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One Black Brant IIA, upper atmosphere research launch combined with high altitude balloons, neutron detector, micrometeorite, Langmuir probe, planar probe, auroral scanner, X-ray detector and electric field potential package : vehicle no. AA-II-60

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

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COPY NO.

NATIONAL RESEARCH COUNCIL OF CANADA
ASSOCIATE COMMITTEE ON SPACE RESEARCH

ELEC. ENG.

OPERATIONS REQUIREMENT
FOR BLACK BRANT ROCKET AA-II-60

PREPARED BY
RADIO AND ELECTRICAL ENGINEERING DIVISION

O.R. 151

OTTAWA
OCTOBER 1964

NRC # 22097

ANALYZED

UNCLASSIFIED

OPERATIONS REQUIREMENT NO. 151

One Black Brant IIA, Upper Atmosphere Research Launch
combined with High Altitude Balloons, Neutron Detector,
Micrometeorite, Langmuir Probe, Planar Probe,
Auroral Scanner, X-ray Detector, and
Electric Field Potential Package

Vehicle No.: AA-II-60

SUBMITTED BY:

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ACCEPTED BY:

Wm. J. Lepore
CRROAR Operations

COPY NO. _____

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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...CRR". Insert "IRIG #14 to #18...TLM AGC and Lift-off Data". Track No. 7, add "100 kc Reference...CRR".
Appendix XII 7 of 8		Tape Track 5, delete "22 kc" and "Radar #1". Insert "40 kc" and "Link No. 1". Tape Track 5, after 30 kc, delete "Radar #2". Insert "Link No. 2". Delete "Tape Track 5 - 40 kc - Radar #3 AGC."
<u>February 15, 1965</u>		
22	2.1.1	Under Data Points/Sec., delete existing detail and insert: "1 pt./sec. launch to about 400,000 ft.; 1 pt./5 sec. 400,000 ft.-apogee-400,000 ft.; 1 pt./sec. 400,000 ft. to impact."
<u>January 27, 1965</u>		
21	1.6.1	Add new sub-para., as follows: "m. DRNL are requested to arrange for PARL to support this test and to pass auroral reports as for OR's 152 and 154".
<u>February 25, 1965</u>		
45	10.1	Add new para., as follows: "A room, or small heated hut is required for a ground station to be operated by University of Saskatchewan personnel in conjunction with their electric fields experiment. The station

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<u>Page</u> <u>No.</u>	<u>Para.</u> <u>No.</u>	<u>Instructions/Remarks</u>
	10.1 cont'd.	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."
35	5.1.1	Add new para.: "A maximum of 500 watts, 115V, 60 cps, is required for equipment in the electric fields ground station. This power is required for a timing generator amongst other equipment and stable frequency is desired."
33	4.4	Add new para.: "One PPM timing marks are required on the records of 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."
<u>March 1, 1965</u>		
14	1.5.2	Add new para.: " <u>Link No. 5</u> - A one watt Mk. VIII transmitter tuned to 227.0 mc/s with a single 70 kc/s SCO has been installed to transmit the signal from a microphone installed in the nose cone. This link is to provide a record of noise levels in a nose cone during flight.
21	1.7.6	Add new item: <div style="display: flex; justify-content: space-between;"><div>5 227.0 mc</div><div>U Telemetry</div><div>Nose Cone Microphone</div></div>
Appendix X		Track 5, under "Data", insert "Nose cone microphone - Link No. 5."

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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 Churchill Research Range, Fort Churchill, in connection with this program:

Project Coordinator	-	A. Staniforth, NRC
Project Scientist	-	Dr. A.G. McNamara, NRC
Mission Controller	-	Capt. E.W. Rance, NRC
Payload & Ground Instrumentation	-	Five NRC personnel to be named
Balloon Group	-	University of Alberta personnel under Dr. C.D. Anger, as detailed in O.R. 155.

It is probable that additional personnel from NRC and two or three each from the Universities of Alberta and Saskatchewan will be present at Fort Churchill in connection with this program. Names of such personnel will be advised later.

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

Times and dates of arrival of all personnel will be passed to DRNL approximately two weeks prior to the arrival of the team at the Range.

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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, 152, 154 and 155.

Range support is also requested for the launching of a number of upper atmosphere balloons by personnel of the University of Alberta to supply data required in support of the rocket firing. The duration and frequency of balloon flights is also unpredictable and will also require a day-to-day rescheduling until the required conditions are met. The balloon requirements are detailed in O.R. 155.

1.2.2 General Countdown

TIME

FUNCTION/SERVICE

Note: See O.R. 155 for balloon countdown.

Preparation Phase:

F-5 day
(approx.)

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).

The rocket motor, igniter and fins for this rocket were airlifted from CARDE, Que., to Fort Churchill in June and August 1964.

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
	Pressurize nose cone to 5 p.s.i.g.	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
	Check pressure of nose cone and pump if necessary.	User
T-180	Vehicle brought to Launch Bay.	LS/TC
Balloon T-75	Balloon group check in. Decision on balloon launch.	BC/MC
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
	Check nose cone pressure and pump if necessary.	User/MC
	Install access hatch in forward body temporarily.	User/MC/TC
	Clean nose cone.	User/MC/TC
T-140 Balloon T-35	Decision re balloon launch. Commence inflation.	BC/MC
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-125 Balloon T-15	Balloon power on.	BC/MC/TC
T-110 Balloon T-0	Balloon launched. Radar to track.	BC/MC/RDR/TC
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
	Decision re second balloon; begin preparations.	BC/MC

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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. Report on balloon readings.	TC/LS BC/MC
T-20	BH control console connected to umbilical. Radar discontinues tracking balloon, ready for Vertical Instrumentation Checks.	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. Vertical checks complete. User instrumentation sites report status. Radar returns to tracking H.A. balloon.	MC/TC MC/TC DRNL/MC
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. <u>Note:</u> Several balloons may be required to be launched due to holds. At least one balloon must be at altitude until rocket fired.	All

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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. Radar to balloon track if hold to be called.	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, except No. 4, 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.	
T+40 sec.	1/4" dia. Probe projects.	
T+60 sec.	EFP package ejected (Link 3, 229 mc; Link 4, 231.4 mc)	
	Plasma probe projects.	
T+200 sec.	Apogee (approximately 98 st. miles)	

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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. <u>Note:</u> Recorders on until Link 3 and Link 4 LOS.	
T+10 min.	Radar AGC, Telemetry AGC, 30 mc Riometer calibration. <u>Note:</u> In cases of tests being aborted with a balloon in flight, radar will be required to continue tracking the balloon for the remainder of the balloon flight.	

1.3 Test Objectives

1.3.1 Primary

It is required that this rocket be launched during a period of solunar darkness when acceptable wind conditions prevail and either a, b, c or d.

- a. Unusually great events exist, as follows, any one being sufficient to justify a launching:

- (1) Aurora intensity III on the trajectory, or
- (2) Balloon X-ray Detector, 1000 counts/sec., or
- (3) PARL radar 20 db on trajectory, or
- (4) Absorption, 3 db.

- b. Minimum launch conditions, requiring simultaneous occurrence:

Balloon X-ray detector 100 cts/sec. plus (PARL radar 10 db or visual aurora intensity II on trajectory) plus reasonably clear sky at DRNL.

- c. Minimum launch conditions with major failures in observing equipment:

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1.3.1 Primary (cont'd.)

(1) Balloon inoperative:

Absorption 1.5 db plus (Radar 10 db or Visual Int. II) plus reasonably clear sky.

(2) PARL radar inoperative:

Balloon X-rays 100 cts/sec. plus Visual Int. II plus reasonably clear sky.

(3) PARL and balloon both inoperative:

Absorption 1.5 db plus Visual Int. II plus reasonably clear sky.

- d. After two days on launcher without satisfying minimum conditions, when all other requirements were in "GO" configuration, conditions will be relaxed to accept any two of:

PARL 10 db on trajectory.

Absorption 1 db.

Visual Intensity II on trajectory.

Balloon 50 cts/sec.

These conditions are required to satisfy the experiments and measuring devices which are carried aboard this vehicle, as follows:

- a. Cosmic Ray experiment concerned with the study of particles associated with auroral activity (NRC).
- b. Plasma Probe measurements of fine structure of electron density and electron energy spectrum inside and outside auroral formation (NRC).
- c. 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).

1.3.1 Primary (cont'd.)

- d. Photometer to indicate periods during which the vehicle is within an auroral formation.
- e. 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-II (U of S).
- f. Neutron Detector 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, γ -rays and charged particles (U of A).
- g. X-ray Detector experiment for observation of auroral X-rays in the range 10-150 Kev and for correlation with a rocket borne auroral scanner, Cosmic Ray experiment and balloon borne X-ray detectors.

1.3.2 Secondary

Magnetometer, accelerometer, and temperature measurements will be taken to assist the evaluation of vehicle performance and attitude.

1.4 Test Description

The description of the balloon launchings required in support of this test is detailed under Appendix XIII.

The Black Brant IIA rocket, AA-II-60, will carry several experiments in its nose cone for scientific investigation of the upper atmosphere. It is desired that the vehicle be launched to obtain an effective elevation of 85° nominal. There is no preferred launch azimuth. Recovery is not required. The desired conditions at launching in order of importance are shown under para. 1.3.1.

1.4 Test Description (cont'd.)

Events of primary importance during the flight are:

- a. Multiplex relay transfer at T+30 seconds.
- b. Extension of 1/4" diameter probes and auroral scanner at T+40 seconds.
- c. Ejection of electric field potential packages at T+60 seconds.
- d. Extension of plasma probe at T+60 seconds.
- e. Motor burnout, apogee and impact are other items of interest.

Range User personnel will attend to all details of concurrent balloon launchings and will man the nose cone instrumentation console in the Blockhouse, monitor equipment in the User Area of the Operations Building, the balloon group instrumentation, and the Scientists' Observation Platform during the countdown. User personnel are required to perform checkout tasks on the nose cone in the launch bay during the Horizontal Instrumentation Checks.

1.5 Test Vehicle Description

The Black Brant IIA is a single-stage, solid propellant, unguided sounding rocket. The motor was filled by CARDE and is fully described under CARDE Technical Notes, copies of which are held by CRROAR. This particular rocket will use motor numbered MT-34, airlifted Quebec to Churchill 21 May 64 and a Canadair, four-fin, stabilizer unit airlifted Quebec to Churchill 28 Aug. 64. The fins were aligned by CARDE to produce zero spin but will be re-aligned during November 1964 at CRR by a Canadair representative to give 0.4 rps. Performance predictions and wind weighting have been supplied to CRROAR by CARDE under Data Booklet for Black Brant vehicles AA-II-37, 58, 59 and 60.

The balloons to be launched in conjunction with this test are plastic balloons with a capacity of 40,000 to 60,000 cu. ft. The balloons will be filled with helium and are fully described in O.R. 155.

1.5 Test Vehicle Description (cont'd.)

Length	-	332.5 inches (approx.)
Diameter	-	17.2 inches
Launch Weight	-	2700 lbs. approx.
Weight at Burnout	-	920 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

The estimated weight and centre of gravity of the nose cone and payload were furnished by NRC to CARDE, who then calculated vehicle performance. Final weighing of the nose cone prior to launch may require minor corrections to performance predictions based on actual nose cone weight.

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, with 218.0 mc as an alternative frequency, 5 watts. 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: A second telemetry transmitter in the nose cone will transmit data from the X-ray detector and auroral scanner experiments. This will be an FM

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1.5.2 Telemetry Systems (cont'd.)

transmitter operating at 240.2 mc, 1 watt. The antenna system consists of two quadraloop radiators mounted 180° apart, 90° to the 219.5 mc link antennas, on the surface of the nose cone. The polarization is linear.

The auroral scanner experiment data on this link will be via a channel "E" 70 kc SCO. For real time display a 70 kc discriminator with a 10 kc bandwidth is required. Range User will provide a suitable output filter for this channel. The X-ray experiment data will be direct modulation on the FM transmitter, 0 to 20 kc bandwidth and will have a scaler modulating a 40 kc SCO. NRC will provide a filter for playback separation of the X-ray signal and the SCO signal.

Link No. 3 and Link No. 4: The electric field probe packages to be ejected at T+60 seconds contain transmitters of 50 milliwatts output power each. Link No. 3 will be set to 229.0 mc and Link No. 4 to 231.4 mc. These links will each consist of a single oscillator FM modulated by the tumbling of the probe after ejection. The antenna of each is linear polarized.

Range User will supply a receiver and pre-recording processing equipment for these links 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. The receivers will be Defense Electronics TMR-2A to provide a 10 mc IF signal. The 10 mc IF output of the receiver is fed to a converter for conversion to 60 kc. The pre-detection 60 kc signals are then recorded on Track 6 and Track 7 of CRROAR telemetry magnetic tape recorders. Filters are incorporated in the converter unit to restrict the frequency range of the recorded signals to 60 kc \pm 30 kc for improved signal-to-noise ratio.

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1.5.2 Telemetry Systems (cont'd.)

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 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.

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1.5.5 Ordnance Items

Characteristics of propellant, igniter, and squib are available in the CARDE Technical Note on the Black Brant 15KS25000 rocket.

Two Bellows actuators (squib) each are used in the ejection of the EFP packages and the projection of the Langmuir Probes and Auroral Scanner. These devices are made by Hercules Powder Company, Wilmington, Delaware.

	<u>Type BA31D2</u>	<u>Type 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 milliseconds (at 1.0 amp.)	0.6 milliseconds (at 1.0 amp.)

The EFP packages use Type BA31D2 and the Langmuir Probes and Auroral Scanner use Type BA31K2.

The location of these items is shown on the 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; also, for the check-out assembly and monitoring of balloon-borne instrumentation (see O.R. 155).

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 IRIG #16 and channel E of the 240.2 mc link, in the

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

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 April 1963 would be suitable. Range User will provide discriminators for IRIG channels #1 to #6 and Channel selector for Channel #16. Refer to block diagram in Appendix VI.

b. User Area, Operations Building

Scientists' Monitors: Discriminator outputs from channels IRIG Nos. 9-17 inclusive from the 219.5 mc link, IRIG E and IRIG #16 and the video output of the T/M receiver on the 240.2 mc link must be available for monitoring, using high impedance instruments, in the User area adjacent to the telemetry station in the Operations Building. A User supplied filter is required to separate signals on 240.2 mc link. These monitors are required by Range User scientific personnel. It is also requested that the panel in the User area of the blockhouse be fitted with a light that will be illuminated when tape recorders at Telemetry are "on".

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 ± 1.00 volt for the desired calibration range of signal strengths at the inputs of the pre-amplifiers and at an

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

impedance level suitable for a subcarrier oscillator input impedance of 100K ohms.

CRR 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 and a signal strength meter.
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 in 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 Link Nos. 3 and 4 fed from CRR circularly polarized telemetry antenna) described in para. 1.5.2 be recorded on magnetic tape recorder Track 2 via a CRR subcarrier oscillator. The AGC output level from these receivers (Defense Electronics Type TMR-2A) 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).

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

Launch telemetry is requested to provide AGC calibration for the User receivers on Links Nos. 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. Launch Telemetry Station

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

Range User will provide discriminators for IRIG channels #1 to #6 and a channel selector for Channel #16, and a suitable output filter for Channel E.

d. Link No. 2, 240.2 mc, Calibration

This link has a wideband X-ray experiment, an X-ray scaler on a 40.0 kc SCO, and a band "E" SCO modulated by an auroral scanner experiment (para. 1.5.2). Data modulation on an FM transmitter and certain special requirements are necessary for calibration of the data and setting the record level on the telemetry magnetic tape recorders. Twin Lakes' receivers should be calibrated for deviation sensitivity referenced to the Launch TLM receivers to be used on this link at T-1 day.

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

Two receivers are requested for Link #2, one on each TLM recorder. All calibration for the X-ray will be controlled from the Blockhouse. This link will require 24 minute tape which will include 60 sec. calibration in horizontal and 60 seconds in vertical instrumentation checks. The Project Scientist will require a monitor output in the User Area of the Operations Building connected to the playback output of Track 4 of one of the Launch telemetry tape recorders.

Telemetry Station support (including Twin Lakes telemetry) will be requested several hours prior to T-4 hours for calibration and final adjustments of Link No. 2. An abbreviated form of the procedure used at this time will be repeated during Horizontal and Vertical Checks.

1.6.1 DRNL Instrumentation Support

DRNL are requested to operate the following equipment and to provide the following services prior to and during the launch phase:

- a. 4" x 5" Rapid Scan Spectrometer, 3000-11,000 \AA° .
- b. HB and other photometers.
- c. 16 mm All Sky Camera plus 16 mm colour pictures of sky in trajectory of rocket. All Sky cameras to be operated at high speed during whole time.
- d. Flux Gate Magnetometer.
- e. Height-finding stations for aurora.
- f. Auroral Radar.
- g. Ionosonde, 4 sweeps per minute from T+0 to T+6 min.
- h. Magnetic tape of voice countdown.
- j. Auroral activity predictions.
- k. Communications for ground support instrumentation.

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1.6.1 DRNL Instrumentation Support (cont'd.)

- l. Communications between DRNL and Prince Albert Radar.
- m. Verbal reports of prevailing auroral conditions, on demand from PS and from T-90 sec. to T-0. Also continuous tape recorded reports of visual observations from T-90 sec. to T+10 min.

1.7 Summary of Frequency Utilization

a. Ground Links: DRNL to Twin Lakes radio link.

b. Rocket Links:

<u>Link No.</u>	<u>Frequency</u>	<u>Class</u>	<u>Equipment</u>	<u>Location</u>
-	2880 mc	U	Radar Beacon	Nose Cone
1	219.5 mc (218.0 mc alternate)	U	Telemetry	Nose Cone
2	240.2 mc	U	Telemetry	Nose Cone, X-ray Data and Auroral Scanner.
3	229.0 mc	U	Telemetry	EFP I Ejected Pkg.
4	231.4 mc	U	Telemetry	EFP I Ejected Pkg.

c. Balloon Link: See O.R. 155.

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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</u> <u>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	5 from T-0 to splash	Plotting Board Data to 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.	NO.	FREQ.	DEV. ±%	MEASURING RATE	RECORDING INTERVAL	CLASS	ACCUR-ACY ±%	REMARKS
1	219.5 mc FM/FM	1	400 cps	7.5	Cont.	T-02 mins. to impact	I	-	EFP Ejection (229 mc)
3	219.5 mc FM/FM	2	560 cps	7.5	Cont.	T-02 mins. to impact	I	-	EFP Ejection (231.4 mc)
4	219.5 mc FM/FM	3	730 cps	7.5	Cont.	T-02 mins. to impact	I	-	Spherical Probe Extension
5	219.5 mc FM/FM	4	960 cps	7.5	Cont.	T-02 mins. to impact	I	-	Spherical Trap Extension
6	219.5 mc FM/FM	5	1.3 kc	7.5	Cont.	T-02 mins. to impact	I	-	70K ft. Altitude Switch
7	219.5 mc FM/FM	6	1.7 kc	7.5	Cont.	T-02 mins. to impact	I	-	Auroral Scanner Extension
8	219.5 mc FM/FM	9	3.9 kc	7.5	Cont.	T-02 mins. to impact	I	2%	±5g Accel. 0° LL/ C.R. Electron Total Energy
9	219.5 mc FM/FM	10	5.4 kc	7.5	Cont.	T-02 mins. to impact	I	2%	±5g Accel. 90° CWLF/ A Neutron Detector
10	219.5 mc FM/FM	11	7.35 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Z-axis Accel./ B Neutron Detector
11	219.5 mc FM/FM	12	10.5 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Plasma Probe Sweep/ C.R. Proton Detector
12	219.5 mc FM/FM	13	14.5 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Planar Probe DC Sig.
13	219.5 mc FM/FM	14	22.0 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Spherical Trap Sig.
14	219.5 mc FM/FM	15	30.0 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Cosmic Ray Commuta- ted

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2.3 Telemetry (cont'd.)

ITEM NO.	LINK FREQ.	NO.	FREQ.	DEV. ±%	MEASURING RATE	RECORDING INTERVAL	CLASS	ACCUR-ACY ±%	REMARKS
15	219.5 mc FM/FM	16	40.0 kc	7.5	Cont.	T-02 mins. to impact	I	2%	Z-axis Vibration/ Spherical Trap AC Signal
16	219.5 mc FM/FM	17	52.5 kc	7.5	Cont.	T-02 mins. to impact	I	2%	90° Vib./Swept Electrometer
17	219.5 mc PAM/FM/FM	18	70.0 kc	7.5	300/sec.	T-02 mins. to impact	I	2%	Commutated Channel 30 x 10 per sec.
18	229.0 mc FM	-	-	-	Cont.	T-02 mins. to LOS	I	2%	Transmitter in EFP Ejected Pkg.
19	231.4 mc FM	-	-	-	Cont.	T-02 mins. to LOS	I	2%	Transmitter in EFP Ejected Pkg.
20	225.7 mc FM/FM	14	22 kc	-	Cont.	T-02 mins. to impact	I	-	Radar No. 1, AGC
21	225.7 mc FM/FM	15	30 kc	-	Cont.	T-02 mins. to impact	I	-	Radar No. 2, AGC
22	225.7 mc FM/FM	16	40 kc	-	Cont.	T-02 mins. to impact	I	-	Radar No. 3, AGC
23	225.7 mc FM/FM	18	70 kc	-	Cont.	T-02 mins. to impact	I	-	ADR Data
24	240.2 mc FM/FM	16	40 kc	7.5	Cont.	T-02 mins. to impact	I	2%	X-ray Scaler Signal
25	240.2 mc FM/FM	E	70 kc	15	Cont.	T-02 mins. to impact	I	2%	Auroral Scanner Sig.
26	240.2 mc FM	-	-	-	Pulse	T-02 mins. to Impact	I	10%	X-ray Signal

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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 IRIG Timing Format "C"
3	Nose Cone Telemetry Link No. 1 (219.5 mc)
4	Nose Cone Telemetry Link No. 2 (240.2 mc)
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. Format C is also required at the Balloon Group instrumentation Site for use with balloon equipment;
- d. Time signals from WWV.

Item (d) 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	CRR C.P.	User TMR-2A	14.5 kc	13
#4-231.4 mc	CRR C.P.	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 and 2 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. Links Nos. 3 and 4 should be received using a Nems-Clarke Type 1510 Receiver using the FM 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. 3 and 4 be recorded via CRR DC

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:

Link No. 1	-	0 to 1000 μ v	) 0, 1, 2, 5, 10, 20,) 50, 100, 200, 500,
Link No. 2	-	0 to 1000 μ v	) 1000 μ v steps.
Link No. 3	-	0 to 100 μ v	) 0, 1, 2, 5, 10, 20,) 50, 100 μ volt steps.
Link No. 4	-	0 to 100 μ v	) 0, 0.1, 0.2, 0.5, 1.0,) 2, 5, 10, 20, 50, 100) μ v steps.

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.

Special requirements for balloon launchings are detailed in O.R. 155.

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

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 to the 3.9 kc, 14.5 kc, 22.0 kc, 40 kc and 52.5 kc subcarrier channels by a calibrator unit in the nose cone.

Signal strength: CRROAR 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, 240.2 mc)	
Link No. 3, 229.0 mc	)	0, 0.1, 0.2, 0.5, 1, 2, 5,
	)	10, 20, 50, 100 μ volts.
Link No. 4, 231.4 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 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:

<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 (concerning the nose cone payload). 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.

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 CRR meteorologist be available for consultation from T-12 hours to launch. Special requirements for the balloon group are detailed in O.R. 155.

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 tracked

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3.2 Observations (cont'd.)

by radar are one solution to detecting wind shears that would jeopardize a successful flight. Every effort is required to observe for wind shears in excess of tolerance to avoid launching under such conditions.

3.3 Minima

See para. 1.3.1 and wind restrictions for Black Brant rockets, as detailed by CARDE.

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4.0 SUPPORT INSTRUMENTATION

4.1 Communications - General

Intercommunications are requested for User use at Launch, DRNL and ground stations, as shown at Appendix XIII. DRNL is requested to provide Telex communications with PARL during the countdown.

A User hard line is requested between the block-house 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, also during the preparation phase if requested, for the rocket and balloon instrumentation.

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. 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, also to the Balloon Ground Instrumentation site for transmission of timing Format C.

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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. Balloon instrumentation ground station.

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

4.3.3 Umbilical Cable

It is understood that CRR will maintain the 70 No. 16 and 70 No. 6 conductors of the Blockhouse to Universal Launcher umbilical cable including the boxes for the User "Mac" panels. The User will wire and supply "Mac" panels for the umbilical for this rocket.

4.4 Timing

Timing on the magnetic tape records is requested to be:

- a. IRIG Format "B", 100 pps with a 1 kc carrier;
- b. IRIG Format "C", 2 pps 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 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. Records for the period the NRC crew are at the Range are required by the Project Scientist.

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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.

5.1.2 Food Services

Eighteen to twenty-two 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 will be required for User personnel at launch.

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 to be fitted with the CARDE supplied Black Brant 4 fin rocket rail system for this test. Installation and alignment of these rails should be completed by CRR prior to T-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 219.5, 229.0, 231.4 and 240.2 mc links, the balloon link, and the radar AGC. 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 will be 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 of the arrival of the rail express shipment at Fort Churchill.

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 possess DND operator's permits.

6.1.2 Cargo

DRNL is requested to meet the Trans Air flight and to provide for the unloading and transport to the Range of the nose cone and check-out equipment. The motor and fin assembly were delivered to the Range by RCAF flights in June and August 1964. Other equipment will probably arrive by air but part may be shipped by rail.

Check-out equipment will be shipped rail express and the 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.

Other cargo will be:

- a. Nose cone and payload in crate: approximately 350 lbs., 24 in. x 25 in. x 10 ft.
- b. About 500 lbs. instrumentation and check-out equipment from the University of Saskatchewan, by rail express.
- c. About 500 lbs. check-out equipment from the University of Alberta, by rail express.

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6.1.2 Cargo (cont'd.)

The above items include equipment to be used in other launch programs sponsored by NRC during the same time period.

Item a. and a portion of the check-out equipment 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 to 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

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7.0 RECOVERY

No recovery is required.

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8.0 AIRCRAFT AND SEACRAFT - NR.

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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		4	T+6H	NRC	NRC	R-PLOT	) note (a)
9.2.1.2 Impact								
2	Impact Coordinates		2	T+10	NRC	NRC	) F-FRPT	

Note (a) - Real time plotting board data of range, azimuth, and elevation is requested for each radar on valid track.

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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		2	T+15	NRC	NRC	R-PHOTO	
	Documentary Film		1	T+15	NRC	NRC	R-PHOTO	
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+1H to T+1	NRC	NRC	R-GRAF	See Appendix XI
	Playback paper	1		T+2	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	3	T+15CD	NRC	NRC	F-FRPT and R-MAGT	
9.3 Meteorological Data								
8	Report on all requested observations		4	T+15	NRC	NRC) F-FRPT	

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9.3 Meteorological Data (cont'd.)

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

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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 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, under temperature conditions as specified under the CARDE TN.
- d. About 100 square feet of space is requested in the blockhouse for the payload check-out console and associated equipment (power supplies, battery chargers, receiver, discriminators, display oscilloscopes, etc.).
- e. Office space and telephone at DRNL.
- f. An observation station beside the Operations Building for use of the Project Scientist. A telephone, an intercom on the DRNL net, and a hard line, PS-MC, 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. Balloon group requirements are detailed in O.R. 155.

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

1 October 1964

OR 151

11.0 RANGE SAFETY

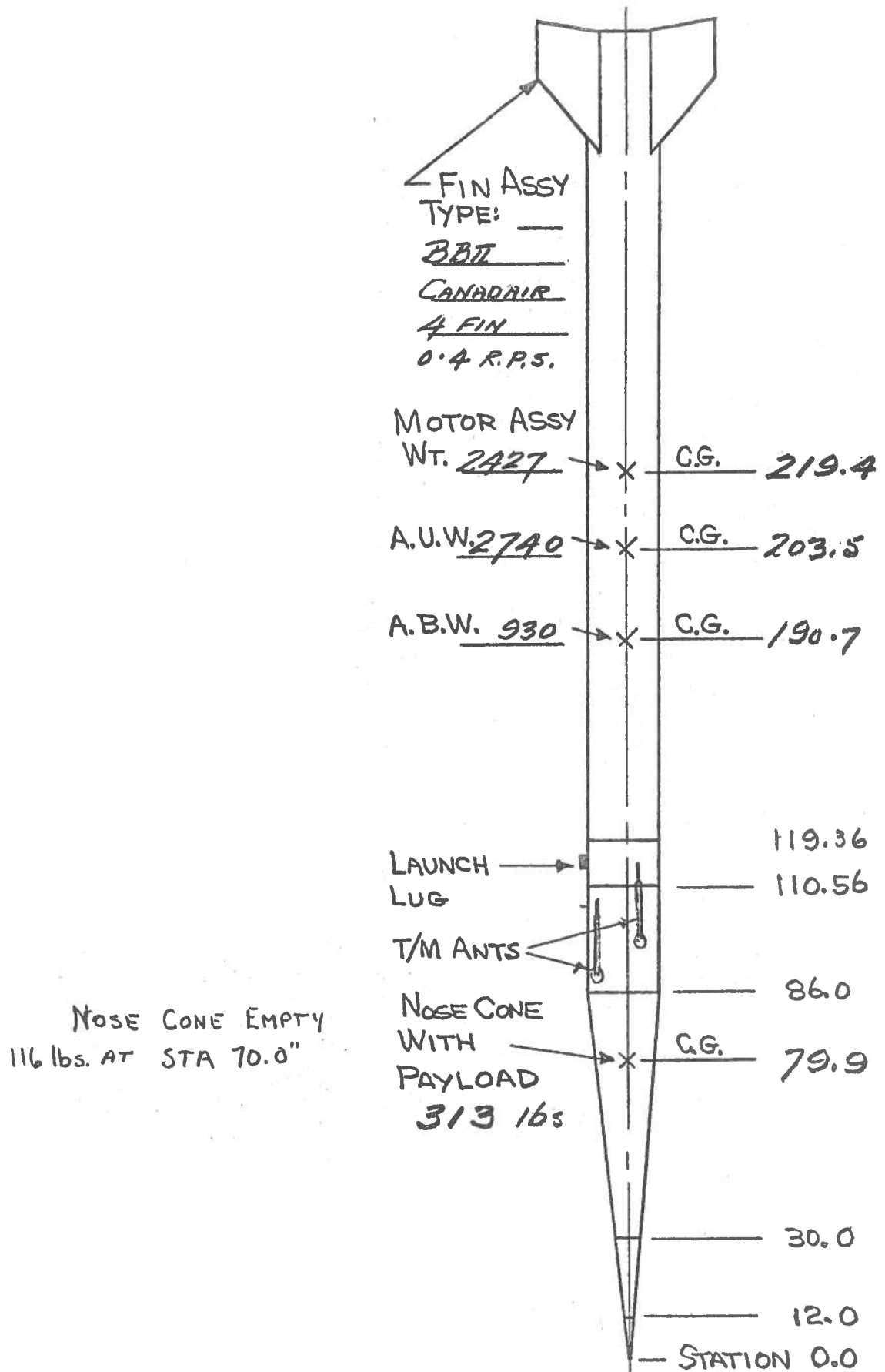
CRROAR is responsible for all range safety.

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. Intercommunications Nets Required.

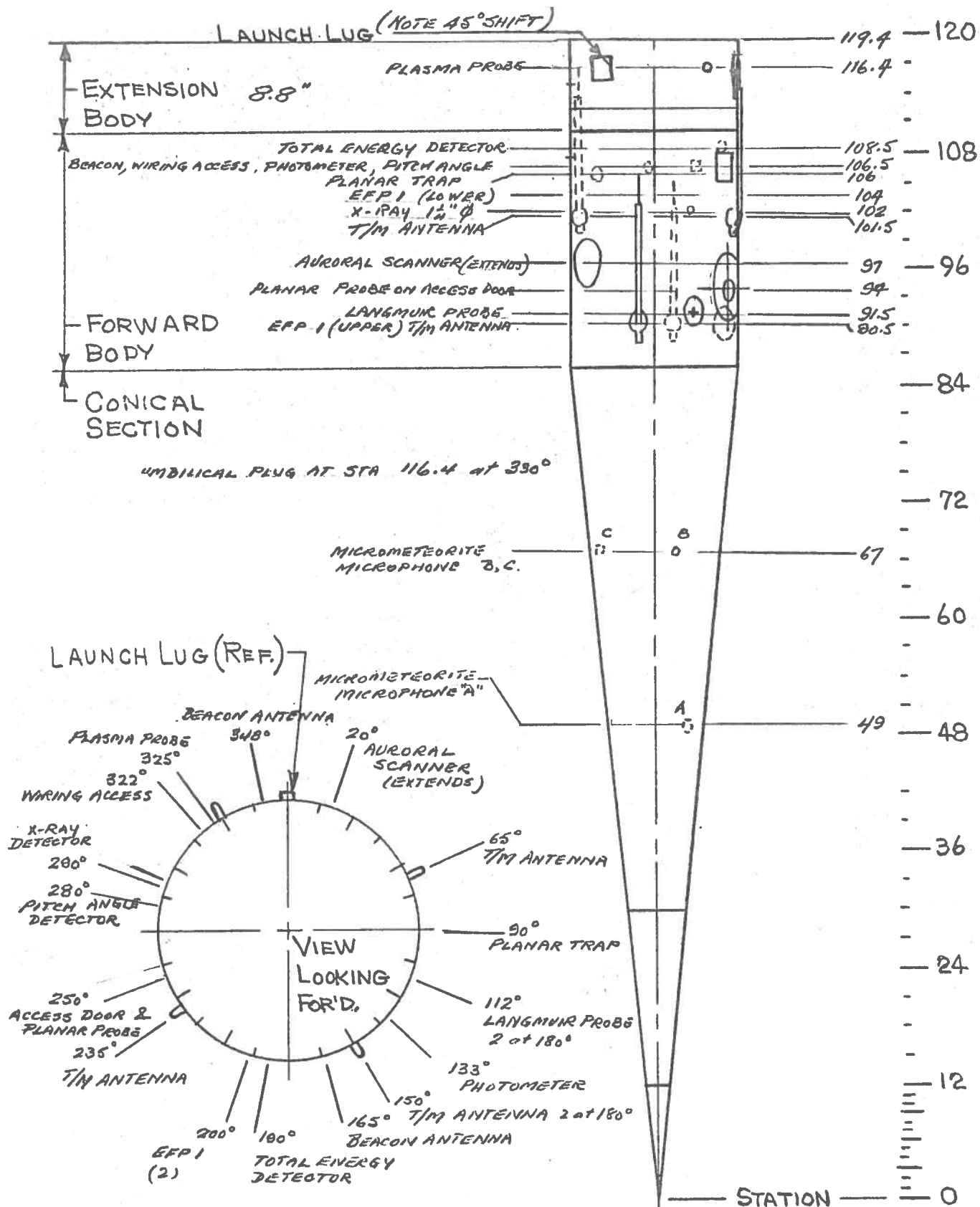
APPENDIX I

Vehicle Drawing - AA-II-60



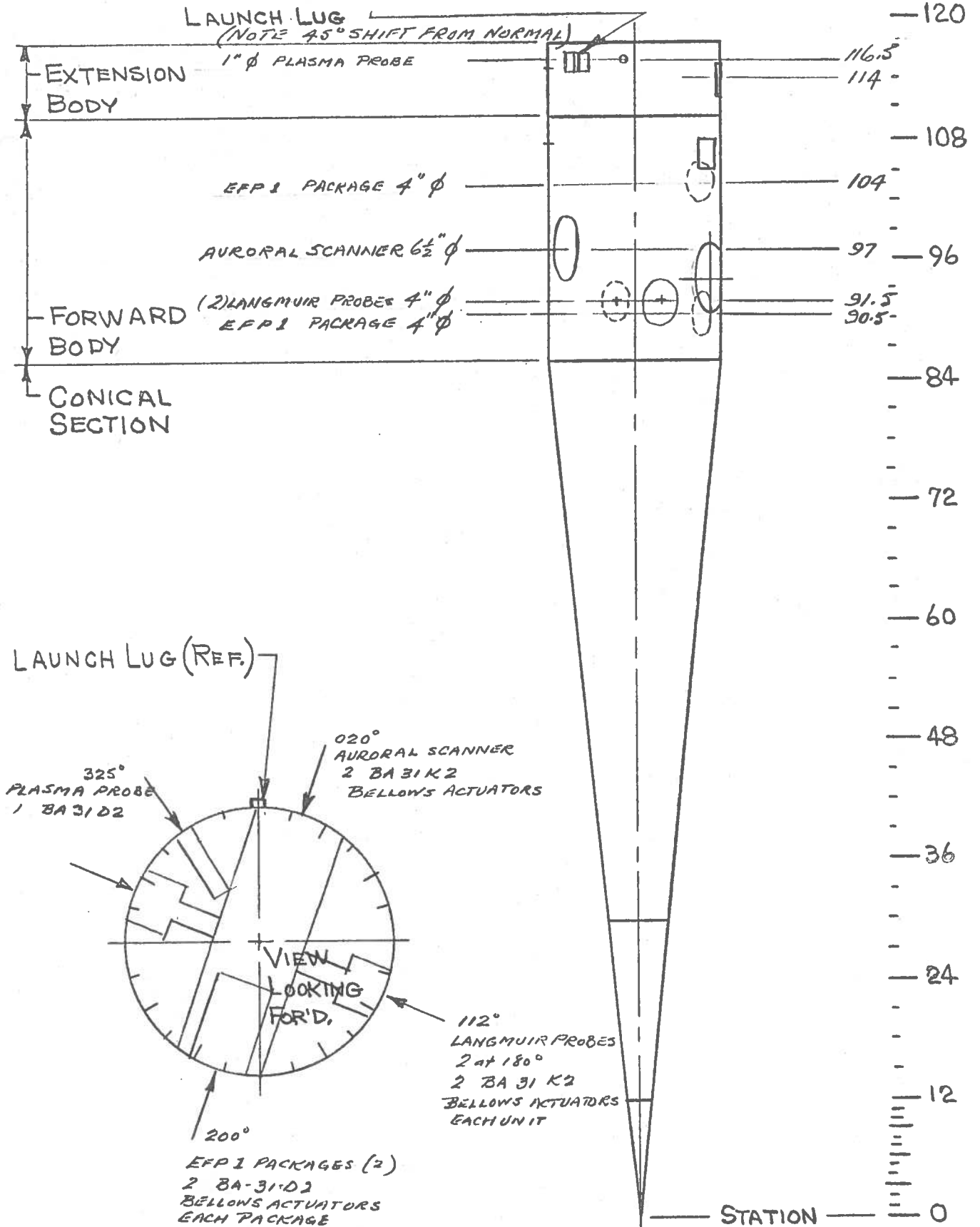
APPENDIX II

Nose Cone Drawing - AA-II-60

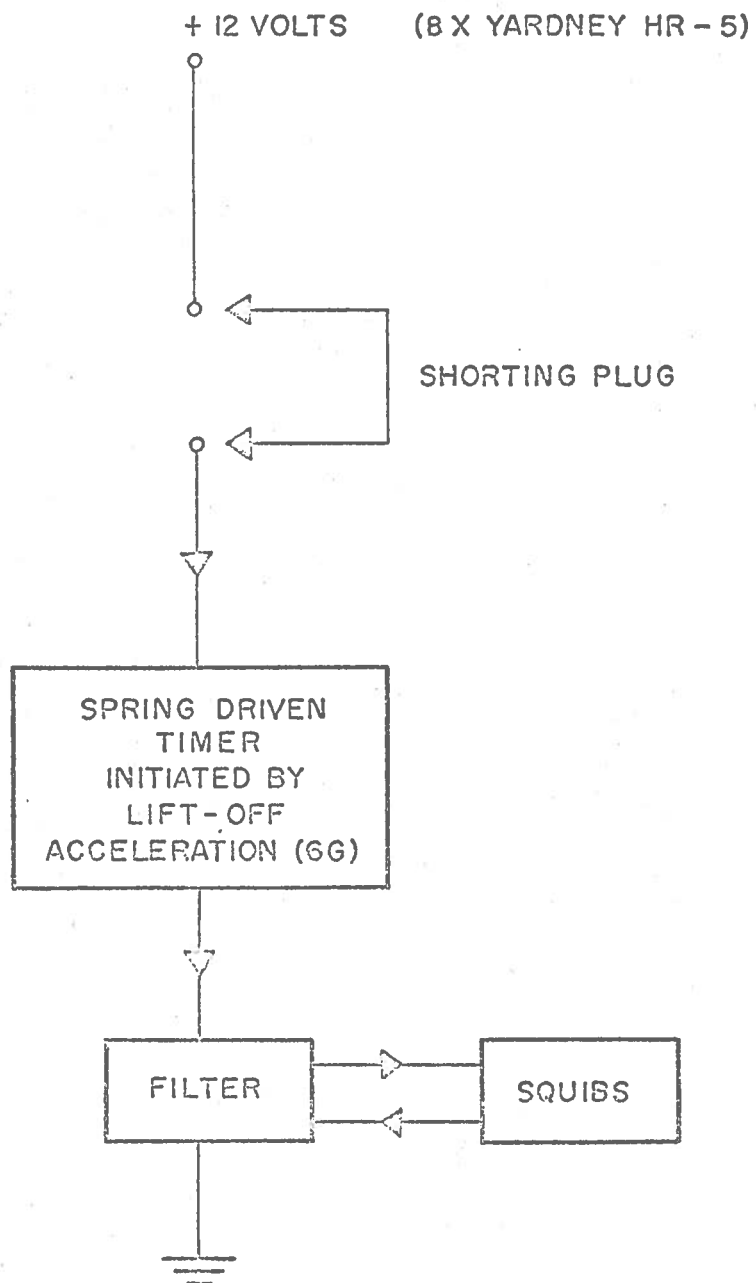


APPENDIX III

Ordnance Items, Nose Cone - AA-II-60



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, Harrison 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

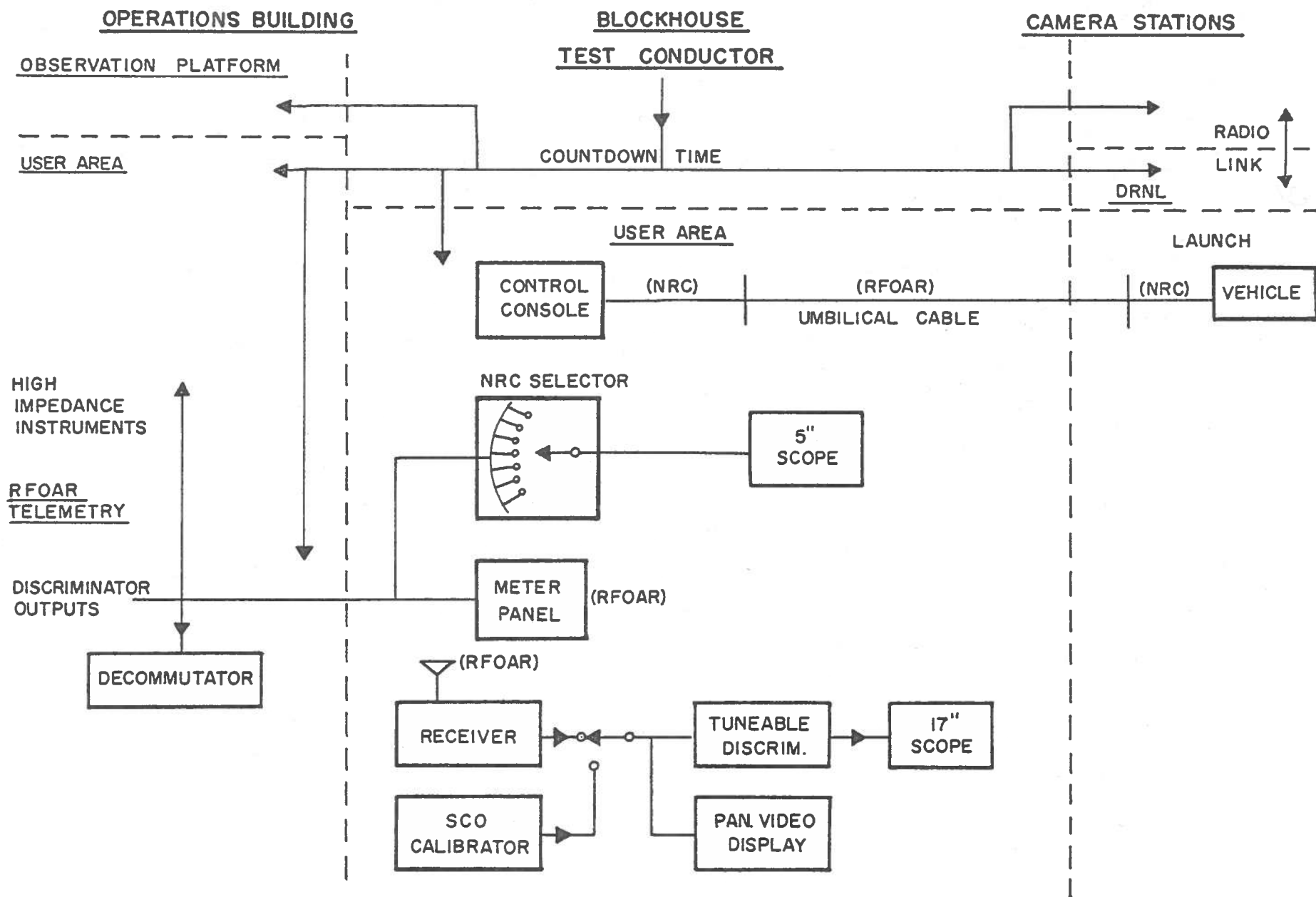
Audio Amplifier, Heathkit Model EA-3

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.

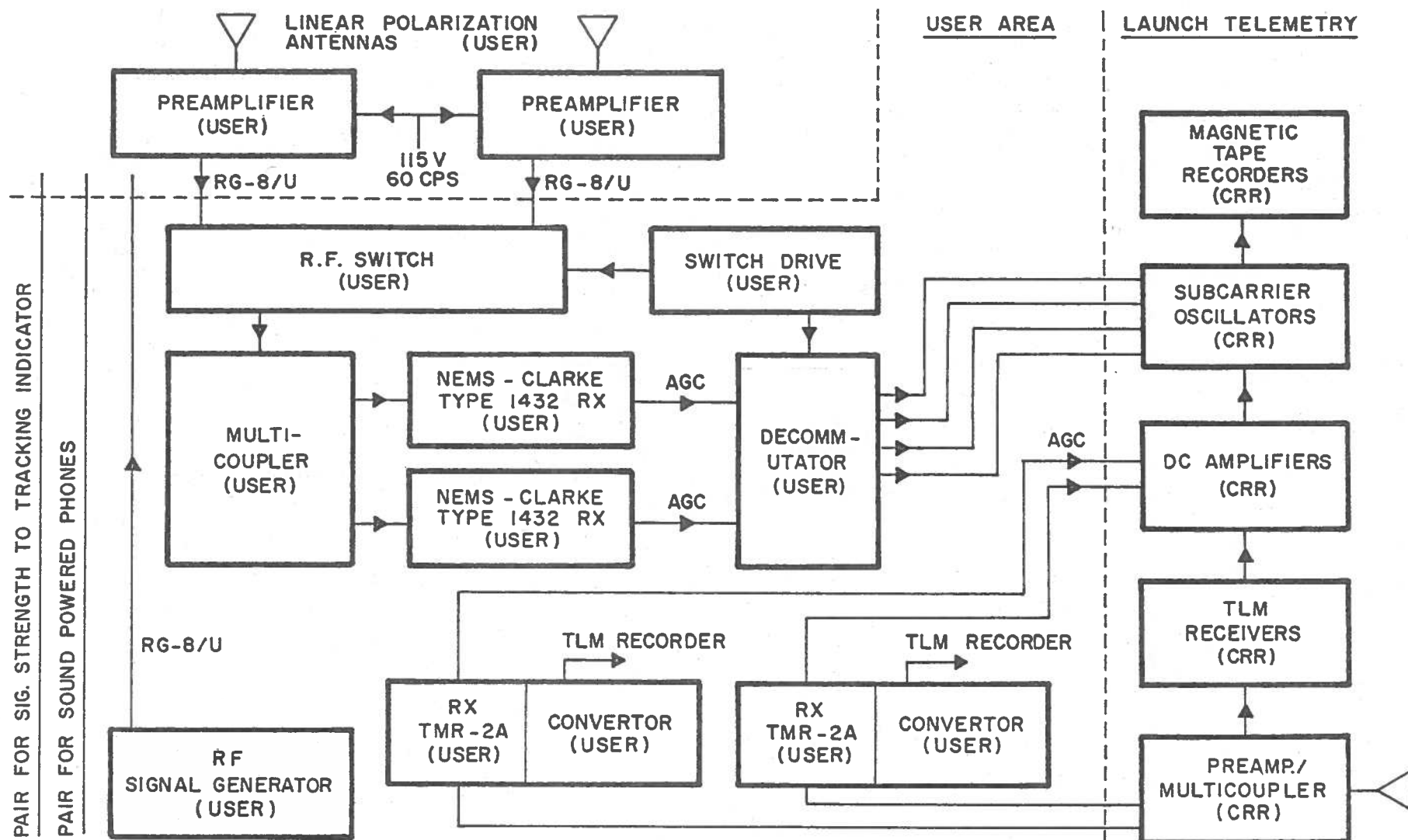
Discriminator Unit, for IRIG Channels #1 to #6, NRC
Type AM-7.



APPENDIX VI MONITOR AND CONTROL SYSTEM

TRACKER No.2 PLATFORM

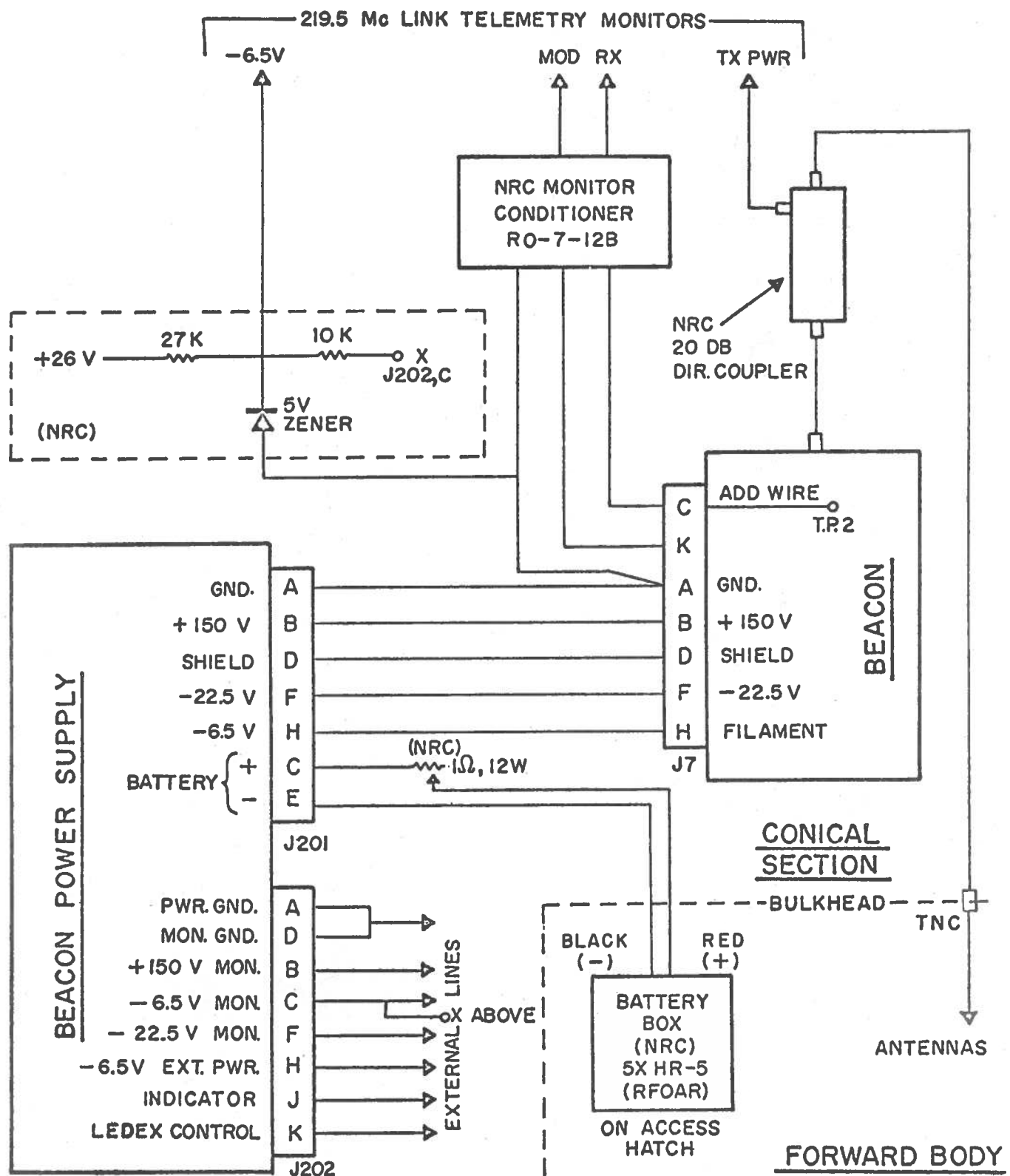
OPERATIONS BUILDING



APPENDIX VII (SHEET I) TLM AGC SYSTEM

RANGE USER SUPPORT INSTRUMENTATION

FUNCTIONS



APPENDIX IX

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

CONNECT TO:

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

	Hot	Gnd.
3.9 Kc DISC	1	0
5.4 Kc DISC	2	0
7.35 Kc DISC	3	0
10.5 Kc DISC	4	0
14.5 Kc DISC	5	0
22 Kc DISC	6	0
30 Kc DISC	7	0
40 Kc DISC	8	0
52.5 Kc DISC	9	0
70 Kc "E" 20 KC FILTER	10	0
40 Kc (57 cps) FILTER	11	0
SOUND PWRD PHONES	12	0
TRACKING METER	13	0
CRR 4 x	14	0
CRR #12	15	0
CRR + SHIELD	16	0
USER 229.0 Mc Rx AGC OUTPUT TO TLM TR. 2	17	0
USER 231.4 Mc Rx AGC OUTPUT TO TLM TR. 2	18	0
3.9 KC	19	0
10.5 KC	20	0
PAIR TO BH FOR LINK #2 CALIBRATION	25	0

CONNECT TO:

TRKR 2 (58)
RADAR (8) →

TRKR2 (8) →

TLM1 (8) →

TLM2 (8) →

TLM3 (58) → TLM RX ON 229.0 Mc LINK #2 VIDEO OUTPUT

TLM4 (58) → TLM TAPE TRACK 4 PLAYBACK OUTPUT

TLM5 (58) → TLM MULTICOUPLER OUTPUT TO USER 229.0 RX

TLM6 (58) → TLM MULTICOUPLER OUTPUT TO USER 231.4 RX

TLM7 (58) → 229.0 Mc LINK 3 DATA TO TAPE TRACK 6

TLM8 (58) → 231.4 Mc LINK 4 DATA TO TAPE TRACK 7

	Hot	Gnd.
ROC	1	0
USER DRNL	2	0
USER	3	0
100 pps AMR	4	0
1 pps AMR	5	0
2 pps No Carrier	6	0
100 pps	7	0
2 pps	8	0
First Motion*	9	0

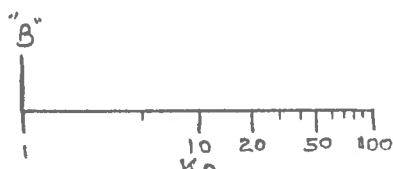
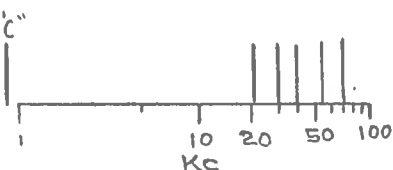
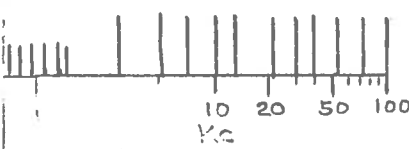
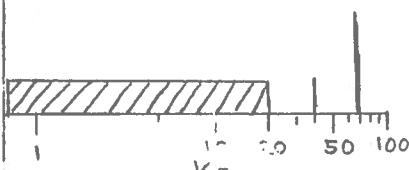
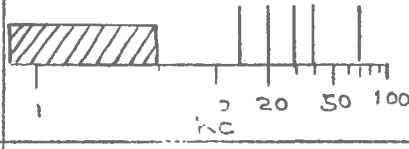


21 0 — 229.0 Mc "A"
22 0 — 229.0 Mc "B"
23 0 — 231.4 Mc "A"
24 0 — 231.4 Mc "B"

USER ASS DECOMMUTATOR OUTPUTS

* -24 volts at First Motion

Launch T/M Tape Recorder Bandwidth Allocations

AA-II-60

TRACK	BANDWIDTH	EQUIPMENT SUPPLIED BY	DATA	
1		CRR	Timing "B"	CRR
2		CRR and NRC	IRIG #14 to #18 Timing "C"	TLM Rx AGC CRR
3		CRR	IRIG #1 to #6 and #9 to #18 100kc Reference	<div style="display: inline-block; vertical-align: middle;"> Nose Cone TLM Link #1 219.5 Mc </div> CRR
4		CRR	X-Ray Detector Pulses & IRIG #16 And Auroral Scanner IRIG "E"	<div style="display: inline-block; vertical-align: middle;"> Nose Cone TLM Link #2 240.2 Mc </div>
5		CRR and NRC	Voice Count Tape Servo Ref. IRIG #16, 17, 18	CRR CRR Lift-off Data
6		CRR and NRC	30kc to 90kc EFP-1B data Processed by User	Ejected Pkge TLM Link #3 229.0 Mc
		CRR and NRC	30kc to 90kc EFP-1B Data Processed by User	Ejected Pkge TLM Link #4 231.4 Mc

APPENDIX XI

REAL TIME PAPER RECORD NO. 1 ROCKET AA-II-60

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

RECORDER: CEC Permanent DATA SOURCE: ^{CRT TLM}Real Time TIME REQ'D.: T+ 1 Day

RECORD INTERVAL: ON OFF PAPER RATE

- a) At request of Project Scientist during Horizontal Check .64 ips
- b) T- 2 Min to T-40 sec .64 ips
- c) T-40 sec To Los 6.4 ips

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	Timing				IRIG Format "B"
2	10.5 kc	STD	160 cps	Equal	30 Sec Sweep planar Probe
3	14.5 kc	"	220 cps	"	DC Planar DC Signal
4	22.0 kc	"	330 cps	"	Spherical Trap Signal
5	40.0 kc	"	600 cps	"	Z-Axis Vibr./ Sph. Trap AC
6	52.5 kc	"	790 cps	"	90° Vibration/ Sweep Electrom.
7	Timing				IRIG Format "B"

APPENDIX XT

REAL TIME PAPER RECORD NO. 2 ROCKET AH-11-60

TRANSMITTER: TDI 5W LOCATION: Nose Cone R.F. FREQ.: 219.5 mc

RECORDER: CEC Permanent DATA SOURCE: CPR TLM Real Time TIME REQ'D.: T+1 Day

RECORD INTERVAL: ON OFF PAPER RATE

T-2 Min T-40 sec 0.4 ips

T-40 sec LOS 4.0 ips

U of A

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	Timing				IRIG Format "B"
2	5.4 kc	Gaussian	81 cps	1 1/2 "	±5G Accel/ A Neutron Det.
3	7.35 kc	"	110 cps	1 1/2 "	Z Axis Accel/ B Neutron Det.
4	Fixed Galvo. at upper edge			7.35 kc	SCO (0 sig condition)
5	Timing				IRIG Format "B"

APPENDIX XT

REAL TIME PAPER RECORD NO. 3 ROCKET AA-II-60

TRANSMITTER: NRC 1W TDL 5W LOCATION: Nose Cone R.F. FREQ.: 240.2 Mc
219.5 Mc

RECORDER: CEC Permanent DATA SOURCE: CRIP TIM TIME REQ'D.: T+1 Day

RECORD INTERVAL: ON OFF PAPER RATE

a) T-2 MIN T-40 sec 1.0 ips
 b) T-40 Sec LOS 10.0 ips

SE

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	Timing				IRIG 'B'
2	3.9 Kc	STD	59 cps	1"	±5G Accel./ Total Energy
3	10.5 Kc	"	160 cps	1"	P.P. Sweep/ CR Proton Det.
4	30.0 Kc	Gaussian	900 cps	1"	Cosmic Ray Commutated
5	70.0 Kc	"	1200 cps	2" to 3"	Commutator 30 x 10
6	70 Kc, Link 2	"	2 Kc	1"	Aurora I Scanner
7	40 Kc Link 2	"	59 cps	3/4"	X-Ray Scaler
8	Timing				IRIG 'B'

APPENDIX XI

REAL TIME PAPER RECORD NO. 4 ROCKET AA-II-60

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

RECORDER: Sanborn DATA SOURCE: CRR TLM TIME REQ'D.: T+1 Hr.

RECORD INTERVAL: ON OFF PAPER RATE

- a) T-2 Min LOS 10 mm/sec
 b) Post-Flight for AGC Calib. 10 mm/sec

SES

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	400 cps	User - Twin-T	10 cps	Equal	EFP Ejection 229 Mc
2	560 cps	"	"	"	EFP Ejection 231.4 Mc
3	730 cps	"	"	"	Lang. Probe Extension
4	960 cps	"	"	"	Lang. Trap Extension
5	1.3 kc	"	"	"	70k Ft. Alt. SW
6	1.7 kc	"	"	"	Auroral Scan. Extension
7	Direct Record AGC OF CRR R ₂ on Link #1 (219.5 Mc)				
8	Timing				IRPG 'C'

APPENDIX XI

REAL TIME PAPER RECORD NO. 5 ROCKET AA-II-60

TRANSMITTER: ^{NRC 1W}TDI 5W LOCATION: Nose Cone R.F. FREQ.: ^{240.2 Mc}219.5 Mc

RECORDER: Sanborn DATA SOURCE: CRP TLM TIME REQ'D.: T+1 Hr.

RECORD INTERVAL: ON OFF PAPER RATE

T-2 Min LOS 10 mm/sec
Past Flight for AGC Calib. 10 mm/sec

SE

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	70 kc CH #3, #18	Gaussian	10 cps	Equal	145° Magnetometer
2	70 kc CH #9, #24	"	"	"	Photometer
3	70 kc CH #14	"	"	"	- 6.5V. Beacon Batt.
4	70 kc CH #20	"	"	"	40 sec Bellows Mon
5	70 kc CH #21	"	"	"	60 sec Bellows Mon
6	70 kc CH #26, 28	"	100 cps	"	Sub commutator
7	Direct	Record AGC of CRP	Re exhibit #2		(240.2 Mc)
8	Timing				IRIG "C"

APPENDIX XII

PLAYBACK PAPER RECORD NO. 2 ROCKET: AA-11-60

TRANSMITTER: 701 SW Waco Cone 213.5 Mc
U.S. OPW LOCATION: FIP-1B R.F. FREQ.: 231.4 Mc

RECORDER: CFC Permanent DATA SOURCE: Launch TIM TAP

COPIES: 1 TIME REQUIRED: 7 + 2 Days

RECORD INTERVAL: ON OFF PAPER RATE

a) 7-10 sec LOS 1"/sec

b) Post flight AGC calibration 1"/sec

u.s.

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
2	Timing				IRIG C
2	CRR 22 kc	STD	50 cps	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	CH #6 70 kc	Gaussian	10 cps	"	ET 1213 RF Mem 60 sec
3	CH #21 70 kc	"	"	"	Squad Mem
3	CH 28+26 70 kc	"	100 cps	"	Subcomm. IRIG "C"
2	Timing				

APPENDIX XII

PLAYBACK PAPER RECORD NO. 3

ROCKET: AA-11-60

TRANSMITTER: 7DI 5W US 50Mw LOCATION: Naval Corp FTP-1B R.F. FREQ.: 219.5 Mc 229.0 Mc

RECORDER: CFC Permanent DATA SOURCE: Launch T1R1 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

VoFS

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
2	Timing				IRIG "C"
2	CRR 14.5 kc	STD	50 cps	Equal	229 AGC User TMP-2A
2	CRR 30.0 kc	"	"	"	229 AGC User A
2	CRR 40.0 kc	"	"	"	229 AGC User B
3	70 kc CH #5	Gaussian	10 cps	"	FT21B RF Mon 60 sec
3	70 kc CH #21	"	"	"	Squib Mon
3	70 kc CH #26, 28	"	100 cps	"	Subcomm
2	Timing				IRIG "C"

APPENDIX VII

PLAYBACK PAPER RECORD NO. 4

ROCKET: 12-II-60

TRANSMITTER: 707-3 IV LOCATION: 1100 100 R.F. FREQ.: 213.5 Mc

RECORDER: Sunbeam DATA SOURCE: Amplified TLM Tape

COPIES: 1 TIME REQUIRED: T + 2 Days

RECORD INTERVAL: ON 7-2 min OFF 1.05 PAPER RATE 10 mm/sec

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	70kc CH #14	Gaussian	10 cps	Equal	Radar -6.5V Beacon
3	70kc CH - 15	"	"	"	" Mod.
3	70kc CH - 16	"	"	"	" R _x
3	70kc CH - 17	"	"	"	" R _F
3	70kc CH-26, 28	"	"	"	Subcomm.
3	70kc CH #9 + 24	"	"	"	Photometer Direct
3	70kc CH 23	"	"	"	Photometer Peak 1100 "C"
2	Tuning				

APPENDIX 279

PLAYBACK PAPER RECORD NO. 5

ROCKET: AN-11-60

TRANSMITTER: 7DP-5W LOCATION: Altoona, Pa. R.F. FREQ.: 2.493 Mc

RECORDER: Tom Horn DATA SOURCE: Launch TTM Tape

COPIES: 1 TIME REQUIRED: T+ 2 Days

RECORD INTERVAL: ON OFF PAPER RATE

7-2162

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VA 12

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	70kc CH #9 & 24	Subcarrier	10 cps	Equal	Line Photometer 145° SW
3	70kc CH #3 & R	"	"	"	Photometer
3	70kc CH #11	"	"	"	MM #1
3	70kc CH #12	"	"	"	MM #2
3	70kc CH #13	"	"	"	MM #3
3	70kc CH 20, 21	"	100 cps	"	Sub carrier 145° "C"
2	70kc Timing				

SHEET 5 OF 8

APPENDIX X/1

PLAYBACK PAPER RECORD NO. 6

ROCKET: AA-II-60

TRANSMITTER: 735-9W LOCATION: 1000 C. M. R.F. FREQ.: 2.11 Mc

RECORDER: Sambor DATA SOURCE: Launch T/F

COPIES: 1 TIME REQUIRED: 7.5 min

RECORD INTERVAL: ON OFF PAPER RATE 1000/sec
7.2 min 1.25

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	70kc CH 9 & 24	Gaussian	100cps	Equal	Direct Photometer 145°
3	70kc CH 3 & 18	"	"	"	Magnetometer 235°
3	70kc CH 14 & 19	"	"	"	Magnetometer 402 Accel
3	3.9kc	STD	59cps	"	500 Accel 156 Accel
3	5.4kc	"	81cps	"	A Magnetometer B Magnetometer
3	7.35kc	"	113cps	"	Subcarrier 14000
3	70kc CH 26 & 28	Gaussian	100cps	"	
2	Timing				

APPENDIX XII

PLAYBACK PAPER RECORD NO. 7 ROCKET: AA-II-60

TRANSMITTER: NBC 1W TDE 5W LOCATION: Alaska Site R.F. FREQ.: 225.7 Mc
219.5 Mc

RECORDER: Sanborn DATA SOURCE: Launch TLM Tape

COPIES: 1 TIME REQUIRED: T-2 Days

RECORD INTERVAL: ON OFF PAPER RATE

a) T-2 Min LOS 101MM/sec

b) Post-Flight for NBC Calibration 10MM/sec

SF-5

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
5	40 kc	STD	50 cps	Equal	AGC Link #1
5	30 kc	"	"	"	AGC Link #2
5	"	"	"	"	"
3	70 kc CH #1 & 19	Gaussian	10 cps	"	40°C CULF 1700000000
3	70 kc CH 5	"	"	"	EFP 221 RF Mon
3	70 kc CH #6	"	"	"	ETP 234 RF Mon
3	70 kc CH 27	"	"	"	50 KHz AH. SW 1870 "C"
2	Tuning				

SHEET 7 OF 8

APPENDIX VII

PLAYBACK PAPER RECORD NO. 5

ROCKET: *AA-71-60*

TRANSMITTER: TDI-5W LOCATION: Agua Cora R.F. FREQ.: 219.5 Mc.

RECORDER: CFC Berman DATA SOURCE: Launch Tr: TLM

COPIES: 1 TIME REQUIRED: T+2 Days

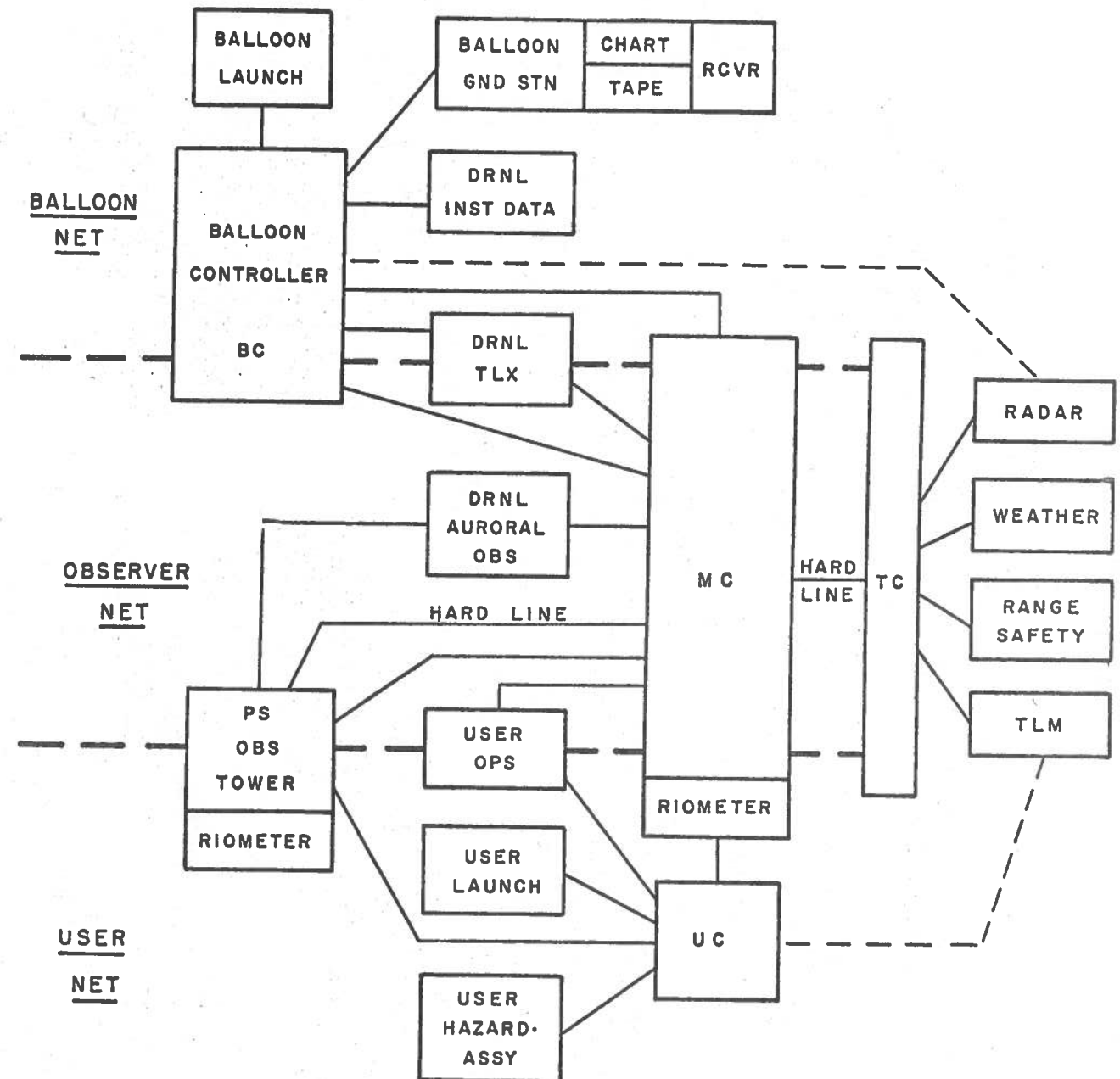
RECORD INTERVAL: ON OFF PAPER RATE

a) $T=2 \text{ Min}$ $T=5 \text{ sec}$ $1''/\text{sec}$
b) $T=5 \text{ sec}$ $T=35 \text{ sec}$ $10''/\text{sec}$

SE5

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	Timing				IRIG "B"
3	40 kc	STD	Use the Galvos.	2"	Z Axis Vibration
3	52.5 kc	"	"	2"	90° Vibration
1	Timing				IRIG "B"

APPENDIX XIII COMMUNICATIONS NETWORKS



NOTE

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