

Raymer ch3

dropped (how?)  
\* # missiles  $\cdot W_{\text{missile}}$

$$W_0 = \cancel{W_{\text{crew}}} + W_{\text{pay}} + W_{\text{fuel}} + W_e$$

$$W_0 = W_{\text{pay}} + \left( \frac{W_f}{W_0} \right) W_0 + \left( \frac{W_e}{W_0} \right) W_0$$

$$W_0 = \frac{W_{\text{pay}}}{1 - \left( \frac{W_f}{W_0} \right) - \left( \frac{W_e}{W_0} \right)}$$

0.6 fig 3.1

$$\frac{W_e}{W_0} = A W_0^c \quad \text{vs} \quad \text{table 3.1}$$

$$A = 2.34 \quad c = -0.13$$

Raymer Ch6

better one (6.3.2, table 6.1) (ft, lb, s)

empty weight:

$$\frac{W_e}{W_0} = \left( a + b \left( \frac{W_0}{AR} \right)^{c_1} \left( \frac{T}{W_0} \right)^{c_2} \left( \frac{W_0}{S} \right)^{c_3} \left( M_{\text{max}} \right)^{c_4} \right) \quad \text{vs}$$

jet fighter

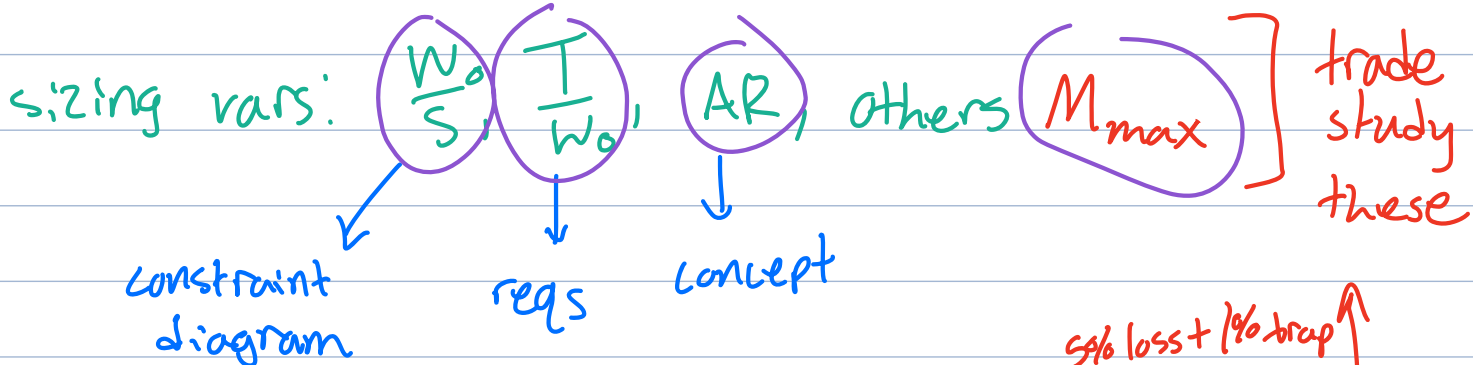
6.1  
eq tab 6.1

Raymer coeffs

$$a = -0.02 \quad b = 2.16 \quad c_1 = -0.10 \quad c_2 = 0.20$$

$$c_3 = 0.04 \quad c_4 = -0.10 \quad c_5 = 0.08$$

or: get 6+ baseline planes, use Matlab for  $a, b, c_n$



fuel weight:  $W_f = \left( \sum_i W_{f_i} \right) (1+k)$  0.06  
\* fix for explicit 30 min reserve segment  
 $W_{f_i} = \left( 1 - \frac{W_i}{W_{i-1}} \right) W_{i-1}$   
→ k=0.01?  $M_{cruise}$

taxi & takeoff  $\frac{W_i}{W_{i+1}} = 0.98$  6.8 (ref)

climb  $\frac{W_i}{W_{i+1}} = \begin{cases} 1.0065 - 0.0325M & M < 1 \\ 0.991 - 0.007M - 0.01M^2 & M \geq 1 \end{cases}$  6.9, 6.10

(x2) cruise  $\frac{W_i}{W_{i+1}} = \exp \left[ \frac{-RC}{V(L/D)_{cruise}} \right]$  SFC 3.3  
breguet range eq 6.11

$\hookrightarrow L=W \rightarrow \frac{L}{D} = \frac{q C_{D_0}}{\frac{W}{S}} + \frac{1}{\frac{W}{S} q \pi e AR}$  6.13  
endurance reqs

loiter  $\frac{W_i}{W_{i+1}} = \exp \left[ \frac{-ED}{L/D} \right]$  SFC  
eq 6.14 (max) L/D assume const

$\frac{1}{2} \rho V_{cruise}^2 = p(alt)$   
endurance eq

$$d_{dash} = \frac{R_{dash} = 100 \text{ nmi}}{V_{max}} = \frac{R_{dash}}{M_{max} \sqrt{\gamma R T}}$$

$$\rightarrow \text{dash } \frac{w_i}{w_{i-1}} = 1 - C\left(\frac{T}{w}\right) d_{dash} = T(aH)$$

$\approx 0.95$

eq 6.16  
known-time burn  
↳ distance

combat (# turns)

$$d_{combat} = \frac{2\pi \times \text{\# turns}}{\dot{\psi}}$$

6.17

turn rate (°/s) reqs? -//-

needed(?)

$$5.17: \dot{\psi} = \frac{g \sqrt{n^2 - 1}}{V}$$

$$6.18: n = \left(\frac{T}{w}\right) \left(\frac{L}{D}\right)$$

load factor

$$\rightarrow \frac{w_i}{w_{i-1}} = 1 - C\left(\frac{T}{w}\right) d_{combat} \approx 0.97$$

$$n \leq n_{max} \text{ (req)}$$

$$\downarrow 6.20, 19$$

$$\frac{q C_{L, max}}{w/s}$$

descend  $w_i/w_{i-1} = 0.990 - 0.995$  (6.22)

$$= \frac{1}{\frac{q C_{D_0} + n^2 \frac{w}{s}}{n(w/s)} \frac{1}{q \pi A e}}$$

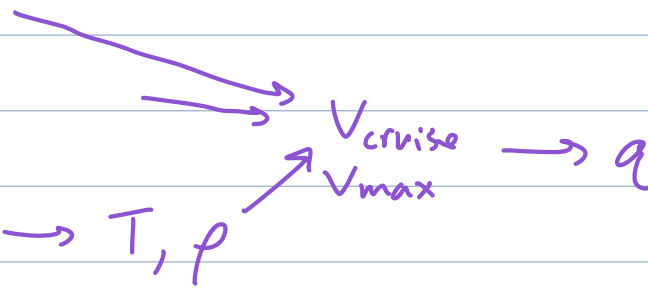
6.21

land/taxi  $w_i/w_{i-1} = 0.992 - 0.997$  (6.23)

reserve: loiter  $w/E_{reserve}$

## Sizing vars:

- # missiles
- $W_0/s$  constraint diagram
- $T/W_0$  reqs
- AR concept
- $M_{max}$  reqs
- $M_{cruise}$
- $C$
- $h_{cruise}$  reqs  $\rightarrow T, p$
- $e$  concept
- $L/D_{max/loiter}$
- $\psi$  reqs
- $C_{D0}$  concept



## Mission-specific:

- $R$
- $h$
- $E$
- $R_{dash}$
- $X_{turns}$
- $E_{reserve}$

? need both?

component buildup