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Black Brant IIA, AG-II-59 : falling probe electron density, electric field probe, x-ray, ionospheric inhomogenities, Langmuir probe, micrometeorite, and neutron detector launch

Cairns, F.V.; 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**

**OPERATIONS REQUIREMENT
FOR BLACK BRANT ROCKET AK-II-59**

**PREPARED BY
RADIO AND ELECTRICAL ENGINEERING DIVISION**

O.R. 146

**OTTAWA
JUNE 1964**

UNCLASSIFIED

OPERATIONS REQUIREMENT NO. 146

BLACK BRANT IIA, AG-II-59

Falling Probe Electron Density, Electric Field Probe, X-Ray,
Ionospheric Inhomogenieties, Langmuir Probe,
Micrometeorite, and Neutron Detector Launch

June 15, 1964

Project No.: AG-II-59

SUBMITTED BY:

F.V. Cairns

F.V. Cairns, Trial Coordinator,
Radio & Electrical Eng. Div.,
National Research Council.

APPROVED BY:

W.L. Haney

W.L. Haney, Head,
Space Electronics Section,
Radio & Electrical Eng. Div.,
National Research Council.

ACCEPTED BY:

RF
RFOAR Operations

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OR ANNEX CONTROL SHEET

<u>PAGE</u>	<u>SECTION NO.</u>	<u>INST./REMARKS</u>
2	1.2.1	Para. 2: Line 4 and line 6, for CARDE read CBA (Canadian Bristol Aerojet Ltd.)
15	1.4	<p>Para. 1, line 4: 85° should read 80°.</p> <p>Last line on page: Should read "CBA Black Brant V fins", not "Canadair four-fin stabilizer".</p> <p>Add para. at end of page 15: "Vehicle AG-II-59 nose cone will be made to duplicate the characteristics for vehicle AE-VA-24/04. Wind weighting data for AE-VA-24/04 is applicable for AG-II-59. The weight and C. of G. of AG-II-59 nose cone will be made as nearly as possible identical to AE-VA-24/04. Specifically, AG-II-59 will have a 7.65 inch cylindrical forward body extension between the standard cylindrical forward body and the motor. The forward launch lug is mounted on the extension so that the spacing between forward and rear launch lugs is not changed from the standard configuration. The umbilical connector is also mounted in the extension section so that its position relative to the launch lugs is the same as on a standard BB II vehicle."</p>
16	1.5	<p>Length should read 342.45 inches.</p> <p>Launch weight should read: 2714 lbs. approx.</p> <p>Burnout weight should read: 934 lbs. approx.</p> <p>Guidance should read: None - 3 - fixed fin stabilization.</p>

28 July 1964

OR 146

UNCLASSIFIED

OR ANNEX CONTROL SHEET

<u>PAGE</u>	<u>SECTION NO.</u>	<u>INST./REMARKS</u>
16	1.5	Last para., section 1.5: Line 1, line 3, line 7 for CARDE read CBA.
	Appendices	Replace Appendix I with revised sheet dated 28 July 1964. Appendix II: Forward body extension not shown, igniter access is at station 113.15 and forward launch lug at station 114.2.

1 August 1964

OR 146

UNCLASSIFIED

OR ANNEX CONTROL SHEET

<u>PAGE</u> <u>NO.</u>	<u>PARA.</u> <u>NO.</u>	<u>CLASS</u>	<u>INSTRUCTIONS/REMARKS</u>
Add following Page 22	1.6(c)		<p>Re: Ground Receiving Station for Ionospheric Inhomogeneity Measurement</p> <p>The receiving station for this experiment will be operated by personnel from University of Western Ontario under the direction of Dr. P.A. Forsyth. The receiving equipment including antennas will be assembled and tested at the University of Western Ontario, and will then be transported to Fort Churchill. The normal lead time of about 5 days between the arrival of Range User personnel at CRR and the scheduled launching is insufficient for setting up and testing the receiving station A small party (Dr. Forsyth and one or two others) plan to arrive at Fort Churchill about one week prior to the arrival of the main group of Range User personnel. During the period prior to the arrival of the User Trial Coordinator support from RFOAR and DRNL is requested for the selection of the site and for the setting up of the receiving equipment by Dr. Forsyth. During this period requests for support will be made by Dr. Forsyth directly to RFOAR and DRNL. Support from the Range Contractor will be requested from RFOAR. The advance party directed by Dr. Forsyth will</p> <p>(a) in consultation with RFOAR, select a receiving site and (b) assemble and test the receiving equipment.</p> <p>The facilities required at the Ground Station are stated in para 1.6(c) of OR 146. Dr. Forsyth and his party will</p>

1 August 1964

OR 146

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OR ANNEX CONTROL SHEET

<u>PAGE NO.</u>	<u>PARA. NO.</u>	<u>CLASS</u>	<u>INSTRUCTIONS/REMARKS</u>
	1.6(c) cont'd.		require accommodation and mess facilities, truck transportation to move the receiving site selected and the use of a jeep or station wagon and driver until the arrival of the main party. Names of personnel and date of arrival will be given by Telex.
			Change designation of this rocket to AK-II-59 on: Front Cover Page i (2 places) Page 15, line 1 of para. 1.4 Page 16, end of para. 1.4 Appendix I, II, III, IX, X, XI and XII Annex page i(a), dated 28 July 1964.

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15 June 1964

OR 146

TEST SECURITY CLASSIFICATION

The security classification of information in this OR is UNCLASSIFIED.

15 June 1964

OR 146

1.0 GENERAL INFORMATION

1.1 Operations Command

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

Trial Coordinator	-	F.V. Cairns, NRC
Project Scientist	-	C.D. Anger, U. of Alta., Clgy.
Mission Controller	-	Capt. E.W. Rance, NRC
Payload & Ground Instrumentation	-	G. Bechthold, NRC D. Hewitt, NRC J. McDougall, NRC M. Spencer, NRC K.A. Steele, NRC

About five additional personnel from NRC and two or three each from the Universities of Alberta, 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 will be forwarded to RFOAR at a later date.

1.2 Range Time Utilization

1.2.1 Test Duration and Frequency

This OR requests support in firing one Black Brant IIA rocket. It is anticipated that Range User equipment and personnel will be at the Rocket Facility for about one month, commencing about September 2nd, 1964. Support for living accommodation, transport, equipment and rocket storage, assembly and blockhouse space, power, and communications is requested for this period. Rocket assembly, fin alignment, arming, placing the rocket on the launcher, etc., will be the responsibility of the range contractor. Operation of the Range Telemetry Station and radar may be requested a day or two before the scheduled firing in conjunction with nose cone instrumentation preparation and a complete "dress rehearsal" of the launching.

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

Desired experiment conditions are:

- (a) aurora
- (b) darkness, no cloud cover and no moon
- (c) no exceptional solar activity or
polar cap absorption event

and are listed in the order of decreasing importance. Absence of either (a) or (b) may justify postponement of a scheduled launching. Holds for aurora may be requested at either or both T - 3.5 min. and T - 1.5 min. with resumption of count on 30 seconds notice. After hold of 1 hr. at T - 1.5 recycle to T - 3.5.

15 June 1964

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1.2.2 General Countdown

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

Preparation Phase:

F-5 day

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 preparation area allotted to this project (6.1.2).

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

F-4 day

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

1. Preparation area space (10.1).
2. Blockhouse space (10.1).
3. Transportation (6.1.1).
4. Power (5.1.1).
5. Support for connection of umbilical cable (4.3.3).
6. Communications (4.1).
7. Parallax camera operation (1.6.1).
8. Meteorological services (3.0).
9. Office space at 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.

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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.)	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. Request support of telemetry station, radar, DRNL and pad services and engineering for launch "dress rehearsal" (5.1.6).	
Launch Phase:		
T-6:00:00	Final visual inspection of payload and battery check. Check complete length of umbilical cable from console in blockhouse to vehicle 50-pin connector with test box.	User User
	Assemble nose cone shroud to payload.	User
	Pressurize nose cone to 5 p.s.i.g.	User
T-4:10:00	All Range User personnel on station.	MC
T-4:00:00	Range begin count with Range User. Move nose cone to hazardous assembly.	All User
T-3:40:00	Obtain weight and C. of G. of Nose Cone. Assemble nose cone to motor.	User/LS User/LS

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-3:40:00 (cont'd.)	Remove strippable paint and clean nose cone.	User
	Check pressure of nose cone and pump if necessary.	User
T-3:00:00	Vehicle brought to Launch Bay.	LS/TC
T-2:50:00	Install vehicle on Launcher.	LS/TC
	Check that payload control console is disconnected from umbilical cable.	MC/TC
	Connect umbilical to vehicle.	M
	Connect motor temperature sensor.	LS/TC
	Connect radar beacon batteries.	MC/TC
	Check nose cone pressure and pump if necessary.	User/MC
	Install access hatch in forward body temporarily.	MC/TC
	Clean nose cone.	MC/TC
T-2:20:00	Clear Launch Bay for Horizontal Instrumentation checks.	LS/TC
	Connect control console to umbilical.	MC/TC
T-2:15:00	Begin horizontal instrumentation checks.	All
	<u>Link No. 1</u> (219.5 mc/s) Turn on to external power	User

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-2:15:00	Telemetry note condition of SCO's during calibration at: 5.0 volts (lower edge) 0 volts (upper edge) 2.5 volts (midband)	MC/TLM
	FCA note Link No. 1 frequency.	FCA
	TLM note modulation and signal strength. Adjust discriminators on event SCO's, IRIG No. 1 to 4	TLM
	Link No. 1 to signal inputs, flight position.	MC
	<u>Link No. 3</u> (227 mc/s)	
	Link No. 1 experiments all on	MC
	Record of subcommutator made at Launch TLM	User/TLM
	PS request Link No. 3 off.	PS/MC
	Link No. 1 multiplex to transfer position.	User
	User checks in Launch Bay: Under direct control of Project Scientist at Operations Building. PS may request certain real time recorders on during these checks.	PS/TLM/User Launch
	Check: Plasma probes, Micrometeorite Detector and Neutron Detector	User Launch/PS
	<u>Link No. 2</u> (240.2 mc/s)	
	Turn on to external power and commence experimenters checks: calibration, record level, Launch Bay tests.	MC/PS/TLM/User Launch
	TLM turn on magnetic tape recorders and adjust levels. MC inform TLM of max. record levels for Track 6. (Link No. 2)	TLM/MC

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-2:15:00 (cont'd.)	TLM and FCA note Link No. 2 frequency, signal strength, and modulation on external and internal power.	TLM/FCA
	Link No. 2 to internal power.	PS/MC
	PS request Link No. 2 turned off.	PS/MC
	Radar interrogate beacon during Launch Bay tests. MC acknowledge Link No. 1 monitors operating.	TC/RDR/MC
	Launch Bay checks complete.	PS/MC
	<u>Link No. 5</u> (231.4 mc/s)	
	Turn on.	MC
	Request check of frequency and signal strength.	MC/PS/FCA
	Link No. 5 off.	MC
	<u>Note:</u> Link No. 4 (108 mc/s) cannot be turned on during the countdown. Transmission begins on ejection of the package from the nose cone at T + 50 seconds.	
	<u>Link No. 1</u> switched to internal power and SCO's at centre frequency calibration.	MC
	Note modulation level, frequency, and signal strength.	FCA/TLM
	Link No. 1 to external power.	MC

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-2:15:00 (cont'd.)	TLM check Link No. 6 (225.7 mc/s)	TLM
	All nose cone power off.	MC/RDR/TC
	User Launch test timer circuit and report reading.	MC/TC
	Install timer shorting plug.	MC/TC
	Remove safety belts, final installation of access hatch.	MC/TC
T-1:35:00	Horizontal checks completed.	
	Stations report results of checks.	
T-1:30:00	Disconnect BH control console from umbilical.	MC/TC
T-1:00:00	Arm vehicle.	TC/LS
T-0:30:00	Elevate launcher.	TC/LS
T-0:20:00	BH control console connected to umbilical.	MC/TC
T-0:15:00	Begin vertical instrumentation checks.	All
	<u>Link No. 1</u>	
	On external power and signal inputs, flight condition.	MC/TC
	TLM note receiver tuning, signal strength, and signal condition of SCO's.	TLM

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-0:15:00 (cont'd.)	TLM adjust paper recorders while: Link No. 1 to 2.5V calibrate (30 sec.) 5.0V calibrate (lower edge, 30 sec.) 0V calibrate (upper edge, 30 sec.)	MC MC MC
	Link No. 1 to signal input, multiplex to transferred position.	MC/PS
	PS announce when scientist monitoring of signal conditions on Link No. 1 complete.	PS/MC
	Link No. 1 - To internal power	MC/TLM
	Link No. 2 - Turned on to external power.	
	Turn on Link No. 2	MC/TLM
	Test Oscillator and commence Link No. 2 calibration with TLM tape recorders on.	MC/PS/TLM
	Details to be supplied later.	
	Link No. 1 calibration with TLM magnetic tape recorders on:	MC/TLM
	Signal input, multiplex transferred (15 sec.)	
	Signal input, multiplex to flight (15 sec.)	
	Calibrate, lower edge (30 sec.)	
	Calibrate, upper edge (30 sec.)	
	Calibrate, centre (30 sec.)	
	TLM magnetic tape recorders off	MC/TLM
	Link No. 1 to signal inputs, flight condition, external power.	MC/TC
	Link No. 2 - Internal power	MC
	PS request Link No. 2 be turned off	PS/MC
	Radar Beacon on and interrogated if not already on.	RDR
	User note beacon monitors on T/M.	MC/TC
	<u>Links Nos. 3 and 5</u>	
	Turned on.	MC

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-0:15:00 (cont'd.)	Telemetry note signal strength and report Twin Lakes reception also.	TLM/TC/MC
	PS request Links be turned off as monitor checks are completed.	PS/MC
	All payload power off, except Link No. 1 filaments.	MC/RDR/TC
T-0:08:00	Vertical checks complete.	MC/TC
	User instrumentation sites report status.	MC
T-0:05:00	Voice count at 1 minute intervals to T-2 minutes.	TC
	Direct voice count to camera sites begins.	DRNL
	All instrumentation sites report status: Telemetry Radar Payload DRNL Ionospheric Inhomogeneities Ground Station Project Scientist	TC
T-0:04:00	MC advise TC of intentions regarding hold at T-3.5 minutes	MC/TC
T-0:03:30	Hold for aurora, resumption of count on 30 seconds notice.	All

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-0:03:30 (cont'd.)	T/M Link No. 1 to external filaments only.	User
	T/M Link No. 2 (X-ray) to standby on Ext. Power.	User
	T/M Link No. 3 (E.D.) to standby on Ext. Power.	User
	T/M Link No. 5 (EFP I) to Ext. Pwr.	User
	All latch power off.	User
	Pre-set all latch relays to internal except calibrator.	User
	Radar interrogate beacon continuously for remainder of test, unless hold occurs.	RDF
T-0:02:30	MC advise TC of intentions regarding hold at T-90 seconds for aurora.	MC/
T-0:02:00	If hold at T-90 seconds is not being called:	
	TLM paper recorders on at slow speed.	TLM
	TLM magnetic tape recorders on high speed.	TLM
	TLM acknowledge recorders on.	TLM
	Payload latch power on and commence 2.5V (midband) calibration.	User
T-0:01:50	5-volt calibration (lower edge).	User
T-0:01:40	0-volt calibration (upper edge).	User
T-0:01:30	Hold for aurora, resumption of count on 30-seconds notice. After 1 hour re-cycle to T-0:03:30.	All

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T-0:01:30 (cont'd.)	<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.	
T-0:01:30	Voice count at 10-second intervals to T-10 seconds.	TC
	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-0:01:15	T/M Link No. 1 to signal inputs and in-flight calibrator on.	User
T-0:00:40	T/M real time recorders to flight speed.	TLM
	Payload multiplex relays to flight position.	User
	Remove latching power.	User
T-0:00:30	Acknowledge all green payload console.	MC/TC
T-0:00:10	Voice count at 1-second intervals to T + 10 seconds.	TC
T-0:00:00	Black Brant motor ignites.	

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1.2.2 General Countdown (cont'd.)

<u>TIME</u>	<u>FUNCTION/SERVICE</u>	<u>RESP.</u>
T+0:00:10	Voice count at 10 sec. intervals to splash.	TC
T+0:00:20	Rocket motor burns out.	
T+0:00:30	Multiplex relay transfer (Link No. 1).	
T+0:00:50	Ejection of Ionospheric Inhomogeneities Probe Pkg. (Link No. 4).	
T+0:00:64	Ejection of Electron Density Probe Package (Link No. 3).	
	Ejection of Electric Field Probe Package (Link No. 5).	
	Signal transfer relays transfer (Link No. 1).	
T+0:00:200	Apogee (approximately 85 miles alt.)	
T+0:00:400	Impact	
T+0:10:00	Radar AGC and Telemetry AGC calibration.	RDR/TLM

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

1.3 Test Objectives

1.3.1 Primary

Concerned with measurements in the upper atmosphere:

1.3.1 Primary (cont'd.)

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

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

(c) X-ray detector experiment, in part for correlation with neutron detector experiment data. (University of Alberta)

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

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

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

(g) Measurement of electric field potential using a pair of probes mounted on the surface of the nose cone--EFP III. (University of Saskatchewan)

(h) Measurement of Ionospheric Inhomogeneities experiment using an ejected package carrying a CW transmitter. (University of Western Ontario).

1.3.2 Secondary

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

1.3.2 Secondary (cont'd.)

(b) Magnetometer, accelerometer, and temperature measurements.

1.4 Test Description

The Black Brant IIA rocket AG-II-59 will carry several experiments in its nose cone for scientific investigation of the upper atmosphere. It is desired that the vehicle be launched at an elevation of 85° nominal. There is no preferred launch azimuth. Presumably impact will be into Hudson's Bay. Recovery is not required. The desirable conditions at launching in order of importance are: (a) aurora, (b) darkness, no cloud cover and no moon, and (c) no exceptional solar activity or polar cap absorption event. Postponement of the launching may be requested if either of conditions (a) or (b) are not met at a scheduled launch time.

Events of primary importance during flight are: multiplex relay transfer at T+30 seconds, the ejection of the ionospheric inhomogeneities package at T+50 seconds, and the ejection of the electron density and electron field potential package at T+64 seconds. Other events of interest are motor burnout, apogee and impact. It is requested that sound ranging equipment be used for impact data, although recovery is not required. Range User personnel will man the nose cone instrumentation console in the blockhouse, monitor equipment in the User area in the Operations Building, the Scientists' Observation platform and the Ionospheric Inhomogeneities Ground Station during the countdown. One or two User personnel will be in the Launch Bay during horizontal instrumentation tests. It is assumed that the parallactic cameras will be operated by DRNL personnel.

1.5 Test Vehicle Description

The Black Brant IIA is a single-stage, solid-propellant unguided, sounding rocket. This vehicle will be fitted with the Canadair four-fin stabilizer.

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

General performance of the vehicle will be obtained from CARDE. The weight and centre of gravity of the nose cone and payload are furnished by NRC to CARDE, who then calculate vehicle performance. It is understood that RFOAR has a manual on the Black Brant IIA furnished by CARDE. Special instructions concerning the fins fitted on AG-II-59 will be furnished to RFOAR by CARDE.

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 a possible alternate 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 located in the nose cone will transmit data from the X-ray

1.5.2 Telemetry Systems (cont'd.)

detector experiment. This will be an FM 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 at Station 91. The polarization is linear.

The modulation on this link is a train of pulses whose rate and amplitude are random. As conditions on the ground are quite different from those expected during portions of the rocket flight, a check-out procedure will be used which incorporates both the use of a radio-active source near the detector and a test pulse generator located in the nose cone. On T-1 day or prior to beginning the countdown while the nose cone is at the Blockhouse, a calibration of the link will be carried out. The maximum pulse amplitude expected during flight will be one of the calibrate conditions and Launch Telemetry are requested to adjust their equipment to accommodate magnetic tape recording of this level. A member of the telemetry staff at Twin Lakes should be present at Launch Telemetry when the initial pre-countdown check of this link is made. The test will be repeated during Horizontal and during Vertical checks.

Link No. 3: The electron density package, to be ejected at T+64 seconds, contains a telemetry transmitter operating at 227 mc with one watt power output. Polarization is linear. The package contains one subcarrier oscillator (IRIG Band E, 70 kc) modulated continuously by the electron density experiment data and also by wideband signals to 40 kc.

Link No. 4: The Ionospheric Inhomogeneities experiment package, to be ejected at T+50 seconds, contains a 1/4 watt CW transmitter operating at 108 mc. Polarization is linear. The transmitter will not be operating until after ejection from the nose cone.

Link No. 5: The electric field probe package to be ejected at T+64 seconds contains two transmitters of 100 milliwatts output power each. One transmitter is crystal controlled at 231.4 mc and the second varies in frequency with a mean offset of 5 kc from the crystal controlled unit. The

1.5.2 Telemetry Systems (cont'd.)

measurement information is contained in the magnitude and rate of change of the frequency difference between the two transmitters. Antenna polarization is linear.

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

It is requested that Twin Lakes telemetry record this link as an AM signal using a Nems-Clarke 1510 receiver.

Link No. 6: A ground telemetry link operating at 225.7 mc will be operated between the radar site and the launch site for the purpose of recording radar data on the same tape recorder as the vehicle telemetry links. Further data is given under para. 1.6.

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

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

1.5.3 Beacon

RFOAR is requested to provide a DPN-41 radar beacon. Range User will provide space and mounts for the beacon, a box for holding five Yardney Type HR-3 batteries, wiring from the beacon to the batteries and to the umbilical connector (seven conductors), and a pair of quadraloop beacon antennas with coaxial cable to the beacon. Range User will also provide a 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 2880 mc and beacon receiver frequency of 2810 mc.

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

1.5.4 Command Control/Destruct System

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

1.5.5 Ordnance Items

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

Two Bellows actuators (squib) each are used in the ejection of the EFP package and the Ionospheric Inhomogeneities package. These devices are type BA31D2, made by Hercules Powder Company, Wilmington, Delaware.

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

A wire cutter is used in the release mechanism of the ED package. This device is manufactured by Horex Inc.,

1.5.5 Ordnance Items (cont'd.)

Hollister, California, Hoxlex Type 2801. It contains two bridge wires which are fired in parallel.

Bridge Wire Resistance:	0.66 \pm .08 ohms each
Maximum Non-fire:	0.5 amp. each
Minimum 100% Fire:	1.5 amp. each
Recommended Fire:	5.0 amp. each
Ignition Time:	5 milliseconds (at 5 amps.)

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.

(a) Blockhouse

Range User personnel will operate the control console unit for the payload and will monitor channels IRIG Nos. 1-4 and Nos. 9-18 inclusive of the 219.5 mc link, and also channel E 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. RFOAR is requested to have available for Range User's receiver a telemetry antenna on the roof of the blockhouse. The one provided in April 1963 would be suitable. Refer to block diagram in Appendix VI.

(b) User Area in Operations Building

Scientists Monitors: Discriminator outputs from channels IRIG Nos. 1-4 and Nos. 9-17 inclusive from the 219.5 mc link, IRIG E from the 227.0 mc link 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. These monitors are required by Range User scientific personnel.

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

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.

RFOAR 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.
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

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

is intended primarily for the purpose of determining motion and attitude of the E.D. and E.F.P. packages (Links Nos. 3 and 5) from signal strength data.

It is intended that the AGC output from the User receiver (on Link No. 5 fed from CRR circularly polarized telemetry antenna) described in para. 1.5.2 be recorded on magnetic tape recorder Track 2 via a CRR sub-carrier oscillator. The AGC output level from this receiver (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).

Launch telemetry is requested to provide AGC calibration for the User receiver on Link No. 5 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 operate a ground station for the reception and recording of Link No. 4. RFOAR is requested to provide:

1. A flat, clear area, 200 ft. x 200 ft. space, for erection of Range User's antennas.
2. A heated room of at least 200 sq. ft. area for Range User's receivers and recorder. An intercom on the User Net is required in this room and a telephone.

Link No. 4 is a CW transmission only. RFOAR is requested to record the AGC level from a receiver tuned to the link frequency, 108 mc/s. At Launch

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

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).

3. The site for the Ionospheric Inhomogeneities Ground Station will be decided after arrival of Range User personnel at Fort Churchill. Some personnel may arrive a week or two prior to the arrival of the main party to set up this station. RFOAR is requested to conduct noise level measurements at some possible sites, such as:

- a) the former location of the F.C.A. facility just east of Fort Churchill
- b) Twin Lakes
- c) between, and possibly a little west of the Operations Building and the F.C.A. Building (U-56 and U-1)
- d) beside the roadblock at the Hudson Drive and A.A. Range intersection.
- e) others considered suitable by RFOAR.

It is desired that the background noise level not exceed 10^{-15} watts per square meter per one kc at $108.000 \text{ mc} \pm 5 \text{ kc}$. It would be convenient if a noise level survey of some sites could be made and results transmitted to NRC, Radio and Electrical Engineering Division, attention W.L. Haney, prior to the departure of User personnel for Fort Churchill.

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

(d) Ground Telemetry Link

RFOAR is requested to provide a receiver and antennas and operate a telemetry link between the Radar Site and the telemetry station in the Operations Building for the transmission of radar ADR and AGC data to be recorded on track 5 of the telemetry magnetic tape recorders. Range User will provide an FM transmitter to operate at 225.7 mc and four subcarrier oscillators for use at the radar site. ADR data is requested at 5 samples per second. A block diagram of the system is given under Appendix VII, Sheet 2.

(e) Launch Telemetry Station

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

(f) Special Time Code Record

Data processing equipment presently being assembled by the Range User will require a special timing code using a 10 kc carrier to be recorded on the telemetry magnetic tape. As a trial, it is desired that the special timing code be mixed with the IRIG timing formats B and C Track 1 of the copy tape only from Launch telemetry. Range User will provide a time code generator with suitable signal input and output connections for mixing.

(g) Link No. 2, 240.2 mc Calibration

This link has wideband X-ray experiment 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. The details of the desired procedure to be followed will be sent to the Range at a later date or agreed upon after arrival of User personnel at Fort Churchill. RFOAR is requested to provide a wire pair between the User Area in the Operations Building and the location of the User payload control console in the Blockhouse. This will be used for transmission of a low frequency calibration signal via the control console to the payload in the nose cone and will be used by the Project Scientist. In addition to monitor lines requested above, the

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

Project Scientist will require a monitor output in the User Area of the Operations Building connected to the playback output of Track 6 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 will be requested to operate the following equipment prior to and during the launch phase:

- (a) 4" by 5" Rapid Scan Spectrometer, 3000-11,000 \AA
- (b) HP and other photometers
- (c) 16 mm All Sky Camera
- (d) Flux Gate Magnetometer
- (e) Height-finding Stations (for aurora)
- (f) Auroral Radar
- (g) Prince Albert Radar (to be arranged by NRC with PARL)
- (h) Ionosonde (4 sweeps per minute from T+0 to T+6 min.)
- (i) DRNL will provide magnetic tape of voice countdown
- (j) Provide auroral activity predictions
- (k) Communications for ground instrumentation (launch sight to Belcher and O'Day)
- (l) Communication between DRNL and Prince Albert Radar.

1.7 Summary of Frequency Utilization

- (a) Ground Link: DRNL to Belcher and O'Day radio link.
DRNL to Prince Albert Radar
Link No. 6 - 225.7 mc Radar Site to
Operations Building, for ADR data
recording.

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1.7 Summary of Frequency Utilization (cont'd.)

(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 or 218.0 mc alternate	U	Telemetry	Nose Cone
2	240.2 mc	U	Telemetry	Nose Co . X-Ray Data
3	227.0 mc	U	Telemetry	ED Eject Pkg.
4	108.0 mc	U	CW Tx.	Ionospheric Inhomogeneities Ejected Pkg.
5	231.4 mc or 229.0 mc alternate	U	Telemetry	EEP Ejected Pkg.

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>
				(Plotting (ADR Tape) Board)		
1.	Position (X,Y,Z)	Throughout Flight	5 from T-0 to splash	1000 ft.	500 ft.	--
2.	Velocity (V_X, V_Y, V_Z, V_S)	Throughout Flight	5 from T-0 to splash	1000 ft.	500 ft.	--
3.	Trajectory Angles (θ and ϕ)	Throughout Flight	1 from T-0 to splash	--	--	--

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

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

where $V_S = \text{tangential velocity.}$

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

2.1.2 Impact

Impact coordinates are desired by sound range 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. Ionospheric Inhomogeneities antennas.
11. Ionospheric Inhomogeneities ground station.
12. 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. \pm %	MEASURING RATE	RECORDING INTERVAL	CLASS	ACCURACY \pm %	REMARKS
1	108.0 mc CW	-	-	-	-	T-0:02 to splash	I	-	Except AGC, Reception and Processing by User Only.
2	219.5 mc FM/FM	1	400 cps	7.5	Cont.	T-0:02 to splash	I	-	Multiplex Relays
3	219.5 mc FM/FM	2	560 cps	7.5	Cont.	T-0:02 to splash	I	-	Signal Transfer Relays
4	219.5 mc FM/FM	3	730 cps	7.5	Cont.	T-0:02 to splash	I	-	70K Alt. Switch
5	219.5 mc FM/FM	4	960 cps	7.5	Cont.	T-0:02 to splash	I	-	EFP Exit "A" Nose Cone Press.
6	219.5 mc FM/FM	9	3.9 kc	7.5	Cont.	T-0:02 to splash	I	2%	"B" Neutron Detector
7	219.5 mc FM/FM	10	5.4 kc	7.5	Cont.	T-0:02 to splash	I	2%	Neutron Detector
8	219.5 mc FM/FM	11	7.35 kc	7.5	Cont.	T-0:02 to splash	I	2%	Z-axis Accel./Photometer
9	219.5 mc FM/FM	12	10.5 kc	7.5	Cont.	T-0:02 to splash	I	2%	E.D. Osc. Cont./EFP III No. 1
10	219.5 mc FM/FM	13	14.5 kc	7.5	Cont.	T-0:02 to splash	I	2%	E.D. R.F./EFP III No. 2
11	219.5 mc FM/FM	14	22.0 kc	7.5	Cont.	T-0:02 to splash	I	2%	E.D. Sawtooth/EFP III No. 3
12	219.5 mc FM/FM	15	30.0 kc	7.5	Cont.	T-0:02 to splash	I	2%	Vib., 0°/Planar Sweep

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2.3 Telemetry (cont'd.)

ITEM NO.	LINK FREQ.	NO.	FREQ.	DEV. \pm %	MEASURING RATE	RECORDING INTERVAL	CLASS	ACCURACY \pm %	REMARKS
13	219.5 mc FM/FM	16	40.0 kc	7.5	Cont.	T-0:02 to splash	I	2%	Planar Trap, DC
14	219.5 mc FM/FM	17	52.5 kc	7.5	Cont.	T-0:02 to splash	I	2%	Z-axis Vib./Planar Trap, DC
15	219.5 mc PAM/FM/FM	18	70.0 kc	7.5	300/sec.	T-0:02 to splash	I	2%	Commutated Channel 30 x 10 per sec.
16	227 mc FM/FM	E	70.0 kc (plus wide band direct modulation: 1 kc to 40 kc)	15	Cont.	T-0:02 to splash	I	2%	Transmitter in ED Ejected Pkg.
17	231.4 mc AM	-	-	-	Cont.	T-0:02 to splash	I	2%	Transmitter in EFP Ejected Pkg.
18	225.7 mc FM/FM	14	22 kc	-	Cont.	T-0:02 to splash	I	-	Radar No. 1, AGC
19	225.7 mc FM/FM	15	30 kc	-	Cont.	T-0:02 to splash	I	-	Radar No. 2, AGC
20	225.7 mc FM/FM	16	40 kc	-	Cont.	T-0:02 to splash	I	-	Radar No. 3, AGC
21	225.7 mc FM/FM	18	70 kc	-	Cont.	T-0:02 to splash	I	-	ADR Data
22	240.2 mc FM	-	-	-	Cont.	T-0:02 to splash	I	2%	Transmitter for X-ray experiment (nose cone)

2.3.1 Recordings

(a) Launch Site

The following recordings on magnetic tape are requested (for approximately 3 minutes during Horizontal Checks and 3 minutes during Vertical Checks at request of MC, and from T-0:02:00 to splash and post-flight for AGC calibration).

<u>Track</u>	<u>Record</u>
1	IRIG Timing Format "B" and "C"
2	Receiver Signal Strength
3	Nose Cone Telemetry Link No. 1 (219.5 mc)
4	Electron Density Package Telemetry Link No. 3 (227 mc)
5	Voice Countdown, Tape Servo Reference, and Radar Data from 225.7 mc link
6	Nose Cone Telemetry Link No. 2 (240.2 mc)
7	EFP Package Telemetry Link No. 5 (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.

Two timing signals are requested:

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

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

The 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>
#3-227.0 mc	CRR C.P.	CRR	14.5 kc	13
#5-231.4 mc	CRR C.P.	User TMR-2A	22.0 kc	14
#3-227.0 mc	User "A"	User 1432	30.0 kc	15
#3-227.0 mc	User "B"	User 1432	40.0 kc	16
#5-231.4 mc	User "A"	User 1432	52.5 kc	17
#5-231.4 mc	User "B"	User 1432	70.0 kc	18

Records of the AGC outputs of CRR receivers on Links Nos. 1, 2 and 4 are requested on Real Time paper only. See Appendix XI. It is realized that the Link No. 4 measurement is dependent on the availability of a suitable antenna.

(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. 5 should be received using a 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.

2.3.1 Recordings (cont'd.)

4. It is requested that AGC signals from receivers on Links Nos. 1 2, 3 4 and 5 be recorded via CRR DC 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 200 μ v		0, 1, 2, 5, 10, 20,
				50, 100, 200 μ v steps.
Link No. 4	-	0 to 100 μ v	)	0, 0.1, 0.2, 0.5, 1, ,
			)	2, 5, 10, 20 50, 100
Link No. 5	-	0 to 100 μ v	)	μ v steps

at the pre-amplifier input. The telemetry report should specify pre-amplifier and/or multicoupler gain. It is realized that this measurement on Link No. 4 is dependent on the availability of a suitable antenna.

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

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

The calibration on the subcarrier oscillators including the 3.9 kc unit and higher is 0 to 5 volts for a $\pm 6.75\%$ deviation. (Zero level corresponds to $+6.75\%$ deviation and + 5 volts to -6.75% deviation.) A Zener diode reference of +5 volts is connected to channel 2 of the commutator on the 70 kc subcarrier oscillator. This reference is also applied at

2.3.2 Special Requirements (cont'd.)

10-second intervals to the 3.9 kc, 7.35 kc, 10.5 kc, 14.5 kc, 22.0 kc, 30.0 kc, 40 kc and 52.5 kc subcarrier channels by a calibrator unit in the nose cone.

(b) 227 mc link: This link with the ejected package has a single subcarrier oscillator on 70.0 kc, the calibration of which is 0 to 5 volts for a $\pm 15\%$ deviation. Wideband modulation to 40 kc is also present on this link.

(c) 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 uvolts.
Link No. 2, 240.2 mc)	
Link No. 3, 227.0 mc		0, 1, 2, 5, 10, 20, 50, 100,
		200 uvolts.
Link No. 4, 108 mc	)	0, 0.1, 0.2, 0.5, 1, 2, 5,
	)	10, 20, 50, 100 uvolts
Link No. 5, 231.4 mc)	

at the preamplifier input. The telemetry report should include details such as receiving antenna type, gain, and polarization, preamplifier 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 227.0 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 RFOAR.

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.)

3.0 METEOROLOGICAL SERVICES

3.1 Forecasts

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

3.1.1 Long Range

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

3.1.2 Planning

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

3.1.3 Operational

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

3.2 Observations

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

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

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3.3 Minima

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

4.0 SUPPORT INSTRUMENTATION

4.1 Communications - General

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

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

None of the transmissions need be recorded.

4.2 Radio

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

4.3 Wire

4.3.1 MOPS

It is requested that a loudspeaker on the missile operations intercom should be located near the checkout and control console provided by the Range User. A clock or digital display of the countdown time is also requested near the control console and in the User area in the Operations Building and the observation station. 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.

4.3.2 Telephone

Telephone 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 RFOAR for radar beacon and DOVAP transponder control and monitoring. Range User will supply junction boxes for use at each end of the RFOAR umbilical cable system for connection to the User control console and to the vehicle pull-away connector. Each of these junction boxes will contain a patch board panel to allow rapid changes to be made in umbilical connections for different rockets.

4.4 Timing

Timing on the magnetic tape records is requested to be:

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

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

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4.4 Timing (cont'd.)

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.

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-6 hrs.	T+10 mins.	To be easily viewed from payload control console. Same facility desired in nose cone preparation area, in Operations Building and Project Scientist's 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.

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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.

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

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.

5.1.3 Fire Protection

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

5.1.4 Medical Service

None required in excess of normal.

5.1.5 Guards and Security - NR.

5.1.6 Pad Services and Engineering

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

5.1.7 Water - NR.

5.1.8 Survey

Belcher and O'Day height finding stations relative to Launcher. Radar Site relative to Launcher.

5.1.9 Air

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

5.2 Vehicles and Ground Handling Equipment

5.2.1 Vehicles

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

5.2.2 Ground and Heavy Equipment

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

5.2.3 Search Lights and Floodlights - NR.

5.2.4 Other Equipment

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

5.3 Propellants, Gases, Chemicals - NR.

5.4 Chemical and Physical Analysis - NR.

5.5 Bioscience - NR.

5.6 Post Instrument Maintenance and Calibration.

RFOAR is requested to supply the calibration for the signal strength records (AGC) of the 108, 219.5, 227.0, 231.4 and 240.2 mc links 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 or Wire 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.

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

6.1.2 Cargo

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

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

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

(b) Fin assembly in crate: 300 lbs.

(c) Check-out equipment: Estimate is for about 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.

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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.

(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 loading and transport of User check-out equipment to railway depot at conclusion of rocket firings.

6.2 Air - NR.

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7.0 RECOVERY

No recovery is required.

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8.0 AIRCRAFT AND SEACRAFT

A helicopter for up to five men and as much as '00 lbs. of equipment may be required for transport to F lcher and O'Day.

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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
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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)
2	Position,		7	T+30 CD	NRC	NRC))
	Velocity,		1	T+30 CD	CARDE	NRC	) F-TRPT	) note (b)*
	Trajectory Angles						) and)
	(X,Y,Z,V _X ,V _Y ,V _Z ,V _S ,θ,φ)						) F-PLOT)

9.2.1.2 Impact

3	Impact		1	T+10	CARDE	NRC)	
	Coordinates		1	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.

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

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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 recording of telemetry data	1	1	T+5 CD	NRC	NRC	R-MAGT	5.2.1.1(3)
				T+5 CD	NRC	NRC	R-MAGT	5.2.1.2(3)
				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		T+15CD	NRC	NRC	F-FRPT and R-MAGT	
9.3 Meteorological Data								
8	Report on all requested observations		1	T+15	CARDE	NRC) F-FRPT	
			3	T+15	NRC	NRC)	

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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	
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9.4 Support Instrumentation

10	30 Mc Riometer		1	T+2	NRC	NRC	R-GRAF	
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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 Fort Chaffee
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9.7 Recovery Reports - NR.

9.8 Aircraft Reports - NR.

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10.0 FACILITIES

10.1 Facilities - General

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

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

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

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

(5) Office space and telephone at DRNL.

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

(7) Tracker No. 2 Platform with manual tracking pedestal for Range User antennas.

(8) 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 User net, and a telephone.

These facilities are requested for the period September 2nd to September 26th, 1964.

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11.0 RANGE SAFETY

RFOAR is responsible for all range safety.

CLASSIFICATION

This document is unclassified.

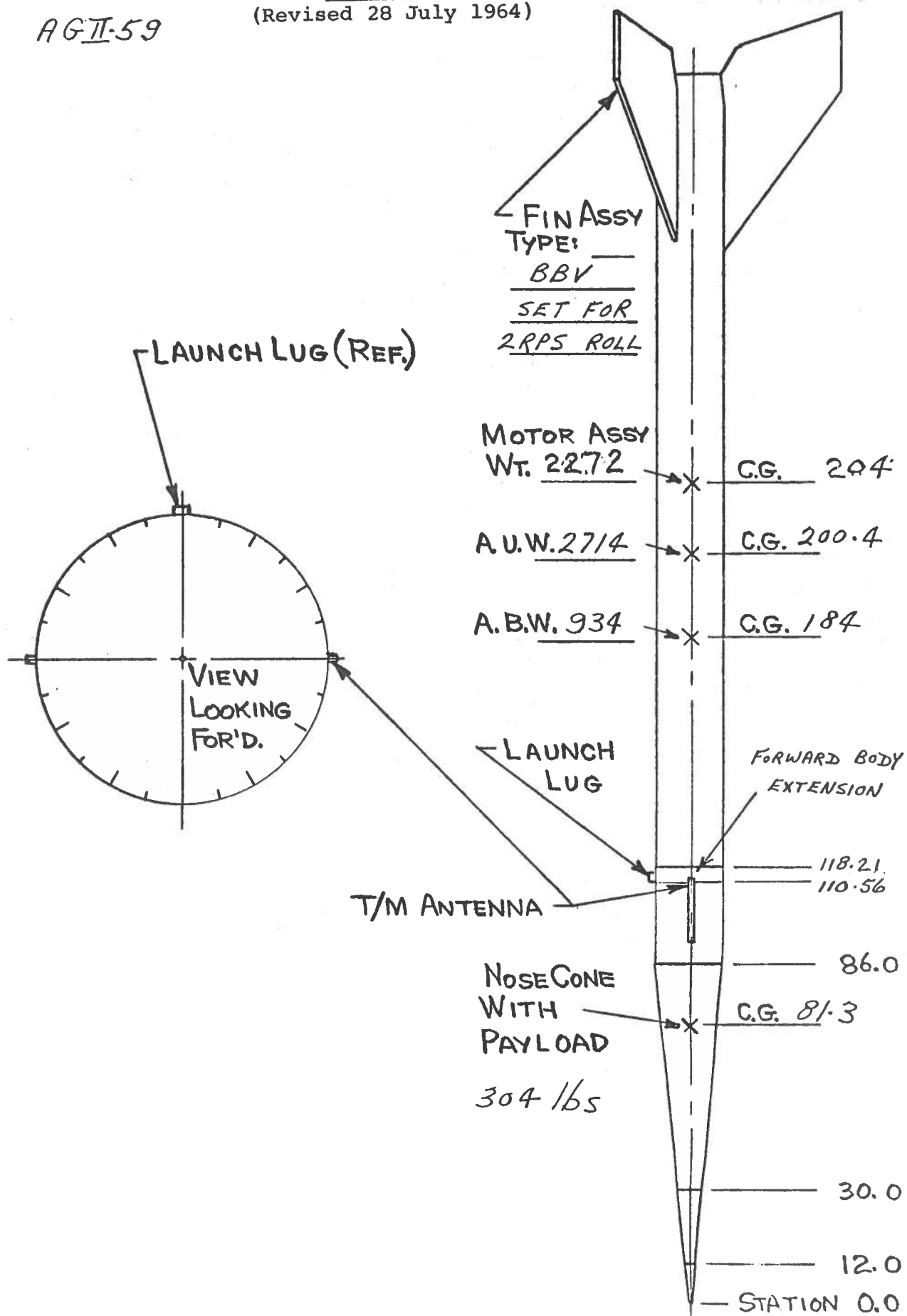
RF

APPENDICES

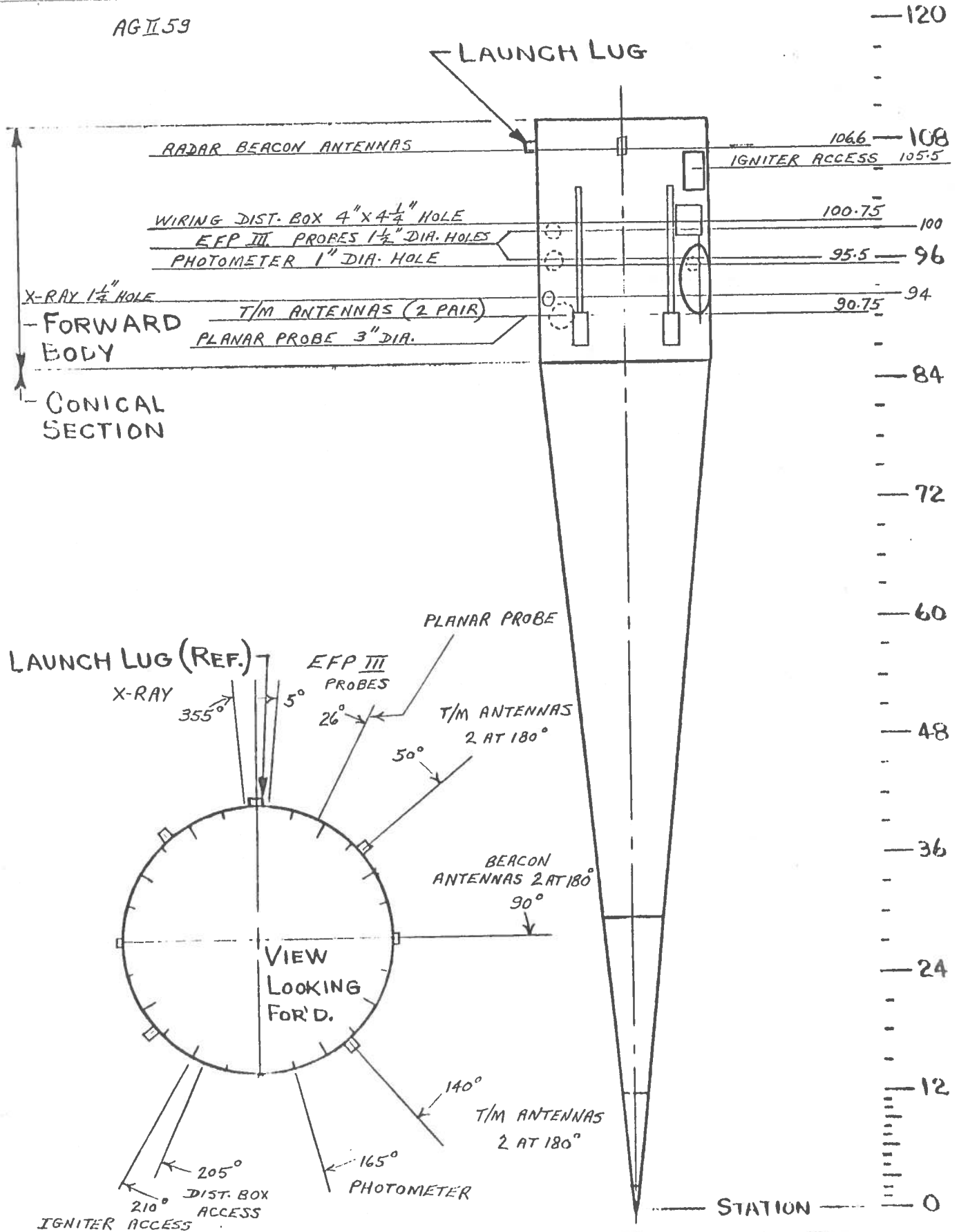
- I. Vehicle Drawing.
- II. Nose Cone Drawing
- III. Ordnance Items Location Drawing.
- IV. Squib Firing Circuit.
- V. Range User Equipment List, Sheets 1 and 2.
- VI. Monitor and Control System Diagram.
- VII. Range User Support Instrumentation Diagram,
Sheet 1 - T/M AGC System
Sheet 2 - ADR Data Link
- 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.

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APPENDIX I
(Revised 28 July 1964)

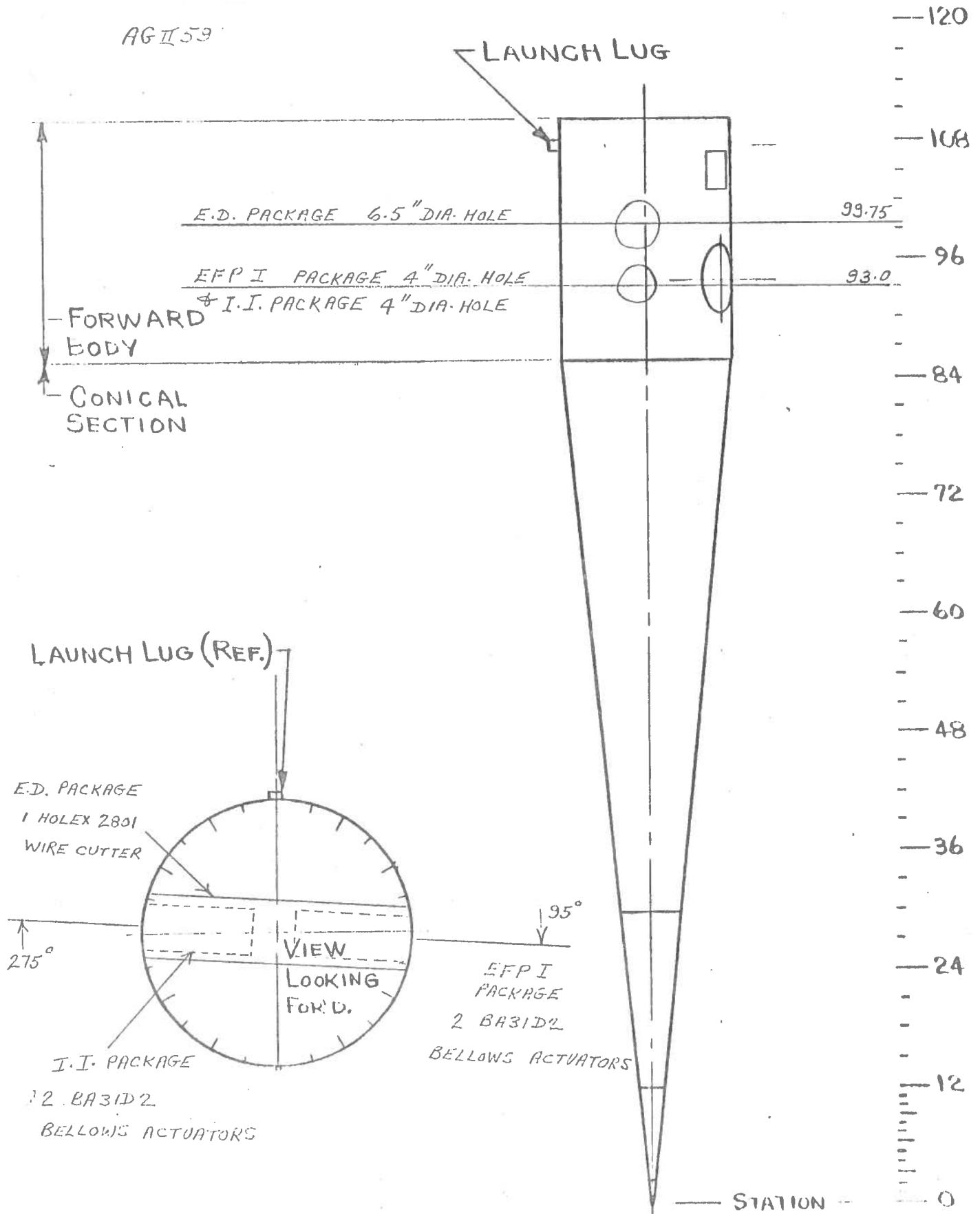


APPENDIX II NOSE CONE DRAWING

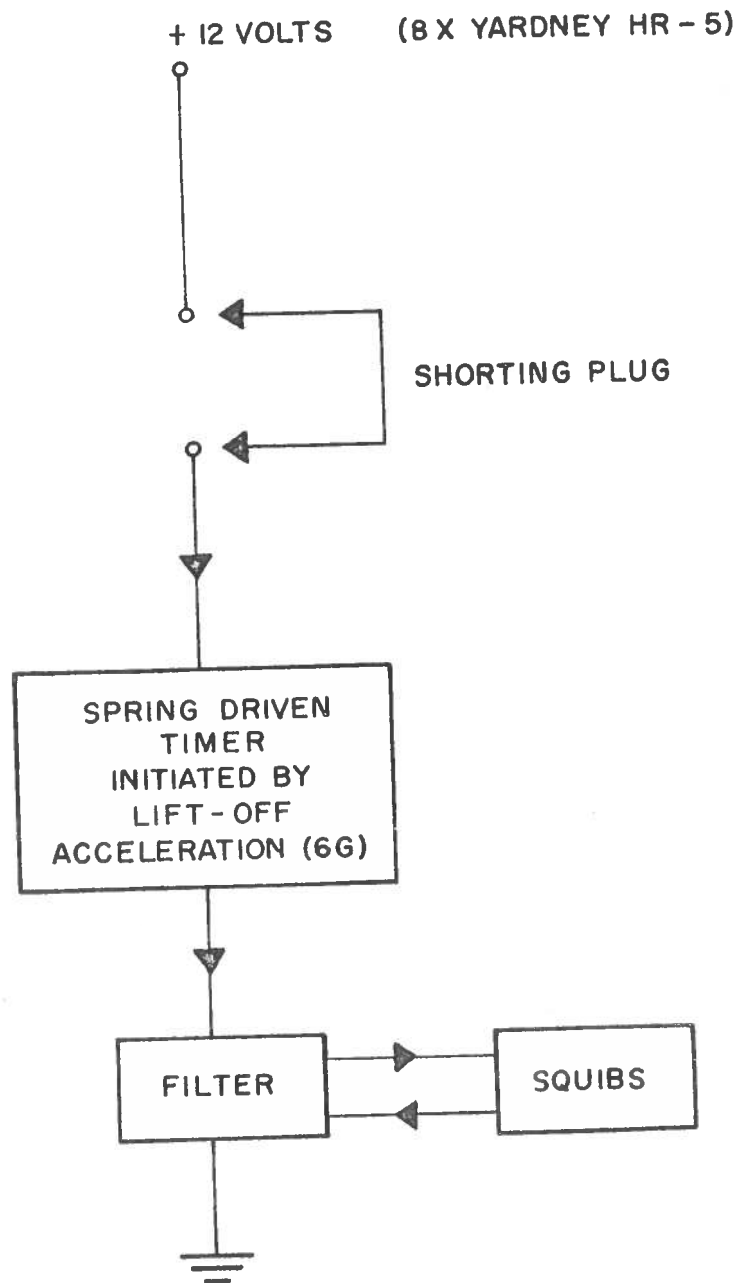


APPENDIX III
ORDNANCE ITEMS

AG 159



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, 7", 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

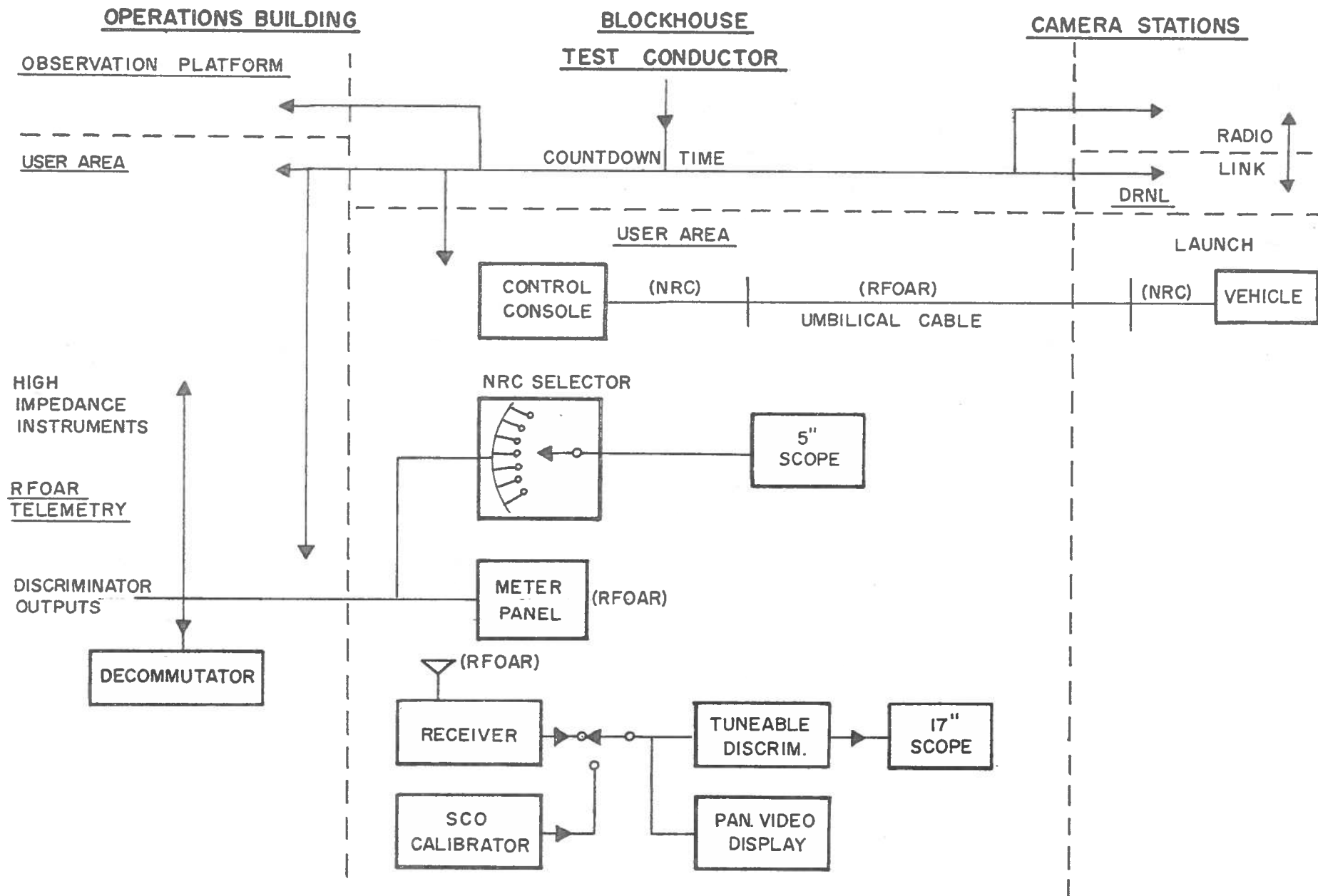
Multicoupler, Nems-Clarke Model MC-406-45-237

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

Audio Amplifier, Heathkit Model EA-3

Control & Monitor Console, Digital	)	Range User Contr	and
Recorder, HP Model 560A	)	Monitor Instrume	ation

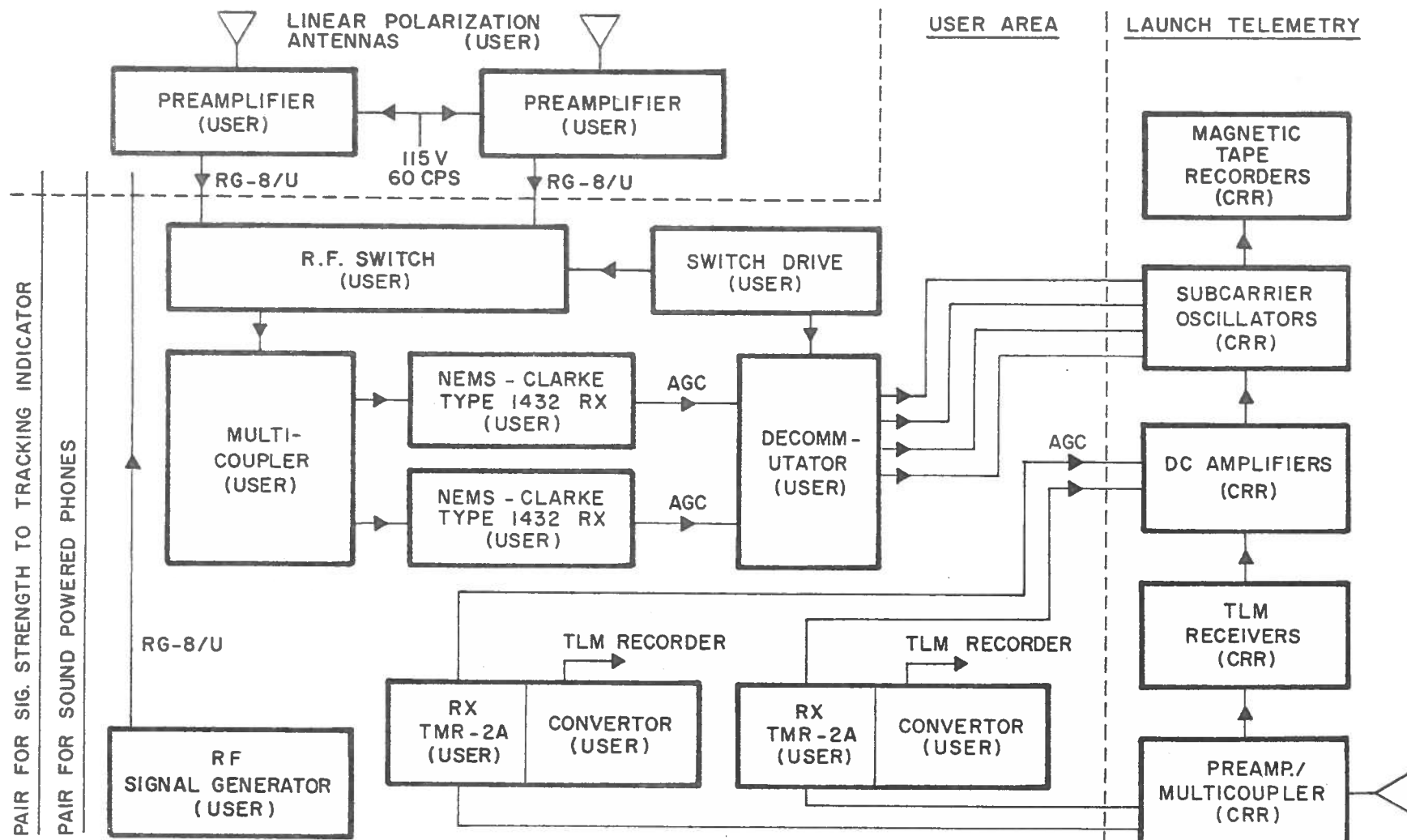
Decommutator, Arnoux Type TDS-300



APPENDIX VI MONITOR AND CONTROL SYSTEM

TRACKER No.2 PLATFORM

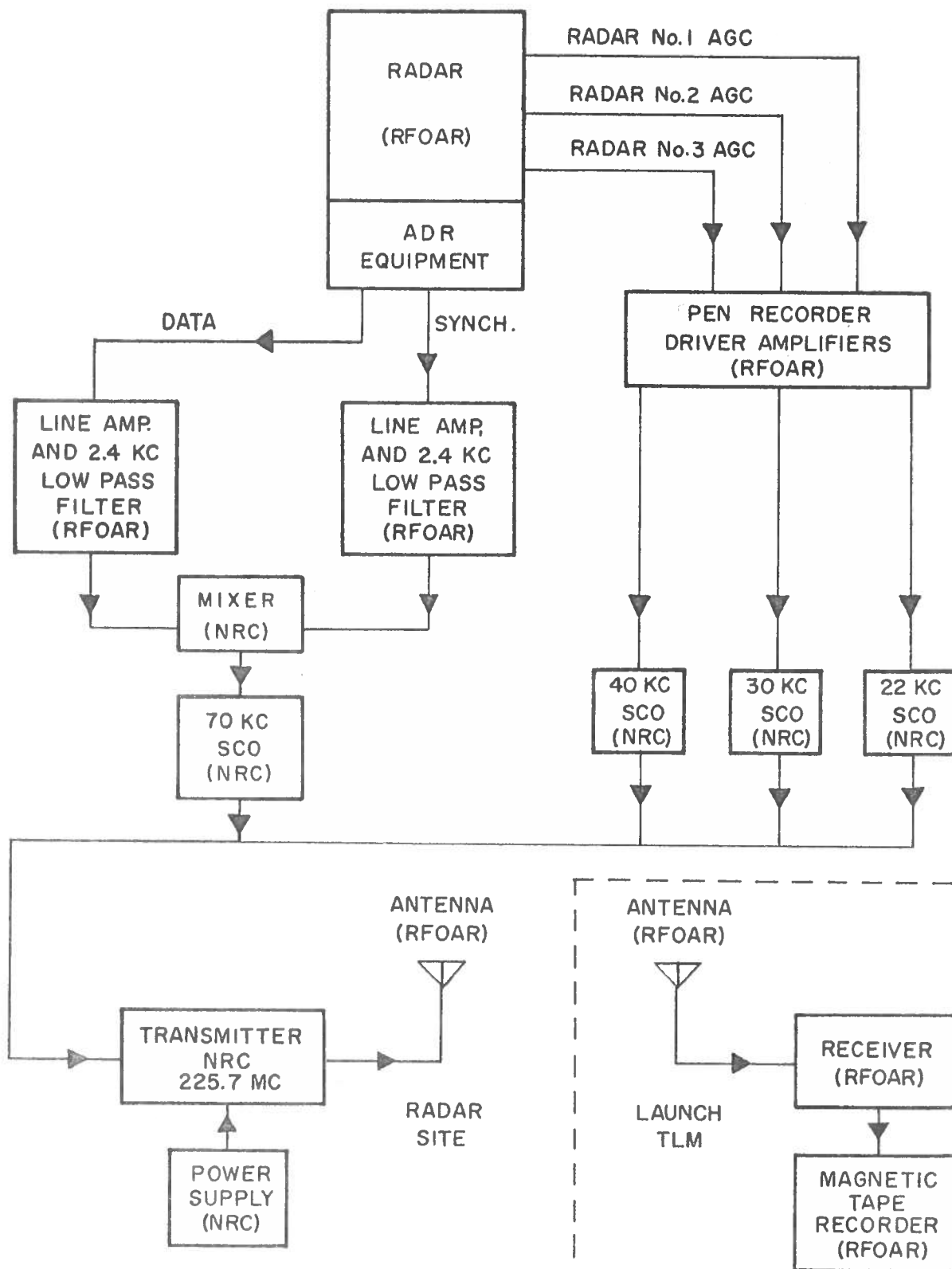
OPERATIONS BUILDING



APPENDIX VII (SHEET I) TLM AGC SYSTEM

RANGE USER SUPPORT INSTRUMENTATION

ADR DATA LINK

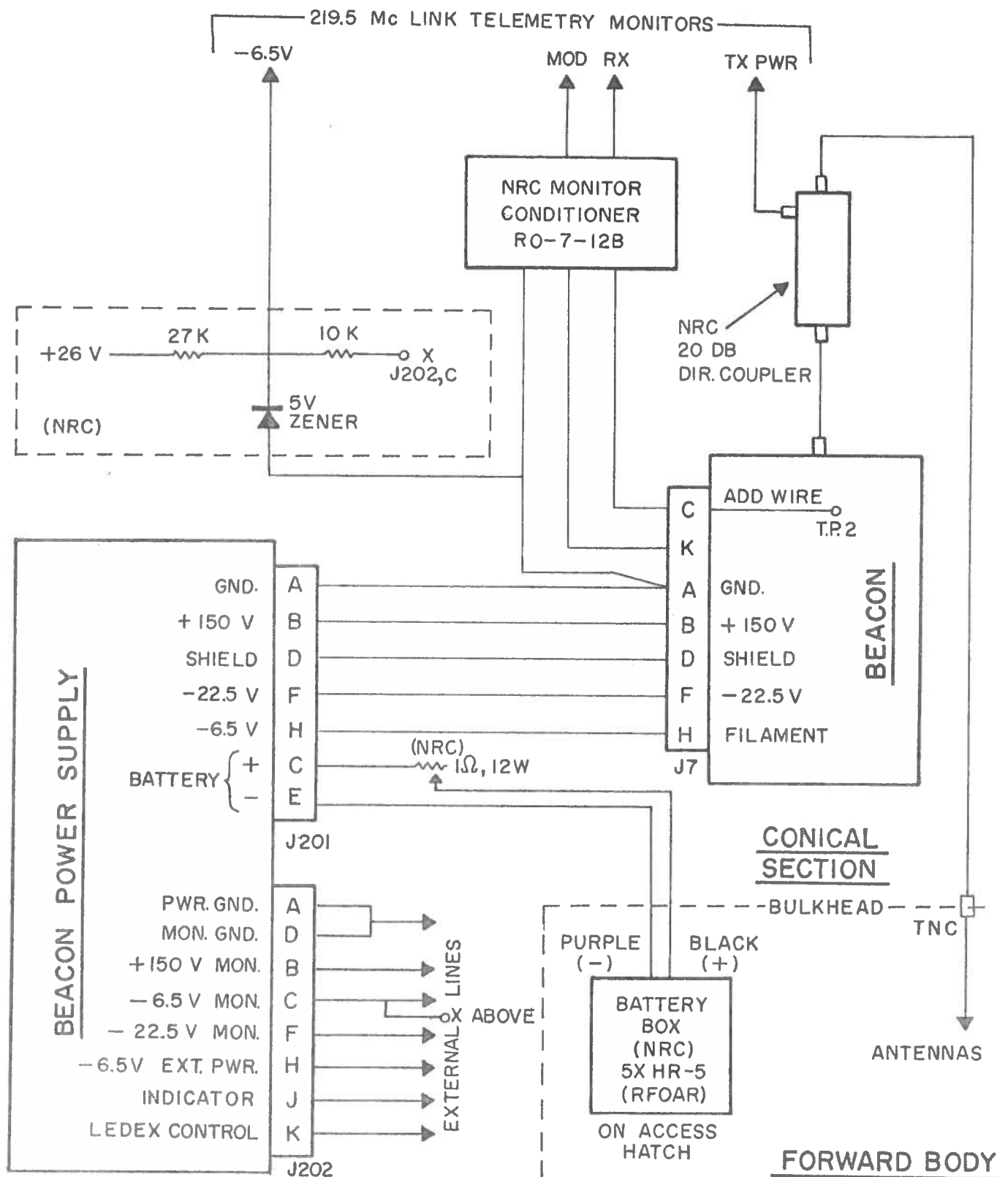


APPENDIX VII (SHEET 2)

RANGER USER SUPPORT INSTRUMENTATION

DPN-41 RADAR BEACON MONITOR

FUNCTIONS

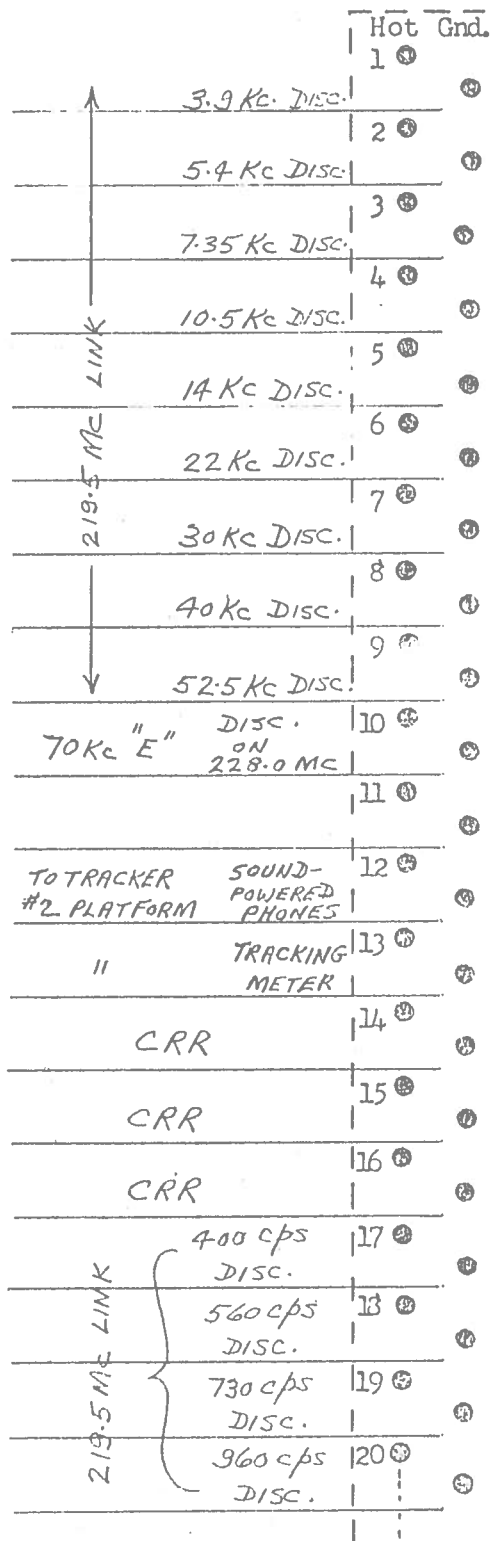


APPENDIX IX
WIRE LINES TO NOSE CONE ASSEMBLY AREA ADJACENT TO
LAUNCH TLM STATION

CONNECT TO:

AG II 59

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



CONNECT TO:

RADAR(8) →

Hot Gnd.



TRKR2(8) - R.F. LINE TO USER
PREAMP "A" AT TRACKER 2
TLM1(8) - R.F. LINE TO USER
PREAMP "B" AT TRACKER 2
TLM2(8) - R.F. CALIBRATE LINE
TO TRACKER 2
TLM3(58) - TLM MULTICOUPLER
OUTPUT TO USER 231.4 Mc Rx
TLM4(58) - 231.4 Mc LINK DATA
TO TAPE TRACK 7
TLM5(58) - USER 231.4 Mc Rx
AGC OUTPUT TO TLM
TLM6(58) - TLM Rx ON 240.2 Mc
LINK #2, VIDEO OUTPUT.
TLM7(58) - TLM TAPE TRACK
#6 PLAYBACK OUTPUT
TLM8(58) -

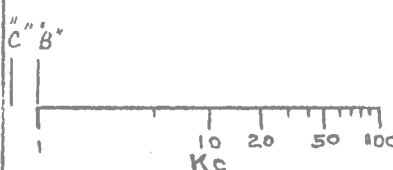
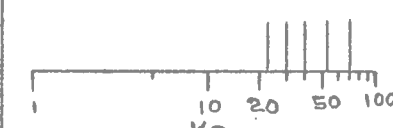
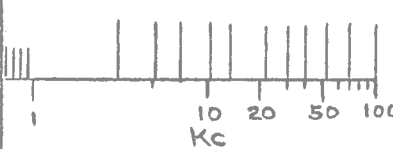
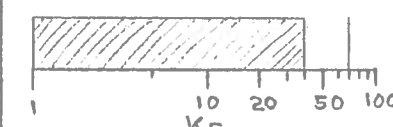
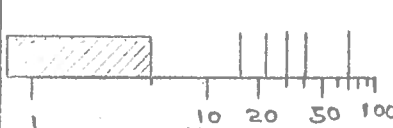
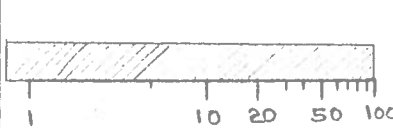

21 o — 227 Mc "A"
22 o — 227 Mc "B"
23 o — 231.4 Mc "A"
24 o — 231.4 Mc "B"

} USER AGC
DECOMMUTATOR
OUTPUTS

PAIR TO BLOCKHOUSE FOR LINK #2 CALIBRATION

* -24 volts at First Motion

APPENDIX X
LAUNCH T/M TAPE RECORDER BANDWIDTH ALLOCATIONS
AGII59

TRACK	BANDWIDTH	EQUIPMENT SUPPLIED BY	DATA AND SOURCE
1		CRR	TIMING "B" CRR
			TIMING "C" CRR
2		CRR + NRC	IRIG #14 T/M RX
			TO #18 AGC
3		CRR	IRIG #1 TO #4
			AND
			#9 TO #18
			<div style="display: flex; align-items: center;"> <div style="font-size: 3em; margin-right: 10px;">{</div> <div> NOSE CONE T/M LINK #1 219.5 MC </div> </div>
			100 Kc REFERENCE CRR
4		CRR	IRIG E E.D. EJECTED
			AND PACKAGE
			WIDE BAND T/M LINK #3
			1 Kc TO 40 Kc 227.0 MC
5		CRR + NRC	VOICE COUNT CRR
			TAPE SERVO REF. CRR
			RADAR ADR & AGC CRR (LINK #5)
6		CRR	X-RAY DETECTOR NOSE CONE
			DATA T/M LINK #2
			(PULSES) 240.2 MC
7		CRR + NRC	1 Kc TO 9 Kc EFP EJECTED
			+30 Kc TO 90 Kc PACKAGE
			PROCESSED BY T/M LINK #5
			NRC 231.4 MC

APPENDIX X1

REAL TIME PAPER RECORD NO. 1 ROCKET AG II 59

TRANSMITTER: TDI 5W LOCATION: NOSE CONE R.F. FREQ.: 219.5 MC

RECORDER: CEC PERMANENT DATA SOURCE: CRR TLM REAL TIME TIME REQ'D.: T+1 DAY

RECORD INTERVAL: ON OFF PAPER RATE

(a) ON/OFF AT REQUEST OF PROJECT SCIENTIST DURING HORIZONTAL CHECKS .64 lps

(b) T-2 MIN. TO T-40 SEC .64 lps

(c) T-40 SEC TO LOS 6.4 lps

UAR

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	#17 52.5 Kc	STD	790 cps	EQUAL	PLANAR TRAP A.C.
2	#16 40 Kc	"	600 cps	"	PLANAR TRAP D.C.
3	#15 30 Kc	"	450 cps	"	PLANAR SWEEP
4	#11 7.35 Kc	"	110 cps	"	PHOTOMETER
5	#18 70 Kc CH. 5+20	GAUSSIAN	10 cps	"	90° CWLF MAGNETOMETER
6	TIMING				IRIG FORMAT "B"

APPENDIX X1

REAL TIME PAPER RECORD NO. 2 ROCKET AG II 59

TRANSMITTER: TDI 5W LOCATION: NOSE CONE R.F. FREQ.: 219.5 MC

RECORDER: CEC PERMANENT DATA SOURCE: CRR TLM REAL TIME TIME REQ'D.: T+1 DAY

RECORD INTERVAL: ON OFF PAPER RATE

T-2 MIN. TO T-40 SEC .4 ips

T-40 SEC TO LOS 4 ips

ALTA.

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	TIMING				IRIG FORMAT "B"
2	#9 3.9 Kc	GAUSSIAN	60 cps	1 1/2"	NEUTRON M.L.
3	#10 5.4 Kc	"	"	1 1/2"	NEUTRON Y
4	FIXED GALVO AT UPPER EDGE 5.4 Kc SCO (ZERO SIG. CONDITION)				
5	TIMING				IRIG FORMAT "B"

APPENDIX X1

REAL TIME PAPER RECORD NO. 3 ROCKET AGII 59

TRANSMITTER: NRC 1W TDI 5W E.D. PACKAGE 227.0 Mc
 LOCATION: NOSE CONE R.F. FREQ.: 219.5 Mc.

RECORDER: CEC UV #5124 DATA SOURCE: CRR TLM TIME REQ'D.: T+1 HOUR
REAL TIME

RECORD INTERVAL: ON OFF PAPER RATE

(a) T-2 MIN. TO T-40 SEC. 1 lps

(b) T-40 SEC. TO LOS 10 lps

SE

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	TIMING			LEFT EDGE	IRIG FORMAT "B"
2	#18 70 Kc	GAUSSIAN	1050 cps	2" TO 3"	COMMUTATOR 30 X 10/SEC
3	#12 10.5 Kc	STD	160 cps	3/4"	E.D. OSC. CONT. EFP III #1
4	#13 14.5 Kc	"	220 cps	3/4"	E.D. R.F. EFP III #2
5	#14 22 Kc	"	330 cps	3/4"	E.D. SAWTOOTH EFP III #3
6	#E 70 Kc 227.0 Mc LINK	"	2000 cps	1" TO 1 1/2"	E.D. PACKAGE DATA
7	TIMING			RIGHT EDGE	IRIG FORMAT "B"

APPENDIX X/

REAL TIME PAPER RECORD NO. 4 ROCKET AGII 59

EVENTS LINK #1 & AGC

TRANSMITTER: TDI 5W LOCATION: NOSE CONE R.F. FREQ.: 219.5 MC

RECORDER. SANBORN DATA SOURCE: CRR TLM
REAL TIME TIME REQ'D.: T+1 HOUR

RECORD INTERVAL: ON OFF PAPER RATE

(a) T-2 MIN. TO LOS 10 MM/SEC

(b) POST-FLIGHT FOR AGC CALIBRATION 10 MM/SEC

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	#1 400 cps	STD	10 cps	EQUAL	MULTIPLEX RELAYS
2	#2 560 cps	"	"	"	SIGNAL TRANSFER RELAYS
3	#3 730 cps	"	"	"	TO K ALT. SWITCH
4	#4 960 cps	"	"	"	EFPI EXIT "A" N. CONE PRESS. "B"
5	DIRECT RECORD: AGC OF CRR Rx ON LINK #1 (219.5 MC), CALIB. 0 TO 1000 μ V				
6	" "	" " "	" " "	#2 (240.2 MC),	CALIB. 0 TO 1000 μ V
7	" "	" " "	" " "	#4 (108 MC),	CALIB 0 TO 100 μ V
8	TIMING				IRIG FORMAT "C"

APPENDIX XI

REAL TIME PAPER RECORD NO. 5 ROCKET AG II 59

TRANSMITTER: TDI 5W LOCATION: NOSE CONE R.F. FREQ.: 219.5 MC

RECORDER: SANBORN DATA SOURCE: CRR TLM
REAL TIME TIME REQ'D.: T+1 HOUR

RECORD INTERVAL: ON OFF PAPER RATE

(a) USER MAY REQUEST A SHORT
RECORD DURING HORIZONTAL
CHECKS 10 MM/SEC

(b) T-2 MIN. TO LOS 10 MM/SEC

SE

TRACE	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	#18 70Kc CH. 3	GAUSSIAN	10 cps	EQUAL	T/M +26 ^u MON.
2	#18 70Kc CH. 4 & 19	"	"	"	0° MAGNETOMETER
3	#18 70Kc CH. 6 & 21	"	"	"	±5G 0° ACCEL.
4	#18 70Kc CH. 14	"	"	"	Z-AXIS ACCEL.
5	#18 70Kc CH. 25	"	"	"	I-I. SQUIB MON.
6	#18 70Kc CH. 27	"	"	"	E.D. & EFPI SQUIB MON.
7	#18 70Kc CH. 28	"	100 cps	"	SUBCOMMUTATOR
8	TIMING				IRIG FORMAT "C"

APPENDIX XII

PLAYBACK PAPER RECORD NO. 1

ROCKET: AG II 59

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

RECORDER: CEC PERMANENT DATA SOURCE: LAUNCH TLM TAPE

COPIES: 1 TIME REQUIRED: T+2 DAYS

RECORD INTERVAL: ON OFF PAPER RATE

T-10 SEC TO SPLASH EQUIV. TO 40 IN/SEC.
REAL TIME

NOTE: PLAYBACK MAY BE DONE AT REDUCED SPEED WITH APPROPRIATE DISCRIMINATOR.

SE

[illegible]

APPENDIX XII

PLAYBACK PAPER RECORD NO. 2 ROCKET: AGT 59

TRANSMITTER: TDI 5W NRC 1W LOCATION: NOSE CONE E.D. PACKAGE R.F. FREQ.: 219.5 MC 227.0 MC

RECORDER: CEC PERMANENT DATA SOURCE: LAUNCH TLM TAPE

COPIES: 1 TIME REQUIRED: T + 2 DAYS

RECORD INTERVAL: ON OFF PAPER RATE

- (a) T - 90 SEC TO T + 60 SEC 1.6 lps
- (b) T + 60 SEC TO LOS 16 lps
- (c) POST-FLIGHT FOR AGC CALIBRATION 1.6 lps

UoFS.

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	TIMING				IRIG FORMAT "B"
4	#E 70Kc 227.0Mc	STD	2000 cps	2"	E.D. DATA
—	FIXED GALVO AT LOWER BAND EDGE (ZERO SIGNAL) OF IRIG #13, AGC LINK #3				
2	#13 14.5Kc	STD	50 cps	1 1/2"	LINK #3 227 Mc AGC
3	#14 22 Kc	"	300 cps	1"	E.D. SAWTOOTH
3	#13 14.5Kc	"	220 cps	1"	E.D. R.F. AMPLITUDE
3	#12 10.5 Kc	"	160 cps	1"	E.D. OSC. CONT. VOLT.
1	TIMING				IRIG FORMAT "B"

APPENDIX XII

PLAYBACK PAPER RECORD NO. 3

ROCKET: AGII 59

TRANSMITTER: TDI 5W UoFS. 200mw NOSE CONE LOCATION: EFPI PKG R.F. FREQ.: 219.5 Mc
231.4 Mc

RECORDER: SANBORN DATA SOURCE: LAUNCH TLM TAPE

COPIES: 1 TIME REQUIRED: T+2 DAYS

RECORD INTERVAL: ON OFF PAPER RATE

(a) T-10 SEC TO LOS 25 MM/SEC

(b) POST-FLIGHT AGC CALIBRATION 25 MM/SEC

UoFS.

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	TIMING				
2	#14 22 Kc	STD	50 cps	EQUAL	231.4 Mc AGC USER TMR-2A
2	#17 52.5 Kc	"	"	"	231.4 Mc AGC USER "A"
2	#18 70 Kc	"	"	"	231.4 Mc AGC USER "B"
3	#18 70 Kc CH. 24	GAUSSIAN	10 cps	"	EEP I R.F. MONITOR
3	#18 70 Kc CH. 27	"	"	"	E.D. & EFP SQUIB MON.
3	#18 70 Kc CH. 28	"	100 cps	"	SUBCOMMUTATOR IRIG FORMAT "C"
1	TIMING				

APPENDIX XII

PLAYBACK PAPER RECORD NO. 4

ROCKET: AGT 59

TRANSMITTER: TDI 5W LOCATION: NOSE 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

T-90 SEC TO LOS 25 MM/SEC

U.S.F.S.

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	#12 10.5 Kc	STD	100 cps	EQUAL	EFPT III OUTPUT #1
3	#13 14.5 Kc	"	100 cps	"	EFPT III OUTPUT #2
3	#14 22.0 Kc	"	100 cps	"	EFPT III OUTPUT #3
3	#18 70Kc CH.	GAUSSIAN	10 cps	"	0° MAGNETOMETER
3	#18 70Kc CH.	"	"	"	90° CWLF MAGNETOMETER
3	#18 70Kc CH.	"	"	"	EFPT III OUTPUT #1
3	#18 70Kc CH.	"	"	"	Z-AXIS ACCEL.
1	TIMING				IRIG FORMAT "C"

APPENDIX XII

PLAYBACK PAPER RECORD NO. 5

ROCKET: AGT 59

TRANSMITTER: TDI 5W LOCATION: NOSE 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

T-2 MIN. TO LOS 10 MM/SEC

UAR

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	#18 70Kc CH. 8	GAUSSIAN	10 cps	EQUAL	RADAR BEACON -6.5v
3	#18 70Kc CH. 9	"	"	"	" MOD.
3	#18 70Kc CH. 10	"	"	"	" Rx.
3	#18 70Kc CH. 11	"	"	"	" R.F.
3	#18 70Kc CH. 15	"	"	"	PLASMA PROBE SWEEP
3	#18 70Kc CH. 13	"	"	"	EEP III OUTPUT #1
3	#18 70Kc CH. 26	"	100 cps	"	SUBCOMMUTATOR
1	TIMING				IRIG FORMAT "C"

APPENDIX XII

PLAYBACK PAPER RECORD NO. 6 ROCKET: AGII 59

TRANSMITTER: TDI 5W LOCATION: NOSE 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

T-2 MIN. TO LOS 10 MM/SEC

UAR

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	#11 7.35 Kc	STD	100 cps	EQUAL	Z-AXIS ACCEL. + PHOTOMETER 0°
3	#18 70Kc CH. 4+19	GAUSSIAN	10 cps	"	MAGNETOMETER
3	#18 70Kc CH. 6+21	"	"	"	±5G 0° ACCEL.
3	#18 70Kc CH. 16	"	"	"	M.M. #1
3	#18 70Kc CH. 17	"	"	"	M.M. #2
3	#18 70Kc CH. 18	"	"	"	M.M. #3
3	#18 70Kc CH. 26	"	100 cps	"	SUBCOMMUTATOR
1	TIMING				IRIG FORMAT "C"

APPENDIX XII

PLAYBACK PAPER RECORD NO. 7 ROCKET: AGT 59

TRANSMITTER: TDI SW LOCATION: NOSE 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
T-2 MIN. TO LOS 10 MM/SEC

SE

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
3	#11 7.35 Kc	STD	100 cps	EQUAL	Z-AXIS ACCEL. + PHOTOMETER 0°
3	#18 70Kc CH. 4 & 19	GAUSSIAN	10 cps	"	MAGNETOMETER
3	#18 70Kc CH. 5 & 20	"	"	"	90° CWLF MAGNETOMETER
3	#18 70Kc CH. 6 & 21	"	"	"	±5G 0° ACCEL.
3	#18 70Kc CH. 7 & 22	"	"	"	±5G 90° CWLF ACCEL.
3	#18 70Kc CH. 12	"	"	"	50K ALT SW. 70K VENTED ALT.
3	#18 70Kc CH. 28	"	100 cps	"	SUBCOMMUTATOR
1	TIMING				IRIG FORMAT "C"

APPENDIX XII

PLAYBACK PAPER RECORD NO. 8 ROCKET: AGII 59

RADAR AGC & LINK #1 FUNCTIONS

TRANSMITTER: — LOCATION: — R.F. FREQ.: —

RECORDER: SANBORN DATA SOURCE: LAUNCH TLM TAPE

COPIES: 1 TIME REQUIRED: T + 2 DAYS

RECORD INTERVAL: ON OFF PAPER RATE

(a) T-2 MIN. TO LOS 10 MM/SEC.

(b) POST-FLIGHT FOR AGC CALIBRATION 10 MM/SEC

SE

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
	#14 22 Kc	STD	50 cps	EQUAL	RADAR #1 AGC
	#15 30 Kc	"	"	"	RADAR #2 AGC
	#16 40 Kc	"	"	"	RADAR #3 AGC
	#18 70 Kc CH. 5 & 20	GAUSSIAN	10 cps	"	90° CWLF MAGNETOMETER
	#18 70 Kc CH. 23	"	"	"	SQUIB +12 V MONITOR
	#18 70 Kc CH. 24	"	"	"	EFPI R.F. MONITOR
	#18 70 Kc CH. 26	"	100 cps	"	SUBCOMMUTATOR
	TIMING				IRIG FORMAT "C"

APIENDIX XII

PLAYBACK PAPER RECORD NO. 9

ROCKET: AGII 59

TRANSMITTER: TDI 5W LOCATION: NOSE CONE 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-2 MIN. TO T-5 SEC 1 lps

(b) T-5 SEC TO T+35 SEC 10 lps

SE

TAPE TRACK	SUBCARRIER FREQUENCY	FILTER	DATA FREQ.	DEFLECTION	DATA
1	TIMING				IRIG
3	#15 30 Kc	STD	USE 1 Kc GALVO.	2"	FORMAT "B"
3	#17 52.5 Kc	"	"	2"	0° VIBRATION ACCELEROMETER
1	TIMING				Z-AXIS VIBRATION ACCELEROMETER
					IRIG
					FORMAT "B"