

Date: April 1st, 1957
Aircraft: C-105 MK 1 with
J75 P3 Engines
1st A/C.



72.113-57/04

Report # 7-0400-44 Iss. 4
Sheet # 1-1
Prepared By: K. Griffin
Checked By: E. Burnett

INTRODUCTION

The following is a Weight & C.G. Summary for the 1st C-105 MK 1 Aircraft with J75 P3 Engines, based on the latest weight estimates available on March 31st 1957. All Weight and C. G. changes are relative to Issue 3 of March 1st 1957.

Note: This summary does NOT apply for the 2nd and subsequent MK 1 Aircraft see context below.

GENERAL

- a) Pratt & Whitney J75 P3 Engines comprise the Power Plant for the 1st Aircraft. J75 P5 Engines, which are partially redesigned versions of the P3 Engines, are to be installed on the 2nd and subsequent MK 1 Aircraft.
(J75 P3 Engines = 6,175 lb each; J75 P5 Engines = 5,950 lb each)
- b) An Instrument Package carrying Flight Test Instrumentation is installed, this also varies between first and subsequent aircraft. It should be noted that no allowance is yet made for other Flight Test installations throughout the aircraft, these will be introduced as information becomes available. A very preliminary check has been made on the Flight Test wiring and equipment installations, other than that housed within the pack and it is felt that the weight involved may well be in excess of 500 lb. A more accurate evaluation will be introduced on May 1st, 1957.
- c) Emergency jettison for the pack, emergency lowering for the Undercarriages and addition ~~emergency~~ fire protection, all to be installed on the 1st aircraft, are allowed for in this summary.
- d) An Interim Radio & Radar system is installed.
- e) It should be noted that due to material substitutions and shop variations introduced by planning or production departments there is a weight penalty to the structure to-date of 198 lb. This is all recorded in the structural weight breakdown. No account has been taken of concessions on machinings etc. since it is impossible to assess these.
- f) Pending Flight Test requirements a "Buzz Damping" system may be installed on the first aircraft. Provisions for this installation are already included in the Structure group. The "Buzz Damper" system weights are not currently recorded, but they incur a weight penalty of 134 lb if necessary.

1. STRUCTURE

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WEIGHT -(lb.)

a) Wing

I/W complete - no weight change.

Actual weights of Spars, Rib # 10 etc.

- 9

Machined panels replace honeycomb ones
on Centre T/Edge -

+ 15

Miscellaneous other changes to I/Wing

- 6

Ailerons - Actual weights

- 13

Aileron Control Box - some actual weights, some re-estimates

- 7

SECRET

45698

continued.

4046

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SECRET

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INTRODUCTION

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1. STRUCTURE: (Cont'd.)

a) Wing: (Cont'd)

WEIGHT (lb)

O/Wing - miscellaneous changes etc. Actual weights of
F/Spar & C/A/Spar

- 9

Weight Change Decrease
Ref. 2-1

- 29

b) Fin & Rudder

No weight change, although actual weight of Rudder now obtained.

c) Fuselage Fwd. Sta. 255"

Miscellaneous changes to re-issues of production drawings of
Formers, Bulkheads, Canopy Arches, Lower
Longerons etc.

+ 10

Air Intakes - redesigned ramp estimate to production drawings
(see weight change sheets for full details)

+ 26

Weight Change Increase
Ref. 2-2

+ 36

d) Centre Fuselage Sta. 255-485"

Miscellaneous production drawing changes

- 2

Weight change Decrease
Ref. 2-3

- 2

e) Duct Bay Sta. 485"-591.65"

No weight change.

f) Engine Bay Sta. 591.65-742.5"

No weight change

g) Rear Fuselage Aft Sta. 742.5"

Tail Cones - Shop variation on material used on Inner Angles
formers Sta. 822.75 & 840.75" .025 Steel used in
error (.018 & .016 resp. correct gauges)

+ 2

Weight Change Increase
Ref. 2-3

+ 2

TOTAL STRUCTURAL WEIGHT INCREASE

+ 7

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INTRODUCTION

2. LANDING GEAR

No Weight Change

WEIGHT (lb)

3. POWER PLANT & SERVICES

Fuel System - Estimates revised to latest drawings in Fuselage
Actual weights of proportioners in Wings

+ 10
+ 21

TOTAL POWER PLANT & SERVICES INCREASE

+ 31

N. B. J75 P3 Engines on 1st A/C only, 2nd and subsequent A/C have
J75 P5 Engines which are 225 lb/engine lighter than the P3
version.

Ref. 2-3

4. FLYING CONTROLS GROUP

No Weight Change.

5. EQUIPMENT GROUP

Interim Radio & Radar - deletion of some relays & duplication of
J2 compass flux valve.

- 6

Electrics - Fire detection wire added in Engine Bay

+ 7

Cockpit Insulation - Production drawing estimates

+ 2

Probe - re-estimated, this may be again redesigned

+ 4

Low Pressure Pneumatics - Piping changes etc.

+ 3

TOTAL EQUIPMENT GROUP INCREASE

+ 10

Ref. 2-3

6. OPERATIONAL LOAD

No Weight Change

SUMMARY

Weight Change - Aircraft Weight Empty

Structure	+ 7 lb
Power Plant & Services	+ 31 lb
Equipment	+ 10 lb
	+ 48 lb

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

Issue 3

45,192 lb

Issue 4

45,240 lb

+ 48 lb.

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

WEIGHT CHANGES

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WEIGHT (lb)

Wing:

-	6.23	I/W Spars - Actual Weight of Main Spars	-	3.50
		Actual Weight of machinings of Rear Spar etc.	-	3.80
		F/Spar I/B end design change	+	1.25
		Miscellaneous items.	-	0.18
			-	6.23
-	2.44	Rib # 10 - Actual Weight obtained		
+	3.28	Centre Trailing Edge - Machined panels replace honeycomb panels in early aircraft	+	15.34
		Fire Extinguisher brackets already in centre box assy.	-	0.72
		Engine pick ups no longer needed with redesigned rear engine mounting	-	5.06
		Miscellaneous production drawing estimates	-	6.28
			+	3.28
+	5.70	Skins M/S to R/S - addition of brackets & angles for dorsal fairing etc.	+	13.23
		hardware overestimated	-	7.53
			+	5.70
-	0.40	Dorsal Fairing I/W - complete redesign from early scheme drawing estimates now fully on production drawings		
-	12.66	Ailerons - Actual Weight of production Aileron, less buzz damping structural provisions, was obtained		
+	1.60	Rib # 12 - Design changes to hardware including addition of nut plates	+	1.86
		Miscellaneous alterations	-	0.26
			+	1.60
-	0.57	O/Wing Posts and Intercostals - completely checked and re-estimated.		
-	6.74	Aileron Control Box - Actual Weights of hinge spar and ribs # 2,5,6A and 8	-	3.59
		Addition of nut plates to ribs	+	1.95
		Control box to O/Wing joint		
		hardware was overestimated	-	4.53
		Miscellaneous changes	-	0.57
			-	6.74
-	10.35	O/W Spars - Actual weight of Front Spar	-	3.38
		Actual weight of Centre Spar Aft	-	6.38
		Miscellaneous changes to drawings	-	0.59
			-	10.35
-	28.81			

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

WEIGHT CHANGES

WEIGHT (lb)

Fin & Rudder:

0.00 Rudder - Actual weight obtained.

0.00

Fuselage Fwd. Sta. 255"

+	0.80	Canopy Arches - minor design changes on production drawing re-issues		
+	0.55	Lower Longerons F.F. - minor design changes, production drawing re-issues.		
+	0.11	Bulkhead Sta. 255" - Angles added to marry-up assy.	+	1.45
		Details of hardware estimated	-	1.34
			+	0.11
+	1.92	Bulkhead Sta. 120" - Addition of 6 shear pin fittings, lipped angles etc. for Radome attach.		
+	1.48	Pilot & Navigator's Bulkheads - Actual weight of seat fittings	+	0.35
		Addition brackets for systems and canopy emergency operation	+	3.39
		Uplock mounting - already included elsewhere and duplicated here	-	2.26
			+	1.48
+	4.38	Formers F.F. - repair scheme to lower formers 188.4" and 194.9 as Stress Office requirement to cater to re-designed Intake Ramp		
+	26.36	Air Intakes - re-design structure first estimate to production drawings		
		Formers Sta. 228, 237.5 & 246 miscellaneous brackets etc.	+	3.10
		Heat Exchanger and Boundary Layer Duct.	+	3.51
		Former Sta. 201.4 addition of heavy extruded angles	+	6.38
		Former Sta. 214.43, brackets added	+	3.06
		Duct side skins .04 were .032 Al.	+	2.62
		Conduit added	+	1.20
		Former Sta. 207.93-brackets etc. added	+	3.19
		Former Sta. 175.5 - lighter, smaller cross sectional area	-	3.43
		Miscellaneous changes mainly due to increase in dias. of posts etc. in truss structure	+	6.73
			+	26.36
+	35.60			

Centre Fuselage Sta. 255"-485"

+	0.89	Miscellaneous items C.F. - Alterations to marry-up hardware of component 54 items		
-	2.92	Pack Mounting Structure - Receptacles now included with skins	-	2.54
		Miscellaneous changes on production drawings, was estimated to scheme drawings	-	0.38
			-	2.92

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

WEIGHT CHANGES

WEIGHT (lb)

Centre Fuselage (Cont'd)

+ 0.27 Armament Bay Roof - clips added for pack pick-ups
- 1.76

Rear Fuselage Sta. 742.5" Aft.

+ 2.44 Tail Cones removable R.F. - Variation from shops on I/B
angles of Formers 822 and 840 made in .025 steel
by mistake, should be .018 & .016 respectively.
+ 2.44

Joints Fuselage

+ 0.41 Joint F.F. to C.F. - straps increased to .04 were .032 due
to skin dimpling difficulties.
+ 0.41

Engine Group

+ 2.21 Engine Mountings - production drawing estimates of redesigned Rear Engine Mounting	
- 2.78 Engine Mounting Accessories - redesign locating block also now in Steel was in Inconel X.	
+ 31.05 Fuel System - Actual Weight of proportioner units in I/W Wing obtained - weight recorded was early estimate Addition of regulators and switches at Sta. 485" in C.F. Miscellaneous changes due to entire re-estimate of Fuselage portion of system.	+ 21.76 + 8.47 + 0.82
	+ 31.05
+ 30.48	

Equipment Fixed and Removable:

- 4.20 Interim Radio & Radar - deletion of 6 relays from junction box R 2.	
- 1.30 J2 Compass - flux valve already included above.	
+ 7.18 Electrics E.B. - Installation of Fire Detection Wiring in the Duct Bay and Engine Bay.	
+ 2.40 Cock-pit Insulation - first estimate to drawings	
+ 10.29 Low Pressure Pneumatics - Piping for machmeter, altimeter, rate of climb indicator and forward pitot piping added (see below)	
- 4.50 Probe - Low Pressure Pneumatics included above Probe & sensor re-estimate to scheme drawings	- 8.00 + 3.50
	- 4.50
+ 9.87	
+ 48.23 TOTAL WEIGHT CHANGES	

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Report # 7-0400-44-4
Sheet # 3-1
Prepared By: J. Struik
Checked By: K. Griffin

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	18,487.74	562.77	137.53
Wing	9,996.13	643.15	142.13
Fin & Rudder	1,029.70	754.74	209.56
Fuselage: Fwd. Sta. 255"	2,583.44	181.20	128.09
Sta. 255"-485"	1,650.42	379.43	130.03
Sta. 485"-591.65"	1,001.05	533.92	104.67
Sta. 591.65-742.5"	1,402.24	660.72	107.45
Sta. 742.5 Aft.	772.18	800.51	129.11
Marr-up	52.58	468.91	103.89
UNDERCARRIAGE - Retracted	2,612.33	488.81	134.66
Main Undercarriage	1,959.62	539.48	141.00
Main U/C Doors & Fairings	294.36	539.29	136.01
Nose Undercarriage	333.81	170.81	99.70
Nose U/C Door & Fairing	24.54	162.24	88.23
POWER PLANT & SERVICES	14,261.69	654.19	120.22
Engines & Accessories	12,557.91	664.92	119.80
Gear Box Installation on Fuselage	280.14	601.46	102.53
Gear Box & Starter on Engine	263.07	591.77	104.40
Engine Controls	32.43	375.76	118.62
Engine De-Icing	70.37	562.80	115.09
Fire Extinguishing System	70.46	702.44	134.83
Engine Mountings	198.75	635.50	127.97
Fuel System	788.56	542.92	135.65
FLYING CONTROLS GROUP	1,819.56	687.03	139.99
Mechanical Flying Controls	942.92	688.24	148.66
Hydraulic Flying Controls	876.64	685.72	130.67
EQUIPMENT FIXED & REMOVABLE	7,090.44	385.48	110.64
Instruments	46.07	163.68	138.70
Probe	18.50	-40.00	108.00
Cockpit Pressure Sealing	5.00	186.00	130.00
Oxygen System	43.44	227.72	142.18
Air Conditioning System	738.02	336.49	134.76
Surface Finish	100.00	591.52	140.20
Hydraulics Main System	587.49	498.76	116.66
Cabin Insulation	14.31	187.48	132.00
Brake Parachute	62.38	769.41	143.24
Electrical System	1,105.89	419.52	112.93
Low Pressure Pneumatics	49.30	444.28	125.94
Intake De-icing Boots	51.84	197.02	118.00
Canopy Actuation	62.05	222.11	154.47
Cabin Consoles	17.45	174.76	124.34
Ejector Seats	186.00	201.10	136.25
Interim Radio & Radar	699.13	322.30	123.46
Instrument Pack Structure	670.61	385.90	94.71
Instrumentation - 1st A/C	2,447.00	389.50	95.00
Additional Fire Protection 1st A/C	154.17	425.05	102.89
Emergency Landing Gear Lowering	12.91	458.83	128.60
		continued.	

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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>
<u>Equipment (Fixed & Removable) (Cont'd.)</u>				
Radome Anti-Icing	8.88	51.49	125.00	
AIRCRAFT WEIGHT EMPTY	44,271.76	564.57	127.57	
USEFUL LOAD (less Fuel)	968.02	354.76	132.64	
Crew	430.00	194.00	136.50	
Oil	134.23	608.92	115.68	
Alcohol - radome de-icing	22.00	93.00	138.00	
Engine Fire Extinguisher Fluid	25.00	730.00	129.00	
Residual Fuel	218.40	553.98	134.04	
Oxygen Charge	13.39	259.69	159.91	
Water for Air Conditioning	125.00	268.00	132.00	
Operational Weight Empty U/C Up	45,239.78	560.08	127.68	34.27
U/C Down		562.24	124.10	34.86
Max. Internal Fuel (2,544 gals. @ 7.8 lb/gal.)	19,843.00	538.88	144.32	
A.U.W. Max. Internal Fuel U/C Up	65,082.78	553.62	132.75	32.49
U/C Down		555.12	130.26	32.90

★ A/C datum is considered to be 120" above an arbitrary ground line.

Above figures are for the Aircraft in the unballasted condition.

If the most Aft point on the C.G. Envelope is to be ballasted to 31% M.A.C. then the 1,382 lb of ballast at Sta. 89.16", as currently provided for on Former Sta. 68.5" and the shear panel, is necessary, plus a further 96 lb on the shear panel (i.e. Total 1,478 lb)

HORIZONTAL CG ENVELOPE

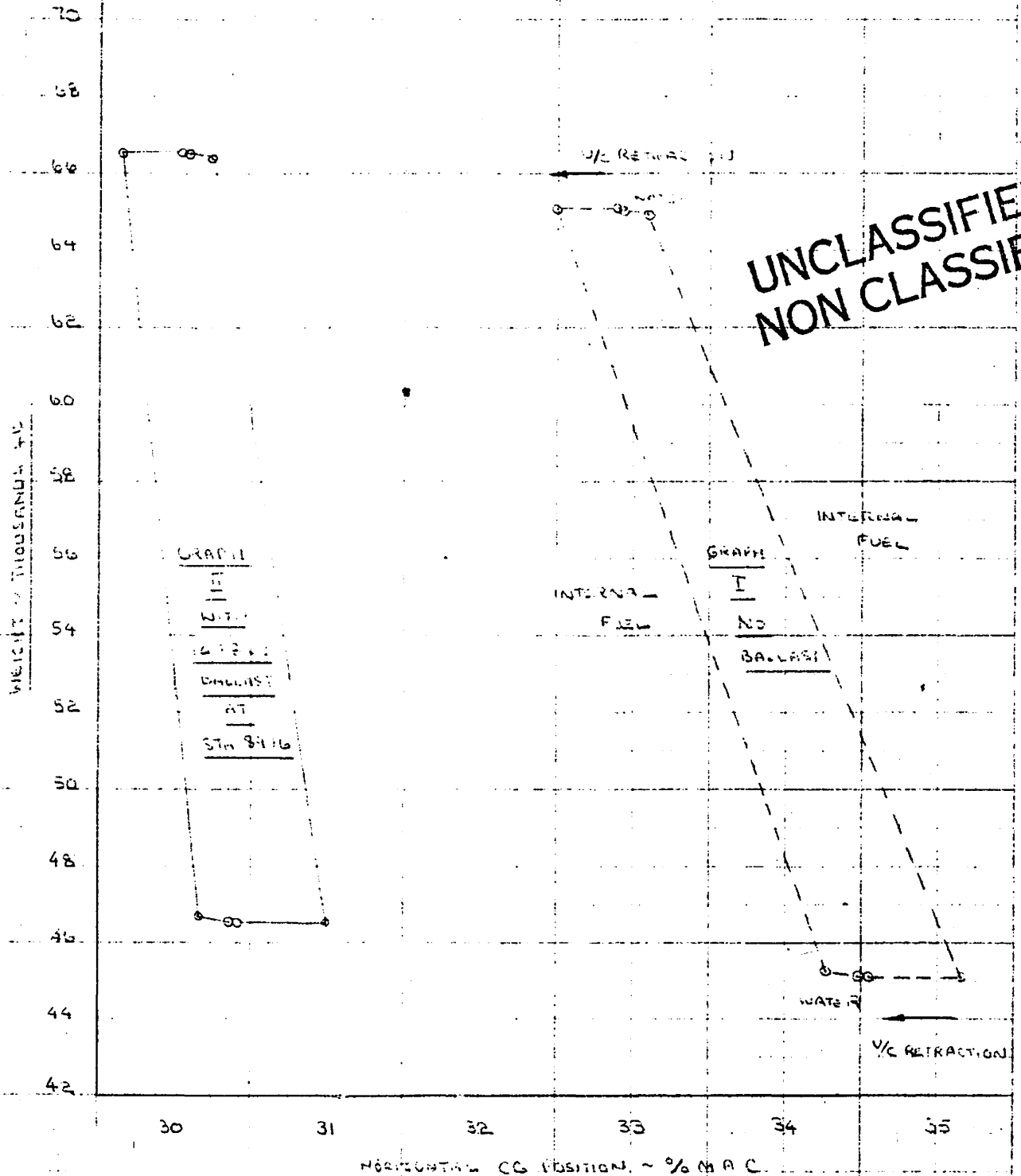
CRUISE 100% V/C FLIGHT CONDITIONS

WITH J75 (3 ENGINES) (20% FUEL) (10% FUEL) (10% FUEL)

1) INTERIM RADIO & RADAR

2) FUEL SYSTEM PROPORTIONERS

3) INSTRUMENT PACKAGE



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REGIST. NO. 7-6400-4A-4

HORIZONTAL C.G. ENVELOPE

CROSSING 1ST A/C FLIGHT CONDITIONS

BY: KAROLAN J. BROWN

DATE: April 15, 1967

WITH

PROPOSED FUEL SYSTEM SEQUENCING

SEQUENCING ORDER: (as per PWTS/121)

R.H.S. 1, 2, 3, 4, 7, 5 (denoted R₁, R₂ etc.)

L.H.S. 2, 8, 7, 6, 3, 4, 2, 5 (denoted L₁, L₂ etc.)

--- L --- U/C EXTENDED

U/C RETRACTED

b₅

U/C RETRACTION

b₆

WATER & ALCOHOL

b₄

b₂

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GALLAST INSTALLED

1476 LG. AT STR 84.16

WEIGHT IN THOUSANDS

52

54

56

58

60

62

64

66

68

70

72

74

76

78

80

82

84

86

28

30

32

34

36

WATER & ALCOHOL

U/C RETRACTION

HORIZONTAL C.G. POSITION - % M.A.C.