

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

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 UNCLASSIFIED
 NON CLASSIFIED
 Report # 7-0100-11 Issue 8

Classification 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: DSIS 3, Secretary CRAD HQ DRP

I N D E X

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1-1 to 1-4	Introductory notes and explanations of weight changes.
2-1 to 2-2	Weight & C.G. Summaries
3-1	Horizontal C.G. Envelopes for Flight conditions with fuel proportioners used.
4-1 to 4-15	I. B. M. detail sheets of weights and C.G.'s.

N. B. The C.G. envelope for the 1st Aircraft 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 & C.G. changes are relative to Issue 7 of July 1st, 1957.

Note:- This Summary does not apply for the 2nd and subsequent MK 1 A/C - 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 Aircraft No 1 to 3 and the installation for the 4th & 5th Aircraft (which are to be used for Astra 1 trial Installations.)
A relatively detailed estimate of other Flight Test Installations throughout the Aircraft has been made. Twin shielded wire at 27lb/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 A/C, 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 & Radar 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 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	+ 8.78 lb
Equipment & Installation	+123.97 lb
	<u>+155.50 lb</u>

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INTRODUCTION & WEIGHT CHANGES

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) shows a consistent increase averaging about 11% over manufacturers quotations or initial specification weights. Preceding 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	63.58% Actual Weight
Undercarriage	67.21% Actual Weight
Power Plant	91.59% Actual Weight
Flying Controls	26.66% Actual Weight
Equipment	19.35% Actual Weight

i.e. 62.06% 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 Centre Trailing Edge

- 1.74

N.B. A complete Inner Wing ~~less~~ elevator control boxes, U/C doors & fairings and some minor shortages was weighed. The Actual Weight obtained, using Electronic Weighing Cells was approximately 25 lb lighter than estimated. i.e. within 0.4%. Since the accuracy of the weighing cells is not guaranteed beyond these limits - the estimated weight will be left unchanged but assumed 100% Actual Weight.

WEIGHT DECREASE WING

- 1.74

b) Fin & Rudder

A complete Fin was weighed, but there was no apparent weight change.

c) Fuselage Fwd. Sta. 255"

No Weight Change.

d) Centre Fuselage Sta. 255"-485"

No Weight Change.

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INTRODUCTION & WEIGHT CHANGES

<u>1. STRUCTURE (cont'd)</u>	<u>WEIGHT (lb)</u>
e) <u>Duct Bay Sta. 485"-591.65"</u>	
No Weight Change	
f) <u>Engine Bay Sta. 591.65" - 742.5"</u>	
No Weight Change	
g) <u>Rear Fuselage Sta. 742-5" Aft.</u>	
Engine Doors - actual weight obtained	- 0.42
<u>Rear Fuselage Decrease</u>	- 0.42
<u>TOTAL STRUCTURAL DECREASE</u>	- 2.16
<u>2. LANDING GEAR</u>	
Main U/C Doors etc. - Addition of Micro Switch mounting on leg.	+ 0.96
<u>TOTAL LANDING GEAR INCREASE</u>	+ 0.96
<u>3. POWER PLANT & SERVICES</u>	
Engines - A Pratt & Whitney J75 P3 Engine was weighed and after allowing for shortages, inhibiting fluid etc. the obtained weight was in agreement with Pratt & Whitney's quotation. Some accessories, packing etc. also weighed	+ 2.07
<u>TOTAL POWER PLANT & SERVICES INCREASE</u>	+ 2.07
<u>4. FLYING CONTROLS GROUP</u>	
Flying Control Hydraulics - Actual Weights of pumps (4 Off)	+ 18.00
Alterations to Engine Bay Piping	+ 1.79
Heat Exchangers - Manufacturers quotation	- 2.60
<u>TOTAL FLYING CONTROLS INCREASE</u>	+ 17.19
<u>5. EQUIPMENT</u>	
Windscreen Demisting - Airesearch Control Units replace Westinghouse	- 6.40
Structural changes and re-estimates	- 1.82
Hydraulics D.B. - Two 110 cu. in. accumulators replace one 200 cu. in.	+ 10.00
Some piping now Steel was Al.	+ 2.87
Pressure relief valve added etc.	+ 1.19
Air Cond'n. Actual Weight of Check Valve	+ 0.53
Actual Weight of some ducting assys.	+ 2.74
Actual Weight of Turbine, was Mnfg. quote	+ 9.19

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INTRODUCTION & WEIGHT CHANGES

<u>5. EQUIPMENT GROUP (cont'd.)</u>	<u>WEIGHT (lb)</u>
Electrics D.B. - Actual Weight of Transformer rectifier Unit	+ 1.43
Canopy Actuation - Alterations to plumbing and emergency release mechanism	+ 2.87
Ram Air Emergency Turbine - introduced for emergency electrical and hydraulic power in the event of double engine flame-out.	+ 60.00
Probe - Redesigned, shorter boom, estimates to stress approved schemes	- 3.50
Damping System - manufacturers quotations on units now available and preliminary estimates of wiring. Previously 60 lb was allowed with Interim Radar (thus increase per Aircraft = +79.13 lb)	+ 139.13
Interim Radio & Radar - Damping System allowance deleted (see above)	- 60.00
Doppler replaces ARN 21 (Tacan)	+ 12.00
<u>TOTAL EQUIPMENT INCREASE</u>	<u>+ 170.23</u>

SUMMARY

Weight Change - Aircraft Weight Empty

Structure	- 2.16 lb.
Landing Gear	+ 0.96 lb.
Power Plant	+ 2.07 lb.
Flying Controls	+ 17.19 lb.
Equipment	+ 170.23 lb.
	<u>+ 188.29 lb.</u>

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

UNBALLASTED CONDITION

<u>Issue 7</u>	<u>Issue 8</u>	
47,408.03 lb	47,596.32 lb	= <u>+ 188.29 lb</u>

N. B. If Aircraft Ballasted such that the C.G. in any flight envelope does not exceed 31% M.A.C. a further 936 lb of ballast are necessary.

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WEIGHT & C.G. SUMMARY

DESCRIPTION	WEIGHT lb.	H. ARM ins.	V. ARM ins.
STRUCTURE	18,493.37	561.88	137.59
Wings	9,963.36	642.91	142.25
Fin & Rudder	1,025.85	754.34	209.31
Fuselage fwd. Sta. 245"	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.	768.97	800.62	129.13
"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	14,322.42	653.01	120.25
Engines & Accessories J75 P3	12,562.29	664.92	119.78
Gear Box Installation on Fuselage	275.54	601.39	102.98
Gear Box and Starter 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	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	1,844.26	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	9,343.40	401.54	110.30
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	140.30
Hydraulics 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	1,111.10	418.87	112.78
Low Pressure Pneumatics	53.15	427.62	124.55
Intake Deicing Boots	51.84	197.02	118.00
Canopy Actuation	64.92	221.99	154.35
Cabin Consoles	17.45	174.76	124.34
M.H. 64 Damping System	139.13	449.26	135.57
Interim Radio & Radar	642.98	301.79	120.28
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	499.05	112.01
Additional Fire Protection 1st A/C	154.17	425.05	102.89
Radome Anti-Icing	8.88	51.49	125.00

continued.

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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>				
Emergency Landing Gear Lowering	12.91	458.83	128.60	
Emergency Ram Air Turbine	60.00	265.00	100.00	
AIRCRAFT BASIC WEIGHT	46,613.30	558.55	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 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	140.00	268.00	132.00	
Oil	134.23	608.92	115.68	
BALLAST	936.00	86.39	116.50	
Operational Weight Empty U/C Up	48,532.32	545.29	126.62	30.19
U/C Down		547.31	123.37	30.75
Maximum Internal Fuel (2,544 gals. @ 7.8 lb/gal.)	19,843.00	538.88	144.32	
A.U.W. Maximum Internal Fuel U/C Up	68,375.32	543.43	131.76	29.68
U/C Down		544.86	129.38	30.07

N.B. 1) Aircraft 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. Flight Envelope does not exceed 31% M.A.C. i.e. 303 lb on Former Sta. 68.5 and 633 lb on the Shear Panel.

REPORT No: 7-0400-44-8

HORIZONTAL C.G. ENVELOPEC105 Mk. 1 1/2 FLIGHT CONDITIONSWITH J75/P3 ENGINES (200 & SUBS. 1/2 J75/P5)

BY: Kathleen G. J. J.

DATE: Aug 1st 1957

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a) INTERIM RADIO & RADARb) INSTRUMENT PANEL & FLIGHT TEST INSTALLATIONSc) FUEL SYSTEM PROPORTIONERSUNCLASSIFIED
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