

$$a) \frac{T_3}{T_0} = \frac{T_3}{T_2} \cdot \frac{T_2}{T_1} \cdot \frac{T_1}{T_0}$$

$$\underbrace{\tau_c}_{\tau_c} \underbrace{\frac{T_2}{T_1}}_{\substack{\text{assume} \\ \text{inlet is} \\ \text{isentropic} \\ = 1}} \underbrace{\frac{T_1}{T_0}}_{1 + \frac{\gamma-1}{2} M_0^2}$$

COMPOSED OF TEMPERATURE RISE DUE TO RAM EFFECT + TEMPERATURE RISE DUE TO WORK ADDITION IN COMPRESSOR

ANY COMBINATION OF T_0 & M_0 SUCH THAT

$$T_0 \cdot \tau_c \cdot \left[1 + \frac{\gamma-1}{2} M_0^2 \right] > 1000 \text{ K}$$

WILL EXCEED THE TEMPERATURE LIMIT.

$$\tau_c = \left(\frac{T_2}{T_1} \right)^{\frac{\gamma-1}{\gamma}} = (25)^{\frac{\gamma-1}{\gamma}} = 2.508$$

FOR

$T_0 = 300 \text{ K}$ LIMIT IS EXCEEDED FOR $M \gtrsim 1.3$
 $T_0 = 216 \text{ K}$ LIMIT IS EXCEEDED FOR $M \gtrsim 2.1$

b) PLUGGING INTO EQNS:

$$M=1.2, T=300\text{K}, \eta_0 = 0.367, \eta_{TH} = 0.69, \eta_p = 0.53$$

$$M=1.2, T=216\text{K}, \eta_0 = 0.298, \eta_{TH} = 0.69, \eta_p = 0.43$$

• η_{TH} DOESN'T CHANGE $\eta_{TH} = 1 - \frac{T_0}{T_3} = 1 - \frac{1}{\tau_c \left[1 + \frac{\gamma-1}{2} M_0^2 \right]}$ (from above)
 IS INDEPENDENT OF T_0 .

• η_p CHANGES BECAUSE AT CONSTANT M_0 , $u_0 \downarrow$ AS $T_0 \downarrow$

$$c) \left[\begin{array}{l} T_{T4} = 1800\text{K}, \quad F/w_{ia0} = 3.16, \quad \eta_0 = 0.298, \quad \eta_{TH} = 0.69, \quad \eta_p = 0.43 \\ T_{T4} = 1400\text{K}, \quad F/w_{ia0} = 2.36, \quad \eta_0 = 0.348, \quad \eta_{TH} = 0.69, \quad \eta_p = 0.54 \end{array} \right.$$

$$T_{T4} = 1400\text{K}, \quad F/w_{ia0} = 2.36, \quad \eta_0 = 0.348, \quad \eta_{TH} = 0.69, \quad \eta_p = 0.54$$

$\eta_0 \uparrow \Rightarrow$ IMPROVES RANGE & ENDURANCE

$F/w_{ia0} \downarrow \Rightarrow$ REDUCED MANEUVERABILITY