance collections community.

DISCUSSION

2. The interim Figure of Merit report was transmitted to the customer on 15 September 1966.

3. The interim Bow Tie Test Slit report was completed and will be transmitted in January 1967.

4. The special report, Density Analysis of Narrow Slit (0.0048-Inch) Photography in Missions [redacted] and [redacted] was transmitted to the customer on 19 October 1966.

PLANNED ACTIVITIES

5. Publish the "Bow Tie Test Slit" report.

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PAR 24-7-5S
9 Dec 66

SUBJECT: Exposure Criteria for Acquisition Films

TASK/PROBLEM

1. Modify and refine the criteria for exposure of acquisition films through analysis of data from operational missions, controlled flight tests, and scientific literature.

DISCUSSION

2. Routine Mission Data Processing. Data collection and processing continue to function smoothly. In order to expedite collection of density data, a system has been worked out so that all data required for both printing purposes and for exposure criteria studies can be collected at one time.

3. Results of Routine Mission Analysis.

a. Routine collection and processing of density data for the Scene Luminance Study were completed for 9 of the 12 missions listed in Table 1. Density/Luminance Profiles and scattergrams were also completed for these nine missions, and are shown in Figures 6 through 19 at the end of this report.

b. Density Analysis for completed missions (except mission [redacted] discussed in paragraph d. below) is summarized in the bar charts, Figures 1, 2, and 3. Also included, for comparison purposes, are similar results from earlier missions. The labeling on the graphs indicates the percent of frames in each mission (or part of a mission) which was within the desired density limits. A detailed analysis has been made using two different criteria for the tolerance limit of the lower density extreme, 0.5 and 0.4. In both cases, 2.0 has been used as the upper density limit. For frames which had density values below or above the desired limits, the graph indicates whether this condition could have been corrected or improved by different levels of processing or exposure.

PAR 24-7-5S
9 Dec 66

Table 1

Mission No.	Density Data Collected	Percent of Processing Completed	Analysis Completed
1000 Series			
1036-1	8/19/66	100%	9/2/66
1036-2	8/25/66	100%	8/31/66
1035-1	9/26/66	100%	10/7/66
1035-2	9/31/66	100%	10/7/66
1037-1	11/18/66	75%	
1037-2	11/28/66	50%	
[redacted]	[redacted]	100%	[redacted]
[redacted]	[redacted]	100%	[redacted]
[redacted]	[redacted]	100%	[redacted]
[redacted]	[redacted]	100%	[redacted]
[redacted]	[redacted]	100%	[redacted]

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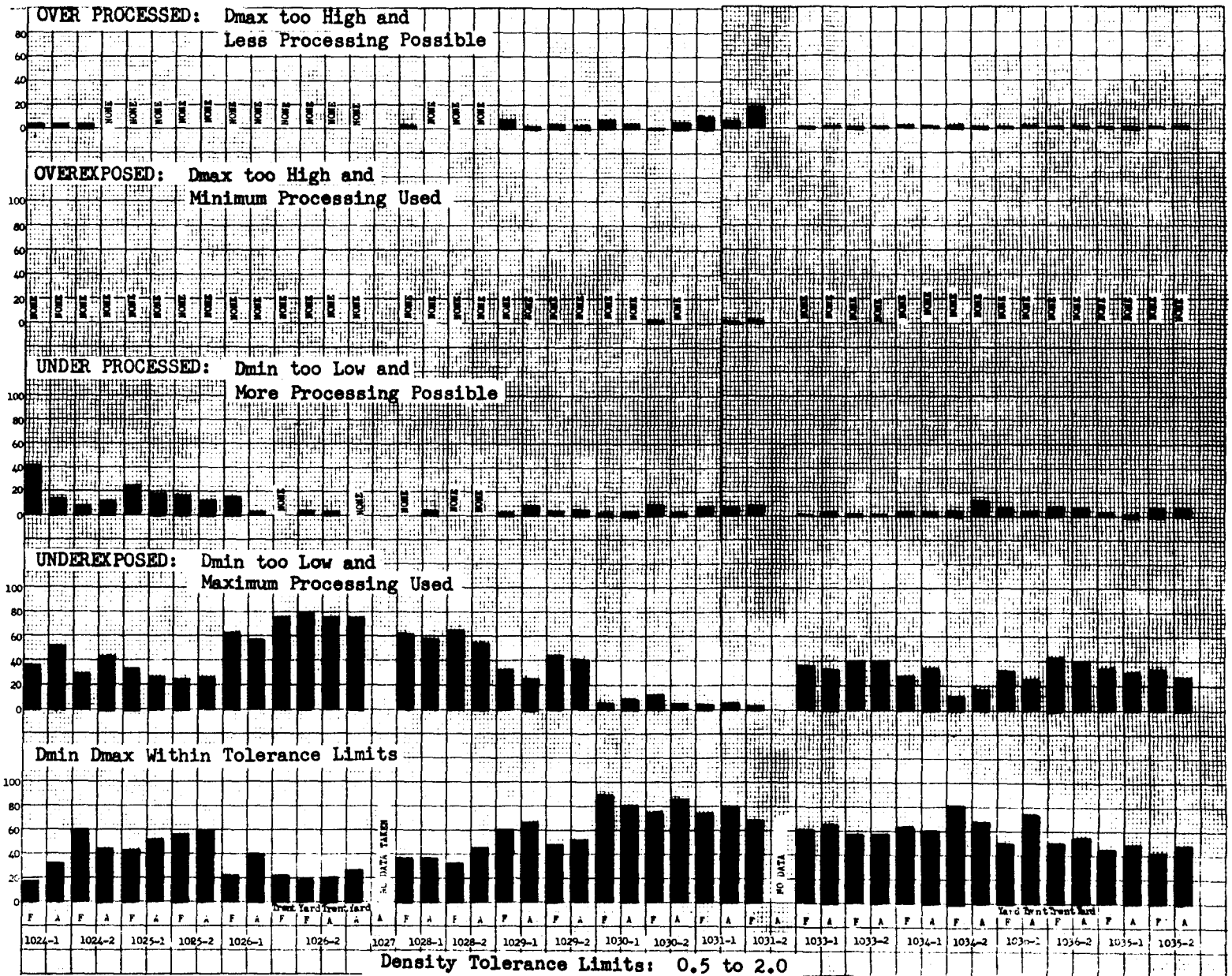

Figure 1. Analysis of Frames Out of Tolerance Using Two Criteria (1000-Series Missions)

[redacted]

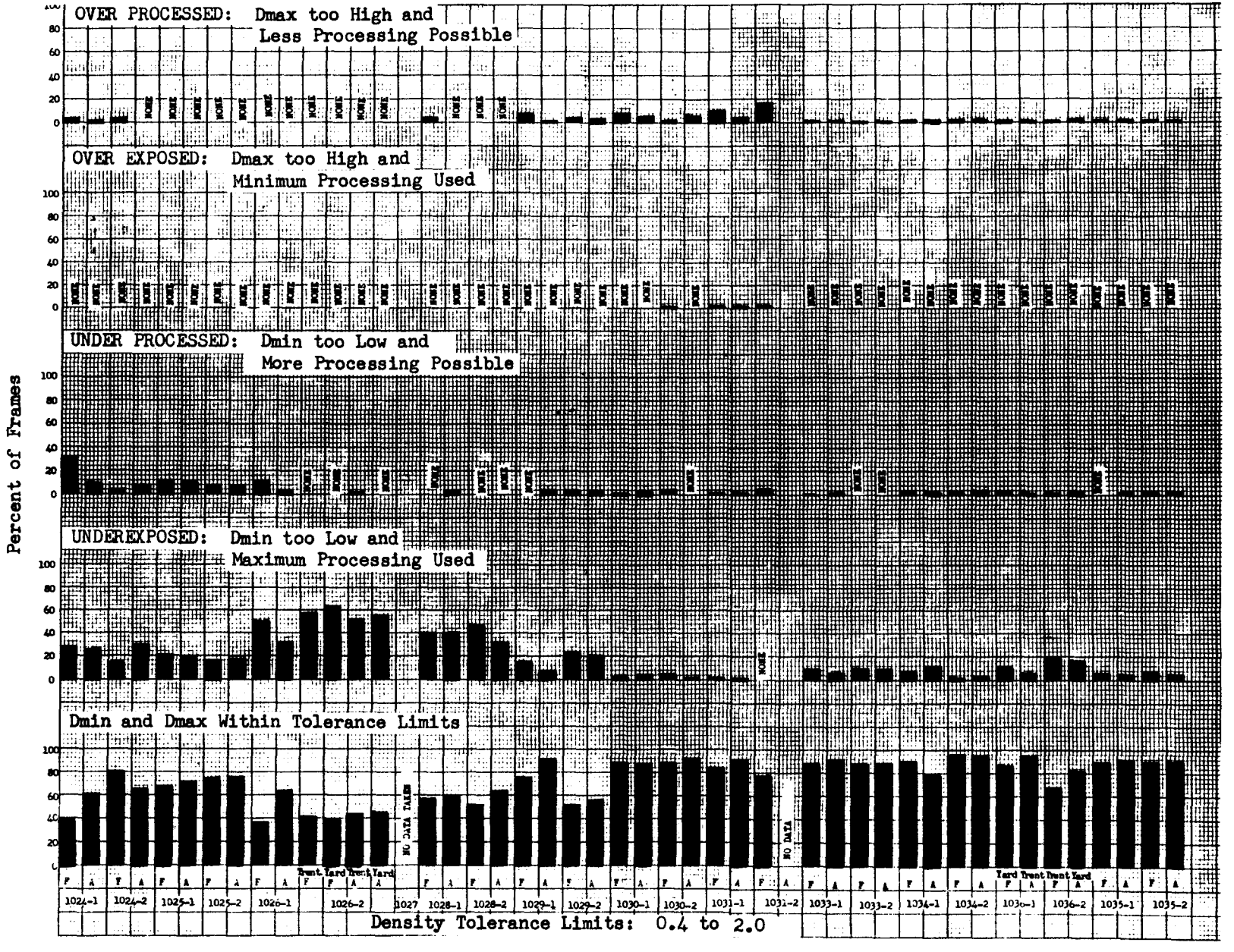

Figure 2. Analysis of Frames Out of Tolerance Using Two Criteria (1000-Series Missions)

c. Summary Evaluation for 1000 Series. Figures 1 and 2 show that the missions processed during the current period (1036 and 1035) had very slightly less satisfactory density results than in the preceding period. Luminance values continued low as in recent missions, probably because of large amounts of vegetation and small amounts of snow. There continued to be significant underexposure—an average of about 30% of frames, as shown in Figure 1.

d. Summary Evaluation for [redacted] Series. Figure 3 shows that missions [redacted] and [redacted] had slightly less satisfactory results than in other recent missions. They continued the low luminance values as in other recent missions, again probably caused by seasonal effects. Exposure, generally, appeared good subjectively, but objectively there was a significant amount of underexposure. Mission [redacted] (shown later in Figure 4) had better exposure results, probably because of seasonally higher luminances.

4. Density Tolerance Limits for Revised In-Tolerance Analysis

a. The routine Mission Density/Luminance reports have been reporting the quality of photography based on minimum and maximum density readings. A density of 0.4 (or 0.5) has been used as a minimum, with 2.0 for the maximum in-tolerance extremes. These tolerance limits do not take into account the process differences, cause confusion because there are two sets of results, and are in other ways unsatisfactory. In the new in-tolerance density analysis, new limits are determined based on densities corresponding to 1.2 contrast levels at the toe and shoulder of the appropriate characteristic curve. Individual limits are determined for each of the three process levels. These new limits replace the present double reporting system. It is expected that these limits will serve as approximations for the peak resolution range until better resolution data are available. Figure 4 compares Missions [redacted] and [redacted] on this basis.

b. Fifteen density categories are included within three exposure classifications for purposes of the routine mission density analysis. These categories are then grouped for purposes of exposure evaluation,

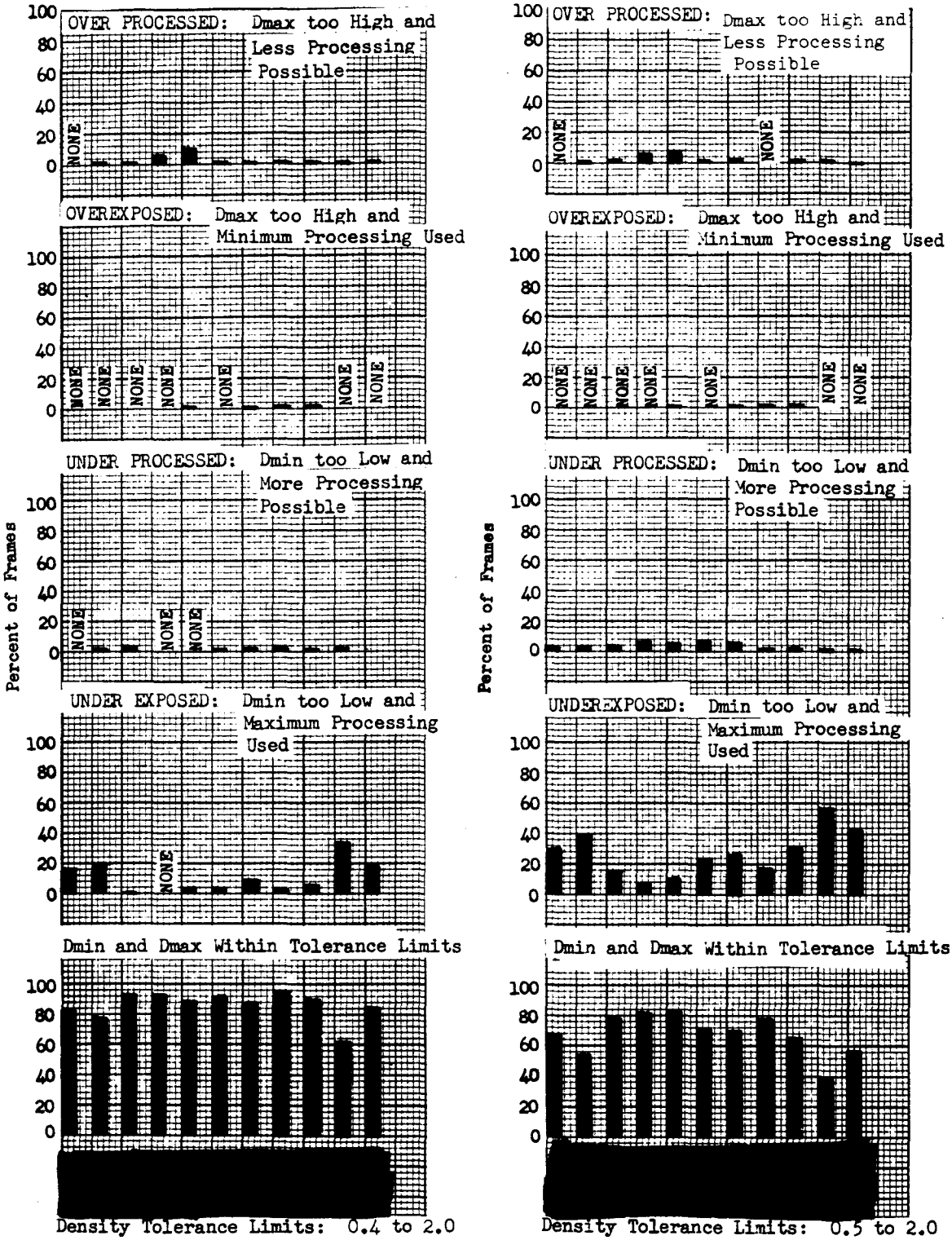

Figure 3. Analysis of Frames Out of Tolerance Using Two Criteria [redacted] Series Missions)

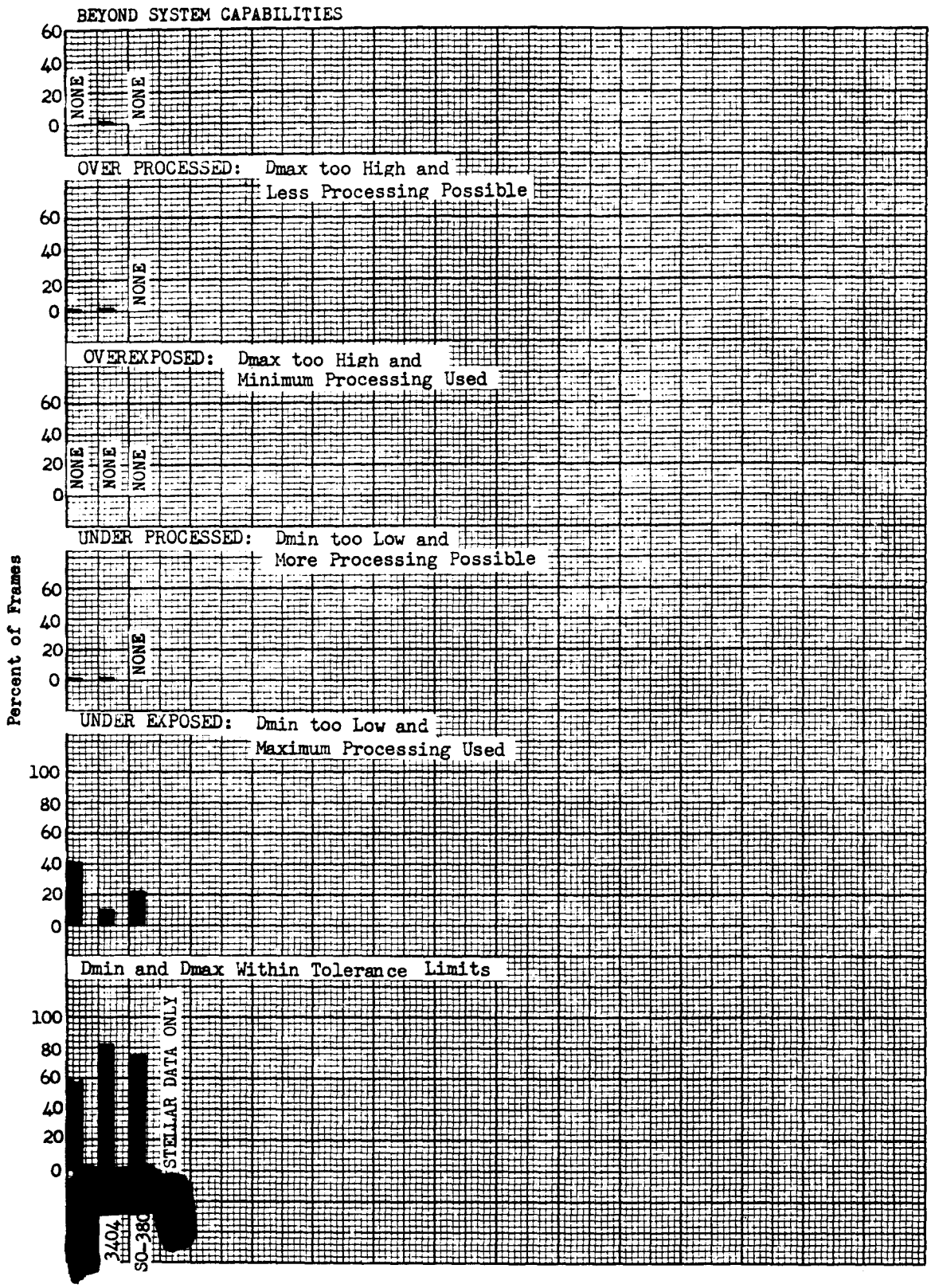

Figure 4. Density Tolerance Limits Based on 1.2 Contrast [redacted]-Series Missions)

processing evaluation, and overall density evaluation. The following is a brief description of these categories and classifications. (Later, Table 2 presents a typical analysis, by category, of Mission 1035).

(1) I: Satisfactory Exposure - within capability of processing to bring minimum and maximum density of a frame within density tolerance extremes.

(a) IA: Within Tolerance - frames within density tolerance extremes, regardless of whether processed at best level or not.

1. IA1: Best Processed - properly processed at the level which would put the density extremes within tolerance and most nearly center the frame density extremes about the peak resolution range (as estimated by the density tolerance limit values).

2. IA2: Over-Processed but Within Tolerance - those frames (with density extremes in tolerance) for which a lower process level would more nearly have centered the frame density extremes about the estimate peak resolution range.

3. IA3: Under Processed but Within Tolerance - those frames (with density extremes in tolerance) for which a higher process level would more nearly have centered the frame density extremes about the estimated peak resolution range.

(b) IB: Out of Tolerance - Those frames which would have been in-tolerance if processed at a different level.

1. IB1: Over Processed - out-of-tolerance frames which would have been within tolerance if processed at a lower level.

2. IB2: Under Processed - out-of-tolerance frames which would have been within tolerance if processed at a higher level.

(2) II: Unsatisfactory Exposure

(a) IIA: Overexposure - frames for which the highest density corresponds to exposure above the 1.2 contrast level on the shoulder of the primary level characteristic curve.

1. IIA1: Best Processed, Overexposed - overexposed frames processed at primary level.

2. IIA2: Overprocessed, Overexposed - overexposed frames processed at intermediate or full level.

(b) IIB: Underexposure - frames for which the lowest density corresponds to exposure below the 1.2 contrast level on the toe of the full level characteristic curve.

1. IIB1: Best Processed, Underexposed - underexposed frames processed at full level.

2. IIB2: Under Processed, Underexposed - underexposed frames processed at primary or intermediate level.

(3) III: Beyond System Capability

(a) IIIA: Beyond System Latitude - frames which have a larger log E range than the log E range of the in-tolerance density extremes. Processing level acceptability is determined based on most nearly centering the frame density range about the estimated peak resolution.

(b) IIIB: Out of Phase - frames which are within system latitude but for which only one density extreme (minimum or maximum) would be within the in-tolerance density limits for any process level. Again, processing acceptability is determined on optimum centering of the frame density extremes about the mid-point of the estimated peak resolution range.

c. Mission reports subsequent to [redacted] and 1035 will use the above described method of analysis. In comparison to control limits used for density analysis in the AFSPPF PET reports, the new limits and categories described above appear to be somewhat tighter. In addition, the new method is more extensive. For instance, a minimum density above 0.9 and processed at other than the primary level is considered overprocessed by AFSPPF criteria. By the new density analysis criteria described above, the frame may be considered overprocessed or within tolerance depending on the accompanying maximum density. With this further breakdown it would be classified into one of the following:

(1) In tolerance, best processing (IA1)

(2) Out of tolerance because of over processing (IB1)

(3) In tolerance but overprocessed (IA2)

(4) Overexposed and overprocessed (IIA2)

(5) Beyond System Latitude, overprocessed (IIIA)

(6) Out of Phase, overprocessed (IIIB)

d. The use of these new Density Tolerance Analysis criteria is illustrated in Table 2. These are the actual results for mission 1035. Note that each part is individually analyzed, as well as the mission as a whole. For [redacted] series missions, the results are presented for each of the several film types used in the mission. At the bottom of the sheet, the actual density values are tabulated which were used as tolerance limits in the analysis.

e. When more precise resolution data becomes available, further work will be done to refine the method of analysis.

5. New Format for Routine Mission-Analysis Reports

a. An improved routine-mission-reporting format has been completed. The new format was used on the three most recent missions analyzed: 1035, [redacted] and [redacted] For comparison, mission 1035-1 is reported in both old and new formats. Results of density and luminance analysis are presented in a clearer, more concise fashion, and causes of out-of-tolerance densities are pinpointed in detail. This should be very useful to the evaluation teams.

b. Further work is being done to prepare a cumulative out-of-tolerance graph for past missions based on the new detailed out-of-tolerance analysis. (Described in detail, paragraph 5).

c. Additional work is planned to include cumulative graphs of several types of data from past missions for ease of direct comparison. Missions will also be ranked in order of:

(1) Overall density performance.

(2) Effect of exposure used on density quality.

(3) Effect of processing conditions on density quality.

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PAR 24-7-58

9 Dec 66

Table 2: Density Tolerance Analysis for Mission 1035

		1 FWD (%)	1 AFT (%)	2 FWD (%)	2 AFT (%)	TOTAL MISSION (%)
I.	SATISFACTORY EXPOSURE	66.8	70.8	69.1	72.7	68.7
	A. Within Tolerance					
	1. Best Possible Process	60.7	63.3	53.7	60.2	59.4
	2. Over Processed	2.2	4.0	2.5	3.5	3.1
	3. Under Processed	3.9	3.2	8.2	6.0	4.8
	B. Out of Tolerance					
	1. Over Processed	0.0	0.0	0.5	0.2	0.2
	2. Under Processed	0.0	0.3	2.2	2.8	1.2
II.	UNSATISFACTORY EXPOSURE	33.2	29.2	32.8	26.8	29.6
	A. Over Exposure					
	1. Best (Primary) Process	0.0	0.0	0.0	0.0	0.0
	2. Over Processed	0.0	0.0	0.0	0.0	0.0
	B. Under Exposure					
	1. Best (Full) Process	33.2	29.2	32.8	26.6	29.5
	2. Under Processed	0.0	0.0	0.0	0.2	0.1
III.	BEYOND SYSTEM CAPABILITY	0.0	0.0	0.0	0.4	0.2
	A. Beyond System Latitude					
	1. Best Process	0.0	0.0	0.0	0.0	0.0
	2. Over Processed	0.0	0.0	0.0	0.2	0.1
	3. Under Processed	0.0	0.0	0.0	0.0	0.0
	B. Out of Phase					
	1. Best Process	0.0	0.0	0.0	0.0	0.0
	2. Over Processed	0.0	0.0	0.0	0.0	0.0
	3. Under Processed	0.0	0.0	0.0	0.2	0.1

Density Tolerance Limits Criteria Used for Analysis:

(1.2 Contrast, W23A Filter, FWD System)

PROCESS	LOWER DENSITY	UPPER DENSITY
PRI.	.42	2.08
INT.	.41	2.10
FULL	.50	2.11

(1.2 Contrast, W21 Filter, AFT System)

PROCESS	LOWER DENSITY	UPPER DENSITY
PRI.	.38	2.06
INT.	.40	2.12
FULL	.50	2.07

[redacted]

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d. The question of correctly weighting solar altitude intervals and processing levels has been resolved by taking a uniform sample over the entire mission record.

6. Input Message in Machine Readable Form

a. As yet, input data on magnetic tape has not been put into use on a routine basis.

b. The data for two more missions (1035-1 and 1036-1) in the originally agreed to format were received on magnetic tape, tested, and found to be satisfactory. It was learned, however, that the customer could not deliver the data in this particular format when it was required (at the time of "Priority 1" pickup).

c. It was suggested to the customer that a satisfactory alternative procedure would be for him to deliver a magnetic tape duplicate of the TWX message at the required time. The customer indicated there was a good probability that he would be able to do this. Sample tapes in this format for 1037-1 and -2 and [redacted] have been received for test purposes. These have been analyzed and the format was determined to be suitable. They can be read satisfactorily. Computer programs are now being written to use them.

d. The customer has agreed to attempt furnishing the message data in this TWX duplicate format on a routine basis (at the time of "Priority 1" pickup) beginning with Mission [redacted].

7. New Exposure-Curve Recommendation for Type 3404 Film in Very High Altitude Photography. Comments were received from only one user. They indicated a desire to base their exposure criteria on the large experimental data base, but at a higher level. Although it was acknowledged that this represented a significant improvement over the current exposure criteria, it was recommended this be done by using the 1σ B min curves as the basis for the criteria. No response to this recommendation has been received as yet. The modified recommendation has not been communicated to any other users.

8. Scene Luminance Curves

a. Calculations of luminance versus solar-altitude estimates based on past missions parametrically analyzed according to camera and time-of-year are nearly completed.

b. An interim report will be prepared recommending exposure based on statistically predicted scene luminance versus solar-altitude curves for three parametric divisions of data. These divisions are:

(1) All of the data (approximately 53,000 pairs of Luminance values).

(2) Camera System.

(3) Camera System and Time-of-Year (2 month intervals). Luminance ratio curves will also be included to assess the expected contrast variation with solar altitude and the parameters described above.

c. Future refinements of luminance vs solar altitude will be based on past missions analyzed according to snow content of a scene, approximate target location, and perhaps CATS angle.

9. Evaluation of Exposure in Index Photography

a. Routine evaluation of index-record exposure is continuing. An interim report recommending exposure for future index records on the basis of past records was prepared and submitted for approval to publish.

b. New computer programs have been prepared for use in evaluating the interrupted processing of the [redacted]-series index record. Preliminary results indicate that interrupted frame-by-frame processing, and the capability to vary exposure time of the [redacted] index camera, have significantly improved index record quality. Further work is being done to analyze scene luminance and scene contrast as recorded in [redacted] and [redacted] index records.

c. Changes to the input message for [redacted]-series index records have been requested to assist in calculation of luminance and contrast on future records.

d. An updated cumulative record of the density distributions from past mission index records is being prepared.

10. Computer Simulation of Exposure/Processing

a. Several variations in the standard exposure/processing conditions have been evaluated by applying computer simulation to past mission data. Photographic quality of the mission (determined by the contractor's density tolerance analysis techniques) as actually flown or processed is then compared to those results derived from simulation of the variation being studied. Variations which have been and will be studied in the future include:

(1) The AI6 increased speed process.

(2) Increased exposure based on new recommended exposure curves for very high altitude photography.

(3) Utilization of only one (or two) of the three available interrupted process levels.

These simulations are especially valuable since they base comparisons of new exposure/processing conditions on an actual mission situation.

b. Further investigations utilizing these same basic computer simulation programs will be done as new exposure/processing conditions are established. Evaluation of recommended exposure criteria will be continued.

11. Haze Studies and CORN Program

a. Evaluation of the effects of haze, in connection with these Exposure Criteria Studies, is based primarily on analysis of those frames in operational missions which contain CORN targets.

b. A substantial file of CORN target data is being accumulated from routine operational missions. More statistically meaningful analyses of the effects of haze are now possible and are proceeding.

c. A special report will be prepared summarizing calculated apparent luminance for CORN edge targets photographed in past [redacted] and [redacted] series missions. All of the information in this report has already been transmitted to one member of the customer organization during November 1966 in response to a TWX request.

d. Camera data that will permit calculation of ground luminance values from photographic photometry at CORN Target sites has not yet been received. It was requested from SPPF in July and they in turn requested the desired information from [redacted] These data are expected by the end of the year.

e. A recommendation was prepared and communicated to the appropriate customer organizations for the sequence in which CORN target displays should be laid out. Other CORN system procedures have been under study, for the purpose of making requested recommendations.

f. The reflectance angle tests on CORN edge target panels, as requested at the 20 July 1966 CORN meeting, were completed by [redacted] and the Hasselblad photometric data was recently received. Analysis of these data has not begun.

12. Exposure Experiments in [redacted] and [redacted] Series Missions

a. "Bow Tie" Test Slit in Mission [redacted] (Reported here for completeness). A special report under PAR 24-6-5S discussing the analysis of this exposure experiment has been prepared and approved for publication.

b. Density Analysis of Narrow Slit (0.0048-Inch) Photography in Missions [redacted] and [redacted] (reported here for completeness). A special report on this subject was published on 10 October under PAR 24-6-5S.

c. Separated Gray Scale Panels in Missions [redacted] and [redacted]. A summary of the results of analysis of this experiment was presented in the last Quarterly Report, dated 9 September 1966, under this PAR. It was recommended that the panels not be separated. A special report on this subject has been approved for publication and will be transmitted in the next few weeks.

d. Evaluation of Exposure Experiments in Past [redacted] Series Missions. The experimental material from Mission [redacted] was recalled and microdensitometer tracing will begin as soon as higher priority tracing on this instrument permits. The follow-on analysis of the microdensitometer

data can begin immediately after data collection.

e. Proposed Future Exposure Experiments. Several exposure experiment recommendations are being prepared in detail for the [redacted] and [redacted] Series.

13. Scanning Methods

a. Present effort in the development of scanning methods is directed at establishing a correlation between scan results using a microdensitometer, and scan results using a high speed scanner such as the PAR 70B scanner.

b. A study is underway to select a microdensitometer scan format (spot size, spacing, and filtering methods) which will be used in scanning areas in a sizable number of frames. (See paragraph 14, Figure of Merit Studies). These studies have made use of all available data on microdensitometer techniques being done on PAR 25-7-2S. These data are needed for work required by the approved study plan for this PAR. These are:

(1) Luminance and density distribution within scenes.

(2) Contrast distribution within scenes.

(3) Haze studies.

(4) Figure of Merit method.

Studies to date include scan examination of spot sizes from 2.9μ to 730μ, about 40μ appearing most useful at this moment. This and further study results are to be included in an interim report. In addition, these scanning method studies are required for work on target brightness studies (PAR 24-7-6S).

c. The frames for which microdensitometer scans are made will also be scanned using the PAR 70B scanner, when that study tool becomes available. Extensive studies will then be made to determine how these PAR 70B scan results should be interpreted relative to luminance, density, contrast distribution, etc.

d. Close coordination is being maintained with the development of the PAR 70B scanner to assure that it will be suitable for these studies, as intended.

e. The scanning methods being developed and the resulting analyses and criteria, while originally intended to evaluate and refine Exposure Criteria, will also be directly useful in applying scan methods and establishing criteria for processing, printing, overall quality determinations, etc.

14. Figure of Merit Method Relating Resolution to Exposure Evaluation

a. Several computer programs have been written to implement the Figure of Merit study. These programs attempt to convert microdensitometric data to meaningful parameters from which Figures of Merit can be calculated. Several techniques for evaluating the Figure of Merit through density, exposure, contrast, and resolution data currently are under study.

b. Study directed toward the Figure of Merit implementation has yielded several useful outputs having more general and immediate applicability. Of particular interest is the Mathematical Model Characteristic Curve. The technique defines the D log E curve with five parameters (i.e. fog plus base density, maximum density, gamma, log E at inflection point and density at inflection point). A computer program has been written to evaluate these parameters from sensitometric test strip data.

15. Controlled Flight Tests. These tests are I Vehicle missions flown for the purpose of collecting luminance information usable in black-and-white exposure criteria studies. Of particular value in controlled testing is the more precise knowledge of, and therefore data on, ground luminance and target object reflectance. From the knowledge of these and other factors relating to exposure, more valid film and system comparisons can be made.

a. A Red Dot test (24-7-5-2) will be conducted in December or January to compare the performance of Type 3400 to 3401, in the B-2

configuration. This test is designed to determine the approximate minimum solar altitude at which Type 3400 can be effectively used. This is a continuation of an experiment conducted during test 24-6-5-7 (GT-256-66).

b. Examination of a number of tests conducted with the B-2, B, and A-2 configuration in the red-green portion of the spectrum has indicated that an average value for the Contrast Constant, at 40° solar altitude, is 15; the haze level average at the same altitude is on the order of 400 foot-Lamberts (apparent luminance). It is of interest to examine the relationship between reflectance and apparent luminance, employing these values in the following computation:

$$\text{Log } B_{a_R} = \text{Log } (R + 15) + 1.426$$

where B_{a_R} = The apparent luminance in foot-Lamberts, for a given reflectance, R.

R = % reflectance of objects.

c. Figure 5, curve (A) illustrates these relationships. Of additional interest are the values which may be derived from applying scene reflectance statistics to this curve. The five vertical lines below the haze line indicate the mode, $\pm 2\sigma$, and $\pm 1\sigma$ limits of reflectance as derived from data collected by Sorem.* These data are for an urban/suburban area in the summertime and are not to be construed as universally applicable.

d. The skylight curve (B) was obtained by shifting the daylight curve by the ratio of daylight to skylight.

e. It is interesting to note some of the values from the resulting relationships.

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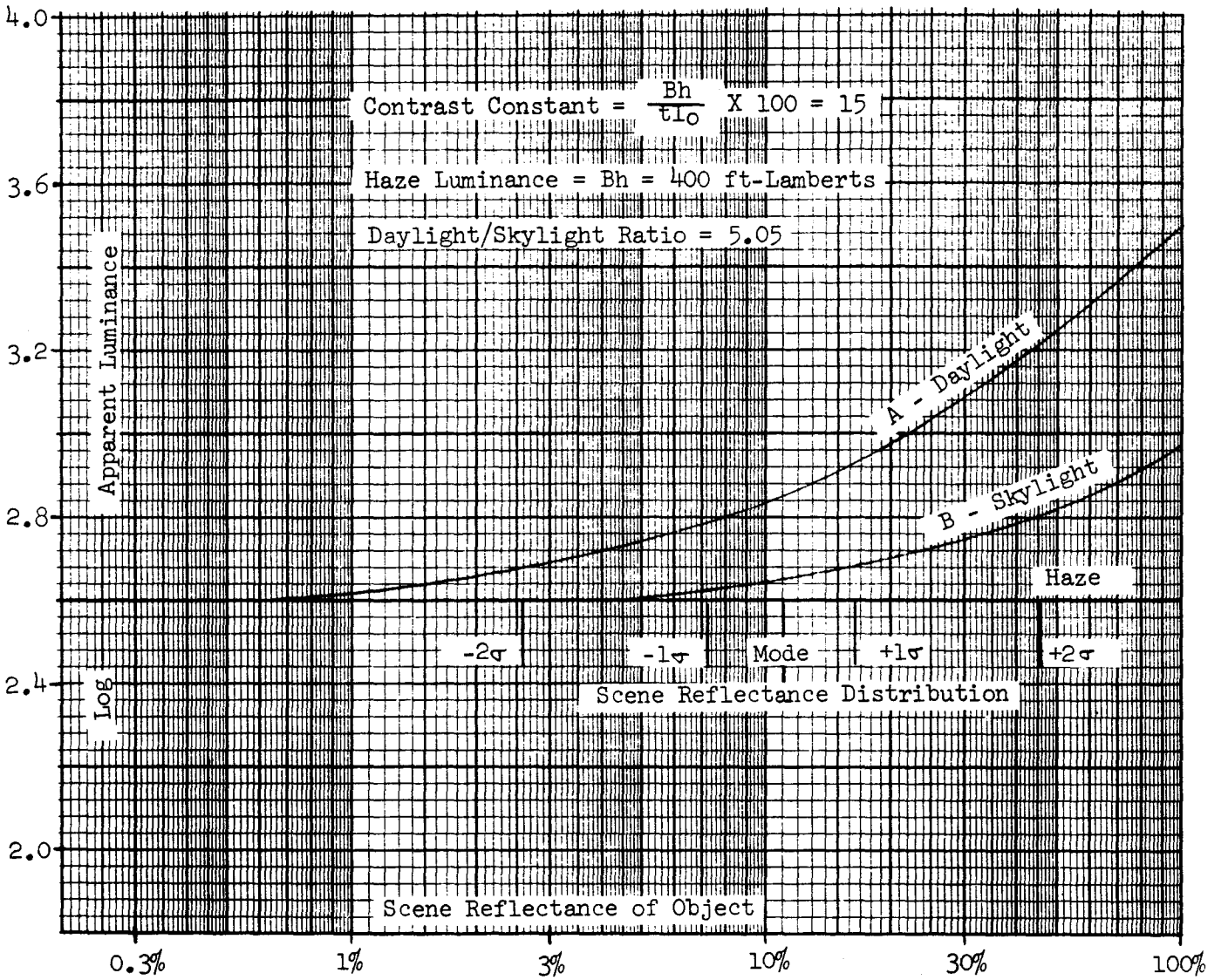
* Sorem, A., et. al., "Luminance Distributions in an Aerial Scene" as presented to the SPSE, Cleveland, Ohio, 17 May 65.

Figure 5

Scene Apparent Luminance for Type 3401 Film at 65,000 Feet
Average Atmospheric Conditions
Wratten 12 Filter
40° Solar Altitude
Vertical Photography
Horizontal Plane



	Daylight	Skylight
Δ Log Ba, for ±2σ R	0.56	0.21
Mode Log Luminance	2.84	2.64
Maximum Log Ba Scale	0.90	0.37

f. The slope of the Daylight curve at any point may be computed from:

$$\frac{R}{R + 15}$$

g. The slope of the skylight curve may be computed by referencing it to the daylight curve.

PLANNED ACTIVITIES

16. Routine Mission Data Processing

a. Continue routine density data collection, processing, and publication of Density/Luminance Analysis Reports for each operational mission.

b. Continue work to prepare cumulative graphs for mission-by-mission comparison of density luminance data. Write computer programs to include updated cumulative graphs in each routine mission report.

c. Integrate customer magnetic tape messages into the mission-data-processing system on a routine basis.

d. Determine effect of using control process curves for calculating luminance/density analysis in place of R-2 process curves.

e. Determine value of various view angle data (CATS angle). Integrate valuable data into data base.

f. Add latitude-longitude data to master data tapes for earlier missions (low priority).

17. Computer Simulation of Exposure/Processing

a. Continue to simulate results which could be expected using recommended (or any other) exposure criteria and variations in standard processing as new conditions are considered or established.

b. Compare photographic quality of simulated conditions to that of the exposure and processing actually used.

18. Scene-Luminance Curves

a. Continue analysis based on time-of-year and camera. Prepare an interim report with these results and refined exposure recommendations.

19. Index Record Exposure Evaluation

a. Continue evaluation of mission index records on a routine basis.

b. Publish the interim report recommending exposure for index photography.

c. Continue work on routine evaluation of the [redacted] series index record to include luminance and contrast analysis.

d. Prepare an updated cumulative record of the density distributions from past index records.

20. Haze Studies and CORN Program

a. Continue routine collection and analysis of CORN target data for haze studies.

b. Analyze data from reflectance angle tests on CORN Edge Target panels.

21. Evaluation of Mission Exposure Experiments

a. Collect data and analyze exposure experiment in Mission [redacted]

b. Complete plans for exposure experiments in the [redacted] and [redacted] series.

c. Continue evaluation of past exposure experiments as outlined in the last quarterly report.

22. Scanning Methods

a. Continue study of microdensitometer scan formats.

b. Continue coordination with PAR 70B scanner development.

c. Start trial tests with PAR 70B scanner when it is completed.

23. Figure-of-Merit Method Relating Resolution to Exposure Evaluation. Continue efforts to implement this approach to exposure evaluation. Develop methods for estimating resolution from scan data. Continue evaluation of microdensitometer data collection formats.

24. Controlled Flight Tests. Conduct and analyze test 24-7-5-2.

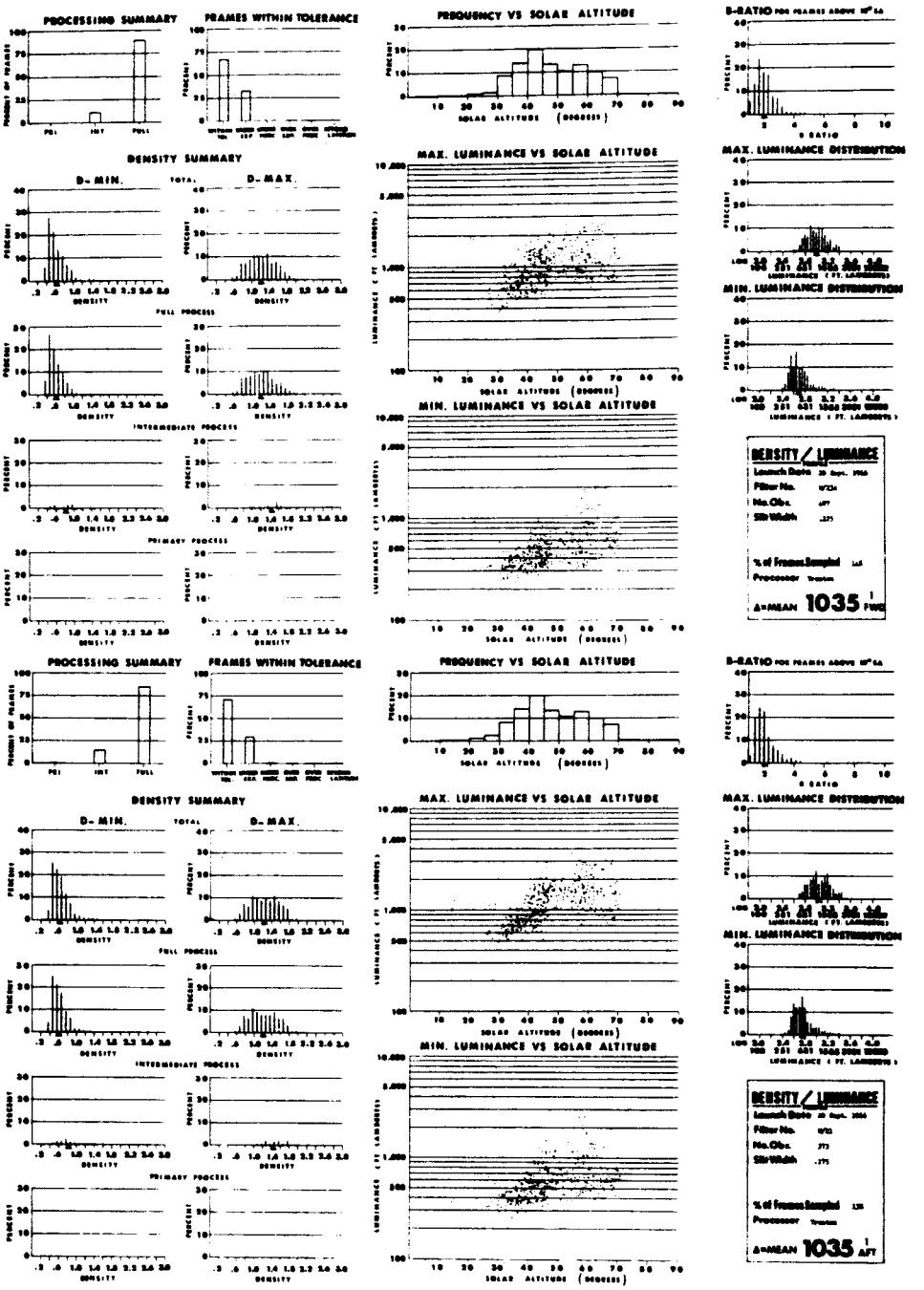


Figure 6

(Note: See also Figures 8 and 15 for previous format)

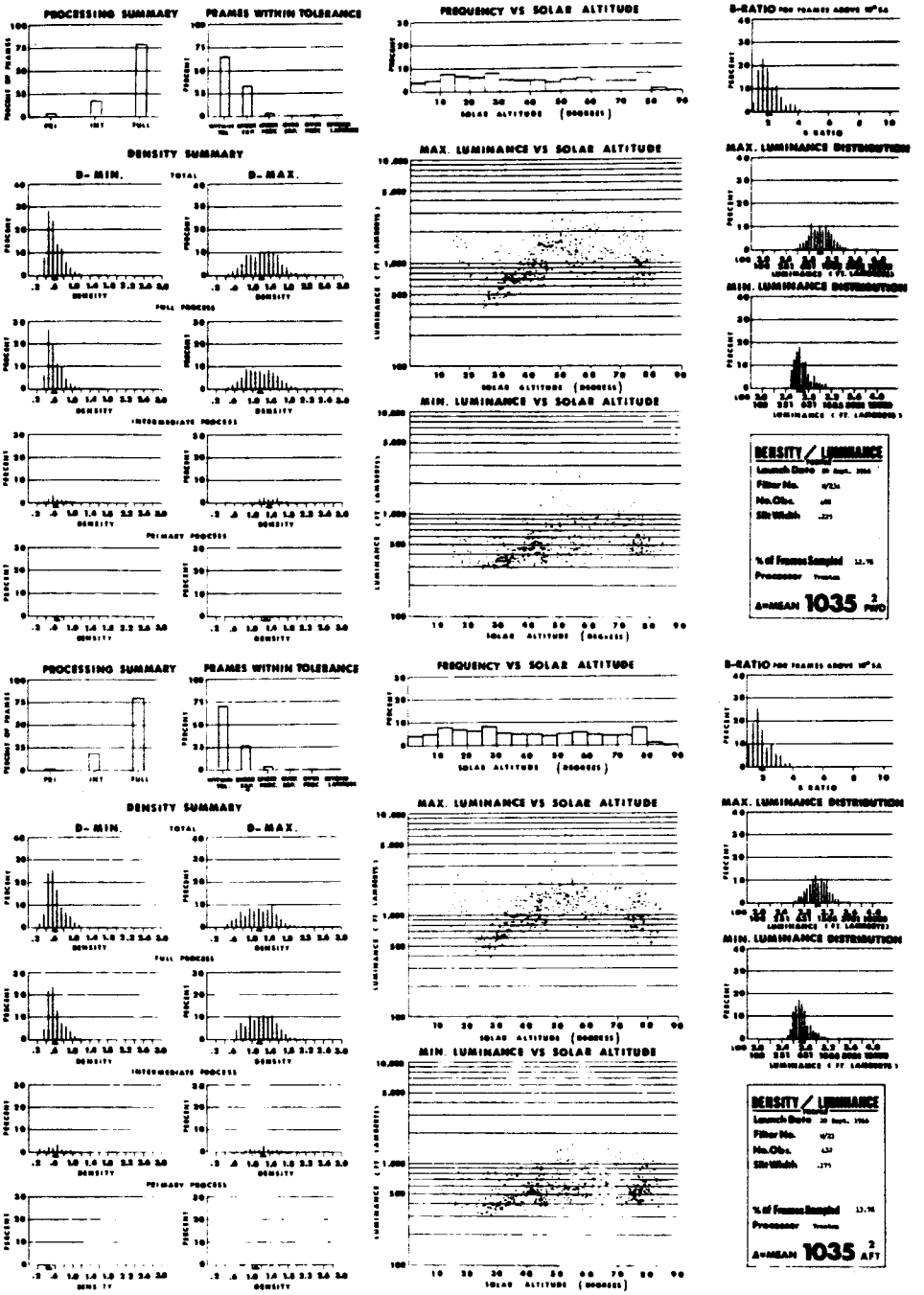
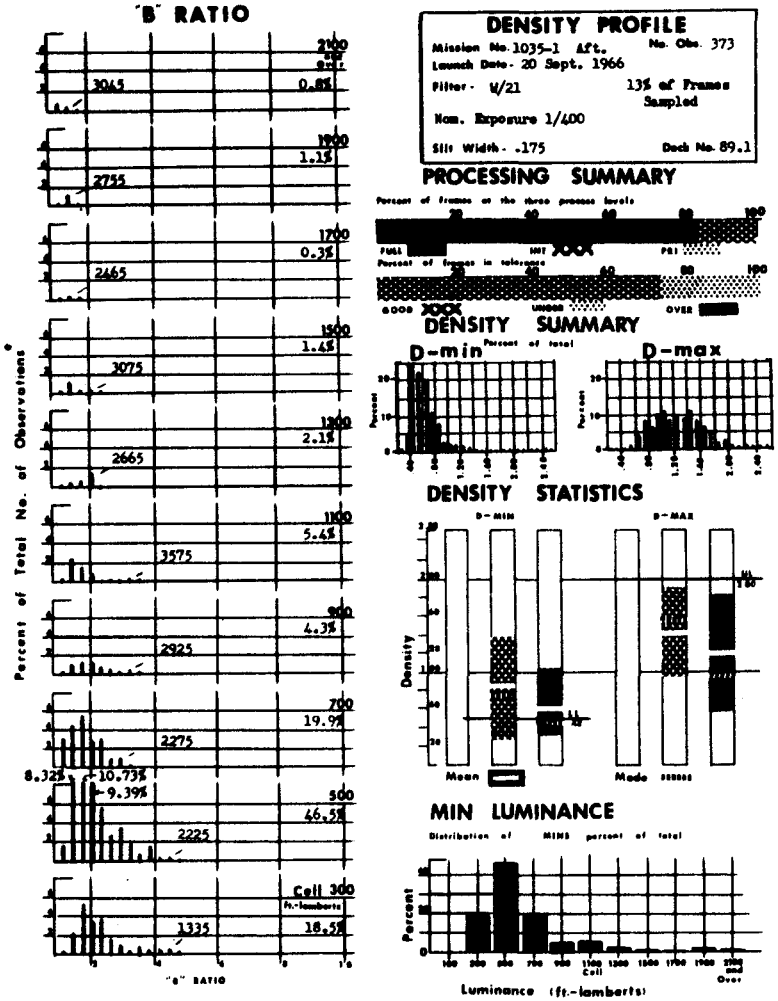
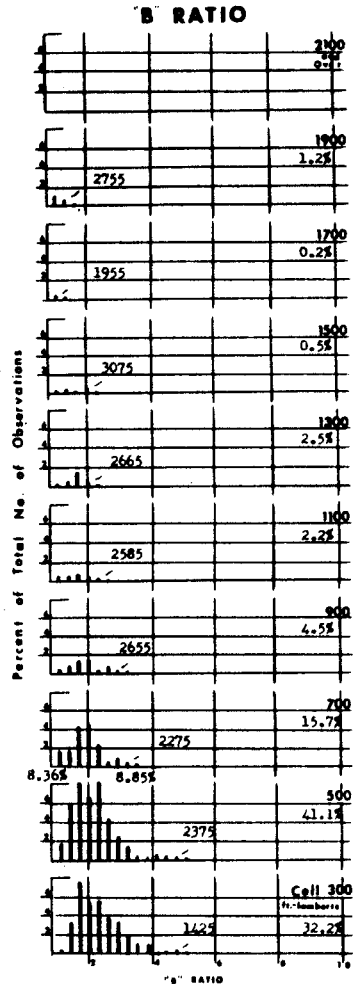

PROCESSING SUMMARY
FRAMES WITHIN TOLERANCE
FREQUENCY VS SOLAR ALTITUDE
B-RATIO
DENSITY SUMMARY
D- MIN.
D- MAX.
MAX. LUMINANCE VS SOLAR ALTITUDE
MAX. LUMINANCE DISTRIBUTION
MIN. LUMINANCE VS SOLAR ALTITUDE
MIN. LUMINANCE DISTRIBUTION
DENSITY / LUMINANCE
PROCESSING SUMMARY
FRAMES WITHIN TOLERANCE
FREQUENCY VS SOLAR ALTITUDE
B-RATIO
DENSITY SUMMARY
D- MIN.
D- MAX.
MAX. LUMINANCE VS SOLAR ALTITUDE
MAX. LUMINANCE DISTRIBUTION
MIN. LUMINANCE VS SOLAR ALTITUDE
MIN. LUMINANCE DISTRIBUTION
DENSITY / LUMINANCE

Figure 7

[redacted]

TOP SECRET


"B" RATIO
Percent of Total No. of Observations
3045
0.8%
2755
1.1%
2465
0.3%
3075
1.4%
2665
2.1%
3575
5.4%
2925
4.3%
2275
19.9%
8.32%
10.73%
9.39%
2225
46.5%
1335
16.5%
Cell 300
"B" RATIO



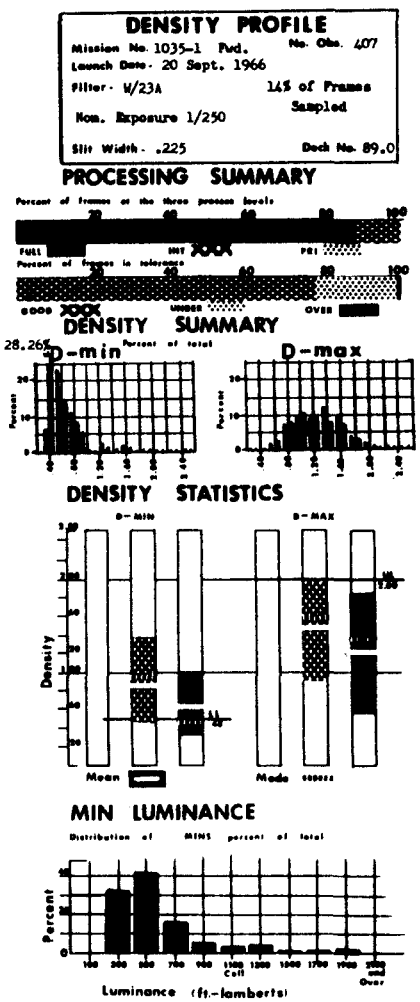


Figure 8

[redacted]

TOP SECRET

(Note: See Figure 6 for new format)

PAR 24-7-5S
9 Dec 66

[redacted]

TOP SECRET

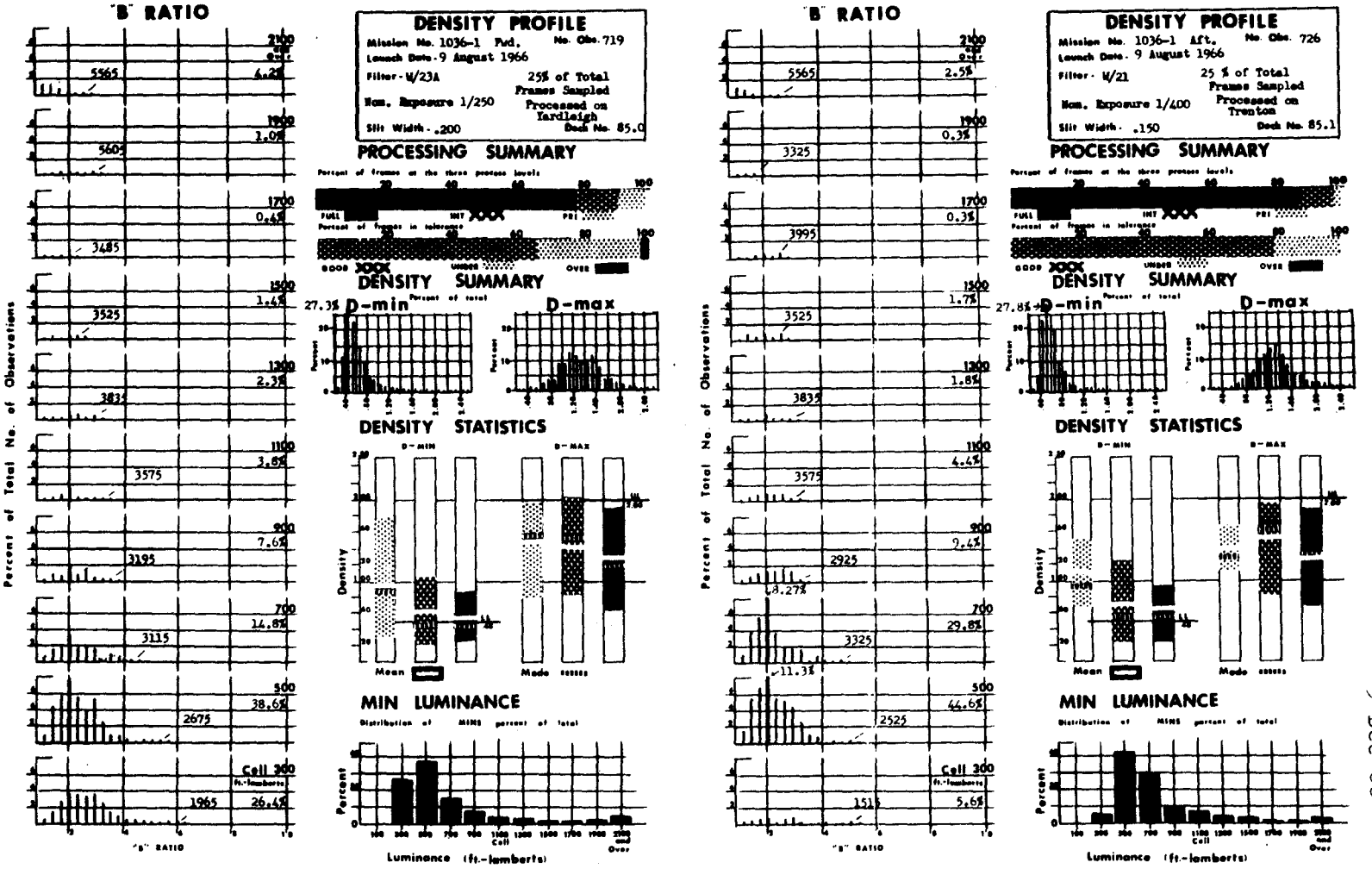


Figure 9

[redacted]

TOP SECRET

-27-

PAR 24-7-5S
9 Dec 66

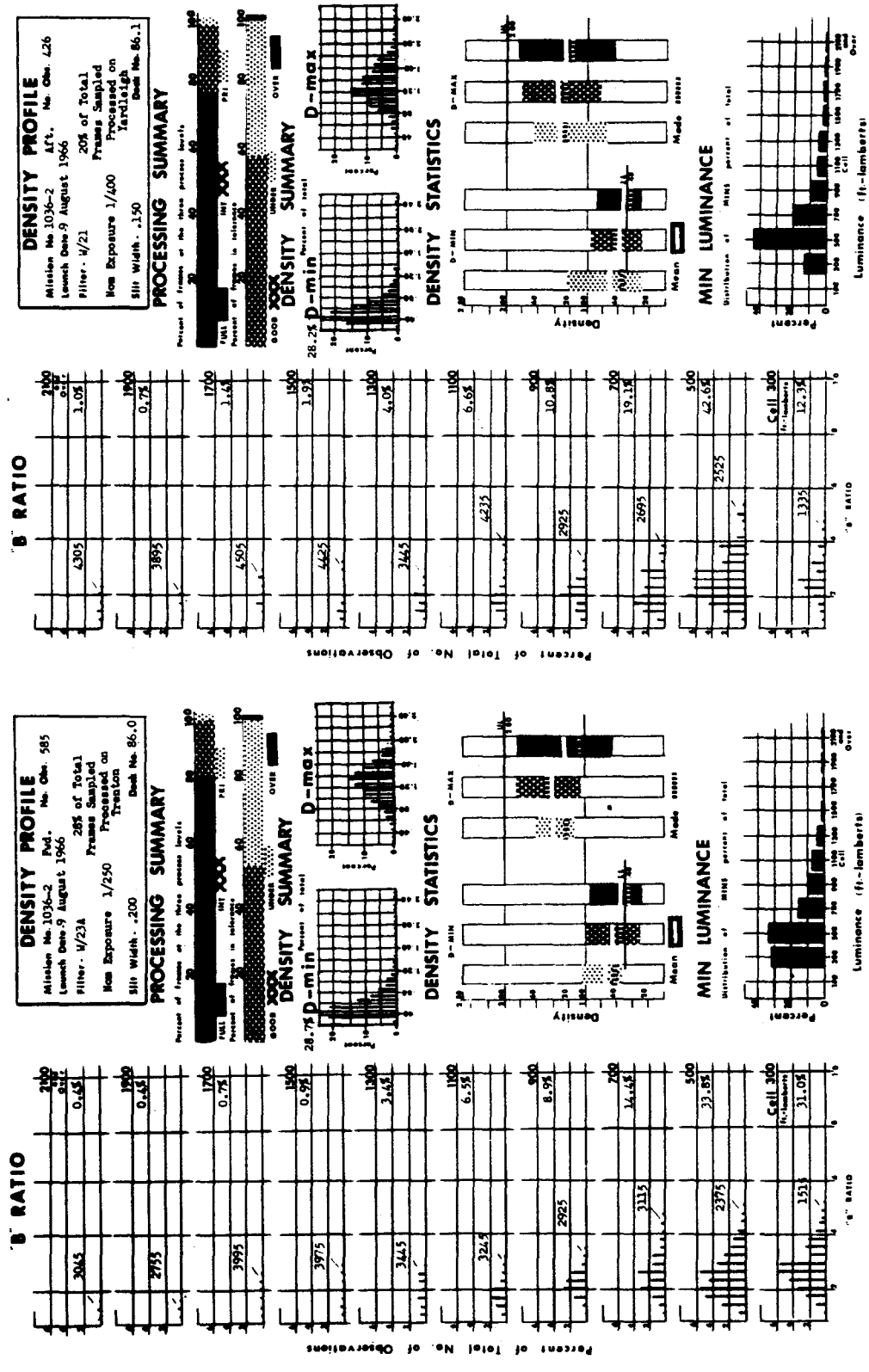

DENSITY PROFILE
PROCESSING SUMMARY
DENSITY SUMMARY
D-max
D-min
DENSITY STATISTICS
MIN LUMINANCE
'B' RATIO
Percent of Total No. of Observations
Luminance (ft-lamberts)

Figure 10

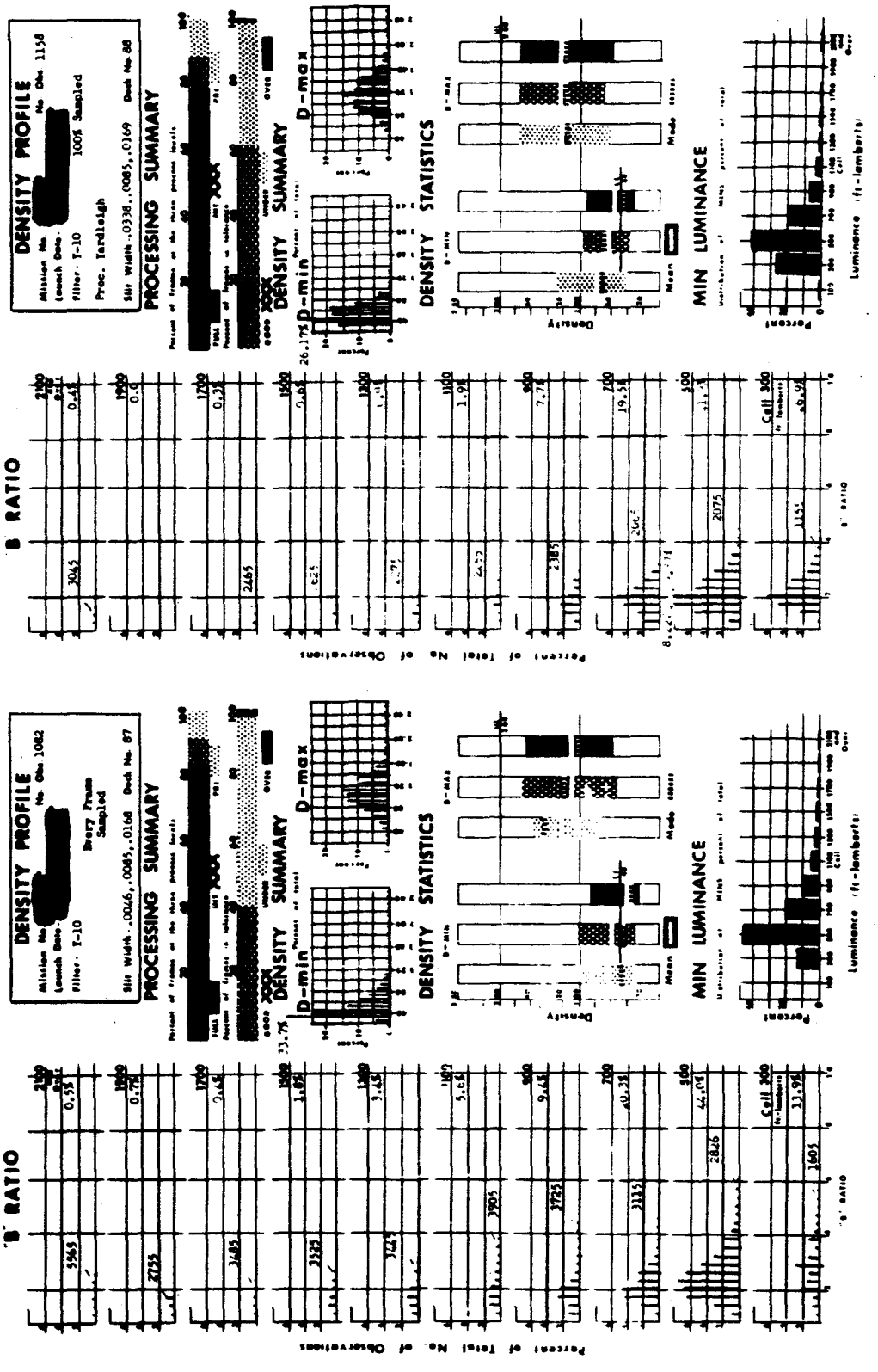

DENSITY PROFILE
PROCESSING SUMMARY
DENSITY SUMMARY
D-min
D-max
DENSITY STATISTICS
MIN LUMINANCE
B RATIO
Percent of Total No. of Observations
Luminance (ft-lamberts)

Figure 11

PAR 24-7-5S

9 Dec 66

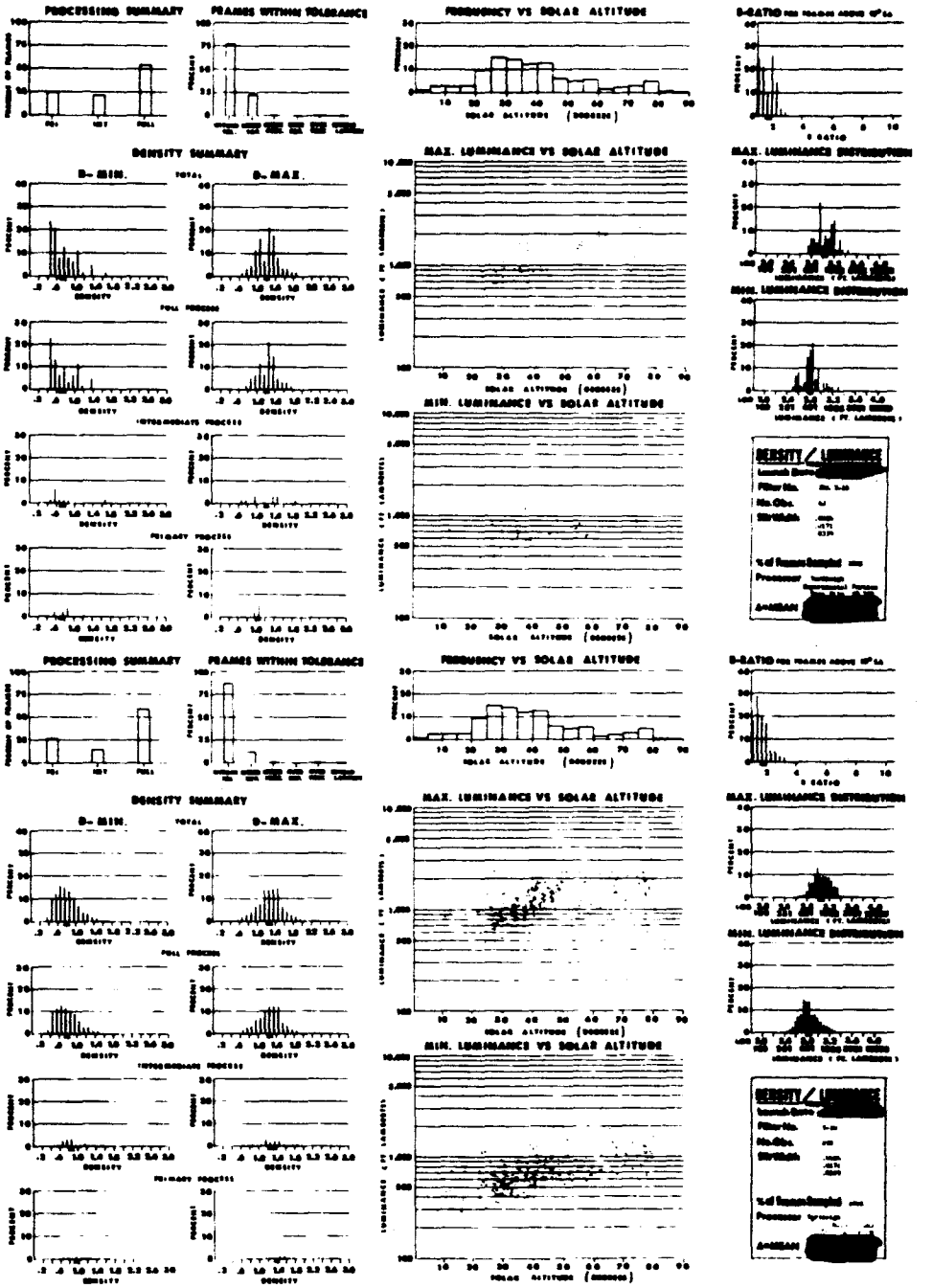


Figure 12

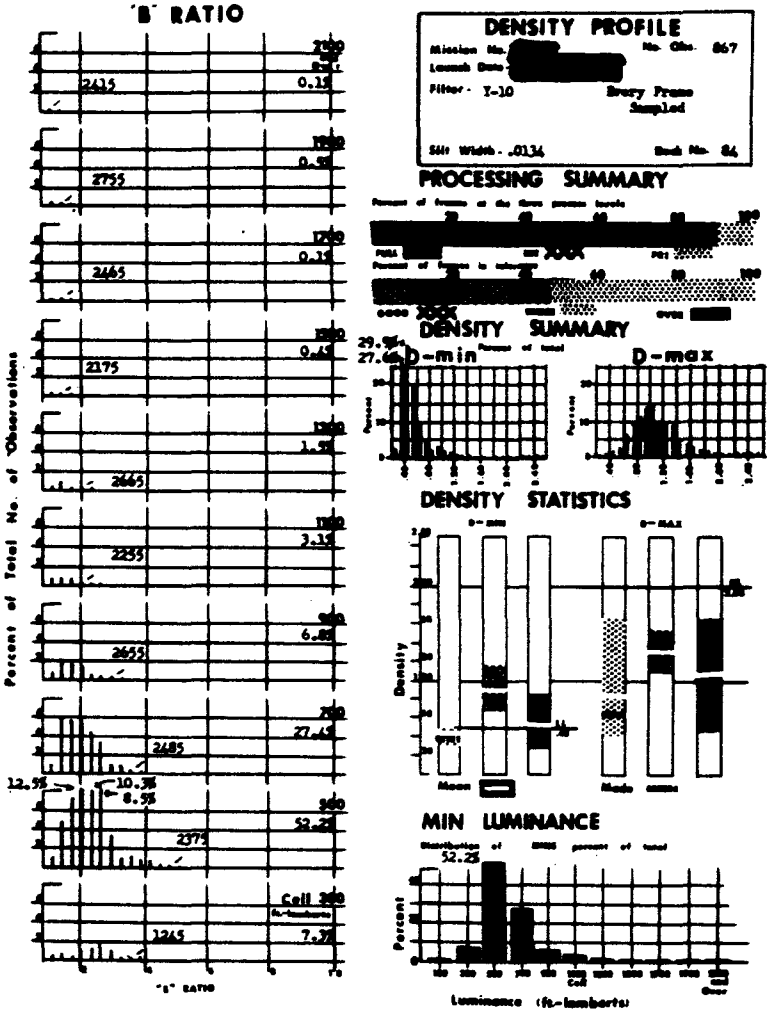

"B" RATIO
Percent of Total No. of Observations
"B" RATIO
DENSITY PROFILE
Filter - Y-10
Every Frame Sampled
PROCESSING SUMMARY
DENSITY SUMMARY
D-min
D-max
DENSITY STATISTICS
Density
MIN LUMINANCE
Percent
Luminance (ft-lamberts)

Figure 13

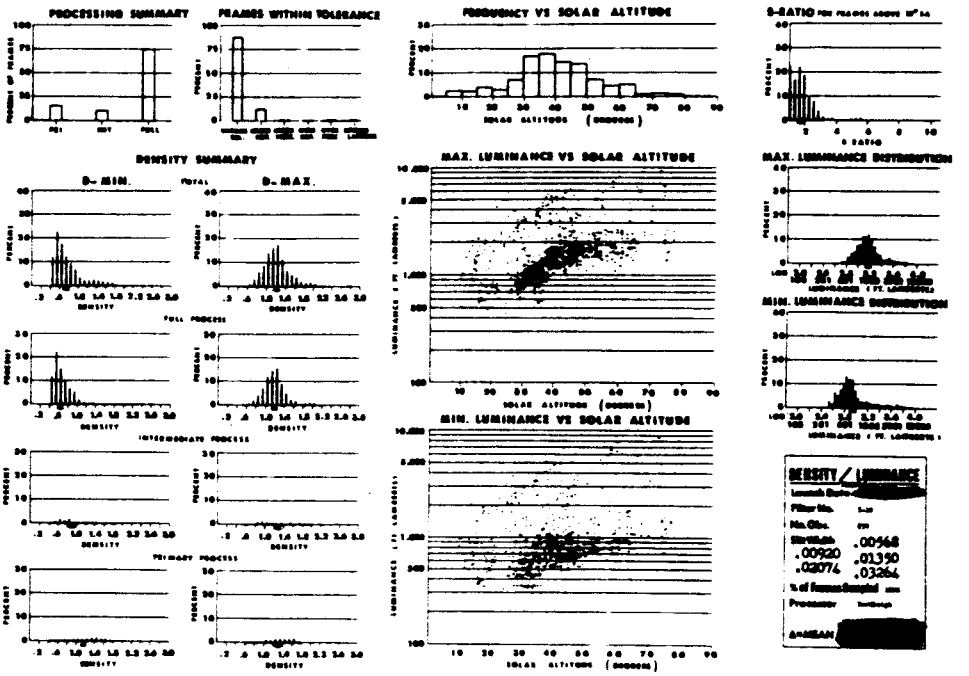

PROCESSING SUMMARY
FRAMES WITHIN TOLERANCE
FREQUENCY VS SOLAR ALTITUDE
S-RATIO
DENSITY SUMMARY
D- MIN.
D- MAX.
MAX. LUMINANCE VS SOLAR ALTITUDE
MAX. LUMINANCE DISTRIBUTION
MIN. LUMINANCE VS SOLAR ALTITUDE
MIN. LUMINANCE DISTRIBUTION
DENSITY / LUMINANCE
.00568
.00920
.01350
.02074
.03264

Figure 14

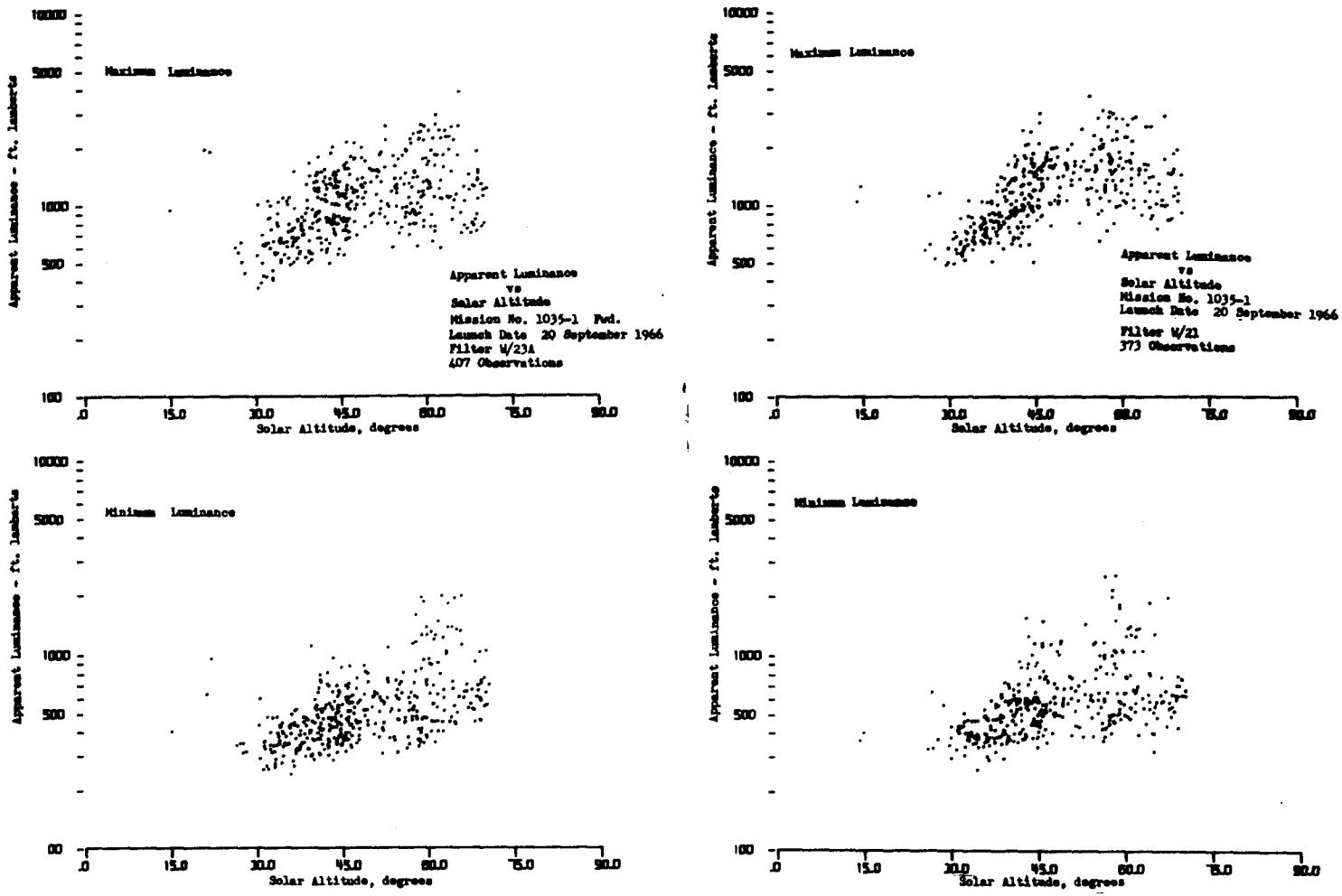


Figure 15

(Note: See Figure 6 for new format)

PAR 24-7-5S
9 Dec 66

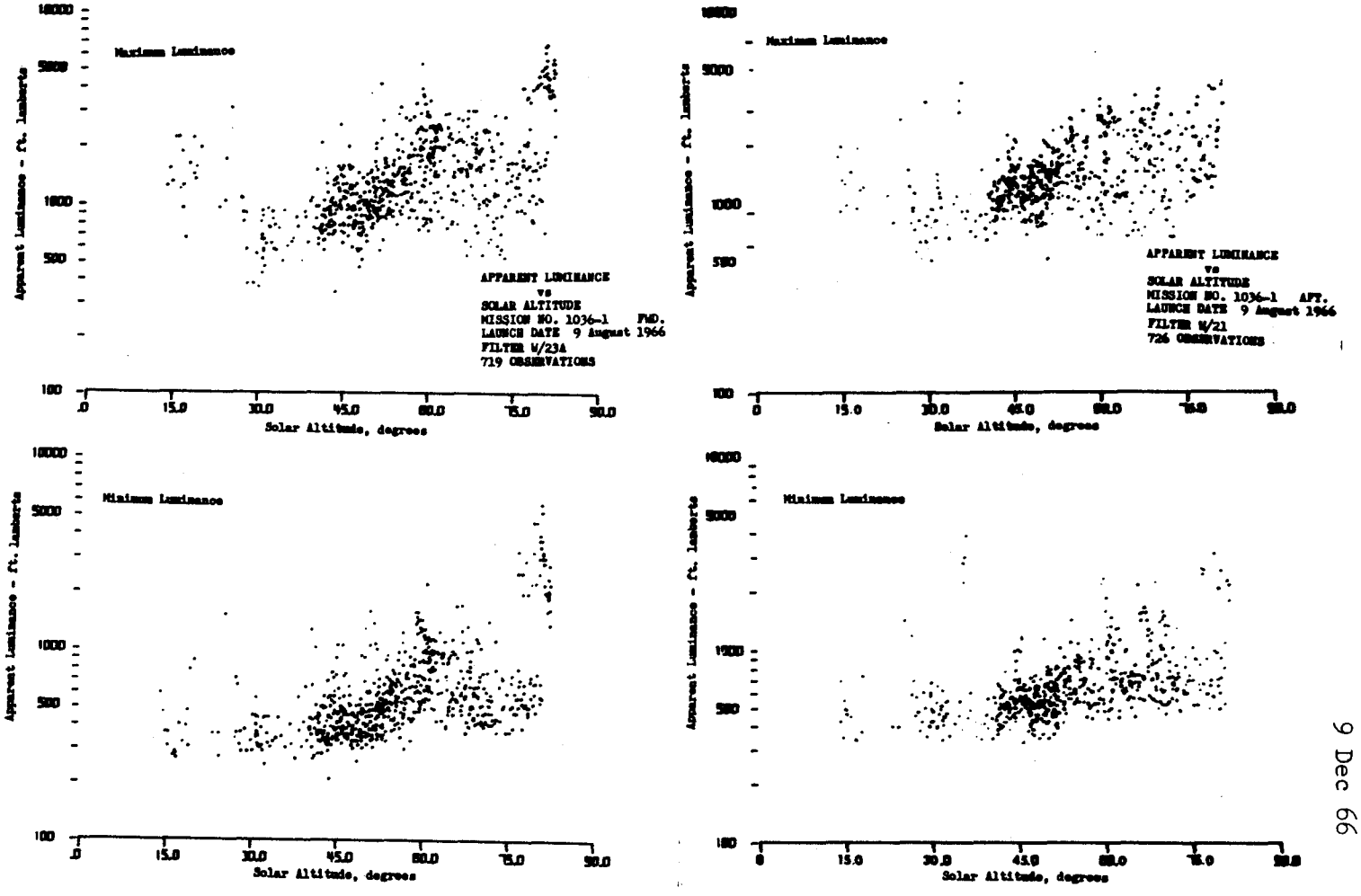

Maximum Luminance
Apparent Luminance - ft. Lamberts
Solar Altitude, degrees
APPARENT LUMINANCE
vs
SOLAR ALTITUDE
MISSION NO. 1036-1 FWD.
LAUNCH DATE 9 August 1966
FILTER W/23A
719 OBSERVATIONS
Maximum Luminance
Apparent Luminance - ft. Lamberts
Solar Altitude, degrees
APPARENT LUMINANCE
vs
SOLAR ALTITUDE
MISSION NO. 1036-1 AFT.
LAUNCH DATE 9 August 1966
FILTER W/21
726 OBSERVATIONS
Minimum Luminance
Apparent Luminance - ft. Lamberts
Solar Altitude, degrees
Minimum Luminance
Apparent Luminance - ft. Lamberts
Solar Altitude, degrees

Figure 16

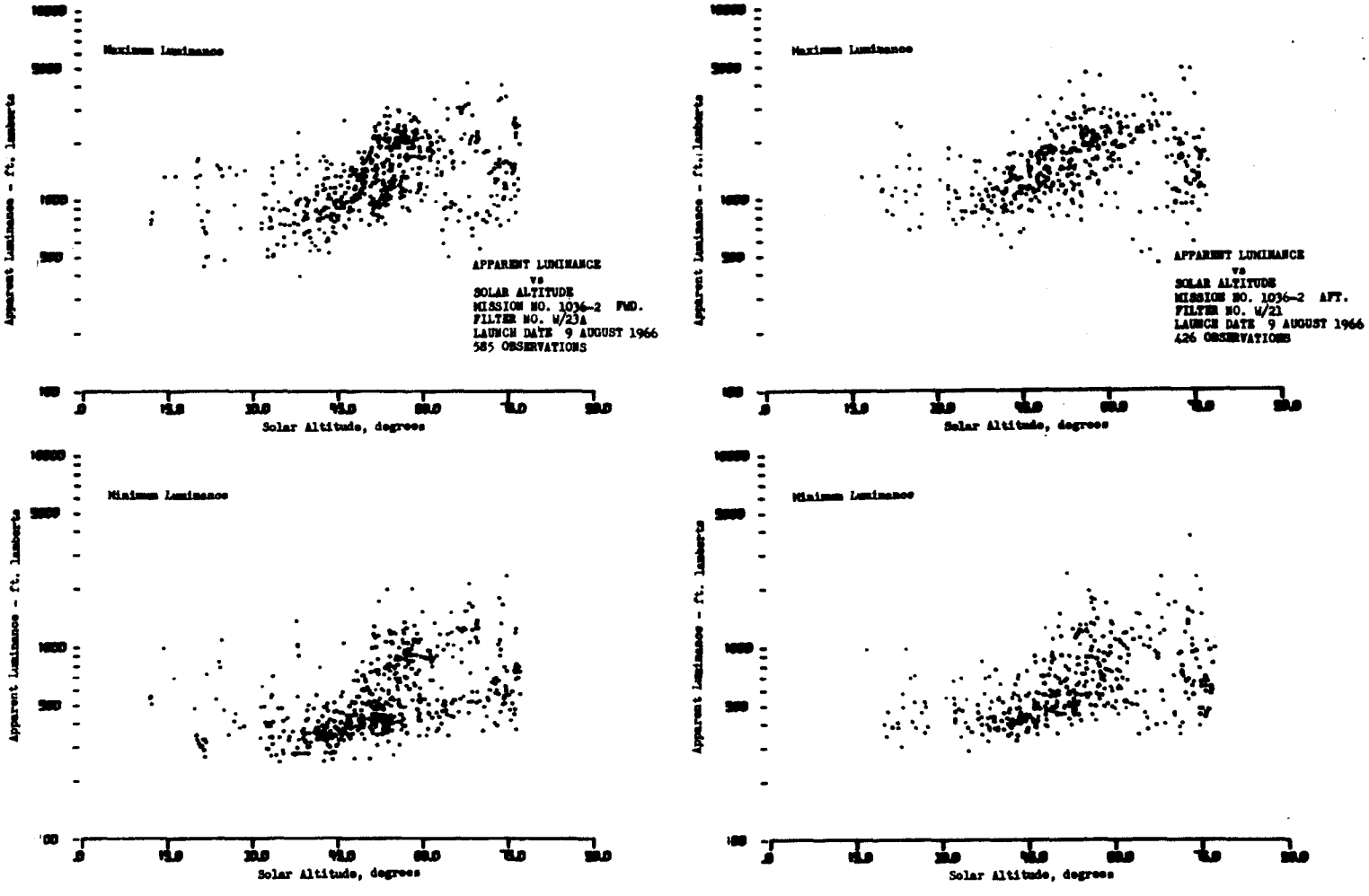

Maximum Luminance
Apparent Luminance - ft. Lamberts
Solar Altitude, degrees
APPARENT LUMINANCE
vs
SOLAR ALTITUDE
MISSION NO. 1036-2 FWD.
FILTER NO. W/23A
LAUNCH DATE 9 AUGUST 1966
585 OBSERVATIONS
Maximum Luminance
Apparent Luminance - ft. Lamberts
Solar Altitude, degrees
APPARENT LUMINANCE
vs
SOLAR ALTITUDE
MISSION NO. 1036-2 AFT.
FILTER NO. W/21
LAUNCH DATE 9 AUGUST 1966
426 OBSERVATIONS
Minimum Luminance
Apparent Luminance - ft. Lamberts
Solar Altitude, degrees
Minimum Luminance
Apparent Luminance - ft. Lamberts
Solar Altitude, degrees

Figure 17

TOP SECRET

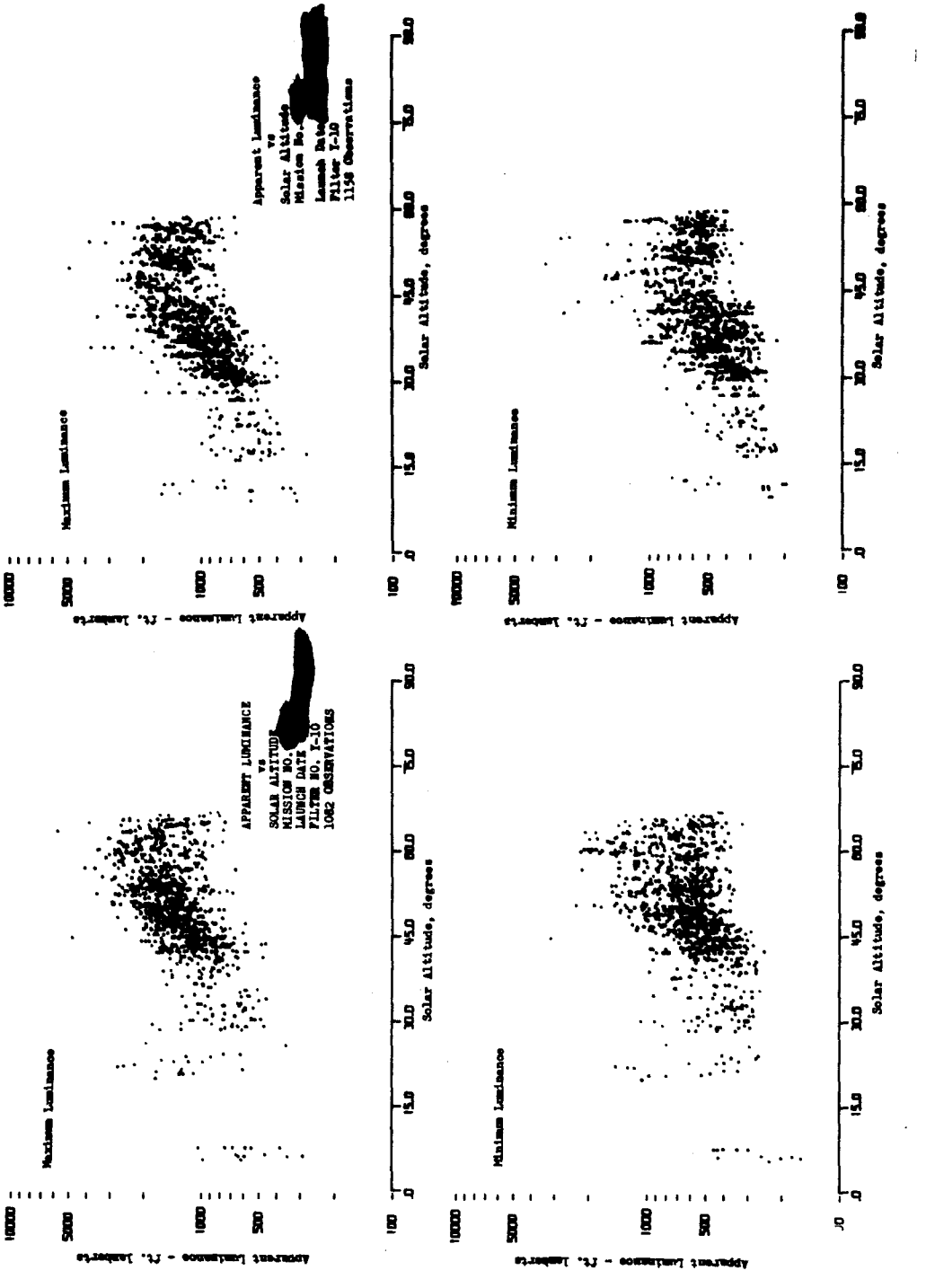


Figure 18

TOP SECRET

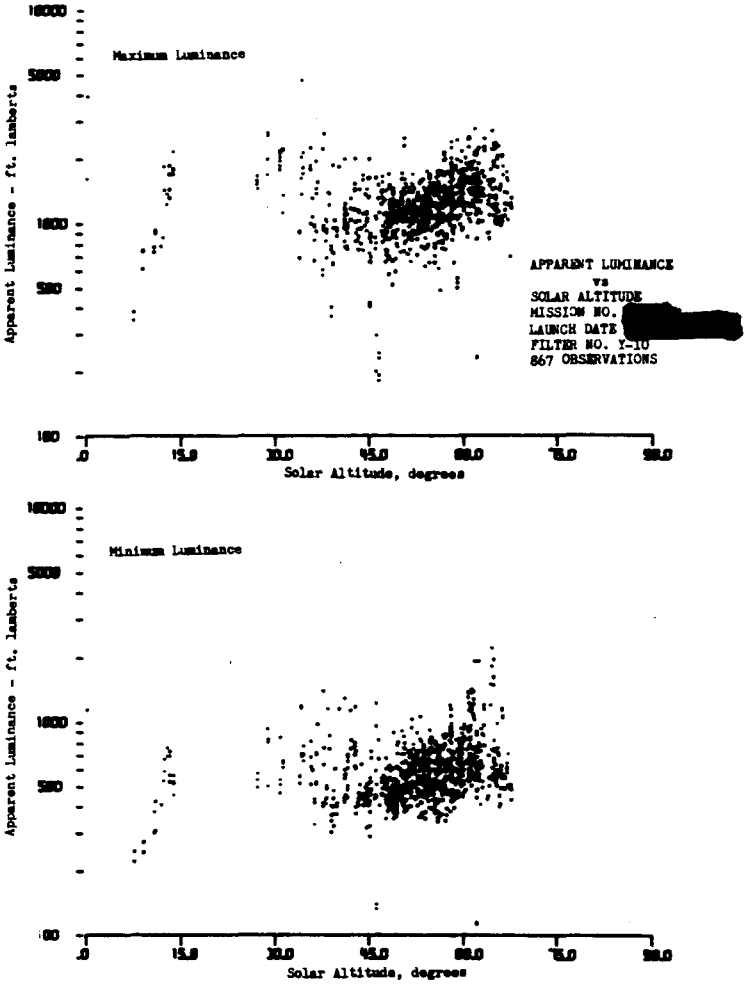

Maximum Luminance
Apparent Luminance - ft. lamberts
APPARENT LUMINANCE
vs
SOLAR ALTITUDE
MISSION NO. [redacted]
LAUNCH DATE
FILTER NO. Y-10
867 OBSERVATIONS
Solar Altitude, degrees
Minimum Luminance
Apparent Luminance - ft. lamberts
Solar Altitude, degrees

Figure 19

Contract [redacted] Task E
Second Quarter FY-67

PAR 24-7-6S
9 Dec 66

SUBJECT: Target Brightness Studies

TASK/PROBLEM

1. Evaluate the feasibility of selecting exposure for operation of very-high-altitude photography on the basis of the individual brightness history of each specific target.

DISCUSSION

2. The customer was informed of requirements with regard to selection of targets for analysis. It is now understood that work on target selection and location in past missions is well along by the customer.

3. Studies of microdensitometer techniques and parameters (PAR 25-7-2S) which have been started in conjunction with the Figure of Merit Studies on PAR 24-7-5S are also applicable to this PAR.

4. Some of the clearances requested for implementation of this PAR have been received.

PLANNED ACTIVITIES

5. Follow-up customer selection of targets.

6. Continue microdensitometer study.

7. Wait for remaining necessary clearances.

Enclosure to [redacted]

[redacted]

6 January 1967

Dear [redacted]

We are forwarding herewith one (1) copy of the following report for your review:

Contract [redacted] Supplement to Quarterly Report - Second Quarter FY-67 - Tasks, F and E (10 September 1966 through 9 December 1966)

[redacted]

Copy [redacted]