$\Rightarrow$

$$\boxed{\frac{u_9/u_0}{(u_9/u_0)_0} = \left[\frac{\tau_{\lambda b}}{\tau_\lambda - \tau_r(\tau_c - 1)}\right]^{1/2}}$$

QED

b) need to construct specific thrust

have a separate stream engine, so

$$F = (\dot{m}_c + \dot{m}_F)\,u_9 + \dot{m}_F\,u_{9'} - (\dot{m}_c + \dot{m}_F)\,u_0$$

(neg)

$$\dot{m} = \dot{m}_c + \dot{m}_F$$

$\Rightarrow$

$$\frac{F}{\dot{m}_c + \dot{m}_F} = \frac{F}{\dot{m}} = \frac{\dot{m}_c}{\dot{m}_c + \dot{m}_F}(u_9 - u_0) + \frac{\dot{m}_F}{\dot{m}_c + \dot{m}_F}(u_{9'} - u_0)$$

$$= \frac{1}{1 + \frac{\dot{m}_F}{\dot{m}_c}}\,u_0\left(\frac{u_9}{u_0} - 1\right) + \frac{\dot{m}_F/\dot{m}_c}{1 + \dot{m}_F/\dot{m}_c}\,u_0\left(\frac{u_{9'}}{u_0} - 1\right)$$

let

$$\alpha = \frac{\dot{m}_F}{\dot{m}_c}$$

$$u_0 = a_0 M_0$$