QC
Avro
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QCX
Avro
CF105
R-7-0400-34
Iss-25

FILE IN VAULT

Arrow 2
Prod. A/C

Report: 7-0400-34
Issue : 25

WEIGHT & C.G. SUMMARY

Mr. A. Crust

Nov/58

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Report no.: QCX - AVRO - CF105 - R-7-0400-34-Iss.25

has been ☐ downgraded to: _____

☒ de-classified

by (Name): Michel W. Drapeau

(Dept.): A/DND Coordinator, Access to Information

Date: Dec. 7, 1992

R. Dugan
Signature

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AVRO AIRCRAFT LIMITED
INTER-DEPARTMENTAL MEMORANDUM

Ref: 7880/11/J
Date: 1 November, 1958
To: See Distribution
From: E.F. Burnett - Weights Supervisor
Subject: Arrow 2 Production A/C Weight and C.G. Summary Report 7-0400-34 Iss. 25

Attached is a copy of Weight and C.G. Summary Report 7-0400-34 Issue 25 dated November 1, 1958, for your retention.

This report is revised monthly and is issued complete on the 1st of each month.

Classification ~~cancelled / changed to:~~ confirmed as UNCLASSSIFIED
By authority of: DRDA 7/DARFT 5-8/DAS Eng 6-4-5
Date: 5 Nov 1992
Signature: B. Aubrey
Unit / Rank / Appointment: DSIS 3, Secretary CRAD HQ DRP

E.F. Burnett

EFB/ag
cc: Messrs.

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

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Sheet	Content
1-1 to 1-5	Introductory notes and explanation of Weight changes.
2-1 to 2-2	Weight & C.G. Summary
3	Horizontal C.G. Plot showing basic fixed points on flight envelope. The possible variations of C.G. with fuel used has been omitted until such time as fully approved fuel sequencing is established.
4-1 to 4-15	I.B.M. Detail sheet of Weight and C.G.'s

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Sheet : 1-1

Introduction and Weight Changes

The following is a weight and C.G. Summary of the Arrow 2 Production Aircraft, based on the latest weight estimates available.

All weight and C.G. changes are relative to issue 24 of this report of October 1st, 1958.

Early Arrow 2 Aircraft will not be as this summary designates but will be Flight Test Vehicles with Instrumentation. Reference should be made to the following reports:-

A/C 25206 Weight Report - 7-0400-82 Issue 3
A/C 25207 Weight Report - 7-0400-85 Issue 1

General:

a) Orenda PS 13 Engines comprise the Power Plant, weight 4835 lb each excluding Nose Bullet, Inlet Frame and Avro installed accessories.

b) A package containing one GENIE missile (812 lb) plus four FALCON missiles (131 lb each) forms the current armament.

c) The Hughes MA 1 Electronic System is installed with an estimated weight of the system comprising both removable and fixed equipment of 2400 lb.

In addition to the above, the Minneapolis-Honeywell MH 64 Damping System is installed.

d) Where actual weights of Arrow I parts that apply to Arrow 2 Aircraft have been obtained, these weights have been recorded in the Arrow 2 records, some weights for Arrow 2 parts have also been obtained.

On I.B.M. sheets in the report, immediately preceeding the item title will be found a number varying from 0 to 100. This is the percentage actual weight recorded in the relevant item.

1. Structure	Weight lb
a) Wings	
Inner Wing Spars actual weights incorporated	
1) front spar inb'd (2 x 2.9)	+ 8.05
2) misc 2.25	
Centre Line Joints actual weights incorporated	- 8.02
Strut Pick-up fitting actual weights incorporated	- 4.24
Structure for Main U/C actual weights incorporated	- 0.98
Ribs 1-9	- 1.02
Wing Weight Decrease	- 6.21

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1. Structure (Cont'd)

		Weight lb
b) Fin and Rudder		
Deletion of Pod for I.R. Tracker ref. Assign. X74-4222	-	10.75
Fin and Rudder Decrease	-	10.75
c) Fuselage Fwd Sta. 255 ins		
Radome redesigned - shortened as per Assign X74-4234	-	52.15
Radar Nose Structure redesigned to accomodate MA 1	+	103.43
Crew Bulkheads add. brackets for pick-up of aileron servo and feel and trim and booster	+	1.61
Shear Panel below Nav's Arch mod to temp. controller mounting	+	0.31
Cockpit Formers add. misc brackets for air cond. & controls	+	1.61
Misc items F.F. add. brackets for mounting panels, controls control lines and toe guards	+	5.34
Bulkhead Sta 255. redesigned pick-up for electronic bay structure	+	1.24
Front Fuselage Increase	+	61.39
d) Centre Fuselage Sta. 255 - 485 ins		
Fuselage Fuel Tank re-estimate - refinement of hardware	-	0.21
Dorsal Fairing over Fuel tank add pick-ups for air conditioning exhaust cover	+	0.47
Structure below lower longeron)	+	0.56
Radar access door) redesigned to accomodate	+	6.39
Equipment Bay Structure) Hughes MA 1 Electronic	+	9.73
Pack Mounting Structure) System	+	2.35
Centre Fuselage Increase	+	19.29
e) Duct Bay Sta 485 - 591.65 ins		
Lower Panels Aft. D.B. act. wt. of exhaust ducts + 2.06 add brackets + 0.86	+	2.92
Heat Exchanger Mountings new report was included in joint D.B. to E.B. see Fuselage Joints	+	7.05
Duct Bay Increase	+	9.97

f) Engine Bay Sta. 591.65 - 742.5 ins

No weight change.

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1. Structure (Cont'd) — Weight lb

g) Rear Fuselage Sta. 742.5 ins - aft

Removable Nacelles R.F. (Tailcones Assign X74-4158 introduces repair scheme which adds two new frames per side to prevent skin buckling + 42.98

Rear Fuselage Increase + 42.98

h) Fuselage Joints

Joint Duct Bay to Engine Bay add. electrics mtg. channel (+ 0.21) heat exchanger mountings now deleted see new report under Duct Bay Structure (- 7.05) - 6.84

Fuselage Joints Decrease - 6.84

Total Structural Increase + 109.83

2. Landing Gear

No Weight change.

3. Power Plant & Services

P.S. 13 Engines Weight increased to 4835 lb each, as per Orenda letter dated Aug. 21/58 (Smallwood - Lindow). When weight reductions are realized the Basic Engine Weight will be revised. + 670.00

Fuel System addition of piping from Armament Pack Tank to Tank 5 + 10.00

Power Plant Increase + 680.00

4. Flying Controls Group

No weight change.

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5. Equipment Fixed & Removable

		Weight lb
Probe - incorporated manufacturer's estimate		- 0.39
Cabin Consoles - add. brackets for Nav's foot guard		+ 0.40
Windscreen Demisting - target weight of system transformer increased due to failure on vibration		+ 1.40
Radio & Radar Fixed	First estimate for Hughes MA 1 Electronic System	- 330.95
Radio & Radar Removable		- 253.48
Sparrow Pack Structure - deleted		- 906.31
Sparrow Pack Mechanisms - deleted		- 557.32
Sparrow Pack Hydraulics - deleted		- 369.70
Sparrow Pack Electrics & Electronics Fixed - deleted		- 188.73
Sparrow Pack Air Conditioning - deleted		- 5.21
Sparrow Pack L.P. Pneumatics - deleted		- 24.45
Sparrow Pack Electronics Removable - deleted		- 186.80
Armament Pack Structure	New reports, first estimates of armament pack to house 1 Genie, and 4 Falcons plus fuel tank.	+ 935.00
Armament Pack Mechanisms		+ 500.00
Armament Pack Hydraulics		+ 180.00
Armament Pack Electrics		+ 90.00
Armament Pack Air Conditioning		+ 5.21
Armament Pack L.P. Pneumatics		+ 24.45
Armament Pack Fuel System		+ 20.00
	Total Equipment Decrease	-1,066.88

6. Trapped Fuel No weight change.

7. Useful Load

Water for Air Conditioning reduced	- 60.00
Missiles - Sparrows deleted, incorporated One Genie plus Four Falcons (1728 - 1336)	- 392.00
Missile Cocoons deleted	- 84.00
Total Useful Load Decrease	- 536.00

Summary

Weight Change - Aircraft Basic Weight	
Structure	+ 109.83
Power Plant & Service	+ 680.00
Equipment	-1,066.88
Total	- 277.05 lb
Useful Load	- 536.00 lb

Issue 24	Weight Change - Operational Weight Empty Issue 25	
46,645.89	45,832.84	- 813.05 lb

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Weight & C.G. Summary

Description	Weight lb	H. Arm ins	V. Arm ins
Structure	19,337.73	565.20	137.12
Wings	10,032.58	642.79	142.17
Fin & Rudder	1,030.94	754.65	208.99
Fuselage Fwd Sta 255 ins	2,665.59	182.40	128.31
Sta 255 - 485 ins	1,734.42	374.84	129.81
Sta 485 - 591.65 ins	1,170.65	538.66	105.52
Sta 591.65 - 742.5 ins	1,576.20	659.72	110.61
Sta 742.5 in aft	1,084.25	807.90	129.11
Marry-Up	43.10	468.17	109.67
Landing Gear - Retracted	2,697.98	489.31	135.08
Main Landing Gear	2,048.67	538.68	141.00
Main Gear Doors & Fairings	287.98	538.52	138.40
Nose Landing Gear	333.81	170.81	99.70
Nose Gear Door & Fairing	27.52	162.22	88.66
Power Plant & Services	11,450.92	672.45	121.72
Engines Bare PS 13	9,670.00	689.94	121.25
Engine Accessories (Inlet Frame etc)	388.05	617.84	118.34
Engine Controls	32.32	379.90	117.49
Gear Boxes & Drives on Fuselage	291.87	608.57	103.28
Gear Boxes & Starters on Engine	146.45	601.97	113.57
Fire Extinguisher System	73.58	686.35	131.21
Engine Mountings	75.39	671.91	141.52
Fuel System	773.26	529.49	135.09
Flying Controls Group	1,965.94	652.84	138.24
Mechanical Flying Controls	958.44	677.70	147.62
Hydraulic Flying Controls	1,007.50	629.19	129.32
Equipment Fixed & Removable	8,015.08	335.89	114.52
Instruments	34.61	167.52	138.92
Probe	14.86	-34.07	108.00
Cockpit Pressure Sealing	5.00	186.00	130.00
Cabin Consoles	17.68	175.29	124.49
Oxygen System	21.16	259.40	156.88
Ejector Seats	342.94	204.50	134.11
Cockpit Equipment	6.00	187.50	145.00
Air Conditioning System	888.56	345.34	136.28
Cockpit Insulation	14.31	187.48	132.00
Hydraulics Utilities System	641.33	498.84	118.15
Mech. Door Stops Main U/C Doors	3.02	516.00	120.00
Anti Skid Controls System	37.68	479.24	113.38
Drag Chute	91.07	786.68	143.19
Electrical System	1,236.69	433.67	113.06
Low Pressure Pneumatics	50.08	394.66	126.02
Surface Finish	100.00	591.52	140.20
Intake De-Icing Boots	88.00	195.82	118.00
Canopy Actuation	64.92	221.99	154.35
Radar Door Actuation	10.00	268.00	95.00
Radio & Radar Removable	1,857.00	179.00	106.05
Radio & Radar Fixed	549.09	255.74	122.61
MH 64 Damping System	186.42	462.33	134.70

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Description	Weight lb	H. Arm ins	V. Arm ins	M.A.C. %
Armament Pack Structure	935.00	388.00	98.60	
Armament Pack Hydraulics	180.00	385.30	98.50	
Armament Pack Mechanisms	500.00	381.80	94.30	
Armament Pack Air Conditioning	5.21	305.50	102.50	
Armament Pack Pneumatics	24.45	386.92	103.50	
Armament Pack Electrics	90.00	369.00	101.00	
Armament Pack Fuel System	20.00	478.00	98.40	
Trapped Fuel	213.80	548.26	141.79	
U/C Up		550.41	128.88	
Aircraft Basic Weight	43,681.45			
U/C Down		552.78	124.98	
Useful Load (less usable fuel)	2,151.39	350.56	109.46	
Crew	390.00	194.00	136.50	
Engine Fire Ext. Fluid	25.00	730.00	129.00	
Oil	162.00	638.31	110.89	
Oxygen Charge	13.39	259.69	159.91	
Water for Air Conditioning	225.00	267.91	131.56	
Missiles	1,336.00	369.10	96.80	
U/C Up		541.04	127.98	29.02
Operational Weight Empty	45,832.84			
U/C Down		543.28	124.26	29.64
Half Max. Int. Fuel	11,276.50	-	-	
Combat Weight (½ Max. Int. Fuel)	57,109.34	-	-	
Max. Int. Fuel				
a) Tanks 1-8: 2491 gal @ 7.8 lb/gal	19,433.00	541.85	144.16	
b) Armanent Pack, 400 gal @ 7.8 lb/gal	3,120.00	408.00	98.40	
U/C Up		535.19	131.23	27.40
Gross Weight (Max. Int. Fuel)	68,385.84			
U/C Down		536.70	128.73	27.82

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

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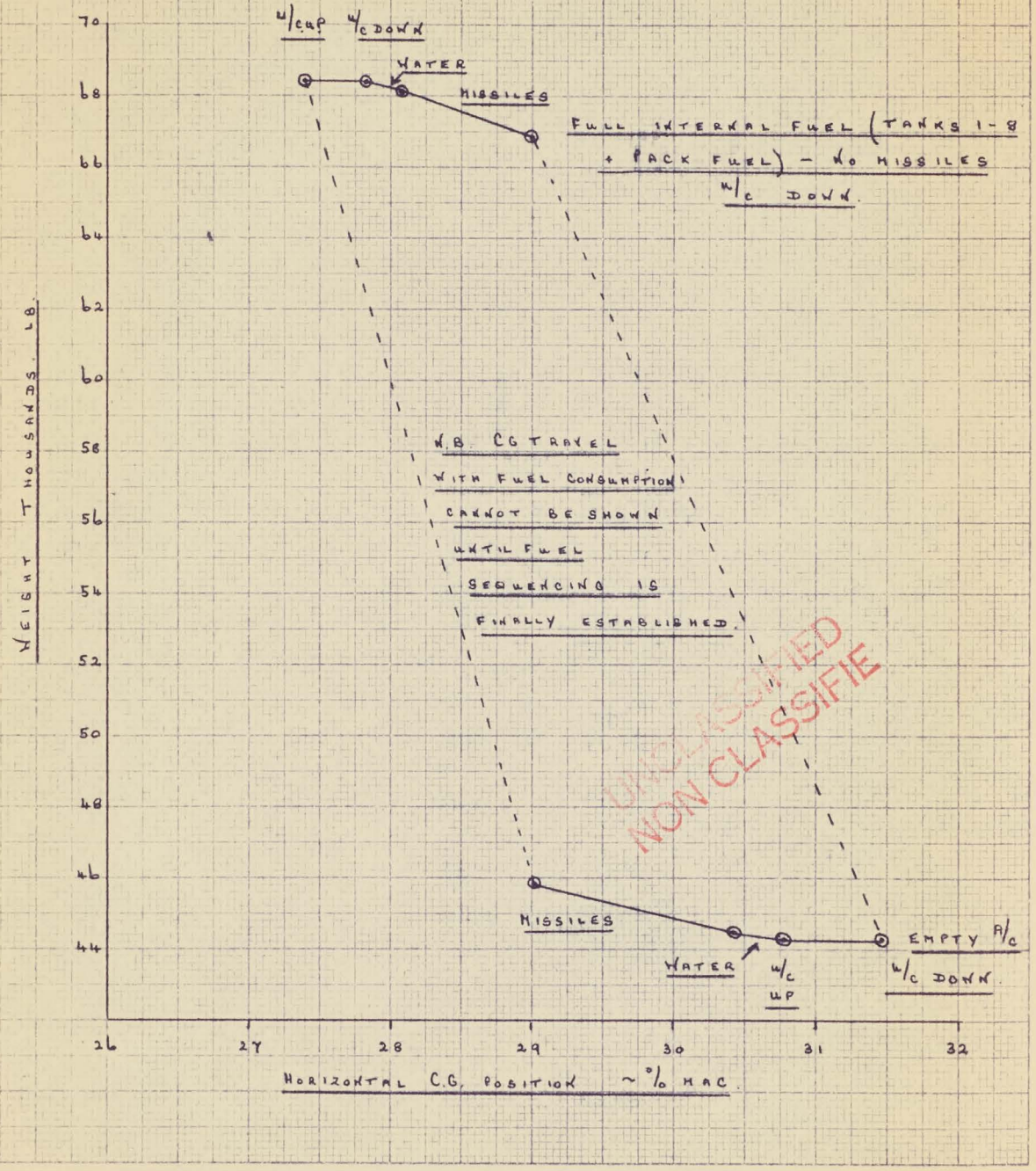
REPORT N° J-0400-34-25
DATE Nov. 1st 1958
SHEET 3
BY P. J. Frenel

HORIZONTAL CG PLOT OF FIXED POINTS ON ARROW 2 FLIGHT ENVELOPE.



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K+E 10 X 10 TO THE ½ INCH 359-12 KEUFFEL & ESSER CO.

AVRO AIRCRAFT LTD.
MALTON, ONT.

PROJECT Arrow 2 Prod. A/C

WEIGHT AND C. OF G BY FUNCTIONAL COMPONE

	DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H.
	TOTAL WING GROUP	1000000			
	OUTER WING	1010000			
100	OUTER WING SKINS	1010001	64	9291070	
100	POSTS AND INTERCOSTALS	1010002	64	2436730	
100	OUTER WING SPARS	1010003	64	3925870	
100	OUTER WING RIBS	1010004	64	1345669	
18	AILERON CONTROL BOX	1010006	64	3792077	
100	RIB 12	1010007	64	762664	
100	O W AILERON JACK FITTING	1010009	64	104672	
	AILERON JOINTS AND FAIRING	1010010		329378	
				197945	
100	AILERON	1020000	74	3360079	
				33600	
20	ELEVATOR	1030000	82	4463875	
20	ELEVATOR MARRY UP	1030001		159773	
				46235	
	INNER WING	1040000			
81	MAIN U C STRUCTURE	1040001	62	3321757	
95	INNER WING SPARS	1040002	62	4191757	
5	I W STRUCTURE F S TO M S	1040007	62	10973049	
	I W STRUCTURE M S TO R S	1040008	62	1513060	
	STRUCT AFT OF REAR SPAR	1040009	62	3160372	
40	ELEVATOR CONTROL BOX I W	1040010	62	4283872	
25	TRANSP JOINT MARRY UP	1040011		706563	
61	CENTRE LINE JOINTS	1040012	62	5828166	
	INNER WING SKINS	1040013	62	22510762	
63	STRUT PICK UP FITTINGS	1040014	62	1231661	
62	RIBS 1 TO 9	1040016	62	4851661	
	DORSAL FAIRING I W	1040017	62	11348	
100	RIB 10	1040018	62	1070663	
49	FUSELAGE HINGE JOINT I W	1040019	62	1262861	
25	TRANSP JOINT	1040020	62	1294263	
49	FUSELAGE HINGE JOINT	1040021		393553	
	DORSAL FAIRING C A	1040023		591356	
	SHUT OFF VALVE OPERAT MECH	1040024	62	51354	
	LEADING EDGE I W	1040025	62	2213846	
				694608	
	LEADING EDGE O W	1050000	65	3087063	
				30870	

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PROJECT_____

DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H
FIN AND RUDDER GROUP	2000000			
FIN	2010000	83	8551775	
FIN TO WING MARRY UP	2010001		494368	
			90460	
94 RUDDER	2020000	84	126348	1
			12634	

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	DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H
	SKIN D B	30400001	56	6227	5
5	FORMERS D B	30400002	56	7335	5
	TOP LONGERONS	30400003	56	498	5
	MTG BRKTS SIDE PANEL	30400004	56	190	5
	LOWER LONGERONS	30400005	56	10301	5
72	MAIN FRAME STA 538 77	30400006	56	5980	5
	ACCESS PANELS	30400007	56	3874	5
	LOWER PANEL ASSY	30400008	56	217	5
	DROP TANK MTG STRUCTURE	30400009	56	841	5
20	LOWER SIDE PANELS FWD	30400010	56	10756	5
	LOWER CENTRE PANEL FWD	30400011	56	2791	5
16	LOWER CENTRE PANEL AFT	30400012	56	6990	5
	LOWER CENTRE PANEL AFT	30400013	56	2609	5
	FLOATING DUCT D B	30400014	56	45555	5
	HEAT EXCHANGER MTG	30400015	56	705	5
				104869	
	ENGINE BAY	3050000			
100	TOP LONGERONS	30500001	58	674	6
84	BOTTOM LONGERONS	30500002	58	8432	6
	ENGINE ACCESS DOORS	30500003	58	13604	6
	ENGINE TUNNEL	30500004	58	61324	6
71	ENG RAILS ATTACH TO FORM	30500005	58	2906	6
	PANELS AT ENG ACCESS DOORS	30500006	58	11117	6
	BOTTOM CTR PANEL FWD	30500007	58	4610	6
	BOTTOM CTR PANEL CENTRE	30500008	58	4120	6
	BOTTOM CTR PANEL AFT	30500009	58	7666	7
5	SIDE PANEL FRONT	30500010	58	8605	6
5	SIDE PANEL CENTRE	30500011	58	7474	6
32	SIDE PANEL AFT	30500012	58	7453	7
41	HEAVY FORMERS	30500013	58	19635	6
				157620	
	REAR FUSELAGE	3060000			
	OUTER SKINS FIXED	30600001	59	5658	7
	FORMERS FIXED R F	30600002	59	10509	7
	LONGERONS FIXED R F	30600003	59	2519	7
	TUNNEL FIXED R F	30600004	59	10994	7
	ENGINE ACCESS DOORS R F	30600005	59	9023	7
	FAIRING UNDER RUDDER FIXED	30600006	59	2839	7
	REMOVABLE TAILCONES	30600007	59	55948	8
	CENTRE STRUC AND STING REM	30600008	59	10935	8
				108425	
	DIVE BRAKES	30700001	72	11790	5
	D B JOINT TO FUSELAGE	30700002		406	4
				12196	

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WEIGHT AND C. OF G BY FUNCTIONAL COMPON

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DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT
ENGINE GROUP	5000000		
PS 13 ENGINES	5010000		10055006
PS 13 ENGINES C A	5010002		3056
			1005805
ACC GEAR BOX ON FUS D B	5020001	56	36765
ACC GEAR BOX ON FUS E B	5020002	58	235336
ACC GEAR BOX ON FUS C A	5020003		8006
ACC GEAR BOX ON FUS I W	5020004	62	11786
			29187
ENGINE CONTROLS	5030000		
ENGINE CONTROLS F F	5030001	52	15761
ENGINE CONTROLS C F	5030002	54	1092
ENGINE CONTROLS E B	5030004	58	8896
ENGINE CONTROLS I W	5030005	62	6585
			3232
STARTER AND GEARBOX	5040000		
STARTER AND GEARBOX ENG	5040001		146456
UNCLASSIFIED			14645
NON CLASSIFIE			
FIRE EXT SYSTEM	5060000		
ENG FIRE EXT SYSTEM E B	5060001	58	59857
ENG FIRE EXT SYSTEM D B	5060002	56	12315
ENG FIRE EXT SYSTEM ENG	5060003		1426
			7358
ENGINE MTGS AND BRACKETS	5070000		
ENGINE MOUNTS	5070001		75396
			7539
FUEL SYSTEM	5080000		
30 FUEL SYSTEM C F	5080001	54	116154
30 FUEL SYSTEM D B	5080002	56	164005
30 FUEL SYSTEM E B	5080003	58	18366
30 FUEL SYSTEM I W	5080004	62	472805
30 FUEL SYSTEM C A	5080005		1956
			77326

EIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

REPORT NO.

SHEET

	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM	H. MOMENT	V. MOMENT
	6000000						
	6010000						
F	601000152		10694	16454	11411	1759591	1220292
F	601000254		1290	39654	11727	511537	151278
IN	601000583		12443	78819	22157	9807448	2756996
W	601000662		40234	71800	14382	28888012	5786454
W	601000764		30520	77053	13561	23516576	4138817
A	6010008		663	70984	14338	470624	95061
			95844			64953788	14148898
ULICS	6020000						
S D B	602000156		3184	56630	10114	1803099	322030
S E B	602000258		39853	64788	11161	2581996 2	4447993
S R F	602000359		48	75875	10824	36420	5196
S I W	602000462		27988	70369	14716	19694876	4118714
S O W	602000564		13170	74034	13586	9750278	1789276
S FIN	602000683		5581	76008	20795	4242006	1160569
S R N	602000751		3500	11309	10513	395815	367955
S F F	602000852		5506	16928	11000	932056	605660
S C F	602000954		1920	37329	11000	716717	211200
			100750			63391229	13028593

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EIGHT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

REPORT NO.

SHEET

	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM	H. MOMENT	V. MOMENT
R N	71400001	51	500	8000	10000	40000	50000
F F	71400002	52	21501	18728	11277	4026707	2424668
C F	71400003	54	8400	26471	10015	2223564	841260
F I N	71400058	3	3200	76180	24600	2437760	787200
C A	71400006		19500	22200	12000	4329000	2340000
I W	71400007	62	1808	54513	16000	985595	289280
			54909			14042626	6732408
	71600000	52	6492	22199	15435	1441159	1002040
			6492			1441159	1002040
	71700000	52	1768	17529	12449	309913	220098
			1768			309913	220098
	71800000	54	1000	26800	9500	268000	95000
			1000			268000	95000
	71900001	52	363	18744	12200	68041	44286
	71900002	53	64	20218	15900	12940	10176
	71900003	54	1400	37197	12455	520758	174370
S	71900045	5	408	22798	12020	93016	49042
	71900055	6	377	53828	11200	202932	42224
	71900065	8	443	66701	11200	295485	49616
	71900075	9	648	80362	13175	520746	85374
	71900086	2	3151	60144	14400	1895137	453744
	71900096	4	1067	70650	13590	753836	145005
EDGE	71900106	5	319	63948	13526	203994	43148
N	71900117	4	353	79190	13556	279541	47853
DR	71900128	2	566	75523	14260	427460	80712
	71900138	3	639	74663	20837	477097	133148
	71900148	4	202	81279	21431	164184	43291
			10000			5915167	1401989

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AVRO AIRCRAFT LTD.
MALTON, ONT.

WEIGHT AND C. OF G BY FUNCTIONAL COMPONE

PROJECT_____

DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H
MISSILE PACK PNEUMATICS	805050094		2445	3
			2445	
MISSILE PACK FUEL SYSTEM	805060094		2000	4
			2000	
MISSILE AIRCONDITIONING	807000094		521	3
			521	
COCKPIT EQUIPMENT	808000052		600	1
			600	

UNCLASSIFIED
NON CLASSIFIE