

Date: September 1st, 1957
Aircraft: C-105 MK 2
Production A/C

SECRET
Report # 7-0400-34 Iss. 11

I N D E X

<u>Sheet #</u>	<u>Content</u>
1-1 to 1-3	Introductory notes and brief explanation of weight changes.
2-1 to 2-2	Detailed explanation of weight changes to weight reports as listed on I.B.M. Sheets.
3-1 to 3-2	Weight & C.G. Summaries.
4-1 to 4-15	I.B.M. Detail Sheets of Weights and C.G's.

N. B. The flight C.G. envelopes for the MK 2 Aircraft have been omitted until such time as a fully approved fuel sequencing is established.

Classification cancelled / changed to: UNCLASSIFIED
By authority of: DRDA 7/DARFT 5-8/DAS Eng 6-4-5
Date: 5 Nov 1992
Signature: Laubrey
Unit / Rank / Appointment: DSIS 3, Secretary CRAD HQ DRP



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Date: September 1st, 1957
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INTRODUCTION

The following is a Weight & C.G. Summary of the C-105 MK 2 Production Aircraft, based on the latest weight estimates available.

All Weight and C.G. changes are relative to Issue 10 of August 1st, 1957.

GENERAL:

- a) Orenda PS 13 Engines comprise the Power Plant (4,500 lb each 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. Radar Astra I System is installed, weight & C.G. location being to the latest breakdown received from them, dated 3rd July 1957. The Sparrow III Auxiliaries, included in the breakdown, have been deleted, however, the Infra Red Tracker System has been re-instated as a requirement; some Avro installed Antennae have been added. (Total Weight = 2,741.0 lb).

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

The early MK 2 A/C will have the "Astra Minus" System installed (i.e. navigational and communication equipment only)

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

N. B. It should be noted that the early MK 2 Aircraft will not be as this summary designates, but will be flight test versions with instrumentation replacing the missile package etc. or for development of Astra I Radar System. etc.

1. STRUCTURE

WEIGHT (lb)

a) Wing:

Inner Wing = production drawing estimates of skins and
centre trailing edge structure

Total Wing Decrease

Ref. 2-1

= 25
= 25

b) Fin & Rudder

No Weight Change.

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INTRODUCTION

1. STRUCTURE

WEIGHT (lb)

c) Fuselage fwd. Sta. 255"

Radome - due to unsatisfactory electrical properties
solid laminate will replace the filled honey-
comb laminate

+ 75

Air Intakes - estimate of MK 2 design

= 3

Fwd. Fuselage Increase

+ 72

Ref. 2-1

d) Centre Fuselage Sta. 255"-485"

Production drawing estimates of Formers, armament bay
roof and C.F. Ducts

= 15

Centre Fuselage Decrease

= 15

Ref. 2-1

e) Duct Bay Sta. 485"-591.65"

Floating Duct - estimated to preliminary schemes
Joint items & H/Exchanger Duct
included here (were in Engine
Bay and Engine Group resp.)

+ 47

Total Duct Bay Increase

+ 18

+ 65

Ref. 2-1

f) Engine Bay Sta. 591.65"-742.5"

Engine Tunnel - increase in insulation based on MK 1A/C etc + 6

Joint Engine to Duct - deletion of allowance (see above) = 12

Total Engine Bay Decrease

= 6

Ref. 2-2

g) Rear Fuselage Sta. 742.5" Aft.

Fixed section 742.5"-803" - first estimates of formers etc + 15

Stinger & Tailcones - N155 cobalt based alloy to be used
with Titanium O/Skin on Tailcones,
previously weight recorded was for
an entirely Titanium structure

+ 168

Total Rear Fuselage Increase + 183

Ref. 2-2

h) Fuselage Joints

No Weight Change.

TOTAL STRUCTURAL INCREASE

+ 274

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INTRODUCTION

2. LANDING GEAR

WEIGHT (lb)

No Weight Change

3. POWER PLANT & SERVICES

Engines - Orenda's earlier estimate did not include inlet frames	+ 160
H/Exchanger Duct with floating duct (see above)	- 6
Fire Extinguishing System - Actual Weight of bottles	- 5
Fuel System - Miscellaneous design changes	+ 23
<u>TOTAL POWER PLANT & SERVICES INCREASE</u>	<u>+ 172</u>

Ref. 2-2

4. FLYING CONTROLS GROUP

No Weight Change

5. EQUIPMENT GROUP

Radar System: - Revised Weights from R.C.A. The I.R. Tracker System and Radar Homer Antenna, previously deleted from this report, have now been re-instated as basic requirements

<u>TOTAL EQUIPMENT GROUP INCREASE</u>	<u>+ 127</u>
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Ref. 2-2

SUMMARY

Weight Change - Aircraft Basic Weight

Structure	+ 274 lb.
Power Plant	+ 172 lb.
Equipment	+ 127 lb.
	<u>+ 573 lb.</u>

Weight Change - Operational Weight Empty (A/C less fuel)

Issue 10

Issue 11

44,516 lb

45,089 lb = 573 lb

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DETAILED WEIGHT CHANGES TO I.B.M.
TABULATED DETAILS OF AUG. 1st, 1957

WEIGHT CHANGES

WEIGHT (lb)

Wings:

- 36.70 I/W Skins - now estimated to production drawings, an error was made in the early estimates
 - + 11.71 I/W Centre Trailing Edge - production drawing estimates increases in caps and webs of beams, particularly # 4 and # 5 for rear engine mountings.
-
- 24.99

Front Fuselage Fwd. 255"

- + 75.50 Radome - solid laminate replaces sandwich construction the electrical properties of the lighter sandwich type are unsatisfactory.
 - 3.26 Air Intakes - estimated to production drawings for MK 2 design
-
- + 72.24

Centre Fuselage Sta. 255" - 485"

- + 9.63 Formers C.F. - production drawing estimates incorporating minor changes (approx. + 0.5 lb/former)
 - 6.94 Armament Bay Roof - production drawing estimates some design changes.
 - 17.34 Duct C.F. - alterations to allow for ram air duct doors (doors and mechanism are included with Air Conditioning see Equip. Group)
-
- 14.65

Duct Bay Sta. 485"-591.65"

- + 65.00 Floating Duct - estimated to preliminary scheme drawings - previously only allowances
 - + 46.75
 - Addition of Joint items (see Engine Bay
 - + 12.00
 - Addition of H/Exch. Duct (see Engine Group.
 - + 6.25
-
- + 65.00
- + 65.00

Engine Bay Sta. 591.65 - 742.5

- + 6.02 Engine Tunnel - increase in insulation weight based on tolerances of actual weights of MK 1 insulation
- Addition of floating duct support structure

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DETAILED WEIGHT CHANGES TO I.B.M.
TABULATED DETAILS OF AUG. 1st, 1957

WEIGHT CHANGES

WEIGHT (lb)

Engine Bay Sta. 591.65"-742.5" (cont'd.)

- 12.00 Joint Engine to Duct - cancelled, now included with floating Duct (see Duct Bay above)
- 5.98

Rear Fuselage Sta. 742.5" Aft.

- + 13.91 Formers Fixed R.F. - first estimates to MK 2 drawings
- + 0.84 Engine Doors - two hinge pins previously omitted
- + 15.27 Parachute Box & Stinger - redesigned, stinger now in N155, Cobalt based alloy, was previously recorded in Titanium.
- + 153.15 Tailcones - first estimate to MK 2 lines using preliminary gauges supplied by Stress Office, structure of N155 except O/Skin of Titanium. Possible further increases may be expected since proposed gauges tend to be too light.

+ 183.17

Power Plant & Services

- 5.00 Fire Extinguishing System - Actual weight of bottles as in MK 1 A/C
- + 154.00 Engines PSL3 - Engine C.G. moved forward by 2.00" Inlet frames were not included in Orenda's previous estimate. Heat Exchanger Duct now with Floating Duct. (see Duct Bay)
 - + 160.00
 - 6.00
 - + 154.00
- + 23.13 Fuel System - filter added between heat exchanger and Engine to reduce risk of Engine contamination
 - Fuel no-air valves Actual weight
 - = 3.5 lb manufacturer's weight was 3.0 lb (22 off)
 - Miscellaneous other changes
 - + 9.00
 - + 11.00
 - + 3.13
 - + 23.13

+ 172.13

Equipment Fixed & Removable.

- + 10.00 Radar fixed - Homer Antenna re-instated
- + 61.50 Radar Remov. - latest R.C.A. estimates, I.R. Tracker system re-inst. (70 lb)
- + 55.00 Missile Pack Electronics - latest R.C.A. estimate for Sparrow II auxiliaries (Sparrow III auxiliaries are not carried)

+ 126.50

+ 573.42 TOTAL WEIGHT CHANGES

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WEIGHT & C.G. SUMMARY

DESCRIPTION	WEIGHT lb.	H. ARM ins.	V. ARM. ins.
STRUCTURE	18,876.21	564.52	137.43
Wings	10,003.73	642.74	142.23
Fin & Rudder	1,024.00	754.25	209.28
Fuselage: Fwd. Sta. 255"	2,565.86	182.44	128.41
Sta. 255" - 485"	1,690.10	374.96	130.07
Sta. 485" - 591.65"	1,110.19	538.21	105.40
Sta. 591.65" - 742.5"	1,547.28	661.11	110.57
Sta. 742.5" Aft.	882.72	801.05	129.40
"Marry-up"	52.33	467.60	103.84
UNDERCARRIAGE - Retracted	2,551.77	487.22	134.79
Main Undercarriages	1,901.62	539.31	141.00
Main U/C Doors & Fairings	291.80	537.10	138.40
Nose Undercarriage	333.81	170.80	99.70
Nose U/C 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	1,780.64	685.55	140.51
Mechanical Flying Controls	946.48	687.84	148.61
Hydraulic Flying Controls	834.16	682.95	131.31
EQUIPMENT FIXED & REMOVABLE	8,229.95	328.80	112.39
Instruments	46.07	163.68	138.70
Probe	15.00	-38.14	108.00
Cockpit Pressure Sealing	5.00	186.00	130.00
Oxygen System	23.59	253.72	156.43
Ejector Seats	284.42	202.80	136.25
Air Conditioning System	856.00	333.49	134.98
Hydraulic Main System	623.15	502.78	117.75
Cabin Insulation	14.31	187.48	132.00
Brake Parachute	62.38	769.41	143.24
Electrical System	1,259.16	432.22	112.68
Low Pressure Pneumatics	55.70	416.79	123.99
Surface Finish	100.00	591.52	140.20
Intake De-icing Boots	51.84	197.02	118.00
Radome Anti-icing	8.88	51.49	125.00
Canopy Actuation	64.92	221.99	154.35
Cabin Consoles	17.45	174.76	124.34
Radar Door Actuation	10.00	268.00	95.00
M.H. 64 Damping System	139.13	449.26	135.57
Radio & Radar Removable	1,912.00	180.31	103.97
Radio & Radar Fixed	631.00	233.41	145.71

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WEIGHT & C.G. SUMMARY

DESCRIPTION	WEIGHT lb	H. ARM ins.	V. ARM ins.	M.A.C. %
<u>Equipment (Fixed & Removable) (cont'd.)</u>				
Sparrow Pack Structure	870.70	389.60	96.00	
Sparrow Pack Mechanisms	582.57	379.30	99.04	
Sparrow Pack Hydraulics	331.94	373.52	99.00	
Sparrow Pack Electronics	198.00	327.96	100.00	
Sparrow Pack Electrics	64.10	362.29	95.00	
Sparrow Pack Air Conditioning	2.64	309.93	104.15	
AIRCRAFT BASIC WEIGHT	42,239.24	546.36	128.40	
USEFUL LOAD (less fuel)	2,850.76	372.91	105.43	
Crew	430.00	194.00	136.50	
Oil	138.97	636.92	110.57	
Alcohol	22.00	93.00	138.00	
Engine Fire Extinguishing 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	45,090.00	535.40	126.95	27.46
U/C Down		537.52	123.44	28.05
O.W.E. less Missiles U/C Up	43,362.00	541.22	128.49	29.07
U/C Down		543.43	124.84	29.68
Normal Combat Mission Fuel * (2,044 gals. @ 7.8 lb/gal.)	15,940.00	542.03	142.30	
U/C Up		537.13	130.96	27.94
Normal Combat Weight U/C Down	61,030.00	538.70	128.37	28.37
Half Combat Mission Fuel (1,022 gals. @ 7.8 lb/gal.)	7,970.00	543.18	139.55	
U/C Up		536.57	128.84	27.78
Combat Weight (half Mission Fuel) U/C Down	53,060.00	538.37	125.86	28.28
Maximum Internal Fuel (2,492 gals. @ 7.8 lb/gal.)	19,438.00	541.85	144.16	
U/C Up		537.34	132.13	28.00
A.U.W. Maximum Internal Fuel U/C Down	64,528.00	538.82	129.68	28.41
Maximum External Fuel (500 gals. @ 7.8 lb/gal. + Drop Tank)	4,248.00	521.84	60.67	
U/C Up		536.38	127.72	27.73
A.U.W. Maximum Internal and External Fuel U/C Down	68,776.00	537.77	125.42	28.12

N.B. 1) * New figures are being prepared by Aerodynamics for Mission Fuel in accordance with latest PS 13 data, but these are not yet available.

2) Aircraft Datum = 120" above and arbitrarily chosen ground line.

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