Date: December 1st, 1956
Aircraft: C-105 With J75 P.5 Engines as Interim Power Plant

Report # 7-0400-05
Sheet # 001-1 Issue 27
Prepared By: K. Griffin
Checked By: E. Burnett

INTRODUCTION

The following is a revised Weight & C.G. Summary for the C-105 Aircraft, based on the latest Weight Estimates available on November 30th, 1956. All Weight and C.G. changes are relative to Issue 26 of May 1st, 1956.

GENERAL

a) As in Issue 26 Pratt & Whitney J75 P5 Engines comprise the Interim Power Plant.

b) A package containing 4 "Semi-Submerged" Sparrow II Missiles (432 lb each) is currently carried.

c) Preliminary Weight Estimates for the R.C.A. Astra I Radar System are now available and are included here together with other allied changes. The Douglas Missile Control System is superseded by Astra I. (Total Weight of the R.C.A. System = 2,731.5 lb + 118.5 lb additional Antennae Avro installed = 2,850 lb.).

1. STRUCTURE

(a) Wing:

The entire Wing has been re-estimated, largely to production drawings with the following results:-

	WEIGHT (lb)	
Elevator - Actual Weight obtained	+	9
Omission of 'Marry-Up' hardware	+	11
Relatively recent redesign of 'Marry-up'	+	9
I/W Structure M/S to R/S - This structure was underestimated and has increased as follows:		
Hardware estimated in detail	+	94
Machined Skins & Doors	+	3
Ribs # 1 to # 10	+	7
Internal Structure details	+	60
Fuselage Strut Pick-ups - some omissions	+	26
C/L Joint I/W - Re-estimate of Centre Joint (excluding transfer of thrust mounting to this report)	+	22
Fuselage to Wing Joint - Re-estimated completely	+	19
Stainless Steel seal added at Fus. Side Rib	+	14
Dorsal Fairing - Previously allowance only, no details	+	13
I/Wing Spars - completely re-estimated	-	11
I/Wing Structure for Main U/C - All attachments underestimated	+	53
Bushings & Bearings Main Pivot	+	28
Main U/C Uplocks - omitted	+	14
Transport Joint O/W to I/W - Allowances made on both Rib #10 and # 12 for buttstraps, other alterations to hardware etc.	-	48
Fairing at Transport Joint allowance was too low	+	18
Leading Edge I/W - Previous allowance was too high	-	15
Structure fwd. M/Spar - Tanks # 3 & 4, internal structure was largely omitted.	+	60
Addition of 2 point refuelling door	+	18
Fixed Structure pivot door was largely omitted	+	45
Miscellaneous changes joints etc.	+	2

continued.

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INTRODUCTION

1. STRUCTURE

a) Wing (Cont'd.)

		WEIGHT (lb)
Elevator Control Box - Production Drawing estimates	+	5
O/W Leading Edge - Marry-up to F/Spar omitted	+	5
Allowance was previously too low	+	30
O/W Skins - Re-estimate of skins, stringers etc.	+	11
O/W Ribs - Completely re-estimated	+	13
Aileron Control Box - Production Drawing estimates - too high an allowance for stiffeners, hardware etc.	-	14
O/W Spars - some redesign & refinement of estimate	+	5
Aileron Marry-up - some redesign & re-estimate	+	7
Aileron - completely checked - skins underestimated	+	15
Miscellaneous other changes I/Wing & O/Wing	-	13
Weight Change Increase	+	515

Ref. 002-1-5

b) Fin & Rudder

Fin - Miscellaneous changes to Production Drawings	+	4
Weight Change Increase	+	4

Ref. 002- 6

c) Fuselage to Sta. 255"

Pilot's Canopy - Production Drawings details plus installation	+	7
Navigator's Canopy - Production Drawings details plus installation	+	3
Canopy Arches - Production Drawing estimates, steam outlets added etc.	+	11
Formers & Bulkhead Sta. 255" - many small Production Drawing changes, slinging fittings included (see also C.F.)	+	11
Intake Ramp - Redesign - previously boundary layer bleed unsatisfactory etc.	+	110
Nose U/C Structure - Pivot bolts & attachs. now in Nose U/C Group	-	4
Lower Longerons F.F. - many small design changes	+	15
Weight Change Increase	+	153

Ref. 002- 6

d) Fuselage Sta. 255" - 485":

Slinging Fittings - These are part of Bulkhead 255" assy. in the Front Fuselage	-	9
Armament Bay Roof - addition of Mounting Brackets etc.	+	4
C.F. Skins - Aft of 469 now .04 Al. was Mg., Access Door added, wing side rib sealing clips added, alterations to splices Sta. 469 etc.	+	10

Continued.

INTRODUCTION

1. STRUCTURE

d) Fuselage Sta. 255" - 485": (cont'd.)

		WEIGHT (lb)
Formers - miscellaneous Production Drawing changes	+	3
Dorsal Fairings, Equipment Bay, Radar Bay etc. - All estimated to Production Drawings	+	10
Air Intake Ducts - Actual weight obtained	-	2
Weight Change Increase	+	16

Ref. 002-7-8

e) Fuselage Sta. 485" Aft.

Duct Bay - Mounting Brackets D.B. - addition of equipment mounting brackets	+	5
Formers D.B. - redesign of many lower formers & centre beams, all production estimates now, previously many were Non-Stress approved schemes.	+	22
Lower Panel D.B. - Redesign Heat Exchanger Mounting (including 3 lb allowed for previously in equipment)	+	8
Diaphs., Intercostals, Stiffiners etc.	+	6
Longerons D.B. - Production Drawing estimates	+	7
Duct D.B. - Some extensive redesign of Gill doors, torque boxes, pressure seals etc. see weight change sheets for details	+	61
Dive Brakes D.B. Re-estimate of main lever & bush	+	2
Engine Bay - Heavy Formers - I/B & O/B rail supports added were in Engine Group	+	17
Miscellaneous design changes	+	6
Intermediate Formers - Redesign, heavier gauge webs and lower booms	+	17
Light Former - Production Drawing estimates	+	6
Longerons - fuller information available	+	6
Torque Boxes - completely re-designed	+	28
Service Access Doors - No. 4 panel larger - re-estimate	+	10
Production estimate of surround structure	+	5
Engine Access Doors - completely redesigned	+	56
Skins - skin splices & manifold added	+	9
hardware detailed	+	12
Engine mounting access door	+	4
Tunnel - increased gauges lower shroud etc.	+	14
Angle seal attach. added aft.	+	4
hardware etc. detailed	+	12
Beam Shroud attach. - gauge increases	+	3
Pressure vents (partly with skins)	+	10
Insulation more details, lighter fastener	-	10
Miscellaneous Structure - Mounting Brackets estimate not included elsewhere	+	9

continued.

INTRODUCTION

1. STRUCTURE

e) Fuselage Sta. 485" Aft. (Cont'd.)

	WEIGHT (lb)
Removable R.F. - Nacelles - Completely estimated to Production Drawings, gauge increases to formers etc.	+ 15
Fixed R.F. - Minor changes to formers, tunnel etc.	+ 3
Weight Change Increase	+ 347
Ref. 002-9-13	
TOTAL STRUCTURE WEIGHT INCREASE	+ 1,035

2. LANDING GEAR

Main Undercarriage - Increase in Weight Goodyear wheels	+ 8
Increase in leg assy. quoted by Dowty	+ 86
Actual Weight of leg assy. further increase	+ 9
Main U/C Doors & Fairings - Production Drawing estimates	+ 7
Nose Undercarriage - Actual Weight of Jarry supplied parts	+ 11
Actual Weight of Dowty liquid spring	+ 3
Pivot bolts added - see Structure	+ 4
Nose U/C Door & Fairing - redesign of ends of Fairing & Door	- 1
Main U/C Hydraulics - now in Utilities Main System - Equip. Group	- 285
Nose U/C Hydraulics - now in Utilities Main System - Equip. Group	- 99
TOTAL LANDING GEAR DECREASE	- 257
Ref. 002-13	

3. POWER PLANT & SERVICES

Accessories Gear Box (Fuse. & Engine Installations) - Weights obtained from Sargent (manufacturer) for the first time. Installation estimates are to Production Drawings	+ 170
Deareator tanks (transferred from Equip.)	+ 6
Starters etc. installation allowance too high	- 4
Engine Mounts - Duplication of rail aft 742.5"	- 9
Rail supports now on E.B. Heavy Formers	- 13
Engine Mounting Accessories on Engine - Production Drawing estimates	- 5
Engine Anti-icing - Ice detectors & Wiring (in Electrics)	- 5
Production Drawing estimates Fairings & Struts	+ 7
Fuel System - Addition of Fuel Oil Heat Exchanger & installation (was in Equip. Group)	+ 85
Manufacturer's Weight of Fuselage Bag Tanks	+ 11
Flow Proportioner Unit - Manufacturer's & Spec. Weights	- 6
Piping, capacitors etc. etc.	- 12

continued.

INTRODUCTION

3. POWER PLANT & SERVICES (Cont'd.)	WEIGHT (lb)
Engine & Service Accessories - Thermo Couples deleted - these are integral with Engine	- 10
Alternator Drive Oil now in Op. Load	- 5
H/Exch. Exhaust Duct part of Engine installation (was in Equip. Group)	+ 6
Engine Can, Fairing etc. Production Drawing estimate	+ 18
Air-bleed outlet - on engine - allowance was previously with Structure E.B.	+ 4
Adaptor Ring design changes	- 3
Addition of lines for oil pressure filler, Nozzle air injection, oil breather pipes etc. - some items were previously installed by Pratt & Whitney.	+ 29
TOTAL ENGINE GROUP INCREASE	+ 264

Ref. 002 14-15

4. FLYING CONTROLS GROUP	
Mechanical Flying Controls - Steel links replace Al. for Elevator, Aileron & Rudder Controls	+ 65
Auto Pilot Tie-in - Integral part of Astra I System in future, included in Equip. Group	- 108
Dive Brake Hydraulics - considered part of Utilities Hydraulics not Flying Control Hydraulics, hence transferred to Equip. Group (see Hydraulics D.B.)	- 41
Flying Control Hydraulics - completely re-estimated to Production Drawings.	
Heat Exchangers added (see Equip.)	+ 11
Filter Assys. - actual weights	+ 15
Elevator Jacks - actual weights	- 11
Aileron Jacks - actual weights	- 2
Rudder Jacks - actual weights	+ 3
Ground Service connections - Actual Weights	+ 4
Jack Support Bracket for Rudder in Fin Struct.	- 4
Aileron jack attach. bracket in O/Wing Struct.	- 7
Specification Weights of Servos	+ 4
Piping & miscellaneous equip. changes.	+ 19
TOTAL FLYING CONTROL DECREASE	- 52

Ref. 002-16

5. EQUIPMENT GROUP

Note: Preliminary information is now available on the weights of R.C.A. Astra I Radar System. Comparisons are made below to Hughes MX 1179 System.

Continued.

INTRODUCTION

5. EQUIPMENT GROUP (Cont'd.)

		WEIGHT (lb)
Radio & Radar Fixed - Decrease in cables, mountings etc.	-	55
Addition of Antennae etc. not R.C.A. supplied	+	118
Radio & Radar Removable - Weights of units of Astra I *	+	428
(N.B. * It should be noted here that 108 lb of Auto Pilot Tie-In were previously included in the F/Controls Group. Therefore actual increase in units is 320 lb)		
Surface Finish - Aircraft to be painted with 1 coat etch primer 1 coat chromate primer and 2 thin coats of white finish.	+	78
Allowance for small quantity of skin filler	+	22
Sparrow Missile Pack has been completely re-evaluated with the following results, compared to Weight allowances that were previously recorded.		
Sparrow Pack Structure - Estimate to initial schemes (the figures here include 106 lb Sealing.)	-	50
Sparrow Pack Mechanisms - Previous figure unrealistic - based on 60" launchers etc., these are now 150" and mechanism is redesigned.	+	300
Sparrow Pack Hydraulics - Re-evaluation of redesigned system	-	155
Sparrow Pack Electrics - No previous allowance	+	64
Electrics for Sparrows - In basic aircraft, provision for pack	+	3
Intake De-icing - Increase due to redesign of Ramp	+	3
Alternator System - This remains a 30KVA System with J75 Engines, however, an Emergency Pack has been added.	+	20
Canopy Actuation - some redesign of system and actual weights of parts obtained; emergency operation added	+	8
Windscreen Demisting - re-evaluated to latest information	+	4
Low Pressure Pneumatics & Fin Pitot - estimate to Production Drawings		
Addition of Pressure Ratio Transducers	+	16
Other details of piping etc.	-	6
Air-Conditioning - Stress approved schemes of exhaust ducts	+	5
Oil & Hydraulic Fluid Cooling - some items from this report are now included with their relevant systems		
Deareator tanks - see Engine Group	-	6
H/Exch. Mounting allowance - see D.B. Struct.	-	3
Oil in Exchangers - see Operational Load	-	20
Fuel Oil Exchanger System - see Engine Group	-	39
H/Exch. Ducts - see Engine Group	-	5
Piping allowances deleted - see other groups	-	35

Continued.

INTRODUCTION

5. EQUIPMENT GROUP(Cont'd.)		WEIGHT (lb)
Utility Hydraulics - completely re-estimated including Dive Brake, Nose & Main U/C Hydraulics. Total Weight was 657 lb now 588 lb i.e. - 69 lb per Aircraft.		
Piping etc. in Wings was overestimated from diagrammatic sketches	- 80	
Structure for mounting U/C Door & Gear Jacks is already included in I/W Structure	- 20	
Piping etc. in Fuselage underestimated particularly in C.F. & D.B.	+ 55	
Installation 80 cu. in. Accumulator was overestimated	- 5	
Dive Brake Installation - piping too high allowance	- 5	
Installation 200 cu.in. Accumulator - far too high allowance was made - no information	- 43	
Pressure Regulator D.B. - no allowance previously	+ 6	
Installation of Pumps - target weight reduced	- 4	
Many small alterations to valves etc.	+ 4	
Total	- 69	
However, this section due to transfer of items shows an increase in weight of 588 - 231 (Weight of Utilities System previously)		+ 357
WEIGHT INCREASE EQUIPMENT		+ 1,052
Ref. 002-17-20		

6. OPERATIONAL LOAD

Oil Usable & Trapped - completely re-estimated; all Oil for Engine and Gear Boxes now included here, previously some was included in Equipment and some in Engine Group. Since 24 lb was transferred from elsewhere Weight change per aircraft is actually 21 lb.	+ 45
Water for Air-Conditioning - previously water was considered only for special high altitude missions, however, apparently it is a requirement for all missions. The max. for Mach 2 is recorded here	+ 125
TOTAL OPERATIONAL LOAD INCREASE	+ 170
Ref. 002-20	

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SUMMARY

Weight Change - Aircraft Weight Empty

Structure	+ 1,035 lb.
Landing Gear	- 257 lb.
Power Plant	+ 264 lb.
Flying Controls	- 52 lb.
Equipment	+ 1,052 lb.
	+ 2,042 lb.

Weight Change - Operational Load Less Fuel

Oil	+ 45 lb.
Water	+ 125 lb.

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

Issue # 26	Issue # 27	
44,316	46,528	= + 2,212 lb.