Report # 7-0400-44 Iss. 9

Date: September 1st, 1957
Aircraft: C-105 MK 1 with
J75 P3 Engines
1st Aircraft

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N. B. The C.G. Envelope for the 1st A/C with fuel sequencing has been omitted until a fully approved sequencing is established.

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INTRODUCTION & WEIGHT CHANGES

The following is a Weight & C.G. Summary for the 1st C-105 Aircraft, with J75 P3 Engines, based on latest information currently available. All weight and C.G. changes are relative to Issue 8 of August 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 Instrumentation is installed, this also varies, the package for Aircraft No. 1 to 3 differing from those for Aircraft No. 4 & 5 (which are to be used for Astra I Trial Installations). A relatively detailed estimate of other Flight Test Installations throughout the Aircraft has been made. Twin shielded wire at 27 lb/1000 ft is used, there being approximately 250 monitored points. These installations amount to 1,323 lb (figure partially confirmed by actual weights of cable assys.).

c) Emergency lowering for the undercarriages and additional fire protection, to be installed on the 1st Aircraft are allowed for in this summary. There is no provision to jettison any or all of the Instrument Package in an emergency.

d) An Interim Radio & Rador System is installed.

e) It should be noted that due to material substitutions and concessions introduced by Planning & Production Departments there is a weight penalty, to-date, to the structure of 203 lb. This is all recorded in the Structural weight breakdown. No account has been taken of variations on machinings etc. nor of shop repair schemes, since it is impossible to assess these, except where actual weights have been obtained.

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 structural group as modifications to the Control Boxes. For the first flight the control surfaces will be unmodified, however, if the need for Dampers is proven, a modified set of Control Surfaces will be made available.

The following weight penalties ensue:-

Ailerons	+ 11.68 lb/A/C
Elevators	+ 11.07 lb/A/C
Rudder	+ 8.78 lb/
Equipment & Installation	+ 123.97 lb
	+ 155.50 lb

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GENERAL (Cont'd.)

g) A considerable number of Actual Weights have now been obtained. Structural weights are checking within 0.5% of estimates on sub-assemblies etc. However, equipment (excluding Engines and Gear Boxes) shows a consistant increase averaging about 11% over manufacturer's quotations or initial specification weights. Preceeding the report titles on the I.B.M. Tabulation Sheets, will be found a number varying from 0 to 100, this is the percentage actual weight recorded within the report.

A summary of Actual Weights obtained so far is as follows:

Structure	69.52%
Undercarriage	67.21%
Power Plant	92.40%
Flying Controls	26.66%
Equipment	19.40%

i.e. 64.68% of the Basic Weight of the Aircraft.

h) The Aircraft is ballasted such that the C.G. on a flight envelope does not travel aft of 31% M.A.C.
However, C.G. Envelopes showing fuel sequencing have currently been omitted until a fully approved sequencing is established.
(N.B. Indications are that for first flights, desirable C.G's are from 28% - 29% M.A.C., this may be achieved by further ballasting or by fuel sequencing with restrictions on the usage of certain tanks imposed.)

1. STRUCTURE	WEIGHT (lb)
a) Wing:	
O/W Aileron Control Box - Actual Weight obtained.	- 3.90
WEIGHT DECREASE WING	- 3.90
b) Fin & Rudder	
No Weight Change.	
c) Fuselage Fwd. Sta. 255"	
Radar Nose Structure - reinforcing plates added on Shear Panel, Miscellaneous brackets added etc.	+ 2.29
Radar Nose Doors - packing added.	+ 0.06
WEIGHT INCREASE FRONT FUSELAGE	+ 2.35
d) Centre Fuselage Sta. 255"-485"	
No. Weight Change.	

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1. STRUCTURE (cont'd)	WEIGHT (lb)
e) Duct Bay Sta. 485"-591.65"	
Floating Duct - minor changes to gill doors	+ 1.29
The duct weight was checked by weighing, estimate & actual weight tallied	
WEIGHT INCREASE DUCT BAY	+ 1.29
f) Engine Bay Sta. 591.65" - 742.5"	
Heavy Formers - Actual weights of machinings, increases probably due to tolerances	+ 3.01
Intermediate Formers - 65% Actual weights obtained	- 0.11
Engine Tunnel - Actual weights of sub-contracted insulation blankets, foil tolerances appear to account for increases.	+ 8.08
WEIGHT INCREASE ENGINE BAY	+ 10.98
g) Rear Fuselage Sta. 742.5" Aft.	
A Rear Fuselage from Sta. 742.5" - 803" was weighed, less insulation blankets, and the actual weight checked satisfactorily with that estimated.	
Engine Doors - Actual weights of Insulation blankets, foil tolerances appear to account for increases	+ 2.15
Tunnel Fixed R.F. - Actual weights of Insulation blankets	+ 6.14
Stinger & Parachute Box - Actual weights of Insulation blankets	+ 0.93
Trial installation of aft ramp-parachute box	+ 2.02
Tailcones - general production drawing revisions and alterations	+ 4.87
WEIGHT INCREASE REAR FUSELAGE	+ 16.11
TOTAL STRUCTURAL INCREASE	+ 26.83
2. LANDING GEAR	
No Weight Change	
3. POWER PLANT & SERVICES	
Engine Mounts - Actual weights, increases probably due to machinings tolerances	+ 2.57
Fire Extinguishing System - Actual weights of bottles	- 5.00
Fuel System - addition of filters to minimize risk of Engine contamination	+ 5.45
Fuel no-air valves actual weight = 3.50 lb was quoted at 3.0 lb 22 Off 1 Aircraft	+ 11.00
Error in estimate of bag spacers in fuselage	+ 2.18
Misc. other fuel system changes	+ 3.09
TOTAL POWER PLANT & SERVICES INCREASE	+ 29.29

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4. FLYING CONTROLS GROUP	WEIGHT (lb)
No Weight Change.	

5. EQUIPMENT GROUP	
Emergency Ram Air Turbine - previous allowance considered insufficient	+ 15.00
Utility Hydraulics D.B. - a production pressure control valve 7-1958-14 failed under test, so on the 1st A/C the heavy original test valve will be installed.	+ 6.07
TOTAL EQUIPMENT GROUP INCREASE	+ 21.07

SUMMARY

Weight Change - Aircraft Basic Weight

Structure	+ 26.83 lb.
Power Plant	+ 29.29 lb.
Equipment	+ 21.07 lb.
	+ 77.19 lb.

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

Issue 8	Issue 9	
47,596.32 lb.	47,673.51 lb.	= 77.19 lb.

N. B. If Aircraft Ballasted such that the C.G. in any flight envelope (not including ~~some possible~~ fuel sequencing) does not exceed 31% M.A.C. a further 945 lb. of ballast are necessary.

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1st A/C

WEIGHT & C.G. SUMMARY

DESCRIPTION	WEIGHT lb.	H. ARM ins.	V. ARM ins.
STRUCTURE	18,520.20	562.05	137.55
Wings	9,959.46	642.86	142.25
Fin & Rudder	1,025.85	754.34	209.31
Fuselage: fwd. Sta. 255"	2,619.36	181.42	128.14
Sta. 255"-485"	1,650.12	379.76	130.80
Sta. 485"-591.65"	998.59	534.01	104.59
Sta. 591.65"-742.5"	1,429.16	661.00	107.32
Sta. 742.5" Aft.	785.08	800.55	129.04
"Marry-Up"	52.58	468.91	103.89
UNDERCARRIAGE - Retracted	2,609.85	488.48	134.94
Main Undercarriages	1,959.62	539.48	141.00
Main U/C Doors & Fairings	291.88	536.80	138.48
Nose Undercarriage	333.81	170.81	99.70
Nose U/C Door & Fairing	24.54	162.24	88.23
POWER PLANT & SERVICES	14,351.71	653.10	120.35
Engines & Accessories J75 P3	12,562.29	664.92	119.78
Gear Box Installation on Fuselage	275.54	601.39	102.98
Gear Box & Starters on Engines	259.65	591.55	104.52
Engine Controls	32.43	375.76	118.62
Engine Nose Bullets	71.01	562.74	115.07
Fire Extinguishing System	65.46	700.45	134.21
Engine Mountings	206.21	635.04	127.71
Fuel System	879.12	536.86	136.38
FLYING CONTROLS GROUP	1,844.26	686.29	139.65
Mechanical Flying Controls	946.48	687.84	148.61
Hydraulic Flying Controls	897.78	684.66	130.21
EQUIPMENT FIXED & REMOVABLE	9,364.47	401.44	110.28
Instruments	46.07	163.68	138.70
Probe	15.00	-38.14	108.00
Cockpit Pressure Sealing	5.00	186.00	130.00
Ejector Seats	284.42	202.80	136.25
Oxygen System	23.59	253.72	156.43
Air Conditioning System	807.28	335.60	134.45
Surface Finish	100.00	591.52	140.20
Hydraulics Main System	629.22	503.61	117.70
Cabin Insulation	14.31	187.48	132.00
Brake Parachute	62.38	769.41	143.24
Electrical System	1,111.10	418.87	112.78
Low Pressure Pneumatics	53.15	427.62	124.55
Intake De-icing Boots	51.84	197.02	118.00
Canopy Actuation	64.92	221.99	154.35
Cabin Consoles	17.45	174.76	124.34
MH 64 Damping System	139.13	449.26	135.57
Interim Radio & Radar	642.98	301.79	120.38
Radome Anti-icing	8.88	51.49	125.00
Instrument Pack Structure	686.80	385.81	94.60
Pack Instrumentation 1st A/C	3,036.00	395.45	95.00

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WEIGHT & C.G. SUMMARY

DESCRIPTION	WEIGHT lb	H.ARM ins.	V. ARM ins.	M.A.C. %
Equipment (Fixed & Removable)(Cont'd.)				
Flight Test Installations	1,322.87	499.20	112.01	
Additional Fire Protection 1st. A/C	154.17	425.05	102.89	
Emergency Landing Gear Lowering	12.91	458.83	128.60	
Emergency Ram Air Turbine	75.00	265.00	100.00	
AIRCRAFT BASIC WEIGHT	46,690.49	558.62	126.73	
USEFUL LOAD (less fuel)	983.02	353.44	132.63	
Crew	430.00	194.00	136.50	
Alcohol - radome de-icing	22.00	93.00	138.00	
Engine Fire Extinguishing 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	140.00	268.00	132.00	
Oil	134.23	608.92	115.68	
BALLAST	945.00	86.48	116.50	
U/C Up		545.30	126.63	30.19
Operational Weight Empty	48,618.51			
U/C Down		547.31	123.30	30.75
Maximum Internal Fuel (2,544 gal. @ 7.8 lb/gal.)	19,843.00	538.88	144.32	
U/C Up		543.44	131.76	29.68
A.U.W Maximum Internal Fuel	68,461.51			
U/C Down		544.87	129.39	30.07

N.B. 1) A/C Datum is considered to be 120" above an arbitrarily chosen ground line.

2) The above figures are for the Aircraft in the BALLASTED Condition such that the Aft C.G. on the horizontal C.G. Envelope does not exceed 31% M.A.C. i.e. 303 lb on former Sta. 68.5" and 642 lb on the Shear Panel.

HORIZONTAL C.G. ENVELOPES

C105 MK1 A/C FLIGHT CONDITIONS

WITH JT3C/P3 ENGINES (2ND & SUBS A/C JT3P6)

a) INTERIM RADIO & RADAR

b) INSTRUMENT PACE & FLIGHT TEST INSTALLATIONS

c) FUEL SYSTEM PROPORTIONERS

BY

DATE Sept 1st

SHEET : 3