

TL 113-58/02

AVRO AIRCRAFT LIMITED
INTER-DEPARTMENTAL MEMORANDUM

UNCLASSIFIED
NON CLASSIFIED

Ref. 5865/11/J
Date February 1st, 1958
To See Distribution
From Mr. E. F. Burnett
Subject ARROW 2 PRODUCTION A/C WEIGHT & C.G. SUMMARY - Report # 7-0400-34 Iss. 16

Attached is a copy of Weight and C.G. Summary Report # 7-0400-34
Issue 16, dated February 1st, 1958 for your retention.

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

Classification ^{confirmed as} ~~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: DS/S 3, Secretary CRAD HQ DRP



amc.

E. F. Burnett
Weights Supervisor

Messrs. J.C. Floyd
R.N. Lindley
J.A. Chamberlin
R. Marshall
C.V. Lindow
F.P. Mitchell
A. Buley
J. Ames
B.C. Alford
D. Wade
R. Vale
E. Kosko
H. Shoji
D. Hayward
D. Scard
J. Booth

F. Brame
W. Czerwinski
J. Lucas
S. Kwiatkowski
A. Cornish
J. Hodge
C. Marshall
J. Zurakowski
A.D. Crust (5) for RCAF
N. Ring
D. Inglis
D. Moore
K. Wreghitt
R. Cairns
G. Eves



52356

Date: February 1st, 1958
Aircraft: ARROW 2
PRODUCTION A/C

UNCLASSIFIED / NON CLASSIFIED

Report # 7-0400-34 Iss. 16

I N D E X

<u>Sheet #</u>	<u>Content</u>
1-1 to 1-4	Introductory notes and explanation of Weight Changes.
2-1 to 2-2	Weight & C.G. Summaries
3	Horizontal C.G. plot showing basic fixed points on flight envelope. The variation of C.G. with fuel used has been omitted until such time as a fully approved fuel sequencing is established.
4-1 to 4-15	I.B.M. Detail Sheets of Weights and C.G.'s.

Date: February 1st, 1958
Aircraft: ARROW 2
Production A/C

UNCLASSIFIED / NON CLASSIFIÉ
SECRET
Report # 0400-34 Iss. 16
Sheet # 1-1

INTRODUCTION & WEIGHT CHANGES

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

All Weight & C.G. changes are relative to issue 15 of January 1st, 1958.

The early Arrow 2 Aircraft # 25206 etc. will not be as this summary designates, but will be flight test aircraft with Instrumentation, Astra Minus Radar, Missile Pack Trial Installation and various equipment Trial Installations. Weight statements for these aircraft will be issued at a later date.

GENERAL:

- a) Orenda PS 13 Engines comprise the Power Plant (4,500 lb each, brochure weight, excluding Nose Bullet and Input Frame).
- b) A package containing 4 "semi-submerged" Sparrow II Missiles (432 lb each) forms the current Armament.
- c) The R.C.A. Astra I Radar System is installed. The basis for the weight and C.G. breakdown is from the latest information received from R.C.A., dated October 4th, 1957. No Sparrow III Auxiliaries are carried in the production aircraft.

Where later weights have been received from Minneapolis-Honeywell these have been incorporated. Allowances have also been added for the missile firing system, junction boxes and some AVRO installed antennae.

Initially it was understood that the R.C.A. weight was for the complete system installed, now, however, it appears that only intercompartment cables were allowed for by R.C.A. not junction boxes etc.

The Infra-red Tracker System seeker head is allowed for in its Fin Pod location. (Total weight of installed system = 3,249.5 lb, including missile actuation and firing system).

In addition to the above the Minneapolis-Honeywell M.H. 64 Damping System is installed.

Arrow 2 Aircraft # 25206 to # 25208 and # 25211 will have the "Astra Minus" System (Navigational and Communication equipment only).

- d) A considerable number of Arrow 1 parts, assemblies and equipment have now been weighed. Where these weights apply to the Arrow 2 Aircraft, they have been recorded in the Arrow 2 records.

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

1. STRUCTURE

WEIGHT (lb)

a) Wings:

No Weight Change.

UNCLASSIFIED / NON CLASSIFIÉ

Date: February 1st, 1958
Aircraft: ARROW 2
Production A/C

UNCLASSIFIED
SECRET
Report # 7-00-34 Iss. 16
Sheet # 1-2
NON CLASSIFIED

INTRODUCTION & WEIGHT CHANGES

1. STRUCTURE (Continued)

WEIGHT (lb)

b) Fin & Rudder:

Fin I. R. Pod - Initial allowance made for seeker mounting
pod

Weight Increase Fin

+ 10.75
+ 10.75

c) Front Fuselage fwd. Sta. 255"

Radome - new design approx. 12" shorter and walls .348" thick,
were .38" thick.

- 18.71

Radar Nose Structure - addition of thrust angles on frame
Sta. 82.25" to 84.25" for ballast
installation

+ 0.42

Top Longerons - incorporation of E.C.N's and production
drawing estimate of transverse beam
Sta. 246.24"

+ 0.98

Aft. Upper Shear Panel - Arrow 2 production drawing
estimates

- 0.73

Air Intakes - Actual weight of tip support casting and
incorporation of design for production split

+ 3.84

Front Fuselage Decrease

- 14.20

d) Centre Fuselage Sta. 255" to 485"

Bulkhead Sta. 485" - Actual weight obtained of Vickers
release mechanism for drop tank

+ 1.10

Fuselage Fuel Tank - miscellaneous production drawing
changes, alterations to dished
panel assys. etc.

+ 2.34

Centre Fuselage Increase

+ 3.44

e) Duct Bay Sta. 485"-591.65"

Dive Brake Accommodations - addition of stiffeners etc to
Refuel and Limiter Access Door

+ 0.51

Dive Brakes - modifications to inner skin

+ 0.34

modifications to main lever design

+ 0.66

O/Skin and doublers - aluminum were
magnesium

+ 5.40

Duct Bay Increase

+ 6.91

f) Engine Bay Sta. 591.65" to 742.5"

No Weight Change

g) Rear Fuselage Sta. 742.5 Aft.

O/Skins fixed R.F. - production drawing estimates made

+ 3.23

Formers Fixed R.F. - production drawing estimates of "U"
bolt assys. etc.

- 2.35

Tailcones - production drawings of some components now
estimated, buttstraps at Sta. 814" were
omitted in error when scheme drawing estimates
were made

+ 14.22

Rear Fuselage Increase

+ 15.10

UNCLASSIFIED / NON CLASSIFIED

Date: February 1st, 1958
Aircraft: Arrow 2
Production A/C

UNCLASSIFIED / NON CLASSIFIED
SECRET
Report # 0400-34 Iss. 16
Sheet # 1

INTRODUCTION & WEIGHT CHANGES

1. STRUCTURE (Continued)

WEIGHT (lb)

h) Fuselage "Marry-Up"

No Weight Change.

TOTAL STRUCTURAL INCREASE

+ 22.00

2. LANDING GEAR

Main Undercarriage - information from Messrs. Dowty is to the effect that the hoped for 25 lb/leg savings on the shortening mechanism has not been realized.

+ 33.32

LANDING GEAR INCREASE

+ 33.32

3. POWER PLANT & SERVICES

No Weight Change.

4. FLYING CONTROLS GROUP

No Weight Change.

In A/C # 25201 boosters have been added at the elevator and aileron quadrants to overcome excessive friction within the system. These together with associated valves, filters and piping account for a weight increase of approx. 77 lb. Some similar system of boosters will have to be built into the Arrow 2 Flying Control Hydraulic System but no information pertaining to details of the installation is yet available. The probable weight increase will be of the same order as that on A/C # 25201.

5. EQUIPMENT GROUP

Probe - amendment of estimate to include manufacturer's quote of sensor weight	+ 0.25
Radio & Radar Removable - R.C.A. previously omitted some antennae from their list; ARA 25 Antenna	+ 18.00
ARN 6 Loop Antenna	+ 8.50
Minneapolis-Honeywell have supplied weights for parts sub-contracted to them: Stable platform and rack	+ 19.50
Platform repeater and rack	+ 11.00
Miscellaneous other equipment changes	+ 11.60

continued.

UNCLASSIFIED / NON CLASSIFIED

Date: February 1st, 1958
Aircraft: ARROW 2
Production A/C

UNCLASSIFIED E T
S E T
Report # 79100-34 Iss. 16
Sheet # 1-4
NON CLASSIFIED

INTRODUCTION & WEIGHT CHANGES

5. EQUIPMENT GROUP (Continued)

WEIGHT (lb)

Radio & Radar Fixed - Addition of missile firing system cables from pack to cockpit	+ 19.60
Junction boxes were not allowed for in R.C.A.'s previous installed weight of Astra I, these are:	
R 1	+ 36.20
R 2	+ 18.50
R 3	+ 2.70
further probable junction box	+ 5.00
Sparrow Pack Electronics Fixed - production drawings of Trial Installation pack boxes, installations and cables have been evaluated and where applicable similar allowances made for a production pack system.	
	+ 63.61

EQUIPMENT GROUP INCREASE

+ 214.46

SUMMARY

Weight Change - Aircraft Basic Weight

Structure	+ 22.00 lb
Landing Gear	+ 33.32 lb
Equipment	+ 214.46 lb
	<u>+ 269.78 lb</u>

Weight Change Operational Weight Empty

Issue 15

Issue 16

45,610.22 lb

45,880.00 lb

+ 269.78 lb

UNCLASSIFIED / NON CLASSIFIED

Date: February 1st, 1958
Aircraft ARROW 2
Production A/C

UNCLASSIFIED / NON CLASSIFIED
SECRET
Report # 7-0400-34 Iss. 16
Sheet # 1

WEIGHT & C.G. SUMMARY

<u>DESCRIPTION</u>	<u>WEIGHT</u> <u>lb</u>	<u>H. ARM</u> <u>ins.</u>	<u>V. ARM</u> <u>ins.</u>
STRUCTURE	19,066.88	567.04	137.43
Wings	10,012.03	642.54	142.22
Fin & Rudder	1,034.75	754.31	209.80
Fuselage - fwd. Sta. 255"	2,559.40	184.19	128.60
Sta. 255"-485"	1,695.27	375.45	130.63
Sta. 485"-591.65"	1,125.95	538.12	105.32
Sta. 591.65"-742.5"	1,550.20	661.04	110.51
Sta. 742.5" Aft.	1,036.95	805.24	128.71
"Marry-Up"	52.33	467.60	103.84
LANDING GEAR - RETRACTED	2,575.63	487.91	134.86
Main Landing Gear	1,934.94	539.49	141.00
Main Gear Doors & Fairings	282.34	537.60	138.37
Nose Landing Gear	333.81	170.80	99.70
Nose Gear Door & Fairing	24.54	162.24	88.23
POWER PLANT & SERVICES	10,800.67	671.41	121.32
Engines & Accessories PS 13	9,186.78	687.95	121.16
Gear Box & Drives on Fuselage	281.84	601.70	102.49
Engine Controls	32.43	375.76	118.61
Gear Box Starter & Drives on Engine	315.45	615.98	105.24
Engine Nose Bullet (Orenda Supplied)	70.00	587.17	116.00
Fire Extinguishing System	65.46	700.45	134.21
Engine Mountings	132.38	666.82	136.52
Fuel System	716.33	530.91	134.48
FLYING CONTROLS GROUP	1,792.80	683.95	140.43
Mechanical Flying Controls	944.53	684.69	148.25
Hydraulic Flying Controls	848.27	683.13	131.72
EQUIPMENT FIXED & REMOVABLE	8,855.26	332.16	113.98
Instruments	46.07	163.68	138.70
Probe	15.25	-23.71	108.00
Cockpit Pressure Sealing	5.00	186.00	130.00
Oxygen System	26.07	240.54	156.70
Ejector Seats	339.06	204.43	134.10
Air Conditioning System	856.00	333.49	134.98
Hydraulics Main System	640.81	504.22	117.77
Cockpit Insulation	14.31	187.48	132.00
Drag Chute	91.07	786.68	143.19
Electrical System	1,276.26	434.44	112.66
Low Pressure Pneumatics	56.94	421.96	128.47
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
Cabin Consoles	17.38	174.63	124.32
Radar Door Actuation	10.00	268.00	95.00
MH 64 Damping System	180.15	471.27	135.69
Radio & Radar Removable	2,079.90	207.28	108.22
Radio & Radar Fixed	767.00	231.73	116.90
Sparrow Pack Structure	890.19	381.67	97.60
Sparrow Pack Mechanisms	551.12	374.40	99.12
Sparrow Pack Hydraulics	331.94	373.52	99.00
Sparrow Pack Electronics Removable	185.50	331.91	100.00
Sparrow Pack Electric & Electronics fixed	217.11	335.24	110.00
Sparrow Pack Air Conditioning	5.21	305.50	102.50

UNCLASSIFIED / NON CLASSIFIED

Date: February 1st, 1958
Aircraft: ARROW 2
Production A/C

UNCLASSIFIED / NON CLASSIFIÉ
SECRET
Report # 7-0400-34 Iss. 16
Sheet # 2

WEIGHT & C.G. SUMMARY

<u>DESCRIPTION</u>		<u>WEIGHT</u> <u>lb</u>	<u>H. ARM</u> <u>ins.</u>	<u>V. ARM</u> <u>ins.</u>	<u>M.A.C</u> <u>%</u>
AIRCRAFT BASIC WEIGHT	U/C Up	43,091.24	545.07	128.54	
	U/C Down		547.31	124.83	
USEFUL LOAD (less fuel)		2,788.76	377.59	104.73	
Crew		390.00	194.00	136.50	
Oil		138.97	636.92	110.57	
Engine Fire Extinguisher Fluid		25.00	730.00	129.00	
Residual Fuel		218.40	553.98	134.04	
Missiles		1,728.00	389.29	88.30	
Oxygen Charge		13.39	259.68	159.91	
Water for Air Conditioning		275.00	268.00	131.75	
Operational Weight Empty	U/C Up	45,880.00	534.90	127.09	27.32
	U/C Down		537.01	123.61	27.91
Operational Weight Empty	U/C Up	44,152.00	540.60	128.61	28.90
Less Missiles	U/C Down		542.80	124.99	29.50
Normal Combat Mission Fuel *					
(2,237 gal. @ 7.8 lb/gal.)		17,450.00	-	-	-
Normal Combat Weight *		63,330.00	-	-	-
Half Combat Mission Fuel *					
(1,118.5 gal. @ 7.8 lb/gal.)		8,725.00	-	-	-
Combat Weight (half					
Mission Fuel)*		54,605.00	-	-	-
Maximum Internal Fuel					
(2,492 gal. @ 7.8 lb/gal.)		19,438.00	541.85	144.16	
A.U.W. Maximum Internal Fuel	U/C Up	65,318.00	536.97	131.98	27.89
	U/C Down		538.45	129.53	28.30
Maximum External Fuel (500 gals.					
@ 7.8 lb/gal + drop tank)		4,248.00	521.84	60.67	
A.U.W. Maximum Internal and	U/C Up	69,566.00	536.05	127.63	27.64
External Fuel	U/C Down		537.44	125.33	28.02

N.B. 1) Aircraft Datum = 120" above an arbitrarily chosen ground line.

2) * Fuel weights in accordance with latest data issued by Aerodynamics November 19th, 1957. Centres of Gravity have temporarily been omitted until a fuel sequencing system is finally established.

3) With the increase of 270 lb in Operational Weight Empty the Normal Combat Mission fuel has increased by a further 80 lb.

UNCLASSIFIED / NON CLASSIFIÉ

REPORT: 7-0400-34-16

BY: *K. J. [illegible]*

DATE: Feb 1958

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

UNCLASSIFIED / NON CLASSIFIED

