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CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1101

VEHICLE 1641

PAYLOAD CR-1

Approved: [redacted]
Advanced Projects

Approved: [redacted]
Program [redacted] Manager

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FOREWORD

This report details the performance of the payload system during the operational phase of the Program [redacted] Flight Test Vehicle 1641.

Lockheed Missiles and Space Company has the responsibility for evaluating payload performance under the Level of Effort and "J" System contracts.

This document is the final payload test and performance evaluation report for Mission 1101, System CR-1 which was launched on 15 September 1967.

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INTRODUCTION

This report presents the final performance evaluation of CORONA Mission 1101. The purpose of this report is to define the performance characteristics of the CR-1 payload system and to evaluate the technical characteristics of the Mission, including analysis of any inflight anomalies.

The payload system was assembled, tested, and certified for flight at the Advanced Projects (A/P) facility of Lockheed Missiles and Space Company (LMSC). A/P also provided services including preflight mission parameter and configuration planning, flight program preparation, inflight operations support and telemetry analysis, and mission reports to the community. The initial evaluation of the recovered film was made by NPIC personnel at the processing facility. The full Performance Evaluation Team (PET) meeting at NPIC included representatives of LMSC, ITEK Corporation, Fairchild Camera Company, Eastman Kodak Company, and cognizant government organizations. Off-line evaluation, using engineering photography acquired over the United States, was performed at facilities of individual contractors.

The quantitative data summarized in this report is obtained from several organizations. The Diffuse Density measurements and MTF/AIM resolution data are produced by the Air Force Special Projects Production Facility. Vehicle attitude readings and frame correlation times are provided by NPIC. The Processing Summary report is published by [redacted]

These quantitative data are used by A/P computer programs to provide processed information allowing correlation of operational photographic conditions with image quality. Analyses are made of image smear components and limiting ground resolution, and also of illumination/exposure/processing components in order to investigate exposure criteria.

SECTION 1

MISSION SUMMARY

A. MISSION OBJECTIVES

The CORONA/J3 payload CR1 was designed and programmed to provide improved search, cartographic, and reconnaissance photography of selected areas of the earth, from orbital altitudes. Two seven-day mission segments were planned, each nominally to return over 5900 panoramic frames of photography covering approximately 1130 square nautical miles apiece.

The payload section was the first of the new J3 configuration, consisting of a space structure containing two "Constant-Rotating" (CR) panoramic cameras and associated control/support equipment, a "Dual Improved Stellar-Index Camera" (DISIC), and recovery subsystems for each mission segment. Figure 1-1 presents an inboard profile of the CR1 configuration, and Table 1-1 provides a record of component assignments and performance.

On-orbit support was provided by the Agena satellite vehicle. These functions included real-time command and telemetry links, electrical power, stored payload program timer, attitude stabilization and control, and a Drag Makeup rocket system. In contrast to the normal J1 flight, the J3 systems are operated in a nosefirst on-orbit configuration.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base at 1941Z on 15 September 1967, on a THORAD booster. All launch, ascent, and injection events occurred as programmed. The orbit parameters achieved were well within the three sigma predicted dispersions.

Both panoramic cameras operated satisfactorily throughout the flight. Average cycle periods for both cameras were within 1 percent of the pre-flight calibrations.

The DISIC system operated normally throughout the flight.

The FMC and exposure control systems were sensitive to noise generated by the command system during the "time-out" portions of their cycles. Command restrictions imposed during the flight precluded early time-out during the majority of the flight.

The command system operated normally with correct responses to all Analog and Uncle commands issued with the exception of a single tracking station problem when 26 transmissions of a command were required for 12 verifications.

The clock system serial output was normal and good clock/system time correlation was obtained.

The pressure make-up (PMU) system operated normally throughout the flight. The total consumption was 9.98 ΔPSI/min. with a supply of 900 PSIA remaining at the end of the flight.

The instrumentation system operated normally with the exception of the horizon camera platen position monitor on the No. 2 unit which indicated an intermittent unclamped condition.

Ascent vibration data appeared normal and within qualification levels.

The thermal environment was approximately 20°F lower than nominal and 10°F lower than predicted for the flight.

Panoramic film switchover from first to second recovery system was commanded on Rev. 86. Cut and wrap, and transfer from the first to the second recovery system occurred normally. DISIC Camera Switchover was commanded on Rev. 88. Cut and splice, and switchover to the second recovery system was normal.

The tape recorder systems in both SRV's operated normally and all recorded data was retrieved.

All six DMU rockets were fired and maintained the orbital period within 5 seconds of nominal.

Tracking and control support was effected by the Air Force Satellite Control Facility, under central control of the Satellite Test Center at Sunnyvale, California. Tracking and command stations are located at [redacted]

Mission segment 1101-1 consisted of a six-day operation followed by air recovery of the capsule. Mission segment 1101-2 was completed with an air recovery following a seven-day photographic operation.

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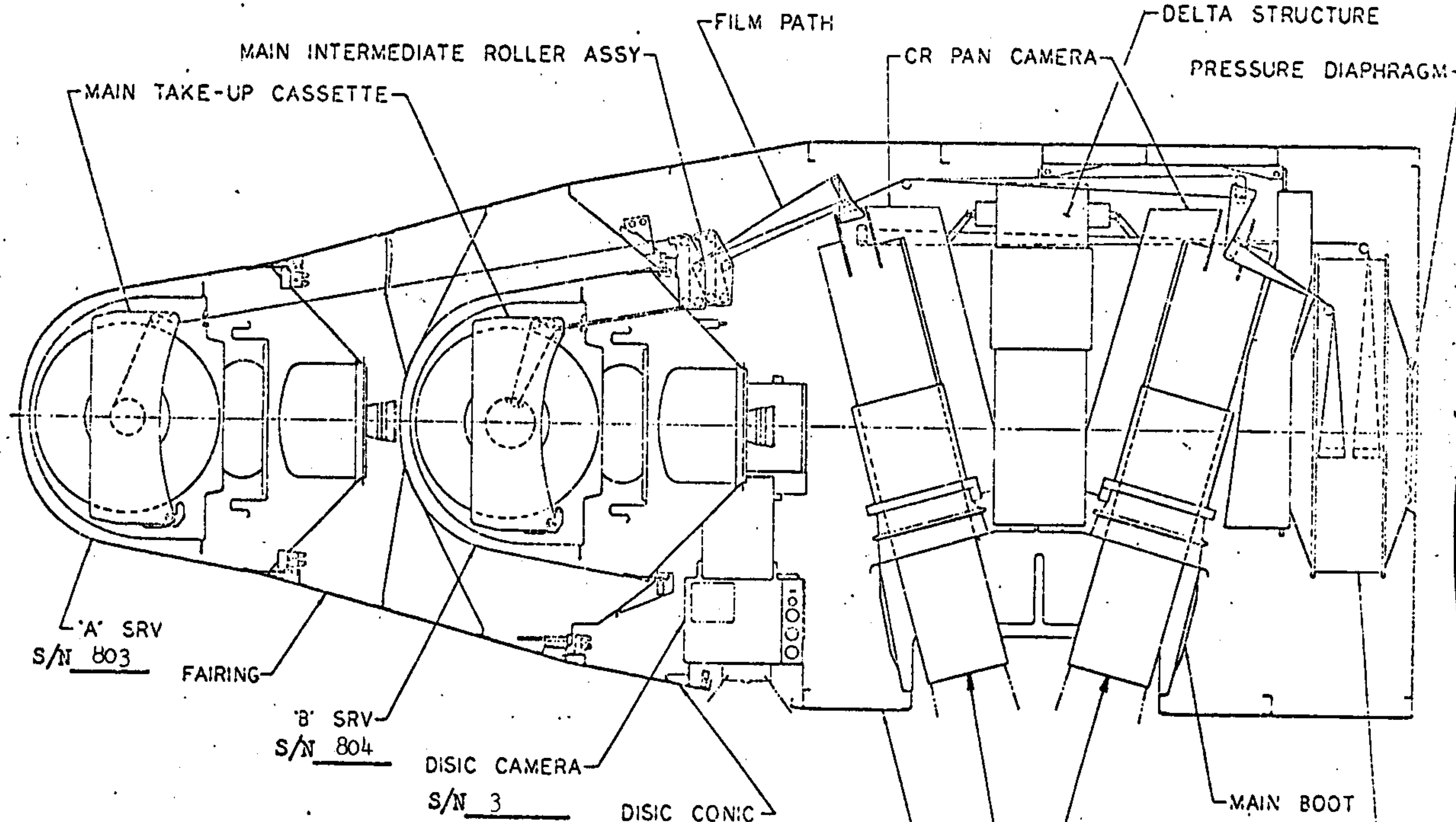
PAYLOAD PROFILE AND SERIAL NUMBERS



SYSTEM NO. CR-1

TEST Flight

PMU S/N 1001

SLOPE PROGRAMMER S/N 201

CLOCK S/N 616

SWITCH PROGRAMMER S/N 202

FIGURE 1-1

C [redacted]

TABLE 1-1

COMPONENT ASSIGNMENT

Mission No.	1101
Agena Vehicle No. (SS01B)	1641
THORAD Booster No. (SLV-2G)	512
Payload System No.	CR-1
Forward Looking Camera Serial No.	303
Aft Looking Camera Serial No.	302
DISIC Camera Serial No.	3

PANORAMIC CAMERAS	Fwd. Looking Unit 303		Aft Looking Unit 302	
Lens Serial No.	I-172		I-167	
Slit Width (Inches)	Nom.	Meas.	Nom.	Meas.
Position 1	.150	.150	.134	.135
Position 2	.171	.157	.134	.132
Position 3	.218	.220	.175	.170
Position 4	.272	.268	.225	.208
Failsafe	.250	.246	.200	.192
Optics Filter Type				
Primary	W-23A (Gelatin)		W-21 (Gelatin)	
Alternate	W-25 (Gelatin)		W-23A (Gelatin)	
E.O. Focal Length (Inches)	24.001		24.000	
Resolution/Film Type				
Static (Lines/Millimeter)				
Filter	W-21 (Gelatin)		W-21 (Gelatin)	
High Contrast	Not Available		263	
Low Contrast	145		150	

Dynamic (Lines/Millimeter)

ITEK Post-Vibration

Filter	W-21 (Gelatin)	W-21 (Gelatin)
High Contrast	209	195
Low Contrast	130	122

A/P Test

Filter	W-21/W-23A	W-21 (Gelatin)
High Contrast	213 (W-21)	207
Low Contrast	118 (W-23A)	118

Distortion/Pincushion (Millimeters)

Angle Off Axis, Degrees

3	.001	.002
2	.000	.001
1	.000	.000
0	.000	.000
359	.000	.000
358	.002	.000
357	.003	.001

HORIZON OPTICS

Forward Looking Camera 303

	Takeup (Starboard)	Supply (Port)
Lens Serial No.	E23764	E23784
Exposure Time (Sec.)	1/100	1/100
Aperture	F/8.0	F/6.3
Filter Type	W-25	W-25
Operational Focal Length MM	55	55

Radial Distortion (MM)		
10 Degrees Off Axis	.02	.02
20 Degrees Off Axis	.05	.05
Tangential Distortion	.01	.03

Resolution (Lines/Millimeter)

Angle Off Axis (Degree)		0	5	10	15	20	25	30
Takeup	(Radial)	209	208	206	202	175	150	45
	(Tangential)	187	207	181	155	116	96	62
Supply	(Radial)	209	200	206	143	139	150	81
	(Tangential)	166	185	181	138	103	96	62

Aft Looking Camera 302

	Takeup (Port)	Supply (Starboard)
Lens Serial No.	E23806	E23788
Exposure Time (Sec.)	1/100	1/100
Aperture	F/6.3	F/6.3
Filter Type	W-25	W-25
Operational Focal Length (MM)	55	55
Radial Distortion (MM)		
10 Degrees Off Axis	.02	.02
20 Degrees Off Axis	.04	.04
Tangential Distortion	.017	.018

Resolution (Lines/Millimeter)

Angle Off Axis (Degree)		0	5	10	15	20	25	30
Takeup	(Radial)	187	186	184	143	139	150	64
	(Tangential)	187	164	181	109	103	96	62

Angle Off Axis (Degree)	0	5	10	15	20	25	30
Supply (Radial)	187	186	184	101	99	150	81
(Tangential)	166	164	144	88	73	96	62

DISIC CAMERA #3

Stellar Cameras	Port	Starboard
Lens Serial No.	1P	1
Reseau Serial No.	1P	1
Aperture	F/2.8	F/2.8
Exposure Time (Sec.)	1.5	1.5
Nominal Focal Length (Inches)	3.0	3.0
Filter	None	None

Terrain Camera

Lens Serial No.	102
Reseau Serial No.	102
Filter Type	W-12
Aperture	F/4.5
Exposure Time (Sec.) Commandable	1/250 or 1/500
Nominal Focal Length (Inches)	3.0

Resolution (High Contrast Lines/Millimeter)

Angle Off-Axis (Deg.)	0	17	34
Radial	77	79	77
Tangential	72	74	57

Film Type	3400
Filter	W-12

FILM TYPES

Forward Looking Camera	No. 303
Split Load	NO

Film Type	3404
Length (Ft.)	16000
Splices	2
Length Between Splices (Ft.)	5555-4640-5805
Emulsion Data	292-2-8-7
Payload Weight (Lbs.)	88.8-79.2
Spool No.	131T
Box Serial No.	30
Aft Looking Camera	No. 302
Split Load	NO
Film Type	3404
Length (Ft.)	16000
Splices	3
Length Between Splices (Ft.)	2970-5300-5910-1820
Emulsion Data	292-2-8-7
Payload Weight (Lbs.)	88.3-79.8
Spool No.	50B
Box Serial No.	30
DISIC Camera	No. 3
Stellar Camera	
Split Load	NO
Film Type	3401
Length (Ft.)	2000
Splices	0
Length Between Splices (Ft.)	0
Emulsion Data	231-9-7-7

Terrain Camera

Split Load	YES
Film Types	3400/SO-230
Length (Ft.)	1800/200
Splices	1
Length Between Splices (Ft.)	1800-200
Emulsion Data	3400-156-9-8-7/SO-230-6-1
Total Film Weight (Lbs.)	20.0/2.4

SECTION 2

PREFLIGHT SYSTEM TESTS

A. ENVIRONMENTAL TESTING

1. Test Objectives

As a standard procedure, the "J" payload systems are subjected to thermal/altitude testing to simulate the orbital environment. The purpose is to demonstrate proper electrical and mechanical function under operational conditions, and to provide confidence in system capability to produce acceptable data throughout a mission. One of the test objectives is to determine susceptibility of the system to corona discharge, which fogs the film and would degrade operational photography.

2. Testing Summary

CR-1 was the first J-3 system to be tested in the thermal/altitude chamber. Three tests were necessary because of corona fogging manifested on both Panoramic and DISIC record. These tests on 8-16 June, 14-17 July, and 2-6 August 1967, were alternated with similar chamber tests of the J-3 qualification system, designated QR-2.

The major environmental problem encountered in these tests was corona marking. Problems not directly related to environment included erratic Panoramic time word recording and irregular 200-cycle time trace, extensive emulsion buildup clogging rail holes and fiducial apertures, and DISIC system transport mismetering. Resolution of these problems was satisfactorily achieved either between, or subsequent to the tests.

3. Panoramic Cameras

CORONA, during the first test, occurred principally on the #2 unit at the frame metering roller, which marked along one edge of the film at pressures from 16 to 35 microns. Post-test inspection indicated a mechanical restraint of the pressure roller on the frame metering unit, which caused it to exert uneven pressure on the film. The assembly was modified and no further marking problems were found due to this cause. Corona marking was light on the #1 unit, occurring only during the pressure sweeps between 40 and 48 microns.

Major corona fogging during the second test occurred on the #1 unit during operations with the Pressure Makeup System (PMU) enabled, at pressures from 25 to 30 microns. Minor marking was also noted between 44 and 48 microns. Because of these markings, and data from QR-2 system qualification tests, the orifice of the PMU was modified to maintain a 50 micron steady-state level for the third test.

The only corona marking noted on the third test record was a light startup type at the #1 unit. From the corona aspect, the system was considered as acceptable. Some very minor corona occurred inflight along the edge of the material from the #1 camera.

TIME recording was not acceptable on all three tests due to several problems with the Silicon Light Pulser (SLP) clamps, the SLP signal conditioner, and the Dual Data Signal Conditioner (DDSC).

The time word appearance was not satisfactory for both units during the first test and for the #2 unit on the second test. The imagery was "soft" in various areas of the word, because of improper clamping of the film to the SLP head. These clamps were reworked, and the third test demonstrated the #1 word imagery as good, and #2 as adequate although not as sharp as #1.

The times indicated by the SLP were grossly irregular during the first two tests. Comparison of time words recorded on the film and on the recoverable tape recorder indicated unacceptable discrepancies, with the apparently correct words on the tape recorder. Investigation revealed the SLP conditioner to be excessively sensitive to noise; the circuitry was modified for the third test.

Time recording on the third test presented a good appearance, but minor irregularities were noted when the words were reduced in order to verify camera cycle period. It became evident that the DDSC was not synchronizing the time word with the 200 PPS time trace. This also accounted for the small, nonincremental variations in the tape-recorded time words from all three tests; these variations had been previously blamed on the tape recording system.

Time words were missing on the last two frames of every operation thruout the tests. This was a characteristic of early CR systems, where the time recording was disabled by the turnoff command.

The 200 PPS time trace of the #1 unit appeared consistently good, while that of the #2 unit was intermittently erratic during the first and third tests. Its display ranged from no trace, to the normal 200 cycles, to 800 PPS, to a solid line. This problem was also traced to the DDSC, which was reworked extensively by the camera contractor and returned for further, more successful tests.

<u>AUXILIARY DATA</u> recording was generally adequate thruout the tests, excepting rail holes and horizon camera fiducials which tended to fill with emulsion particles.

The slur pulse was mislocated or missing on several frames in each test. This was always coincident with missing fiducials, but seldom with an anomalous time word.

The start-of-pass mark was sensitive to power supply voltage during the first test, not appearing below 24 volts. Performance was adequate during the last two tests, and no further problems were experienced.

The serial number appeared adequate thruout the tests. There was a characteristic dimming on alternate frames, with horizon data. The serial number was occasionally multiple-printed during transport, especially at instrument startup.

The horizon camera fiducials were marginally acceptable thruout the tests. However, they showed a tendency to fill with emulsion particles during each test, but imagery was always visible.

The lens scan lines were generally adequate thruout the tests. A double image was noted on the #2 unit during the first test. The assembly was adjusted, and subsequent tests demonstrated satisfactory performance.

An excessive number of rail hole images were unacceptable on all three tests, as the holes in all four rails tended to become plugged with emulsion particles. Intensive cleaning subsequent to the third test produced more acceptable images, but the problem continued thruout the test sequence.

PHYSICAL MARKING of the test film was not considered severe. Horizon camera clamp marks were evident on both units, the heavier marks being from the #1 unit. Rail scratching ranged from light to heavy, with several changes in magnitude evident on some single frames, especially at startup. Numerous scratches and abrasions were noted in the format areas on all material from the tests, apparently caused primarily by the scan head rollers. It was anticipated that most of this marking would be reduced with instrument cleaning after the third test, however some scratching in the format area was noted in the flight material.

OPERATIONS during the tests proceeded, for the most part, according to procedures. Some operational problems did develop, involving camera controls, exposure control, and the instrumentation system.

A "runaway" of the #1 unit occurred during the first test; the unit failed to shut down at the command to end an operation. A power-down sequence was required to stop the instrument. After the test chamber returned to ambient pressure, a confidence operation indicated normal function. The chamber was re-evacuated, and the unit functioned normally for the remainder of the test. Inspection later revealed a misaligned scan switch, which was corrected.

Also during the first test, the slit position programmer in the exposure control was noted to step spontaneously. Data from the second test confirmed adequate function after circuit modification, but revealed an intermittent timer malfunction. This was corrected prior to the third test; no further exposure control anomalies were indicated.

Cycle rates of both units were consistently one to two percent slow relative to the calibrated values, thruout the tests. This was attributed to a noisy trim potentiometer, which was discovered after the third test. Subsequent calibration data indicated proper operation.

Some difficulty was experienced in analysis of the test data because of instrumentation system noise and various sensor malfunctions. Most problems were eventually adequately resolved.

4. DISIC Cameras

CORONA was evident on material from all three tests, exceeding the maximum specified allowable incidence and magnitude.(1) Improvement was noted, however, on the third test, both in general appearance of the record and in its projected utility.

(1) not more than 10% of the formats marked; none to a net density greater than 0.4.

Stellar Corona marking, during the third test, was first noted at ambient pressure during a confidence run prior to chamber pumpdown where the metering roller caused static marking. During the test proper, metering roller corona affected 15 percent of the legal formats, marking only the starboard side, to a maximum net density of 0.41. This marking occurred at internal pressures from 20 to 69 microns; it had not been observed on material from the two previous tests.

Corona from other sources affected 9 percent of the formats to a maximum net density of 0.68. These corona forms, which were similar to the first two tests, were noted only at pressures less than 45 microns.

Skew bead marking between the active format and film edges affected 99 percent of the frames. Light dendritic static, noted only at 45-47 microns, occasionally extended into the format area from the film edges. It should be noted that frequency of corona marking tended to increase as the test progressed, suggesting a film environmental conditioning factor.

Terrain Corona marking, during the third test, affected 14 percent of the formats to a maximum net density less than 0.4; one-third of this was considered minor. This marking, also typical of previous testing, consisted of two bands parallel to the film edges extending thru the formats of operations also showing a high incidence of stellar corona marking. Correlation with PMU operation appears good; this marking occurred only at pressures less than 36 microns.

Very light marking, along the edges outside the format, affected most frames; these marks have been attributed to the skew beads. Dendritic static was noted occasionally at 25 to 47 microns, often associated with the termination of a corona display.

MECHANICAL problems affected all three tests. A metering cycle was missed at a change from slave to independent mode during the first test, resulting in a short frame on both Stellar and Terrain. A few frames of two operations early in the second test were severely mismetered because of a short-duration clutch command. A microswitch controlling the function was replaced, and no subsequent problems were encountered.

A Stellar capping shutter malfunction was noted during the third test on one independent operation. This operation started properly, with the starboard unit commanded to be capped; this command remained on throughout the operation. The last active port frame (before two shutdown frames) was noted to have a corresponding normal-appearing starboard format. This was followed by two normal shutdown frames with both sides capped. The source of the apparent uncapping signal was not determined.

TIME RECORDING appeared adequate during the first two tests, although spurious "ghost" bits appeared frequently in the Stellar time word; these were of much less density than the real time bits, and easily detectable. Accuracy of the time words was verified for the second test, because of the problem with the pan time words.

Similar harness connectors to the Terrain and Stellar SLP blocks were inadvertently reversed during assembly for the third test. This caused the Stellar time words to record on the Terrain film, and vice versa. These connectors were subsequently color-coded on this and other DISIC units, so as to help prevent improper time word recording on future operations.

There were two missing time words on material from both the Stellar and Terrain units during the second test. One each on the pretest confidence runs did not correlate, and occurred independently. One each on the test material did occur simultaneously, indicating an intermittent clock interrogate problem. This anomaly was not observed during subsequent testing, or in flight.

AUXILIARY DATA was generally good thruout the testing. Fogging lamps were too bright during the first two tests, making evaluation of the format areas difficult. The Stellar reseau illumination level was dissimilar for the two units. The port side was measured at a typical net density of 0.32-0.38, and the starboard side at 0.46-0.56. The specified range is 0.2 to 0.4. A contributing factor to the excessive density on the starboard side may be pre-sensitization by the pressure pads, as described below.

PHYSICAL MARKING was slight on most material from the tests. Excessive pressure marking and film scratches were noted throughout the Stellar material from the second test. The source was determined by New York to be improper threadup; a guide roller had been missed, allowing the film to drag against the chute. Correct threading was verified prior to the third test, and scratching was significantly reduced.

During the third test, most Stellar formats were affected by a density variation which conformed to the texture of the platen pressure pads. This mottling involved between 40% and 100% of the format area, and appeared accentuated on the starboard formats. Usually only the format area was involved; however, the pattern extended beyond the format area on a few startup frames. The mottling, which is caused by mechanical or electro-static sensitization of the film, did not appear to be associated with internal pressure; it has progressively less effect during the test. While the density variation was usually less than 0.1, it could produce difficulty in timely automatic data reduction. This was the first time this anomaly had been observed during A/P testing.

OPERATIONS were generally normal thruout the testing, except for the short clutch command. Minor problems were experienced in analysis of data from the second and third tests because of some inoperative instrumentation sensors.

B. RESOLUTION

Resolution tests at A/P demonstrated a variety of CR1 optical performance anomalies. Because of this, an intensive study was conducted to define the causes of performance variability and to determine the optical acceptability of the panoramic cameras.

1. Resolution Criteria

The sole requirement at the time of testing was that each camera should demonstrate a minimum dynamic resolution of 110 lines per millimeter, utilizing low contrast (0.30 Δ Density) targets under standard conditions. No criterion was stated concerning location of the peak focus.

In flight, the peak focal position would be expected to vary from the film plane in a manner partially predictable with temperature changes. The "zero" focus position, at that time, represented the best estimate of optimum flight performance with normal temperatures (70° $\pm$ 30°).

2. Test History

Acceptance testing of panoramic camera resolution was performed at ITEK-Boston on the 120-inch collimator. Both cameras used Wratten 21 gelatin filters and 0.140 inch slits. The resulting high and low-contrast data were typical for a J-type system, demonstrating unquestionably acceptable performance. The low-contrast data showed a wide range of focal positions where resolution exceeded the requirement.

There were four series of resolution tests at A/P. The first was run after the first environmental test in a similar configuration to the Boston Acceptance Test, with Wratten 21 filters and 0.134 inch slits. The results showed comparable resolution, but there was an apparent peak focal position displacement of approximately one mil, for both cameras.

The second A/P test was conducted after the second environmental test. At this time, the eight drum rollers in front of each scan head had been raised, although the scan heads were not shimmed. Both cameras used 0.134 inch slits and gelatin filters; a Wratten 21 was on #302 and a Wratten 23A on #303. Again resolution values were comparable to previous tests, but both cameras showed an additional peak position shift of approximately one mil. The resulting peaks were at plus one-half mil for #302 and at plus two mils for #303 ("plus" designates behind the emulsion).

The third A/P resolution test was run after the last environmental test. A two mil shim had been added to #303 scan head to compensate the apparent focal shift. Glass equivalents to Wratten gelatin filters were installed for the first time: A type 21 in #302 and a type 23A in #303. In general, the resulting data showed #302 as marginally acceptable and #303 as definitely unacceptable.

By the time of the fourth A/P test series, the flight plan had been defined, specifying types 21 and 23A filters in #302, and types 23A and 25 in #303. Therefore, both glass and gelatin filter types were tested in the appropriate cameras. Preliminary data indicated unacceptable performance in some cases, as well as extensive variation between data readers.

3. Data Analysis

The results of the fourth A/P test were reanalyzed with rigorous application of MIL-STD-150, and with controls to minimize variability among the readers. Some factors tending to degrade the test results included lack of target image sharpness, target underexposure, and defective target strips; these were compensated, insofar as possible, and are not significant factors in the overall results. Smear, target drive irregularities, image motion matching, and camera vibration were not noted as degrading elements. One factor which partially accounted for reader variability was the presence of spurious target resolution. There were numerous instances where a large target would be unresolved, but several smaller targets in the group were resolvable; this did not appear to be caused by defective targets.

Results of the evaluation indicated adequate system performance with gelatin filters. The glass filters produced uniformly unacceptable results, and were returned to the contractor for re-evaluation. Camera #302 produced the better resolution values using the Wratten 21, with a 118 lines/millimeter peak near the estimated optimum location. Camera #303 met the minimum requirement, but was predicted to produce poorer inflight results.

4. Conclusions

As a result of the study, it was concluded that the panoramic camera resolution was acceptable for flight only with gelatin filters. All tests in that configuration were substantially satisfactory according to established criteria.

5. Sequel

Subsequent to the CR-1 flight, additional information available to the ITEK company for certain lens systems, including CR-1, indicated that focal shift in vacuum, and the back focus, was less than previously computed. As a result, the scan heads of remaining systems were shimmed, and resolution was retested to verify the peak focus location.

Inflight optical performance is discussed in detail in Section 4 (Photographic Performance). In general, performance of #303 was very good, despite preflight predictions. Performance of #302 was poor because it was out of focus.

As a result of the CR-1 resolution problems, the J3 collimators have been adjusted to reflect the changes in focal shift. Performance criteria have been revised to include the location of peak focus.

C. LIGHT LEAK TESTING

The CR-1 system was given a preliminary light leak test on 24 May 1967. Evaluation indicated one major and two more minor leaks at the horizon camera boots. The #1 unit input side had a small leak. The #2 unit input side had a severe leak, which marked the film in several places. There was also a small leak on the output side. The horizon camera boots were repaired, and no further leaking at that location was noted during test.

The second live-film light leak test indicated a small leak only affecting film from the #1 unit. This leak was probably located in the main door seal area, near the #2 unit. Correction was verified by photomultiplier tests. Although the photomultipliers showed substantial instrument leaks, the payload was generally unaffected.

Light search testing was conducted as part of the final loading procedure. Special photomultiplier sensors were installed in the top of the conic structure and at the aft of the barrel, as well as in both port and starboard access doors. All aspects of the search were considered normal and acceptable.

D. SPECIAL TESTS

Extensive special testing was necessary with CR-1, in order to clarify certain component problems. These problems included time word recording and 200-cycle time trace irregularities on the panoramic record.

1. SLP Tests

Thruout component testing, problems had been encountered with the quality of the time words as recorded by the panoramic cameras. Poor payload contact was responsible for movement during exposure, variable density, size, and sharpness. The clamps also caused physical damage to the mylar covering of both SLP heads. Spurious bits were probably caused by current leakage within the SLP.

The clamps were redesigned and replaced by ITEK, during early system testing. The new design yielded improved images, with good apparent payload contact, but additional damage to the SLP heads was apparent.

During the first and second environmental tests, some variation in dot density was observed, again related to payload contact problems. Continuing physical damage to the heads necessitated replacement, and a subsequent lamp verification test. This material had dots of good size and density, but variations in sharpness demonstrated obviously poor contact.

Samples from the lamp verification test were sent to the Fairchild Company for evaluation using the new Multiformat Data Block Reader. Several problems were found; the original negatives were readable, but the duplicate positives were unreadable because of dot size variation in the duplicated material, and because of tracking difficulties in the reader. Missing time words (typically, for the first and last frames of each operation) caused the reader to stop, forcing a complete restart sequence.

The clamps were readjusted for the third environmental test, and time word appearance was improved. Film samples from this and a subsequent special test, taken at various exposures on each instrument, were sent to the [redacted] for flight-type processing at the three standard levels. The negatives were returned to A/P for evaluation of conformance to specification, while duplicate positives were sent for further testing on the Data Block Reader.

A special test, coincident with the second light leak test, verified the exposure settings and established that clamping was adequate.

2. Time Tests

Many of the problems associated with time word accuracy have been reviewed in the environmental test section of this report. Numerous additional special tests were necessary, both to isolate the problems in the SLP conditioner and DDSC, and to verify the hardware modifications. Clock accuracy was consistently good thruout all testing.

E. PREFLIGHT PREPARATION

1. Flight Readiness

The Flight Readiness Test was the first performed on a J-3 system, and consisted of several separate operations.

Verification of flight settings to the SLP Signal Conditioner was performed on 25 August. Test payload was processed to both "full" and "intermediate" levels. Microdensitometer records of samples from both main cameras at both processing levels showed that all SLP images met the requirements of MIL-STD 782C. Except for the microdensitometer samples, the entire test film was forwarded to the processing facility to provide duplicates for adjustment of the automatic data reader. This material provides approximately ten cycles at each processing level for each instrument.

The main camera readiness test was run on 29 August. The test film showed acceptable data recording. The following anomalies were considered within acceptable levels: Both cameras produced a narrow low-density band of fog near the time word edge of the main formats due to stray light from the rail hole lamps; and instrument 303 showed one instance of a spurious slur pulse and one instance of a spurious serial image, both occurring on startup. Both of the instrument 303 anomalies were traced to the Dual Data Signal Conditioner. DDSC synchronization of time words with 200 cycle marks was verified and found correct throughout the test.

An exposure slit measurement test was also conducted on 29 August. The test method, consisting of measuring slit silhouettes imaged on film by extremely short stoboscope flashes, had not been fully validated for accuracy. However, the test did show that the correct control cams were installed and all widths were within ten percent of the specified nominal values.

The DISIC readiness test was run on 30 August. Both Stellar and Terrain films showed acceptable data recording with two exceptions. One exception was multiple columns of SLP time words affecting both stellar and terrain records at starts of operates. This anomaly is caused by bench test conditions and is never observed in system tests. The second exception was excessive fogging density on the starboard Stellar unit during independent mode operation. After adjusting the lamp controls, a second Stellar readiness run showed acceptable density values.

2. Loading Sequence and Acceptance

Loading of DISIC flight film was accomplished without incident on 1 September. Sensitometric samples of both the type 3400 Terrain film and the type 3401 Stellar film showed normal characteristics. The Terrain flight load contained 200 feet of SO-230 film at the supply core and no sensitometric sample or data was available for this material.

Loading of the main camera supply cassette was accomplished on 5 September. Although new J-3 fixtures were used, the loading procedure was essentially the same as for J-1 systems and was completed in a routine manner. Sensitometric samples of type 3404 film for both main cameras showed normal characteristics.

The final loading procedure was completed on 7 September. During these operations emulsion scratches on film from both main cameras was noted. The extent of scratches on instrument 303 film was very slight and well within normal levels. Scratches on instrument 302 film were larger and more extensive. While appearing continuously for several cycles, they did not affect all frames. The source of scratching could not be determined under the conditions of this test. While the scratches may have been sufficient in some cases to produce slight plus and/or minus density marks in processed film, it was decided that no further attempts to correct the condition were warranted. All other aspects of final loading including light leak search were normal and acceptable.

Customer review and acceptance of the system was completed on 8 September.

3. Final Operations

The system was transported by van to Vandenberg AFB, where a premate receiving inspection operation and functional checkout indicated no problems. The system was then taken to the west pad of Satellite Launch Complex 1.

After mating the system to the Agena, a successful confidence operation was run, and repeated on launch day as a routine sequence in the countdown procedure.

SECTION 3

FLIGHT OPERATIONS

A. SUMMARY

Mission 1101 utilized AGENA satellite vehicle No. 1641, boosted by THORAD launch vehicle No. 512. The AGENA, the first of a series, was programmed for nosefirst on-orbit configuration, and had the following additional features:

Low altitude capability (85 N.M. perigee)

6 drag makeup rockets

Fourth telemetry link for payload data

"UNCLE" command system (additional UHF link)

Pyro battery diode bypass (by real-time command)

Additional control gas sphere (3 total)

Augmented battery configuration (5 type 1H, 2 type VI, and 2 type 1H for pyros)

The payload was the first J3 camera system flown, consisting of ITEK stereo panoramic cameras and Fairchild terrain/indexing and dual stellar cameras. Major payload components were identified in Table 1-1. Special payload features included:

Constant-Rotating (CR) panoramic cameras

CR Exposure Control with commandable slits (4) and filters (2)

CR FMC programmer with eccentricity and oblateness control

DISIC system for stellar and index data

Cut and splice device to transfer DISIC film between SRV's

Tape recorder in each SRV to monitor functions during camera operations

Ascent instrumentation for vibration and temperature

Sixteen real-time commands (RTC) for system control (8 analog and 8 UHF)

Seven days operation was planned for each mission segment. The first mission actually operated for six days, and the second for seven. Both recoveries terminated in air catches, with all of the film supply successfully transferred.

B. ASCENT

Liftoff occurred on 15 September 1967 at 1241 PDT (system time 70875). All ascent events were normal with In-Flight Reset (door ejection), A/P to Orbit Mode, instrumentation switchover, and panoramic camera transfer to orbit mode occurring on time and as programmed. There was no indication of panoramic camera rotation during ascent; this was considered possible because of rotation observed during preflight vibration tests. The pyro current monitor showed a maximum of 18 amps at the time of door ejection.

Ascent vibration was monitored by 8 sensors, reading out on telemetry link 4. Observed vibration levels were within the qualification levels:

ASCENT VIBRATION

Accelerometer Location	Station	G's (O-P)
Instrument Fwd Barrel Ring	86	2.6
Instrument Delta, Mounting Fitting	114	3.4
Instrument Delta, Plus Y Apex	114	2.5
Agena IRP	255	2.2

A maximum longitudinal ("pogo") frequency of 17.5 CPS occurred during the last 10 seconds of THORAD main engine burn.

Ascent temperatures were monitored by 49 sensors, also reading out on telemetry link 4. The observed temperature ranges were within predicted limits:

ASCENT TEMPERATURES (deg. F.)

Area		# Sensors	Range °F
CR units:	camera #1; lens, rails, head, AO, motor	5	63-69
	camera #2; lens, rails, head, AO, motor	6	66-73
	delta structure	2	63-79
	supply cassette	1	77-78
FMC programmer, PMU, Main elect. unit		3	69-73
DISIC		2	64-69
A SRV; skin and battery		2	94-109
	takeup and retro	2	67-78
B SRV; takeup and retro		2	71-101
Blast shield		2	66-83
Structure*; barrel		10	68-320
	conic	6	60-437
	fairing	6	60-486

* peaking 225-250 seconds after launch

Camera system operation during [redacted] station acquisition on rev. 1 indicated normal functions. Reconnaissance operation commenced on rev. 5.

C. ORBIT CONTROL

The orbit parameters achieved were very close to nominal. Planned and actual parameters are compared in the following table:

REV. 2 ORBIT PARAMETERS

	Predicted	Actual
Period	90.04	90.04
Perigee (N.M.)	84.8	84.8
Apogee (N.M.)	215.1	213.8
Eccentricity	0.0182	0.0180
Inclination	80.00	80.08
Argument of Perigee	162	174.3

The DMU rockets were used to maintain the desired ground track throughout the flight. Five of the six rockets were utilized during the photographic mission. The last rocket was used for AGENA deboost after the second recovery. Operation of the DMU rockets was normal, for all firings:

DMU ROCKET OPERATION

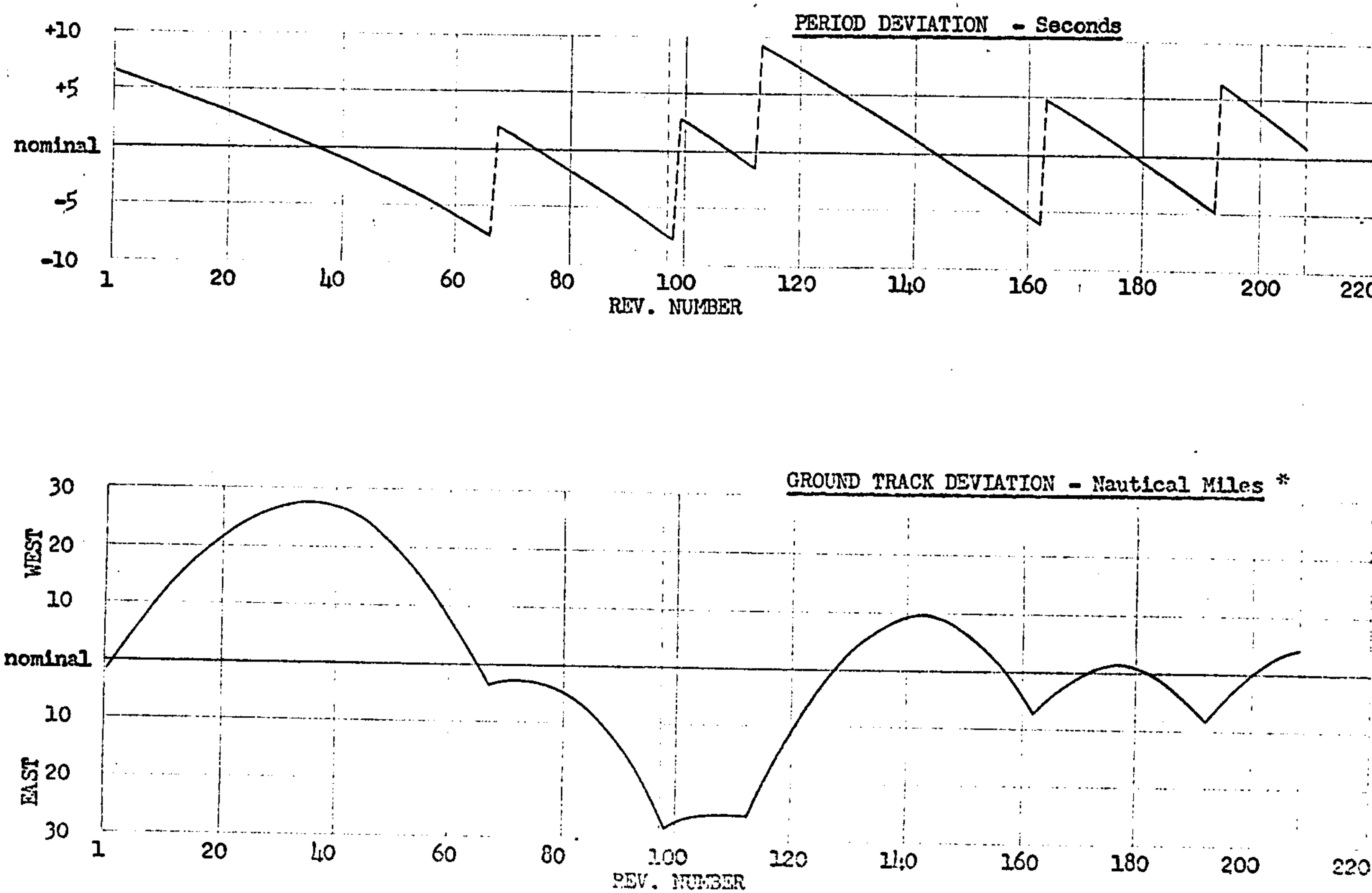
Rev.	Rocket No.	Velocity Change (FPS)	Period Change (Sec)
66	1	+15.35	+ 9.8
98	2	+16.8	+10.7
112	3	+17.6	+11.2
162	4	+17.6	+11.2
192	5	+17.45	+11.1
230	6 (Deboost)	-20.5	-13.0

Figure 3-1 shows the period variations and ground track deviations for the mission.

D. PANORAMIC CAMERA PERFORMANCE

Both panoramic cameras operated normally throughout the flight. Camera system dynamic operation, 99/101 percent clutch operation, start-up, shut-down, and transport functions were normal for all passes with telemetry data available. Response

Figure 3-1



* at equator; maximum values

to the exposure control system commands appeared normal, however Pan No. 1 response to slit width commands was not as rapid as Pan No. 2. Response to filter change commands was comparable. Cycle period data for the eleven engineering operations within range of [redacted] tracking station indicated both units cycling within 0.9 percent of preflight calibration, and within 0.5 percent of each other.

1. Film Consumption

The film supply was exhausted by both cameras during operation on rev. 200.

	Frames	
	Unit #1	Unit #2
Preflight samples	19	19
Prelaunch operations	165	164
First mission	2848	2836
Second mission	3034	3042
Total	6066	6061

2. FMC Programmer Operation

The FMC Programmer settings were generally good throughout the mission. Early in the flight, unexpected difficulty was experienced; the programmer started from 200 to 500 seconds earlier to the time anticipated according to the command settings. Correlation of apparent start times, telemetered power data, and flight command history revealed early starts to occur only on those revs. when real-time commands were transmitted during the interval the Delay Timer was operating, between the timer start brush command from the Orbit Timer and the actual programmer start. Real-time commanding was immediately restricted during that interval. Subsequent checks on non-photographic revs. demonstrated that the programmer was started by severe EMI noise on the unregulated 28 volt D.C. buss, which occurred at the time of command transmission. Tests at A/P with identical hardware duplicated the problem, showing noise spikes up to 180 volts causing premature shutdown of the Delay Timer. Circuit modifications to prevent recurrence of this problem have been incorporated for all subsequent CR systems.

Operations during revs. 1, 5, 6, 8, 9, and 22 were affected by the FMC Programmer start anomaly. Resulting FMC errors ranged as high as 29 percent.

3. FMC Match to Orbit

The FMC rate match to the orbit was generally adequate thruout the flight. During the first mission, over 73 percent of the frames from both cameras were taken with FMC rate errors of one percent or less. If the frames affected by the FMC Programmer delay start anomaly are disregarded, that value would rise to over 85 percent.

For the second mission, somewhat fewer frames were taken at FMC errors of one percent or less; over 42 percent of the forward-looking photography and 65 percent of the aft were within that limit. The lower trend is largely the result of operations near the equator or below. FMC match is normally optimized for coverage of the primary northern areas, and for perigee. As perigee rotated northwards, northern area coverage was not compromised by attempting to optimize southern area FMC match.

The difference between the two cameras during the second mission, as noted above, resulted from a slight reduction in the peak data values and a slight spreading of the values about the peak. However the 1.65 sigma level for the forward camera (2.12 percent) indicates a comparable data dispersion to the level for the aft (2.15 percent). The cause of the irregularities in the operating rates of the forward-looking camera are not yet known.

Plots of the V/H match, arrayed by camera and mission segment, are presented in figures 3-2 to 3-5.

4. Exposure Control

The exposure control programmer operated normally until rev. 159. On rev. 159 a command was issued during the time-out of the delay timer. This resulted in the delay timing out 43 seconds early. The same thing occurred again on rev. 175 resulting in a 23 second early time-out of the delay. These were the only two passes where the command was issued during the time-out or where an apparent anomaly occurred during the flight.

E. DISIC CAMERA PERFORMANCE

The DISIC system operated normally throughout the flight. All transport and internal camera control monitors indicated normal operation. Response to the exposure control and mode select commands were normal. Cut and splice and transfer to the second mission configuration was successfully commanded on rev. 88.

1. Film Consumption

The Terrain film supply was exhausted during the Stateside engineering operation (northbound) on rev. 200. Approximately 150 feet of film remained on the Stellar supply at the end of the second mission.

	Stellar Frames		Terrain
	Port	Stbd	Frames
Prelaunch operations			153
First mission	3572	3578	2098
Second mission	3800	3805	2446
Total	7372	7383	4697

FIGURE 3-2

FRAMES 1-6 OF EACH CP OMITTED 90 PERCENT = 3.2[illegible]

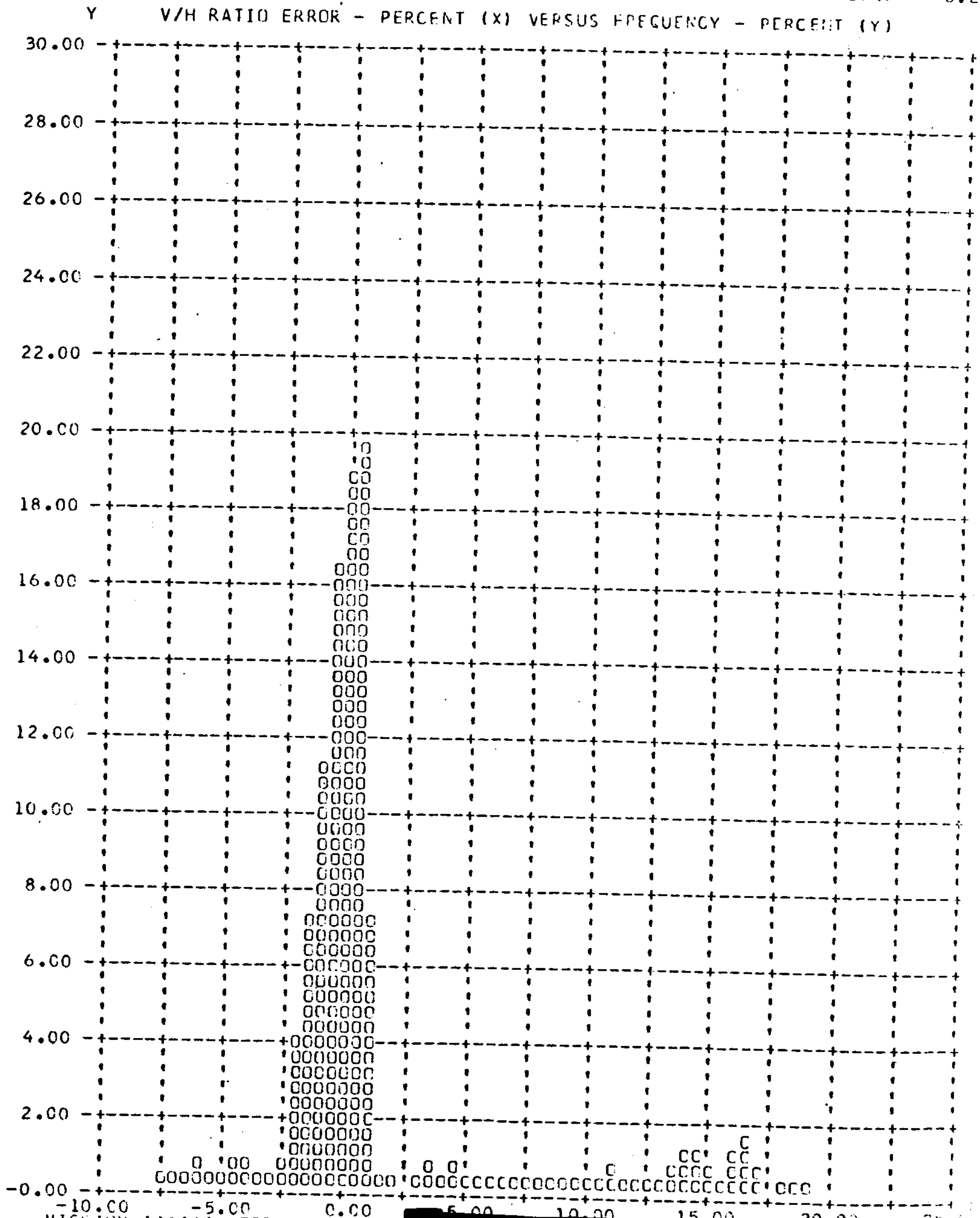


FIGURE 3-3

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 8.31

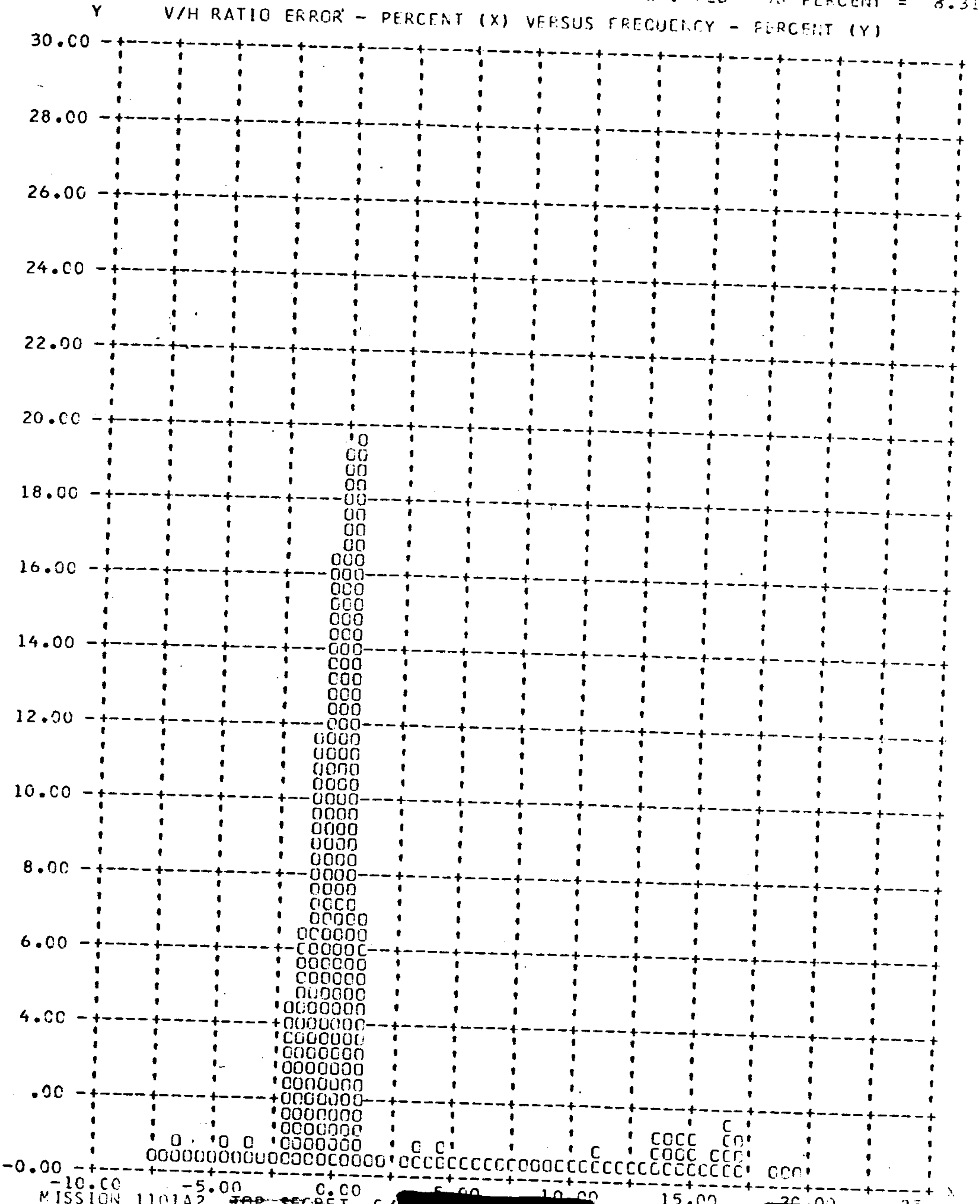
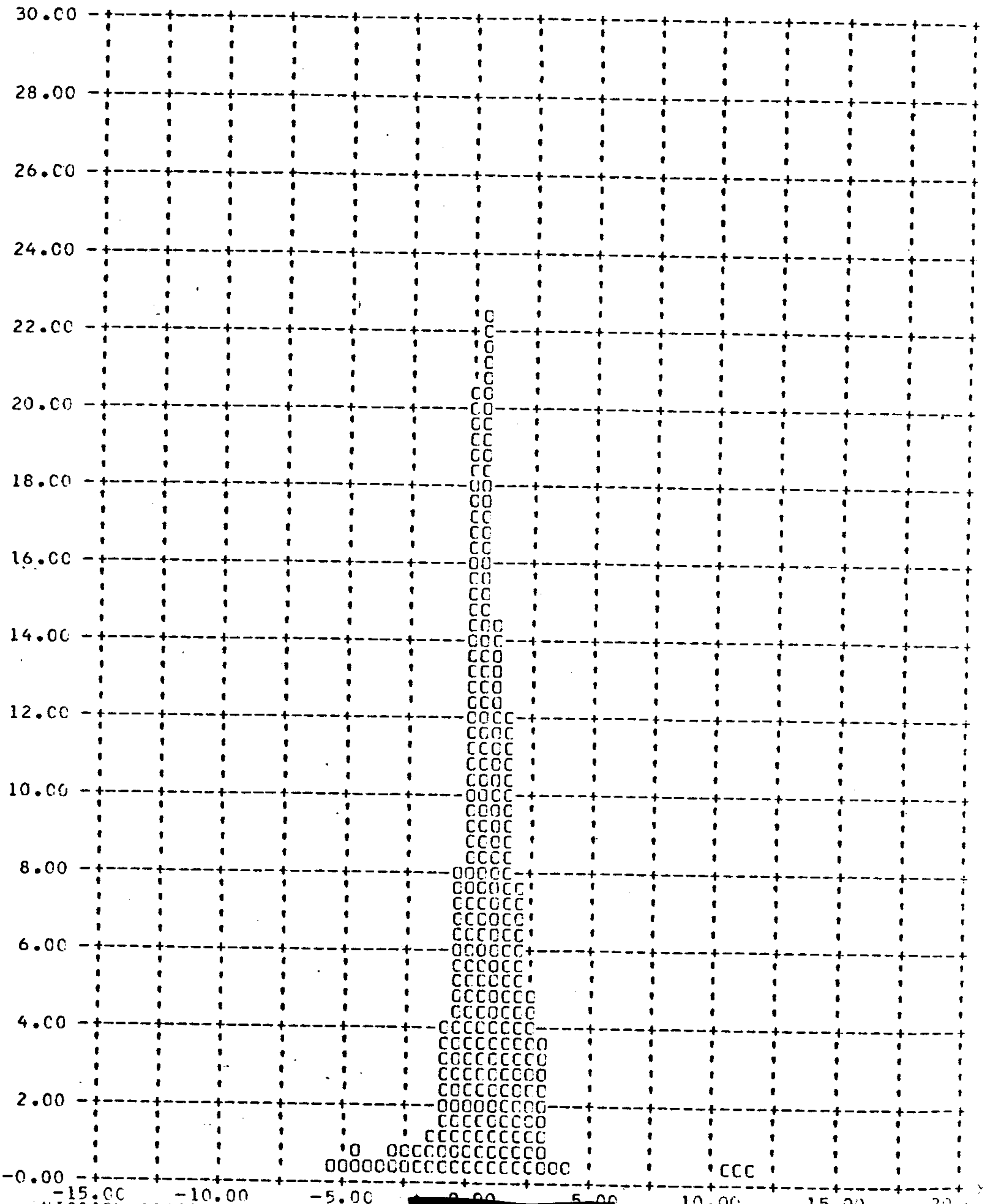


FIGURE 3-4

MISSION 110181 ~~TOP SECRET~~ C [redacted] - CONTROL NO. [redacted]

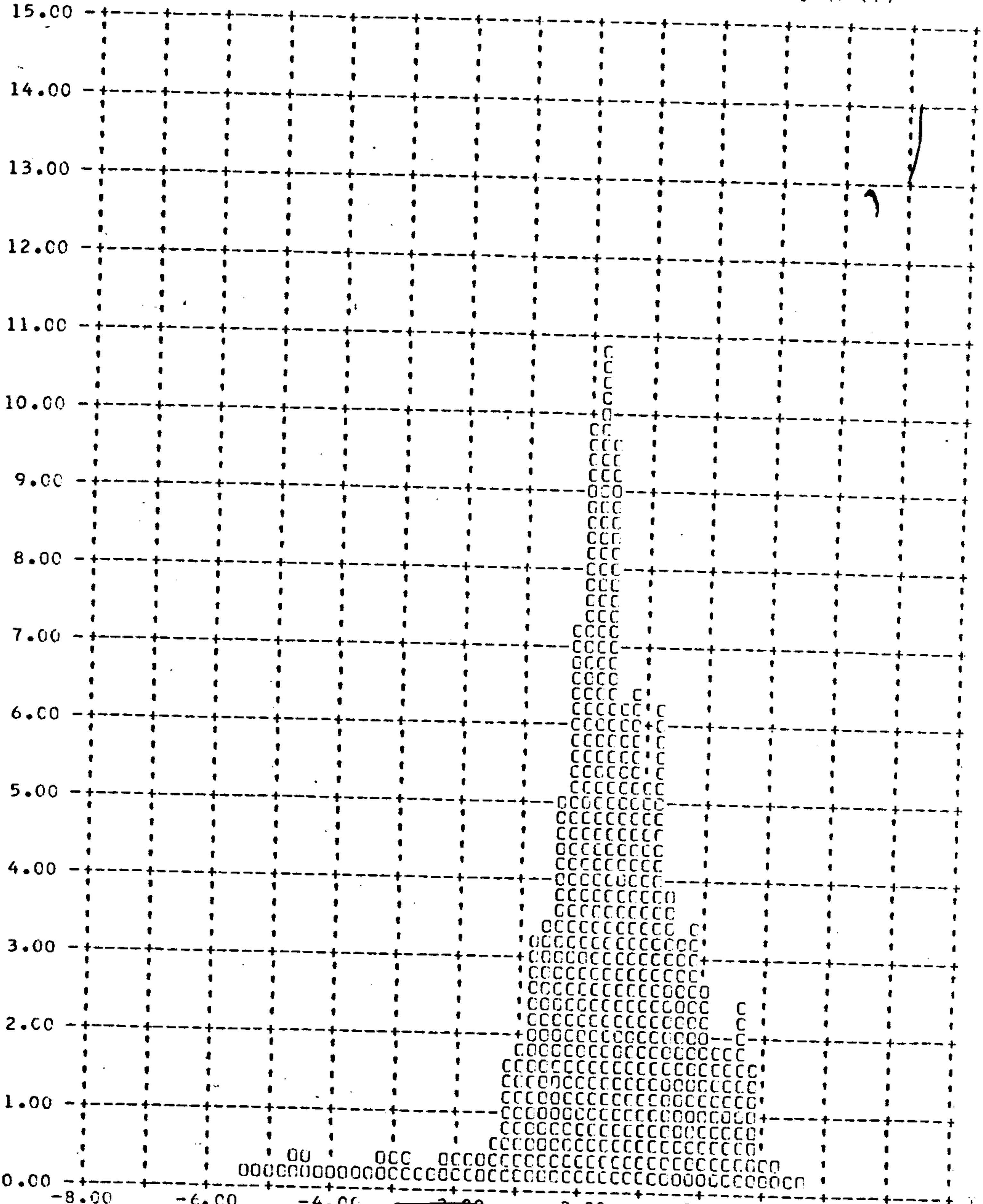
FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 2.15

Y V/H RATIO ERROR - PERCENT (X) VERSUS FREQUENCY - PERCENT (Y)



FRAMES [redacted] EACH OP OMITTED   90 PERCENT = 2.12

Y   V/H RATIO ERROR - PERCENT (X) VERSUS FREQUENCY - PERCENT (Y)



2. Exposure Control

The DISIC timers T_2 and T_5 were reversed pre-flight. Therefore, the switch to 1/500 second exposure time occurred 320 seconds late and switch to 1/250 second exposure time occurred 320 seconds early. This was a setup error; the programmer operated correctly as programmed. Setup procedures have been changed so as to help prevent recurrence of this problem.

F. RECOVERY SYSTEM PERFORMANCE

Both capsules were successfully recovered by air catch; the first on rev. 97 and the second during rev. 208. All re-entry events occurred as programmed and within tolerance; system operation appeared normal. No extensive damage due to the re-entry environment was noted.

The predicted and actual impact points are as follows:

	First Mission	Second Mission
Predicted Impact	21°00'N/154°12'W	21°41'N/147°53'W
Actual Impact	20°56'N/154°07'W	21°48'N/147°51'W

G. SUBSYSTEM PERFORMANCE

1. Instrumentation and Command

The instrumentation system operated normally with the exception of:

1) The Pan No. 1 A.O. platen position monitor which indicated an intermittent unclamped platen.

2) One missed shutter monitor on the DISIC terrain camera.

3) Uncertainty in the pressure gage calibrations.

The command system operated normally throughout the flight with all commands received being executed by the payload command system. There was one case of numerous Analog 9 commands not being executed during a [redacted] acquisition indicating probable ground station trouble.

2. Clock

The clock system operated normally throughout the flight. Good correlation between the clock and [redacted] tracking station system time was obtained.

3. Pressure Makeup

The pressure makeup system performance was normal. Average gas consumption was 9.98 ΔPSI per minute with a total operate time of 192.25 minutes in 126 operations. There was a pressure of 900 PSIA remaining at the end of the flight.

4. Thermal Control

Changes to the standard thermal configuration consisted of adding aluminized tape to several areas to increase reflection qualities. The tape was applied to 50% of the white areas of the external skin. It was also applied to the interior side of the horizon camera boots, with a layer of foil insulation, to decrease absorptive effects of the large black external surfaces of the boots.

Temperature data for the [redacted] tracking station acquisitions indicate the system was approximately 20°F lower than the 70°F nominal and about 10°F lower than the predicted temperatures for the launch time and beta angle for the flight. Temperatures generally ranged within the specified 70° ± 30°.

5. Capsule Tape Recorders

The tape recorder data was generally of good quality and accuracy.

The center-of-format data from Digital Data 2 indicated occasional pulses that were not at the center-of-format position. These pulses would occur 200 to 300 ms early with relation to the proper pulse position. This problem was also present on CR-2 and has been investigated, and appeared related to horizon camera platen clamps causing a noise pulse, triggering the DDSC.

Digital Data 2 also had indications of long pulses at recorder shutdown. Occasional spurious pulses were present at recorder start-up. These pulses presented no problems in processing the flight data unless they appeared with the same pulse widths as either instrument No. 1 or No. 2 and occurred before the first two center-of-format pulses for each instrument after turnon.

The commutator/multiplexer data was good with no apparent malfunctions. Old data still on the SRV recorders would appear for approximately 50 milliseconds during tape recorder shut-down coast. This problem will be eliminated on future flights by removing old data prior to launch.

The first mission recorder recorded all operational data from lift off to panoramic system A to B Transfer (KZ-38) for a total of 98.5 minutes. The second mission recorder recorded all operational data after panoramic film transfer to the second capsule for a total of 93.5 minutes. The playback monitor indicated this recorder did not return to start-of-tape for pre-launch. Post-recovery data revealed the recorder was at start-of-tape indicating a faulty monitor.

H. POST-MISSION TESTING

Post-mission testing of the flight system included functional verification of all Analog and UHF commands including those not utilized during the active mission, operation of the Panoramic and DISIC camera systems in stereo, mono, slave and independent modes, and evaluation of the FMC and exposure control time-out problems experienced during the flight.

No command system anomalies occurred with the exception of early time-out of the FMC programmer as a result of issuing a UHF command during the FMC programmer delay period on rev. 217. No cause of early time-out other than being sensitive to noise was evident in the data.

Panoramic camera No. 1 operated a total of 3327 cycles and panoramic camera No. 2 operated a total of 3284 cycles after second recovery, prior to the end of the orbital programmer tape. Several monoscopic operations were run using both operation and brush advance modes of programming. No anomalies were observed in the data available. Agena gas valve data during the mono operates indicated excessive roll correction was required to stabilize the vehicle. At start-up on a mono operation the vehicle roll rate was 4500 degrees per hour reaching a maximum roll angle of 8.5 degrees in 10 seconds. The rate then reversed sharply and returned to zero roll angle by 45 seconds after the on command. The off command was given at 47 seconds. The roll rate due to shut-down was 3270 degrees per hour with a maximum roll of 5.5 degrees in 10 seconds. The vehicle was stabilized again 45 seconds after the off command.

The DISIC camera operated for only 10 cycles during the post-mission testing before failing. Failure occurred during the first cycle of an operate on rev. 224. However, data indicated one additional cycle was completed between revs. 224 and 227. Failure was apparently due to Stellar film jam up in the system and resulted in a continuous 3 ampere load on the vehicle buss.

SECTION 4

PHOTOGRAPHIC PERFORMANCE

A. PANORAMIC CAMERAS

The best panoramic photography of this mission, obtained with the forward-looking camera, was equal to or better than any previous Corona photography. Photointerpretability of the forward record generally ranged from fair to good for the first half of the mission, and generally good thruout the remainder. The aft-looking record is considered poor to fair thruout for photo interpretation, because of a focus problem.

Several anomalies contributed in some degree to degradation of the panoramic photography. Resolution was affected by focal position and scan head disturbances. Photogrammetric utility was lessened by partial loss of rail hole images, intermittent scan lines, and minor time word problems. General quality was affected to a lesser degree by scratches, light leaks, and corona.

1. Resolution

As noted above, the resolution performance of the forward-looking camera was generally good, while the aft-looking imagery appeared soft; the aft camera was not correctly focused. An analysis by ITEK of lens fabrication data showed a back focus shift of 0.001 inch less than anticipated. Additionally, tests showed an additional vacuum shift of approximately 0.0005 inches. The forward-looking camera was focused so that these changes were permitted without a resolution loss, while the aft camera original focal position was such that these shifts would significantly degrade the product.

As a result of this focus problem, several tests were planned, relating to determination of optimum flight focus settings, and to the relationship of resolution testing at ITEK and A/P.

The focus situation was well demonstrated by readings of Controlled Range Network (CORN) targets photographed during the flight. The best targets observed yielded approximately six foot ground resolution in the FMC direction for the forward-looking camera, and twelve feet for the aft. The best ground resolution in the scan direction was ten feet for the forward, and sixteen feet for the aft.

The above difference in target resolution values in the FMC and scan directions is attributed to a phenomenon observed during testing at ITEK When the film is lifted by the scan head during the active photographic scan, a differential film velocity is produced in the scan direction. This velocity is proportional to lift. As lift is increased, the apparent film velocity at the scan head is also increased. The loss of resolution, as observed, is a function of both the lift and the slit width. Laboratory tests with the narrowest slits exhibit one-target variation in the scan and FMC directions. The lower temperatures were considered as contributory to the lift problem; it was estimated the lift increased 0.004 inch as a result, by ITEK.

Another scanning problem developed in the form of a narrow lateral smeared band near the start-scan format end from both cameras. It was caused as the trailing scan head roller impacted the film, causing relative film motion in the slit area.

2. Performance Measurements

The photography acquired by both panoramic cameras during Missions 1101-1 and 1101-2 received an MIP rating of 95. A summary is tabulated below of the MTF/AIM resolution values measured by AFSPPF and reported in cycles/mm. The microdensitometer slit used was 1 micron by 80 microns.

Mission	Camera	Cycles/mm	Avg.	Standard Deviation
1101-1	Fwd	31-113	69	21
1101-2	Fwd	29-107	63	19
1101-1	Aft	29-102	50	19
1101-2	Aft	20-75	45	15

The details of the measurement and computing techniques, targets measured and target locations are fully reported in the evaluation report published by AFSPPF and are not included in this report. These values were determined by using the "Interim MTF/AIM Program" technique.

3. Photogrammetric Data

Rail hole images progressively became faint or unusable during the mission as a result of the holes becoming filled with scraped emulsion particles. This problem, common with J1 Panoramic Geometry systems, was not expected to recur again with CR systems. Subsequent CR rails are filled with a transparent substance, which significantly reduces the possibility of lost hole images.

Emulsion buildup on the rail edges was also responsible for breaks in the scan trace imagery, starting midway thru the second mission. As the emulsion deposit increased, it extended into the projected scan trace.

The reported problems with time word recording on the film were resolved by use of the tape recorded data, which was processed by A/P and transmitted to the users. No information loss was reported to be caused by the few anomalous time words on the film.

4. General Quality

Scratches were noted intermittently in the aft-looking format area thruout the mission, becoming less significant as the flight progressed. Similar scratching was observed on Readiness Test material, prior to flight; they were not considered sufficiently degrading to delay the mission.

Minor light leak fog patterns were present on the first frame and next to last frame of some operations. These patterns were very difficult to detect on duplicated material, making determination of the source impractical. Because of the minor nature of the patterns, no loss of intelligence was incurred.

Very minor corona marking was noted thruout the aft-looking record. The marks were caused by the frame metering roller, and were located between the film edge and rail scratch along the time word side. No degradation was caused by this marking.

B. HORIZON CAMERAS

In general, the horizon cameras produced adequate imagery. Some degradation was apparent as a result of vignetting and a solenoid problem.

All four horizon cameras produced vignetted imagery. From 25 to 40 percent of the horizon line was obscured, but this did not appear to degrade utility of the photography. Testing at A/P has indicated the cause of this vignetting attributable to partial collapse of the rubber light shields ("boots") into the field of view, and to movement of the Velcro door pyrotechnic device covers. On subsequent J3 flights, the pyro covers have been removed, and the boots reinforced with a steel ring.

The horizon imagery was not as sharp in appearance as normally expected. The most probable cause was the shutter solenoid reaching the end of travel while the shutter was still open, resulting in a jarring motion and minor image or film movement. The timing of the shutter trip solenoid was to be adjusted on future systems.

C. DISIC - STELLAR

During the first mission segment, stars up to 6.5 magnitude were recorded by the starboard-looking Stellar camera. This was adequate for attitude determination. However, normal orbit precession gradually brought the vehicle into a position so as to cause flare off the camera baffle to progressively increase. This decreased the quantity of stars detectable, so that attitude determination was very difficult. The port camera star field was weak thruout the first mission, and useless during the second. Some of the stellar formats are degraded by light leaks and electrostatic marking.

1. Baffle Flare

The progressive deterioration of Stellar record utility during the mission revealed a serious problem in Stellar baffle design. Correlation of all available data indicated inadequate baffling for some conditions of sun position relative to the Stellar doors. Additional baffling was found to be necessary within the boot areas, where baffles had not been previously specified. The boot area was redesigned for subsequent missions.

2. Light Leak

Stellar film was fogged by a light leak at the seal between the Terrain lens and camera cover during inoperative periods. Degradation ranged from minor to severe for the 5 or 6 formats lying in that area. Testing at A/P indicated that final camera installation procedures could be improved so that a higher degree of light-tightness would be assured for subsequent systems.

3. Electrostatic Marking

Several forms of corona marking were noted occasionally thruout the Stellar record. This marking was very similar to that noted during the preflight altitude/environmental testing at A/P. However, the marking density appeared somewhat lighter.

The first few frames of many port Stellar operations were degraded by a waffle-patterned mottling, similar to that observed during A/P testing. This was caused by the coarse-textured platen pressure pads.

D. DISIC - TERRAIN

The image quality of the Terrain camera appeared fair. The material was suitable to meet minimum customer requirements for attitude determination, relative orientation, and auxiliary cartography. The imagery lacked sharpness, appearing somewhat soft. This situation was complicated by an exposure control problem, and possibly by the lower system temperatures encountered, so as to make isolation impossible of the effect of single variables.

The DISIC exposure control command did not cause a switch to the 1/500 second position at the desired time, as noted in section 3. The timer which controls the Terrain exposure was improperly set prior to launch because of a misidentification by personnel of various time delay functions with the corresponding control hardware assignments. This resulted in a net reversal of timer functions, with most northern photography being taken at 1/250 second exposure time.

Attempts were made at [redacted] to partially compensate this overexposure by processing the film from the first mission to a lower gamma than normal. This resulted in more tolerance to exposure variation. It also resulted in a very flat (low contrast) appearance. Material from the second mission was processed to a somewhat higher gamma, although not normal, and the contrast appeared improved. The SO-230 film at the end of the second mission was processed normally.

SECTION 5

PANORAMIC CAMERA EXPOSURE

A. LAUNCH WINDOW

The J3 system is designed to be relatively free from the launch time constraints familiar to the J1 system. The double Stellar camera eliminates having to avoid flare caused by sunstruck baffles, as either side alone should produce sufficient attitude data. The panoramic camera exposure control allows additional exposure flexibility and lens dependence upon launch time to regulate available illumination. The vehicle and payload thermal design allows beta angles from plus to minus 65 degrees (8.6 hours, including orbital precession).

Mission 1101 launch window selection was based upon the criterion that the system should encounter local noon at the equator, southbound. Because of orbit plane precession, this yielded a window for a 15 day flight from 1938Z (first rev. at noon) to 2206Z (last rev. at noon). Nominal launch time was 2045Z, when equatorial noon would occur in mid-mission. Absolute limit ("hard cutoff") for the pans was 1820-2255Z, and for the Stellar was 1540-2400Z.

Actual launch was at 1941Z.

B. EXPOSURE SETTINGS

Primary filter selections were a Wratten 23A for the forward-looking camera, and a Wratten 21 for the aft. This was similar to the normal J1 configuration. Alternate filters were Wratten types 25 and 23A, respectively. The slit selection was based upon these filters, the launch window, and the anticipated orbit parameters. It was attempted to maintain exposure within the [redacted] processing tolerances thruout the mission, but close to the upper limits. The failsafe settings were established to provide proper exposure southwards from the limiting condition at 60 degrees North.

C. INFLIGHT EXPOSURE

Frequency distributions of solar elevations and directions encountered during photographic operations are shown in Figures 5-1 thru 5-2. The ranges shown are typical for this type of mission.

Inflight exposure was very close to that anticipated. The exposure control programmer functioned properly, with the two minor exceptions noted in Section 3 (item D4). Exposure times for each camera are compared with [redacted] processing tolerances for representative passes in Figures 5-3 thru 5-5.

D. INFLIGHT THRU-EXPOSURE EXPERIMENT

An experiment was conducted during a Stateside engineering operation on rev. 159. Using the primary filters, the slit selector was commanded to step thru each position at least once, in order to attempt correlation of image quality effects with exposure variation.

Material was evaluated from the forward-looking camera only, because of the soft aft imagery. FMC programmer matching error for this operation was approximately one percent. Total IMC error was less. Sun elevation ranged from 43 to 48 degrees.

When judged by the 0.4-2.0 density tolerance criterion, all of the frames - and targets within the frames - were satisfactorily exposed regardless of slit width. When judged by the 1.2 gradient density tolerance criterion, the frames taken with the narrowest slit (0.150) were considered underexposed. No frames were overexposed when judged by either criterion.

FIGURE 5-1

SOLAR ELEVATION FREQUENCY DISTRIBUTION

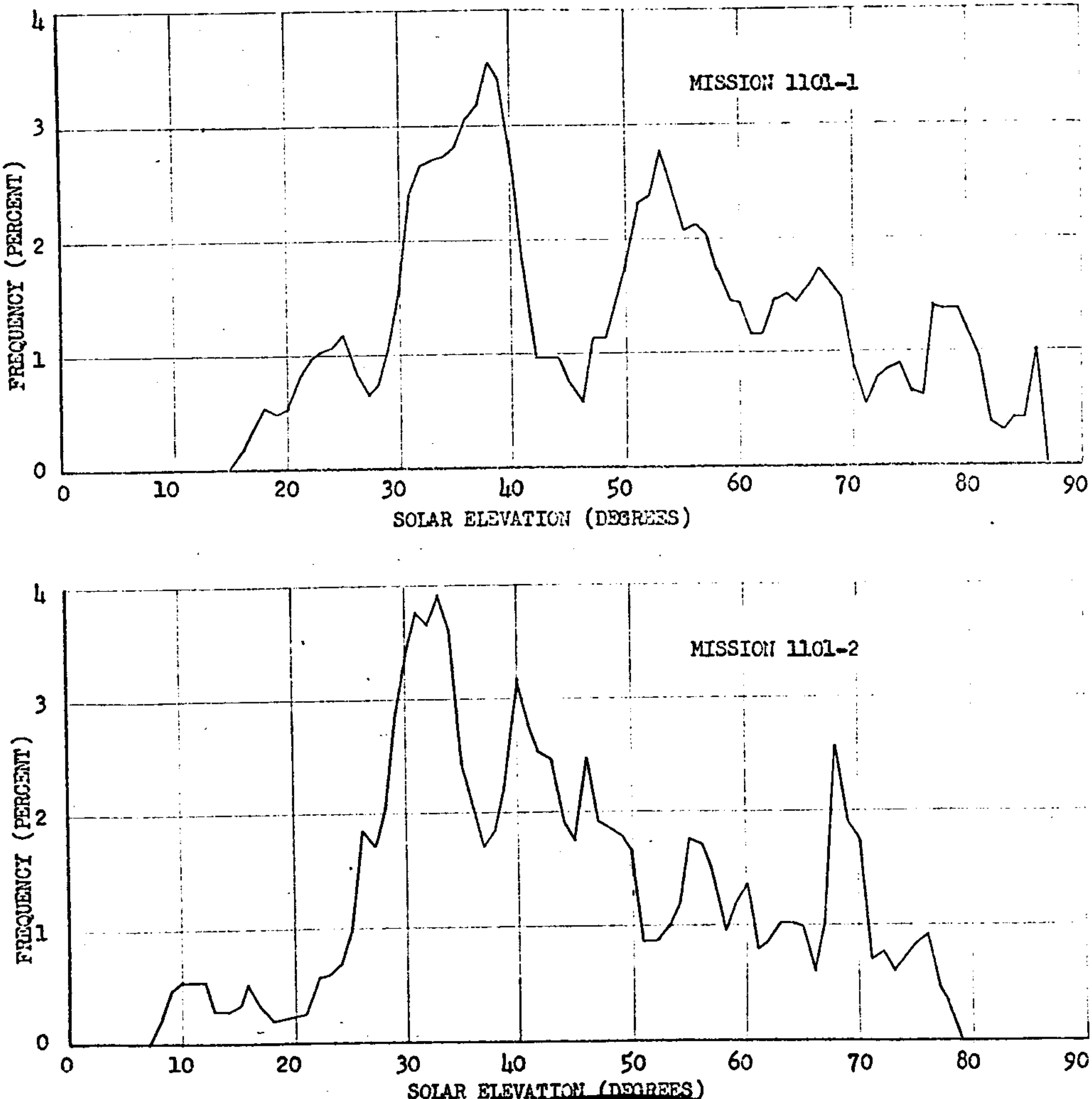


FIGURE 5-2

SOLAR DIRECTION FREQUENCY DISTRIBUTION

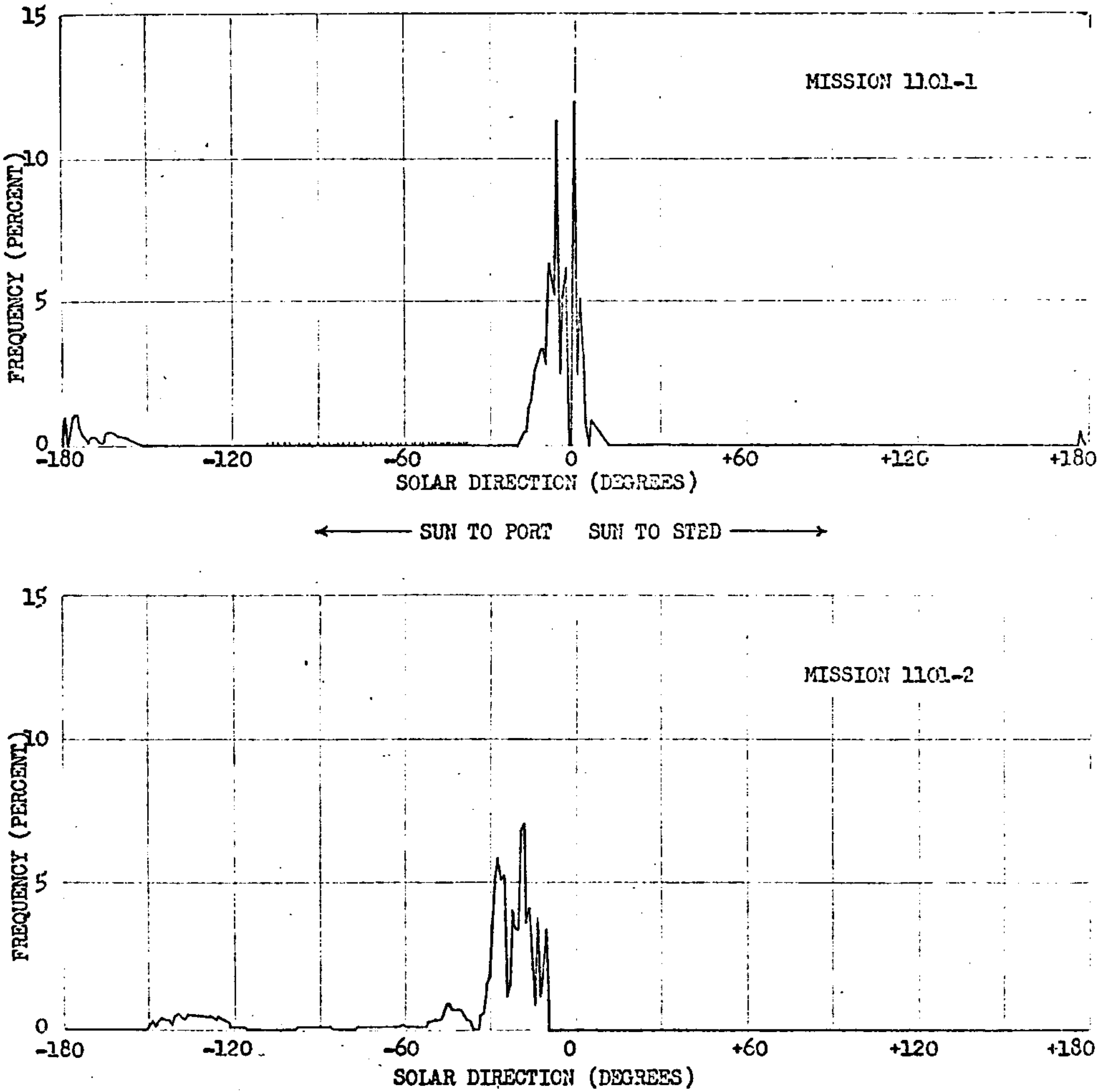


FIGURE 5-3

TYPICAL EXPOSURE CONDITIONS
REVS 1-80

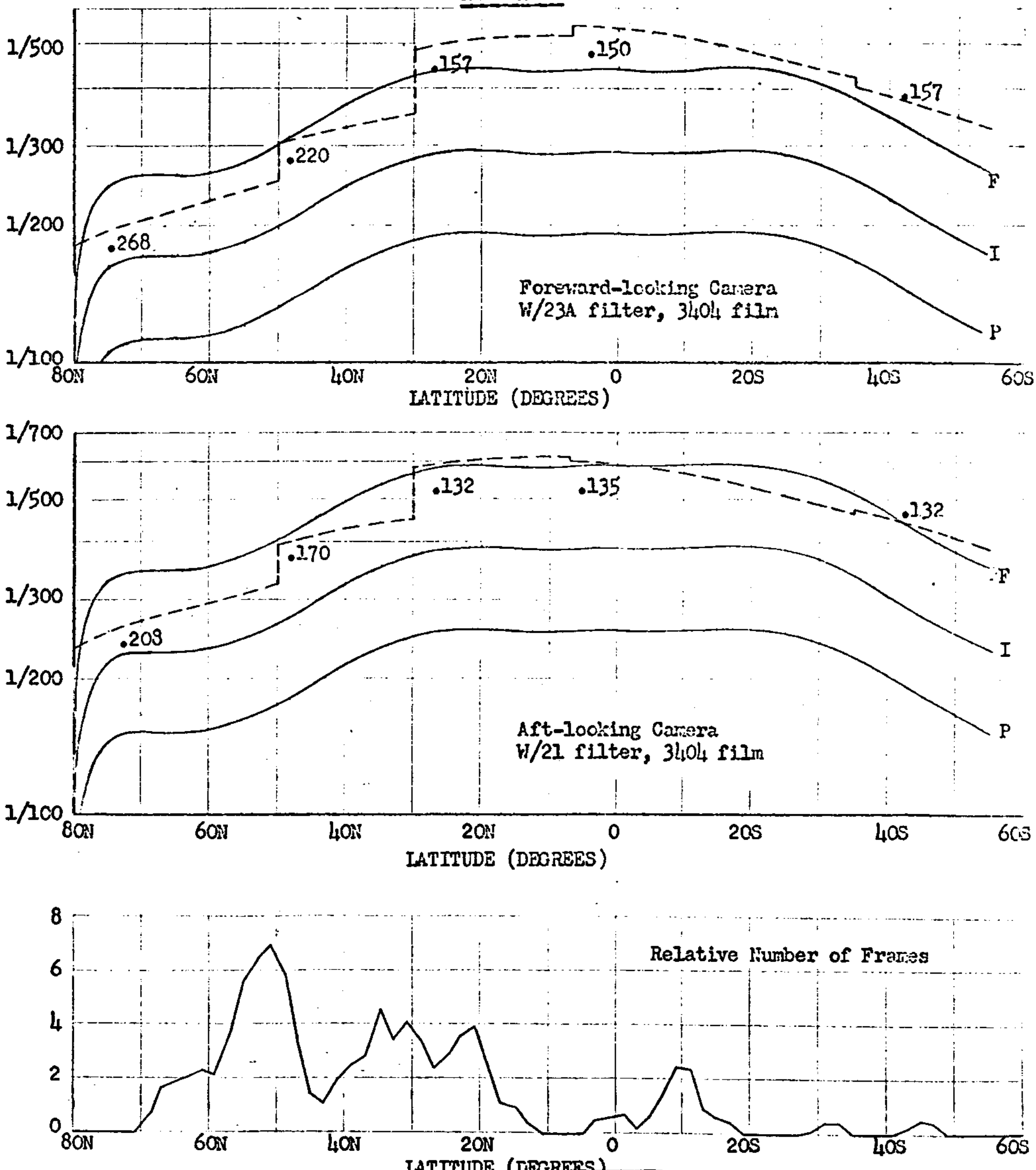


FIGURE 5-4

TYPICAL EXPOSURE CONDITIONS
REVS 80-160

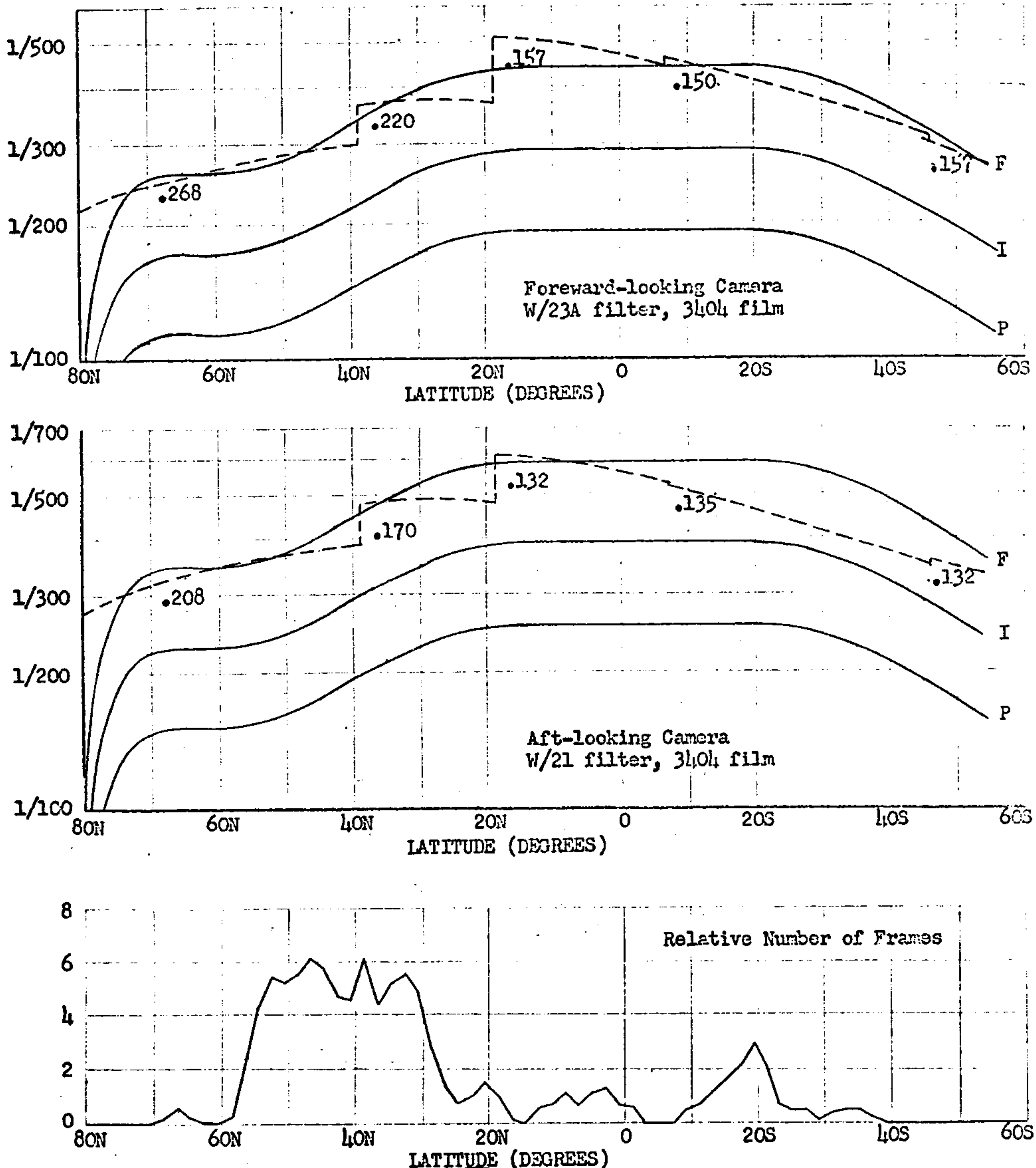
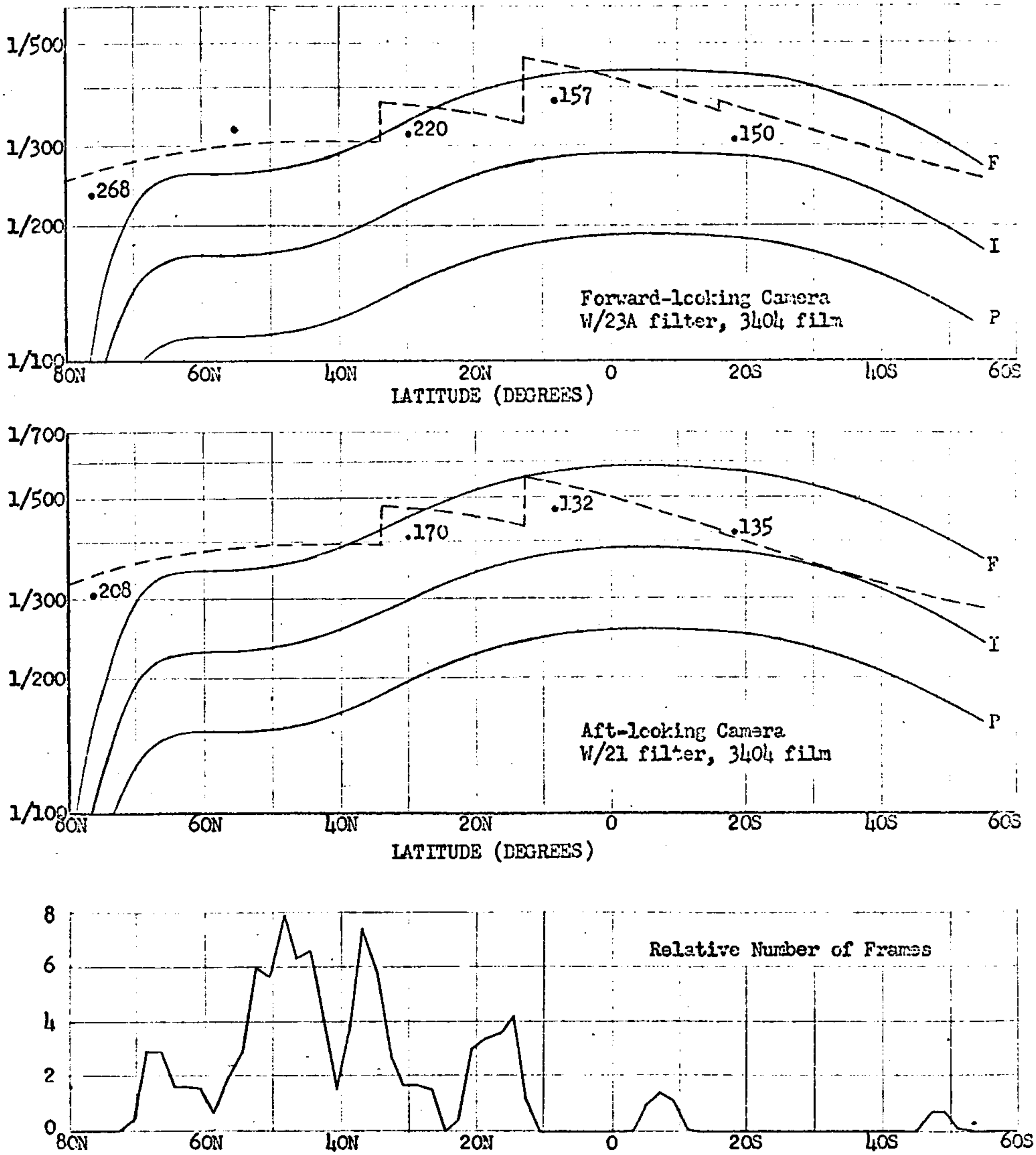


FIGURE 5-5

TYPICAL EXPOSURE CONDITIONS
REVS 160-208



SECTION 6

PROCESSING AND DENSITY ANALYSIS

The panoramic film from both mission segments was processed with Trenton equipment. Sensitometric tests indicated similar characteristics for the control stock, preflight samples, and mission materials.

Diffuse density measurements made by AFSPPF were computer sorted at A/P to permit analysis of the density ranges encountered at the three processing levels. A study of sorting techniques showed that no absolute method was available to separate the density values as the accuracy of the processing history published by [redacted] appears rather low and processing transition phases are not accounted for. The sorting technique selected uses the base-plus-fog density values where measurements up to 0.09 density are considered as having received primary processing 0.10 to 0.17 as intermediate and above 0.17 as full. The percentage of original negative that was processed at each level, based on the computer sort, is tabulated below with the processing percentages reported by [redacted]

			Percent of Frames Processed			
			Primary	Intermediate	Full	(Transition)
First Mission	Fwd	Reported	3	3	84	10
		Computed	0	14	86	--
	Aft	Reported	0	8	85	7
		Computed	0	26	74	--
Second Mission	Fwd	Reported	3	7	82	8
		Computed	0	14	86	--
	Aft	Reported	3	5	82	10
		Computed	0	14	86	--

The tabulations of density frequency distributions for both missions are included in the Appendix, Table A-1 thru A-4. The graphical presentation of the density distribution are computer plotted in the Appendix, pages A-1 thru A-36.

A summary of the processing and exposure analysis is shown in Table 6-1. The terrain D-Min criteria, (range) for proper exposure and processing is 0.40 to 0.90 density units. The area measured for D-Min is selected subjectively and is not necessarily the absolute D-Min in the photography.

A density range chart, Figure 6-1, is included in this report. This type of chart for Missions 1004 to 1041 is included in the A/P final report for Mission 1041.

These charts are produced from the same density measurements previously mentioned in this section. The computer produced the mean, median and range figures for the various processing levels used. The chart includes the number of frames (samples) in which the density measurements were made. These measurements are made on approximately every tenth frame throughout the mission.

TABLE 6-1

MISSION 1101-1 INSTR - FWD 1/17/68 PROCESSING AND EXPOSURE ANALYSIS

PROCESS LEVEL	SAMPLE SIZE	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0	0 PC	0 PC	2 PC	16 PC	16 PC
INTERMEDIATE	31	C PC	23 PC	65 PC	13 PC	0 PC
FULL	194	57 PC	0 PC	40 PC	3 PC	0 PC
ALL LEVELS	225	49 PC	3 PC	43 PC	4 PC	0 PC

MISSION 1101-1 INSTR - AFT 1/17/68 PROCESSING AND EXPOSURE ANALYSIS

PROCESS LEVEL	SAMPLE SIZE	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0	0 PC	0 PC	0 PC	30 PC	30 PC
INTERMEDIATE	58	0 PC	28 PC	64 PC	7 PC	2 PC
FULL	166	30 PC	0 PC	67 PC	2 PC	0 PC
ALL LEVELS	224	22 PC	7 PC	67 PC	4 PC	0 PC

MISSION 1101-2 INSTR - FWD 1/17/68 PROCESSING AND EXPOSURE ANALYSIS

PROCESS LEVEL	SAMPLE SIZE	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0	0 PC	0 PC	0 PC	18 PC	18 PC
INTERMEDIATE	35	3 PC	11 PC	63 PC	23 PC	0 PC
FULL	218	47 PC	0 PC	50 PC	3 PC	0 PC
ALL LEVELS	253	41 PC	2 PC	52 PC	6 PC	0 PC

MISSION 1101-2 INSTR - AFT 1/17/68 PROCESSING AND EXPOSURE ANALYSIS

PROCESS LEVEL	SAMPLE SIZE	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0	0 PC	0 PC	0 PC	19 PC	18 PC
INTERMEDIATE	35	0 PC	6 PC	83 PC	11 PC	0 PC
FULL	209	40 PC	0 PC	59 PC	1 PC	0 PC
ALL LEVELS	244	34 PC	1 PC	62 PC	3 PC	0 PC

PROCESS LEVEL	BASE & FOG	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0.01-0.09	0.C1-C.13	0.14-0.39	0.40-0.90	---------	0.91 AND UP
INTERMED	0.10-0.17	0.C1-C.20	0.21-0.39	0.40-0.90	0.91-1.34	1.35 AND UP
FULL	0.18 AND UP	0.01-0.39	---------	0.40-0.90	0.91-1.69	1.70 AND UP

J MISSION DENSITY RANGES

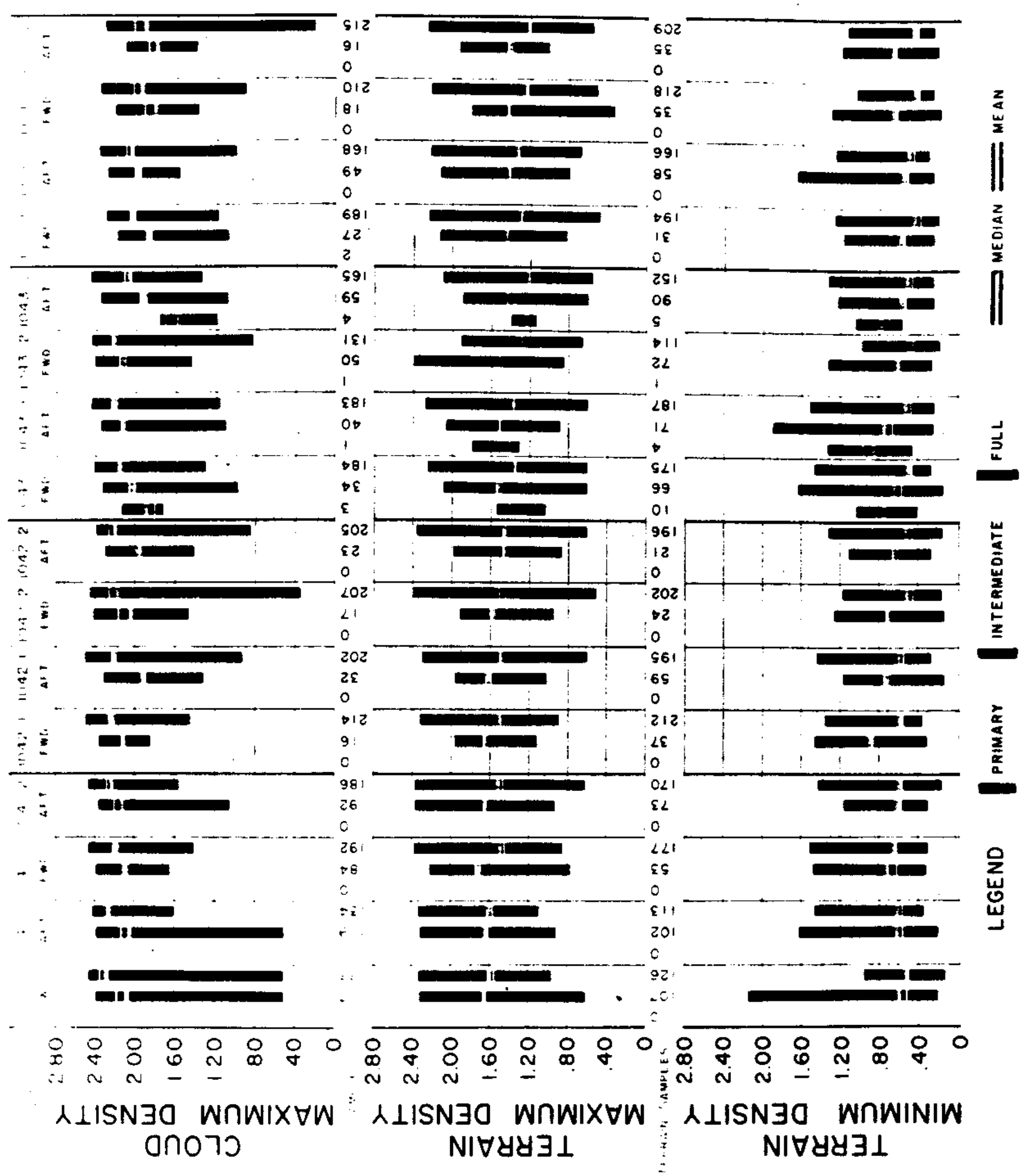


FIGURE 6-1

SECTION 7

VEHICLE ATTITUDE

The vehicle attitude errors for Mission 1101 were derived primarily from the reduction of the Stellar camera photography. This attitude date is supplied to A/P by NPIC.

The attitude errors for each frame and the attitude control rates are calculated at the A/P computer facility. The computer also plots the frequency distribution of the rates and errors. Figures 7-1 through 7-12 show these distributions for Mission 1101-1 and Figures 7-13 through 7-24 for Mission 1101-2.

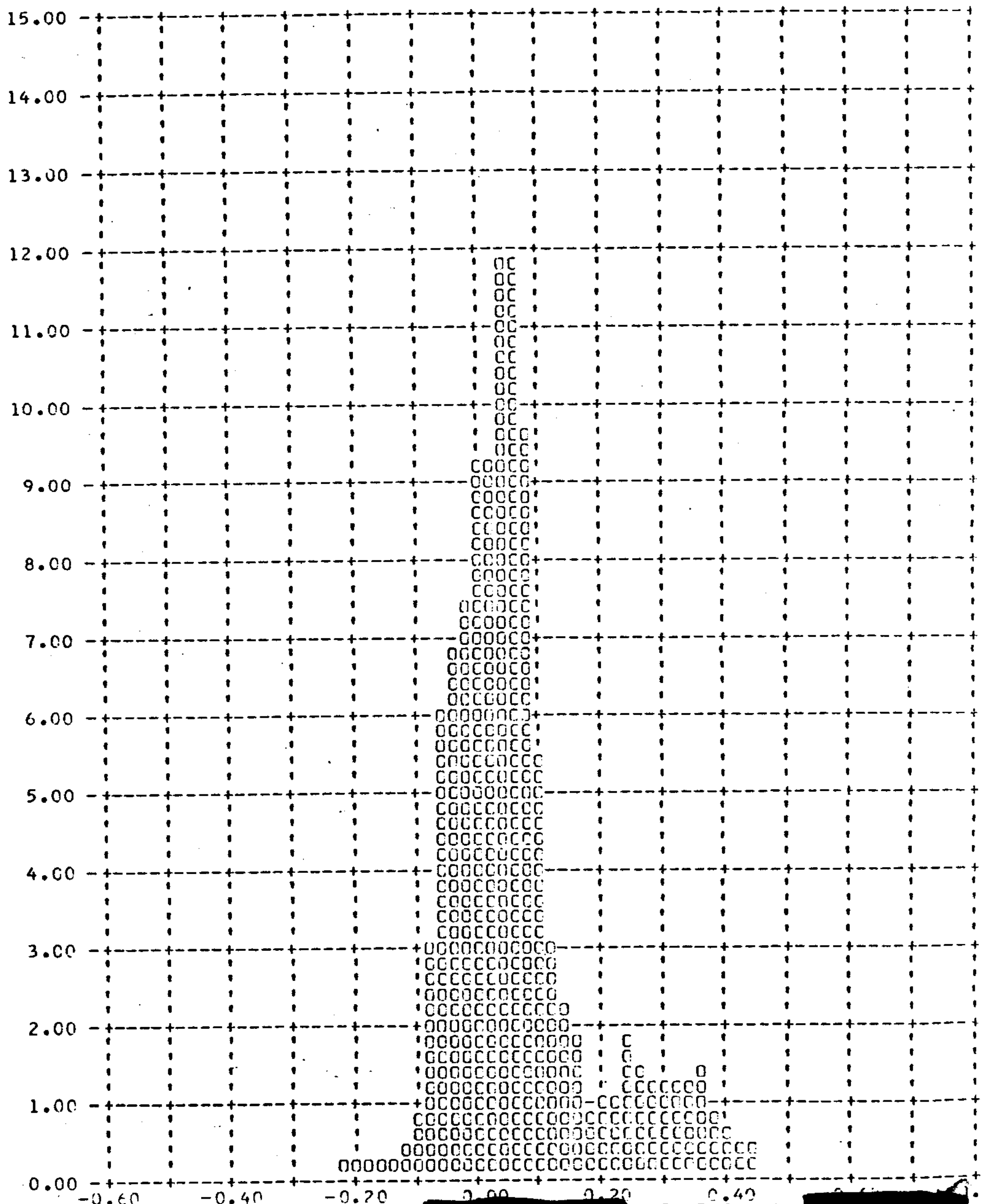
The summary table below lists the maximum attitude errors and rates that were experienced during 90% of the Fwd camera photographic operations, excluding the first three and the last frames of each operation and the total range of the errors and rates.

	Mission 1041-1				Mission 1041-2			
	90%	Range			90%	Range		
Pitch Error (°)	0.23	-0.25	to	+0.44	0.37	-0.32	to	+0.56
Roll Error (°)	0.28	-0.10	to	+0.54	0.28	0.08	to	+0.92
Yaw Error (°)	0.78	-0.25	to	+2.25	1.01	0	to	+1.40
Pitch Rate (°/hr.)	30.96	-95	to	+100	40.57	-90	to	+95
Roll Rate (°/hr.)	26.00	-90	to	+80	29.07	-85	to	+100
Yaw Rate (°/hr.)	33.62	-80	to	+80	44.04	-95	to	+90

The performance of the attitude control system is comparable to the control system used on recent missions. The panoramic photography was not degraded by the attitude control system.

MISSION 1101A1 ~~TOP SECRET~~ C [redacted] - CONTROL NO. [redacted]
FRAMES 1-6 [redacted] OMITTED 50 PERCENT = 0.23

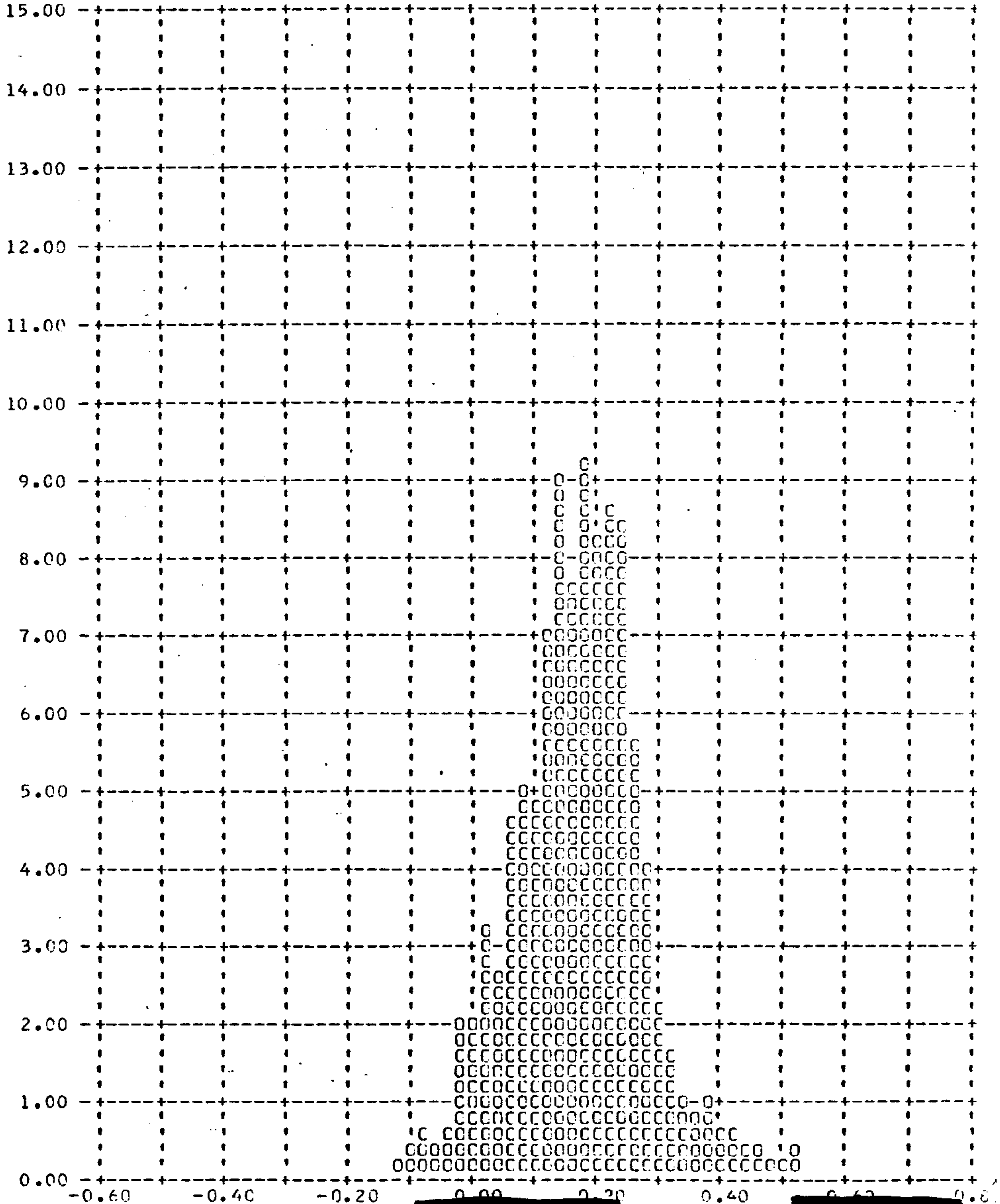
Y PITCH ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



MISSION 1101A1 ~~TOP~~ SECRET C [redacted] - CONTROL NO. [redacted]

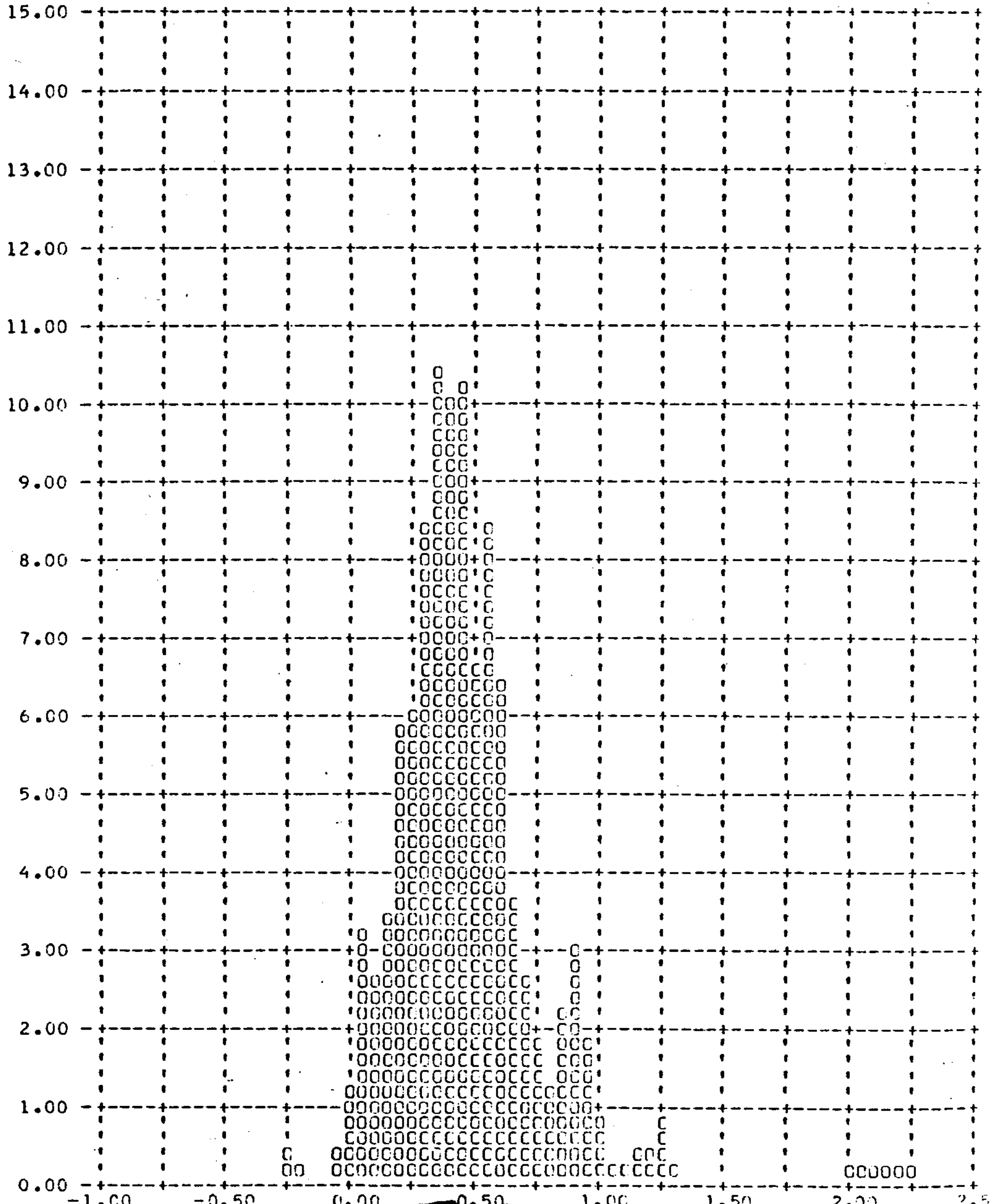
FRAMES 1-6 [redacted] OMITTED 90 PERCENT = [redacted].27

Y ROLL ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



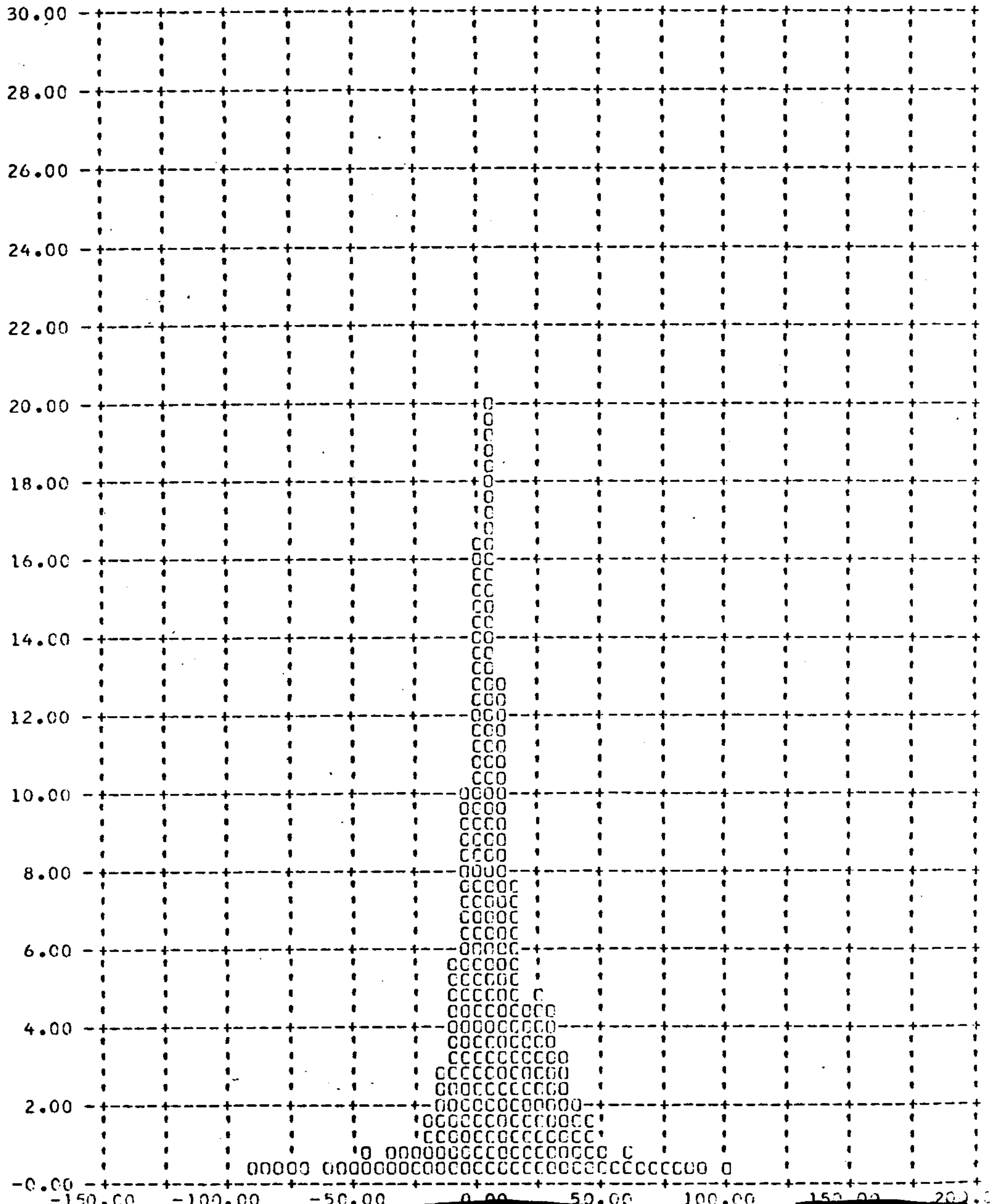
FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = [redacted].77

Y YAW ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 51.4

Y PITCH RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)

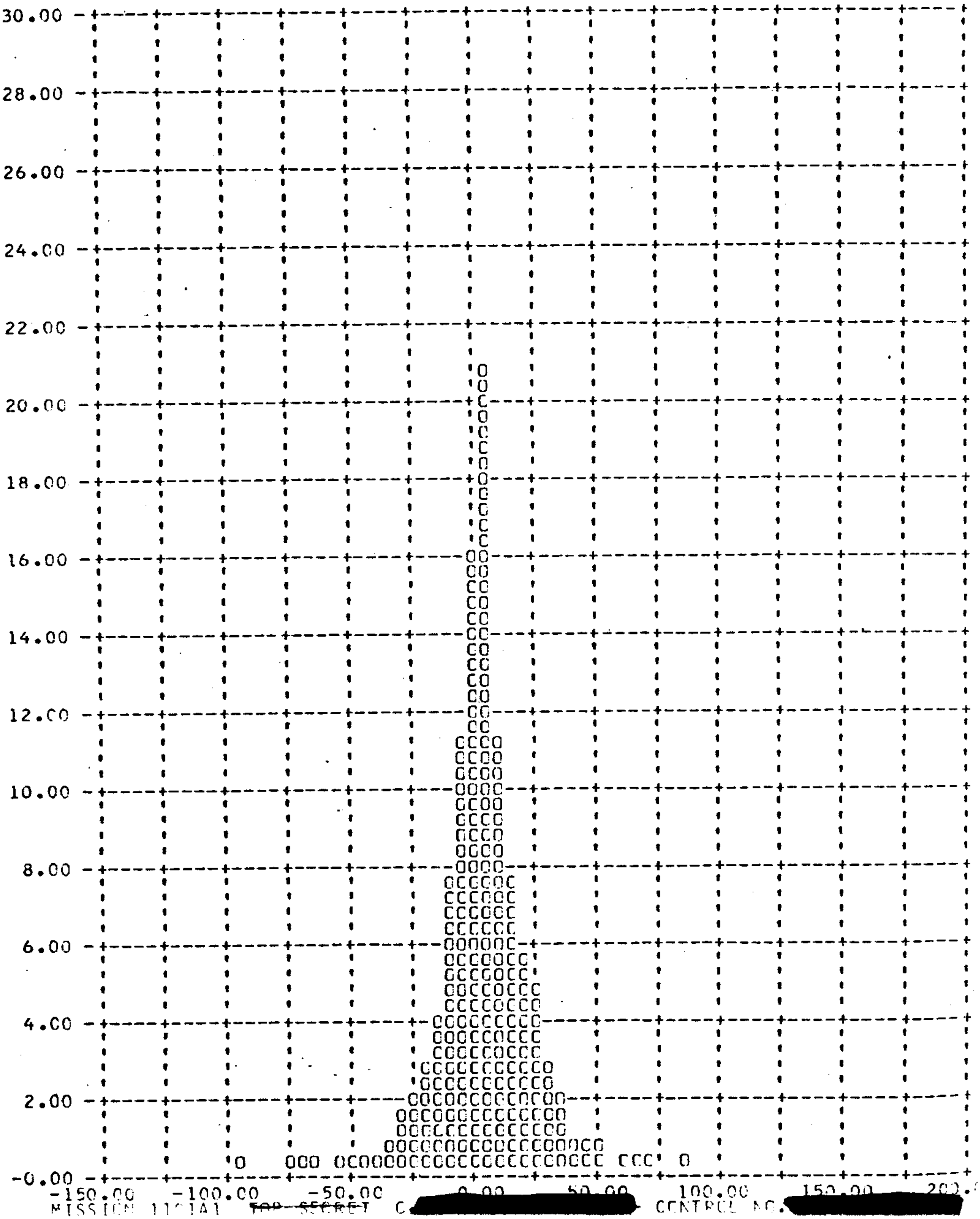


Notice of Missing Page(s)

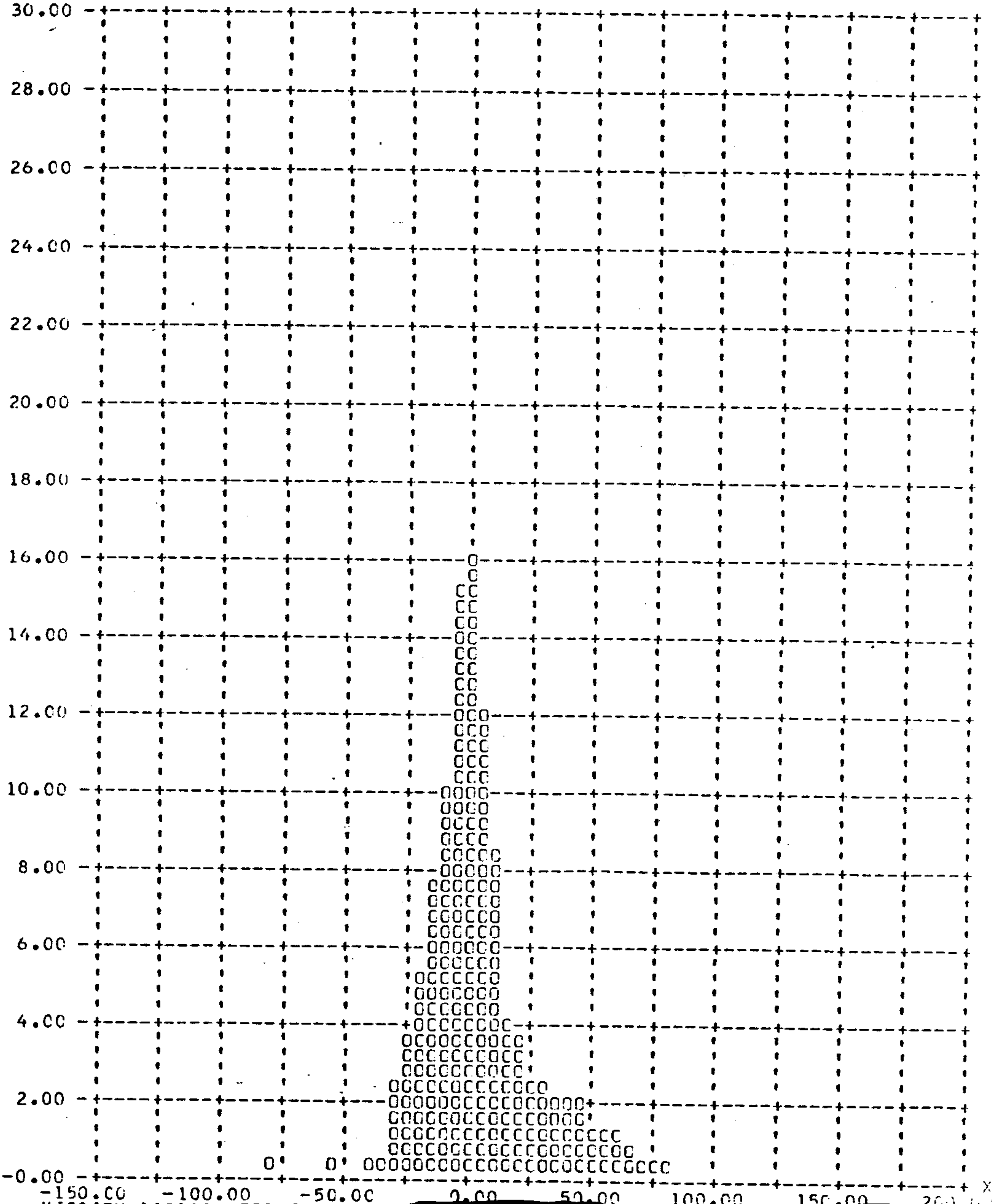
Page 67 of the original document was missing.

FRAMES 1-6 OF EACH CP OMITTED 90 PERCENT = 26.03

Y ROLL RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)

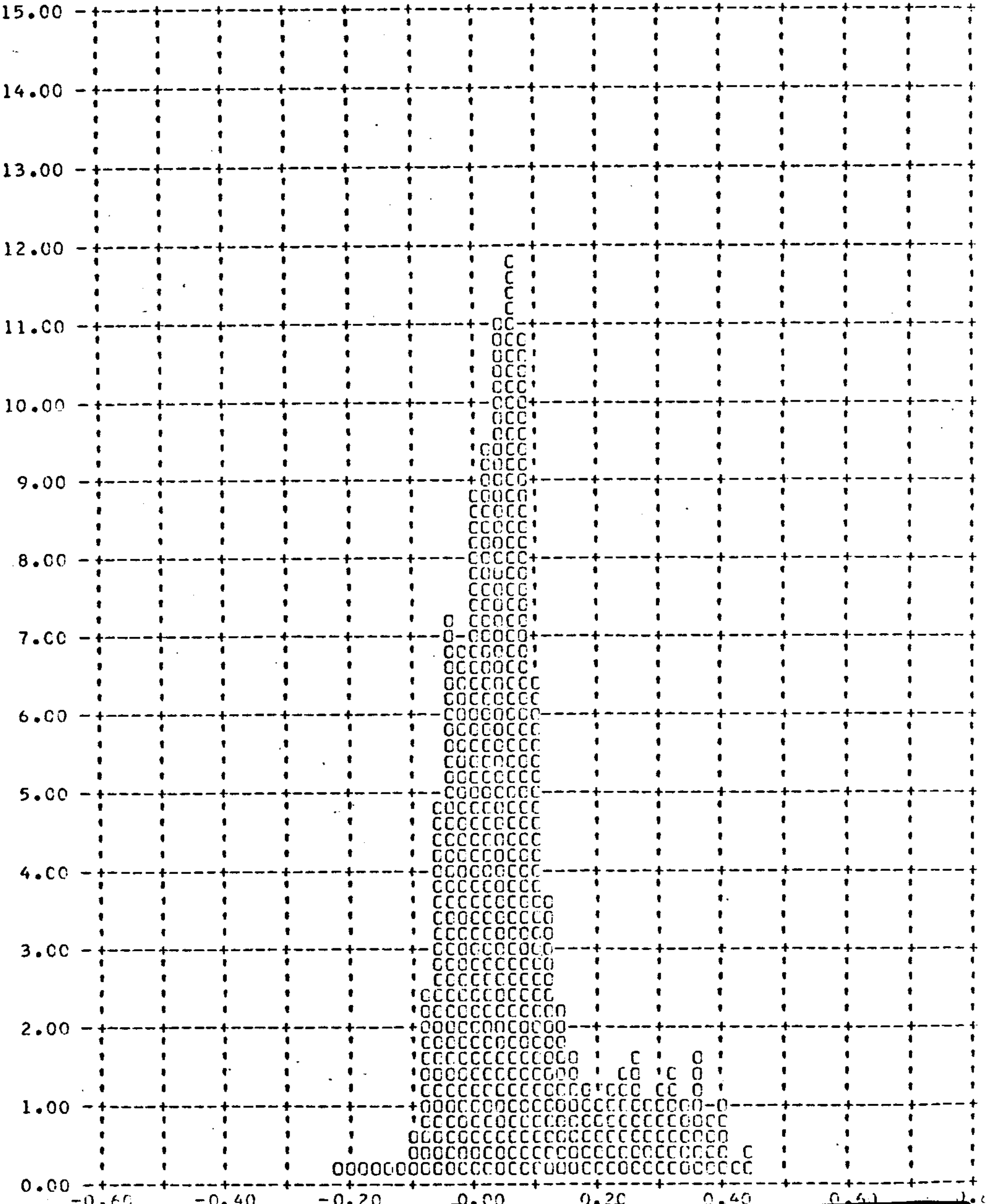


Y YAW RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)



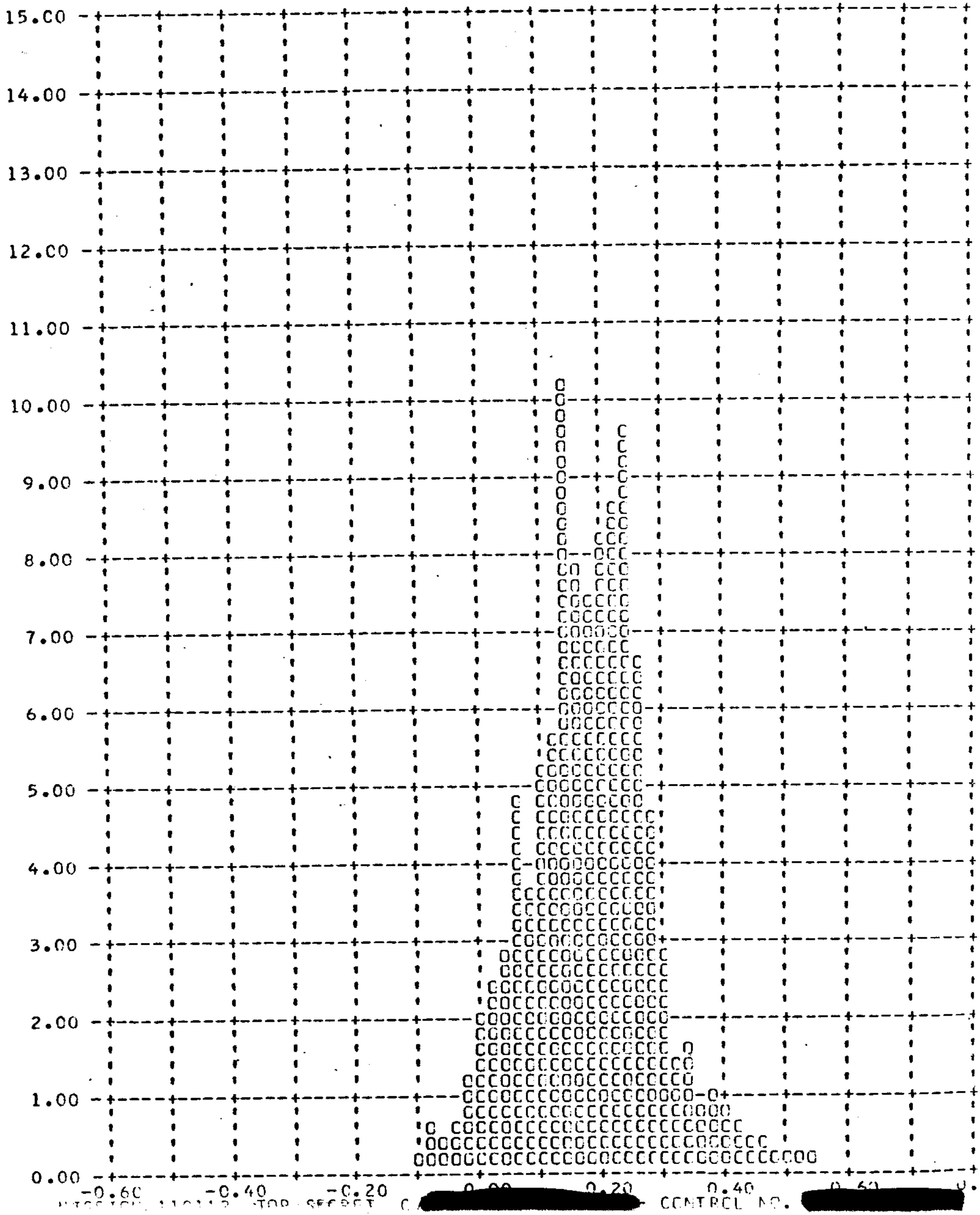
FRAMES 1-6 OF EACH CP OMITTED 90 PERCENT = 0.23

Y PITCH ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



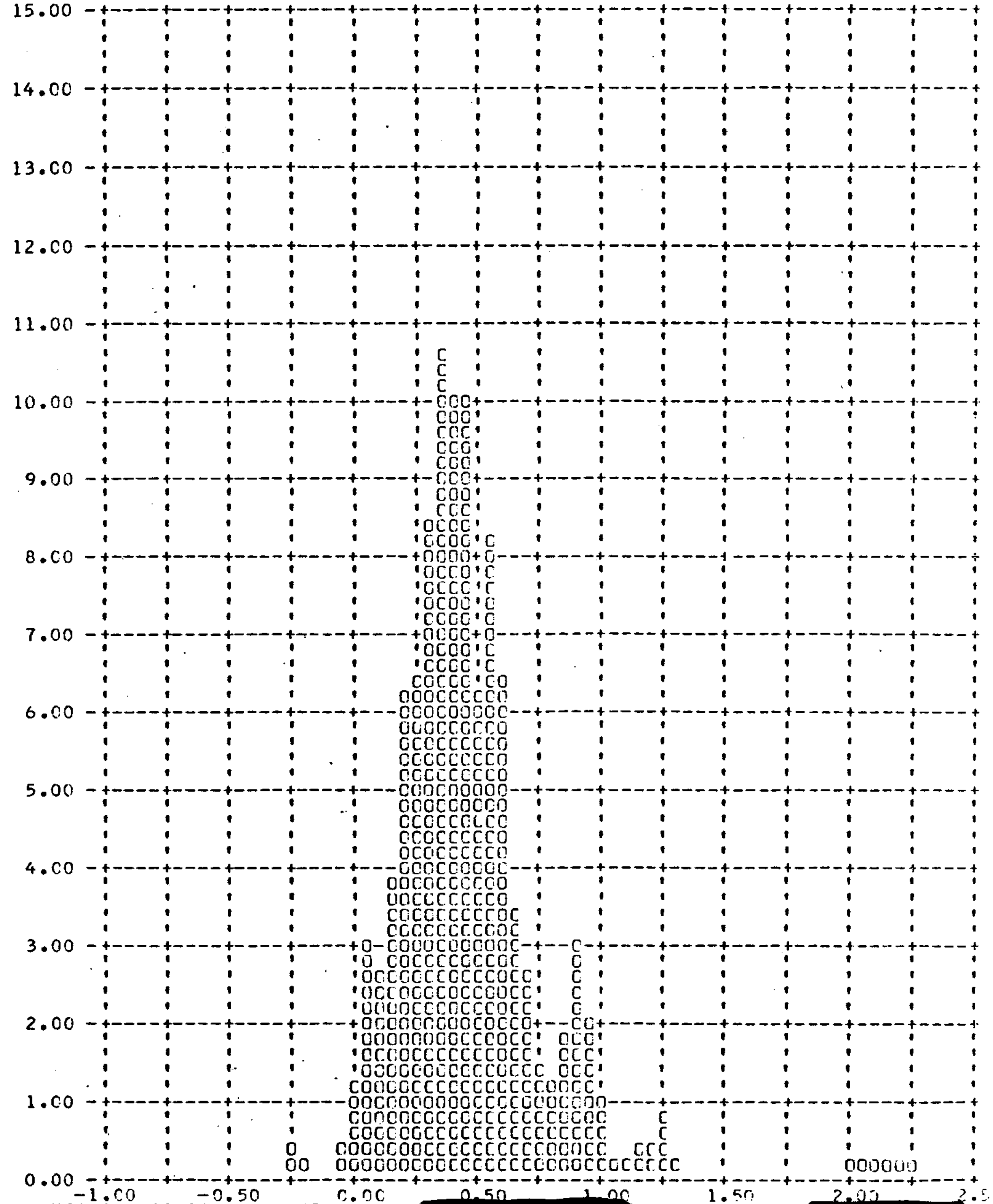
FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 0.28

Y ROLL ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 0.7

YAW ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 30.0

Y PITCH RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)

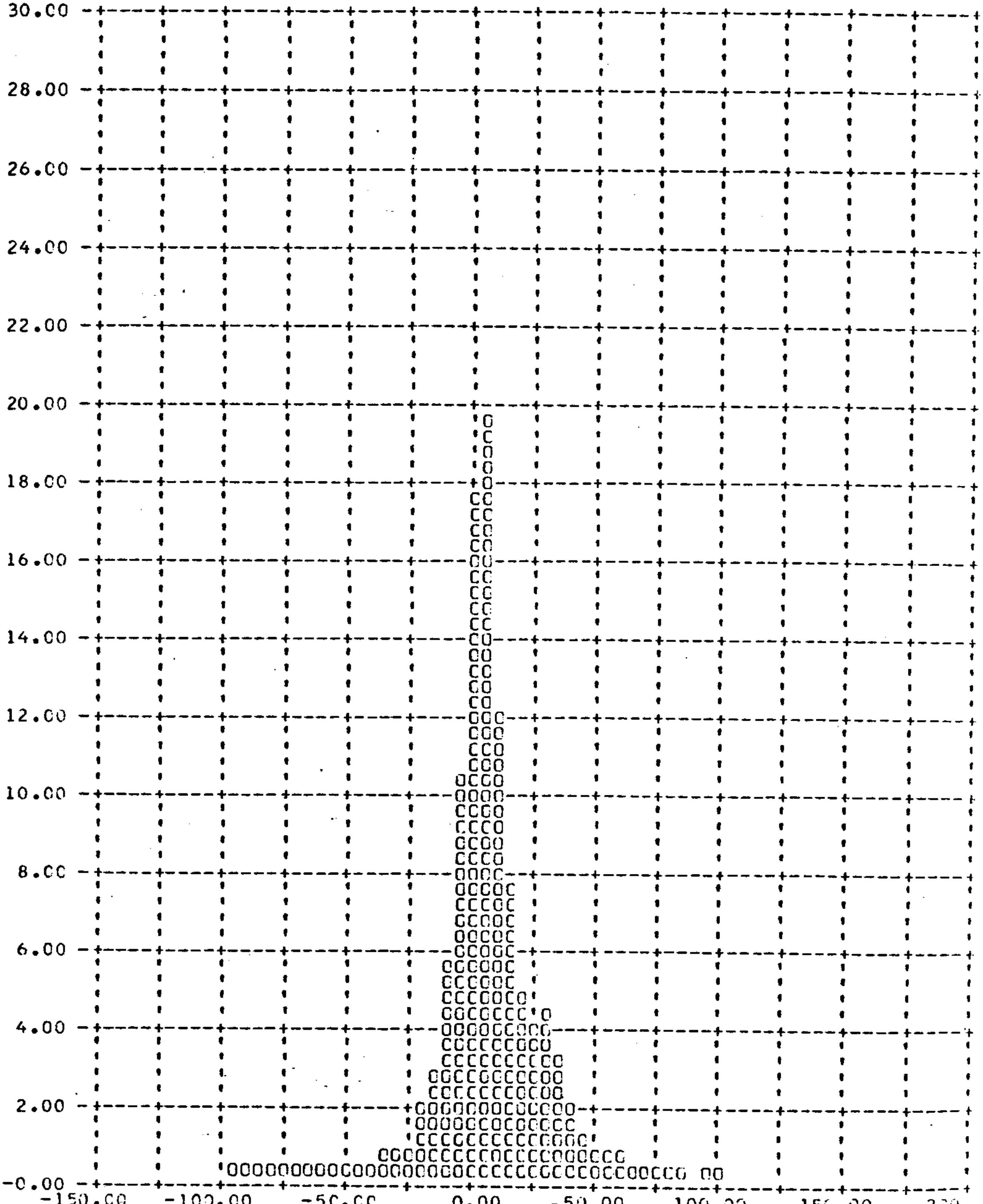
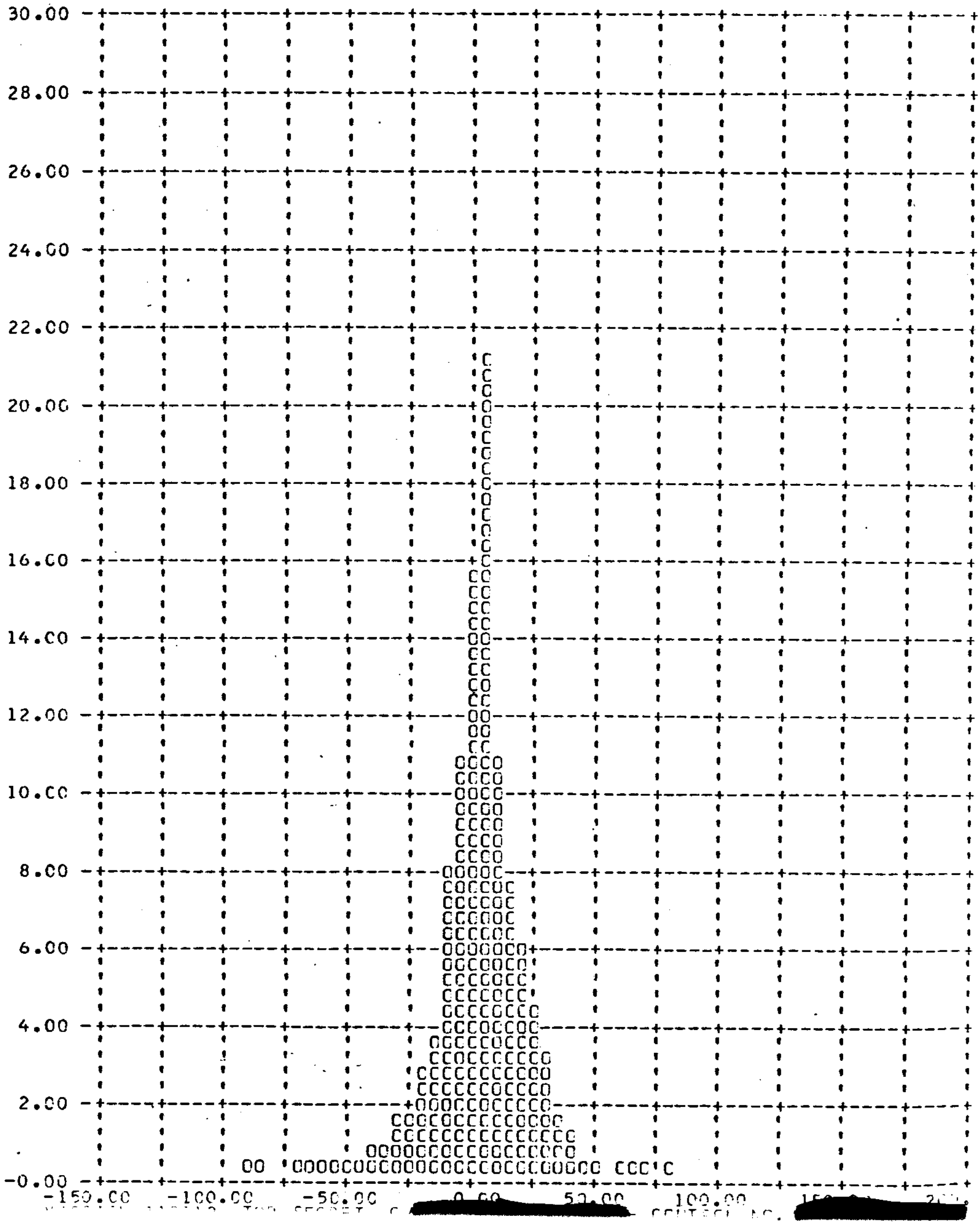


Figure 7-11

MISSION 1101A2 ~~TOP SECRET~~ C[redacted] - CONTROL NO.[redacted]

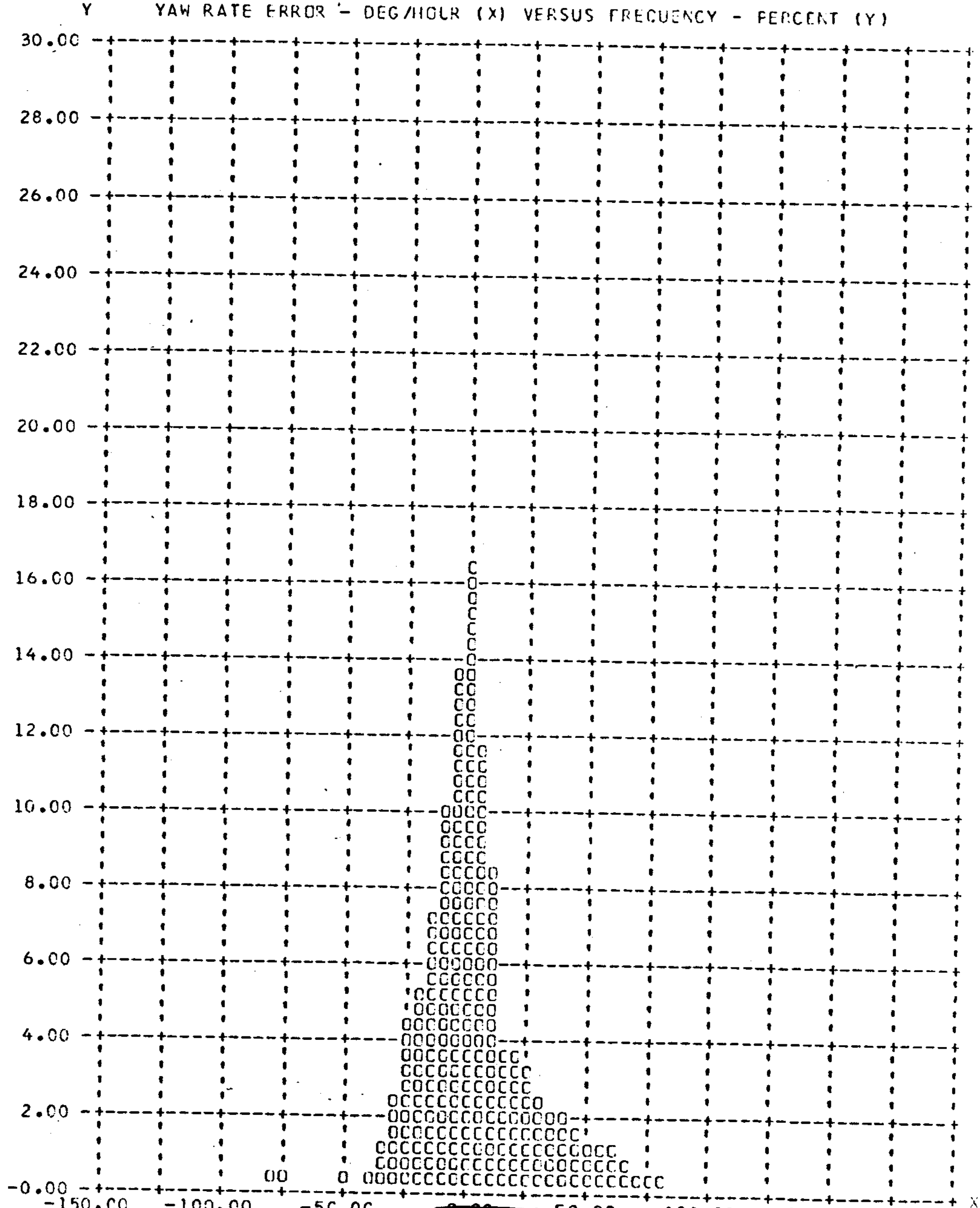
FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 25.00

Y ROLL RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)



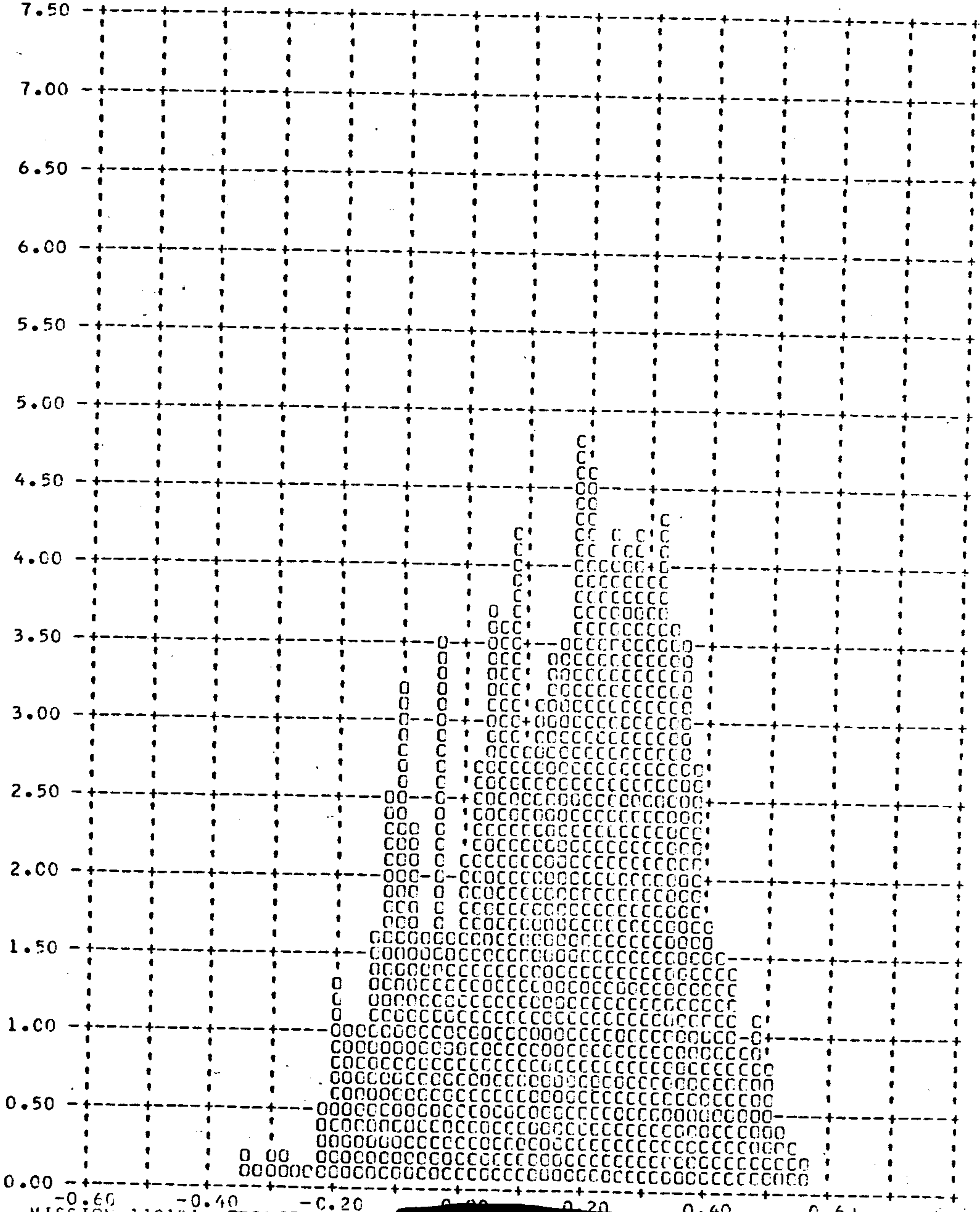
FRAMES 1-6 OF EACH CP OMITTED 90 PERCENT = 33.62

YAW RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)



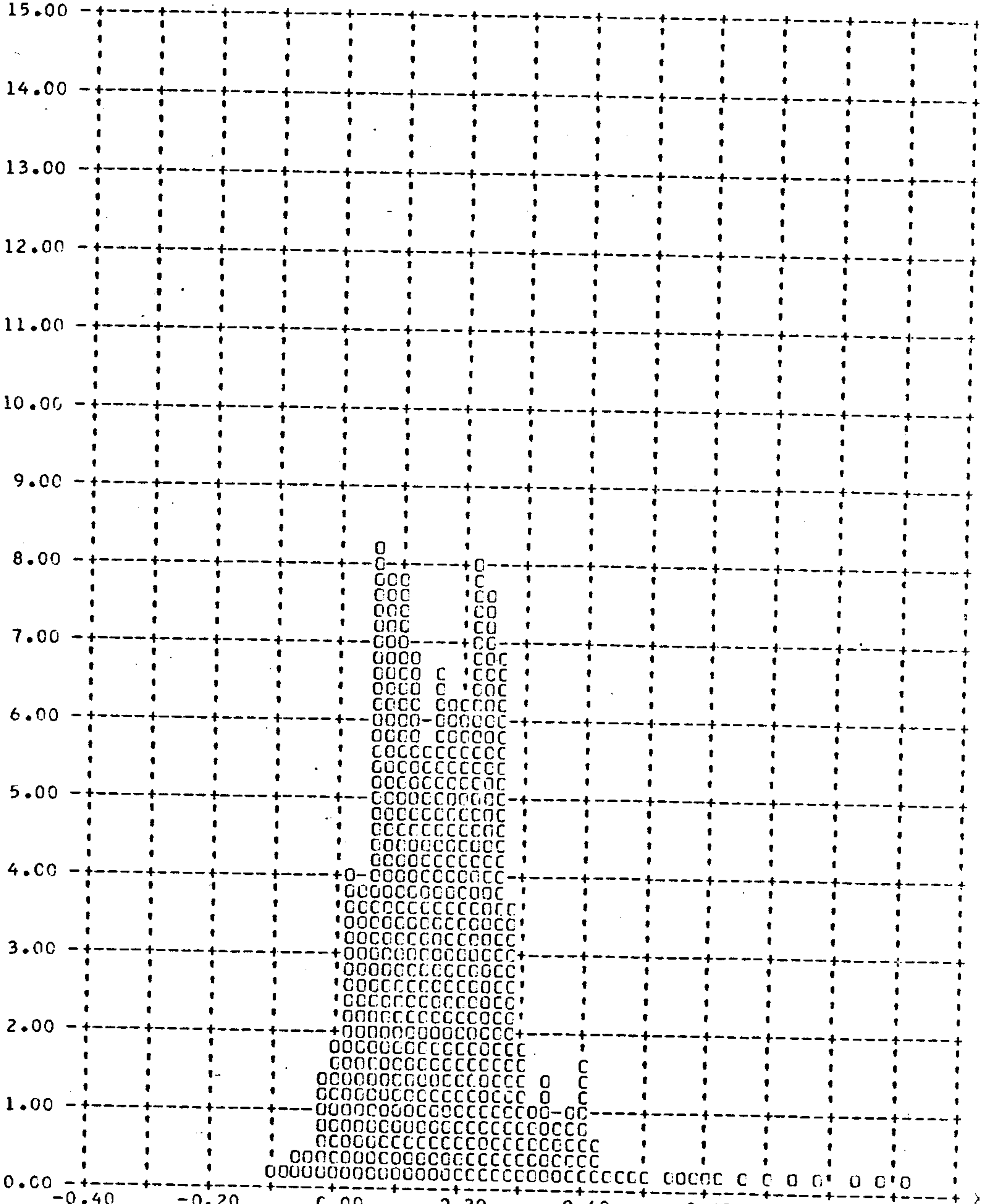
FRAMES 1-6 OF EACH CP OMITTED 90 PERCENT = 0.35

Y PITCH ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 0.27

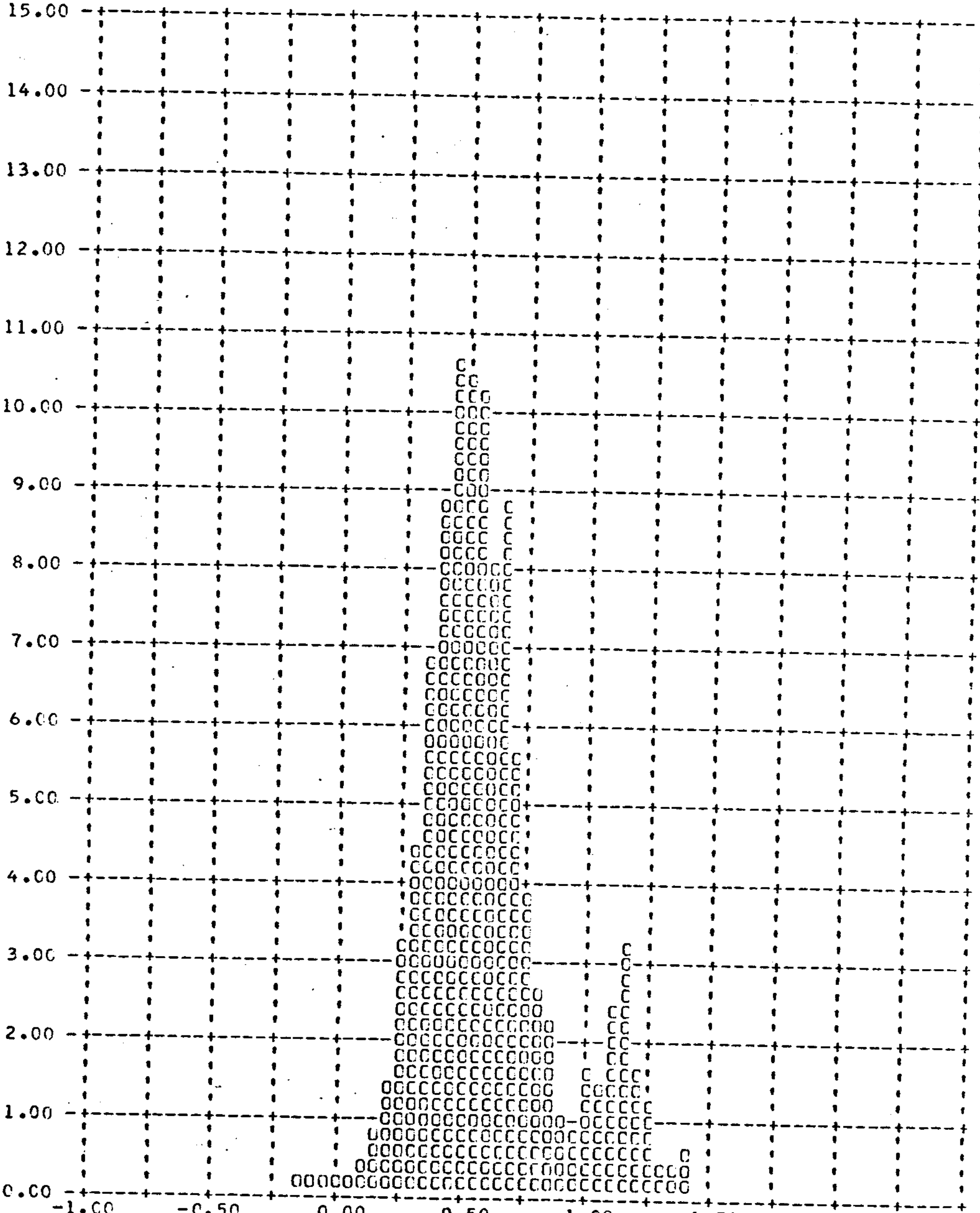
Y ROLL ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



MISSION 110181 ~~TOP SECRET~~ C[redacted] - CONTROL NO [redacted]

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 1.01

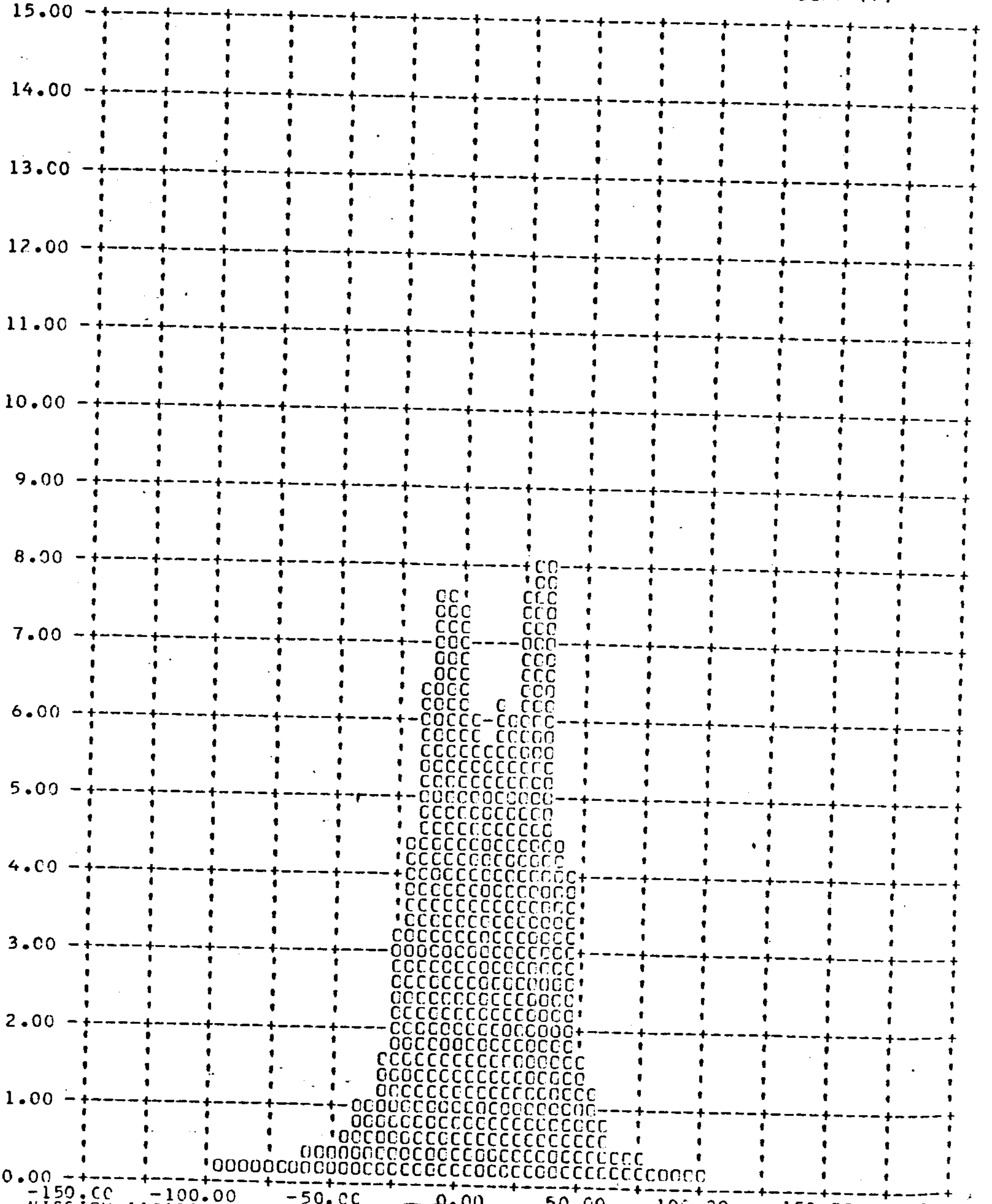
Y YAW ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



MISSION 110181 ~~TOP SECRET~~ C[redacted] CONTROL NO.[redacted]

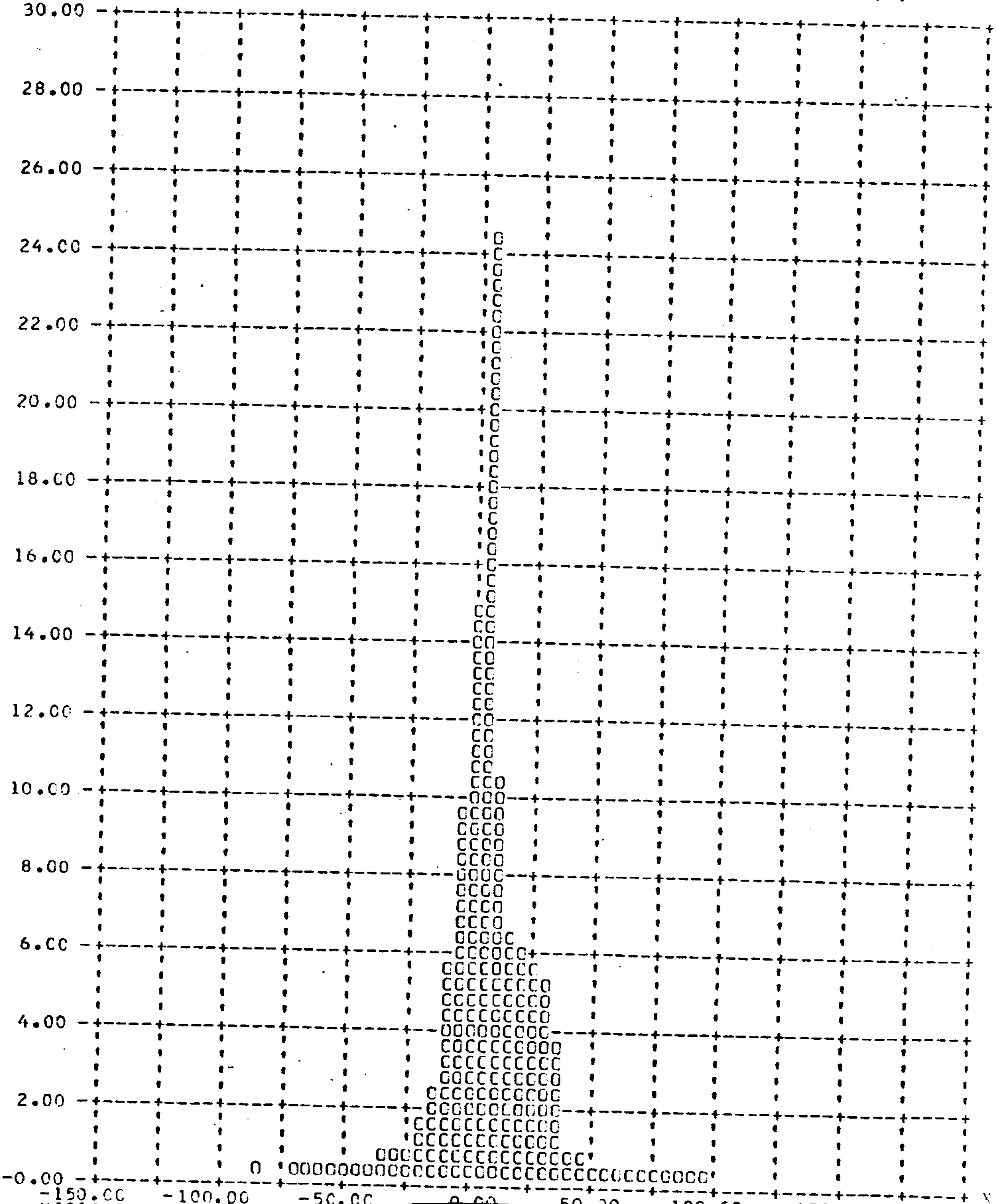
FRAMES [redacted] EACH OP OMITTED 90 PERCENT [redacted] 40.83

Y PITCH RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)

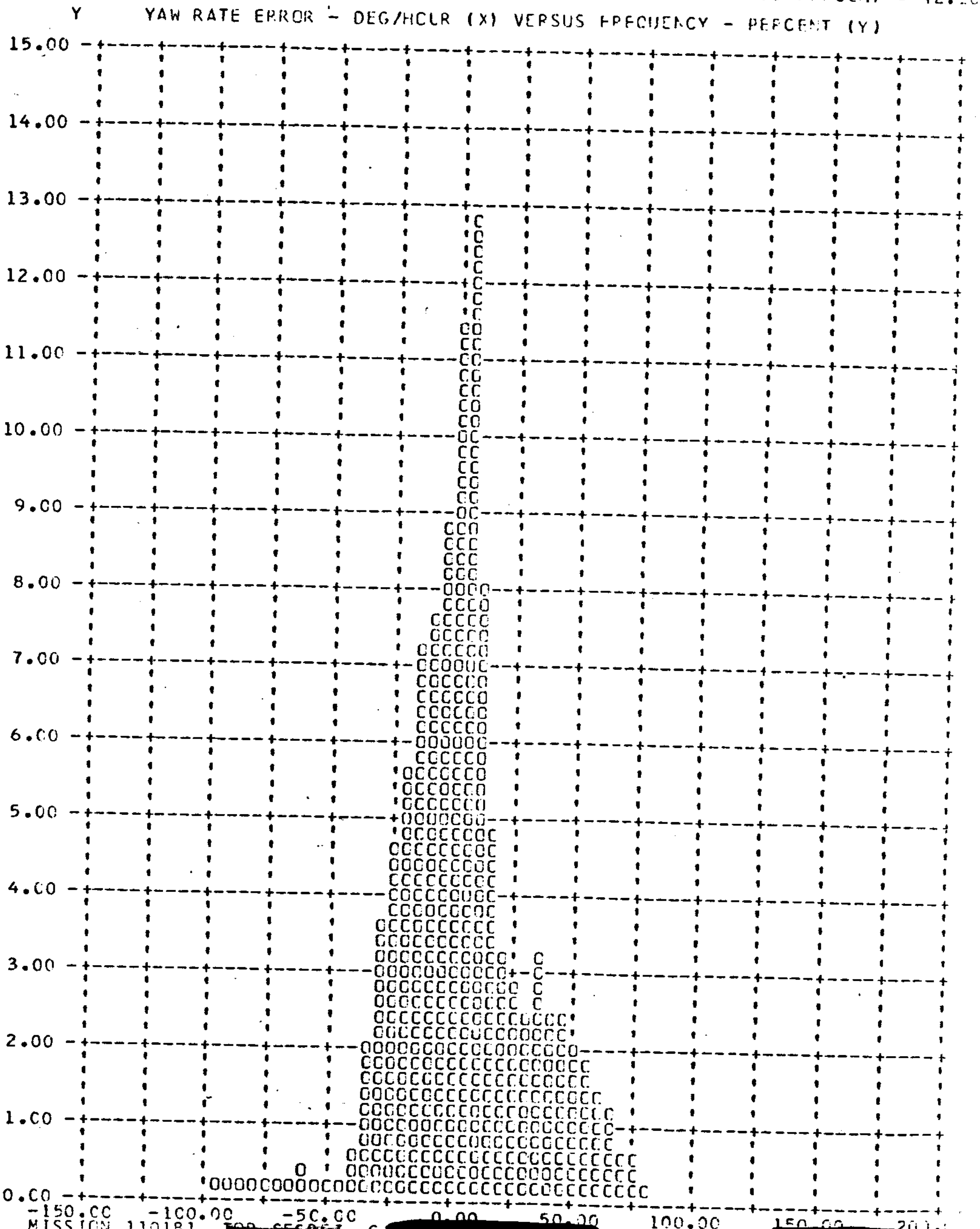


FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 29.06

ROLL RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)

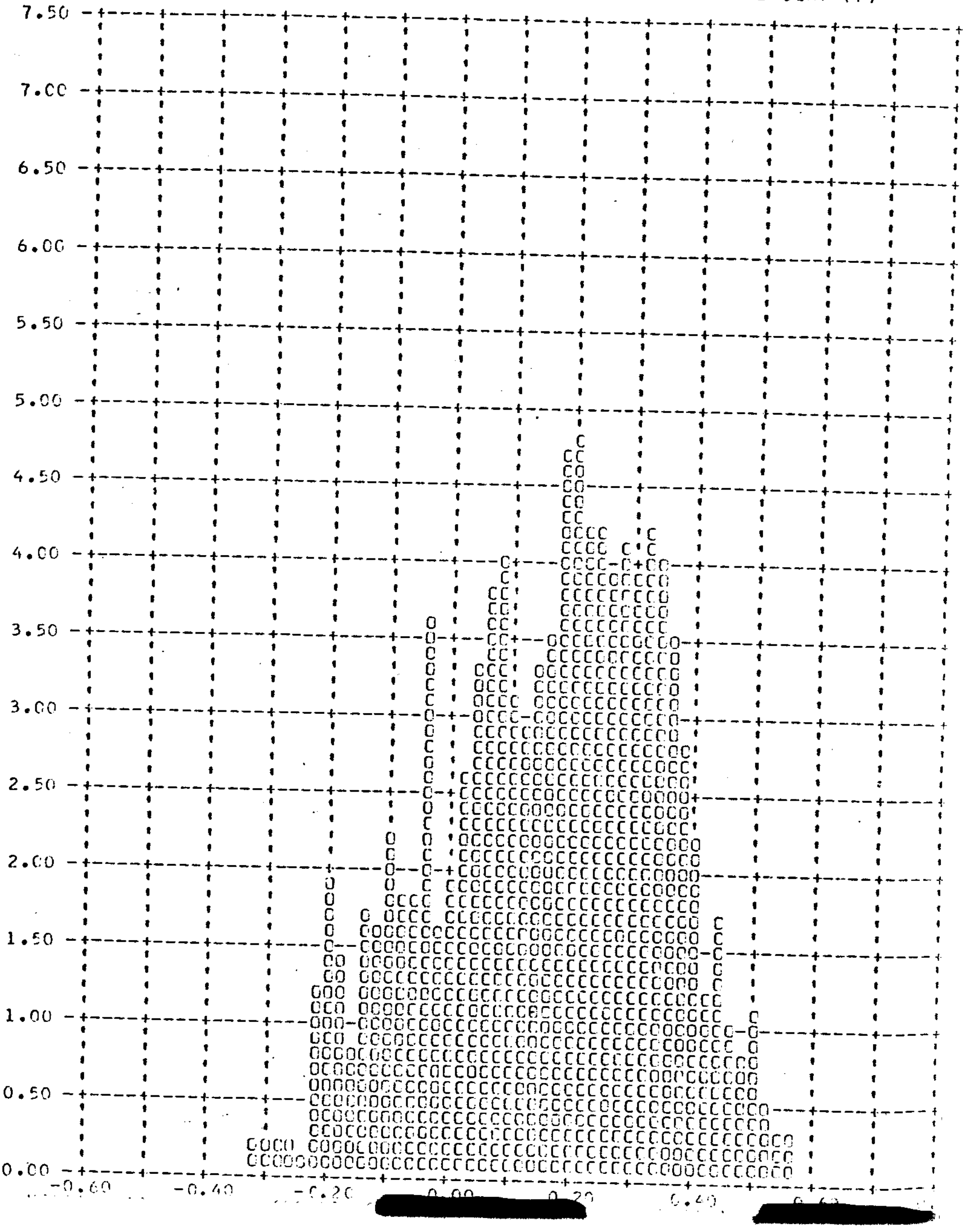


FRAMES 1-6 OF EACH CP OMITTED 90 PERCENT = 42.1



FRAMES 1-6 OF EACH CP OMITTED 90 PERCENT = [illegible]

Y PITCH ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)



[redacted] [redacted]

FRAMES 1-8 OF EACH OP OMITTED 90 PERCENT =

Y ROLL ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)

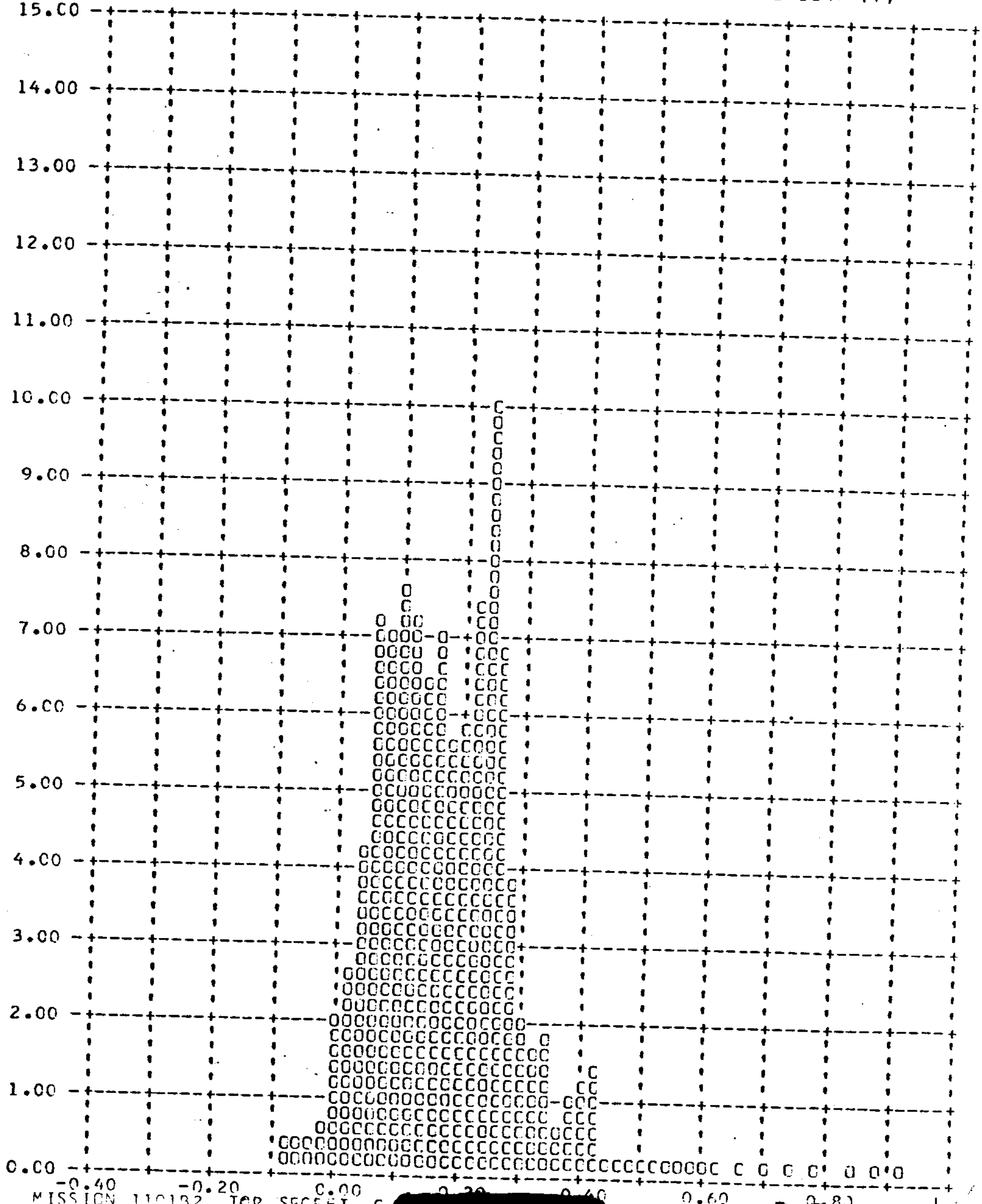


Figure 7-2

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 1.01

YAW ANGLE ERROR - DEGREES (X) VERSUS FREQUENCY - PERCENT (Y)

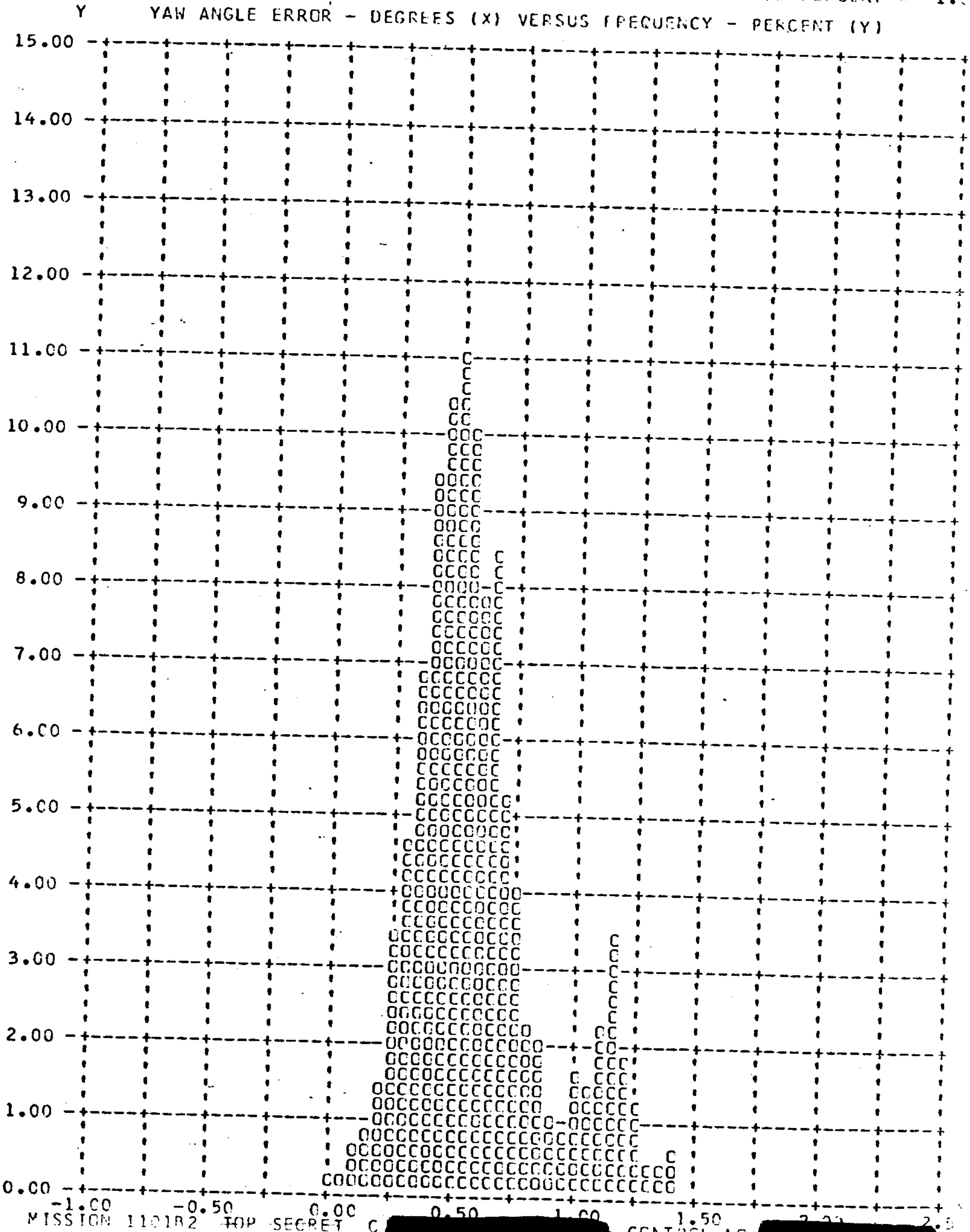


Figure 7-22

FRAMES 1-6 OF EACH CP OMITTED 90 PERCENT = 4[illegible].57

Y PITCH RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)

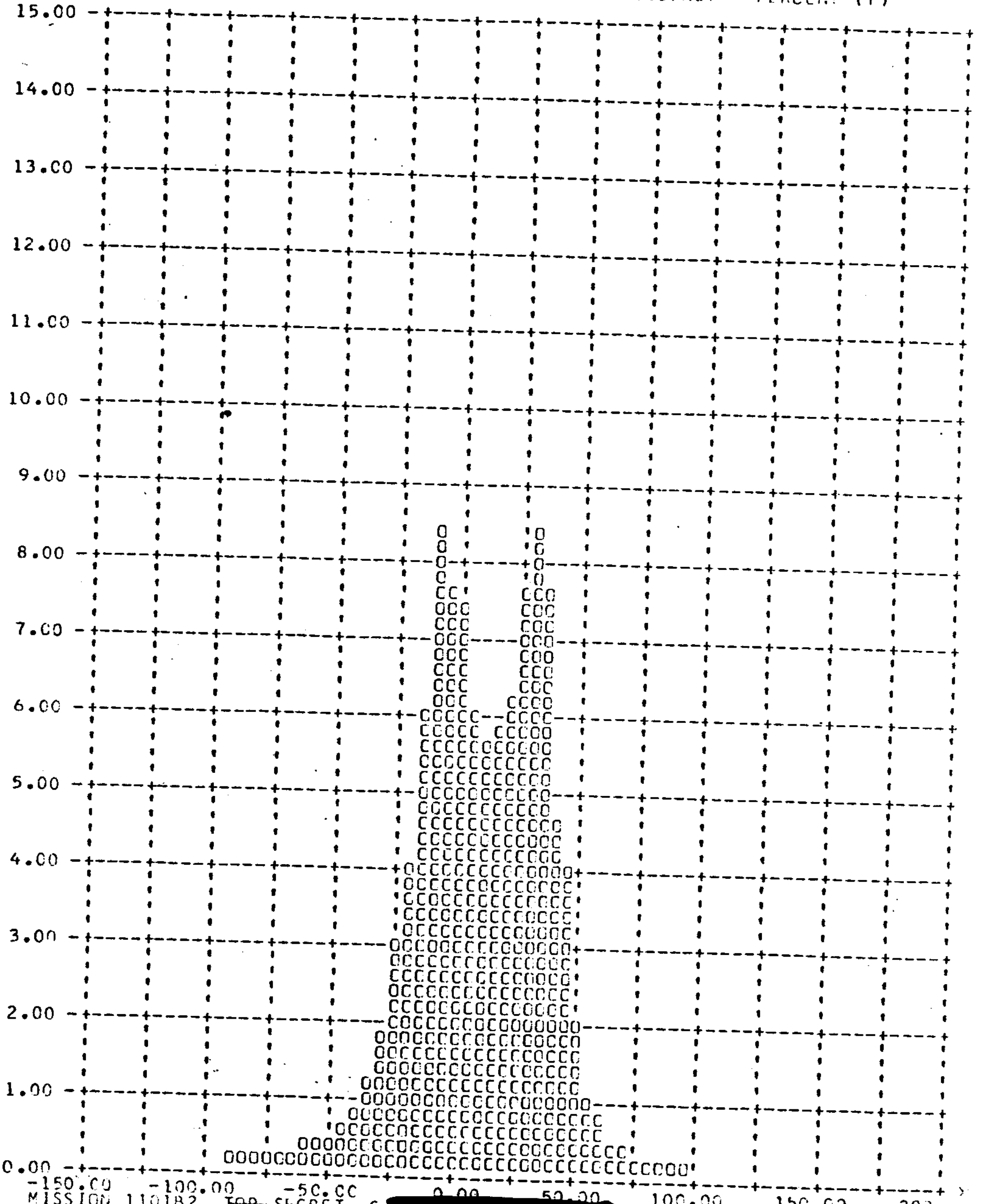
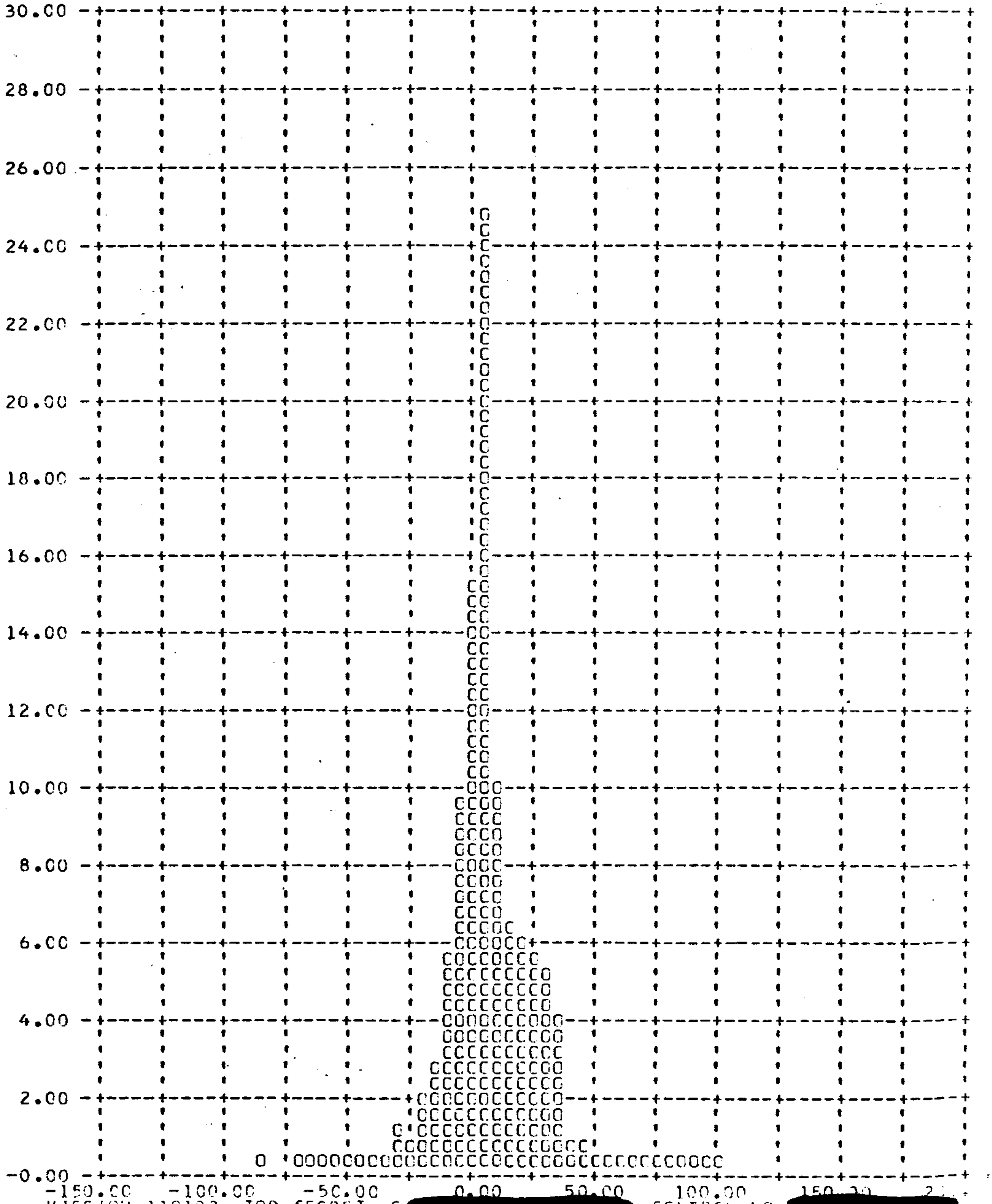


Figure V-23

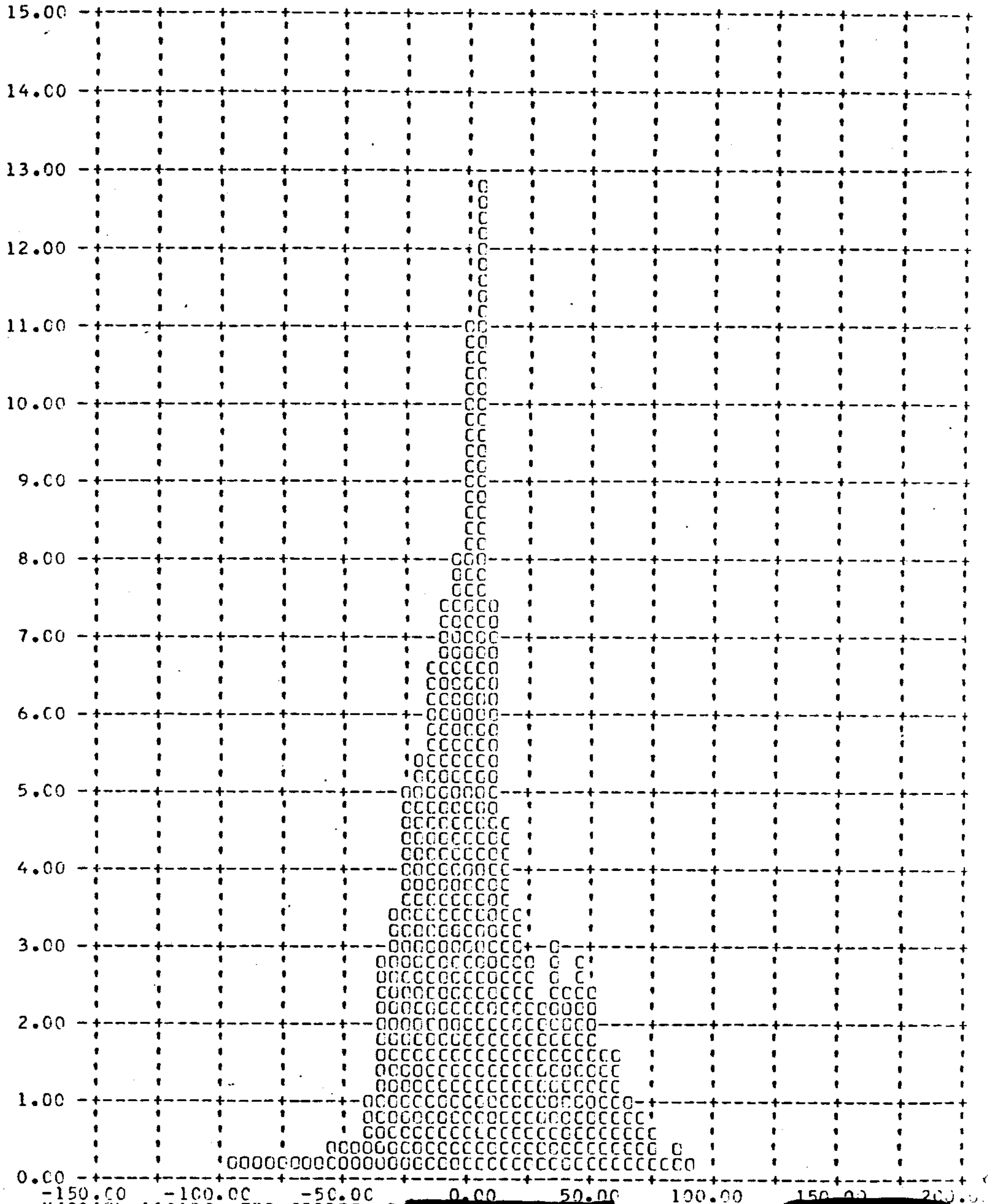
FRAMES 1-6 OF EACH OP OMITTED   90 PERCENT = 29.07

Y   ROLL RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)



FRAMES 1-6 OF EACH CP OMITTED 90 PERCENT =

Y YAW RATE ERROR - DEG/HOUR (X) VERSUS FREQUENCY - PERCENT (Y)



SECTION 8

IMAGE SMEAR ANALYSIS

The frame correlation tape supplied to A/P by NPIC contains the binary time word of each frame of photography. A computer program has been assembled at A/P which calculates the exposure time of each frame and compares the camera cycle rate with the ephemeris to calculate the V/H mismatch. This data is combined with the vehicle attitude error and rate values of each frame and the crab error caused by earth rotation at the latitude of each frame. The program outputs the total along-track and cross-track IMC error and the limit of ground resolution that can be acquired by a camera regardless of focal length and system capabilities.

The computer rejects the first three frames of all operations as well as the creep frame, because the large FMC error induced by camera start-up is not representative of the overall system operations. The frequency distribution of the IMC errors and resolution limits are computer-plotted and are shown in Figures 8-1 through 8-12.

The summary table 8-1 presents the maximum IMC ratio errors and resolution limits that existed during 90% of the photographic operations and the total range of values during all operations that were computed.

MISSION 1101

V/H RATIO AND RESOLUTION LIMITS

VALUE	UNITS	CAMERA	MISSION 1101-1 90%	MISSION 1101-1 Range	MISSION 1101-2 90%	MISSION 1101-2 Range
IMC Error	%	Fwd	8.19	* -7.5 to +19.0	2.01	-5.6 to +5.6
		Aft	8.16	* -7.0 to +19.0	2.30	-5.5 to +12.5
Along Track Resolution Limit	Feet	Fwd	5.20	0.5 to 16.5	1.64	0.2 to 5.4
		Aft	6.48	0.5 to 20.5	2.25	0.2 to 11.0
Cross Track Resolution Limit	Feet	Fwd	1.12	0.2 to 3.6	1.34	0.05 to 2.85
		Aft	1.23	0.2 to 5.4	1.46	0.05 to 2.35

TABLE 8-1

* Data include frames taken during FMC Programmer delay timer problems (see Section 3)

Figure 8-1

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 6.4

Y ALONG TRACK RESOLUTION LIMIT - FEET (X) VERSUS FREQUENCY - PERCENT (Y)

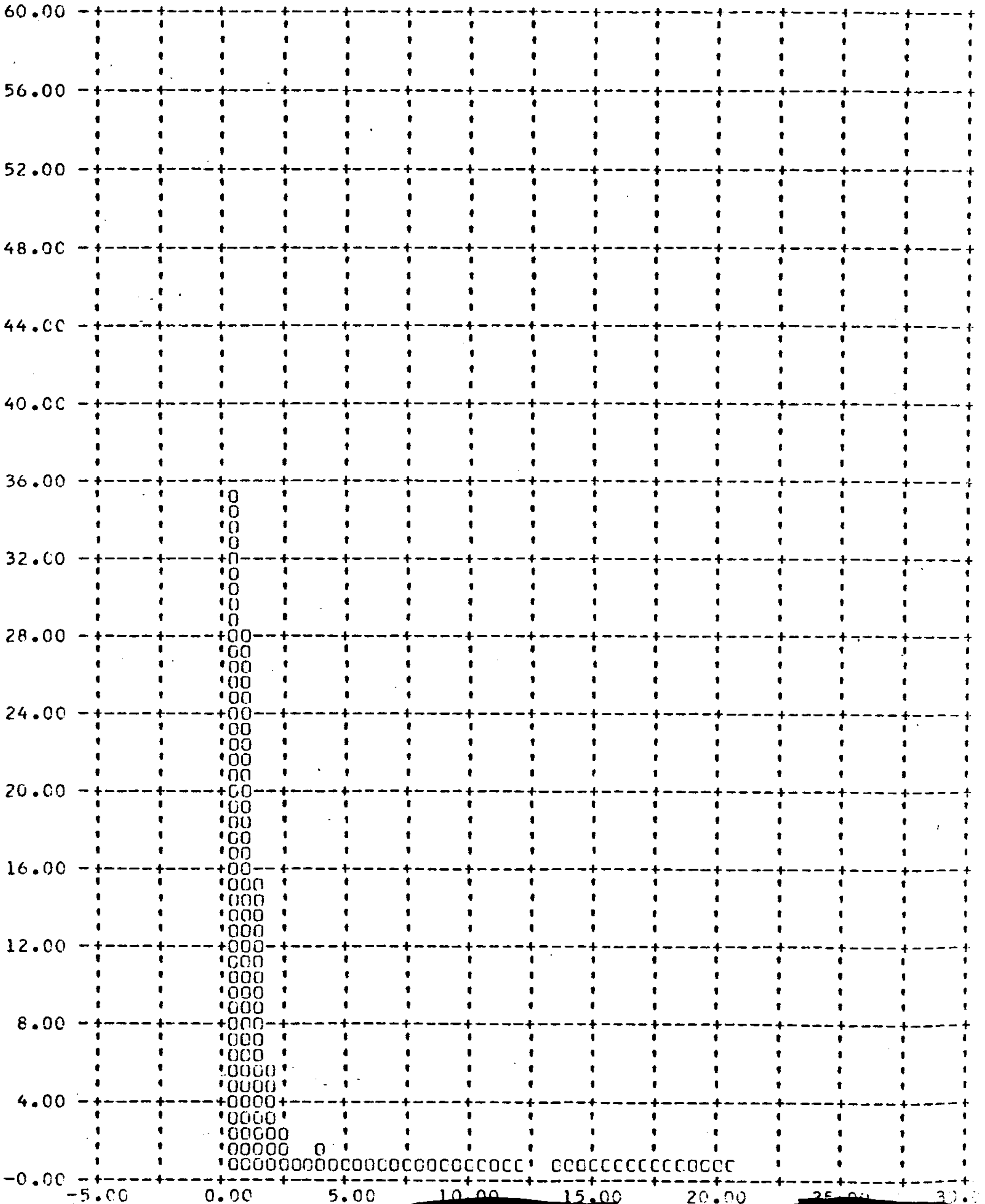


Figure [redacted]

MISSION 1101A1 ~~TOP SECRET~~ C[redacted] - CONTROL NO. [redacted]

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 1.23

Y CROSS TRACK RESOLUTION LIMIT - FEET (X) VERSUS FREQUENCY - PERCENT (Y)

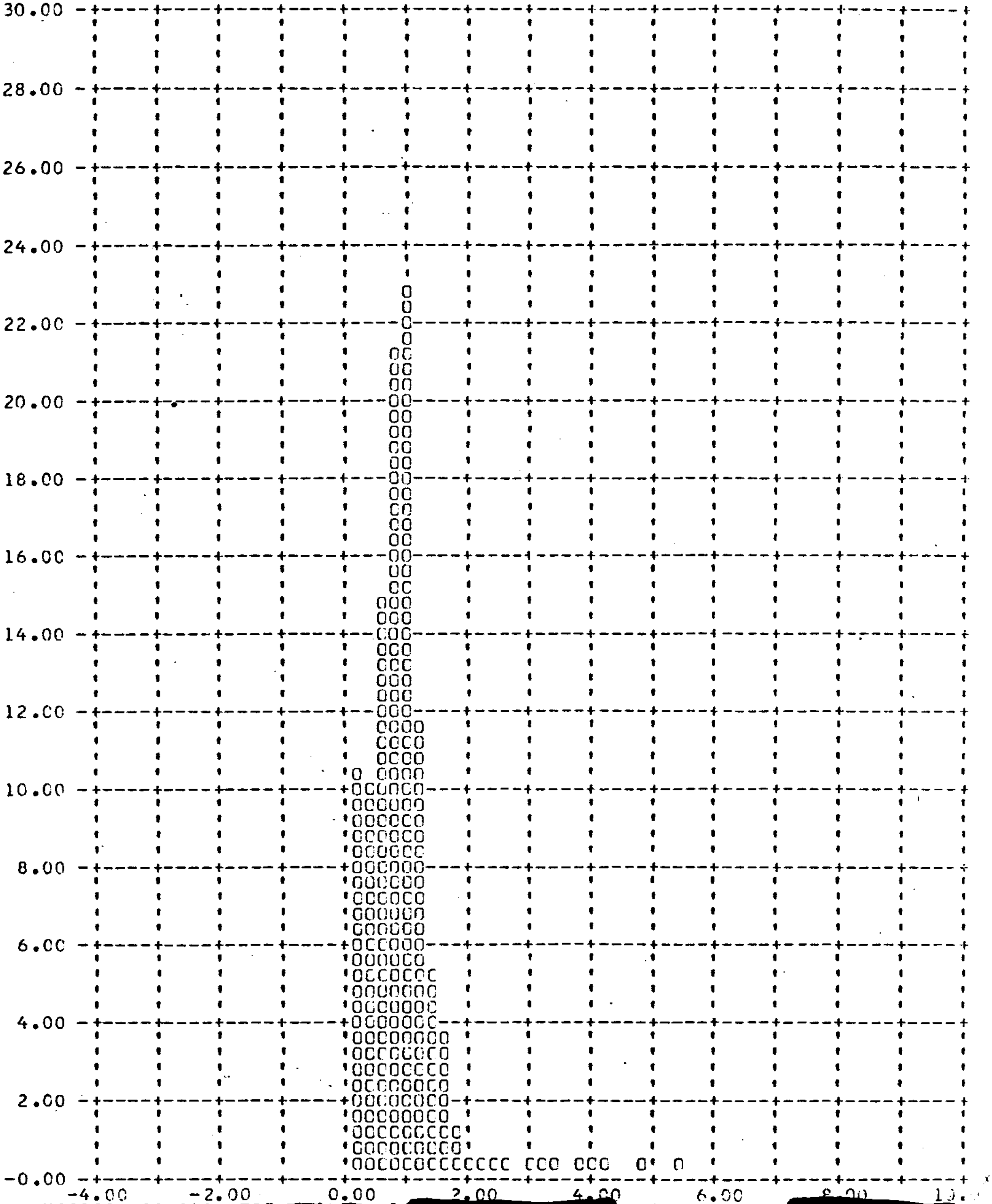


Figure 8-3

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 3.1

Y IMC ERROR -- PERCENT (X) VERSUS FREQUENCY -- PERCENT (Y)

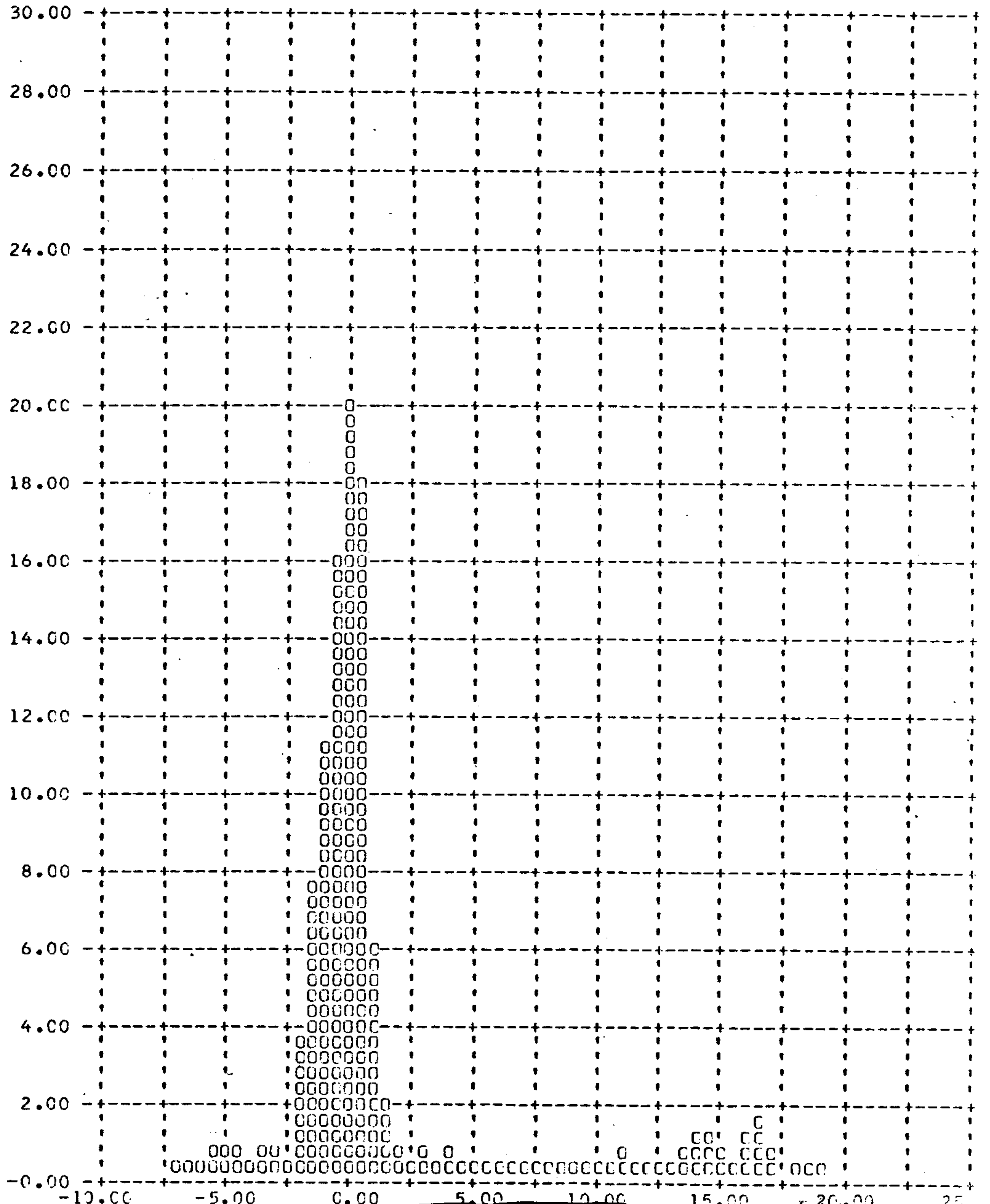


Figure 8-4

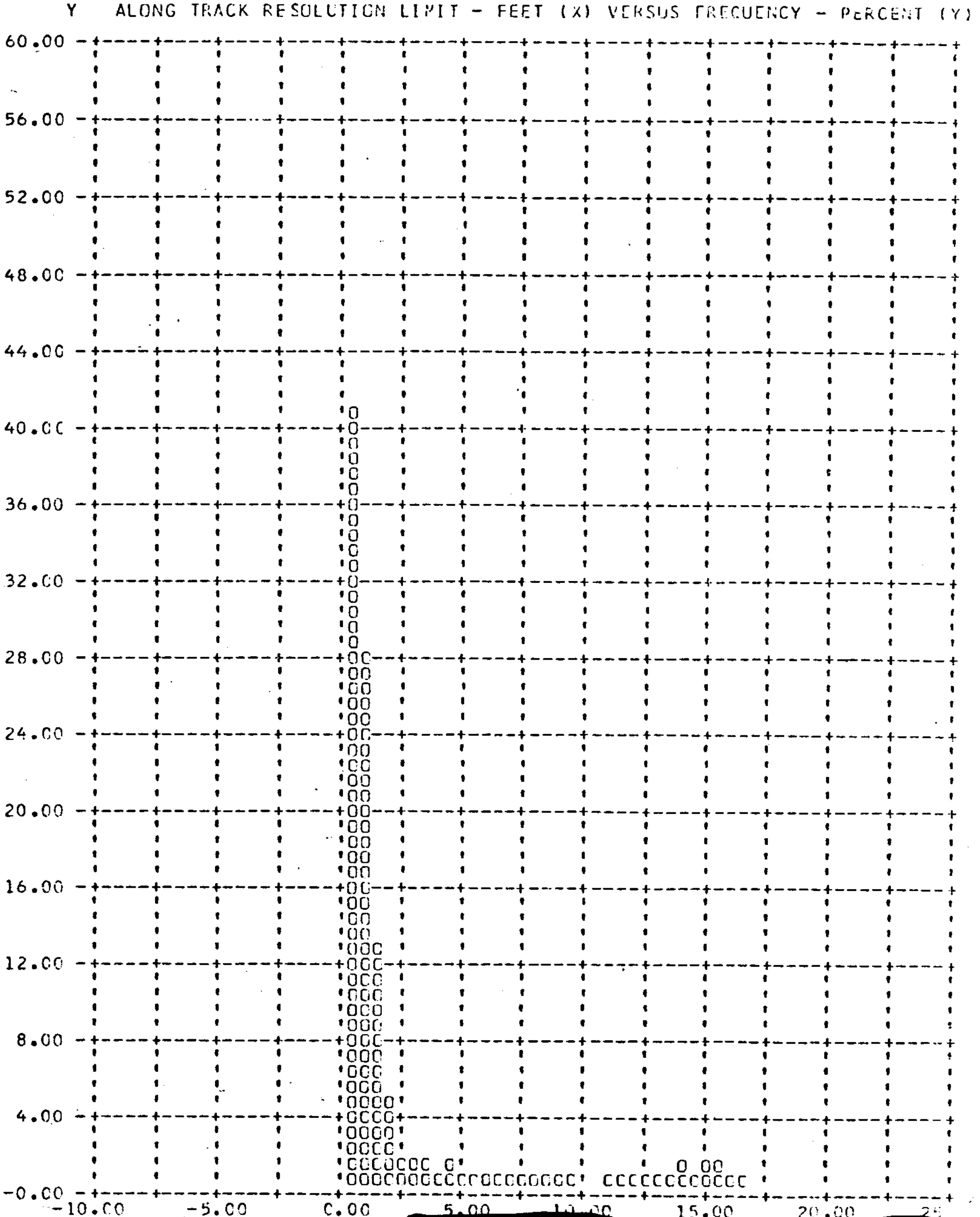

Y ALONG TRACK RESOLUTION LIMIT - FEET (X) VERSUS FRECUENCY - PERCENT (Y)
60.00
56.00
52.00
48.00
44.00
40.00
36.00
32.00
28.00
24.00
20.00
16.00
12.00
8.00
4.00
-0.00
-10.00
-5.00
0.00
5.00
10.00
15.00
20.00

Figure 8-5

MISSION 1101A2 ~~TOP SECRET~~ C[redacted] - CONTROL NO. [redacted]

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 1.12

Y CROSS TRACK RESOLUTION LIMIT - FEET (X) VERSUS FREQUENCY - PERCENT (Y)

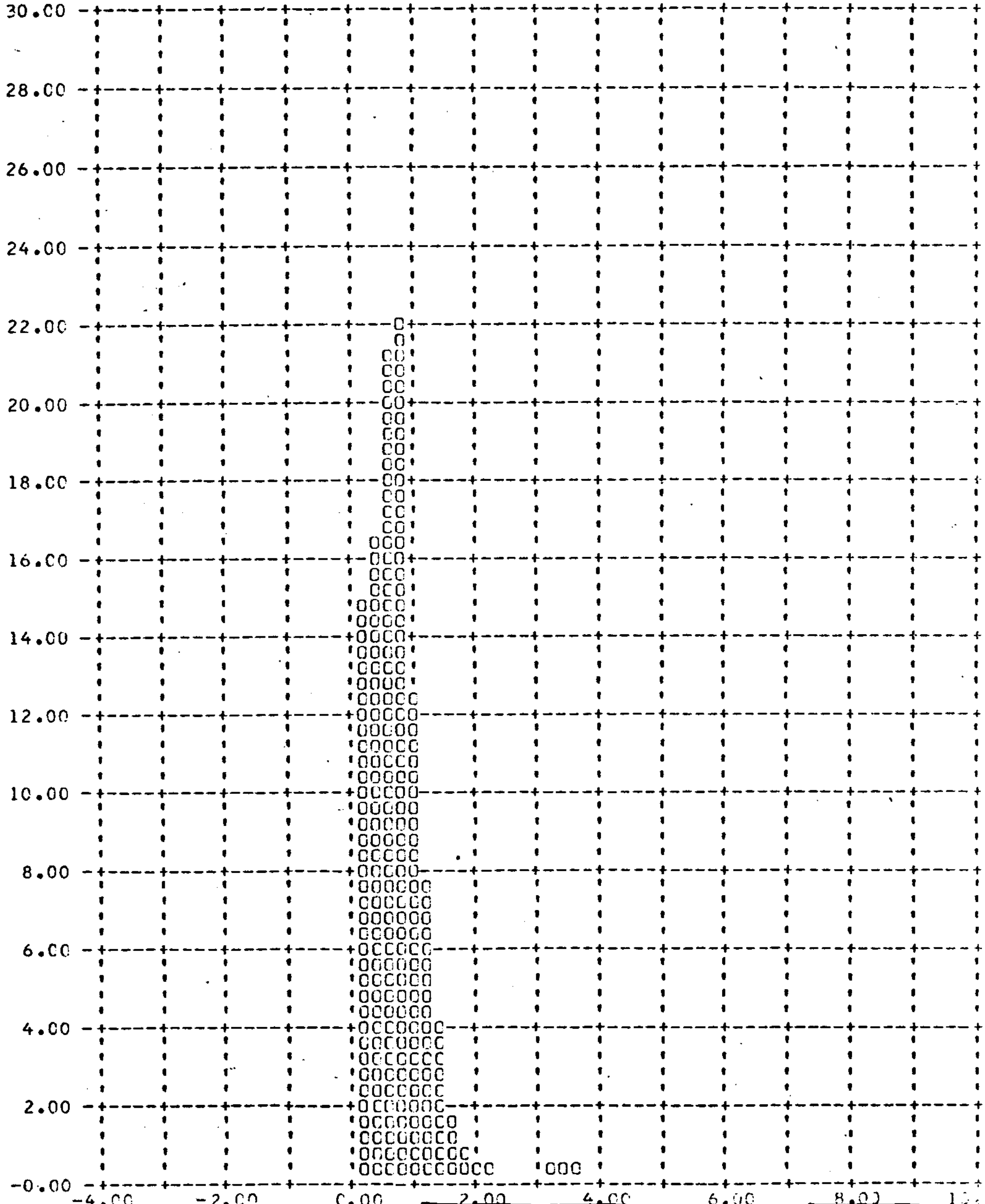
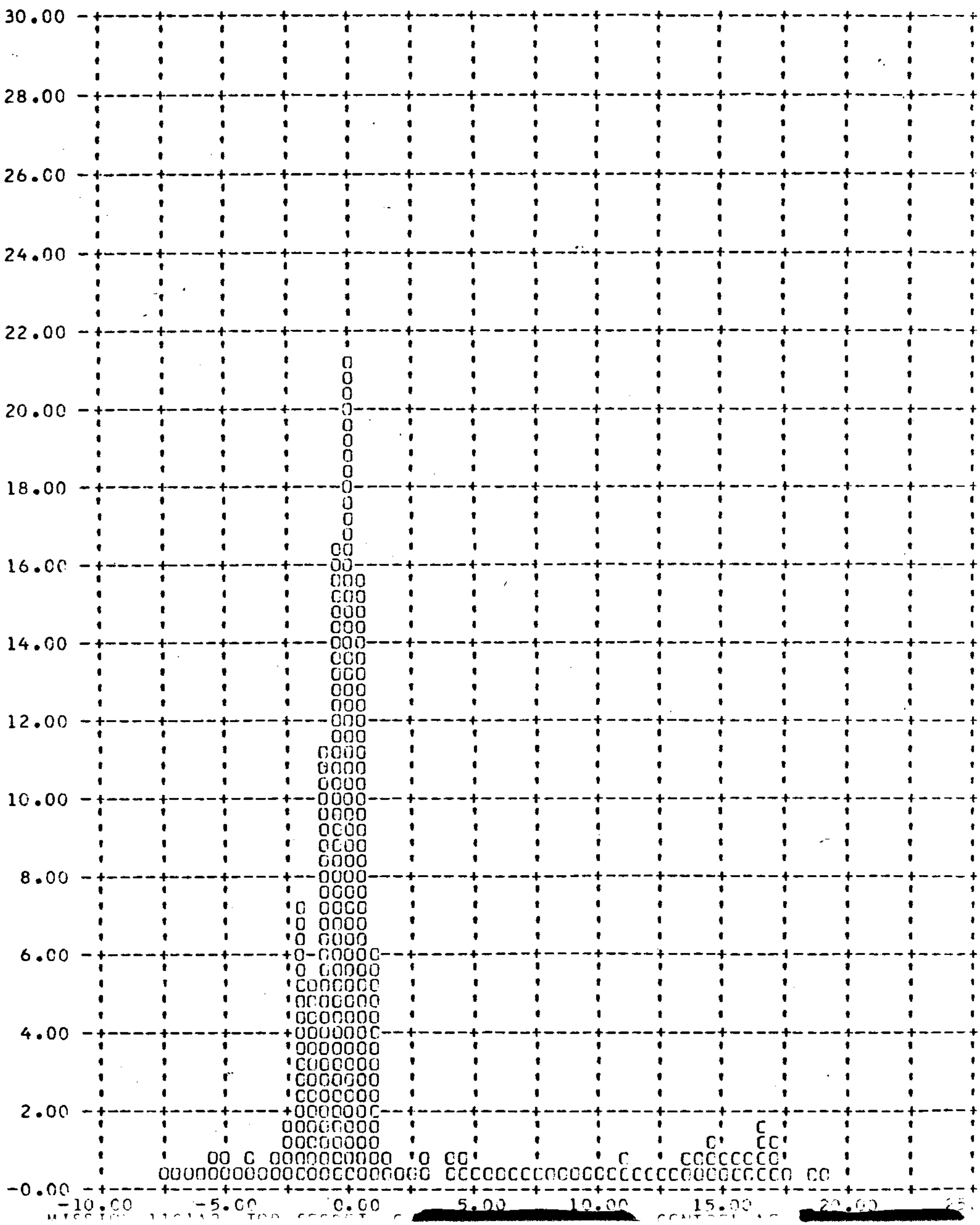


Figure 8-6

MISSION 1101A2 ~~TOP SECRET~~ C/[redacted] - CONTROL NO. [redacted]

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = [illegible]

Y IMC ERROR -- PERCENT (X) VERSUS FREQUENCY -- PERCENT (Y)

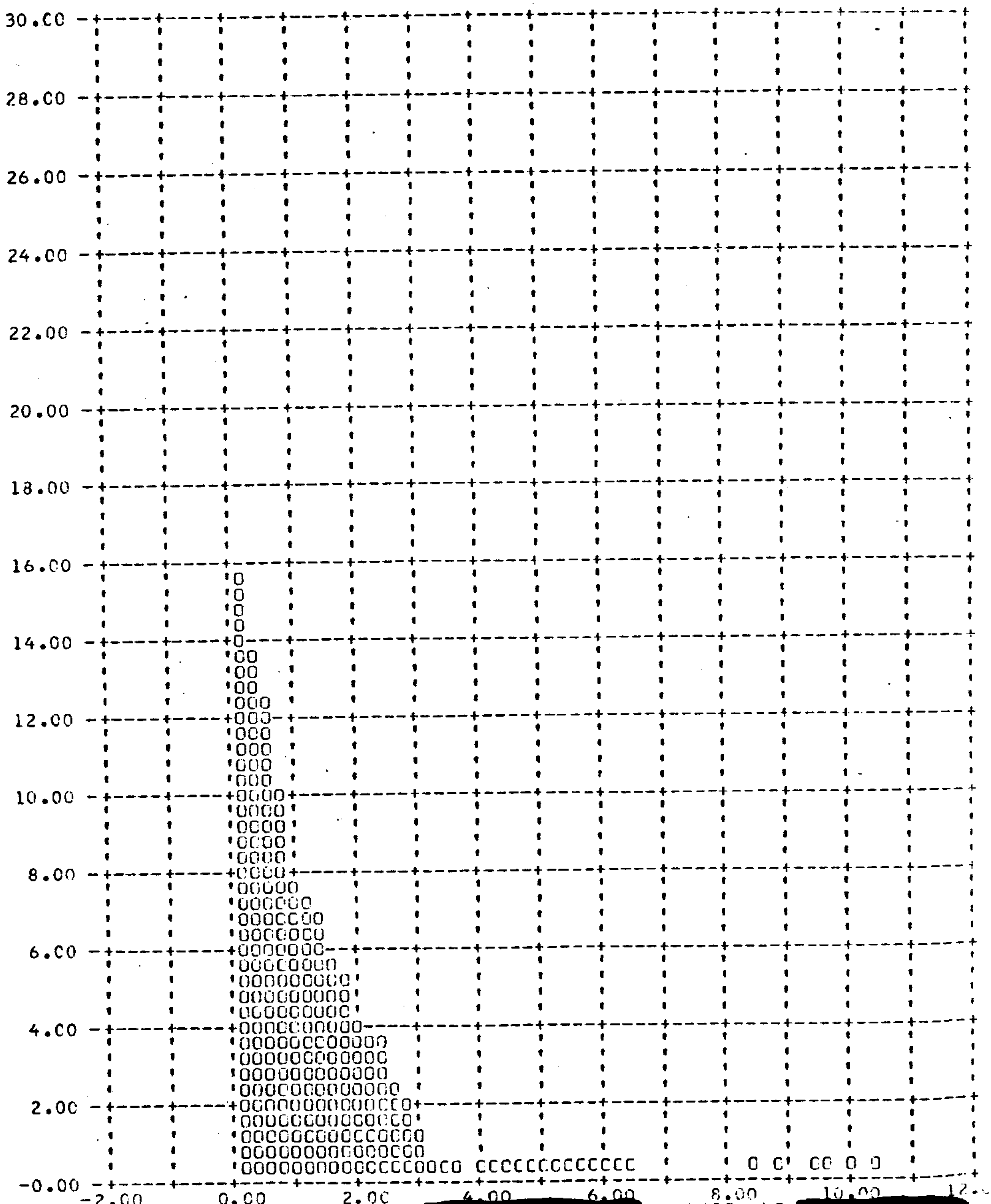


MISSION 1101A2 TOP SECRET C[redacted] CONTROL NO [redacted]

Figure 8-7

MISSION 110181 TOP SECRET C [redacted] - CONTROL NO. [redacted]
FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 2.25

Y ALONG TRACK RESOLUTION LIMIT - FEET (X) VERSUS FREQUENCY - PERCENT (Y)



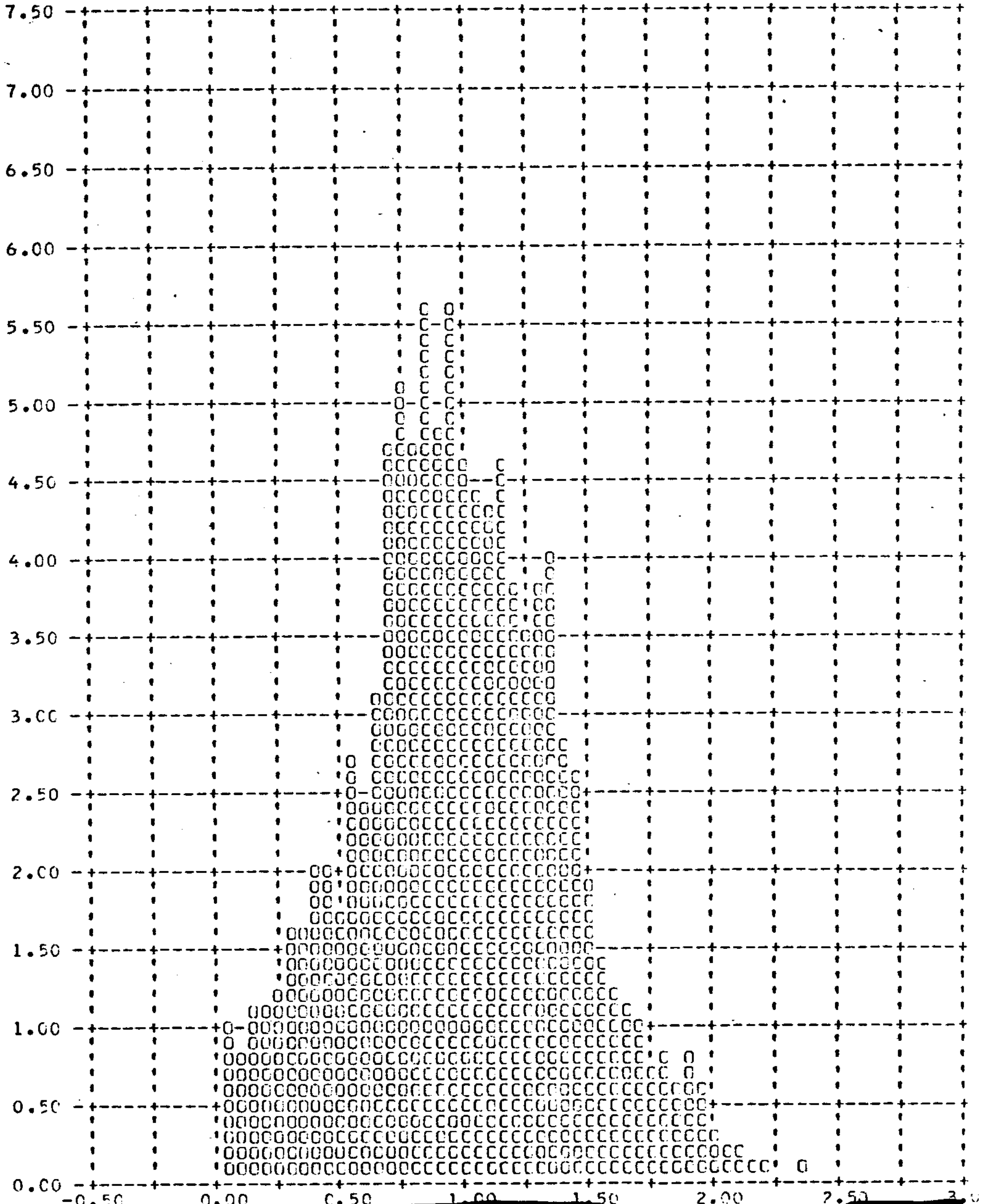
MISSION 110181 TOP SECRET C [redacted] CONTROL NO. [redacted]

Figure 8-6

MISSION 110181 ~~TOP SECRET~~ C [redacted] - CONTROL NO. [redacted]

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 1.40

Y CROSS TRACK RESOLUTION LIMIT - FEET (X) VERSUS FREQUENCY - PERCENT (Y)



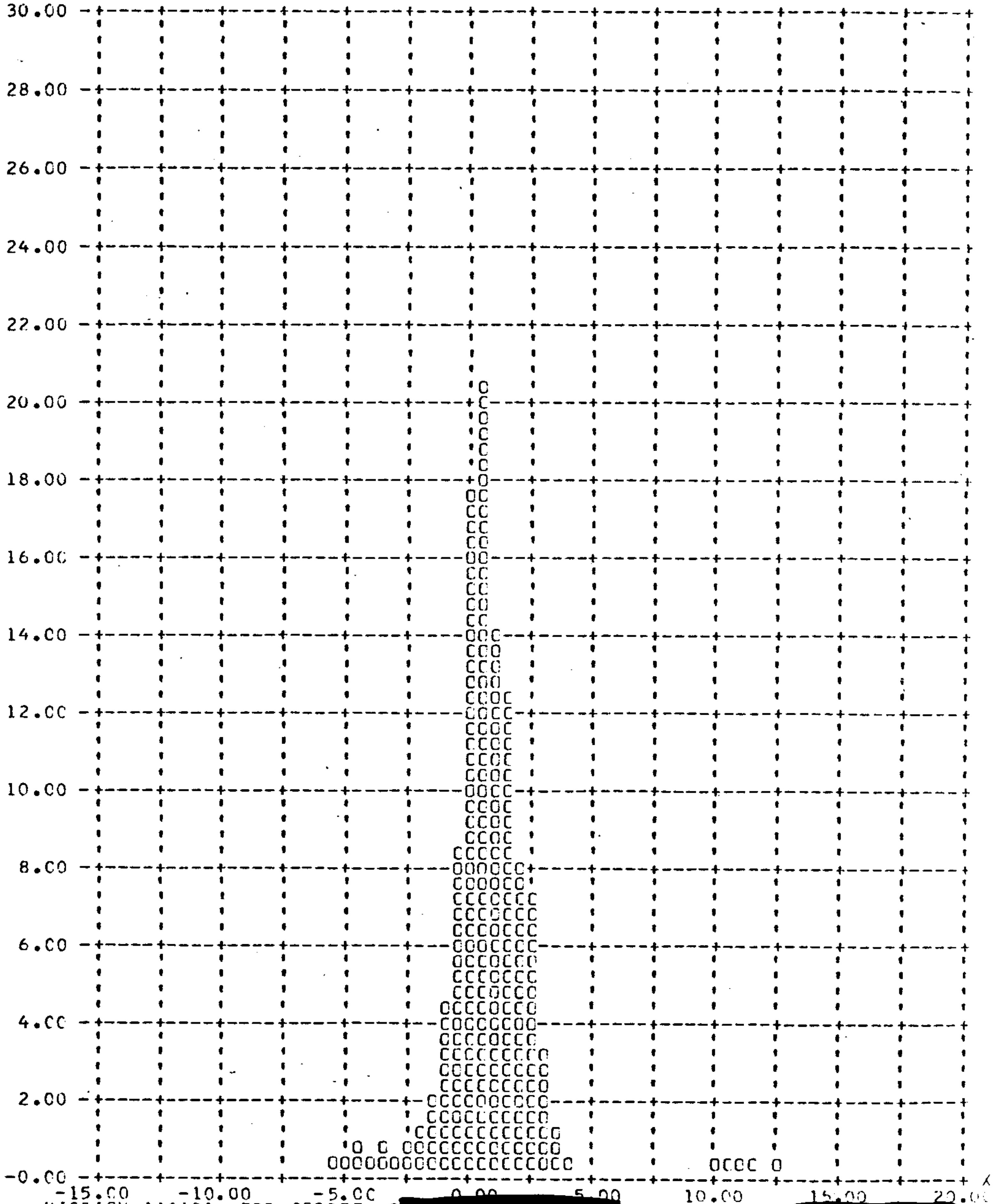
MISSION 110181 ~~TOP~~ SECRET C [redacted] CONTROL NO. A/P [redacted]

Figure 8-9

MISSION 110181 ~~TOP SECRET~~ C[redacted] - CONTROL NO. [redacted]

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 2.3

Y IMC ERROR -- PERCENT (X) VERSUS FREQUENCY -- PERCENT (Y)



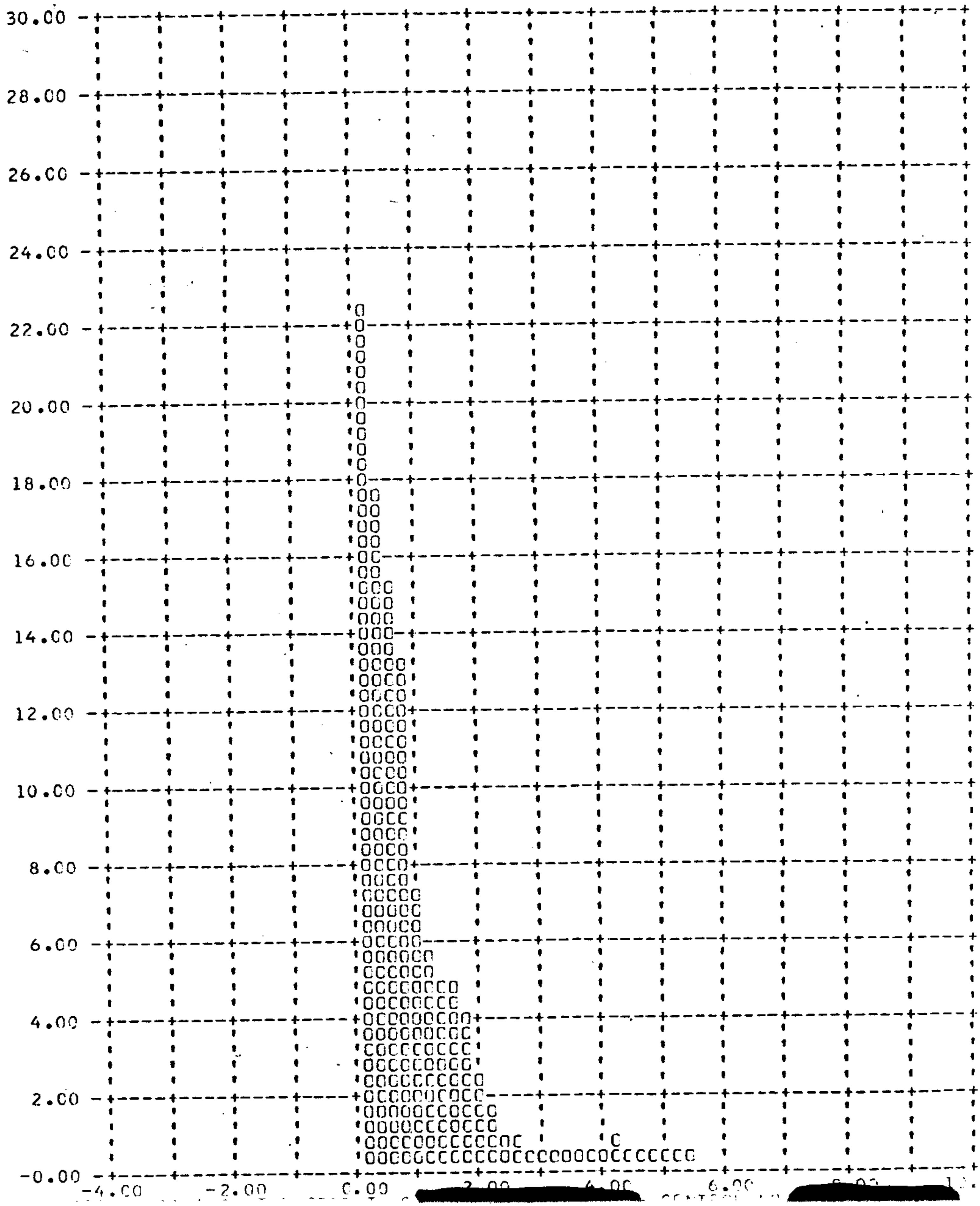
MISSION 110181 ~~TOP~~ SECRET C[redacted] CONTROL NO. [redacted]

Figure 8-10

MISSION 110182 ~~TOP SECRET~~ C[redacted] - CONTROL NO. [redacted]

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 1.84

Y ALONG TRACK RESOLUTION LIMIT - FEET (X) VERSUS FREQUENCY - PERCENT (Y)



[redacted]

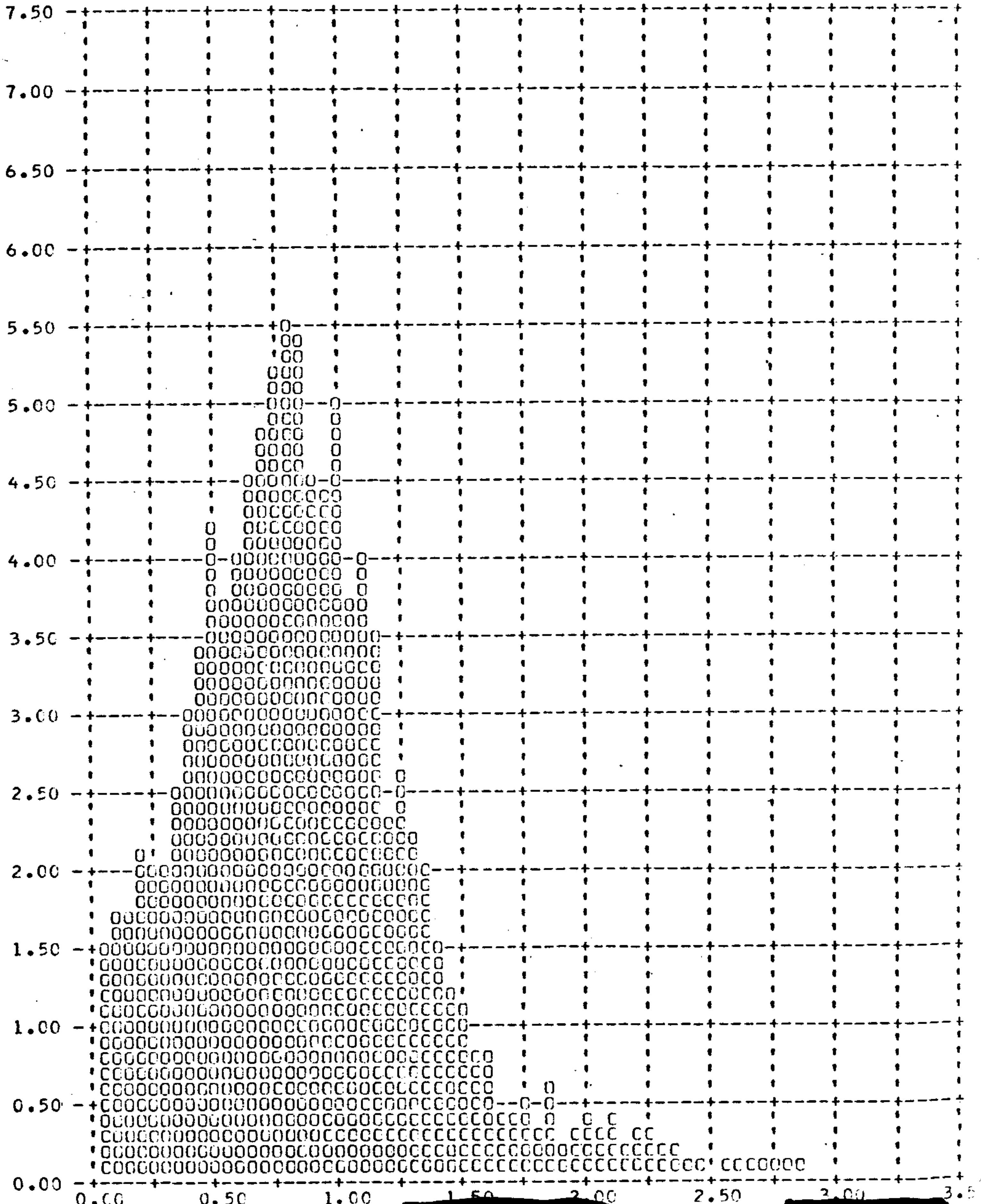
[redacted]

Figure 6-11

MISSION 1101B2 ~~TOP SECRET~~ C [redacted] - CONTROL NO. [redacted]

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 1.34

Y CROSS TRACK RESOLUTION LIMIT - FEET (X) VERSUS FREQUENCY - PERCENT (Y)

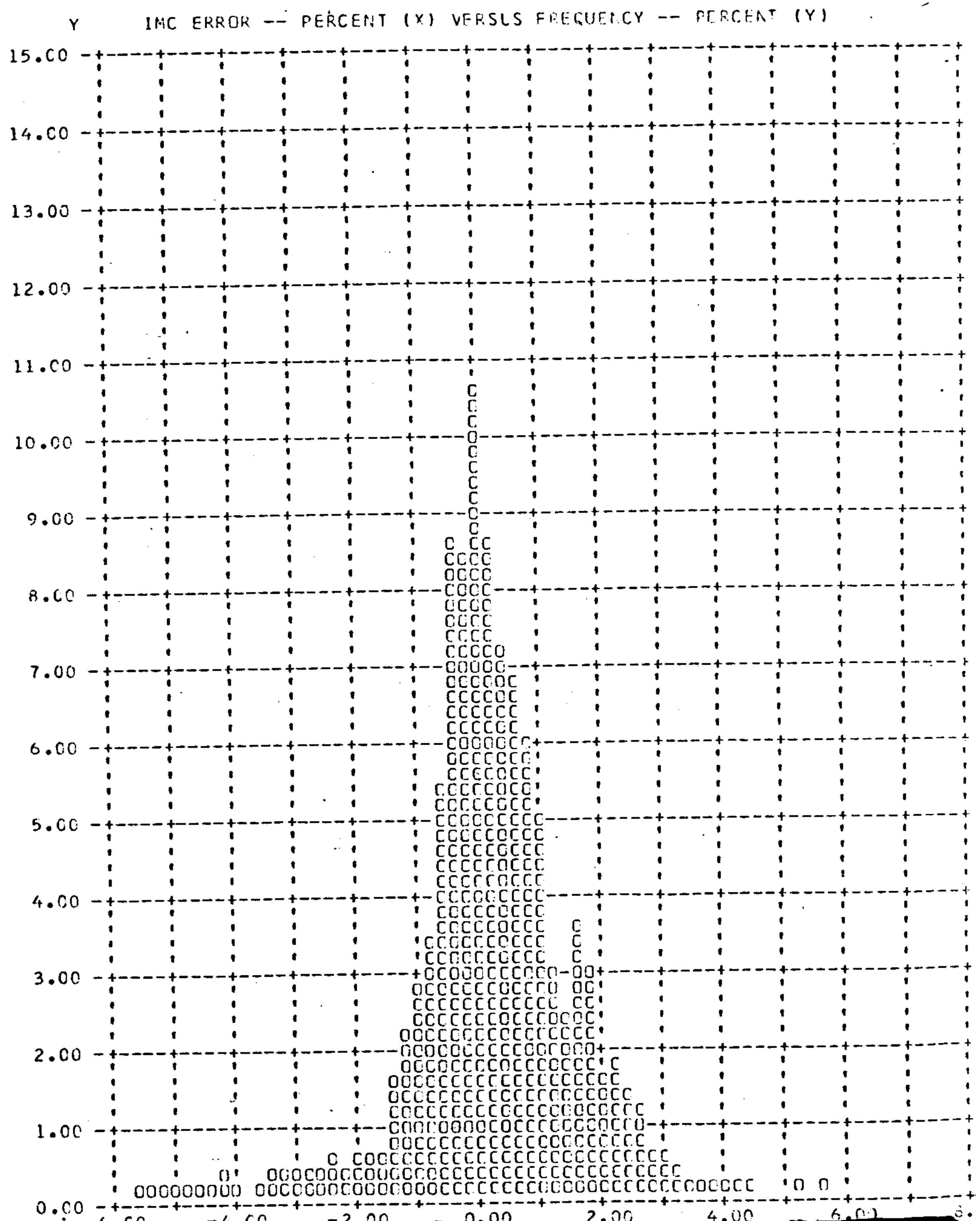


MISSION 1101B2 TOP SECRET C [redacted] - CONTROL NO. [redacted]

Figure 8-12

MISSION 1101B2 ~~TOP SECRET~~ C[redacted] - CONTROL NO. [redacted]

FRAMES 1-6 OF EACH OP OMITTED 90 PERCENT = 2.01



SECTION 9

SYSTEM RELIABILITY

CORONA system reliability data are based upon a sample beginning with M-7. Hence, twenty Mural program systems and all of the "J" program to date are included in several calculations. The sample origin is changed only when system modifications or new designs are introduced because reliability was one of the principal reasons for the change, as the Horizon cameras and DISIC. The sample size is consistent with reliability reporting for the vehicle, for primary mission functions.

These reliability estimates deal exclusively with the electrical and mechanical functions of the payload. Vehicle-induced failures are excluded, such as not achieving orbit. Film quality is not considered in the computations. Recoveries prior to completion of a full mission are considered as complete missions, providing that payload operations problems did not cause the early termination.

The reliability data are divided into two categories. The primary section considers those elements which contribute to retrieval of the more significant information, such as panoramic imagery and time data. The secondary section considers auxiliary camera functions, excluding those affecting primary information. The following data summarize system reliability, estimated to a fifty per cent confidence level:

FUNCTIONS:

Primary (M7 and Up)	Opportunities To Operate	Failures	Estimated Reliability
Panoramic Cameras	191	2	98.6%
Main Doors	122	0	99.4%
Command and Control	11208 (hrs)	2	96.1%
Clock	11208 (hrs)	0	98.9%
Total Payload Functions	-	-	96.5%
Recovery System	87	1	98.1%
Secondary			
Horizon Cameras (J5 & Up)			
Single Camera	112000	0	99.1%
4 units, parallel redundant	-	-	99.9%
DISIC Camera	12965	0	77.2%

TABLE 9-1

ESTIMATED RELIABILITY SUMMARY

(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	** 96.1	11,208	0	** 98.9	** 96.5	87	1	98.1	12,965	0	* 77.2	112,000	0	99.1

** CALCULATIONS ADJUSTED TO NOMINAL 14-DAY MISSION STANDARD

* DISIC REPLACES S/I CAMERAS ON 1100 SERIES SYSTEMS

SECTION 10

SUMMARY DATA

The comparison of the operating parameters and the performance achieved by previous missions has been difficult due to the large volume of data that results from each mission. Some of the pertinent characteristics from prior missions have been summarized in Tables 10-1 through 10-3.

The summary data was started with Mission 1104 as the J-5 camera system was the first to incorporate the major modifications of the titanium drum and scan arm, four roller scan head and Corona J capabilities. Only those missions that culminated in the recovery of some photography have been listed, therefore Missions 1003, 1005 and 1032 are deleted.

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MISSION SUMMARY

MISSION NUMBER	PAYLOAD NUMBER	VEHICLE NUMBER	LAUNCH DATE	LAUNCH TIME	ORBIT INCLINATION (°)	PERIGEE ALTITUDE (NM)	PERIGEE LOCATION (°N)	RECOVERY PASS	MASTER CAMERA: CAMERA NUMBER	MASTER CAMERA: SLIT (")	MASTER CAMERA: FILTER TYPE	SLAVE CAMERA: CAMERA NUMBER	SLAVE CAMERA: SLIT (")	SLAVE CAMERA: FILTER TYPE	STELLAR-INDEX CAMERA NUMBER
1004	J-05	1174	2/15/64	2138 Z	74.9	99.9	29.0	49 / 112	124	0.250	W-21	125	0.250	W-21	D29/29/29 / D42/42/37
1006	J-09	1176	6/4/64	2259 Z	79.9	84.0	63.2	65 / 128	148	0.200	W-21	149	0.200	W-21	D45/47/45 / D49/53/42
1007	J-07	1609	6/19/64	2318 Z	85.0	99.2	41.5	65 / 128	144	0.250	W-25	145	0.200	W-21	D43/43/43 / D54/56/51
1008	J-10	1177	7/10/64	2314 Z	85.0	99.4	40.8	49 / 112	150	0.200	W-21	151	0.200	W-21	D48/45/48 / D33/28/33
1009	J-12	1605	8/5/64	2316 Z	80.1	99.6	39.5	49 / 128	154	0.200	W-21	155	0.200	W-21	D56/54/56 / D38/38/34
1010	J-11	1178	9/14/64	2254 Z	84.9	97.4	42.5	65 / 144	152	0.175	W-21	153	0.175	W-21	D41/41/41 / D44/46/44
1011	J-3X	1170	10/5/64	2150 Z	79.9	99.3	20.9	65 / —	160	0.175	W-21	161	0.175	W-21	D30/30/30 / D57/57/57
1012	J-13	1179	10/17/64	2202 Z	75.0	96.2	32.4	49 / 81	156	0.200	W-21	157	0.200	W-21	D51/51/47 / D46/52/53
1013	J-15	1173	11/2/64	2130 Z	80.0	100.0	25.0	65 / 81	158	0.225	W-21	159	0.225	W-21	D52/49/55 / D47/48/54
1014	J-16	1180	11/18/64	2036 Z	70.0	103.2	65.6	81 / 145	162	0.250	W-25	139	0.175	W-21	D53/59/49 / D50/44/46
1015	J-17	1607	12/19/64	2110 Z	74.9	96.7	21.5	81 / 175	138	0.250	W-25	141	0.175	W-21	D61/61/61 / D58/58/58
1016	J-18	1608	1/15/65	2101 Z	74.9	99.4	30.2	81 / 159	132	0.250	W-25	133	0.175	W-21	D55/55/50 / D59/50/59
1017	J-14	1611	2/25/65	2144 Z	75.0	97.2	25.9	81 / 145	140	0.250	W-25	165	0.175	W-21	D21/21/21 / D60/81/1
1018	J-19	1612	3/25/65	2111 Z	96.0	100.2	40.3	66 / 99	122	0.250	W-25	123	0.175	W-21	D20/20/20 / D22/22/22
1019	J-04	1614	4/29/65	2144 Z	85.0	99.1	27.1	80 / —	118	0.250	W-25	119	0.175	W-21	D39/39/35 / D19/18/19
1020	J-20	1613	6/9/65	2158 Z	75.1	97.1	40.6	97 / 113	136	0.250	W-25	137	0.175	W-21	D67/85/80 / D62/65/65
1021	J-21	1615	5/18/65	1803 Z	75.0	109.2	24.3	81 / 161	166	0.175	W-21	167	0.250	W-25	D63/69/69 / D25/27/25
1022	J-22	1617	7/19/65	2201 Z	85.0	99.7	30.3	65 / 144	168	0.250	W-25	169	0.175	W-21	D65/77/70 / D24/24/24
1023	J-23	1618	8/17/65	2100 Z	70.0	97.8	29.0	81 / 144	170	0.225	W-25	171	0.150	W-21	D17/19/82 / D66/75/72
1024	J-24	1619	9/22/65	2131 Z	80.0	95.9	18.4	81 / 161	172	0.225	W-25	173	0.150	W-21	D69/72/84 / D64/02/66
1025	JX-28	1616	10/5/65	1746 Z	75.0	112.9	44.3	81 / 161	142	0.175	W-21	127	0.175	W-21	D73/78/89 / D70/89/81
1026	J-25	1620	10/28/65	2117 Z	75.0	93.0	17.0	81 / 160	174	0.225	W-25	175	0.150	W-21	D75/92/93 / D72/89/65
1027	JX-27	1621	12/9/65	2110 Z	80.0	97.4	17.3	17 / 33	164	0.250	W-25	163	0.175	W-21	D71/87/87 / D68/74/83
1028	J-26	1610	12/24/65	2106 Z	80.0	97.6	28.4	81 / 144	176	0.250	W-25	177	0.175	W-21	D77/91/97 / D74/76/95

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MISSION SUMMARY

TABLE 10-1

MISSION NUMBER	PAYLOAD NUMBER	VEHICLE NUMBER	LAUNCH DATE	LAUNCH TIME	ORBIT INCLINATION (°)	PERIGEE ALTITUDE (NM)	PERIGEE LOCATION (°N)	RECOVERY PASS	MASTER CAMERA CAMERA NUMBER	MASTER CAMERA SLIT (°)	MASTER CAMERA FILTER TYPE	SLAVE CAMERA CAMERA NUMBER	SLAVE CAMERA SLIT (°)	SLAVE CAMERA FILTER TYPE	STELLAR-INDEX CAMERA NUMBER
1029	J-27	1623	2/2/66	2132 Z	75.1	99.5	22.5	81 / 160	178	0.275	W-25	179	0.175	W-21	D79/94/91 / D76/70/94
1030	J-29	1622	3/9/66	2202 Z	75.0	97.5	18.7	81 / 159	182	0.275	W-25	183	0.175	W-21	D94/100/107 / D32/195/102
1031	J-30	1627	4/7/66	2202 Z	75.1	104.5	23.3	113 / 177	184	0.225	W-23A	185	0.150	W-21	D83/101/89 / 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	66.1	102.0	60.7	82 / 178	194	0.200	W-21	195	0.200	W-21	D91/105/109 / D84/102/75
1034	J-31	1626	6/21/66	2131 Z	80.1	105.4	18.2	81 / 161	186	0.200	W-23A	187	0.150	W-21	D85/109/76 / D87/107/105
1035	J-36	1628	9/20/66	2114 Z	85.0	99.5	29.1	81 / 160	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	D89/110/111 / D88/108/106
1037	J-38	1632	11/8/66	1957 Z	100.0	91.8	14.5	66 / 197	198	0.225	W-23A	199	0.175	W-21	D101/129/128 / D100/136/134
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	D93/86/112 / 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	D103/131/132 / D99/125/125
1040	J-35	1636	3/30/67	1854 Z	85.1	99.7	28.3	81 / 145	196	0.175	W-21	197	0.225	W-23A	D78/95/96 / D92/79/110
1041	J-40	1634	5/9/67	2152 Z	85.1	100.1	33.0	93 / 215	208	0.225	W-23A	209	0.175	W-21	D105/134/133 / 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 / D96/121/118
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	D107/135/135 / D112/143/139
1101	CR-1	1641	9/15/67	1941 Z	80.0	84.8	5.7	97 / 208	302	*	W-21 / W-23A	303	*	W-23A / W-25	DISIC NO. 3

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

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PERFORMANCE SUMMARY

MISSION NUMBER	CAMERA	SERIAL NUMBER	M I P VALUE	VISUAL RES.	AFSPPL SLIT (μ)	AFSPPL AVERAGE	MTF/AIM SLIT (μ)	MTF/AIM AVERAGE	[redacted] SLIT (μ)	MTF/AIM AVERAGE ALL	MTF/AIM AVERAGE HIGH	90% ATTITUDE ERROR (°) PITCH	ROLL	YAW	90% ATTITUDE RATES (°/HR) PITCH	ROLL	YAW	90% V/H ERROR (%)	90% RESOLUTION LIMIT (FEET) ALONG TRACK	CROSS TRACK
1004-1	FWD	124	85	78	350	97	43	109	320	115	127	0.45	0.42	1.08	30.0	25.0	21.0	5.1	7.7	6.1
	AFT			86		80		96		117	124									
1004-2	FWD	125	85	76		88		113		82	90	0.74	0.50	0.91	44.0	30.0	29.0	4.9	6.8	6.5
	AFT			73		83		106		89	95									
1006-1	FWD	148	90	78	350	65	43	88	320	84	97	0.41	0.42	1.14	26.8	28.5	27.8	15.4	13.8	6.7
	AFT			74		71		90		87	92									
1006-2	FWD	149	90	85		64		81		84	90	0.49	0.40	1.08	31.1	27.9	30.0	11.6	10.1	7.0
	AFT			83		72		90		87	94									
1007-1	FWD	144	85	80	350	60	43	87	320	82	91	0.58	0.46	1.43	37.6	23.9	29.9	3.6	3.1	9.4
	AFT			86		63		83		97	110							4.6	2.1	7.6
1007-2	FWD	145	85	79		72		81		68	74	0.64	0.47	—	43.0	25.8	—	3.2	2.4	—
	AFT			81		77		92		74	81							4.2	1.8	—
1008-1	FWD	150	85	80	350	80	43	95	320	81	89	0.59	0.39	0.94	43.8	23.9	29.6	2.9	4.9	5.9
	AFT			76		73		89		86	95									
1008-2	FWD	151	85	62		84		96		83	92	0.63	0.36	0.71	42.9	24.0	32.5	2.8	4.2	5.4
	AFT			79		91		83		85	91									
1009-1	FWD	154	85	92	350	80	—	—	80	75	88	0.65	0.65	0.71	29.2	22.7	27.6	3.3	5.3	5.8
	AFT			89		85				75	83									
1009-2	FWD	155	85	94		85				76	84	0.48	0.65	0.59	33.6	23.9	27.2	2.6	4.9	5.9
	AFT			87		87				72	79									
1010-1	FWD	152	85	90	350	90	80	88	80	87	96	0.93	0.30	0.87	39.1	23.6	30.8	4.5	2.3	4.4
	AFT			88		86		80		92	103									
1010-2	FWD	153	85	92		81		82		82	93	0.59	0.70	1.21	45.4	23.6	30.7	4.6	7.5	3.8
	AFT			90		82		85		87	98									
1011-1	FWD	160	90	84	350	76	80	96	80	78	87	0.77	0.39	0.97	43.1	28.9	31.1	2.3	5.3	5.6
	AFT	161		84		77		86		83	93									
1012-1	FWD	156	85	92	—	—	80	91	80	84	98	0.65	0.51	—	47.1	33.2	—	1.5	4.8	—
	AFT			91				87		89	100									
1012-2	FWD	157	85	91				89		84	91	0.97	0.77	0.51	45.2	30.7	20.4	5.9	3.3	5.9
	AFT			89				96		85	98									
1013-1	FWD	158	85	89	—	—	80	94	80	65	99	0.64	0.32	1.34	36.9	29.0	32.3	3.7	7.8	8.3
	AFT	159		77				97		81	103	0.64	0.32	1.34	36.9	29.0	32.3	4.5	9.6	8.2
1014-1	FWD	162	80	87	—	—	80	78	80	74	86	0.62	0.41	1.46	35.0	36.1	38.5	2.2	6.2	8.3
	AFT			83				80		95	107	0.62	0.41	1.44	34.8	36.0	38.3	3.3	2.8	6.3
1014-2	FWD	139	80	83				75		70	77	1.06	0.55	—	36.4	36.4	—	1.4	6.4	—
	AFT			86				84		80	88	1.06	0.59	—	38.1	36.0	—	3.2	2.2	—
1015-1	FWD	138	85	87	—	—	80	76	80	90	—	0.65	0.38	0.53	47.0	29.4	38.2	5.0	5.5	7.8
	AFT			87				73		97		0.64	0.39	0.53	46.9	29.2	38.2	6.3	3.4	5.5
1015-2	FWD	141	85	83				72		89		0.50	0.61	0.64	39.1	27.1	36.2	3.2	6.8	7.5
	AFT			82				72		90		0.50	0.61	0.64	39.1	27.0	36.3	3.3	4.6	5.3
1016-1	FWD	132	85	85	—	—	80	56	80	81	—	0.72	0.83	2.01	48.9	30.2	40.4	2.0	5.5	10.5
	AFT			83				61		94		0.72	0.83	2.01	48.4	30.1	40.4	2.8	3.4	7.4
1016-2	FWD	133	85	90				55		92		0.83	0.93	2.19	42.2	27.2	39.9	1.5	4.9	6.0
	AFT			91				56		91		0.83	0.93	2.19	42.2	27.3	39.9	2.3	3.3	7.1
1017-1	FWD	140	85	72	—	—	80	57	80	78	86	0.49	0.76	2.50	35.5	32.2	38.4	3.3	9.8	11.6
	AFT			75				70		94	107	0.49	0.76	2.49	35.3	32.0	38.5	4.3	8.3	8.1
1017-2	FWD	165	85	85				65		80	94	0.69	0.45	—	36.5	34.0	—	1.8	6.2	—
	AFT			85				69		86	101	0.69	0.45	—	36.3	33.8	—	2.3	5.3	—
1018-1	FWD	122	85	79	—	—	80	70	80	82	92	0.91	0.48	—	47.4	36.7	—	3.4	5.6	—
	AFT			77				74		96	109	0.90	0.47	—	48.2	36.2	—	3.2	3.7	—
1018-2	FWD	123	85	84				75		77	89	0.84	0.63	—	34.7	30.7	—	3.1	5.6	—
	AFT			88				71		91	103	0.85	0.63	—	34.8	30.7	—	2.8	4.1	—

PERFORMANCE SUMMARY

MISSION NUMBER	CAMERA	SERIAL NUMBER	M I P VALUE	VISUAL RES.	AFSPPF SLIT (µ)	AFSPPF AVERAGE	MTF/AIM SLIT (µ)	MTF/AIM AVERAGE	SLIT (µ)	MTF/AIM AVERAGE ALL	MTF/AIM AVERAGE HIGH	90% ATTITUDE ERROR (°) PITCH	ROLL	YAW	90% ATTITUDE RATES (°/HR) PITCH	ROLL	YAW	90% V/H ERROR (%)	90% RESOLUTION LIMIT (FEET) ALONG TRACK	CROSS TRACK
1019-1	FWD	118	85	81	—	—	80	76	80	83	104	0.43	0.36	0.97	31.6	34.7	33.0	3.3	9.3	9.1
	AFT	119		99				63		87	101	0.44	0.37	0.96	31.6	34.9	33.1	3.8	5.0	6.5
1020-1	FWD	136	80	88	—	—	80	69	80	78	90	0.46	0.35	0.78	37.4	31.8	26.7	5.4	5.8	8.4
	AFT			89				82		94	105	0.46	0.35	0.78	37.4	31.8	26.7	5.3	4.2	5.9
1020-2	FWD	137	—	—				—		—	—	0.41	0.17	1.06	42.6	23.8	42.5	3.5	6.4	7.6
	AFT			—				—		—	—	0.41	0.17	1.06	42.6	23.8	42.5	3.4	4.5	2.8
1021-1	FWD	166	85	88	—	—	80	77	80	86	99	0.55	0.37	0.81	34.9	32.6	26.2	2.7	8.8	8.0
	AFT			90				90		98	109	0.55	0.38	0.81	34.8	33.0	26.3	5.4	6.6	5.5
1021-2	FWD	167	85	85				74		88	112	0.59	0.65	—	44.7	50.6	—	3.1	9.2	—
	AFT			74				62		—	—	—	—		—	—		—	—	
1022-1	FWD	168	85	88	—	—	80	66	80	78	91	0.47	0.51	0.89	28.3	27.1	23.8	3.5	9.8	8.6
	AFT			91				83		101	111	0.47	0.51	0.90	27.9	26.6	23.8	3.0	6.2	6.1
1022-2	FWD	169	85	90				68		74	84	0.40	0.51	0.90	29.4	27.3	31.0	2.6	8.0	8.4
	AFT			92				92		99	110	0.40	0.51	0.90	29.4	27.3	31.1	1.8	4.9	5.9
1023-1	FWD	170	85	—	—	—	80	94	80	97	110	0.49	0.33	0.50	33.0	28.7	23.5	3.4	4.0	6.4
	AFT							87		83	101	0.49	0.33	0.50	32.9	28.7	23.5	3.5	2.7	4.3
1023-2	FWD	171	85					71		76	87	0.42	0.36	0.53	29.7	21.0	28.6	2.4	3.9	6.3
	AFT							89		68	76	0.43	0.37	0.53	29.6	21.3	28.6	2.5	2.7	4.2
1024-1	FWD	172	85	—	—	—	80	79	80	90	102	0.42	0.25	0.62	32.2	24.9	30.5	2.6	5.9	6.8
	AFT							95		94	105	0.42	0.25	0.62	32.2	24.9	30.4	2.1	3.8	4.5
1024-2	FWD	173	85					86		89	101	0.36	0.31	0.93	30.4	24.5	36.4	5.5	4.7	5.4
	AFT							95		100	114	0.36	0.31	0.93	30.6	23.6	36.4	5.1	3.3	3.6
1025-1	FWD	142	85	—	—	—	80	87	80	80	97	0.50	0.41	0.85	28.1	28.7	25.9	2.0	3.9	6.7
	AFT							97		101	114	0.51	0.42	0.85	28.6	29.7	25.7	3.2	2.8	6.8
1025-2	FWD	127	85					85		96	107	0.52	0.44	0.82	28.0	26.1	29.0	1.7	4.7	6.9
	AFT							91		89	103	0.52	0.44	0.82	28.1	26.0	29.0	1.8	6.7	6.9
1026-1	FWD	174	85	—	—	—	80	76	80	80	92	0.65	0.24	0.70	37.9	33.2	28.5	6.1	13.5	6.2
	AFT							88		98	113	0.65	0.24	0.70	37.9	33.2	28.5	6.1	9.1	4.1
1026-2	FWD	175	85					85		92	104	0.55	0.56	0.87	41.1	46.5	30.8	6.1	5.5	6.7
	AFT							93		90	103	0.59	0.65	0.88	43.3	50.0	27.7	6.7	3.3	4.5
1027-1	FWD	164	85	—	—	—	80	69	80	80	—	0.51	0.37	0.74	47.2	25.5	26.4	4.7	10.5	7.2
	AFT	163						79		92		0.51	0.37	0.74	47.3	25.2	26.2	3.8	6.0	5.2
1028-1	FWD	176	85	—	—	—	80	81	80	89	—	0.52	0.37	0.50	36.6	28.0	30.5	3.9	4.8	8.0
	AFT							92		93		0.52	0.37	0.50	36.6	28.0	30.5	3.1	4.0	5.6
1028-2	FWD	177	85					88		87		0.76	0.52	—	42.7	25.7	—	3.2	4.2	—
	AFT							77		84		0.76	0.52		42.5	25.6		2.9	3.3	
1029-1	FWD	178	85	—	80	89	80	91	80	77	—	0.67	0.34	0.77	29.1	31.3	34.4	2.9	7.8	7.4
	AFT					91		95		73		0.68	0.33	0.77	28.5	30.8	34.6	4.6	3.3	4.3
1029-2	FWD	179	85			83		82		77		0.64	0.48	0.44	38.8	32.5	25.7	2.3	7.5	7.5
	AFT					91		94		81		0.65	0.48	0.44	37.5	32.1	25.7	3.6	2.9	4.9
1030-1	FWD	182	85	—	80	95	80	76	80	66	—	0.67	0.25	0.89	29.6	22.7	36.1	3.9	8.9	8.6
	AFT					74		79		77		0.67	0.25	0.89	29.6	22.8	35.9	5.4	5.1	5.6
1030-2	FWD	183	85			77		81		71		0.70	0.27	0.87	26.4	22.7	36.3	4.9	11.2	3.6
	AFT					91		74		71		0.70	0.26	0.87	28.2	21.9	36.3	5.0	6.6	5.5
1031-1	FWD	184	85	—	80	65	80	76	80	90	—	0.50	0.47	0.96	16.2	17.3	26.6	6.1	13.8	6.4
	AFT					57		71		66		0.54	0.41	0.91	18.1	18.7	22.8	6.0	12.0	5.6
1031-2	FWD	185	85			91		94		74		0.57	0.20	0.75	19.0	19.3	15.7	5.4	10.3	4.9
	AFT					—		—		—		—	—	—	—	—	—	—	—	—
1033-1	FWD	194	85	—	80	77	80	94	80	87	—	0.11	0.33	0.80	11.3	34.9	27.3	3.5	8.2	6.2
	AFT					67		93		72		0.15	0.27	0.39	8.2	59.6	18.8	4.9	6.1	5.6
1033-2	FWD	195	85			75		90		95		0.21	0.24	1.09	22.3	49.3	17.5	2.6	5.8	6.9
	AFT					93		92		73		0.20	0.24	1.08	22.3	50.7	17.4	2.9	7.3	6.7

REC/JOM 12/65

PERFORMANCE SUMMARY

~~TOP SECRET~~ C[redacted]

MISSION NUMBER	CAMERA	SERIAL NUMBER	M.I.P. VALUE	AFSPPF MTF/AIM			90% ATTITUDE ERROR (°)			90% ATTITUDE RATES (°/HR.)			90% V/H ERROR (%)	90% RESOLUTION LIMIT (FEET)		IMC ERROR
				AVERAGE (INTERIM)	SLIT (μ)	AVERAGE (STANDARD)	PITCH	ROLL	YAW	PITCH	ROLL	YAW		ALONG TRACK	CROSS TRACK	
1034-1	FWD	186	80	75	80	81	0.20	0.19	0.99	19.3	20.4	24.9	15.0	17.9	5.9	—
	AFT			93		90	0.20	0.19	0.99	19.3	20.4	24.9	15.2	13.6	4.5	—
1034-2	FWD	187	80	74		89	0.34	0.36	0.33	21.1	28.9	16.2	8.7	10.4	7.1	—
	AFT			69		86	0.34	0.36	0.33	21.1	29.0	16.2	6.9	6.0	5.3	—
1035-1	FWD	188	85	66	80	—	0.16	0.55	2.39	18.9	27.9	33.9	4.0	4.8	3.7	4.0
	AFT			80			0.17	0.54	2.43	19.3	23.4	32.2	4.1	3.7	2.4	4.1
1035-2	FWD	189	85	81			0.16	0.50	3.02	18.4	30.1	27.5	3.2	4.0	3.5	3.2
	AFT			82			0.17	0.51	3.02	19.9	24.7	26.3	3.4	3.3	2.4	3.4
1036-1	FWD	190	85	89	80	—	0.76	0.96	0.60	31.2	25.6	29.5	3.4	5.1	6.6	—
	AFT			94			0.76	0.96	0.60	31.1	25.5	29.4	3.3	3.6	5.1	—
1036-2	FWD	191	85	73			0.94	0.70	0.40	33.0	29.7	23.3	3.3	3.8	6.5	—
	AFT			84			0.94	0.70	0.40	32.9	29.7	23.3	3.1	2.7	4.9	—
1037-1	FWD	198	85	80	80	—	0.25	0.25	1.50	22.8	40.0	29.3	9.5	10.1	5.0	9.8
	AFT			71			0.25	0.27	1.51	28.7	36.9	32.4	10.1	8.0	6.1	10.3
1037-2	FWD	199	85	88			0.24	0.30	1.17	26.5	52.5	26.2	6.3	6.6	7.5	6.5
	AFT			81			0.27	0.32	1.18	33.8	36.6	53.4	6.6	5.4	5.9	7.0
1038-1	FWD	192	80	53	80	—	0.22	0.25	2.98	18.7	33.7	39.9	3.6	4.1	3.7	3.5
	AFT			76			0.27	0.24	2.99	41.8	27.2	34.4	3.4	3.3	2.5	3.7
1038-2	FWD	193	80	63			0.39	0.51	2.87	20.0	46.7	27.8	3.4	3.6	3.8	3.1
	AFT			77			0.39	0.51	2.90	50.4	28.3	27.3	3.4	3.6	2.4	3.9
1039-1	FWD	206	85	59	80	—	0.21	0.43	3.03	19.0	27.8	39.2	5.1	6.2	4.6	5.2
	AFT			71			0.20	0.41	3.05	37.5	23.0	28.5	5.2	4.8	3.2	5.2
1039-2	FWD	207	85	71			0.30	0.54	2.50	33.1	30.2	25.0	4.6	5.5	5.4	4.7
	AFT			65			0.34	0.53	2.52	27.1	24.2	23.9	4.8	4.6	3.0	5.0
1040-1	FWD	196	85	94	80	—	0.33	0.56	2.99	26.0	22.2	28.4	2.6	3.9	2.1	2.0
	AFT			68			[illegible]	0.56	3.00	22.1	23.2	28.5	2.1	1.9	2.5	2.1
1040-2	FWD	197	85	61			[illegible]	0.49	2.96	27.5	30.0	32.5	1.6	2.2	2.0	1.7
	AFT			75			[illegible]	0.46	2.96	27.2	26.4	28.7	2.7	2.5	2.2	2.6
1041-1	FWD	208	85	72	80	—	0.34	0.16	3.05	14.7	14.0	12.7	5.1	6.4	3.4	5.2
	AFT			82			0.35	0.16	3.05	15.8	13.5	13.0	5.8	5.7	3.0	5.7
1041-2	FWD	209	85	73			0.26	0.23	2.94	22.9	15.7	18.8	4.9	6.4	2.1	4.9
	AFT			78			0.28	0.24	3.01	23.9	16.2	21.0	5.6	5.5	2.0	5.5
1042-1	FWD	204	85	79	80	—	0.31	0.22	2.86	22.1	30.3	27.0	3.1	3.3	1.5	3.1
	AFT			85			0.32	0.24	2.83	23.4	33.0	25.9	3.2	2.7	1.1	3.4
1042-2	FWD	205	85	70			0.31	0.38	2.39	16.1	46.1	31.4	2.1	2.5	2.2	2.3
	AFT			74			0.32	0.37	2.31	19.9	33.6	25.6	2.6	2.3	1.8	2.6
1043-1	FWD	200	85	65	80	—	0.28	0.23	3.11	23.9	22.0	41.5	4.2	5.4	1.5	4.2
	AFT			67			0.31	0.23	3.14	25.4	20.5	34.9	3.3	2.8	0.8	3.3
1043-2	FWD	201	85	65			0.30	0.34	2.73	29.2	31.6	47.9	4.3	5.3	2.2	4.4
	AFT			75			0.34	0.34	2.78	27.3	29.9	45.1	3.1	2.8	0.9	3.2
1101-1	FWD	302	95	69	80	—	0.23	0.27	*0.77	31.4	26.0	32.2	** 8.2	** 6.5	1.2	8.2
	AFT			50			0.23	0.28	0.78	31.0	26.0	33.6	** 8.3	** 5.2	1.1	8.2
1101-2	FWD	303	95	63			0.36	0.27	1.01	40.8	29.1	42.2	2.2	2.3	1.5	2.3
	AFT			45			0.36	0.28	1.01	40.6	29.1	44.0	2.1	1.6	1.3	2.0

* YAW STEERING ERROR. PREVIOUS MISSIONS AND 1044 INDICATE TOTAL YAW ANGLE. ** RESULT OF INITIAL RAMP MISMATCH. NOT TYPICAL OF ENTIRE MISSION.

HEC/JOM 6/67

~~TOP SECRET~~ C[redacted]

TABLE 10-3

EXPOSURE - PROCESSING SUMMARY

~~TOP SECRET~~ C [redacted]

MISSION NUMBER	CAMERA	SOLAR ELEVATION RANGE (°) LOW	SOLAR ELEVATION RANGE (°) HIGH	SOLAR AZIMUTH RANGE (°) LOW	SOLAR AZIMUTH RANGE (°) HIGH	PREDICTED PROCESSING (%) P	PREDICTED PROCESSING (%) I	PREDICTED PROCESSING (%) F	REPORTED PROCESSING (%) P	REPORTED PROCESSING (%) I	REPORTED PROCESSING (%) F	COMPUTED PROCESSING (%) P	COMPUTED PROCESSING (%) I	COMPUTED PROCESSING (%) F	TERRAIN D-MIN RANGE LOW	TERRAIN D-MIN RANGE HIGH	TERRAIN D-MIN MEAN	TERRAIN D-MIN MEDIAN	TERRAIN D-MAX RANGE LOW	TERRAIN D-MAX RANGE HIGH	TERRAIN D-MAX MEAN	TERRAIN D-MAX MEDIAN	CLOUD D-MAX RANGE LOW	CLOUD D-MAX RANGE HIGH	CLOUD D-MAX MEAN	CLOUD D-MAX MEDIAN	UNDER EXPOSED (%)	UNDER PROCESSED (%)	NOMINAL EXP & PRO (%)	OVER PROCESSED (%)	OVER EXPOSED (%)	CLOUD COVER (%)
1004-1	FWD	-3	61	25	124	5	76	19	4	79	17	0	79	21	0.26	1.89	0.83	0.78	0.43	2.43	1.97	2.02	1.00	2.43	2.04	2.08	0	4	60	31	5	35
	AFT	-3	61	25	124	5	74	21	4	79	17	0	80	20	0.22	1.56	0.76	0.70	0.93	2.45	1.92	1.94	1.08	2.43	1.98	2.03	1	4	67	26	3	35
1004-2	FWD	-4	68	10	131	7	76	17	37	50	13	4	83	13	0.29	1.80	0.83	0.78	0.36	2.30	1.84	1.90	0.41	2.37	1.87	1.93	0	4	59	27	9	35
	AFT	-4	68	10	131	7	76	17	37	50	13	4	77	19	0.29	1.91	0.81	0.73	0.36	2.39	1.89	1.99	0.43	2.46	1.89	1.98	0	4	67	20	9	35
1006-1	FWD	38	56	52	140	1	99	0	1	51	48	0	51	49	0.23	1.81	0.71	0.68	0.80	2.31	1.58	1.52	1.31	2.40	2.20	2.24	0	5	72	21	1	60
	AFT	38	56	52	140	1	99	0	0	23	77	0	24	76	0.36	1.66	0.87	0.84	0.96	2.35	1.72	1.72	1.14	2.40	2.24	2.28	0	1	58	40	1	60
1006-2	FWD	32	64	36	147	2	98	0	30	41	29	11	59	30	0.21	1.14	0.53	0.50	0.56	2.28	1.49	1.50	1.30	2.33	2.11	2.16	2	21	72	4	0	45
	AFT	32	64	36	147	2	98	0	35	40	25	21	54	25	0.26	1.34	0.62	0.58	0.65	2.19	1.48	1.47	1.56	2.50	2.12	2.16	0	11	77	9	3	45
1007-1	FWD	12	49	50	103	0	5	95	1	20	79	0	25	75	0.26	1.22	0.52	0.47	0.62	2.20	1.44	1.40	1.22	1.36	2.17	2.21	20	8	67	5	0	60
	AFT	11	49	48	102	0	100	0	10	42	48	6	77	17	0.26	1.76	0.58	0.55	0.78	2.31	1.52	1.52	1.54	2.39	2.20	2.24	1	13	80	5	1	60
1007-2	FWD	32	57	43	112	0	25	75	3	28	69	0	26	74	0.26	1.23	0.51	0.48	0.70	2.32	1.44	1.40	0.90	2.37	2.15	2.20	18	9	71	2	0	65
	AFT	31	57	38	111	0	100	0	19	41	40	3	88	9	0.24	1.56	0.60	0.56	0.44	2.27	1.50	1.52	0.84	2.41	2.17	2.25	1	16	74	9	1	65
1008-1	FWD	30	51	50	102	0	100	0	4	32	64	1	35	64	0.32	1.48	0.66	0.62	0.78	2.24	1.55	1.54	1.46	2.35	2.21	2.24	2	2	86	8	1	45
	AFT	30	51	50	102	0	100	0	4	27	69	0	34	66	0.32	1.57	0.71	0.69	0.81	2.21	1.57	1.58	1.08	2.37	2.21	2.24	1	1	84	13	0	45
1008-2	FWD	29	56	42	105	0	100	0	3	31	66	0	27	73	0.14	1.81	0.76	0.72	0.57	2.10	1.54	1.55	1.09	2.40	2.20	2.25	2	1	73	23	1	65
	AFT	29	56	42	105	0	100	0	3	30	67	0	29	71	0.32	1.64	0.77	0.76	0.73	2.10	1.55	1.55	1.10	2.35	2.18	2.22	1	3	69	27	0	65
1009-1	FWD	12	49	42	132	0	100	0	1	26	73	0	34	66	0.32	1.40	0.65	0.62	0.85	2.41	1.53	1.52	0.83	2.51	2.30	2.36	5	4	77	14	0	50
	AFT	12	49	42	132	0	100	0	0	40	60	0	45	55	0.28	1.42	0.70	0.64	0.92	2.28	1.58	1.55	0.63	2.51	2.32	2.36	1	5	73	20	0	50
1009-2	FWD	23	58	35	138	2	98	0	3	21	76	0	40	60	0.29	1.55	0.69	0.64	0.73	2.37	1.53	1.53	1.06	2.45	2.25	2.30	4	4	74	17	0	55
	AFT	23	58	35	138	2	98	0	4	47	49	0	56	44	0.26	1.47	0.69	0.64	0.44	2.42	1.61	1.60	1.61	2.50	2.31	2.34	1	4	77	18	0	55
1010-1	FWD	18	47	45	83	0	21	79	0	13	87	0	9	91	0.28	1.14	0.52	0.47	0.43	2.32	1.38	1.32	1.11	2.42	2.16	2.20	18	3	75	4	0	48
	AFT	18	47	45	83	0	21	79	0	19	81	0	16	84	0.27	1.25	0.57	0.52	0.78	2.42	1.45	1.41	0.96	2.46	2.20	2.26	9	4	81	6	0	48
1010-2	FWD	15	52	38	76	0	50	50	0	16	84	0	13	87	0.26	1.51	0.55	0.50	0.52	2.36	1.41	1.38	1.00	2.44	2.14	2.20	22	4	67	6	0	45
	AFT	15	52	38	76	0	50	50	0	23	77	0	25	75	0.20	1.48	0.59	0.56	0.30	2.40	1.47	1.45	1.29	2.48	2.18	2.22	13	3	76	8	0	45
1011-1	FWD	2	55	33	66	0	64	36	2	23	75	2	23	75	0.18	0.99	0.50	0.46	0.56	2.36	1.48	1.43	0.78	2.40	2.07	2.16	17	11	70	2	0	40
	AFT	2	55	33	66	0	67	33	3	47	50	0	37	63	0.24	1.48	0.60	0.56	0.50	2.35	1.57	1.55	0.74	2.37	2.11	2.18	3	7	81	8	0	40
1012-1	FWD	0	45	38	71	0	64	36	7	56	37	0	65	35	0.25	1.30	0.59	0.53	0.54	2.39	1.40	1.42	0.90	2.39	1.93	2.00	6	17	68	10	0	60
	AFT	0	45	38	71	0	64	36	0	33	67	0	49	51	0.26	1.40	0.61	0.58	0.47	2.27	1.44	1.40	0.72	2.32	1.89	1.96	5	10	74	11	0	60
1012-2	FWD	0	57	34	106	0	77	23	6	44	50	0	49	51	0.30	1.20	0.58	0.55	0.73	2.32	1.49	1.42	0.57	2.34	1.91	2.00	4	9	80	7	0	40
	AFT	0	57	34	106	0	77	23	3	15	92	0	10	90	0.30	1.27	0.68	0.62	0.48	2.33	1.55	1.58	0.70	2.38	1.96	2.02	4	0	72	23	0	40
1013-1	FWD	0	56	28	83	0	64	36	0	42	58	0	55	45	0.20	1.66	0.56	0.36	0.52	2.29	1.56	1.59	1.21	2.41	2.03	2.10	7	13	76	4	0	47
	AFT	0	56	26	82	0	64	36	2	7	91	0	33	67	0.28	1.56	0.66	0.48	0.64	2.28	1.59	1.63	1.10	2.36	1.97	2.03	5	5	74	16	0	47
1014-1	FWD	0	59	15	71	0	21	79	1	38	61	0	63	37	0.17	0.99	0.40	0.36	0.26	2.36	1.40	1.42	1.01	2.38	1.94	2.05	27	33	39	1	0	40
	AFT	0	59	14	69	0	31	69	0	13	87	0	36	64	0.18	1.26	0.51	0.48	0.25	2.38	1.42	1.49	0.42	2.43	1.91	2.00	19	12	64	5	0	40
1014-2	FWD	0	77	0	36	0	21	79	0	26	74	0	61	39	0.17	1.06	0.36	0.31	0.23	2.32	1.30	1.36	0.42	2.36	1.72	1.80	31	40	27	2	0	40
	AFT	0	76	0	34	0	29	71	0	5	95	0	68	32	0.18	1.49	0.44	0.40	0.27	2.28	1.34	1.45	0.26	2.44	1.71	1.84	19	29	50	2	0	40
1015-1	FWD	5	68	19	68	0	8	92	2	2	96	0	2	98	0.25	1.70	0.54	0.47	0.54	2.28	1.44	1.46	0.46	2.41	1.86	1.90	28	0	65	7	0	45
	AFT	4	68	18	67	0	30	70	0	5	95	0	4	96	0.29	1.20	0.60	0.56	0.46	2.28	1.49	1.50	0.80	2.36	1.86	1.95	14	0	77	8	0	45
1015-2	FWD	0	80	-2	71	0	10	90	0	10	90	0	11	89	0.22	1.10	0.50	0.46	0.34	2.07	1.29	1.30	0.28	2.34	1.69	1.78	28	4	65	3	0	40
	AFT	0	79	-2	71	0	21	79	0	9	91	0	9	91	0.26	1.21	0.59	0.52	0.36	2.22	1.37	1.38	0.38	2.40	1.74	1.80	17	1	70	12	0	40
1016-1	FWD	5	69	13	76	0	7	93	1	41	58	0	59	41	0.13	1.55	0.51	0.45	0.70	2.43	1.67	1.68	0.85	2.44	1.91	1.90	19	17	56	8	1	45
	AFT	4	69	12	76	0	27	73	0	26	74	0	42	58	0.22	1.65	0.64	0.58	0.62	2.34	1.69	1.72	0.98	2.46	1.90	1.92	11	9	62	17	1	45
1016-2	FWD	1	84	-4	76	0	8	92	0	31	69	0	48	52	0.18	1.56	0.48	0.44	0.29	2.35	1.45	1.44	0.34	2.50	1.76	1.82	22	18	56	3	0	40
	AFT	0	84	-4	76	0	19	81	1	27	72	0	40	60	0.20	1.88	0.55	0.49	0.26	2.32	1.52	1.60	0.30	2.49	1.75	1.82	23	5	65	6	1	40
1017-1	FWD	-11	50	21	99	0	0	100	13	63	24	0	82	18	0.20	1.65	0.66	0.61	0.46	2.23	1.74	1.78	0.60	2.32	1.93	2.00	1	8	77	13	1	25
	AFT	-1	57	19	98	0	17	83	24	58	18	4	90	6	0.20	1.62	0.64	0.60	0.60	2.29	1.75	1.75	1.18	2.36	1.89	1.90	1	13	74	11	2	25
1017-2	FWD	1	78	9	139	0	0	100	5	62	33	7	77	16	0.22	1.22	0.58	0.55	0.37	2.30	1.70	1.80	0.85	2.37	1.93	1.94	3	14	74	9	0	30
	AFT	1	79	7	135	0	7	93	18	62	20	0	89	11	0.20	1.54	0.64	0.62	0.30	2.30	1.62	1.68	0.33	2.34	1.85	1.92	2	13	74	10	1	30
1018-1	FWD	6	77	13	134	0	0	100	9	63	28	1	83	16	0.19	1.46	0.56	0.52	0.64	2.22	1.66	1.73	1.00	2.32	1.96	1.99	2	19	71	7	0	35
	AFT	6	78	10	125	0	22	78	9	53	38	5	72	23	0.18	1.36	0.62	0.58	0.68	2.20	1.68	1.80	1.03	2.28	1.95	2.00	1	12	77	9	2	35
1018-2	FWD	8	77	14	134	0	0	100	18	74	8	17	79	4	0.16	1.78	0.57	0.49	0.50	2.24	1.50	1.54	0.90	2.25	1.85	1.91	1	31	56	9	4	45
	AFT	8	77	10	132	0	15	85	1	50	49	0	74	26	0.22	1.50	0.81	0.79	0.94	2.26	1.70	1.74	1.09	2.35	1.90	2.04	0	5	58	35	2	45

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~~TOP SECRET~~ C [redacted]

TABLE 10-5

EXPOSURE - PROCESSING SUMMARY

~~TOP SECRET~~ C [redacted]

MISSION NUMBER	CAMERA	SOLAR ELEVATION RANGE (°) LOW	SOLAR ELEVATION RANGE (°) HIGH	SOLAR AZIMUTH RANGE (°) LOW	SOLAR AZIMUTH RANGE (°) HIGH	PREDICTED PROCESSING (%) P	PREDICTED PROCESSING (%) I	PREDICTED PROCESSING (%) F	REPORTED PROCESSING (%) P	REPORTED PROCESSING (%) I	REPORTED PROCESSING (%) F	COMPUTED PROCESSING (%) P	COMPUTED PROCESSING (%) I	COMPUTED PROCESSING (%) F	TERRAIN D-MIN RANGE LOW	TERRAIN D-MIN RANGE HIGH	TERRAIN D-MIN MEAN	TERRAIN D-MIN MEDIAN	TERRAIN D-MAX RANGE LOW	TERRAIN D-MAX RANGE HIGH	TERRAIN D-MAX MEAN	TERRAIN D-MAX MEDIAN	CLOUD D-MAX RANGE LOW	CLOUD D-MAX RANGE HIGH	CLOUD D-MAX MEAN	CLOUD D-MAX MEDIAN	UNDER EXPOSED (%)	UNDER PROCESSED (%)	NOMINAL EXP. & PRO. (%)	OVER PROCESSED (%)	OVER EXPOSED (%)	CLOUD COVER (%)
1019-1	FWD	24	70	24	152	0	21	79	22	32	46	4	56	40	0.26	1.92	0.71	0.61	0.60	2.15	1.45	1.50	0.84	2.26	1.94	2.00	4	7	64	17	7	45
	AFT	23	70	21	152	0	92	8	26	55	19	3	87	10	0.13	1.70	0.66	0.60	0.39	2.26	1.46	1.45	0.80	2.30	1.96	2.02	1	13	70	14	3	45
1020-1	FWD	30	75	19	156	0	19	81	13	48	39	1	58	41	0.23	1.30	0.55	0.52	0.80	2.28	1.57	1.54	1.40	2.38	2.10	2.16	1	18	78	4	0	42
	AFT	29	75	17	156	0	64	36	15	56	29	0	74	26	0.23	1.20	0.55	0.54	0.70	2.20	1.47	1.46	1.22	2.29	2.04	2.10	0	18	76	5	0	42
1020-2	FWD	47	69	18	35	← INSUFFICIENT DATA →																										
	AFT	46	68	17	33																											
1021-1	FWD	15	66	-148	-23	0	69	32	14	39	47	1	52	47	0.25	1.90	0.64	0.58	0.74	2.18	1.50	1.50	0.97	2.36	1.92	2.00	5	9	72	11	3	35
	AFT	14	66	-147	-25	0	99	1	15	38	47	0	57	43	0.17	1.70	0.65	0.57	0.54	2.24	1.45	1.42	0.85	2.30	1.90	2.00	5	5	75	12	3	35
1021-2	FWD	13	52	-133	-41	0	29	71	13	41	46	0	57	43	0.18	1.52	0.54	0.50	0.60	2.36	1.36	1.34	1.05	2.23	1.82	1.85	14	13	66	6	0	20
	AFT	13	52	-133	-41	0	100	0	53	25	22	0	50	50	0.33	1.38	0.76	0.76	0.70	2.30	1.52	1.50	1.30	2.36	1.94	1.94	6	0	71	21	1	20
1022-1	FWD	28	67	30	150	0	36	64	8	36	56	0	42	58	0.18	1.49	0.45	0.40	0.54	2.42	1.57	1.60	1.32	2.55	2.24	2.29	30	19	47	3	0	35
	AFT	27	67	26	150	0	89	11	7	42	51	0	53	47	0.24	1.48	0.57	0.50	0.52	2.30	1.63	1.68	1.30	2.47	2.21	2.25	4	15	71	9	1	35
1022-2	FWD	29	74	21	152	0	8	92	1	37	62	0	43	57	0.20	0.99	0.39	0.35	0.62	2.65	1.45	1.45	1.16	2.45	2.23	2.28	35	28	35	1	0	45
	AFT	28	74	19	152	0	100	0	10	44	46	0	53	47	0.21	1.40	0.48	0.44	0.50	2.32	1.51	1.52	1.45	2.49	2.25	2.28	10	25	61	4	0	45
1023-1	FWD	22	82	8	164	0	5	95	19	54	27	0	72	28	0.15	1.26	0.39	0.35	0.43	2.41	1.22	1.22	0.87	2.41	2.06	2.11	20	44	34	2	0	35
	AFT	20	81	5	163	0	11	89	0	39	61	0	42	58	0.20	1.40	0.53	0.48	0.41	2.21	1.31	1.37	0.94	2.45	2.15	2.20	13	14	65	7	0	35
1023-2	FWD	29	81	-13	177	0	7	93	0	19	81	0	18	82	0.22	1.38	0.48	0.42	0.41	2.03	1.18	1.22	0.90	2.41	2.03	2.11	35	2	60	2	1	35
	AFT	28	80	-13	178	0	3	97	0	34	66	0	28	72	0.22	1.60	0.52	0.48	0.44	2.31	1.24	1.24	1.08	2.46	2.10	2.17	13	10	73	4	0	35
1024-1	FWD	10	61	24	137	0	0	100	0	57	43	0	72	28	0.17	1.74	0.35	0.32	0.40	2.25	1.22	1.15	0.58	2.34	1.97	2.03	27	49	23	0	0	35
	AFT	9	61	21	136	0	0	100	0	28	72	0	82	18	0.20	1.22	0.40	0.37	0.48	2.32	1.30	1.24	0.94	2.40	1.97	2.06	13	46	39	2	0	35
1024-2	FWD	9	79	11	151	0	0	100	12	19	69	0	25	75	0.24	1.17	0.46	0.42	0.35	2.40	1.30	1.27	1.01	2.45	1.91	1.99	36	3	58	2	0	35
	AFT	8	79	9	151	0	0	100	1	22	77	0	66	34	0.20	1.39	0.47	0.40	0.29	2.26	1.31	1.32	0.90	2.40	1.89	1.95	20	25	50	5	0	35
1025-1	FWD	1	70	-123	-18	0	68	32	10	41	49	0	56	44	0.18	1.42	0.43	0.37	0.29	2.36	1.37	1.39	0.42	2.35	1.81	1.92	33	25	38	4	1	35
	AFT	0	70	-121	-19	0	72	28	8	49	43	0	61	39	0.18	1.69	0.49	0.42	0.26	2.26	1.33	1.38	0.23	2.32	1.75	1.90	25	20	47	7	1	35
1025-2	FWD	0	56	-124	-31	0	71	29	3	42	55	0	56	44	0.18	1.22	0.45	0.39	0.26	2.24	1.32	1.33	0.63	2.29	1.78	1.89	29	21	45	4	0	22
	AFT	0	56	-122	-33	0	73	27	3	45	52	0	51	49	0.21	1.32	0.53	0.40	0.39	2.16	1.31	1.35	0.48	2.23	1.71	1.79	19	12	61	8	0	22
1026-1	FWD	0	57	23	135	0	4	96	0	21	79	0	24	76	0.20	1.26	0.38	0.33	0.31	2.27	1.22	1.22	0.40	2.28	1.77	1.87	57	13	28	2	0	45
	AFT	0	57	21	135	0	5	95	0	4	96	0	38	62	0.20	1.16	0.39	0.34	0.24	2.36	1.29	1.30	0.37	2.40	1.78	1.86	39	27	33	1	0	45
1026-2	FWD	1	72	8	84	0	0	100	1	5	94	0	5	95	0.19	1.32	0.36	0.30	0.23	2.17	1.05	1.02	0.48	2.24	1.63	1.70	78	2	19	1	0	50
	AFT	0	57	13	78	0	0	100	2	5	93	0	15	85	0.21	1.35	0.39	0.32	0.27	2.20	1.08	1.03	0.30	2.26	1.61	1.70	60	12	25	3	0	50
1027-1	FWD	3	63	26	110	0	0	100	0	0	100	0	3	97	0.26	1.54	0.52	0.46	0.50	2.36	1.45	1.52	0.71	2.39	2.03	2.10	36	2	58	4	0	50
	AFT	2	63	26	108	0	0	100	0	21	79	0	20	80	0.26	1.34	0.58	0.53	0.54	2.30	1.46	1.46	0.40	2.40	1.96	2.06	12	3	78	7	0	50
1028-1	FWD	3	73	15	135	0	4	96	0	4	96	0	11	89	0.22	1.08	0.37	0.32	0.40	2.32	1.42	1.42	0.62	2.30	1.77	1.83	65	6	26	1	0	30
	AFT	1	73	14	133	0	5	95	0	16	84	0	11	89	0.20	1.01	0.41	0.36	0.30	2.23	1.35	1.40	0.68	2.26	1.72	1.77	56	5	37	1	0	30
1028-2	FWD	2	81	5	48	0	3	97	1	9	90	0	15	85	0.23	0.98	0.40	0.35	0.37	2.20	1.36	1.38	0.30	2.33	1.72	1.77	59	3	37	1	0	30
	AFT	1	80	5	43	0	10	90	0	6	94	0	6	94	0.22	1.40	0.50	0.40	0.28	2.21	1.40	1.43	0.30	2.35	1.69	1.75	47	1	44	7	1	30
1029-1	FWD	3	63	18	130	0	8	92	1	16	83	0	14	86	0.25	1.80	0.64	0.54	0.50	2.30	1.72	1.76	0.48	2.39	2.03	2.08	20	0	62	14	3	35
	AFT	2	62	16	128	0	20	80	0	21	79	0	25	75	0.16	1.73	0.57	0.48	0.20	2.32	1.62	1.65	0.36	2.40	1.91	1.95	24	5	59	10	1	35
1029-2	FWD	0	80	4	146	0	4	96	2	28	70	0	20	80	0.22	1.68	0.54	0.45	0.31	2.35	1.52	1.59	0.45	2.40	1.88	2.00	33	5	50	11	2	25
	AFT	0	80	3	145	0	10	90	2	24	74	0	25	75	0.20	1.58	0.56	0.49	0.30	2.34	1.52	1.60	0.34	2.40	1.87	1.93	23	5	59	11	2	25
1030-1	FWD	5	63	27	130	0	58	42	3	32	65	1	52	47	0.30	1.86	0.81	0.75	0.61	2.34	1.75	1.79	0.78	2.38	2.01	2.08	4	3	61	28	5	40
	AFT	4	63	22	129	0	53	47	0	46	54	0	71	29	0.25	1.64	0.76	0.69	0.66	2.30	1.69	1.74	1.00	2.40	1.97	2.05	1	9	64	22	4	40
1030-2	FWD	3	78	10	158	1	42	57	0	53	47	0	70	30	0.24	1.65	0.64	0.57	0.76	2.26	1.69	1.70	1.17	2.36	1.99	2.05	5	9	71	13	2	30
	AFT	2	79	7	157	1	23	76	0	28	72	0	30	70	0.34	1.94	0.82	0.77	0.83	2.40	1.79	1.82	0.63	2.43	2.06	2.10	2	0	66	30	2	30
1031-1	FWD	17	70	20	140	0	99	1	18	34	48	0	51	49	0.25	1.67	0.71	0.63	0.72	2.33	1.74	1.80	1.36	2.44	2.10	2.18	2	8	70	17	3	45
	AFT	17	70	18	140	0	14	86	15	43	42	0	47	53	0.24	1.66	0.71	0.62	0.53	2.35	1.65	1.70	1.15	2.35	2.00	2.05	4	4	70	18	4	45
1031-2	FWD	19	82	6	67	0	99	1	8	53	39	0	60	40	0.26	1.88	0.80	0.72	0.40	2.34	1.73	1.82	1.40	2.57	2.05	2.09	0	5	64	22	9	40
	AFT	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					—	—	—	—	—	—
1033-1	FWD	10	47	46	135	0	89	11	0	3	97	0	2	98	0.28	1.10	0.54	0.50	0.70	2.28	1.35	1.30	1.26	2.42	2.15	2.20	11	1	85	3	0	45
	AFT	11	47	45	135	0	10	90	3	8	89	0	3	97	0.30	1.20	0.53	0.50	0.64	2.32	1.40	1.40	0.84	2.44	2.13	2.20	8	1	90	1	0	45
1033-2	FWD	0	54	34	131	0	84	16	1	4	95	0	0	100	0.30	1.52	0.53	0.49	0.49	2.30	1.30	1.26	0.54	2.41	2.15	2.21	16	0	79	5	0	50
	AFT	0	54	34	131	0	86	14	0	5	95	0	1	99	0.26	1.38	0.54	0.50	0.50	2.32	1.25	1.20	0.38	2.44	2.15	2.24	12	0	84	4	0	50

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TABLE 10-3

EXPOSURE - PROCESSING SUMMARY

~~TOP SECRET~~ C/[redacted]

MISSION NUMBER	CAMERA	SOLAR ELEVATION RANGE (°) LOW	SOLAR ELEVATION RANGE (°) HIGH	SOLAR AZIMUTH RANGE (°) LOW	SOLAR AZIMUTH RANGE (°) HIGH	PREDICTED PROCESSING (%) P	PREDICTED PROCESSING (%) I	PREDICTED PROCESSING (%) F	REPORTED PROCESSING (%) P	REPORTED PROCESSING (%) I	REPORTED PROCESSING (%) F	COMPUTED PROCESSING (%) P	COMPUTED PROCESSING (%) I	COMPUTED PROCESSING (%) F
1034-1	FWD	23	77	15	165	0	96	4	3	21	76	0	20	80
	AFT	23	77	10	165	0	55	45	2	31	67	0	16	84
1034-2	FWD	29	86	0	178	0	88	12	9	26	65	0	27	73
	AFT	30	86	0	178	0	41	59	6	37	57	0	34	66
1035-1	FWD	13	68	19	144	0	17	83	0	11	89	0	5	95
	AFT	13	68	18	144	0	5	95	1	14	85	0	9	91
1035-2	FWD	4	81	10	158	0	22	78	4	18	78	0	18	82
	AFT	3	81	8	158	0	23	77	1	20	79	0	12	88
1036-1	FWD	13	82	7	170	0	66	34	8	14	78	1	14	85
	AFT	15	83	5	171	0	5	95	3	9	88	0	10	90
1036-2	FWD	10	78	12	167	0	15	85	1	19	80	0	18	82
	AFT	12	78	9	168	0	4	96	3	20	77	0	17	83
1037-1	FWD	9	84	-172	-6	0	29	71	8	10	82	0	11	89
	AFT	9	84	-171	-6	0	25	75	0	19	81	0	12	88
1037-2	FWD	8	87	-175	-3	0	25	75	14	26	60	0	12	88
	AFT	8	87	-173	-3	0	24	76	11	33	56	0	23	77
1038-1	FWD	5	68	18	131	0	22	70	2	16	82	1	15	64
	AFT	5	69	18	130	0	22	78	1	13	86	0	14	86
1038-2	FWD	7	80	1	164	1	37	62	0	15	85	0	13	88
	AFT	7	80	1	164	3	29	68	0	27	73	0	26	74
1039-1	FWD	7	65	27	140	0	62	38	8	22	70	1	24	75
	AFT	7	65	25	140	0	30	40	6	30	64	0	31	69
1039-2	FWD	8	75	10	144	4	61	35	19	38	43	3	41	56
	AFT	8	75	10	144	2	47	51	20	45	35	7	57	36
1040-1	FWD	11	73	-149	-15	0	79	21	10	31	59	2	35	63
	AFT	11	73	-149	-16	0	67	33	14	42	44	2	53	45
1040-2	FWD	12	68	-149	-21	0	66	34	7	30	63	3	29	68
	AFT	11	66	-149	-24	1	58	41	3	35	62	0	32	68
1041-1	FWD	10	66	30	129	0	100	0	7	40	53	0	46	54
	AFT	9	69	21	129	0	99	1	9	43	48	0	47	53
1041-2	FWD	28	78	14	126	1	99	0	7	26	67	0	23	77
	AFT	28	80	11	130	1	99	0	6	30	64	0	30	70
1042-1	FWD	9	76	16	163	0	19	81	9	9	82	0	15	85
	AFT	9	76	15	164	0	7	93	5	8	87	0	13	77
1042-2	FWD	37	88	-179	177	0	11	89	5	16	79	0	11	89
	AFT	37	88	-179	177	0	10	90	8	16	76	0	10	90
1043-1	FWD	12	74	16	156	0	20	80	6	26	68	4	26	70
	AFT	12	74	12	157	0	3	97	9	12	79	2	27	71
1043-2	FWD	19	86	-175	179	1	19	80	5	16	79	0	39	61
	AFT	19	86	-175	179	0	7	93	14	21	65	2	36	62
1101-1	FWD	17	86	-179	178		*		5	7	83	0	14	86
	AFT	16	86	-179	178				0	11	89	0	26	74
1101-2	FWD	9	78	-151	-10				4	11	85	0	14	86
	AFT	3	78	-150	-11				5	8	87	0	14	86

MISSION NUMBER	CAMERA	TERRAIN D-MIN RANGE LOW	TERRAIN D-MIN RANGE HIGH	TERRAIN D-MIN MEAN	TERRAIN D-MIN MEDIAN	TERRAIN D-MAX RANGE LOW	TERRAIN D-MAX RANGE HIGH	TERRAIN D-MAX MEAN	TERRAIN D-MAX MEDIAN	CLOUD D-MAX RANGE LOW	CLOUD D-MAX RANGE HIGH	CLOUD D-MAX MEAN	CLOUD D-MAX MEDIAN
1034-1	FWD	0.25	1.80	0.57	0.50	0.55	2.42	1.58	1.61	0.88	2.45	2.22	2.26
	AFT	0.29	1.63	0.56	0.50	0.41	2.35	1.55	1.60	0.97	2.44	2.19	2.25
1034-2	FWD	0.19	1.52	0.57	0.52	0.72	2.40	1.63	1.60	1.21	2.47	2.25	2.31
	AFT	0.26	1.60	0.54	0.49	0.70	2.32	1.59	1.62	1.08	2.48	2.22	2.29
1035-1	FWD	0.28	1.90	0.52	0.45	0.61	2.44	1.40	1.40	1.06	2.43	2.15	2.22
	AFT	0.24	1.39	0.50	0.43	0.60	2.42	1.48	1.53	0.90	2.55	2.15	2.24
1035-2	FWD	0.21	1.50	0.52	0.47	0.43	2.33	1.32	1.30	0.96	2.50	2.09	2.18
	AFT	0.21	1.39	0.55	0.51	0.50	2.25	1.34	1.30	0.74	2.60	2.09	2.16
1036-1	FWD	0.20	1.91	0.48	0.42	0.80	2.40	1.54	1.53	1.10	2.47	2.26	2.33
	AFT	0.24	1.65	0.55	0.51	0.55	2.25	1.49	1.52	1.20	2.43	2.23	2.29
1036-2	FWD	0.26	1.43	0.47	0.42	0.50	2.20	1.30	1.36	1.18	2.60	2.12	2.16
	AFT	0.28	1.14	0.48	0.44	0.48	2.10	1.37	1.40	1.54	2.40	2.15	2.20
1037-1	FWD	0.31	1.47	0.64	0.58	0.61	2.38	1.54	1.53	1.05	2.46	2.07	2.14
	AFT	0.25	1.45	0.66	0.61	0.84	2.33	1.48	1.44	1.15	2.45	2.02	2.10
1037-2	FWD	0.26	1.20	0.66	0.61	0.82	2.43	1.51	1.46	0.90	2.50	2.04	2.12
	AFT	0.25	1.80	0.67	0.64	0.55	2.33	1.51	1.45	1.10	2.43	2.03	2.10
1038-1	FWD	0.16	1.11	0.51	0.46	0.84	2.36	1.56	1.52	1.18	2.46	2.11	2.19
	AFT	0.25	1.37	0.53	0.47	0.52	2.31	1.53	1.52	1.13	2.43	2.05	2.16
1038-2	FWD	0.21	1.40	0.58	0.51	0.55	2.42	1.57	1.54	1.00	2.50	1.99	2.06
	AFT	0.19	1.78	0.61	0.49	0.47	2.38	1.56	1.57	0.35	2.48	1.96	2.01
1039-1	FWD	0.24	1.53	0.65	0.58	0.79	2.39	1.78	1.60	1.11	2.68	2.14	2.18
	AFT	0.27	1.55	0.67	0.62	0.77	2.39	1.75	1.79	1.11	2.47	2.13	2.18
1039-2	FWD	0.30	1.38	0.65	0.59	1.06	2.36	1.69	1.66	0.84	2.50	2.04	2.12
	AFT	0.27	1.60	0.67	0.65	0.93	2.30	1.61	1.60	0.77	2.51	2.02	2.09
1040-1	FWD	0.25	1.71	0.71	0.68	0.94	2.38	1.71	1.74	1.18	2.40	2.04	2.10
	AFT	0.26	1.62	0.66	0.60	0.85	2.38	1.65	1.64	0.96	2.41	2.04	2.15
1040-2	FWD	0.24	1.67	0.77	0.72	0.77	2.58	1.61	1.61	1.09	2.45	2.01	2.06
	AFT	0.11	1.43	0.68	0.63	0.90	2.43	1.72	1.74	1.07	2.45	2.00	2.12
1041-1	FWD	0.14	2.14	0.56	0.51	0.62	2.33	1.62	1.58	0.17	2.46	2.19	2.26
	AFT	0.22	1.62	0.62	0.57	0.92	2.33	1.62	1.58	0.15	2.43	2.15	2.23
1041-2	FWD	0.31	1.51	0.66	0.62	0.70	2.38	1.54	1.51	1.40	2.46	2.15	2.19
	AFT	0.17	1.42	0.60	0.57	0.62	2.37	1.55	1.54	1.05	2.47	2.19	2.25
1042-1	FWD	0.33	1.47	0.63	0.57	0.89	2.33	1.53	1.55	1.45	2.49	2.22	2.26
	AFT	0.14	1.44	0.62	0.57	0.61	2.31	1.52	1.53	0.93	2.49	2.15	2.21
1042-2	FWD	0.14	1.26	0.54	0.47	0.52	2.39	1.48	1.55	0.35	2.45	2.17	2.25
	AFT	0.15	1.31	0.52	0.47	0.62	2.37	1.47	1.48	0.85	2.39	2.17	2.25
1043-1	FWD	0.15	1.63	0.54	0.47	0.61	2.25	1.40	1.39	0.98	2.41	2.13	2.16
	AFT	0.24	1.89	0.59	0.53	0.61	2.29	1.42	1.43	1.11	2.44	2.16	2.23
1043-2	FWD	0.19	1.32	0.54	0.50	0.66	2.39	1.39	1.39	0.84	2.44	2.18	2.23
	AFT	0.25	1.32	0.54	0.50	0.55	2.08	1.27	1.27	1.09	2.46	2.02	2.06
1101-1	FWD	0.20	1.25	0.46	0.39	0.48	2.24	1.31	1.30	1.09	2.30	2.01	2.06
	AFT	0.26	1.65	0.52	0.46	0.68	2.23	1.35	1.36	1.01	2.38	2.02	2.06
1101-2	FWD	0.18	1.29	0.47	0.42	0.34	2.23	1.27	1.29	0.91	2.36	1.93	2.02
	AFT	0.21	1.20	0.49	0.44	0.54	2.25	1.24	1.24	0.22	2.32	1.90	2.01

MISSION NUMBER	CAMERA	UNDER EXPOSED (%)	UNDER PROCESSED (%)	NOMINAL EXP. & PRO. (%)	OVER PROCESSED (%)	OVER EXPOSED (%)	CLOUD COVER (%)
1034-1	FWD	18	3	70	7	2	35
	AFT	13	4	71	7	0	35
1034-2	FWD	12	4	76	8	0	45
	AFT	12	10	73	4	2	45
1035-1	FWD	23	1	71	4	1	30
	AFT	27	3	66	5	0	30
1035-2	FWD	24	5	66	4	0	40
	AFT	14	3	76	7	0	40
1036-1	FWD	33	5	59	2	1	.40
	AFT	12	2	80	5	0	40
1036-2	FWD	38	6	53	3	0	35
	AFT	28	4	64	4	0	35
1037-1	FWD	4	1	83	12	0	35
	AFT	3	2	79	16	0	35
1037-2	FWD	4	0	84	13	0	30
	AFT	4	5	77	14	0	30
1038-1	FWD	29	3	65	3	0	35
	AFT	33	3	57	6	0	35
1038-2	FWD	23	1	65	10	0	40
	AFT	14	12	56	17	1	40
1039-1	FWD	3	4	79	14	0	40
	AFT	4	3	77	15	1	40
1039-2	FWD	2	5	01	12	0	35
	AFT	1	4	81	12	2	35
1040-1	FWD	0	3	79	17	0	25
	AFT	1	6	79	13	1	25
1040-2	FWD	1	1	72	25	1	30
	AFT	3	2	78	16	0	30
1041-1	FWD	6	10	79	4	1	45
	AFT	1	5	86	8	1	45
1041-2	FWD	4	2	80	13	1	45
	AFT	9	3	83	5	0	45
1042-1	FWD	7	0	80	11	1	37
	AFT	5	1	83	11	0	37
1042-2	FWD	24	0	66	9	0	35
	AFT	20	2	75	4	0	35
1043-1	FWD	20	4	67	9	1	35
	AFT	16	2	71	8	2	35
1043-2	FWD	21	5	66	7	0	35
	AFT	18	11	64	6	1	35
1101-1	FWD	49	3	43	4	0	35
	AFT	22	7	67	4	0	35
1101-2	FWD	41	2	52	6	0	30
	AFT	34	1	62	3	0	30

* NOT APPLICABLE

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SECTION A

APPENDIX

MISSION * 1101-1 * INSTR * FWD * 1/17/68 PLOT OF D MIN * TERRAIN * PROCESSING * INTERMEDIATE
ARITH MEAN * 0.59 * MEDIAN * 0.55 * STD DEV * 0.24 * RANGE * 0.25 TO 1.17 WITH 31 SAMPLES

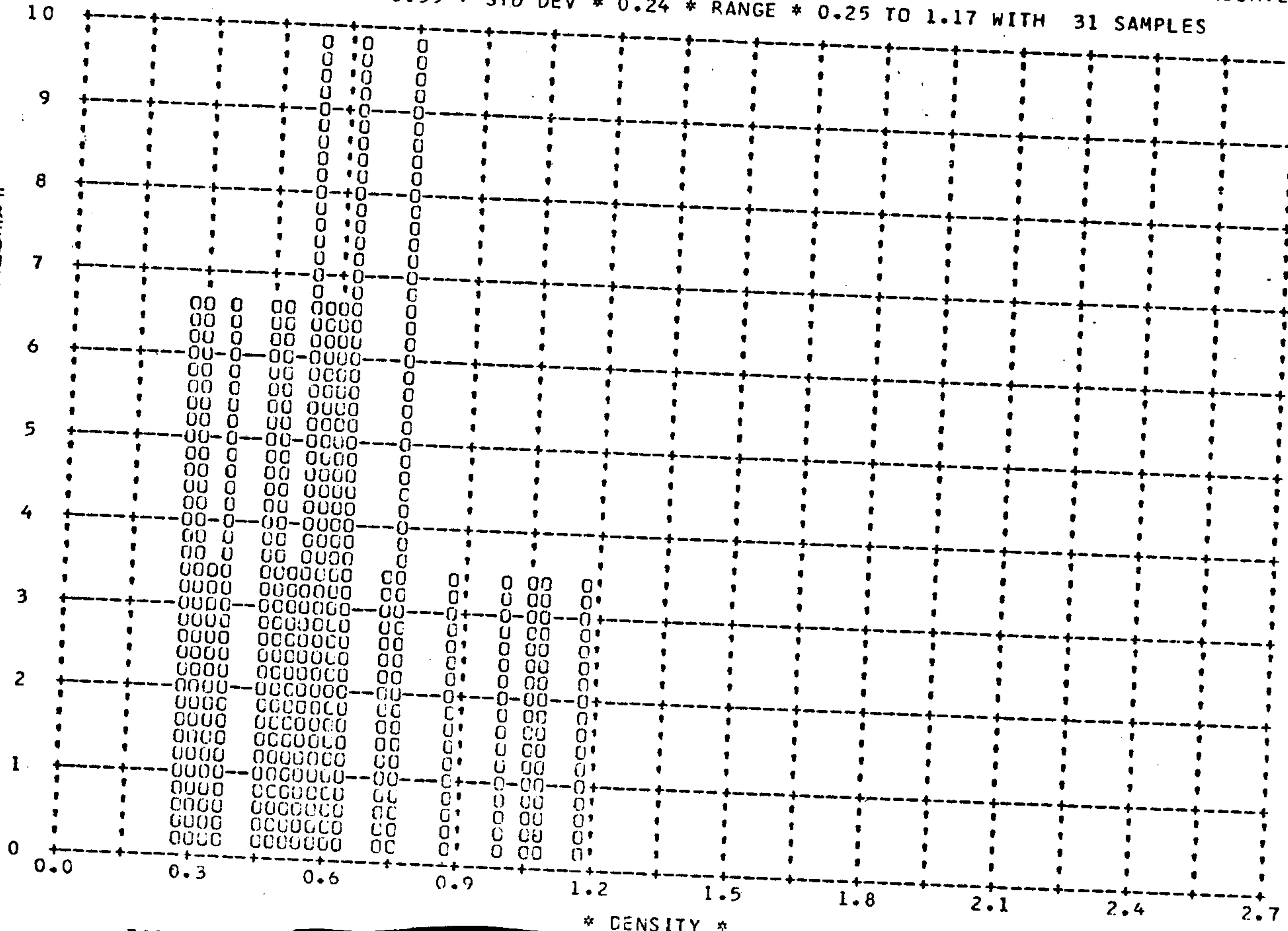

FIGURE A-1

TOP SECRET C [redacted]

MISSION * 1101-1 * INSTR * FWD * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * INTERMEDIATE

ARITH MEAN * 1.46 * MEDIAN * 1.44 * STD DEV * 0.29 * RANGE * 0.83 TO 2.12 WITH 31 SAMPLES

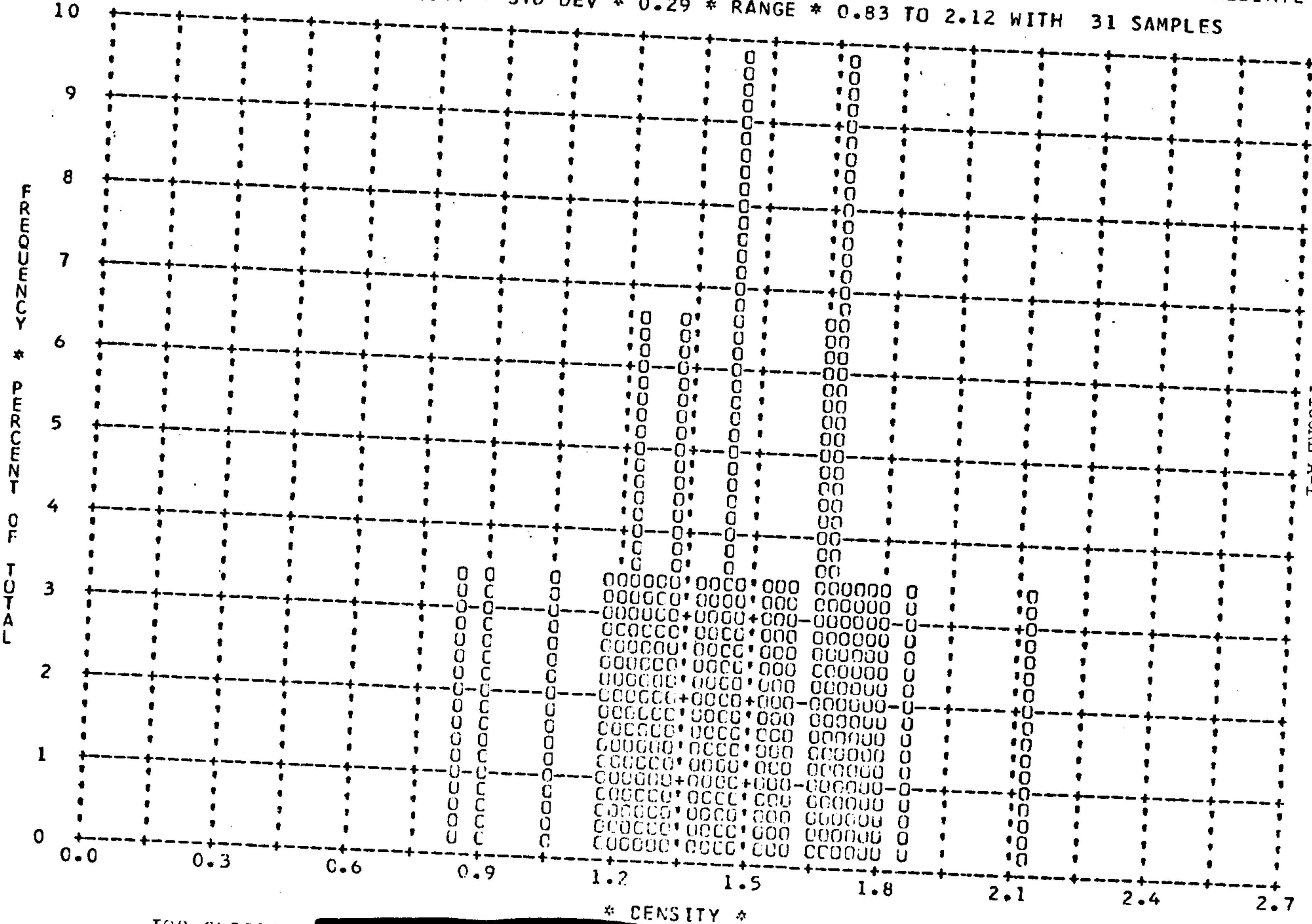

FIGURE A-1

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TOP SECRET C [redacted]

FIGURE A-1

MISSION * 1101-1 * INSTR * FWD * 1/17/68 PLOT OF D MAX * CLOUD * PROCESSING * INTERMEDIATE

ARITH MEAN * 1.87 * MEDIAN * 1.92 * STD DEV * 0.27 * RANGE * 1.09 TO 2.19 WITH 27 SAMPLES

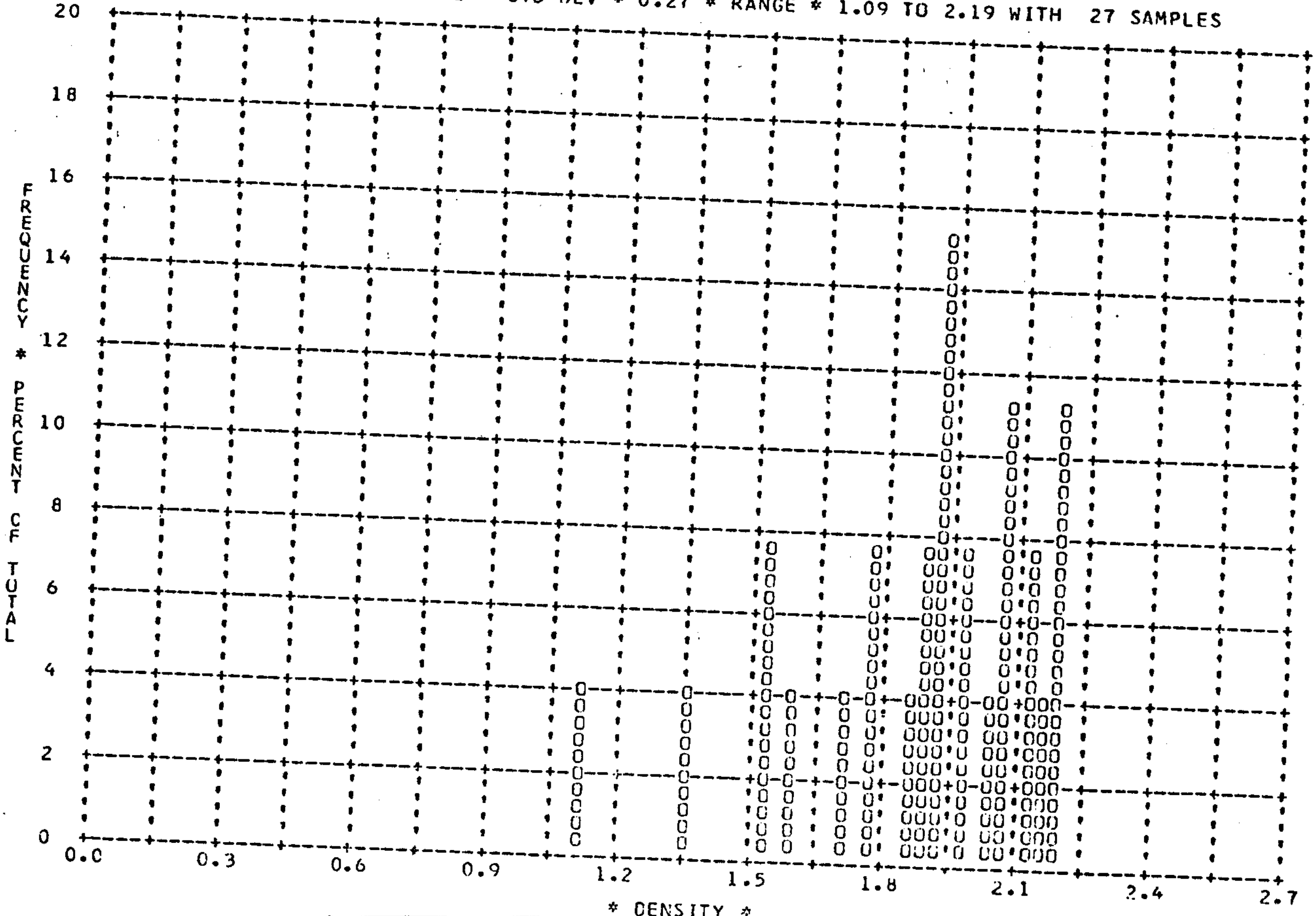

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FIGURE A-1

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MISSION * 1101-1 * INSTR * FWD * 1/17/68 PLOT OF D MIN * TERRAIN * PROCESSING * FULL
ARITH MEAN * 0.44 * MEDIAN * 0.38 * STD DEV * 0.19 * RANGE * 0.20 TO 1.25 WITH 194 SAMPLES

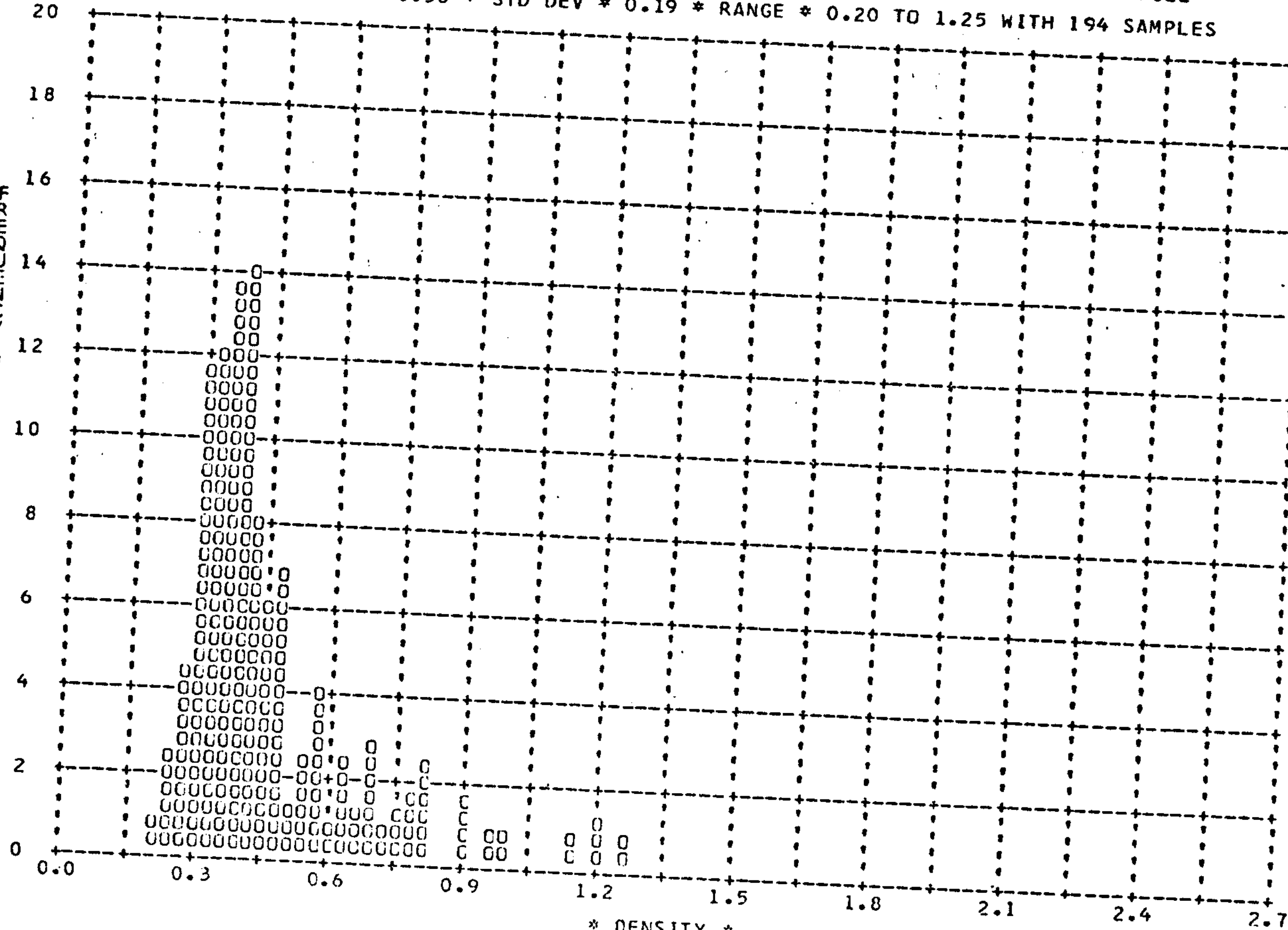

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FIGURE A-1

MISSION * 1101-1 * INSTR * FWD * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * FULL

ARITH MEAN * 1.29 * MEDIAN * 1.28 * STD DEV * 0.41 * RANGE * 0.48 TO 2.24 WITH 194 SAMPLES

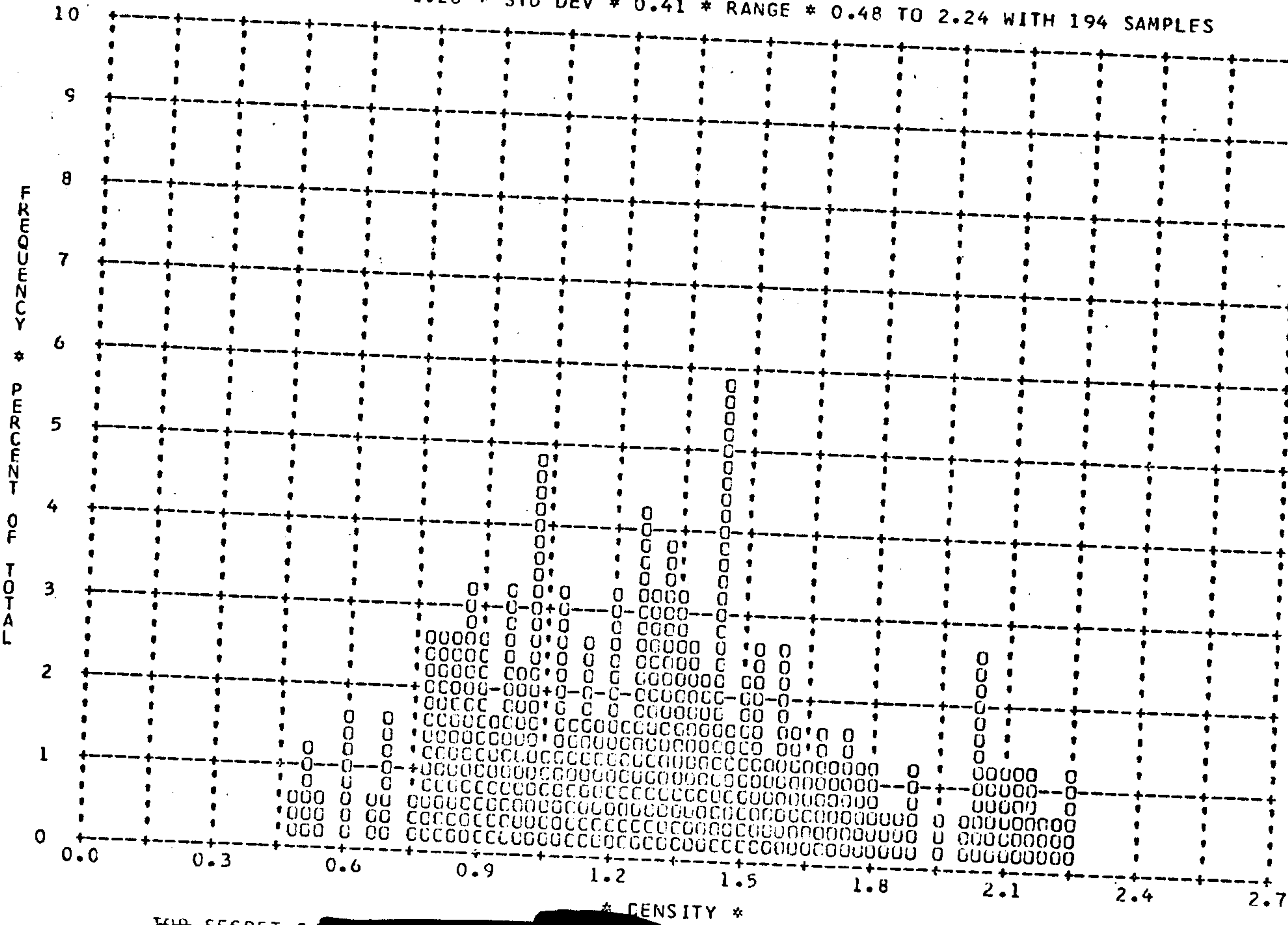

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FIGURE A-1

TOP SECRET C[redacted]

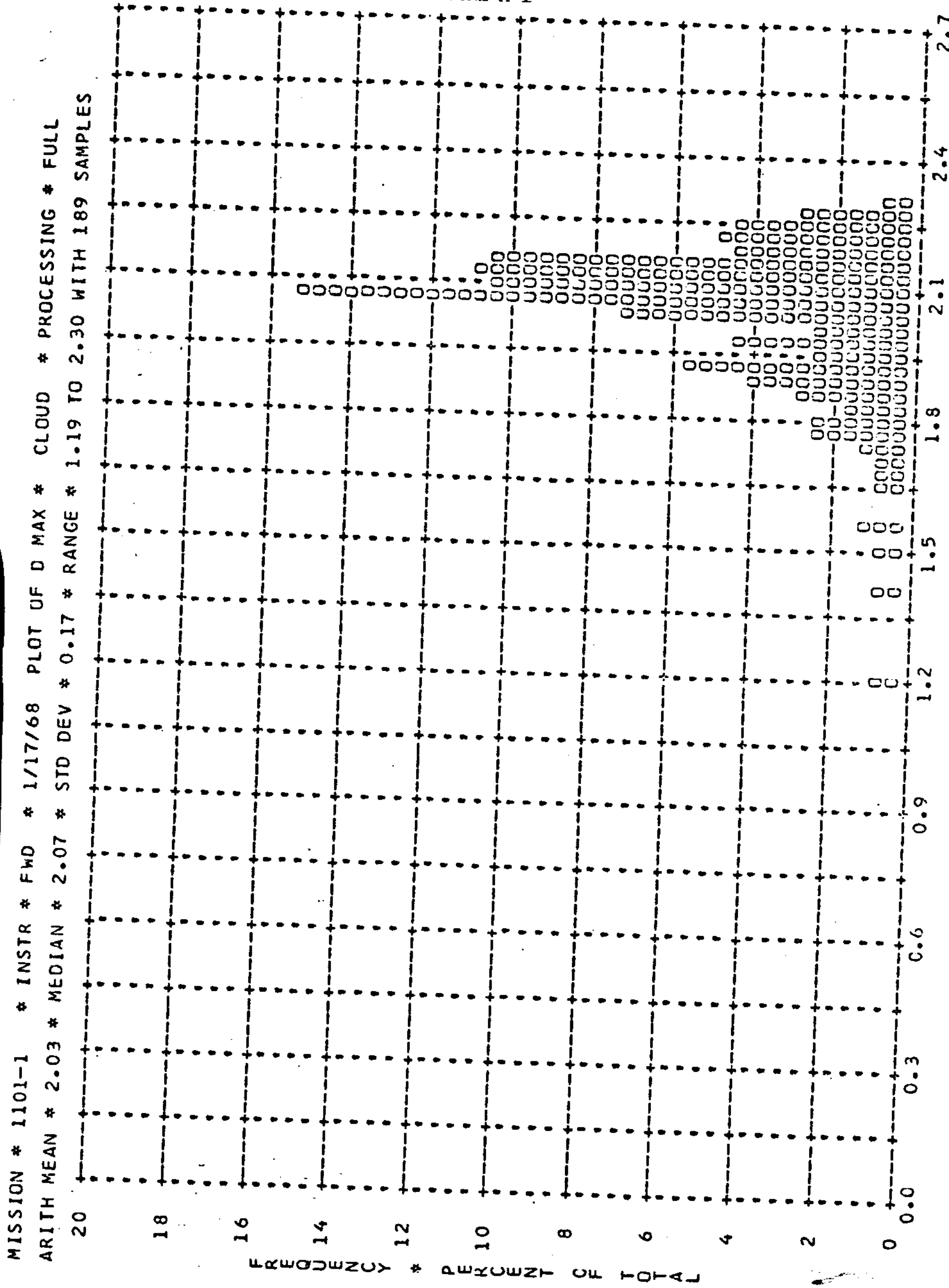

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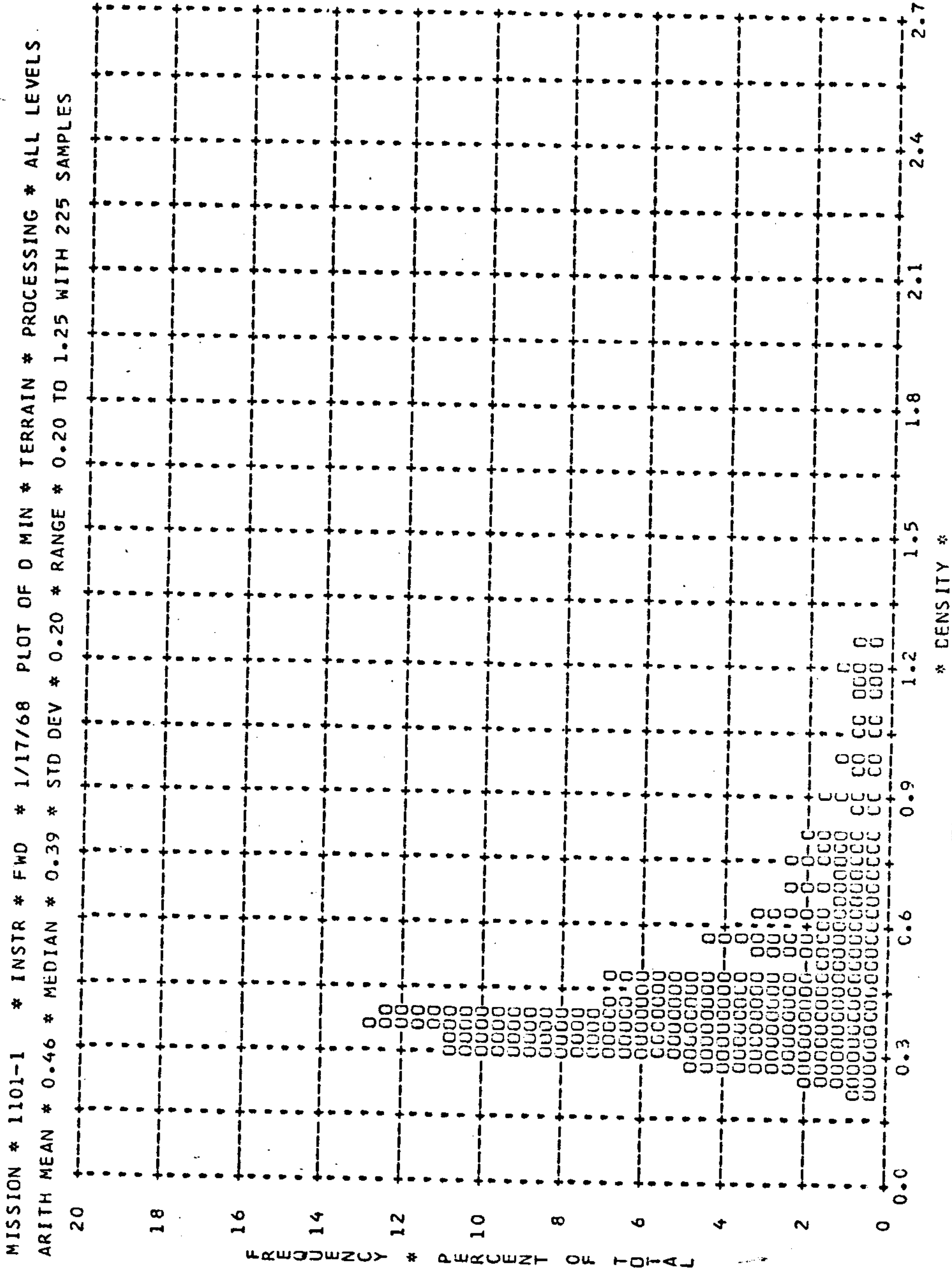
FIGURE A-1

TOP SECRET C[redacted]



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TOP SECRET C

FIGURE A-1

MISSION * 1101-1 * INSTR * FWD * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * ALL LEVELS
ARITH MEAN * 1.31 * MEDIAN * 1.30 * STD DEV * 0.40 * RANGE * 0.48 TO 2.24 WITH 225 SAMPLES

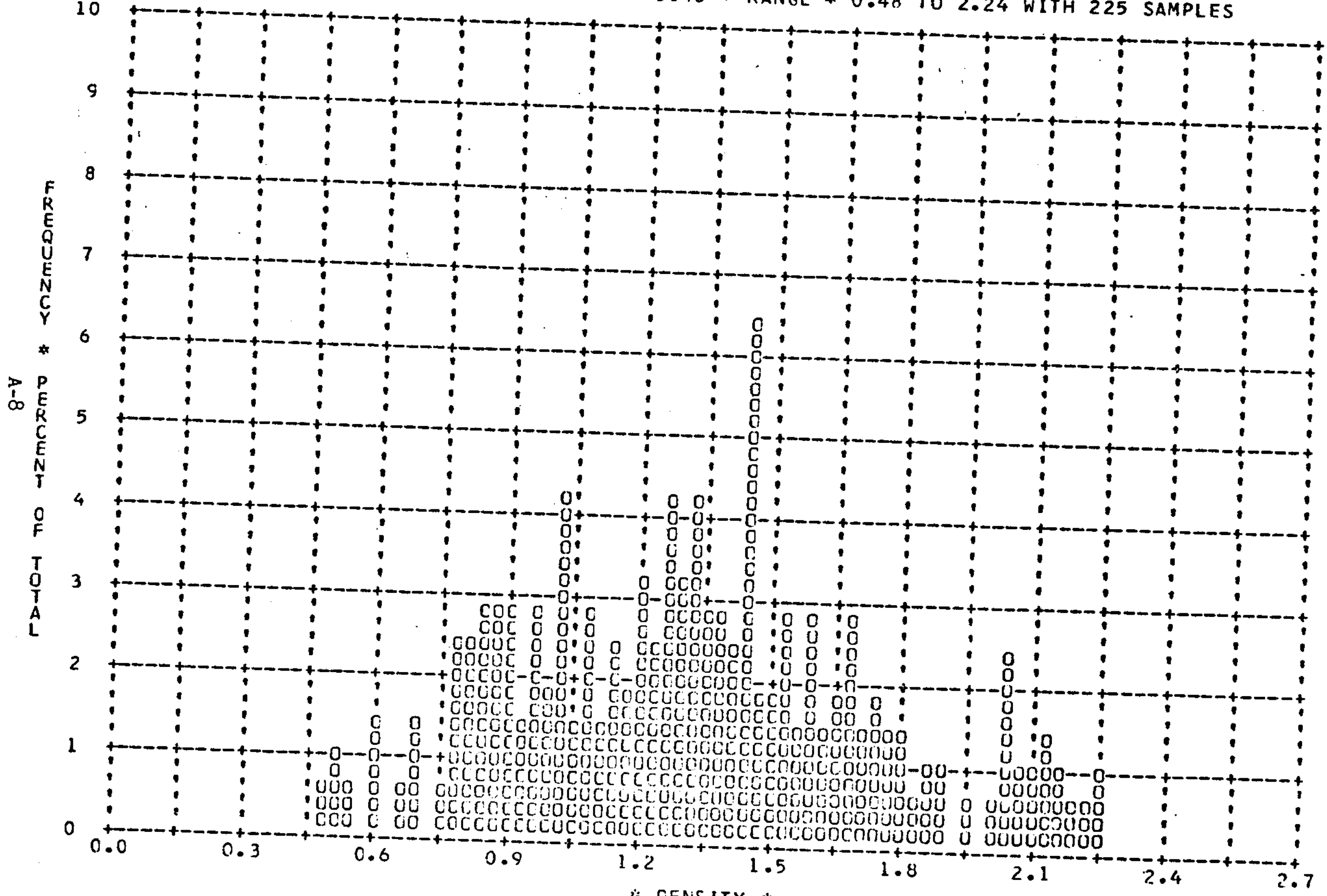
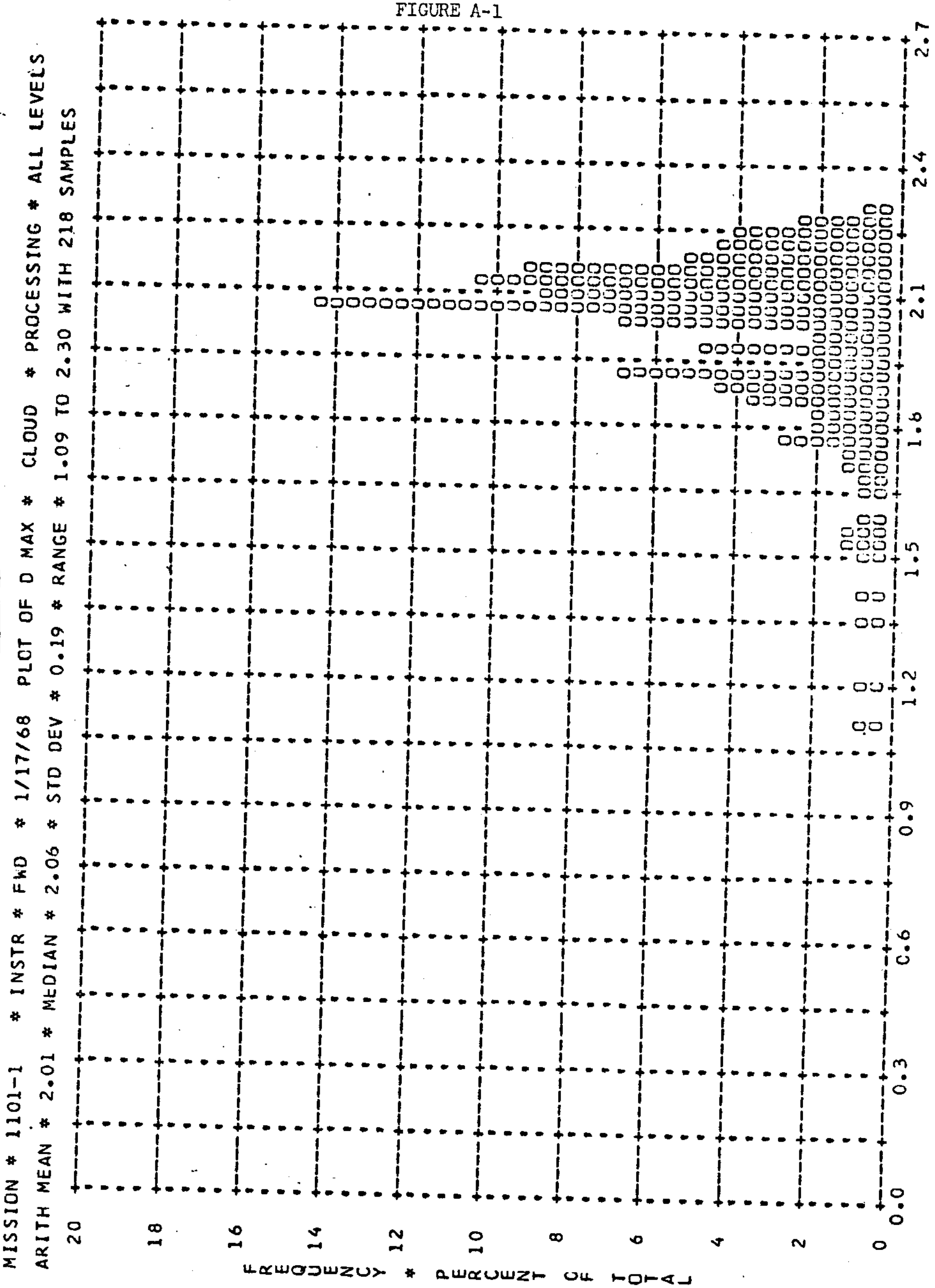


FIGURE A-1

TOP SECRET C[redacted]



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TOP SECRET C[redacted]

FIGURE A-2

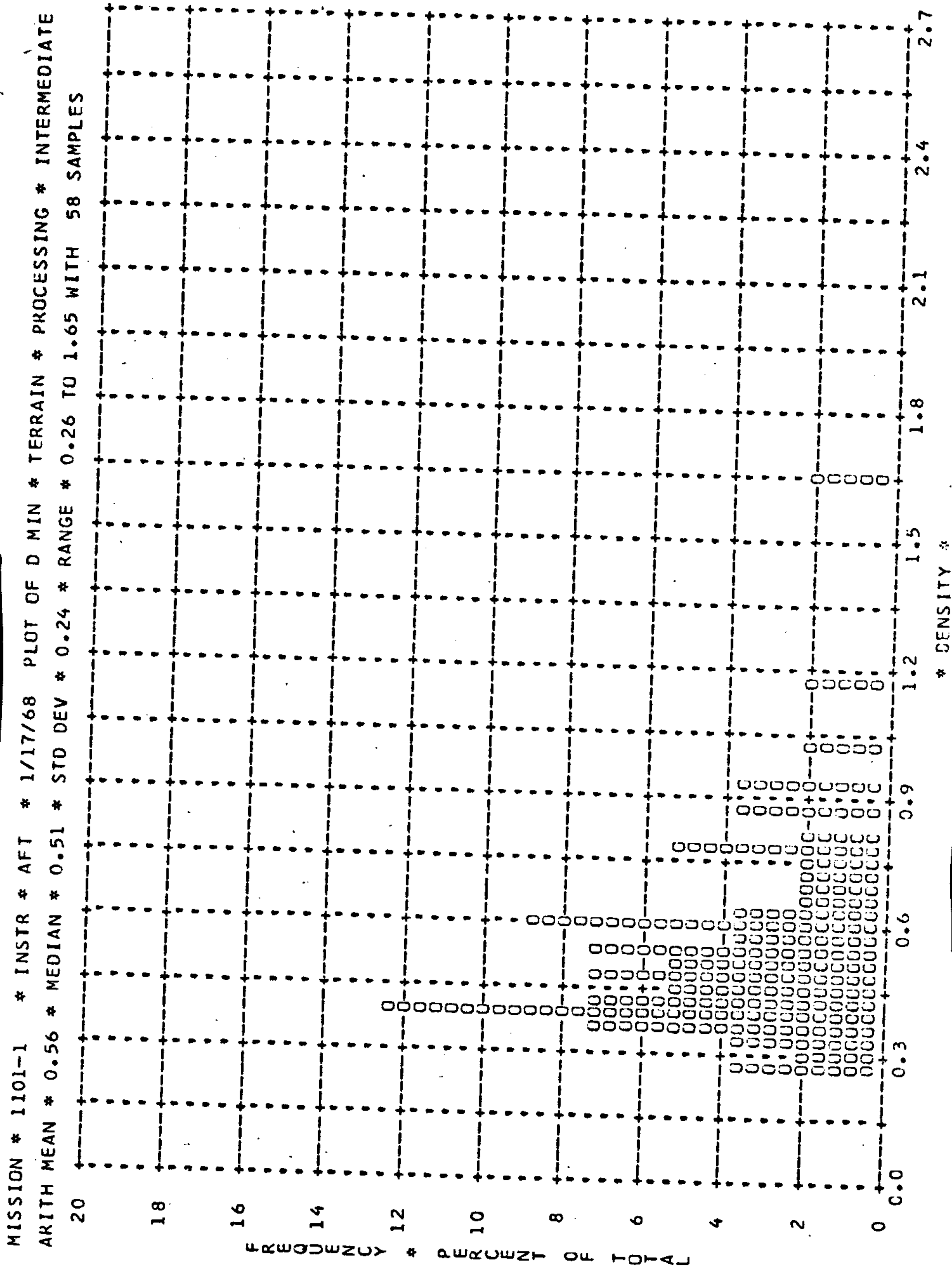

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FIGURE A-2

MISSION * 1101-1 * INSTR * AFT * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * INTERMEDIATE

ARITH MEAN * 1.43 * MEDIAN * 1.41 * STD DEV * 0.32 * RANGE * 0.80 TO 2.12 WITH 58 SAMPLES

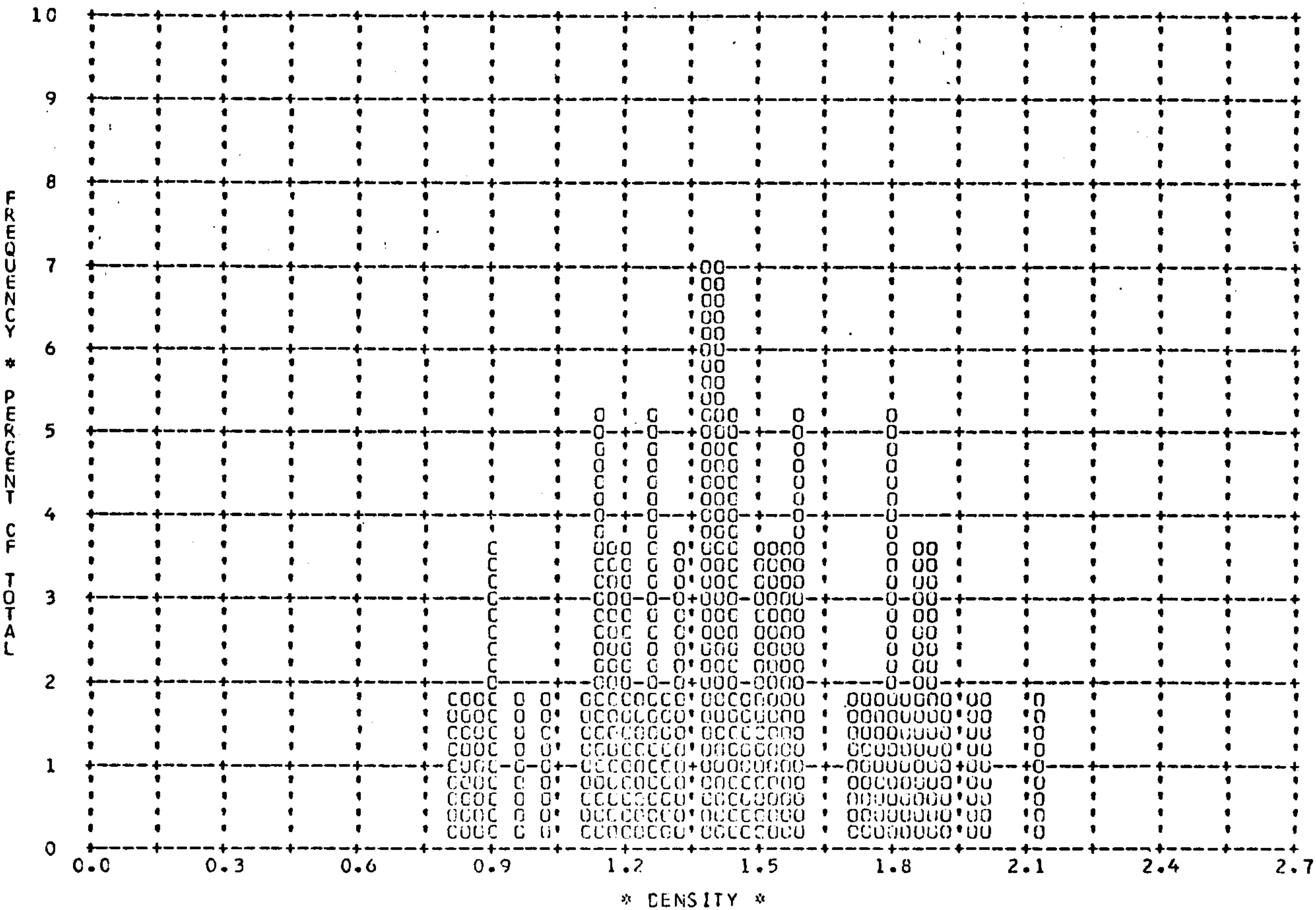

FIGURE A-2

MISSION * 1101-1 * INSTR * AFT * 1/17/68 PLOT OF D MAX * CLOUD * PROCESSING * INTERMEDIATE

ARITH MEAN * 1.97 * MEDIAN * 2.01 * STD DEV * 0.16 * RANGE * 1.58 TO 2.29 WITH 49 SAMPLES

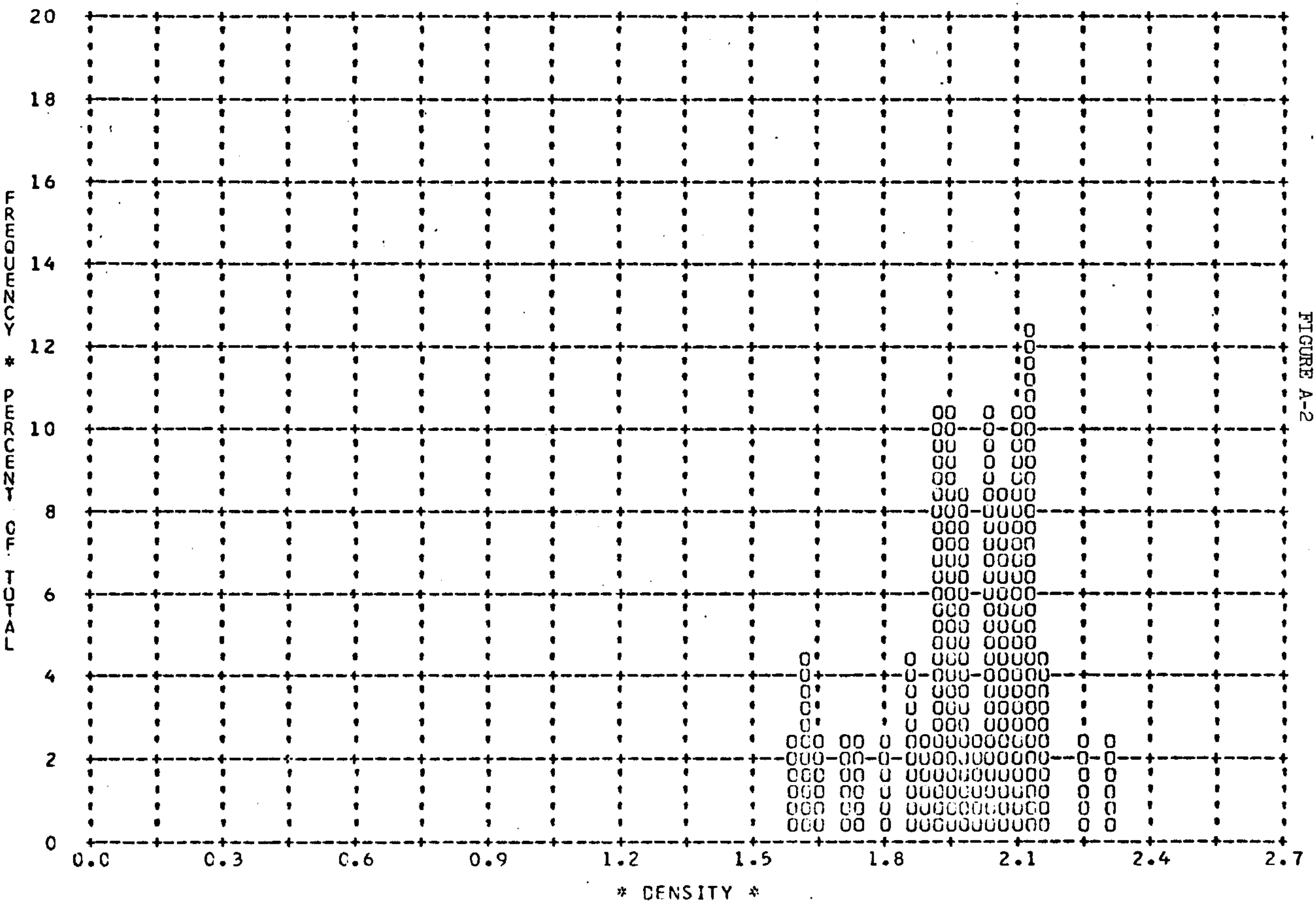

FIGURE A-2

MISSION * 1101-1 * INSTR * AFT * 1/17/68 PLOT OF D MIN * TERRAIN * PROCESSING * FULL

ARITH MEAN * 0.50 * MEDIAN * 0.46 * STD DEV * 0.16 * RANGE * 0.30 TO 1.24 WITH 166 SAMPLES

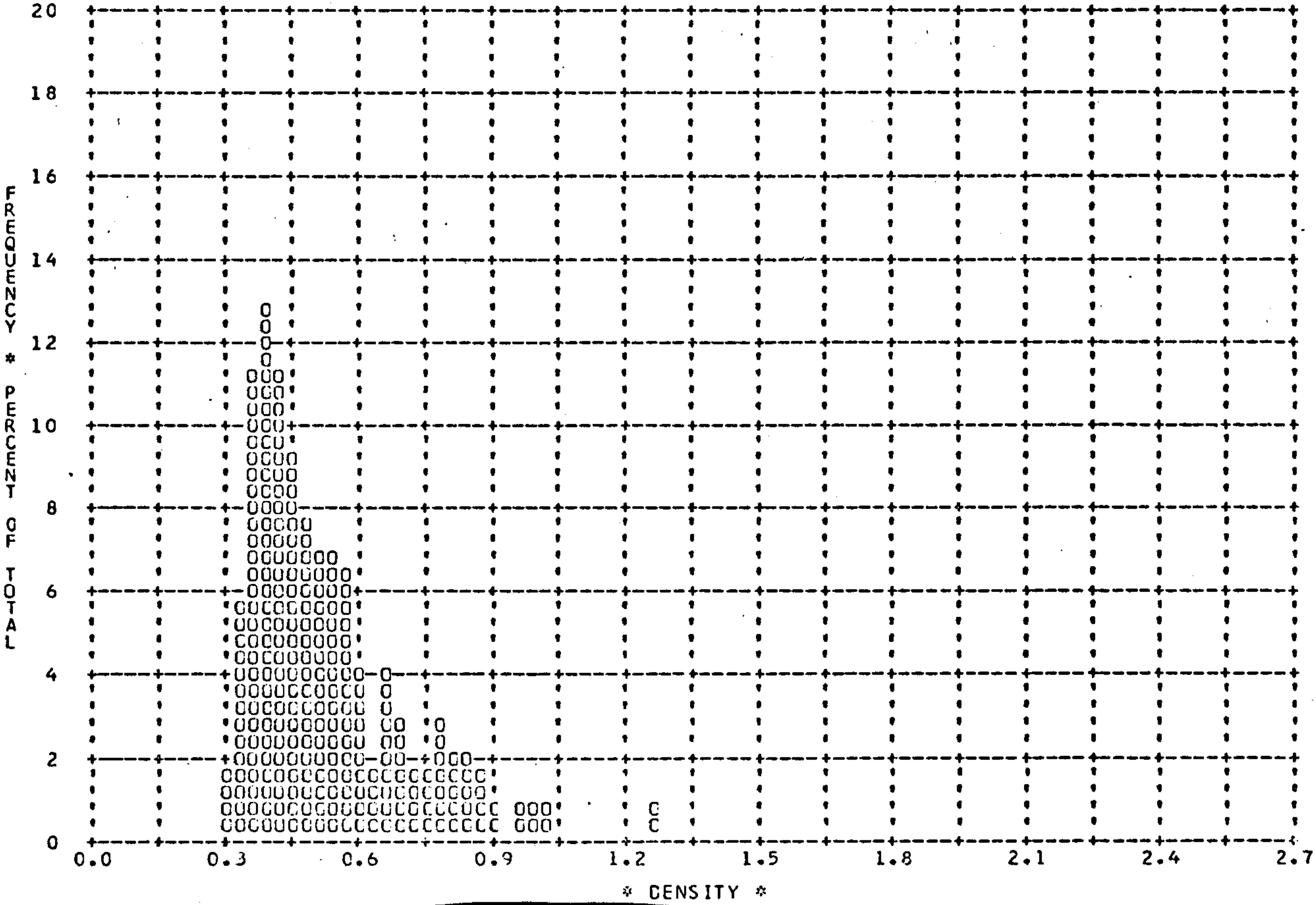

FIGURE A-2

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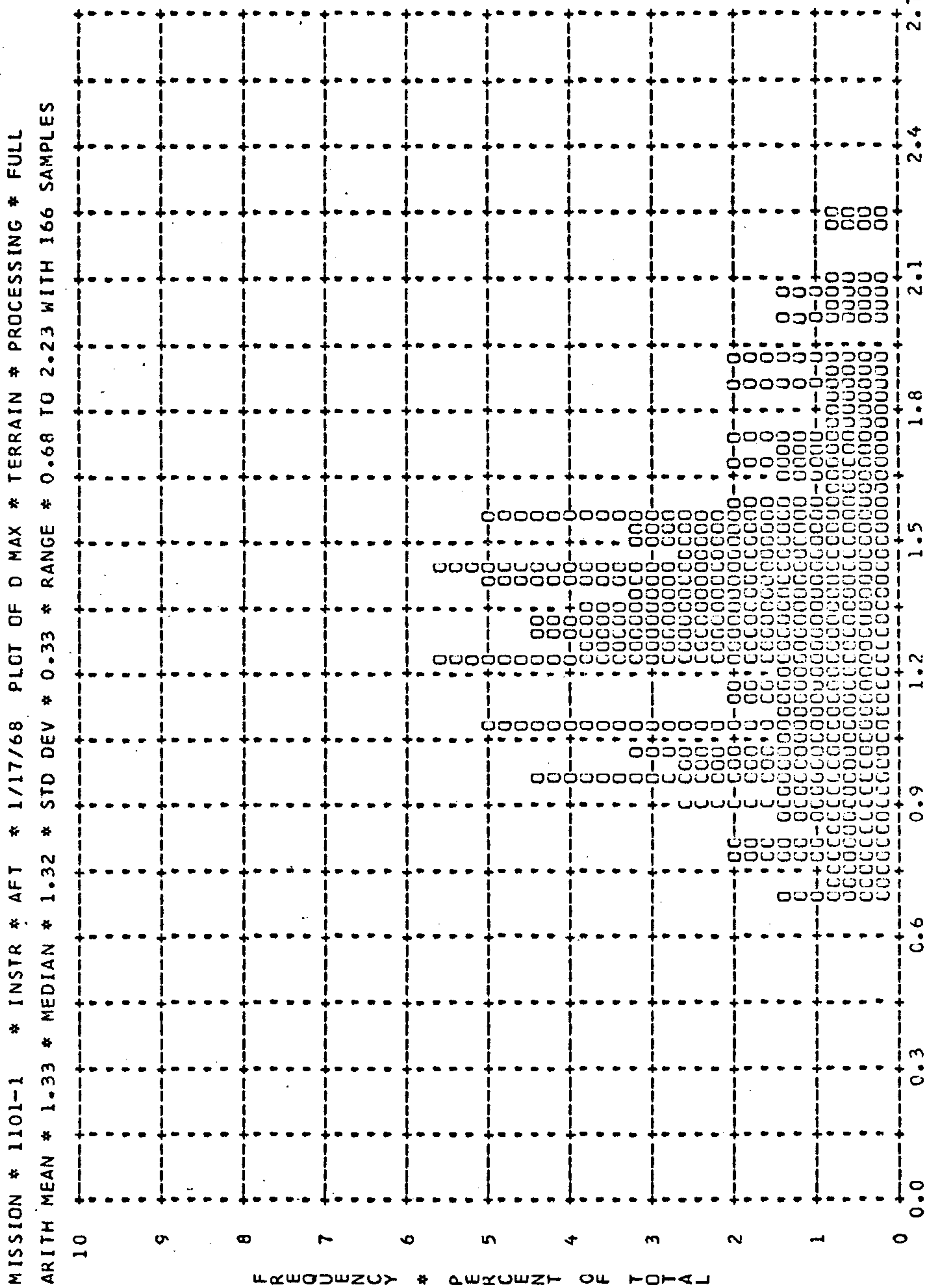

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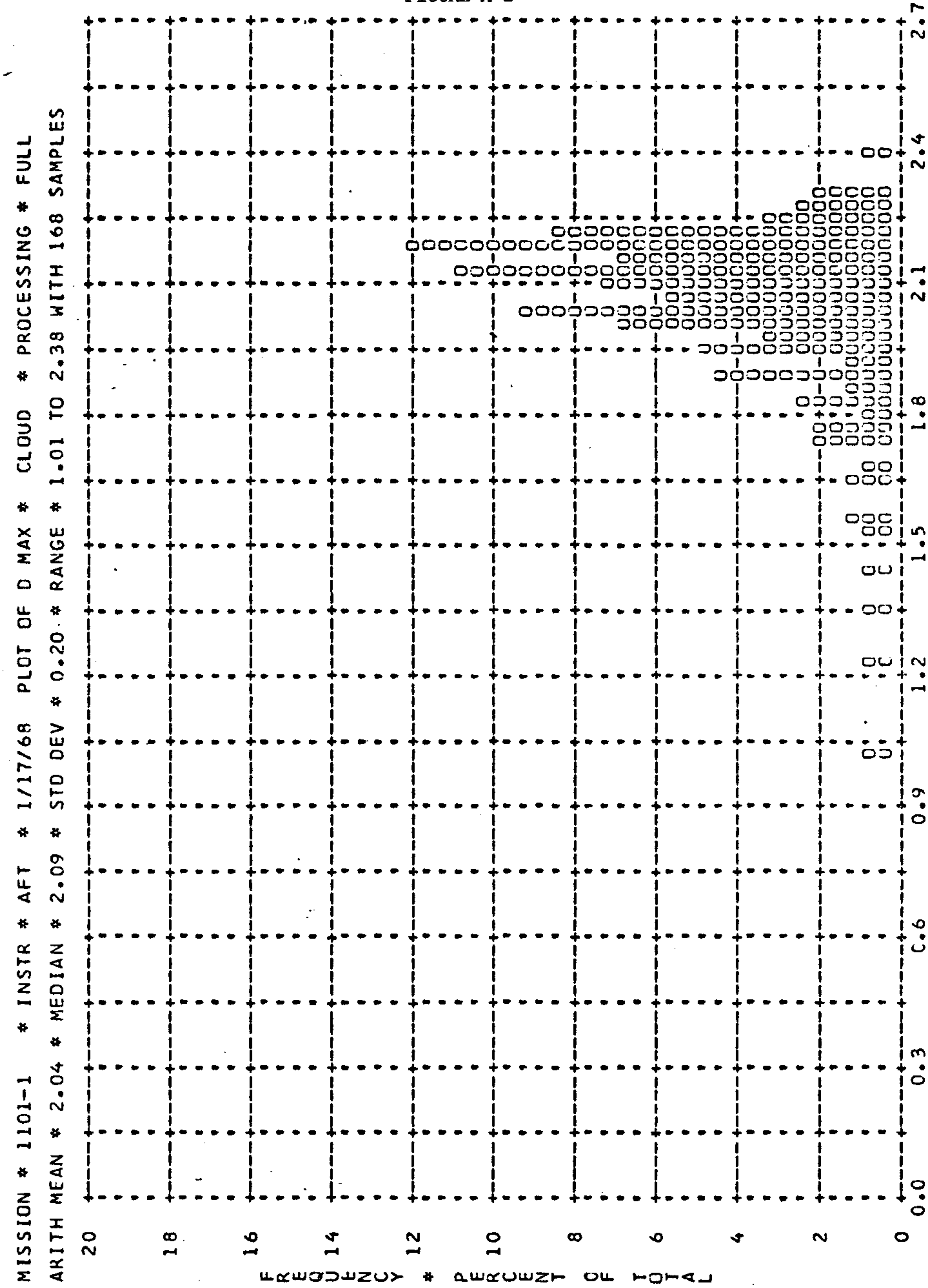
FIGURE A-2

TOP SECRET C[redacted]



[redacted]

TOP SECRET C

MISSION * 1101-1 * INSTR * AFT * 1/17/68 PLOT OF D MIN * TERRAIN * PROCESSING * ALL LEVELS
ARITH MEAN * 0.52 * MEDIAN * 0.46 * STD DEV * 0.19 * RANGE * 0.26 TO 1.65 WITH 224 SAMPLES

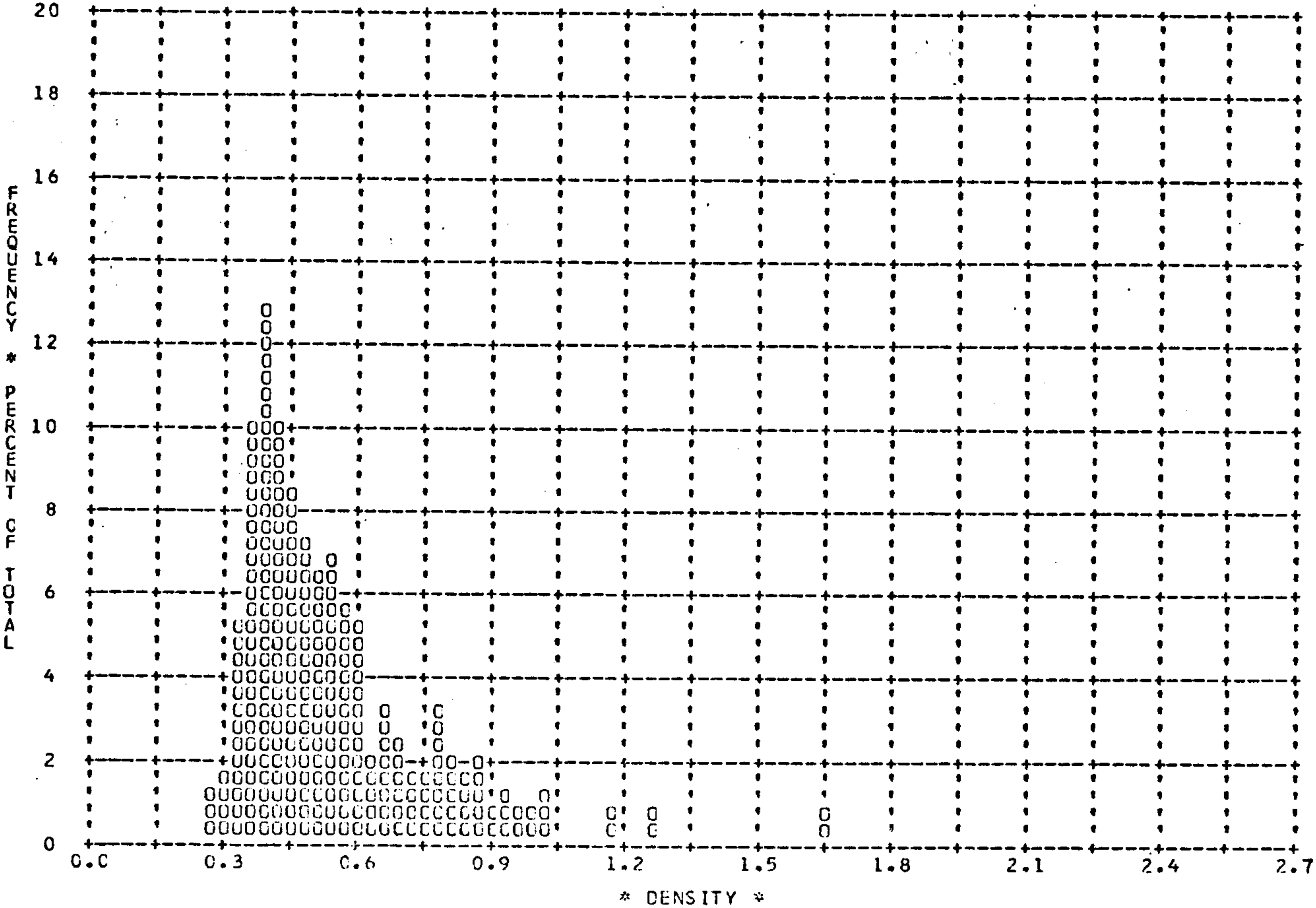


FIGURE A-2

FIGURE A-2

MISSION * 1101-1 * INSTR * AFT * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * ALL LEVELS
ARITH MEAN * 1.35 * MEDIAN * 1.36 * STD DEV * 0.33 * RANGE * 0.68 TO 2.23 WITH 224 SAMPLES

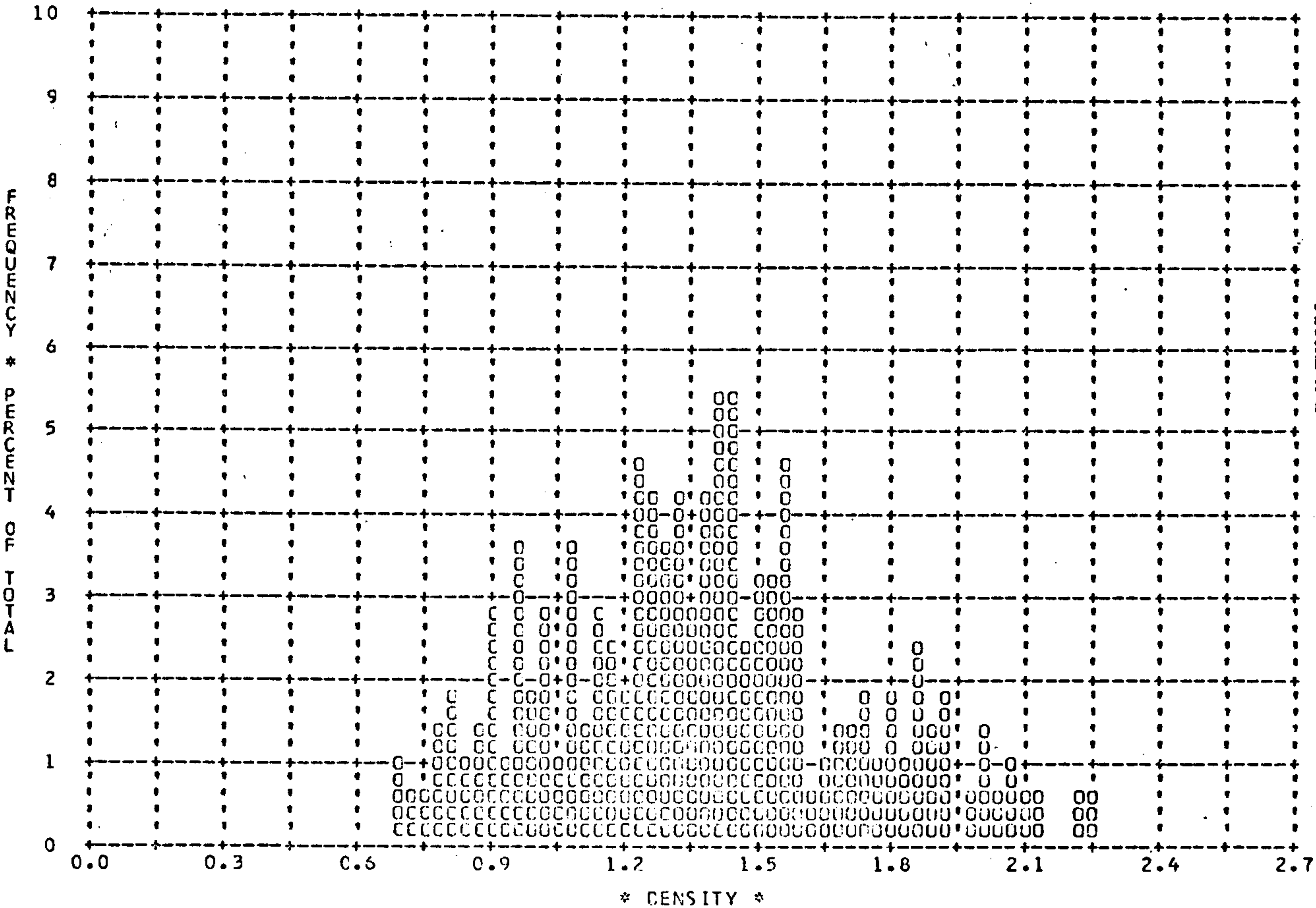


FIGURE A-2

MISSION * 1101-1 * INSTR * AFT * 1/17/68 PLOT OF D MAX * CLOUD * PROCESSING * ALL LEVELS

ARITH MEAN * 2.C2 * MEDIAN * 2.06 * STD DEV * 0.19 * RANGE * 1.01 TO 2.38 WITH 217 SAMPLES

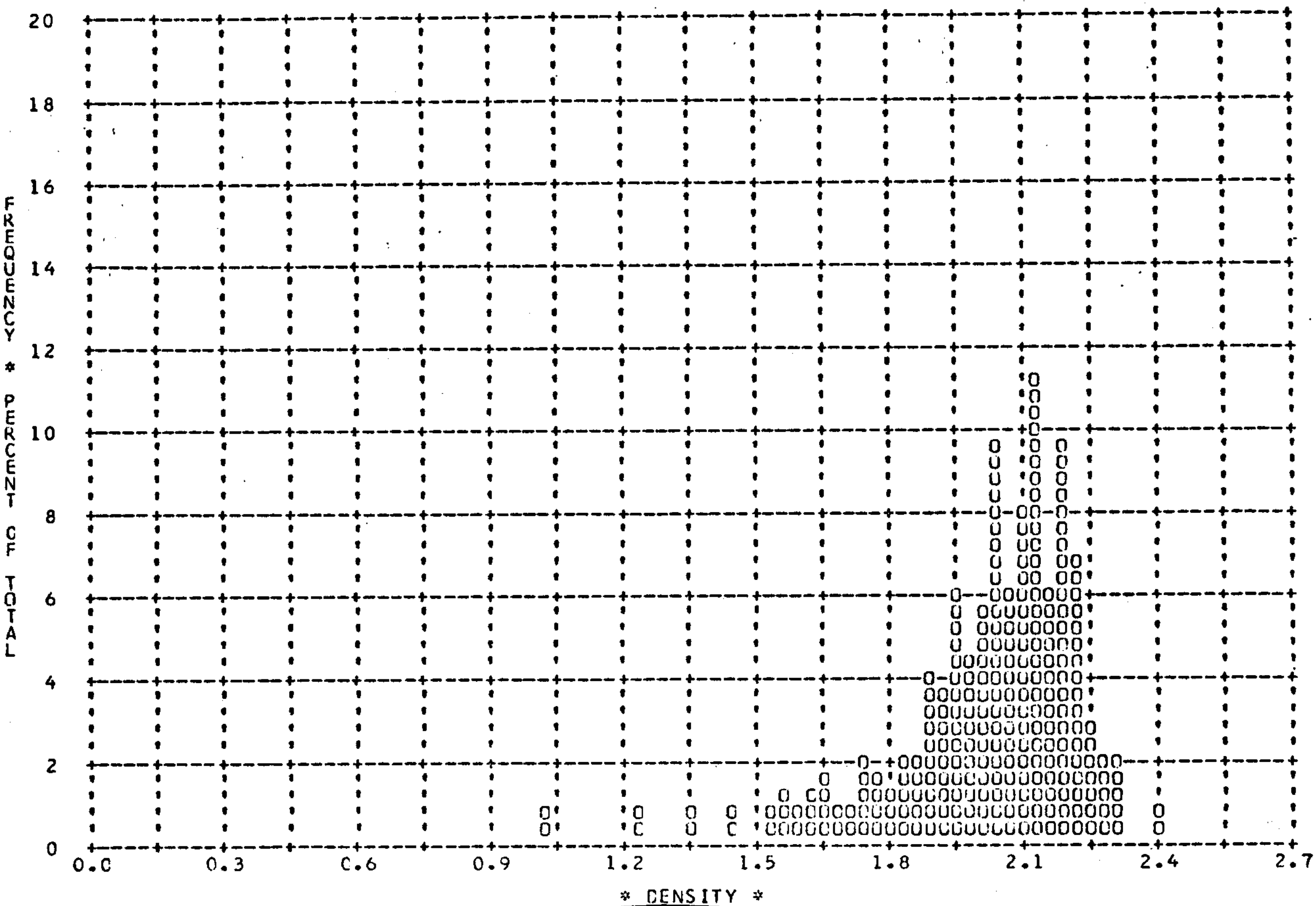


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FIGURE A-3

MISSION * 1101-2 * INSTR * FWD * 1/17/68 PLOT OF D MIN * TERRAIN * PROCESSING * INTERMEDIATE

ARITH MEAN * 0.67 * MEDIAN * 0.63 * STD DEV * 0.28 * RANGE * 0.18 TO 1.29 WITH 35 SAMPLES

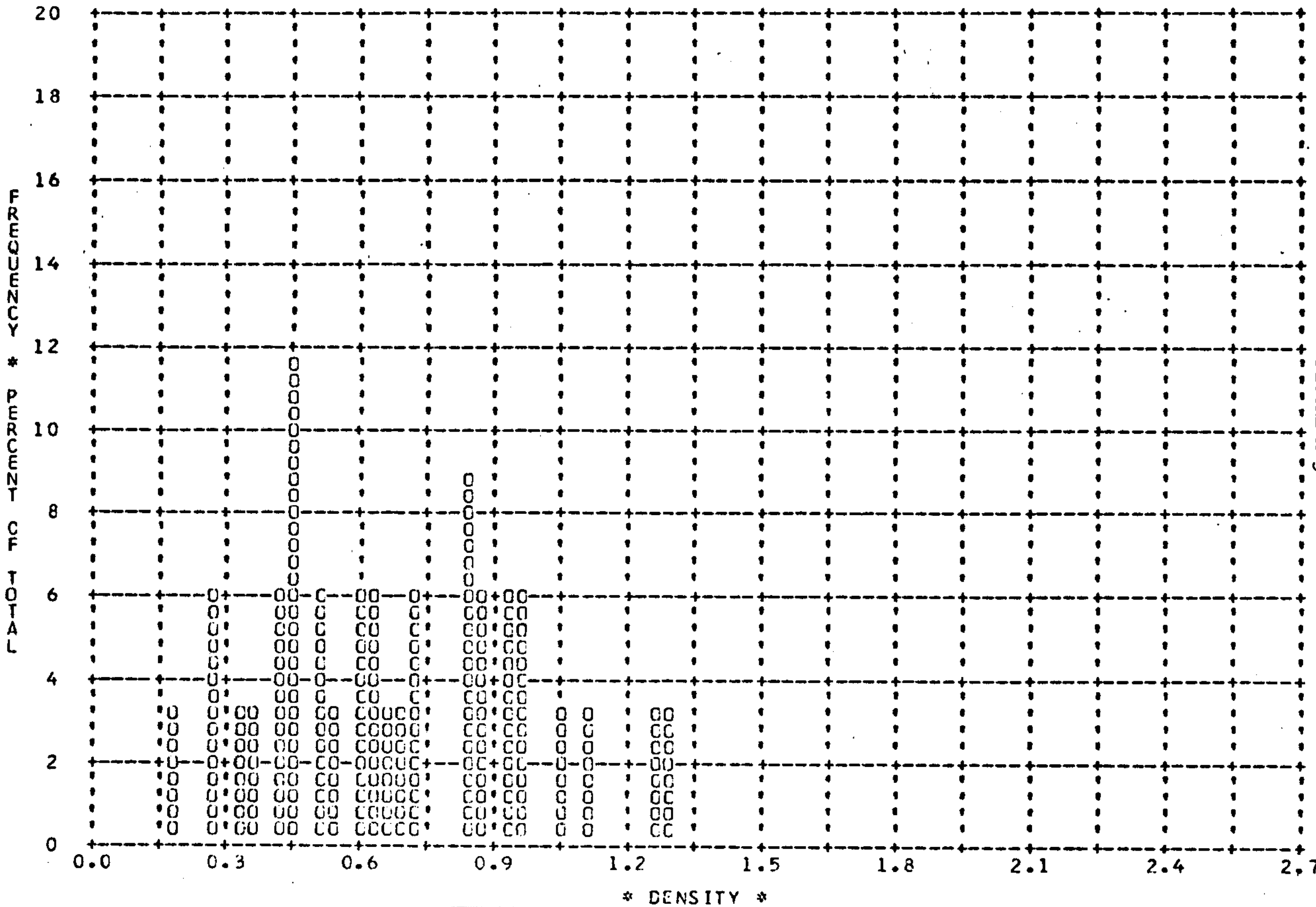

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FIGURE A-3

TOP SECRET C/[redacted]

MISSION * 1101-2 * INSTR * FWD * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * INTERMEDIATE

ARITH MEAN * 1.43 * MEDIAN * 1.44 * STD DEV * 0.24 * RANGE * 0.34 TO 1.80 WITH 35 SAMPLES

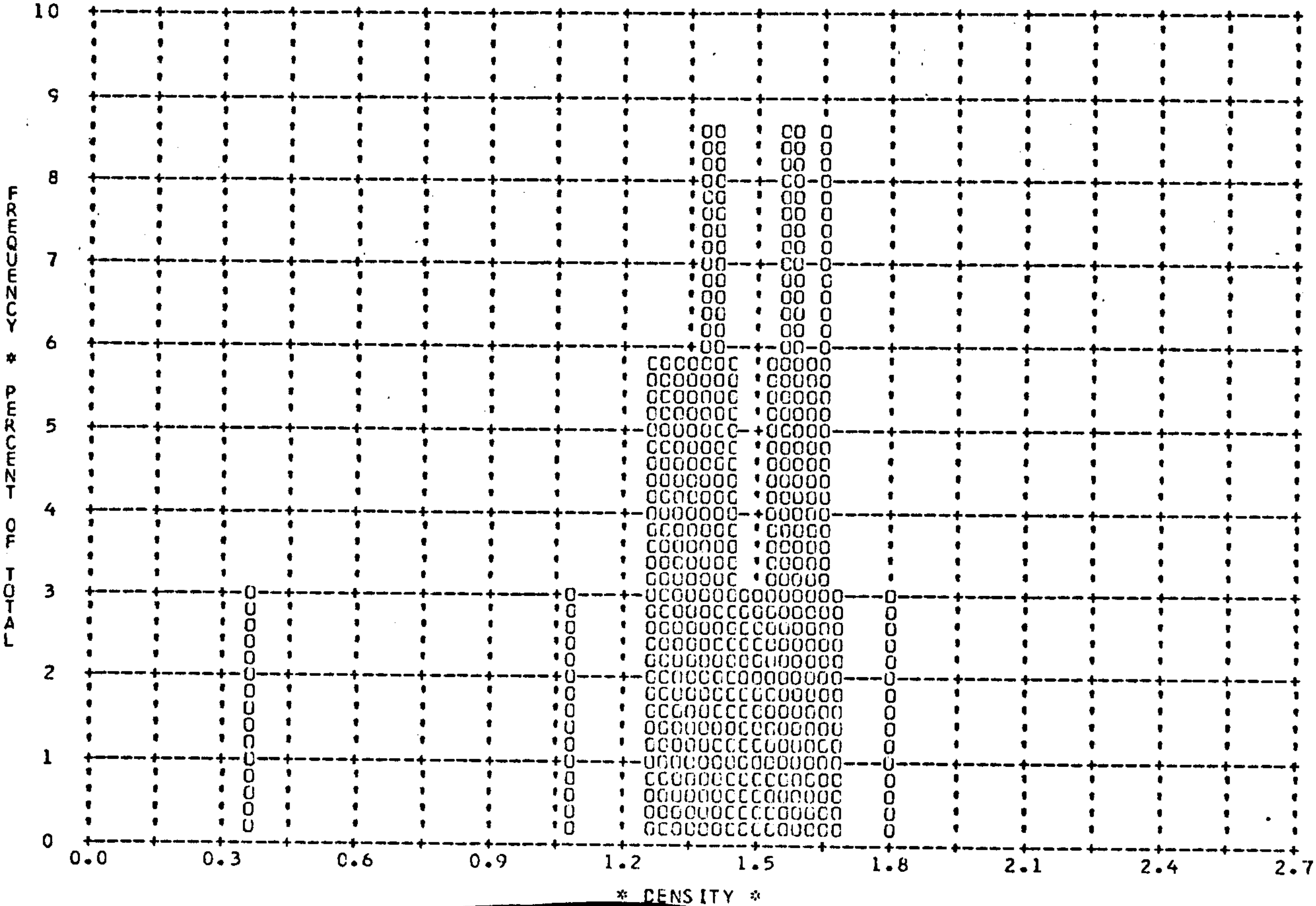

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FIGURE A-3

MISSION * 1101-2 * INSTR * FWD * 1/17/68 PLOT OF D MAX * CLOUD * PROCESSING * INTERMEDIATE
ARITH MEAN * 1.82 * MEDIAN * 1.92 * STD DEV * 0.23 * RANGE * 1.39 TO 2.21 WITH 18 SAMPLES

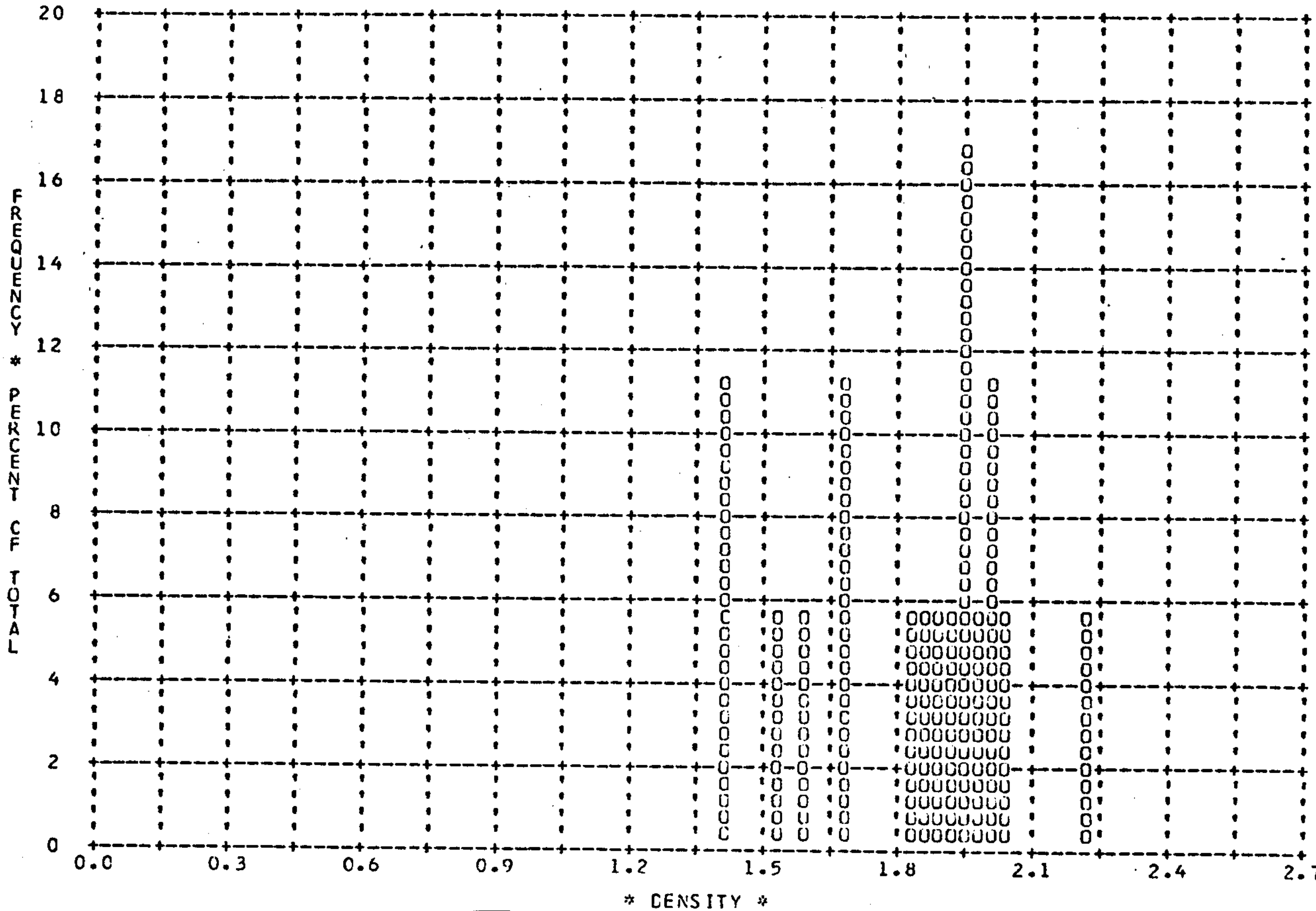

FIGURE A-3

MISSION * 1101-2 * INSTR * FWD * 1/17/68 PLOT OF D MIN * TERRAIN * PROCESSING * FULL
ARITH MEAN * 0.44 * MEDIAN * 0.40 * STD DEV * 0.15 * RANGE * 0.26 TO 1.04 WITH 218 SAMPLES

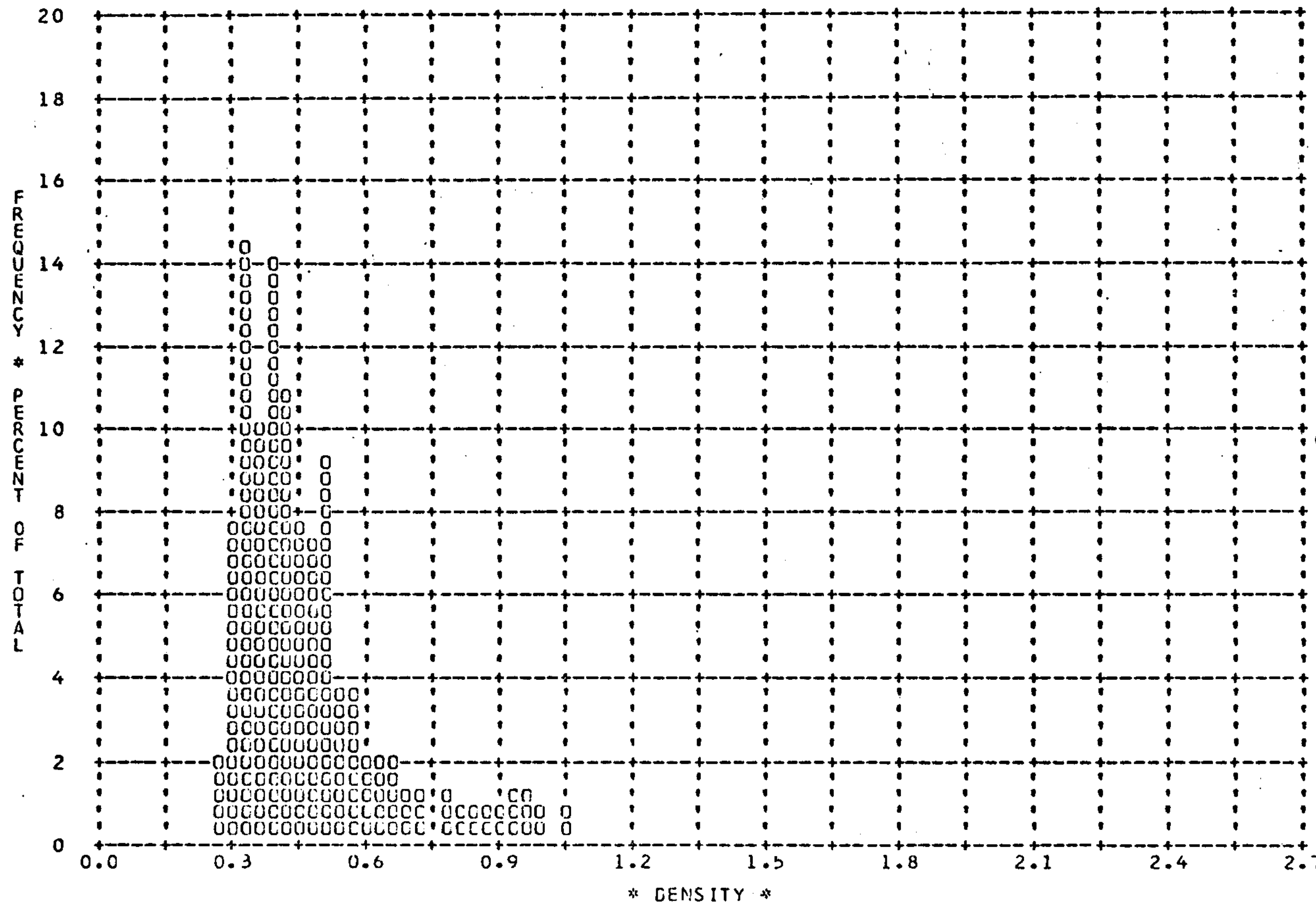

FIGURE A-3

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MISSION * 1101-2 * INSTR * FWD * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * FULL

ARITH MEAN * 1.24 * MEDIAN * 1.24 * STD DEV * 0.34 * RANGE * 0.51 TO 2.23 WITH 218 SAMPLES

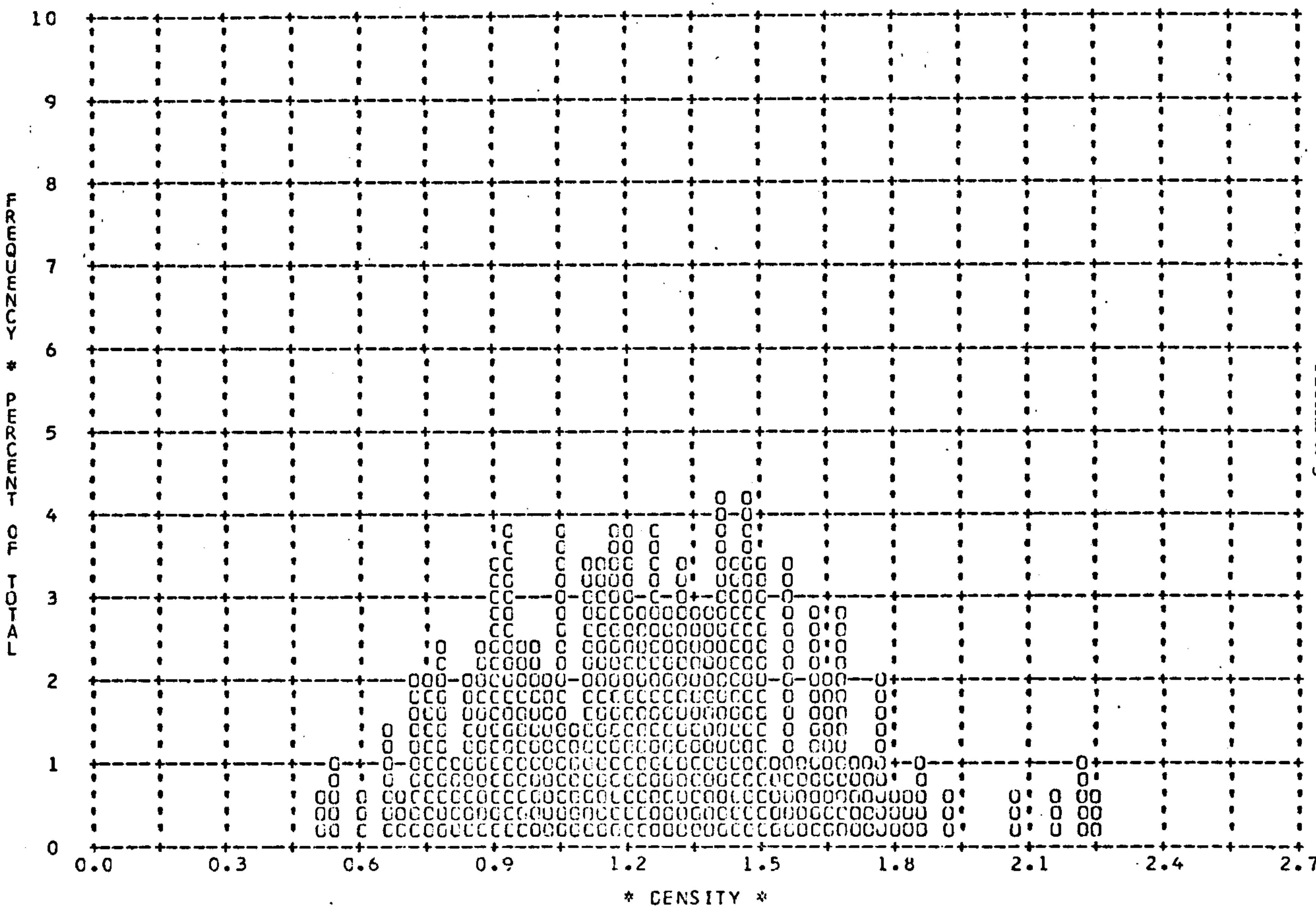

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FIGURE A-3

MISSION * 1101-2 * INSTR * FWD * 1/17/68 PLOT OF D MAX * CLOUD * PROCESSING * FULL

ARITH MEAN * 1.94 * MEDIAN * 2.03 * STD DEV * 0.28 * RANGE * 0.91 TO 2.36 WITH 210 SAMPLES

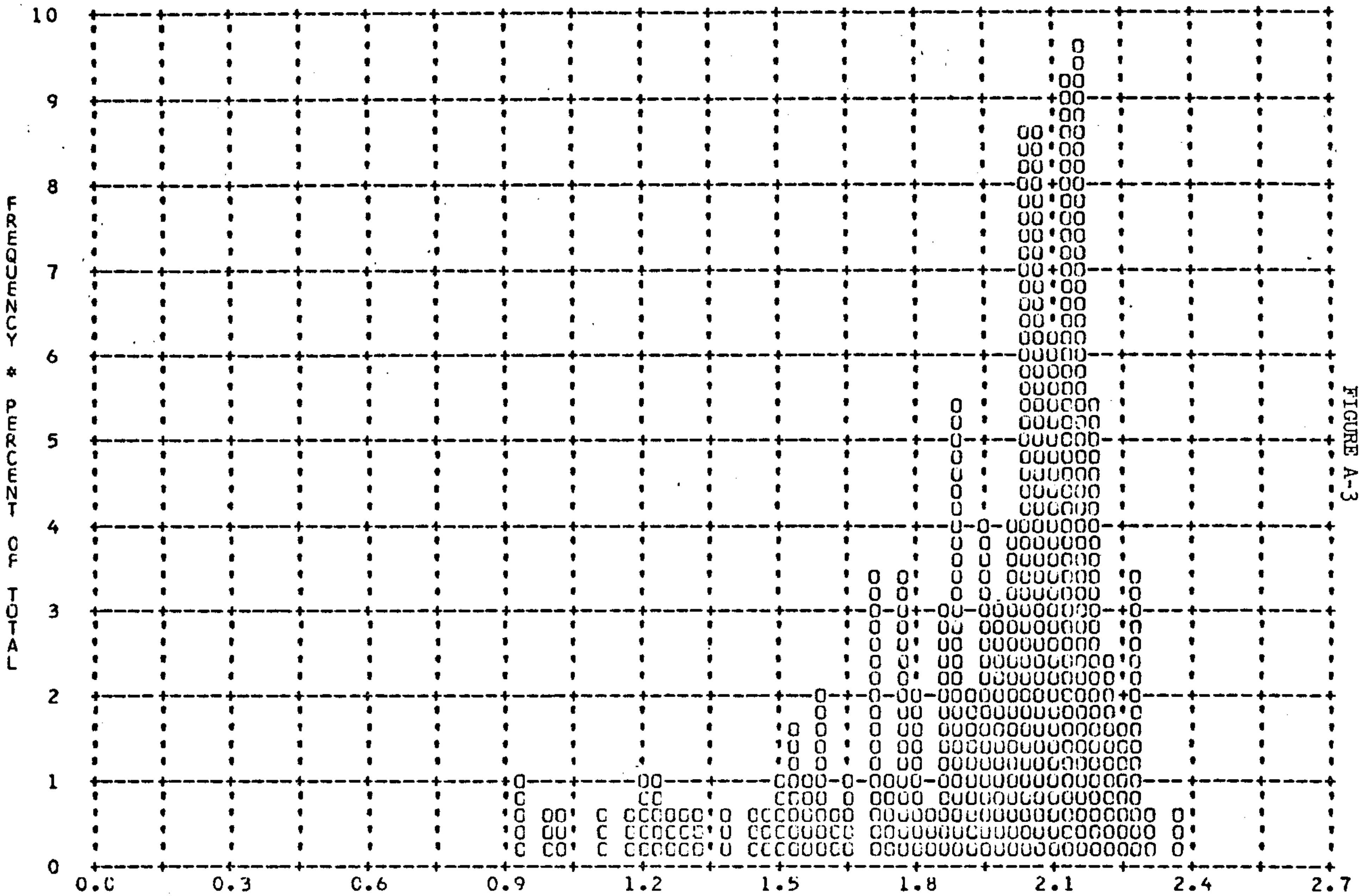


FIGURE A-3

MISSION * 1101-2 * INSTR * FWD * 1/17/68 PLOT OF D MIN * TERRAIN * PROCESSING * ALL LEVELS.

ARITH MEAN * 0.47 * MEDIAN * 0.42 * STD DEV * 0.19 * RANGE * 0.18 TO 1.29 WITH 253 SAMPLES

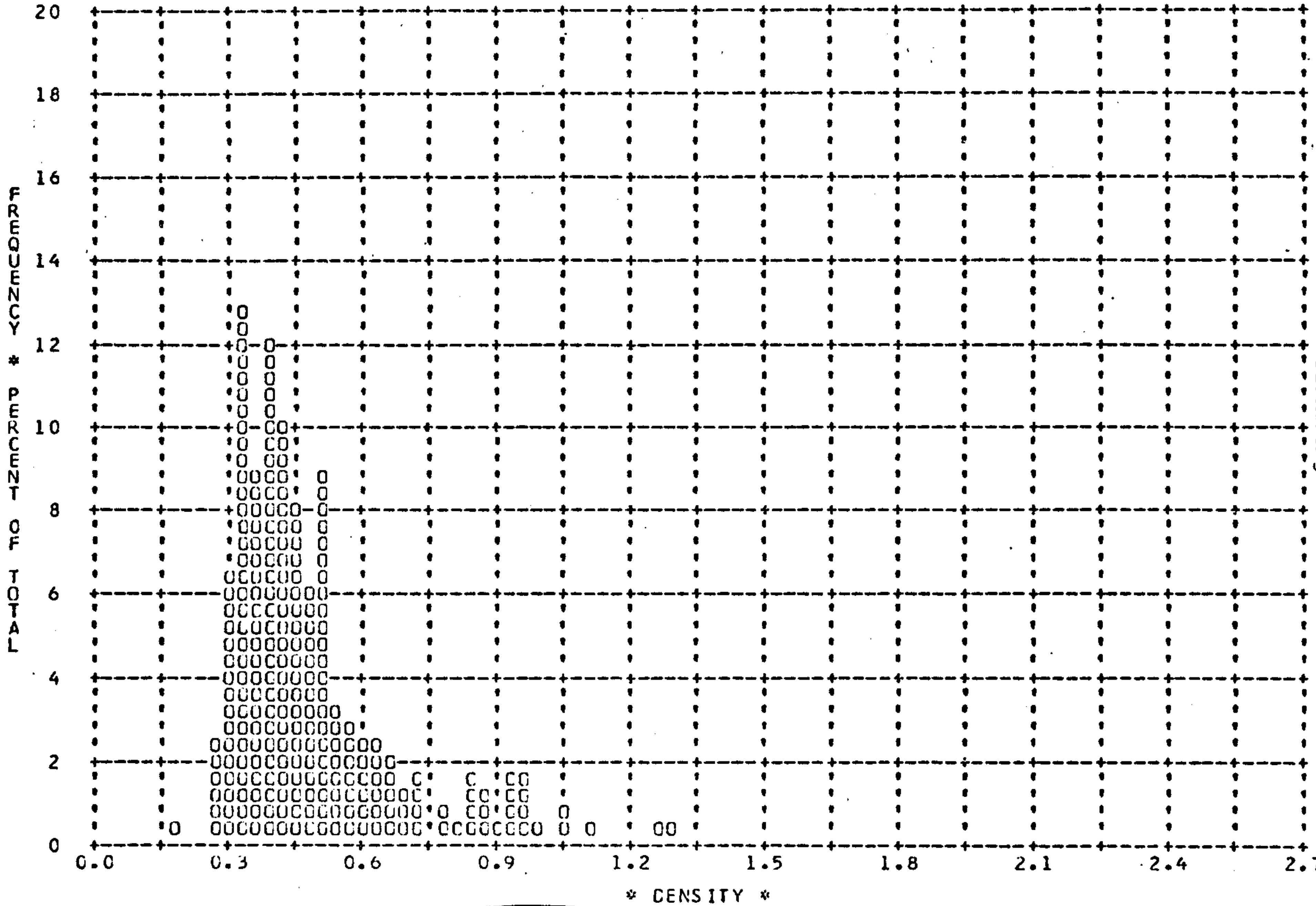


FIGURE A-3

MISSION * 1101-2 * INSTR * FWD * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * ALL LEVELS
ARITH MEAN * 1.27 * MEDIAN * 1.29 * STD DEV * 0.33 * RANGE * 0.34 TO 2.23 WITH 253 SAMPLES

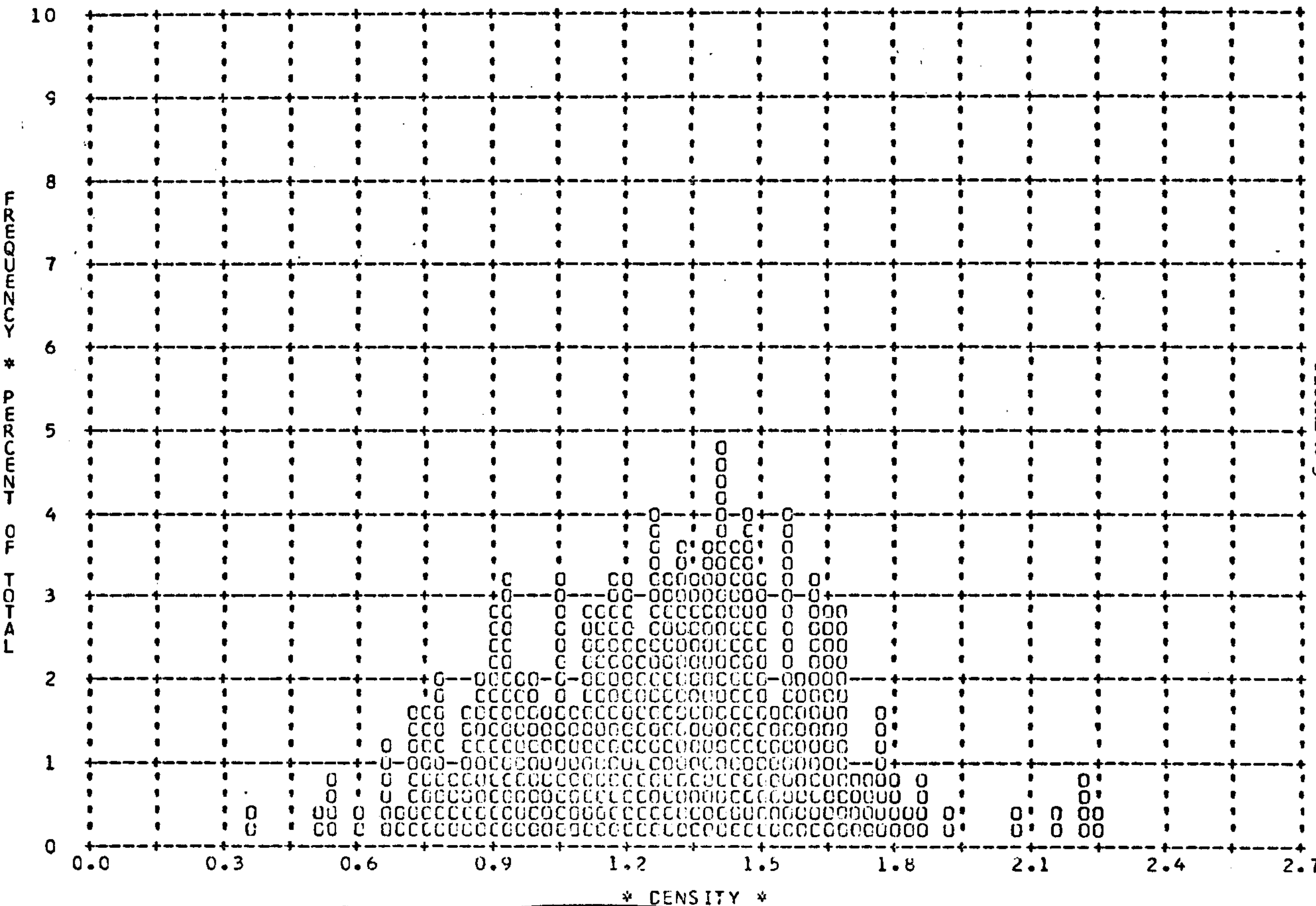
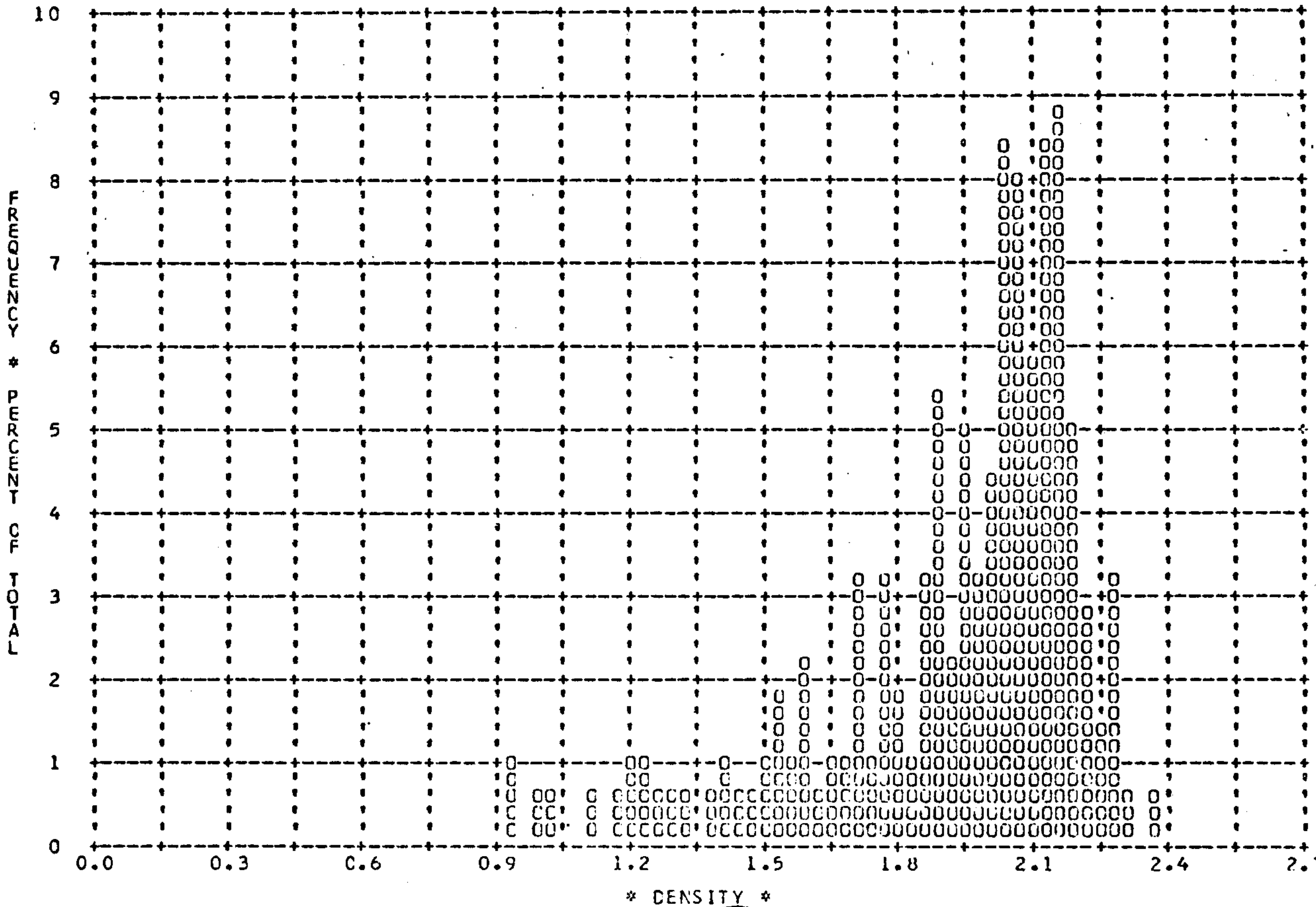


FIGURE A-3

MISSION * 1101-2 * INSTR * FWD * 1/17/68 PLOT OF D MAX * CLOUD * PROCESSING * ALL LEVELS

ARITH MEAN * 1.93 * MEDIAN * 2.02 * STD DEV * 0.28 * RANGE * 0.91 TO 2.36 WITH 228 SAMPLES



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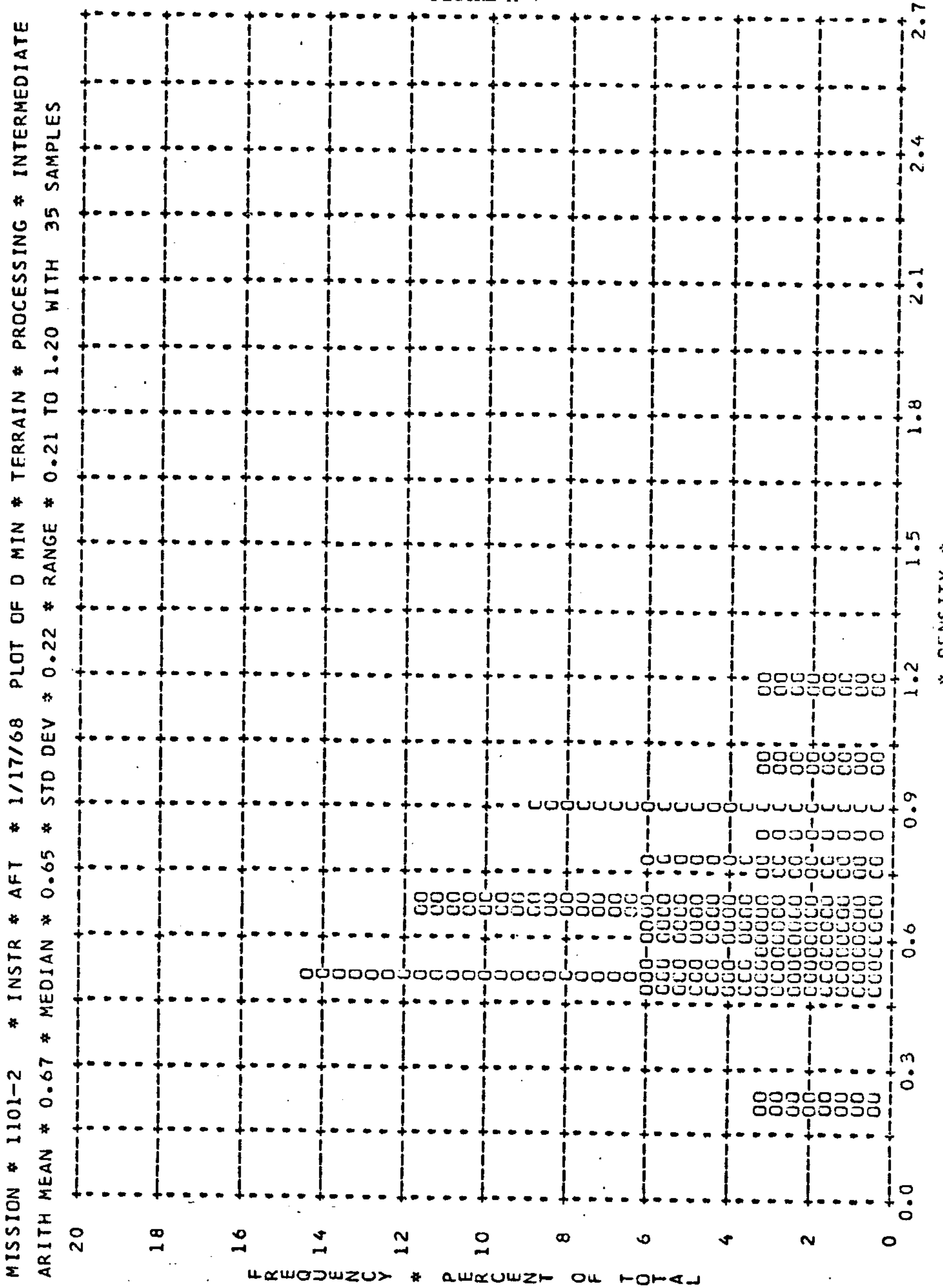

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FIGURE A-4

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MISSION * 1101-2 * INSTR * AFT * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * INTERMEDIATE

ARITH MEAN * 1.41 * MEDIAN * 1.44 * STD DEV * 0.19 * RANGE * 1.01 TO 1.93 WITH 35 SAMPLES

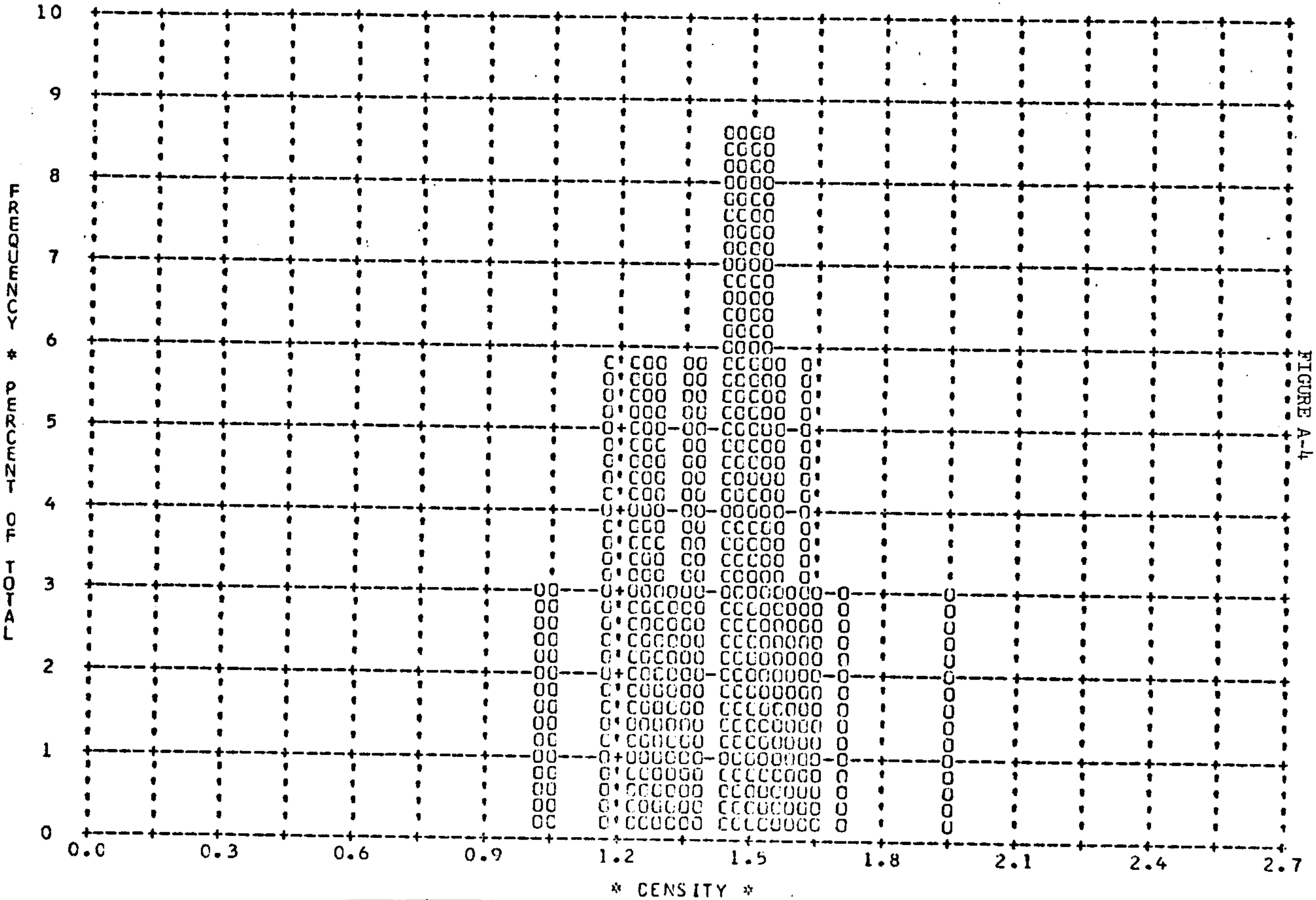

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FIGURE A-4

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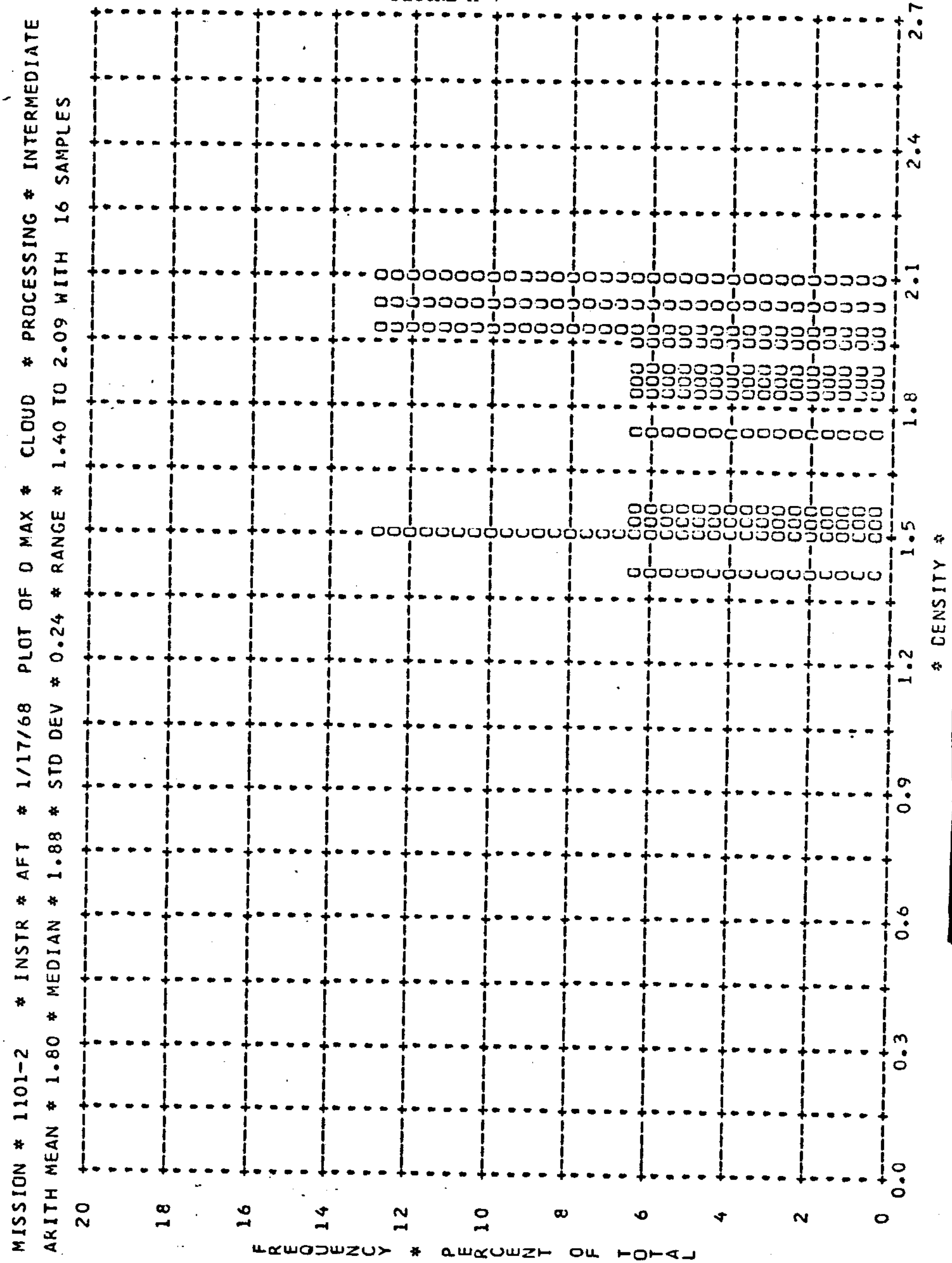

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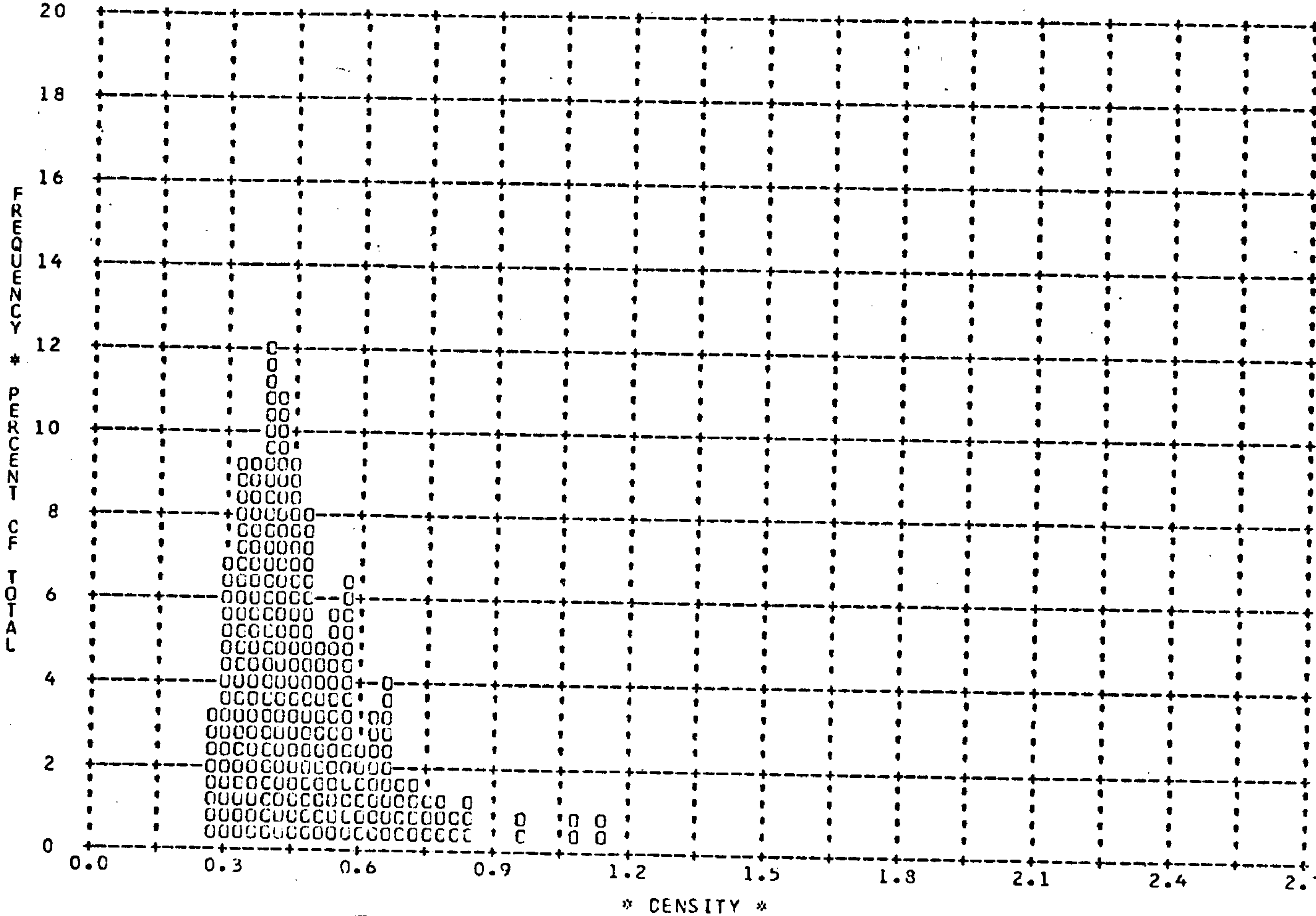
FIGURE A-4

TOP SECRET C [redacted]

MISSION * 1101-2 * INSTR * AFT * 1/17/68 PLOT OF D MIN * TERRAIN * PROCESSING * FULL
ARITH MEAN * 0.46 * MEDIAN * 0.42 * STD DEV * 0.14 * RANGE * 0.25 TO 1.13 WITH 209 SAMPLES



TOP SECRET C [redacted]

TOP SECRET C [redacted]

MISSION * 1101-2 * INSTR * AFT * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * FULL

ARITH MEAN * 1.21 * MEDIAN * 1.21 * STD DEV * 0.32 * RANGE * 0.54 TO 2.25 WITH 209 SAMPLES

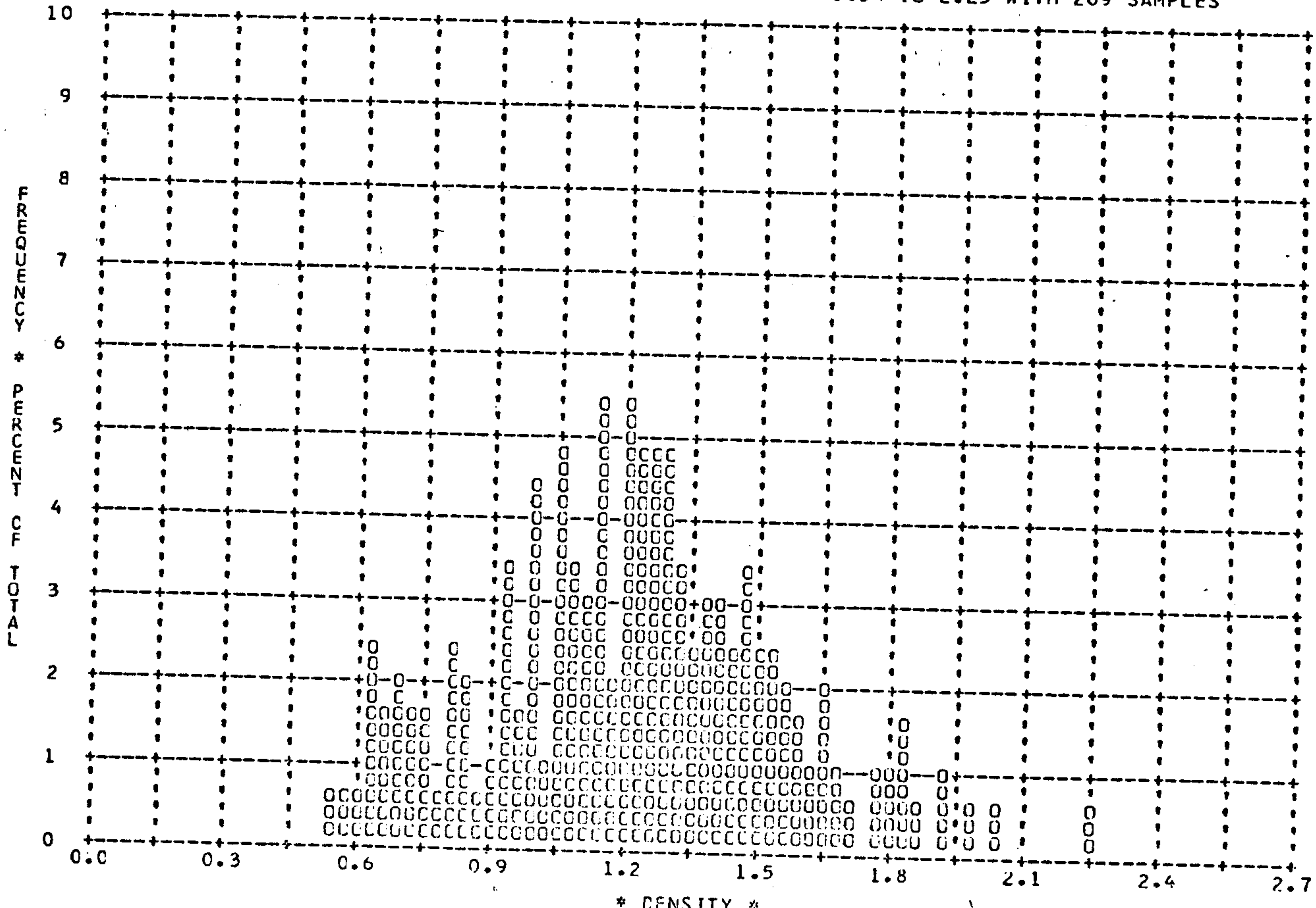


FIGURE A-4

TOP SECRET C [redacted]

~~TOP SECRET~~ C [redacted]

FIGURE A-4

MISSION * 1101-2 * INSTR * AFT * 1/17/68 PLOT OF D MAX * CLOUD * PROCESSING * FULL

ARITH MEAN * 1.91 * MEDIAN * 2.02 * STD DEV * 0.32 * RANGE * 0.22 TO 2.32 WITH 215 SAMPLES

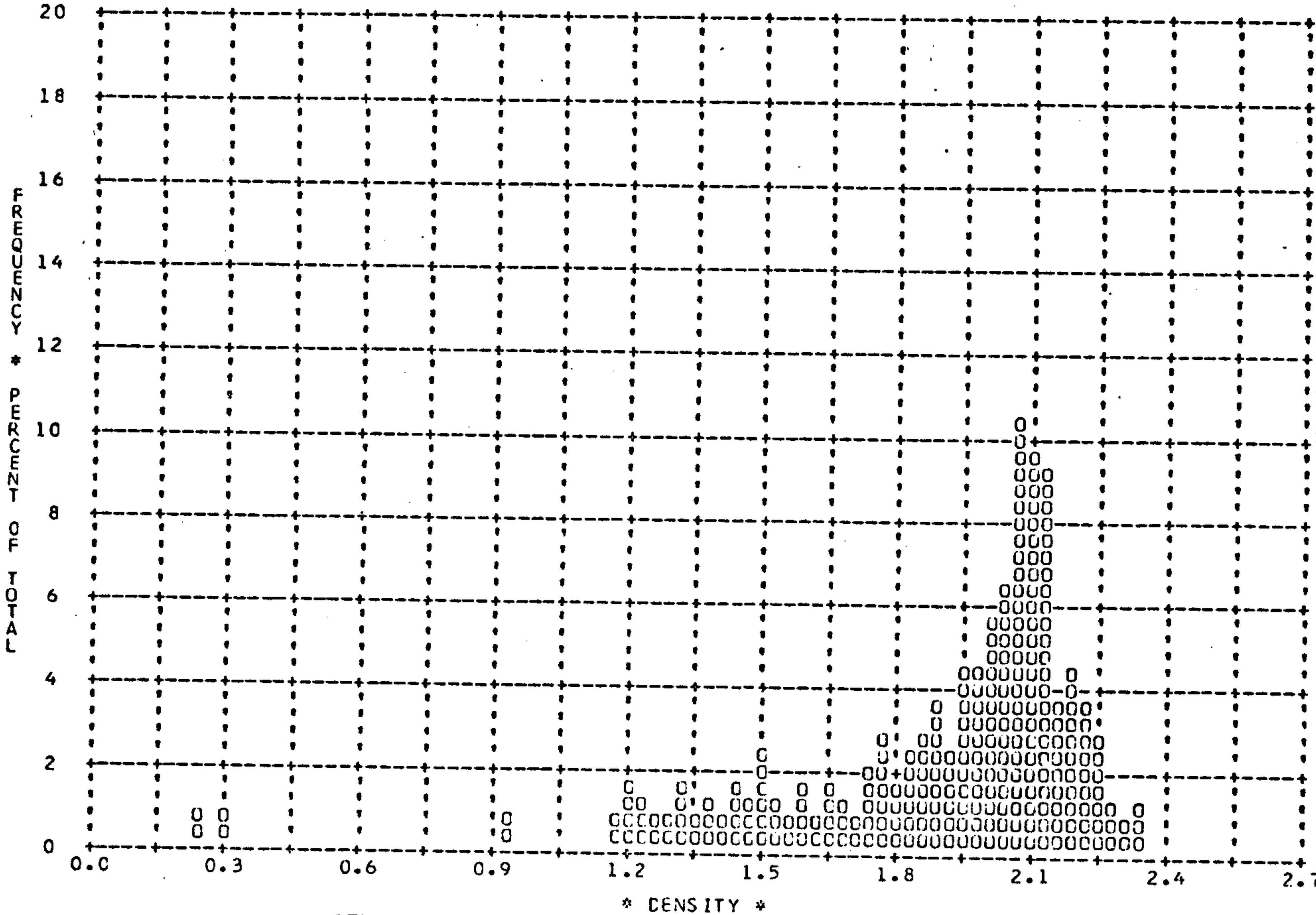


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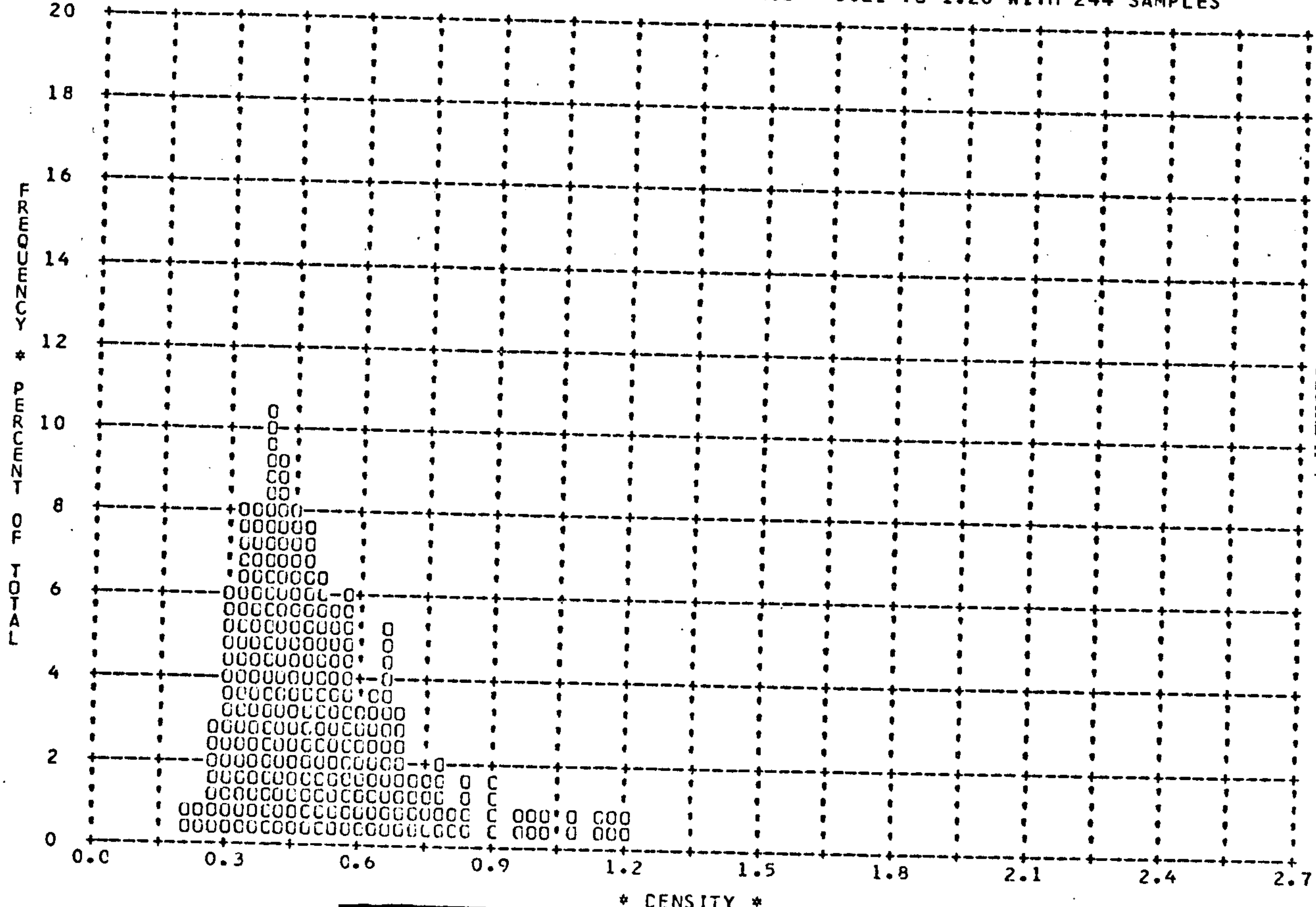
FIGURE A-4

MISSION * 1101-2 * INSTR * AFT * 1/17/68 PLOT OF D MIN * TERRAIN * PROCESSING * ALL LEVELS

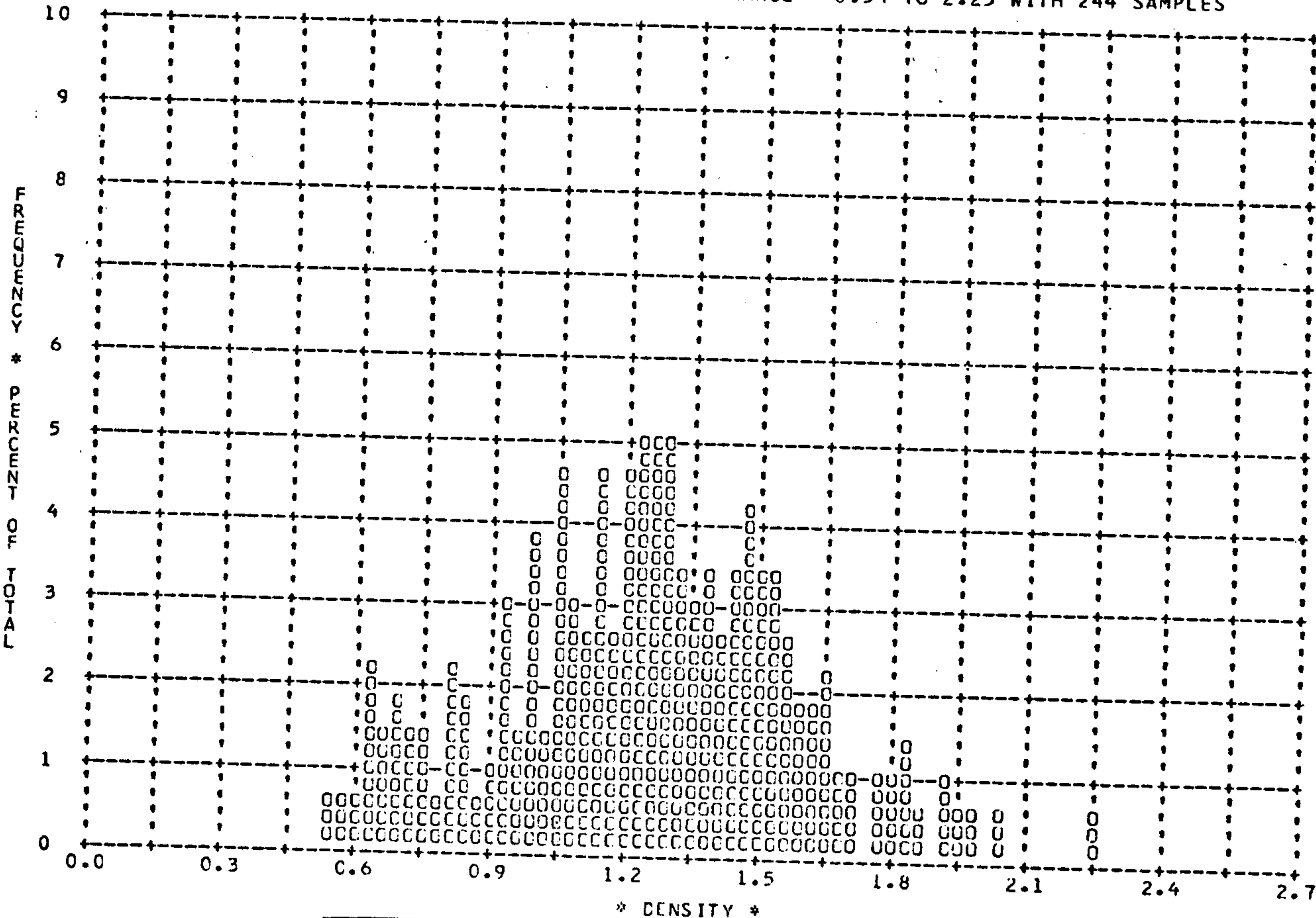
ARITH MEAN * 0.49 * MEDIAN * 0.44 * STD DEV * 0.17 * RANGE * 0.21 TO 1.20 WITH 244 SAMPLES



~~TOP SECRET~~ C [redacted]

MISSION * 1101-2 * INSTR * AFT * 1/17/68 PLOT OF D MAX * TERRAIN * PROCESSING * ALL LEVELS

ARITH MEAN * 1.24 * MEDIAN * 1.24 * STD DEV * 0.31 * RANGE * 0.54 TO 2.25 WITH 244 SAMPLES

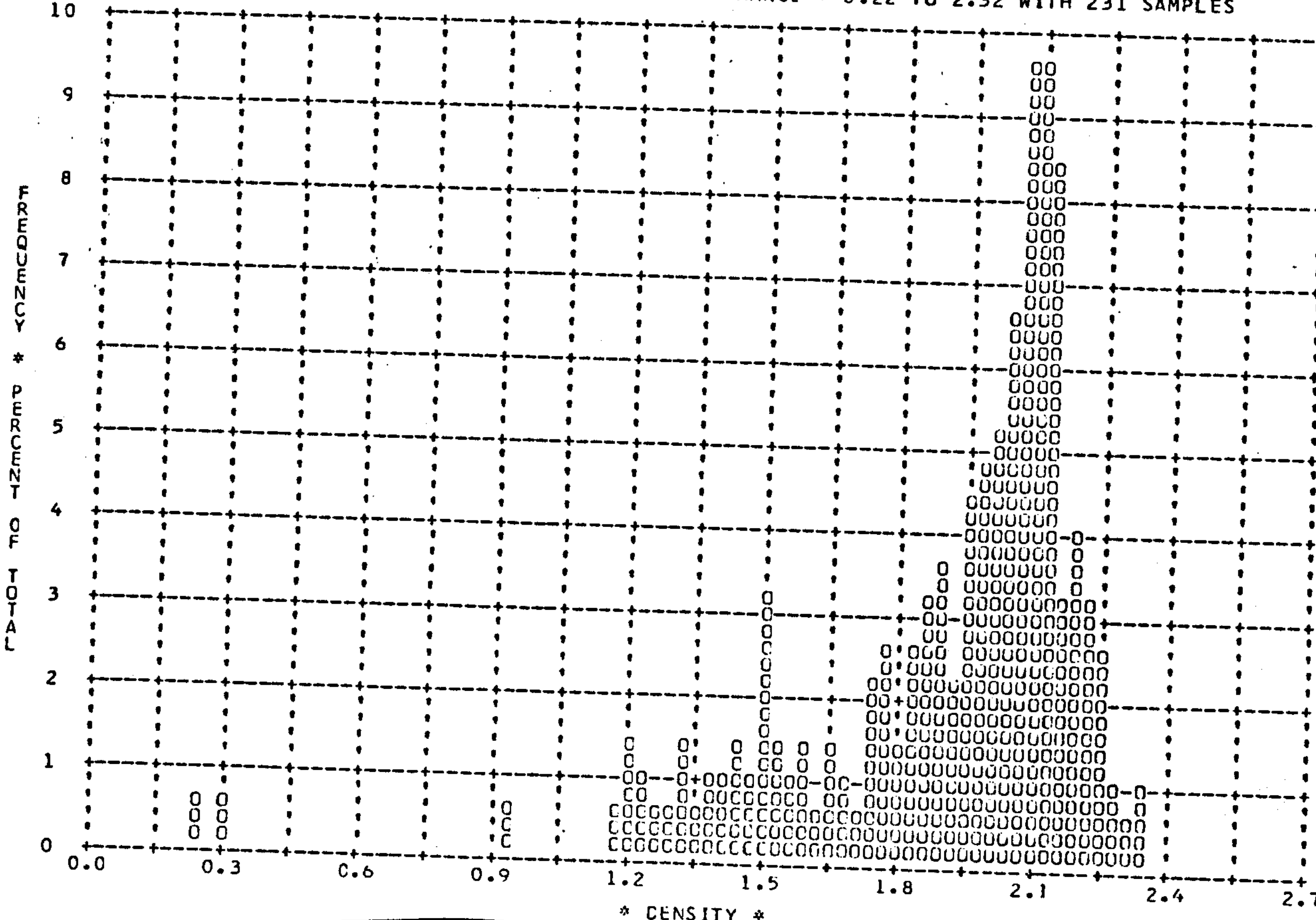


~~TOP SECRET~~ C [redacted]

FIGURE A-4

~~TOP SECRET~~ C [redacted]

MISSION * 1101-2 * INSTR * AFT * 1/17/68 PLOT OF D MAX * CLOUD * PROCESSING * ALL LEVELS
ARITH MEAN * 1.90 * MEDIAN * 2.01 * STD DEV * 0.31 * RANGE * 0.22 TO 2.32 WITH 231 SAMPLES



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