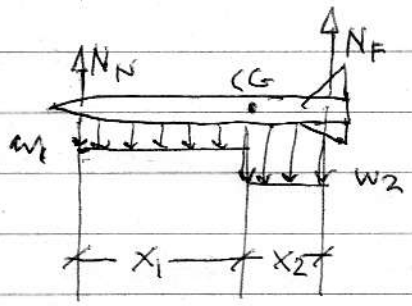
CALCULATE UNIFORMLY DISTRIBUTED FORCE ON ROCKET TO REACT NOSE & FIN LATERAL FORCES



Summation of forces & moments:

$$\Sigma F: \quad 0 = N_N + N_F - w_1 x_1 - w_2 x_2 \qquad (1)$$

$$\Sigma M_{CG}: \quad 0 = N_F x_2 - N_N x_1 + w_1 x_1\left(\frac{x_1}{2}\right) - w_2 x_2\left(\frac{x_2}{2}\right) \qquad (2)$$

From (1)
$$\boxed{w_1 = \frac{N_N + N_F - w_2 x_2}{x_1}} \qquad (1')$$

Re-arrange (2)

$$0 = N_F x_2 - N_N x_1 - w_2 \frac{x_2^2}{2} + w_1 \frac{x_1^2}{2} \qquad (2')$$

PUT (1') INTO (2')

$$0 = N_F x_2 - N_N x_1 - w_2 \frac{x_2^2}{2} + \frac{x_1^2}{2}\left(\frac{N_N + N_F - w_2 x_2}{x_1}\right)$$

$$0 = N_F x_2 - N_N x_1 - w_2 \frac{x_2^2}{2} + \frac{x_1}{2}\left(N_N + N_F - w_2 x_2\right)$$

Group terms

$$0 = N_F\left(x_2 + \frac{x_1}{2}\right) + N_N\left(\frac{x_1}{2} - x_1\right) - w_2\left(\frac{x_2^2}{2} + \frac{x_1 x_2}{2}\right)$$

$$\frac{1}{2} w_2\left(x_2^2 + x_1 x_2\right) = N_F\left(x_2 + \frac{x_1}{2}\right) + N_N\left(\frac{x_1}{2} - x_1\right)$$

$$\frac{1}{2} w_2\left(x_2^2 + x_1 x_2\right) = N_F\left(x_2 + \frac{x_1}{2}\right) - N_N \frac{x_1}{2}$$

Solving for w_2

$$\boxed{w_2 = \frac{N_F\left(2x_2 + x_1\right) - N_N x_1}{x_2^2 + x_1 x_2}}$$