Report # 7-0400-44 Issue 7
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C-105 MK 1 WITH J75 P3 ENGINES 1st AIRCRAFT

I N D E X

INTRODUCTION & WEIGHT CHANGES

The following is a Weight and C.G. Summary for the 1st C-105 Aircraft, with J75 P3 Engines, based on the latest weight estimates currently available. All Weight and C.G. changes are relative to Issue 6 of June 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 packs 1 to 3 and those for 4th and 5th Aircraft. Information based on Flight Test Layout of June 18/57.
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 as yet, no provision to jettison any or all of the Instrument package in an emergency.

d) An Interim Radio and Radar System is installed.

e) It should be noted that due to material substitutions and concessions introduced by Planning or 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 flights 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	+ 8.50 lb
Equipment & Inst.	+125.17 lb
	+156.42 lb

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g) A considerable number of Actual Weights have now been obtained. Structural weights are showing very insignificant deviations from the calculated weights, but equipment shows a consistant increase averaging about 11% over manufacturers quotations or 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 -	42.30%	Actual Weight
Undercarriage -	70.07%	" "
Power Plant -	4.80%	" "
Flying Controls	-23.28%	" "
Equipment	-17.02%	" "

i.e.26.53% 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.

1. STRUCTURE

a) Wing:

	WEIGHT (lb)
I/W Fuselage Hinge Joint - Actual wts of most hinges	- 11.84
I/W Centre Trailing Edge - Actual wts of beams # 1 to 6, skins, panels, extrusions etc.	+ 0.74
I/W Strut. Pick-up Fittings - over 70% actual weights	- 0.31
Elevator Control Box - Actual Weights of ribs, spars, etc.	+ 1.21
WEIGHT DECREASE WING	- 10.20

b) Fin & Rudder

No WEIGHT CHANGE

c) Fuselage fwd. Sta 255 ins.

Pilot's Canopy - .04 AI Inner Skin replaces .051 Mg. Skin due to forming difficulties	+ 0.73
Top Longerons - Actual Weights of fitting etc.	+ 0.78
FWD. FUSELAGE INCREASE	+ 1.51

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d) Centre Fuselage Sta. 255 - 485"

Formers	- miscellaneous prod. dry changes	+0.38
Skin	- repair scheme at Stringer # 11 aft end	+1.34
Bulkhead Sta. 485	- minor equip. bracketry added	+1.16
	CENTRE FUSELAGE INCREASE	+2.88

A Centre Fuselage less dorsal fairings and structure below the lower longerons was weighed. After allowing for shortages and equipment installed, the actual weight checked to within 0.2% of the estimate. Consequently all structural parts included in that section weighed are considered 100% Actual Weight.

e) Duct Bay Sta. 485 - 591.65

NO WEIGHT CHANGE

f) Engine Bay Sta. 591.65 - 742.5

NO WEIGHT CHANGE

g) Rear Fuselage Sta 742.5 aft

Rudder Fairing	- Actual Weight of parabrake socket	+0.06
	Actual Weight of Upper I/B Longeron	+0.04
	REAR FUSELAGE INCREASE	+0.10

TOTAL STRUCTURAL DECREASE -5.71

2. LANDING GEAR

Main U/C Doors	- Actual Weights of 25% of parts	-0.88
	TOTAL LANDING GEAR INCREASE	-0.88

3. POWER PLANT & SERVICES

Fuel System	- general production drawing changes, actual weights of some equipment etc.	+10.00
	TOTAL POWER PLANT INCREASE	+10.00

4. FLYING CONTROLS GROUP

NO WEIGHT CHANGE

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5. EQUIPMENT GROUP

Instrument Pack Structure	- proposed addition of access panels	+ 2.00
Pack Instrumentation	- revised estimate by Flight Test	+689.00
	allowance for pack ejection deleted	-100.00
Flight Test Installations	- previously an allowance of 710 lb was carried. Sufficient data has since become available to make a reasonable weight estimate - in some cases cable assys. were weighed - all estimates based on incomplete data have the concurrence of Flight Test.	+612.37
	TOTAL EQUIPMENT INCREASE	+1203.37

SUMMARY

Weight Change - Aircraft Weight Empty

Structure	- 5.71
Landing Gear	- 0.88
Power Plant	+ 10.00
Equipment	+1,203.37
	1,206.78

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

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46,201.25	47,408.03	+ 1,206.78 lb

N.B.* A/C in UNBALLASTED Condition. If ballasted such that aft. C.G. does not exceed 31% MAC a further 1,004 lb. of ballast are necessary.

WEIGHT & C.G. SUMMARY

Description	WEIGHT lb.	H. ARM ins.	V. ARM ins.
STRUCTURE	18,495.53	561.90	137.59
Wings.	9,965.10	642.93	142.25
Fin & Rudder	1,025.85	754.34	209.31
Fuselage fwd. Sta. 255"	2,617.01	181.50	128.15
Sta. 255"-485"	1,650.12	379.76	130.80
Sta. 485"-591.65"	997.30	533.97	104.59
Sta. 591.65"- 742.5"	1,418.18	660.80	107.30
Sta. 742.5 Aft.	769.39	800.60	129.11
" Marry Up "	52.58	468.91	103.89
UNDERCARRIAGE RETRACTED	2,608.89	488.46	134.94
Main Undercarriages	1,959.62	539.48	141.00
Main U/C Doors & Fairings	290.92	536.83	138.49
Nose Undercarriage	333.81	170.81	99.70
Nose U/C Door & Fairing	24.54	162.24	88.23
POWER PLANT & SERVICES	14,320.35	653.01	120.25
Engines & Accessories J75 P3	12,560.22	664.92	119.78
Gear Box Installation on Fuselage	275.54	601.39	102.98
Gear Boxes & Starters on Engine	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	70.46	702.44	134.83
Engine Mountings	203.64	609.88	123.63
Fuel System	847.40	536.57	136.16
FLYING CONTROLS GROUP	1,827.07	686.88	140.02
Mechanical Flying Controls	946.48	687.84	148.61
Hydraulic Flying Controls	880.59	685.84	130.78
EQUIPMENT FIXED & REMOVABLE	9,173.17	402.30	110.21
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	23.59	253.72	156.43
Air Conditioning System	794.82	336.05	134.34
Surface Finish	100.00	591.52	140.20
Hydraulics Main System	609.09	500.86	117.57
Cabin Insulation	14.31	187.48	132.00
Brake Parachute	62.38	769.41	143.24
Electrical System	1,117.89	417.17	112.83
Low Pressure Pneumatics	53.15	427.62	124.55
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	284.42	202.80	136.25

WEIGHT & C.G. SUMMARY

Description	WEIGHT lb.	H.ARM ins.	V.ARM ins.	M.A.C. %
Interim Radio & Radar	690.98	322.67	123.64	
Radome Anti-Icing	8.88	51.49	125.00	
Instrument Pack Structure	686.80	385.81	94.68	
Pack Instrumentation 1st A/C	3,036.00	395.45	95.00	
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	
AIRCRAFT BASIC WEIGHT	46,425.01	559.26	126.78	
USEFUL LOAD (LESS FUEL)	983.02	353.44	132.63	
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 Ext. 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	
BALLAST	1,004.00	86.97	116.5	
Operational Wt. Empty U/C Up	48,412.03	545.28	126.69	30.19
Operational Wt. Empty U/C Down		547.30	123.34	30.74
Maximum Internal Fuel (2,544 gals. @ 7.8 lb/gal.)	19,843.00	538.88	144.32	
A.U.W. maximum Int.Fuel U/C Up	68,255.03	543.42	131.82	29.67
A.U.W. maximum Int.Fuel U/C Down		544.85	129.44	30.07

N.B. 1) A/C Datum is considered to be 120 ins. 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. Flight Envelope does not exceed 31% M.A.C. i.e. 303 lb on Former Sta. 68.5 and 701 lb on the Shear Panel.

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BY: Kathleen [illegible]
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SHEET: 3-1

HORIZONTAL C.G. ENVELOPE

105 MK1 A/C FLIGHT CONDITIONS

WITH J75 P3 ENGINES (2nd & SUBSEQUENT A/C J75 P5)

1) INTERIM RADIO & RADAR

2) INSTRUMENT PACK & FLIGHT TEST INSTALLATIONS

3) FUEL SYSTEM PROPORTIONERS