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C-105 P/FREE FLIGHT MODELS/1

SUMMARY OF FIRINGS OF FREE FLIGHT MODELS 1 AND 2 WEEK COMMENCING DECEMBER 12TH 1954

W. Taylor January 5, 1955.

Avro Aircraft Limited

INTER-DEPARTMENTAL MEMORANDUM

Date January 10, 1955
To Mr. J.C. Floyd - Vice-President Engineering
From W. Taylor - Project Leader
Subject SUMMARY OF FIRINGS OF FREE FLIGHT MODELS 1 AND 2

Attached herewith the following report:-

P/Free Flight Model/1 - Summary of Firings of Free Flight Models 1 and 2

Week Commencing December 12th 1954.

W. Taylor.

WT/ym

W. Taylor

c.c. Messrs. R.N. Lindley
J.A. Chamberlin
J. Dobrzanski
W. Czerwinski
J. Kenny
S.E. Harper
G. Hake
R. Adey
T.A.G. Randell

A. Duguid - C.A.R.D.E.
R. Chinnick - Picton Range

A. V ROE CANADA LIMITED
MALTON · ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

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AIRCRAFT: C-105

REPORT NO P/F.F. MODEL/1

FILE NO

NO. OF SHEETS:

TITLE

SUMMARY OF FIRINGS OF FREE FLIGHT MODELS 1 AND 2

WEEK COMMENCING DECEMBER 12TH 1954

PREPARED BY W. Taylor DATE Jan. 5/55

CHECKED BY DATE

SUPERVISED BY DATE

APPROVED BY DATE

ISSUE NO	REVISION NO	REVISED BY	APPROVED BY	DATE	REMARKS

FORM 1316A

SUMMARY OF FIRINGS OF FREE FLIGHT MODELS 1 AND 2

WEEK COMMENCING DECEMBER 12TH 1954.

FREE FLIGHT MODEL 1

Assembly of Booster Fittings to Booster commenced December 12th.

December 13th

Alignment completed.

Telemetry installation and checks commenced, power supply built and activated in the evening. It was discovered during check-out that the Booster spoon plunger was shorting the micro-switches to earth (i.e. cutting the insulation of the wiring). The complete fittings were removed, modified, rewired and replaced.

December 14th

Telemetry checks to external power and internal power completed, the model was mated to the booster and the combination 'swung' for C.G. check.

The armed combination was placed on the launcher and wheeled to the launching pad immediately after the tracking test vehicle had been fired. After aligning the combination and connecting internal power supply, the launcher was elevated to the firing position and all safety screws removed.

On learning that the $\bigstar f$ launches were satisfactory, the pad was cleared of all except two personnel to allow the firing circuit to be made.

At this stage, it was discovered that one of the less important telemetry channels had failed and that full camera coverage was not available. It was decided to proceed without. The firing plugs were inserted (the last one is inserted at the Control Building) and firing took place at 14.08 hours.

Launch and separation were successful. Telemetry records were good throughout the duration of the flight. No excessive accelerations were recorded at separation. Integration of boost acceleration indicates that a Mach No. of 1.74 was reached. Separation signal shows separation at 3.38 seconds.

$\bigstar$ sub-carrier frequencies at launch.

A. V. ROE CANADA LIMITED
MALTON - ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT		REPORT NO. P/F.F. MODELS/1	
		SHEET NO. 2	
		PREPARED BY	DATE
		W. Taylor	Jan. 5, 1955
		CHECKED BY	DATE

FREE FLIGHT MODEL 2

The procedure followed was identical to Model 1.

Firing took place at 15.20 hours, December 16th.

Launching and separation were successful. All telemetry channels were successfully recorded. Small amplitude high frequency angular acceleration in pitch is noticeable a little before separation. Otherwise, the records are almost identical. Telemetry indicates separation took place at 3.45 seconds. Integration of the boost acceleration gives a Mach No. of 1.69 .

Reduced data from two of the telemetry channels are attached.

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MALTON ONTARIO
TECHNICAL DEPARTMENT (Aircraft)

REPORT NO P/F.F. MODELS/1
SHEET NO 3

AIRCRAFT:		PREPARED BY	DATE
C-105	APPENDIX 1	W. Taylor	Jan. 5, 1955
		CHECKED BY	DATE

CRUDE MODEL 1

See Chart - Telemeter Data Crude F.F. 1

Power Supply

Activated at 9 p.m., Monday 13, December)
) 17 hours stand time.
Fired at 2 p.m., Tuesday 14 December)

No Load Voltage	Filament	108 Volt Line	180 Volt Line	Ref.
	7.3	128.1	206	5.3
After 3 min. load	5.7	107.3	175	5.2
20 mins. later on for .75 min.	5.7	109	179	5.2

On at launcher at 13.35)
) 32.5 mins.
Fired at 14.07½)

Total use of power supply 36.25 mins.

★ Weather Conditions at Time of Firing

Ground

Barometer	1000
Temperature	34.3°F
Wind	E/North East
Speed	12 m.p.h.

Upper Air

Height	Wind (m.p.h.)	Direction °
5,000	24	175
10,000	14	145
15,000	19	186
20,000	33	176
25,000	72	192

★ Extracted from C.A.R.D.E. Range Officer's Report.

Upper Air (Continued)

MB	HT. (ft.)	TEMP. (°C)	D.P. (°C)
1000	210	+ 3.28	+ 1.1
850	4639	+ 2.5	+ 1.5
700	9596	- 4.0	- 5.6
500	18064	-19.9	-22.2
400	23392	-26.7	-28.2

CRUDE MODEL 2

See Chart - Telemeter Data Crude F.F. 2

Power Supply

Activated at 12 a.m., Thursday, December 16)
) 3 hours, 20 mins. stand
Fired at 15.22 Thursday, December 16) time

No Load Voltage	Filament		108 Volt Line		180 Volt Line		Ref.
	7.5	2.2 A	133.8	12 mA	216.5	111 mA	5.4
On at 12.40 for 3.5 mins.	5.8		109		179.5		5.2

On at launcher at 15.00)
) 22 mins.
Fired at 15.22)

Total use of power supply 25.5 mins.

Voltages read on Simpson Model 260 meter and corrected after calibration with Polyranger.

★ Weather Conditions at Time of Firing

Ground

Barometer	1002.5
Temperature	27°F
Wind	North West
Speed	14 m.p.h.

Upper Air

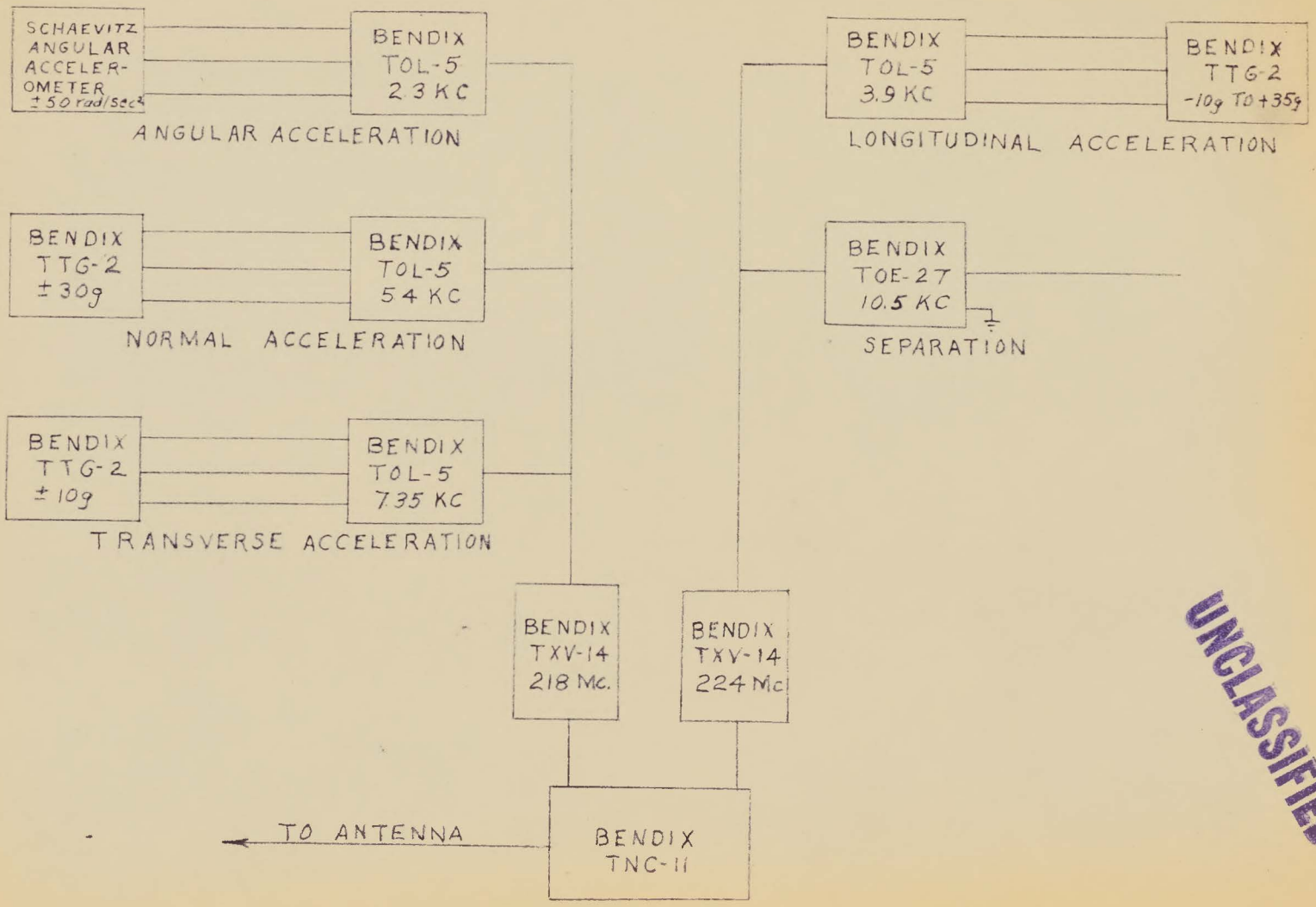
Height	Wind (m.p.h.)	Direction °
5,000	19	340
10,000	31	342
15,000	36	308
20,000	31	290
25,000	38	278
30,000	60	278

★ Extracted from C.A.R.D.E. Range Officer's Report.

Upper Air (Continued)

MB	HT. (ft.)	TEMP. (°C)	D.P. (°C)
1000	807	- 1.9	- 7.6
850	5047	- 5.5	-20.7
700	9944	-13.8	-29.7

BLOCK DIAGRAM OF TELEMETER PACKAGE FOR C-105
CRUDE MODELS 1&2



CHANNEL	OSCILLATOR TYPE	TRANSDUCER TYPE	FUNCTION	LOW FREQ. LIMIT	f_h	f_L	Δ f TOLERA
2.3 K.C.	TOL-5 B-5317	Shaevitz Angular Acceleration. ± 50 rad./sec.^{2} Serial No. 363	Angular Acceleration	2100	2344	2344	± 7 c.p
5.4 K.C.	TOL-5 B-5342	Bendix TTG-2 B-1554 ± 30 g	Pitch Acceleration	5085	5489	5492	± 16 c.
7.35 K.C.	TOL-5 B-4669	Bendix TTG-2 B-1910 ± 10 g	Transverse Acceleration	6872	7350	7350	± 22 c.
3.9 K.C.	TOL-5 B-5309	Bendix TTG-2 B-1900 - 10 + 35 g	Longitudinal Acceleration	3643	3799	3809	± 12 c.
10.5 K.C.	TOE-27 B-1900	+ 5V Applied at Separation	Separation	9712			

NOTE: (1) Two Bendix type TXV-14 Transmitters were used, one operating at 218 mc. and modulated
The other transmitter operated at 224 mc. and was modulated by the 3.9 K.C. and 10.5 K

(2) The two Transmitters were connected to a single notch antenna through a Bendix TNC-11

(3) Power applied at 13^{35} and Model fired at $14^{07.5}$

(4) First frequency check started at 13^{26} and completed at 13^{29} (Model approximately hori
Second Frequency check started at 13^{49} and completed at 13^{51} (Model in launching pos
Third frequency check started at 14^{01} and completed at 14^{02} (Model in launching posit
Fourth frequency check started at 14^{06} and completed at 14^{07} (Model in launching posi

(5) f_h - Desired frequency with model in horizontal position.
f_L - Desired frequency with model in launching position.

(6) 5.4 K.C. Channel failed just prior to firing.

TELEMETER DATA CRUDE F.F. 1

TION	LOW FREQ. LIMIT	f_h	f_L	Δf TOLERATED	HIGH FREQ. LIMIT	MAX. FREQ. RESPONSE	1st FREQ. CHECK	2nd FREQ. CHECK	3rd FREQ. CHECK	4th FREQ. CHECK
eration	2100	2344	2344	± 7 c.p.s.	2500	35 c.p.s.	2346	2350	2350	2350
ation	5085	5489	5492	± 16 c.p.s.	5710	80 c.p.s.	5506	5510	5509	-
celeration	6872	7350	7350	± 22 c.p.s.	7737	7392	7393	7392	7391	7391
Acceleration	3643	3799	3809	± 12 c.p.s.	4128	±12 c.p.s.	3809	3818	3817	3817
	9712				11288	150 c.p.s.	11138	11133	11133	11131

sed, one operating at 218 mc. and modulated by the 2.3 K.C., 54. K.C. and 7.35 K.C. Channels.
and was modulated by the 3.9 K.C. and 10.5 K.C. Channels.

ingle notch antenna through a Bendix TNC-11 Diplex Coupler.

$4^{07.5}$

completed at 13^{29} (Model approximately horizontal)
completed at 13^{51} (Model in launching position)
completed at 14^{02} (Model in launching position)
completed at 14^{07} (Model in launching position)

ontal position.
hing position.

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CHANNEL	OSCILLATOR TYPE	TRANSDUCER TYPE	FUNCTION	LOW FREQ. LIMIT	f_h	f_L	Δf TOLERA
2.3 K.C.	TOL-5 B-5326	Shaevitz Angular Acceleration. Serial No. 409 $\pm$ 50 rad./sec.^{2}	Angular Acceleration	2127	2301	2301	$\pm$ 7 c.
5.4 K.C.	TOL-5 B-5231	Bendix TTG-2 B-1878 $\pm$ 15 g	Pitch Acceleration	5013	5376	5382	$\pm$16 c.
7.35 K.C.	TOL-5 B-5318	Bendix TTG-2 B-1908 $\pm$ 10 g	Transverse Acceleration	6845	7350	7350	$\pm$22 c.
3.9 K.C.	TOL-5 B-5344	Bendix TTG-2 B-5344 - 10 g + 35 g	Longitudinal Acceleration	3650	3780	3790	$\pm$12 c.
10.5 K.C.	TOL-5 B-1895	Five Volts applied at Separation	Separation	9712			

NOTE: (1) Two Bendix type TXV-14 transmitters were used, one operating at 218 mc. and modulated b
The other transmitter operated at 224 mc. and was modulated by the 3.9 K.C. and 10.5 K.

(2) The two transmitters were connected to a single notch antenna through a Bendix type TN

(3) Power applied at $15^{\underline{00}}$ and Model fired at $15^{\underline{22}}$

(4) First frequency check started at $15^{\underline{01}}$ and finished at $15^{\underline{02}}$ (Model approximately ho
Second frequency check started at $15^{\underline{07}}$ and finished at $15^{\underline{08}}$ (Model in launching pos
Third frequency check started at $15^{\underline{11}}$ and finished at $15^{\underline{12}}$ (Model in launching pos
Fourth frequency check started at $15^{\underline{21}}$ and finished at $15^{\underline{21.5}}$ (Model in launching po

(5) f_h - Desired frequency with Model in horizontal position.
f_L - Desired frequency with Model in launching position.

TELEMETER DATA CRUDE F.F. 2

TION	LOW FREQ. LIMIT	f_h	f_L	Δ f TOLERATED	HIGH FREQ. LIMIT	MAX. FREQ. RESPONSE	1st FREQ. CHECK	2nd FREQ. CHECK	3rd FREQ. CHECK	4th FREQ. CHECK
ration	2127	2301	2301	± 7 c.p.s.	2450	35 c.p.s.	2305	2308	2309	2309
tion	5013	5376	5382	±16 c.p.s.	5791	80 c.p.s.	5390	5392	5397	5397
celeration	6845	7350	7350	±22 c.p.s.	7740	80 c.p.s.	7386	7387	7386	7386
Acceleration	3650	3780	3790	±12 c.p.s.	4160	60 c.p.s.	3786	3790	3794	3793
	9712				11288	150 c.p.s.	10922	10903	10902	10902

sed, one operating at 218 mc. and modulated by the 2.3 K.C., 5.4 K.C. and 7.35 K.C. Channels.
and was modulated by the 3.9 K.C. and 10.5 K.C. Channels.

ingle notch antenna through a Bendix type TNC-11 Diplex Couper.

$15\frac{22}{}$

nd finished at $15\frac{02}{}$ (Model approximately horizontal)
nd finished at $15\frac{08}{}$ (Model in launching position)
nd finished at $15\frac{12}{}$ (Model in launching position)
nd finished at $15\frac{21.5}{}$ (Model in launching position)

ontal position.
ning position.

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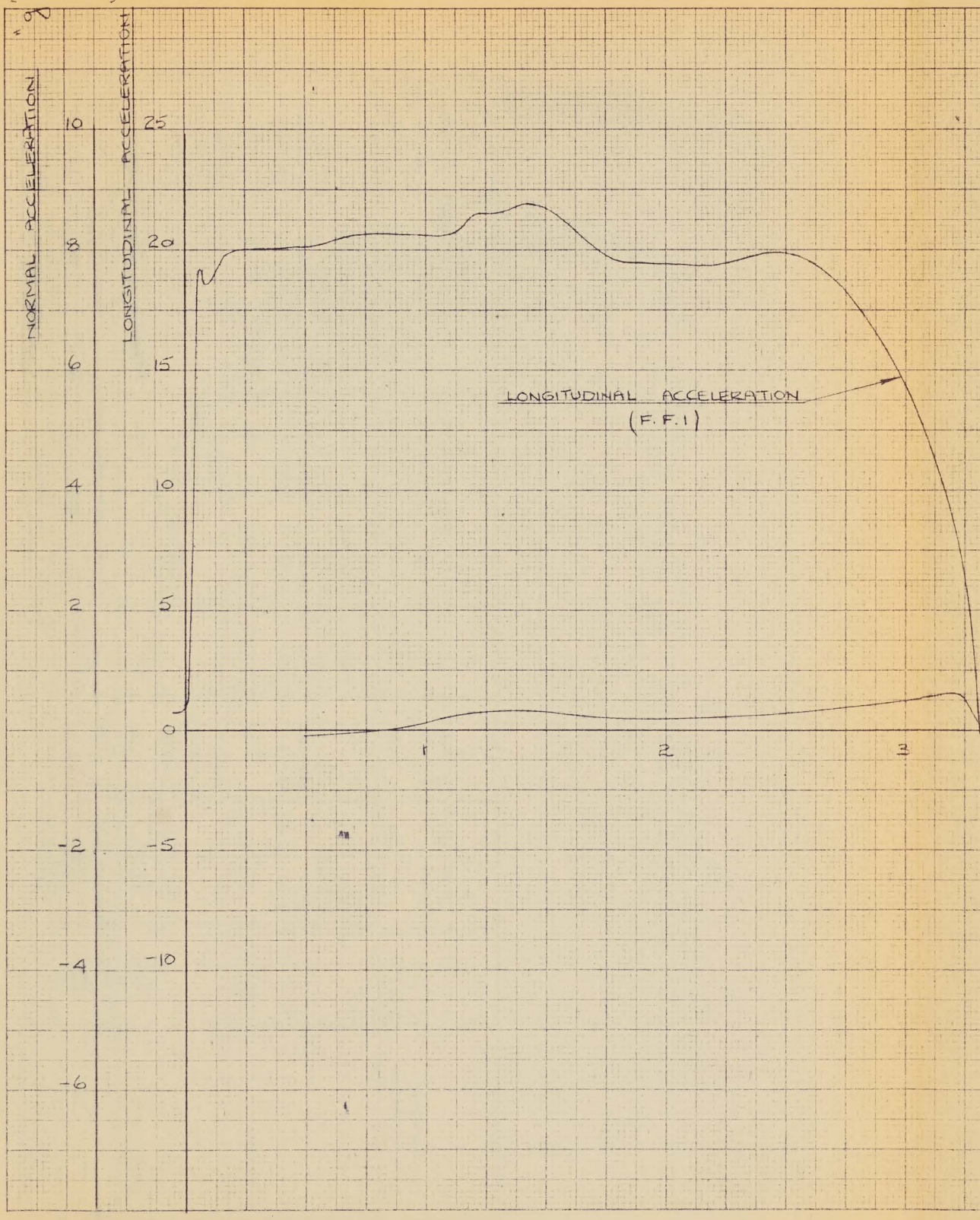
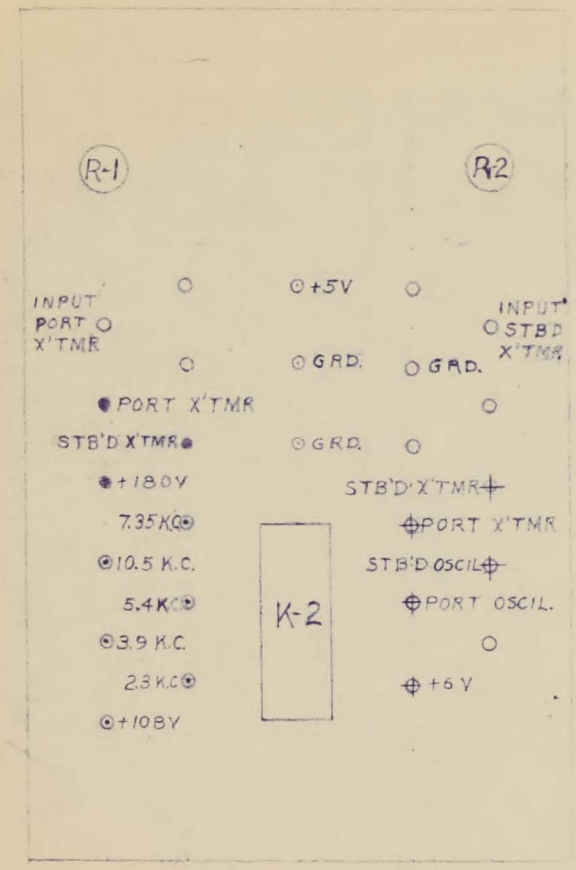


COMPARISON OF ESTIMATED WEIGHT AND C.G. DATA WITH ACTUAL WEIGHT AND C.G. DATA
FOR 1ST AND 2ND CRUDE MODEL FIRINGS

	ESTIMATED			ACTUAL - 1ST MODEL			ACTUAL - 2ND MODEL		
	WEIGHT	CENTRE OF GRAVITY		WEIGHT	CENTRE OF GRAVITY		WEIGHT	CENTRE OF GRAVITY	
		HORIZONTAL	VERTICAL		HORIZONTAL	VERTICAL		HORIZONTAL	VERTICAL
Model	472.5	65.81" (25% MAC)	1.80" Above Fuselage Datum	463.0	65.81 (25% MAC)	1.865" Above Fuselage Datum	456.0	65.81 (25% MAC)	1.83 Above Fuselage Datum
Booster	1788.1	71.56" From Front Face Booster Case	.29" Below Booster ℄	1820.0 (XM5-) (Ser.) (No.) (2471)	69.96" From Front Face Booster Case	.32" Below Booster ℄	1823.0 (XM5-) (Ser.) (No.) (2464)	70.09 From Front Face Booster Case	.31 Below Booster ℄
Model-Booster Combination	2260.6	161.12" From Model Nose Datum	.034" Above Booster ℄	2283.0	160.60" From Model Nose Datum	.014" Above Booster ℄	2279.0	160.95 From Model Nose Datum	.010" Above Booster ℄

FWD.



TERMINAL BOARD

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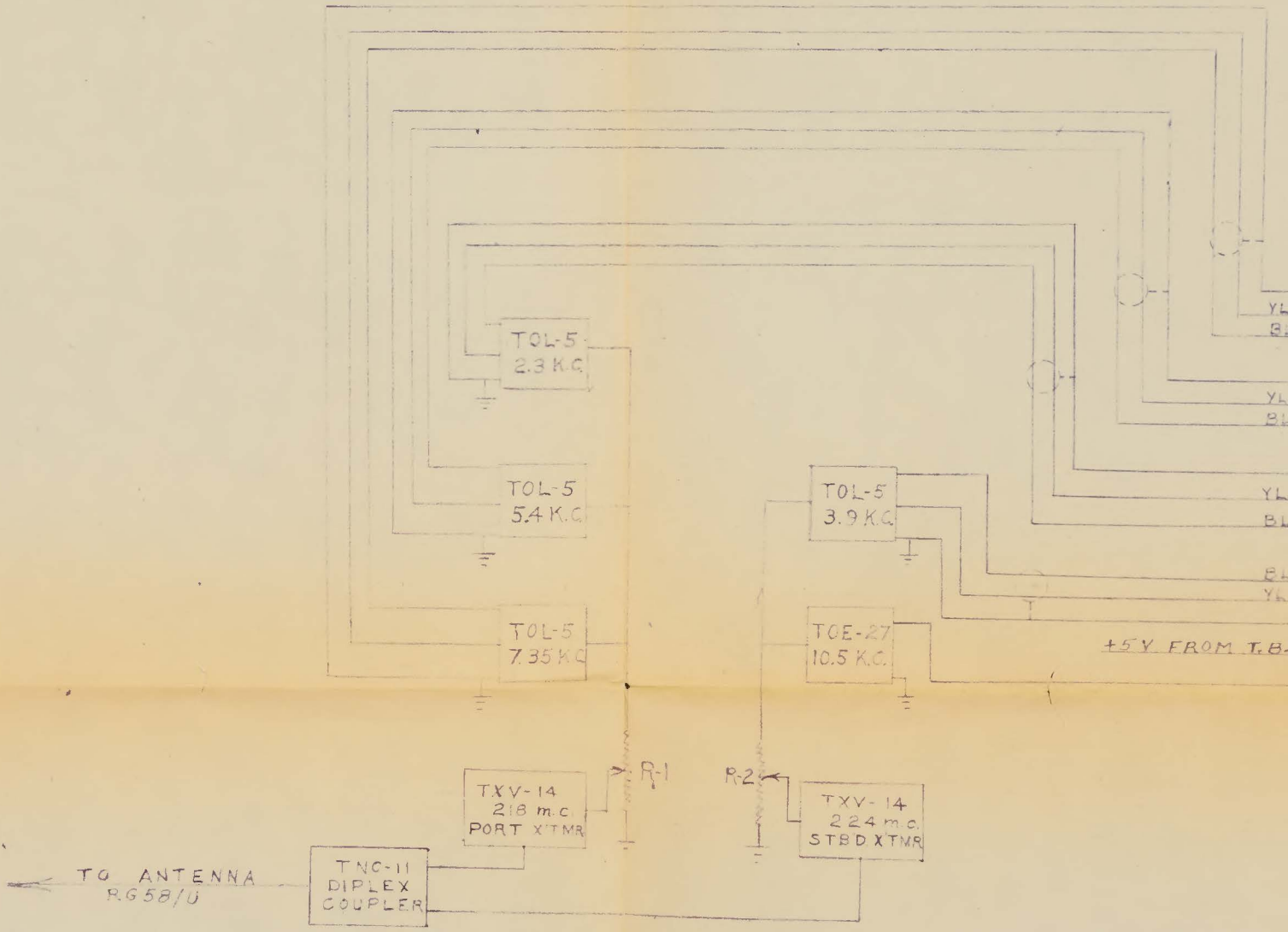
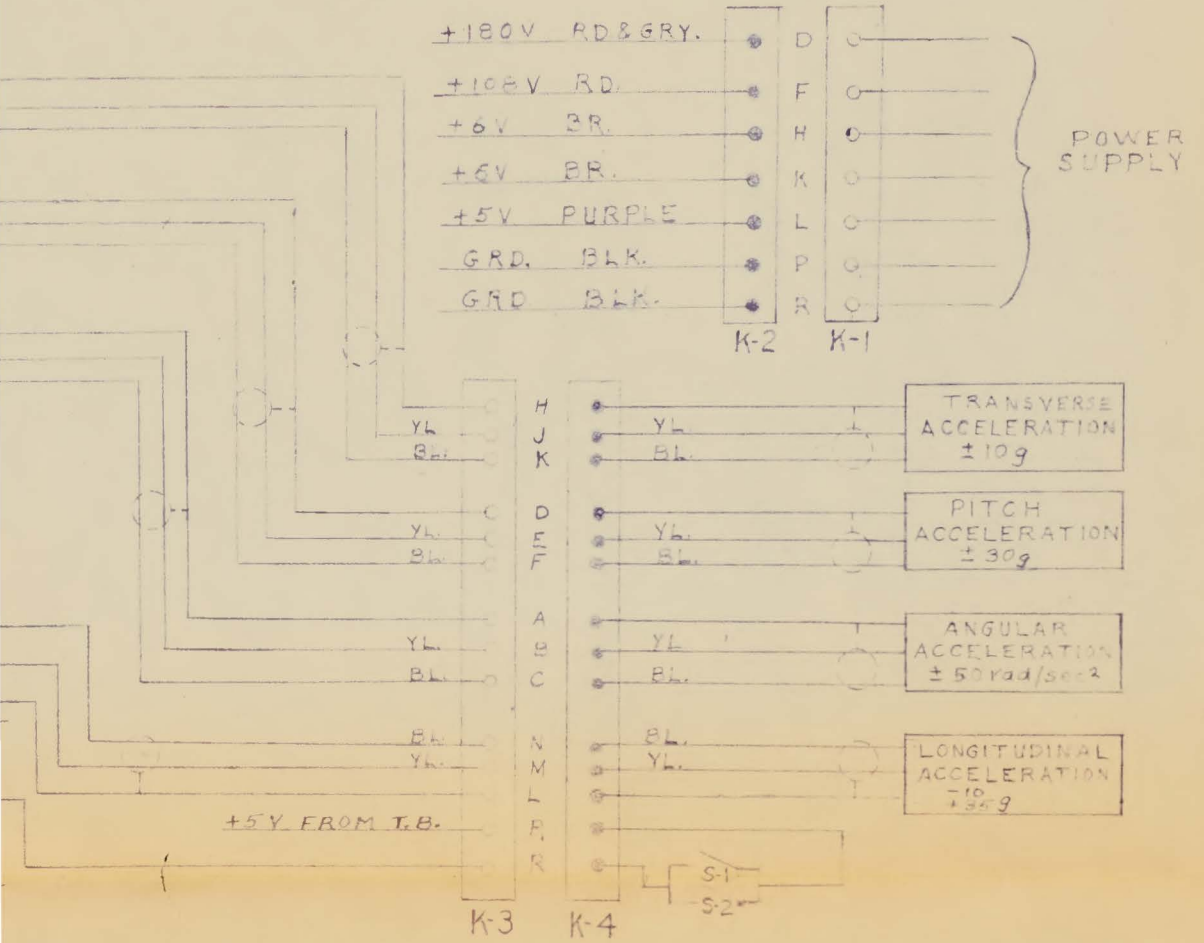

TOL-5
2.3 K.C.
TOL-5
5.4 K.C.
TOL-5
7.35 K.C.
TOL-5
3.9 K.C.
TOE-27
10.5 K.C.
+5 V FROM T.B.
R-1
R-2
TXV-14
218 m.c.
PORT X'TMR
TXV-14
224 m.c.
STBD X'TMR
TO ANTENNA
RG58/U
TNC-11
DIPLEX
COUPLER



K-1 & K-3	CONTINETAL TYPE 14-20S
K-2 & K-4	CONTINETAL TYPE 14-20P
R-1 & R-2	500K TELEMETER POT.
S-1 & S-2	ELECTROSNAP SI-2 A5-1

2.3 K.Ω ⊙ +108 V

⊕ +6 V

TERMINAL BOARD

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										ISSUE No.
										MOD. No.
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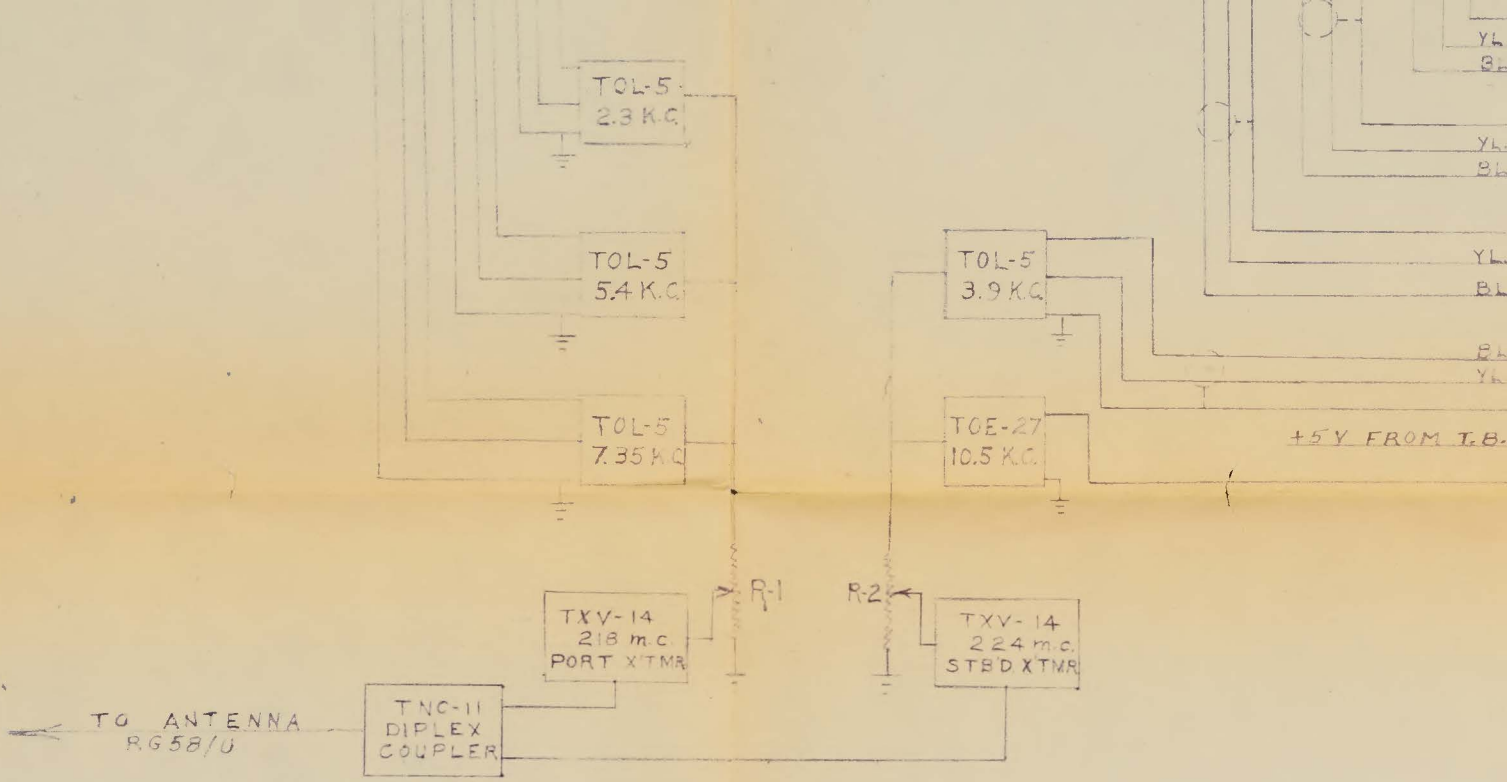

REF.	PART No.	DESCRIPTION	L.H.	R.H
			UNIT No. OF	

DRAWING PA

ISSUE No.	
MOD. No.	
E.R.N. No.	
DRAWN BY	L.E. PACKHAM
DATE	
CHECKED	
STRENGTH APP.	
DESIGN APP.	

REFERENCE DRAWINGS	
DWG. No.	DESCRIPTION

DESCRIPTION

SCHEMATIC DIAG
TELEMETER SYS
CRUDE MODELS N

A.V. ROE CANA

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