

QCX
Avro
CF105
R-7-0400-44
Iss-2

FILE IN VAULT

C-105 MK 1 Report # 7-0400-44
J75 P3 Engines ISSUE 2

WEIGHT SUMMARY & C.G. POSITION 33

N.A.E. **UNCLASSIFIED** Feb. 1/57



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Report no.: QCX-AVRO-CF105-R-7-0400-44-Iss-2

has been ☐ downgraded to : _____

☒ de-classified

by (Name): Michel W. Drapeau

(Dept.): A/DND Coordinator, Access to Information

Date: Dec. 7, 1992

R. Auger
Signature

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

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



UNCLASECRED

Report # 7-0400-44
Sheet # 1 Issue 2
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 January 31st, 1956. All Weight and C.G. changes are relative to Issue 1 of December 1st 1956.

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 will be installed, this also varies between first and subsequent aircraft.
- c) An interim Radio and Radar System is installed.

1. STRUCTURE

(a) Wing:

WEIGHT -(lb.)

Transport Joint I/W to O/W - this has now been entirely re-estimated to production drawings - the hardware allowances were previously too high.

- 7.66

Structural provisions for Buzz Dampers - the provisions will be installed in the first A/C as follows:-

Inner Wing	+	8.60
Outer Wing	+	8.70
Elevator	+	7.40
Aileron	+	6.30

Whether on no the system will be installed is still undecided (see also Flying Controls Group).

I/Wing Skins - Actual weights have been checked and the estimates currently recorded tally with the actual weight at nominal thickness. However, some skins notably in those machined at AVRO are considerably above nominal tolerances, excess weight being of the order of 6 lb/panel. Thus with a set of 12 similarly machined AVRO manufactured skins excess weight could be as much as 70 lb/A/C.

WEIGHT INCREASE WING

+ 23.34

(b) Fin & Rudder:

Fin - Addition of dorsal fairing angles	+	3.96
AN373 Nut Plates replace K1100 (not available)	+	4.59
Misc. Structural & hardware changes	+	2.98
Addition of Structural provisions for 'Buzz Dampers'	+	1.20

44264

Continued.

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INTRODUCTION

1. STRUCTURE

(b) Fin and Rudder (Continued)

WEIGHT (lb)

Rudder - Addition of structural provisions for 'Buzz Dampers' + 7.80
Joint changes also skin splices added etc. + 4.88

WEIGHT INCREASE FIN & RUDDER + 25.41

(c) Fuselage Fwd. Sta. 255"

Radar Nose Access Doors - now entirely estimated to production drawings - 3.38

Radar Nose Structure - previous estimate was to non-stress approved schemes - many design changes - fuller information - also includes radome de-icing tank (see also equipment group) + 28.76

Skin F.F. - Material concession allows the use of Al. instead of Mg. on the 1st 5 A/C. + 28.55

Shear Panel Aft Nav. Bulkhead - minor changes to stiffeners etc. production drawing re-issues. + 1.84

WEIGHT INCREASE FRONT FUSELAGE + 55.77

(d) Centre Fuselage Sta. 255" - 485"

Electronics Bay Structure - Doppler mounting structure redundant for Interim Radar System - 1.56

Equipment Bay Structure - Material concession allows .04 Mg. in lieu of .032 Mg. on 1st. 5 A/C + 1.34

WEIGHT DECREASE CENTRE FUSELAGE - 0.22

(e) Rear Fuselage Sta. 485" Aft.

Engine Access Doors E.B. - Estimated to production drawings previous estimates had insufficient hardware allowance 8% of Structure weight whereas details reveal 15% + 14.70

Heavy Formers E.B. - minor production drawing changes + 1.83

Engine Tunnel E.B. - O/B Beam was previously omitted + 7.70

Service Access Doors - Transducer support added. + 0.49

Light Formers E.B. - removal of allowance for some stabilizers which do not exist - 0.17

Misc. Items E.B. - minor changes to bracketry + 0.05

Engine Access Doors R.F. - Production drawing estimates + 10.11

Nacelles R.F. - now estimated to production drawings, steel replaces titanium for early aircraft, previously too high an allowance was made - 10.76

Centre Structure R.F. - Production drawing estimates - previous allowance for Steel replacing titanium was too high - 1.46

WEIGHT INCREASE AFT FUSELAGE + 22.49

TOTAL STRUCTURAL WEIGHT INCREASE + 126.79

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INTRODUCTION

2. LANDING GEAR

No Weight Change

3. POWER PLANT & SERVICES

WEIGHT (lb)

Engines [†] - Miscellaneous alterations to airbleed outlet etc.	+	4.61
Engine Service Accessories - Pressure switches now in Electrics	-	2.27
Addition of pneumatic lines	+	3.17
Production drawing estimates of oil breather pipes, nozzle air ejection, oil filler etc.	+	4.37
Gear Boxes & Starter on Engine - Add pneumatic starter connection	+	1.64
Engine Mounting Accessories - "Inconel X" sleeve at rear mounting omitted	+	4.68
Hardware for installation further details available	+	5.45
Engine Controls - Actual weight of tension regulator and throttle box	+	1.78
Fuel System [‡] - Actual weights of bulkhead couplings and revision of pump installation	+	7.52
Fire Extinguishing System* - Vendors increase in bottle weight	+	5.00
<u>WEIGHT INCREASE POWER PLANT GROUP</u>	<u>+</u>	<u>35.95</u>

N.B. 1) [†] J75 P3 Engines on 1st A/C only, 2nd & subsequent A/C have J75 P5 Engines which are 225 lb/engine lighter than the P3 Version.

2) [‡] The 1st Aircraft will be fitted with fuel proportioners, 2nd Aircraft may have both proportioners and a selection system fitted, though details of the selection system are not yet finite.

3) * Additional fire protection will be installed in the 1st A/C, the bottles being mounted within the instrument package. For details of the weight involved see Equipment Group.

4. FLYING CONTROLS GROUP

Mechanical Flying Controls - Completely re-estimated to production drawings for the redesigned steel linkage system. Previously weight allowances of 65 lb were carried to cover this redesign. Now, however, there is a further increase of

+ 26.09
+ 6.81

N.B. 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 + 134.3 lb. if necessary.

WEIGHT INCREASE FLYING CONTROLS GROUP

+ 32.90

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INTRODUCTION

5. EQUIPMENT GROUP

WEIGHT (lb)

Instruments - fully detailed to production drawings some panels now included with Electrics Group	- 7.23
Cabin Consoles - first detailed estimates of Navigator's Consoles	- 3.20
Canopy Actuation - addition of recuperators etc.	+ 7.64
Air Conditioning - production drawing estimate of 'S' duct	+ 12.07
Other ducts, couplings etc.	+ 20.83
Valves & Equipment, actual weights etc.	+ 23.10
Radome Anti-icing - Tank weight now included in nose structure	- 5.00
Wiring & detectors in Electrics	- 2.55
Actual weights of valves, Al. tubing replaces Temflex, general allowances too high	- 7.03
Intake De-icing - this report contains weight of boots only, all equipment, wiring etc. included with general electrical circuits weights	- 34.00
Windscreen Demisting - wiring now in electrical reports	- 5.17
Electrical System - the report system has been entirely changed and the electrics completely estimated to production drawings for the first aircraft. Including the 48.95 lb allowances, deleted above, the electrical group shows an increase in weight of	+ 138.64
Previous allowances for connectors were too low, many more details now available etc.	
Interim Radio & Radar - re-estimated in detail	+ 5.68
Additional Fire Protection - fully estimated to drawings	- 0.83
Radar Access Door Actuation - now included in Interim Radar Wt.	- 10.00

WEIGHT INCREASE EQUIPMENT

+ 132.95

SUMMARY

WEIGHT CHANGE - AIRCRAFT WEIGHT EMPTY

Structure	+ 126.79 lb.
Power Plant	+ 35.95 lb.
Flying Controls	+ 32.90 lb.
Equipment	+ 132.95 lb.
	<u>+ 328.59 lb.</u>

WEIGHT CHANGE - OPERATIONAL WEIGHT EMPTY (A/C less fuel)

Issue 1

Issue 2

44,783.07 lb

45,111.66 lb

= + 328.59 lb.

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WEIGHT AND 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	18,453.73	563.95	137.60
Wing	10,012.41	643.87	142.09
Fin & Rudder	1,025.37	754.93	209.68
Fuselage Struct. Fwd. Sta. 255"	2,549.18	180.69	128.59
Sta. 255" - 485"	1,664.68	379.06	130.04
Aft. 485"	3,202.09	654.11	111.60
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	14,204.48	654.59	120.23
Engines	12,681.91	663.94	119.75
Gear Box Installation on Fuselage	237.06	603.73	104.00
Gear Box & Starter on Engine	151.82	610.53	96.45
Engine Controls	30.97	366.27	119.61
Engine De-icing	70.37	562.80	115.09
Fire Extinguishing System	75.52	703.76	128.23
Engine Mountings	199.32	635.71	128.02
Fuel System	757.51	543.10	135.69
FLYING CONTROLS GROUP	1,710.72	687.58	140.35
Mechanical Flying Controls	937.30	687.59	148.22
Hydraulic Flying Controls	773.42	687.56	130.81
EQUIPMENT - FIXED & REMOVABLE	7,166.22	384.94	110.52
Instruments	46.07	163.68	138.70
Probe	23.00	9.74	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	588.36	501.22	117.38
Cabin Insulation	11.91	179.24	130.00
Brake Parachute	69.69	784.88	131.17
Electrical System	1,119.35	419.79	112.94
Low Pressure Pneumatics	39.01	478.47	127.28
Oil & Hydraulic Fluid Cooling	22.00	579.50	92.00
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	762.38	311.06	122.69
Instrument Pack Structure	670.61	385.90	94.71
Instrumentation - 1st A/C	2,447.00	389.50	95.00
Additional Fire Protection	154.17	425.05	102.89
Radome Anti-icing	8.88	51.49	125.00
AIRCRAFT WEIGHT EMPTY	44,147.48	564.40	127.55

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WEIGHT AND C.G. SUMMARY

DESCRIPTION	WEIGHT lb.	H.ARM ins.	V. ARM ins.	C.G. POSITION % M.A.C.
USEFUL LOAD (less fuel)	964.18	353.79	132.91	
Crew	430.00	194.00	136.50	
Oil	130.39	609.19	117.17	
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	45,111.66	559.87	127.66	34.21
U/C Down		562.04	124.07	34.81
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	64,954.66	553.46	132.75	32.44
U/C Down		554.96	130.26	32.86
Max. External Fuel & Tank (500 gals. @ 7.8 lb/gal.)	4,226.00	522.34	60.64	
A.U.W. Max. Internal and U/C Up	69,180.66	551.56	128.35	31.92
External Fuel U/C Down		552.97	126.01	32.31

N. B. 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 at Sta. 89.16", as currently provided for on Former 68.5 and the Shear Panel, is necessary plus a further 75 lb on the Shear Panel. (i.e. Total of 1,457 lb)

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WEIGHT AND C. OF G BY FUNCTIONAL COMPONENTS

 PROJECT C-105 MK 1

DESCRIPTION		REFERENCE NO.	COMP. NO.	WEIGHT	H
TOTAL WING GROUP		10000000			
OUTER WING		10100000			
14	OUTER WING SKINS	10100001	64	928.89	70
14	POSTS AND INTERCOSTALS	10100002	64	249.37	73
14	OUTER WING SPAR	10100003	64	402.93	70
14	OUTER WING RIBS	10100004	64	134.56	69
14	AILERON CONTROL BOX	10100006	64	385.94	77
3	RIB 12	10100007	64	74.66	64
14	O W AILERON JACK FITTING	10100009	64	10.46	72
14	AILERON JOINTS AND FAIRING	10100010		32.93	78
75	BUZZ DAMP STRUC PROV O W	10100011	64	8.70	75
				2004.00	
AILERON		10200000			
17	AILERON STRUCTURE	10200001	74	348.66	79
75	BUZZ DAMP STRUC PROV AIL	10200002	74	6.30	73
				354.96	
ELEVATOR		10300000			
20	ELEVATOR MARRY UP	10300000		449.00	73
20	ELEVATOR MARRY UP	10300000		15.97	73
75	BUZZ DAMP STRUC PROV ELEV	10300001	82	7.40	74
				472.37	
INNER WING		10400000			
12	MAIN U C STRUCTURE	10400001	62	329.59	51
12	FRONT SPAR I W	10400002	62	109.85	48
12	MAIN SPAR I W	10400003	62	154.56	55
12	FWD CENTRE SPAR I W	10400004	62	54.10	55
12	AFT CENTRE SPAR I W	10400005	62	36.37	66
12	REAR SPAR I W	10400006	62	80.48	70
12	I W STRUCTURE F S TO M S	10400007	62	1035.81	14
12	I W STRUCTURE M S TO R S	10400008	62	158.86	66
12	STRUCTURE AFT OF REAR SPAR	10400009	62	319.84	77
12	ELEVATOR CONTROL BOX I W	10400010	62	427.17	77
16	TRANSP JOINT MARRY UP	10400011		70.65	66
12	CENTRE LINE JOINTS	10400012	62	633.62	66
12	INNER WING SKINS	10400013	62	2179.80	66
12	STRUT PICK UP FITTINGS I W	10400014	62	54.24	45
12	STRUT PICK UP FITTINGS	10400015		1.44	66
12	RIBS 1 TO 9 INNER WING	10400016	62	517.56	66
12	DORSAL FAIRINGS	10400017	62	57.64	45
12	RIB 10	10400018	62	110.44	66
12	WING TO FUSELAGE JOINT	10400019	62	138.12	66
16	TRANSP JOINT	10400020	62	131.00	66

WGT AND C. OF G BY FUNCTIONAL GROUP COMPONENT

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	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM	H. MOMENT	V. MOMENT
ION	4000000						
UP	4010000						
	401010092		195962	53948	14100	105717580	27630642
			195962			105717580	27630642
S	401020092		29436	53929	13601	15874540	4003590
			29436			15874540	4003590
UP	4020000						
	402010091		33381	17080	9970	5701475	3328086
			33381			5701475	3328086
ING	402020052		2454	16224	8823	398137	216516
			2454			398137	216516

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SHEET 7

	REFERENCE NO.	COMP. NO.	WEIGHT	H. ARM	V. ARM	H. MOMENT	V. MOMENT
	5000000						
	5010000		1252426	66501	11983	832875814	150078208
			1252426			832875814	150078208
ESS	5010100		15765	57924	11340	9131719	1787751
			15765			9131719	1787751
LINES	5020000		23706	60373	10400	14312023	2465424
			23706			14312023	2465424
	5030000						
	5030001	52	1434	16201	12473	232322	178863
	5030002	54	2653	11661	11803	82590	31278
	5030003	56	5215	00471	13379	260745	69705
	5030004	58	8776	37031	10330	558675	90594
			3097			1134332	370440
N ENG	5040000		15182	61053	9645	9269066	1464304
			15182			9269066	1464304
	5050000		7037	56280	11509	3960424	809888
			7037			3960424	809888
	5060000						
	5060001		7552	70376	12823	5314796	968393
			7552			5314796	968393
ETS	5070000						
ETS	5070001		13877	62498	12950	8672847	1797072
ETS	5070002		6055	66031	12463	3998177	754635
			19932			12671024	2551707
	5080000						
	5080001	54	1211	14402	25141	872857	1718613
	5080002	56	1421	05371	0109	8476321	9156082

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**WEIGHT AND C. OF G BY FUNCTIONAL
COMPO**

PROJECT C-105 MK 1

	DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT
	FIXED EQUIPMENT GROUP	7000000		
	INSTRUMENTS	7010000		
69	INSTRUMENTS F F	7010001	52	44071
	PROBE SERVICES	7010003	51	800
106	NAVIG TABLE AND STOWAGE	7010004	52	2002
				5407
3	COCKPIT PRESSURE SEALING	7020000	52	5001
				500
	OXYGEN SYSTEM	7030000		
63	OXYGEN SYSTEM F F	7030001	52	22791
63	OXYGEN SYSTEM C F	7030002	54	20652
				4344
	AIR CONDITIONING SYSTEM	7040000		
65	AIRCONDITIONING F F	7040001	52	94152
65	AIRCONDITIONING C F	7040002	54	537023
65	AIRCONDITIONING D B	7040003	56	74305
65	AIRCONDITIONING E B	7040004	58	16196
65	AIRCONDITIONING ENG	7040006		15566
12	AIRCONDITIONING I W	7040007	62	805
				73802
	HYDRAULICS MAIN SYSTEM	7050000		
57	UTILITY HYDRAULICS F F	7050001	52	80782
57	UTILITY HYDRAULICS C F	7050002	54	43334
57	UTILITY HYDRAULICS D B	7050003	56	228295
57	UTILITY HYDRAULICS E B	7050004	58	73286
57	UTILITY HYDRAULICS I W	7050005	62	128615
57	UTILITY HYDRAULICS F F	7050006	91	4571
57	UTILITY HYDR MAIN U C	7050007	92	29505
				58836
69	CABIN INSULATION	7070000	52	11911
				1191
	BRAKE PARACHUTE	7080000		

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COMPONE

[illegible]

THE TANG
3558
CHANGHAI