

7L 113 58/11
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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.

confirmed as
Classification ~~cancelled / changed to:~~ UNCLASSIFIED

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
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



58799

Aircraft: Arrow 2
 Prod. A/C
 Date : 1 November, 1958

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I N D E X

<u>Sheet</u>	<u>Content</u>
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 2406 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
<u>Wing Weight Decrease</u>	<u>- 6.21</u>

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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
<u>Fin and Rudder Decrease</u>	-	<u>10.75</u>

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 tie guards	+	5.34
Bulkhead Sta 255. redesigned pick-up for electronic bay structure	+	1.24
<u>Front Fuselage Increase</u>	+	<u>61.39</u>

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
<u>Centre Fuselage Increase</u>	+	<u>19.29</u>

e) Duct Bay Sta 485 - 591.65 ins

Lower Panels Aft. D.B. act. wt. of exhaust ducts	+	2.06
add brackets	+	0.86
Heat Exchanger Mountings new report was included in joint D.B. to E.B. see Fuselage Joints	+	7.05
<u>Duct Bay Increase</u>	+	<u>9.97</u>

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	-	330.95
Radio & Radar Removable) Electronic System	-	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)	+	935.00
Armament Pack Mechanisms) New reports, first estimates	+	500.00
Armament Pack Hydraulics) of armament pack to house	+	180.00
Armament Pack Electrics) 1 Genie, and 4 Falcons	+	90.00
Armament Pack Air Conditioning) plus fuel tank.	+	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

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

Weight Change - Operational Weight Empty

Issue 24
46,645.89

Issue 25
45,832.84

- 813.05 lb

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Weight & C.G. Summary

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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 ($\frac{1}{2}$ 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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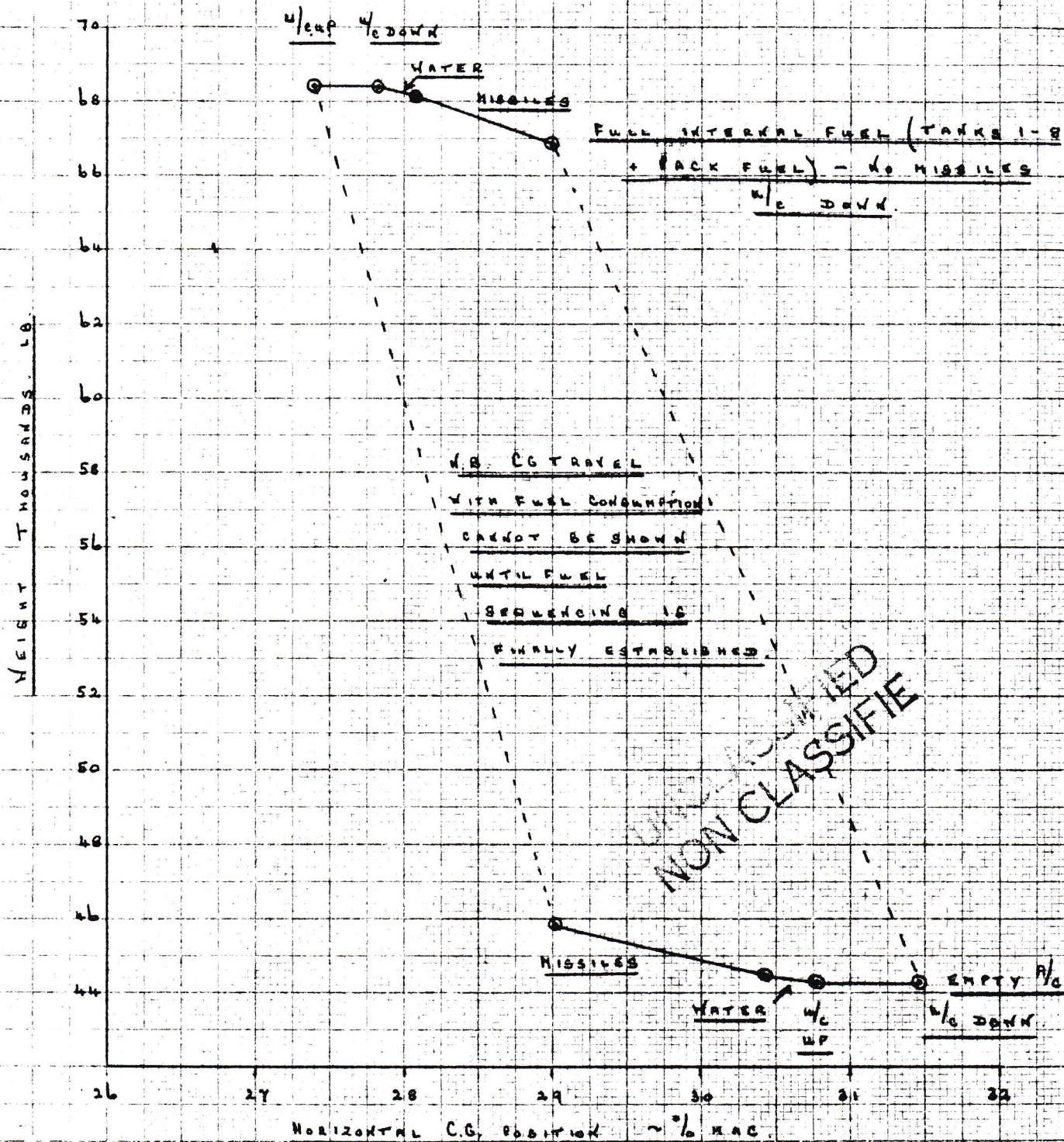
HORIZONTAL CG PLOT OF FIXED POINTS ON ARROW 2 FLIGHT ENVELOPE

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BY P. J. French



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