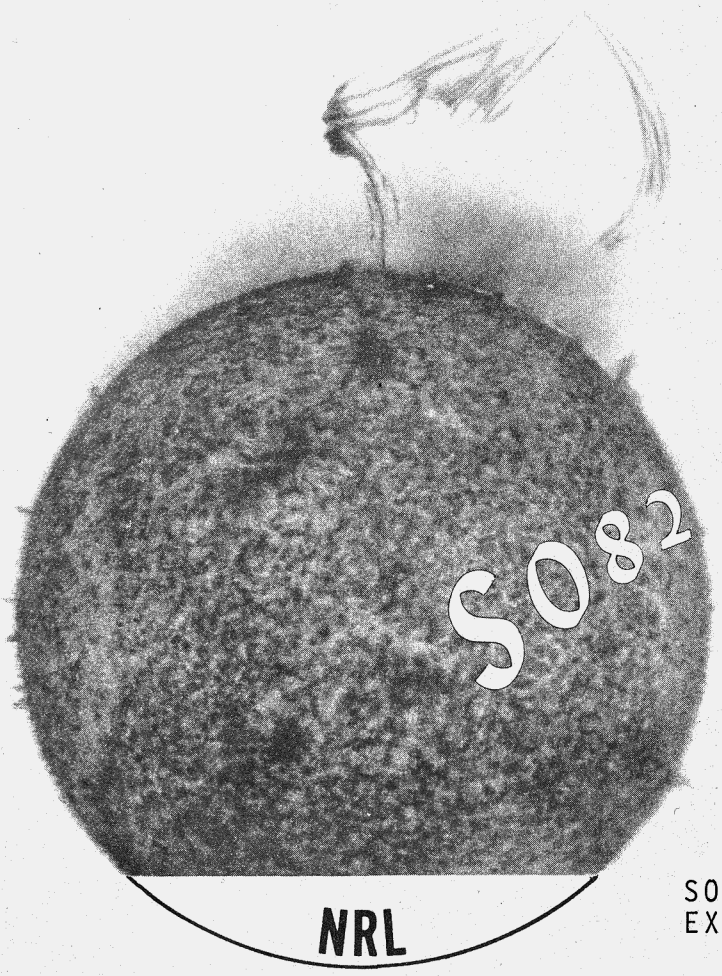
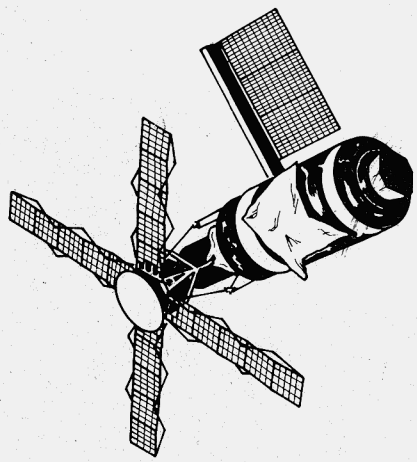
"A" Data Room

NRL / ATM
MISSION ENGINEERING DATA





S082A SPECTROHELIOGRAPH
EXPOSURES 1A-001 THROUGH 1A-019

PREPARED FOR
UNITED STATES NAVAL RESEARCH LABORATORY
WASHINGTON, D.C.

BALL BROTHERS RESEARCH CORPORATION
SUBSIDIARY OF BALL CORPORATION
BOULDER, COLORADO

A HUGE ERUPTION FROM THE SURFACE OF THE SUN SEEN IN THE LIGHT OF HE II AT 304Å
9 AUGUST 1973

This photograph, obtained during the Skylab 3 Mission, reveals for the first time that helium erupting from the sun can stay together to altitudes up to 500,000 miles. After being ejected from the sun, the gas clouds seem to have come to a standstill, as though blocked by an unseen wall, and some material appears to have been directed back toward the sun as rain, distinguished by fine threads. At present it is a challenge to explain this mystery — what forces expelled these huge clouds, then blocked its further progress, yet allowed the cloud to maintain its threads. Both magnetic fields and gravity must play a part, but these curious forms seem to defy explanation based on magnetic and gravitational fields alone.

The instrument which produced this image was an extreme ultraviolet spectroheliograph, designed and constructed by the Naval Research Laboratory and the Ball Brothers Research Corporation under the direction of Dr. R. Tousey, the Principal Investigator for this NASA experiment. To the left may be seen the sun's image in emission from iron atoms which have lost 14 electrons by collision in the suns' million-degree coronal plasma gas.

Camera No A1 SL 1/2

Log Sequence

ATM No.	Film Roll Strip Cut	Dev Run	ATM No.	Film Roll Strip Cut	Dev Run	ATM No	Film Roll Strip Cut	Dev Run	ATM No.	Film Roll Strip Cut	Dev Run
1A001	19-17	1									
1A002	19-16	↑									
1A003	19-14										
1A004	19-13										
1A005	19-12										
1A006	19-11										
1A007	19-10										
1A008	19-9										
1A009	19-8										
1A010	19-7										
1A011	19-6										
1A012	19-5										
1A013	20-91										
1A014	20-90										
1A015	20-89										
1A016	20-88										
1A017	20-87										
1A018	20-86	↓									
1A019	20-85	1									
1A020	19-18	2									
1A021	18-20	2									

Film Data	
Roll No.	Film Type
18	104-06-05
19	104-06-05
20	104-06-05

BALL BROTHERS RESEARCH CORPORATION

BOULDER, COLORADO

NRL/ATM
MISSION ENGINEERING DATA
FOR
S082A SPECTROHELIOGRAPH
EXPOSURES 1A-001 THROUGH 1A-019

620-239 22 May 1974
Rev A 15 May 1975

Contract No. N00014-67-C-0470
Exhibit C-1 Phase III CDRL
Sequence No. 16

PREPARED

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Project Engineer
Configuration Management

APPROVED

M. W. Frank
NRL/ATM Program Manager

FORM BR-72

FOREWORD

The purpose of this document is to provide the camera photographic log, the JSC science console data, and the MSFC engineering data for S082A Film Camera, S/N CM10A-003 (exposure numbers 1A-001 through 1A-019). The requirements for the Mission Engineering Data (MED) and the Camera Photographic Log (CPL) are combined in this document. This document was prepared by Ball Brothers Research Corporation, Boulder, Colorado, under Contract N00014-67-C-0470 with the Naval Research Laboratory, Washington, DC. The authority for the MED is BBRC Proposal C-474 which was added by Contract Modification P00055. The authority for the CPL is BBRC NRL/ATM Engineering Change Proposal PPD-054 Rev 1 which was added by Contract Modification P00064.

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INTRODUCTION

1.0 INTRODUCTION

This document contains a history of each flight film frame from its receipt by BBRC from NRL through the time of its development. This includes camera identification and mission use, ground and orbit environment, loading and unloading data, filter data if applicable and the camera life history. Also included are engineering and scientific parameters related to each frame during exposure on the Skylab Mission. This exposure data is provided in the form of Engineering Data Books (EDB's) obtained from MSFC and JSC and edited by BBRC, and a Diode Array Data Log provided by NRL.

The Camera Flight Load Number, Camera Serial Number and the Exposure Numbers relative to each Skylab Mission are given in the following tables (Tables 1 and 2). Noted are the BBRC 620 Documents that should be consulted for the respective exposures. Each document is confined to a block of exposures obtained by a specific camera during the various Skylab Missions.

Table 1-1

S082A Camera Related Data

Skylab Mission	Flight Load No.	Camera Serial No.	Exposure Numbers	Referenced 620 Documents
SL-1 & 2	A-1 A-2	CM10A-003 CM10A-007	1A-001→1A-019 1A-201→1A-402	620-239 620-240
SL-3	A-2* A-3	CM10A-005 CM10A-006	2A-001→2A-201 2A-301→2A-501	620-241 620-242
SL-4	A-4 A-5	CM10A-006 HRE CM10A-005 HRE	3A-001→3A-201 3A-301→3A-500	620-243 620-244

*Replacement load for original A-2 load used during SL-1 & 2 instead of during SL-3 due to a malfunction of A003 camera.

HRE designates reflight (i.e., flown on a previous mission).

Table 1-2
S082B Camera Related Data

Skylab Mission	Flight Load No.	Camera Serial No.	Exposure Numbers	Referenced 620 Documents
SL-1 & 2	B-1	CM11A-003	1B-001-1→1B-201-8	620-245
SL-3	B-2 B-3	CM11A-005 CM11A-004	2B-001-1→2B-201-4 2B-301-1→2B-500-1	620-246 620-247
SL-4	B-4	CM11A-003 HRE	3B-001-1→3B-201-8	260-248

HRE designates reflight (i.e., flown on a previous mission).

Thermal Distortion data for the instruments relative to each Skylab Mission may be obtained from BBRC Document No. 620-238, entitled NRL/ATM Thermal Distortion Performance for S082A and S082B Instruments. Distortion data relative to a particular exposure may be time correlated to the information in the noted document. The document is published in five (5) volumes.

Volume I	Thermal Distortion Program Description
Volume II	S082A Thermal Distortion Plots SL-3 & SL-4
Volume III	S082B Thermal Distortion Plots SL-3
Volume IV	S082B Thermal Distortion Plots SL-4 DOY 332 through DOY 362
Volume V	S082B Thermal Distortion Plots SL-4 DOY 363 through DOY 383 (18 of 1974)

Additional sorting of the JSC EDB data by Joint Observing Program (JOP), target, etc. has been accomplished and is published in BBRC Document No. 620-249, entitled NRL/ATM S082 Exposure Catalog.

CAMERA AND FILM HISTORY

2.0 CAMERA AND FILM HISTORY

This section contains a compilation of data that traces the history of each exposed flight film frame beginning with camera identification and mission application. The period covered is from cold storage at BBRC, just prior to the film cutting for installation in the camera, to the time of its development at NRL. Film temperature and radiation environmental data is provided. Included are loading and unloading data providing traceability of each exposure number to a specific film roll and type, and to each control sample, film holder and exposure sequence. Preflight and post-flight aluminum filter data for the S082A cameras are included. Also included is an extraction, from BBRC Document No. 620-132, entitled Film Camera History, for each respective camera.

2.1 CAMERA IDENTIFICATION AND MISSION USE

Camera:	P/N 36360-501; S/N CM10A-003
Flight:	L/N A-1
No. of Film Holders:	Upper 100; Lower 101; Carrier 1
Skylab Mission:	SL-1 & 2
Launch Date:	14 May 1973
Installed on Instrument:	2 April 1973
Removed from Instrument:	7 June 1973
Splashdown:	22 June 1973

Significant Remarks:

The A003 camera jammed during the SL-1 & 2 Mission. Only 19 exposures were taken. Reference BBRC Failure Report No. 2630. The camera was unloaded 27 June 1973. Camera was launched on SL-1, exposed on SL-2 and returned on SL-2.

2.2 ENVIRONMENTAL DATA

The Environmental Data Section includes a graph of temperature vs day-of-year from loading to unloading of the cameras, and cumulative radiation vs day-of-year for the mission period. These graphs provide a quick look at the environmental parameters to which the film was subjected (See Fig. 2-1). The source for the in-flight data is from the environmental log book maintained at the NRL Science Console.

2.3 LOADING DATA

The film camera was loaded at BBRC just prior to shipment to KSC. Film strips were cut from a roll of bulk film which was 70mm wide and approximately 120 feet long. The film strips were cut to 35 x 248mm. These strips were placed into film holders, loaded into the camera, vacuum dried, and cooled to 40°F. The attached chart (See Table 2-1) shows the relationship between each strip of film as it was cut from the bulk roll of film to control sample number or exposure number and the holder number in the order in which it was loaded. The two columns entitled "Roll #" lists the film roll number and strip number as it was cut from the roll. The column entitled "Control Sample #" numerically lists each control sample. The column entitled "Exposure #" is the number assigned by NRL to each individual exposure. The column entitled "Film Holder #" shows the film holder number at the time of loading. This chart provides a cross reference for roll, strip, exposure and holder. It also provides a cross reference between roll and strip number to control sample.

There were four (4) control samples taken at the beginning of each roll, one taken at intervals of approximately ten (10) film

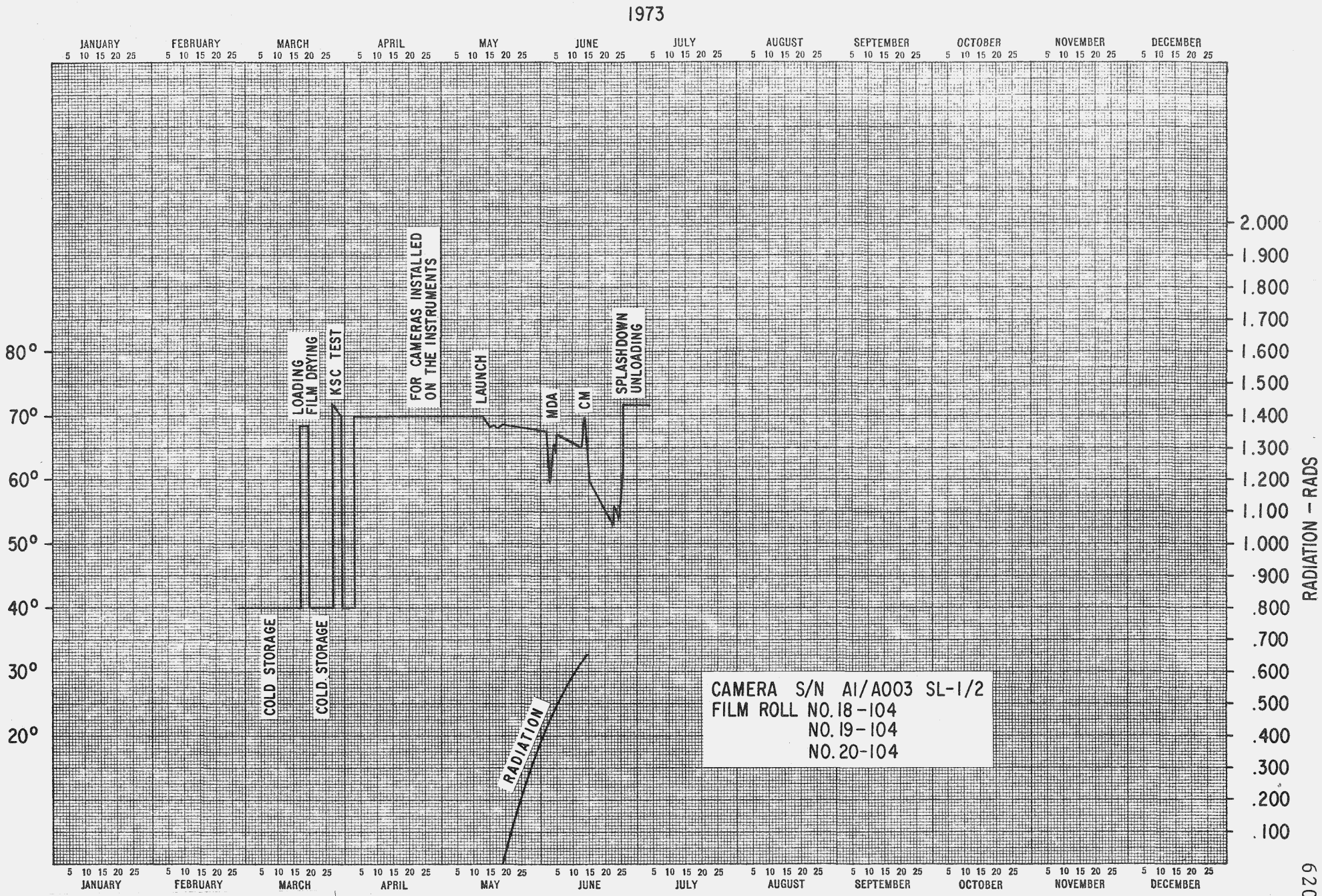


Figure 2-1. Environmental Parameters

620-239

Table 2-1

FILM TRACEABILITY CHART

DATE 3-19-74 CAMERA P/N 36360-501 S/N A1/A003

ROLL NO	CONTROL SAMPLE NO.	EXPOSURE NO.	FILM HOLDER NO.
19-1	14		
19-2	15		
19-3	16		
19-4	17		
19-5		1A012	81
19-6		1A011	82
19-7		1A010	83
19-8		1A009	84
19-9		1A008	85
19-10		1A007	86
19-11		1A006	87
19-12		1A005	88
19-13		1A004	89
19-14		1A003	90
19-15	18		
19-16		1A002	91
19-17		1A001	92
19-18		1A020	93
19-19			94
19-20			95
19-21			96
19-22			97
19-23			98
19-24			99
19-25			100
19-26	19		
19-27			101
19-28			102
19-29			103
19-30			104
19-31			105
19-32			106
19-33			107
19-34			108
19-35			109
19-36			110
19-37	20		
19-38			111
19-39			112
19-40			113
19-41			114
19-42			115
19-43			116
19-44			117
19-45			118
19-46			119
19-47			120
19-48	21		
19-49			121
19-50			122
19-51			123
19-52			124
19-53			125
19-54			126
19-55			127
19-56			128
19-57			129
19-58			130
19-59	22		
19-60			131
19-61			132
19-62			133
19-63			134
19-64			135
19-65			136
19-66			137
19-67			138
19-68			139
19-69			140
19-70	23		
19-71			141
19-72			142
19-73			143
19-74			144
19-75			145
19-76			146
19-77			147
19-78			148
19-79			149
19-80			150
19-81	24		
19-82			151
19-83			152
19-84			153
19-85			154
19-86			155
19-87			156
19-88			157
19-89			158
19-90			159
19-91			160
19-92	25		
19-93	26		
18-1	27		
18-2	28		
18-3	29		
18-4	30		
18-5			161
18-6			162
18-7			163
18-8			164
18-9			165
18-10			166
18-11			167
18-12			168
18-13			169
18-14			170
18-15			171
18-16	31		
18-17			172
18-18			173
18-19			174
18-20		1A021	175
18-21			176
18-22			177
18-23			178
18-24			179
18-25			180
18-26			181
18-27	32		
18-28			182
18-29			183
18-30			184
18-31			185
18-32			186

ROLL NO.	CONTROL SAMPLE NO.	EXPOSURE NO.	FILM HOLDER NO.
18-33			187
18-34			188
18-35			189
18-36			190
18-37			191
18-38	33		
18-39			192
18-40			193
18-41			194
18-42			195
18-43			196
18-44			197
18-45			198
18-46			199
18-47			200
18-48			201
18-49			202
18-50	34		
18-51	35		
18-52	36		
18-53	37		
20-1	1		
20-2	2		
20-3	3		
20-4	4		
20-5			1
20-6			2
20-7			3
20-8			4
20-9			5
20-10			6
20-11			7
20-12			8
20-13			9
20-14			10
20-15	5		
20-16			11
20-17			12
20-18			13
20-19			14
20-20			15
20-21			16
20-22			17
20-23			18
20-24			19
20-25			20
20-26	6		
20-27			21
20-28			22
20-29			23
20-30			24
20-31			25
20-32			26
20-33			27
20-34			28
20-35			29
20-36			30
20-37	7		
20-38			31
20-39			32
20-40			33
20-41			34
20-42			35
20-43			36
20-44			37
20-45			38
20-46			39
20-47			40
20-48	8		
20-49			41
20-50			42
20-51			43
20-52			44
20-53			45
20-54			46
20-55			47
20-56			48
20-57			49
20-58			50
20-59	9		
20-60			51
20-61			52
20-62			53
20-63			54
20-64			55
20-65			56
20-66			57
20-67			58
20-68			59
20-69			60
20-70	10		
20-71			61
20-72			62
20-73			63
20-74			64
20-75			65
20-76			66
20-77			67
20-78			68
20-79			69
20-80			70
20-81	11		
20-82			71
20-83			72
20-84			73
20-85		1A019	74
20-86		1A018	75
20-87		1A017	76
20-88		1A016	77
20-89		1A015	78
20-90		1A014	79
20-91		1A013	80
20-92	12		
20-93	13		

NOTES

This camera jammed during SL-2. Holder 73 was the jammed holder. Exposure 1A-021, the first holder at the rear of the top stack, film holder 175, was removed and developed. It revealed no exposure to sunlight which gave further proof a transport jam occurred between 19 and 101 cycles.

Exposure 1A-020, film holder 93, was developed as a calibration film strip.

FILM DATA	
ROLL NO.	FILM TYPE
18	104-06-05
19	104-06-05
20	104-06-05

holders and two (2) taken at the end of the roll. Therefore, two (2) control samples could be used to bracket each ten (10) film holders in the event of any film degradation.

The block entitled "Film Data" at the bottom of Table 2-1 lists each roll of bulk film by number and type of film.

2.4 UNLOADING DATA

The cameras were flown to NRL after splashdown for unloading. The attached chart (see Table 2-2) shows the order in which the film holders were placed into the cassettes during the unloading operation. The film holder numbers can be traced to the loading data chart, Table 2-1, to cross reference exposure, roll and strip numbers.

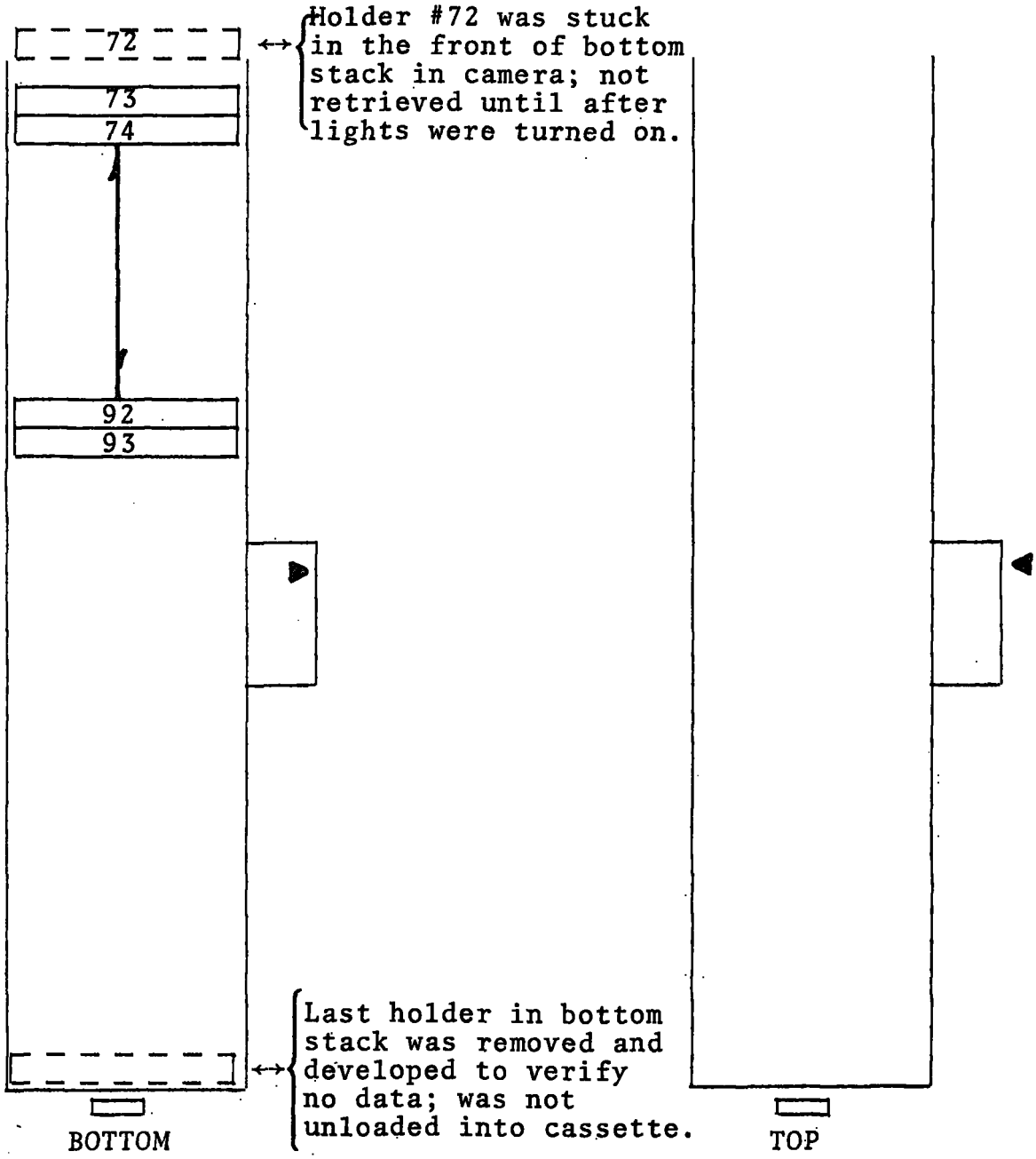
The table (see Table 2-3) entitled "Developing" lists the exposure numbers and development control samples in the order in which they were developed. The development control samples are strips of film cut from the same type of film, although a different roll, to check the developing solutions, process, etc. For exposure information concerning these samples refer to the NRL McPherson Log. These samples do not relate to the control samples taken during loading. Regular development runs are numbered 1, 2, 3, etc., runs numbered A, B, etc. are preselected holders removed during unloading the camera to be developed prior to developing the complete camera load. These holders were not loaded into cassettes but were used to verify film position.

2.5 ALUMINUM FILTER DATA

An aluminum filter was located just behind the camera aperture and consisted of a thin sheet (1000Å thick) of aluminum on a wire mesh substrate. This filter screened out all light wavelengths

Table 2-2

Unloading Traceability Chart



Camera A1/A003

Date 27 Jun 1973

Table 2-3
Developing

Camera Serial No. CM10A-003

Flight Load No. A-1

Run No.	Exposure Numbers	Dev. Control Sample	Date
1	1A-015 through 1A-019	MC 1-2	7/2/73
2	1A-001 through 1A-014, 1A-020, 1A-021	MC 1-4	7/2/73

except the desired wavelength band between 150 and 650Å. This filter data includes manufacturing, test and evaluation data relating to the aluminum filter installed in the camera prior to film loading. These data were compiled by the filter manufacturer, Sigmatron Inc., and the Naval Research Laboratory, and is included for reference. The contents of these data are as follows:

- Photograph of Filter (see Fig. 2-2)
- Pinhole Fogging Map (see Fig. 2-3)
- Pinhole Plugging Map (see Fig. 2-4)
- Manufacturing and Environmental Test Data (see Data Sheets, Pages 2-12 through 2-18.
- Preflight Transmission Data (see Data Sheet, page 2-19).
- Post Flight Transmission Data (see Fig. 2-5).

The post flight measurements were performed at NRL by Code 7143. The printouts of the reduced data (see Table 2-4) are described below:

Key to table of measured transmittances of the ATM-2 Al filters:

Column 1 Wavelength (Å)

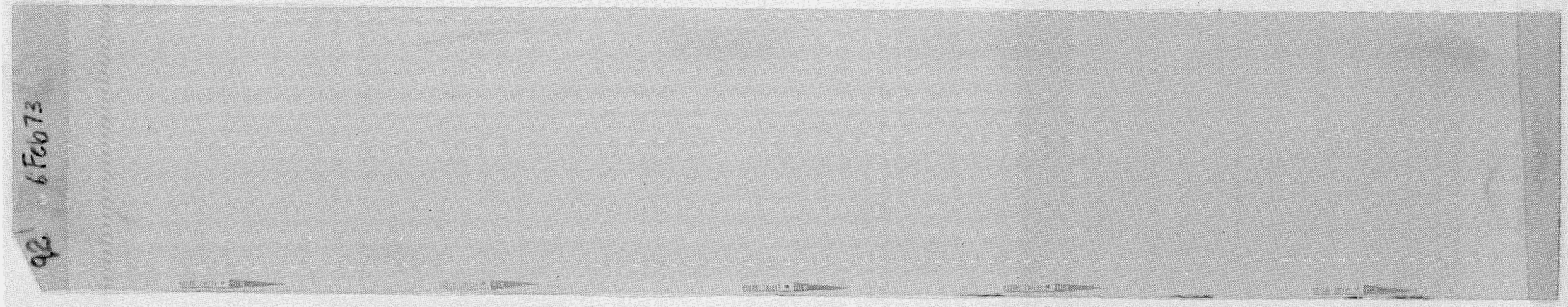
Column 2 Although labelled "ANG. INC." these numbers identify the filters and the position on that filter at which the measurement was made. A key to these numbers is given at the top of each first page.

Column 3 Measured Transmittance.

Column 4 Probable Error of the Measurement.

Column 5 Probable error converted to % error.

Figure 2-2 Photograph of Filter



PINHOLE FOGGING MAP DATE: 6 Feb 73

ATM-2- 92

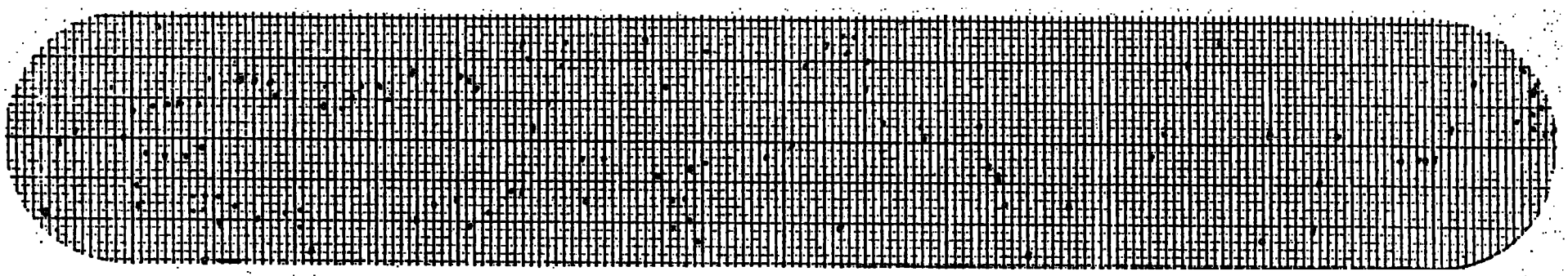
Figure 2-3 Pinhole Fogging Map

Figure 2-4

PINHOLE PLUGGING MAP

Filter I.D. No.: ATM-2-92 Operator: G Steele Date: 1 Feb 73

Plug Material: 3022:18/210:180 Lot No.: B2-007 Exp. Date: 6-6-74



ATM-2-92

Comments: 1st grade - no breaks or nickel balls - no palladium effect - no full square plugs - margin has many small pinholes not plugged

Returned from NRL

620-239

ATM FILTER DATA SHEET

FRAME NUMBER ATM-2-9

1. Frame Data:

Date Received 7-5-72 Reclaimed By NRL

Certification —

Cleaning:

Date 7-1-72 Operator LLS

Wash:

Same cleaning procedure Lot

1-26-72 Lot

Freon Lot 041-28

Lot

Bake Temp. 100°C Time 24 HRS

2. Mounting:

Information on separate sheet.

3. Margining:

Date 7-24-72 Time 1345 Operator RC

Width .100"

Epoxy

Epon 828 Lot 3E#520 Amount 10.0gm 3-17-73

Versamid 125 Lot 24788C Amount 10.0gm "

M.I.K. Lot 36782 Amount 40.0gm

4. Prebake Photograph:

Date 7-27-72 Operator H Hill

5. Cold Cycle:

Date 7-25-72 Operator RC

Time in 1000 Temp. -20°C Time Out 1200

6. Sanitizing Bake:

Date 7-27-72 Operator RWR

Time in 1730 Time out 1500 7-28-72

Temp. < 60°C Pressure < 100μ

7. Pre Environmental Test Photograph:

Date 8-3-72 Operator H Hill

8. Environmental Testing:

Vibration and acoustic: Date 8-3-72 Carrier P Turk

Vibration specs. NRL - 7149 - 107 3-10-70

Acoustic specs. NRL - 7149 - 107 3-10-70

9. Post Environmental Test Photograph:

620-239

FOIL MOUNTING

FOIL NUMBER 686

Al 1370Å

Date 7-10-72

Time 1145

Operator RE

Epoxy

Type Epco 210/410 48 Lot S-20#2 Ex-3-7-74 Amt 20 gm

Type Epco 180 Lot 61-039 Ex-4-18-74 Amt 3.9 gm

Type _____ Lot _____ Amt _____

Solvent _____ Lot _____ Amt _____

_____ Lot _____ Amt _____

Comments .010" squeeze

Frames

Type ATM-2- # 92 Res. 40Ω # _____ Res. _____

Type _____ # _____ Res. _____ # _____ Res. _____

Type _____ # _____ Res. _____ # _____ Res. _____

Type _____ # _____ Res. _____ # _____ Res. _____

Type _____ # _____ Res. _____ # _____ Res. _____

Type _____ # _____ Res. _____ # _____ Res. _____

Type _____ # _____ Res. _____ # _____ Res. _____

Type _____ # _____ Res. _____ # _____ Res. _____

Trim

Date 7-10-72

Time 1630

Operator RE

Comments _____

ENVIRONMENTAL TEST

DATE: 8-2-72 SIGMATRON CARRIER: Peter Turbe

TEST LOCATION: Environmental Laboratory Pt Mugu.

VIBRATION TEST: NRL 7149-107 3-10-70

ACOUSTIC TEST: NRL 7149-107 3-10-70

ITEM NO.	FILTER NO.
1	ATM-2-92 ✓
2	ATM-2-93
3	ATM-2-94

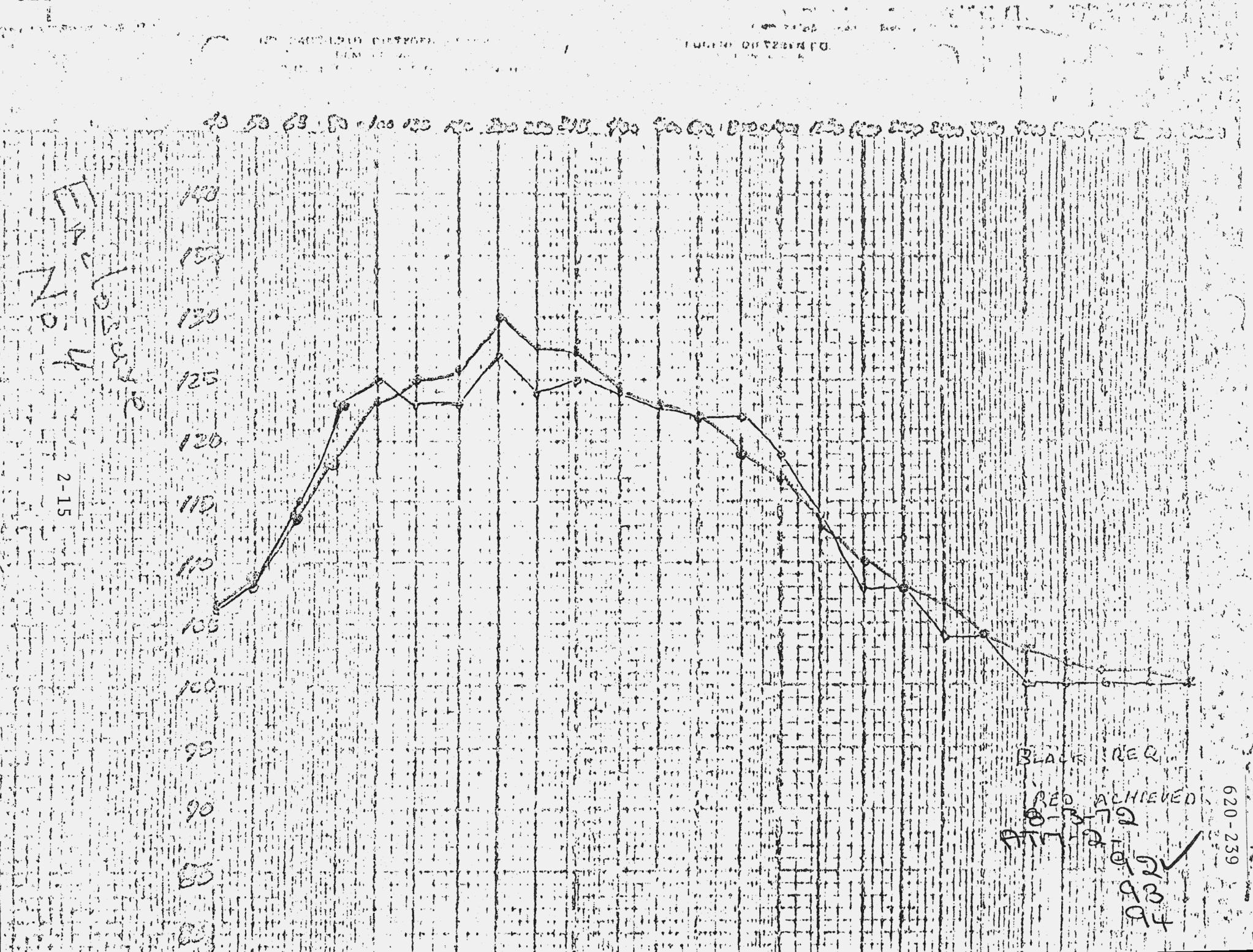
Received 8-2-72 [illegible]

VIBRATION SINE AND RANDOM STARTED AT 1300. AT 1415 ALL THREE AXIS OF VIBRATION BOTH SINE AND RANDOM WAS COMPLETED ON FILTERS ATM-2-92, 93 AND 94. FILTERS STORED IN DRY CHAMBER FOR PM-ACOUSTIC TEST NEXT TOMORROW AM 0700 ON 8-3-72 RAN ACOUSTIC TEST O.K.

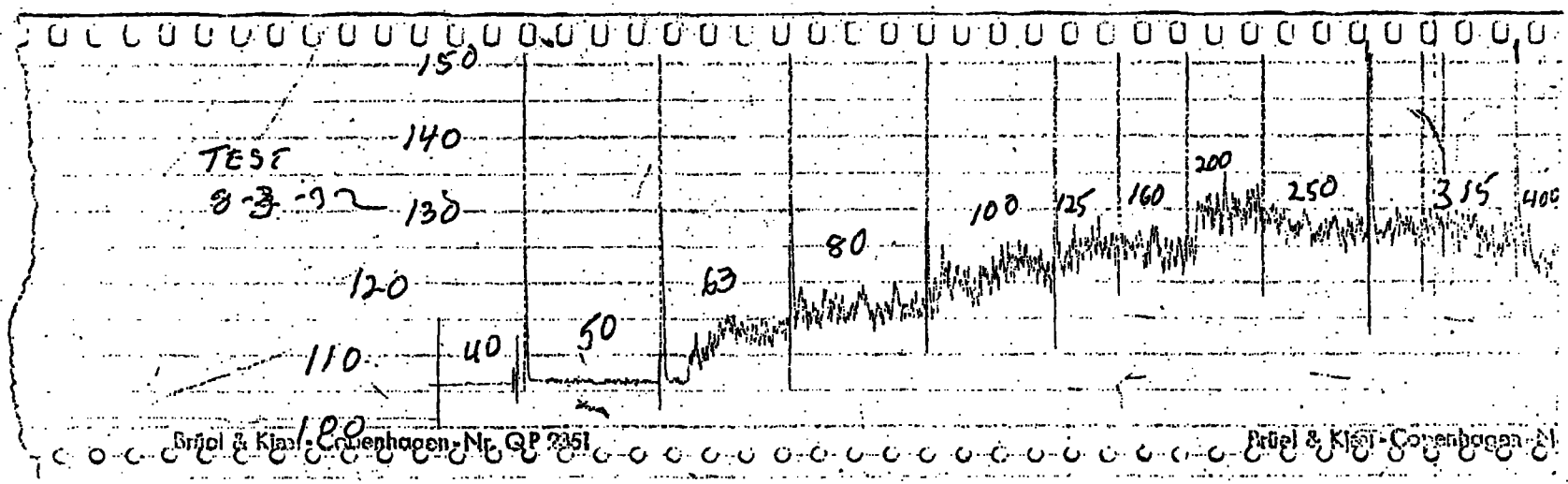
COMMENTS:

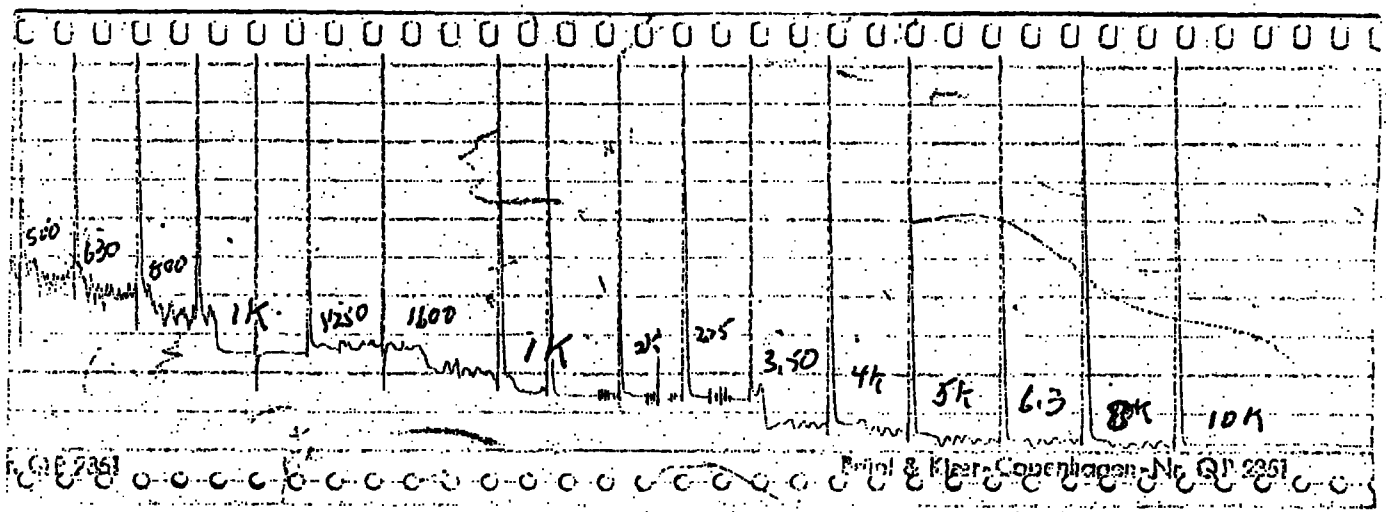
See enclosed PLOT + READOUT CHART ON ACOUSTIC TEST!

[signature]


140
135
130
125
120
115
110
105
100
95
90
85
80
BLACK REQ.
RED ACHIEVED
BLUE REQ.
BLUE ACHIEVED
2-15
620-239

ATM -2- 92✓93, 94. 8-3-72





A003

MONITOR 1370 Å

RUN 686 A

620-239

SUBSTRATE

Date 11/25/71 Operator [illegible]

Glass 0211-083752 Lot n/a

Cleaning method 6 (like) MK (20 min in new Mixer bath) (20 min in new Clean rinse bath) Water RK - Rinse with Conductivity Water

Parlodion

Type 2.6 Lot 111771

Quantity 25 cc.

Time 1900

Installation

Date 11/30/71 Time 1400 Operator [illegible]

Method Wet Ag for 10 min then strip

SOURCE

Date 11/29/71 Operator [illegible] (1st) 2nd 3rd Run

Material: Filament lot: J107 Tantalum lot: C6-187

Al Mg Si lot: 80 1577 lot: lot:

DEPOSITION

		TIME	PRESSURE
Date 12/01/71 Operator [illegible]			
Pump down	DATE 11/30/71	1410	—
Bake out: Temp. n/a Time n/a		—	—
Start Ti pump		915	8.3×10^{-7}
Fill cold trap		900	1.1×10^{-6}
Fluorescein source on: @ .68A for 4 hr	11/30/71	1630	3.2×10^{-6}
Fluorescein run: Lot 81-3-101 Thickness 340 Å		1700	4.0×10^{-5}
Top SiO source on @ n/a Lot n/a		—	—
Bottom SiO source on @ n/a Lot n/a		—	—
LN through side plates		1100	2×10^{-7}
Ti pump off	-65	1130	6×10^{-8}
Source on		1130	6×10^{-8}
Run @ 47±1 Set 180		1131	3×10^{-6}
Crystal frequency .5 to 1.2 Run # 65			
Warm up side plates		1130	2×10^{-7}
Substrate Removed	Date 12/01/71	1315	8×10^{-7}

SCREEN PREPARATION

Date 11-30-71 Operator Re

Screen

Lot 137665 B-2

Lines/inch 70

Thickness .0006"

Orientation NORMAL

Pressing pressure N/A

Heat Treatment

Temp. 500°C

Time 1HR

Method See screen control sheet

Storage N/A

2-18

SCREEN MOUNTING

Date 12-7-71 Operator Re

#5 Method Dry stick/magnetic block

SCREEN INSPECTION

Date 12-7-71 Operator Re

Comments No Breaks.

Film No. 686

CEMENTING

Date 12-8-71 Operator Re/ES

Cement		Proportion
Type Epon 828	Lot 110H457	10.0 gm
Type Versamid 125	Lot IFB 534	10.0 gm
Solvent Chloroform	Lot 40776	570.0 gm
	Lot	

Date Mixed 12-7-71 Operator Re

Spraying

Tank pressure 40 PSI

Fluid pressure 70

Atomizing pressure 30

Delta frequency 210 Hz

Pressing

Pressure 3 PSI

#1 Time 1605

RELEASING

Remove from press fixture and prepare for release

Date 12-9-71 Time 1645 Operator Re

Clamps Yes, polyethylene in place

Release

Date 12-9-71 Time 1720 Operator Re

Solvent Acetone Lot 40727

Remove from release bath and store

Date 12-10-71 Time 0930 Operator RWR

Wash solvent Acetone Lot 40727

From TF Solvent Lot 144-1A

A003

620-239

FILTER TRANSMISSION DATA

FILTER NO.: ATM-2-92

DATE MEASURED, NRL: FEB 8 1973

OPERATOR: LMG

COMMENTS: PULSED SOURCE, 1A21+SS

CHART DISPOSITION SENT WITH FILTER, BBRC, 12FEB73

WAVELENGTH	AVE. TRANSMISSION %	WAVELENGTH	AVE. TRANSMISSION
192	51.0		
301	37.5		
461	27.0		
584	14.5		
728	7.5		

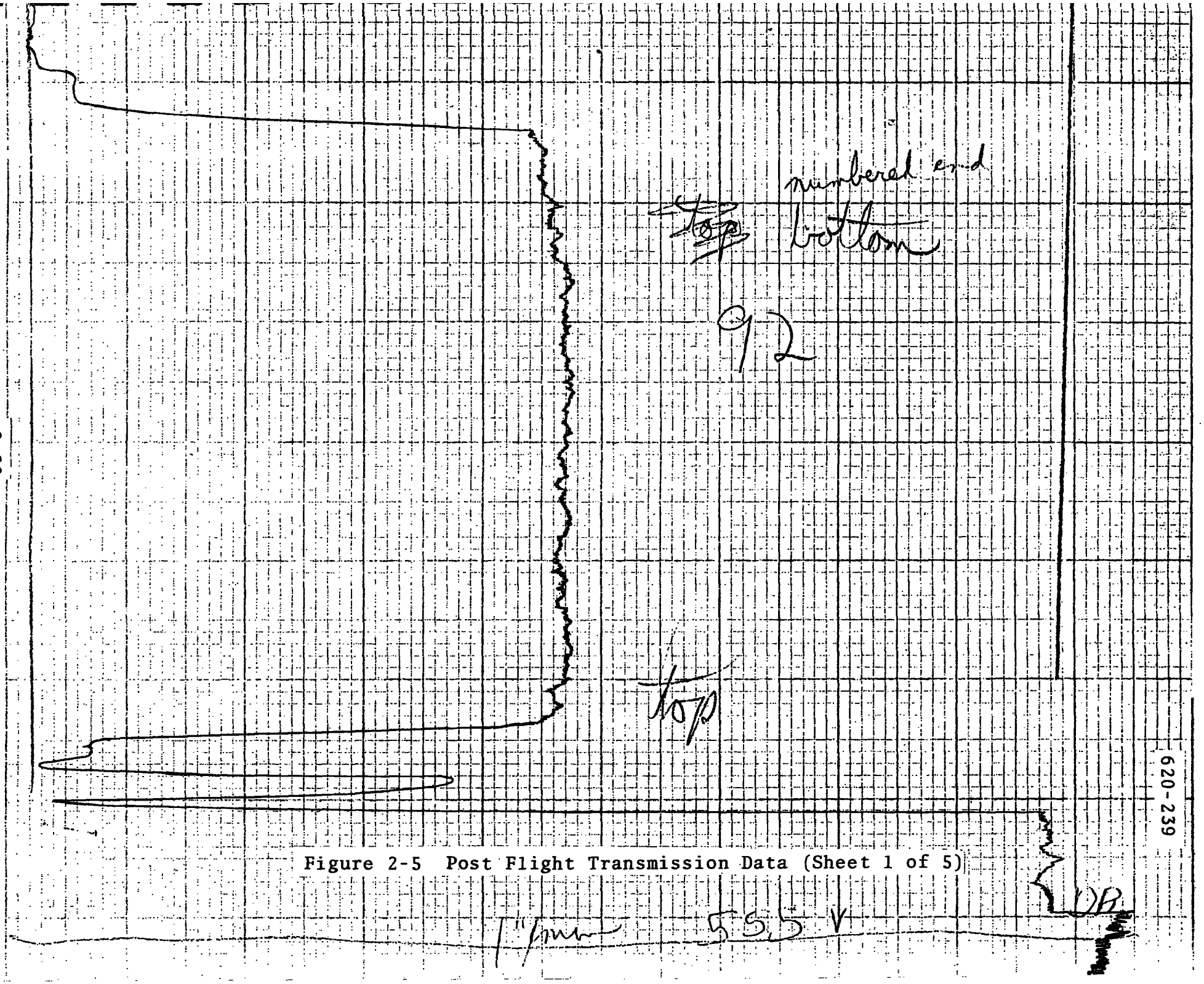


Figure 2-5 Post Flight Transmission Data (Sheet 1 of 5)

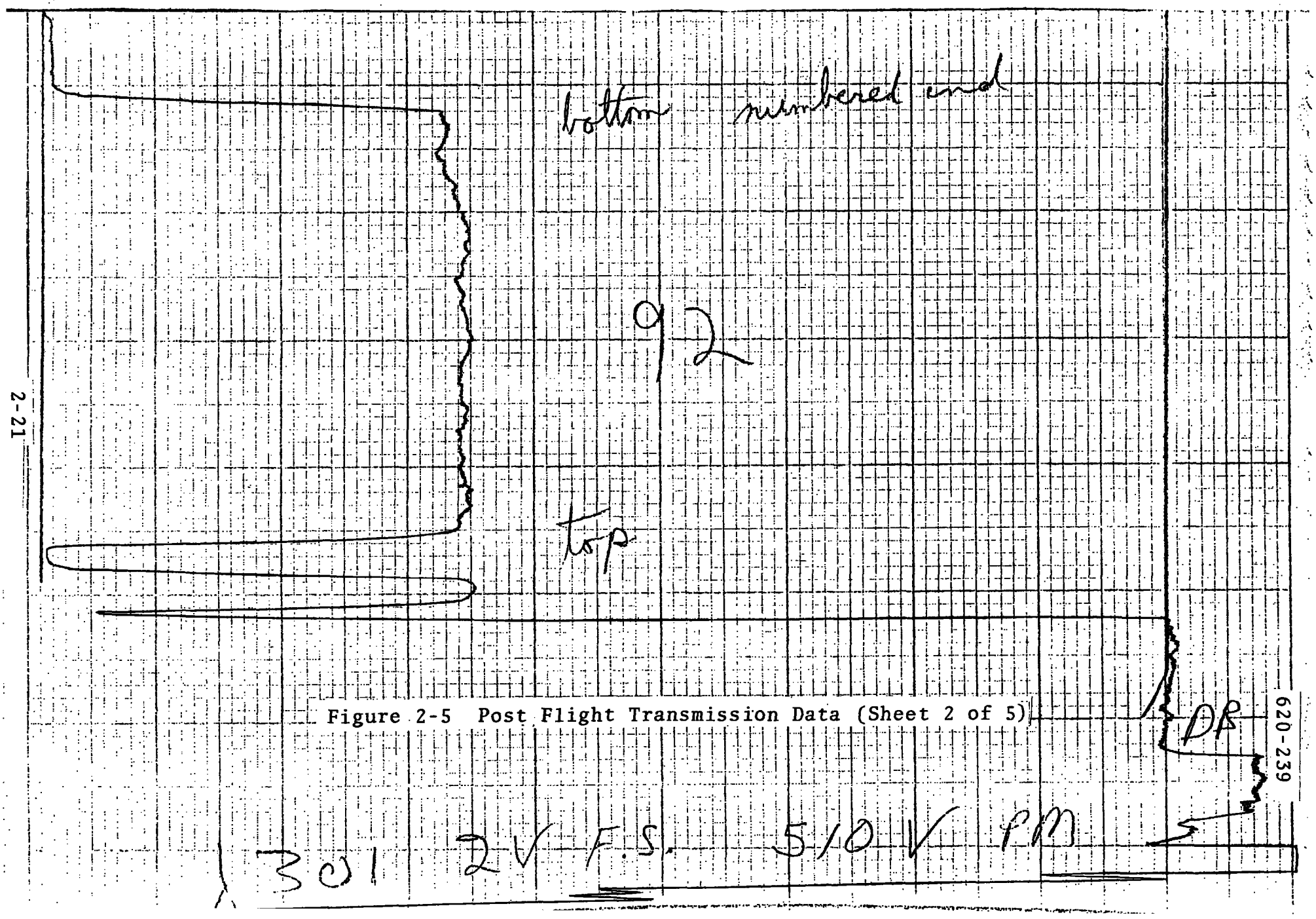


Figure 2-5 Post Flight Transmission Data (Sheet 2 of 5)

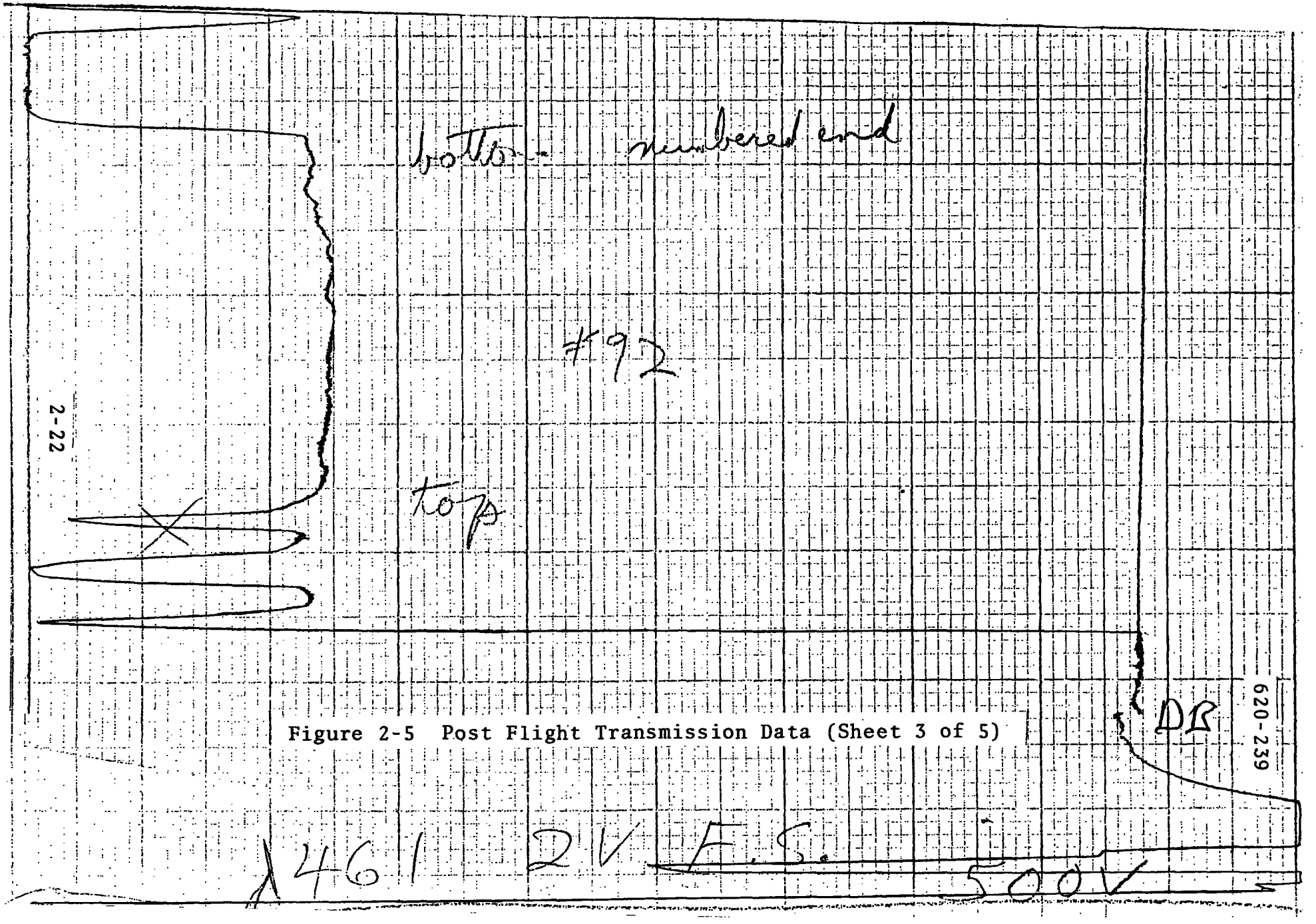


Figure 2-5 Post Flight Transmission Data (Sheet 3 of 5)

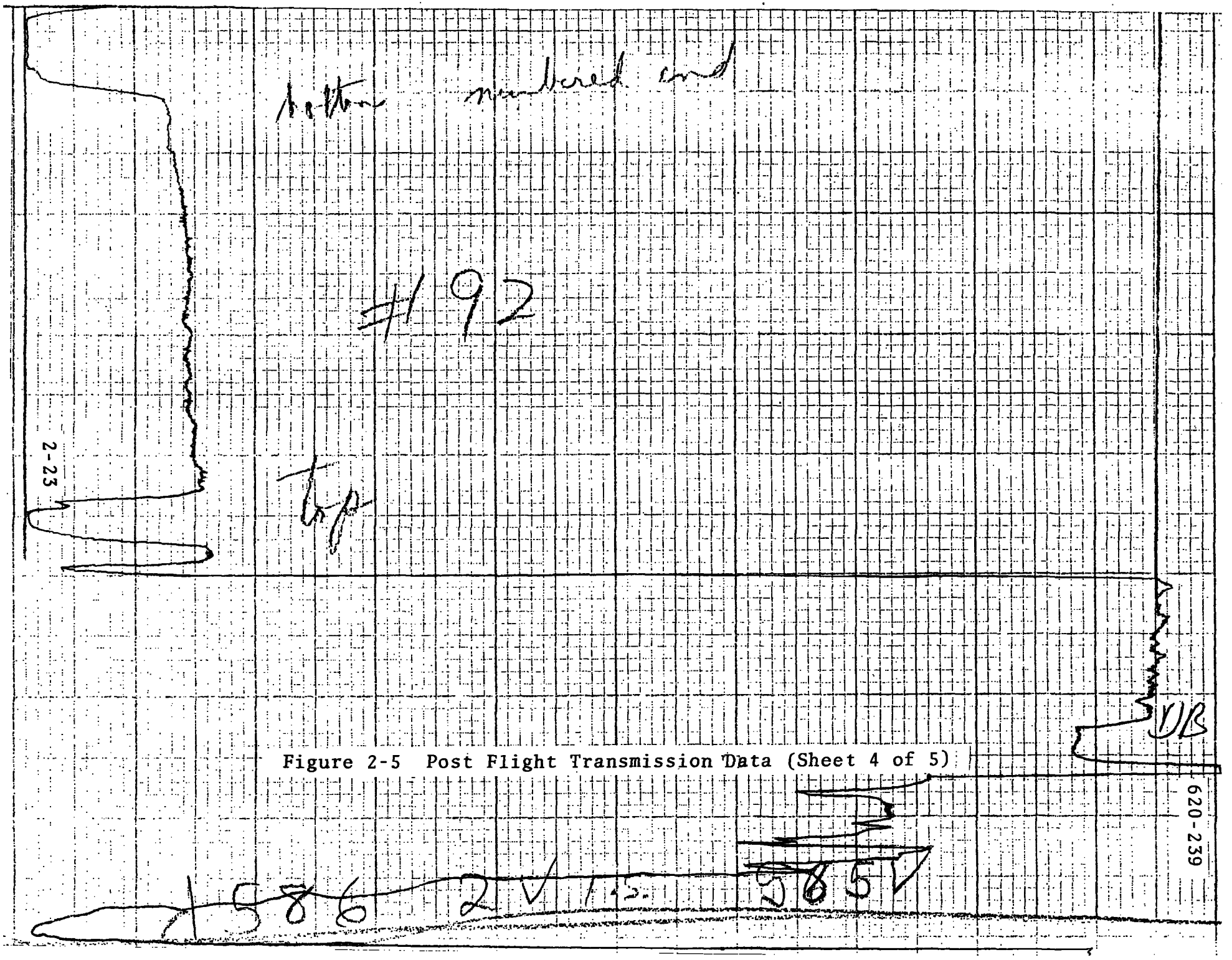


Figure 2-5 Post Flight Transmission Data (Sheet 4 of 5)

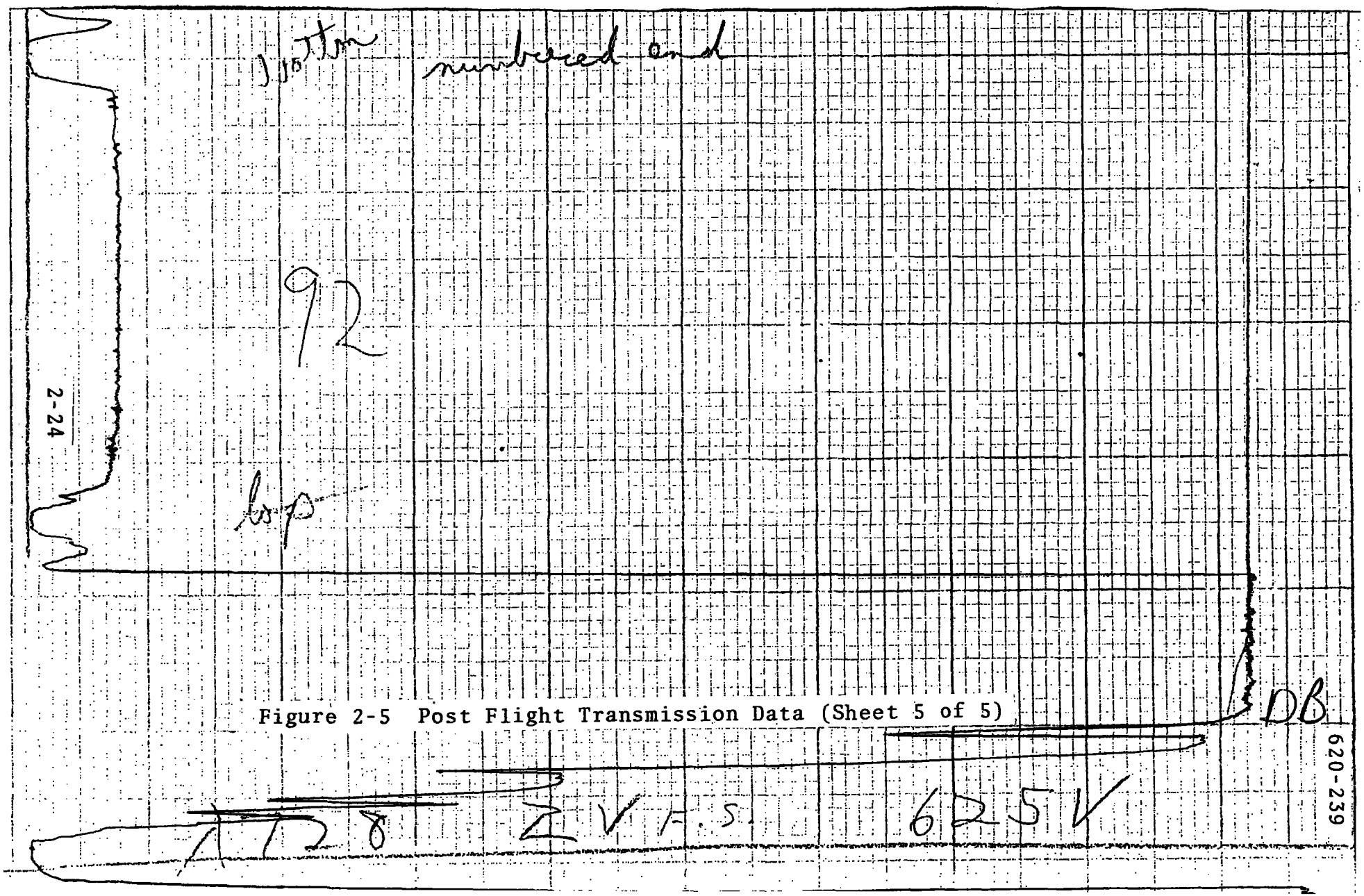


Figure 2-5 Post Flight Transmission Data (Sheet 5 of 5)

Table 2-4

POST FLIGHT MEASUREMENTS

5
TRANSMITTANCE OF ALUMINUM FILTER ATM-2-92 TAKEN FROM CAMERA A-003
MEASURED 28 JUNE 1973 LMG POST FLIGHT MEASUREMENT
FILTER IS ORIENTED SO THAT POSITION 12 IS AT END NEAR INSCRIBED NUMBER.
POSITION 32 IS AT OPPOSITE END AND POSITION 22 IS IN CENTER.
VODAR 1P21 + SS PULSED DISCHARGE 35 PPS ARGON 45 MICRONS 10 KV

AVE LEN.	ANG. INC.	REFLEC.	PROB. ERR.	PERCENT ERR.		CHEM. SYM.
717	32.00	0.[illegible]5549	0.0002673	0.46		AL
717	22.00	0.0645096	0.0004885	0.76		AL
717	12.00	0.0633143	0.0007022	1.11		AL
717					V = 605 NCS1	AL
704	12.00	0.0767094	0.0003760	0.49		AL
704	22.00	0.0825729	0.0004548	0.55		AL
704	32.00	0.0815017	0.0004185	0.51		AL
704					V = 580 NCS1	AL
685	32.00	0.0832975	0.0006457	0.78		AL
685	22.00	0.0800283	0.0007480	0.93		AL
685	12.00	0.0707000	0.0004626	0.65		AL
685					V = 665 NCS1	AL
662	12.00	0.1169970	0.0009730	0.83		AL
662	22.00	0.1239332	0.0012019	0.97		AL
662	32.00	0.1196048	0.0010242	0.86		AL
662					V = 710 NCS1	AL
640	32.00	0.0830706	0.0005324	0.64		AL
640	22.00	0.0876664	0.0004307	0.49		AL
640	12.00	0.0889548	0.0004460	0.50		AL
640					V = 595 NCS1	AL
620	12.00	0.1286904	0.0006997	0.54		AL
620	22.00	0.1312822	0.0005374	0.41		AL
620	32.00	0.1186343	0.0006699	0.56		AL
620					V = 620 NCS1	AL
586	32.00	0.1445247	0.0007618	0.53		AL
586	22.00	0.1362812	0.0006421	0.47		AL
586	12.00	0.1211682	0.0007077	0.58		AL
586					V = 575 NCS1	AL
560	12.00	0.1520929	0.0007910	0.52		AL
560	22.00	0.1517551	0.0009017	0.59		AL
560	32.00	0.1461294	0.0006641	0.45		AL
560					V = 585 NCS1	AL

540	32.00	0.1854537	0.0008253	0.45		AL
540	22.00	0.2013101	0.0010990	0.55		AL
540	12.00	0.1965016	0.0008571	0.44		AL
540					V = 650 NCS1	AL
530	12.00	0.2130547	0.0011227	0.53		AL
530	22.00	0.2274075	0.0022150	0.97		AL
530	32.00	0.2175399	0.0015551	0.71		AL
530					V = 585 NCS1	AL
513	32.00	0.2251420	0.0008809	0.39		AL
513	22.00	0.2182604	0.0007982	0.37		AL
513	12.00	0.1947437	0.0006598	0.34		AL
513					V = 585 NCS1	AL
482	12.00	0.2276310	0.0008003	0.35		AL
482	22.00	0.2316597	0.0008078	0.35		AL
482	32.00	0.2238438	0.0010246	0.46		AL
482					V = 560 NCS1	AL
461	32.00	0.2628565	0.0007531	0.29		AL
461	22.00	0.2739038	0.0005544	0.20		AL
461	12.00	0.2601690	0.0006761	0.26		AL
461					V = 535 NCS1	AL
440	12.00	0.2495030	0.0007675	0.31		AL
440	22.00	0.2720539	0.0011001	0.40		AL
440	32.00	0.2766655	0.0011155	0.40		AL
440					V = 625 NCS1	AL
420	32.00	0.2761186	0.0010398	0.38		AL
420	22.00	0.2832133	0.0014094	0.50		AL
420	12.00	0.2771860	0.0011710	0.42		AL
420					V = 635 NCS1	AL
400	12.00	0.2924665	0.0011189	0.38		AL
400	22.00	0.3086497	0.0015743	0.51		AL
400	32.00	0.2998719	0.0011405	0.38		AL
400					V = 685 NCS1	AL
380	32.00	0.3075087	0.0008177	0.27		AL
380	22.00	0.3041219	0.0011060	0.36		AL
380	12.00	0.2871890	0.0009078	0.32		AL
380					V = 620 NCS1	AL
355	12.00	0.3241186	0.0011662	0.36		AL
355	22.00	0.3423319	0.0012709	0.37		AL
355	32.00	0.3375505	0.0012123	0.36		AL

Table 2-4 (continued)

355					V = 635 NCS1	AL
334	32.00	0.3393537	0.0012732	0.38		AL
334	22.00	0.3352157	0.0013361	0.40		AL
334	12.00	0.3234915	0.0010911	0.34		AL
334					V = 625 NCS1	AL
304	12.00	0.3482090	0.0023036	0.66		AL
304	22.00	0.3199306	0.0023094	0.72		AL
304	32.00	0.3184124	0.0017496	0.55		AL
304					V = 685 NCS1	AL
284	32.00	0.3901301	0.0014400	0.37		AL
284	22.00	0.3941921	0.0016985	0.43		AL
284	12.00	0.3707546	0.0010652	0.29		AL
284					V = 605 NCS1	AL
270	12.00	0.3838255	0.0024324	0.63		AL
270	22.00	0.3701499	0.0021171	0.57		AL
270	32.00	0.3637513	0.0024087	0.66		AL
270					V = 725 NCS1	AL
260	32.00	0.4010467	0.0029539	0.74		AL
260	22.00	0.4049924	0.0027334	0.67		AL
260	12.00	0.3962291	0.0020693	0.52		AL
260					V = 670 NCS1	AL
230	12.00	0.4356942	0.0026308	0.60		AL
230	22.00	0.4423072	0.0021860	0.49		AL
230	32.00	0.4458162	0.0022110	0.50		AL
230					V = 670 NCS1	AL
210	32.00	0.4735203	0.0028467	0.60		AL
210	22.00	0.4729936	0.0024194	0.51		AL
210	12.00	0.4523157	0.0019944	0.44		AL
210					V = 670 NCS1	AL
192	12.00	0.4957663	0.0033457	0.67		AL
192	22.00	0.5161133	0.0027479	0.53		AL
192	32.00	0.5290048	0.0029412	0.56		AL
192					V = 650 NCS1	AL
175	32.00	0.4635740	0.0040635	0.88		AL
175	22.00	0.4641473	0.0029740	0.64		AL
175	12.00	0.4520259	0.0026456	0.59		AL
175					V = 660 NCS1	AL

Table 2-4 (concluded)

168	12.00	0.1410491	0.0017351	1.23		AL
168	22.00	0.1456535	0.0014309	0.98		AL
168	32.00	0.1477618	0.0016881	1.14		AL
168					V = 700 NCS1	AL
160	32.00	0.1422183	0.0014987	1.05		AL
160	22.00	0.1372836	0.0013261	0.97		AL
160	12.00	0.1279046	0.0011732	0.92		AL
160					V = 685 NCS1	AL
150	12.00	0.1224771	0.0012174	0.99		AL
150	22.00	0.1280777	0.0017249	1.35		AL
150	32.00	0.1272043	0.0017490	1.37		AL
150					V = 720 NCS1	AL

1

Between Columns 5 and 6, entries of the type "V = 750NCJ1" are for the operator's information only.

Column 6 Chemical symbol designates the metal of which the filter was made.

From 5 to 11 lines are used at the top of each first page to describe the items being measured and the conditions of measurement; i.e., type of monochromate, light source, etc.

2.6 CAMERA HISTORY

The camera Life History consists of a historical record (see Table 2-5) of the camera from the beginning of its production functional testing to the period of crew compartment fit function (C^2F^2) testing.

Operating Cycles

Column No. 1 identifies total operating cycles and starts with the initiation of production functional tests. This is the point where the camera has become an assembled and adjusted end item. For both cameras the number of cycles relates to the number of film holders transferred from the upper level to the lower level. The number of film exposures for the S082B camera is acquired by multiplying this number by eight.

Column No. 2 identifies the number of operating cycles since the last major relubrication was performed per maintenance specification 37102 (S082A) and 37103 (S082B).

Column No. 3 identifies the number of operating cycles since the last lubrication of an area exhibiting a failure condition possibly related to lubrication wearout.

Table 2-5

S/N A-003

FILM CAMERA LIFE HISTORY

Table 2-5
CAMERA HISTORY

CAMERA SER. NO. A003

Date	Test Location	Test Description	Nonconf. Rpt No.	Failure Mode	Failure Cause	Failure Corrective Action	Operating Cycles 1	2	3	Type of Lubrication on Failure Area	Environment	Camera Configuration	Remarks
07/07/70 07/14/70	BBRC	Production Functional 35854, Rev A	N/A	N/A			775				Ambient Clean Room		Broke MS carrier lever bearing during static torque measurements. Bearing replaced.
07/16/70 07/29/70	BBRC	Production Incorporate EO's	N/A	N/A			775			Relube per para. 4.3 of 37102 - MoS_2 added per BMS 18.20.	Ambient Clean Room	23740, Rev Z 37102 (maintenance spec) initial release	Reworked mount, Part No. 22734-1 & Washers, Part No. 23663.
08/03/70 08/06/70	BBRC	Production Functional retest 35854, Rev C	NMR 24547	Shutter operating time	Increased actuating time at 24 VDC.	ECP114 to increase time from 50 to 60MS.	1378	378			Ambient Clean Room		Reworked MS Spring, Part No. 22726 (installed backwards)
08/19/70 10/07/70	BBRC	Production Incorporate EO's.	N/A	N/A			1488	488			Ambient Clean Room	34360, Rev K 23740, RevAB 23818, Rev B 29837, Rev C 23850, Rev G	Installed full compliment bearings, Part No. 36396 in retractor assembly.
10/07/70	BBRC	I&T Physical meas. 30557	N/A	N/A			1488				Ambient Clean Room		
10/08/70 10/29/70	BBRC	I&T Pre-Qual 30558	NMR 25468 NMR 25806	Stray Light Leak	Screw omitted from cable clamp.	Screw installed	1552	552			Ambient Clean Room		
10/30/70 11/06/70	BBRC	I&T Flight Instrument Compatibility 36636	NMR 25808 RDR1282	Lockout counter malfunction (lockout counter does not prevent motor switch actuation).	Incorrect timing between 3rd tooth of ratchet wheel & motor switch setting.	Adjustment spec. 34360 revised to define new switch setting criteria.	1668	668			Ambient Clean Room	34360, Rev N 23810, Rev Y	Three malfunctions and associated investigations noted on NMR 25808.

Table 2-5 (continued)

CAMERA SER. NO. A003

Date	Test Location	Test Description	Nonconf. Rpt No.	Failure Mode	Failure Cause	Failure Corrective Action	Operating Cycles 1	2	3	Type of Lubrication on Failure Area	Environment	Camera Configuration	Remarks
11/07/70 11/16/70	BBRC	I&T Qual Vibration 30559	NMR 25849 FR 2365	Loose holders at front of lower stack.	Retractor hooks flex outward during vibration & permit holders to fall off of guide rails.	Design changed to incorporate stops to prevent forward travel of retractor mech.	1870	870			Vehicle dynamics & high/low random qual levels. high 1 min/axis & low 4 min/axis		Only X & Z axis completed. Reference PPD-014 for retractor mod.
01/25/71 03/01/71	BBRC	Production incorporate EO's (Retractor mod.)	N/R	N/R			2278	1278			Ambient Clean Room	23810, RevAD 23740, RevAG 34360, Rev S 23677, Rev J 23788, Rev C	Camera configuration verified to CIL, Rev G on 02/22/71. Functional retest required.
06/07/71 08/03/71	BBRC	Production incorporate EO's	N/R	N/R			3460	2460			Ambient Clean Room	23810, RevAJ 34360, Rev U 35854, Rev G 22721, Rev T 23782, Rev M	New bow springs installed & functional test completed. Configuration verified to Rev K of CIL.
08/04/71 08/10/71	BBRC	Production incorporate EO's	NMR 25849	Lube wear-out on cams	Premature wear-out as evidenced on A002 camera, possibly due to lube process.	Strip NPI 425 from cam assemblies and relube per SPS 18.09.	3555	95	95	NPI 425 & burnished MoS_2 per BPS 18.02	Ambient Clean Room	23740, RevAK 34360, Rev W 37102, Rev C 30530, Rev C	Conducted 4000 cy maintenance per 37102. SPS 18.09 is polyimide per BPS 18.07 & burnished MoS_2 per BPS 18.06.
08/11/71 08/26/71	BBRC	I&T Pre-Qual 30558	NMR 26763	No film transport (Jam at feed claw/carrier interface.)	Marginal force available to rotate feed claws outward.	Polished feed claw spacers & mech. plates to obtain smooth action of feed claws. Added measurement of force to rotate feed claws outward.	4218	758	758		Ambient Clean Room	34360, Rev Y 23741, Rev U 35854, Rev J	
08/27/71 09/01/71	BBRC	Production Functional 35854, RevJ	NMR 26763	No film transport (Jam at shuttle)	Free falling film holder (attitude A) became captured between holder partially on feed stack & balance of feed stack.	Requirement added to 35854 to determine number of film holders by force measurement.	4288	828	828		Ambient Clean Room	35854, Rev K 23665, Rev H	

Table 2-5 (continued)

CAMERA SER. NO. A003

Date	Test Location	Test Description	Nonconf. Rpt No.	Failure Mode	Failure Cause	Failure Corrective Action	Operating Cycles 1	2	3	Type of Lubrication on Failure Area	Environment	Camera Configuration	Remarks
09/02/71 09/03/71	BBRC	Production Incorporate EO's	NMR 26763	N/A			4819	936	108		Ambient Clean Room	23811, Rev L 23810, RevAL 23826, Rev A 23741-35, Rev U	Program decision to replace "A" retractor cams & levers with "B" design to increase lub wear life. Test per 35854 as directed by NMR.
09/03/71	BBRC	I&T Pre-Qual 30558 Repeat	NMR 26763	N/A			4837	954	126		Ambient Clean Room		
09/04/71 09/09/71	BBRC	I&T Qual Vibration 30559 Repeat	NMR 26712	No film transport (Jam at feed claw/ carrier interface.) (Post vib.)	Increased friction due to wear at film holder/ feed claw interface which precluded proper function of feed claws. Also, screw came out of transfer lever which caused feed claw release arm malfunction.	Burnished feed claws with MoS_2 per BMS 18.20. Installed additional feed claw springs Part No. 39671-1 to increase feed claw outward rotation force. Installed new screw in transfer lever.	6051	2168	1340 cams 332 Feed claws	Polyimide per BPS 18.07 & burnished MoS_2 per BPS 18.02.	Vehicle dynamics & high/low random - 3 axis	23823, Rev E 23810, RevAM	Opened slots in transfer levers by 0.015 in. to slow down shuttle operation and thus improve feed stack dynamics. Completed functional test per 35854, para. 4.14 & 4.15. (Reference adj. spec 34360, Rev AA, for transfer lever adjustment.)
09-10-71 10-01-71	BBRC	I&T Qual Vibration 30559 Repeat	NMR 26712	Transport time excessive & escapements did not release on 1st cycle. (Post Vib.)	Marginal reliability of escapement system.	Escapement system modified to rolling ratchet system per ECP PPD-032.	6383				Sine and random vibration at Qual. levels.		Escapement released on 2nd cy, however, camera jammed due to holder not latched in MS of carrier 15° from retractor position. Complete coating of lub verified on escapement pawls & ratchets. Operated 26 cy during troubleshooting.

Table 2-5 (continued)

CAMERA SER. NO. A003

Date	Test Location	Test Description	Nonconf. Rpt No.	Failure Mode	Failure Cause	Failure Corrective Action	Operating Cycles 1	2	3	Type of Lubrication on Failure Area	Environment	Camera Configuration	Remarks
Revision A dated 4 February 1972													
01-05-72 01-17-72	BBRC	Production - Incorporate escapement mod. PPD-032 & falling film holder mod. PPD-033.	N/A				6383				Ambient - clean room	23740, Rev AK 23813, Rev G 22721, Rev U 23756, Rev H 23757, Rev J 23786, Rev J 23826, Rev B 30534, Rev C 23788, Rev H 36360, Rev K	Configuration to CIL, Rev N. Installed new bearings on cam shaft.
01-18-72 01-19-72	BBRC	Production - Functional (35854)	N/A				6952				Ambient - clean room & 1×10^{-5} torr (201 cycles)		
01-24-72	BBRC	I&T - Physical Measurements (30557)	N/A				6952				Ambient - clean room		
01-24-72	BBRC	I&T - Pre-Acceptance (30558)	N/A				7022				Ambient - clean room		
01-25-72	BBRC	I&T - Vibration (30559)	N/A				7225		842 (Escape) 2182 (Cams) 1174 (Feed Claws)		Random vibration in canister		
01-25-72 02-01-72	BBRC	I&T - Thermal Vacuum (30560)									1×10^{-5} torr		Test in progress as of 2-1-72.

Table 2-5 (continued)

CAMERA SER. NO. A-003

Date	Test Location	Test Description	Nonconf. Rpt No.	Failure Mode	Failure Cause	Failure Corrective Action	Operating Cycles 1	2	3	Type of Lubrication on Failure Area	Environment	Camera Configuration	Remarks
Revision B dated 9 June 1972													
01-25-72 02-01-72	BBRC	I&T - Thermal Vacuum (30560)	NMR 26929 FR 2413	No indication of shutter open.	Defective internal adjustment of 1HM25 microswitch.	Switch replaced. Part history shows low failure rate for this type of defect. Part usage continued.					1×10^{-5} torr		Functional test, 35854, para 4.4 and 100 shutter cycles performed after switch replacement.
02-03-72 02-17-72	BBRC	I&T - Post Thermal Vacuum (30561)					6130	2726			Ambient - clean room		
02-18-72 03-08-72	BBRC	Production camera cleaning	NMR 27100				6130				Ambient - clean room		Camera cleaned with solution of 20% alcohol and 80% chlorothene nu Shutter stops may have been degraded.
03-09-72	BBRC	I&T - Post cleaning functional (30561)	NMR 27100				6145				Ambient - clean room		Camera hand-carried to MSFC.
03-13-72 05-24-72	MSFC	Support of Flt ATM Post Mfg Checkout					6231				Ambient - clean room		Camera used for instrument compatibility check, diode array check, alignment check, Hi-low all systems test and C^2F^2 (5/8 and 5/11).
Revision C dated 15 February, 1973													
05-25-72 06-21-72	MSFC	Support of Prototype Instrument Testing					6241				Ambient-Clean Room		Camera Loaded with 10 Film Strips and Dummy Stack, Installed on Proto Instrument. Used to take alignment pictures per Procedure TCP-1200,1; removed from Proto Instrument, bagged, and shipped to BBRC

Table 2-5 (concluded)

CAMERA SER. NO. A003

Date	Test Location	Test Description	Nonconf. Rpt No.	Failure Mode	Failure Cause	Failure Corrective Action	Operating Cycles 1	2	3	Type of Lubrication on Failure Area	Environment	Camera Configuration	Remarks
Revision C dated		15 February, 1973											
05-22-72 06-30-72	BBRC	Test per 35854 (a) 4.4.1 Except operate 10 times in Attitudes A & C (b) 4.4.5 Voltage down "A" Attitude (c) 4.4.6 Voltage Down "C" Attitude	NMR 27472		Degradation of Shutter Stops due to Cleaning Procedure	Replace Shutter Stops	6276				Ambient-Clean Room		Problem was identified on A004 Camera
06-30-72 08-07-72	BBRC	Storage									Ambient-Clean Room		
08-08-72 11-20-72	BBRC	Film Storage Test	NMR 27472				6279				Inside Canister Ambient		Ref: NRL Letter 7149-299 Dated 3 August, 1972
11-20-72 11-28-72	BBRC	Testing of Camera after Film Storage Test	NMR 27422	None			6324				Ambient-Clean Room		
11-30-72	KSC	C^2F^2											

Type of Lubrication on Failure Area

Various process specifications are identified in this column with most being BBRC proprietary processes. Brief descriptions of each are as follows:

No.	Description
NPI 425	Dry film, polyimide bonded lubricant - a proprietary process of National Process Industries. It is the same as Midwest Research's MLR-2 lubricant.
BMS 18.20	Slurry of molybdenum disulfide (MoS_2) in volatile solvents - generally applied when specified by maintenance documents 37102 and 37103 and then burnished by cycling the camera approximately 50 cycles.
BPS 18.02 or 18.06	Burnished coating of MoS_2 (mechanical adhesion only).
BPS 18.07	BBRC's equivalent of MLR-2 polyimide, dry lubricant coating.
SPS 18.09	Relubrication procedure - special process for sequencing the use of BPS 18.06 and 18.07 to lubricate film camera peculiar parts. Implemented in the 37102 and 37103 documents.

Camera Serial No.	Change
A003	1. Refined film holder load by determining number of holders by force measurements (35854, Rev K). Reference ECP PPD-027.

DIODE ARRAY DATA

3.0 DIODE ARRAY DATA

The diode array was located immediately adjacent to the camera mounting plate and consisted of a light emitting diode array and a lens assembly. The diode array system projected binary coded decimal time onto the film chip for exposures of 0.25 second or longer. Twenty-five bits of time of day data were recorded at shutter open and 13 least significant bits were recorded at shutter close. NRL developed the film chips, decoded and stored the data and produced a computer printout. BBRC assisted by editing the computer printout.

The time of day recorded by the diode array is mission elapsed time (MET) and is furnished by an ATM on-board computer. This computer time varied from Greenwich Mean Time (GMT) by as much as a few seconds and, therefore, required periodic updates by ground command. These updates are listed in NASA MSFC Memorandum MO-I-35-74, Subject: ATMDC Timer Updates, dated March 26, 1974.

Rev A

DOY	Day of Year
EXP TIME	Duration of Exposure

The wavelengths (λ) shown on the computer printout are manually read from the spectrograph prints and entered in the computer printout.

Rev A

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812

REPLY TO ATTN OF: MO-I-35-74

March 26, 1974

TO: Distribution

FROM: MO-I/Harvey Golden

SUBJECT: ATMDC Timer Updates

Enclosed is a list of ATMDC timer updates. These updates were taken from the MDRS Position Log at JSC. Although some of this information is difficult to decipher, it seems to be the best source available on timer updates. If questions arise concerning the list they should be directed to Steve Bales of the Flight Computer Section (483-3421) at JSC and discussed with someone who manned the ASCO position during the Skylab Mission. I have included a copy of the MDRS Position Log for your information.

ATMDC Timer Updates (Onboard Time)

Timer B was used in the beginning of the mission until DOY 154 when ATMDC switchover occurred. Timer A was used for the remainder of the mission except for DOY 157 when ASCO tried the Timer B again. Below is a list of clock updates and explanation as well as can be deciphered from the MDRS Position Log. These times were provided to MDRS by ASCO as he completed each timer update. All Delta updates are negative values.

2

GMT OF CLOCK RESET	ZERO SET TIME	DELTA UPDATE	COMMENTS
144:02:05:10.000	134:00:00:00.000	-11 Sec	Timer B update
148:07:40:00.0	-	-11 Sec	Timer B update
154:12:22:10.749	134:00:00:00.000	-4 Sec	Timer A update over HSK
157:01:50:00	133:23:59:44.780	-	Timer B selected
157:03:33:00	-	-18 Sec	Timer B update
157:04:09:00	-	-	Timer A selected
160:16:38:00	133:23:59:55.876	-	Changed from a timer in primary computer to a timer in secondary computer that was driven by Timer B.
162:17:16:44	-	-4 Sec	Timer A update
178:19:07:00	178:19:07:00	-4 Sec	Timer A update
189:16:02:00	134:00:00:00.401	-3 Sec	Timer A update
198:00:00:00	064:00:00:00	-	64 day clock rollover
197:23:59:57	-	-3 Sec	Timer A update over GDS
205:19:43:49	-	-3 Sec	Timer A update
219:06:13:33	198:00:00:01.553	-5 Sec	Timer A update
230:16:44:47	-	-4 Sec	Timer A update
246:01:38:00	-	-4 Sec	Timer A update
256:04:50:50	198:00:00:00.301	-3 Sec	Timer A update
267:03:17:21.277	262:00:00:01.277	-4 Sec	Timer A update
280:04:45:20.988	262:00:00:00.988	-4 Sec	Timer A update
288:07:30:00	-	-3 Sec	Timer A update
297:07:25:53	262:00:00:01.168	-3 Sec	Timer A update
306:16:10:50	262:00:00:00.775	-3 Sec	Timer A update
316:22:35:43	054:22:35:43	-3 Sec	Timer A update
326:00:00:00	000:00:00:00	-	Timer Reset
331:04:09:47	326:00:00:00.101	-3 Sec	Timer A update
342:10:29:02	-	-3 Sec	Timer A update
353:04:27:09	027:04:27:09	-3 Sec	Timer A update
367:02:51:20	041:02:51:20	-3 Sec	Timer A update
388:04:06:00	062:04:06:00	-3 Sec	Timer A update
390:00:00:01.911	008:19:30:51.249	-4 Sec	Timer A update

for Harvey Golden

Enclosure

4/24/74

FILM NR	DATE	DOY	SHUTTER OPEN	CLOSE	EXP TIME	WAVELENGTH
1A 1	MAY 28.73	148	18H 51M 35.00S	51M 54.75S	19.75S	LONG
1A 2	MAY 28.73	148	18H 51M 56.75S	52M 6.75S	10.00S	SHORT
1A 3	MAY 28.73	148	18H 52M 8.75S	53M 28.25S	79.50S	LONG
1A 4	MAY 28.73	148	18H 53M 30.25S	54M 10.00S	39.75S	SHORT
1A 5	MAY 28.73	148	18H 54M 12.25S	59M 30.50S	318.25S	LONG
1A 6	MAY 28.73	148	18H 59M 32.75S	2M 11.75S	159.00S	SHORT
1A 7	MAY 29.73	149	18H 30M 18.00S	30M 28.00S	10.00S	SHORT
1A 8	MAY 29.73	149	18H 30M 30.00S	31M 9.75S	39.75S	SHORT
1A 9	MAY 29.73	149	18H 31M 11.75S	33M 51.00S	159.25S	SHORT
1A 10	MAY 29.73	149	19H 30M 18.75S	31M 58.50S	99.75S	LONG
1A 11	MAY 29.73	149	19H 39M 15.25S	43M 22.00S	246.75S	LONG
1A 12	MAY 30.73	150	0H 28M 39.00S	28M 59.00S	20.00S	LONG
1A 13	MAY 30.73	150	1H 38M 54.75S	45M 36.00S	401.25S	LONG
1A 14	MAY 30.73	150	2H 10M 28.00S	11M 8.75S	40.75S	LONG
1A 15	MAY 30.73	150	14H 14M 27.50S	14M 47.50S	20.00S	LONG
1A 16	MAY 30.73	150	14H 14M 49.50S	14M 59.25S	9.75S	SHORT
1A 17	MAY 30.73	150	14H 15M 1.25S	16M 20.75S	79.50S	LONG
1A 18	MAY 30.73	150	14H 16M 23.00S	17M 2.75S	39.75S	SHORT
1A 19	MAY 30.73	150	14H 17M 4.75S	17M 47.75S	43.00S	LONG
1A 20	MAY 30.73	150	0H 0M 0.00S	0M 0.00S	0.00S	BLANK
1A 21	MAY 30.73	150	0H 0M 0.00S	0M 0.00S	0.00S	BLANK

4.0 ENGINEERING DATA BOOK - JSC

During all of the manned phases of the Skylab Program, NRL maintained a science console in the ATM Staff Support room at JSC. One of the duties of the NRL team member manning the science console was to record information in support of each frame of S082A and S082B film exposed by the astronauts or during unattended operations. Experiment log books for each camera were
Rev A used to record the time of each shutter opening (accurate to one minute of GMT), the day/night cycle number, the Joint Observing Program (JOP), step and building block number, the solar feature or target being studied, the exposure duration and wavelength and appropriate comments pertaining to individual frames as necessary

At the conclusion of the Skylab Program, the experiment log books were compared frame by frame with engineering data compiled at JSC and MSFC, and with each instrument's internal diode array information. The results for this film camera are tabulated at the end of this section. Each column is labeled on the first
Rev A page of the tabulation. The FILM STRIP column is a permanently assigned frame number that identifies the mission and instrument as well as the sequence in which each frame was taken. All of the remaining columns were taken directly from the experiment log books and contain information in exactly the order described above. Comments from the experiment log books are recorded in Volume I of the NRL/ATM S082 Exposure Catalog (BBRC Document No. 620-249).

The glossary included in this section will identify all the abbreviations and symbols used as well as the name of each numbered JOP.

MED Book Glossary

X represents a number assigned by the planning committee or by NOAA:

BSP	Bright Spot
BSX	Bright Spot and Number
CAL	Calibration, Target Unspecified
CHX	Coronal Hole and Number
EFR	Emerging Flux Region
ELB	East Limb
FXX	Filament and Number
JOP 1	Chromospheric Network
JOP 1A*	Near Sun Center (R < .5R.)
JOP 1A-1*	Step One of JOP 1A
JOP 2	Active Regions
JOP 3	Flares
JOP 4	Prominences
JOP 5	Limb Profile Studies
JOP 6	Synoptic Observations
JOP 7	Atmospheric Extinction
JOP 8	Coronal and Disk Transients
JOP 9	Solar Wind
JOP 10	Lunar Libration Clouds
JOP 11	Chromospheric Oscillations
JOP 12	Calibration
JOP 13	Night Sky Objects
JOP 14	Solar Eclipse
JOP 15	Coronal Holes
JOP 17	Bright Spot
JOP 18	Comet Kohoutek
JOP 19	Alfven Waves
JOP 20	Rapidly Changing Coronal Structure
JOP 21	Time Variations in Coronal Structure
JOP 24	Latitude Variation of Coronal Structure
JOP 25	S055 Maxi Roster

	JOP 26	Coronal and Chromospheric Structures
	JOP 27	Velocities
	K	Comet Kohoutek
	KC	Kohoutek Coma
	KN	Kohoutek Nucleus
	KT	Kohoutek Tail
	LBX	Limb and Number, 0 means 10
	LB	Limb
	LSX	Limb Scan and Number
	NCX	Network Cell and Number
	NP	North Pole
Rev A	OBS	Observing Time for Crew
	PXX	Prominence and Number
	QL	Quiet Limb
	QRX	Quiet Region and Number
	QR	Quiet Region
Rev A	S	Shopping List Designation
Rev A	SXX	Shopping List and Number
	SC	Sun Center
Rev A	SGL	Single Instrument Operation
	SP	South Pole
	UNA	Unattended
	UNK	Unknown
	VEL	Star Gamma Vel
	WLB	West Limb
	XX	Active Region Identifying Numbers, i.e. 00, 19, 27 etc.

* Sample - for specific JOP and step definitions, see JOP Summary Sheets.

DATE	TIME	FILM-STRIP	D/N	JOP-ST BB	TGT	EXP	WVL
MAY 28	148:18:51	1A-001	51	UNA	SC	:20	L
MAY 28	148:18:51	1A-002	51	UNA	SC	:10	S
MAY 28	148:18:52	1A-003	51	UNA	SC	01:20	L
MAY 28	148:18:53	1A-004	51	UNA	SC	:40	S
MAY 28	148:18:54	1A-005	51	UNA	SC	05:18	L
MAY 28	148:18:59	1A-006	51	UNA	SC	02:40	S
MAY 29	149:18:30	1A-007	66	02D-1 04	14	:10	S
MAY 29	149:18:30	1A-008	66	02D-1 04	14	:40	S
MAY 29	149:18:31	1A-009	66	02D-1 04	14	02:40	S
MAY 29	149:19:30	1A-010	67	06 -1 01A	SC	01:40	L
MAY 29	149:19:39	1A-011	67	06 -1 01B	SC	04:07	L
MAY 30	150:00:28	1A-012	70	02A-7 10	15	:20	L
MAY 30	150:01:38	1A-013	71	06 -1 01A	SC	06:41	L
MAY 30	150:02:10	1A-014	71	02D-5 07	18	:40	L
MAY 30	150:14:14	1A-015	79	06 -1 01A	SC	:20	L
MAY 30	150:14:14	1A-016	79	06 -1 01A	SC	:10	S
MAY 30	150:14:15	1A-017	79	06 -1 01A	SC	01:20	L
MAY 30	150:14:16	1A-018	79	06 -1 01A	SC	:40	S
MAY 30	150:14:17	1A-019	79	06 -1 01A	SC	:43	L

ENGINEERING DATA BOOK—MSFC

5.0 ENGINEERING DATA BOOK - MSFC

This portion of the Mission Engineering Data Book was originated at MSFC from the telemetered data during the Skylab Missions. The shutter open and shutter close times were GMT corrected and superimposed on this data and the exposure time was computed from these times. In addition, all other ATM instruments operating
Rev A while S082A was recording scientific data are noted.
Also included are pointing information and certain selected orbital or ephemeris data. This data is in the form of a computer printout and is recorded on magnetic tape.

The telemetry system was noisy during the mission and often data was missing from the printouts (dropouts). The telemetry noise caused many false exposure data to appear on the telemetry, while the dropouts caused exposure data lines to be missing. Consequently it was necessary to correct these engineering data using several other sources of information through time correlation.

The corrected EDB (MSFC) has been coordinated with data from the diode array, MSFC quick look data (AUTO SCAN), MSFC and JSC console logs, MSFC Data Book Six, and the JSC EDB. The corrected roll information as provided by IBM under contract with MSFC has been incorporated into the computer tabulations.

Rev A The initial IBM issue of these reconstructed values was based on 1950 Ephemeris Data. Additional information provided by IBM updated these values to the 1973 Ephemeris Data. These delta corrections have been incorporated into the computer tabulations. The roll values contained in this book are accurate to within 3 arc minutes of the IBM values.

Rev A

S082A EDB PRINTOUT INDEX

OPEN	Complete Greenwich Mean-time when shutter was opened (Column A).
CLOSE	Greenwich Mean-time in minutes, seconds, and milliseconds when shutter was closed (Column B).
EXPOSURE TIME	Difference between shutter OPEN and CLOSE time (Column C).
FRAME COUNT	The film strip number as assigned by NRL (Column D).
WVL	Wavelength - 'G' is grating position and 'M' is the mirror position. 'S' is printed in both columns for Short Wavelength, and 'L' is Long Wavelength (Columns E and F).
MULT	Multiplier - '1' is normal exposure time, '1/4' is normal exposure time divided by four, and '4' is normal exposure time multiplied by four (Column G).
MODE	Operating Mode of Instrument - 'AUTO 1' is Auto 1 Mode, 'AUTO 2' is Auto 2 Mode, 'FLARE' is Flare Mode, and 'MAN' is Manual or Time Mode (Column H).
OP EXP	Operating Experiments - A number in the respective columns indicates the experiment was operating while the shutter was OPEN, 'X' indicates the Instrument assigned to that column was not operating. The columns are assigned as follows: Col I is S-052; Col J is S-054; Col K is S-055; Col L contains operating modes of the S-055 experiments, 'ML' is Line Mirror Mode, 'M3' is 3 Raster Mirror Mode, 'MA' is Auto Mirror Mode, 'GA' is Grating Advance Single Step Mode, 'GS' is Grating Scan Mode, 'G3' is 3 Grating Scan Modes, 'GR' is Grating Reference Mode, a void indicates no mode, BT23 indicates mode unknown; Col M is S-056; Col N is S082B; and Col O is Hα 1.

TEMP	Temperature of Instrument - Provide quick check of instrument temperatures when shutter was opened (OP-Column P) and closed (CL-Column Q). 'OK' is printed in the 'OP' column when: 1) the absolute temperatures of the instrument are 70 ± 13°F; 2) the absolute temperature of the grating is 73 ± 10°F; and 3) the differential temperatures are 0 ± 5°F. If any of the temperatures are not within the above described limits, an 'X' is printed in the 'OP' column. If the above measured temperatures vary during the time the shutter was OPEN by less than 1) ±5.4°F for all absolute temperatures, 2) ±6.6°F for the grating, 3) ±0.2°F for the vertical differential temperatures, and 4) ±0.5°F for horizontal differential temperatures, 'OK' is printed in the TEMP 'CL' Column. If these requirements are not met, 'X' is printed in the TEMP 'CL' Column.
ROLL	GAMRR - Roll position is printed in Column R.
MAX PT. EXC.	Maximum Pointing Excursion - The maximum deviation of the Point Control during the shutter OPEN period is printed in these three columns. GAMX, GAMY and GAMRR Point Positions are printed in the respective columns, S, T and U.
NRL BIAS	The alignment bias values for the S082B instrument are printed at S082A shutter OPEN and CLOSE.

S082A EDB PRINTOUT INDEX
Page 3

ANGLE	'B' (Column V) is the minimum angle (β, Fig. 5-1) from sun-earth line to Skylab orbital plane, and 'E' (Column W) is the minimum angle (α, Fig. 5-2) between Skylab-sun line and nearest forward earth horizon as measured in the vertical plane. Both angles were printed when shutter opened.
ALTITUDE	The altitude (A, Fig. 5-2) of the Skylab in kilometers when shutter was opened (Column X).
Zm	The distance of the viewing line above earth (Zm, Fig. 5-2) in kilometers when the shutter was opened (Column Y). Z_M = (6378 + A) cosine E - 6378 where E is from Column 'W' and A is from Column 'X'. NOTE: Zm is meaningful only for values E between 0 and -1290 arc minutes.
ORBIT NO.	Orbit number (Column Z).

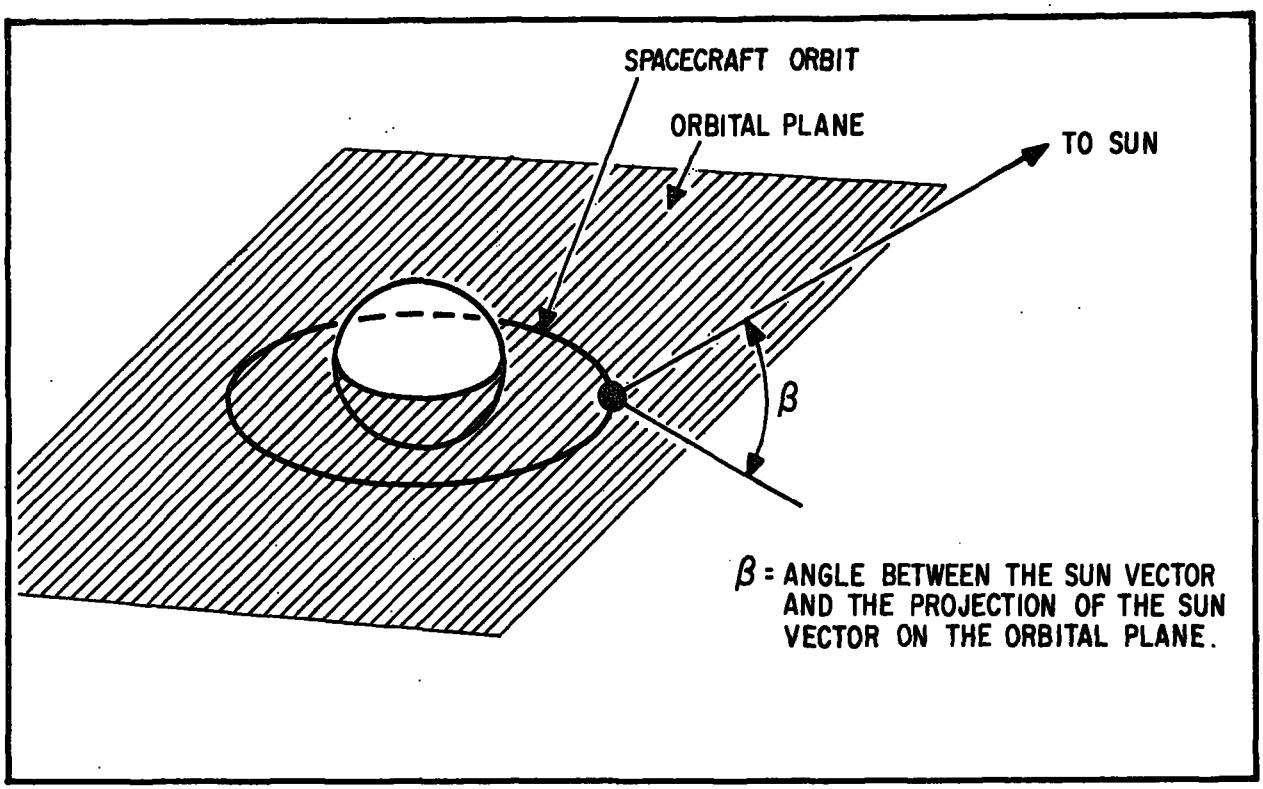


Figure 5-1 Beta Angle

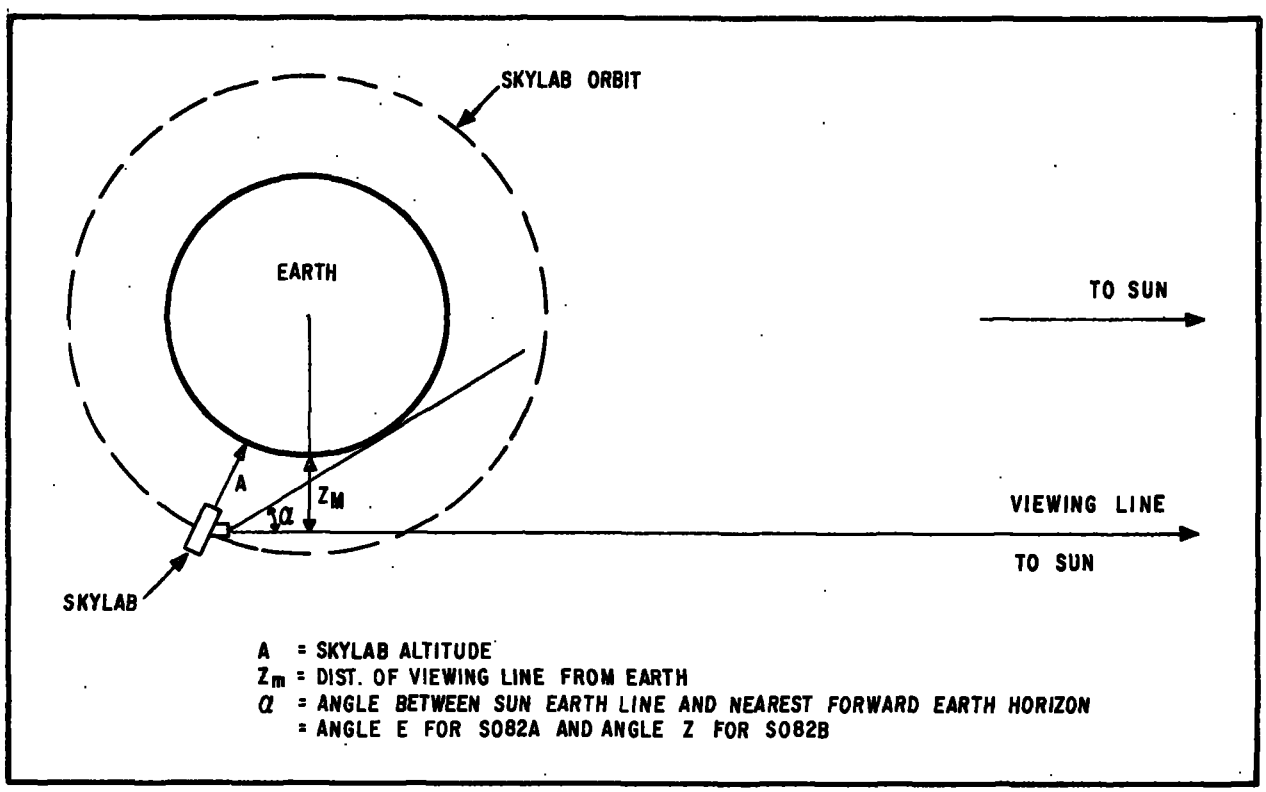


Figure 5-2 Extinction Parameters

S082A-EDB
INSTRUMENT OPERATION 5-31-75 AT 2 HOURS 46 MINS 7 SECS
PAGE 1- 1

SHUTTER OPEN (A)	SHUTTER CLOSE (B)	EXPOSURE TIME (C)	FRAME COUNT (D)	WVL -G- (E)	WVL -M- (F)	MULT (G)	MODE (H)	(I)	OP EXP (J)	(K)	(L)	(M)	(N)	(O)	TEMP OP (P)	TEMP CL (Q)
148:18:51:35:776	51:55:775	0:19:999	IA-001	L	L	1	AUTO 2	X	4	5		X	X	X	OK	OK
148:18:51:57:525	52: 7:524	0: 9:999	IA-002	S	S	1	AUTO 2	X	4	5		X	X	X	OK	OK
148:18:52: 9:524	53:29:269	1:19:745	IA-003	L	L	1	AUTO 2	X	4	5	MA	X	X	X	OK	OK
148:18:53:31: 19	54:11: 17	0:39:998	IA-004	S	S	1	AUTO 2	X	4	5	MA	X	X	X	OK	OK
148:18:54:13: 17	59:31:503	5:18:486	IA-005	L	L	1	AUTO 2	X	4	5	MA	X	X	X	OK	OK
148:18:59:33:502	2:12:745	2:39:243	IA-006	S	S	1	AUTO 2	X	X	5	MA	X	X	X	OK	OK
149:18:30:18: 93	30:28: 93	0:10: 0	IA-007	S	S	1	AUTO 1	X	4	5	MA	6	X	HI	OK	OK
149:18:30:30: 93	31: 9:841	0:39:748	IA-008	S	S	1	AUTO 1	X	4	5	MA	6	X	HI	OK	OK
149:18:31:11:841	33:51: 86	2:39:245	IA-009	S	S	1	AUTO 1	X	4	5	MA	6	X	HI	OK	OK
149:19:30:18:894	31:58:639	1:39:745	IA-010	L	L	1	MAN	X	4	5	MA	6	X	HI	OK	OK
149:19:39:15:368	43:21:977	4: 6:609	IA-011	L	L	1	MAN	X	4	5	G3	6	X	HI	OK	OK
150: 0:28:39:106	28:59:104	0:19:998	IA-012	L	L	1	MAN	X	4	5	GS	6	B	HI	OK	OK
150: 1:38:54:623	45:36:144	6:41:521	IA-013	L	L	1	MAN	X	4	5	MA	6	X	HI	OK	OK
150: 2:10:28: 69	11: 8:567	0:40:498	IA-014	L	L	1	MAN	X	4	5	MA	6	B	HI	OK	OK
150:14:14:27: 65	14:47: 64	0:19:999	IA-015	L	L	1	AUTO 2	X	4	5	MA	6	X	HI	OK	OK
150:14:14:49: 64	14:59: 63	0: 9:999	IA-016	S	S	1	AUTO 2	X	4	5	MA	6	X	HI	OK	OK
150:14:15: 0:813	16:20:560	1:19:747	IA-017	L	L	1	AUTO 2	X	4	5	MA	6	X	HI	OK	OK
150:14:16:22:560	17: 2:308	0:39:748	IA-018	S	S	1	AUTO 2	X	4	5	MA	6	X	HI	OK	OK
150:14:17: 4:308	17:47:306	0:42:998	IA-019	L	L	1	AUTO 2	X	4	5	MA	6	X	HI	OK	OK

5082A-EDB
INSTRUMENT OPERATION 5-31-75 AT 2 HOURS 45 MINS 7 SECS
PAGE 2- 1

FRAME COUNT	GAMRR (ARCMINS)	MAX PT EXC (ARCSEC) GAMX	GAMY	(ARCMINS) GAMRR	--NRL BIAS-- (ARCSEC) GXB1	GYB1	ANGLE (ARCMINS) -B- OPEN	-E- OPEN	ALTITUDE (KM)	Z(M) (KM)	ORBIT NUMBER
(D)	(R)	(S)	(T)	(U)			(V)	(W)	(X)	(Y)	(Z)
1A-001	-7240.00				.00	.00	-1551.37	3605.42	444.89	-1097.06	192
		.000	.000	.000	.00	.00					
1A-002	-7240.00				.00	.00	-1551.37	3605.42	444.89	-1097.06	192
		.000	.000	.000	.00	.00					
1A-003	-7240.00				.00	.00	-1551.28	3704.05	445.07	-1222.72	192
		.000	.000	.000	.00	.00					
1A-004	-7240.00				.00	.00	-1551.21	3778.01	445.16	-1319.84	192
		.000	.000	.000	.00	.00					
1A-005	-7240.00				.00	.00	-1551.16	3823.79	445.16	-1381.28	192
		.000	.000	.000	.00	.00					
1A-006	-7241.00				.00	.00	-1551.22	3600.20	444.05	-1092.57	193
		.000	.000	.000	.00	.00					
1A-007	-9894.00				15.00	50.00	-1436.38	1553.67	439.29	411.09	218
		.000	.000	.000	15.00	50.00					
1A-008	-9894.00				15.00	50.00	-1436.38	1553.67	439.29	411.09	218
		.000	.000	.000	15.00	50.00					
1A-009	-9894.00				15.00	50.00	-1436.36	1346.06	439.29	436.10	218
		.000	.000	.000	15.00	50.00					
1A-010	-10611.00				15.00	50.00	-1430.18	1331.84	435.93	433.31	218
		.000	.000	.000	15.00	50.00					
1A-011	-5258.00				15.00	50.00	-1428.04	3043.05	443.40	-467.24	218
		.000	.000	.000	15.00	50.00					
1A-012	-5394.00				15.00	50.00	-1400.76	3976.82	444.35	-1595.07	221
		.000	.000	.000	15.00	50.00					
1A-013	10542.00				15.00	50.00	-1396.07	395.17	431.19	231.41	222
		.000	.000	.000	15.00	50.00					
1A-014	-10362.00				15.00	50.00	-1392.25	2830.05	440.89	-272.93	222
		.000	.000	.000	15.00	50.00					
1A-015	-5594.00				15.00	50.00	-1318.56	2293.41	440.99	125.21	229
		.000	.000	.000	15.00	50.00					
1A-016	-5594.00				15.00	50.00	-1318.56	2293.41	440.99	125.21	229
		.000	.000	.000	15.00	50.00					
1A-017	-5594.00				15.00	50.00	-1318.32	2494.68	441.74	-4.54	230
		.000	.000	.000	15.00	50.00					
1A-018	-5594.00				15.00	50.00	-1318.08	2692.38	442.41	-153.20	230
		.000	.000	.000	15.00	50.00					
1A-019	-5594.00				15.00	50.00	-1317.86	2885.65	443.00	-318.43	230
		.000	.000	.000	15.00	50.00					

TEMPERATURE DATA—MSFC

6.0 TEMPERATURE DATA - MSFC

The temperature data was originated at MSFC from the telemetered data during the Skylab Missions. This data is a computer tabulation which has been corrected by coordination with other sources of information. All columns are entered below the respective measurement numbers and the time of each entry is recorded in the left hand column. An entry in each column is made at each SHUTTER OPEN and approximately each five (5) minutes during the time period the shutter remains open. Entries are not made more often than four (4) minute intervals, consequently not all "Shutter Open" will have associated temperature data. This data is provided in the form of a computer printout and is recorded on magnetic tape.

S082A TEMPERATURE

Column	Description
Time	Greenwich Mean Time of Entry
REAR (C090)	Absolute Temperature, Rear Center Base
CENT (C091)	Absolute Temperature, Center Base
FNT (C092)	Absolute Temperature, Front Center Base
REAR (C095)	Absolute Temperature, Rear Center, Right Side
CENT (C096)	Absolute Temperature, Center, Left Side
FNT (C197)	Absolute Temperature, Front Center, Left Side
GRATING (C200)	Absolute Temperature, Grating, Lower Edge
F. CENT (C201)	Differential Temperature, Front Center, Lid to Base
CENT (C202)	Differential Temperature, Center, Lid to Base
R. CENT (C203)	Differential Temperature, Rear Center, Lid to Base
F. CENT (C204)	Differential Temperature, Front Center, Side to Side
CENT (C205)	Differential Temperature, Center, Side to Side
R. CENT (C206)	Differential Temperature, Rear Center, Side to Side

See Figure 6-1 for locations of measurements.

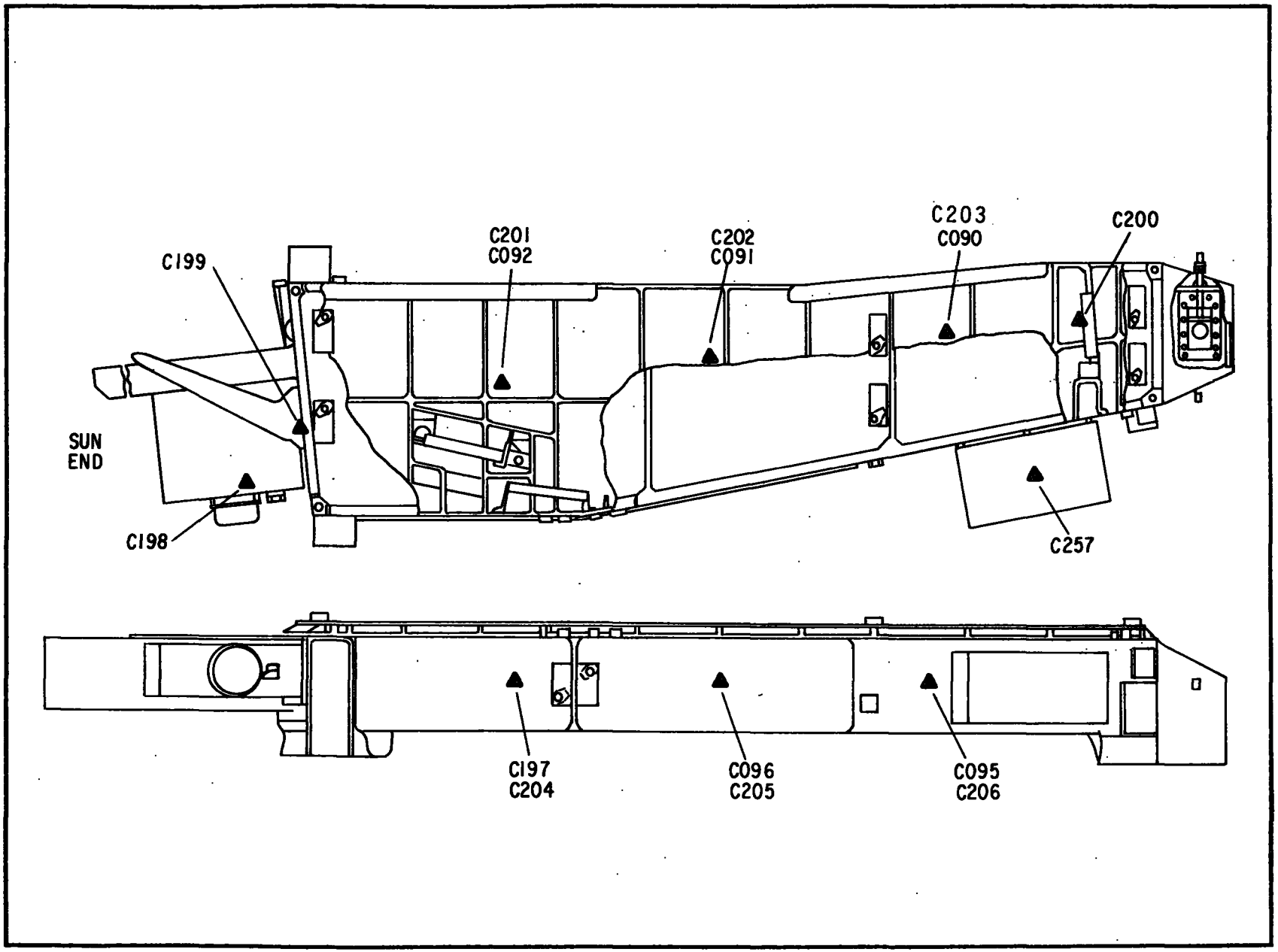


Figure 6-1. Measurement Locations for NRL-A (S082A)

S082A-EDB
TEMPERATURE DATA 5-31-75 AT 2 HOURS 45 MINS 7 SECS
PAGE 1

		ABSOLUTE TEMPERATURES							DIFFERENCE TEMPERATURES					
		BASE TEMP (57 TO 83 DEGF)			SIDE TEMP (57 TO 83 DEGF)		GRATING (63 TO 83 DEGF)		LID - BASE (-5 TO 5 DEGF)			SIDE - SIDE (-5 TO 5 DEGF)		
FRAME	TIME	REAR (C090)	CENT (C091)	FNT (C092)	REAR (C095)	CENT (C096)	FNT (C197)	(C200)	F CENT (C201)	CENT (C202)	R CENT (C203)	F CENT (C204)	CENT (C205)	R CENT (C206)
1A-001	148:18:51:35:776	67.23	68.16	67.91	67.48	68.65	68.10	66.78	.96	.48	.56	-.18	.08	-.02
1A-005	148:18:56:36: 12	67.26	68.16	67.85	67.48	68.59	68.10	66.83	.94	.48	.56	-.10	.07	.01
1A-006	148:19: 1:36: 39	67.23	68.10	67.91	67.51	68.59	68.04	66.78	.94	.48	.56	-.09	.08	-.02
1A-007	149:18:30:18: 93	67.42	68.28	68.10	67.57	68.84	68.25	67.12	.89	.46	.56	-.18	.08	-.02
1A-010	149:19:30:18:894	67.48	68.28	68.13	67.63	68.78	68.34	67.29	.89	.45	.54	-.12	.08	-.06
1A-011	149:19:39:15:368	67.48	68.28	68.13	67.60	68.90	68.34	67.29	.87	.45	.54	-.13	.07	-.06
1A-012	150: 0:27:45:994	66.31	68.53	68.34	67.97	68.62	68.41	67.87	.85	.40	.48	-.16	.05	-.05
1A-013	150: 1:38:54:623	67.91	68.50	68.47	68.10	68.96	68.59	68.50	.82	.41	.45	-.17	.04	-.10
1A-014	150: 2:10:28: 69	67.97	68.59	68.47	68.13	69.02	68.62	68.62	.82	.40	.43	-.18	.07	-.11
1A-015	150:14:14:27: 65	67.60	68.37	68.22	67.79	68.84	68.34	67.24	.86	.42	.49	-.12	.05	-.04