

The Load-Bearing Lunch

Bridge #:
5VNWRCNZ8SF

Category H

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PROBLEM STATEMENT

Design a rectangular cross section sandwich beam that holds a distributive load of 1,600 lbf applied at the center.

Initial Design

There are four components to this beam:

- Two equally sized face sheets made of 0/90° prepreg carbon fiber
- 1" thick aluminum honeycomb core
- Film adhesive along entire length to bond face sheets to core
- Balsa wood inserts within honeycomb to reinforce load points

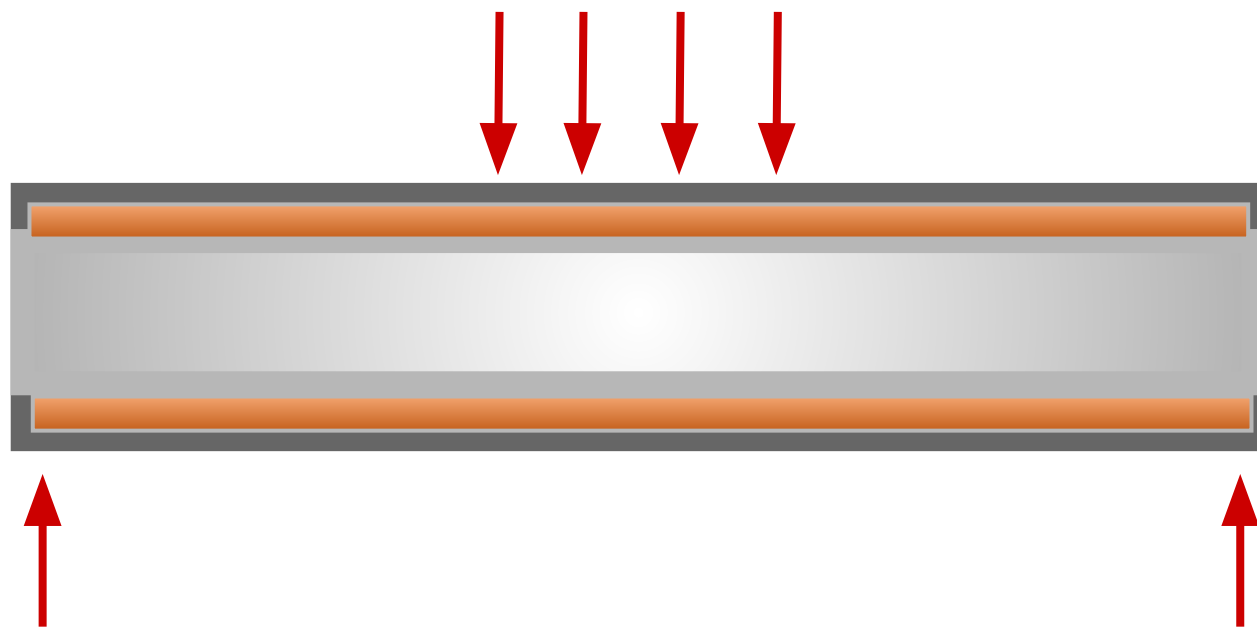


Fig 1. Red arrows represent load points, with inserts in the honeycomb. Orange represents film adhesive

MANUFACTURING

Face sheets are cut, laid up, and cured at 350F for 3 hours (Figure 2). The face sheets and adhesives are then trimmed to their intermediate shape. Small 1" thick balsa wood pieces were cut to be inserted into the honeycomb structure. Then the beam was laid up in the order of adherent, film adhesive, honeycomb core, film adhesive and adherent. The assembled beam is placed in a 1" aluminum tool to support autoclave pressure (Figure 3). After cure, the beam is removed from bagging/tooling and trimmed to final dimensions.

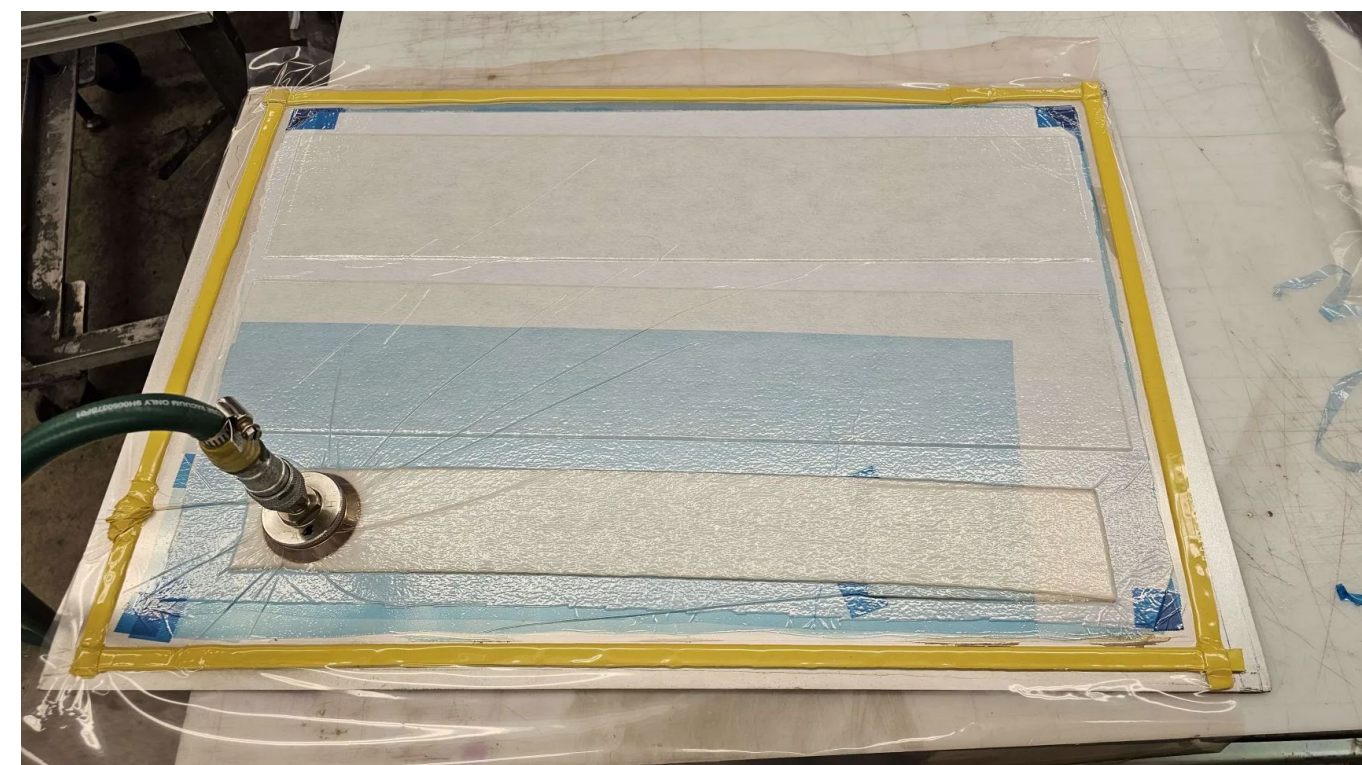


Fig 2. Layup of Face Sheets

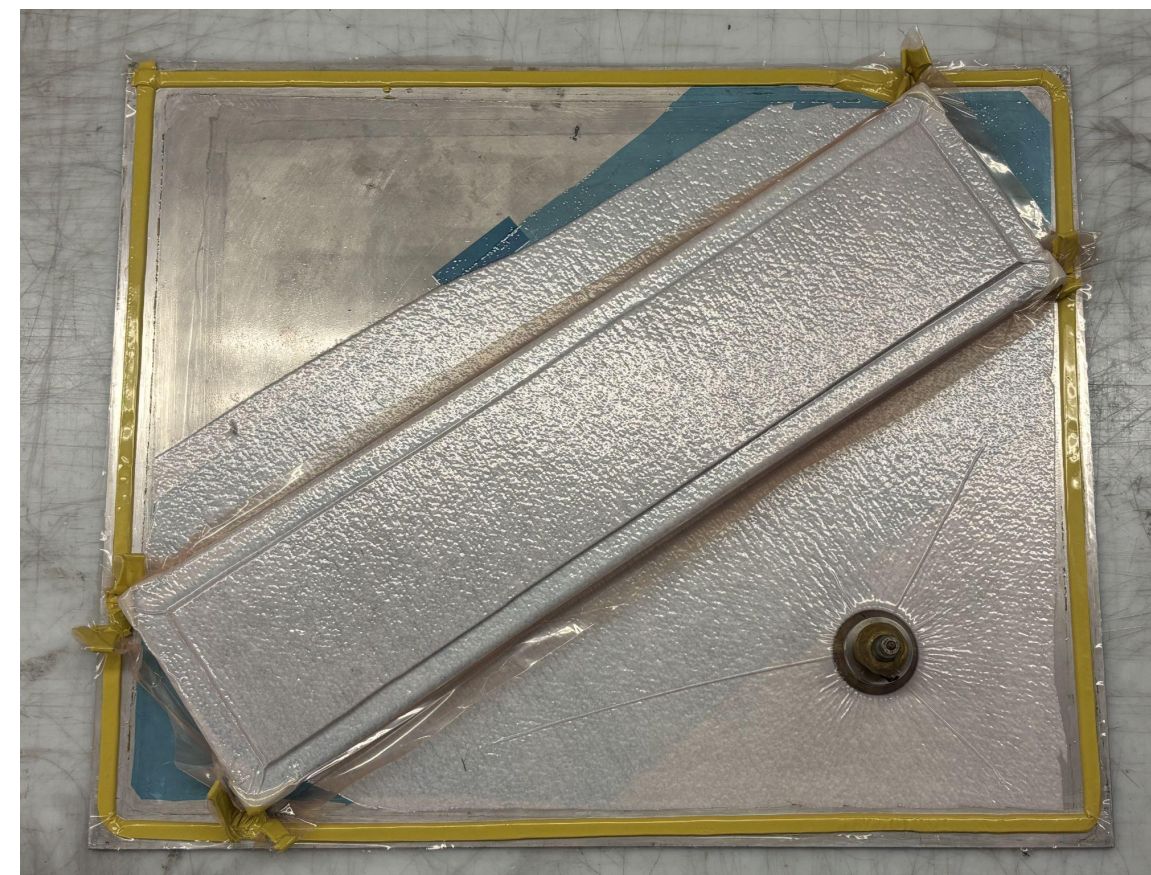


Fig 3. Final Bag

TESTING

The first iteration was built with 1" thick core and was tested (Figure 4). It failed from core crushing at 1499 lbf at the contact points. The final iteration addressed this issue by adding balsa wood inserts to the contact points to help increase compressive strength.



Fig 4. Final Beam

FUTURE IMPROVEMENTS

There are several improvements to the design and manufacturing that can be done to produce a better beam:

- Try different core materials and experiment with thicknesses and cell sizes
- Experiment with hybrid-material core system

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