

Date: 1st. Sept. 1955
Aircraft: C-105 with J75 Engines
as Interim Power Plant

SECRET

DECLASSIFIED on Aug. 29,
2016 by Steven Zan

WEIGHT & C. G. SUMMARY

Initial: *SG*

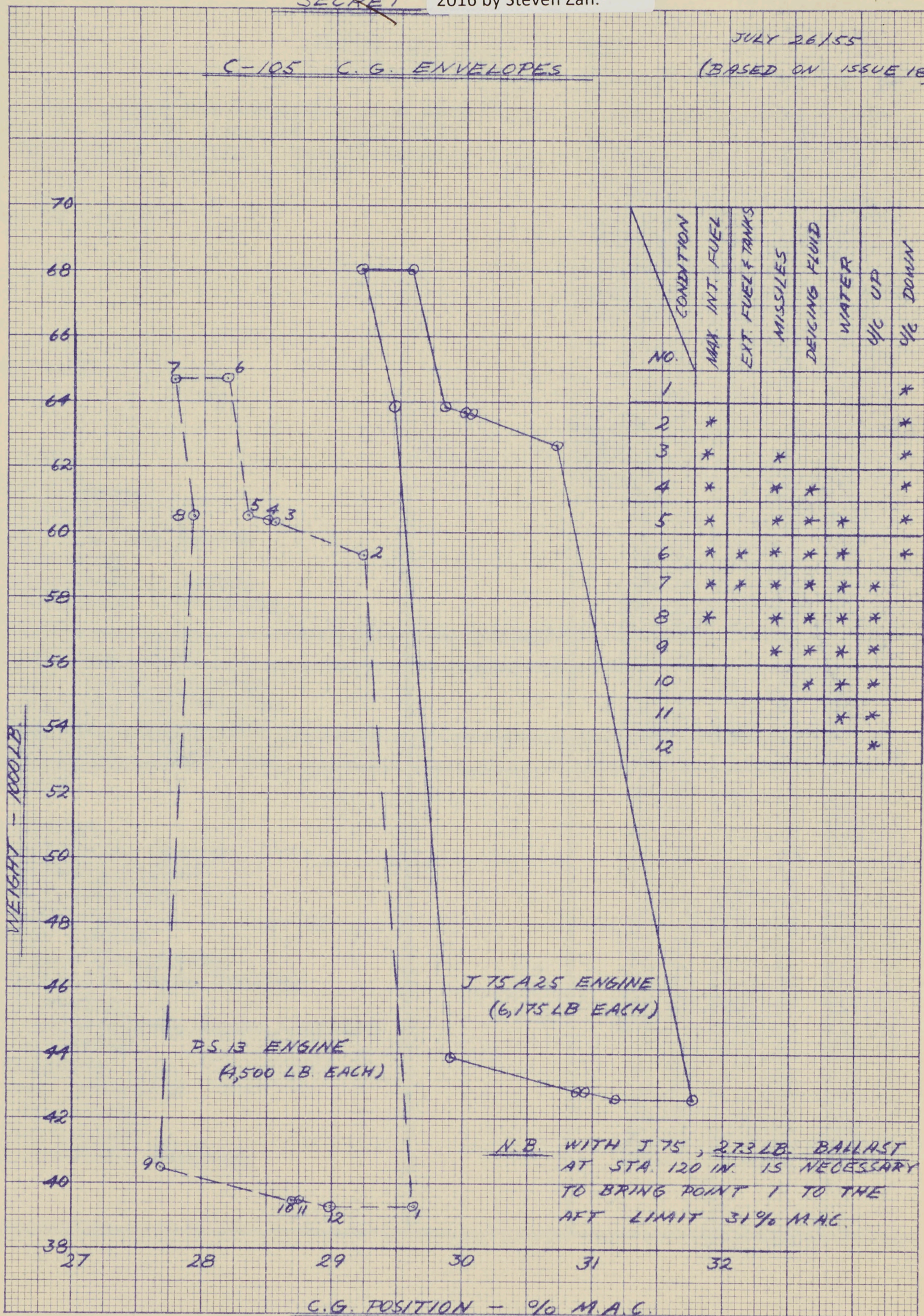
DESCRIPTION	(PS 13)	WEIGHT lb.	H. ARM Ins.	V. ARM ins.	C.G. POSITION % M.A.C.
EQUIPMENT (Fixed & Remov. (Cont'd))					
Ejector Seats		204.00	200.10	136.25	
Emergency Provision		16.95	166.01	130.65	
Radar Removable		1,259.70	141.75	114.53	
Radio Removable & I.F.F.		276.20	284.51	123.98	
Missile Pack Structure		676.17	385.26	95.61	
Missile Pack Mechanisms		410.48	373.88	102.86	
Missile Pack Hydraulics		293.00	336.29	101.00	
Missile Pack Electronics		318.00	389.15	101.22	
AIRCRAFT WEIGHT EMPTY	(38,521.95)	41,871.95	552.53	128.24	
USEFUL LOAD		17,692.67	522.11	140.37	
Crew		430.00	194.00	136.50	
Oil		85.08	611.71	135.00	
Alcohol for Radome De-Icing		22.00	93.00	138.00	
Residual Fuel		219.80	536.70	135.07	
Fuel for Combat Mission		15,880.00	539.20	143.50	
Missiles (Armament)		1,042.40	399.12	95.60	
Oxygen Charge		13.39	259.69	159.91	
Normal Combat Mission U/C Up		59,564.62	543.49	131.85	29.69
U/C Down			545.06	129.69	30.13
Half Combat Mission Fuel 1011 @ 7.85 lb/gal.		7,940.00	540.85	139.60	
U/C Up			544.40	129.45	29.94
Combat Weight (Half Combat Mission Fuel) U/C Down		51,624.62	546.21	126.97	30.44
U/C Up			545.05	127.61	30.12
Operational Weight Empty		43,684.62			
U/C Down			547.19	124.67	30.71
U/C Up			548.62	128.39	31.11
Operational Weight Empty (Less Missiles) U/C Down		42,642.22	550.81	125.38	31.71
Maximum Internal Fuel 2,544 gal. @ 7.85 lb/gal.		19,970.00	538.88	144.33	
Water (Air-Conditioning System)		125.00	268.00	95.00	
U/C Up			542.58	132.78	29.44
A.U.W. Max. Internal Fuel		63,779.62			
U/C Down			544.04	130.77	29.84
Max. External Fuel, 500 gal. @ 7.85 lb/gal. & Drop Tank		4,235.00	528.90	62.00	
U/C Up			541.73	128.37	29.21
A.U.W. Max. Internal & External Fuel U/C Down		68,014.62	543.10	126.49	29.59

Initial: CGO

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C-105 C.G. ENVELOPES

JULY 26/55
(BASED ON ISSUE 18)



NATIONAL RESEARCH COUNCIL

L.O.
NRE-301

MEMORANDUM

TO: File

FILE NO.

DATE 22.9.55

Attached 2 pages are excerpts from Avro
Report #7-0400-05 Issue 18 C-105 With
J75 Production Engines. Weight Summary &
C.G. Position. Sept. 1, 1955.

6 copies typed:

- 1:
- 2:
- 3:
- 4:
- 5:
- 6: Herewith

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STRUCTURE		16,792.19	566.33	138.88
Wing		9,529.38	642.15	142.58
Fin and Rudder		911.57	756.76	211.28
Fuselage Structure Fwd. 255"		2,142.09	184.05	129.83
255" to 485"		1,501.32	371.63	132.24
Aft. 485"		2,707.83	645.75	112.30
UNDERCARRIAGE - Up Position		2,843.97	485.08	134.10
Main Undercarriage		1,847.60	539.88	141.00
Main U/C Doors & Fairings		287.32	539.21	136.40
Main U/C Hydraulics		279.84	535.01	137.75
Nose Wheel Undercarriage		284.34	165.18	100.04
Nose U/C Doors & Fairings		25.92	163.71	89.22
Nose U/C Hydraulics		118.95	220.34	103.95
POWER PLANT & SERVICES	(10,620.78)	13,970.78	653.53	119.06
Engines J75	(9,297.00)	12,647.00	662.35	117.82
Gear Box & Drive		150.00	606.00	94.66
Engine Controls		25.10	356.68	119.39
Pneumatic Starting System		70.00	610.00	94.75
Engine De-Icing		65.75	564.53	114.37
Fire Extinguishing System		90.00	610.65	129.00
Engine Mountings & Brackets		221.11	645.29	132.67
Fuel System		701.82	536.24	143.92
FLYING CONTROLS GROUP		1,738.26	652.07	140.52
Mechanical Flying Controls		773.43	679.76	145.88
Flying Controls Electronics		108.00	222.33	131.43
Flying Controls Hydraulics		856.83	681.24	136.83
EQUIPMENT FIXED & REMOVABLE		6,526.75	303.70	114.72
Instruments		57.30	146.41	137.04
Probe		15.00	-18.00	108.00
Oxygen System		46.12	220.36	138.15
Air Conditioning System		624.95	326.22	134.63
Hydraulic Main System		215.66	591.04	117.41
Armament Provisions		31.34	327.65	104.45
Brake Parachute		68.03	794.01	126.23
Electrical System		779.19	402.81	121.36
Low Pressure Pneumatics		16.60	217.17	133.41
Oil & Hydraulic Fluid Cooling		119.80	567.91	104.22
Intake De-Icing		50.60	204.55	113.76
Radio & Radar Fixed, Power Supplies		921.10	220.05	111.00
Canopy Actuation		47.00	223.43	156.83
Cabin Consoles		20.85	177.01	125.38
Radar Door Actuation		10.00	268.00	95.00
Radome Anti-Icing		16.80	66.35	124.40
Cabin Insulation		11.91	179.24	130.00
Cockpit Pressure Sealing		20.00	186.01	130.00

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WEIGHT ESTIMATION DATA

*Fighter
config 2.0*

It is assumed that the weight breakdown of the CF-105 type of fighter aircraft falls under the following main headings:

1. Structure
2. Undercarriage
3. Power Plant and Services
4. Flying Controls System
5. Equipment (Fixed and Removable)
6. Useful Load

The following fixed values and empirical formulae are suggested for the fighter configuration study.

1. Structure

(a) Wing

$$\frac{W_w}{S} = \frac{W_c^{0.8} A^F}{150 b} \left[1 + \frac{A^F}{\tau} \left(0.818 + 1.68 \sqrt{0.013 + \lambda^2} \right) \right] + 2.20$$

where W_w = wing weight (lb.)

W_c = combat weight (lb.)

b = span (ft.)

S = gross wing area (sq.ft.)

$A = b^2/S$

$\tau = 100 \times \frac{t}{c}$ = thickness-chord ratio at section where bending moment is maximum (percent)

λ = taper ratio $\frac{C_t}{C_r}$

$$F = \sqrt{1 + \left[\tan^2 \alpha_{LE} - 1.4 \frac{1-\lambda}{A(1+\lambda)} \right]^2}$$

α_{LE} = leading edge sweep angle

(b) Horizontal tail (including elevator if any)

$$W_H = 1.4 S_H^{1.2} \left(1 + \frac{3}{\tau} \right)$$

where S_H = net tail area (sq.ft.)

(c) Vertical tail (including rudder)

$$W_V = 1.2 S_V^{1.2} \left(1 + \frac{3}{\tau} \right)$$

where S_V = net vertical tail area (sq.ft.)

(d) Fuselage

$$W_F = 2.9 L P$$

where L = fuselage length (ft.)

P = maximum fuselage perimeter (ft.)

(e) Nacelles (if separate from fuselage)

$$W_N \text{ (per nacelle)} = 2.3 L P$$

where L and P are length and perimeter of nacelles.

2. Undercarriage

$$W_{U/C} = W_C (0.0178 + 0.0045 L)$$

where W_C = a/c combat weight (lb.)

L = length of main undercarriage leg (ft.) from top pivot to wheel axle.

3. Power Plant and Services

9,919 lb. not including fuel system weight. This is value given in Sept., 1955 weight list.

Fuel system weight = 0.275 lb/gal. of internal fuel
= 0.0367 lb/lb. fuel

4. Flying Controls System

$$W_{F/C} = 1.84 (2 b_a \bar{c}_a^2 + b_r \bar{c}_r^2 + 0.16 b_H \bar{c}_H^2)$$

where b_a = span of each aileron (ft.)

$\bar{c}_a$ = aileron mean chord (ft.)

b_r = rudder span (ft.)

$\bar{c}_r$ = rudder mean chord

b_H = net span of horizontal tail (not including imaginary portion in fuselage)

$\bar{c}_H$ = mean chord of horizontal tail (ft.)

This equation assumes that the elevator mean chord is 0.4 x horizontal tail chord, and that if there is no elevator (all-moving tail), the hinge moment is the same.

5. Equipment (fixed and Removable) = 6527 lb. (Avro list)

6. Useful Load

Crew, oil, etc.	771 (includes residual fuel in system)
Missiles	<u>1042</u>
	1813 lb.

Plus fuel for combat mission (to be worked out)

RJT/PM
28.9.55