

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

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UNCLASSIFIED
Report # 7-0400-14 Iss. 10.
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I N D E X

<u>Sheet # 1</u>	<u>Content</u>
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 & C.G.'s.
<u>N. B.</u>	The C.G. Envelope for the 1st Aircraft with fuel sequencing has been omitted until a fully approved sequencing is established.

Classification cancelled / changed to: UNCLASSIFIED

By authority of: DRDA 7/DARFT 5-S/DAS Eng 6-4-5

Date: 5 Nov 1992

Signature: *B. Aubrey*
Unit / Rank / Appointment: DSIS 3, Secretary CRAD HQ DRP



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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 the latest information currently available. All weight and C.G. changes are relative to Issue 9 of September 1st, 1957.

- Note: 1) This Summary does not apply for the 2nd and subsequent MK 1 Aircraft see context below.
- 2) This Summary is for the 1st Aircraft complete to drawings and not necessarily in the condition for first flight, since there may be some shortages in non-essential equipment, some flight test installations will probably be incomplete etc. A statement for 1st Flight will be issued later.

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 A/C's No. 1 to 3 differing from those for A/C's No. 4 and 5 (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 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 in the 1st Aircraft, are allowed for in the summary. There is no provision to jettison any or all of the Instrument Package in an emergency.
- d) An Interim Radio & Radar System, with Minneapolis-Honeywell MH 64 Damping System is installed.
- e) It should be noted that due to material substitutions and concessions introduced by Planning & Production Departments there is a structural weight penalty of 203 lb to-date. 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.

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INTRODUCTION & WEIGHT CHANGES

GENERAL

f) (Cont'd.)

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
	<hr/>
	+ 155.50 lb

- 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 consistent increase averaging about 11% over manufacturer's 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 of actual weight recorded within the report.

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

Structure	71.32%
Undercarriage	67.21%
Power Plant	92.71%
Flying Controls	47.59%
Equipment	34.59%

i.e. 69.33% of the Basic Weight of the 1st Aircraft.

- h) The Aircraft is ballasted such that the C.G. on a flight envelope (using fuel proportioners) does not travel aft of 31.0% M.A.C.
For first flight the Aft restriction is 30% M.A.C.- this may be achieved by maximum ballast.
C.G. Envelopes showing fuel sequencing have currently been omitted until a fully approved sequencing is established.

1. STRUCTURE

a) Wing:

WEIGHT (lb)

No Weight Change.

b) Fin & Rudder

No Weight Change.

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INTRODUCTION & WEIGHT CHANGES

1. STRUCTURE (Cont'd)

c) Fuselage Fwd. Sta. 255"

WEIGHT (lb)

Cockpit Floor - Production Drawing re-issues, addition
of systems bracketry etc.

+ 1.61

Canopy Arches - some actual weights of fittings etc.

- 0.74

Navigator's Canopy - Actual Weights obtained.

+ 9.80

WEIGHT INCREASE FRONT FUSELAGE

+ 10.67

d) Centre Fuselage Sta. 255" - 485"

No Weight Change

e) Duct Bay Sta. 485" - 591.65"

No Weight Change

f) Engine Bay Sta. 591.65" - 742.5"

Lower Longerons - actual Weight obtained

- 0.63

WEIGHT DECREASE ENGINE BAY

- 0.63

g) Rear Fuselage Sta. 742.5" Aft.

Centre Fairing & Stinger - actual weight obtained

+ 1.26

WEIGHT INCREASE REAR FUSLAGE

+ 1.26

TOTAL STRUCTURAL INCREASE

+ 11.30

2. LANDING GEAR

No Weight Change.

3. POWER PLANT & SERVICES

Fuel System - Actual Weight of pumps in the collector
tanks (were manufacturer's quotes)

+ 8.00

Production drawings of filter installation

+ 2.50

Addition of collector tank vent extractor

+ 1.70

Miscellaneous other changes

+ 1.68

TOTAL POWER PLANT & SERVICES INCREASE

+ 13.88

4. FLYING CONTROLS GROUP

Mechanical Flying Controls - addition of emergency release
mechanism aft attach. elevator feel and
trim unit

+ 2.94

Alterations to rudder feel and trim

- 0.71

Stick force transmitter added.

+ 0.33

continued.

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INTRODUCTION & WEIGHT CHANGES

<u>4. FLYING CONTROLS GROUP (Continued.)</u>	<u>WEIGHT (lb)</u>
Hydraulic Flying Controls I/Wing - actual weights of complete elevator jack assys.	+ 16.66
Hydraulic Flying Controls O/Wing - Actual Weight of complete aileron jack assys.	- 6.30
<u>TOTAL FLYING CONTROLS GROUP INCREASE</u>	<u>+ 12.92</u>
<u>5. EQUIPMENT GROUP</u>	
Low Pressure Pneumatics - re-routing of piping, alterations to Fin pitot heads etc.	+ 1.24
Air Conditioning - fuel pressurization outlet added	+ 3.05
Actual weights of some equipment	+ 2.08
Utility Hydraulics F.F. - minor changes, some equipment weighed	- 0.03
Utility Hydraulics C.F. - some equipment weighed	+ 1.10
Utility Hydraulics D.B. - Addition of surge damping accumulator	+ 3.70
Actual weights of some parts	+ 1.55
Miscellaneous alterations	+ 3.24
Electrics Air Intakes - Actual Weight of De-icing Controller	+ 2.13
Brake Parachute - Manufacturer now quoting their actual weight, previously their estimate was recorded	+ 28.40
Flight Test Installations - Production Drawing estimates of Installations in Duct & Engine Bays completed	+ 1.22
<u>TOTAL EQUIPMENT GROUP INCREASE</u>	<u>+ 47.68</u>

SUMMARY

Weight Change - Aircraft Basic Weight

Structure	+ 11.30 lb
Power Plant	+ 13.88 lb
Flying Controls	+ 12.92 lb
Equipment	+ 47.68 lb
	<u>+ 85.78 lb</u>

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

UNBALLASTED CONDITION

Issue 9

47,673.51 lb

Issue 10

47,759.29 lb = + 85.78

N.B. If Aircraft Ballasted such that the C.G. in any flight envelope (excluding some suggested fuel sequencings) does not exceed 31% M.A.C. a further 959 lb of ballast are necessary.

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WEIGHT & C.G. SUMMARY

DESCRIPTION	WEIGHT lb	H. ARM ins.	V. ARM ins.
STRUCTURE	18,531.50	561.88	137.56
Wings	9,959.46	642.86	142.25
Fin & Rudder	1,025.85	754.34	209.31
Fuselage: Fwd. Sta. 255"	2,630.03	181.62	128.25
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	1,428.53	661.00	107.32
Sta. 742.5 Aft	786.34	800.61	129.05
"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	14,365.59	652.98	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	893.00	536.67	136.12
FLYING CONTROL GROUP	1,857.18	686.26	139.66
Mechanical Flying Controls	949.04	687.85	148.43
Hydraulic Flying Controls	908.14	684.60	130.50
EQUIPMENT FIXED & REMOVABLE	9,412.21	403.04	112.92
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	812.41	335.87	134.32
Surface Finish	100.00	591.52	140.20
Hydraulics Main System	638.84	504.20	117.72
Cabin Insulation	14.31	187.48	132.00
Brake Parachute	90.78	786.65	143.16
Electrical System	1,113.23	418.50	112.83
Low Pressure Pneumatics	54.39	432.78	129.22
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	120.28
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
		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) (Continued)</u>				
Flight Test Installations	1,324.09	500.54	129.75	
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	46,776.33	558.74	127.25	
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	959.00	86.60	116.50	
Operational Weight Empty	48,718.35	545.30	127.13	30.19
	U/C Down	547.31	123.80	30.75
Maximum Internal Fuel (2,544 gal. @ 7.8 lb/gal.)	19,843.00	538.88	144.32	
A.U.W. Maximum Internal Fuel	68,561.35	543.44	132.11	29.68
	U/C Down	544.87	129.74	30.07

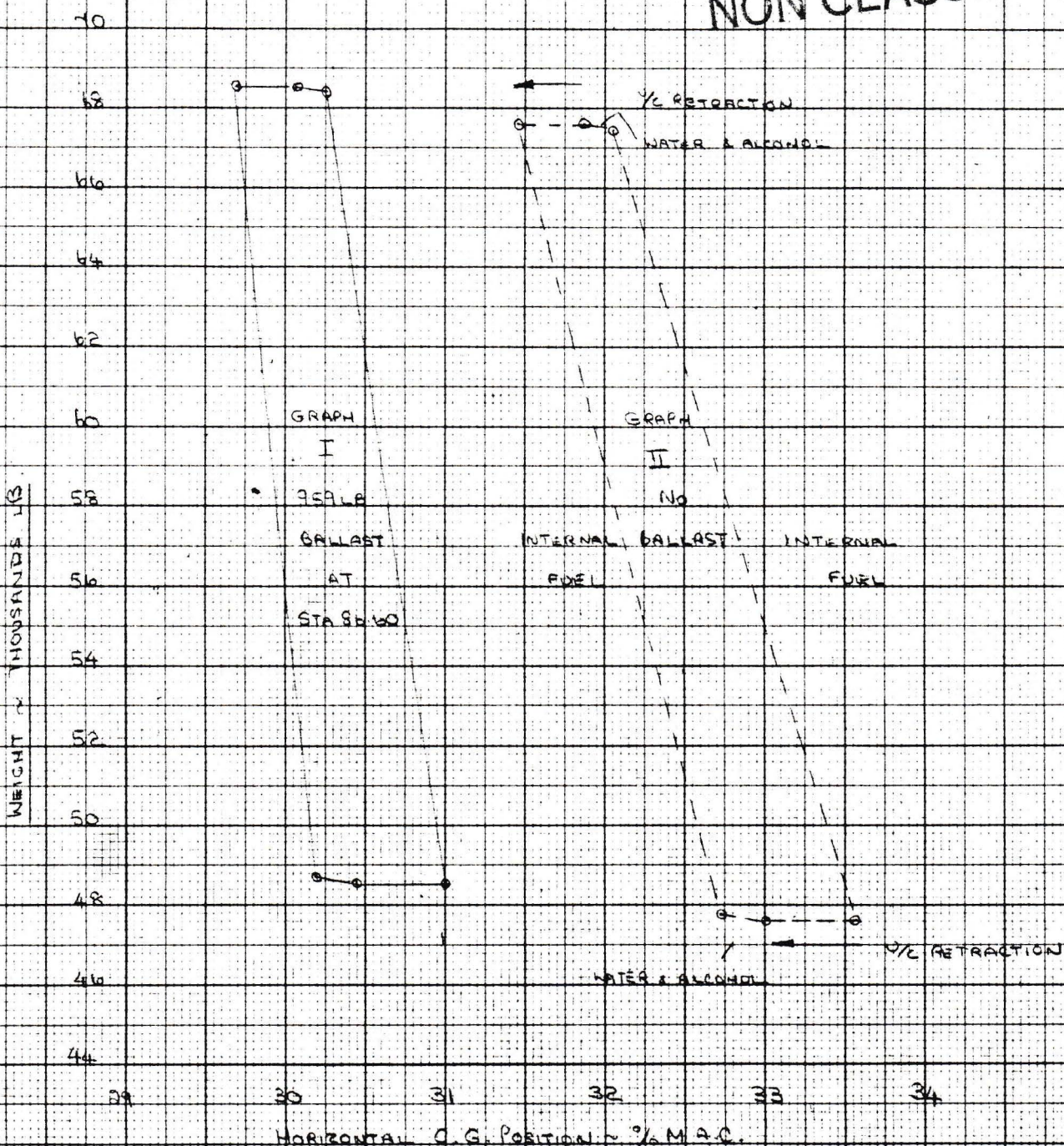
N. B. 1) A/C Datum is considered to be 120" above an arbitrarily chosen ground line.

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 656 lb on the Shear Panel.

HORIZONTAL C.G. ENVELOPE
0.05 MK 1 1/2 NORMAL FLIGHT CONDITION
FOR 1ST A/C (1ST FLIGHT AIRFRAME)
FUEL SYSTEM PROPORTIONERS USED

BY: Kokkonen, J.
DATE: OCT 15 1957
SHEET: 3

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