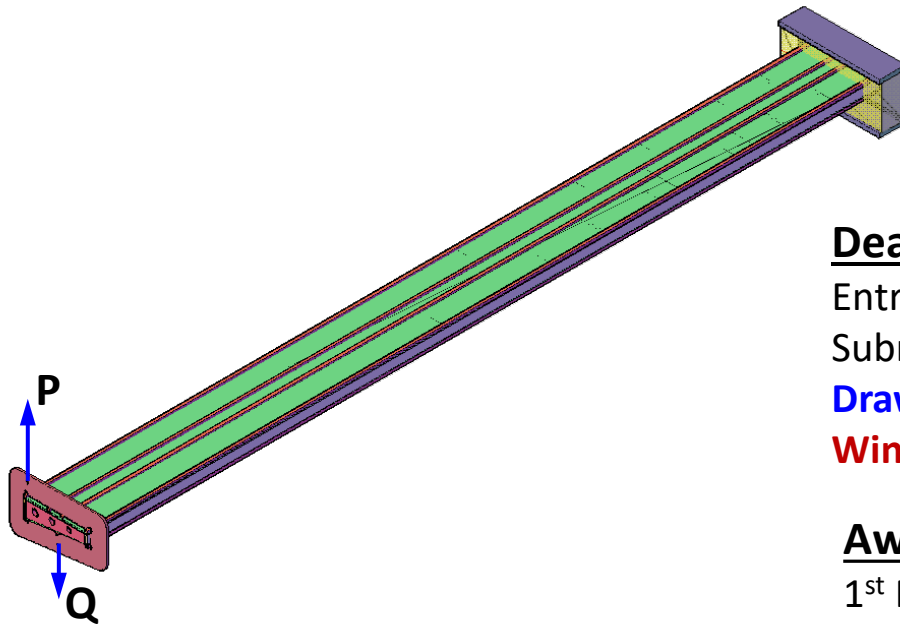


# AirBus-A525 Wingbox contest (Fall 2023)

Design and Build the **lightest semi-monocoque wingbox** to withstand the bending and twisting loads. The cantilevered wingbox weighing **no more than 0.75 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 ( $\leq 5$ ) enrolled in the Fall 2023 AE 525 course

## Deadlines:

Entry : Enrolled in AE 525

Submissions :

**Drawings : 5PM (CDT), November 27<sup>th</sup> 2023**

**Wingbox & Report : 6 PM (CDT), December 8<sup>th</sup> 2023**

## Awards:

1<sup>st</sup> Place : \$1500

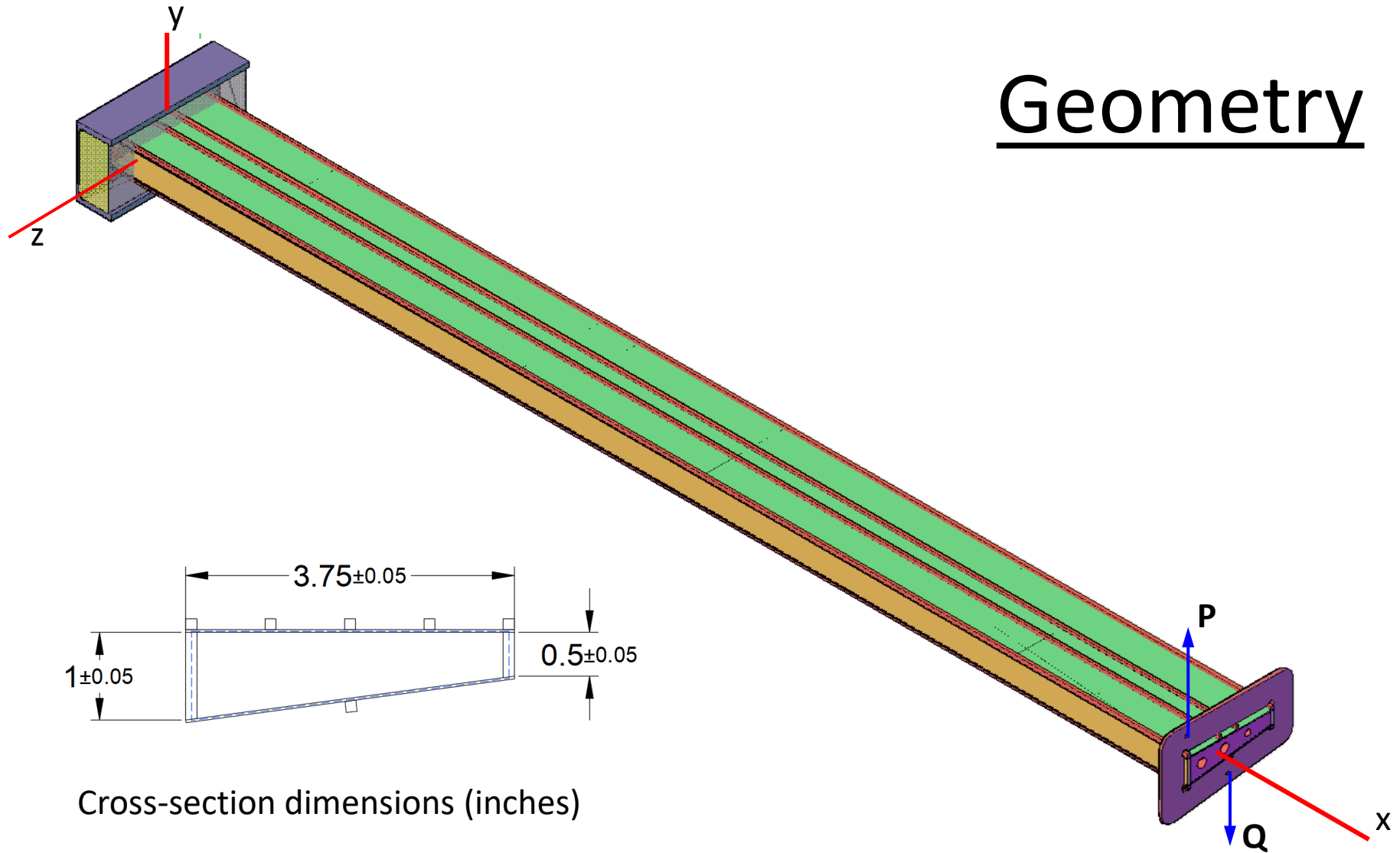
2<sup>nd</sup> Place : \$1000

3<sup>rd</sup> Place : \$500

**AIRBUS**



# Geometry

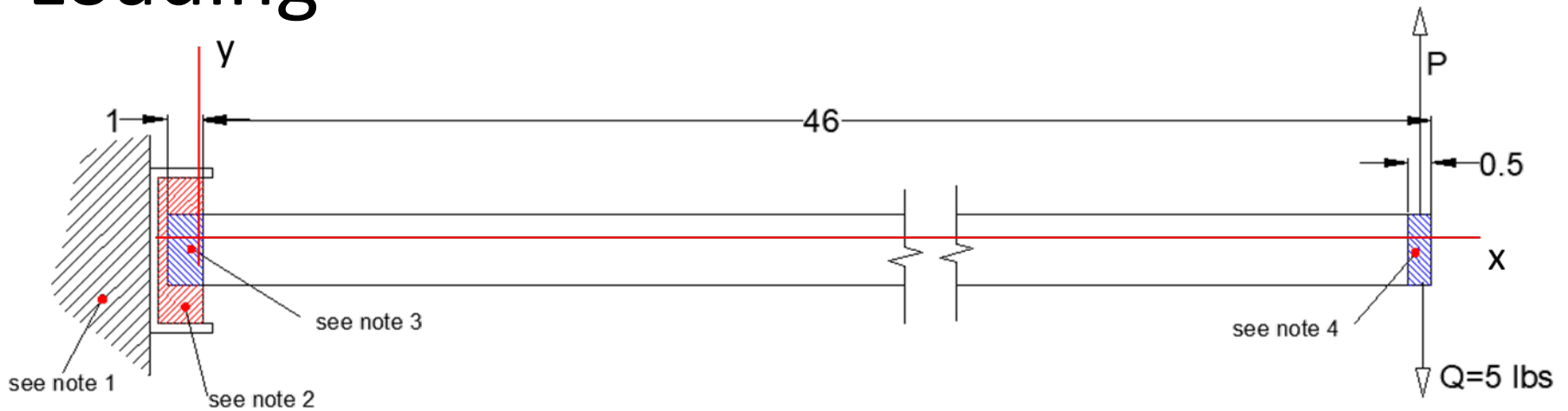


Cross-section dimensions (inches)

## Notes:

1. Active length of 46 inches + 1 inch for potting end
2. The stringers must be placed on the outside (locations shown in the figure are for illustration only)
3. End will be potted by Flight Structures Lab

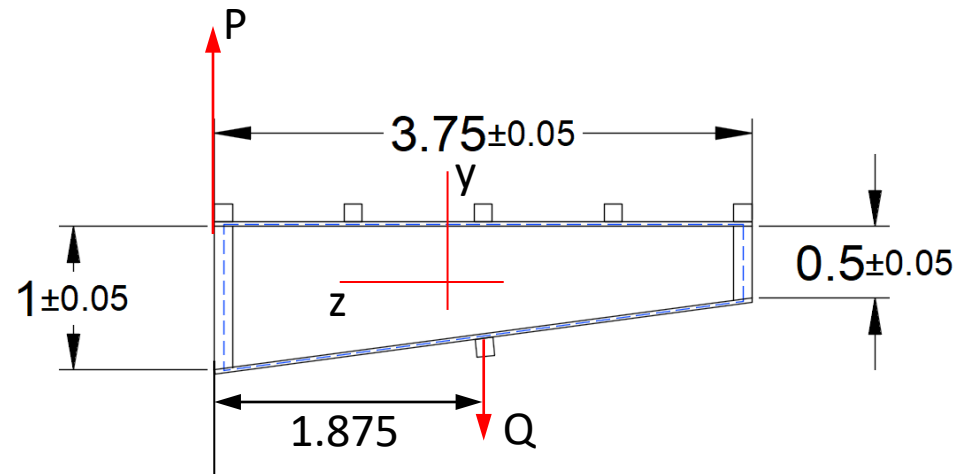
# Loading



## NOTES

1. Rigid support
2. Fixed end potted in epoxy resin
3. Fixed end to be reinforced with 1.00 inch thick rib
4. Free end to be reinforced with 0.50 inch thick rib

Dimensions in INCHES



NOTE: The teams will be provided with a Basswood ribs for the fixed end (1.00 inch thick) and free end (0.5inch thick). The stringers, spars and skin must extend the entire length (47 inches)

# Scoring rubric

The designs will be scored based on the following formula

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

$$S_{design} = 100 \left[ 0.6 \frac{(N_{stringer} - 5)}{0.003(N_{stringer} + 5)^3} + 0.4 \frac{15}{(N_{rib})} - \left( \frac{N_{stacked}}{8} + \frac{N_{adjacent}}{8} \right) \right]$$

$$S_{performance} = 0.5 \frac{P_{max}}{W_{Wing}} + 0.1 \frac{Q}{\delta_Q} + 0.05 \left[ \frac{P_{max}}{\delta_{max}} + \frac{P_{max}}{\theta_{max}} \right] - 10 \frac{W_{Wing}}{0.75}$$

$$S_{analysis} = 10 \left( 1 - f(P_{max}, P_{pred}, 0.1) \right) + 10 \left( 1 - f(\delta_Q, \delta_{Q\_pred}, 0.1) \right) + 10 \left( 1 - f(\delta_{15}, \delta_{15\_pred}, 0.1) \right)$$

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

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 0.75 lbs)

$P_{max}$  ~ Measured failure load

$P_{pred}$  ~ predicted failure load (lbs)

$\delta_{30}$  ~ Measured end deflection (along load) at P=15 lbs (+Q=5lbs)

$\delta_{30\_pred}$  ~ Predicted end deflection (along load) at P=15 lbs (+Q=5lbs)

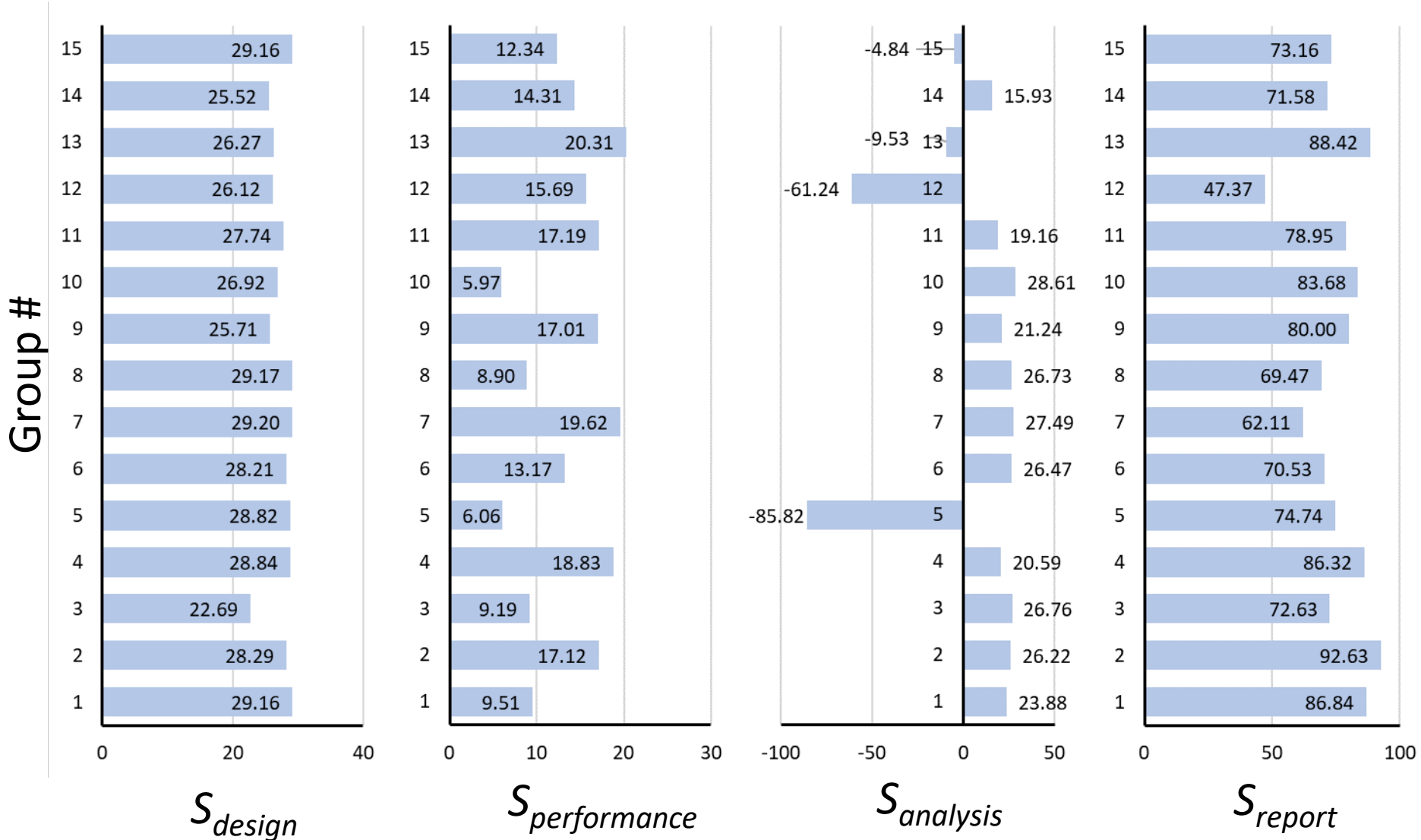
$\delta_Q$  ~ Measured end deflection (along load) at Q=5 lbs

$\delta_{Q\_pred}$  ~ Predicted end deflection (along load) at Q=5 lbs

$\delta_{max}$  ~ Measured end deflection at failure

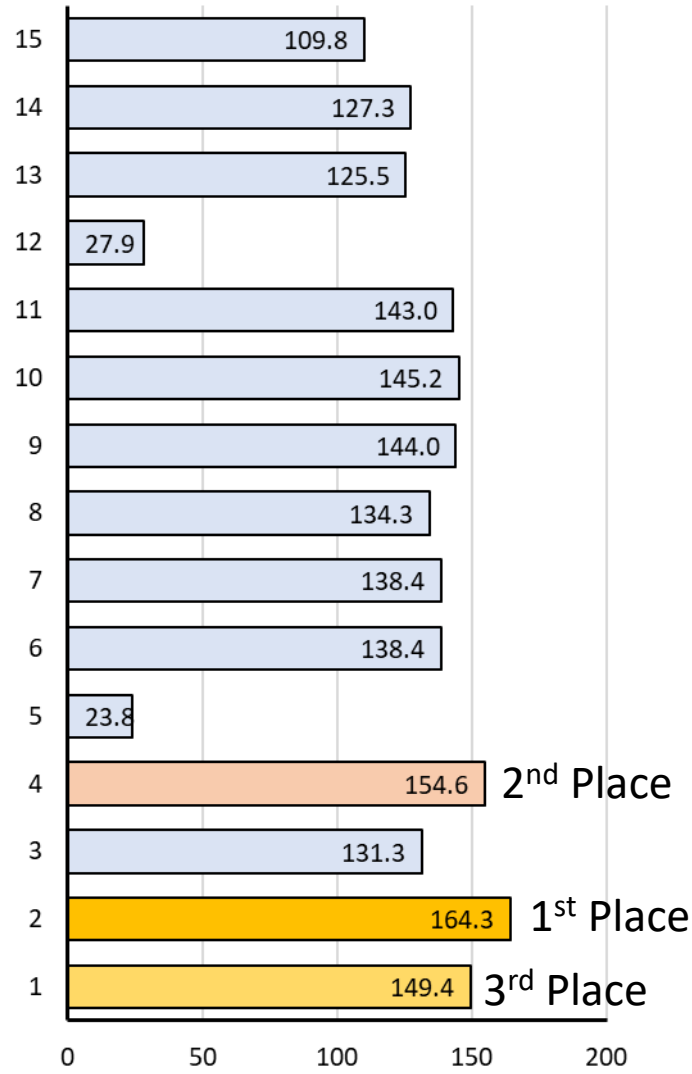
$\theta_{max}$  ~ Measured end twist at failure (degrees)

## Category Scores



## AirBus-AE525 Wingbox contest (2023 Fall) :Winners

Group #



Score

- 1<sup>ST</sup> PLACE
  - Mason Hensley, Joseph Macko, Caleb Perkins, Peter Stuhlsatz
- 2<sup>ND</sup> PLACE
  - Erik Anderson, Julia Buie, Zachary Oakley, Hunter Robertson
- 3<sup>RD</sup> PLACE
  - Treyton Blecke, Luke Cotter, Diego Fuentealba, Aiden Holt