WEIGHT ESTIMATION DATA

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

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

where W_w = wing weight (lb.)

W_c = combat weight (lb.)

b = span (ft.)

S = gross wing area (sq.ft.)

$A = b^2/S$

$\tau = 100 \cdot x\,\dfrac{t}{c}$ = thickness-chord ratio at section where bending moment is maximum (percent)

λ = taper ratio $\dfrac{C_t}{C_r}$

$$F = \sqrt{1 + \left[\tan \Lambda_{L.E.} - 1.4\frac{1-\lambda}{A(1+\lambda)}\right]^2}$$

Λ_{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

$$W_F = 2.9 \times L \times P$$

where L = fuselage length (ft.)
       P = maximum fuselage perimeter (ft.)

(e) Nacelles (if separate from fuselage)

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

where L and P are length and perimeter of nacelles.

2. Undercarriage

$$W_{U/C} = W_c(0.0173 + 0.0045L)$$

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

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

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. <u>Useful Load</u>

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

<u>Plus</u> fuel for combat mission (to be worked out)