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## OPTICAL TECHNOLOGY DIVISION

## PROJECT MEMORANDUM

PM-1572-X

19 NOVEMBER 1975

## SENSOR SYSTEM POST FLIGHT REPORT

SV-10 (S/N 013)

Prepared by: Flight Operations and  
Evaluation Section

Reviewed by:

J.W. McNERNEY, Manager  
Flight Operations and Evaluation

Approved by:

F.L. HARRIGAN, JR., Manager  
Field Operations Department~~HX TOP SECRET~~

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PROJECT MEMORANDUM NUMBER: PM-1572-X

PREPARED BY: Flight Operations & Evaluation

DATE: 19 NOVEMBER 1975

SUBJECT: Sensor System Post Flight Report  
SV-10 (SN-013)

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K. Meserve  
G. Hefferon  
J. Garrish  
P. Petty  
C. Karatzas  
B. Malin

ABSTRACT: This report outlines the flight history  
for the SV-10 (SN 013)

DESCRIPTORS: Flight Report, S/N 013  
Flight Operations, S/N 013

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MISSION 1210SENSOR SYSTEM OPERATIONPOST FLIGHT REPORT1.0 INTRODUCTION1.1 Mission Objective

The primary objective of the HEXAGON Mission is to provide high resolution search and surveillance photography. The secondary objective of this, the tenth mission, was to demonstrate a system lifetime capability of up to 130 days as defined by the intelligence community requirements. Intelligence requirements were programmed such that film depletion occurred on day 120 without incident. However, solo performance has demonstrated that longer lifetime could have been attained had the intelligence community required it.

1.2 Mission Description

The HEXAGON Mission 1210 satellite vehicle was launched from VAFB, SLC-4E, at 1130 PDT, 8 June 1975 using a Titan 3D booster vehicle. Launch was originally attempted on 7 June 1975, but was postponed due to a booster problem. All recovery vehicles were successfully air retrieved within predicted impact dispersions. Recoveries were Day 17, 52, 89, and 121 respectively.

Operational photography began on Rev 7, Mission Op 4 and continued without system malfunction or anomaly throughout RV-1. The last operation taken during RV-1 was Rev 253, Mission Op 140.

RV-2 operations began on Rev 265, Mission Op 141 and continued normally until Rev 433 when an Aft camera ESD shut-down both cameras. A relay in the Power Distribution System (PDS) was pinpointed as failing to supply power to the Aft camera when commanded. Health operations were conducted and on Rev 449 the relay began responding properly to commands. Following confidence tests normal camera operations were resumed on Rev 461, Mission Op 233. The system continued to perform normally throughout the remainder of RV-2 and the last operation taken was Rev 825, Mission Op 356.

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1.2 Mission Description-Cont'd.

RV-3 operations began on Rev 832, Mission Op 357 and continued normally through Rev 852, Mission Op 367 when data evaluation indicated that the Aft camera take-up integrator reset had ceased to function. On Rev 917, Mission Op 390 the reset resumed it's normal operation which continued until Rev 1206, Mission Op 490 at which time it again ceased to function. On Rev 1302, Mission Op 514 the reset again resumed it's normal operation and continued to operate properly throughout the last RV-3 operation on Rev 1405, Mission Op 555. The failure of the integrator to reset at no time resulted in abnormal system performance. It did however, impact operational flexibility as it was necessary to restrict nested camera operations during RV-3 beginning with Rev 867, Mission Op 375 in order to preclude a potential Emergency Shut Down. ~~RESTRICTION REMOVED WITH REV 884~~

The constraint against nested camera operations was removed with the first operation in RV-4 on Rev 1416, Mission Op 556. The camera system performed normally throughout RV-4 and the film supply was exhausted on Rev 1940, Mission Op 789.

Evaluation of RV-1 photography indicated a need to change the Fwd camera OOAA in-track nominal from -1 step to +1 step. This change was made effective for Mission Op 171.

Evaluation of RV-2 photography indicated need to change the four OOAA nominals. The adjustments were implemented for Rev 881, Mission Op 380 and subsequent as follows:

Fwd camera in-track increased one step to a new nominal of +2 steps.

Fwd camera cross-track decreased one step to a new nominal of -1 step.

Aft camera in-track increased one step to a new nominal of -3 steps.

Aft camera cross-track decreased two steps to a new nominal of -2 steps.

The Fwd camera operational film supply consisted of approximately 113,025 feet of 1414 film utilized on the 789 camera operations occurring between Rev 6 and Rev 1940.

In addition to approximately 92,265 feet of operational 1414 film the Aft camera film supply also contained three segments of SO-130 IR color film (3,150 feet total), three segments of SO-255 color film (9,150 feet total) and one 3,750 foot segment of SO-124 high resolution black and white film.

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## 1.2 Mission Description-Cont'd.

The lengths and operational intervals associated with these special (non 1414) segments were as follows:

|        |         |             |                |
|--------|---------|-------------|----------------|
| S0-130 | 900 ft  | Ops 31-34   | Revs 41-42     |
| S0-255 | 2150 ft | Ops 280-300 | Revs 594-660   |
| S0-130 | 1500 ft | Ops 301-322 | Revs 663-728   |
| S0-130 | 750 ft  | Ops 475-485 | Revs 1166-1192 |
| S0-255 | 5000 ft | Ops 486-521 | Revs 1193-1318 |
| S0-255 | 2000 ft | Ops 724-742 | Revs 1725-1789 |
| S0-124 | 3750 ft | Ops 743-789 | Revs 1790-1940 |

The active photographic mission was terminated with RV-4 recovery on Day 121 following depletion of both film supplies.. A solo phase of the mission extended the vehicle life to Day 150 at which time the vehicle was deboosted and re-entered.

## 1.3 Mission Highlights

Sensor System highlights of the mission can be summarized as follows:

- a. The Sensor System demonstrated a functional orbital life of 120 Days. Approximately 98% of the available pneumatics was expended.
- b. Both Forward and Aft cameras utilized 100% of their respective film supplies.
- c. The Sensor System demonstrated the capability to operate satisfactorily with S0-130 Infrared color film, S0-255 color film, and S0-124 black and white film in the Aft camera.
- d. The image quality for both cameras ranged from very good to poor during the mission; the poor being attributable to adverse atmospheric and acquisition conditions. There was a preference for Forward camera imagery when compared to the Aft.

Figure 1-1 presents a graphic history of remaining system life percentages throughout the mission.

## 1.4 Launch Configuration

- a. Mission Operation Number 1210
- b. Inter-range Operation No. 6381
- c. Satellite Vehicle - SV-10
- d. Sensor System - S/N 013

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1.4 Launch Configuration-Cont'd.e. Sensor System Configuration

|                                          | <u>Forward Camera</u> | <u>Aft Camera</u>         |
|------------------------------------------|-----------------------|---------------------------|
| Filter Types                             | W-12                  | W-12                      |
| Focal Length                             | 59.9724 in.           | 59.9844 in.               |
| Focus Setting                            | 31 Microns            | 31 Microns                |
| OOAA Setting                             |                       |                           |
| In-Track                                 | -1 Cmd Step           | -4 Cmd Steps              |
| Cross-Track                              | Zero                  | Zero                      |
| Film Type                                | 1414                  | 1414/SO-255/SO-130/SO-124 |
| Estimated Film Length<br>(Including Pad) | 115,460 ft            | 110,746 ft                |
| Film Weight                              | 904.2 lbs.            | 907.5 lbs.                |
| Spool Number                             | 2730                  | 2740                      |
| Pneumatics Loaded                        | 35.0 lbs.             |                           |

1.5 Launch and Orbital Parameters

|                          | <u>Planned</u> | <u>Actual</u> |
|--------------------------|----------------|---------------|
| Launch Time - GMT        | 1830Z          | 1830Z         |
| Launch Time - SVT        | 67.0           | 67.6          |
| Inclination - degrees    | 96.4           | 96.4          |
| Initial Perigee - N.M.I. | 88.6           | 88.8          |
| Initial Apogee           | 153.0          | 155.6         |
| Argument of Perigee      |                |               |
| Degree                   | 145.2          | 140.4         |
| Initial Period           |                |               |
| Minutes                  | 88.87          | 88.90         |

Table 1-1 and Figure 1-2 define the basic orbital parameter consideration for the active mission. Forty-nine orbit adjusts were performed.

1.6 Mission Film Usage Summary

The distribution of film footage as functions of the various operating modes is presented in Figures 1-3 to 1-15. The mission segment to segment film usage is summarized as follows:

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1.6 Mission Film Usage Summary - Cont'd.

|      | <u>Rev Span</u> | <u>Camera</u> | <u>Recovered*</u> |
|------|-----------------|---------------|-------------------|
| RV-1 | Launch - 253    | Forward       | 28,763            |
|      |                 | Aft           | 28,713            |
| RV-2 | 253-825         | Forward       | 29,766            |
|      |                 | Aft           | 27,994            |
| RV-3 | 825-1405        | Forward       | 29,506            |
|      |                 | Aft           | 27,697            |
| RV-4 | 1405-1940       | Forward       | 27,154            |
|      |                 | Aft           | 26,098            |

\* Based on measurements supplied by processor.

Of this footage, the engineering and other non-intelligence operations consumed approximately 4157 and 4244 feet for the A and B sides, respectively, as summarized in the following:

1210 Non-Intelligence Film Usage

|                       | <u>Forward Camera</u> | <u>Aft Camera</u> |
|-----------------------|-----------------------|-------------------|
| Pre-Launch            | 1,884                 | 1,866             |
| RV-1 Engineering      | 735                   | 731               |
| RV-2 Engineering      | 838                   | 947               |
| RV-3 Engineering      | 371                   | 371               |
| RV-4 Engineering      | 329                   | 329               |
| Total Utilization     | 4,157                 | 4,244             |
| Film Recovered        | 115,189               | 110,502           |
| Pct. Non-Intelligence | 3.6                   | 3.8               |

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# CONSUMPTION PROFILES

SV-10

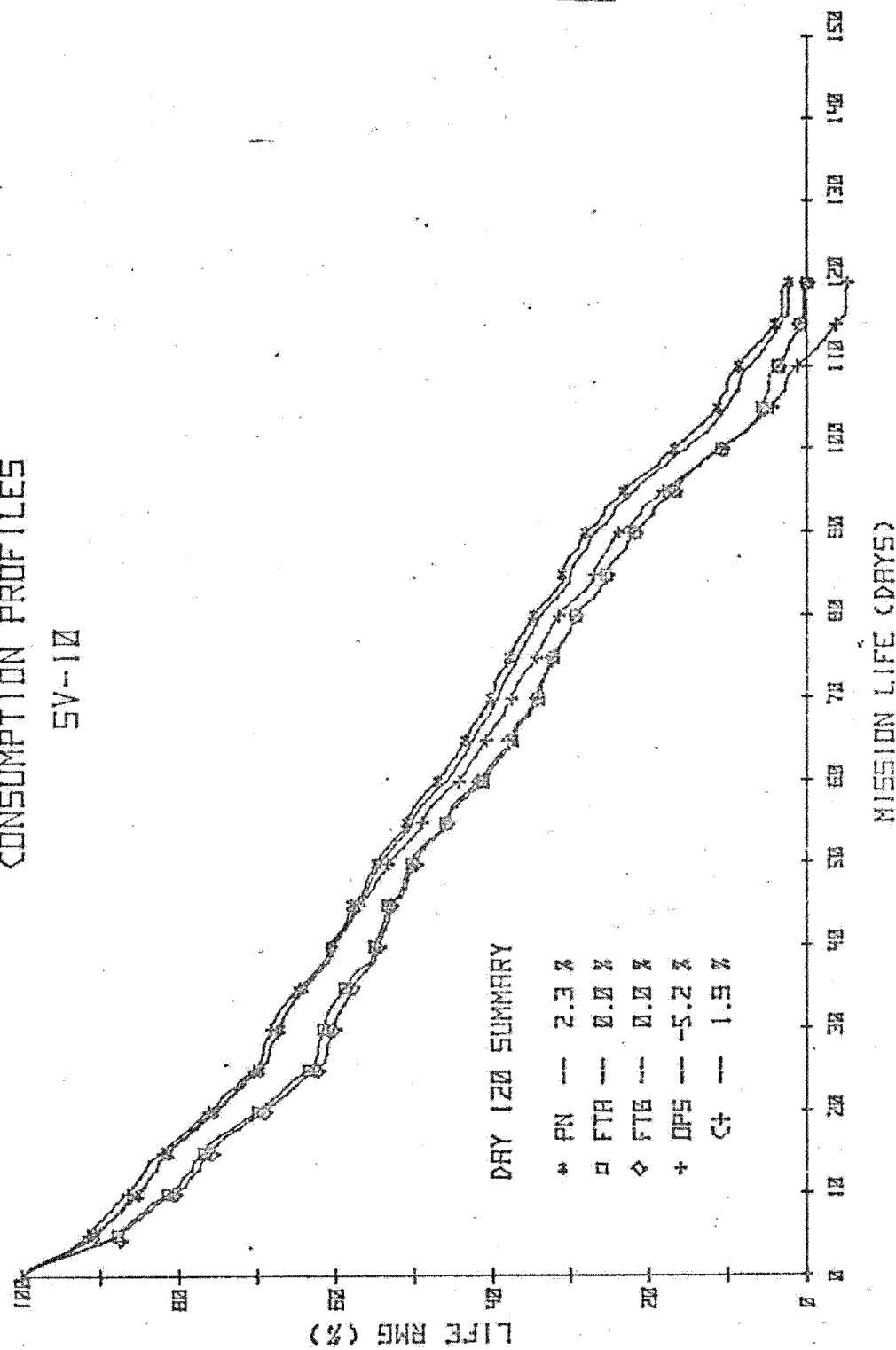


Figure 1-1

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TABLE 1 - 1

## BASIC ORBITAL PARAMETERS

| DAY    | REV | PERIOD | PERIGEE | APOGEE | INC. | ARG. PER. | B-AVG |
|--------|-----|--------|---------|--------|------|-----------|-------|
| NOM    | 0   | 88:54  | 88.8    | 155.6  | 96.4 | 148.4     | -     |
| 0      | 1   | 88:56  | 90.4    | 158.3  | 96.4 | 133.7     | 21.2  |
| 1      | 8   | 88:53  | 89.0    | 156.7  | 96.3 | 133.3     | 21.2  |
| 2      | 24  | 88:50  | 89.1    | 155.6  | 96.3 | 129.5     | 21.3  |
| 3      | 41  | 88:47  | 89.3    | 154.3  | 96.4 | 125.5     | 21.3  |
| 4      | 57  | 88:44  | 89.3    | 152.7  | 96.4 | 121.7     | 21.3  |
| OR# 1  | 63  |        |         |        |      |           |       |
| 5      | 73  | 88:46  | 89.2    | 155.2  | 96.4 | 118.7     | 21.3  |
| 6      | 89  | 88:42  | 89.1    | 153.5  | 96.4 | 115.3     | 21.4  |
| 7      | 106 | 88:39  | 89.1    | 151.4  | 96.4 | 111.5     | 21.4  |
| OR# 2  | 111 |        |         |        |      |           |       |
| OR# 3  | 113 |        |         |        |      |           |       |
| 8      | 122 | 88:51  | 88.7    | 154.6  | 96.4 | 137.7     | 21.4  |
| 9      | 138 | 88:48  | 88.5    | 153.3  | 96.4 | 133.8     | 21.5  |
| 10     | 154 | 88:45  | 88.5    | 151.8  | 96.4 | 129.9     | 21.5  |
| OR# 4  | 159 |        |         |        |      |           |       |
| 11     | 170 | 88:49  | 88.5    | 155.6  | 96.4 | 129.0     | 21.5  |
| 12     | 192 | 88:46  | 88.6    | 154.0  | 96.4 | 125.3     | 21.6  |
| 13     | 203 | 88:43  | 88.6    | 152.4  | 96.4 | 121.3     | 21.6  |
| OR# 5  | 209 |        |         |        |      |           |       |
| 14     | 219 | 88:51  | 88.5    | 159.6  | 96.4 | 120.7     | 21.6  |
| 15     | 235 | 88:48  | 88.5    | 158.1  | 96.4 | 117.2     | 21.7  |
| 16     | 251 | 88:45  | 88.5    | 156.6  | 96.4 | 114.0     | 21.8  |
| OR# 6  | 263 |        |         |        |      |           |       |
| 17     | 268 | 88:50  | 88.6    | 161.5  | 96.4 | 113.0     | 21.8  |
| 18     | 284 | 88:47  | 88.5    | 159.7  | 96.4 | 109.5     | 21.9  |
| 19     | 300 | 88:44  | 88.3    | 157.6  | 96.4 | 106.1     | 22.0  |
| OR# 7  | 306 |        |         |        |      |           |       |
| OR# 8  | 309 |        |         |        |      |           |       |
| 20     | 316 | 88:50  | 88.5    | 153.4  | 96.4 | 138.1     | 22.0  |
| 21     | 332 | 88:47  | 88.6    | 152.0  | 96.4 | 134.1     | 22.1  |
| 22     | 349 | 88:43  | 88.6    | 150.1  | 96.4 | 129.9     | 22.1  |
| OR# 9  | 354 |        |         |        |      |           |       |
| 23     | 363 | 88:49  | 88.5    | 155.3  | 96.4 | 128.8     | 22.2  |
| 24     | 381 | 88:45  | 88.5    | 153.5  | 96.4 | 125.1     | 22.3  |
| 25     | 397 | 88:42  | 88.4    | 151.6  | 96.4 | 121.4     | 22.3  |
| OR# 10 | 403 |        |         |        |      |           |       |
| 26     | 414 | 88:51  | 88.7    | 159.2  | 96.4 | 122.2     | 22.4  |
| 27     | 430 | 88:47  | 88.5    | 157.6  | 96.4 | 118.4     | 22.5  |
| 28     | 446 | 88:44  | 88.4    | 155.8  | 96.4 | 114.9     | 22.5  |
| OR# 11 | 452 |        |         |        |      |           |       |
| OR# 12 | 454 |        |         |        |      |           |       |
| 29     | 462 | 88:49  | 88.4    | 152.9  | 96.4 | 138.3     | 22.6  |
| 30     | 478 | 88:46  | 88.6    | 151.1  | 96.4 | 134.3     | 22.7  |
| 31     | 495 | 88:41  | 88.4    | 148.5  | 96.4 | 130.0     | 22.8  |

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TABLE 1 - 1 (CON'T)

## BASIC ORBITAL PARAMETERS

| DAY   | REV | PERIOD | PERIGEE | APOGEE | INC. | ARG. PER. | B-ANG |
|-------|-----|--------|---------|--------|------|-----------|-------|
| OR#13 | 500 |        |         |        |      |           |       |
| 32    | 511 | 88:51  | 88.7    | 155.3  | 96.3 | 132.9     | 22.8  |
| 33    | 527 | 88:47  | 88.7    | 153.4  | 96.3 | 129.2     | 22.9  |
| 34    | 543 | 88:43  | 88.7    | 151.3  | 96.3 | 125.4     | 23.0  |
| OR#14 | 549 |        |         |        |      |           |       |
| 35    | 559 | 88:51  | 88.5    | 158.4  | 96.3 | 124.5     | 23.0  |
| 36    | 577 | 88:47  | 88.5    | 156.5  | 96.3 | 120.4     | 23.1  |
| 37    | 592 | 88:43  | 88.3    | 154.4  | 96.3 | 116.7     | 23.2  |
| OR#15 | 599 |        |         |        |      |           |       |
| OR#16 | 601 |        |         |        |      |           |       |
| 38    | 608 | 88:49  | 88.4    | 152.6  | 96.3 | 138.5     | 23.3  |
| 39    | 624 | 88:46  | 88.6    | 150.7  | 96.3 | 134.7     | 23.3  |
| 40    | 641 | 88:42  | 88.6    | 148.6  | 96.3 | 130.4     | 23.4  |
| OR#17 | 646 |        |         |        |      |           |       |
| 41    | 657 | 88:50  | 88.6    | 155.4  | 96.3 | 132.3     | 23.5  |
| 42    | 673 | 88:47  | 88.7    | 153.4  | 96.3 | 128.6     | 23.6  |
| 43    | 689 | 88:43  | 88.6    | 151.7  | 96.3 | 124.8     | 23.6  |
| OR#18 | 695 |        |         |        |      |           |       |
| 44    | 718 | 88:50  | 88.4    | 158.7  | 96.3 | 123.0     | 23.7  |
| 45    | 722 | 88:47  | 88.5    | 156.8  | 96.3 | 119.3     | 23.8  |
| 46    | 738 | 88:44  | 88.3    | 155.2  | 96.3 | 117.1     | 23.9  |
| OR#19 | 744 |        |         |        |      |           |       |
| OR#20 | 746 |        |         |        |      |           |       |
| 47    | 754 | 88:49  | 88.5    | 152.7  | 96.3 | 138.2     | 23.9  |
| 48    | 770 | 88:45  | 88.4    | 150.6  | 96.3 | 134.4     | 24.0  |
| 49    | 787 | 88:41  | 88.5    | 148.4  | 96.3 | 130.0     | 24.1  |
| OR#21 | 792 |        |         |        |      |           |       |
| 50    | 803 | 88:50  | 88.6    | 155.8  | 96.3 | 132.3     | 24.1  |
| 51    | 819 | 88:47  | 88.6    | 154.1  | 96.3 | 128.6     | 24.2  |
| 52    | 835 | 88:44  | 88.5    | 152.1  | 96.3 | 124.9     | 24.3  |
| OR#22 | 847 |        |         |        |      |           |       |
| 53    | 851 | 88:52  | 88.9    | 158.6  | 96.3 | 126.8     | 24.3  |
| 54    | 868 | 88:48  | 88.9    | 156.6  | 96.3 | 122.7     | 24.4  |
| 55    | 884 | 88:44  | 88.8    | 154.4  | 96.3 | 118.8     | 24.4  |
| OR#23 | 890 |        |         |        |      |           |       |
| 56    | 908 | 88:49  | 88.6    | 159.6  | 96.3 | 116.4     | 24.5  |
| 57    | 916 | 88:45  | 88.5    | 157.3  | 96.3 | 112.8     | 24.6  |
| 58    | 933 | 88:41  | 88.2    | 154.4  | 96.3 | 108.8     | 24.6  |
| OR#24 | 938 |        |         |        |      |           |       |
| OR#25 | 940 |        |         |        |      |           |       |
| 59    | 949 | 88:51  | 88.5    | 154.1  | 96.3 | 138.8     | 24.7  |
| 60    | 965 | 88:47  | 88.4    | 151.9  | 96.3 | 133.9     | 24.7  |
| 61    | 981 | 88:43  | 88.3    | 149.8  | 96.3 | 129.9     | 24.8  |
| OR#26 | 986 |        |         |        |      |           |       |
| 62    | 997 | 88:50  | 88.7    | 154.7  | 96.3 | 132.8     | 24.8  |

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TABLE 1 - 1 (CON'T)

## BASIC ORBITAL PARAMETERS

| DAY   | REV  | PERIOD | PERIGEE | APOGEE | INC. | ARG.PER. | B-ANG |
|-------|------|--------|---------|--------|------|----------|-------|
| 63    | 1014 | 88:45  | 88.7    | 152.1  | 96.3 | 128.1    | 24.9  |
| 64    | 1030 | 88:40  | 88.5    | 149.3  | 96.3 | 124.1    | 24.9  |
| OR#27 | 1036 |        |         |        |      |          |       |
| 65    | 1046 | 88:52  | 88.5    | 158.7  | 96.3 | 128.0    | 25.0  |
| 66    | 1062 | 88:48  | 88.5    | 156.3  | 96.3 | 124.2    | 25.0  |
| 67    | 1078 | 88:44  | 88.4    | 153.7  | 96.3 | 120.5    | 25.1  |
| OR#28 | 1084 |        |         |        |      |          |       |
| 68    | 1095 | 88:49  | 88.5    | 158.5  | 96.3 | 120.8    | 25.1  |
| 69    | 1111 | 88:44  | 88.2    | 155.4  | 96.3 | 117.1    | 25.1  |
| 70    | 1127 | 88:40  | 87.9    | 152.5  | 96.3 | 113.3    | 25.2  |
| OR#29 | 1133 |        |         |        |      |          |       |
| OR#30 | 1135 |        |         |        |      |          |       |
| 71    | 1143 | 88:53  | 88.5    | 155.9  | 96.3 | 138.4    | 25.2  |
| 72    | 1160 | 88:49  | 88.6    | 153.6  | 96.3 | 134.0    | 25.2  |
| 73    | 1176 | 88:45  | 88.5    | 151.6  | 96.3 | 129.9    | 25.3  |
| OR#31 | 1182 |        |         |        |      |          |       |
| 74    | 1189 | 88:50  | 88.5    | 155.8  | 96.3 | 131.1    | 25.3  |
| 75    | 1205 | 88:45  | 88.3    | 153.3  | 96.3 | 127.2    | 25.3  |
| 76    | 1224 | 88:40  | 88.3    | 150.2  | 96.3 | 122.4    | 25.3  |
| OR#32 | 1230 |        |         |        |      |          |       |
| 77    | 1241 | 88:51  | 88.6    | 158.4  | 96.3 | 125.2    | 25.4  |
| 78    | 1257 | 88:47  | 88.5    | 156.2  | 96.3 | 121.4    | 25.4  |
| 79    | 1273 | 88:42  | 88.3    | 153.6  | 96.3 | 117.7    | 25.4  |
| OR#33 | 1278 |        |         |        |      |          |       |
| 80    | 1289 | 88:49  | 88.6    | 159.2  | 96.3 | 119.2    | 25.4  |
| 81    | 1306 | 88:44  | 88.5    | 156.5  | 96.3 | 115.1    | 25.4  |
| 82    | 1322 | 88:40  | 88.1    | 153.7  | 96.3 | 111.5    | 25.4  |
| OR#34 | 1328 |        |         |        |      |          |       |
| OR#35 | 1330 |        |         |        |      |          |       |
| 83    | 1338 | 88:51  | 88.4    | 154.1  | 96.3 | 138.4    | 25.4  |
| 84    | 1354 | 88:46  | 88.3    | 151.5  | 96.3 | 134.4    | 25.5  |
| 85    | 1370 | 88:41  | 88.2    | 148.8  | 96.3 | 130.2    | 25.5  |
| OR#36 | 1376 |        |         |        |      |          |       |
| 86    | 1387 | 88:51  | 88.6    | 155.9  | 96.3 | 134.2    | 25.5  |
| 87    | 1403 | 88:47  | 88.6    | 153.4  | 96.3 | 130.1    | 25.5  |
| 88    | 1419 | 88:43  | 88.4    | 151.1  | 96.3 | 126.5    | 25.5  |
| OR#37 | 1431 |        |         |        |      |          |       |
| 89    | 1435 | 88:53  | 88.6    | 158.4  | 96.3 | 130.2    | 25.5  |
| 90    | 1451 | 88:48  | 88.6    | 155.6  | 96.3 | 126.2    | 25.5  |
| 91    | 1468 | 88:42  | 88.3    | 152.0  | 96.3 | 121.8    | 25.4  |
| OR#38 | 1474 |        |         |        |      |          |       |
| 92    | 1484 | 88:52  | 88.4    | 159.4  | 96.3 | 124.7    | 25.4  |
| 93    | 1500 | 88:46  | 88.2    | 155.9  | 96.3 | 120.8    | 25.4  |
| 94    | 1516 | 88:39  | 87.8    | 151.7  | 96.3 | 116.9    | 25.4  |
| OR#39 | 1522 |        |         |        |      |          |       |

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TABLE 1 - 1 (CON'T)

## BASIC ORBITAL PARAMETERS

| DAY   | REV  | PERIOD | PERIGEE | APOGEE | INC. | ARG. PER. | B-ANG |
|-------|------|--------|---------|--------|------|-----------|-------|
| 95    | 1533 | 88:51  | 88.3    | 160.3  | 96.3 | 122.0     | 25.4  |
| 96    | 1549 | 88:45  | 87.9    | 156.5  | 96.3 | 118.0     | 25.4  |
| 97    | 1565 | 88:39  | 87.5    | 152.4  | 96.3 | 114.3     | 25.4  |
| OR#40 | 1570 |        |         |        |      |           |       |
| 98    | 1581 | 88:53  | 88.5    | 162.5  | 96.3 | 120.7     | 25.4  |
| 99    | 1597 | 88:48  | 88.3    | 159.1  | 96.3 | 116.9     | 25.4  |
| 100   | 1614 | 88:45  | 87.9    | 155.6  | 96.3 | 112.6     | 25.3  |
| OR#41 | 1620 |        |         |        |      |           |       |
| OR#42 | 1622 |        |         |        |      |           |       |
| 101   | 1630 | 88:52  | 88.6    | 154.9  | 96.3 | 138.1     | 25.3  |
| 102   | 1646 | 88:47  | 88.4    | 152.1  | 96.3 | 134.0     | 25.3  |
| 103   | 1662 | 88:41  | 88.2    | 148.8  | 96.3 | 129.9     | 25.3  |
| OR#43 | 1668 |        |         |        |      |           |       |
| 104   | 1679 | 88:48  | 88.6    | 153.0  | 96.3 | 132.6     | 25.2  |
| 105   | 1695 | 88:43  | 88.4    | 151.0  | 96.3 | 128.5     | 25.2  |
| 106   | 1711 | 88:38  | 88.1    | 147.8  | 96.3 | 124.4     | 25.2  |
| OR#44 | 1717 |        |         |        |      |           |       |
| 107   | 1727 | 88:49  | 88.6    | 155.4  | 96.3 | 129.4     | 25.2  |
| OR#45 | 1737 |        |         |        |      |           |       |
| 108   | 1743 | 88:54  | 88.6    | 153.6  | 96.3 | 129.8     | 25.1  |
| 109   | 1760 | 88:49  | 88.5    | 156.5  | 96.3 | 125.5     | 25.1  |
| 110   | 1776 | 88:44  | 88.4    | 153.6  | 96.3 | 121.3     | 25.1  |
| OR#46 | 1782 |        |         |        |      |           |       |
| 111   | 1792 | 88:40  | 88.3    | 157.0  | 96.3 | 121.9     | 25.1  |
| 112   | 1808 | 88:41  | 87.9    | 152.8  | 96.3 | 118.0     | 25.0  |
| 113   | 1825 | 88:34  | 87.4    | 148.3  | 96.3 | 113.6     | 25.0  |
| OR#47 | 1830 |        |         |        |      |           |       |
| 114   | 1841 | 88:56  | 88.7    | 163.3  | 96.3 | 123.5     | 25.0  |
| 115   | 1857 | 88:51  | 88.5    | 160.3  | 96.3 | 120.0     | 24.9  |
| 116   | 1873 | 88:46  | 88.2    | 156.9  | 96.3 | 115.8     | 24.9  |
| OR#48 | 1879 |        |         |        |      |           |       |
| 117   | 1889 | 88:51  | 88.3    | 160.7  | 96.3 | 116.3     | 24.9  |
| 118   | 1906 | 88:44  | 87.9    | 156.8  | 96.3 | 112.2     | 24.9  |
| 119   | 1922 | 88:42  | 87.4    | 152.6  | 96.3 | 108.3     | 24.8  |
| OR#49 | 1928 |        |         |        |      |           |       |
| 120   | 1938 | 88:40  | 86.8    | 156.0  | 96.3 | 128.2     | 24.8  |

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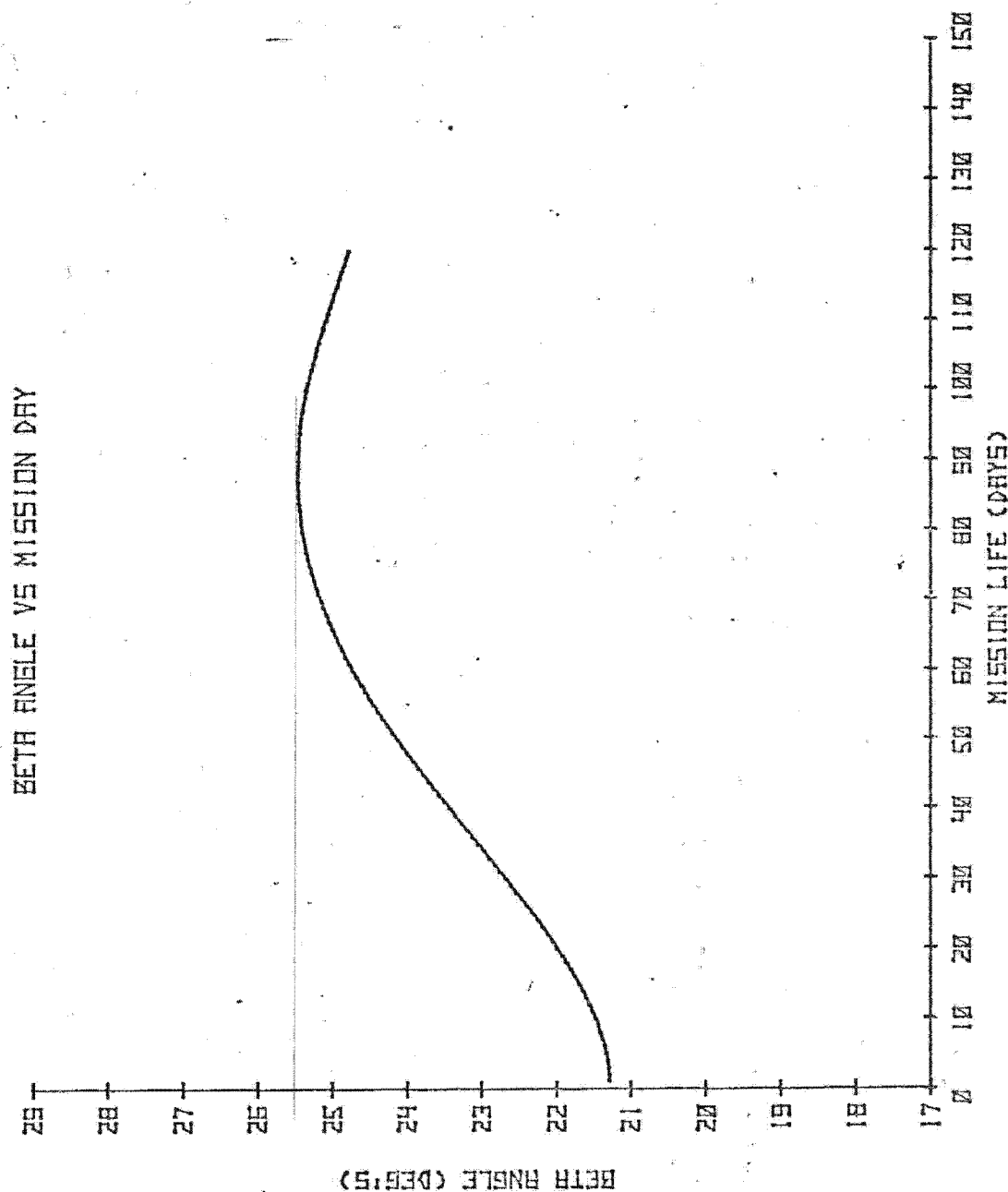


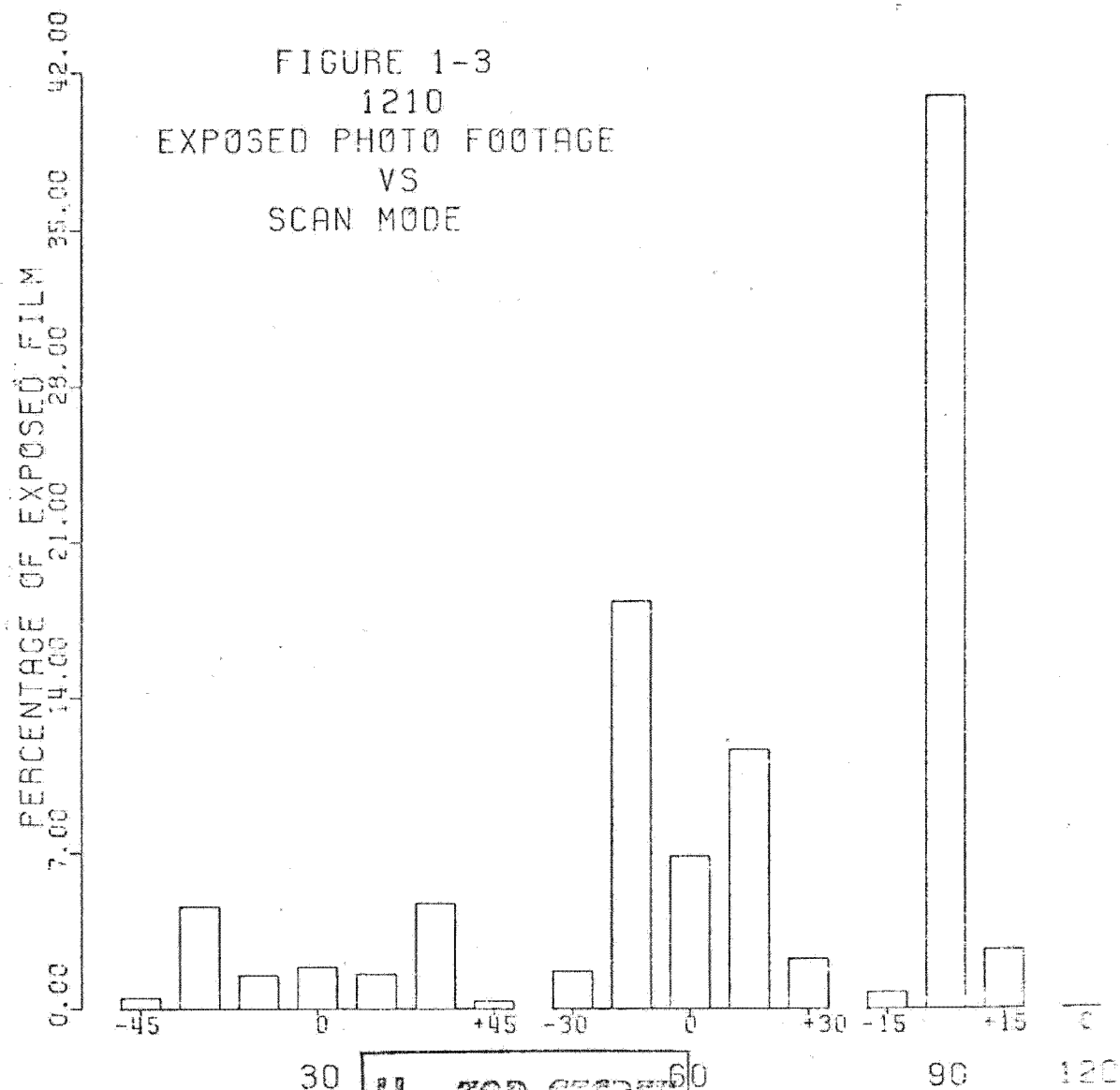
Figure 1-2

FIGURE 1-2. BETA ANGLE VS MISSION DAY

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30

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60

90

120

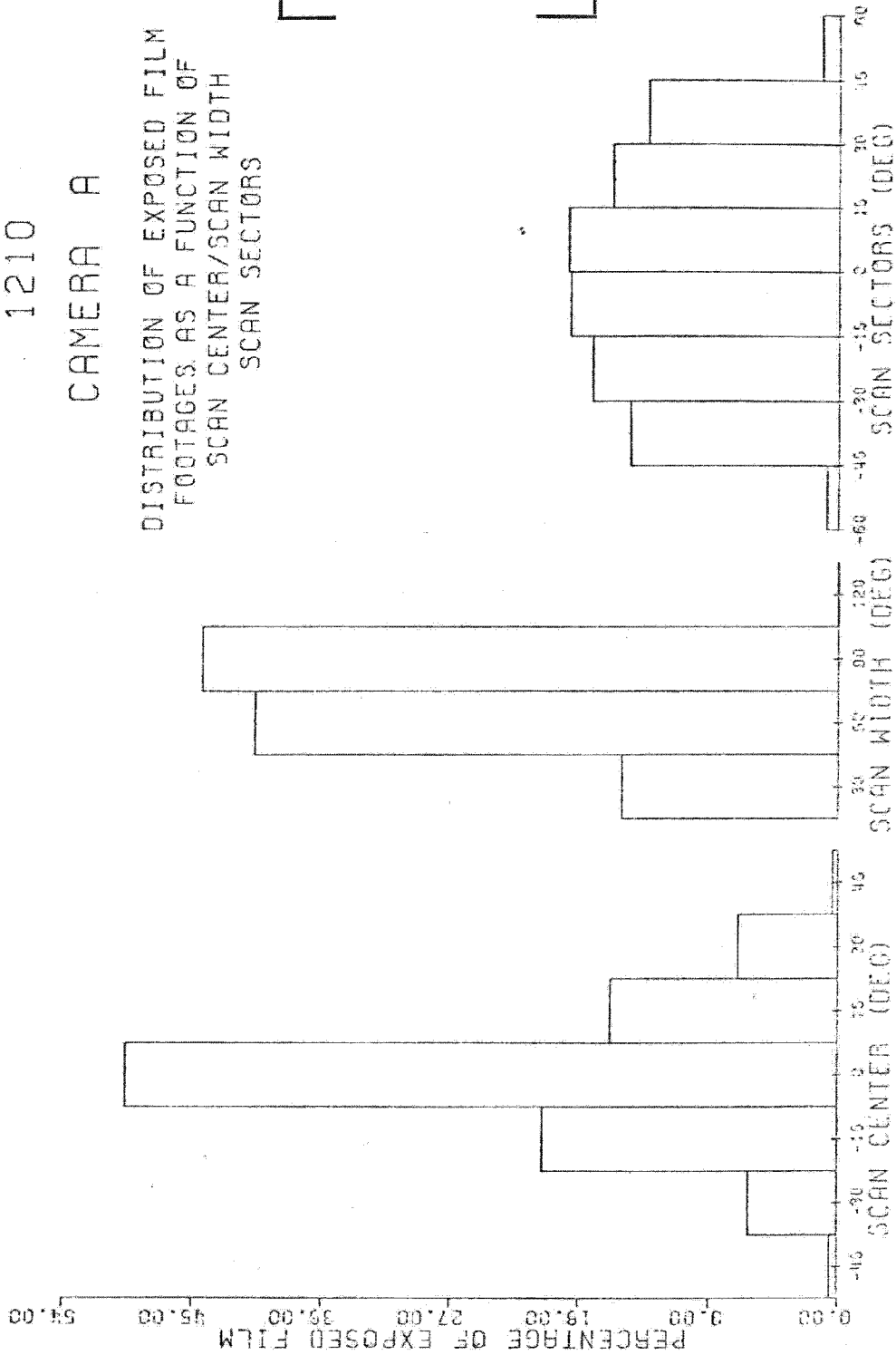
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FIGURE 1-4

1210

CAMERA A

DISTRIBUTION OF EXPOSED FILM  
FOOTAGES AS A FUNCTION OF  
SCAN CENTER/SCAN WIDTH  
SCAN SECTORS



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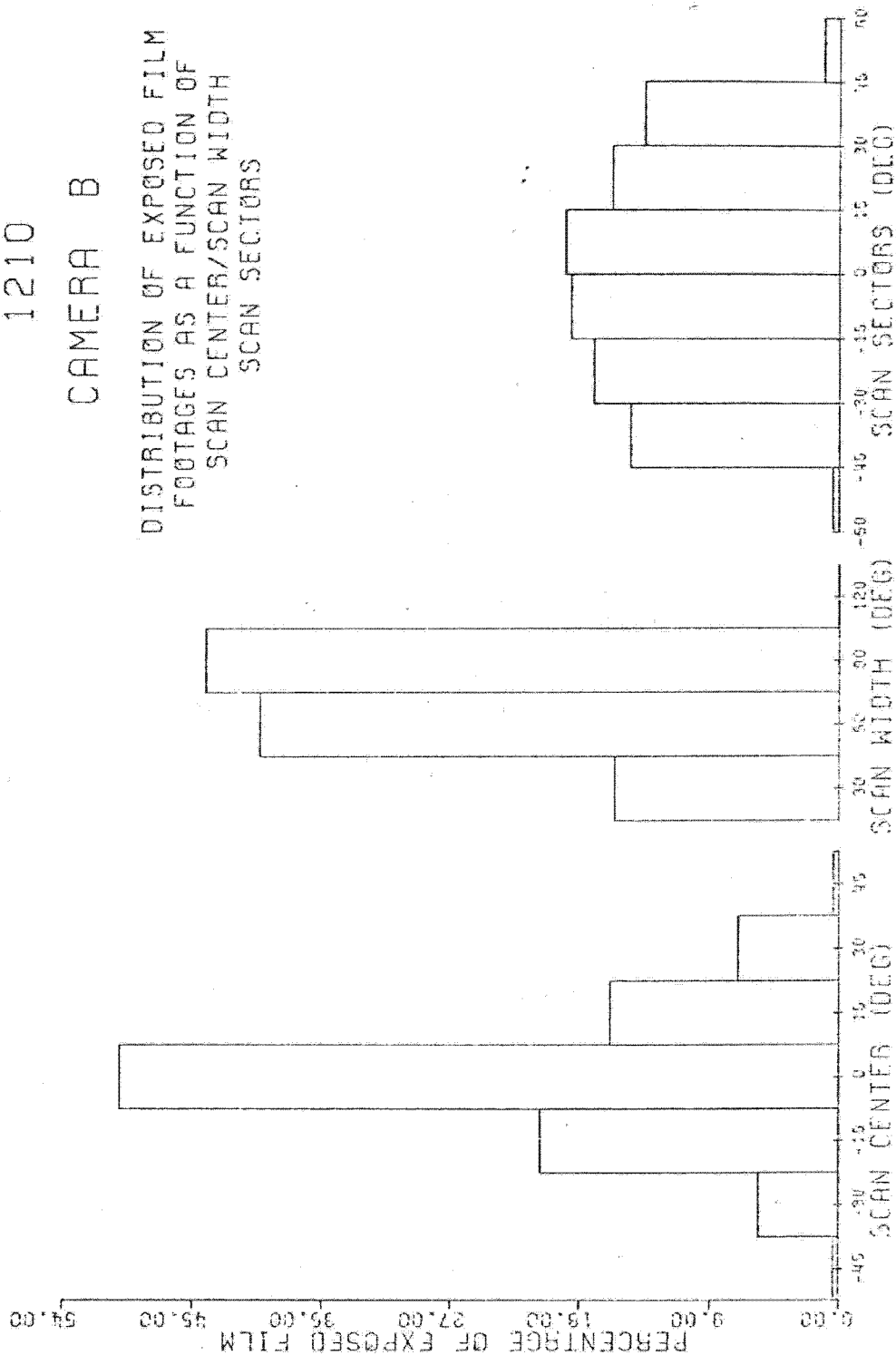
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FIGURE 1-5

1210

CAMERA B

DISTRIBUTION OF EXPOSED FILM  
FOOTAGES AS A FUNCTION OF  
SCAN CENTER/SCAN WIDTH  
SCAN SECTORS



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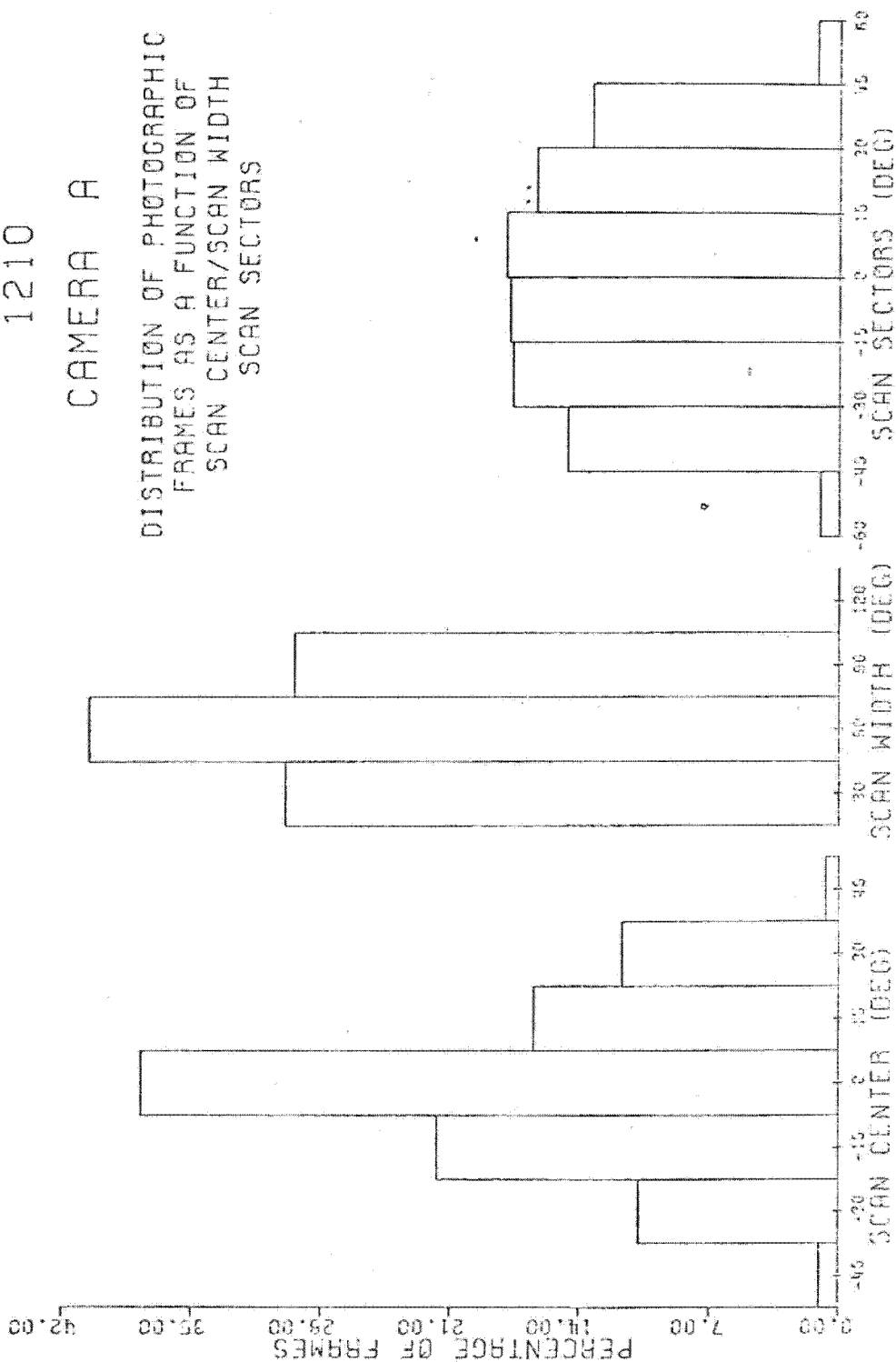
BIF-007/D-0071-75

FIGURE 1-6

1210

CAMERA A

DISTRIBUTION OF PHOTOGRAPHIC  
FRAMES AS A FUNCTION OF  
SCAN CENTER/SCAN WIDTH  
SCAN SECTORS



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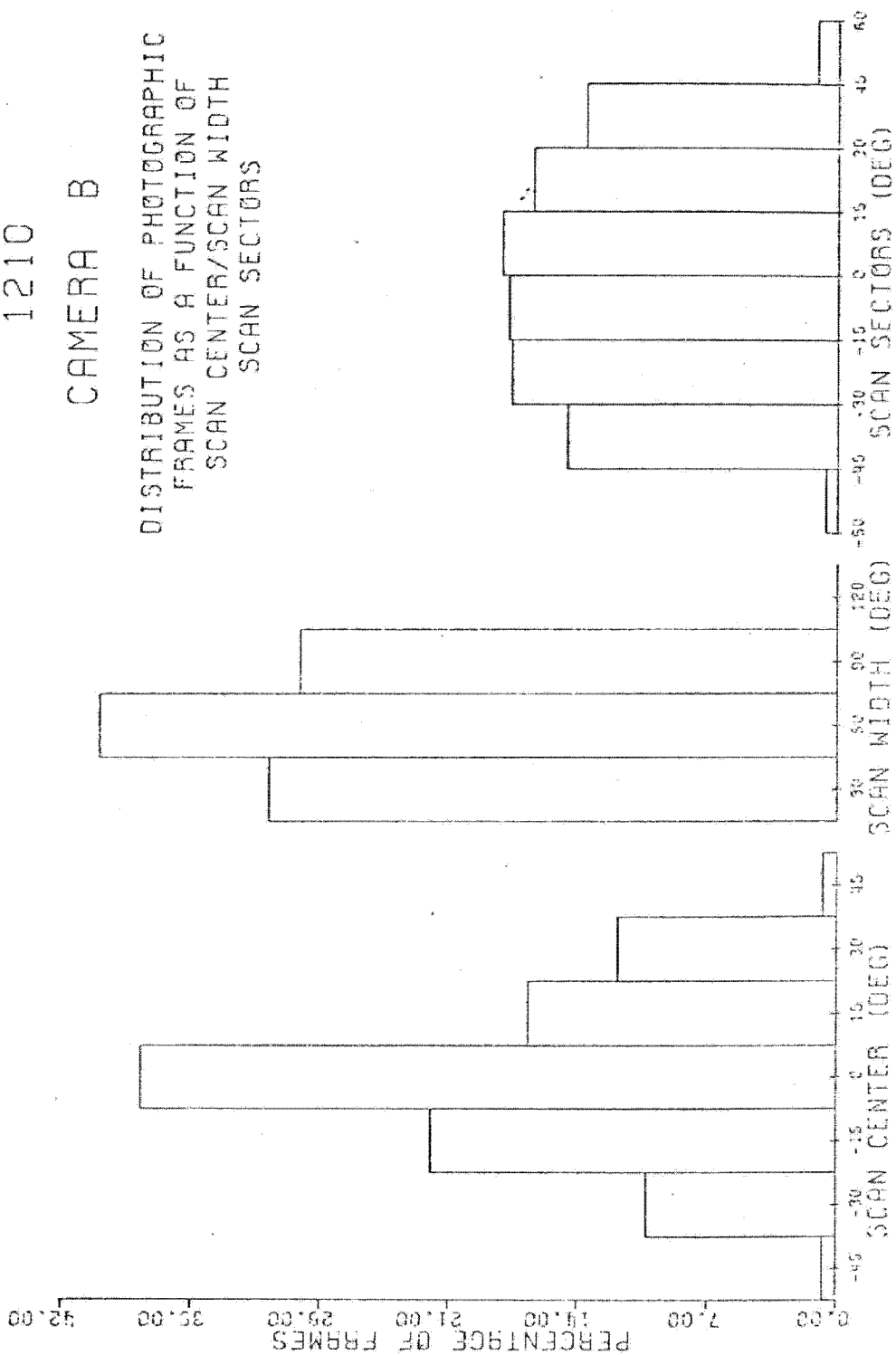
BIF-007/D-0071-75

FIGURE 1-7

1210

CAMERA B

DISTRIBUTION OF PHOTOGRAPHIC  
FRAMES AS A FUNCTION OF  
SCAN CENTER/SCAN WIDTH  
SCAN SECTORS



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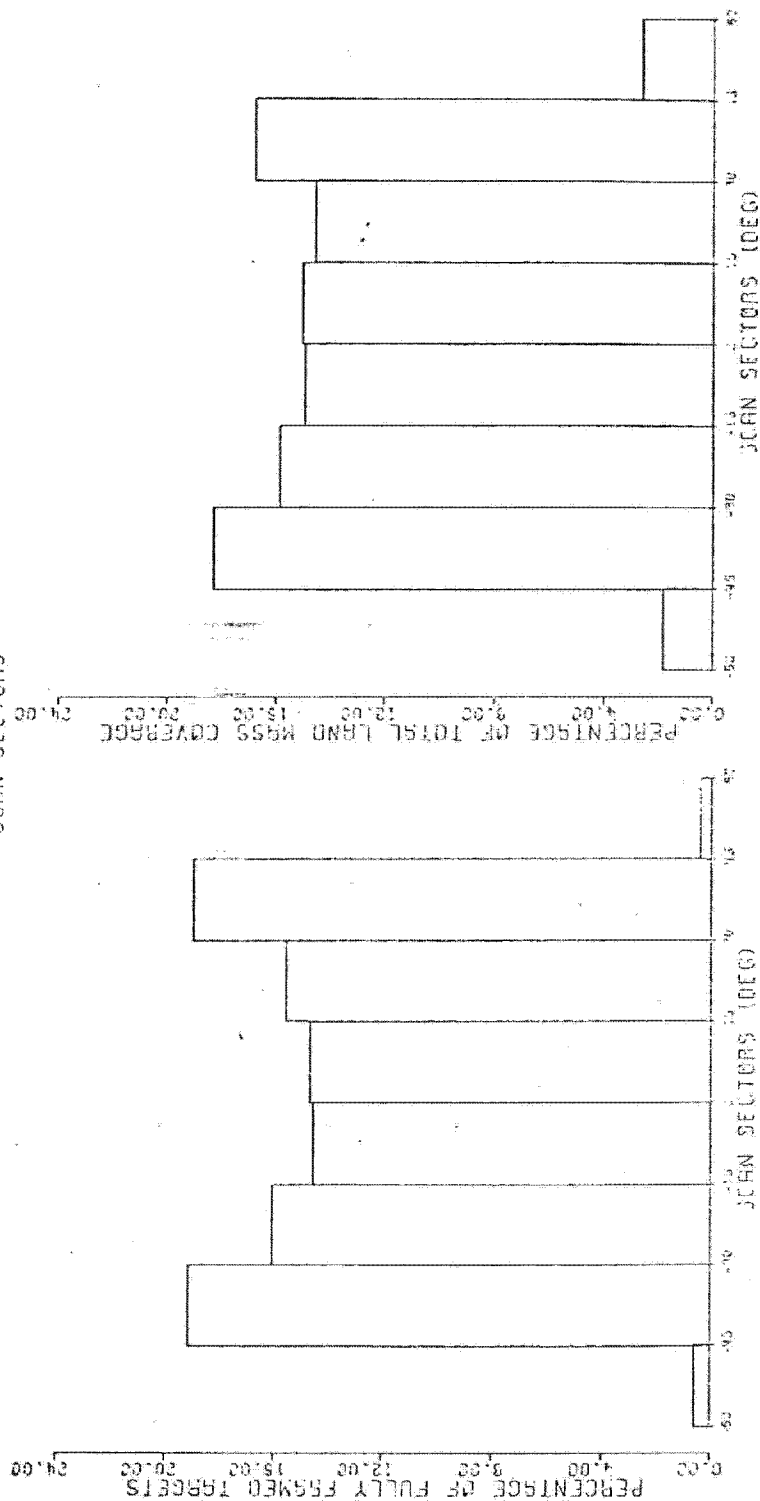
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FIGURE 1-8

1210

CAMERA A

DISTRIBUTION OF FULLY FRAMED  
TARGETS / TOTAL LAND MASS  
COVERAGE AS A FUNCTION OF  
SCAN SECTORS

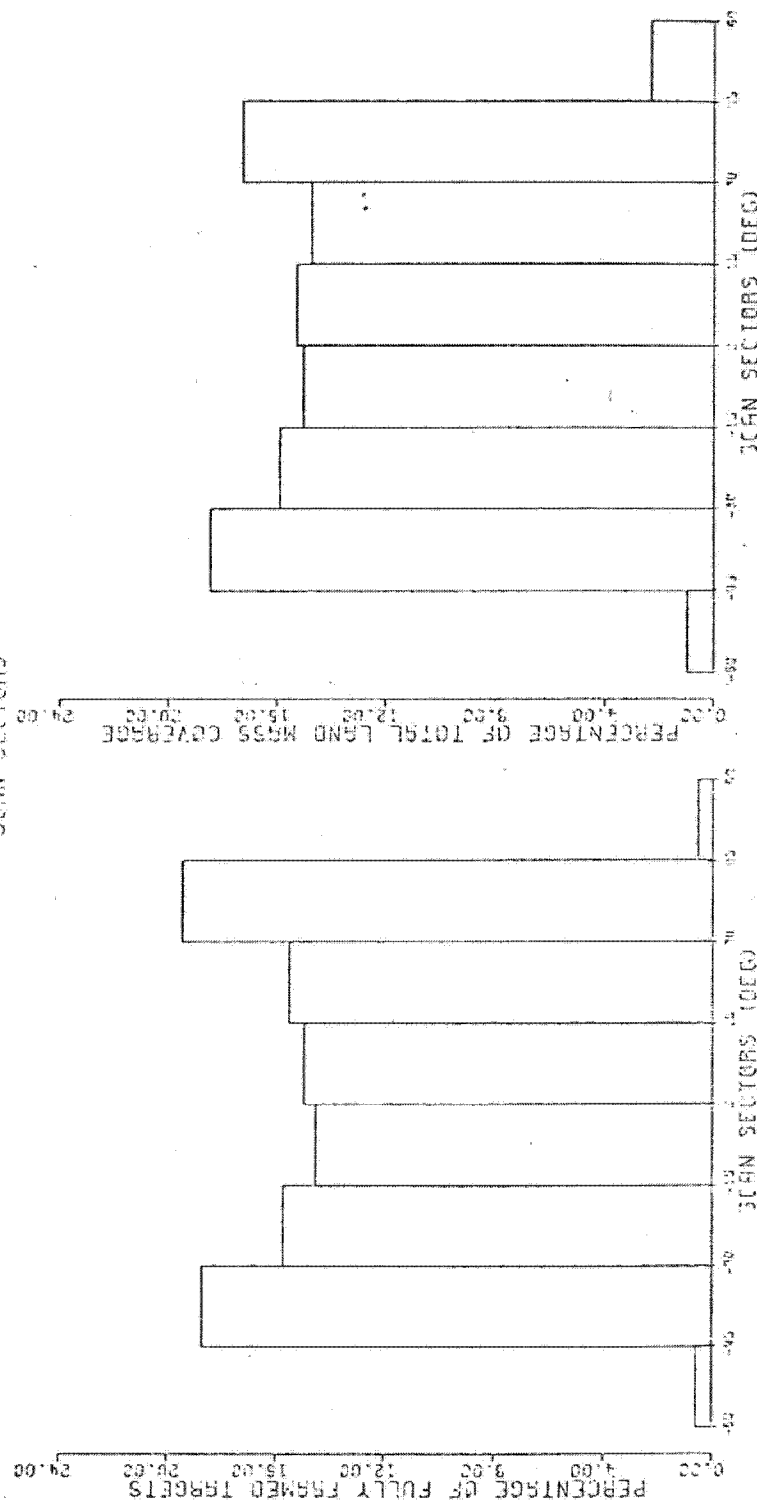


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FIGURE 1-9  
1210  
CAMERA B

DISTRIBUTION OF FULLY FRAMED  
TARGETS / TOTAL LAND MASS  
COVERAGE AS A FUNCTION OF  
SCAN SECTORS



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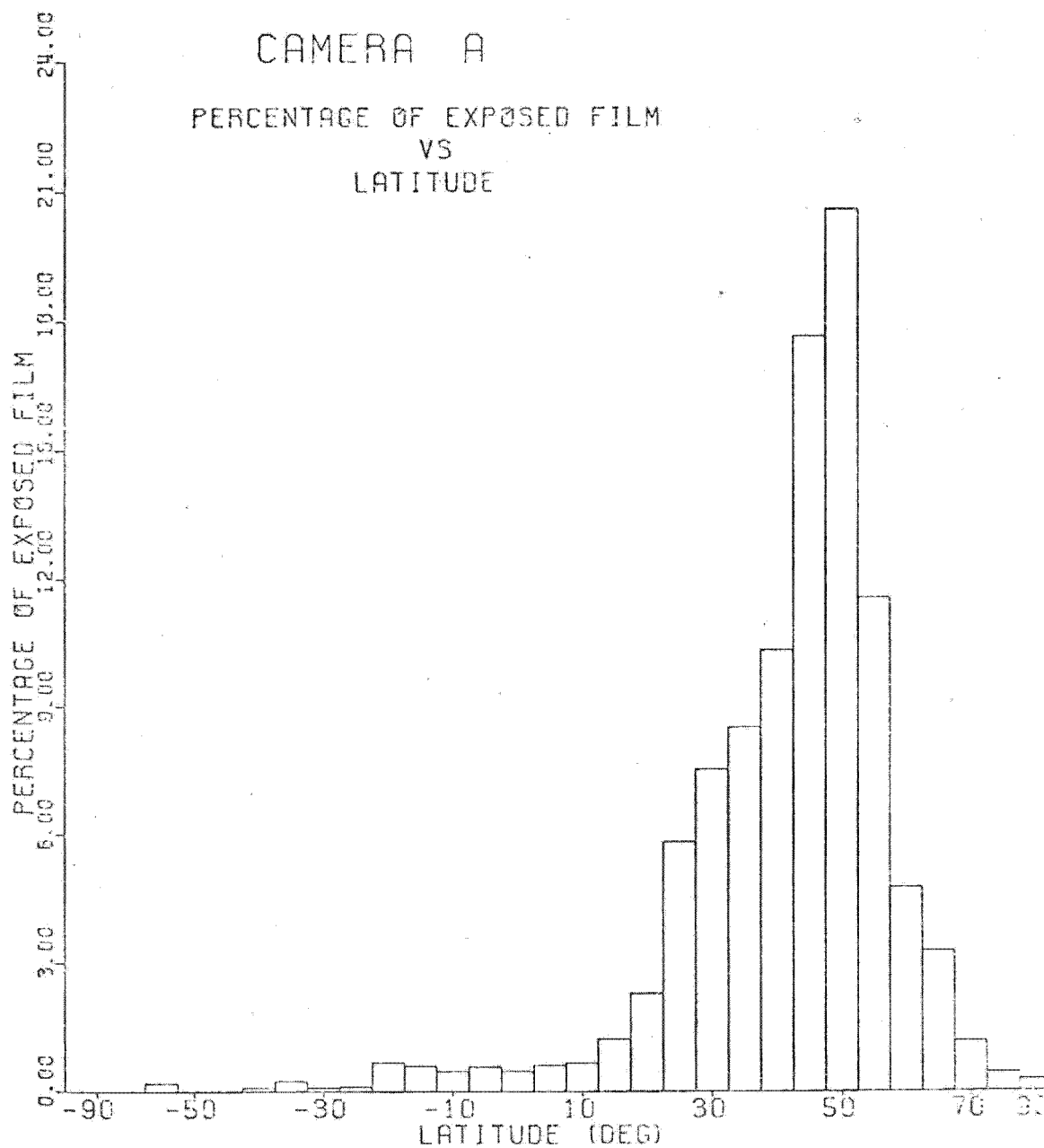
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FIGURE 1-10

1210

CAMERA A

PERCENTAGE OF EXPOSED FILM  
VS  
LATITUDE

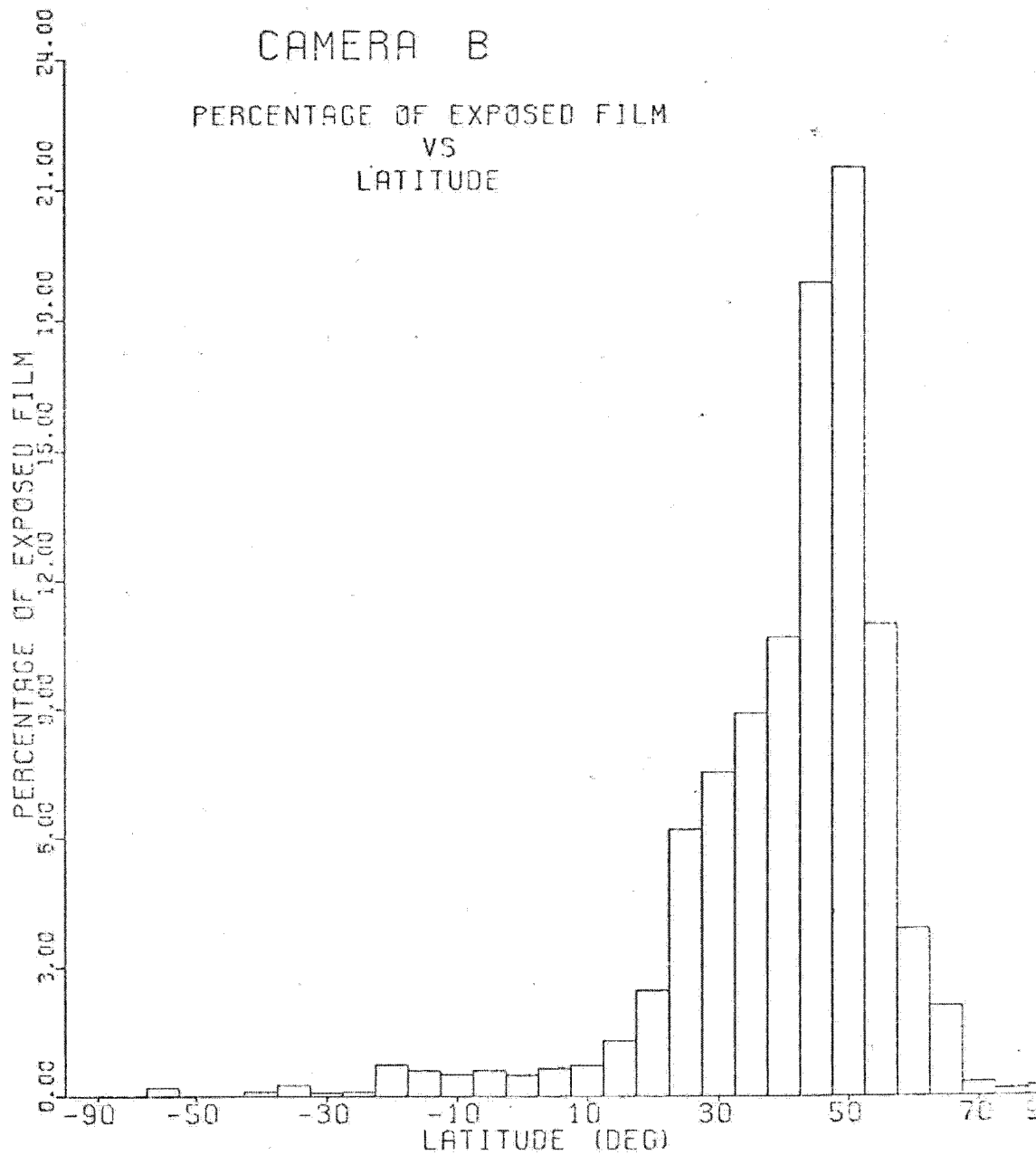
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FIGURE 1-11

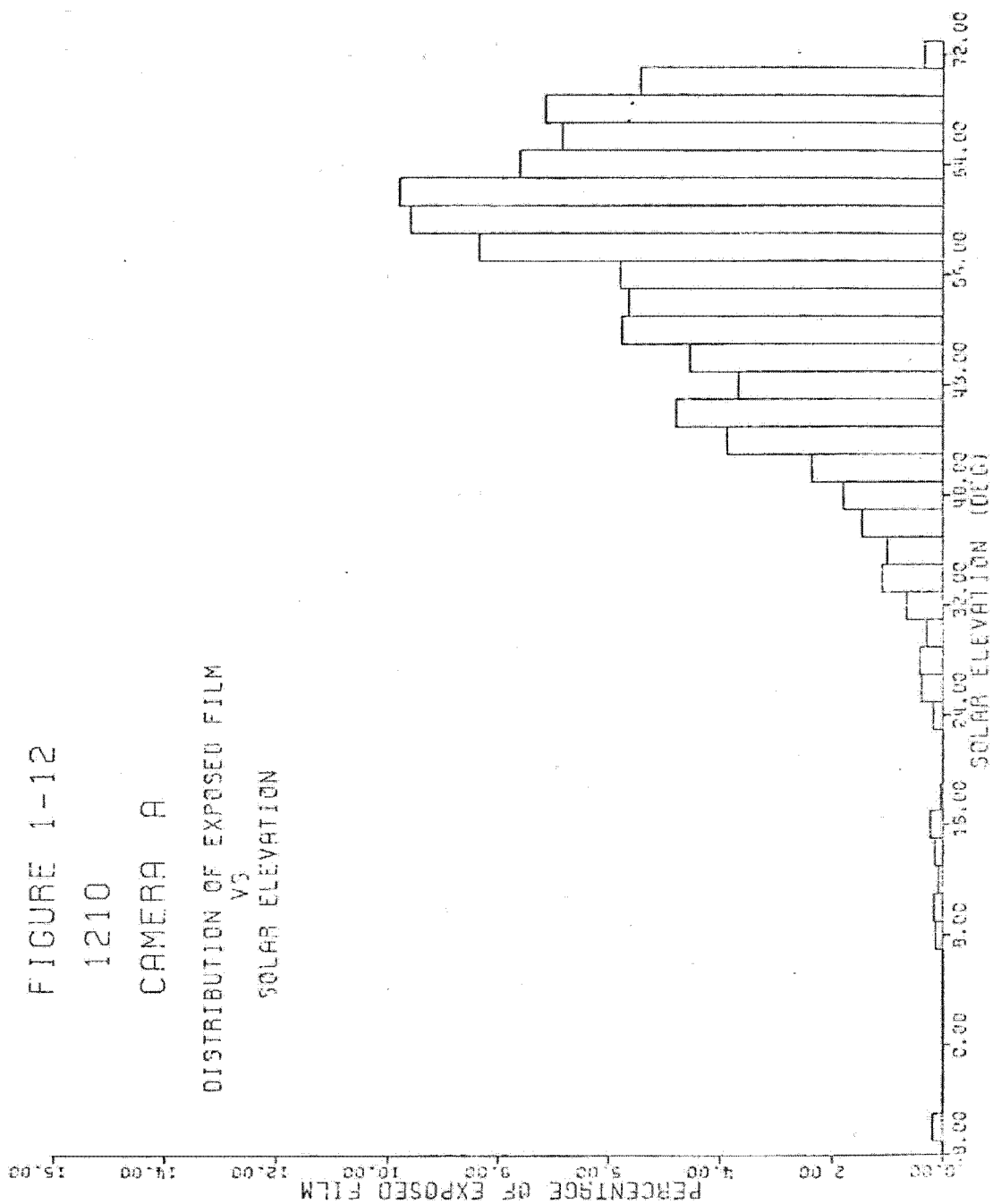
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CAMERA B

PERCENTAGE OF EXPOSED FILM  
VS  
LATITUDE~~TOP SECRET~~

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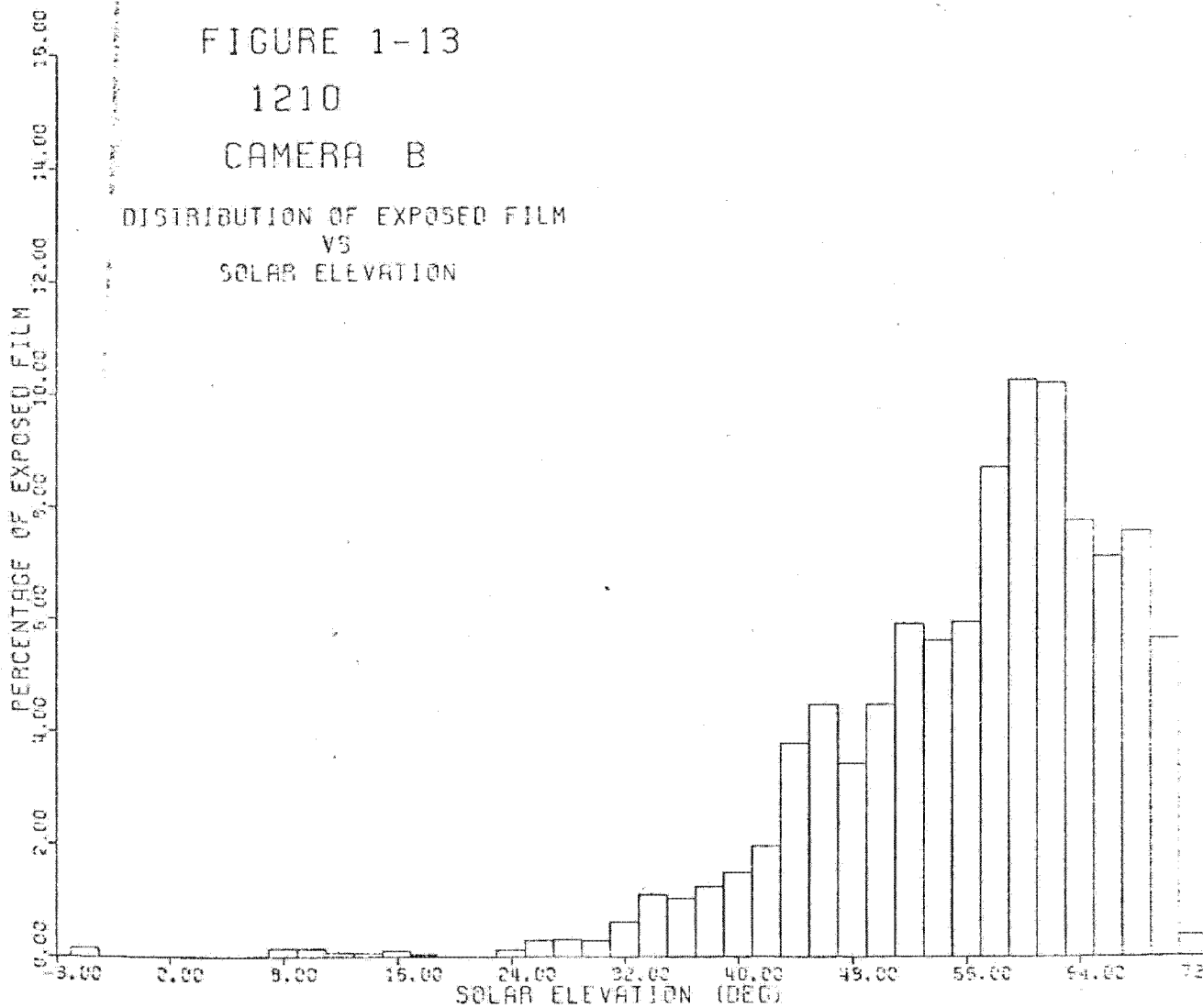
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FIGURE 1-13

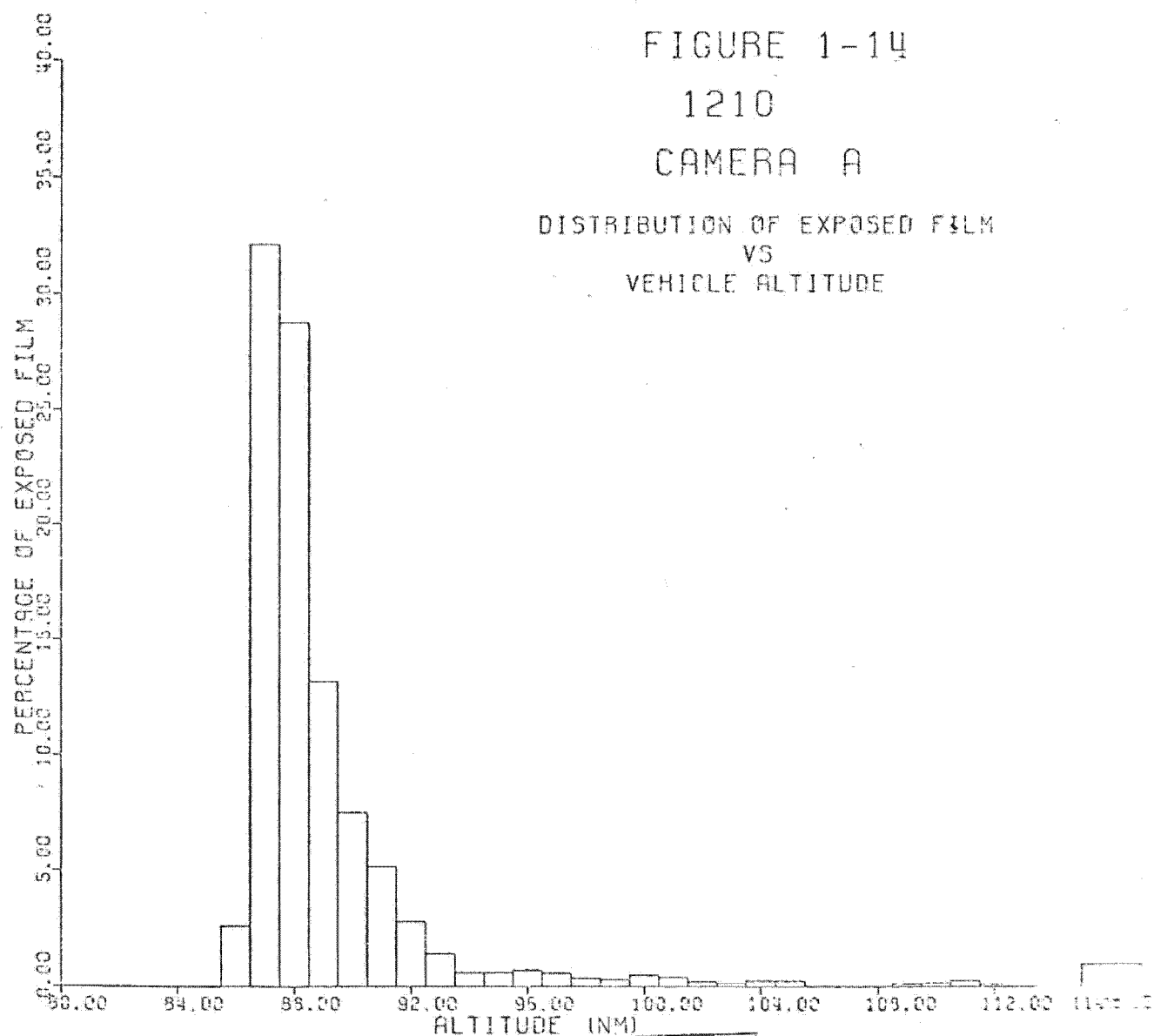
1210

CAMERA B

DISTRIBUTION OF EXPOSED FILM  
VS  
SOLAR ELEVATION~~TOP SECRET~~

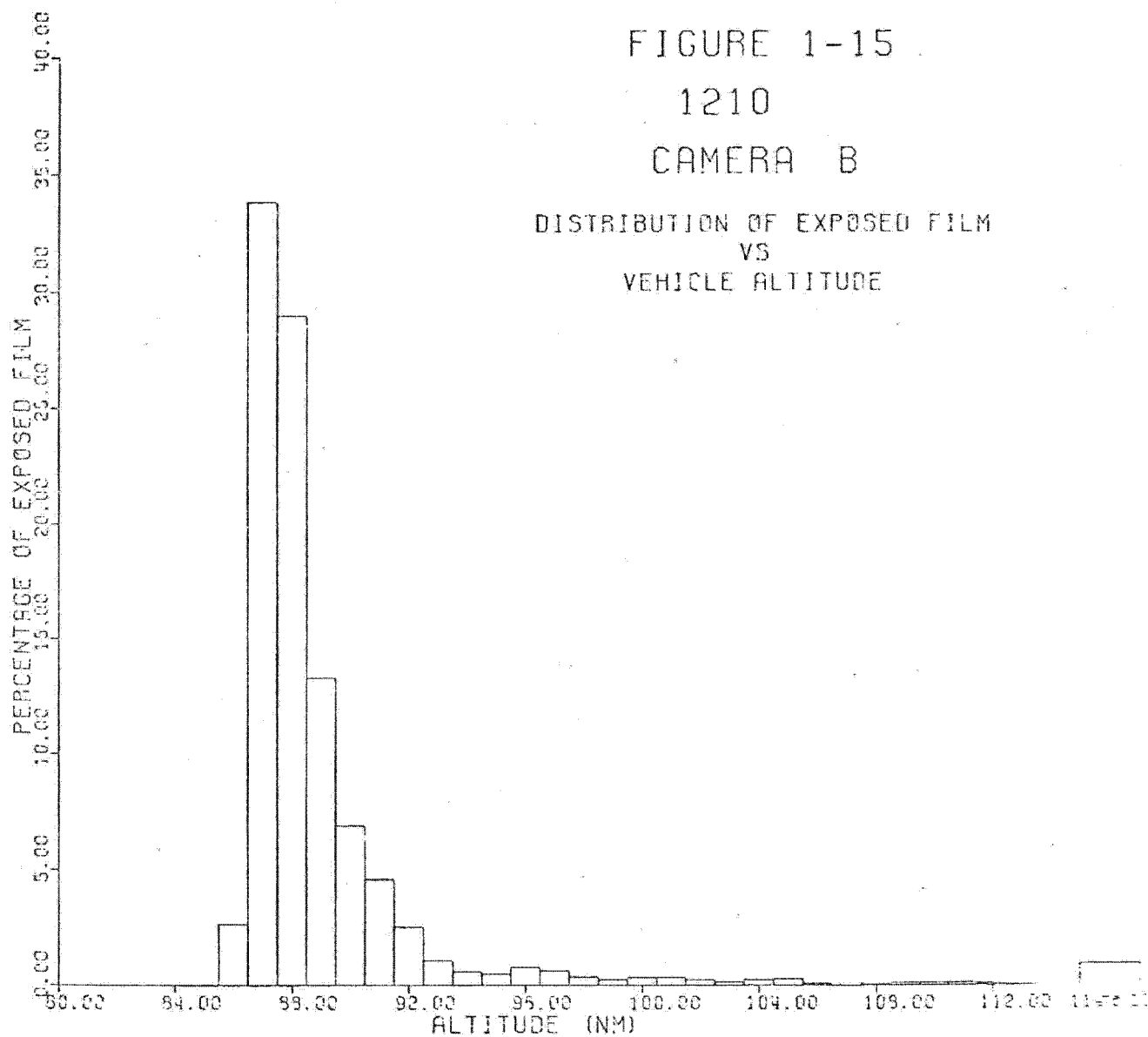
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## 2.0 SENSOR SYSTEM PERFORMANCE

### 2.1 Coarse Film Path

The coarse film path telemetry indicated proper hardware performance throughout Mission 1210 with the one exception noted below:

#### 2.1.1 RV-3 Integrator Reset Anomaly

During B-side operations in RV-3, the take-up integrator reset was found to be unpredictable. Consequently the system was constrained from nested operations. Improper performance of the reset function was noted on operations 367 through 388 and on operations 490 through 513.

The integrator signal in the take-up servo is used as a direct input to the loop to compensate for output coarse tension offset from a nominal 2.5 pounds. The integrated coarse tension offset is input to the servo loop from the time camera power comes on until camera power goes off. Until the transports are actually turned on the integrator signal is in itself in error because it is not indicative of an active transport. The normal procedure, then, is to reset the integrator signal at the time film transports are turned on and eliminate the false error input to the servo. Failure of the reset signal can result in an ESD, if, at the time transports are turned on, the integrator signal is sufficiently large. Proper operation of the film path can be accomplished with minor variances in output and input tensions at startup if the time between camera power on and film transports on is minimized. In normal stereo or mono operations this time period presents no problem, but in a nested operation, it can become excessive. Thus the system must be constrained from nested operations to allow proper system performance in the absence of a reset signal.

The problem is apparently the same as the one which occurred in RV-4 operations of Mission 1208 and in fact caused an ESD. Further detail on the problem may be found in the Post Flight Report of that Mission. (PM-1519-X).

Presently, analyses on the recovered take-up electronics unit are being conducted to try to repeat the failure and isolate the fault. From this data, suitable recommendations for avoiding the failure mode in the future will be forthcoming.

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### 2.1.2 Film Path Tracking

The system was constrained to a maximum rewind of five inches per second, but there were no constraints regarding scan angle or scan center.

No evidence of significant mistracking was noted during the mission. Improved stacking on RV's 2, 3, and 4 was attributed to the 180° builder roller configuration incorporated in these units.

### 2.1.3 Film Stack Depletion

The Forward camera stack was depleted in frame 63 of operation 789, and the Aft stack was depleted in the up-ramp of what was planned as operation 790. In both cases the expected loss of film path tension occurred and the system was shut down. The film remaining in the path was pulled onto the take-up on Rev 1944 during a constant velocity operation. This operation was part of the recovery preps and was implemented with ESD conditions over-ridden.

## 2.2 Fine Film Path

Prior to launch, due to the one day postponement, the camera system was caged, uncaged, then re-caged. Since the caging sequence has three power on/off's, the looper was cycled 12 times without film being transported in the interim. During the final caging sequence, torque disturbances were noted on the B-side output film drive and metering capstan servos. Evaluation of both the E/M data and the film indicated that the disturbances were probably related to rubbing of the film in the metering capstan area during the final caging sequence. This film rub and its subsequent effect on the system performance during the post launch OB stow sequence are further discussed in section 3.1.

Fine film path diagnostics indicated proper hardware performance throughout the mission with a minor exception in RV-4 operations. During this time noise level on the input and output drive summed errors for the Aft camera was noted to have increased by approximately two to one. An increase in B-side metering capstan summed error reports during RV-4 operations was attributed to degradation of the drive signals. The smear effect this degradation had on the product was negligible.

## 2.3 Command and Control

The Sensor System performance with respect to the Command and Control Subsystem was nominal throughout the mission except for the following anomalies:



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### 2.3 Command and Control - Cont'd.

The telemetry data on Rev 434 Guam indicated an ESD-B was generated on Rev 433. Evaluation of playback data showed a normal A-side turn-on, while the B-side did not respond to the CB+ command. At FT+ the B-side generated an ESD causing the A-side to shut down. The cause of the B-side ESD at FT+ was the combination of the SU and TU brakes being released without power being applied to the TU and SU motors, thereby causing the film to go slack and an undertension ESD was generated.

Subsequently a Mono-B mini-creep was attempted with ESD override on Rev 440. Camera B power failed to properly execute but telemetry indicated that some components were being powered at CB+ as evidenced by a current increase and clearing of the MFA ESD monitor. On Rev 442 an attempt was made to power the Aft camera by commanding CB+ which was unsuccessful. On Rev 449 a CB+ blink test was run where the command for power turn-on was pulsed repeatedly. This sequence was successful and a B-side creep was run and performed properly. This was followed by a constant velocity run and an OB stow on Rev 456. On Rev 458 Guam, an engineering sequence was run as a Mono-B health test. The proper operation during this test led to normal operations beginning on Rev 461. The cause of the problem was apparently contamination between contacts in relay K11 of the Power Distribution System.

### 2.4 Sensor System Control

Sensor System Control was accomplished throughout the mission utilizing SCC II without anomalies or failures.

### 2.5 Optical Bar Performance

The optical bars performed properly throughout the mission. Variation between commanded and actual OB velocities was as noted in pre-flight testing, and was within the specification limits of 0.00054 rad/sec.

### 2.6 LSFS/Focus

The LSFS output, as with previous Sensor Systems, was deemed reliable only on the first operation of each day (i.e., after three hours of non-operation and during the first five minutes of the first subsequent operation). Readings of the LSFS output were taken only at those times throughout mission 1210.

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## 2.6 LSFS/Focus - Cont'd.

Pre-flight determined focus settings were 31 microns for 1414 film on the Forward camera; 61 microns for SO-255 and SO-130 on the Aft camera; and 31 microns for both 1414 and SO-124 on the Aft camera.

## 2.7 Instrumentation

All instrumentation operated normally throughout the mission. The system provided consistent and accurate data for analysis and verification of camera status.

## 2.8 Pneumatics

The pneumatic system nitrogen reserve status for Mission 1210 was as follows:

|                              | <u>TANK A</u>                 |                            |                             | <u>TANK B</u>                |                            |                             | <u>Total</u>                |
|------------------------------|-------------------------------|----------------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|-----------------------------|
| <u>Event</u>                 | <u>Press.</u><br><u>(psi)</u> | <u>Temp</u><br><u>(°f)</u> | <u>Mass</u><br><u>(lbs)</u> | <u>Press</u><br><u>(psi)</u> | <u>Temp</u><br><u>(°f)</u> | <u>Mass</u><br><u>(lbs)</u> | <u>Mass</u><br><u>(lbs)</u> |
| Liftoff                      | 3262                          | 68                         | 17.29                       | 3332                         | 68                         | 17.60                       | 34.89                       |
| End of<br>Primary<br>Mission | 98                            | 70                         | 0.55                        | 140                          | 69                         | 0.78                        | 1.33                        |

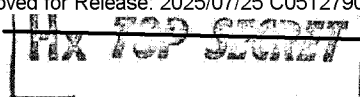
The average nitrogen use rate was 0.023 lbs/min throughout the mission.

## 2.9 Trend Analysis

A statistical trend analysis of sensor system performance was maintained by the Systems Integration Section throughout Mission 1210. Data samples were taken from one operation per day, when available, and mean values and standard deviations were calculated and plotted for selected functions to facilitate the detection of any long term trends that would indicate the onset of system degradation. The functional parameters used for the analysis were as follows:

1. Film to Bar Sync Velocity Error (P451, P452)
2. Metering Capstan Summed Error (P403, P404)
3. Platen Skew Error (P415, P416)
4. Platen Photo Summed Error (P411, P412)
5. Input Drive Capstan Summed Error (P803, P804)

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## 2.9 Trend Analysis - Cont'd.

6. Output Drive Capstan Summed Error (P811, P812)
7. Supply Drive Summed Error (P105, P106)
8. Take-up in Use Drive Summed Error (TSEA, TSEB)
9. Optical Bar Summed Error (P501, P502)
10. OB Velocity Error
11. Looper Position (P601, P602)
12. Film Path Carriage Position (P713, P714)
13. Take-up Carriage Position (P951, P952)

System performance was normal throughout the mission. However, small shifts were evident in certain parameters and are summarized in chronological order as follows:

- RV-1 All signals indicated nominal performance.
- RV-2 At transition from 1414 to S0-255 material, the 2 sigma value of MCSE-B shifted from 0.015 to 0.052 i.p.s., the 2 sigma value of FBS-B increased slightly, and the 2 sigma value of the skew error was 0.00 for 30° scan angles.
- RV-3 The TU-B carriage position shifted in the outboard direction from 0.038 inches in RV-2 to 0.047 inches in RV-3.
- RV-4 Both TU carriage positions (A&B) shifted upon transfer from RV-3 to RV-4. The A&B shifts were from +0.033 to 0.043 and from 0.047 to 0.058 inches, respectively.

All B-side capstans (MCSE, IDC, ODC) and FBS-B contained distinct frequency components at 23 & 35 Hz. In addition, MCSE-B exhibited a predominant 76 Hz component.



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### 3.0 MISSION EVENT HISTORY

A summary listing of all sensor system photographic operations is presented in Appendix A-1 of this report. The summary primarily covers operational photography, but also includes SS and PFA engineering photography. The following is a chronological description of the engineering operations plus other special events that occurred during Mission 1210.

#### 3.1 Ascent

The countdown and launch were accomplished without incident on 8 June 1975. Uncage (sequences 204 and 205) and OB stow (sequences 213 and 214) occurred and were verified at Rev 1 Pogo. During review of the OB stow data a lack of expected dither was observed on the Aft camera M.C. during Camera Power On. During this sequence the M.C. Summed Error also assumed a level equivalent to approximately 1.2 oz-in. of torque but was unable to overcome the friction in the fine path. This friction, apparently caused by the film rubbing in the M.C. area and brought about by the multiple caging sequences prior to launch (section 2.2) resulted in the failure of the M.C. to dither. Proper tracking was established during the Rev 3 constant velocity run and this anomaly had no further impact on system operations.

#### 3.2 Health Checks

Day 1 operations thru Rev 4 were designed to verify systems health and confirm on-orbit operational readiness. Health check sequence 175, originally scheduled for 4 Guam, was performed at 6 Boss, the delay was due to late arrival of Rev 3 playback data that had to be evaluated prior to the release of inhibits. Health check events were performed as follows:

- Rev 1 The system uncage verification checks were performed at Pogo.
- Rev 3 A constant velocity run, sequence 208, was made to verify proper operation of the film transport system. Steerers, tensions, take-up and supply summed errors were nominal.
- Rev 6 The sensor system health check, sequence 175, was performed over Boss. All sensor system commands were functionally verified, including all tested bits of the variable commands. Focal plane position TM indicated 31 microns for both cameras.
- Rev 13 An engineering operation, sequence 209, was performed over Guam to provide characteristic telemetry data for comparison with subsequent operations for anomaly evaluation.

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## 3.3 MISSION 1210 ENGINEERING

| TEST TYPE                     | OBJECTIVE                                                                                 |
|-------------------------------|-------------------------------------------------------------------------------------------|
| 1 1414 THRU FOCUS             | OPTIMIZE FOCUS SETTINGS<br>COMPLETED                                                      |
| 3A 1414 SHEAR SLITS           | DETERMINE OPTIMUM SKEW ANGLE<br>AND FILM VELOCITY DOOR SETTINGS<br>COMPLETED IN TU2       |
| 4A S0255 RADIONETRIC CAL      | DETERMINE IMAGE TRANSFER AND<br>RADIONETRIC CALIBRATION<br>COMPLETED IN TU2, TU4          |
| 5 S0130 RADIONETRIC CAL       | DUPE TONE REPRODUCTION AND<br>RADIONETRIC CALIBRATION<br>COMPLETED IN TU3                 |
| 7A 1414 TUCSON ACQUISITION    | STANDARD SCENE FOR MISSION TO<br>MISSION QUALITY COMPARISON<br>COMPLETED IN TU1, TU2, TU3 |
| 7B S0124 TUCSON ACQUISITION   | PROVIDE STANDARD SCENE FOR<br>1414/S0124 COMPARISON<br>COMPLETED IN TU4                   |
| 9 TRI-BARS FOR RESOLUTION     | PHOTO QUALITY ASSESSMENT<br>COMPLETED IN TU1, TU2, TU3, TU4                               |
| 12 1414 QUALITY MONITOR       | MONITOR VARIATION IN<br>IMAGE QUALITY<br>COMPLETED IN TU1, TU2, TU3, TU4                  |
| 16A S0255 COB DETECTION       | VERIFY RED DOT SIMULATION<br>TEST NOT ACCOMPLISHED                                        |
| 16B S0130 COB DETECTION       | PROVIDE RED DOT S0255/S0130<br>COMPARISON<br>COMPLETED IN TU3                             |
| 17 S0124 THRU EXPOSURE        | COMPARE NOMINAL/UNDEREXPOSURE<br>PHOTO QUALITY OF S0124<br>COMPLETED IN TU4               |
| 18A S0130 THRU EXPOSURE NHEAT | REPRODUCTION/INSITE CALIBRATION<br>COMPLETED IN TU2, TU3                                  |
| 18C S0255 THRU EXPOSURE NHEAT | REPRODUCTION CALIBRATION<br>COMPLETED IN TU3                                              |

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## 3.4 MISSION 1210-1 SPECIAL EVENTS

| REV | OPN | TEST | PRE<br>WX | EVENT/LOCATION                             | VER<br>WX | FTG  |
|-----|-----|------|-----------|--------------------------------------------|-----------|------|
|     |     |      |           | PREFLIGHT FOOTAGE TUA                      |           | 1084 |
|     |     |      |           | PREFLIGHT FOOTAGE TUB                      |           | 1866 |
| 0.8 |     |      |           | UNCAGE/SCC 2 SELECT                        |           |      |
| 0.8 |     |      |           | STOW A/STOW B                              |           |      |
| 0.9 |     |      |           | UNCAGE VERIFY                              |           |      |
| 3   |     |      |           | INHIBITED CV                               |           | 102  |
| 6   | 1-3 |      |           | SS HEALTH CHECK                            |           | 188  |
| 13  | 12  |      |           | SS ENGINEERING TEST                        |           | 64   |
| 32  | 27  | 1    | 90        | 1414 THRU FOCUS<br>PHOENIX -6/0            | 99        | 20   |
| 41  | 31  |      |           | TRANSFER TO S0130                          |           |      |
| 42  | 34  |      |           | TRANSFER TO 1414                           |           |      |
| 80  | 65  | 1    | 85        | 1414 THRU FOCUS<br>DALLAS/FT WORTH 20/10/0 | 75        | 20   |
| 121 | 80  |      |           | PN EQUALIZATION                            |           |      |
| 144 | 92  | 1    | 70        | 1414 THRU FOCUS<br>PHILADELPHIA -20/-10/0  | 00        | 130  |
|     |     |      | 70        | BALTIMORE 10/20                            | 00        |      |
|     |     |      | 70        | WASHINGTON 10/20                           | 00        |      |
| 146 | 93  | 1    | 65        | 1414 THRU FOCUS<br>SACRAMENTO -20/-10      | 95        | 39   |
|     |     |      | 65        | STOCKTON 6/0                               | 95        |      |

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## 3.4 MISSION 1210-1 SPECIAL EVENTS CONT'D

| REV | OPN | TEST       | PRE<br>WX | EVENT/LOCATION                                           | VER<br>WX | FTG |
|-----|-----|------------|-----------|----------------------------------------------------------|-----------|-----|
| 177 | 108 | 1          | 25<br>70  | 1414 THRU FOCUS<br>MILWAUKEE -10/0<br>CHICAGO 10/0/-10/0 | 00<br>75  | 61  |
| 178 | 109 | 1          | 99        | 1414 THRU FOCUS<br>PHOENIX -10/0                         | 95        | 30  |
| 194 | 114 | 7A:9<br>12 | 90        | 1414 QUALITY STANDARD<br>ALBUQUERQUE W/ST                | 95        | 27  |
| 211 | 119 | 1          | 85        | 1414 THRU FOCUS<br>SAN FRANCISCO -10/0/10                | 10        | 38  |
| 248 | 135 |            |           | PN EQUALIZATION                                          |           |     |
| 259 |     |            |           | TRANSFER TO TU2-PREP 1                                   |           |     |

|               |      |      |
|---------------|------|------|
| TU FOOTAGE    | 2619 | 2597 |
| TOTAL FOOTAGE | 2619 | 2597 |

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## 3.5 MISSION 1210-2 SPECIAL EVENTS

| REV | OPN | TEST | PRE<br>WX | EVENT/LOCATION                 | VER<br>WX | FTG |
|-----|-----|------|-----------|--------------------------------|-----------|-----|
| 259 |     |      |           | TRANSFER TO TU2-PREP 1         |           | 23  |
| 260 |     |      |           | TU2 - PREP 2 :                 |           | 50  |
| 292 | 162 | 3A   |           | 1414 SMEAR SLITS<br>SACRAMENTO |           | 60  |
|     |     |      | 99        | SAN FRANCISCO BAY              | 99        |     |
| 308 | 169 | 3A   |           | 1414 SMEAR SLITS               |           | 120 |
|     |     |      | 85        | LOS ANGELES                    | 99        |     |
|     |     |      | 85        | SAN DIEGO                      | 99        |     |
| 314 | 171 |      |           | 1414 OORA PSIA NOM TO +1       |           |     |
| 324 | 181 | 1,12 |           | 1414 THRU FOCUS                |           | 35  |
|     |     |      | 99        | PHOENIX                        | 99        |     |
| 340 | 188 | 1    |           | 1414 THRU FOCUS                |           | 30  |
|     |     |      | 85        | ALBUQUERQUE 10/0               | 95        |     |
| 355 | 194 | 1    |           | 1414 THRU FOCUS                |           | 30  |
|     |     |      | 70        | BUFFALO -10/0                  | 75        |     |
|     | 195 |      | 70        | PITTSBURG -10/0                | 75        | 32  |
|     |     |      |           | PN EQUALIZATION                |           |     |
| 357 | 196 | 3A   |           | 1414 SMEAR SLITS               |           | 30  |
|     |     |      | 75        | SEATTLE                        | 75        |     |
| 371 | 205 | 3A   |           | 1414 SMEAR SLITS               |           | 35  |
|     |     |      | 85        | NEW YORK                       | 95        |     |
| 433 |     |      |           | ESP B                          |           |     |
| 440 |     |      |           | CREEP B - ESO                  |           | 1   |
| 442 |     |      |           | CB+ VERIFY                     |           |     |
| 446 | 231 |      |           | MONO A ENGINEERING             |           | 51  |
| 449 |     |      |           | CB+ BLINK TEST                 |           |     |
| 450 |     |      |           | CONFIGURE MONO A               |           |     |
| 454 |     |      |           | CREEP B - ESO                  |           | 1   |

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## 3.5 MISSION 1210-2 SPECIAL EVENTS CONT'D

| REV | OPN | TEST | PRE<br>WX | EVENT/LOCATION                                                    | VER<br>WX | FTG |
|-----|-----|------|-----------|-------------------------------------------------------------------|-----------|-----|
| 456 |     |      |           | CV B                                                              |           | 100 |
| 456 |     |      |           | DB B STOW                                                         |           |     |
| 458 | 232 |      |           | MONO B HEALTH CHECK                                               |           | 68  |
| 469 | 236 | 1    | 75        | 1414 THRU FOCUS<br>ST LOUIS 10/0                                  | 25        | 38  |
| 485 | 239 | 1    | 75        | 1414 THRU FOCUS<br>LOUISVILLE 10/0                                | 90        | 38  |
| 567 | 266 | 1    | 75        | 1414 THRU FOCUS<br>DENVER -10/0                                   | 75        | 38  |
| 584 | 274 | 3A   | 70        | 1414 SMEAR SLITS<br>SAN FRANCISCO BAY                             | 90        | 38  |
| 594 | 280 |      |           | TRANSITION TO S0255                                               |           |     |
| 596 |     |      |           | TRANSFER TO S0255                                                 |           |     |
| 599 | 281 | 4A   | 60        | S0255 RADIOMETRIC CAL<br>DALLAS N/60                              | 70        | 35  |
| 661 | 300 |      |           | TRANSITION TO S0130                                               |           |     |
| 663 | 301 |      |           | TRANSFER TO S0130                                                 |           |     |
| 681 | 300 | 10A  | 75        | S0130 WHEAT THRU EXPOSURE<br>MONTANA 5<br>NORTH CORN NOT DEPLOYED | 99        | 41  |
| 729 |     |      |           | TRANSFER TO 1414                                                  |           |     |

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## 3.5 MISSION 1210-2 SPECIAL EVENTS CONT'D

| REV | OPN | TEST       | PRE<br>WX | EVENT/LOCATION                                             | VER<br>NX | FTG |
|-----|-----|------------|-----------|------------------------------------------------------------|-----------|-----|
| 762 | 336 | 9          | 95        | 1414 TRI-BAR RESOLUTION<br>NEEDLES W/ST<br>PN EQUALIZATION | 99        | 30  |
| 777 | 340 | 1          | 85        | 1414 THRU FOCUS<br>INDIANAPOLIS -10/0                      | 70        | 30  |
| 778 | 342 | 7A,9<br>12 | 75        | 1414 QUALITY STANDARD<br>TUCSON W/ST                       | 70        | 30  |
| 811 | 350 | 1          | 85        | 1414 THRU FOCUS<br>SACRAMENTO 10/0                         | 99        | 30  |
| 826 |     |            |           | TRANSFER TO IU3-PREP 1                                     |           |     |

|               |      |      |
|---------------|------|------|
| TU FOOTAGE    | 838  | 947  |
| TOTAL FOOTAGE | 3457 | 3544 |

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## 3.6 MISSION 1210-3 SPECIAL EVENTS

| REV  | OPN | TEST       | PRE<br>WX | EVENT/LOCATION                                                       | VER<br>WX | FTG  |
|------|-----|------------|-----------|----------------------------------------------------------------------|-----------|------|
| 826  |     |            |           | TRANSFER TO TU3-PREP 1                                               |           | 23   |
| 827  |     |            |           | TU3 - PREP 2                                                         |           | 50   |
| 867  | 375 |            |           | TU3B INTEGRATOR<br>RESET FAILURE<br>NESTED OPS CONSTRAINED           |           |      |
| 881  | 380 |            |           | QORA NOMINALS CHANGED                                                |           |      |
| 924  | 392 | 7A:9<br>12 | 99        | 1414 QUALITY STANDARD<br>TUCSON W/ST                                 | 65        | 32   |
| 957  | 408 | 12         | 65        | 1414 QUALITY MONITOR<br>SAN FRANCISCO BAY                            | 70        | 125  |
| 973  | 418 |            |           | PH EQUALIZATION                                                      |           |      |
| 1164 |     |            |           | TRANSFER TO S0130                                                    |           |      |
| 1166 | 475 |            |           | 1ST OF S0130                                                         |           |      |
| 1182 | 480 | 160        | 40        | S0130 COS DETECTION<br>RADC W/60                                     | 65        | 30   |
| 1184 | 482 | 180        | 50        | S0130 THRU EXPOSURE<br>WASHINGTON 6 WHEAT<br>2/3, 1/3, 0, -1/3, -2/3 | 65        | 36   |
| 1184 | 483 | 5          | 99        | S0130 RADIOMETRIC CAL<br>STOCKTON W/60                               | 90        | 35   |
| 1193 | 486 |            |           | TRANSFER TO S0255                                                    |           |      |
| 1200 | 488 | 180        | 75        | S0255 THRU EXPOSURE<br>MONTANA 5 WHEAT<br>2/3, 1/3, 0, -1/3, -2/3    | 90        | 38   |
| 1216 | 492 |            |           | PH EQUALIZATION                                                      |           |      |
| 1318 | 521 |            |           | TRANSITION TO 1414                                                   |           |      |
| 1319 | 522 |            |           | TRANSFER TO 1414                                                     |           |      |
| 1410 |     |            |           | TRANSFER TO TU4-PREP 1                                               |           |      |
|      |     |            |           | TU FOOTAGE                                                           | 371       | 371  |
|      |     |            |           | TOTAL FOOTAGE                                                        | 3828      | 3915 |

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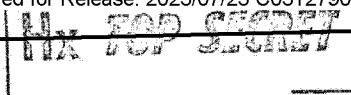
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## 3.7 MISSION 1210-4 SPECIAL EVENTS

| REV  | OPN | TEST | PRE<br>WX | EVENT/LOCATION                                           | VER<br>WX | FTG  |
|------|-----|------|-----------|----------------------------------------------------------|-----------|------|
| 1410 |     |      |           | TRANSFER TO TU4-PREP 1                                   |           | 23   |
| 1411 |     |      |           | TU4 - PREP 2                                             |           | 50   |
| 1431 | 562 |      |           | PN EQUALIZATION                                          |           |      |
| 1622 | 669 | 12   | 95        | 1414 QUALITY MONITOR<br>SAN FRANCISCO                    | 85        | 32   |
| 1637 | 679 | 9,12 | 85        | 1414 QUALITY MONITOR<br>DALLAS/FT WORTH W/ST             | 35        | 32   |
| 1642 | 681 |      |           | PN EQUALIZATION                                          |           |      |
| 1725 |     |      |           | TRANSFER TO S0255                                        |           |      |
| 1725 | 724 |      |           | 1ST OP S0255                                             |           |      |
| 1751 | 731 | 4A   | 99        | S0255 RADIONETRIC CAL<br>ALBUQUERQUE W/ST, 6C            | 99        | 38   |
| 1766 | 734 |      |           | PATRICK AFB CAL                                          |           | 55   |
| 1789 | 742 |      |           | TRANSITION TO S0124                                      |           |      |
| 1790 | 743 |      |           | TRANSFER TO S0124                                        |           |      |
| 1816 | 760 | 7B   | 99        | S0124 QUALITY STANDARD<br>TUCSON W/ST<br>PN EQUALIZATION | 99        | 38   |
| 1849 | 774 | 17   |           | S0124 THRU EXPOSURE<br>SACRAMENTO/STOCKTON               | 99        | 38   |
| 1863 | 779 | 17   | 65        | S0124 THRU EXPOSURE<br>BOSTON/PROVIDENCE                 | 95        | 38   |
| 1908 |     |      |           | PATH PRESSURIZATION                                      |           |      |
| 1918 |     |      |           | PATH PRESSURIZATION                                      |           |      |
| 1929 |     |      |           | PATH PRESSURIZATION                                      |           |      |
| 1936 |     |      |           | PATH PRESSURIZATION                                      |           |      |
| 1940 | 789 |      |           | LAST OP (63A/60B)                                        |           |      |
|      |     |      |           | TU FOOTAGE                                               | 329       | 329  |
|      |     |      |           | TOTAL FOOTAGE                                            | 4157      | 4244 |

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### 3.8 SOLO PHASE

#### 3.8.1 TEST OBJECTIVES

SOLO TESTING ON SV 10 WAS DESIGNED TO MEET THE FOLLOWING OBJECTIVES:

1. TEST D2  
PROVIDE VEHICLE DYNAMICS FOR SBAC EVALUATION OF THEIR RCS THRUSTER LIFETIME BY SIMULATING DAILY MISSION OPERATIONS.
2. TEST E8  
PROVIDE OPTICAL BAR PERFORMANCE DATA THROUGHOUT THE VX/H OPERATIONAL RANGE. PROVIDE MONO OPERATION DATA AND SCC COMPARISON DATA.
3. TEST E13  
INVESTIGATED THE FEASIBILITY OF USING THE NCYU BOX TO OPERATE THE OPTICAL BARS AND PLATENS IN THE PHOTO MODE WITHOUT TRANSPORTING MATERIAL, FOR IN HOUSE EVALUATION.

#### 3.8.2 TEST DESCRIPTIONS

TEST D2 CONSISTED OF OB SEQUENCES OF 40 SECONDS TO 317 SECONDS DURATION, PERFORMED AT APPROXIMATELY THE NORMAL MISSION AVERAGE OPERATING FREQUENCY, COVERING THE AREAS OF INTEREST, UTILIZING PRIMARILY STEREO MODE, BUT WITH OCCASIONAL MONO RUNS. THIS TEST WAS PLANNED TO CONTINUE THROUGHOUT THE SOLO PHASE, TERMINATING THE DAY BEFORE DE-BOOST.

TEST E8 CONSISTED OF OPTICAL BAR SEQUENCES PROVIDING VX/H OPERATIONS FROM STEP 40 THRU STEP 120 WITH A MINIMUM OF 20 CYCLES AT EACH 10TH STEP, AND AT LEAST 2 CYCLES BETWEEN EACH INTERMEDIATE STEP, AND A SIMILAR SEQUENCE WITH VX/H DECREASING FROM STEP 100 TO STEP 80, AND A MONO A SEQUENCE WITH VX/H STEPS 80 THRU 100. A NESTED SEQUENCE WAS USED TO PROVIDE DATA ON WHEN INTERMEDIATE VX/H UPDATES TAKE EFFECT, AND WAS REPEATED ON A WEEKLY BASIS TO PROVIDE ENGINEERING DATA ON BEARING LUBRICANT LIFETIME. ALL E8 TESTS WERE PERFORMED IN BOTH SCC'S.

TEST E13 WAS A STEREO SEQUENCE WITH TU ONLY AND SU ONLY COMMANDED AFTER C+ BUT BEFORE COMMANDING OB+ AND FT+.

#### 3.8.3 SOLO EVENTS

GN2 DEPLETION TO THE POINT WHERE INSUFFICIENT GAS REMAINED TO OPEN THE SEALED DOORS OCCURRED AT THE 8TH SOLO OPERATION, IN REV 1981, PROVIDING 2819 SECONDS OF PNEUMATICS OPERATION IN THE SOLO PHASE.

AN OB PHASE DISCREPANCY WAS NOTED ON REV 2115, RESULTING FROM A TIMING PROBLEM IN THE NESTED SEQUENCE PERFORMED IN REV 2109. OB STOW SEQUENCES WERE RUN ON REV 2125 AND AFTER ALL SUBSEQUENT RUNS OF THE NESTED SEQUENCE.

THE FOLLOWING IS A CHRONOLOGICAL LISTING OF ALL SEQUENCES RUN IN THE SOLO PHASE (WITH OB ON-TIME, C+ TO C- COMMANDS):

| REV    | TEST/SEQ    | OB<br>CMD TIME<br>(SEC'S) | TOTAL |
|--------|-------------|---------------------------|-------|
| 1962   | E8/450      | 535                       | 535   |
| 1965   | E8/451      | 394                       | 929   |
| 1968   | D2/452      | 317                       | 1246  |
| 1969   | D2/452      | 317                       | 1563  |
| 1970   | D2/452      | 317                       | 1880  |
| 1971   | D2/452      | 317                       | 2197  |
| 1979   | E8/452      | 317                       | 2514  |
| 1981   | E8/453      | 267                       | 2781  |
| 1986   | D2/452      | 317                       | 3098  |
| 1987   | D2/452      | 317                       | 3415  |
| 1988   | D2/452      | 317                       | 3732  |
| **1995 | E8/454      | 552                       | 4284  |
| **1997 | E8/455      | 406                       | 4690  |
| 2001   | D2/173      | 40                        | 4730  |
| 2002   | D2/173      | 40                        | 4770  |
| 2003   | D2/173      | 40                        | 4810  |
| 2004   | D2/173      | 40                        | 4850  |
| 2005   | D2/173      | 40                        | 4890  |
| 2011   | E8/459      | 123                       | 5013  |
| **2013 | E8/457      | 274                       | 5287  |
| 2017   | D2/173      | 40                        | 5327  |
| 2018   | D2/173      | 40                        | 5367  |
| 2019   | D2/173      | 40                        | 5407  |
| *2020  | D2/461      | 40                        | 5447  |
| 2033   | D2/173      | 40                        | 5487  |
| 2034   | D2/173      | 40                        | 5527  |
| 2035   | D2/173      | 40                        | 5567  |
| *2036  | D2/461      | 40                        | 5607  |
| 2050   | D2/173      | 40                        | 5647  |
| 2051   | D2/173      | 40                        | 5687  |
| 2052   | D2/173      | 40                        | 5727  |
| *2053  | D2/461      | 40                        | 5767  |
| **2060 | E8/456      | 325                       | 6092  |
| 2062   | E8/458      | 320                       | 6412  |
| 2066   | D2/173      | 40                        | 6452  |
| 2067   | D2/173      | 40                        | 6492  |
| 2068   | D2/173      | 40                        | 6532  |
| 2069   | D2/461      | 40                        | 6572  |
| 2076   | E8/450/SCC1 | 535                       | 7107  |
| 2078   | E8/451/SCC1 | 394                       | 7501  |
| 2082   | D2/173      | 40                        | 7541  |
| 2083   | D2/173      | 40                        | 7581  |
| 2084   | D2/173      | 40                        | 7621  |
| 2084   | D2/461      | 40                        | 7661  |
| 2093   | E8/452/SCC1 | 317                       | 7978  |
| 2094   | E8/453/SCC1 | 267                       | 8245  |

A Mono - 21  
B Mono - 8  
TOTAL MONO - 29

STEREO OPS - 112

TOTAL OPS (INCL  
STOWS) - 141

\*MONO A

\*\*MONO B

| REV    | TEST/SEQ | OB<br>CMD TIME<br>(SEC'S) | TOTAL |
|--------|----------|---------------------------|-------|
| 2098   | D2/173   | 40                        | 8285  |
| 2099   | D2/173   | 40                        | 8325  |
| 2100   | D2/173   | 40                        | 8365  |
| *2101  | D2/461   | 40                        | 8405  |
| 2109   | E8/459   | 123                       | 8528  |
| 2115   | D2/173   | 40                        | 8568  |
| 2116   | D2/173   | 40                        | 8608  |
| 2117   | D2/173   | 40                        | 8648  |
| 2118   | D2/173   | 40                        | 8688  |
| 2119   | D2/461   | 40                        | 8723  |
| *2125  | STON/213 | 70                        | 8793  |
| **2125 | STON/214 | 70                        | 8863  |
| 2131   | D2/173   | 40                        | 8903  |
| 2132   | D2/173   | 40                        | 8943  |
| 2133   | D2/173   | 40                        | 8983  |
| 2134   | D2/173   | 40                        | 9023  |
| 2135   | D2/461   | 40                        | 9063  |
| 2143   | D2/173   | 40                        | 9103  |
| 2144   | D2/173   | 40                        | 9143  |
| 2144   | D2/461   | 40                        | 9183  |
| *2149  | D2/461   | 40                        | 9223  |
| 2149   | D2/173   | 40                        | 9263  |
| 2149   | D2/173   | 40                        | 9303  |
| 2163   | D2/173   | 40                        | 9343  |
| 2164   | D2/173   | 40                        | 9383  |
| 2165   | D2/173   | 40                        | 9423  |
| 2166   | D2/173   | 40                        | 9463  |
| 2167   | D2/461   | 40                        | 9503  |
| 2179   | D2/173   | 40                        | 9543  |
| 2180   | D2/173   | 40                        | 9583  |
| 2181   | D2/173   | 40                        | 9623  |
| 2182   | D2/173   | 40                        | 9663  |
| *2183  | D2/461   | 40                        | 9703  |
| 2196   | D2/173   | 40                        | 9743  |
| 2197   | D2/173   | 40                        | 9783  |
| 2198   | D2/173   | 40                        | 9823  |
| 2199   | D2/173   | 40                        | 9863  |
| *2200  | D2/461   | 40                        | 9903  |
| 2206   | E8/452   | 317                       | 10220 |
| 2212   | D2/173   | 40                        | 10260 |
| 2213   | D2/173   | 40                        | 10300 |
| 2214   | D2/173   | 40                        | 10340 |
| 2215   | D2/173   | 40                        | 10380 |
| *2216  | D2/461   | 40                        | 10420 |
| 2222   | E8/459   | 123                       | 10543 |
| *2222  | STON/213 | 40                        | 10583 |

\*MONO A

\*\*MONO B

| REV    | TEST/SEQ | GB<br>CMD/TIME | TOTAL |
|--------|----------|----------------|-------|
| **2222 | STOW/214 | 40             | 10623 |
| 2228   | D2/173   | 40             | 10663 |
| 2229   | D2/173   | 40             | 10703 |
| 2230   | D2/173   | 40             | 10743 |
| 2231   | D2/173   | 40             | 10783 |
| *2232  | D2/461   | 40             | 10823 |
| 2309   | D2/173   | 40             | 10863 |
| 2310   | D2/173   | 40             | 10903 |
| 2311   | D2/173   | 40             | 10943 |
| 2312   | D2/173   | 40             | 10983 |
| *2313  | D2/461   | 40             | 11023 |
| *2320  | E8/452   | 317            | 11340 |
| 2325   | D2/173   | 40             | 11380 |
| 2326   | D2/173   | 40             | 11420 |
| 2327   | D2/173   | 40             | 11460 |
| 2328   | D2/173   | 40             | 11500 |
| *2329  | D2/461   | 40             | 11540 |
| 2336   | E8/459   | 123            | 11663 |
| *2336  | STOW/213 | 40             | 11703 |
| **2336 | STOW/214 | 40             | 11743 |
| 2342   | D2/173   | 40             | 11783 |
| 2343   | D2/173   | 40             | 11823 |
| 2344   | D2/173   | 40             | 11863 |
| 2345   | D2/173   | 40             | 11903 |
| *2345  | D2/461   | 40             | 11943 |
| 2352   | E8/504   | 45             | 11989 |
| 2358   | D2/173   | 40             | 12029 |
| 2359   | D2/173   | 40             | 12069 |
| 2360   | D2/173   | 40             | 12109 |
| 2361   | D2/173   | 40             | 12149 |
| *2362  | D2/461   | 40             | 12189 |
| 2374   | D2/173   | 40             | 12229 |
| 2375   | D2/173   | 40             | 12269 |
| 2376   | D2/173   | 40             | 12309 |
| 2377   | D2/173   | 40             | 12349 |
| *2378  | D2/461   | 40             | 12389 |
| 2390   | D2/173   | 40             | 12429 |
| 2391   | D2/173   | 40             | 12469 |
| 2392   | D2/173   | 40             | 12509 |
| 2393   | D2/173   | 40             | 12549 |
| *2394  | D2/461   | 40             | 12589 |
| 2406   | D2/173   | 40             | 12629 |
| 2407   | D2/173   | 40             | 12669 |
| 2408   | D2/173   | 40             | 12709 |
| 2409   | D2/173   | 40             | 12749 |
| *2410  | D2/461   | 40             | 12789 |
| 2417   | E8/459   | 123            | 12912 |
| *2417  | STOW/213 | 40             | 12952 |
| **2417 | STOW/214 | 40             | 12992 |

\*MONO A

\*\*MONO B

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#### 4.0 SENSOR SYSTEM TEST OBJECTIVES

##### 4.1 Photographic Performance

The post flight material evaluation of mission segments 1210-1 through 1210-4 indicated the capability of the SS optical system to provide the specified photographic performance. Mission 1210 was a summer mission launched in June prior to the summer solstice. However, due to the active mission length of 120 days, the flight extended through the summer and terminated in early October.

Summer missions in general acquire a large percentage of photography at solar altitudes above 30 degrees, resulting in smaller operational slits, thus shorter exposure times and less image smear. The overall image quality, however, was affected to some extent, as it always is at this time of the year, by varying degrees of weather and haze.

Previous summer missions have suffered severe image degradation due to specular reflections. The early morning launch time of Mission 1210 moved this problem out in scan to approximately 20 degrees or greater. The sun synchronous orbit fixed this condition in scan and as the mission progressed through the summer the specular reflections moved south in latitude.

Mission segment 1210-1 contained one part of S0-130 infrared color material. Mission segments 1210-2 and 1210-3 each contained one part of S0-130 and one part of S0-255 conventional color. Mission segment 1210-4 contained one part of S0-255 and one part S0-124.

Operational performance predictions based on CRYSPER predictions and the actual operation parameters are included in Figures 4-1 thru 4-4 for each mission segment and Figure 4-5 for the total mission length.

The PFA team reported that the general overall image quality of both the Forward and Aft looking cameras for the entire mission ranged from very good to very poor with a preference for the Forward camera image quality. The very poor imagery was limited to the S0-124 material which, due to its slower emulsion (1.4 stops slower than 1414), was more severely affected by smear. The discussions of image quality as a function of mission segment, which follows, was abstracted in part from the REBOUND 831 messages.

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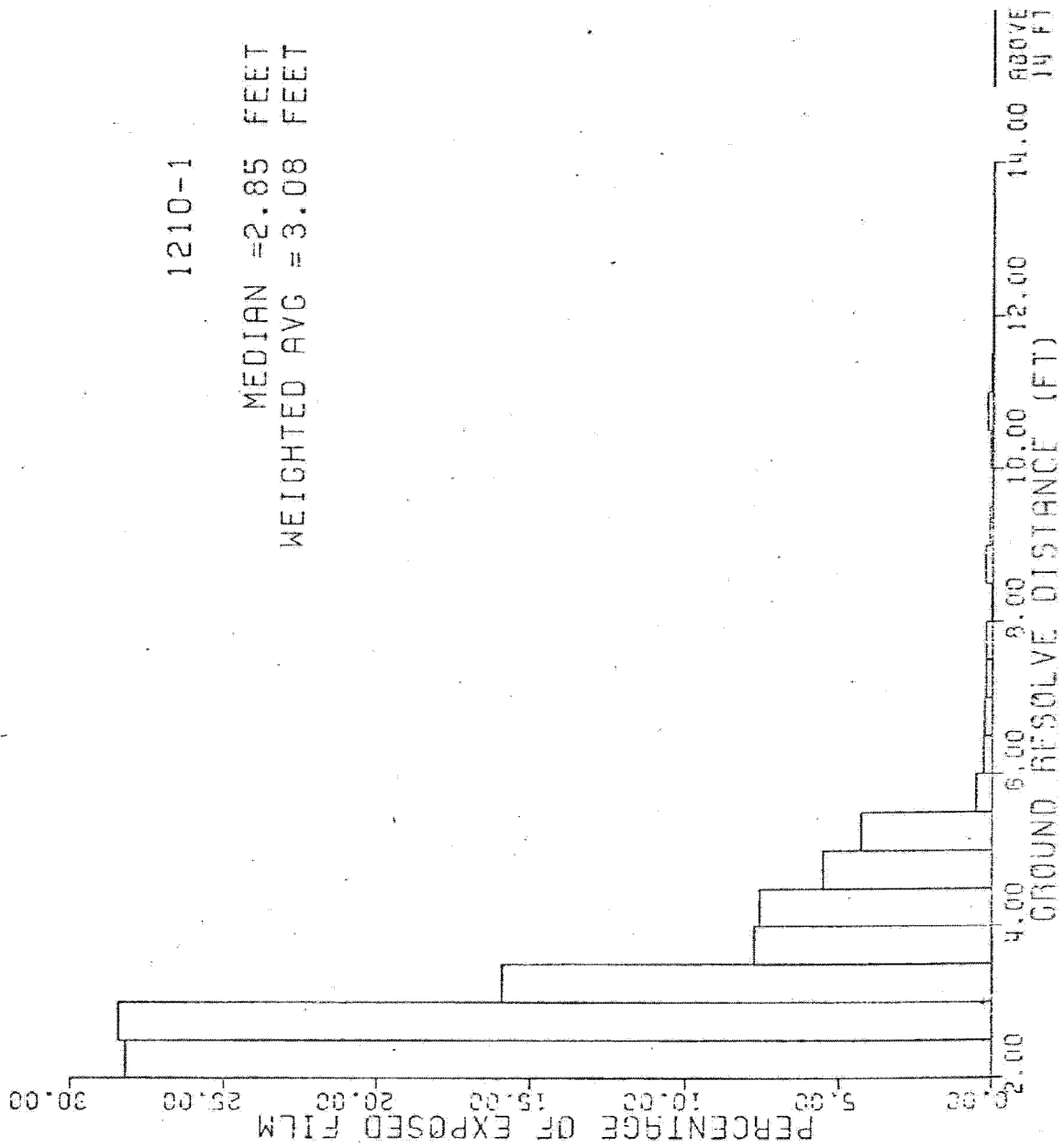


Figure 4-1

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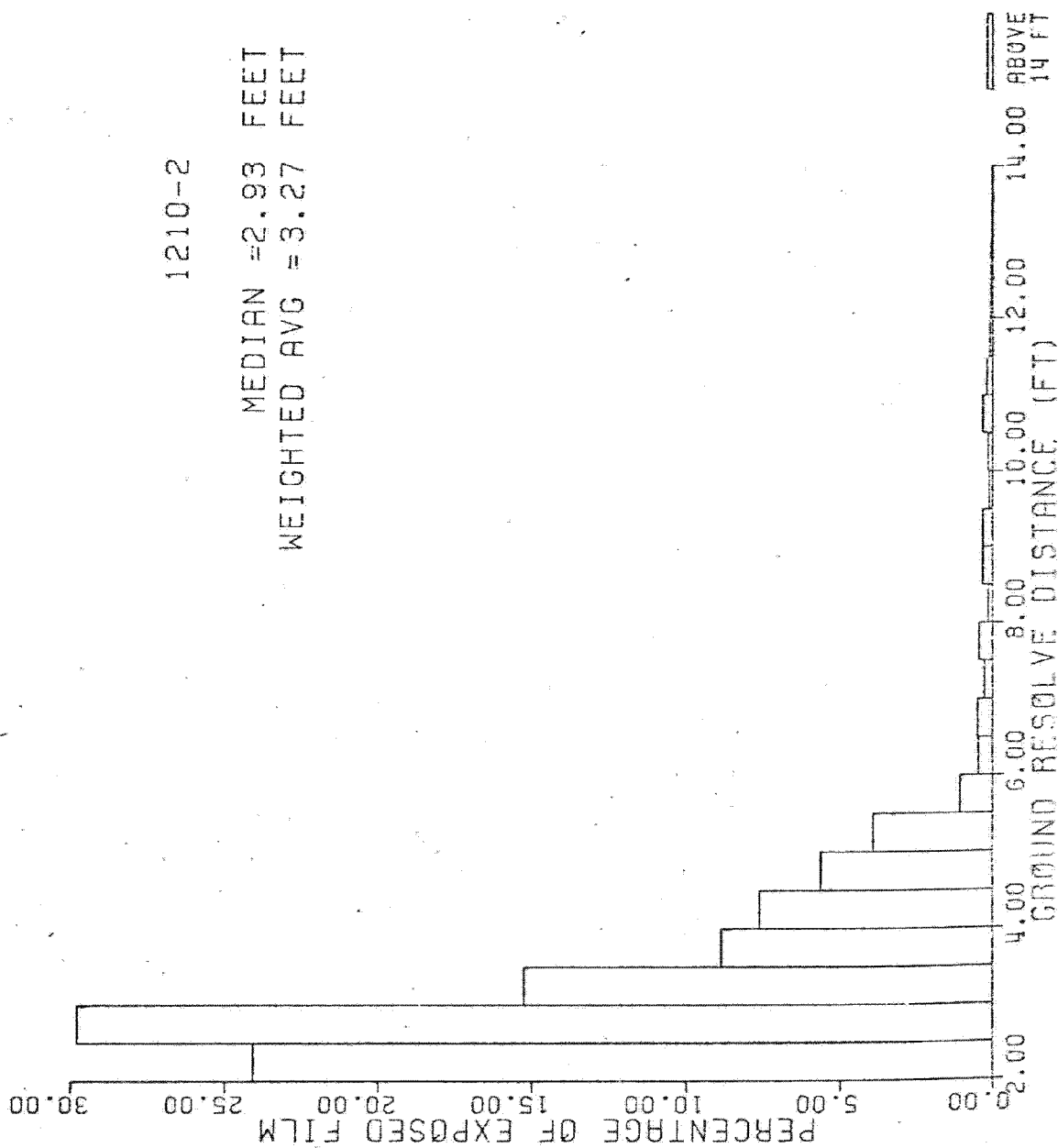


Figure 4-2

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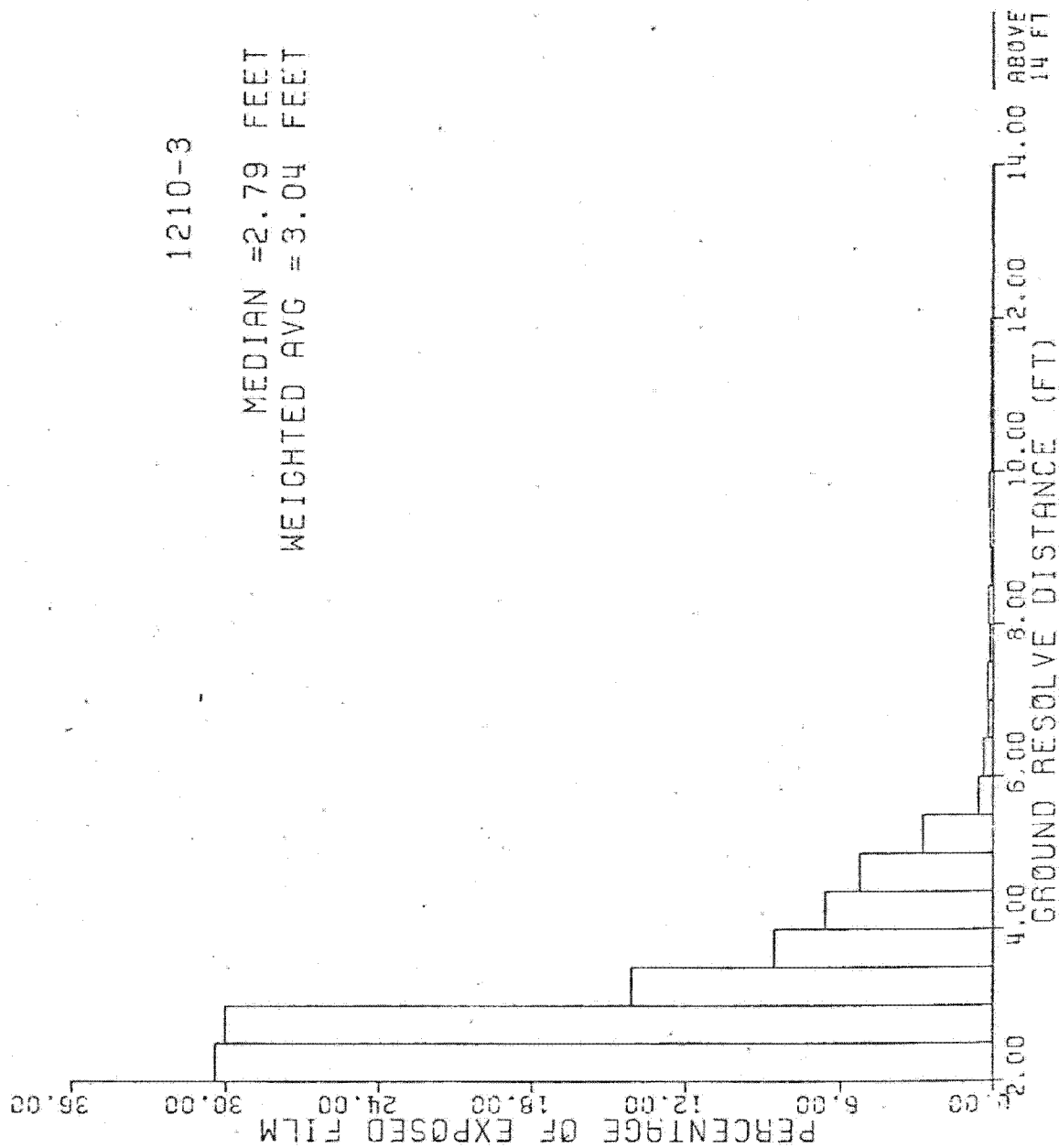


Figure 4-3

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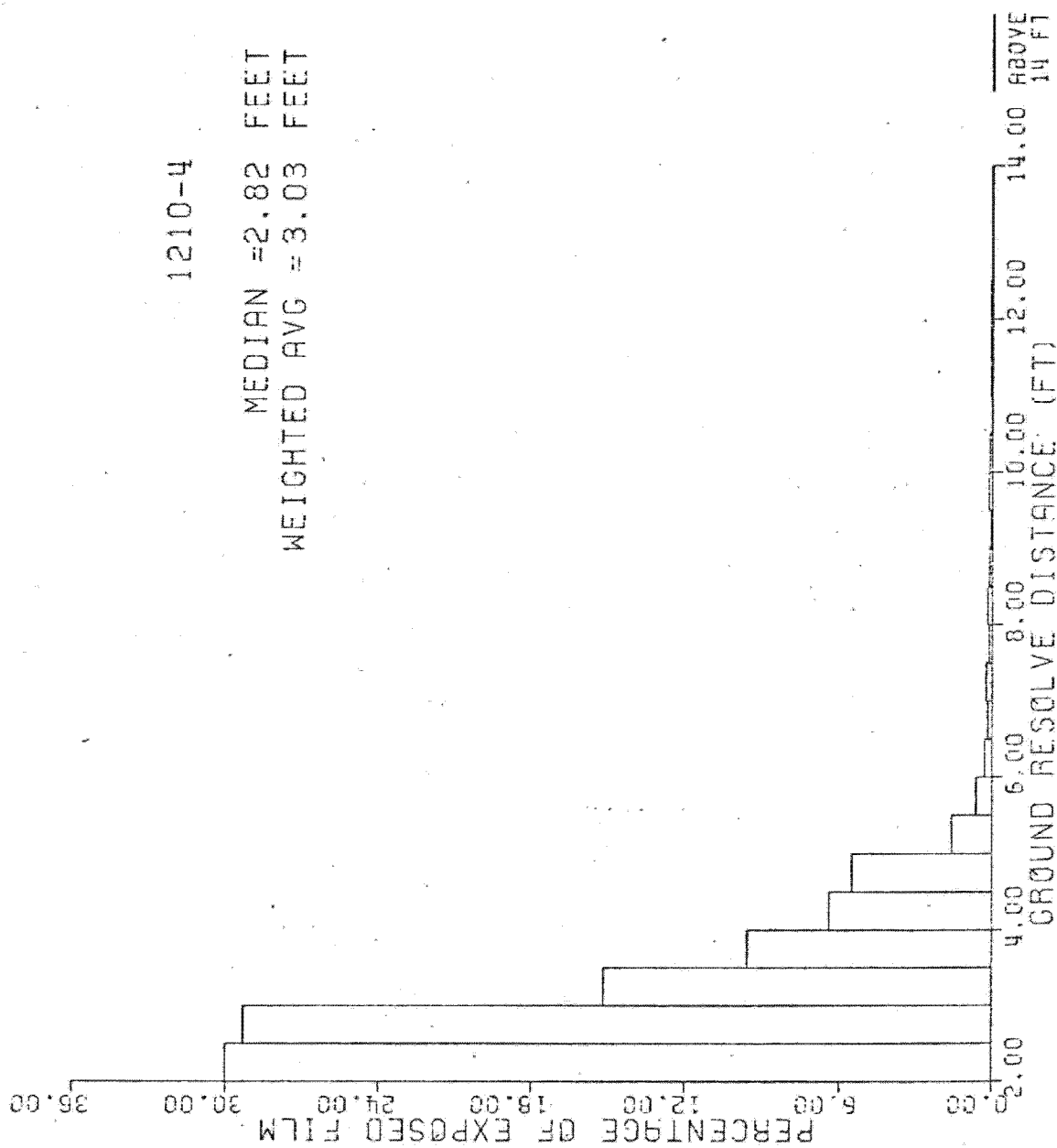


Figure 4-4

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Figure 4-5

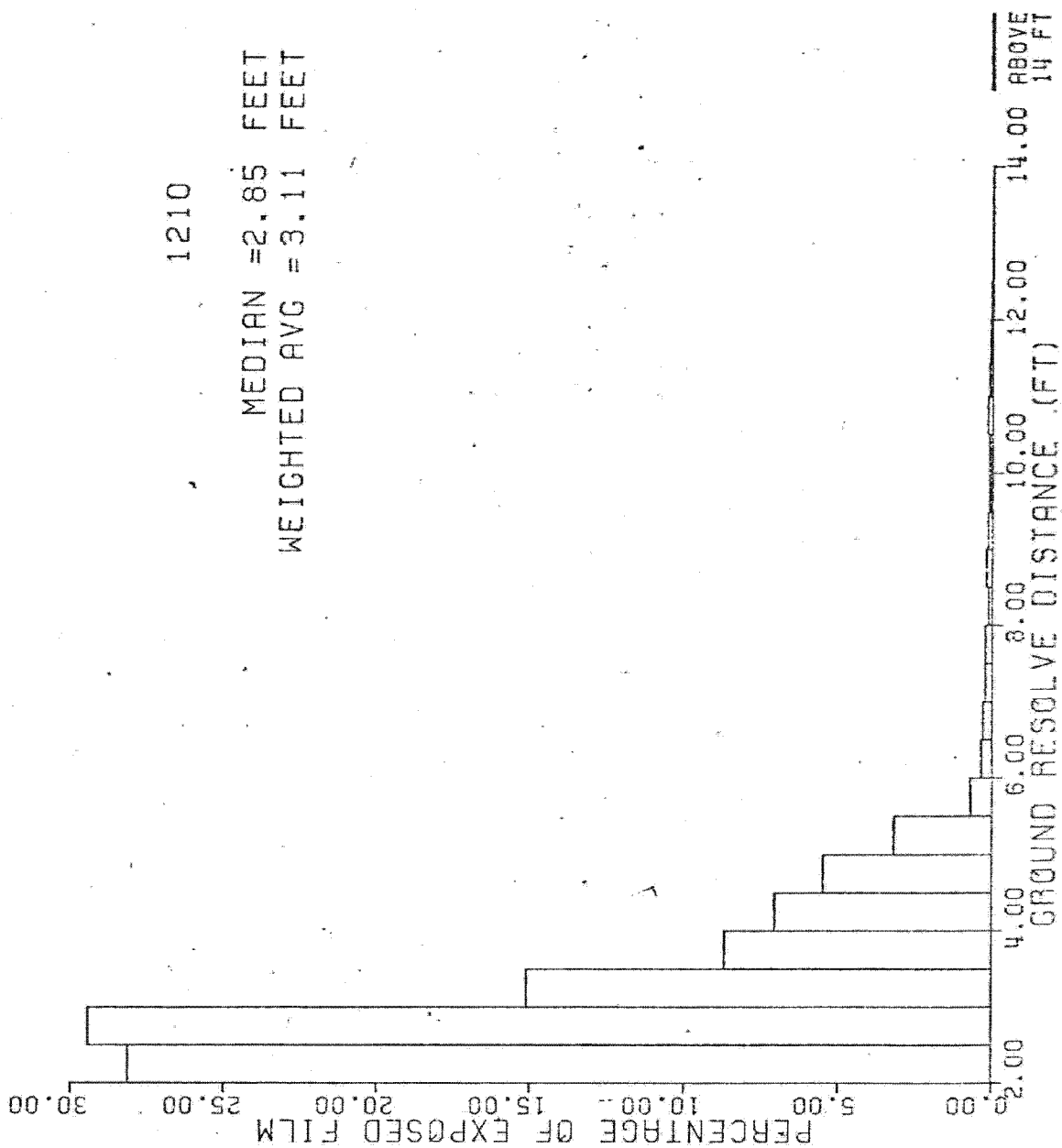


Figure 4-5

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~~TOP SECRET~~Mission Segment 1210-1

Subjective analysis indicated that both cameras were at optimum focus, but due to the minimal amount of through focus material this could not be adequately confirmed by VEM analysis. The overall image quality of both cameras ranged from good to poor with the majority being rated as fair. The poor imagery was for the most part attributed to atmospheric and weather conditions which reduced image contrast and resulted in the overall grainy appearance and poor edge definition. Subjectively, the image quality of the Forward camera, appeared to be sharper than that of the Aft and this was reinforced by the corn target readings.

One 51/51 tri-bar corn target was acquired on the Forward and Aft cameras. The data follows:

| CAMERA | OP  | FR | SCAN | FIELD | PLATEN | UNADJUSTED |      | 2:1 ADJUSTED |      |
|--------|-----|----|------|-------|--------|------------|------|--------------|------|
|        |     |    |      |       |        | GRD (FT)   |      | GRD (FT)     |      |
|        |     |    |      |       |        | IT         | XT   | IT           | XT   |
| FWD    | 114 | 3  | +7.0 | +2.3  | 31     | 1.48       | 2.25 | 1.85         | 2.74 |
| AFT    | 114 | 4  | +8.0 | +0.5  | 31     | 1.61       | 2.36 | 2.08         | 3.04 |

S0-130 Infrared Color

The overall image quality was good for S0-130, and was comparable to 1209-4. The color balance of the original positive had a slight greenish cast in the highlight areas and a cyan cast in the mid tone and shadow areas. The magnitude of this cast was less than any previous IR acquisitions. This may have been due to seasonal variations. Subjective analysis of the overall exposure indicated that it was good.

Mission Segment 1210-2

Subjective and objective analyses of the through focus test photography indicated that neither the Forward nor the Aft cameras required any change to focal plane position. The overall image quality ranged from good to poor with the majority rated as fair. Prevailing atmospheric haze and poor weather continued to significantly affect image quality. The poor image quality was characterized primarily by poor edge definition, graininess and an overall lack of sharpness when viewed at high magnification. The good imagery was essentially limited to clear weather acquisitions on the Forward camera. The Forward camera imagery was judged to be better than that of the Aft. A subjective image quality comparison was made between 1210-1 and 1210-2 and they were judged to be comparable.

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Mission Segment 1210-2 - Cont'd.

Five 51/51 corn targets were acquired on the Forward camera. Of these, three were obscured by clouds or were in cloud shadows. Three targets were acquired on the Aft camera, two being obscured by clouds or cloud shadow. Those which were unobscured are:

| CAMERA | OP  | FR | SCAN | FIELD | PLATEN | UNADJUSTED |      | 2:1 ADJUSTED |      |
|--------|-----|----|------|-------|--------|------------|------|--------------|------|
|        |     |    |      |       |        | GRD (FT)   |      | GRD (FT)     |      |
|        |     |    |      |       |        | IT         | XT   | IT           | XT   |
| FWD    | 336 | 2  | +1.0 | +2.8  | 31     | 2.21       | 2.43 | 2.36         | 2.60 |
| FWD    | 336 | 3  | +2.0 | -2.7  | 31     | 2.03       | 2.04 | 2.16         | 2.18 |
| AFT    | 336 | 3  | +2.0 | +0.5  | 31     | 1.83       | 2.35 | 1.93         | 2.48 |

S0-255 Color

The quality of the color photography ranged from good to poor, with the majority being rated as fair. The poor image quality resulted from the same atmospheric conditions that affect the 1414. The majority of imagery exhibited a slight yellowish cast in the highlight areas, reddish cast in the midtones and bluish cast in the shadows. The magnitude of the color cast was similar to previous summer missions employing S0-255. Subjective evaluation of overall density indicated exposure to be adequate.

S0-130 Infrared Color

The image quality of the original was good for S0-130, and was similar to that of 1210-1. The color balance of the original was slightly greenish cyan. Exposure analysis, both subjectively and objectively (Macrodensitometry), led to the conclusion that it was one-half stop underexposed when considering urban/industrial area imagery.

Mission Segment 1210-3

The overall quality ranged from poor to very good with the majority being rated from fair to good. The poor and fair photography was attributed to adverse atmospheric and acquisition conditions. The Forward camera imagery continued to be better than the Aft. Several instances of very good photography on the Forward camera were rated only good on the Aft. VEM analysis showed the camera's performance stable between 1210-2 and 1210-3. The overall image quality was slightly improved over 1210-2.

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Mission Segment 1210-3 - Cont'd.

Six 51/51 tri-bar targets were acquired on 1414 film; four on the Forward and two on the Aft:

| CAMERA | OP  | FR | SCAN  | FIELD | PLATEN | UNADJUSTED<br>GRD (FT) |      | 2:1 ADJUSTED<br>GRD (FT) |      |
|--------|-----|----|-------|-------|--------|------------------------|------|--------------------------|------|
|        |     |    |       |       |        | IT                     | XT   | IT                       | XT   |
| FWD    | 392 | 3  | - 1.0 | -0.5  | 31     | 2.10                   | 2.20 | 2.28                     | 2.39 |
| FWD    | 480 | 3  | -15.0 | -0.0  | 31     | 1.58                   | 2.25 | 1.94                     | 2.71 |
| FWD    | 483 | 2  | -13.0 | -1.5  | 31     | 1.75                   | 1.75 | 2.10                     | 2.10 |
| FWD    | 492 | 3  | + 4.0 | -2.0  | 31     | 2.00                   | 2.52 | 2.31                     | 2.93 |
| AFT    | 392 | 3  | -0.0  | -2.9  | 31     | 2.83                   | 2.25 | 2.86                     | 2.27 |
| AFT    | 392 | 4  | -0.0  | +2.9  | 31     | 3.17                   | 3.56 | 3.20                     | 3.60 |

S0-255 Color

The quality of the color photography ranged from poor to good, with the majority rated fair to good. The imagery exhibited a slight reddish-yellow cast. Subjective evaluation indicated that the exposure was adequate and the contrast was nominal to slightly flat.

One 51/51 corn target was acquired on S0-255 on the Aft camera. The data follows:

| CAMERA | OP  | FR | SCAN | FIELD | PLATEN | UNADJUSTED<br>GRD (FT) |      |
|--------|-----|----|------|-------|--------|------------------------|------|
|        |     |    |      |       |        | IT                     | XT   |
|        |     |    |      |       | 61     |                        |      |
| AFT    | 492 | 3  | +4.5 | -1.0  | 61     | 2.52                   | 3.56 |

S0-130 Infrared Color

The image quality of the original was good, and was comparable to that acquired on 1210-1 and 1210-2 the color balance was neutral. The exposure was judged to be adequate. The contrast varied from nominal to slightly high.

One 51/51 corn target was acquired on S0-130 film on the Aft camera. The data follows:

| CAMERA | OP  | FR | SCAN  | FIELD | PLATEN | UNADJUSTED<br>GRD (FT) |      |
|--------|-----|----|-------|-------|--------|------------------------|------|
|        |     |    |       |       |        | IT                     | XT   |
| AFT    | 483 | 2  | -12.5 | -1.5  | 61     | 5.85                   | 6.37 |

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Mission Segment 1210-4

The overall quality ranged from poor to good with the majority rated fair to good. The poor and fair photography was attributed to adverse atmospheric and acquisition conditions. VEM analysis showed the camera performance stable between 1210-3 and 1210-4. The overall image quality was slightly decreased from 1210-3.

Three 51/51 corn tri-bar targets were acquired on the Forward camera. Of these one was partially obscured by clouds. One tri-bar was acquired on the Aft camera but it was partially obscured by clouds. Only the Forward camera targets which were not obscured by clouds are reported:

| OP  | FR | SCAN  | FIELD | PLATEN | UNADJUSTED |      | 2:1 ADJUSTED |      |
|-----|----|-------|-------|--------|------------|------|--------------|------|
|     |    |       |       |        | GRD (FT)   |      | GRD (FT)     |      |
|     |    |       |       |        | IT         | XT   | IT           | XT   |
| 731 | 3  | +11.5 | -2.0  | 31     | 2.47       | 2.58 | 3.04         | 3.19 |
| 760 | 3  | -26.0 | -0.0  | 31     | 2.02       | 3.40 | 2.28         | 3.87 |

S0-255 Color

The quality of the color photography ranged from good to poor with the majority being rated as fair to good. The poorer quality imagery resulted from the same atmospheric conditions that affected the black and white acquisitions. The majority of the imagery exhibited a slight yellow cast in the highlights and cyan-blue cast in the shadows. Subjective evaluation of the overall density indicated that the exposure was adequate.

One 51/51 corn target was acquired on S0-255 film by the Aft camera. The data follows:

| OP  | FR | SCAN  | FIELD | PLATEN | UNADJUSTED |      |
|-----|----|-------|-------|--------|------------|------|
|     |    |       |       |        | GRD (FT)   |      |
|     |    |       |       |        | IT         | XT   |
| 731 | 3  | -12.5 | -1.5  | 61     | 2.52       | 3.56 |

S0-124 High Resolution Black and White

The overall image quality ranged from very good to very poor with the majority rated as fair. The image quality when compared to 1414 was more variable. This increased variability is due to smear, which was anticipated, because of the emulsion speed difference between the films. The best imagery of the S0-124 was better than the best of the 1414. This is due mainly to the

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S0-124 High Resolution Black and White - Cont'd.

inherently higher low contrast resolutions and to the apparent finer grain structure of the S0-124. The poorest quality 1414 was better than the poorest quality S0-124 due mainly to smear which was most noticable in the off axis field positions. Subjective analysis of the thru exposure test resulted in a slight preference for the one stop under exposure.

One 51/51 corn tri-bar target was acquired on S0-124 film by the Aft camera:

| OP  | FR | SCAN | FIELD | PLATEN | UNADJUSTED |      | 2:1 ADJUSTED |      |
|-----|----|------|-------|--------|------------|------|--------------|------|
|     |    |      |       |        | GRAD (FT)  |      | GRD (FT)     |      |
|     |    |      |       |        | IT         | XT   | IT           | XT   |
| 760 | 3  | -26  | -1.5  | 31     | 2.00       | 2.25 | 2.52         | 2.83 |

4.2 Take-Up Survival Through Recovery

The RV/TU assemblies all arrived at the processing facility in good condition, signifying that light tight integrity was maintained during orbital separation, re-entry, recovery and transportation to the processing site.

The core locking pins were engaged and sheared on all TU's. Varying amounts of film spillage occurred in each. The film was well stacked and centered on all take-ups. A 6 inch and 30 inch piece of film, along with some smaller pieces, were found in the 1210-1 canister.

Two pyro tubes on 1210-1 were disconnected with some charring observed.

Related discussion of de-filming for each mission segment follows:

Mission Segment 1210-1

The RV/TU arrived at the processing site at 0915 hours on 25 June 1975. Two pyro tubes on the Rv were found disconnected from their brass blocks. Charring was observed on and around the disconnected tubes. Two large pieces of film (6 and 30 inches long) were found in the Rv cannister along with some small pieces. Both core locking pins had sheared resulting in Fwd and Aft outer wrap film spills. In general the spills resulted in reverse wraps over and around the builder roller assembly, with some shredding and tearing. There were several

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Mission Segment 1210-1 - Cont'd.

180 degree longitudinal film twists in the Aft record. Approximately 43 feet of the Fwd and 72 feet of the Aft records were damaged to the extent that they were removed for repair and special handling during processing. The remainder of both stacks was good with no evidence of telescoping.

Mission Segment 1210-2

The RV/TU arrived at the processing site at 0915 hours on 30 July 1975. Both Fwd and Aft core locking pins had sheared resulting in outer wrap film spills each approx. 200 feet.

In general the film in the spills was twisted, wrinkled and creased, but there was no tearing or shredding.

Both Fwd and Aft side wall profiles were very flat with no evidence of blocking or stickout. The quality of the stack is attributed to improved tracking associated with the 180 degree builder roller which was implemented for the first time in this mission.

During the despooling operation a bump attributed to foreign matter was felt in the Fwd stack approx. 2.5 inches from the titled edge and approx. 700 feet from the Mfg. splice no. 46/45. The foreign material, an irregular shaped piece of epoxy, was found and retrieved prior to the film being processed and was returned with the bucket.

Mission Segment 1210-3

The RV/TU arrived at the processing site at 1000 hours on 5 September 1975. Both Forward and Aft core-locking pins had sheared resulting in outer wrap film spills of approximately 180 feet on the Forward and 120 feet on the Aft. In general, the spilled film was creased, wrinkled and twisted. Ninety eight feet of the Forward spill was removed for repairs of tears and a hole. The material was then spliced back onto the take up roll. No repairs were required on the Aft record. Sidewall profile of both Forward and Aft film stacks were in good condition with no evidence of blocking.

Mission Segment 1210-4

The RV/TU arrived at the processing facility at 0930 hours on 7 October 1975. Both Forward and Aft core locking pins had sheared resulting in outer wrap film spills of approximately 139 feet. The edge profile of both stacks was in good condition.

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#### 4.3 Optimum Focus Determination

Plane of Best Focus for Mission 1210 was established as 30 microns on both cameras. While 30 microns was the launch setting, T/M readout of focal plane position consistently indicated 31 microns due to granularity of the T/M data. For this reason 31 microns is consistently used elsewhere in this report. Based upon the resolution performance the platen positions for best resolution across the field from readiness test data were 30 microns for the Forward and 33 microns for the Aft camera. These platen positions were corrected for vehicle altitude, gravity effects, and collimator focus as follows:

A plus 14 micron adjustment on both cameras for the altitude shift from infinity (A-2 collimator settings) to 85 to 90 nautical mile minimum mission altitude. A minus 16 micron adjustment on both the Forward and Aft cameras for the folding flat gravity effects. A plus 2 micron adjustment on the Forward and a minus 1 micron adjustment on the Aft camera to account for defocus of the test collimators.

Following the evaluation of the on orbit thru-focus tests performed in RV-1 and RV-2 no focus change was recommended for either the Forward or Aft cameras. Both the VEM and subjective analysis indicated that both cameras were at optimum focus.

#### 4.4 Optimum OAAA Settings

On orbit smear data was evaluated by the PFA team following each of the mission segments. Actual OAAA engineering tests were performed only during RV-2.

Subjective assessment of smear slit imagery from engineering Ops 27, 65, 93, 108, 109, 114, and 119 and from denied area Ops 21, 51, 106, and 117 was used to evaluate the adequacy of the nominal OAAA settings. The smear slit imagery on the Fwd camera titled edge indicated double imagery on Op 108 and subsequent operations. No double imagery was evident in the operations prior to Op 108. Consistent double imagery appeared on Op 109 and became less frequent following Op 109. Measurements on Op 109 indicated a mean velocity error approximately .02 ips in addition to the orbital fixed known error. The untitled edge did not indicate double imagery on any of the operations. Both observations are consistent with the skew angle being too small. An OAAA skew adjustment change was implemented to the Fwd camera in-track setting of plus two command steps.

The subjective assessments of the Fwd camera cross-track and the Aft camera both in-track and cross-track did not indicate any film velocity errors.

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#### 4.4 Optimum OAAA Settings - Cont'd.

Analysis of smear slit imagery from OAAA engineering Ops 162, 169 and 205 verified the plus two command step change implemented to the Fwd camera in the in-track direction to be correct and that an additional plus one count change was required. An OAAA change was implemented to the Fwd camera cross-track velocity of minus one command count. The Aft camera smear slit imagery indicated that changes of plus one count be made to the in-track setting and minus two counts be made to the cross-track.

##### Summary of OAAA Nominals (1414 Film)

|     |    | <u>1210-1</u> | <u>1210-2</u> | <u>1210-3/1210-4</u> |
|-----|----|---------------|---------------|----------------------|
| FWD | IT | -1            | +1            | +2                   |
|     | XT | 0             | 0             | -1                   |
| AFT | IT | -4            | -4            | -3                   |
|     | XT | 0             | 0             | -2                   |

#### 4.5 Optics Thermal Profile

The following subparagraphs describe the thermal environment for Mission 1210. Definitions of measured and calculated temperature parameters are contained in the Mission 1207 Post Flight Report, PM-1496-X. Thermal control for SV-10 can be generally summarized as follows:

- All SS temperatures were within design limits throughout the mission.

##### 4.5.1 SV Environment

SV thermal control parameters are summarized as follows:

- Orbital Elements (Ref. Paragraph 1.5)

|                     |                                      |
|---------------------|--------------------------------------|
| Perigee Altitude    | $h_p = 88.6 \text{ n.m.}$            |
| Period              | $\tau = 88.5 \text{ min.}$           |
| Inclination         | $i = 96.3 \text{ deg.}$              |
| Argument of Perigee | $\alpha = 123 \text{ deg.}$          |
| Beta Range          | $\beta = 21.2 \text{ deg. (Day 0)}$  |
|                     | $\beta = 25.5 \text{ deg. (Day 85)}$ |

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4.5.1 SV Environment - Cont'd.● Midsection Thermal Control Design ValuesCocoon  $\alpha/\epsilon = 0.359/0.265$ Thermal Baffle  $\alpha/\epsilon = 0.90/0.90$ ● MLI Effective EmittanceLower 210 Degrees  $\epsilon^* = 0.0045$ Fwd & Aft Bulkheads  $\epsilon^* = 0.0045$ Viewport Baffle  $\epsilon^* = 0.0045$ Under TCA Cocoon  $\epsilon^* = 0.04$ Under SU Cocoon  $\epsilon^* = 0.6$ 4.5.2 TCA Environment

Table 4-1 is a summary of temperature levels, spatial distributions, and temporal variations over a typical orbital revolution in terms of the thermal ICD (1420316A) requirements. Figures 4-6 thru 4-8 show the corresponding orbital profiles of the ICD parameters.

4.5.3 Optical Bar Temperatures

Tref ranged from 66°F to 69°F throughout the mission. The temperature range for the A and B optical bars was from 66°F to 70°F, and 62°F to 66°F respectively. The cross gradient was due to the off-zero Beta angle. Figure 4-9 shows an orbital profile of the OB temperatures in the stowed position.

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| MISSION 1210, REV 911                                                                                                 |                      |                                |                  |
|-----------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------|------------------|
| Description                                                                                                           | Designated Zones     | Max Allowable<br>ICD Value(°f) | Flight Value(°f) |
| Temperature Level<br>Index (T TCA)                                                                                    |                      | 70 ± 21                        | 66               |
| Zone I Mean Temp.                                                                                                     | Not Applicable       | N/A                            | 65               |
| Zone II Mean Temp.                                                                                                    |                      | N/A                            | 64               |
| Zone III Mean Temp.                                                                                                   |                      | N/A                            | 67               |
| Zone IV Mean Temp.                                                                                                    |                      | N/A                            | 69               |
| Forward Bulkhead                                                                                                      |                      | N/A                            | 67               |
| Middle Bulkhead                                                                                                       |                      | N/A                            | 68               |
| Variation of Mean Temp.<br>Between Designated<br>Zones                                                                | I to IV              | 9                              | 4                |
|                                                                                                                       | II to III            | 6                              | 3                |
|                                                                                                                       | I to II              | 4                              | 1                |
|                                                                                                                       | III to IV            | 4                              | 2                |
|                                                                                                                       | Bulkhead to Bulkhead | 6                              | 2                |
| Spatial Variation of<br>Time-Average Temp.<br>Measurements at<br>Locations Within<br>Designated Zone                  | I                    | 11                             | 5                |
|                                                                                                                       | II                   | 9                              | 5                |
|                                                                                                                       | III                  | 9                              | 2                |
|                                                                                                                       | IV                   | 11                             | 3                |
|                                                                                                                       | Forward Bulkhead     | 5                              | 5                |
|                                                                                                                       | Middle Bulkhead      | 17                             | 16               |
| Temporal Variation (Peak<br>to Valley) of Temperature<br>Measurement at any one<br>Location within Designated<br>Zone | I                    | 46                             | 14               |
|                                                                                                                       | II                   | 20                             | 2                |
|                                                                                                                       | III                  | 20                             | 2                |
|                                                                                                                       | IV                   | 46                             | 14               |
|                                                                                                                       | Forward Bulkhead     | 26                             | 4                |
|                                                                                                                       | Middle Bulkhead      | 57                             | 17               |

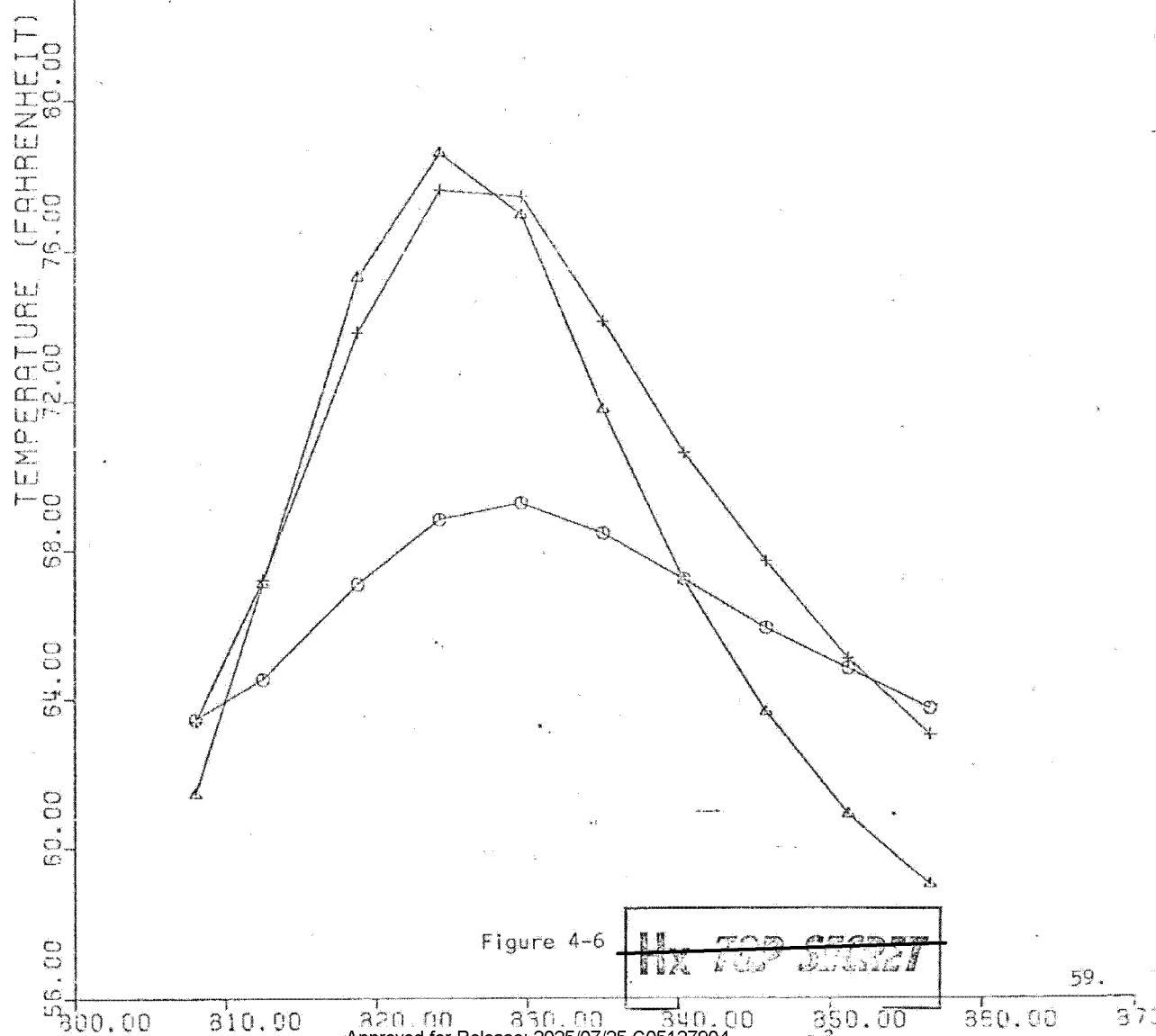
TABLE 4-1

Approved for Release: 2025/07/25 C05127904

MISSION 1210 , SV-10, S/N 013 , JUN 1975  
SBA TEMPERATURE DATA . ATU 3.  
SBA MID-SECTION TEMPERATURES, REV 911.3  
4TH PWR SPATIAL AVERAGE VALUES

○ P969 T TCA  
△ P970 T SU  
+ P971 T FS

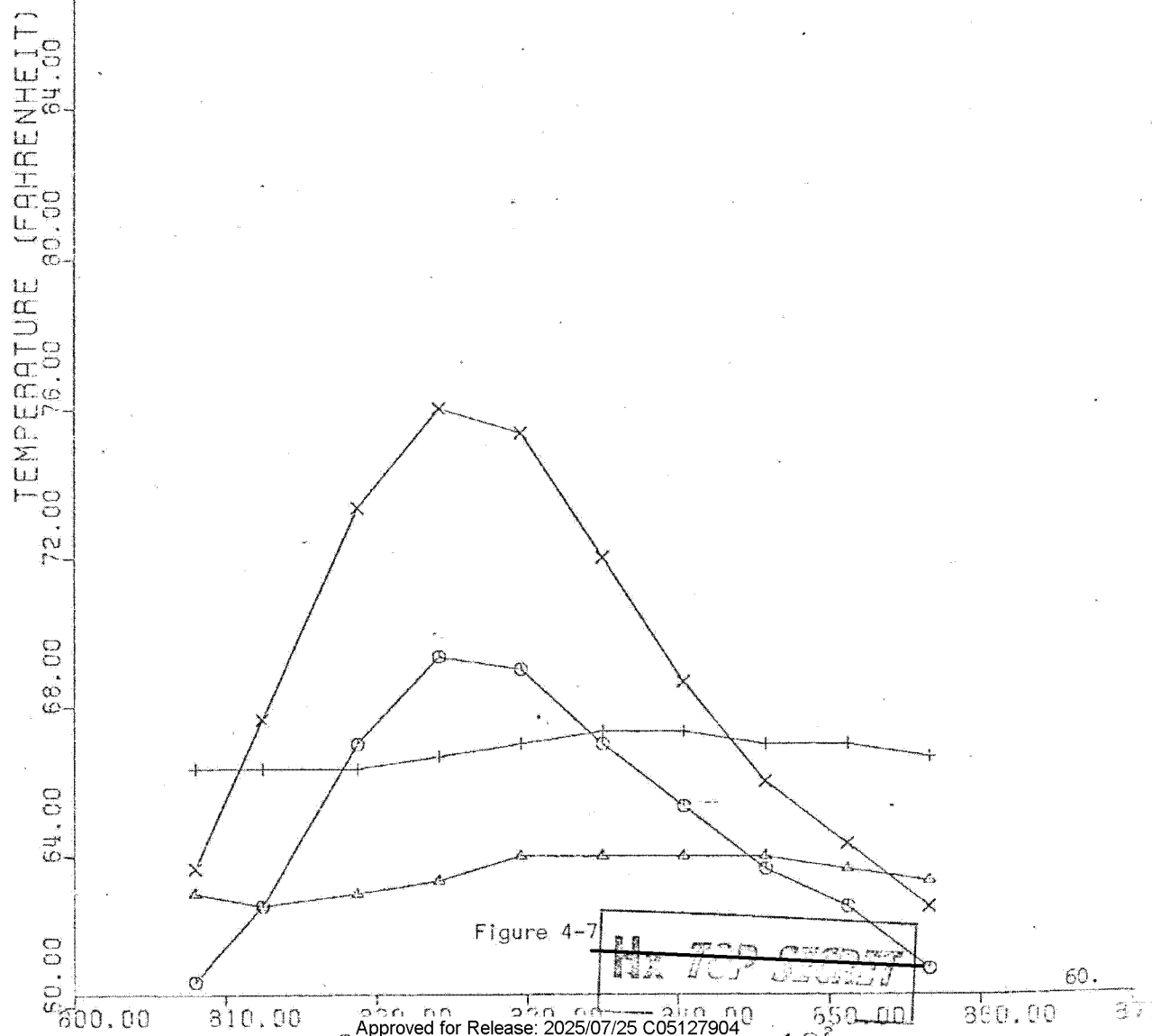
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MISSION 1210 , SV-10, S/N 013 , JUN 1975  
SBA TEMPERATURE DATA ATU 3  
SBA TCA ZONE (1-4) TEMPERATURES, REV 911.3  
1ST PWR SPATIAL AVERAGE VALUES

- A950 ZONE 1 (-Z/+Y)  
△ A951 ZONE 2 (+Y/+Z)  
+ A952 ZONE 3 (+Z/-Y)  
X A953 ZONE 4 (-Y/-Z)

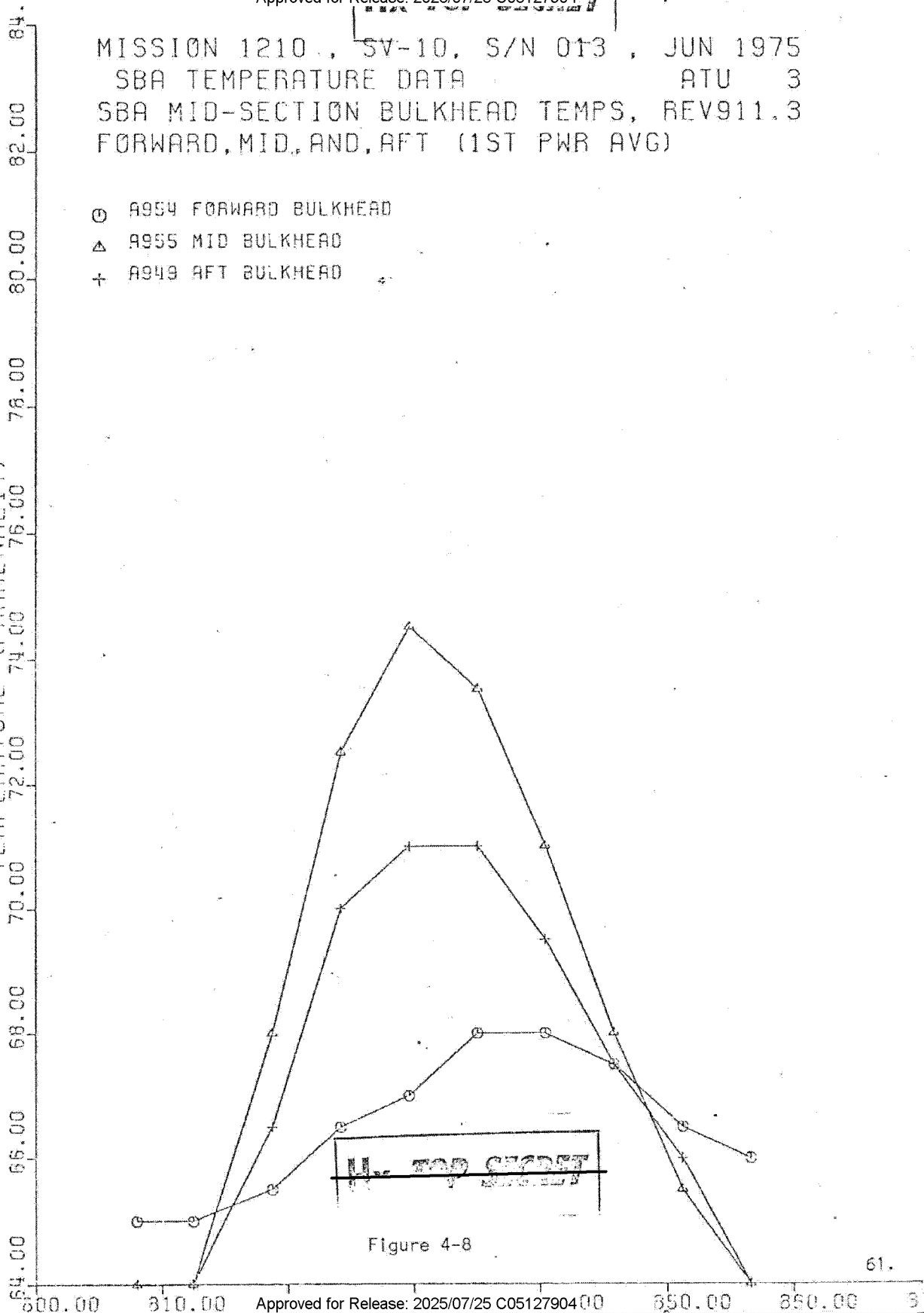
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MISSION 1210 , SV-10, S/N 013 , JUN 1975  
SBA TEMPERATURE DATA ATU 3  
SBA MID-SECTION BULKHEAD TEMPS, REV911.3  
FORWARD, MID, AND, AFT (1ST PWR AVG)

- A954 FORWARD BULKHEAD
- △ A955 MID BULKHEAD
- + A949 AFT BULKHEAD

TEMPERATURE (FAHRENHEIT)



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REV 911.3

|   |      |   |      |    |
|---|------|---|------|----|
| ⊙ | P910 | A | SIDE | OB |
| △ | P240 | A | SIDE | CP |
| + | P920 | B | SIDE | OB |
| × | P238 | B | SIDE | CP |



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5.0 SCF SUPPORT5.1 'TUNITY MISSION 1210

Mission 1210 used the 'TUNITY Mod 3.3 Block of Software for the first time. Two changes modified previous procedure for commanding and evaluating slit changes. One change modeled the slit-width command servo to execute early to compensate for the time it takes for the slit command to respond. The other change modeled MPR to display the slit value as it occurs rather than indicating an instantaneous change at the execution of the command.

In addition, modifications were incorporated to allow separate widening of station parameters, and a new capability for requesting manual stations. These changes permitted last minute weather decisions when selecting targets in the load station cone; and improved automatic recorder and format deconflicting for operations overlapping station cones.

Mission 1210 also inaugurated a new technique which used existing 'TUNITY Software to adjust/bias the flight hardware to accommodate film type changes "on-the-fly"; i.e. the focus, filter, exposure and smear were modified in mid-operation of the camera system. This precluded the attenuation or omission of scheduled flight operations which would have been impacted by the former requirement to terminate operations at the material transfer point; incorporate the hardware changes; and then re-commence operations with the modified Software/Hardware.

The 'TUNITY Software performed well throughout Mission 1210. Some minor procedural and/or documentation problems were noted. Most of them required no correction on flight and are to be considered as product improvements for future software delivery. Some errors were discovered in software documentation, and are/will be corrected.

The following software items impacted the SS Operational Performance and the SS Operational Reporting:

- 5.1.1 A Load Message with SS Payload was not loaded on Rev 21 because of a missing DIU "ON" command. The command was omitted due to the preceding MCS message being updated prior to the starting of the MCS clock. This caused an erroneous load time and thus status was not propagated properly.

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- 5.1.2 An Ascending Operation on Rev 46 was processed by MPR with the last frame (13) time and other parameters being duplicated in the reporting of the first frame (1) time and parameters. This item prevented proper processing of MPR for ascending Ops and was considered flight critical for this reason. A change was implimented in 'TINCO and the problem was corrected.
- 5.1.3 A Command Message loaded on Rev 777 included an Op performed on Rev 778 prior to the Rev 778 load station. This Op required an automatic focus adjust which was reset at the end of the Op. The Rev 778 Load Message reprinted this Op in 'TBALL and moved the focus reset to the next Op in 'TBALL which occurred after the load station. The Rev 777 message ran the Op with A minus Two micron focal plane shift and then returned the focal planes to nominal. If the original message for Rev 778 was loaded, it would have stepped the focal planes to Plus Two microns. The Rev 778 message was regenerated with the Focus Shift Commands deleted.
- 5.1.4 A preliminary 'TSEL run was constructed which included a "Real Time MOP" (RTM). A subsequent message requested the MOP without the RTM option, however the message assembled with the RTM option. Investigation revealed once a "Real Time MOP" (RTM) has been assembled for a given Rev, the Rev must be reconstructed (not SELUP'ed) if the RTM option is to be eliminated.

## 5.2 AUGIE

### 5.2.1 Overall Performance

Realtime Augie modes met all system requirements for Mission 1210. The playback modes also met system requirements with two minor exceptions early in the flight and these are noted below:

Slit width position data was improperly processed in PCM Format C from flight inception until operation 121 when corrective measures were implemented. In Take-up 2, Operation 141, Augie data indicated that the builder roller may not have performed properly during rewind. Analysis showed that the builder roller, a new design configuration, did operate properly but did not exhibit the amount of travel during rewind that builder rollers of the previous design did.

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### 5.2.1 Overall Performance - Cont'd.

The present Augie rate for the data in question (RADA, RADB) is too high to always allow detection of the builder roller lift operation during rewind. However, the rate can not be lowered without creating redundant reporting in the event field of the mode, and unless more risk is established, the present rate will be used on the next mission.

### 5.2.2 Modifications

No modifications were necessary during the flight. Some additional processing of frozen time data is being requested for Mission 1211 to facilitate verification of proper shutter timing from one frame to the next.

### 5.2.3 Display Television (DTV)

SSC utilization of the DTV was limited to passive real time status verification. The use of the DTV will remain limited to status monitoring for Mission 1211.

## 5.3 RTS Tapes and Microwave

### 5.3.1 RTS Tapes

The use of RTS tapes was minimal due to reliance on the microwave link capability between the STC and Building 156. However, when they were needed, the RTS tapes satisfied SSC requirements.

### 5.3.2 Microwave Link

The microwave link into Building 156, its associated terminals, and the SSTC were successful in receiving and processing more than 98% of the data transmissions from VTS via the STC. When necessary, unsuccessful data transmissions were either successfully retransmitted post pass or obtained from a tape dub supplied by the STC ground station.

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APPENDIX

A - 1

OPERATIONS SUMMARY

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A. 1210-1

B. CAMERA OPERATIONS SUMMARY REVS PAD THROUGH REV 253, CP 140

| REV | MSN | SCA | SCC | FRAMES |     | INTEROP |     | PHOTO-FT |     | CUM-TU-FEET |      |
|-----|-----|-----|-----|--------|-----|---------|-----|----------|-----|-------------|------|
|     |     |     |     | FWD    | AFT | FWD     | AFT | FWD      | AFT | FWD         | AFT  |
| PRE | LO  | 60  | 0   | 6      | 6   | 122     | 128 | 33       | 33  | 155         | 161  |
| PRE | LO  | 60  | 0   | 6      | 6   | 33      | 33  | 33       | 33  | 221         | 227  |
| PRE | LO  | 60  | 0   | 6      | 6   | 33      | 33  | 33       | 33  | 287         | 293  |
| PRE | LO  | 60  | 0   | 6      | 6   | 33      | 33  | 33       | 33  | 353         | 359  |
| PRE | LO  | 30  | 30  | 6      | 6   | 75      | 66  | 17       | 17  | 445         | 442  |
| PRE | LO  | 60  | 15  | 7      | 4   | 12      | 20  | 39       | 22  | 496         | 484  |
| PRE | LO  | 120 | 0   | 8      | 8   | 42      | 74  | 86       | 86  | 624         | 644  |
| PRE | LO  | 120 | 0   | 8      | 8   | 116     | 116 | 86       | 86  | 826         | 846  |
| PRE | LO  | 30  | 30  | 6      | 6   | 77      | 53  | 17       | 17  | 920         | 916  |
| PRE | LO  | 60  | 15  | 7      | 4   | 13      | 20  | 39       | 22  | 972         | 958  |
| PRE | LO  | 60  | 0   | 6      | 6   | 9       | 25  | 33       | 33  | 1014        | 1016 |
| PRE | LO  | 30  | 30  | 6      | 6   | 74      | 66  | 17       | 17  | 1105        | 1099 |
| PRE | LO  | 60  | 15  | 7      | 4   | 12      | 19  | 39       | 22  | 1156        | 1140 |
| PRE | LO  | 30  | 30  | 6      | 6   | 3       | 11  | 17       | 17  | 1176        | 1168 |
| PRE | LO  | 60  | 15  | 7      | 4   | 12      | 19  | 39       | 22  | 1227        | 1209 |
| PRE | LO  | 120 | 0   | 8      | 8   | 41      | 73  | 86       | 86  | 1354        | 1368 |
| PRE | LO  | 120 | 0   | 8      | 8   | 115     | 114 | 86       | 86  | 1555        | 1568 |
| PRE | LO  | 60  | 0   | 6      | 6   | 93      | 66  | 33       | 33  | 1671        | 1667 |
| PRE | LO  | 60  | 0   | 6      | 6   | 31      | 32  | 33       | 33  | 1735        | 1732 |
| PRE | LO  | 60  | 0   | 6      | 6   | 31      | 32  | 33       | 33  | 1799        | 1797 |
| PRE | LO  | 60  | 0   | 6      | 6   | 32      | 32  | 33       | 33  | 1864        | 1861 |
| 6   | 1   | 60  | 0   | 6      | 6   | 127     | 126 | 33       | 33  | 2024        | 2020 |
| 6   | 2   | 60  | -15 | 6      | 6   | 22      | 24  | 33       | 33  | 2079        | 2077 |
| 6   | 3   | 60  | 30  | 6      | 6   | 34      | 33  | 33       | 33  | 2146        | 2143 |
| 7   | 4   | 30  | 30  | 22     | 22  | 29      | 22  | 64       | 64  | 2239        | 2229 |
| 7   | 5   | 30  | 30  | 7      | 7   | 13      | 13  | 20       | 20  | 2272        | 2262 |
| 7   | 6   | 30  | 15  | 4      | 4   | 13      | 13  | 12       | 12  | 2297        | 2287 |
| 8   | 7   | 60  | -15 | 10     | 10  | 19      | 28  | 55       | 55  | 2371        | 2370 |
| 8   | 8   | 90  | 15  | 45     | 45  | 46      | 52  | 365      | 365 | 2782        | 2787 |
| 9   | 9   | 30  | -30 | 29     | 29  | 46      | 31  | 84       | 84  | 2912        | 2902 |
| 9   | 10  | 30  | 30  | 39     | 39  | 12      | 12  | 113      | 113 | 3037        | 3027 |
| 11  | 11  | 60  | -15 | 20     | 20  | 20      | 29  | 110      | 110 | 3167        | 3166 |
| 13  | 12  | 60  | 0   | 6      | 6   | 34      | 32  | 33       | 33  | 2334        | 3231 |
| 13  | 13  | 20  | 20  | 10     | 10  | 25      | 17  | 29       | 29  | 3288        | 3277 |
| 22  | 14  | 60  | 30  | 40     | 40  | 18      | 25  | 220      | 220 | 3526        | 3522 |
| 23  | 15  | 60  | -15 | 13     | 13  | 35      | 37  | 72       | 72  | 3633        | 3631 |
| 24  | 16  | 90  | 0   | 53     | 53  | 47      | 55  | 429      | 429 | 4109        | 4115 |
| 25  | 17  | 90  | 0   | 77     | 77  | 65      | 64  | 624      | 624 | 4793        | 4803 |
| 25  | 18  | 90  | 0   | 35     | 35  | 65      | 66  | 284      | 284 | 5147        | 5153 |
| 25  | 19  | 20  | 0   | 10     | 10  | 46      | 29  | 29       | 29  | 5222        | 5211 |
| 26  | 20  | 60  | -15 | 13     | 13  | 16      | 25  | 72       | 72  | 5310        | 5308 |
| 26  | 21  | 60  | -15 | 29     | 29  | 33      | 33  | 160      | 160 | 5503        | 5501 |

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|     |    |    |     |     |     |    |    |      |      |       |       |
|-----|----|----|-----|-----|-----|----|----|------|------|-------|-------|
| 26  | 22 | 90 | 0   | 17  | 17  | 46 | 54 | 139  | 138  | 5687  | 5693  |
| 27  | 23 | 60 | -15 | 32  | 32  | 53 | 45 | 176  | 176  | 5916  | 5914  |
| 27  | 24 | 30 | 30  | 17  | 17  | 27 | 18 | 49   | 49   | 5992  | 5981  |
| 27  | 25 | 30 | 15  | 36  | 36  | 11 | 12 | 104  | 104  | 6107  | 6097  |
| 29  | 26 | 60 | 0   | 22  | 22  | 17 | 24 | 121  | 121  | 6245  | 6242  |
| 32  | 27 | 30 | 0   | 5   | 5   | 24 | 17 | 15   | 15   | 6284  | 6274  |
| 39  | 28 | 60 | 30  | 14  | 14  | 21 | 27 | 77   | 77   | 6382  | 6378  |
| 39  | 29 | 30 | 30  | 10  | 10  | 27 | 20 | 29   | 29   | 6438  | 6427  |
| 40  | 30 | 90 | 0   | 128 | 128 | 31 | 47 | 1037 | 1037 | 7506  | 7511  |
| 41  | 21 | 90 | 0   | 83  | 83  | 66 | 66 | 672  | 672  | 8244  | 8249  |
| 41  | 22 | 60 | -15 | 19  | 19  | 54 | 47 | 105  | 105  | 8403  | 8401  |
| 41  | 33 | 30 | 30  | 31  | 31  | 28 | 20 | 90   | 90   | 8521  | 8511  |
| 42  | 34 | 60 | 0   | 25  | 25  | 20 | 28 | 138  | 138  | 8679  | 8677  |
| 42  | 35 | 90 | 0   | 12  | 12  | 46 | 54 | 67   | 97   | 8822  | 8828  |
| 42  | 36 | 60 | -15 | 7   | 7   | 54 | 46 | 39   | 39   | 8915  | 8913  |
| 42  | 37 | 30 | -15 | 6   | 6   | 27 | 20 | 17   | 17   | 8959  | 8950  |
| 43  | 38 | 30 | 30  | 22  | 22  | 12 | 11 | 64   | 64   | 9025  | 9025  |
| 43  | 39 | 30 | -30 | 31  | 31  | 12 | 12 | 90   | 90   | 9137  | 9127  |
| 43  | 40 | 30 | 30  | 30  | 30  | 13 | 12 | 87   | 87   | 9237  | 9226  |
| 45  | 41 | 30 | -30 | 28  | 28  | 12 | 13 | 81   | 81   | 9330  | 9320  |
| 46  | 42 | 30 | 30  | 13  | 13  | 12 | 11 | 38   | 38   | 9380  | 9369  |
| 46  | 43 | 90 | 0   | 16  | 16  | 25 | 41 | 130  | 130  | 9535  | 9540  |
| 54  | 44 | 60 | 15  | 59  | 59  | 48 | 40 | 325  | 225  | 9908  | 9905  |
| 54  | 45 | 30 | -30 | 31  | 31  | 28 | 21 | 90   | 90   | 10026 | 10016 |
| 55  | 46 | 30 | 30  | 13  | 13  | 14 | 14 | 38   | 38   | 10078 | 10068 |
| 56  | 47 | 90 | 0   | 83  | 83  | 22 | 48 | 692  | 692  | 10802 | 10808 |
| 57  | 48 | 30 | 15  | 16  | 16  | 46 | 30 | 46   | 46   | 10894 | 10884 |
| 57  | 49 | 90 | 0   | 54  | 54  | 32 | 47 | 437  | 437  | 11363 | 11368 |
| 57  | 50 | 60 | 15  | 10  | 10  | 53 | 45 | 55   | 55   | 11471 | 11468 |
| 58  | 51 | 90 | 0   | 56  | 56  | 45 | 54 | 454  | 454  | 11970 | 11976 |
| 58  | 52 | 60 | 15  | 32  | 32  | 54 | 45 | 176  | 176  | 12200 | 12197 |
| 59  | 53 | 90 | 0   | 53  | 53  | 46 | 54 | 429  | 429  | 12675 | 12680 |
| 64  | 54 | 60 | -15 | 28  | 28  | 53 | 47 | 154  | 154  | 12882 | 12881 |
| 69  | 55 | 30 | 30  | 7   | 7   | 28 | 17 | 20   | 20   | 12930 | 12918 |
| 70  | 56 | 30 | -30 | 14  | 14  | 12 | 14 | 41   | 41   | 12983 | 12973 |
| 70  | 57 | 30 | -30 | 69  | 69  | 13 | 16 | 200  | 200  | 13196 | 13189 |
| 72  | 58 | 60 | -15 | 119 | 119 | 21 | 29 | 655  | 655  | 13872 | 13872 |
| 73  | 59 | 90 | 0   | 32  | 32  | 47 | 54 | 260  | 260  | 14179 | 14187 |
| 74  | 60 | 60 | -15 | 41  | 41  | 54 | 47 | 226  | 226  | 14459 | 14460 |
| 74  | 61 | 60 | -15 | 92  | 92  | 36 | 30 | 506  | 506  | 15001 | 14996 |
| 75  | 62 | 90 | 0   | 65  | 65  | 46 | 56 | 524  | 524  | 15571 | 15576 |
| 77  | 63 | 60 | 15  | 4   | 4   | 54 | 46 | 22   | 22   | 15647 | 15644 |
| 79  | 64 | 30 | -30 | 14  | 14  | 27 | 19 | 38   | 38   | 15712 | 15701 |
| 80  | 65 | 30 | 0   | 6   | 6   | 13 | 13 | 16   | 16   | 15741 | 15730 |
| 87  | 66 | 60 | 15  | 10  | 10  | 20 | 27 | 55   | 55   | 15816 | 15812 |
| 88  | 67 | 90 | 0   | 68  | 68  | 46 | 55 | 551  | 551  | 16413 | 16418 |
| 90  | 68 | 30 | -15 | 34  | 34  | 46 | 30 | 99   | 99   | 16558 | 16547 |
| 93  | 69 | 30 | -30 | 8   | 8   | 13 | 13 | 22   | 22   | 16593 | 16582 |
| 97  | 70 | 60 | -15 | 5   | 5   | 20 | 29 | 27   | 27   | 16640 | 16638 |
| 104 | 71 | 90 | 15  | 25  | 25  | 47 | 54 | 203  | 203  | 16890 | 16895 |

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|     |     |    |     |    |    |    |    |     |     |       |       |
|-----|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 105 | 72  | 30 | -30 | 7  | 7  | 46 | 31 | 20  | 20  | 16956 | 16946 |
| 105 | 73  | 60 | 0   | 62 | 62 | 31 | 28 | 341 | 341 | 17328 | 17315 |
| 106 | 74  | 90 | 15  | 22 | 22 | 47 | 54 | 178 | 178 | 17553 | 17547 |
| 106 | 75  | 60 | -15 | 19 | 19 | 54 | 47 | 105 | 105 | 17712 | 17699 |
| 107 | 76  | 90 | 0   | 40 | 40 | 46 | 54 | 318 | 318 | 18076 | 18071 |
| 107 | 77  | 30 | -30 | 9  | 9  | 45 | 29 | 25  | 25  | 18146 | 18125 |
| 113 | 78  | 60 | -15 | 35 | 35 | 20 | 29 | 191 | 191 | 18357 | 18345 |
| 115 | 79  | 60 | -15 | 22 | 22 | 34 | 35 | 120 | 120 | 18511 | 18500 |
| 121 | 80  | 90 | 0   | 37 | 37 | 47 | 53 | 300 | 300 | 18858 | 18853 |
| 122 | 81  | 60 | 15  | 34 | 34 | 53 | 45 | 187 | 187 | 19098 | 19085 |
| 122 | 82  | 60 | 0   | 7  | 7  | 34 | 34 | 39  | 39  | 19171 | 19158 |
| 123 | 83  | 60 | 15  | 13 | 13 | 34 | 33 | 72  | 72  | 19277 | 19263 |
| 123 | 84  | 60 | -15 | 38 | 38 | 34 | 35 | 209 | 209 | 19520 | 19507 |
| 123 | 85  | 60 | -15 | 4  | 4  | 35 | 35 | 22  | 22  | 19577 | 19564 |
| 127 | 86  | 30 | -15 | 25 | 25 | 27 | 19 | 73  | 73  | 19677 | 19656 |
| 135 | 87  | 30 | 15  | 4  | 4  | 12 | 11 | 12  | 12  | 19701 | 19679 |
| 136 | 88  | 90 | 0   | 13 | 13 | 21 | 48 | 105 | 105 | 19837 | 19832 |
| 137 | 89  | 90 | 15  | 47 | 47 | 66 | 65 | 381 | 381 | 20284 | 20278 |
| 138 | 90  | 90 | 0   | 13 | 13 | 64 | 65 | 105 | 105 | 20453 | 20448 |
| 139 | 91  | 60 | -15 | 41 | 41 | 54 | 46 | 226 | 226 | 20733 | 20720 |
| 144 | 92  | 90 | 0   | 26 | 26 | 48 | 56 | 211 | 211 | 20992 | 20987 |
| 146 | 93  | 30 | -15 | 9  | 9  | 46 | 30 | 26  | 26  | 21064 | 21043 |
| 150 | 94  | 60 | -15 | 19 | 19 | 21 | 29 | 105 | 105 | 21190 | 21177 |
| 152 | 95  | 90 | 0   | 20 | 20 | 48 | 56 | 162 | 162 | 21400 | 21395 |
| 153 | 96  | 60 | 15  | 45 | 45 | 54 | 45 | 248 | 248 | 21702 | 21688 |
| 154 | 97  | 60 | -15 | 10 | 10 | 35 | 36 | 55  | 55  | 21792 | 21779 |
| 155 | 98  | 90 | 0   | 59 | 59 | 47 | 55 | 478 | 478 | 22317 | 22312 |
| 156 | 99  | 30 | 0   | 9  | 9  | 46 | 30 | 26  | 26  | 22389 | 22368 |
| 156 | 100 | 30 | 0   | 9  | 9  | 13 | 13 | 26  | 26  | 22428 | 22407 |
| 156 | 101 | 90 | 0   | 60 | 60 | 32 | 49 | 486 | 486 | 22946 | 22942 |
| 168 | 102 | 90 | 0   | 83 | 83 | 65 | 65 | 672 | 672 | 23683 | 23679 |
| 169 | 103 | 60 | -15 | 7  | 7  | 54 | 46 | 39  | 39  | 23776 | 23764 |
| 170 | 104 | 60 | -15 | 8  | 8  | 35 | 35 | 44  | 44  | 23855 | 23843 |
| 171 | 105 | 30 | 0   | 10 | 10 | 28 | 19 | 29  | 29  | 23912 | 23891 |
| 172 | 106 | 60 | 0   | 68 | 68 | 18 | 27 | 374 | 374 | 24304 | 24292 |
| 173 | 107 | 60 | 15  | 34 | 34 | 35 | 34 | 187 | 187 | 24526 | 24513 |
| 177 | 108 | 30 | 0   | 16 | 16 | 28 | 21 | 46  | 46  | 24600 | 24580 |
| 178 | 109 | 30 | 0   | 6  | 6  | 15 | 15 | 17  | 17  | 24632 | 24612 |
| 183 | 110 | 30 | 45  | 34 | 34 | 13 | 12 | 99  | 99  | 24744 | 24723 |
| 184 | 111 | 60 | 15  | 10 | 10 | 21 | 29 | 55  | 55  | 24820 | 24807 |
| 188 | 112 | 30 | 30  | 7  | 7  | 27 | 19 | 20  | 20  | 24867 | 24846 |
| 192 | 113 | 30 | 30  | 16 | 16 | 11 | 11 | 47  | 47  | 24925 | 24904 |
| 194 | 114 | 30 | 0   | 5  | 5  | 12 | 13 | 15  | 15  | 24952 | 24932 |
| 203 | 115 | 60 | 15  | 37 | 37 | 20 | 27 | 204 | 204 | 25176 | 25163 |
| 203 | 116 | 30 | 0   | 21 | 21 | 27 | 30 | 90  | 90  | 25293 | 25273 |
| 204 | 117 | 90 | 0   | 72 | 72 | 31 | 47 | 583 | 583 | 25907 | 25903 |
| 204 | 118 | 90 | 0   | 27 | 27 | 63 | 62 | 219 | 219 | 26189 | 26184 |
| 211 | 119 | 30 | 30  | 8  | 8  | 47 | 31 | 24  | 24  | 26260 | 26239 |
| 216 | 120 | 60 | 15  | 10 | 10 | 21 | 29 | 55  | 55  | 26336 | 26323 |
| 219 | 121 | 60 | 15  | 16 | 16 | 35 | 35 | 88  | 88  | 26459 | 26446 |

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|     |     |    |     |    |    |    |    |     |     |       |       |
|-----|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 220 | 122 | 30 | -15 | 11 | 11 | 27 | 20 | 32  | 32  | 26518 | 26498 |
| 221 | 123 | 30 | 30  | 7  | 7  | 13 | 12 | 21  | 21  | 26552 | 26531 |
| 221 | 124 | 60 | 15  | 13 | 13 | 20 | 29 | 72  | 72  | 26644 | 26632 |
| 221 | 125 | 30 | 0   | 4  | 4  | 27 | 19 | 12  | 12  | 26683 | 26663 |
| 222 | 126 | 90 | 0   | 8  | 8  | 32 | 49 | 65  | 65  | 26780 | 26777 |
| 231 | 127 | 30 | 30  | 4  | 4  | 47 | 30 | 12  | 12  | 26839 | 26819 |
| 233 | 128 | 60 | 0   | 7  | 7  | 21 | 29 | 39  | 39  | 26899 | 26887 |
| 235 | 129 | 60 | -15 | 56 | 56 | 35 | 35 | 308 | 308 | 27242 | 27230 |
| 236 | 130 | 60 | 15  | 10 | 10 | 36 | 36 | 55  | 55  | 27333 | 27321 |
| 236 | 131 | 30 | 0   | 8  | 8  | 28 | 20 | 23  | 23  | 27384 | 27364 |
| 237 | 132 | 60 | 0   | 10 | 10 | 21 | 29 | 55  | 55  | 27460 | 27448 |
| 237 | 133 | 90 | 0   | 31 | 31 | 48 | 56 | 251 | 251 | 27759 | 27755 |
| 237 | 134 | 60 | -30 | 11 | 11 | 55 | 48 | 61  | 61  | 27875 | 27864 |
| 248 | 135 | 30 | -30 | 7  | 7  | 28 | 20 | 21  | 21  | 27924 | 27905 |
| 249 | 136 | 60 | 15  | 19 | 19 | 22 | 29 | 105 | 105 | 28051 | 28039 |
| 251 | 137 | 30 | 30  | 16 | 16 | 29 | 20 | 47  | 47  | 28127 | 28106 |
| 252 | 138 | 30 | 15  | 4  | 4  | 14 | 15 | 12  | 12  | 28153 | 28133 |
| 253 | 139 | 60 | 15  | 19 | 19 | 23 | 30 | 105 | 105 | 28281 | 28268 |
| 253 | 140 | 60 | -15 | 23 | 20 | 26 | 38 | 125 | 105 | 28442 | 28415 |

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MSN CP 140

A-SIDE FRAME 23 IS 4 FEET, IN TU1, FRAME 24 IS 1 FOOT  
AND IN TU 2.

B-SIDE FRAME 20 IS 4 FEET, IN TU1, FRAME 21 IS 1 FOOT  
AND IN TU 2.

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A. 1310-2

B. CAMERA OPERATIONS SUMMARY REV 253, OP 140 THROUGH REV 825, OP 356

| REV<br>NUM | MSN<br>OP<br>NUM | SAL | SC  | FRAMES |     | INTEROP<br>FEET |     | PHOTO-FT |     | CUM-TU-FEET |      |
|------------|------------------|-----|-----|--------|-----|-----------------|-----|----------|-----|-------------|------|
|            |                  |     |     | FWD    | AFT | FWD             | AFT | FWD      | AFT | FWD         | AFT  |
| 253        | 140              | 60  | -15 | 8      | 11  | 0               | 0   | 45       | 56  | 45          | 56   |
| 265        | 141              | 60  | -15 | 13     | 13  | 109             | 109 | 72       | 72  | 226         | 237  |
| 266        | 142              | 90  | -15 | 29     | 0   | 49              | 0   | 235      | 0   | 510         | 237  |
| 266        | 143              | 60  | -15 | 7      | 7   | 55              | 37  | 39       | 39  | 604         | 313  |
| 269        | 144              | 60  | 15  | 28     | 28  | 38              | 37  | 154      | 154 | 796         | 504  |
| 269        | 145              | 60  | -30 | 24     | 24  | 37              | 38  | 132      | 132 | 965         | 674  |
| 270        | 146              | 60  | 15  | 28     | 28  | 39              | 37  | 154      | 154 | 1158        | 865  |
| 270        | 147              | 30  | 30  | 4      | 4   | 29              | 22  | 12       | 12  | 1199        | 899  |
| 270        | 148              | 30  | -30 | 18     | 18  | 15              | 15  | 53       | 53  | 1267        | 967  |
| 271        | 149              | 30  | 30  | 28     | 28  | 13              | 13  | 92       | 82  | 1362        | 1062 |
| 272        | 150              | 60  | 0   | 16     | 16  | 17              | 25  | 88       | 88  | 1467        | 1175 |
| 275        | 151              | 60  | 15  | 37     | 37  | 33              | 32  | 204      | 204 | 1704        | 1411 |
| 281        | 152              | 30  | -45 | 5      | 5   | 29              | 22  | 15       | 15  | 1748        | 1448 |
| 281        | 153              | 90  | 0   | 24     | 24  | 35              | 51  | 195      | 195 | 1978        | 1694 |
| 281        | 154              | 30  | 15  | 7      | 7   | 49              | 32  | 21       | 21  | 2048        | 1747 |
| 282        | 155              | 60  | 30  | 35     | 35  | 21              | 30  | 193      | 193 | 2262        | 1970 |
| 282        | 156              | 60  | -15 | 20     | 20  | 38              | 39  | 110      | 110 | 2410        | 2118 |
| 284        | 157              | 90  | 0   | 50     | 50  | 49              | 57  | 405      | 405 | 2864        | 2580 |
| 285        | 158              | 30  | 30  | 7      | 7   | 49              | 32  | 21       | 21  | 2934        | 2632 |
| 285        | 159              | 60  | -15 | 23     | 23  | 22              | 31  | 127      | 127 | 3083        | 2791 |
| 285        | 160              | 30  | -30 | 10     | 10  | 29              | 21  | 29       | 29  | 3141        | 2841 |
| 286        | 161              | 90  | 0   | 50     | 50  | 35              | 51  | 405      | 405 | 3581        | 3297 |
| 292        | 162              | 30  | -15 | 16     | 16  | 49              | 33  | 46       | 46  | 3676        | 3376 |
| 297        | 163              | 30  | -15 | 4      | 4   | 14              | 15  | 12       | 12  | 3702        | 3403 |
| 298        | 164              | 90  | 0   | 12     | 0   | 34              | 0   | 106      | 0   | 3842        | 3403 |
| 300        | 165              | 60  | 30  | 43     | 43  | 56              | 29  | 237      | 237 | 4135        | 3669 |
| 300        | 166              | 60  | 0   | 12     | 12  | 37              | 38  | 66       | 66  | 4238        | 3773 |
| 302        | 167              | 90  | 0   | 83     | 83  | 50              | 58  | 673      | 673 | 4961        | 4504 |
| 303        | 168              | 60  | -15 | 25     | 25  | 55              | 47  | 138      | 138 | 5154        | 4689 |
| 308        | 169              | 60  | 0   | 15     | 15  | 37              | 37  | 83       | 83  | 5274        | 4809 |
| 312        | 170              | 60  | 0   | 7      | 7   | 36              | 36  | 39       | 39  | 5349        | 4984 |
| 314        | 171              | 90  | 0   | 7      | 7   | 47              | 55  | 57       | 57  | 5453        | 4996 |
| 316        | 172              | 60  | 30  | 89     | 89  | 53              | 45  | 490      | 490 | 5956        | 5521 |
| 317        | 173              | 60  | -15 | 26     | 26  | 36              | 36  | 143      | 143 | 6175        | 5710 |
| 317        | 174              | 30  | -30 | 32     | 32  | 28              | 20  | 93       | 93  | 6296        | 5823 |
| 318        | 175              | 30  | -30 | 19     | 19  | 13              | 13  | 55       | 55  | 6264        | 5891 |
| 318        | 176              | 90  | 0   | 86     | 86  | 20              | 46  | 697      | 697 | 7091        | 6634 |
| 319        | 177              | 30  | 0   | 4      | 4   | 46              | 30  | 12       | 12  | 7149        | 6676 |
| 319        | 178              | 30  | -30 | 4      | 4   | 13              | 13  | 12       | 12  | 7174        | 6701 |
| 324        | 179              | 30  | 30  | 22     | 22  | 14              | 13  | 64       | 64  | 7252        | 6778 |
| 324        | 180              | 30  | -30 | 8      | 8   | 14              | 15  | 24       | 24  | 7290        | 6817 |
| 324        | 181              | 30  | 15  | 7      | 7   | 13              | 13  | 21       | 21  | 7324        | 6851 |

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|     |     |    |     |    |    |    |    |     |     |       |       |
|-----|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 332 | 182 | 60 | 0   | 10 | 10 | 23 | 30 | 55  | 55  | 7402  | 6936  |
| 333 | 182 | 90 | 0   | 26 | 26 | 48 | 57 | 211 | 211 | 7661  | 7204  |
| 333 | 184 | 60 | 15  | 4  | 4  | 57 | 48 | 22  | 22  | 7740  | 7274  |
| 334 | 185 | 60 | 15  | 10 | 10 | 36 | 37 | 55  | 55  | 7831  | 7366  |
| 334 | 186 | 90 | 0   | 63 | 63 | 48 | 55 | 511 | 511 | 8290  | 7932  |
| 334 | 187 | 60 | 0   | 7  | 7  | 56 | 48 | 39  | 39  | 8485  | 8019  |
| 340 | 188 | 30 | 15  | 5  | 5  | 29 | 22 | 15  | 15  | 8529  | 8056  |
| 348 | 189 | 90 | 0   | 50 | 50 | 34 | 50 | 405 | 405 | 8968  | 8511  |
| 349 | 190 | 30 | -30 | 7  | 7  | 49 | 33 | 21  | 21  | 9038  | 8565  |
| 350 | 191 | 90 | 0   | 80 | 80 | 32 | 47 | 648 | 648 | 9718  | 9260  |
| 350 | 192 | 90 | 0   | 36 | 36 | 66 | 66 | 292 | 292 | 10076 | 9618  |
| 350 | 193 | 30 | 15  | 7  | 7  | 50 | 34 | 21  | 21  | 10147 | 9673  |
| 355 | 194 | 30 | -15 | 5  | 5  | 14 | 15 | 15  | 15  | 10176 | 9703  |
| 355 | 195 | 30 | -15 | 6  | 6  | 16 | 16 | 18  | 18  | 10210 | 9737  |
| 357 | 196 | 30 | -15 | 5  | 5  | 13 | 13 | 15  | 15  | 10238 | 9765  |
| 363 | 197 | 30 | 30  | 25 | 25 | 15 | 14 | 73  | 73  | 10326 | 9852  |
| 364 | 198 | 30 | -30 | 35 | 35 | 14 | 15 | 102 | 102 | 10442 | 9969  |
| 365 | 199 | 60 | 15  | 13 | 13 | 22 | 29 | 72  | 72  | 10536 | 10070 |
| 366 | 200 | 60 | -15 | 62 | 62 | 36 | 37 | 341 | 341 | 10913 | 10448 |
| 366 | 201 | 60 | -15 | 10 | 10 | 36 | 36 | 55  | 55  | 11004 | 10539 |
| 368 | 202 | 90 | 0   | 7  | 7  | 50 | 57 | 57  | 57  | 11111 | 10653 |
| 368 | 203 | 30 | 0   | 4  | 4  | 48 | 33 | 12  | 12  | 11171 | 10698 |
| 369 | 204 | 60 | -15 | 25 | 25 | 20 | 28 | 138 | 138 | 11329 | 10864 |
| 371 | 205 | 30 | 15  | 7  | 7  | 27 | 18 | 21  | 21  | 11377 | 10903 |
| 373 | 206 | 30 | -15 | 7  | 7  | 14 | 15 | 21  | 21  | 11412 | 10939 |
| 382 | 207 | 90 | 15  | 41 | 41 | 33 | 49 | 333 | 333 | 11778 | 11321 |
| 382 | 208 | 30 | 30  | 7  | 7  | 48 | 31 | 21  | 21  | 11847 | 11373 |
| 383 | 209 | 90 | 0   | 77 | 77 | 34 | 50 | 624 | 624 | 12505 | 12047 |
| 384 | 210 | 30 | 15  | 16 | 16 | 48 | 32 | 47  | 47  | 12600 | 12126 |
| 389 | 211 | 30 | -30 | 11 | 11 | 14 | 15 | 32  | 32  | 12646 | 12173 |
| 393 | 212 | 60 | -15 | 7  | 7  | 22 | 30 | 39  | 39  | 12707 | 12242 |
| 397 | 213 | 60 | -30 | 16 | 16 | 37 | 38 | 88  | 88  | 12832 | 12368 |
| 397 | 214 | 60 | 15  | 63 | 63 | 37 | 26 | 347 | 347 | 13216 | 12751 |
| 397 | 215 | 90 | 0   | 7  | 7  | 50 | 58 | 57  | 57  | 13323 | 12866 |
| 398 | 216 | 30 | 30  | 43 | 43 | 47 | 31 | 125 | 125 | 13495 | 13022 |
| 398 | 217 | 60 | -15 | 74 | 74 | 22 | 30 | 407 | 407 | 13924 | 13459 |
| 399 | 218 | 90 | 15  | 38 | 38 | 48 | 54 | 308 | 308 | 14280 | 13821 |
| 399 | 219 | 60 | 0   | 18 | 18 | 54 | 48 | 99  | 99  | 14433 | 13968 |
| 399 | 220 | 30 | -30 | 4  | 4  | 32 | 24 | 12  | 12  | 14477 | 14004 |
| 409 | 221 | 30 | -15 | 13 | 13 | 15 | 15 | 38  | 38  | 14530 | 14057 |
| 407 | 222 | 90 | 0   | 31 | 31 | 32 | 48 | 251 | 251 | 14813 | 14356 |
| 411 | 223 | 30 | -30 | 10 | 10 | 48 | 23 | 29  | 29  | 14890 | 14418 |
| 412 | 224 | 60 | -15 | 10 | 10 | 23 | 31 | 55  | 55  | 14968 | 14504 |
| 413 | 225 | 60 | 15  | 31 | 31 | 37 | 36 | 171 | 171 | 15176 | 14711 |
| 414 | 226 | 60 | -15 | 22 | 22 | 36 | 37 | 121 | 121 | 15333 | 14869 |
| 416 | 227 | 30 | 30  | 28 | 28 | 19 | 19 | 82  | 82  | 15443 | 14970 |
| 429 | 228 | 30 | 30  | 19 | 19 | 14 | 13 | 56  | 56  | 15513 | 15039 |
| 429 | 229 | 60 | -15 | 15 | 15 | 21 | 31 | 83  | 83  | 15617 | 15153 |
| 431 | 230 | 90 | 0   | 16 | 16 | 50 | 57 | 130 | 130 | 15797 | 15340 |
| 446 | 231 | 60 | 0   | 6  | 0  | 51 | 0  | 33  | 0   | 15881 | 15340 |

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|     |     |    |     |    |    |    |     |     |     |       |       |
|-----|-----|----|-----|----|----|----|-----|-----|-----|-------|-------|
| 458 | 232 | 60 | 0   | 0  | 6  | 0  | 145 | 0   | 33  | 15881 | 15518 |
| 461 | 233 | 60 | -15 | 20 | 20 | 22 | 31  | 110 | 110 | 16023 | 15659 |
| 463 | 234 | 50 | 0   | 23 | 23 | 40 | 48  | 187 | 187 | 16250 | 15894 |
| 463 | 235 | 30 | 15  | 10 | 10 | 41 | 25  | 29  | 29  | 16320 | 15948 |
| 469 | 236 | 30 | 0   | 8  | 8  | 15 | 14  | 24  | 24  | 16359 | 15986 |
| 472 | 237 | 60 | -15 | 37 | 37 | 20 | 29  | 204 | 204 | 16583 | 16219 |
| 479 | 238 | 30 | 30  | 4  | 4  | 28 | 20  | 12  | 12  | 16623 | 16251 |
| 485 | 239 | 30 | -15 | 5  | 5  | 15 | 15  | 15  | 15  | 16653 | 16281 |
| 497 | 240 | 30 | 30  | 25 | 25 | 14 | 14  | 73  | 73  | 16740 | 16368 |
| 497 | 241 | 60 | 15  | 35 | 35 | 22 | 29  | 193 | 193 | 16955 | 16590 |
| 509 | 242 | 60 | 0   | 7  | 7  | 37 | 38  | 39  | 39  | 17031 | 16667 |
| 512 | 243 | 30 | 30  | 28 | 28 | 30 | 21  | 81  | 81  | 17142 | 16769 |
| 513 | 244 | 30 | 30  | 62 | 62 | 13 | 14  | 180 | 180 | 17335 | 16963 |
| 513 | 245 | 30 | 30  | 4  | 4  | 14 | 14  | 12  | 12  | 17361 | 16989 |
| 518 | 246 | 30 | -15 | 19 | 19 | 15 | 15  | 56  | 56  | 17432 | 17060 |
| 518 | 247 | 30 | 30  | 21 | 21 | 14 | 13  | 90  | 90  | 17526 | 17163 |
| 525 | 248 | 30 | 30  | 31 | 31 | 14 | 14  | 90  | 90  | 17640 | 17267 |
| 527 | 249 | 60 | -15 | 14 | 14 | 22 | 32  | 77  | 77  | 17739 | 17376 |
| 527 | 250 | 60 | -15 | 18 | 18 | 38 | 37  | 99  | 99  | 17876 | 17512 |
| 529 | 251 | 60 | -15 | 29 | 29 | 37 | 37  | 160 | 160 | 18073 | 17709 |
| 541 | 252 | 60 | 30  | 23 | 0  | 36 | 0   | 127 | 0   | 18236 | 17709 |
| 544 | 253 | 30 | 30  | 13 | 13 | 29 | 21  | 38  | 38  | 18303 | 17768 |
| 545 | 254 | 60 | -15 | 11 | 11 | 22 | 30  | 61  | 61  | 18386 | 17859 |
| 545 | 255 | 60 | 15  | 20 | 20 | 31 | 31  | 110 | 110 | 18527 | 18000 |
| 545 | 256 | 60 | 15  | 51 | 51 | 38 | 37  | 281 | 281 | 18846 | 18318 |
| 545 | 257 | 30 | 0   | 4  | 4  | 29 | 22  | 12  | 12  | 18887 | 18352 |
| 557 | 258 | 30 | -45 | 47 | 0  | 14 | 0   | 137 | 0   | 19038 | 18352 |
| 557 | 259 | 90 | 15  | 16 | 0  | 32 | 0   | 130 | 0   | 19200 | 18352 |
| 557 | 260 | 30 | -15 | 10 | 10 | 48 | 15  | 29  | 29  | 19277 | 18396 |
| 559 | 261 | 60 | -15 | 14 | 14 | 23 | 31  | 77  | 77  | 19377 | 18504 |
| 560 | 262 | 30 | -45 | 4  | 4  | 30 | 22  | 12  | 12  | 19419 | 18538 |
| 560 | 263 | 30 | 30  | 4  | 4  | 15 | 14  | 12  | 12  | 19446 | 18564 |
| 561 | 264 | 60 | 15  | 19 | 19 | 21 | 30  | 105 | 105 | 19572 | 18699 |
| 562 | 265 | 30 | -30 | 19 | 19 | 29 | 21  | 56  | 56  | 19657 | 18776 |
| 567 | 266 | 30 | 0   | 5  | 5  | 14 | 14  | 15  | 15  | 19686 | 18805 |
| 574 | 267 | 30 | 15  | 4  | 4  | 15 | 16  | 12  | 12  | 19713 | 18822 |
| 574 | 268 | 30 | 30  | 10 | 10 | 15 | 14  | 29  | 29  | 19757 | 18876 |
| 577 | 269 | 90 | 0   | 37 | 37 | 36 | 51  | 300 | 300 | 20093 | 19227 |
| 577 | 270 | 30 | 30  | 10 | 10 | 43 | 33  | 29  | 29  | 20170 | 19289 |
| 577 | 271 | 30 | 30  | 17 | 17 | 15 | 14  | 50  | 50  | 20235 | 19353 |
| 578 | 272 | 60 | 15  | 28 | 28 | 22 | 30  | 154 | 154 | 20411 | 19537 |
| 578 | 273 | 30 | -20 | 21 | 21 | 29 | 22  | 61  | 61  | 20501 | 19620 |
| 584 | 274 | 30 | 15  | 8  | 8  | 15 | 14  | 23  | 23  | 20539 | 19657 |
| 590 | 275 | 90 | 0   | 23 | 23 | 34 | 52  | 187 | 187 | 20760 | 19896 |
| 592 | 276 | 60 | 20  | 28 | 28 | 58 | 48  | 154 | 154 | 20972 | 20098 |
| 592 | 277 | 30 | 30  | 11 | 11 | 29 | 22  | 32  | 32  | 21033 | 20152 |
| 593 | 278 | 30 | 0   | 4  | 4  | 15 | 15  | 12  | 12  | 21060 | 20179 |
| 593 | 279 | 60 | -15 | 9  | 9  | 23 | 31  | 50  | 50  | 21133 | 20260 |
| 594 | 280 | 90 | 0   | 42 | 42 | 49 | 57  | 349 | 349 | 21531 | 20666 |
| 599 | 281 | 30 | 0   | 7  | 7  | 48 | 32  | 21  | 21  | 21600 | 20719 |

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|     |     |    |     |    |    |    |    |     |     |       |       |
|-----|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 606 | 282 | 90 | 0   | 81 | 81 | 33 | 49 | 657 | 657 | 22290 | 21425 |
| 607 | 283 | 90 | -15 | 29 | 0  | 64 | 0  | 235 | 0   | 22589 | 21425 |
| 609 | 284 | 60 | -15 | 32 | 32 | 52 | 49 | 176 | 176 | 22817 | 21650 |
| 609 | 285 | 60 | 0   | 17 | 17 | 37 | 37 | 94  | 94  | 22948 | 21781 |
| 610 | 286 | 60 | -15 | 31 | 0  | 38 | 0  | 171 | 0   | 23157 | 21781 |
| 613 | 287 | 90 | 15  | 22 | 0  | 41 | 0  | 179 | 0   | 23377 | 21781 |
| 622 | 288 | 60 | -15 | 33 | 33 | 48 | 37 | 182 | 182 | 23607 | 22000 |
| 625 | 289 | 30 | 15  | 5  | 5  | 29 | 21 | 15  | 15  | 23651 | 22036 |
| 625 | 290 | 60 | -15 | 8  | 8  | 22 | 30 | 44  | 44  | 23717 | 22110 |
| 626 | 291 | 30 | -30 | 10 | 10 | 30 | 23 | 29  | 29  | 23776 | 22162 |
| 626 | 292 | 30 | 30  | 10 | 10 | 15 | 15 | 29  | 29  | 23820 | 22206 |
| 638 | 293 | 30 | -30 | 10 | 10 | 15 | 15 | 29  | 29  | 23864 | 22250 |
| 641 | 294 | 60 | -15 | 17 | 17 | 23 | 30 | 94  | 94  | 23981 | 22374 |
| 641 | 295 | 60 | 0   | 7  | 7  | 36 | 36 | 39  | 39  | 24056 | 22449 |
| 658 | 296 | 30 | -30 | 10 | 10 | 29 | 21 | 29  | 29  | 24114 | 22499 |
| 658 | 297 | 30 | -15 | 7  | 7  | 14 | 14 | 21  | 21  | 24149 | 22534 |
| 658 | 298 | 90 | 0   | 15 | 15 | 33 | 50 | 122 | 122 | 24304 | 22706 |
| 659 | 299 | 30 | 15  | 4  | 4  | 49 | 33 | 12  | 12  | 24365 | 22751 |
| 660 | 300 | 30 | -20 | 10 | 10 | 15 | 15 | 29  | 29  | 24409 | 22795 |
| 663 | 301 | 30 | -15 | 7  | 7  | 14 | 14 | 21  | 21  | 24444 | 22830 |
| 672 | 302 | 30 | 30  | 41 | 41 | 14 | 13 | 119 | 119 | 24577 | 22962 |
| 672 | 303 | 30 | -15 | 4  | 4  | 14 | 15 | 12  | 12  | 24603 | 22989 |
| 673 | 304 | 30 | 30  | 41 | 41 | 14 | 14 | 119 | 119 | 24736 | 23122 |
| 674 | 305 | 30 | -15 | 4  | 4  | 14 | 13 | 12  | 12  | 24762 | 23147 |
| 674 | 306 | 30 | -30 | 4  | 4  | 14 | 15 | 12  | 12  | 24788 | 23174 |
| 675 | 307 | 60 | -15 | 14 | 14 | 23 | 30 | 77  | 77  | 24888 | 23281 |
| 681 | 308 | 30 | 15  | 9  | 9  | 29 | 21 | 26  | 26  | 24943 | 23328 |
| 687 | 309 | 60 | -15 | 35 | 35 | 23 | 31 | 193 | 193 | 25159 | 23552 |
| 688 | 310 | 30 | -30 | 7  | 7  | 30 | 22 | 21  | 21  | 25210 | 23595 |
| 688 | 311 | 30 | 15  | 4  | 4  | 14 | 15 | 12  | 12  | 25236 | 23622 |
| 690 | 312 | 30 | -30 | 10 | 10 | 15 | 15 | 29  | 29  | 25280 | 23666 |
| 690 | 313 | 30 | -30 | 12 | 12 | 15 | 15 | 35  | 35  | 25330 | 23716 |
| 690 | 314 | 60 | 15  | 16 | 16 | 23 | 30 | 88  | 88  | 25441 | 23834 |
| 705 | 315 | 60 | 30  | 19 | 0  | 26 | 0  | 105 | 0   | 25582 | 23834 |
| 706 | 316 | 30 | -30 | 7  | 7  | 29 | 22 | 21  | 21  | 25632 | 23877 |
| 706 | 317 | 30 | 30  | 4  | 4  | 14 | 13 | 12  | 12  | 25658 | 23902 |
| 707 | 318 | 30 | 30  | 7  | 7  | 14 | 14 | 21  | 21  | 25693 | 23937 |
| 714 | 319 | 30 | 0   | 4  | 4  | 14 | 15 | 12  | 12  | 25719 | 23964 |
| 722 | 320 | 30 | 15  | 20 | 20 | 15 | 15 | 58  | 58  | 25792 | 24037 |
| 722 | 321 | 30 | 30  | 31 | 31 | 14 | 14 | 90  | 90  | 25896 | 24141 |
| 728 | 322 | 90 | -15 | 7  | 7  | 35 | 51 | 57  | 57  | 25988 | 24249 |
| 730 | 323 | 90 | 0   | 73 | 73 | 68 | 68 | 592 | 592 | 26648 | 24909 |
| 735 | 324 | 90 | 0   | 40 | 40 | 69 | 68 | 324 | 324 | 27041 | 25301 |
| 737 | 325 | 30 | -30 | 10 | 10 | 48 | 34 | 29  | 29  | 27118 | 25364 |
| 738 | 326 | 30 | 30  | 10 | 10 | 15 | 16 | 29  | 29  | 27162 | 25409 |
| 739 | 327 | 30 | 15  | 7  | 7  | 15 | 15 | 21  | 21  | 27198 | 25445 |
| 739 | 328 | 60 | 15  | 11 | 11 | 22 | 29 | 61  | 61  | 27281 | 25535 |
| 740 | 329 | 30 | 30  | 7  | 7  | 29 | 20 | 21  | 21  | 27331 | 25576 |
| 751 | 330 | 90 | 0   | 19 | 19 | 33 | 50 | 154 | 154 | 27518 | 25780 |
| 753 | 331 | 30 | -30 | 4  | 4  | 48 | 32 | 12  | 12  | 27578 | 25824 |

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|     |     |    |     |    |    |    |    |     |     |       |       |
|-----|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 754 | 332 | 30 | -45 | 10 | 10 | 15 | 16 | 29  | 29  | 27622 | 25869 |
| 754 | 333 | 30 | 30  | 5  | 5  | 15 | 13 | 15  | 15  | 27652 | 25897 |
| 755 | 334 | 30 | -15 | 7  | 7  | 13 | 14 | 21  | 21  | 27686 | 25932 |
| 756 | 335 | 90 | 0   | 41 | 41 | 29 | 45 | 333 | 333 | 28048 | 26310 |
| 762 | 336 | 30 | 0   | 5  | 5  | 46 | 30 | 15  | 15  | 28109 | 26355 |
| 767 | 337 | 30 | -30 | 8  | 8  | 15 | 14 | 24  | 24  | 28148 | 26393 |
| 768 | 338 | 30 | 30  | 4  | 4  | 14 | 15 | 12  | 12  | 28174 | 26420 |
| 772 | 339 | 30 | 30  | 19 | 19 | 15 | 14 | 55  | 55  | 28244 | 26489 |
| 777 | 340 | 30 | 0   | 5  | 5  | 14 | 15 | 15  | 15  | 28273 | 26519 |
| 778 | 341 | 60 | -30 | 13 | 13 | 19 | 29 | 72  | 72  | 28364 | 26620 |
| 778 | 342 | 30 | -15 | 5  | 5  | 27 | 17 | 15  | 15  | 28406 | 26652 |
| 784 | 343 | 60 | 15  | 16 | 16 | 23 | 30 | 88  | 88  | 28517 | 26770 |
| 788 | 344 | 60 | 15  | 19 | 19 | 27 | 27 | 105 | 105 | 28659 | 26912 |
| 788 | 345 | 60 | 15  | 10 | 10 | 35 | 35 | 55  | 55  | 28749 | 27002 |
| 801 | 346 | 30 | -30 | 9  | 9  | 30 | 22 | 27  | 27  | 28806 | 27051 |
| 802 | 347 | 30 | -45 | 8  | 8  | 14 | 14 | 24  | 24  | 28844 | 27089 |
| 804 | 348 | 90 | 0   | 38 | 38 | 30 | 46 | 308 | 308 | 29182 | 27443 |
| 804 | 349 | 90 | -15 | 15 | 15 | 68 | 69 | 122 | 122 | 29372 | 27634 |
| 811 | 350 | 30 | 0   | 5  | 5  | 48 | 22 | 15  | 15  | 29435 | 27681 |
| 816 | 351 | 30 | 30  | 8  | 8  | 15 | 14 | 24  | 24  | 29474 | 27719 |
| 820 | 352 | 30 | -30 | 5  | 5  | 14 | 14 | 15  | 15  | 29503 | 27748 |
| 820 | 353 | 30 | -30 | 9  | 9  | 14 | 14 | 27  | 27  | 29544 | 27789 |
| 821 | 354 | 30 | 15  | 8  | 8  | 14 | 14 | 24  | 24  | 29582 | 27827 |
| 823 | 355 | 60 | 0   | 8  | 8  | 22 | 30 | 44  | 44  | 29648 | 27901 |
| 825 | 356 | 60 | -15 | 11 | 9  | 38 | 39 | 56  | 49  | 29742 | 27989 |

MSN OP 356

A-SIDE FRAME 11 IS 1 FOOT, IN TU2, AND FRAME 12 IS 5 FEET IN TU3.

B-SIDE FRAME 9 IS 5 FEET, IN TU2, AND FRAME 11 IS 5 FEET IN TU3.

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A. 1210-3

B. CAMERA OPERATIONS SUMMARY REV 825, DP 256 THROUGH REV 1405, CP 555

| REV<br>NUM | MSN<br>OP<br>NUM | SAL | SC  | FRAMES |     | INTEROP<br>FEET |     | PHOTO-FT |     | CUM-TU-FEET |      |
|------------|------------------|-----|-----|--------|-----|-----------------|-----|----------|-----|-------------|------|
|            |                  |     |     | FWD    | AFT | FWD             | AFT | FWD      | AFT | FWD         | AFT  |
| 825        | 356              | 60  | -15 | 8      | 9   | -               | -   | 43       | 49  | 43          | 49   |
| 832        | 357              | 60  | -15 | 19     | 19  | 110             | 109 | 105      | 105 | 258         | 263  |
| 833        | 358              | 30  | 30  | 10     | 10  | 29              | 22  | 29       | 29  | 316         | 314  |
| 833        | 359              | 60  | -15 | 9      | 9   | 23              | 30  | 50       | 50  | 389         | 394  |
| 833        | 360              | 90  | 0   | 25     | 25  | 50              | 59  | 203      | 203 | 642         | 656  |
| 835        | 361              | 90  | 0   | 25     | 0   | 64              | 0   | 203      | 0   | 909         | 656  |
| 825        | 362              | 30  | -30 | 4      | 4   | 46              | 31  | 12       | 12  | 967         | 699  |
| 837        | 363              | 30  | 0   | 4      | 4   | 15              | 15  | 12       | 12  | 994         | 726  |
| 838        | 364              | 30  | 30  | 37     | 37  | 15              | 14  | 107      | 107 | 1116        | 847  |
| 851        | 365              | 90  | 0   | 44     | 44  | 34              | 50  | 357      | 357 | 1507        | 1254 |
| 852        | 366              | 60  | 15  | 10     | 10  | 56              | 48  | 55       | 55  | 1618        | 1357 |
| 852        | 367              | 60  | -15 | 16     | 16  | 37              | 39  | 88       | 88  | 1743        | 1484 |
| 853        | 368              | 60  | -15 | 7      | 7   | 39              | 37  | 39       | 39  | 1821        | 1560 |
| 854        | 369              | 60  | -15 | 10     | 10  | 36              | 37  | 55       | 55  | 1912        | 1652 |
| 855        | 370              | 90  | 0   | 21     | 21  | 54              | 54  | 251      | 251 | 2217        | 1957 |
| 857        | 371              | 60  | 15  | 13     | 13  | 41              | 40  | 72       | 72  | 2330        | 2069 |
| 863        | 372              | 60  | -30 | 41     | 0   | 35              | 0   | 226      | 0   | 2591        | 2069 |
| 865        | 373              | 60  | -15 | 77     | 77  | 25              | 37  | 424      | 424 | 3050        | 2530 |
| 865        | 374              | 60  | -15 | 21     | 21  | 37              | 36  | 116      | 116 | 3203        | 2682 |
| 867        | 375              | 30  | 15  | 4      | 4   | 31              | 23  | 12       | 12  | 3246        | 2717 |
| 868        | 376              | 60  | 15  | 28     | 28  | 23              | 30  | 154      | 154 | 3423        | 2901 |
| 869        | 377              | 60  | 15  | 13     | 13  | 37              | 37  | 72       | 72  | 3532        | 3010 |
| 870        | 378              | 30  | -30 | 7      | 7   | 29              | 22  | 21       | 21  | 3582        | 3053 |
| 872        | 379              | 90  | 0   | 24     | 24  | 29              | 45  | 275      | 275 | 3886        | 3373 |
| 881        | 380              | 60  | -15 | 29     | 29  | 52              | 44  | 160      | 160 | 4098        | 3577 |
| 885        | 381              | 60  | -15 | 53     | 53  | 38              | 38  | 292      | 292 | 4428        | 3907 |
| 886        | 382              | 30  | 15  | 4      | 4   | 29              | 21  | 12       | 12  | 4469        | 3940 |
| 898        | 383              | 60  | -30 | 41     | 0   | 22              | 0   | 226      | 0   | 4717        | 3940 |
| 898        | 384              | 60  | 0   | 21     | 21  | 37              | 31  | 116      | 116 | 4870        | 4087 |
| 900        | 385              | 30  | -30 | 9      | 9   | 29              | 21  | 27       | 27  | 4926        | 4135 |
| 901        | 386              | 60  | 15  | 9      | 9   | 21              | 29  | 50       | 50  | 4997        | 4214 |
| 914        | 387              | 90  | 0   | 45     | 0   | 49              | 0   | 365      | 0   | 5411        | 4214 |
| 914        | 388              | 90  | 0   | 18     | 18  | 68              | 58  | 146      | 146 | 5625        | 4418 |
| 916        | 389              | 90  | 15  | 25     | 0   | 68              | 0   | 203      | 0   | 5896        | 4418 |
| 917        | 390              | 30  | 15  | 5      | 5   | 47              | 33  | 15       | 15  | 5958        | 4466 |
| 919        | 391              | 30  | 30  | 25     | 25  | 15              | 15  | 73       | 73  | 6046        | 4554 |
| 924        | 392              | 30  | 0   | 6      | 6   | 14              | 14  | 18       | 18  | 6078        | 4586 |
| 928        | 393              | 60  | -30 | 21     | 0   | 22              | 0   | 116      | 0   | 6216        | 4586 |
| 932        | 394              | 30  | 0   | 5      | 5   | 29              | 14  | 15       | 15  | 6260        | 4615 |
| 933        | 395              | 30  | 0   | 5      | 5   | 15              | 15  | 15       | 15  | 6290        | 4645 |
| 933        | 396              | 30  | -30 | 9      | 9   | 14              | 14  | 27       | 27  | 6331        | 4686 |
| 934        | 397              | 90  | 0   | 86     | 86  | 34              | 50  | 697      | 697 | 7062        | 5433 |

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|      |     |    |     |    |    |    |    |     |     |       |       |
|------|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 934  | 309 | 30 | -15 | 5  | 5  | 48 | 32 | 15  | 15  | 7125  | 5480  |
| 935  | 399 | 60 | 15  | 29 | 29 | 23 | 30 | 160 | 160 | 7308  | 5670  |
| 938  | 400 | 60 | 0   | 13 | 13 | 23 | 34 | 72  | 72  | 7413  | 5776  |
| 945  | 401 | 30 | 30  | 13 | 13 | 25 | 17 | 38  | 38  | 7476  | 5831  |
| 947  | 402 | 60 | 15  | 17 | 17 | 23 | 30 | 94  | 94  | 7593  | 5955  |
| 949  | 403 | 90 | 0   | 58 | 58 | 45 | 55 | 470 | 470 | 8108  | 6480  |
| 950  | 404 | 60 | 0   | 29 | 29 | 56 | 47 | 160 | 160 | 8324  | 6687  |
| 951  | 405 | 60 | -15 | 34 | 34 | 37 | 37 | 187 | 187 | 8548  | 6911  |
| 952  | 406 | 30 | 30  | 25 | 25 | 28 | 20 | 73  | 73  | 8649  | 7004  |
| 956  | 407 | 30 | -30 | 17 | 17 | 14 | 14 | 50  | 50  | 8713  | 7068  |
| 957  | 408 | 90 | 0   | 7  | 7  | 34 | 49 | 57  | 57  | 8804  | 7174  |
| 963  | 409 | 60 | 15  | 30 | 30 | 56 | 49 | 165 | 165 | 9025  | 7388  |
| 966  | 410 | 30 | 0   | 9  | 9  | 30 | 22 | 27  | 27  | 9082  | 7437  |
| 966  | 411 | 30 | -30 | 5  | 5  | 14 | 14 | 15  | 15  | 9111  | 7466  |
| 966  | 412 | 30 | -30 | 49 | 49 | 13 | 14 | 143 | 143 | 9267  | 7623  |
| 966  | 413 | 30 | 30  | 5  | 5  | 13 | 12 | 15  | 15  | 9295  | 7650  |
| 967  | 414 | 60 | 15  | 22 | 22 | 22 | 29 | 121 | 121 | 9438  | 7800  |
| 967  | 415 | 60 | 15  | 9  | 9  | 37 | 38 | 50  | 50  | 9525  | 7888  |
| 968  | 416 | 60 | 0   | 13 | 13 | 38 | 38 | 72  | 72  | 9635  | 7998  |
| 970  | 417 | 90 | 0   | 21 | 21 | 38 | 46 | 171 | 171 | 9844  | 8215  |
| 973  | 418 | 30 | 0   | 5  | 5  | 38 | 22 | 15  | 15  | 9897  | 8252  |
| 978  | 419 | 60 | -15 | 13 | 13 | 23 | 31 | 72  | 72  | 9992  | 8355  |
| 981  | 420 | 30 | 0   | 5  | 5  | 29 | 22 | 15  | 15  | 10036 | 8392  |
| 982  | 421 | 60 | -15 | 66 | 66 | 22 | 30 | 363 | 363 | 10421 | 8785  |
| 983  | 422 | 90 | 0   | 22 | 22 | 49 | 56 | 179 | 179 | 10649 | 9020  |
| 984  | 423 | 30 | 30  | 45 | 45 | 48 | 31 | 131 | 131 | 10828 | 9182  |
| 988  | 424 | 30 | 15  | 34 | 34 | 14 | 15 | 99  | 99  | 10941 | 9296  |
| 999  | 425 | 30 | -30 | 13 | 13 | 14 | 14 | 38  | 38  | 10993 | 9348  |
| 999  | 426 | 90 | 0   | 65 | 65 | 33 | 48 | 527 | 527 | 11553 | 9923  |
| 999  | 427 | 30 | 0   | 5  | 5  | 46 | 31 | 15  | 15  | 11614 | 9969  |
| 1004 | 428 | 90 | 0   | 22 | 22 | 33 | 49 | 179 | 179 | 11826 | 10197 |
| 1015 | 429 | 30 | 45  | 25 | 25 | 46 | 29 | 73  | 73  | 11945 | 10299 |
| 1016 | 430 | 30 | 30  | 13 | 13 | 13 | 14 | 38  | 38  | 11996 | 10351 |
| 1016 | 431 | 30 | -30 | 30 | 30 | 14 | 14 | 87  | 87  | 12097 | 10452 |
| 1016 | 432 | 90 | 0   | 33 | 33 | 33 | 48 | 268 | 268 | 12358 | 10768 |
| 1016 | 433 | 90 | 0   | 19 | 19 | 66 | 67 | 154 | 154 | 12618 | 10989 |
| 1021 | 434 | 90 | 0   | 9  | 9  | 67 | 67 | 73  | 73  | 12759 | 11129 |
| 1027 | 435 | 60 | 15  | 25 | 25 | 57 | 49 | 138 | 138 | 12953 | 11316 |
| 1031 | 436 | 90 | 0   | 5  | 5  | 50 | 58 | 41  | 41  | 13044 | 11415 |
| 1032 | 437 | 90 | 0   | 46 | 46 | 68 | 68 | 373 | 373 | 13485 | 11956 |
| 1033 | 438 | 90 | 0   | 9  | 9  | 68 | 68 | 73  | 73  | 13625 | 11997 |
| 1043 | 439 | 60 | -15 | 30 | 30 | 56 | 49 | 165 | 165 | 13847 | 12211 |
| 1045 | 440 | 60 | -15 | 17 | 17 | 38 | 37 | 94  | 94  | 13979 | 12342 |
| 1047 | 441 | 30 | -30 | 9  | 9  | 29 | 21 | 27  | 27  | 14035 | 12390 |
| 1042 | 442 | 30 | 30  | 5  | 5  | 14 | 14 | 15  | 15  | 14064 | 12419 |
| 1048 | 443 | 30 | -30 | 9  | 9  | 14 | 14 | 27  | 27  | 14105 | 12460 |
| 1058 | 444 | 30 | 0   | 9  | 9  | 14 | 14 | 27  | 27  | 14146 | 12501 |
| 1060 | 445 | 60 | -15 | 9  | 9  | 22 | 31 | 50  | 50  | 14218 | 12582 |
| 1061 | 446 | 60 | -15 | 13 | 13 | 38 | 38 | 72  | 72  | 14328 | 12692 |
| 1062 | 447 | 60 | 0   | 45 | 45 | 36 | 36 | 248 | 248 | 14612 | 12976 |

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|      |     |    |     |    |    |    |    |     |     |       |       |
|------|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 1063 | 448 | 30 | -30 | 9  | 9  | 29 | 21 | 27  | 27  | 14668 | 13024 |
| 1070 | 449 | 30 | -30 | 10 | 10 | 14 | 14 | 29  | 29  | 14711 | 13067 |
| 1077 | 450 | 60 | 0   | 25 | 25 | 23 | 31 | 138 | 138 | 14872 | 13236 |
| 1078 | 451 | 60 | -15 | 13 | 13 | 37 | 37 | 72  | 72  | 14981 | 13345 |
| 1079 | 452 | 30 | -15 | 50 | 50 | 29 | 20 | 145 | 145 | 15155 | 13510 |
| 1083 | 453 | 60 | -15 | 21 | 21 | 19 | 29 | 116 | 116 | 15290 | 13655 |
| 1085 | 454 | 30 | -15 | 13 | 13 | 27 | 18 | 39  | 39  | 15356 | 13712 |
| 1093 | 455 | 60 | 15  | 33 | 33 | 22 | 30 | 182 | 182 | 15560 | 13924 |
| 1094 | 456 | 90 | 0   | 34 | 34 | 49 | 56 | 276 | 276 | 15885 | 14256 |
| 1097 | 457 | 90 | 0   | 29 | 29 | 69 | 69 | 235 | 235 | 16189 | 14560 |
| 1097 | 458 | 60 | 15  | 21 | 21 | 56 | 48 | 116 | 116 | 16361 | 14724 |
| 1098 | 459 | 30 | 30  | 5  | 5  | 28 | 20 | 15  | 15  | 16404 | 14759 |
| 1099 | 460 | 60 | -15 | 45 | 45 | 19 | 29 | 248 | 248 | 16671 | 15036 |
| 1109 | 461 | 60 | 15  | 33 | 33 | 25 | 33 | 187 | 187 | 16893 | 15256 |
| 1110 | 462 | 60 | -15 | 50 | 50 | 38 | 39 | 275 | 275 | 17206 | 15570 |
| 1123 | 463 | 30 | 30  | 13 | 13 | 30 | 22 | 38  | 38  | 17274 | 15630 |
| 1125 | 464 | 60 | 0   | 21 | 21 | 23 | 30 | 116 | 116 | 17413 | 15776 |
| 1125 | 465 | 90 | 0   | 34 | 34 | 49 | 58 | 276 | 276 | 17738 | 16110 |
| 1126 | 466 | 60 | 0   | 10 | 10 | 56 | 47 | 55  | 55  | 17849 | 16212 |
| 1126 | 467 | 60 | -15 | 10 | 10 | 38 | 39 | 55  | 55  | 17942 | 16306 |
| 1139 | 468 | 30 | -45 | 13 | 13 | 31 | 23 | 38  | 38  | 18011 | 16367 |
| 1141 | 469 | 30 | -30 | 34 | 34 | 14 | 14 | 99  | 99  | 18124 | 16480 |
| 1141 | 470 | 60 | 0   | 21 | 21 | 22 | 29 | 116 | 116 | 18262 | 16625 |
| 1144 | 471 | 30 | -45 | 5  | 5  | 29 | 22 | 15  | 15  | 18306 | 16662 |
| 1157 | 472 | 30 | -30 | 13 | 13 | 14 | 14 | 38  | 38  | 18358 | 16714 |
| 1158 | 473 | 60 | -15 | 15 | 15 | 23 | 31 | 83  | 83  | 18464 | 16828 |
| 1160 | 474 | 60 | -15 | 36 | 36 | 36 | 36 | 198 | 198 | 18698 | 17062 |
| 1166 | 475 | 30 | 30  | 14 | 14 | 29 | 20 | 41  | 41  | 18768 | 17122 |
| 1167 | 476 | 30 | 0   | 6  | 6  | 14 | 15 | 18  | 18  | 18800 | 17156 |
| 1175 | 477 | 60 | 0   | 10 | 10 | 22 | 30 | 55  | 55  | 18877 | 17241 |
| 1176 | 478 | 30 | -30 | 10 | 10 | 29 | 25 | 29  | 29  | 18935 | 17295 |
| 1177 | 479 | 60 | -15 | 44 | 44 | 23 | 30 | 242 | 242 | 19200 | 17567 |
| 1182 | 480 | 30 | -15 | 5  | 5  | 29 | 22 | 15  | 15  | 19244 | 17604 |
| 1183 | 481 | 30 | 15  | 5  | 5  | 15 | 14 | 15  | 15  | 19274 | 17632 |
| 1184 | 482 | 30 | 15  | 8  | 8  | 14 | 13 | 24  | 24  | 19312 | 17670 |
| 1184 | 483 | 30 | -15 | 7  | 7  | 14 | 15 | 21  | 21  | 19347 | 17706 |
| 1192 | 484 | 30 | 15  | 22 | 22 | 14 | 14 | 64  | 64  | 19425 | 17784 |
| 1192 | 485 | 30 | -15 | 9  | 9  | 14 | 14 | 27  | 27  | 19466 | 17825 |
| 1193 | 486 | 60 | -15 | 62 | 62 | 21 | 30 | 341 | 341 | 19828 | 18196 |
| 1198 | 487 | 30 | -30 | 7  | 7  | 29 | 20 | 21  | 21  | 19878 | 18237 |
| 1200 | 488 | 30 | 30  | 8  | 8  | 14 | 13 | 24  | 24  | 19916 | 18274 |
| 1204 | 489 | 60 | 0   | 13 | 13 | 21 | 30 | 72  | 72  | 20009 | 18376 |
| 1206 | 490 | 60 | 0   | 10 | 10 | 37 | 38 | 55  | 55  | 20101 | 18469 |
| 1209 | 491 | 30 | -30 | 9  | 9  | 30 | 21 | 27  | 27  | 20158 | 18517 |
| 1216 | 492 | 30 | 0   | 5  | 5  | 14 | 14 | 15  | 15  | 20187 | 18546 |
| 1224 | 493 | 60 | -15 | 28 | 28 | 23 | 31 | 154 | 154 | 20364 | 18731 |
| 1225 | 494 | 60 | 15  | 13 | 13 | 37 | 36 | 72  | 72  | 20473 | 18839 |
| 1226 | 495 | 60 | 15  | 72 | 72 | 27 | 27 | 396 | 396 | 20506 | 19272 |
| 1240 | 496 | 60 | -15 | 50 | 50 | 37 | 37 | 275 | 275 | 21218 | 19584 |
| 1241 | 497 | 30 | 15  | 5  | 5  | 29 | 22 | 15  | 15  | 21262 | 19621 |

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|      |     |    |     |    |    |    |    |     |     |       |       |
|------|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 1241 | 498 | 60 | 0   | 15 | 15 | 22 | 29 | 83  | 83  | 21367 | 19732 |
| 1242 | 499 | 90 | 0   | 29 | 29 | 47 | 55 | 235 | 235 | 21649 | 20023 |
| 1256 | 500 | 60 | -30 | 14 | 14 | 56 | 49 | 77  | 77  | 21782 | 20149 |
| 1257 | 501 | 30 | 45  | 13 | 13 | 30 | 22 | 38  | 38  | 21850 | 20209 |
| 1257 | 502 | 30 | 0   | 5  | 5  | 15 | 15 | 15  | 15  | 21880 | 20239 |
| 1258 | 503 | 60 | -15 | 74 | 74 | 22 | 29 | 407 | 407 | 22309 | 20675 |
| 1258 | 504 | 60 | 0   | 47 | 47 | 37 | 37 | 259 | 259 | 22605 | 20971 |
| 1269 | 505 | 30 | 30  | 9  | 9  | 28 | 20 | 27  | 27  | 22660 | 21018 |
| 1272 | 506 | 60 | 15  | 9  | 9  | 21 | 30 | 50  | 50  | 22731 | 21098 |
| 1273 | 507 | 30 | -30 | 13 | 13 | 30 | 22 | 38  | 38  | 22799 | 21158 |
| 1274 | 508 | 60 | 0   | 42 | 42 | 23 | 30 | 231 | 231 | 23053 | 21419 |
| 1285 | 509 | 30 | -30 | 12 | 12 | 30 | 23 | 35  | 35  | 23118 | 21477 |
| 1287 | 510 | 60 | -15 | 14 | 14 | 23 | 31 | 77  | 77  | 23218 | 21585 |
| 1289 | 511 | 30 | 15  | 21 | 21 | 30 | 21 | 61  | 61  | 23309 | 21667 |
| 1290 | 512 | 30 | 45  | 17 | 17 | 14 | 14 | 50  | 50  | 23373 | 21731 |
| 1290 | 513 | 30 | 0   | 17 | 17 | 14 | 14 | 50  | 50  | 23437 | 21795 |
| 1302 | 514 | 60 | -15 | 46 | 46 | 22 | 32 | 253 | 253 | 23712 | 22080 |
| 1303 | 515 | 30 | 30  | 13 | 13 | 30 | 21 | 38  | 38  | 23780 | 22139 |
| 1306 | 516 | 60 | 15  | 37 | 37 | 20 | 27 | 204 | 204 | 24004 | 22370 |
| 1307 | 517 | 60 | 15  | 11 | 11 | 35 | 36 | 61  | 61  | 24100 | 22467 |
| 1307 | 518 | 60 | 15  | 9  | 9  | 37 | 37 | 50  | 50  | 24187 | 22554 |
| 1307 | 519 | 30 | -15 | 9  | 9  | 29 | 21 | 27  | 27  | 24243 | 22602 |
| 1308 | 520 | 60 | 15  | 25 | 25 | 22 | 29 | 138 | 138 | 24403 | 22769 |
| 1318 | 521 | 60 | 15  | 21 | 21 | 37 | 37 | 116 | 116 | 24556 | 22922 |
| 1319 | 522 | 30 | 30  | 5  | 5  | 29 | 22 | 15  | 15  | 24600 | 22959 |
| 1319 | 523 | 90 | 0   | 21 | 21 | 35 | 50 | 171 | 171 | 24806 | 23180 |
| 1321 | 524 | 60 | 0   | 29 | 29 | 54 | 47 | 160 | 160 | 25020 | 23387 |
| 1322 | 525 | 30 | 20  | 17 | 17 | 29 | 20 | 50  | 50  | 25099 | 23457 |
| 1323 | 526 | 60 | -15 | 18 | 18 | 21 | 31 | 99  | 99  | 25219 | 23587 |
| 1323 | 527 | 30 | -30 | 9  | 9  | 30 | 21 | 27  | 27  | 25276 | 23635 |
| 1323 | 528 | 90 | 0   | 38 | 38 | 34 | 50 | 308 | 308 | 25618 | 23993 |
| 1324 | 529 | 90 | 0   | 33 | 33 | 68 | 67 | 268 | 268 | 25954 | 24328 |
| 1337 | 530 | 60 | 15  | 22 | 22 | 54 | 46 | 121 | 121 | 26129 | 24495 |
| 1338 | 531 | 60 | 0   | 10 | 10 | 37 | 38 | 55  | 55  | 26221 | 21598 |
| 1339 | 532 | 30 | -30 | 5  | 5  | 29 | 21 | 15  | 15  | 26265 | 24624 |
| 1339 | 533 | 90 | 0   | 17 | 17 | 34 | 50 | 138 | 138 | 26437 | 24812 |
| 1339 | 534 | 30 | -15 | 10 | 10 | 48 | 22 | 29  | 29  | 26514 | 24873 |
| 1340 | 535 | 60 | 15  | 13 | 13 | 22 | 29 | 72  | 72  | 26608 | 24974 |
| 1340 | 536 | 30 | -15 | 7  | 7  | 27 | 20 | 21  | 21  | 26656 | 25015 |
| 1341 | 537 | 30 | -15 | 5  | 5  | 14 | 14 | 15  | 15  | 26685 | 25044 |
| 1342 | 538 | 90 | 0   | 5  | 5  | 34 | 49 | 41  | 41  | 26760 | 25134 |
| 1350 | 539 | 60 | 15  | 13 | 13 | 54 | 47 | 72  | 72  | 26886 | 25253 |
| 1351 | 540 | 30 | 15  | 13 | 13 | 29 | 21 | 38  | 38  | 26953 | 25312 |
| 1353 | 541 | 90 | 0   | 17 | 17 | 32 | 48 | 138 | 138 | 27123 | 25498 |
| 1355 | 542 | 60 | -15 | 70 | 70 | 54 | 47 | 385 | 385 | 27562 | 25930 |
| 1355 | 543 | 30 | 0   | 13 | 13 | 20 | 21 | 38  | 38  | 27630 | 25989 |
| 1356 | 544 | 60 | 15  | 9  | 9  | 21 | 28 | 50  | 50  | 27701 | 26067 |
| 1356 | 545 | 30 | 15  | 5  | 5  | 28 | 21 | 15  | 15  | 27744 | 26103 |
| 1368 | 546 | 30 | -30 | 5  | 5  | 13 | 14 | 15  | 15  | 27772 | 26132 |
| 1372 | 547 | 30 | -30 | 13 | 13 | 14 | 14 | 38  | 38  | 27824 | 26184 |

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|      |     |    |     |    |    |    |    |     |     |       |       |
|------|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 1385 | 548 | 60 | 0   | 31 | 0  | 22 | 0  | 171 | 0   | 28017 | 26184 |
| 1389 | 549 | 90 | 0   | 32 | 33 | 49 | 48 | 268 | 268 | 28334 | 26500 |
| 1392 | 550 | 30 | -15 | 5  | 5  | 45 | 30 | 15  | 15  | 28394 | 26545 |
| 1400 | 551 | 60 | -15 | 34 | 34 | 22 | 29 | 187 | 187 | 28603 | 26761 |
| 1404 | 552 | 30 | 30  | 9  | 9  | 30 | 22 | 26  | 26  | 28659 | 26809 |
| 1404 | 553 | 60 | 0   | 25 | 25 | 21 | 30 | 138 | 138 | 28818 | 26977 |
| 1404 | 554 | 90 | 0   | 43 | 43 | 48 | 55 | 349 | 349 | 29215 | 27381 |
| 1405 | 555 | 90 | 0   | 35 | 33 | 68 | 69 | 279 | 263 | 29562 | 27713 |

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MSN OP 555

A-SIDE FRAME 25 IS 3 FEET IN TU3, AND FRAME 01 IS 7 FEET  
IN TU4

B-SIDE FRAME 33 IS 4 FEET IN TU3, AND FRAME 34 IS 6 FEET  
IN TU4

~~Hx TOP SECRET~~

A. 1210-4

B. CAMERA OPERATIONS SUMMARY REV 1405, OP 555 THROUGH REV 1440, OP 789

| REV<br>NUM | MSN<br>OP<br>NUM | SAL | SC  | FRAMES |     | INTEROP<br>FEET |     | PHOTO-FT |     | CUM-TU-FEET |      |
|------------|------------------|-----|-----|--------|-----|-----------------|-----|----------|-----|-------------|------|
|            |                  |     |     | FWD    | AFT | FWD             | AFT | FWD      | AFT | FWD         | AFT  |
| 1405       | 555              | 90  | 0   | 2      | 4   | 0               | 0   | 15       | 31  | 15          | 31   |
| 1416       | 556              | 60  | 0   | 29     | 29  | 126             | 117 | 160      | 160 | 301         | 308  |
| 1419       | 557              | 30  | -30 | 10     | 10  | 29              | 22  | 29       | 29  | 359         | 359  |
| 1420       | 558              | 60  | 15  | 29     | 29  | 23              | 30  | 160      | 160 | 542         | 549  |
| 1420       | 559              | 60  | 15  | 14     | 14  | 36              | 26  | 77       | 77  | 655         | 662  |
| 1421       | 560              | 90  | 0   | 35     | 35  | 48              | 57  | 284      | 284 | 987         | 1003 |
| 1422       | 561              | 60  | -15 | 23     | 23  | 57              | 49  | 127      | 127 | 1171        | 1179 |
| 1431       | 562              | 60  | -30 | 13     | 13  | 38              | 39  | 72       | 72  | 1281        | 1290 |
| 1432       | 563              | 60  | 15  | 22     | 22  | 37              | 35  | 121      | 121 | 1439        | 1446 |
| 1436       | 564              | 30  | 30  | 4      | 4   | 29              | 21  | 12       | 12  | 1480        | 1479 |
| 1436       | 565              | 30  | 0   | 5      | 5   | 14              | 14  | 15       | 15  | 1509        | 1508 |
| 1449       | 566              | 90  | 0   | 26     | 26  | 34              | 51  | 211      | 211 | 1754        | 1770 |
| 1451       | 567              | 30  | 15  | 13     | 13  | 49              | 33  | 38       | 38  | 1841        | 1841 |
| 1452       | 568              | 60  | 15  | 10     | 10  | 24              | 31  | 55       | 55  | 1920        | 1927 |
| 1452       | 569              | 60  | -30 | 14     | 14  | 36              | 37  | 77       | 77  | 2033        | 2041 |
| 1452       | 570              | 90  | 0   | 11     | 11  | 49              | 55  | 90       | 90  | 2172        | 2186 |
| 1453       | 571              | 60  | -15 | 23     | 23  | 51              | 44  | 127      | 127 | 2350        | 2357 |
| 1457       | 572              | 30  | 30  | 28     | 28  | 29              | 19  | 82       | 82  | 2460        | 2458 |
| 1464       | 573              | 30  | 0   | 4      | 4   | 13              | 14  | 12       | 12  | 2485        | 2484 |
| 1465       | 574              | 30  | -30 | 23     | 23  | 15              | 15  | 67       | 67  | 2567        | 2566 |
| 1465       | 575              | 30  | -30 | 9      | 9   | 14              | 14  | 27       | 27  | 2608        | 2607 |
| 1465       | 576              | 90  | 0   | 27     | 27  | 22              | 47  | 219      | 219 | 2859        | 2873 |
| 1468       | 577              | 60  | 15  | 22     | 22  | 55              | 46  | 121      | 121 | 3035        | 3040 |
| 1468       | 578              | 30  | -15 | 16     | 16  | 28              | 21  | 47       | 47  | 3110        | 3108 |
| 1468       | 579              | 30  | -30 | 16     | 16  | 14              | 14  | 47       | 47  | 3171        | 3169 |
| 1469       | 580              | 60  | -15 | 13     | 13  | 22              | 30  | 72       | 72  | 3265        | 3271 |
| 1469       | 581              | 60  | -15 | 29     | 29  | 36              | 36  | 160      | 160 | 3461        | 3467 |
| 1469       | 582              | 60  | -15 | 9      | 9   | 37              | 37  | 50       | 50  | 3548        | 3554 |
| 1469       | 583              | 30  | -15 | 7      | 7   | 30              | 22  | 21       | 21  | 3599        | 3597 |
| 1476       | 584              | 90  | 0   | 5      | 5   | 35              | 50  | 41       | 41  | 3675        | 3688 |
| 1480       | 585              | 60  | -30 | 41     | 0   | 54              | 0   | 326      | 0   | 3955        | 3688 |
| 1480       | 586              | 30  | 30  | 28     | 28  | 29              | 32  | 82       | 82  | 4066        | 3802 |
| 1481       | 587              | 90  | 0   | 62     | 62  | 35              | 51  | 503      | 503 | 4604        | 4356 |
| 1482       | 588              | 60  | 15  | 4      | 4   | 57              | 48  | 22       | 22  | 4683        | 4426 |
| 1484       | 589              | 30  | 30  | 13     | 13  | 29              | 22  | 38       | 38  | 4750        | 4486 |
| 1484       | 590              | 60  | 15  | 11     | 11  | 23              | 30  | 61       | 61  | 4834        | 4577 |
| 1485       | 591              | 90  | 0   | 10     | 10  | 40              | 58  | 81       | 81  | 4964        | 4716 |
| 1496       | 592              | 90  | 0   | 10     | 10  | 48              | 31  | 29       | 29  | 5041        | 4776 |
| 1498       | 593              | 90  | 0   | 22     | 22  | 35              | 52  | 179      | 179 | 5255        | 5007 |
| 1499       | 594              | 60  | 15  | 7      | 7   | 57              | 48  | 39       | 39  | 5351        | 5094 |
| 1513       | 595              | 90  | 0   | 26     | 26  | 49              | 59  | 227      | 227 | 5627        | 5380 |
| 1514       | 596              | 90  | 0   | 38     | 38  | 70              | 69  | 308      | 308 | 6005        | 5757 |

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|------|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 1516 | 597 | 30 | -30 | 10 | 10 | 48 | 32 | 29  | 29  | 6082  | 5818  |
| 1516 | 598 | 60 | 15  | 15 | 15 | 23 | 30 | 83  | 83  | 6188  | 5931  |
| 1517 | 599 | 30 | 15  | 16 | 16 | 30 | 23 | 47  | 47  | 6265  | 6001  |
| 1518 | 600 | 30 | 30  | 7  | 7  | 14 | 13 | 21  | 21  | 6300  | 6035  |
| 1518 | 601 | 30 | 0   | 5  | 5  | 14 | 15 | 15  | 15  | 6329  | 6065  |
| 1518 | 602 | 60 | 15  | 14 | 14 | 23 | 30 | 77  | 77  | 6429  | 6172  |
| 1518 | 603 | 60 | -15 | 57 | 57 | 37 | 38 | 314 | 314 | 6780  | 6524  |
| 1518 | 604 | 60 | 0   | 7  | 7  | 37 | 37 | 39  | 39  | 6856  | 6600  |
| 1518 | 605 | 30 | -30 | 4  | 4  | 28 | 20 | 12  | 12  | 6896  | 6632  |
| 1521 | 606 | 30 | 30  | 68 | 68 | 13 | 12 | 56  | 56  | 6965  | 6700  |
| 1529 | 607 | 30 | -30 | 41 | 41 | 13 | 14 | 119 | 119 | 7097  | 6833  |
| 1530 | 608 | 30 | 15  | 5  | 5  | 14 | 13 | 15  | 15  | 7126  | 6861  |
| 1530 | 609 | 90 | 0   | 56 | 56 | 35 | 51 | 454 | 454 | 7615  | 7366  |
| 1531 | 610 | 30 | 15  | 29 | 29 | 46 | 31 | 85  | 85  | 7746  | 7482  |
| 1532 | 611 | 60 | 0   | 13 | 13 | 22 | 30 | 72  | 72  | 7840  | 7584  |
| 1532 | 612 | 60 | 0   | 16 | 16 | 38 | 37 | 88  | 88  | 7966  | 7709  |
| 1537 | 613 | 30 | 0   | 22 | 22 | 28 | 21 | 64  | 64  | 8058  | 7794  |
| 1546 | 614 | 30 | -45 | 4  | 4  | 14 | 14 | 12  | 12  | 8084  | 7820  |
| 1546 | 615 | 30 | 30  | 4  | 4  | 14 | 14 | 12  | 12  | 8110  | 7846  |
| 1546 | 616 | 30 | -30 | 5  | 5  | 15 | 15 | 15  | 15  | 8140  | 7876  |
| 1546 | 617 | 60 | -15 | 19 | 19 | 23 | 31 | 105 | 105 | 8268  | 8012  |
| 1548 | 618 | 60 | -15 | 10 | 10 | 37 | 37 | 55  | 55  | 8260  | 8104  |
| 1550 | 619 | 30 | -15 | 11 | 11 | 30 | 22 | 32  | 32  | 8422  | 8158  |
| 1550 | 620 | 30 | -30 | 12 | 12 | 15 | 15 | 35  | 35  | 8472  | 8208  |
| 1550 | 621 | 60 | 15  | 22 | 22 | 23 | 31 | 121 | 121 | 8616  | 8360  |
| 1550 | 622 | 60 | 15  | 16 | 16 | 37 | 37 | 88  | 88  | 8741  | 8485  |
| 1551 | 623 | 30 | 30  | 4  | 4  | 29 | 21 | 12  | 12  | 8782  | 8518  |
| 1551 | 624 | 90 | 0   | 13 | 13 | 33 | 49 | 106 | 106 | 8921  | 8673  |
| 1561 | 625 | 30 | 0   | 22 | 22 | 46 | 30 | 64  | 64  | 9031  | 8767  |
| 1562 | 626 | 90 | 0   | 41 | 41 | 35 | 51 | 333 | 333 | 9299  | 9151  |
| 1564 | 627 | 60 | 15  | 19 | 19 | 58 | 49 | 105 | 105 | 9562  | 9305  |
| 1564 | 628 | 30 | -30 | 30 | 30 | 30 | 23 | 87  | 87  | 9679  | 9415  |
| 1564 | 629 | 30 | 0   | 4  | 4  | 15 | 14 | 12  | 12  | 9706  | 9441  |
| 1565 | 630 | 30 | -30 | 11 | 11 | 14 | 15 | 32  | 32  | 9752  | 9488  |
| 1566 | 631 | 30 | -30 | 10 | 10 | 15 | 15 | 29  | 29  | 9796  | 9532  |
| 1566 | 632 | 30 | -45 | 39 | 39 | 15 | 15 | 112 | 112 | 9924  | 9660  |
| 1566 | 633 | 30 | 30  | 14 | 14 | 14 | 14 | 41  | 41  | 9979  | 9715  |
| 1566 | 634 | 30 | 30  | 9  | 9  | 14 | 13 | 27  | 27  | 10020 | 9755  |
| 1566 | 635 | 30 | 0   | 4  | 4  | 14 | 15 | 12  | 12  | 10046 | 9782  |
| 1578 | 636 | 60 | -15 | 62 | 62 | 23 | 30 | 341 | 341 | 10410 | 10153 |
| 1579 | 637 | 30 | -15 | 25 | 25 | 30 | 23 | 73  | 73  | 10513 | 10249 |
| 1580 | 638 | 30 | -30 | 7  | 7  | 14 | 14 | 21  | 21  | 10548 | 10284 |
| 1580 | 639 | 90 | 0   | 25 | 0  | 35 | 0  | 203 | 0   | 10786 | 10284 |
| 1581 | 640 | 60 | 15  | 22 | 22 | 54 | 29 | 121 | 121 | 10961 | 10434 |
| 1582 | 641 | 60 | 30  | 43 | 43 | 37 | 37 | 237 | 237 | 11235 | 10708 |
| 1582 | 642 | 30 | -30 | 12 | 12 | 28 | 21 | 35  | 35  | 11298 | 10764 |
| 1582 | 643 | 30 | -30 | 12 | 12 | 15 | 15 | 35  | 35  | 11348 | 10814 |
| 1582 | 644 | 60 | 15  | 34 | 34 | 23 | 30 | 187 | 187 | 11558 | 11031 |
| 1583 | 645 | 30 | 45  | 16 | 16 | 29 | 21 | 47  | 47  | 11634 | 11099 |
| 1583 | 646 | 60 | -15 | 7  | 7  | 22 | 31 | 39  | 39  | 11695 | 11169 |

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|------|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 1583 | 647 | 30 | -45 | 4  | 4  | 29 | 22 | 12  | 12  | 11736 | 11203 |
| 1583 | 648 | 30 | 0   | 4  | 4  | 14 | 13 | 12  | 12  | 11762 | 11228 |
| 1589 | 649 | 30 | -30 | 5  | 5  | 14 | 14 | 15  | 15  | 11791 | 11257 |
| 1595 | 650 | 90 | 0   | 31 | 31 | 35 | 50 | 252 | 252 | 12078 | 11559 |
| 1595 | 651 | 90 | 0   | 39 | 39 | 67 | 68 | 316 | 316 | 12461 | 11943 |
| 1598 | 652 | 90 | 0   | 10 | 10 | 70 | 69 | 81  | 81  | 12612 | 12093 |
| 1599 | 653 | 30 | 30  | 7  | 7  | 48 | 33 | 21  | 21  | 12681 | 12147 |
| 1599 | 654 | 60 | 15  | 16 | 16 | 22 | 29 | 88  | 88  | 12791 | 12264 |
| 1603 | 655 | 60 | 15  | 13 | 13 | 33 | 33 | 72  | 72  | 12896 | 12369 |
| 1611 | 656 | 90 | 0   | 62 | 62 | 47 | 56 | 503 | 503 | 13446 | 12928 |
| 1611 | 657 | 60 | -15 | 38 | 38 | 58 | 50 | 209 | 209 | 13713 | 13187 |
| 1612 | 658 | 60 | 0   | 13 | 13 | 37 | 37 | 72  | 72  | 13822 | 13296 |
| 1612 | 659 | 60 | 15  | 19 | 19 | 27 | 27 | 105 | 105 | 13964 | 13438 |
| 1612 | 660 | 30 | 30  | 7  | 7  | 30 | 31 | 21  | 21  | 14015 | 13490 |
| 1613 | 661 | 60 | 15  | 10 | 10 | 23 | 31 | 55  | 55  | 14093 | 13576 |
| 1614 | 662 | 60 | 30  | 8  | 8  | 28 | 29 | 44  | 44  | 14175 | 13658 |
| 1614 | 663 | 60 | 0   | 7  | 7  | 27 | 37 | 39  | 39  | 14251 | 13734 |
| 1614 | 664 | 30 | -30 | 47 | 47 | 23 | 21 | 137 | 137 | 14416 | 13892 |
| 1615 | 665 | 30 | 0   | 7  | 7  | 14 | 14 | 21  | 21  | 14451 | 13927 |
| 1615 | 666 | 60 | -15 | 12 | 12 | 23 | 31 | 66  | 66  | 14540 | 14024 |
| 1615 | 667 | 90 | 0   | 24 | 24 | 50 | 59 | 195 | 195 | 14785 | 14278 |
| 1619 | 668 | 60 | 15  | 10 | 10 | 51 | 41 | 55  | 55  | 14891 | 14374 |
| 1622 | 669 | 30 | 15  | 6  | 6  | 26 | 19 | 18  | 18  | 14935 | 14411 |
| 1630 | 670 | 90 | 0   | 38 | 38 | 32 | 47 | 308 | 308 | 15275 | 14766 |
| 1630 | 671 | 30 | 30  | 10 | 10 | 46 | 31 | 29  | 29  | 15350 | 14828 |
| 1630 | 672 | 60 | 15  | 10 | 10 | 23 | 31 | 55  | 55  | 15428 | 14912 |
| 1630 | 673 | 30 | 30  | 10 | 10 | 29 | 21 | 29  | 29  | 15486 | 14962 |
| 1631 | 674 | 30 | 0   | 4  | 4  | 15 | 15 | 12  | 12  | 15513 | 14989 |
| 1631 | 675 | 30 | -15 | 10 | 10 | 14 | 14 | 29  | 29  | 15556 | 15032 |
| 1632 | 676 | 30 | 30  | 10 | 10 | 15 | 15 | 29  | 29  | 15600 | 15076 |
| 1632 | 677 | 90 | 0   | 80 | 80 | 32 | 48 | 648 | 648 | 16280 | 15772 |
| 1632 | 678 | 60 | 15  | 27 | 27 | 55 | 46 | 149 | 149 | 16484 | 15967 |
| 1637 | 679 | 30 | 15  | 6  | 6  | 20 | 23 | 18  | 18  | 16532 | 16008 |
| 1642 | 680 | 60 | 0   | 19 | 0  | 21 | 0  | 105 | 0   | 16658 | 16008 |
| 1642 | 681 | 30 | 30  | 11 | 11 | 27 | 14 | 32  | 32  | 16717 | 16054 |
| 1642 | 682 | 60 | -15 | 21 | 21 | 22 | 30 | 116 | 116 | 16855 | 16200 |
| 1645 | 683 | 30 | 0   | 4  | 4  | 29 | 22 | 12  | 12  | 16896 | 16234 |
| 1645 | 684 | 30 | -15 | 4  | 4  | 15 | 31 | 12  | 12  | 16923 | 16277 |
| 1647 | 685 | 30 | -30 | 7  | 7  | 15 | 15 | 21  | 21  | 16959 | 16313 |
| 1647 | 686 | 60 | 15  | 10 | 10 | 21 | 29 | 55  | 55  | 17035 | 16397 |
| 1647 | 687 | 60 | 0   | 29 | 29 | 36 | 36 | 160 | 160 | 17231 | 16593 |
| 1648 | 688 | 30 | 0   | 10 | 10 | 29 | 20 | 29  | 29  | 17239 | 16642 |
| 1648 | 689 | 90 | 0   | 22 | 22 | 32 | 48 | 179 | 179 | 17500 | 16869 |
| 1648 | 690 | 90 | 0   | 60 | 60 | 65 | 65 | 486 | 486 | 18051 | 17420 |
| 1651 | 691 | 30 | -15 | 22 | 22 | 55 | 40 | 64  | 64  | 18170 | 17524 |
| 1651 | 692 | 30 | 0   | 18 | 18 | 12 | 12 | 53  | 53  | 18235 | 17589 |
| 1654 | 693 | 30 | 45  | 7  | 7  | 14 | 13 | 21  | 21  | 18270 | 17623 |
| 1658 | 694 | 30 | -30 | 12 | 12 | 14 | 15 | 35  | 35  | 18319 | 17673 |
| 1660 | 695 | 90 | 0   | 50 | 50 | 35 | 51 | 405 | 405 | 18759 | 18129 |
| 1664 | 696 | 60 | 0   | 12 | 12 | 56 | 48 | 66  | 66  | 18881 | 18234 |

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|---------------|-----|----|-----|----|----|----|----|-----|-----|-------|-------|
| 1792          | 747 | 30 | -45 | 7  | 7  | 28 | 22 | 21  | 21  | 23606 | 22771 |
| 1793          | 748 | 60 | 15  | 10 | 10 | 23 | 29 | 55  | 55  | 23684 | 22855 |
| 1793          | 749 | 30 | 0   | 16 | 16 | 29 | 22 | 47  | 47  | 23760 | 22924 |
| 1795          | 750 | 30 | -30 | 20 | 20 | 13 | 14 | 58  | 58  | 23831 | 22996 |
| 1795          | 751 | 30 | 30  | 4  | 4  | 15 | 14 | 12  | 12  | 23858 | 23022 |
| 1800          | 752 | 30 | -30 | 5  | 5  | 15 | 16 | 15  | 15  | 23888 | 23053 |
| 1805          | 753 | 30 | 30  | 9  | 9  | 15 | 14 | 27  | 27  | 23930 | 23094 |
| 1806          | 754 | 30 | -15 | 10 | 10 | 14 | 14 | 29  | 29  | 23973 | 23137 |
| 1806          | 755 | 60 | 15  | 56 | 56 | 23 | 31 | 308 | 308 | 24204 | 23476 |
| 1809          | 756 | 30 | 30  | 4  | 4  | 30 | 21 | 12  | 12  | 24346 | 23509 |
| 1810          | 757 | 30 | -45 | 7  | 7  | 14 | 15 | 21  | 21  | 24381 | 23545 |
| 1810          | 758 | 30 | -45 | 4  | 4  | 14 | 15 | 12  | 12  | 24407 | 23572 |
| 1810          | 759 | 30 | -30 | 7  | 7  | 14 | 13 | 21  | 21  | 24442 | 23606 |
| 1816          | 760 | 30 | -15 | 5  | 5  | 14 | 15 | 15  | 15  | 24471 | 23636 |
| 1822          | 761 | 30 | 15  | 4  | 4  | 15 | 14 | 12  | 12  | 24498 | 23662 |
| 1822          | 762 | 30 | -30 | 22 | 22 | 14 | 15 | 64  | 64  | 24576 | 23741 |
| 1824          | 763 | 30 | -30 | 4  | 4  | 14 | 14 | 12  | 12  | 24602 | 23767 |
| 1824          | 764 | 60 | -15 | 21 | 21 | 22 | 30 | 116 | 116 | 24740 | 23913 |
| 1825          | 765 | 30 | -30 | 13 | 12 | 30 | 20 | 38  | 38  | 24808 | 23971 |
| 1826          | 766 | 30 | 0   | 7  | 7  | 14 | 15 | 21  | 21  | 24843 | 24007 |
| 1832          | 767 | 60 | -15 | 17 | 17 | 22 | 30 | 94  | 94  | 24959 | 24131 |
| 1839          | 768 | 60 | 0   | 16 | 16 | 37 | 36 | 88  | 88  | 25034 | 24255 |
| 1840          | 769 | 60 | 0   | 37 | 0  | 37 | 0  | 204 | 0   | 25325 | 24255 |
| 1842          | 770 | 30 | -30 | 19 | 19 | 29 | 22 | 56  | 56  | 25410 | 24333 |
| 1842          | 771 | 90 | 0   | 35 | 35 | 34 | 50 | 284 | 284 | 25728 | 24667 |
| 1844          | 772 | 30 | -30 | 22 | 22 | 47 | 21 | 64  | 64  | 25839 | 24762 |
| 1849          | 773 | 30 | -30 | 22 | 22 | 14 | 14 | 64  | 64  | 25917 | 24840 |
| 1849          | 774 | 30 | 0   | 8  | 8  | 15 | 14 | 24  | 24  | 25956 | 24878 |
| 1855          | 775 | 60 | 0   | 16 | 16 | 21 | 30 | 88  | 88  | 26065 | 24996 |
| 1858          | 776 | 30 | -15 | 7  | 7  | 29 | 21 | 21  | 21  | 26115 | 25038 |
| 1858          | 777 | 30 | -30 | 7  | 7  | 14 | 14 | 21  | 21  | 26150 | 25073 |
| 1860          | 778 | 30 | -30 | 7  | 7  | 14 | 14 | 21  | 21  | 26185 | 25108 |
| 1863          | 779 | 30 | 0   | 8  | 8  | 14 | 14 | 24  | 24  | 26223 | 25146 |
| 1871          | 780 | 30 | 30  | 20 | 20 | 14 | 14 | 58  | 58  | 26295 | 25218 |
| 1874          | 781 | 60 | 15  | 7  | 7  | 22 | 29 | 39  | 39  | 26356 | 25286 |
| 1874          | 782 | 60 | -15 | 12 | 13 | 34 | 35 | 72  | 72  | 26462 | 25393 |
| 1875          | 783 | 30 | 15  | 19 | 19 | 27 | 19 | 56  | 56  | 26545 | 25468 |
| 1875          | 784 | 30 | -30 | 7  | 7  | 14 | 14 | 21  | 21  | 26580 | 25503 |
| 1876          | 785 | 30 | 15  | 19 | 19 | 14 | 14 | 56  | 56  | 26650 | 25573 |
| 1876          | 786 | 30 | 0   | 6  | 6  | 14 | 14 | 18  | 18  | 26682 | 25605 |
| 1876          | 787 | 30 | -15 | 21 | 21 | 14 | 14 | 61  | 61  | 26757 | 25680 |
| 1897          | 788 | 30 | -30 | 13 | 13 | 14 | 14 | 38  | 38  | 26809 | 25732 |
| 1940          | 789 | 60 | 0   | 62 | 60 | 22 | 30 | 347 | 320 | 27178 | 26092 |
| END OF SUPPLY |     |    |     |    |    | 67 | 67 |     |     | 27245 | 26159 |

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