

Arrow 2
A/C 25207

Report: 7-0400-85
Issue : 4

~~CONFIDENTIAL~~
WEIGHT-SUMMARY

1 Feb/59

AFHQ TECHNICAL LIBRARY

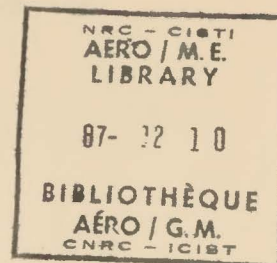
FEB 18 1959

Copy No: 1 of 1

ACC No: 8689

~~CONFIDENTIAL~~
UNCLASSIFIED

AVRO AIRCRAFT LIMITED
INTER-DEPARTMENTAL MEMORANDUM

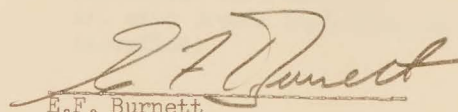


Ref: 1259/11/J
Date: 1 February, 1959
To: See Distribution
From: E.F. Burnett - Weight Supervisor
Subject: Arrow 2 A/C 25207 - Weight & C.G. Summary Report: 7-0400-85 Issue 4

Attached is a copy of Weight and C.G. Summary Report 7-0400-85 Issue 4, dated February 1st, 1959, covering the engine test A/C 25207.

The report defines the aircraft with full Orenda Instrumentation installed. An appendix covers early flights of the aircraft before Orenda installation are effected.

This report will be issued monthly until the actual weighing of the aircraft has been obtained.


E.F. Burnett

ag
cc: Messrs. J.C. Floyd
R.N. Lindley
C.V. Lindow
F.P. Mitchell
A.R. Buley
T.G. Higgins
B.C. Alford
D.N. Scard
R. Marshall
F. Brame
W. Czerwinski
J. Lucas
S. Kwiatkowski
A. Cornish
T. Roberts
R. Wade
C. Marshall
W. Potocki
A. Crust (6 copies R.C.A.F.)
D. Inglis
D. Moore
R. Cairns

UNCLASSIFIED

Classification cancelled/changed to.....

by authority of.....(date).....

Signature.....Rank.....

AFHQ TECHNICAL LIBRARY

FEB 18 1959

Copy No:.....of.....

ACC No:.....8689.....

~~CONFIDENTIAL~~
UNCLASSIFIED

Aircraft: Arrow 2
A/C 25207
Date : 1 February, 1959

Report: 7-0400-85
Issue : 4

I N D E X

<u>Sheet</u>	<u>Content</u>
1-1 to 1-5	Introduction
2-1 to 2-2	Weight & C.G. Summary
3-1 to 3-4	Appendix 1 - Aircraft 25207 For initial flight prior to installation of Orenda Instrumentation.
4-1	Horizontal C.G. Envelope for A/C with Orenda Instrumentation installed.
4-2	Horizontal C.G. Envelope for A/C with Orenda Instrumentation not installed.
5-1 to 5-15	I.B.M. Detail sheets of Weight and C.G. of A/C. with Orenda Instrumentation installed.

UNCLASSIFIED

Aircraft: Arrow 2
A/C 25207
Date : 1 February, 1959

Report: 7-0400-85
Issue : 4
Sheet : 1-1

Introduction and Weight Changes

The following is a Weight & C.G. Summary for Arrow 2 A/C 25207 based on the latest information available. All changes quoted herein are relative to Issue 3 of this report dated 1st January, 1959.

Note:

This summary is for the Aircraft in the completed stage i.e. with full Orenda Instrumentation fitted, for an estimate of the Aircraft for initial flights see Appendix 1.

General:

The primary role of A/C 25207 is that of a Flight Test Vehicle for Orenda Engines Ltd., the engine installed in the right hand nacelle being heavily instrumentated.

- a) Power Plant will consist of two prototype - instrumentated PS 13 engines with weights as follows:-

1. Left Hand 5245 lb)
2. Right Hand 5346 lb) Basic Engine weight 4799 lb.

The above weights are based on Orenda-Avro letter AWS/SAW, dated October 7th, 1958.

- b) Landing Gear Arrow 2A Main landing gear is fitted.
- c) Electrical System will consist of only one alternator and drive, consequently the constant speed drive together with piping and wiring and alternator have been removed from the R.H. Engine.
- d) Partial Electronics System as defined in report 72/AIREQ/13/2-7 of October 1958, is installed.
- e) Damping System MH 64 is fitted.
- f) Flight Test Instrumentation can be considered as two parts viz.
1. Orenda Equipment comprising Pressure Logger, compensators etc. in Radar Nose; Controls Panels and instruments in cockpits; transducer hot-box, amplifiers oxygen bottle etc. in C.F.
 2. Avro Installations consisting of structural provisions for mounting the above equipment; piping from R.H. Engine to Radar Nose and thermo-couple, instrumentation and control wiring from forward areas to R.H. Engine disconnect at Sta. 591.65 in.

The estimated weight of the complete system is 1794 lb. It should be noted that for the initial flights the Orenda Equipment (790 lb) will not be fitted.

Aircraft: Arrow 2
A/C 25207
Date : 1 February, 1959

~~CONFIDENTIAL~~
UNCLASSIFIED

Report: 7-0400-85
Issue : 4
Sheet : 1-2

- g) Pack Instrumentation The weight of equipment and wiring is estimated to be 1142 lb. Assuming the empty pack weight to be 692 lb. it will be necessary to ballast the pack with 2060 lb. so that the pack complete is 3894 lb. This is necessary since the Orenda Equipment installed in the Radar Nose precludes the mounting in that area of ballast required to maintain the C.G. of the A/C within the defined limits.
- h) The addition Fire Protection as installed in A/C 25206 is not required.
- i) Provision for Tailcone Plugs deleted as per R.C.A.F letter S36-38-105-15.
- j) Where actual weights of Arrow 1 parts that apply to Arrow 2 Aircraft have been obtained, these weights have been recorded in the Arrow 2 records. some weights of Arrow 2 Parts have also been obtained on the I.B.M. sheets contained in this report, preceeding the item will be found a number varying from 0 - 100. This is the percentage actual weight recorded in the relevant item.

UNCLASSIFIED
CONFIDENTIAL

Aircraft: Arrow 2
A/C 25207
Date : 1 February, 1959

Report: 7-0400-85
Issue : 4
Sheet : 1-3

1. Structure

Weight lb.

- a) Wings No weight change
b) Fin and Rudder No weight change.
c) Fuselage Fwd Sta. 255 in

Pilot's Canopy - actual weights obtained + 2.82

Total Front Fuselage Increase + 2.82

- d) Centre Fuselage Sta. 255 - 485 in

Dorsal over Fwd Tank - actual weights of fairings obtained - 3.22
Fuselage Fuel Tank - re-estimated + 0.69

Equip. Bay Structure - Assign X74.377 stiffening of Air
Conditioning Tray for accelerometer
mounting + 10.85

Formers C.F. - re-estimated - 0.74

Pack Mounting Structure - re-estimated + 1.52

Sealing Missile Bay - re-estimated + 0.38

Armament Bay Roof - re-estimated + 0.75

Deflector Shield - actual weight obtained - 1.13

Total Centre Fuselage Increase + 9.10

- e) Duct Bay Sta. 485 - 591.65 ins

Centre Panel Aft - addition of switch to indicate drop tank
jettison, first estimate of closing plate. + 1.27

Total Duct Bay Increase + 1.27

- f) Engine Bay Sta. 591.65 - 742.5 in. No weight change.

- g) Rear Fuselage Sta 742.5 in - aft

Centre Structure & Stinger - actual weights of blankets obtained + 1.68

Engine Access Doors - actual weights of blankets obtained - 0.66

Tunnel Fixed - actual weights of blankets obtained - 1.72

Total Rear Fuselage Decrease - 0.70

- h) Fuselage Joints No weight change.

Total Structure Increase + 12.59

2. Landing Gear

Nose U/C Door & Fairing - actual weights incorporated + 1.52

Total Landing Gear Increase + 1.52

3. Power Plant & Services No weight change.

~~CONFIDENTIAL~~
UNCLASSIFIED

Aircraft: Arrow 2
A/C 25207
Date : 1 February, 1959

Report: 7-0400-85
Issue : 4
Sheet : 1-4

4. Flying Controls

Weight lb.

Hydraulic Flying Controls Fuselage - actual weights incorporated = 1.00

Total Flying Controls Decrease = 1.00

5. Equipment Fixed & Removable

Probe - addition of wires & piping		+ 1.14
Air Conditioning -		+ 21.87
a) Turbine & Compressor weighed weight in excess of manufactures quote	+ 3.50	
b) Evaporator weighed weight in excess of spec. weight	+ 12.50	
c) Transition Duct under-estimated	+ 1.02	
d) Heat Exchanger Exhaust Duct: actual weight	+ 0.62	
e) Engine Bleed Duct - valves over wt	+ 0.40	
- insulation	+ 3.07	
over weight and/or duct underestimated		
f) Misc over-estimates	- 0.81	
Low Pressure Pneumatics - re-estimated		- 0.01
Intake De-Icing - estimate based on actual weights obtained of experimental boots		- 19.60
Damping System - repackaging of Amp. Calibrator		+ 2.20
Electrics Duct Bay - actual weight of T.R.U.		- 7.94
Electrics Engine Bay - actual weight of alternator		+ 4.00
<u>Total Equipment Group Increase</u>		<u>+ 1.66</u>

6. Trapped Fuel No weight change.

7. Ballast Not required except as noted on sheet 1-2 Para. (g)

8. Useful Load No weight change.

Summary

Weight Change - Aircraft Basic Weight

Structure	+ 12.49 lb
Landing Gear	+ 1.52 lb
Flying Controls	- 1.00 lb
Equipment	+ 1.66 lb
 Total	 <u>+ 14.67 lb</u>

Weight Change - Operational Weight Empty

Issue 3
47,362.96

Issue 4
47,377.63

+ 14.67 lb

~~CONFIDENTIAL~~
UNCLASSIFIED

Aircraft: Arrow 2
A/C 25207
Date : 1 February, 1959

Report: 7-0400-85
Issue : 4
Sheet : 2-1

Weight & C.G. Summary for Orenda Flight Testing

Description	Weight lb	H. Arm ins	V. Arm ins
Structure	19,315.79	567.00	137.24
Wings	10,050.68	642.93	142.17
Fin & Rudder	1,030.94	754.65	209.00
Fuselage Fwd. Sta. 255 ins	2,609.20	184.71	128.64
Sta. 255 - 485 ins	1,725.00	374.98	129.73
Sta. 485 - 591.65 ins	1,172.15	538.84	105.54
Sta. 591.65 - 742.5 ins	1,597.61	659.27	111.67
Sta. 742.5 in aft	1,087.03	807.93	129.08
"Marry-Up"	43.18	467.77	109.70
Landing Gear - Retracted	2,814.76	491.66	135.28
Main Landing Gear	2,158.67	539.23	141.00
Main Gear Doors & Fairings	293.19	539.39	138.30
Nose Landing Gear	333.81	170.81	99.70
Nose Gear Door & Fairing	29.09	162.66	88.68
Power Plant & Services	11,979.20	676.46	121.81
Engine Bare (PS13) (Instrumented Prototype)	9,598.00	693.16	121.21
Engine Accessories (Inlet Frame etc)	405.05	620.51	121.69
Engine Instrumentation	663.00	690.00	121.25
Engine Controls	32.32	379.90	117.49
Gear Box & Drives on Fuselage	291.87	608.57	103.28
Gear Box & Starter on Engine	76.73	601.97	113.57
Fire Extinguisher System - Basic	73.58	686.35	131.21
Engine Mountings	75.39	671.91	141.52
Fuel System	763.26	529.78	135.19
Flying Controls Group	1,964.22	655.44	138.03
Mechanical Flying Controls	958.44	677.70	117.62
Hydraulics Flying Controls	1,005.78	634.22	128.89
Equipment Fixed & Removable	9,990.34	353.33	112.28
Instruments	34.61	167.52	138.92
Probe	16.00	-29.85	107.78
Cockpit Pressure Sealing	5.00	186.00	130.00
Oxygen System	21.16	259.40	156.88
Cabin Consoles	17.68	175.29	124.49
Ejector Seats	342.94	204.50	134.11
Air Conditioning System	944.91	343.67	135.75
Cockpit Insulation	14.31	187.48	132.00
Hydraulic Utility System	656.12	498.91	117.95
Mechanical Door Stops Main U/C Door	3.02	516.00	120.00
Drag Chute	96.26	786.06	143.24
Electrical System	1,134.65	415.11	112.37
Low Pressure Pneumatics	50.07	394.64	125.98
Surface Finish	100.00	572.83	139.57
Intake De-icing Boots	68.40	197.24	118.00
Canopy Actuation	63.52	209.61	154.34
MH 64 Damping System	111.28	460.25	139.72
Partial Electronics System	622.50	346.83	120.14
Instrument Pack Structure	692.00	384.84	93.56
Pack Instrumentation (+ Ballast)	3,202.00	370.99	98.00
Flight Test Installation	1,739.91	232.30	115.30
Trapped Fuel	213.80	548.26	111.79
Ballast	-	-	-

UNCLASSIFIED

Aircraft: Arrow 2
 A/C 25207
 Date : 1 February, 1959

Report: 7-0400-85
 Issue : 4
 Sheet : 2-2

Description	Weight lb	H. Arm ins.	V. Arm ins	MAC %
U/C Up				
Aircraft Basic Weight	46,278.11	548.29	127.79	
U/C Down				
Useful Load (less usable fuel)	1,099.52	550.60	123.98	
Crew	390.00	368.51	131.59	
Engine Fire Ext. Fluid	25.00	194.00	136.50	
Oil	159.13	730.00	129.00	
Residual Fuel	287.00	638.98	110.86	
Oxygen	13.39	508.14	135.33	
Water for Air Conditioning	225.00	259.68	159.91	
U/C Up				
Operational Weight Empty	47,377.63	267.91	131.56	
U/C Down				
Max. Int. Fuel (2455 gals @ 7.8 lb/gal)	19,146.00	544.12	127.88	29.87
U/C Up				
Gross Weight (Max. Int. Fuel)	66,523.63	546.38	124.16	30.49
U/C Down				
Max. Ext. Fuel (500 gals @ 7.8 lb/gal + Drop tank)	4,242.36	542.36	114.29	
U/C Up				
Max. Gross Weight (Int + Ext. Fuel)	70,765.99	543.61	132.60	29.73
U/C Down				
		545.22	129.95	30.17
		520.32	60.79	
		542.21	128.29	29.34
		543.72	125.80	29.76

N.B. Aircraft Datum = 120 in. above an arbitrary chosen ground line.

~~CONFIDENTIAL~~
UNCLASSIFIED

Aircraft: Arrow 2
A/C 25207
Date : 1 February, 1959

Report: 7-0400-85
Issue : 4
Sheet : 3-1

Appendix 1

Introduction

This appendix is to cover the condition of A/C 25207 for initial flights. All weight changes are quoted relative to the complete aircraft as defined in the main text of this report.

Changes Applicable for Initial Flights of A/C 25207

Weight lb.

1. <u>Structure</u>	No weight change.	
2. <u>Landing Gear</u>	No weight change.	
3. <u>Power Plant & Services</u>		
Engine Instrumentation	deletion of vibration slip ring, wiring and piping of Sta 591.65 on R.H. Engine	- 101.00
Constant speed Drives	on Engine R.H. C.S.U. Fitted	+ 76.72
	<u>Total Power Plant Decrease</u>	<u>- 24.28</u>
4. <u>Flying Controls Group</u>	No weight change.	
5. <u>Equipment Fixed and Removable</u>		
Electrics Engine Bay R.H. Alternator Added		+ 91.00
Flight Test Installations Oreanda supplied units not installed		- 789.69
Pack Instrumentation Telemetry and ballast plus empty pack		
Maintained at approx. 3900 lb by		+ 6.00
	<u>Total Equipment Group Decrease</u>	<u>- 692.69</u>
6. <u>Trapped Fuel</u>	No weight change.	
7. <u>Ballast</u>		+ 864.00
8. <u>Useful Load</u>		
Engine & Access. Gear Box Oil Trapped, add oil for R.H. C.S.U.		+ 2.87
	<u>Total Useful Load Increase</u>	<u>+ 2.87</u>

Summary

Weight Change - Aircraft Basic Weight

Power Plant	- 24.28
Equipment	- 692.69
Ballast	+ 864.00

Total	+ 147.03
-------	----------

Weight Change Operational Weight Empty

Complete A/C

Early Flights

47,377.63

47,527.53

+ 149.90 lb

UNCLASSIFIED
CONFIDENTIAL

Aircraft: Arrow 2
A/C 25207
Date : 1 February, 1959

Report: 7-0400-85
Issue : 4
Sheet : 3-2

Weight & C.G. Summary for Initial Flight (Orenda Units not Installed)

Description	Weight lb	H. Arm ins	V. Arm ins
Structure	19,315.79	567.00	137.24
Wings	10,050.68	642.93	142.17
Fin & Rudder	1,030.94	754.65	209.00
Fuselage Fwd. Sta. 255 ins	2,609.20	184.71	128.48
Sta. 255 - 485 ins	1,725.00	374.98	127.73
Sta. 485 - 591.65 ins	1,172.15	538.84	105.54
Sta. 591.65 - 742.5 ins	1,597.61	659.27	111.67
Sta. 742.5 in aft.	1,087.03	807.93	129.08
"Marry-Up"	43.18	467.77	109.70
Landing Gear - Retracted	2,814.76	491.66	135.28
Main Landing Gear	2,158.67	539.23	141.00
Main Gear Doors & Fairings	293.19	539.39	138.30
Nose Landing Gear	333.81	170.81	99.70
Nose Gear Door & Fairing	29.09	162.66	88.68
Power Plant & Services	11,954.92	675.87	121.75
Engine Bare (PS13) (Instrumentated Prototype)	9,598.00	693.16	121.21
Engine Accessories (Inlet Frame etc)	405.05	620.51	121.69
Engine Instrumentation	562.00	690.00	121.25
Engine Controls	32.32	379.90	117.49
Gear Box & Drives on Fuselage	291.87	608.57	103.28
Gear Box & Starter on Engine	153.45	601.97	113.57
Fire Extinguisher System - Basic	73.58	686.35	131.21
Engine Mounting	75.39	671.91	141.52
Fuel System	763.26	529.78	135.19
Flying Controls Group	1,964.22	655.44	138.03
Mechanical Flying Controls	958.44	677.70	147.62
Hydraulic Flying Controls	1,005.78	634.22	128.89
Equipment Fixed and Removable	9,297.65	384.24	111.90
Instruments	34.61	167.52	138.92
Probe	16.00	-29.85	107.78
Cockpit Pressure Sealing	5.00	186.00	130.00
Oxygen System	21.16	259.40	156.88
Cabin Consoles	17.68	175.29	124.49
Ejector Seats	342.94	204.50	134.11
Air Conditioning System	944.91	343.67	135.75
Cockpit Insulation	14.31	187.48	132.00
Hydraulic Utility System	656.12	498.91	117.95
Mechanical Door Stops Main U/C Door	3.02	516.00	120.00
Drag Chute	96.26	786.06	143.24
Electrical System	1,225.65	427.82	112.62
Low Pressure Pneumatics	50.07	394.64	125.98
Surface Finish	100.00	572.83	139.57
Intake De-icing Boots	68.40	197.24	118.00
Canopy Actuation	63.52	209.61	154.34
MH 64 Damping System	111.28	460.25	139.72
Partial Electronics System	622.50	346.83	120.14
Instrument Pack Structure	692.00	384.84	93.56
Pack Instrumentation (*ballast)	3,208.00	389.50	98.00
Flight Test Installations	1,004.22	342.73	113.53
Trapped Fuel	213.80	548.26	141.79
Ballast	864.00	100.00	114.00

UNCLASSIFIED

Aircraft: Arrow 2
A/C 25207
Date : 1 February, 1959

Report: 7-0400-85
Issue : 4
Sheet : 3-3

Description	Weight lb	H. Arm ins	V. Arm ins	M.A.C. %
U/C Up		548.83	127.68	
Aircraft Basic Weight	46,425.14			
U/C Down		551.13	123.88	
Useful Load (less usable fuel)	1,102.39	369.12	131.54	
Crew	390.00	194.00	136.50	
Engine Fire Ext. Fluid	25.00	730.00	129.00	
Oil	162.00	638.31	110.89	
Residual Fuel	287.00	508.14	135.33	
Oxygen	13.39	259.68	159.91	
Water for Air Conditioning	225.00	267.91	131.56	
U/C Up		544.66	127.77	30.02
Operational Weight Empty	47,527.53			
U/C Down		546.91	124.06	30.64
Max. Int. Fuel (2455 gals. @ 7.8 lb/gal)	19,146.00	542.36	114.29	
U/C Up		544.00	132.51	29.83
Gross Weight (Max. Int. Fuel)	66,673.53			
U/C Down		545.60	129.87	30.27
Max. Ext. Fuel (500 gal @ 7.8 lb/gal + Drop Tank)	4,242.36	520.32	60.79	
U/C Up		542.58	128.22	29.44
Max. Gross Weight (Int. + Ext. Fuel)	70,915.89			
U/C Down		544.09	125.74	29.85

- N.B. 1. Aircraft Datum = 120 ins. above an arbitrarily chosen ground line.
2. Aircraft is ballasted with 864 lb. at H.A. = 100 ins. such that the aft C.G. on a typical Flight Envelope, excluding any effects of fuel sequencing (see note on sheet 4-2) does not exceed 31% M.A.C.

REPORT 7-0400-85 4

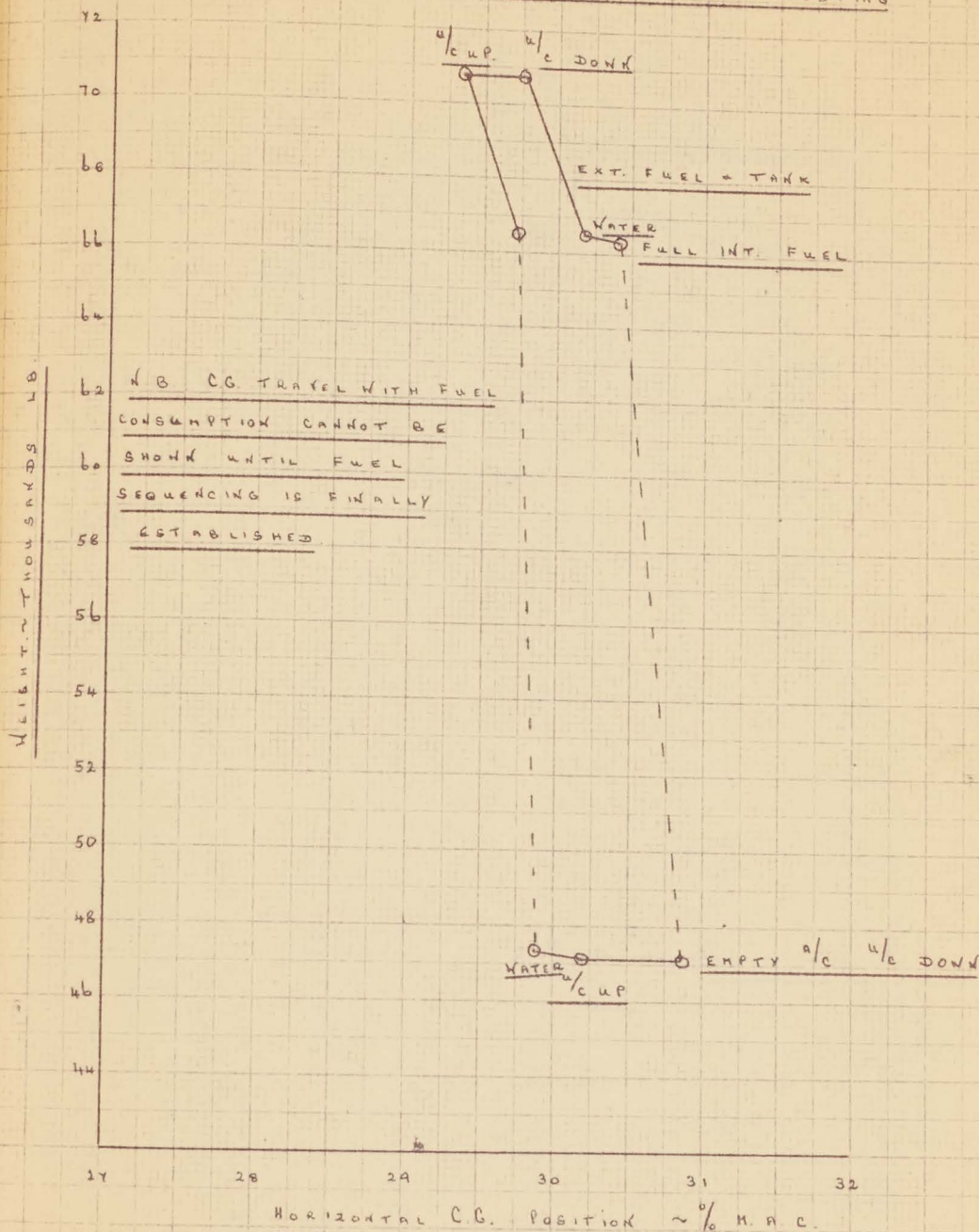
DATE FEB 1st 1959

SHEET 4-1

BY. [Signature]

HORIZONTAL C.G. PLOT OF FIXED POINTS
ON ARROW 2 A/C 25207 FLIGHT ENVELOPE

A/C IN COMPLETED STATE FOR ORANDA FLIGHT TESTING



REPORT NO 7 0400-85 4

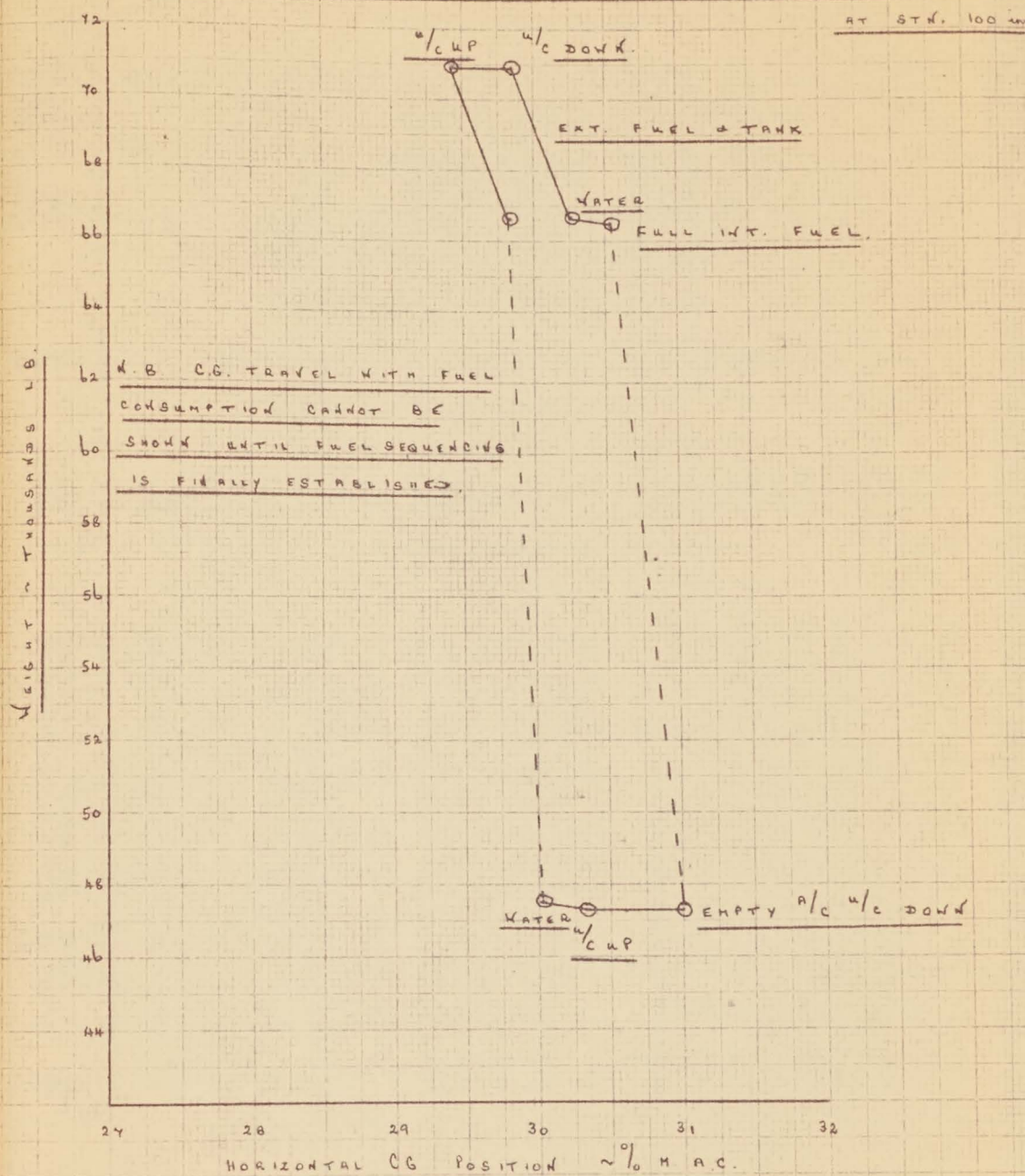
DATE FEB. 1st 1959

SHEET 4-2

BY P. L. Paul

HORIZONTAL CG PLT OF FIXED POINTS
ON ARROW 2 ^{W/C} 25207 FLIGHT ENVELOPE

EARLY FLIGHTS ~ OREGON TEST UNITS NOT FITTED 864 LB. BALLAST
AT STN. 100 IN



AVRO AIRCRAFT LTD.

MALTON, ONT.

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

PROJECT Arrow 2 A/C 25207 1 February, 1959

DESCRIPTION		REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM
TOTAL WING GROUP 25207		10000000				
OUTER WING		10100000				
100	OUTER WING SKINS	10100001	64	929.10	70646	13597
100	POSTS AND INTERCOSTALS	10100002	64	2436	73207	13410
100	OUTER WING SPARS	10100003	64	39258	70608	13579
100	OUTER WING RIBS	10100004	64	13456	69506	13650
18	AILERON CONTROL BOX	10100006	64	37920	77409	13508
100	RIB 12	10100007	64	76266	4873	1383
100	O W AILERON JACK FITTING	10100009	64	1046	72791	13670
	AILERON JOINTS AND FAIRING	10100010		3293	78726	1322
				197945		
100	AILERON	10200000	74	33600	79213	1355
				33600		
20	ELEVATOR	10300000	82	44638	75618	1426
20	ELEVATOR MARRY UP	10300001		1597	73810	1426
				46235		
INNER WING		10400000				
81	MAIN U C STRUCTURE	10400001	62	33217	57748	1398
95	INNER WING SPARS	10400002	62	41917	57902	1432
61	I W STRUCTURE F S TO M S	10400007	62	108539	49846	1439
17	I W STRUCTURE M S TO R S	10400008	62	15001	60868	1456
30	CENTRE TRAILING EDGE	10400009	62	31898	72041	1488
40	ELEVATOR CONTROL BOX	10400010	62	43398	72472	1432
25	TRANSP JOINT MARRY UP	10400011		7065	63621	1387
61	CENTRE LINE JOINTS	10400012	62	58264	66233	1502
91	INNER WING SKINS	10400013	62	28048	62689	1446
63	STRUC PICK UP FITTINGS	10400014	62	12316	61654	1458
62	RIBS 1 TO 9	10400016	62	48516	61133	1451
	DORSAL FAIRING I W	10400017	62	11348	270	1615
100	RIB 10	10400018	62	10706	63683	1383
49	FUSELAGE HINGE JOINT I W	10400019	62	12628	61688	1379
25	TRANSP JOINT	10400020	62	12942	63071	1371
49	FUSELAGE HINGE JOINT	10400021		3935	53234	1436
	DORSAL FAIRING C A	10400023		5913	56740	1596
	SHUT OFF VALVE OPERAT MECH	10400024	62	5135	4965	1418
62	LEADING EDGE I W	10400025	62	21489	46830	1442
				696418		
LEADING EDGE O W		10500000	65	30870	63013	1356
				30870		

FUNCTIONAL GROUP COMPONENT

WEIGHT AND C. OF G BY,

PROJECT_____

[illegible]

AVRO AIRCRAFT LTD.
MALTON, ONT.

WEIGHT AND C. OF G BY FUNCTIONAL GROUP
COMPONENT

PROJECT _____

	DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM
	TOTAL FUSELAGE GROUP	3000000				
	RADAR NOSE STRUCTURE	3010000				
	RADOME	3010001	51	15958	3992	1107
22	RADAR NOSE STRUCTURE C A	3010002		2701	2000	1120
22	RADAR NOSE STRUCTURE R N	3010003	51	16449	9532	1137
				32677		
	FRONT FUSELAGE STRUCTURE	3020000				
	SKIN F F	3020001	52	8264	19296	123
	COCKPIT FORMERS	3020002	52	10728	18257	120
	LOWER LONGERONS F F	3020003	52	6837	18460	90
31	TOP LONGERONS F F	3020004	52	18947	19430	147
66	NOSE U C SUPPORT STRUCT	3020005	52	3343	21049	91
	CREW BULKHEADS	3020006	52	13224	20528	123
	BULKHEAD STA 120	3020007	52	3110	12000	114
	BULKHEAD STA 255	3020008	52	10921	25500	119
	COCKPIT FLOOR	3020009	52	5881	17695	115
	SHEAR PANEL BELOW NAV ARCH	3020010	52	2057	25706	153
3	MISC STRUCTURE F F	3020011	52	1600	18821	120
	LOWER SHEAR PANEL	3020012	52	3141	23423	89
22	CANOPY ARCHES	3020013	52	8553	22594	160
58	WIND SCREEN	3020014	52	13285	13828	150
				109891		
	CENTRE FUSELAGE STRUCTURE	3030000				
	SKIN C F	3030001	54	22112	36736	144
	FORMERS C F	3030002	54	28675	37498	133
5	BULKHEAD STA 485	3030003	54	12815	48500	103
66	LONGERONS C F	3030004	54	14453	41038	121
	STR BELOW LOWER LONGERONS	3030005	54	4887	27466	93
	RADAR ACCESS DOOR	3030006	54	2418	27908	90
	FWD DORSAL FAIRING	3030008	54	2969	28927	164
100	DEFLECTOR SHIELD	3030009	54	1932	33739	164
100	DORSAL OVER FUEL TANK	3030010	54	3863	41244	142
	PACK MTG STRUCTURE	3030011	54	2432	29283	102
	SEALING MISSILE BAY	3030012	54	597	29620	110
	MISC ITEMS C F	3030013	54	1216	37000	125
	ARMAMENT BAY ROOF	3030014	54	12507	38369	114
	FUSELAGE FUEL TANK	3030015	54	22713	39477	145
	DUCT C F	3030016	54	31867	35898	129
	EQUIPMENT BAY STRUCTURE	3030017	54	7044	28348	133
				172500		
	DUCT BAY STRUCTURE	3040000				

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

REPORT NO. _____

SHEET _____

	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM	H. MOMENT	V. MOMENT
P	3000000						
E	3010000						
E C A	3010001	51	15958	3992	11070	637043	1766551
E R N	3010002		270	12000	11200	32400	30240
	3010003	51	16449	9532	11321	1567919	1862191
			32677			2237362	3658982
CTURE	3020000						
	3020001	52	8264	19296	12301	1594621	1016555
	3020002	52	10728	18257	12024	1958611	1289935
	3020003	52	6837	18460	9045	1262110	618407
RUCT	3020004	52	18947	19430	14763	3681402	2797146
	3020005	52	3343	21049	9186	703668	307088
	3020006	52	13224	20528	12377	2714623	1636734
	3020007	52	3110	12000	11477	373200	356935
	3020008	52	10921	25500	11927	2784855	1302548
AV ARCH	3020009	52	5881	17695	11569	1040643	680373
	3020010	52	2057	25706	15352	528772	315791
	3020011	52	1600	18821	12072	301136	193152
	3020012	52	3141	23423	8900	735716	279549
	3020013	52	8553	22594	16023	1932465	1370447
	3020014	52	13285	13828	15000	1837050	1992750
			109891			21448872	14157410
CTURE	3030000						
	3030001	54	22112	36736	14420	8123064	3188550
	3030002	54	28675	37498	13303	10752552	3814635
	3030003	54	12815	48500	10337	6215275	1324687
ERONS	3030004	54	14453	41038	12144	5931222	1755172
	3030005	54	4887	27466	9322	1342263	455566
	3030006	54	2418	27908	9016	674815	218007
	3030008	54	2969	28927	16400	858843	486916
K	3030009	54	1932	33739	16400	651837	316848
	3030010	54	3863	41244	14210	1593256	548932
	3030011	54	2432	29283	10216	712163	248453
	3030012	54	597	29620	11089	176831	66201
	3030013	54	1216	37000	12500	449920	152000
	3030014	54	12507	38369	11428	4798811	1429300
	3030015	54	22713	39477	14535	8966411	3301335
URE	3030016	54	31867	35898	12969	11439616	4132831
	3030017	54	7044	28348	13324	1996833	938543
			172500			64683712	22377976
	3040000						

AVRO AIRCRAFT LTD.
MALTON, ONT.

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

PROJECT _____

	DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM
	SKIN D B	30400001	56	63.66	535.60	112.4
5	FORMERS D B	30400002	56	73.35	535.30	114.3
	TOP LONGERONS	30400003	56	4.98	538.99	135.5
	MTG BRKTS SIDE PANEL	30400004	56	1.90	518.66	130.6
	LOWER LONGERONS	30400005	56	103.01	522.36	99.1
72	MAIN FRAME STA 538 77	30400006	56	59.80	538.77	103.8
	ACCESS PANELS	30400007	56	38.74	528.18	99.7
	LOWER PANEL ASSY	30400008	56	2.17	545.57	89.0
	DROP TANK MTG STRUCTURE	30400009	56	8.41	585.54	88.4
20	LOWER SIDE PANELS FWD	30400010	56	107.56	508.54	92.6
	LOWER CENTRE PANEL FWD	30400011	56	26.86	513.89	88.9
16	LOWER SIDE PANELS AFT	30400012	56	69.90	567.90	88.6
	LOWER CENTRE PANEL AFT	30400013	56	27.36	566.92	87.9
60	FLOATING DUCT D B	30400014	56	456.27	553.70	117.1
	HEAT EXCHANGER MTG	30400015	56	7.05	579.50	90.8
				1051.02		
	ENGINE BAY	30500000				
100	TOP LONGERONS	30500001	58	6.74	667.78	139.2
84	BOTTOM LONGERONS E B	30500002	58	84.64	659.09	114.4
	ENGINE ACCESS DOORS	30500003	58	134.94	638.78	90.5
	ENGINE TUNNEL	30500004	58	631.35	655.52	121.5
71	ENG RAILS ATTACH TO FORM	30500005	58	29.06	687.63	113.6
	PANELS AT ENG ACCESS DOORS	30500006	58	112.72	649.96	92.5
	BOTTOM CTR PANEL FWD	30500007	58	47.27	617.54	89.1
	BOTTOM CTR PANEL CENTRE	30500008	58	41.68	670.85	92.4
	BOTTOM CTR PANEL AFT	30500009	58	77.19	721.16	95.5
5	SIDE PANEL FWD	30500010	58	85.97	616.09	116.9
5	SIDE PANEL CENTRE	30500011	58	74.81	670.63	119.2
32	SIDE PANEL AFT	30500012	58	74.63	721.46	121.8
41	HEAVY FORMERS	30500013	58	196.61	660.51	109.6
				1597.61		
	REAR FUSELAGE	30600000				
	OUTER SKINS FIXED	30600001	59	56.58	772.70	137.0
	FORMERS FIXED R F	30600002	59	105.09	779.90	137.3
	LONGERONS FIXED R F	30600003	59	25.19	771.59	128.1
25	TUNNEL FIXED R F	30600004	59	108.22	775.41	132.0
97	ENGINE ACCESS DOORS	30600005	59	92.04	774.92	98.5
29	FAIRING UNDER RUDDER FIXED	30600006	59	29.01	782.76	155.8
	REMOV TAILCONES	30600007	59	559.48	826.37	127.8
100	CENTRE STRUC AND STING REM	30600008	59	111.42	833.31	139.1
				1087.03		
97	DIVE BRAKES	30700001	72	116.91	508.84	90.4
97	DIVE BRAKES C A	30700002		42.24	487.97	93.6
				121.13		

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

PROJECT		DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM
5	AIR INTAKES	30800001	55		769.49	211.29	118.28
					769.49		
	FUSELAGE JOINTS	30900000					
	JOINT AIR INTAKES TO F F	30900001			6.63	220.00	120.00
	JOINT F F TO C F	30900002			10.36	257.06	122.50
	JOINT D B TO C F	30900003			4.28	479.40	115.90
	JOINT D B TO E B	30900004			14.67	589.57	91.57
	JOINT AT STA 742 50	30900005			7.24	742.50	115.00
					43.18		
	CANOPIES	31000000					
98	PILOTS CANOPY	31000001	52		247.66	176.94	159.20
	NAVIGATORS CANOPY	31000002	53		166.37	232.48	162.56
					414.03		

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

REPORT NO. _____

SHEET _____

REFERENCE NO.				COMP. NO.	WEIGHT	H. ARM	V. ARM	H. MOMENT		V. MOMENT	
30800001				55	769.49	211.29	118.28	162	58554	910	1528
					769.49			162	58554	910	1528
30900000											
0 F F	30900001				663	22000	12000	145	860	795	60
	30900002				1036	25706	12250	266	314	1269	10
	30900003				428	47940	11590	205	183	496	05
	30900004				1467	58957	9157	864	899	1343	33
	30900005				724	74250	11500	537	570	832	60
					4318			201	9826	473	668
31000000											
31000001				52	24766	17694	15920	438	2096	394	2747
31000002				53	16637	23248	16256	386	7770	270	4511
					41403			824	9866	664	7258

WEIGHT AND C. OF G BY, FUNCTIONAL GROUP COMPONENT

PROJECT _____

[illegible]

AVRO AIRCRAFT LTD.
MALTON, ONT.

WEIGHT AND C. OF G BY FUNCTIONAL GROUP
COMPONENT

PROJECT _____

DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM
ENGINE GROUP	5000000				
PS 13 ENGINES	5010000		1000000	69023	1212
ENGINE INSTRUMENTATION	5010001		66300	69000	1212
PS 13 ENGINES	5010002		305	65853	1030
			1066605		
ACC GEAR BOX ON FUS D B	5020001	56	3676	57768	944
ACC GEAR BOX ON FUS E B	5020002	58	23533	61295	1030
ACC GEAR BOX ON FUS C A	5020003		800	61550	970
ACC GEAR BOX ON FUS I W	5020004	62	1178	61270	1395
			29187		
ENGINE CONTROLS	5030000				
ENGINE CONTROLS F F	5030001	52	1576	16723	1236
ENGINE CONTROLS C F	5030002	54	109	26444	1180
ENGINE CONTROLS E R	5030004	58	889	66633	990
ENGINE CONTROLS I W	5030005	62	658	52142	1275
			3232		
CONST SPEED DRIVE ON ENG	5040001		7673	60197	1135
			7673		
FIRE EXT SYSTEM	5060000				
ENG FIRE EXT SYSTEM E B	5060001	58	5985	71074	1358
ENG FIRE EXT SYSTEM D B	5060002	56	1231	56856	1121
ENG FIRE EXT SYSTEM ENG	5060003		142	67960	997
			7358		
ENGINE MTGS AND BRACKETS	5070000				
ENGINE MOUNTS	5070001		7539	67191	1411
			7539		
FUEL SYSTEM	5080000				
17 FUEL SYSTEM C F	5080001	54	11280	39995	1409
18 FUEL SYSTEM D B	5080002	56	15735	53738	1091
4 FUEL SYSTEM E B	5080003	58	1836	61392	110
39 FUEL SYSTEM I W	5080004	62	47280	55432	143
FUEL SYSTEM C A	5080005		195	68630	99
			76326		

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

REPORT NO. _____

SHEET _____

	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM	H. MOMENT	V. MOMENT
	5000000						
	5010000		1000000	69023	12123	690230000	121230000
ION	5010001		66300	69000	12125	45747000	8038875
	5010002		305	65853	10306	200852	31433
			1066605			736177852	129300308
D B	5020001	56	3676	57768	9442	2123552	347088
E B	5020002	58	23533	61295	10307	14424552	2425546
C A	5020003		800	61550	9700	492400	77600
I W	5020004	62	1178	61270	13950	721761	164331
			29187			17762265	3014565
	5030000						
	5030001	52	1576	16723	12368	263554	194920
	5030002	54	109	26444	11800	28824	12862
	5030004	58	889	66633	9904	592367	88047
	5030005	62	658	52142	12751	343094	83902
			3232			1227839	379731
N ENG	5040001		7673	60197	11359	4618916	871576
			7673			4618916	871576
E B	5060000						
D B	5060001	58	5985	71074	13583	4253779	812943
ENG	5060002	56	1231	56856	11237	699897	138327
	5060003		142	67960	9970	96503	14157
			7358			5050179	965427
CKETS	5070000						
	5070001		7539	67191	14152	5065529	1066919
			7539			5065529	1066919
	5080000						
	5080001	54	11280	39995	14090	4511436	1589352
	5080002	56	15735	53738	10957	8455674	1724084
	5080003	58	1836	61392	11024	1127157	202401
	5080004	62	47280	55432	14346	26208250	6782789
	5080005		195	68630	9920	133829	19344
			76326			40436346	10317970

MALTON, ONT.

FUNCTIONAL GROUP COMPONENT

PROJECT _____

DESCRIPTION				REFERENCE NO.		COMP. NO.	WEIGHT	H. ARM	V. ARM
FLYING CONTROLS GROUP				6000000					
MECHANICAL CONTROLS				6010000					
60	MECHANICAL CONTROLS	F F		6010001	52		10694	16454	1141
	MECHANICAL CONTROLS	C F		6010002	54		1290	39654	1172
70	MECHANICAL CONTROLS	FIN		6010005	83		12443	78819	2215
71	MECHANICAL CONTROLS	I W		6010006	62		40234	71800	1438
80	MECHANICAL CONTROLS	O W		6010007	64		30520	77053	1356
	MECHANICAL CONTROLS	C A		6010008			663	70984	1433
							95844		
FLYING CONTROLS HYDRAULICS				6020000					
6	FLYING CONTROLS	HYDR D B		6020001	56		3299	55757	1091
34	FLYING CONTROLS	HYDR E B		6020002	58		39573	64645	1097
6	FLYING CONTROLS	HYDR R F		6020003	59		34754	40108	1
73	FLYING CONT	HYDRAULICS I W		6020004	62		27988	70369	1471
66	FLYING CONT	HYDRAULICS O W		6020005	64		13170	74034	1358
72	FLYING CONT	HYDRAULICS FIN		6020006	83		5820	75988	2076
6	FLYING CONTROLS	HYDR F F		6020008	52		7713	17716	1058
6	FLYING CONTROLS	HYDR C F		6020009	54		2981	37175	1087
							100578		

AVRO AIRCRAFT LTD.
MALTON, ONT.

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

PROJECT _____

DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM
FIXED EQUIPMENT GROUP	7000000				
INSTRUMENTS	7010000				
INSTRUMENTS	7010001	52	3261	16430	13947
NAVIG TABLE AND STOWAGE	7010004	52	200	22000	13000
			3461		
COCKPIT SEALING	7020000	52	500	18600	13000
			500		
OXYGEN SYSTEM	7030000				
OXYGEN SYSTEM	7030001	52	2116	25940	15688
			2116		
AIR CONDITIONING SYSTEM	7040000				
28 AIRCONDITIONING F F	7040001	52	11239	21908	11931
61 AIRCONDITIONING C F	7040002	54	56638	28809	13567
28 AIRCONDITIONING D B	7040003	56	706	51474	12263
61 AIRCONDITIONING C A	7040005		24334	50486	14357
28 AIRCONDITIONING ENG	7040006		1503	67100	14000
28 AIRCONDITIONING I W	7040007	62	715	2247	15728
			94491		
HYDRAULICS MAIN SYSTEM	7050000				
28 UTILITY HYDRAULICS F F	7050001	52	9602	20241	10816
3 UTILITY HYDRAULICS C F	7050002	54	5068	42772	10325
19 UTILITY HYDRAULICS D B	7050003	56	22332	54978	10984
67 UTILITY HYDRAULICS E B	7050004	58	11075	60747	11152
30 UTILITY HYDRAULICS I W	7050005	62	14441	55240	14254
28 UTILITY HYDR NOSE U C	7050006	91	114	18860	9320
30 UTILITY HYDR MAIN U C	7050007	92	2980	54325	14100
			65612		
MUC DOOR STOPS	7060000	56	302	51600	12000
			302		
CABIN INSULATION	7070000	52	1431	18748	13200
			1431		

AVRO AIRCRAFT LTD.
MALTON, ONT.

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

PROJECT_____

DESCRIPTION					REFERENCE NO.		COMP. NO.	WEIGHT		H. ARM	V. ARM
83	BRAKE PARACHUTE				70800000						
83	BRAKE	PARACHUTE	F	F	70800001	52		4.79	15664	12903	
83	BRAKE	PARACHUTE	R	F	70800005	59		9018	82187	14401	
83	BRAKE	PARACHUTE	I	W	70800006	62		129	61969	14200	
									9626		
ELECTRICAL SYSTEM					70900000						
ELECTRICAL WIRING R N					70900001	51		129	9285	12000	
ELECTRICAL WIRING F F					70900002	52		2966	19977	11200	
ELECTRICAL WIRING C F					70900003	54		2354	39703	11000	
ELECTRICAL WIRING A I					70900004	55		1274	21984	12000	
ELECTRICAL WIRING D B					70900005	56		9015	52769	9921	
ELECTRICAL WIRING E B					70900006	58		64	59500	9200	
ELECTRICAL WIRING I W					70900008	62		9236	53995	13900	
ELECTRICAL WIRING FIN					70900009	83		3527	9754	30000	
ELECTRICAL WIRING NUC					70900010	91		3301	8600	9800	
ELECTRICAL WIRING ENG					70900011			2002	60683	10000	
ELECTRICAL WIRING C A					70900012			13746	33473	11234	
ELECTRICS F F					70900013	52		16429	15547	10538	
ELECTRICS C F					70900014	54		8636	45193	10767	
81	ELECTRICS E B				70900015	58		1117	61545	10765	
90	ELECTRICS E B				70900016			9254	58656	11636	
ELECTRICS C A					70900017			8026	61350	11591	
ELECTRICS FIN					70900018	83		4489	050	28840	
ELECTRICS I W					70900019	62		2275	62053	14500	
ELECTRICS CAW					70900020			1206	7488	13661	
ELECTRICS MUC					70900021	92		7451	600	13700	
ELECTRICS A I					70900022	55		4906	22092	13988	
ELECTRICS D B					70900023	56		2467	451809	10236	
ELECTRICS R F					70900024	59		1768	0759	11687	
WINDSCREEN DEMISTING					70900025	52		3490	19954	10638	
									113465		
L P PNEUMATICS					71000000						
11	L P	PNEUMATICS	F	F	71000001	52		1881	19626	1213	
11	L P	PNEUMATICS	C	F	71000002	54		796	32403	1161	
11	L P	PNEUMATICS	E	B	71000004	58		596	66300	1000	
11	L P	PNEUMATICS	FIN		71000005	83		4147	4966	2523	
11	L P	PNEUMATICS	R	N	71000006	51		200	7067	926	
11	L P	PNEUMATICS	C	A	71000008			909	62238	1040	
11	L P	PNEUMATICS	I	W	71000009	62		2115	52750	1593	
									5007		
INTAKE DE ICING					71200000	55		6840	19724	1180	
									6840		
60 CANOPY ACTUATION					71600000	52		6352	20961	1543	
									6352		

AVRO AIRCRAFT LTD.
MALTON, ONT.

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

PROJECT_____

[illegible]

AVRO AIRCRAFT LTD.
MALTON, ONT.

WEIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

PROJECT _____

DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM
OPERATIONAL LOAD	9000000			
CREW MEMBERS	9010000	52	390.00	19400.1
			390.00	
ENGINE OIL	9020000			
ENGINE OIL DRAINABLE ENG	9020001		92.90	64000.1
ENGINE OIL DRAINABLE E B	9020002	58	41.10	65640
ENGINE OIL TRAPPED D B	9020003	56	7.53	58176
ENGINE OIL TRAPPED E B	9020004	58	17.60	61736.1
			159.13	
OXYGEN CHARGE	9050000			
OXYGEN CHARGE F F	9050001	52	72	20493.1
OXYGEN CHARGE C F	9050002	54	12.67	26280.1
			13.39	
ENGINE FIRE EXT FLUID	9060000		25.00	73000.1
			25.00	
RESIDUAL FUEL C F	9070001	54	57.00	39263.1
RESIDUAL FUEL I W	9070002	62	230.00	53676.1
			287.00	
TRAPPED FUEL	9080000			
TRAPPED FUEL C F	9080001	54	24.30	41426.1
TRAPPED FUEL D B	9080002	56	6.90	49400.1
TRAPPED FUEL I W	9080003	62	182.60	56814.1
			213.80	
WATER FOR AIR CONDITIONING	9100000	54	200.00	26800.1
UNUSABLE WATER FOR AIRCOND	9100001	54	25.00	26700.1
			225.00	

WEIGHT AND C. OF G BY

REPORT NO.

SHEET.

IONING
IRCOND

