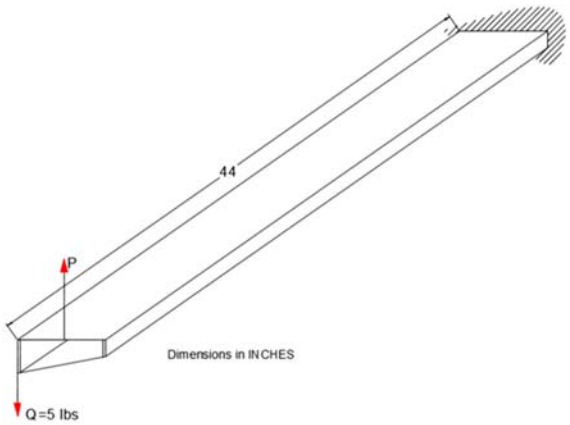
AirBus-A525 Wingbox contest (2018-19)

Design and Build the lightest semi-monocoque wingbox to withstand the bending and twisting loads. The cantilevered wingbox weighing no more than **0.7 lbs** must carry a dead load 'Q' of 5 lbs and minimum end load 'P' of **15 lbf** to qualify. The wingbox will be tested to failure and the team achieving the highest score based on a weighted rubric will be the winner. The score will be based on the wing design documentation, construction quality, and performance.

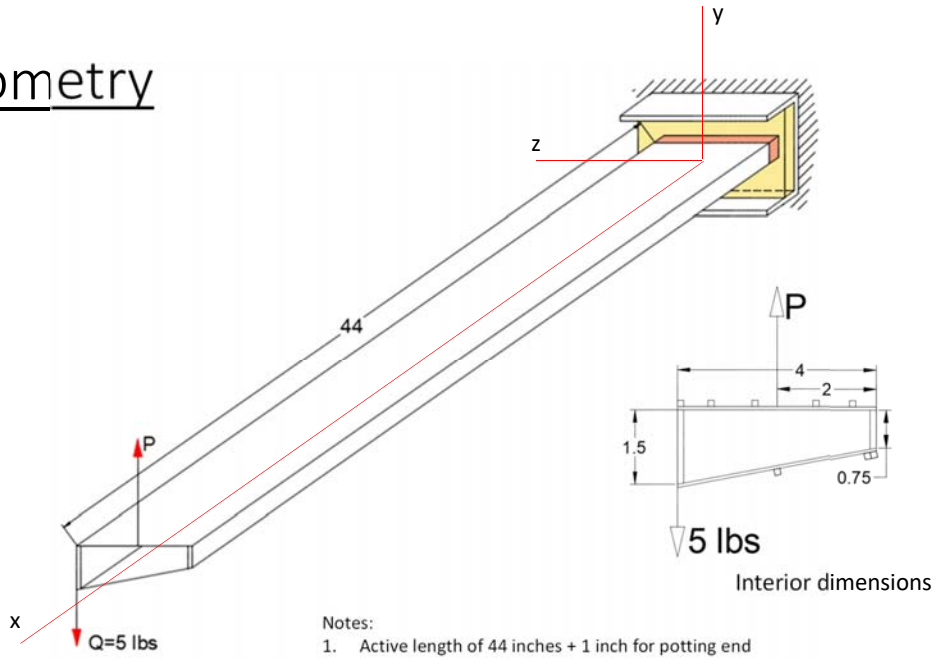


Eligibility:
Open to student groups (≤ 6) enrolled in the Fall 2018 AE 525 course

Deadlines:
Entry : Enrolled in AE 525
Submission : **12/03/2018**

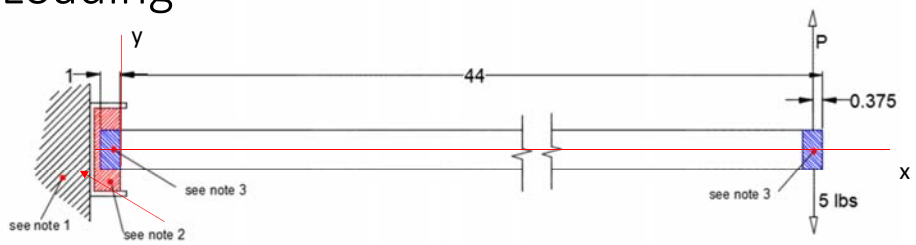
Awards:
1st Place : $1000
2nd Place : $500
3rd Place : $250

Geometry

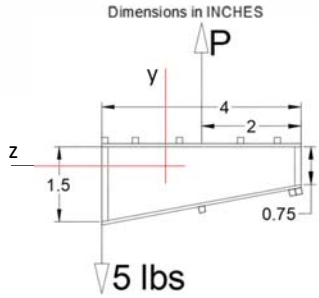


Notes:
1. Active length of 44 inches + 1 inch for potting end
2. The stringers must be placed on the outside.
3. End will be potted by Flight Structures Lab

Loading



NOTES
1. Rigid support
2. End potted in epoxy resin
3. Ends to be reinforced with 1.00 in thick foam rib



NOTE: The teams will be provided with end foam ribs (1.00in thick) to be inserted at the free and fixed ends. The stringers, spars and skin must extend the entire length (45 inches)

Scoring rubric

The designs will be scored based on the following formula

$$Score = S_{performance} + S_{analysis} + S_{report}$$

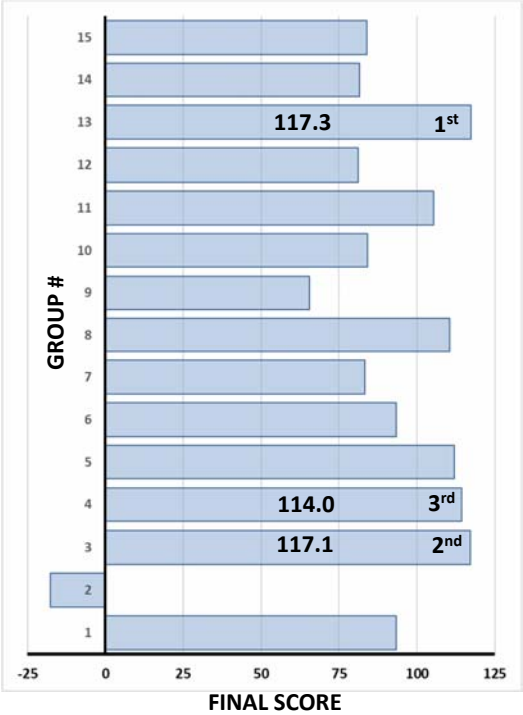
$$S_{performance} = 0.5\frac{P_{\max}}{W_{Wing}} + 0.1\frac{Q}{\delta_Q} + 0.05\left[\frac{P_{\max}}{\delta_{\max}} + \frac{P_{\max}}{\theta_{\max}}\right] - 10\frac{W_{Wing}}{0.5}$$

$$S_{analysis} = 10\left(1 - f\left(P_{\max}, P_{pred}, 0.1\right)\right) + 10\left(1 - f\left(\delta_Q, \delta_{Q\_pred}, 0.1\right)\right) + 10\left(1 - f\left(\delta_{10}, \delta_{10\_pred}, 0.1\right)\right)$$

$$f\left(A, A_{pred}, \beta\right) = \begin{cases} 0 & \frac{\left|A - A_{pred}\right|}{A_{pred}} \le \beta \\ \frac{\left|A - A_{pred}\right|}{A_{pred}} - \beta & otherwise \end{cases}$$

Note : The tolerances for strength and stiffness are based on variability in material properties.

W_{TOTAL} ~ Total weight (wing box + end block)
$W_{SUPPORT}$ ~ Weight of end block
W_{WING} ~ weight of wingbox (lbs)
(should not exceed 0.7 lbs)
$P_{\max}$ ~ Measured failure load
P_{pred} ~ predicted failure load (lbs)
δ_{15} ~ Measured end deflection (along load) at P=15 lbs (+Q=5lbs)
δ_{15_pred} ~ Predicted end deflection (along load) at P=15 lbs (+Q=5lbs)
δ_Q ~ Measured end deflection (along load) at Q=5 lbs
δ_{Q_pred} ~ Predicted end deflection (along load) at Q=5 lbs
$\delta_{\max}$ ~ Measured end deflection at failure
$\theta_{\max}$ ~ Measured end twist at failure (degrees)



AirBus-A525 Wingbox contest (2018-19) :Winners

- 1ST PLACE
  - Paul Fawcett, Jonathan Carlson, Leandre Copil, Selman Okmen, Kristopher Stewart
- 2ND PLACE
  - Chun Yu Lim, Jongwon Lee, Jun Chang Teoh, Yee Min Choo, Zhao Heng Tan
- 3RD PLACE
  - Darin Parker, Oleksiy Zadorozhnyy, Ruben Reyes, Ryan Lynch

BREAKDOWN OF SCORES