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Publisher's version / Version de l'éditeur:

<https://doi.org/10.4224/21274233>

Report (National Research Council of Canada. Radio and Electrical Engineering Division : ERB); no. ERB-687, 1964-10

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ANALYZED

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COPY NO.

NATIONAL RESEARCH COUNCIL OF CANADA
ASSOCIATE COMMITTEE ON SPACE RESEARCH

ELEC. ENG.

OPERATIONS REQUIREMENT
FOR BLACK BRANT ROCKET AD-II-52

PREPARED BY
RADIO AND ELECTRICAL ENGINEERING DIVISION

O. R. NO. 152 _____

OTTAWA
OCTOBER 1964

NRC #22098.

UNCLASSIFIED

ANALYZED

OPERATIONS REQUIREMENT NO. 152

One Black Brant IIA, Upper Atmosphere Research Launch
Planar Probes, Ejected Spherical Probe, Electric Field Probes,
Ionospheric Inhomogeneity, Pressure Transducer and Photometer

October 1964

Vehicle No.: AD-II-52

SUBMITTED BY:

A. Staniforth
A. Staniforth, Project Coordinator,
Radio & Electrical Eng. Div.,
National Research Council.

APPROVED BY:

W.L. Haney
W.L. Haney, Head,
Space Electronics Section,
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ACCEPTED BY:

Alvin S. Jones Maj
CRROAR Operations

COPY NO. _____

RF

i

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1 October 1964

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UNCLASSIFIED
OR ANNEX CONTROL SHEET

<u>Page</u> <u>No.</u>	<u>Para.</u> <u>No.</u>	<u>Instructions/Remarks</u>												
<u>January 1965</u>														
Appendix X		Track No. 5, delete "Radar ADR & AGC CRR". Insert "IRIG #14 to #18 TLM AGC and lift-off data". Tracks Nos. 6 and 7, add "100 kc Reference CRR".												
Appendix XI														
1 of 5		Trace No. 5 under "Data". Delete "90°" and "AC". Insert "Shelf 5" and "DC".												
2 of 5		Trace No. 2. Delete "STD". Insert "Gaussian". Delete "Press Transd". Insert "U of S Photo Cal Lamp". Trace No. 3. Under "Filter", insert "STD".												
3 of 5		Trace No. 4. Delete "0° Vibration/". Insert "Shelf 5 Vibration/".												
Appendix XII														
1 of 7		Delete all detail.												
5 of 7		Track No. 3. Delete "Ch #11", insert "Ch #12 and #27". Delete "#1" and insert "#2". Delete "Ch #12", and insert "Ch #3 and #18". Delete "MM #2" and insert "90° Magnetometer". Delete "70 kc/CH #13" and all detail. Insert: <table border="1"><thead><tr><th><u>Track</u></th><th><u>SCF</u></th><th><u>Filter</u></th><th><u>Data Freq.</u></th><th><u>Deflection</u></th><th><u>Data</u></th></tr></thead><tbody><tr><td>3</td><td>3.9kc</td><td>STD</td><td>59 cps</td><td>Equal</td><td>MM #1</td></tr></tbody></table>	<u>Track</u>	<u>SCF</u>	<u>Filter</u>	<u>Data Freq.</u>	<u>Deflection</u>	<u>Data</u>	3	3.9kc	STD	59 cps	Equal	MM #1
<u>Track</u>	<u>SCF</u>	<u>Filter</u>	<u>Data Freq.</u>	<u>Deflection</u>	<u>Data</u>									
3	3.9kc	STD	59 cps	Equal	MM #1									
6 of 7		Track No. 3. Delete "100 cps". Insert "330 cps", under "Data" for first item.												
7 of 7		Track No. 5, first item, delete "22 kc". Insert "40 kc". Delete "Radar #1" and insert "Link #1". Second item, delete "Radar #2" and insert "Link #2". Delete third item entirely. Track No. 3, item 3, delete "CH #6". Insert "CH #23".												

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<u>Page</u> <u>No.</u>	<u>Para.</u> <u>No.</u>	<u>Instructions/Remarks</u>
<u>February 15, 1965</u>		
33	4.4	Delete from "First motion" to "pulses".
21	2.1.1	Under data points/sec. delete "to splash" and insert "to about 400,000 ft; then 1 pt./5 sec. through apogee to about 400,000 ft., then 1 pt./sec. to impact".
<u>February 25, 1965</u>		
32	4.1	Add new para.: "The U. of S. electric fields ground station will require communications for the count-downs and with the balloon and rocket Project Scientists."
33	4.3.4	Add new para.: "The range user has arranged for the installation of a Telex equipment in the User area of the Operations Building. This Telex will be used to receive aurora status reports from Prince Albert Radar. The range user will bring display equipment to the range, and an operator, to enable the aurora status to be displayed on a panel in the observation tower for the Project Scientist. It is requested that the Range install two pairs AWG22, or larger, from the Ops. Bldg. to the Obs. Tower to connect the status display panels."
	4.4	Add new para.: "One PPM timing marks are required on the records at the U of S electric fields ground station. A one PPM timing generator will be taken to the Range by U of S for this task."

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<u>Page No.</u>	<u>Para. No.</u>	<u>Instructions/Remarks</u>
35	5.1.1	<p>Add new sub-para., as follows:</p> <p>"A maximum of 500 watts, 115V, 60 cps is required for the equipment in the electric fields ground station. This power is required for a timing generator amongst other equipment and stable frequency is desired."</p>
45	10.1	<p>Add new sub-para., as follows:</p> <p>"i. A room, or small heated hut, is required for a ground station to be operated by University of Saskatchewan in conjunction with their electric fields experiment. This station requires a field site, reasonably level with a minimum clear area of 200 sq. ft.; clear of well-travelled roads and free of smoke from power plants, etc. A portion of the FCA building at launch will be satisfactory for this station."</p>

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TEST SECURITY CLASSIFICATION

The security classification of information in this OR is UNCLASSIFIED.

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1.0 GENERAL INFORMATION

1.1 Operations Command

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

Project Coordinator	-	A. Staniforth, NRC
Project Scientist	-	D.W. Johnson, U. of Sask.
Mission Controller	-	Capt. E.W. Rance, NRC
Payload & Ground Instrumentation	-	Five personnel, to be named.

About five additional personnel from NRC and two or three each from the Universities of Saskatchewan and Western Ontario will be present at Fort Churchill in connection with this program.

It is expected that Mr. W.L. Haney of NRC will be present as an observer during this test.

Arrival dates of the above personnel and names will be advised to DRNL by Telex at a later date.

1.2 Range Time Utilization

1.2.1 Test Duration and Frequency

This OR requests range time and range support to launch one Black Brant IIA rocket into the upper atmosphere under specific (see 1.3.1) conditions of weather and auroral activity to satisfy the requirements of several upper atmosphere experiments. The duration and frequency of the tests required to meet this objective cannot be predicted and day-to-day rescheduling will be required until the desired conditions are met. This launching will be a nighttime launching.

Range User equipment and personnel will be at CRR for approximately one month, commencing about 12 February 1965, to carry out this test and, also, launchings under OR's 119, 151 and 154.

1.2.2 General Countdown

TIMEFUNCTION/SERVICEPreparation Phase:

F-5 day (approx.)	Rocket motor, fins, igniter, arrive at Fort Churchill via air transport. These parts may 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 DRNL. DRNL is requested to supervise the unloading and arrange to have the equipment transported and stored in the

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1.2.2 General Countdown (cont'd.)

TIME

FUNCTION/SERVICE

F-5 day (approx) preparation area allotted to this project
(cont'd.) (6.1.2).

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

F-4 day
(approx.)

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 DRNL 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 if not moved
before.
Battery charging complete.
Install all batteries to payload.
Complete instrumentation check-out with nose
cone shroud off.
Range install radar beacon and check operation.
Magnetometer check.

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
F-1 day (cont'd.)	Check complete length of umbilical cable from console in blockhouse to vehicle 50-pin connector with test box.	Range
<u>Launch Phase:</u>		
T-360	Final visual inspection of payload and battery check.	User
	Assemble nose cone shroud to payload.	User
T-250	All Range User personnel on station.	MC
T-240	Range begin count with Range User.	All
	Move nose cone to Hazardous Assembly.	User
T-220	Obtain weight and C.of G. of Nose Cone.	User/LS
	Assemble nose cone to motor.	User/LS
	Obtain weight and C.of G. of complete vehicle.	User/LS
	Remove strippable paint and clean nose cone.	User
T-180	Vehicle brought to Launch Bay.	LS/TC
T-170	Install vehicle on Launcher.	LS/TC
	Check that payload control console is disconnected from umbilical cable.	MC/TC

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-170 (cont'd.)	Connect umbilical to vehicle.	User/MC/TC
	Connect radar beacon batteries.	User/MC/TC
	Install access hatch in forward body temporarily.	User/MC/TC
	Clean nose cone.	User/MC/TC
T-140	Clear Launch Bay for Horizontal Instrumentation Checks.	LS/TC
	Connect control console to umbilical.	MC/TC
T-135	Begin horizontal instrumentation checks.	All
	<u>Note:</u> Detailed procedure will be supplied approx. F-30 days to facilitate inclusion in Master Countdown.	
T-95	Horizontal checks completed.	
	Stations report results of checks.	
T-90	Disconnect BH control console from umbilical.	MC/TC
T-60	Arm vehicle.	TC/LS

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-30	Elevate launcher.	TC/LS
T-20	BH control console connected to umbilical.	MC/TC
T-15	Begin Vertical Instrumentation Checks. <u>Note:</u> Detailed procedure will be supplied approx. F-30 days to facilitate inclusion in Master Countdown.	All
T-8	All payload power off, except Link No. 1 filaments. Vertical checks complete.	MC/RDR/TC MC/TC
T-5	Voice count at 1-minute intervals to T-2 minutes. Direct voice count to camera sites begins.	TC DRNL
T-4	MC advise TC of intentions regarding hold at T-3.5 minutes.	MC/TC
T-3.5	Hold for aurora, resumption of count on 30 seconds notice. All latch power off. Pre-set all latch relays to internal except calibrator.	All User User

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-3.5 (cont'd.)	Radar interrogate beacon continuously for remainder of test, unless hold occurs.	RDR
T-2.5	MC advise TC of intentions regarding hold at T-90 seconds for aurora.	MC/TC
T-2	If hold at T-90 seconds is <u>not</u> being called: TLM paper recorders on at slow speed. TLM magnetic tape recorders on high speed. TLM acknowledge recorders on. Payload latch power on and commence 2.5V (midband) calibration.	TLM TLM TLM User
T-110 sec.	5-volt calibration (lower edge).	User
T-100 sec.	0-volt calibration (upper edge).	User
T-90 sec.	Hold for aurora, resumption of count on .30-seconds notice. After 1/2 hr. re-cycle to 3.5 min.; PS may request re-cycle at less than 1/2 hr. to allow 1/2 hr. hold at T-90 sec. at more opportune time.	All
	<u>Note:</u> Telemetry real time and magnetic recorders and payload T/M links, to come on 30 seconds prior to resumption of count.	
	Voice count at 10-second intervals to T-10 seconds.	TC

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-90 sec. (cont'd.)	Radar beacon to internal power.	RD
	Link No. 1, 3 cycles of 11-step (0 to 5 volts) calibration.	User
	Multiplex relays to transfer position.	User
T-75 sec.	T/M Link No. 1 to signal inputs and in-flight calibrator on.	User
T-40 sec.	T/M real time recorders to flight speed.	TLM
	Payload multiplex relays to flight position.	User
	Remove latching power.	User
T-30 sec.	Acknowledge user equipment and payload "GO".	MC/TC
T-10 sec.	Voice count at 1-second intervals to T+10 seconds.	TC
T-0 sec.	Black Brant motor ignites.	
T+10 sec.	Voice count at 10 sec. intervals to splash.	TC
T+15.5 sec.	Rocket motor burns out.	
T+30 sec.	Multiplex relay transfer (Link #1)	
T+45 sec.	Nose cone tip blows off exposing photometer. Ejection of Ionospheric Inhomogen- eities Probe Pkg. (Link #5) 1/4" dia. Spherical Probes extended.	
T+60 sec.	Ejection of Electric Field Probe Pkgs. (Links #3 and 4) 5" dia. Spherical Plasma Probe Ejected (Link #2)	
T+200 sec.	Apogee (approximately 103 st. miles alt.)	

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T+400 sec.	Impact	
T+10 min.	Radar AGC, Telemetry AGC and Riometer calibration.	RDR/TLM

Apart from initial preparations and checkout, the camera sites at Twin Lakes and Digges need not be manned, except on those days scheduled for a launching.

1.3 Test Objectives

1.3.1 Primary

The primary objective of this test is to launch a Black Brant IIA vehicle under specific conditions, as follows:

- a. Aurora, visual and radar, present in the anticipated rocket trajectory, and
- b. Solunar darkness, no clouds in flight area, and
- c. Winds within tolerances of velocity and shear required for stable flight.

These conditions are required to obtain measurements in the upper atmosphere, as follows:

- a. Measurement of electric field potential profile using two ejected packages carrying their own transmitters and small enough to minimize distortion of the electric field (EFP-I, University of Saskatchewan).
- b. Plasma probe measurements of fine structure of electron density and electron energy spectrum inside and outside auroral formations using Planar Probes on the vehicle and ejecting a five inch diameter sphere containing its own transmitter (NRC).

1.3.1 Primary (cont'd.)

- c. Micrometeorite Detector - an acoustic type impact counter concerned with impact rates and energy distribution inside and outside major meteor showers and associated with auroral activity (NRC).
- d. Measurement of ionospheric inhomogeneities experiment using an ejected package carrying a CW transmitter (University of Western Ontario).
- e. To test the operation of a photometer in a rocket. This photometer is a two-channel instrument containing filters to separate specific wavelengths in the visible spectrum. It is being tested for future use in air glow measurements in the upper atmosphere. A similar instrument will be mounted in the Observation Tower. The photometer is mounted looking forward at the front end of the nose cone and will be exposed by blowing off the nose cone tip at T + 45 secs. (approx. alt. 193,000 ft.).

1.3.2 Secondary

The nose cone instrumentation will also include:

- a. A photometer mounted with a small lateral operation to indicate occurrence of direction of visual aurora.

1.3.2 Secondary (cont'd.)

- b. Magnetometers, linear accelerometers, and vibration accelerometers to indicate vehicle attitude and performance.

1.4 Test Description

The Black Brant IIA rocket, AD-II-52 will carry several experiments in its nose cone for scientific investigation of the upper atmosphere. The rocket is to be launched to obtain an effective elevation of 85° ; there is no preferred launch azimuth. The conditions required at launching are detailed under para. 1.3.1. Events of primary importance during the flight are:

- a. Multiplex relay transfer at T+30 seconds.
- b. The ejection of the Ionospheric Inhomogeneities package and separation of the nose cone tip at T+45 seconds.
- c. The ejection of the spherical probe and electron field potential packages at T+60 seconds.
- d. Motor burnout, vehicle apogee and impact.

The Range User will supply, install and operate in the Blockhouse, suitable equipment to monitor and control nose cone instrumentation. The test will also require that the observation tower be manned by the Project Scientist to select optimum timing of the launch based upon visual observation of aurora plus station reports. The ionospheric inhomogeneities experiment will require a special ground receiving station in an area of relative RF silence. This station will be equipped and staffed by University of Western Ontario personnel and will be operated in a similar manner to a similar station set up and operated in support of O.R. 146 in September 1964. User personnel will be required in the Launch Bay during horizontal instrumentation checks.

1.5 Test Vehicle Description

The Black Brant IIA is a single stage, solid propellant, unguided, sounding rocket as described under CARDE Technical Notes held by CRROAR. This particular vehicle will use a 15KS25000 motor filled by CARDE, and delivered to the Range by RCAF ATC. A stabilizer unit, Canadair 4-fin design, has been supplied to the Range and will be fitted to the motor at approx. F-4 days. Critical weights and dimensions are:

1.5 Test Vehicle Description (cont'd.)

Length	-	332.5 inches (approx.)
Diameter	-	17.2 inches
Launch Weight	-	2682 lbs. approx.
Weight at Burnout	-	900 lbs. approx.
Propellant	-	Aluminized single grain poly-urethane-ammonium perchlorate
Total Impulse (sea level)	-	380,000 lbs.
Motor burning time	-	15.5 seconds
Guidance	-	None - 4-fixed fin stabilization
Cut-down system	-	None

General performance of the vehicle will be supplied by CARDE in the form of a Data Booklet which will also contain wind weighting data. 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 CRROAR has a Technical Note on the Black Brant IIA furnished by CARDE. The stabilizer unit will be delivered assembled and aligned to produce a roll rate of 0.5 rps.

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

Link No. 1: The primary nose cone telemetry is a PAM/FM/FM system operating at 219.5 mc, 1 watt. The antenna system consists of two quadraloop radiators mounted 180° apart on the surface of the nose cone at station 91. The polarization is linear.

Link No. 2: The spherical, 5-inch diameter probe is to be ejected at T + 60 seconds and contains a telemetry package, FM, operating at 227.0 mc with 50 mw power output. Polarization is linear.

1.5.2 Telemetry Systems (cont'd.)

Link No. 3: One of the two electric field probe packages to be ejected at T + 60 seconds contains a telemetry package operating at 229.0 mc, 50 mw power, amplitude modulated with a frequency of 5 kc. The antenna is linear polarized.

Link No. 4: The second electric field probe package, also to be ejected at T + 60 seconds, contains a telemetry package operating at 231.4 mc, 50 mw power, amplitude modulated with a frequency of 5 kc. The antenna is linear polarized.

Link No. 5: The Ionospheric Inhomogeneities experiment package is to be ejected at T + 45 seconds and contains a 1/4 watt CW transmitter operating at 108 mc/s. Polarization is linear. The transmitter will not be operated until after ejection from the nose cone.

Range User will supply three receivers and pre-recording processing equipment for links 2, 3 and 4 for use at Launch Site telemetry. Coaxial line connections between the CRR telemetry multicoupler output and the User receivers and from the receivers to the telemetry tape recorders are requested. One receiver will be Defence 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 CRROAR 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.

The other two receivers will be: (a) a Nems-Clarke 1432 and (b) a Defence Electronics Type TMR-2A, both with converters to 60 kc IF for predetection recording of the FM signal.

1.5.2 Telemetry Systems (cont'd.)

It is requested that Twin Lakes telemetry record the link with the AM signal using a Nems-Clarke 1510 receiver.

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 CRROAR telemetry station for this program.

Operation of the "back-up" telemetry facilities at Twin Lakes to duplicate functions at the launch site as much as possible is requested.

1.5.3 Beacon

CRROAR 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 directional coupler for monitoring incident power to the antenna system. The coupling will be 20 db down. User will monitor beacon functions on Link No. 1; see Appendix VIII.

The beacon antennas will be tuned for a beacon transmitter frequency of 2900 mc and beacon receiver frequency of 2800 mc.

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

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 the CARDE Technical Note held by CRROAR detailing the 15KS25000 rocket motor.

Two Bellows actuators (squib) each are used in the ejection of the EFP packages and the Ionospheric Inhomogeneities package. These devices are type BA31D2, made by Hercules Powder Company, Wilmington, Delaware. Four Bellows actuators (squib) are used in the nose cone tip ejection mechanism; these are type BA31K2. The characteristics of these squibs are:

	<u>BA31D2</u>	<u>BA31K2</u>
Bridge Resistance:	5-9 ohms	4-5 ohms
Maximum Non-fire:	50 ma., one 30 sec. pulse	50 ma., one 30 sec. pulse
Minimum Fire:	0.3 amp.	0.3 amp.
Recommended Fire:	1.0 amp.	1.0 amp.
Ignition Time:	0.25 milli- secs. (at 1.0 amp.)	0.6 milli- secs. (at 1.0 amp.)

Drawings of these devices will be brought to the Range with the test equipment and will be available, if required, for study.

The location of these items is shown on drawing given in Appendix III. The 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.

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

a. Blockhouse

Range User personnel will operate the control console unit for the payload and will monitor channels IRIG Nos. 1-6 and Nos. 9-18 inclusive of the 219.5 mc link, and also channels 9 and 12 of the 227.0 link, in the blockhouse during the launching. Discriminator outputs from the main telemetry station are requested to be displayed on meters in the blockhouse. In addition, Range User will operate a receiver on the 219.5 mc link, a tunable discriminator and a 17-inch display oscilloscope. CRROAR is requested to have available for Range User's receiver a telemetry antenna on the roof of the blockhouse. The one provided in September 1964 would be suitable. Range User will provide discriminators for IRIG Channels 1 to 6. Refer to block diagram in Appendix VI.

b. User Area in Operations Building

Scientists Monitors: Discriminator outputs from channels IRIG Nos. 9-17 inclusive from the 219.5 mc link and IRIG #9 and #12 from the 227.0 mc link 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.

Telemetry AGC: Range User will provide a pair of orthogonally-oriented linearly polarized antennas together with pre-amplifiers for mounting on the Tracker No. 2 platform beside the Operations Building. The outputs from the pre-amplifiers will be connected to an RF commutator in the User Area and thence to a multicoupler and two Nems-Clarke type 1432 receivers. The AGC outputs from the receivers will be fed to a decommutator whose outputs are to be recorded on telemetry magnetic tape recorder track 2 via CRR subcarrier oscillators. DC amplifiers will not be required between the User decommutator and CRR subcarrier oscillators. The outputs from the User AGC decommutator will be ground referenced signals of ± 1.25 volts for the desired calibration range of signal strengths at the inputs of the pre-amplifiers and at an impedance level suitable for a subcarrier oscillator input impedance of 100K ohms.

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

CRROAR is requested to provide:

1. Tracker No. 2 platform with a manually trainable antenna pedestal similar to that provided in April 1964.
2. 60 cps, 115 volt power (15 amp. service) at the tracker platform.
3. Cables between Tracker No. 2 platform and the User Area in the Operations Building:
 - a. three coaxial lines (preferably RG-8/U with female type N terminations) for receiver RF signal lines and a calibration signal line.
 - b. wire pair for sound powered phones, wire pair for signal strength indication at platform.
 - c. two signal lines from the Observation Tower to the User's Area in the Operations Building.
4. Wire lines between the User Area and Launch TLM patch panel for signal inputs to CRR subcarrier oscillators.

A block diagram of the above instrumentation system is included as Appendix VII, Sheet 1. This equipment is intended primarily for the purpose of determining motion and attitude of the EFP packages (Links Nos. 3 and 4) from signal strength data.

It is intended that the AGC output from the User receivers (on Links No. 2, 3 & 4, fed from CRR circularly polarized telemetry antenna) described in para. 1.5.2 be recorded on magnetic tape recorder Track 2 via CRR subcarrier oscillators. The AGC output level from the Defense Electronics Type TMR-2A receivers will be approximately 0 volts for zero signal input and -4 to -7 volts for full-scale calibration signal input (impedance less than 1000 ohms). The Nems-Clarke receiver AGC output is approximately 7 1/2 volts for full-scale calibration signal.

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

Launch telemetry is requested to provide AGC calibration for the User receivers on Links No. 3 and 4 in terms of 0 to 100 μ volts signal at the pre-amplifier input. Calibration should be done post-flight to coincide with User and Radar AGC calibration. The following sequence of calibrate levels are requested: 0, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 100 μ v.

Wire Lines to User Area: See Appendix IX for wire lines into nose cone assembly area (User Area).

c. Ionospheric Inhomogeneities Ground Station

Range User will supply all instrumentation and staff to operate a ground station for the reception and recording of Link No. 5 (108 mc). This ground receiving station will be set up in the trailer adjacent to the former SAC "Ready" area in the same manner as used successfully for O.R. 146 in September 1964. The station will be staffed by University of Western Ontario personnel under the direction of Dr. P.A. Forsyth. It is probable that this staff will be at the Range prior to the main party to assemble and test the receiving equipment. This group will require "on-call" transport from DRNL plus the services of a heater mechanic from CRR and will normally operate independently of the main party.

Link No. 5 is a CW transmission only. CRROAR is requested to record the AGC level from a receiver tuned to the link frequency, 108 mc/s. At launch telemetry this is to be done as a real time paper record only. At Twin Lakes the AGC level is to be recorded on the magnetic tape recorder via a subcarrier oscillator. Calibration is requested in terms of 0 to 100 μ v signal at the receiver input (or pre-amplifier input, if one is used).

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

d. Launch Telemetry Station

User will provide a decommutator and operator for use at Launch TLM station.

Range User will provide discriminator equipment for IRIG Channels 1 to 6, and channel selectors for IRIG Channels 9, 12 and 16.

e. Two-channel Photometer

Range User will operate a two-channel photometer in the Observation Tower. This photometer will be similar to the photometer carried on the rocket. A 115V AC outlet is required to power this instrument.

1.6.1 DRNL Instrumentation Support

DRNL are requested to operate the following equipment prior to and during the Launch Phase:

- a. 4" by 5" Rapid Scan Spectrometer, 3000-11,000 A°
- b. HB and other Photometers
- c. 16 mm All Sky Camera
- d. Flux Gate Magnetometer
- e. Height-finding Stations (for aurora)
- f. Auroral Radar
- g. Ionsonde (4 sweeps per minute from T+0 to T+6 min.)
- h. DRNL will provide magnetic tape of voice countdown
- j. Provide auroral activity predictions
- k. Communications for ground instrumentation
- l. Communication between DRNL and Prince Albert Radar (Telex)

DRNL are requested to arrange for Prince Albert Radar to support this test.

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1.7 Summary of Frequency Utilization

- a. Ground Link DRNL to Twin Lakes radio link.
DRNL to Prince Albert Radar, Telex.

b. Rocket Links

<u>Link No.</u>	<u>Frequency</u>	<u>Class</u>	<u>Equipment</u>	<u>Location</u>
-	2900 mc	U	Radar Beacon	Nose Cone
1	219.5 mc	U	Telemetry	Nose Cone
2	227.0 mc	U	Telemetry	5" Dia. Ejected Sphere
3	229.0 mc	U	Telemetry	EFP Ejected Package
4	231.4 mc	U	Telemetry	EFP Ejected Package
5	108.0 mc	U	CW Tx	Ionospheric Inhomogeneities Ejected Package

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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 Points/Sec.</u>	<u>Reduced Data Accuracy</u>		
				<u>Class I</u>	<u>Class II</u>	<u>Class III</u>
1.	Position (X,Y,Z)	Throughout Flight	1 from T-0 to splash	Plotting Board Data (Best possible accuracy)		

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

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. Assembly to motor.
6. Placing complete vehicle on launcher.
7. Launch.

4 x 5 still photography is requested on call throughout the program for coverage of payload assembly, checkout, and vehicle assembly. Two prints of each photograph taken are 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. User equipment on Tracker No. 2 platform.

Engineering analysis of the launch phase is not required.

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2.3 Telemetry

ITEM NO.	LINK FREQ.	CHANNEL NO.	FREQ.	DEV. ± %	MEASURING RATE	RECORDING INTERVAL	ACCUR-		
							CLASS	ACY ± %	REMARKS
1	108.0 mc								
	CW	-	-	-	-	T-02 mins. to impact	I	-	Except AGC, Reception and Processing by User only.
2	219.5 mc	1	400 cps	7.5	Cont.	T-02 mins. to impact	I	-	EFP I (229 mc) Ejection.
	FM/FM								
3	219.5 mc	2	560 cps	7.5	Cont.	T-02 mins. to impact	I	-	EFP I (231.4 mc) Ejection.
	FM/FM								
4	219.5 mc	3	730 cps	7.5	Cont.	T-02 mins. to impact	I	-	I.I. Ejection
	FM/FM								
5	219.5 mc	4	960 cps	7.5	Cont.	T-02 mins. to impact	I	-	5" Spherical Probe Ejection
	FM/FM								
6	219.5 mc	5	1300 cps	7.5	Cont.	T-02 mins. to impact	I	-	Nose Cone Tip Ejection
	FM/FM								
7	219.5 mc	6	1700 cps	7.5	Cont.	T-02 mins. to impact	I	-	70K ft. Altitude Switch
	FM/FM								
8	219.5 mc	9	3.9 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Pressure Transducer
	FM/FM								
9	219.5 mc	10	5.4 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Magnetometer 0° LL
	FM/FM								
10	219.5 mc	11	7.35 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Z-axis Accelerometer/U of S Photometer
	FM/FM								
11	219.5 mc	12	10.5 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Lateral Accel. 0°/U of S Photometer
	FM/FM								
12	219.5 mc	13	14.5 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Lateral Accel. 90° CWLF/Plasma Probe Sweep
	FM/FM								
13	219.5 mc	14	22.0 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Photometer, NRC
	FM/FM								

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2.3 Telemetry (cont'd.)

ITEM NO.	LINK FREQ.	CHANNEL NO.	FREQ.	DEV. MEASURING ± % RATE	RECORDING INTERVAL	CLASS	ACCUR- ACY ± %	REMARKS
14	219.5 mc FM/FM	15	30.0 kc	7.5 Cont.	T-02 mins. to impact	I	2%	Planar Trap
15	219.5 mc FM/FM	16	40.0 kc	7.5 Cont.	T-02 mins. to impact	I	2%	Z-axis Vibration/ Plasma Probe/Swept Electrometer
16	219.5 mc FM/FM	17	52.5 kc	7.5 Cont.	T-02 mins. to impact	I	2%	Lateral Vibration Plasma Probe/AC
17	219.5 mc PAM/FM/FM	18	70.0 kc	7.5 300/sec.	T-02 mins. to impact	I	2%	Commuted Channel
18	227 mc FM/FM	9	3.9 kc	7.5 Cont.	T-02 mins. to impact	I	2%	Sweep
19	227 mc FM/FM	12	10.5 kc	7.5 Cont.	T-02 mins. to impact	I	2%	5" Sphere Plasma Pr. Signal
20	229.0 mc FM	-	-	Cont.	T-02 mins. to impact	I	2%	Transmitter in second EFP Pkg.
21	231.4 mc AM	-	-	Cont.	T-02 mins. to impact	I	2%	Transmitter in EFP Ejected Pkg.
22	225.7 mc FM/FM	14	22 kc	Cont.	T-02 mins. to impact	I	-	Radar No. 1, AGC
23	225.7 mc FM/FM	15	30 kc	Cont.	T-02 mins. to impact	I	-	Radar No. 2, AGC
24	225.7 mc FM/FM	16	40 kc	Cont.	T-02 mins. to impact	I	-	Radar No. 3, AGC

2.3.1 Recordings

a. Launch Site

The following recordings on magnetic tape are requested (for approximately 1 minute during Horizontal Checks and 2 minutes during Vertical Checks at request of MC, and from T-2 mins. to impact and post-flight for AGC calibration).

<u>Track</u>	<u>Record</u>
1	IRIG Timing Format "B"
2	Receiver Signal Strength and Timing Format "C"
3	Nose Cone Telemetry Link No. 1 (219.5 mc)
4	Telemetry Link No. 2 (227 mc); Ejected 5" dia. Plasma Probe
5	Voice Countdown, Tape Servo Reference, and Radar Data from 225.7 mc link
6	EFP Package Telemetry Link No. 3 (229.0 mc)
7	EFP Package Telemetry Link No. 4 (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 3 with the nose cone telemetry signal. Refer to Appendix X for T/M, Tape Recorder bandwidth allocations.

Three timing signals are requested:

- a. standard time, Format B, with a 1 kc carrier;
- b. standard time, Format C, with a 100 cps carrier;
- c. time signals from WWV.

Item (c) can be recorded during post-flight calibration together with items (a) and (b).

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

The following signal strength data will be recorded on tape track 2 using DC amplifiers where necessary and voltage-controlled subcarrier oscillators supplied by CRR.

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2.3.1 Recordings (cont'd.)

RECEIVER SIGNAL STRENGTH ON TRACK 2

<u>T/M LINK</u>	<u>ANTENNA</u>	<u>RX</u>	<u>SUBCARRIER FREQUENCY</u>	<u>IRIG NO.</u>
#3-229.0 mc	CP	User TMR-2A	14.5 kc	13
#4-231.4 mc	CP	User TMR-2A	22.0 kc	14
#3-229.0 mc	User "A"	User 1432	30.0 kc	15
#3-229.0 mc	User "B"	User 1432	40.0 kc	16
#4-231.4 mc	User "A"	User 1432	52.5 kc	17
#4-231.4 mc	User "B"	User 1432	70.0 kc	18

Records of the AGC outputs of CRR receivers on Links Nos. 1, 2 & 5 are requested on Real Time paper only. See Appendix XI.

b. Twin Lakes

Telemetry magnetic tape recording of data as requested for Launch Site is desired except:

1. No effort to receive or record the 225.7 mc link data is requested.
2. Link No. 3 or 4 should be received using Nems-Clarke Type 1510 Receiver using the AM Detector. It is understood that these receivers have a 500 kc IF bandwidth. It would be preferable to use a receiver with a narrower IF bandwidth, 50 kc or 100 kc, if available.
3. It is requested that AGC signals from receivers on Links Nos. 2, 3 & 4 be recorded via CRR DC

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2.3.1 Recordings (cont'd.)

amplifiers and subcarrier oscillators on magnetic tape recorder Track 2. Calibration, which may be done post-flight, is requested:

[illegible]

Link No. 2 - 0 to 100 μ v)

Link No. 3 - 0 to 100 μv) 0, 0.1, 0.2, 0.5, 1.0,
Link No. 4 - 0 to 100 μv) 2, 5, 10, 20, 50, 100,
 μv steps.

Link No. 5 - 0 to 100 μ v)

at the pre-amplifier input. The telemetry report should specify pre-amplifier and/or multicoupler gain.

2.3.2 Special Requirements

Real time paper record requirements are detailed under Appendix XI.

Playback paper record requirements are indicated under Appendix XII.

Calibration, 219.5 mc link: The event channels, IRIG Nos. 1-6 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

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2.3.2 Special Requirements (cont'd.)

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 during flight to IRIG Channels 9 to 17 inclusive by a calibrator unit in the nose cone.

Calibration, 227.0 mc link: This link with the ejected package has two subcarrier oscillators on 3.9 and 10.5 kc, the calibration of which is 0 to 5 volts for a 7 1/2% deviation.

Signal strength: RFOAR is requested to provide receiver AGC calibration for all rocket telemetry links at Launch Site and at Twin Lakes. The following calibration ranges are requested:

Link No. 1, 219.5 mc)	0, 1, 2, 5, 10, 20, 50, 100,
)	200, 500, 1000 μ volts.
Link No. 2, 227.0 mc)	
Link No. 3, 229.0 mc)	0, 0.1, 0.2, 0.5, 1, 2, 5,
Link No. 4, 231.4 mc)	10, 20, 50, 100 μ volts
Link No. 5, 108.0 mc)	

at 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 231.4 mc, 227.0 mc and 229.0 mc receiver calibration.

2.4 Other Data

Other data collected includes photographs from the parallax cameras of the star field and aurora, and other records furnished by DRNL in reduced form. This data does not require processing or reduction by CRROAR.

Range User personnel assigned to instrumentation sites are as follows:

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2.4 Other Data (cont'd.)

<u>NAME</u>	<u>SECURITY CLEARANCE</u>	<u>PURPOSE</u>	<u>PLACE</u>
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(Names, location and duties of Range
User personnel will be supplied at
a later date.)

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3.0 METEOROLOGICAL SERVICES

3.1 Forecasts

Data concerning launching restriction due to weather conditions has been supplied by CARDE. The following information is requested for planning and operational purposes. This information should be presented to the Range User Mission Controller 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 CRROAR 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 Impact Predictor and Range Safety Officers. Over-inflated Rawin balloons with corner reflectors to be tracked by radar are one solution to detecting wind shears that would jeopardize a successful flight. Every effort is

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3.2 Observations (cont'd.)

is required to observe for wind shears and avoid launching the rocket into out-of-tolerance shears.

3.3 Minima

The camera sites at Twin Lakes and DRNL 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.

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4.0 SUPPORT INSTRUMENTATION

4.1 Communications - General

The Range User will require a number of stations on various nets of the range intercommunications installation. These requirements are shown under Appendix XIII.

A User hard line is requested between the blockhouse and the Project Scientists' observation station. This will be used primarily for conferences between the Project Scientist and the Mission 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 and during the preparation phase on a request basis.

4.3 Wire

4.3.1 MOPS

It is requested that a loudspeaker on the missile operations intercom should be located near the check-out 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. Communication with DRNL is required for relaying the countdown.

A wire line to DRNL is requested for transmission of Range timing for time correlation of ground measurements made by DRNL with vehicle data and to "SAC" site for use of Ionospheric Inhomogeneities team.

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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
- e. Ionospheric Inhomogeneities Ground Station

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 CRROAR for radar beacon and DOVAP transponder control and monitoring. Range User has supplied junction boxes for use at each end of the CRR umbilical cable system for connection to the User control console and to the vehicle pull-away connector. Each of these rapid changes to be made in umbilical connections for different rockets. CRR will maintain the umbilical, including the junction boxes, but the User will supply patch boards, "MAC" panels, for this rocket.

4.4 Timing

Timing on the magnetic tape records is requested to be IRIG Format "B", 100 pps with a 1 kc carrier, and IRIG Format "C", 2 pps with a 100 cps carrier. A magnetic tape recording of timing IRIG "B" and "C", and time signals from WWV are requested during post-flight calibration.

First motion is to be indicated by an increase in the amplitude of the timing pulses. It is assumed that timing equipment is on prior to the start of Horizontal Checks.

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.

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4.5 Sequencer

Sequencer not required.

4.6 Visual Countdown and Status Indicators

<u>NO.</u>	<u>FUNCTION TO BE DISPLAYED</u>	<u>TYPE INDICATOR</u>	<u>INTERVAL</u>		<u>REMARKS</u>
			<u>START</u>	<u>STOP</u>	
1	Range Countdown	Clock, digital preferred	T-240 mins.	T+10 mins.	To be easily viewed from payload con- trol console. Same facility desired in nose cone pre- paration area, in Operations Bldg., and Project Sci- entists' Station.

4.7 Data Handling

Range User will obtain all data produced by the CRR from Detachment No. 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.

DRNL instrumentation support is requested under Para. 1.6.1.

CRR is requested to operate the 30 mc Riometer at the Blockhouse. The riometer antenna should be directed along the expected vehicle trajectory. Calibration is required early in the count and 5-30 minutes after launching. A copy of the Riometer record for the launch day is required by the User.

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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.

A 15 amp. service outlet is requested on the Tracker No. 2 platform, and in the Project Scientists' Observation Tower.

Two 15 amp. services, 115V, 60 cps, are required in the trailer provided for the Ionospheric Inhomogeneities ground station.

5.1.2 Food Services

Thirteen to fifteen University and NRC personnel will require food services for approximately one month. DRNL will be requested to arrange for this service and accommodation. Food services at Launch will be required for most of these personnel plus box lunches for U. of Western Ontario personnel proceeding to the I.I. Ground Station each day.

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

The Universal Launcher is required for this test and is to be fitted with the Black Brant rail system for four-fin stabilizers as supplied by CARDE. Installation and alignment of these rails should be completed by CRR prior to F-1 day.

5.1.7 Water - NR.

5.1.8 Survey

Twin Lakes and DRNL height-finding stations relative to Launcher. Radar Site relative to Launcher.

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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 CRROAR by NRC or has been supplied by CARDE and is held at the Range.

5.2.2 Ground and Heavy Equipment

CRROAR 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.

CRROAR is requested to supply equipment for, and obtain all-up weight and centre of gravity of the nose cone and of the complete vehicle.

5.3 Propellants, Gases, Chemicals - NR.

5.4 Chemical and Physical Analysis - NR.

5.5 Bioscience - NR.

5.6 Test Instrument Maintenance and Calibration

CRR is requested to supply the calibration for the signal strength records (AGC) of the 108, 219.5, 227.0 229.0 and 231.4 mc links, and the radar AGC data may be calibrated in terms of relative db (although desirable, absolute calibration is not essential).

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5.7 Climatic Clothing Requirements

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

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6.0 TRANSPORTATION LOGISTICS

DRNL is requested to inform W.L. Haney by Telex communication 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.

CRROAR 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. CRROAR 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 part may be shipped by rail.

It is assumed that any special equipment, such as may be required for vehicle assembly, etc., has been supplied by CARDE. The shipments will consist of:

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

b. Fin assembly in crate: 300 lbs.

c. User check-out equipment: Estimate is for about 50 wooden boxes, each weighing between 20 and 200 lbs. and 12 transit cases, each weighing between 200 and 350 lbs. Total weight is expected to be approximately 7500 lbs. (Rail Express)

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6.1.2 Cargo (cont'd.)

d. Nose cone and payload in crate:
approximately 350 lbs., 24 in. x 24 in. x 10 ft. (Air express)

e. About 500 lbs. instrumentation and
check-out equipment from the University of Saskatchewan.

f. About 2000 lbs. instrumentation from
the University of Western Ontario.

g. About 500 lbs. check-out equipment
from the University of Alberta.

Items c and e include equipment used in
other launch programs sponsored by NRC during the same
time period.

Item d and a portion of item c will
arrive at Fort Churchill by air about F-5 on the same plane
as the main group of Range User personnel.

DRNL is requested to provide for, or
arrange for the loading and transport of User check-out
equipment to railway depot at conclusion of rocket firings.
Equipment will be returned express, collect.

6.2 Air - NR.

1 October 1964

OR 152

7.0 RECOVERY

No recovery is required.

1 October 1964

OR 152

8.0 AIRCRAFT AND SEACRAFT - NR.

1 October 1964

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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 and 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

ITEM NO.	DESCRIPTION	ORIG.	CYS.	TIME REQUIRED	FINAL RECIPIENT	AGENCY TO PICK UP DATA	TYPE OF PRESENTATION	REMARKS
-------------	-------------	-------	------	------------------	--------------------	---------------------------	-------------------------	---------

9.2.1 Metric Data

9.2.1.1 Launch to Impact

1	Position	1		T+6H	CARDE	NRC	R-PLOT) note (a)
		3		T+6H	NRC	NRC)

9.2.1.2 Impact

2	Impact 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 for each radar on valid track.

1 October 1964

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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 Documentary Film	2	T+15	NRC	NRC	NRC	R-PHOTO	
		1	T+15	NRC	NRC	NRC	R-PHOTO	
9.2.3 Telemetry								
9.2.3.1 Recording								
5	Magnetic tape recording of telemetry data	1	T+5 CD	NRC	NRC	NRC	R-MAGT	5.2.1.1(3)
		1	T+5 CD	NRC	NRC	NRC	R-MAGT	5.2.1.2(3)
		1	T+5 CD	NRC	NRC	NRC	R-MAGT	5.3.1.3(3)
9.2.3.2 Special Requirements								
6	Real Time paper records playback paper	1	T+1H to T+1 T+2	NRC	NRC	NRC	R-GRAF	See Appendix XI
		1		NRC	NRC	NRC	R-GRAF	See Appendix XII
9.2.4 Other Data - DRNL								
7	Magnetic recording of voice countdown, Records and reduced data from DRNL observations	1	T+15CD	NRC	NRC	NRC	F-FRPT and R-MAGT	
9.3 Meteorological Data								
8	Report on all requested ob- servations	1	T+15	CARDE	NRC	NRC	F-FRPT)
		3	T+15	NRC	NRC	NRC))

1 October 1964

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9.3 Meteorological Data (cont'd.)

ITEM NO.	DESCRIPTION	ORIG.	CYS.	TIME REQUIRED	FINAL RECIPIENT	AGENCY TO PICK UP DATA	TYPE OF PRESENTATION	REMARKS
9	Final report on all requested observations		3	T+30 CD	NRC	NRC	F-FRPT	
9.4 Support Instrumentation								
10	30 Mc Riometer		1	T+2	NRC	NRC	R-GRAF	
9.5 Material and Services Report - NR.								
9.6 Transportation Reports								
11	Receiving and Shipping Report		1	T+30	NRC	NRC	F-FRPT	All equipment in and out of Fort Churchill
9.7 Recovery Reports - NR.								
9.8 Aircraft Reports - NR.								

10.0 FACILITIES

10.1 Facilities - General

- a. 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.
- b. Preparation area in the Operations Building of about 300 sq. ft. for nose cone assembly and check-out and User instrumentation.
- c. Hazardous storage for the motor, igniter and squib is requested as specified under the CARDE TN.
- d. 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.).
- e. Office space and telephone at DRNL.
- f. The use of the observation station beside the Operations Building for the Project Scientist. A telephone, an intercom on the DRNL net, and a hard line to the User Area in the Blockhouse are desired at this station; also a digital clock of range countdown.
- g. Tracker No. 2 platform with manual tracking pedestal for Range User antennas.
- h. About 200 sq. ft. heated room for Ionospheric Inhomogeneities ground station with two 15-ampere, 115 volt, 60 cps service outlets, an intercom on the ROC and DRNL nets, and a telephone. The trailer in the former SAC "Ready" area, as used in September 1964 for O.R. 146, is ideal for this application and is again requested for this O.R. and for O.R. 154.

These facilities are requested for the period 12 February 1965 to early March 1965.

1 October 1964

OR 152

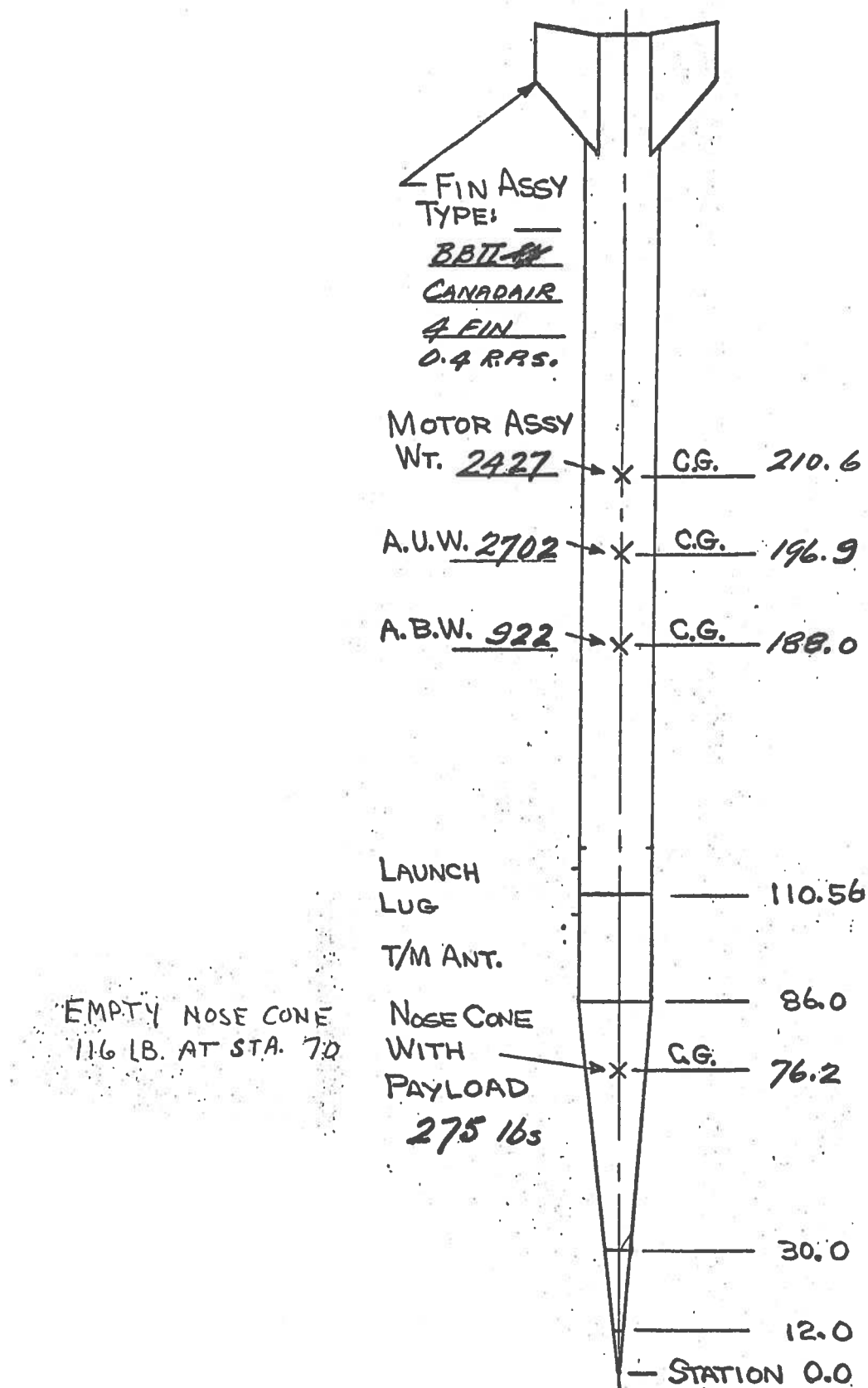
11.0 RANGE SAFETY

CRROAR is responsible for all Range safety.

APPENDICES

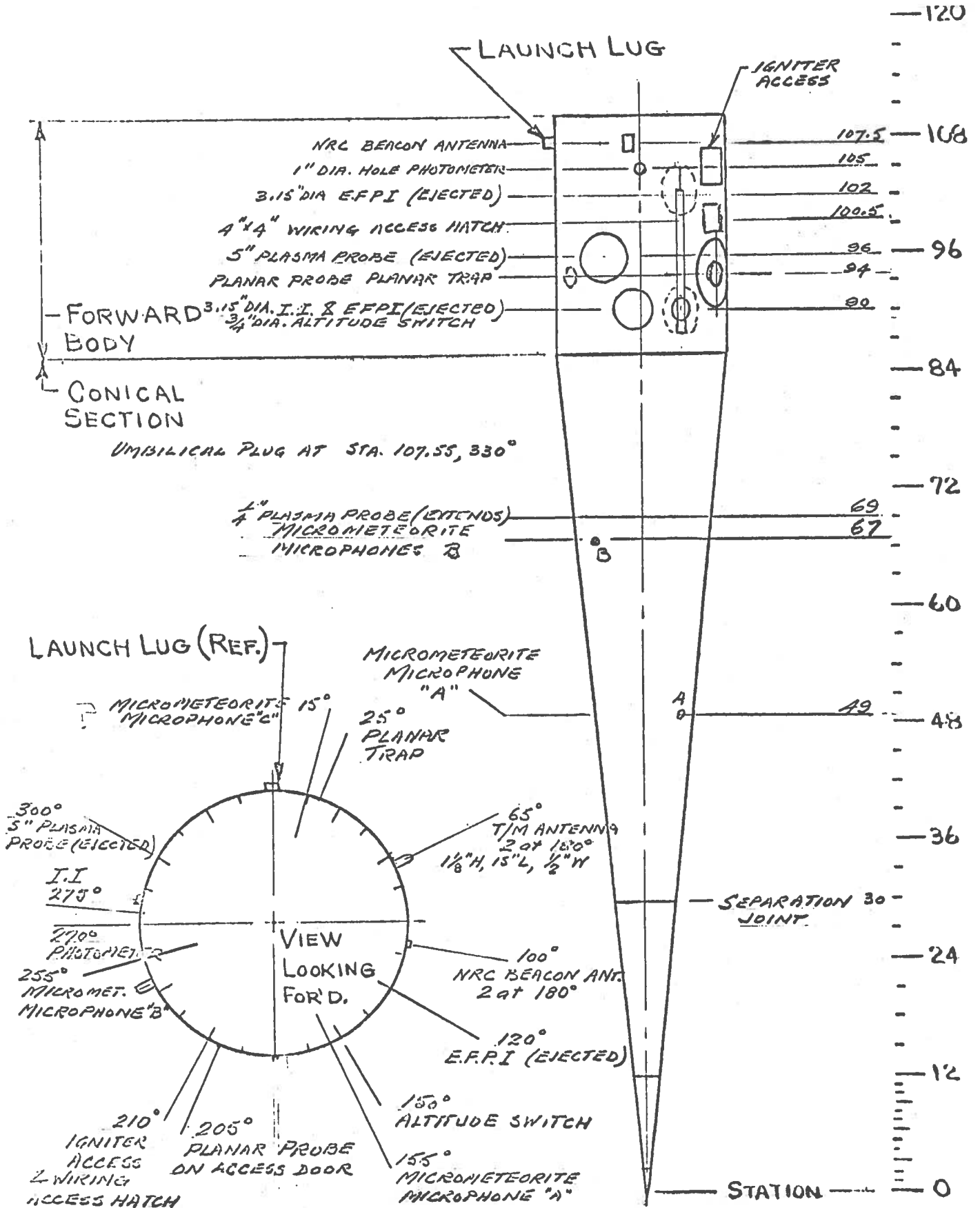
- I. Vehicle Drawing.
- II. Nose Cone Drawing
- III. Ordnance Items Location Drawing.
- IV. Squib Firing Circuit.
- V. Range User Equipment List, Sheets 1 and 2.
- VI. Monitor and Control System Diagram.
- VII. Range User Support Instrumentation Diagram,
Sheet 1 - T/M AGC System
- VIII. Beacon Monitor Functions on Link No. 1.
- IX. Wire Lines to Nose Cone Assembly Area
adjacent to Launch T/M Station.
- X. Launch T/M Tape Recorder Bandwidth Allocations.
- XI. Real Time Paper Record Requirements.
- XII. Playback Paper Record Requirements.
- XIII. Communications Nets

APPENDIX I
Vehicle Drawing - AD-II-52



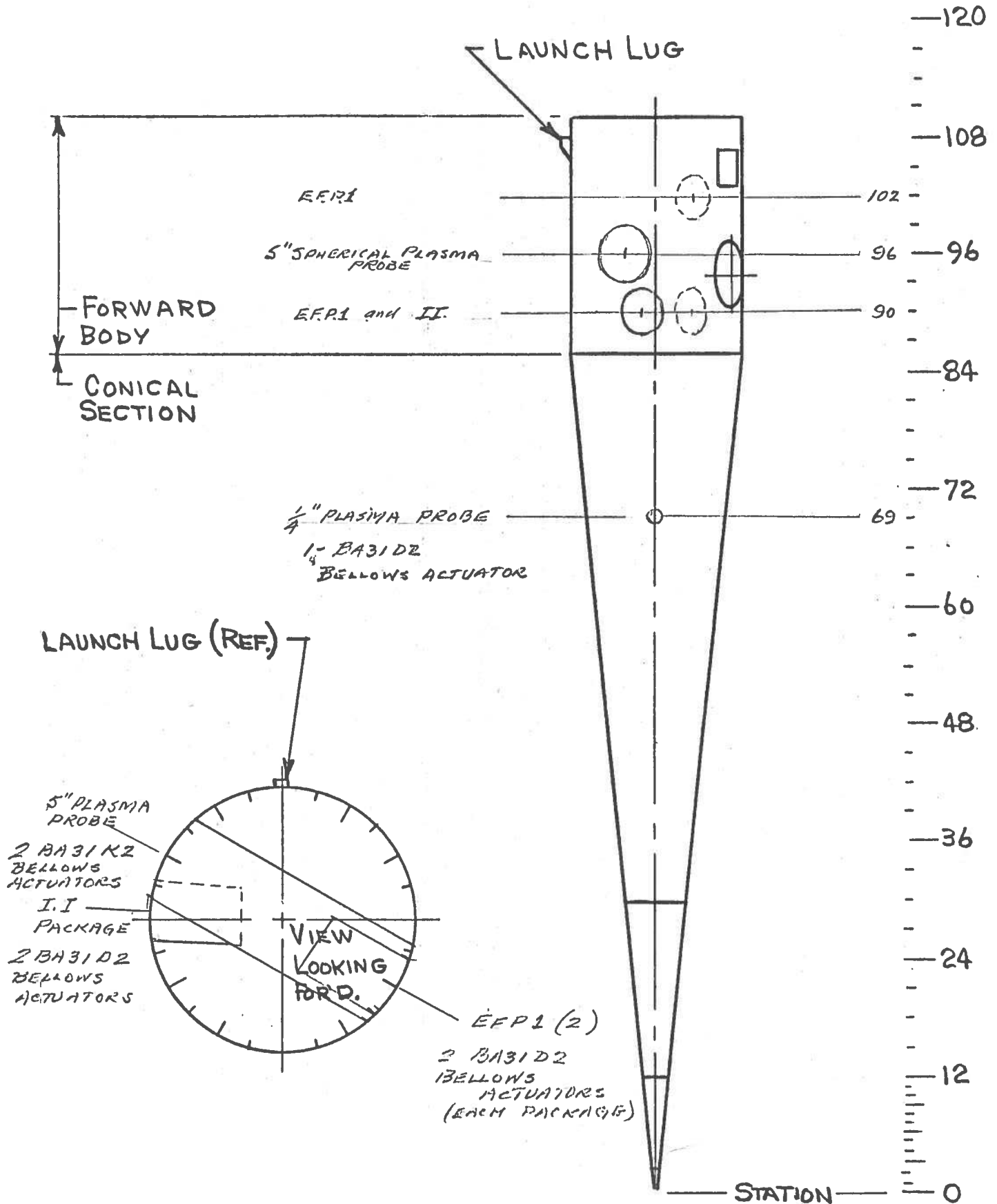
APPENDIX II

Nose Cone Drawing - AD-II-52

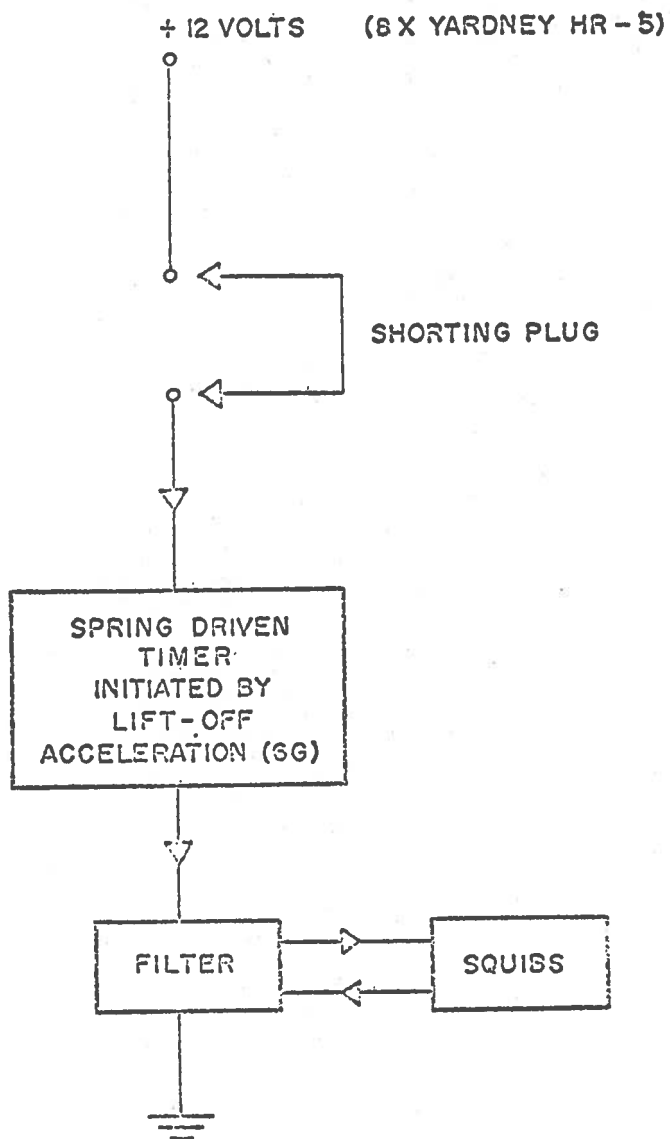


APPENDIX III

Ordinance Items, Nose Cone - AD-II-52



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 (two)
Telemetry Receiver, Nems-Clarke Model 1501A
Telemetry Receivers, Defence Electronics Model TMR-2A (two)
Oscilloscope, 5", HP Model 122AR
Oscilloscope, 5", Tektronics Model 536
Oscilloscope, 3", Tektronics Model 310
Oscilloscope, 3", Tektronics 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 (two)
Telemetry Calibrator, Dynatronics Model 612
Tunable Discriminator, EMR Model 97H
Variable Filter, EMR Model 95F
Power Supplies 0-36V, Harrison Labs Model 808A

(cont'd.)

APPENDIX V (cont'd.)

Power Supplies 0-36V, Harzison Labs Model 809A

Power Supplies 0-36V, Harrison Labs Model 814A

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

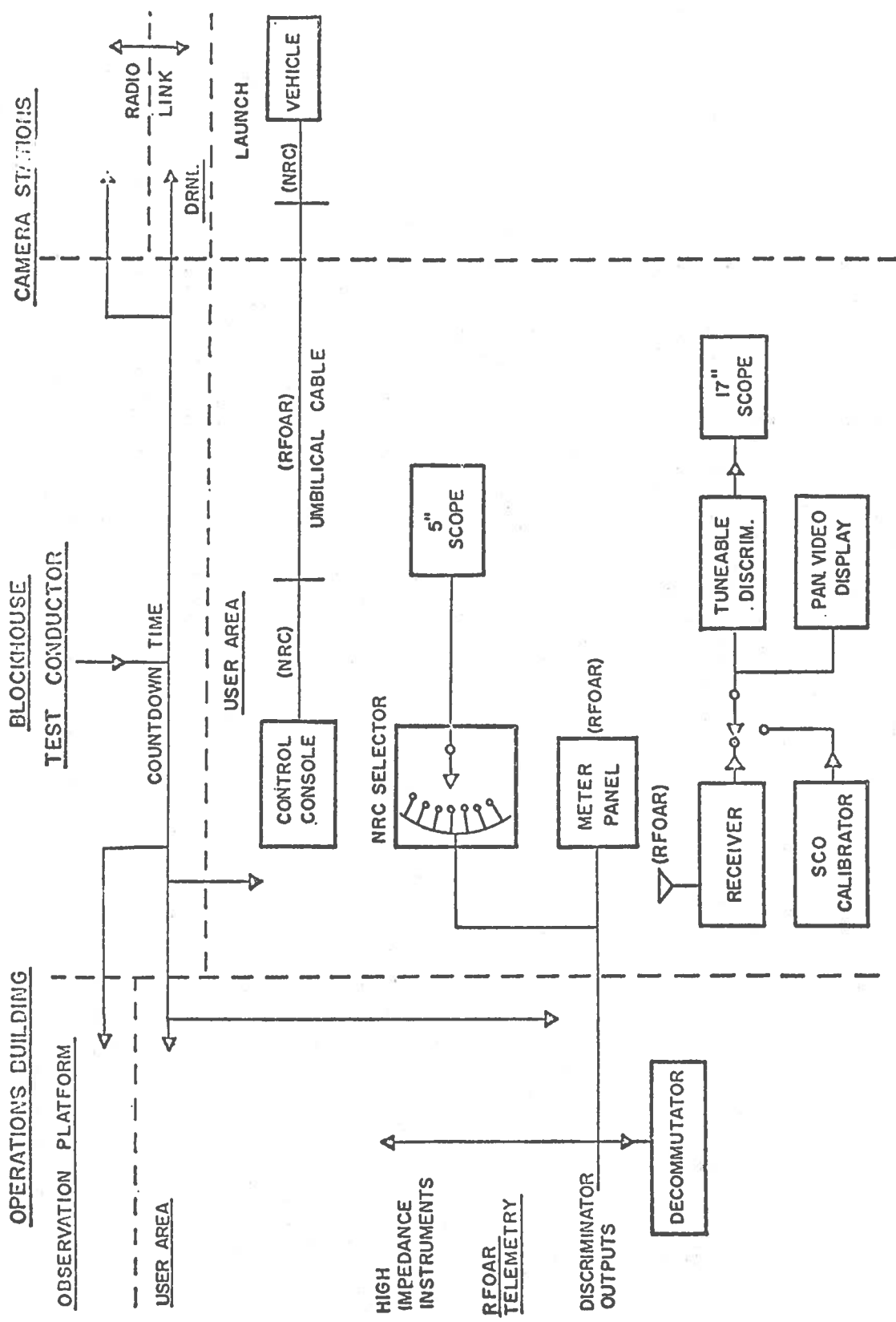
Audio Amplifier, Heathkit Model EA-3

Control & Monitor Console, Digital)	Range User Control and
Recorder, HP Model 560A)	Monitor Instrumentation

Decommutator, Arnoux Type TDS-300

Channel Selectors, IRIG #9, #12 and #16 for use with
CRR EMR discriminators.

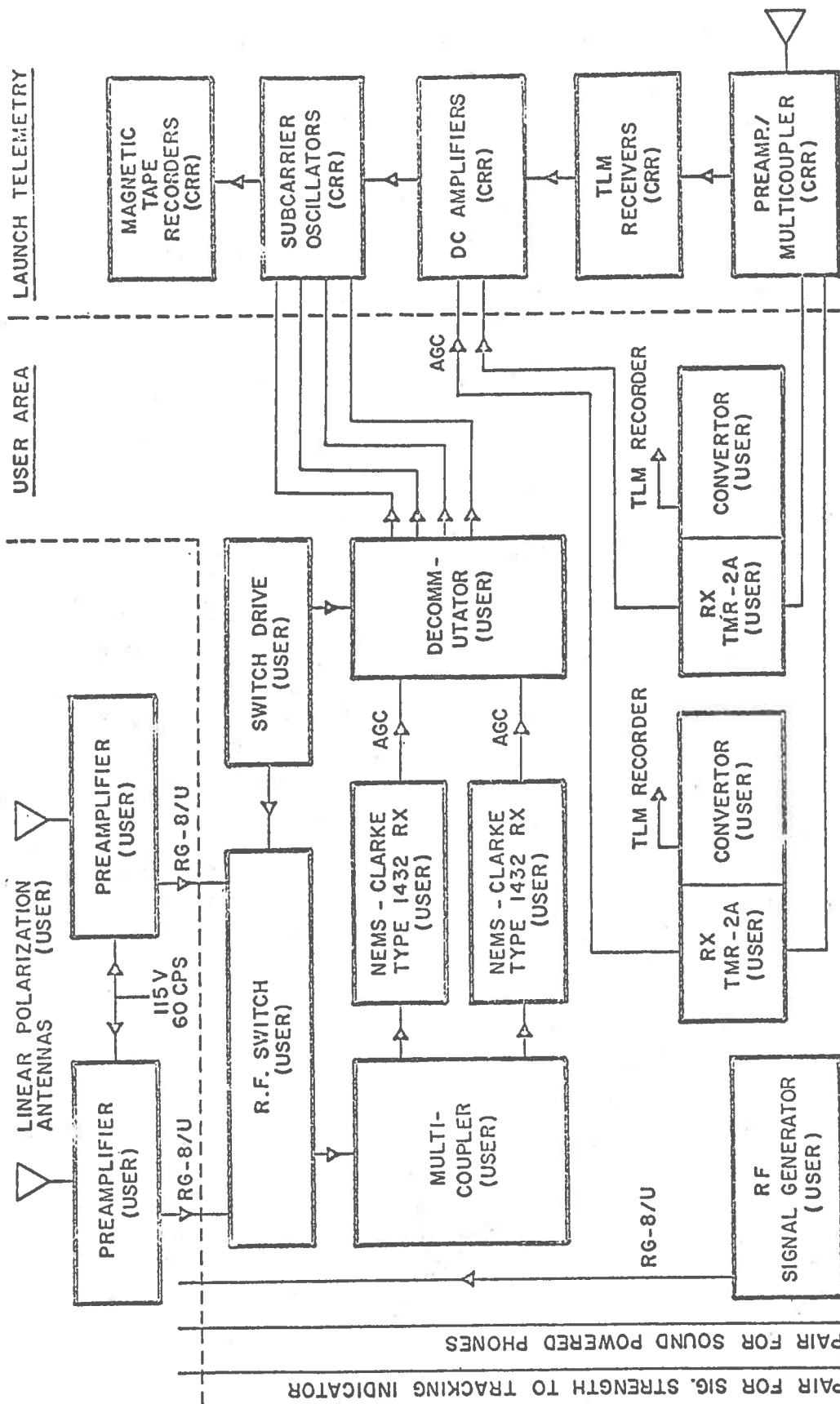
Discriminator Unit, for IRIG Channels, #1 to #6, NRC
Type AM-7.



APPENDIX VI MONITOR AND CONTROL SYSTEM

TRACKER No.2 PLATFORM

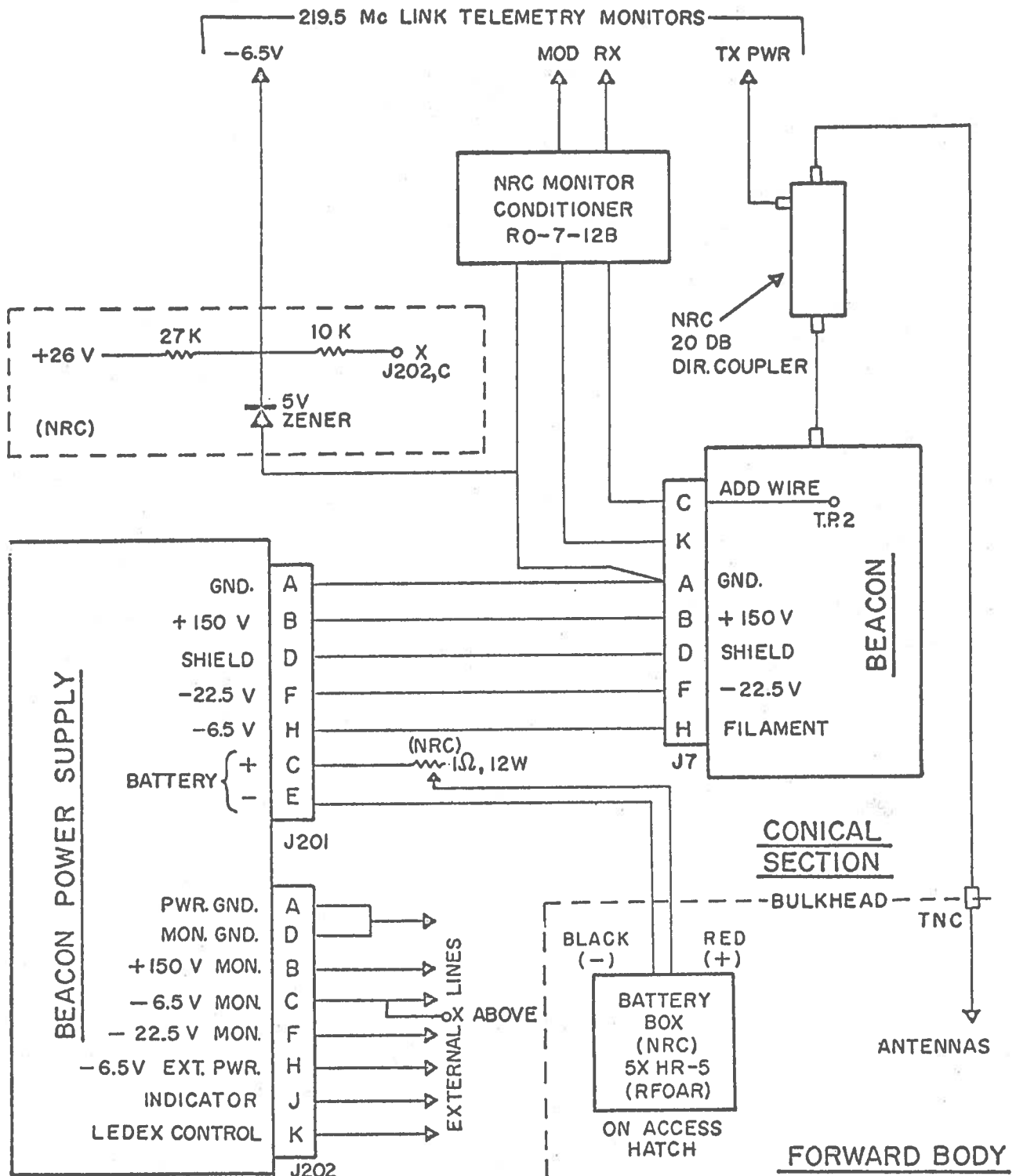
OPERATIONS BUILDING



APPENDIX VII (SHEET-1) TLM AGC SYSTEM

RANGE USER SUPPORT INSTRUMENTATION

APPENDIX VIII DPN-4I RADAR BEACON MONITOR FUNCTIONS

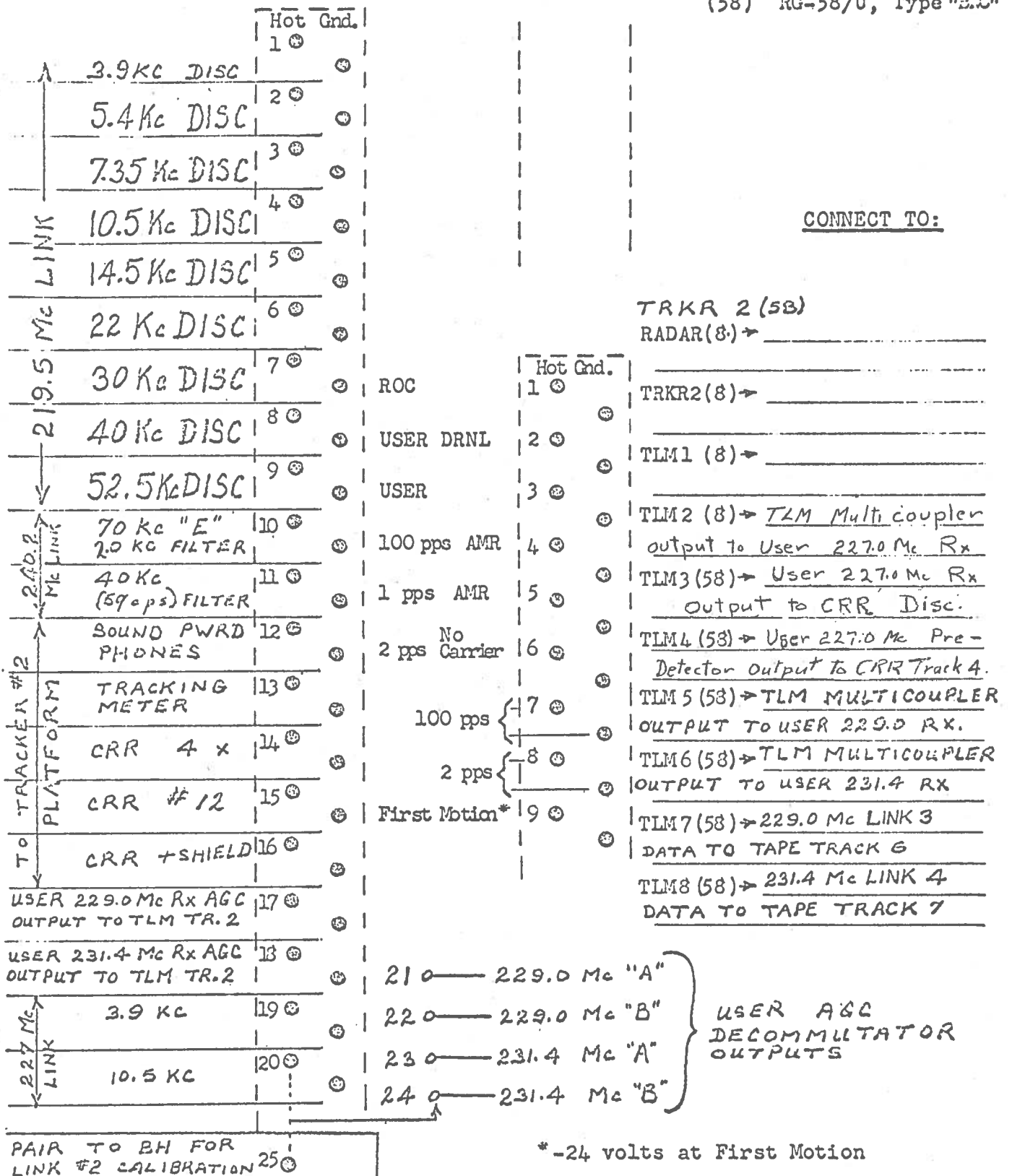


APPENDIX IX

Wire Lines to Nose Cone Assembly Area Adjacent to Launch TLM Station

CONNECT TO:

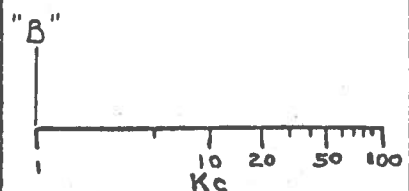
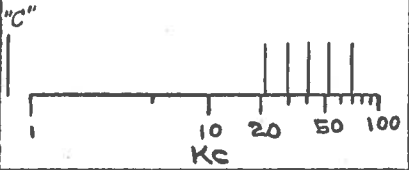
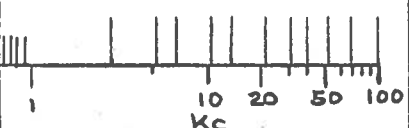
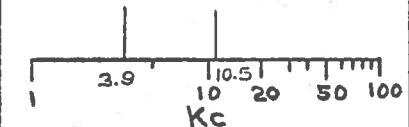
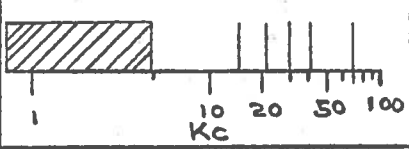
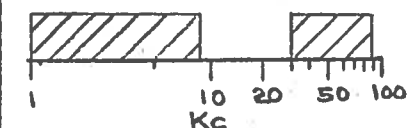
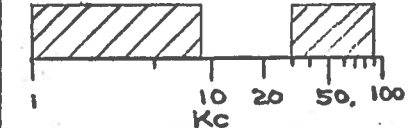
(8) RG-8/U, Type "11"
(58) RG-58/U, Type "21C"



APPENDIX X

OR-152

Launch T/M Tape Recorder Bandwidth Allocations - AD-II-52

TRACK	BANDWIDTH	EQUIPMENT SUPPLIED BY	DATA AND SOURCE
1		CRR	TIMING "B" CRR
2		CRR AND NRC	IRIG #14 TO 18 T/M RX AGC
			TIMING "C" CRR
3		CRR	IRIG #1 TO #6 { NOSE CONE.
			AND #9 TO #18 { T/M LINK #1
			219.5 MC
4		CRR	IRIG #9 AND #12 EJECTED 5"
			SPHERE PLASMA
			PROBE T/M LINK #2, 227.0 MC
5		CRR AND NRC	VOICE COUNT CRR
			TAPE SERVO REF CRR
			IRIG 14 TO #18 TLM AGC and Lift-off Data
6		CRR AND NRC	1 KC TO 9 KC EFP EJECTED
			430 KC TO 90 KC PACKAGE T/M
			PROCESSED BY LINK #3
7		CRR AND NRC	NRC 229.0 MC
			1 KC TO 9 KC EFP EJECTED
			430 KC TO 90 KC PACKAGE T/M
			PROCESSED BY LINK #4
			NRC 231.4 MC

APPENDIX XI

REAL TIME PAPER RECORD NO. 1 ROCKET AD-II-52

TRANSMITTER: NRC 50mw 5" Sphere Ejected 227 Mc
CBA - 1W LOCATION: Nose Cone R.F. FREQ.: 219.5 Mc

RECORDER: CIC Perminit DATA SOURCE: CPR TLM TIME REQ'D.: T-1 Day

RECORD INTERVAL: ON OFF PAPER RATE

- a) AT request of project scientist .64 ips
during Horiz. Check
- b) T-2 Min T-40 sec .64 ips
- c) T-40 Sec LOS 6.4 ips

UAR

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	<u>Timing</u>				<u>IRIG</u> <u>Format "B"</u>
2	<u>14.5 kc</u>	<u>STD</u>	<u>220 cps</u>	<u>Equal</u>	<u>±5G Accel./</u> <u>Plasma Probe Sw</u>
3	<u>30.0 kc</u>	<u>"</u>	<u>450 cps</u>	<u>"</u>	<u>Plasma Trap</u>
4	<u>40.0 kc</u>	<u>"</u>	<u>600 cps</u>	<u>"</u>	<u>Z-Axis Vib./</u> <u>Dc Swept Elect.</u>
5	<u>52.5 kc</u>	<u>"</u>	<u>790 cps</u>	<u>"</u>	<u>Shelf 5 Vib./</u> <u>AC Swept Elect.</u>
6	<u>Link #2</u> <u>3.9 kc</u>	<u>"</u>	<u>59 cps</u>	<u>"</u>	<u>Ejected probe</u> <u>Sweep</u>
7	<u>Link #2</u> <u>10.5 kc</u>	<u>"</u>	<u>160 cps</u>	<u>"</u>	<u>Ejected Probe</u> <u>Signal</u>
8	<u>Timing</u>				<u>IRIG</u> <u>"B"</u>

APPENDIX XI

REAL TIME PAPER RECORD NO. 2

ROCKET AD-II-52

TRANSMITTER: CBA - 1W LOCATION: Nose Cone R.F. FREQ.: 219.5 Mc

RECORDER: CFC Permanent DATA SOURCE: CRR TLM TIME REQ'D.: 7+1 Day

RECORD INTERVAL:

ON

OFF

PAPER RATE

T-2 Min

LOS

2.5 ips

Vof S

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	Timing				IRIG 'C'
2	70 kc CH " 9	Gaussian	10 cps	Equal	Vof S Phot. CHL. LAMP
3	5.4 kc	STD.	81 cps	"	0° Magnetometer
4	7.35 kc	"	110 cps	"	Z-AXIS Accel/ Vof S Phot. Ref.
5	10.5 kc	"	160 cps	"	±5G Accel./ Vof S Phot. Emme.
6	22.0 kc	"	330 cps	"	NRC Photometer
7	Timing				IRIG 'C'

SHEET 2 OF 5

APPENDIX XI

REAL TIME PAPER RECORD NO. 3 ROCKET AD-II-52

TRANSMITTER: CBA 1W LOCATION: Nasc Cone R.F. FREQ.: 219.5 Mc

RECORDER: CFC Permanent DATA SOURCE: GPR TLM TIME REQ'D.: T+1 Day

RECORD INTERVAL:	<u>ON</u>	<u>OFF</u>	<u>PAPER RATE</u>
a)	<u>T-2 Min</u>	<u>T-40 sec</u>	<u>1 ips</u>
b)	<u>T-40 sec</u>	<u>LOS</u>	<u>10 ips</u>

SES

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	Timing				IRIG 'B'
2	70 kc	Gaussian	1200 cps	2" to 3"	Commutator 30 x 10
3	40 kc	STD	600 cps	1"	Z-Axis Vib./ Swept Electr. ^{DC}
4	52.5 kc	"	790 cps	1"	Shelf 5 Vib./ Swept Electr. AC
5	Timing				IRIG 'B'

APPENDIX XI

REAL TIME PAPER RECORD NO. A ROCKET AA-II-52

TRANSMITTER: CBA 1W LOCATION: Nose Cone R.F. FREQ.: 215.5 Mc.

RECORDER: SPN BORN DATA SOURCE: CRR TLM TIME REQ'D.: T-1 1 Hr.

RECORD INTERVAL: ON OFF PAPER RATE

a) T-2 min LOS 10 mm/sec

b) Post-Flight for AGC Calibration. 10 mm/s

SES

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	400 cps	User TWINT	10 cps	Equal	EFP Ejection 229 mc
2	560 cps	"	"	"	EFP Ejection 231.4 mc
3	730 cps	"	"	"	I.T. Ejection
4	960 cps	"	"	"	5" pl. probe Ejection
5	1.3 kc	"	"	"	NC Tips Ejection
6	1.7 kc	"	"	"	70kft Alt. Sw.
7	Direct	Record AGC	of CRR	Rx Link #1	(215.5 Mc)
8	Timing				1 PIC "C"

APPENDIX 81

REAL TIME PAPER RECORD NO. 5 ROCKET AD-II-52

TRANSMITTER: NRC 50MW CBA-1W LOCATION: Nose Cone R.F. FREQ.: 227 Mc
217.5 Mc

RECORDER: Sunbeam DATA SOURCE: CPR TLM TIME REQ'D.: T+1 Hr.

RECORD INTERVAL: ON OFF PAPER RATE

T-2 Min LOS 10 mm/sec
Post Flight for AGC Calibration 10mm/sec

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	70kc CH #3 & 18	Gaussian	10 cps	Equal	90° Magnetometer
2	70kc CH #19	"	"	"	-6.5V Beacon Batt.
3	70kc CH #21	"	"	"	45 Sec Squib
4	70kc CH #22	"	"	"	60 Sec Squib
5	70kc CH #26 & 28	"	"	"	Sub Commutator
6	Direct	Record AGC	of User	R _x Link #2	(227 Mc)
7	Direct	Record AGC	of CPR	R _x Link #5	(108 Mc)
8	Timing				1 RIG "C"

THERE WILL NOT BE AN APPENDIX XII

SHEET 1

PLEASE GO FROM APPENDIX XI SHEET 5

TO APPENDIX XII, SHEET 2

APPENDIX XII

PLAYBACK PAPER RECORD NO. 2 ROCKET: AD-II-52

TRANSMITTER: UofS 50MHz EFP-1A 231.4 Mc
TDI-5W LOCATION: Nase Camp R.F. FREQ.: 219.5 Mc

RECORDER: CEC Permanent DATA SOURCE: Launch TLM Tape

COPIES: 1 TIME REQUIRED: T + 2 Days

RECORD INTERVAL: ON OFF PAPER RATE

a) T-10sec LOS 1"/sec

b) Post flight AGC calibration 1"/sec

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
2	Timing				IRIC "C"
2	CRR 22 kc	STD	50cps	Equal	231.4 AGC User TMR-2A
2	CRR 52.5 kc	"	"	"	231.4 AGC User "A"
2	CRR 70 kc	"	"	"	231.4 AGC User "B"
3	70kc CH #25	Gaussian	10cps	"	EFP-1A RF Mon
3	70kc CH 22	"	"	"	60 sec Squib Mon
3	70kc CH #26 + 28	"	100cps	"	Sub comm
2	Timing				IRIC C
					SHEET 2 OF 7

APPENDIX XII

PLAYBACK PAPER RECORD NO. 3

ROCKET: AD-II-52

TRANSMITTER: U of S 50111 LOCATION: 141-1A R.F. FREQ.: 229 Mc
TDI-5W Abaco Cove 219.511

RECORDER: CEC Permanent DATA SOURCE: Launch TLM Tape

COPIES: 1 TIME REQUIRED: 7-12 Days

RECORD INTERVAL: ON OFF PAPER RATE

a) $7-10 \text{ sec}$ LOS $1''/\text{sec}$

b) Post Night AGC Calibration 1"/sec

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
2	Timing				IRIG "C"
2	CRR 14.5kc	STD	50 cps	Equal	229 AGC User THR-2A
2	CRR 30 kc	"	"	"	229 AGC User "A"
2	CRR 40 kc	"	"	"	229 AGC User B
3	70kc CH #24	Gaussian	10cps	"	EEP-1A RF Mon
3	70kc CH #22	"	"	"	60 Sec Spills Mon
3	70kc CH 26-228	"	100cps	"	Sub Comm IRIG "C"
2	Timing				

SHEET 3 OF 7

APPENDIX XII

PLAYBACK PAPER RECORD NO. 4

ROCKET: AD-II-52

TRANSMITTER: T-11-111 LOCATION: Nose Cone R.F. FREQ.: 213.7 Mc

RECORDER: Sanborn DATA SOURCE: Launch TLM Tape

COPIES: 1 TIME REQUIRED: T+2 Days

RECORD INTERVAL: ON T-2 min OFF LOS PAPER RATE 10MM/sec

SES

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	70kc CH #14	Gaussian	10 cps	Equal	Radar - 6.5V 3sec
3	70kc CH #15	"	"	"	" Mod
3	70kc CH #16	"	"	"	" Rx
3	70kc CH #17	"	"	"	" R.F.
3	70kc CH #7	"	"	"	TLM Batt. Plan.
3	70kc CH #26+28	"	100 cps	"	Sub comm
2	Timing				IRIG "C"

APPENDIX XII

PLAYBACK PAPER RECORD NO. 5

ROCKET: AD-II-52

TRANSMITTER: TDE-TM LOCATION: Nase Cone R.F. FREQ.: 219.5 Mc

RECORDER: Sanborn DATA SOURCE: Launch TLM Tape

COPIES: 1 TIME REQUIRED: T + 2 Days

RECORD INTERVAL: ON OFF PAPER RATE
7-2 min. Las 10mm/sec

UAR

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	7.35 kc	STD	110 cps	Equal	Z Axis Acc./ VofS photometer
3	5.4 kc	"	81 cps	"	0° Magnetometer
3	40 kc	"	600 cps	"	Z Axis Vib./ plasma Probe
3	3.9 kc	"	59 cps	"	MM #1
3	70 kc CH #12 + #27	Gaussian	10 cps	"	MM #2
3	70 kc CH #3 + #13	"	"	"	90° Magnetometer
3	70 kc CH #26 + 28	"	100 cps	"	Subcomm
2	Timing				IRIG C

APPENDIX XII

PLAYBACK PAPER RECORD NO. 6

ROCKET: AD-II-52

TRANSMITTER: TDE-5W LOCATION: Nose Cone R.F. FREQ.: 219.5 Mc

RECORDER: Sanborn DATA SOURCE: Launch TLM Taps

COPIES: 1 TIME REQUIRED: T-1 2 Days

RECORD INTERVAL: ON OFF PAPER RATE
7-2 min LOS 15MM/sec

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	22kc	STD	330 cps	Equal	Fwd Body Vib/ NIRC Phot.
3	5.4kc	"	80 cps	"	0° Magnification
3	70kc CH #3 & 18	Gaussian	10 cps	"	90° Roll Magnification
3	10.5kc	STD	50 cps	"	0° Lateral Acc./ Vof S Phot.
3	11.5kc	"	"	"	90° Lateral Acc/ p.p. record
3	7.35kc	"	"	"	Z Axis Acc./ Vof S Phot.
3	70kc CH #26 & 28	Gaussian	100 cps	"	Sub carrier 1K10 "C"
2	Timing				

APPENDIX XII

PLAYBACK PAPER RECORD NO. 7

ROCKET: AD-II-52

TRANSMITTER: NRC-1W 7DJ-5W LOCATION: Radio Site Nase Conc R.F. FREQ.: 225.7 Mc 219.5 Mc

RECORDER: Sonhorn DATA SOURCE: Launch T/M Tape

COPIES: 1 TIME REQUIRED: 7-2 Days

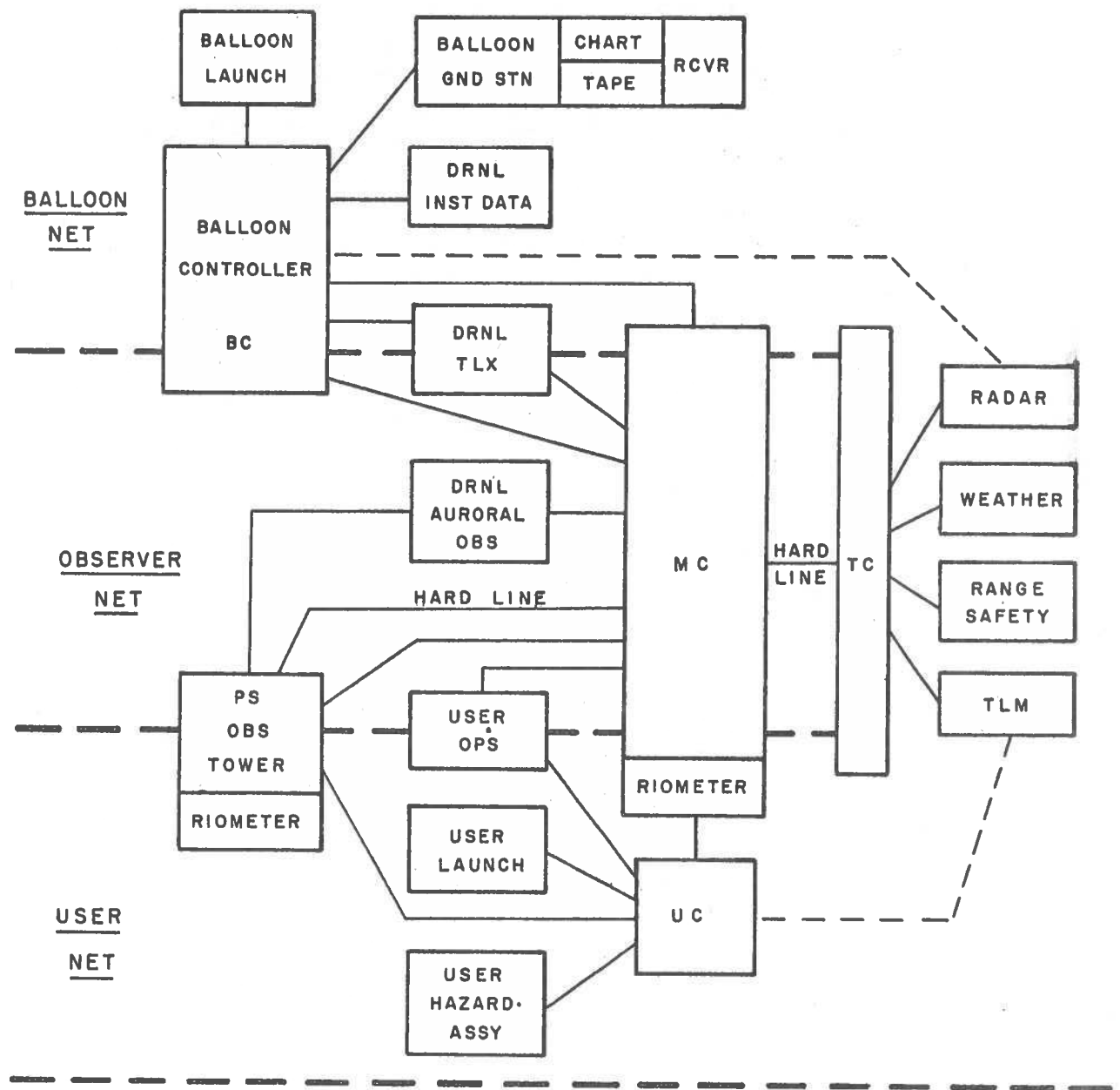
RECORD INTERVAL: ON OFF PAPER RATE

a) T= 2 Min LOS 10mm/sec
b) Post-flight for AGC Calibration 10mm/sec

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
5	40kc	STD	50 cps	Equal	AGC Link #1
5	30kc	"	"	"	AGC Link #2
5					
3	70kc CH #24	Gaussian	10cps	"	EFP 227 MC RF P101
3	70kc CH #25	"	"	"	EFP 231.4 RF P101
3	70kc CH #23	"	"	"	70kc Alt. Sec Internal
3	1.7kc	STD	"	"	70kc Alt. Sec Verified
2	Timing				1/16 "C"

SHEET 7 OF 7

APPENDIX XIII
COMMUNICATIONS NETWORKS



NOTE

BALLOON CONTROL IS LOCATED AT BALLOON
GROUND STATION UNTIL AFTER ROCKET LAUNCH,
THEN MOVES TO DRNL

