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### **Operations requirement for Black Brant Rocket AD-II-44 : falling probe electron density, electric field probe, cosmic ray, Langmuir probe, micrometeorite, and neutron detector launch from Churchill Research Range**

Staniforth, A.; Steele, K.A.; National Research Council of Canada. Radio and Electrical Engineering Division

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NATIONAL RESEARCH COUNCIL OF CANADA  
ASSOCIATE COMMITTEE ON SPACE RESEARCH

OPERATIONS REQUIREMENT  
FOR BLACK BRANT ROCKET AD-II-44

PREPARED BY  
RADIO AND ELECTRICAL ENGINEERING DIVISION

O.R. NO. \_\_\_\_\_

OTTAWA  
NOVEMBER 1963  
(REVISED EDITION)

OPERATIONS REQUIREMENT FOR BLACK BRANT ROCKET AD-II-44

Falling Probe Electron Density, Electric Field Probe, Cosmic Ray,  
Langmuir Probe, Micrometeorite, and Neutron Detector  
Launch from Churchill Research Range

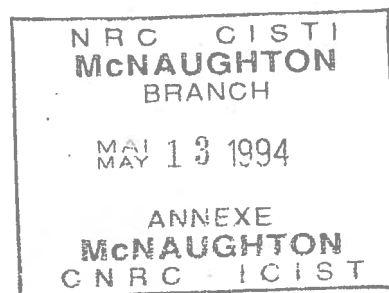
CRR Operations Requirement No. 131

Prepared by: A. Staniforth and K.A. Steele

(Revised Edition)

OTTAWA

APRIL 1964



DDN# 6662652

## FOREWORD

The Operations Requirement is a document prepared by the Range User, describing in detail the requirements at the rocket range to accomplish a specific test or a series of tests in the over all test program. The accepted OR is the established method by which Users obtain support from the Churchill Research Range.

## ABSTRACT

Black Brant Rocket AD-II-44 was instrumented by NRC, the University of Saskatchewan, and the University of Alberta, Calgary, to measure various phenomena associated with auroral activity. The instrumentation included an ejected package equipped for measurement of electron density detail structure by a radio frequency impedance probe method, a second ejected package for measurement of the electric field potential profile, a cosmic ray experiment concerned with the direction of energetic particles associated with auroral activity, Langmuir probe measurements of the fine structure of electron density, acoustic-type micrometeorite detectors, and a neutron detector utilizing the "phoswich" technique for energies in the range 0.2 to 10 Mev. The rocket is to be launched into a visible auroral display under conditions of solunar darkness and no cloud cover. The Operations Requirement states requirements for working space, transport, power, communications, meteorological, and other technical support at the Range. It describes briefly the test and the rocket, and gives details of the telemetry used and the data to be recorded. A detailed User countdown is also included.

15 Feb. 1964

OR

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OR ANNEX CONTROL SHEET

| PAGE<br>NO. | PARA.<br>NO. | INSTRUCTIONS/REMARKS    |
|-------------|--------------|-------------------------|
| 8           | 1.3.2        | Delete item (c).        |
| 12          | 1.6          | Delete para. 2 and add: |

Range User intends to operate two receivers (Nems-Clarke Type 1432) connected to a pair of orthogonally oriented linearly polarized antennas on the Tracker #2 platform. This equipment is intended primarily to yield signal strength data for the purpose of determining the motion of the EFP package. Signal strength (AGC) data from the receivers will modulate two User voltage-controlled subcarrier oscillators for recording on telemetry magnetic tape recorder Track 2. RFOAR is requested to make Tracker #2 platform available, provide 60 cps, 115V power (15 amp. service) at the platform, and provide four coaxial lines, RG-58/U or RG-8/U between the platform and the nose cone assembly area in the Operations Building. All other facilities for this measurement will be provided by Range User.

|    |       |                                                           |
|----|-------|-----------------------------------------------------------|
| 21 | 2.3.1 | Revise "Received Signal Strength on Track 2", as follows: |
|----|-------|-----------------------------------------------------------|

| <u>T/M LINK</u> | <u>ANTENNA</u>                | <u>SUBCARRIER<br/>FREQ.</u> | <u>IRIG<br/>NO.</u> |
|-----------------|-------------------------------|-----------------------------|---------------------|
| #1-219.5 mc     | Range Circ. Pol.<br>CRR Rx #1 | 22 kc                       | 14                  |
| #2-228.0 mc     | Range Circ. Pol.<br>CRR Rx    | 30 kc                       | 15                  |
| #3-231.4 mc     | Range Circ. Pol.<br>User Rx   | 40 kc                       | 16                  |
| #3-231.4 mc     | User Linear "A"<br>User Rx    | 52.5 kc                     | 17                  |
| #3-231.4 mc     | User Linear "B"<br>User Rx    | 70 kc                       | 18                  |

|    |      |                                                            |
|----|------|------------------------------------------------------------|
| 40 | 10.1 | Add Item (7) - Tracker 2 platform for Range User antennas. |
|----|------|------------------------------------------------------------|

COPY NO. \_\_\_\_\_

15 Nov. 1963

OR

## TABLE OF CONTENTS

| <u>PARA. NO.</u> | <u>PARAGRAPH TITLE</u>                      | <u>PAGE NO.</u> |
|------------------|---------------------------------------------|-----------------|
|                  | Title and Signature Page                    | i               |
|                  | Distribution List                           | ii              |
|                  | OR Revision Control Sheet                   | iii             |
|                  | Table of Contents                           | iv              |
|                  | Test Security Classification                | vi              |
| 1.0              | GENERAL INFORMATION                         | 1               |
| 1.1              | Operations Command                          | 1               |
| 1.2              | Range Time Utilization                      | 2               |
| 1.3              | Test Objectives                             | 7               |
| 1.4              | Test Description                            | 8               |
| 1.5              | Test Vehicle Description                    | 9               |
| 1.6              | Range User's Instrumentation                | 12              |
| 1.7              | Summary of Frequency Utilization            | 15              |
| 2.0              | DATA                                        | 16              |
| 2.1              | Metric                                      | 16              |
| 2.2              | Engineering Photography                     | 17              |
| 2.3              | Telemetry                                   | 19              |
| 2.4              | Other Data                                  | 24              |
| 3.0              | METEOROLOGICAL SERVICES                     | 25              |
| 3.1              | Forecasts                                   | 25              |
| 3.2              | Observations                                | 25              |
| 3.3              | Minima                                      | 26              |
| 4.0              | SUPPORT INSTRUMENTATION                     | 27              |
| 4.1              | Communications - General                    | 27              |
| 4.2              | Radio                                       | 27              |
| 4.3              | Wire                                        | 27              |
| 4.4              | Timing                                      | 28              |
| 4.5              | Sequence                                    | 29              |
| 4.6              | Visual Countdown and Status Indicators      | 29              |
| 4.7              | Data Handling                               | 29              |
| 4.8              | Command Control                             | 29              |
| 4.9              | Other Support Instrumentation               | 29              |
| 5.0              | MATERIAL AND SERVICES                       | 30              |
| 5.1              | Services                                    | 30              |
| 5.2              | Vehicles and Ground Handling Equipment      | 31              |
| 5.3 NR           | Propellants, Gases, Chemicals               | 31              |
| 5.4 NR           | Chemical and Physical Analysis              | 31              |
| 5.5 NR           | Bioscience                                  | 31              |
| 5.6              | Test Instrument Maintenance and Calibration | 31              |
| 5.7              | Climatic Clothing Requirements              | 32              |

15 Nov. 1963

OR

TABLE OF CONTENTS (CONTINUED)

| <u>PARA. NO.</u> | <u>PARAGRAPH TITLE</u>          | <u>PAGE NO.</u> |
|------------------|---------------------------------|-----------------|
| 6.0              | TRANSPORTATION LOGISTICS        | 33              |
| 6.1              | Surface                         | 33              |
| 6.2 NR           | Air                             | 34              |
| 7.0              | RECOVERY                        | 35              |
| 8.0              | AIRCRAFT AND SEACRAFT           | 36              |
| 9.0              | DATA PROCESSING AND DISPOSITION | 37              |
| 9.1              | General Information             | 37              |
| 9.2              | Disposition of Data             | 37              |
| 9.3              | Meteorological Data             | 38              |
| 9.4 NR           | Support Instrumentation         | 39              |
| 9.5 NR           | Material and Services Report    | 39              |
| 9.6              | Transportation Reports          | 39              |
| 9.7 NR           | Recovery Reports                | 39              |
| 9.8 NR           | Aircraft Reports                | 39              |
| 10.0             | FACILITIES                      | 40              |
| 10.1             | Facilities - General            | 40              |
| 11.0             | RANGE SAFETY                    | 41              |
|                  | APPENDICES                      | 43              |

15 Nov. 1963

OR

## 1.0 GENERAL INFORMATION

### 1.1 Operations Command

The following personnel will be at the Rocket Facility, Fort Churchill, in connection with this program:

A total of ten Range User personnel (NRC) will work on this program at Fort Churchill.

Two or three representatives from the University of Saskatchewan and one or two representatives from the University of Alberta may be present to assist in experiment preparations.

No visitors are expected at this test.

A list of names with duties and dates of arrival will be forwarded to RFOAR at a later date.

|                   |   |               |
|-------------------|---|---------------|
| Trial Coordinator | - | A. Staniforth |
| Project Scientist | - | D. Johnson    |



15 Nov. 1963

OR

## 1.2 Range Time Utilization

### 1.2.1 Test Duration and Frequency

This OR is for requested support in firing one Black Brant IIA rocket. It is anticipated that Range User equipment and personnel will be at the Rocket Facility for about one month, commencing about March 26th, 1964. Support for living accommodation, transport, equipment and rocket storage, assembly and blockhouse space, power, and communications is requested for this period. Rocket assembly, fin alignment, arming, placing the rocket on the launcher, etc. will be the responsibility of the range contractor. Operation of the Range Telemetry Station and radar may be requested a day or two before the scheduled firing in conjunction with nose cone instrumentation preparation and a complete "dress" rehearsal of the launching.

Day-to-day rescheduling of the launching may be necessary due to weather and other requirements of the vehicle and experiments. Data on vehicle performance and launch restrictions will be made available from CARDE for this particular rocket. This data is based, in part, on information supplied to CARDE by NRC on estimated nose cone weight and C. of G. and nose cone shroud holes and projections. It is understood that a report concerning the Black Brant IIA vehicle originating from CARDE is available to CRR.

Desired experiment conditions are:

- (a) aurora
- (b) darkness, no cloud cover and no moon
- (c) no exceptional solar activity or polar cap absorption event
- (d) during a near pass of the Alouette satellite, if still operating

and are listed in the order of decreasing importance. Absence of (a), (b) and (c) may justify postponement of a scheduled launching. A hold for aurora is desired at T - 3.5 min. with provision for resumption of count on 30 seconds notice.

### 1.2.2 General Countdown

#### TIME

#### FUNCTION/SERVICE

Preparation Phase:

F-7 day                      Rocket motor, fins, igniter, arrive at Fort Churchill via air transport. These parts may

15 Nov. 1963

OR

1.2.2 General Countdown (cont'd.)

| <u>TIME</u> | <u>FUNCTION/SERVICE</u> |
|-------------|-------------------------|
|-------------|-------------------------|

Preparation Phase:

F-7 day (cont'd.)

be shipped several weeks prior to this time. Range requested to unload and transport to launch site storage (6.1.2).

Nose cone, nose cone instrumentation, check-out equipment and nose cone control unit arrive at Fort Churchill. This equipment will be consigned to DRML. DRML is requested to supervise the unloading and arrange to have the equipment transported and stored in the preparation area allotted to this project. (6.1.2)

Range User personnel arrive at Fort Churchill. Accommodation and personnel transportation support requested. (Request for accommodation will be made to DRML.) (5.1.2)

F-6 day

Range User personnel begin setting up check-out equipment and preparation of nose cone instrumentation. Request:

1. Preparation area space (10.1).
2. Blockhouse space (10.1).
3. Transportation (6.1.1).
4. Power (5.1.1).
5. Support for connection of umbilical cable (4.3.3).
6. Communications (4.1).
7. Parallax camera operation (1.6.1).
8. Meteorological services (3.0).
9. Office space at DRML and telephone (10.1).
10. Support for setting up Range User's instrumentation (1.6).

F-1 day

Nose cone preparation complete.  
Move nose cone, payload control console, power supplies, etc., to blockhouse.  
Battery charging complete.  
Install all batteries to payload.  
Complete instrumentation check-out with nose cone shroud off.  
Radar beacon check.  
Rangefinder check.  
Request support of telemetry station, radar, DRML and pad services and engineering for launch "dress rehearsal". (5.1.6)

15 Nov. 1963

OR

1.2.2 General Countdown (cont'd.)

TIME

FUNCTION/SERVICE

Launch Phase: If it is very cold, it is desirable to keep the time between elevation of the launcher and ignition to a minimum. It is understood that minimum motor temperature for launching is 0°F on the engine skin. Heaters will be used in the nose cone payload space as the payload temperature must be kept above 32°F.

T-6:00:00 Final visual inspection of payload and battery check.  
Check complete length of umbilical cable from console in blockhouse to vehicle 50-pin connector with test box.  
Assemble nose cone shroud to payload.  
Pressurize nose cone to 5 p.s.i.g.

T-4:10:00 All Range User personnel on station.

T-4:00:00 Move nose cone to hazardous assembly.

T-3:50:00 Range begin count with Range User.

T-3:40:00 Mount nose cone on motor.  
Remove strippable paint and clean nose cone  
Check pressure of nose cone and pump, if necessary.

T-3:00:00 Vehicle brought to launch bay.

T-2:50:00 Install vehicle on launcher.  
Check that payload control console is disconnected from umbilical.  
Connect umbilical to vehicle.  
Connect motor temperature sensor.  
Connect beacon batteries.  
Attach radioactive source to launch boom near sta. 20 of rocket to test neutron detector.  
Check nose cone pressure and pump if necessary.  
Install access hatch in forward body temporarily.  
Clean nose cone.

T-2:20:00 Clear launch bay for horizontal instrumentation checks:

T-2:15:00 Begin horizontal instrumentation checks.

15 Nov. 1963

OR

1.2.2 General Countdown (cont'd.)

| <u>TIME</u>               | <u>FUNCTION/SERVICE</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Launch Phase<br>(cont'd.) | Link #1 (219.5 Mc) -<br>External power.<br>Discharge batteries to plateau.<br>Internal power.<br>Telemetry note signal condition of SCO's.<br>Check Langmuir Probes with resistance unit<br>(User in launch bay).<br>Check micrometeorite detectors.<br>Check neutron detector.<br>Check cosmic ray altimeter switch to external power.<br>Link #2 (228.0 Mc) -<br>External power.<br>Discharge batteries to plateau.<br>Internal power.<br>Telemetry note signal condition of SCO.<br>Link #3 (231.4 Mc) -<br>External power.<br>Discharge batteries to plateau.<br>Internal power.<br>Telemetry note received signal.<br>External power.<br>Link #1 (219.5 Mc) -<br>Internal power.<br><br>Radar beacon check.<br>Radar interrogate beacon while SCO calibration<br>is done at 0, 2.5 and 5 volts for Link #1.<br>Payload switched to external.<br>All umbilical power off.<br>Telemetry check ground Link #4 (225.7 Mc) from<br>radar site.<br>Install shorting plug (Bellows actuators)<br>Remove safety belts.<br>Final installation of access hatch.<br>T-1:35:00 Horizontal checks completed.<br><br>T-1:00:00 Arm Vehicle.<br><br>T-0:30:00 Elevate Launcher.<br><br>T-0:15:00 Begin vertical instrumentation checks.<br>External power on (warm-up only).<br>Internal power on. |

15 Nov. 1963

OR

1.2.2 General Countdown (cont'd.)

TIME

FUNCTION/SERVICE

T-0:15:00  
(cont'd.)

Check: Main telemetry, Twin Lakes telemetry,  
Radar site Link #2 receiver.

Telemetry note tuning and signal strength of  
receivers and signal condition of SCO's.

Check status of scientific experiments recorded  
by User at Operations Building.

Payload telemetry switched to 2.5 volt calibrate  
for adjustment of telemetry paper recorders.

Telemetry paper recorders record signals for 30  
seconds at 0.4" per second.

Check magnetometer readings and battery monitors.

Check beacon. Radar interrogate beacon.

Payload switched to external, filament power  
and heaters on only. All power off if hold of  
30 minutes or more called.

T-0:08:00

Vertical checks complete. All instrumentation  
stations report status: Telemetry, Radar, Vehicle  
Payload, DRWL, Project Scientist.

T-0:06:00

Automatic hold, check with User Vehicle Controller.  
Indefinite hold, with one minute notice of  
resumption of count.

T-0:05:00

Direct voice count to camera sites begins.

T-0:04:00

External power on to payload filaments, if not  
already on.

T-0:03:30

Hold for aurora, resumption of count on 30 sec.  
notice.

T-0:03:00

Telemetry links turned on internal power and to  
signal input.

Beacon turned on internal power.

Check beacon. Radar interrogate beacon.

Radar check instrumentation for ejected package  
range determination.

Radar and Telemetry check Link #4 (225.7 Mc).

T-0:02:00

Start all instrumentation recorders. T/M acknowledge.  
Commence 2.5 volt calibration.  
Paper recorders on at slow speed.

15 Nov. 1963.

OR

### 1.2.2 General Countdown (cont'd.)

| <u>TIME</u>               | <u>FUNCTION/SERVICE</u>                                                                                                                                                                                 |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Launch Phase<br>(cont'd.) |                                                                                                                                                                                                         |
| T-0:01:35                 | Telemetry switched to 0 volt calibration.                                                                                                                                                               |
| T-0:01:25                 | Telemetry switched to 5 volt calibration.                                                                                                                                                               |
| T-0:01:15                 | Begin 3 cycles of 11-step (0 to 5 volts) calibration on telemetry.                                                                                                                                      |
| T-0:01:00                 | Telemetry switched to signal input and internal calibration.<br>Radar start camera operation.<br>Acknowledge all green on payload control console.<br>Telemetry acknowledge signal conditions of SCO's. |
| T-0:00:40                 | Paper recorders on fast speed.                                                                                                                                                                          |
| T-0:00:00                 | Black Brant IIA rocket ignites.                                                                                                                                                                         |
| T+0:00:20                 | Rocket motor burns out.                                                                                                                                                                                 |
| T+0:00:30                 | Multiplex relay transfer.                                                                                                                                                                               |
| T+0:00:50                 | Ejection of Electron Density Probe Pkg. (Link #2).                                                                                                                                                      |
| T+0:00:60                 | Ejection of Electric Field Probe package (Link #3)                                                                                                                                                      |
| T+0:00:200                | Apogee (approximately 85 miles alt.)                                                                                                                                                                    |
| T+0:00:400                | Impact                                                                                                                                                                                                  |

Apart from initial preparations and checkout, the camera sites at O'Day and Belcher need not be manned, except on those days scheduled for a launching or a complete "dress rehearsal". Helicopter may be required for up to five people and 500 lbs. of equipment.

### 1.3 Test Objectives

#### 1.3.1 Primary

Concerned with measurements in the upper atmosphere:

(a) Measurement of electron density detail structure within an auroral formation by a radio frequency impedance probe method using an ejected package. (University of Saskatchewan)

15 Nov. 1963

OR

### 1.3.1 Primary cont'd.)

(b) Measurement of electric field potential profile using an ejected package carrying its own transmitter and small enough to minimize distortion of the electric field. (University of Saskatchewan)

(c) Cosmic Ray experiment concerned with study of particles associated with auroral activity. (NRC)

(d) Lanmuir Probe measurements of fine structure of electron density and electron energy spectrum inside and outside auroral formations. (NRC)

(e) Micrometeorite Detector - an acoustic type impact counter concerned with impact rates and energy distribution inside and outside major meteor showers and association with auroral activity. (NRC)

(f) Neutron Detector - is designed to measure the intensity of neutrons at high altitude in the energy range 0.2 to 10 Mev. It employs a "phoswich" technique to discriminate between neutrons,  $\gamma$ -rays and charged particles.

### 1.3.2 Secondary

(a) To obtain ejected package (228.0 Mc) range data by use of an S-band receiver in the package.

(b) To test a new magnetic aspect sensor and a cosmic ray altimeter.

(c) To obtain vehicle attitude data from analysis of telemetry signal strength records.

(d) To test a new S-band beacon antenna.

(e) Photometer to indicate periods during which the vehicle is within an auroral formation.

### 1.4 Test Description

The Black Brant IIA rocket AD-II-44 will carry several experiments in its nose cone for scientific investigation of the upper atmosphere. It is desired that the vehicle be launched at an elevation of 85° nominal. There is no preferred launch azimuth. Presumably impact will be into Hudson's Bay. Recovery is not required. The desirable conditions at launching in order of importance are: (a) aurora, (b) darkness, no cloud cover and no moon, (c) no exceptional solar activity or polar cap absorption

15 Nov. 1963

OR

#### 1.4 Test Description (cont'd.)

event, and (d) during a near passage of the Alouette Satellite if still operating. Postponement of the launching may be requested if either of conditions (a), (b) or (c) is not met at a scheduled launch time.

Events of primary importance during flight are :  
----- the ejection of the electron density probe (ED) package at T + 50 seconds, and the ejection of the electric field probe (EFP) package at T + 60 seconds. Other events of interest are motor burnout, apogee and impact. It is requested that sound ranging equipment be used for impact data, although recovery is not required. Range User personnel will man the nose cone instrumentation console in the blockhouse, monitor equipment in the User area in the Operations Building, and the Scientists' Observation platform during the countdown. One or two User personnel will be in the Launch Bay during horizontal instrumentation tests. It is assumed that the parallactic cameras will be operated by DRNL personnel.

#### 1.5 Test Vehicle Description

The Black Brant IIA is a single-stage, solid-propellant, unguided, sounding rocket. This vehicle will be fitted with the Black Brant IIA modified fins.

|                           |   |                                                           |
|---------------------------|---|-----------------------------------------------------------|
| Length                    | - | 332.5 inches (approx.)                                    |
| Diameter                  | - | 17.2 inches                                               |
| Launch weight             | - | 2760 lbs. approx.                                         |
| Weight at burnout         | - | 900 lbs. approx.                                          |
| Propellant                | - | Aluminized single grain polyurethane-ammonium perchlorate |
| Total Impulse (sea level) | - | 380,000 lbs.                                              |
| Motor burning time        | - | 15.5 seconds                                              |
| Guidance                  | - | None - 3 fixed fin stabilization                          |
| Cut-down system           | - | None                                                      |

General performance of the vehicle will be obtained from CARDE. The weight and centre of gravity of the nose cone and payload are furnished by NRC to CARDE, who then calculate vehicle performance. It is understood that RFOAR has a manual on the Black Brant IIA furnished by CARDE. Special instructions concerning the fins fitted on AD-II-44 will be furnished to RFOAR by CARDE.



15 Nov. 1963

OR

### 1.5.1 Complete Vehicle Drawing

#### 1.5.1.1 Vehicle Drawing

See Appendix I.

#### 1.5.1.2 Nose Cone Drawing

See Appendix II.

### 1.5.2 Telemetry Systems

The nose cone telemetry is a PAM/FM/FM system operating at 219.5 mc with 218.0 mc as a possible alternate frequency, 5 watts. The antenna system consists of two quadra-loop radiators mounted 180° apart on the surface of the nose cone at station 91. The polarization is linear.

The electron density package, to be ejected at T+50 seconds, contains a telemetry transmitter operating at 223 mc with one watt power output. Polarization is linear. The package contains one subcarrier oscillator (IRIG Band E, 70 kc) modulated continuously by the electron density experiment data and also by wideband signals to 40 kc for duration of 100 ms at 5 second intervals by the output of an S-band receiver.

The electric field probe package to be ejected at T+60 seconds contains two transmitters of 100 milliwatts output power each. One transmitter is crystal controlled at 231.4 mc and the second varies in frequency with a mean offset of 5 kc from the crystal controlled unit. The measurement information is contained in the magnitude and rate of change of the frequency difference between the two transmitters. Antenna polarization is linear.

Range User will supply a receiver and pre-recording processing equipment for this link in duplicate for use at main telemetry and Twin Lakes. The receiver will be a Defense Electronics TMR-2A to provide both an AM detected signal and a 10 mc IF signal. The 10 mc IF output of the receiver is fed to a converter for conversion to 60 kc. The AM detected signal and the predetection 60 kc signal are then summed for recording on Track 7 of RFOAR telemetry magnetic tape recorders. Filters are incorporated in the converter unit to restrict the frequency range of the two recorded signals to  $5 \text{ kc} \pm 4 \text{ kc}$  and  $60 \text{ kc} \pm 30 \text{ kc}$  for improved signal to noise ratio and reduced interaction between the signals.

15 Nov. 1963

OR

#### 1.5.2 Telemetry Systems (cont'd.)

A ground telemetry link (Link #4) operating at 225.7 mc will be operated between the radar site and the launch site for the purpose of recording radar data on the same tape recorder as the vehicle telemetry links. Further data is given under para. 1.6.

It would be desirable to duplicate all telemetry reception and recording functions whenever possible. Appendix V contains a list of equipment Range User will take to Fort Churchill. Some items, such as receivers, may be made available for operation and under complete control by the RFOAR telemetry station for this program.

Operation of the telemetry facilities at Twin Lakes to duplicate functions at the launch site as much as possible is requested. User will provide amplifiers and subcarrier oscillators for tape recording AGC data at Twin Lakes.

#### 1.5.3 Beacon

RFOAR is requested to provide a DPN-41 radar beacon. Range User will provide space and mounts for the beacon, a box for holding five Yardney Type HR-3 batteries, wiring from the beacon to the batteries and to the umbilical connector (seven conductors), and a pair of quadraloop beacon antennas with coaxial cable to the beacon. Range User will also provide a dual directional coupler for monitoring incident and reflected power to the antenna system. The coupling will be 20 db down. This is a necessary in-flight measurement for evaluation of the new beacon antenna to be tested on this rocket. User will monitor beacon functions on Link #1; see Appendix VIII.

The beacon antennas will be tuned for a beacon transmitter frequency of 2380 mc and beacon receiver frequency of 2310 mc.

It is understood that operation, control, and check-out of the beacon is to be the responsibility of RFOAR.

#### 1.5.4 Command Control/Destruct System

The Black Brant IIA rocket contains no destruct or flight termination system.

#### 1.5.5 Ordnance Items

Characteristics of propellant, igniter, and squib are available in CARDE manual on Black Brant IIA rocket.

15 Nov. 1963

OR

#### 1.5.5 Ordnance Items (cont'd.)

Bellows actuators (squib) are used in the ejection of the EFP and ED packages. These devices are type BA31D2, made by Hercules Powder Company, Wilmington, Delaware.

|                    |                               |
|--------------------|-------------------------------|
| Bridge Resistance: | 5-9 ohms                      |
| Maximum Non-fire:  | 50 ma., one 30 sec. pulse     |
| Minimum Fire:      | 0.3 amp.                      |
| Recommended Fire:  | 1.0 amp.                      |
| Ignition Time:     | 0.25 milliseconds at 1.0 amp. |

The location of these items is shown on the drawing given in Appendix III. The Bellows actuator timer and arming circuit is given in Appendix IV.

#### 1.6 Range User's Instrumentation

The Range User will supply all equipment for check-out and assembly of the nose cone payload.

##### (a) Blockhouse

Range User personnel will operate the control console unit for the payload and will monitor channels IRIG Nos. 1-4 and Nos. 9-13 inclusive of the 219.5 mc link, and also channel E of the 228.0 mc link, in the blockhouse during the launching. Discriminator outputs from the main telemetry station are requested. In addition, Range User will operate a receiver on the 219.5 mc link, a tunable discriminator, a 17-inch display oscilloscope.

RFOAR is requested to have available for Range User's receiver a telemetry antenna on the roof of the blockhouse. The one provided in April 1963 would be suitable.

##### (b) User Area in Operations Building

Discriminator outputs from channels IRIG Nos. 1-4 and Nos. 9-17 inclusive must be available for monitoring, using high impedance instruments, in the User area adjacent to the telemetry station in the Operations Building. These monitors are required by Range User scientific personnel.

In the same area, Range User equipment will receive signal strength data from the EFP and ED ejected packages and will provide an output for recording on Track 2 of the RFOAR telemetry magnetic tape recorders. Range User will provide a set of three telemetry band antennas with vertical, horizontal, and

15 Nov. 1963

OR

## 1.6 Range User's Instrumentation

### (b) User Area in Operations Building (cont'd.)

RH circular polarization for mounting on Tracker #2 platform. The signals from these antennas will be sampled and fed via coaxial cable to a multicoupler and receivers. The separated signal strength data will modulate a set of subcarrier oscillators whose mixed outputs are then recorded on the RFOAR telemetry tape recorders. RFOAR is requested to assist with mounting of the antennas and to provide two coaxial cables, one for receiver input and one for calibration, and a shielded cable of four #20 or larger conductors for synchronizing signals to the multiplexer. A single wire line which will use the shield of the synchronizer wires as return is requested for a User intercom. All equipment for this experiment, concerned with determining ejected package attitude from signal strength data, will be supplied by Range User except cabling to Tracker #2 and a coaxial cable to the telemetry magnetic tape recorder input panel. AGC outputs from the CRR receivers on Links 1 and 2 (one each) are requested to the User subcarrier oscillator panel in the User area for subsequent recording with User signal strength data on magnetic tape track #2.

Range User will provide an S-band antenna for receiving radar transmitted pulses on the roof of the Operations Building. RFOAR is requested to assist with the installation of this antenna and to provide a coaxial cable to connect the antenna to Range User's receiving equipment in the User area adjacent to the telemetry room. This equipment is part of the ejected package range determination experiment. RFOAR is requested to provide a coaxial cable from this equipment to the telemetry magnetic tape recorder input panel for recording on track #1.

See Appendix IX for wire lines into nose cone assembly area.

### (c) Radar Site

Range User desires to have an antenna and receiver for the 228 mc telemetry signal from the electron density package, and a 5-inch oscilloscope with its trace initiated by the radar pulse trigger, all provided by RFOAR at the radar site. The oscilloscopes will display the transponded return of the radar pulse via the 228 mc telemetering link. Range User will provide a camera for photographic recording of the data which will give a measure of the slant range to the ejected package. It is requested that Radar Site personnel check for satisfactory operation of the oscilloscope and receiver, and initiate camera operation at T-1 minute.

15 Nov. 1963

OR

## 1.6 Range User's Instrumentation (cont'd.)

### (d) Ground Telemetry Link

RFOAR is requested to provide a receiver and antennas and operate a telemetry link between the Radar Site and the telemetry station in the Operations Building for the transmission of radar ADR data to be recorded on track 5 of the telemetry magnetic tape recorders. Range User will provide an FM transmitter to operate at 225.7 mc and three sub-carrier oscillators for use at the radar site. User may supply a 5-unit subcarrier oscillator panel so that AGC from all three radars can be recorded via this link.

Data required is to include radar timing ADR data and radar receiver AGC signal.

Block diagrams indicating the above instrumentation systems are included as Appendices VI and VII.

#### 1.6.1 DRNL Instrumentation Support

DRNL will be requested to operate the following equipment prior to and during the launch phase:

- (a) 4" by 5" Rapid Scan Spectrometer, 3000-11,000 Å<sup>2</sup>
- (b) H<sub>β</sub> and other photometers
- (c) 16 mm All Sky Camera
- (d) Flux Gate Magnetometer
- (e) Height-Finding Stations (for aurora)
- (f) Auroral Radar
- (g) Prince Albert Radar (to be arranged by MRC with PARL)
- (h) Ionosonde (4 sweeps per minute from T+0 to T+6 min.)
- (i) 30 mc Polar Riometer (to be arranged by MRC with CRR)
- (j) DRNL will provide magnetic tape of voice countdown
- (k) Provide auroral activity predictions
- (l) Communications for ground instrumentation (launch sight to Belcher and O'Day)
- (m) Communication between DRNL and Prince Albert Radar.

#### 1.7 Summary of Frequency Utilization

- (a) Ground Link: DRNL to Belcher and O'Day radio link.  
DRNL to Prince Albert Radar  
Link #4 - 225.7 mc Radar Site to Operations Building, for ADR data recording.

15 Nov. 1963

OR

1.7 Summary of Frequency Utilization (cont'd.)

(b) Rocket Links:

| <u>Link No.</u> | <u>Freq.</u>                         | <u>Class</u> | <u>Equipment</u> | <u>Location</u>  |
|-----------------|--------------------------------------|--------------|------------------|------------------|
| -               | 2380 mc                              | U            | Radar beacon     | Nose cone        |
| 1               | 219.5 mc or<br>218.0 mc<br>alternate | U            | Telemetry        | Nose cone        |
| 2               | 228 mc                               | U            | Telemetry        | ED Ejected Pkg.  |
| 3               | 231.4 mc or<br>229.0 mc<br>alternate | U            | Telemetry        | EFP Ejected Pkg. |

15 Nov. 1963

OR

## 2.0 DATA

### 2.1 Metric

Coordinate System: cartesian, with origin at base centre of launcher, Z-axis passing through origin and earth centre of gravity. X-axis passing through the origin perpendicular to Z-axis and oriented true North, Y-axis passing through origin and perpendicular to X and Z axes. Positive directions Z, X, Y are up, north and east respectively.

#### 2.1.1 Launch to Impact

| <u>Item</u> | <u>Data</u>                          | <u>Interval</u>      | <u>Data<br/>Points/Sec.</u> | <u>Reduced Data Accuracy</u>          |                                  |                  |
|-------------|--------------------------------------|----------------------|-----------------------------|---------------------------------------|----------------------------------|------------------|
|             |                                      |                      |                             | <u>Class I</u><br>(Plotting<br>Board) | <u>Class II</u><br>(ADR<br>Tape) | <u>Class III</u> |
| 1.          | Position<br>(X,Y,Z)                  | Throughout<br>Flight | 5 from T-O<br>to splash     | 1000 ft.                              | 500 ft.                          | --               |
| 2.          | Velocity<br>( $V_X, V_Y, V_Z, V_S$ ) | Throughout<br>Flight | 5 from T-O<br>to splash     | 1000 ft.                              | 500 ft.                          | --               |

where  $\theta = \arcsine \frac{V(Z)}{V(S)}$

$\phi = \arctangent \frac{V(Y)}{V(X)}$

where  $V_S$  = tangential velocity.

0. Radar data is requested from Lift-off, T -

15 Nov. 1963

OR

### 2.1.2 Impact

Impact coordinates are desired by sound ranging equipment even though recovery is not a requirement.

### 2.2 Engineering Photography

Documentary 16 mm color photography is requested from the arrival time of project personnel. This is to include coverage of payload assembly and checkout as well as the launch phase.

The movie coverage should include the following sequences:

1. Setting up racks in preparation area.
2. Working on nose cone instrumentation with shroud off.
3. Placing shroud on instrumentation.
4. Moving nose cone to Hazardous Assembly.
5. Installing T/M antennas.
6. Assembly to motor.
7. Placing complete vehicle on launcher.
8. Launch.

4 x 5 still photography is requested on call throughout the program for coverage of payload assembly, checkout, and vehicle assembly. One negative of each photograph taken is to be sent to NRC, Radio and Electrical Engineering Division, Attention: Mr. W.L. Haney.

Still photographs, which may include some 35 mm color transparencies, should include the following:

1. Equipment in preparation area.
2. Nose cone instrumentation, shroud off.
3. Nose cone instrumentation, shroud on.
4. Control console in blockhouse.
5. Assembled rocket and motor on dolly.
6. Rocket on launcher, horizontal.
7. Rocket on launcher, vertical.
8. Close up of umbilical cable from launcher boom to vehicle.
9. Equipment at DRNL.
10. Equipment at radar site.
11. NRC antennas on platform near Operations Building.
12. Scientists observation platform.



15 Nov. 1963

OR

2.2 Engineering Photography (cont'd.)

Engineering analysis of the launch phase is not required.

15 Nov. 1963

OR

## 2.3 Telemetry (cont'd.)

| ITEM NO. | LINK FREQ.        | NO. | FREQ.   | DEV. $\pm\%$ | MEASURING RATE | RECORDING INTERVAL | CLASS | ACCURACY $\pm\%$ | REMARKS          |
|----------|-------------------|-----|---------|--------------|----------------|--------------------|-------|------------------|------------------|
| 1        | 219.5 mc<br>FM/FM | 1   | 400 cps | 7.5          | Cont.          | T-0:02 to splash   | I     |                  | )                |
| 2        | 219.5 mc<br>FM/FM | 2   | 560 cps | 7.5          | Cont.          | T-0:02 to splash   | I     |                  | )                |
| 3        | 219.5 mc<br>FM/FM | 3   | 730 cps | 7.5          | Cont.          | T-0:02 to splash   | I     |                  | )                |
| 4        | 219.5 mc<br>FM/FM | 4   | 960 cps | 7.5          | Cont.          | T-0:02 to splash   | I     |                  | )                |
| 5        | 219.5 mc<br>FM/FM | 9   | 3.9 kc  | 7.5          | Cont.          | T-0:02 to splash   | I     | 2%               | ) Event Channels |
| 6        | 219.5 mc<br>FM/FM | 10  | 5.4 kc  | 7.5          | Cont.          | T-0:02 to splash   | I     | 2%               |                  |
| 7        | 219.5 mc<br>FM/FM | 11  | 7.35 kc | 7.5          | Cont.          | T-0:02 to splash   | I     | 2%               |                  |
| 8        | 219.5 mc<br>FM/FM | 12  | 10.5 kc | 7.5          | Cont.          | T-0:02 to splash   | I     | 2%               |                  |
| 9        | 219.5 mc<br>FM/FM | 13  | 14.5 kc | 7.5          | Cont.          | T-0:02 to splash   | I     | 2%               |                  |
| 10       | 219.5 mc<br>FM/FM | 14  | 22.0 kc | 7.5          | Cont.          | T-0:02 to splash   | I     | 2%               |                  |
| 11       | 219.5 mc<br>FM/FM | 15  | 30.0 kc | 7.5          | Cont.          | T-0:02 to splash   | I     | 2%               |                  |
| 12       | 219.5 mc<br>FM/FM | 16  | 40.0 kc | 7.5          | Cont.          | T-0:02 to splash   | I     | 2%               |                  |
| 13       | 219.5 mc<br>FM/FM | 17  | 52.5 kc | 7.5          | Cont.          | T-0:02 to splash   | I     | 2%               |                  |

15 Nov. 1963

OR

## 2.3 Telemetry (cont'd.)

| ITEM NO. | LINK FREQ.            | NO. | FREQ.   | DEV. $\pm\%$ | MEASURING RATE | RECORDING INTERVAL | CLASS | ACCURACY $\pm\%$ | REMARKS                                        |
|----------|-----------------------|-----|---------|--------------|----------------|--------------------|-------|------------------|------------------------------------------------|
| 14       | 219.5 mc<br>PAI/FM/FM | 13  | 70.0 kc | 7.5          | 300/sec.       | T-0:02 to splash   | I     | 2%               | Commutated Channel, 30 x 10 per sec.           |
| 15       | 228 mc<br>FM/FM       | E   | 70.0 kc | 15           | Cont.          | T-0:02 to splash   | I     | 2%               | Transmitter in ED ejected pkg.                 |
| 16       | 231.4 mc<br>AM        | -   | -       | -            | Cont.          | T-0:02 to splash   | I     | 2%               | Transmitter in EFP ejected pkg.                |
| 17       | 225.7 mc<br>FM/FM     | 14  | 22 kc   | -            | Cont.          | T-0:02 to splash   | I     | )                | Ground Link: Radar site to Operations Building |
| 18       | 225.7 mc<br>FM/FM     | 15  | 30 kc   | -            | Cont.          | T-0:02 to splash   | I     |                  |                                                |
| 19       | 225.7 mc<br>FM/FM     | 16  | 40 kc   | -            | Cont.          | T-0:02 to splash   | I     |                  |                                                |
| 20       | 225.7 mc<br>FM/FM     | 17  | 52.5 kc | -            | Cont.          | T-0:02 to splash   | I     |                  |                                                |
| 21       | 225.7 mc<br>FM/FM     | 18  | 70 kc   | -            | Cont.          | T-0:02 to splash   | I     |                  |                                                |

15 Nov. 1963

OR

### 2.3.1 Recordings

The following recordings on magnetic tape are requested: (From T-0:02:00 to splash)

| <u>Track</u> | <u>Record</u>                                                            |
|--------------|--------------------------------------------------------------------------|
| 1            | IRIG Timing Format "B" and "C" and received radar pulse                  |
| 2            | Receiver Signal Strength                                                 |
| 3            | Nose Cone Telemetry Link #1 (219.5 mc)                                   |
| 4            | Electron Density Package Telemetry Link #2 (228 mc)                      |
| 5            | Voice Countdown, Tape Servo reference, and Radar Data from 225.7 mc link |
| 6            | Nose cone Telemetry Link #1 (219.5 mc)                                   |
| 7            | EFP Package Telemetry Link #3 (231.4 mc)                                 |

The tape servo reference to be recorded on Track 5 should be a 17 kc square wave, modulated 50% by a precision 60 cps supply. A 100 kc sinusoidal reference is to be recorded on Track 6 with the nose cone telemetry signal.

Two timing signals are requested:

- (a) standard time, Format B, with a 1 kc carrier
- (b) standard time, Format C, with a 100 cps carrier

First motion is to be indicated by an increase in amplitude of the timing signals (level increased by three times).

The signal strength information of the 219.5 mc link and the 228 mc link is to be recorded from T-0:02:00 to impact. This will be recorded on Track 2 as FM information, using a set of voltage-controlled subcarrier oscillators supplied by the Range User.

#### RECEIVED SIGNAL STRENGTH ON TRACK 2

| <u>T/M Link</u> | <u>Antenna</u>                   | <u>Subcarrier Freq.</u> | <u>IRIG No.</u> |
|-----------------|----------------------------------|-------------------------|-----------------|
| #1-219.5 mc     | User Circular Pol.               | 3.9 kc                  | 9               |
| "               | User Horizontal Pol.             | 5.4 kc                  | 10              |
| "               | User Vertical Pol.               | 7.35 kc                 | 11              |
| #2-228.0 mc     | User Circular Pol.               | 10.5 kc                 | 12              |
| "               | User Horizontal Pol.             | 14.5 kc                 | 13              |
| "               | User Vertical Pol.               | 22.0 kc                 | 14              |
| #3-231.4 mc     | User Circular Pol.               | 30.0 kc                 | 15              |
| "               | User Horizontal Pol.             | 40.0 kc                 | 16              |
| "               | User Vertical Pol.               | 52.5 kc                 | 17              |
| "               | Range Circular Pol.<br>(User Rx) | 70.0 kc                 | 18              |

15 Nov. 1963

OR

### 2.3.2 Special Requirements

Real time paper records of the following channels is requested.

| ITEM NO.                      | S.C.O. FREQ.  | DATA FREQ. (cps)           | PAPER RATE (in./sec.) | RECORD INTERVAL (sec.) | DATA                                          |
|-------------------------------|---------------|----------------------------|-----------------------|------------------------|-----------------------------------------------|
| <u>219.5 Mc FM/FM Link #1</u> |               |                            |                       |                        |                                               |
| 1                             | 400 cps       | 5                          | 0.4                   | T-2 to Impact          | EFP ejection                                  |
| 2                             | 560 cps       | 5                          | 0.4                   | T-2 to Impact          | ED ejection                                   |
| 3                             | 730 cps       | 5                          | 0.4                   | T-2 to Impact          | Pressure/50K Alt. Sw.                         |
| 4                             | 960 cps       | 5                          | 0.4                   | T-2 to Impact          | Multiplex Relays                              |
| 5                             | 3.9 kc        | 10                         | 2                     | T-2 to Impact          | Neutron Detector 1                            |
| 6                             | 5.4 kc        | 81                         | 2                     | T-2 to Impact          | Neutron Detector 2                            |
| 7                             | 7.35 kc       | 110                        | 2                     | T-2 to Impact          | ED Sawtooth/Magnetometer                      |
| 8                             | 10.5 kc       | 160                        | 2                     | T-2 to Impact          | ED Oscillator/Pl. Pr. Sawtooth                |
| 9                             | 14.5 kc       | 220                        | 2                     | T-2 to Impact          | Neutron Detector 3                            |
| 10                            | 22.0 kc       | 330                        | 2                     | T-2 to Impact          | ED R.F./Planar Probe #1 AC                    |
| 11                            | 30.0 kc       | 450                        | 2                     | T-2 to Impact          | Planar Probe #2 DC                            |
| 12                            | 40.0 kc       | 600                        | 2                     | T-2 to Impact          | Planar Probe #2 AC                            |
| 13                            | 52.5 kc       | 790                        | 10                    | T-2 to Impact          | Cosmic Ray Pitch Angle Unit                   |
| 14                            | 70.0 kc       | Commutator<br>30 x 10/sec. | 10                    | T-2 to Impact          | All commutated data.                          |
| <u>Ground Telemetry</u>       |               |                            |                       |                        |                                               |
| 15                            | Direct Record | 50                         | 0.4                   | T-2 to Impact          | Signal Strength 219.5 mc Link #1              |
| 16                            | Direct Record | 50                         | 0.4                   | T-2 to Impact          | Signal Strength 223.0 mc Link #2              |
| 17                            | Direct Record | 50                         | 0.4                   | T-2 to Impact          | Signal Strength 231.4 mc Link #3              |
| <u>223.0 Mc FM/FM Link #2</u> |               |                            |                       |                        |                                               |
| 18                            | 70.0 kc       | 1000                       | 2                     | T-2 to Impact          | Electron Density Data from<br>Ejected Package |

(continued)

15 November 1964

OR

### 2.3.2 Special Requirements (Cont'd.)

Real time paper records of the following channels is requested.

| ITEM<br>NO. | S.C.O.<br>FREQ. | DATA FREQ.<br>(cps) | PAPER RATE<br>(in./sec.) | RECORD<br>INTERVAL<br>(sec.) | DATA |
|-------------|-----------------|---------------------|--------------------------|------------------------------|------|
|-------------|-----------------|---------------------|--------------------------|------------------------------|------|

Note: Group 1 - Items 1, 2, 3, 4, 15, 16 and 17 may be recorded, each equal displacement, on one paper tape.

Group 2 - Items 5, 6, 9 and 13 are desired on one paper record, each equal displacement.

Group 3 - Items 8, 7, 10, 11 and 12 are requested on one real time paper record, each equal displacement.

Group 4 - Items 13 and 14 are requested on one real time paper record, each equal displacement.

Items 15 and 16 to be Range Receivers. Item 17 to be User Receiver.

Paper records at 4 inches per second or slower should include timing Format C and those at faster than 4 inches per second should have timing Format B.

Range User will provide a decommutator to be used at the Launch T/M Station. CRR is requested to provide an eight channel Sanborn recorder for recording seven commutator functions on the 70.0 kc channel of the 219.5 mc link and IRIG timing "C" in real time. User will supply an operator for the decommutator.

See Appendix X for additional playback record requirements.

15 Nov. 1963

OR

### 2.3.2 Special Requirements (cont'd.)

#### Calibration

(a) 219.5 mc link: The event channels, IRIG Nos. 1-4, should be calibrated in terms of a 0 to 5 volt signal for  $\pm 7.5\%$  deviation (0 volts corresponds to a  $+7\frac{1}{2}\%$  deviation and +5 volts to  $-7\frac{1}{2}\%$  deviation).

The calibration on the subcarrier oscillators including the 3.9 kc unit and higher is 0 to 5 volts for a  $\pm 6.75\%$  deviation. (Zero level corresponds to  $+6.75\%$  deviation and +5 volts to  $-6.75\%$  deviation.) A Zener diode reference of +5 volts is connected to channel 2 of the commutator on the 70 kc subcarrier oscillator. This reference is also applied at 10-second intervals to the 10.5 kc, 14.5 kc, 22.0 kc, 30.0 kc, and 40 kc subcarrier channels by a calibrator unit in the nose cone.

(b) 228 mc link: This link with the ejected package has a single subcarrier oscillator on 70.0 kc, the calibration of which is 0 to 5 volts for a  $\pm 15\%$  deviation.

(c) Signal strength: Calibration of the CRR receivers on the 219.5 mc and 228.0 mc links is requested in terms of 0 to 1 millivolt, applied to the pre-amplifier input. The telemetry report should include details such as receiving antenna type, gain, and polarization, pre-amplifier and/or multicoupler gain, and diversity combiner characteristics (if used). Calibration is requested post-flight to coincide with radar AGC calibration and User signal strength calibration.

#### 2.4 Other Data

Other data collected includes photographs from the parallax cameras of the star field and light on the rocket nose cone, and other records furnished by DRNL in reduced form. This data does not require processing or reduction by RFOAR.

Range User personnel assigned to instrumentation sites are as follows:

| <u>NAME</u> | <u>SECURITY<br/>CLEARANCE</u> | <u>PURPOSE</u> | <u>PLACE</u> |
|-------------|-------------------------------|----------------|--------------|
|-------------|-------------------------------|----------------|--------------|

(Names, location and duties of Range User personnel will be supplied at a later date.)

15 Nov. 1963

OR

### 3.0 METEOROLOGICAL SERVICES

#### 3.1 Forecasts

Data concerning launching restriction due to weather conditions may be obtained from CARDE. The following information is requested for planning and operational purposes (concerning the nose cone payload). This information should be presented to the Range User Trial Coordinator who will be responsible for informing all Range User personnel in the Fort Churchill area. DRNL should keep the personnel at the outlying camera sites informed of anticipated weather conditions.

##### 3.1.1 Long Range

3-5 day outlook of general weather conditions, particularly temperature, wind, and cloud cover.

##### 3.1.2 Planning

30-72 hour forecasts (wind, cloud cover, temperature).

##### 3.1.3 Operational

30 hour or less forecasts (wind, cloud cover, temperature). It is requested that the RFOAR meteorologist be available for consultation from T-12 hours to launch.

#### 3.2 Observations

Rawinsonde data on wind, temperature, humidity, pressure and density is requested as close to the firing time and launch site as possible. Standard surface measurement of wind velocity, temperature and pressure are also requested commencing at T-6 hours at one-hour intervals.

It is likely that wind data will be requested to at least 2000 feet at hourly intervals from T-6 to launching for use of Range wind predictor and Range Safety Officer.



15 Nov. 1963

OR

### 3.3 Minima

The camera sites at O'Day and Belcher must be clear of cloud cover and ground haze for a clear view of the aurora. It is essential that visibility be at least 7 miles, and that the aurora be visible from the launch site and camera sites at launch time.

15 Nov.1963

OR

#### 4.0 SUPPORT INSTRUMENTATION

##### 4.1 Communications - General

Intercom communications (User net) are requested between the preparation area, project scientists' observation station, blockhouse, hazardous assembly, launch bay, and DRNL. It is understood that DRNL will provide communication by SSB to the camera sites at Belcher and O'Day. DRNL is also requested to provide radio communication with PARL.

A User hard line is requested between the blockhouse and two locations in the Operations Building: (a) the Project Scientists' observation station, and (b) the User preparation area adjacent to the telemetry station. This will be used primarily for conferences between the Project Scientist and the User Vehicle Controller.

None of the transmissions need be recorded.

##### 4.2 Radio

The Frequency Control and Analysis Facility should be available to monitor radio frequency transmissions during the test.

##### 4.3 Wire

###### 4.3.1 MOPS

It is requested that a loudspeaker on the missile operations intercom should be located near the checkout and control console provided by the Range User. A clock or digital display of the countdown time is also requested near the control console and in the User area in the Operations Building and the observation station. Wire communication with DRNL is required for relaying the countdown to the camera sites from T-5 minutes to the termination of the voice count.

A wire line to DRNL is requested for transmission of Range timing for time correlation of ground measurements made by DRNL with vehicle data.

15 Nov. 1963

OR

#### 4.3.2 Telephone

Telephones for Range User personnel are requested at the following locations:

- a) DRNL
- b) User Preparation Area in Operations Building
- c) Project Scientists' Station
- d) User Area in Blockhouse.

Charges for long distance service will be borne by the Range User.

#### 4.3.3 Umbilical Cable

It is understood that the cabling from the blockhouse to the Universal Launcher consists of 70 No. 16 conductors and 70 No. 6 conductors for nose cone instrumentation monitoring and control by Range User as well as 40 No. 6 conductors for use by RFOAR for radar beacon and Dovap transponder control and monitoring. Range User will supply junction boxes for use at each end of the RFOAR umbilical cable system for connection to the User control console and to the vehicle pull-away connector. Each of these junction boxes will contain a patch board panel to allow rapid changes to be made in umbilical connections for different rockets.

#### 4.4 Timing

Timing on the magnetic tape records is requested to be:

- a) IRIG Format "B", 100 pps with a 1 kc carrier, and
- b) IRIG Format "C", 2 pps with a 100 cps carrier.

First motion is to be indicated by an increase in the amplitude of the timing pulses. It is assumed that timing commences with calibration at T - 0:02.

Timing Format C is requested on all paper records at 4 inches per second or slower. Timing Format B is requested on all paper records at 4 inches per second or higher.

15 Nov. 1963

OR

#### 4.5 Sequence

| NO. | FUNCTION       | INTERVAL |      | REMARKS |
|-----|----------------|----------|------|---------|
|     |                | START    | STOP |         |
| 1   | Ignition Pulse | T-0      | -    | -       |

#### Voice Countdown

The voice time count is requested at each minute from T-00:05:00 to T-00:01:00, at 10-second intervals from T-00:01:00 to T-00:00:10, at 1-second intervals from T-00:00:10 to T+00:00:10, and at 10-second intervals from T+00:00:10 to splash. Voice countdown is also required at 1 second intervals from T + 0:00:45 to T + 0:01:05.

#### 4.6 Visual Countdown and Status Indicators

| NO. | FUNCTION TO<br>BE DISPLAYED | TYPE<br>INDICATOR              | INTERVAL    |               | REMARKS                                                                                                                                                                                |
|-----|-----------------------------|--------------------------------|-------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                             |                                | START       | STOP          |                                                                                                                                                                                        |
| 1   | Range Countdown             | Clock,<br>digital<br>preferred | T-6<br>hrs. | T+10<br>mins. | To be easily viewed<br>from payload<br>control console.<br>Same facility<br>desired in nose<br>cone preparation<br>area, in Operations<br>Building and Project<br>Scientist's Station. |

#### 4.7 Data Handling

Range User will obtain all data produced by the CRR from Detachment #2, USAF/OAR, Fort Churchill.

#### 4.8 Command Control

No command control or destruct system will be used.

#### 4.9 Other Support Instrumentation

It is requested that sound ranging equipment be used to determine impact coordinates. Recovery is not required.

15 Nov. 1963

OR

## 5.0 MATERIAL AND SERVICES

### 5.1 Services

#### 5.1.1 Power

115V, 60 cps power is requested in assembly area and blockhouse. This should consist of one 30 amp. service outlet and three 15 amp. outlets. Each service is to be independently fused.

#### 5.1.2 Food Services

Ten NRC personnel will require food services for approximately one month. DRNL will be requested to arrange for this service and accommodation.

#### 5.1.3 Fire Protection

No additional fire protection services are anticipated in excess of normal.

#### 5.1.4 Medical Service

None required in excess of normal.

#### 5.1.5 Guards and Security - NR

#### 5.1.6 Pad Services and Engineering

A complete "dress rehearsal" of the launching is requested on the day previous to the scheduled firing. This will include installing the rocket on the launcher, performing all payload checks, and testing of all communications. All personnel and services involved in an actual launching should be involved in this system test.

#### 5.1.7 Water - NR

#### 5.1.8 Survey

Belcher and O'Day height finding stations relative to launcher.

15 Nov. 1963

OR

#### 5.1.9 Air

A supply of clean, dry air to pressurize the conical section of the nose cone to about 5 p.s.i.g. is requested to be available in the hazardous assembly. The fitting on the nose cone will be similar to that used on automobile tires. The Range User will supply a suitable pressure gauge.

### 5.2 Vehicles and Ground Handling Equipment

#### 5.2.1 Vehicles

The rocket and all necessary hardware will be supplied to RFOAR by NRC or CARDE.

#### 5.2.2 Ground and Heavy Equipment

RFOAR should supply suitable dollies and lifting equipment for movement of the motor and complete rocket in the assembly area and at the launcher.

#### 5.2.3 Search Lights and Floodlights - NR

#### 5.2.4 Other Equipment

RFOAR is requested to supply equipment for, and obtain all up weight and centre of gravity of the nose cone and of the complete vehicle. This may be done during the launch "dress rehearsal"

### 5.3 Propellants, Gases, Chemicals - NR

### 5.4 Chemical and Physical Analysis - NR

### 5.5 Bioscience - NR

### 5.6 Test Instrument Maintenance and Calibration

RFOAR is requested to supply the calibration for the signal strength records (AGC) of the 219.5 mc and 228.0 mc links and the radar AGC. Radar AGC data may be calibrated in terms of relative db (although desirable, absolute calibration is not essential).

15 Nov. 1963

OR

### 5.7 Climatic Clothing Requirements

DRNL will be requested to supply the climatic clothing requirements of Range User personnel.

15 Nov. 1963

OR

## 6.0 TRANSPORTATION LOGISTICS

DRNL is requested to inform W.L. Haney by Telex of the arrival of check-out equipment at CRR.

### 6.1 Surface

#### 6.1.1 Personnel

On occasion, Range User personnel may wish to use the bus service provided by the Range Contractor for transport of range personnel to and from the launch site.

DRNL will be requested for the loan of two station wagons or panel trucks for the full-time use of the User personnel attached to this program. Drivers will have DND operator's permits.

RFOAR is requested to have two bicycles available at the blockhouse for use by Range User personnel proceeding to and from Hazardous Assembly and the Launch Bay.

#### 6.1.2 Cargo

DRNL is requested to provide for the unloading and transport to the Range of the nose cone and check-out equipment. RFOAR is requested to provide for the unloading and transport to the range of the motor and fin assembly. The motor and fin assembly will arrive at Fort Churchill by air transport. Other equipment will probably arrive by air but may be shipped by rail.

It is assumed that any special equipment, such as may be required for vehicle assembly, fin alignment, etc., will be supplied by CARDE.

a) Motor in crate: 3000 lbs., 24 in. x 30 in. x 17 ft.

b) Fin assembly in crate: 300 lbs.

c) Check-out equipment: Estimate is for about 60 wooden boxes, each weighing between 20 and 200 lbs. Total weight about 6000 lbs.

d) Nose cone and payload in crate: Approximately 350 lbs., 24 in. x 24 in. x 10 ft.



15 Nov. 1963

OR

6.1.2 Cargo (Cont'd.)

Item (c) includes equipment used in other launch programs sponsored by NRC during the same time period.

Item (d) will arrive at Fort Churchill by air about F-7 on the same plane as the main group of Range User personnel.

DRNL is requested to provide for loading and transport of User check-out equipment to railway depot at conclusion of rocket firings.

6.2 Air - NR.

15 Nov. 1963

OR

## 7.0 RECOVERY

No recovery is required.

15 Nov. 1963

OR

#### 8.0 AIRCRAFT AND SEACRAFT

A helicopter for up to five men and as much as 500 lbs. of equipment may be required for transport to Belcher and O'Day.

15 Nov. 1963

OR

## 9.0 DATA PROCESSING AND DISPOSITION

### 9.1 General Information

After the one-year period of retention, all raw data is to be released to NRC (Radio & Electrical Engineering Division, Attention: Mr. W.L. Haney).

After the two years retention period, all file copies of the Flight Test Report are to be released to NRC (Radio and Electrical Engineering Division, Attention: Mr. W.L. Haney).

If all NRC personnel have departed from the range before data is available, data should be forwarded to NRC (Radio and Electrical Engineering Division, Attention: Mr. W.L. Haney).

### 9.2 Disposition of Data

| <u>ITEM NO.</u>          | <u>DESCRIPTION</u>                                                         | <u>ORIG.</u> | <u>CYS.</u> | <u>TIME REQUIRED</u> | <u>FINAL RECIPIENT</u> | <u>AGENCY TO PICK UP DATA</u> | <u>TYPE OF PRESENTATION</u> | <u>REMARKS</u> |
|--------------------------|----------------------------------------------------------------------------|--------------|-------------|----------------------|------------------------|-------------------------------|-----------------------------|----------------|
| 9.2.1 Metric Data        |                                                                            |              |             |                      |                        |                               |                             |                |
| 9.2.1.1 Launch to Impact |                                                                            |              |             |                      |                        |                               |                             |                |
| 1                        | Position                                                                   | 1            | 1           | T+6H                 | CARDE                  | NRC                           | R-PLOT                      | } note (a)     |
|                          |                                                                            | 1            | 1           | T+6H                 | NRC                    | NRC                           |                             |                |
| 2                        | Position,<br>Velocity,<br>Trajectory Angles<br>(X,Y,Z,VX,VY,VZ,<br>VS,θ,φ) |              | 5           | T+30 CD              | NRC                    | NRC                           | } F-TRPT<br>and<br>F-PLOT   | } note (b)     |
|                          |                                                                            |              | 1           | T+30 CD              | CARDE                  | NRC                           |                             |                |
|                          |                                                                            |              |             |                      |                        |                               |                             |                |
|                          |                                                                            |              |             |                      |                        |                               |                             |                |
| 9.2.1.2 Impact           |                                                                            |              |             |                      |                        |                               |                             |                |
| 3                        | Impact<br>Coordinates                                                      |              | 1           | T+10                 | CARDE                  | NRC                           | } F-FRPT                    |                |
|                          |                                                                            |              | 1           | T+10                 | NRC                    | NRC                           |                             |                |

Note (a) - Real time plotting board data of range, azimuth, and elevation is requested.

(b) - This report should include tabulated data and plots of position, velocity, and trajectory angles with time. The method of smoothing data should be explained.

15 Nov. 1963

CR

9.2 Disposition of Data (cont'd.)

| ITEM NO.                     | DESCRIPTION                                                                            | ORIG. | CYS.   | TIME REQUIRED | FINAL RECIPIENT | AGENCY TO PICK UP DATA | TYPE OF PRESENTATION | REMARKS       |
|------------------------------|----------------------------------------------------------------------------------------|-------|--------|---------------|-----------------|------------------------|----------------------|---------------|
| 9.2.2 Photography            |                                                                                        |       |        |               |                 |                        |                      |               |
| 4                            | Still Photos and Documentary Film                                                      |       | 1      | T+15          | NRC             | NRC                    | R-PHOTO              | Note (c)      |
| 9.2.3 Telemetry              |                                                                                        |       |        |               |                 |                        |                      |               |
| 9.2.3.1 Recording            |                                                                                        |       |        |               |                 |                        |                      |               |
| 5                            | Magnetic tape                                                                          | 1     |        | T+5 CD        | NRC             | NRC                    | R-MAGT               | 5.2.1.1(3)    |
|                              | recording of                                                                           |       | 1      | T+5 CD        | NRC             | NRC                    | R-MAGT               | 5.2.1.2(3)    |
|                              | telemetry data                                                                         | 1     |        | T+5 CD        | NRC             | NRC                    | R-MAGT               | 5.3.1.3(3)    |
| 9.2.3.2 Special Requirements |                                                                                        |       |        |               |                 |                        |                      |               |
| 6                            | Real time paper records                                                                | 1     |        | T+12 H        | NRC             | NRC                    | R-GRAF               | Groups 1 to 4 |
|                              | Playback paper                                                                         | 1     |        | T+2           | NRC             | NRC                    | R-GRAF               | See Appendix  |
| 9.2.4 Other Data - DRNL      |                                                                                        |       |        |               |                 |                        |                      |               |
| 7                            | Magnetic recording of voice countdown, Records and reduced data from DRNL observations | 1     |        | T+15CD        | NRC             | NRC                    | F-FRPT and R-MAGT    |               |
| 9.3 Meteorological Data      |                                                                                        |       |        |               |                 |                        |                      |               |
| 8                            | Report on all requested observations                                                   | 1     | 1<br>3 | T+15<br>T+15  | CARDE<br>NRC    | NRC<br>NRC             | } F-FRPT             |               |

Note (c) - One negative of all photos (still and movie documentary) and one copy of the processed documentary are requested.

15 Nov. 1963

OR

9.2 Disposition of Data (cont'd.)

| <u>ITEM</u><br><u>NO.</u> | <u>DESCRIPTION</u> | <u>ORIG.</u> | <u>CYS.</u> | <u>TIME</u><br><u>REQUIRED</u> | <u>FINAL</u><br><u>RECIPIENT</u> | <u>AGENCY TO</u><br><u>PICK UP DATA</u> | <u>TYPE OF</u><br><u>PRESENTATION</u> | <u>REMARKS</u> |
|---------------------------|--------------------|--------------|-------------|--------------------------------|----------------------------------|-----------------------------------------|---------------------------------------|----------------|
|---------------------------|--------------------|--------------|-------------|--------------------------------|----------------------------------|-----------------------------------------|---------------------------------------|----------------|

9.3 Meteorological Data (cont'd.)

|   |                                                  |  |   |         |     |     |        |  |
|---|--------------------------------------------------|--|---|---------|-----|-----|--------|--|
| 9 | Final report<br>on all requested<br>observations |  | 3 | T+30 CD | NRC | NRC | F-FRPT |  |
|---|--------------------------------------------------|--|---|---------|-----|-----|--------|--|

9.4 Support Instrumentation - NR

9.5 Material and Services Report - NR

9.6 Transportation Reports

|    |                                  |  |   |      |     |     |        |                                                  |
|----|----------------------------------|--|---|------|-----|-----|--------|--------------------------------------------------|
| 10 | Receiving and<br>Shipping Report |  | 1 | T+30 | NRC | NRC | F-FRPT | All equipment<br>in and out of<br>Fort Churchill |
|----|----------------------------------|--|---|------|-----|-----|--------|--------------------------------------------------|

9.7 Recovery Reports - NR

9.8 Aircraft Reports - NR

15 Nov. 1963

OR

## 10.0 FACILITIES

### 10.1 Facilities - General

(1) Storage for equipment crates of about 200 sq. ft. area by 8 ft. high. It is requested that no Range User equipment be stored where the equipment temperature may become lower than 0°F.

(2) Preparation area of about 300 sq. ft. for nose cone assembly and check-out.

(3) Hazardous storage for the motor, igniter and squib is requested.

(4) About 100 square feet of space is requested in the blockhouse for the payload checkout console and associated equipment (power supplies, battery chargers, receiver, discriminators, display oscilloscopes, etc.).

(5) Office space and telephone at DRNL.

(6) An observation station beside the Operations Building for use of the Project Scientist. A telephone, an intercom on the User net, and a hard line to the User area in the blockhouse are desired at this station, also a digital clock of range countdown.

These facilities are requested for the period March 26th to April 20th, 1964.

15 Nov. 1963

OR

## 11.0 RANGE SAFETY

RFOAR is responsible for all range safety.



CLASSIFICATION

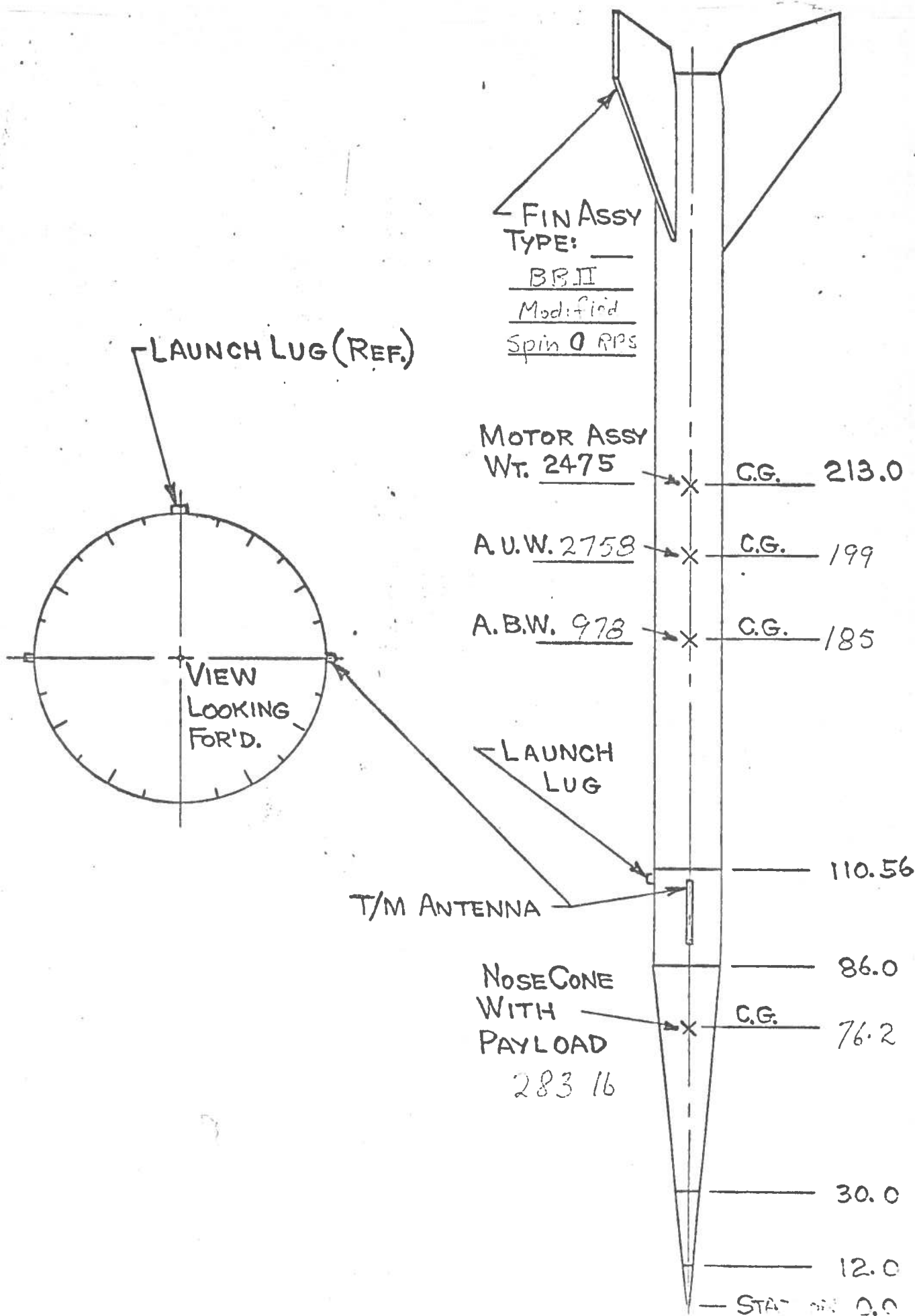
This document is Unclassified.

RF

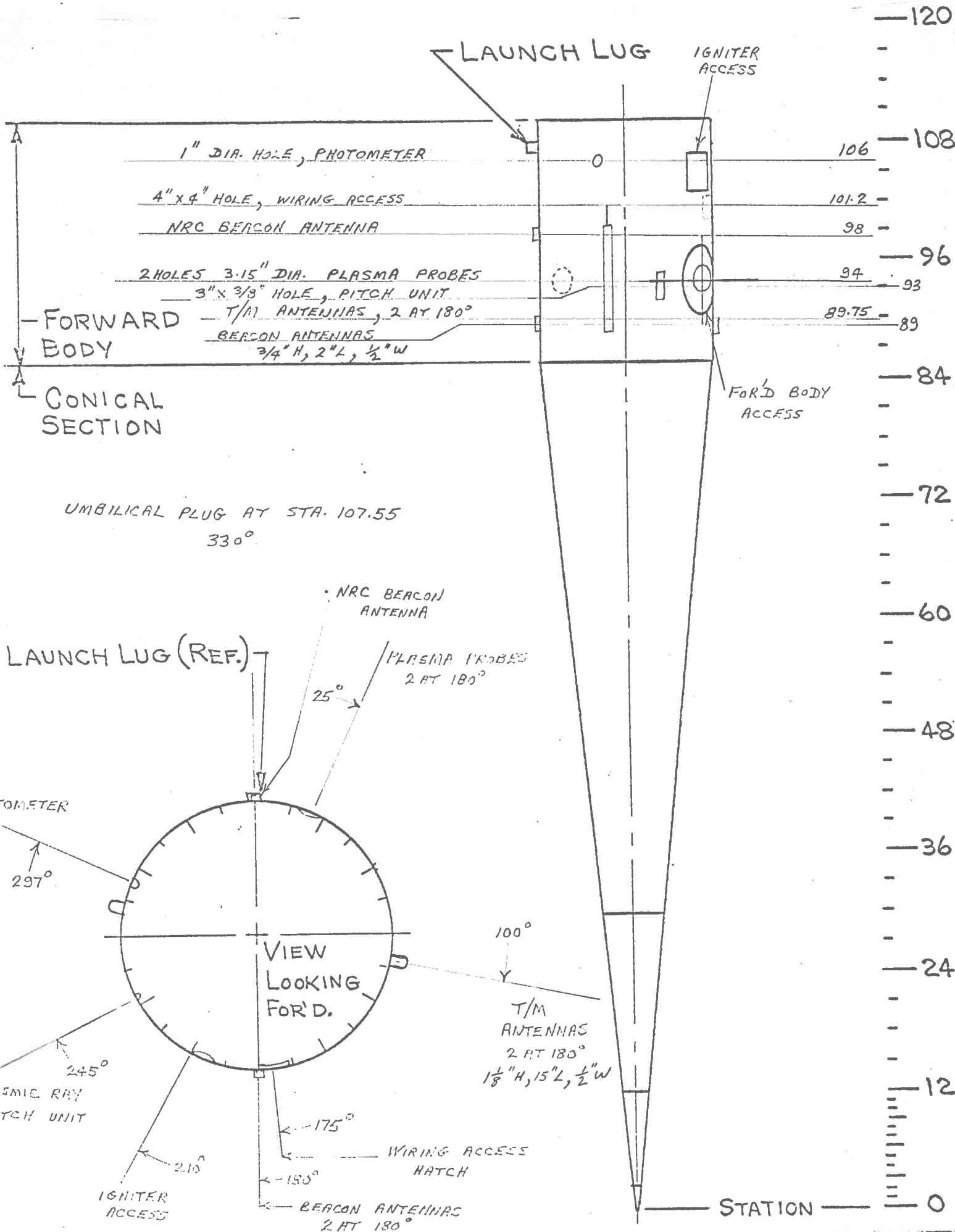
## APPENDICES

- I. Vehicle Drawing
- II. Nosecone Drawing
- III. Ordnance Items Location Drawing
- IV. Squib Firing Circuit
- V. Range User Equipment List, Sheets 1 and 2
- VI. Monitor and Control System Diagram
- VII. Range User Support Instrumentation Diagram, Sheets 1,2,3.
- VIII. Beacon Monitor Functions on Link #1.
- IX. Wire Lines to Nose Cone Assembly Area adjacent to Launch T/M Station.
- X. Playback Paper Record Requirements.

# APPENDIX I



# APPENDIX II



APPENDIX III

LAUNCH LUG

6.5" DIA. HOLE, EDP PACKAGE

4" DIA. HOLE, EFP PACKAGE

100.2

94.5

FORWARD  
BODY

CONICAL  
SECTION

LAUNCH LUG (REF.)

VIEW  
LOOKING  
FOR'D.

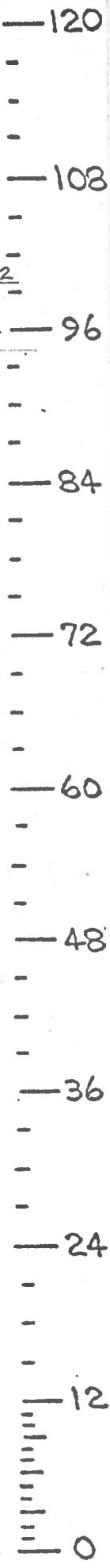
240°

EDP PACKAGE  
2 BELLOWS  
ACTUATORS

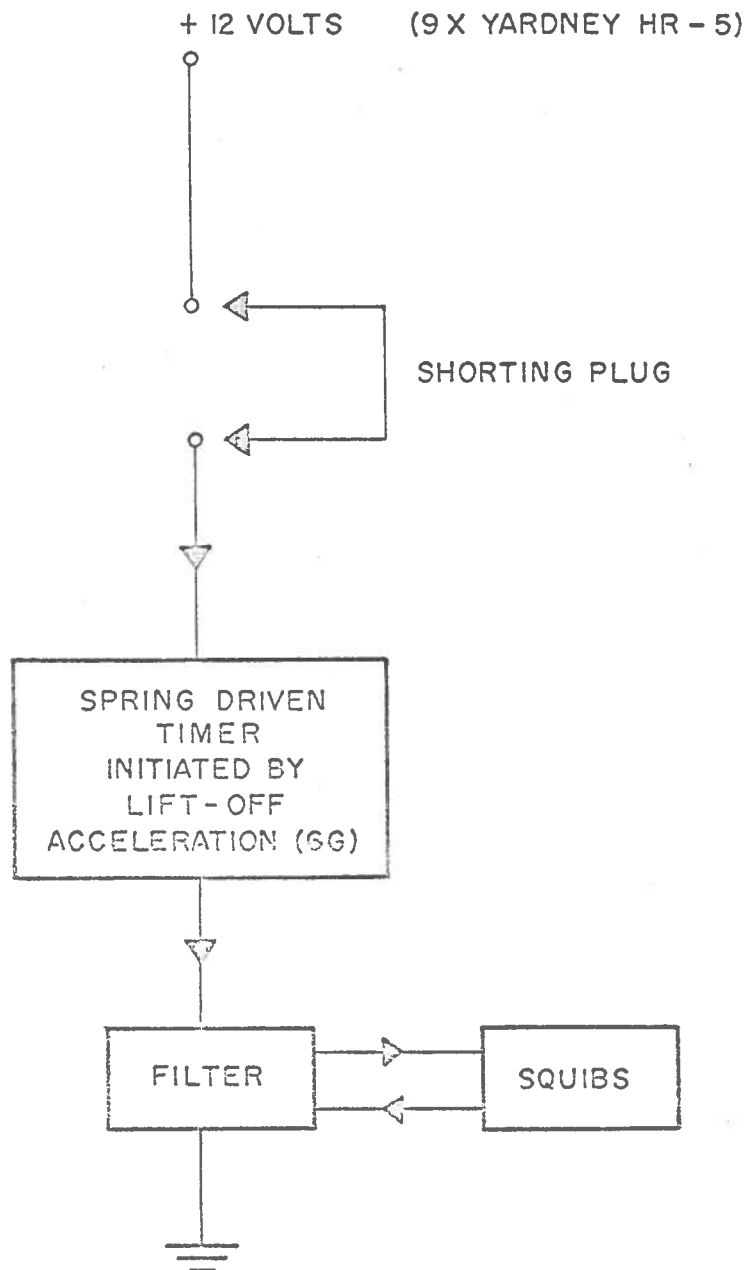
150°

EFP PACKAGE  
2 BELLOWS  
ACTUATORS

STATION



## APPENDIX IV



SQUIB FIRING CIRCUIT

APPENDIX V

PRELIMINARY LIST OF RANGE USER EQUIPMENT  
FOR FIRINGS AT FORT CHURCHILL RESEARCH RANGE

Panoramic Telemetering Indicator, Model TMI-Ib  
Telemetering Test Oscillator, HP Model 200TR  
FM-AM Signal Generator, Boonton Model 202G  
Telemetry Receivers, Nems Clarke Model 1433 (two)  
Telemetry Receivers, Nems Clarke Model 1432  
Telemetry Receivers, Nems Clarke Model 1501A  
Telemetry Receivers, Defence Electronics Model TMR-2A  
Oscilloscope, 5", HP Model 122AR  
Oscilloscope, 5", Tektronic Model 536  
Oscilloscope, 3", Tektronic Model 310  
Oscilloscope, 3", Tektronic Model 316  
Oscilloscope, 17", I.T.T. Model 1735-0  
Counter, Computer Meas. Model 225-C  
V.T.V.M., HP Model 400 HR  
Voltmeter, Digital, HP Model 405 CR  
Telemetry Calibrator, Dynatronics Model 612  
Tunable Discriminator, EMR Model 97H  
Variable Filter, EMR Model 95F  
Power Supplies 0-36V, Harrison Labs Model 808A  
Power Supplies 0-36V, Harrison Labs Model 809A  
Power Supplies 0-36V, Harrison Labs Model 814A

(cont'd.)

Spectrum Display, Nems-Clarke Model 200-3

Multicoupler, Nems-Clarke Model MC-406-45-237

Pre-amplifier (RF), Nems-Clarke Model PR-203-45-237

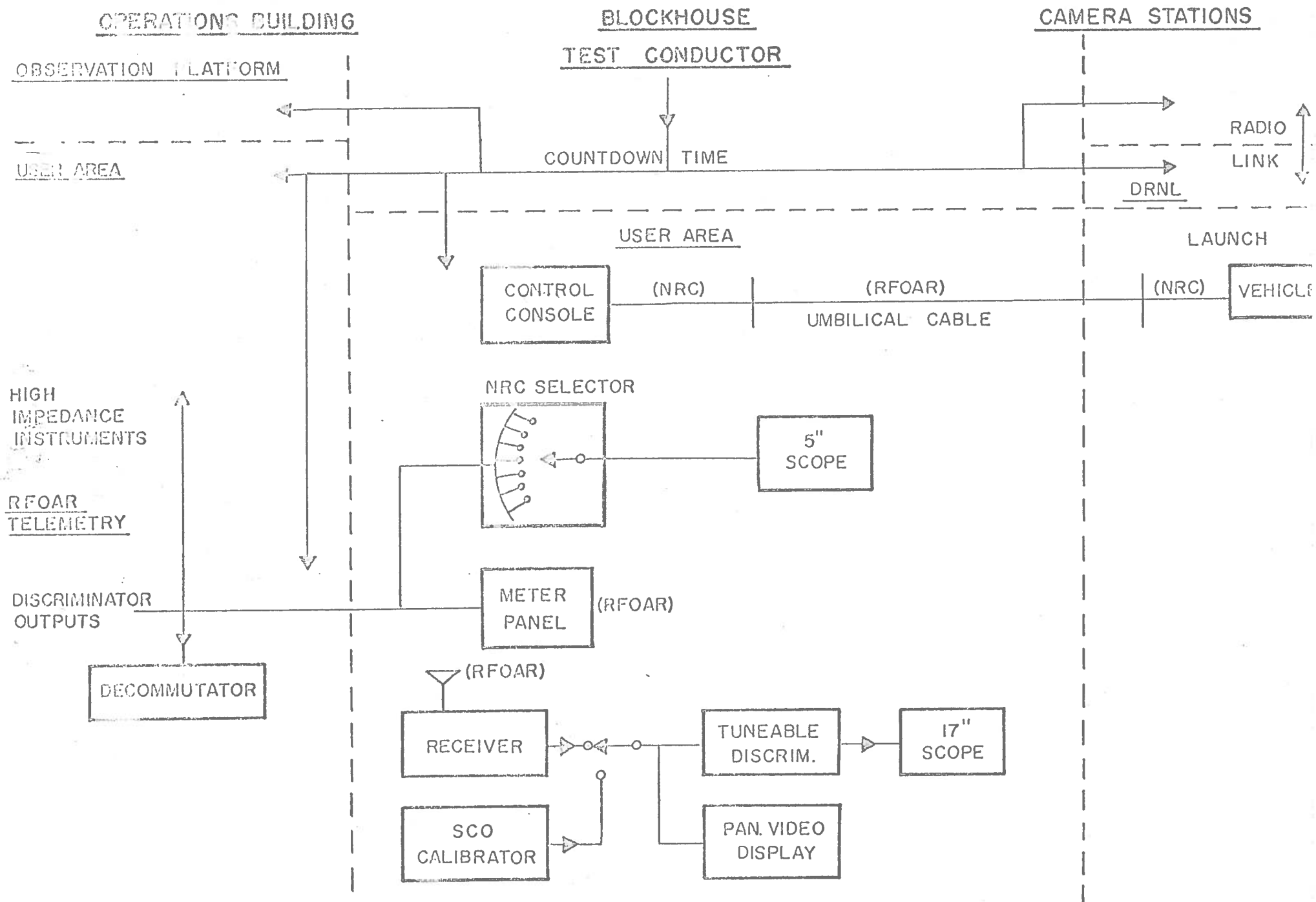
Audio Amplifier, Heathkit Model EA-3

|                                  |   |                                       |
|----------------------------------|---|---------------------------------------|
| Subcarrier Oscillators, antennas | } | Range User Support<br>Instrumentation |
| S-band receiver, camera, etc.    |   |                                       |

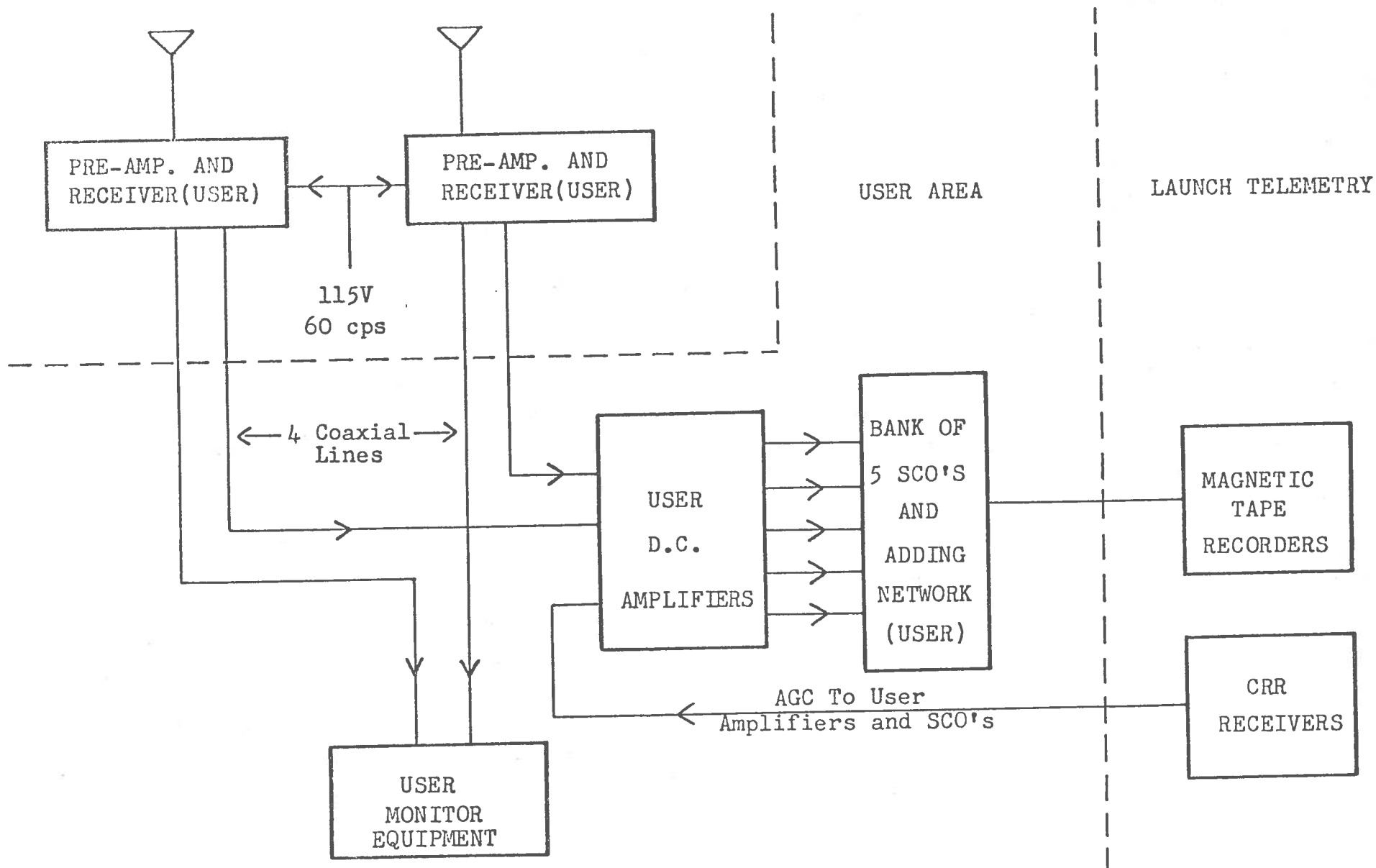
|                                  |   |                                                   |
|----------------------------------|---|---------------------------------------------------|
| Control & Monitor Console, Meter | } | Range User Control and<br>Monitor Instrumentation |
| Bank, etc.                       |   |                                                   |

Decommutator, Arnoux Type TDS-300

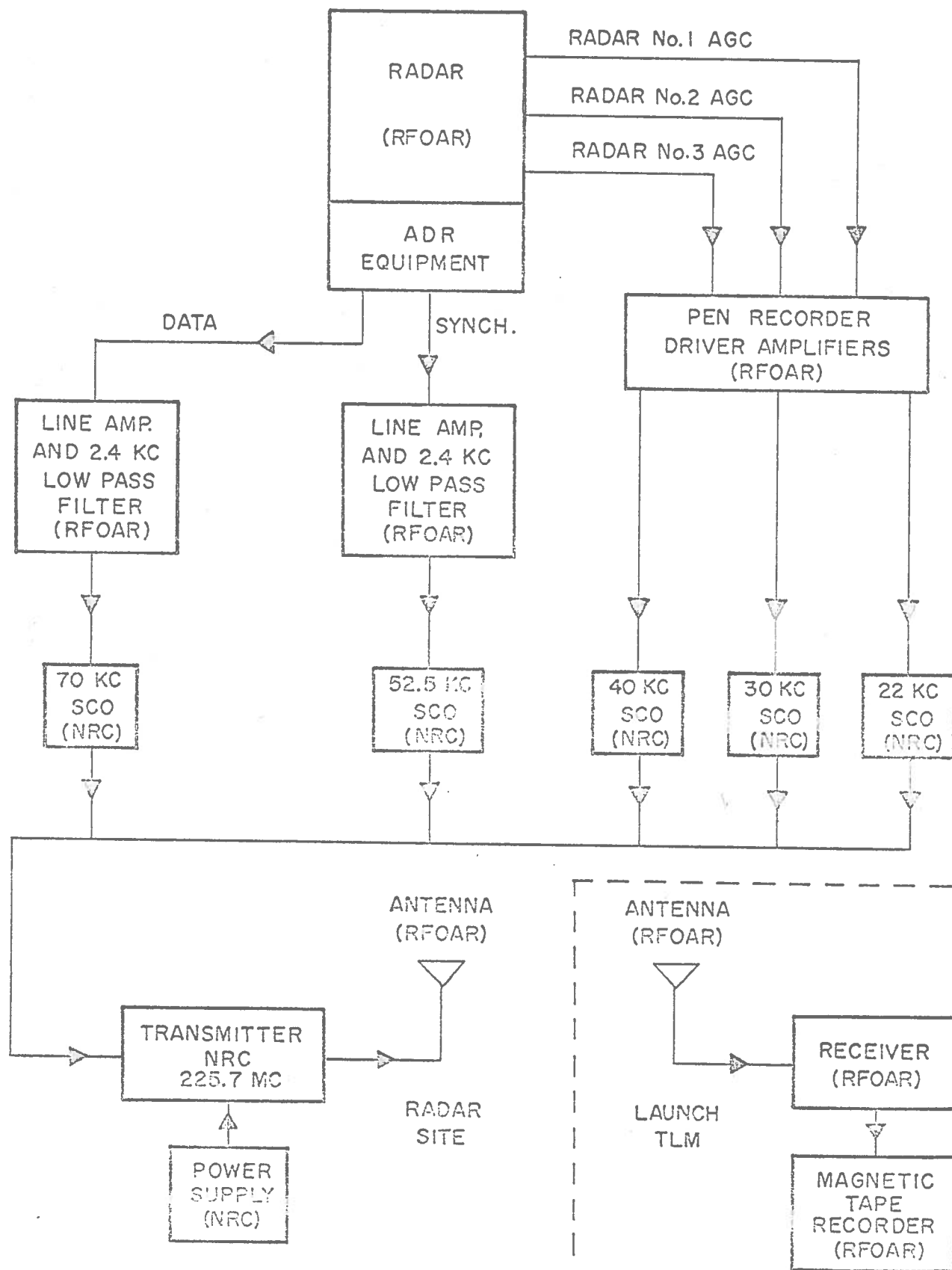




APPENDIX VI MONITOR AND CONTROL SYSTEM



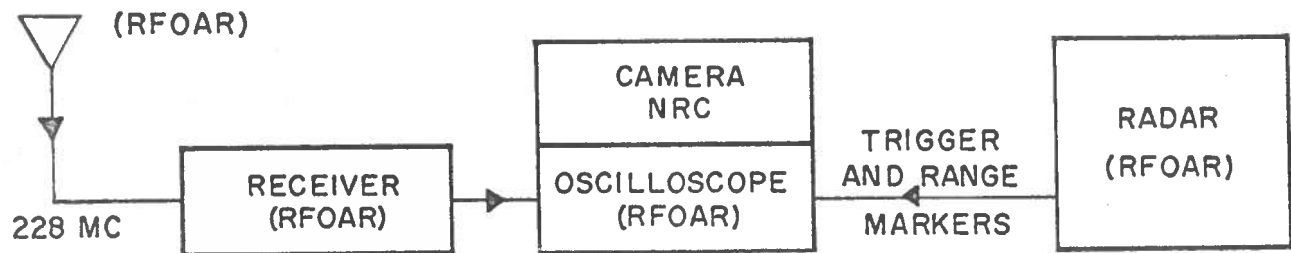
# ADR DATA LINK



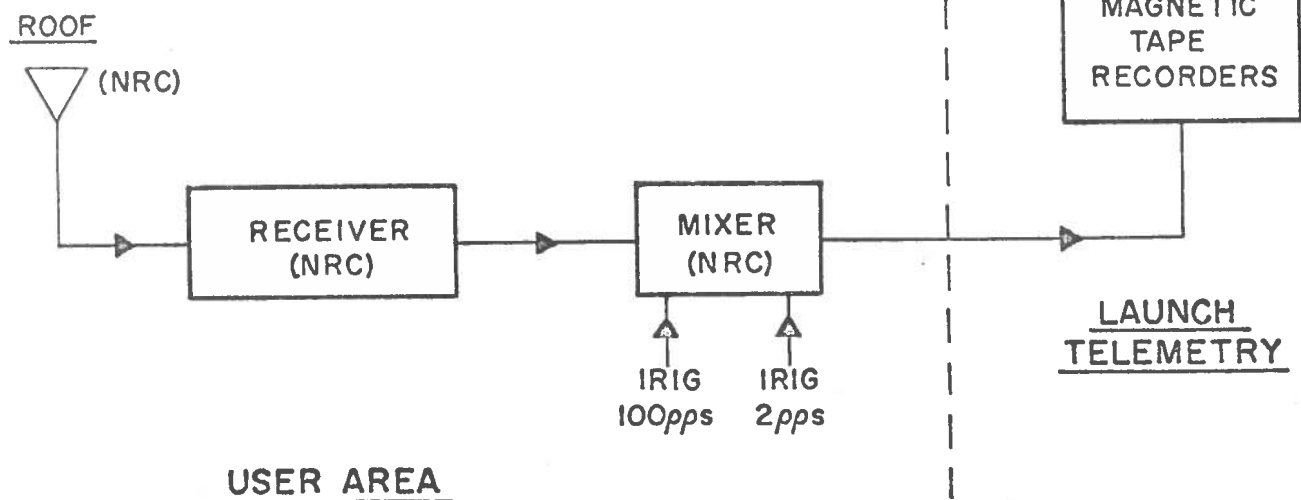
# EJECTED PACKAGE RANGE MEASUREMENT

## EQUIPMENT

### RADAR SITE



### OPERATIONS BUILDING



### USER AREA

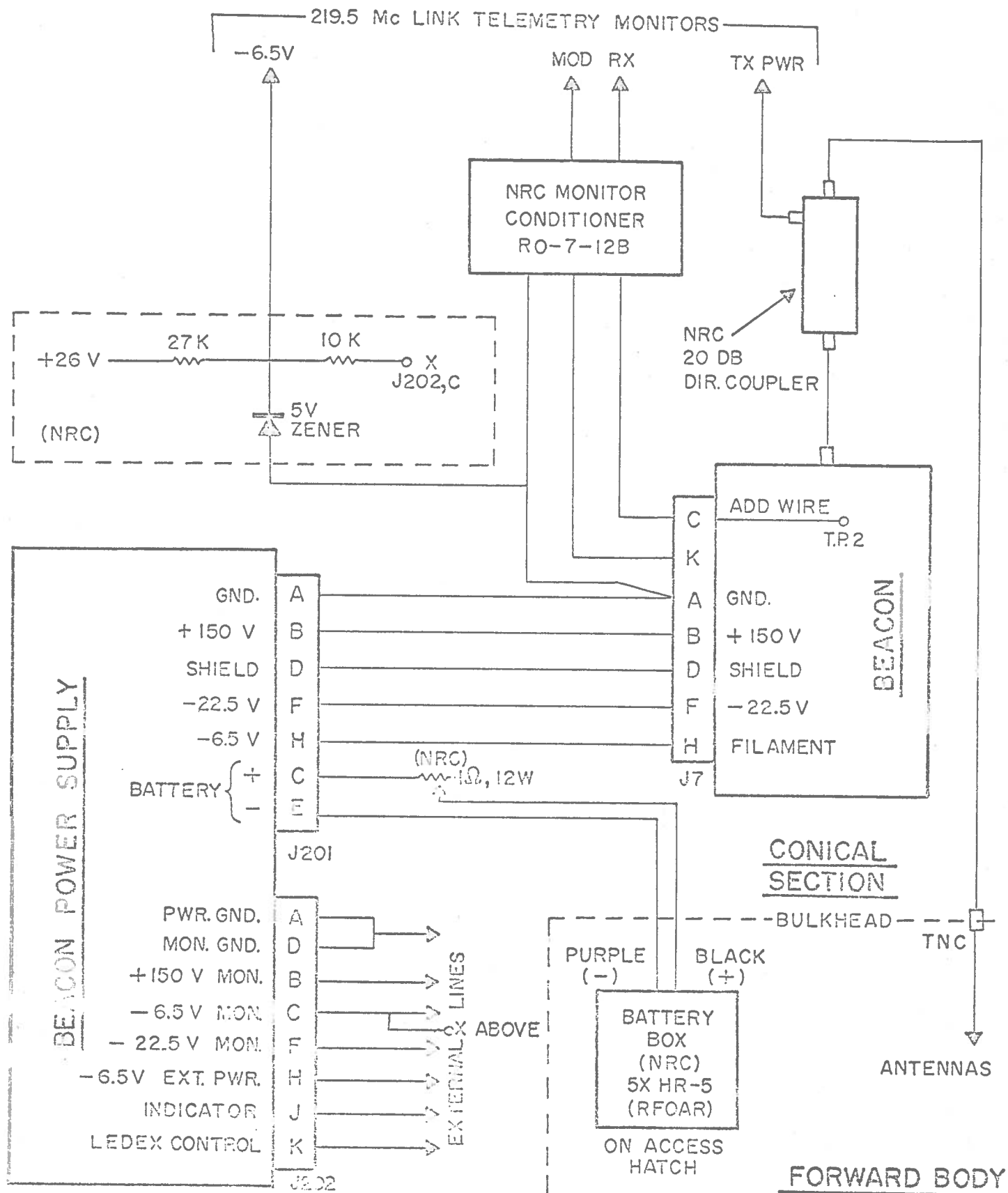
## APPENDIX VII (SHEET 3)

## RANGE USER SUPPORT INSTRUMENTATION

# APPENDIX VIII

## DPN-4I RADAR BEACON MONITOR

### FUNCTIONS



# APPENDIX IX

## WIRE LINES TO NOSE CONE ASSEMBLY AREA ADJACENT TO LAUNCH T/M STATION

(Revised 20 Feb. 1964)

CONNECT TO:

ADII 44

(8) RG-8/U, Type "N"  
(58) RG-58/U, Type "BNC"

|                     | Hot | Gnd. |
|---------------------|-----|------|
| 1                   | ○   | ○    |
| 3.9 Kc Disc.        | ○   | ○    |
| 2                   | ○   | ○    |
| 5.4 Kc Disc.        | ○   | ○    |
| 3                   | ○   | ○    |
| 7.35 Kc Disc.       | ○   | ○    |
| 4                   | ○   | ○    |
| 10.5 Kc Disc.       | ○   | ○    |
| 5                   | ○   | ○    |
| 14 Kc Disc.         | ○   | ○    |
| 6                   | ○   | ○    |
| 22 Kc Disc.         | ○   | ○    |
| 7                   | ○   | ○    |
| 30 Kc Disc.         | ○   | ○    |
| 8                   | ○   | ○    |
| 40 Kc Disc.         | ○   | ○    |
| 9                   | ○   | ○    |
| 50-5 Kc Disc.       | ○   | ○    |
| 10                  | ○   | ○    |
| 70 Kc E Disc.       | ○   | ○    |
| 11                  | ○   | ○    |
| T/M #1 219.5 Mc AGC | ○   | ○    |
| 12                  | ○   | ○    |
| T/M #1 219.5 Mc AGC | ○   | ○    |
| 13                  | ○   | ○    |
| 14                  | ○   | ○    |
| 15                  | ○   | ○    |
| 16                  | ○   | ○    |
| 17                  | ○   | ○    |
| 18                  | ○   | ○    |
| 19                  | ○   | ○    |
| 20                  | ○   | ○    |
| 25                  | ○   | ○    |

ROC

USER DRNL

USER

100 pps AMR

1 pps AMR

2 pps No Carrier

100 pps

2 pps

First Motion\*

Hot Gnd.

1 ○

2 ○

3 ○

4 ○

5 ○

6 ○

7 ○

8 ○

9 ○

RADAR(8) → NRC "S"-BAND

ANTENNA ON ROOF

TRKR2(8) → SIGNAL LINE

FROM TRKR 2

TLM1 (8) → SIGNAL LINE

FROM TRKR 2

TLM2 (8) → T/M MULTICOUPLER

OUTPUT TO USER 231.4 MC RX

TLM3 (58) → AGC TO TAPE

TRACK 2

TLM4 (58) → TIMING "B" & "C"

AND PAPER PULSE TO TRACK 1

TLM5 (58) → 231.4 MC LINK

DATA TO TAPE TRACK 7

TLM6 (58) → USER 231.4 MC

AGC TO T/M PAPER REC.

TLM7 (58) → MONITOR LINE

FROM TRKR 2

TLM8 (58) → MONITOR LINE

FROM TRKR 2

\*-24 volts at First Motion

# APPENDIX X

PAPER RECORD # 1

TRANSMITTER NRC 1W LOCATION RADAR SITE R.F. FREQ. 225.7 MC

COPIES 1 at paper rate EQUIV. TO 40 in/SEC CEC PERMANENT  
REAL TIME

RECORD INTERVAL: FROM: T - 10 SEC TO: SPLASH

DATA SOURCE: LAUNCH T/M TAPE

TIME REQUIRED: T + 2 DAYS

| TRACK | SUBCARRIER<br>FREQUENCY                                                  | FILTER   | DATA FREQ. | DEFLECTION | DATA               |
|-------|--------------------------------------------------------------------------|----------|------------|------------|--------------------|
| 5     | #17<br>52.5 Kc.                                                          | GAUSSIAN | 1600 cps   | 1"         | ADR<br>SYNCH.      |
| 5     | #18<br>70.0 Kc                                                           | "        | 1600 cps   | 1"         | ADR<br>DATA        |
| 1     |                                                                          |          |            |            | IRIG FORMAT<br>"B" |
|       | NOTE: REVERSE POLARITY OF ADR SYNCH SO                                   |          |            |            |                    |
|       | SYNCH PULSES ARE OPPOSITE DATA PULSES                                    |          |            |            |                    |
|       | TAPE PLAYBACK MAY BE AT REDUCED SPEED<br>WITH APPROPRIATE DISCRIMINATORS |          |            |            |                    |
|       |                                                                          |          |            |            |                    |
|       |                                                                          |          |            |            |                    |
|       |                                                                          |          |            |            |                    |
|       |                                                                          |          |            |            |                    |
|       |                                                                          |          |            |            |                    |

APPENDIX X  
(Revised 20 Feb. 1964)

PAPER RECORD # 2

ADII 44

AGC DATA

TRANSMITTER \_\_\_\_\_ LOCATION \_\_\_\_\_ R.F. FREQ. \_\_\_\_\_

COPIES 1 at paper rate 10 MM/SEC ..... SANBORN

RECORD INTERVAL: FROM: T-2 MIN. TO: END OF CALIBRATION

DATA SOURCE: LAUNCH T/M TAPE

TIME REQUIRED: T+2 DAYS

| TRACK | SUBCARRIER<br>FREQUENCY | FILTER   | DATA FREQ. | DEFLECTION | DATA                        |
|-------|-------------------------|----------|------------|------------|-----------------------------|
| 5     | #14<br>22 Kc            | STD      | 50 cps     |            | AGC<br>RADAR #1             |
| 5     | #15<br>30 Kc            | "        | "          |            | AGC<br>RADAR #2             |
| 5     | #16<br>40 Kc            | "        | "          |            | AGC<br>RADAR #3             |
| 2     | #14<br>22 Kc            | "        | "          |            | AGC<br>CRR C.P.<br>219.5 MC |
| 2     | #15<br>30 Kc            | "        | "          |            | AGC<br>CRR C.P.<br>228.0 MC |
| 2     | #16<br>40 Kc            | "        | "          |            | AGC<br>CRR C.P.<br>231.4 MC |
| 3     | #17 70Kc<br>CH. 4 & 19  | GAUSSIAN | 10         |            | 69°<br>MAGNETOMETER.        |
| 1     |                         |          |            |            | IRIG FORMAT<br>"C"          |
|       |                         |          |            |            |                             |
|       |                         |          |            |            |                             |



# APPENDIX X

(Revised 20 Feb. 1964)

PAPER RECORD # 3

ADII44

## AGC DATA

TRANSMITTER \_\_\_\_\_ LOCATION \_\_\_\_\_ R.F. FREQ. \_\_\_\_\_

COPIES 1 at paper rate 10 MM/SEC ..... SANBORN

RECORD INTERVAL: FROM: T-2 MIN TO: END OF  
CALIBRATION

DATA SOURCE: LAUNCH T/M TAPE

TIME REQUIRED:  
T+2 DAYS

| TRACK | SUBCARRIER FREQUENCY    | FILTER   | DATA FREQ. | DEFLECTION | DATA                        |
|-------|-------------------------|----------|------------|------------|-----------------------------|
| 2     | #14<br>22 Kc            | STD      | 50 cps     |            | AGC<br>CRR C.P.<br>219.5 MC |
| 2     | #15<br>30 Kc            | "        | "          |            | AGC<br>CRR C.P.<br>228.0 MC |
| 2     | #16<br>40 Kc            | "        | "          |            | AGC<br>CRR C.P.<br>231.4 MC |
| 2     | #17<br>52.5 Kc          | "        | "          |            | AGC<br>USER "A"<br>231.4 MC |
| 2     | #18<br>70 Kc            | "        | "          |            | AGC<br>USER "B"<br>231.4 MC |
| 3     | #18 70 Kc<br>CH. 3      | GAUSSIAN | 5 cps      |            | 339°<br>MAGNETOMETER        |
| 3     | #18 70 Kc<br>CH. 4 & 19 | "        | 10 cps     |            | 69°<br>MAGNETOMETER         |
| 1     |                         |          |            |            | IRIG FORMAT<br>"C"          |
|       |                         |          |            |            |                             |
|       |                         |          |            |            |                             |

## APPENDIX X

PAPER RECORD # 4

ADII44

TRANSMITTER TDI 5W LOCATION NOSE CONE R.F. FREQ. 219.5 MCCOPIES 2 at paper rate 10 IN./SEC ... CEC PERMANENTRECORD INTERVAL: FROM: T-2 MIN TO: SPLASHDATA SOURCE: LAUNCH T/M TAPETIME REQUIRED:  
T + 2 DAYS

| TRACK | SUBCARRIER<br>FREQUENCY | FILTER   | DATA FREQ. | DEFLECTION | DATA                     |
|-------|-------------------------|----------|------------|------------|--------------------------|
| 3     | #9<br>3.9 Kc            | GAUSSIAN | 60 cps     | EQUAL      | NEUTRON                  |
| 3     | #10<br>5.4 Kc           | "        | 60 cps     | "          | $\gamma$<br>NEUTRON      |
| 3     | #13<br>14.5 Kc          | "        | 200 cps    | "          | $\eta$<br>NEUTRON        |
| 3     | #17<br>52.5 Kc          | "        | 800 cps    | "          | COSMIC RAY<br>PITCH      |
| 3     | #18 70 Kc<br>CH. 3      | "        | 5          | "          | 0°<br>MAGNETOMETER       |
| 3     | #18 70 Kc<br>CH. 4 & 19 | "        | 10         | "          | 90° CULF<br>MAGNETOMETER |
| 3     | #18 70 Kc<br>CH. 7 & 22 | "        | 10         | "          | PHOTOMETER<br>DIRECT     |
| 3     | #18 70 Kc<br>CH. 5 & 20 | "        | 10         | "          | C.R.A.                   |
| 1     |                         |          |            |            | IRIG FORMAT<br>"B"       |

PAPER RECORD # 5

ADT 44

TRANSMITTER TDI 5W LOCATION NOSE CONE R.F. FREQ. 219.5 MCCOPIES 1 at paper rate 6.4 IN./SEC CEC PERMANENTRECORD INTERVAL: FROM: T-2 MIN TO: SPLASHDATA SOURCE: LAUNCH T/M TAPETIME REQUIRED: T+2 DAYS

| TRACK | SUBCARRIER<br>FREQUENCY | FILTER   | DATA FREQ. | DEFLECTION | DATA                     |
|-------|-------------------------|----------|------------|------------|--------------------------|
| 3     | #12<br>10.5 Kc          | STD      | 160 cps    | EQUAL      | PLANAR PR.<br>SAWTOOTH   |
| 3     | #14<br>22 Kc            | "        | 330 "      | "          | PLANAR PR.<br>A.C.       |
| 3     | #15<br>30 Kc            | "        | 450 "      | "          | PLANAR PR.<br>D.C.       |
| 3     | #16<br>40 Kc            | "        | 600 "      | "          | PLANAR PR.<br>SWEEP      |
| 3     | #18 70 Kc<br>CH. 3      | GAUSSIAN | 5 cps      | "          | 0°<br>MAGNETOMETER       |
| 3     | #18 70 Kc<br>CH. 4 & 19 | "        | 10 "       | "          | 90° CWLF<br>MAGNETOMETER |
| 3     | #18 70 Kc<br>CH 7 & 22  | "        | 10 "       | "          | PHOTOMETER<br>DIRECT     |
| 3     | #18 70 Kc<br>CH. 23     | "        | 5 "        | "          | PHOTOMETER<br>PEAK       |
| 1     |                         |          |            |            | IRIG FORMAT<br>"B"       |

## APPENDIX X

PAPER RECORD # 6

ADT 44

TRANSMITTER TDI 5W LOCATION NOSE CONE R.F. FREQ. 219.5 MCCOPIES 1 at paper rate 10 MM/SEC ... SANBORNRECORD INTERVAL: FROM: T - 10 SEC. TO: SPLASHDATA SOURCE: LAUNCH T/M TAPE

TIME REQUIRED:

T + 2 DAYS

| TRACK | SUBCARRIER<br>FREQUENCY | FILTER   | DATA FREQ. | DEFLECTION | DATA                     |
|-------|-------------------------|----------|------------|------------|--------------------------|
| 3     | #18 70Kc<br>CH. 3       | GAUSSIAN | 5 cps      | EQUAL      | 0'<br>MAGNETOMETER       |
| 3     | #18 70Kc<br>CH. 4 & 19  | "        | 10 cps     | "          | 90° CWLF<br>MAGNETOMETER |
| 3     | #18 70Kc<br>CH. 25      | "        | 5 cps      | "          | Z-AXIS<br>ACCELEROMETER  |
| 3     | #18 70Kc<br>CH. 11      | "        | 5 cps      | "          | RADAR<br>BEACON<br>TX    |
| 3     | #18 70Kc<br>CH. 17      | "        | 5 cps      | "          | ED SQUIB<br>MON.         |
| 3     | #18 70Kc<br>CH. 18      | "        | 5 cps      | "          | FFP SQUIB<br>MON.        |
| 3     | #18 70Kc<br>CH. 28      | "        | 100 cps    | "          | SUBCOMIM.                |
| 1     |                         |          |            |            | IRIG FORMAT<br>"C"       |
|       |                         |          |            |            |                          |
|       |                         |          |            |            |                          |

## APPENDIX X

PAPER RECORD # 7

ADII44

TRANSMITTER TDI 5W LOCATION NOSE CONE R.F. FREQ. 219.5 MCCOPIES 1 at paper rate 10 MM./SEC SANBORNRECORD INTERVAL: FROM: T-10 SEC TO: SPLASHDATA SOURCE: LAUNCH T/M TAPETIME REQUIRED: T+2 DAYS

| TRACK | SUBCARRIER<br>FREQUENCY | FILTER   | DATA FREQ. | DEFLECTION | DATA                   |
|-------|-------------------------|----------|------------|------------|------------------------|
| 3     | #18 70Kc<br>CH. 5+20    | GAUSSIAN | 10 cps     | EQUAL      | C.R.A.                 |
| 3     | #18 70Kc<br>CH. 7+22    | "        | 10 cps     | "          | PHOTOMETER<br>DIRECT   |
| 3     | #18 70Kc<br>CH. 6+21    | "        | 10 cps     | "          | PLASMA PR.<br>SAWTOOTH |
| 3     | #18 70Kc<br>CH. 23      | "        | 5 cps      | "          | PHOTOMETER<br>PEAK     |
| 3     | #18 70Kc<br>CH. 24      | "        | 5 cps      | "          | PLASMA PR.<br>PROGRAM  |
| 3     | #18 70Kc<br>CH. 27      | "        | 5 cps      | "          | EFP R.F.<br>MON.       |
| 3     | #18 70Kc<br>CH. 28      | "        | 100 cps    | "          | SUBCOMM.               |
| 1     |                         |          |            |            | IRIG FORMAT<br>"C"     |
|       |                         |          |            |            |                        |
|       |                         |          |            |            |                        |

## APPENDIX X

PAPER RECORD # 8

ADII 44

TRANSMITTER TDI 5W LOCATION NOSE CONE R.F. FREQ. 219.5 MCCOPIES 1 at paper rate 10 MM/SEC SANBORNRECORD INTERVAL: FROM: T-10 SEC TO: SPLASHDATA SOURCE: LAUNCH T/M TAPETIME REQUIRED:  
T+2 DAYS

| TRACK | SUBCARRIER<br>FREQUENCY | FILTER   | DATA FREQ. | DEFLECTION | DATA                    |
|-------|-------------------------|----------|------------|------------|-------------------------|
| 3     | #18 70Kc<br>CH. 8       | GAUSSIAN | 5 cps      | EQUAL      | RADAR<br>BEACON -6.5V   |
| 3     | #18 70Kc<br>CH. 9       | "        | "          | "          | " MOD.                  |
| 3     | #18 70Kc<br>CH. 10      | "        | "          | "          | " Rx                    |
| 3     | #18 70Kc<br>CH. 11      | "        | "          | "          | " Tx                    |
| 3     | #18 70Kc<br>CH. 12      | "        | "          | "          | " Tx<br>REFL.           |
| 3     | #18 70Kc<br>CH. 13      | "        | "          | "          | NRC BEACON<br>ANT. MON. |
| 3     | #18 70Kc<br>CH. 26      | "        | 100 cps    | "          | SUBCOMM.                |
| 1     |                         |          |            |            | IRIG FORMAT<br>"C"      |
|       |                         |          |            |            |                         |
|       |                         |          |            |            |                         |

PAPER RECORD # 9

ADT 44

TRANSMITTER TDI 5W LOCATION NOSE CONE R.F. FREQ. 219.5 MCCOPIES 1 at paper rate 10 MM/SEC ... SANBORNRECORD INTERVAL: FROM: T-10 SEC TO: SPLASHDATA SOURCE: LAUNCH T/M TAPETIME REQUIRED: T+2 DAYS

| TRACK | SUBCARRIER<br>FREQUENCY | FILTER | DATA FREQ. | DEFLECTION | DATA                     |
|-------|-------------------------|--------|------------|------------|--------------------------|
| 3     | #18 70Kc<br>CH. 14      |        |            |            | M.M. #1                  |
| 3     | #18 70Kc<br>CH. 15      |        |            |            | M.M. #2                  |
| 3     | #18 70Kc<br>CH. 16      |        |            |            | M.M. #3                  |
| 3     | #18 70Kc<br>CH. 25      |        |            |            | Z-AXIS<br>ACCELEROMETER  |
| 3     | #18 70Kc<br>CH. 3       |        |            |            | 0°<br>MAGNETOMETER       |
| 3     | #18 70Kc<br>CH. 4+19    |        |            |            | 90° CWLF<br>MAGNETOMETER |
| 3     | #18 70Kc<br>CH. 26      |        |            |            | SUBCOMM.                 |
| 1     |                         |        |            |            | IRIG FORMAT<br>"C"       |
|       |                         |        |            |            |                          |
|       |                         |        |            |            |                          |

APPENDIX X  
(Revised 20 Feb. 1964)

PAPER RECORD # 10

ADII 44

U.O.F.S. DATA

TRANSMITTER ED PKG 1W.  
4 T-1 5W

LOCATION ED PKG 4  
NAIR CONE

R.F. FREQ. 228.0 MC  
219.5 MC

COPIES 1 at paper rate 16 in/sec

CEC PERMANENT

RECORD INTERVAL: FROM: T-2 1000 TO: SPLASH

DATA SOURCE: LAUNCH T/M TAPE

TIME REQUIRED: T+2 DAYS

| TRACK | SUBCARRIER FREQUENCY    | FILTER        | DATA FREQ. | DEFLECTION      | DATA                        |
|-------|-------------------------|---------------|------------|-----------------|-----------------------------|
| 1     | #14<br>7.85 Kc          | STD           | 110 cps    | $\frac{1}{2}$ " | ED<br>SAWTOOTH              |
| 2     | #15<br>1.5 Kc           | "             | 160 cps    | $\frac{1}{2}$ " | ED<br>OSC. CONT. VOLT.      |
| 3     | #16<br>22 Kc            | "             | 350 cps    | $\frac{1}{2}$ " | ED<br>R.F. AMPLITUDE        |
| 4     | #15<br>30.0 Kc          | "             | 50 cps     | $\frac{1}{2}$ " | AGC<br>CRR C.P.<br>228.5 MC |
| 5     | #16<br>40 Kc            | "             | 50 cps     | $\frac{1}{2}$ " | AGC<br>CRR C.P.<br>231.5 MC |
| 6     | #15 70 Kc<br>CH. 7 & 22 | GAUSSIAN      | 10 cps     | $\frac{1}{2}$ " | PHOTOMETER<br>DIRECT        |
| 7     | #15 70 Kc               | STD           | 2000 cps   | 2"              | ED<br>DATA                  |
| 8     |                         | ON BOTH EDGES |            |                 | IRIG FORMAT<br>"B"          |
| 9     |                         |               |            |                 |                             |
| 10    |                         |               |            |                 |                             |