42. The mass of the jet is $m = W/g = 2.36 \times 10^4$ kg. Its acceleration is found from Eq. 2-16:

$$v^2 = v_0^2 + 2a\Delta x \quad \Longrightarrow \quad a = \frac{85^2}{2(90)} = 40 \text{ m/s}^2 \ .$$

Thus, Newton's second law provides the needed force F from the catapult.

$$F + F_{\text{thrust}} = ma \quad \Longrightarrow \quad F = \left(2.36 \times 10^4\right)(40) - 107 \times 10^3$$

which yields $F = 8.4 \times 10^5$ N.