Cardboard Boat

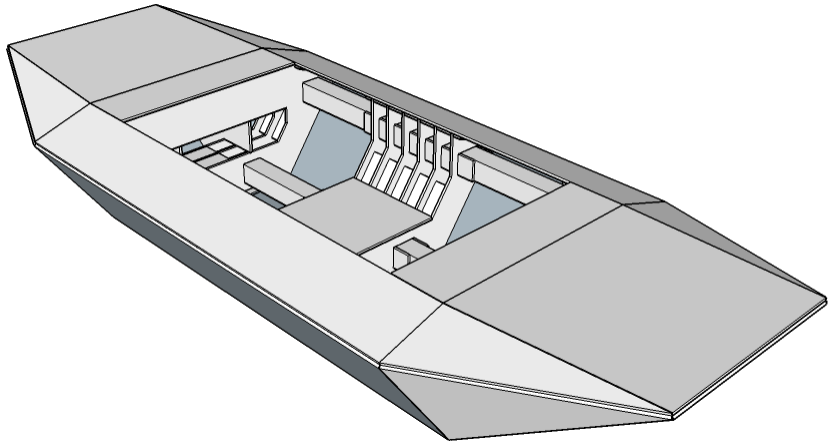
Config 1

Design

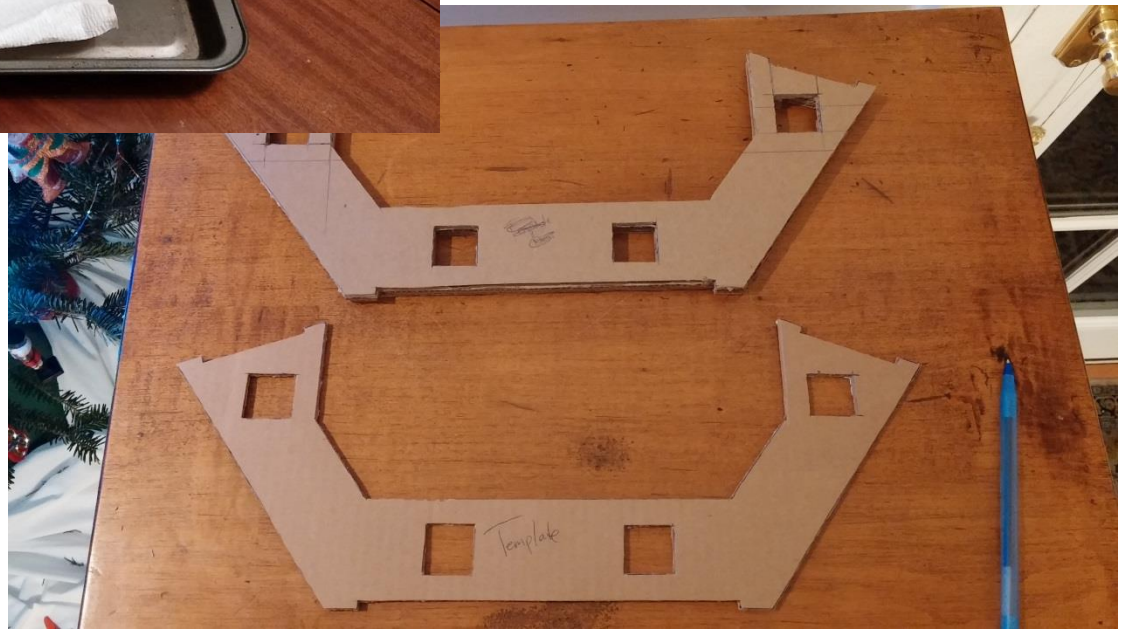
- Cage and skin structure
- Internal cage for longitudinal load distribution
  - Keeps hull skin from having to carry longitudinal bending moment and out-of-plane shear (boat won't fold up when wet)
  - Beams can be isolated from water (wrap in strapping tape)
  - Modular bay structure carries full load of 1 pax (175 lbs)
  - Add bays to add pax
- Single piece skin folded to correct shape and strapped around cage (strapping tape)
  - No hull penetrations, slow to take on water
  - Skin still provides reasonable torsional rigidity when wet
- Config 1 (full scale)
  - Kayak-like configuration
  - Seat depth of 1 in below WL, height of 4 in. above floor
  - Four beams, 2 in. square, glued cardboard lamina, strapping tape
  - 55 deg. sidewall, 35 deg. bow angle, 4 ft. x 33 in. bays

Subscale Test Article

- 46% scale, single bay model
  - Single piece hull skin fits on extra large moving box
- Design load of 18 lbs (buoyant force scales as L^3)
- Structural stress (for a given load) scales as 1/L^2
  - Structural margin @ design load doubles for a half scale model
- “Seat” bulkhead in center for load testing



Construction Pics



Construction Pics

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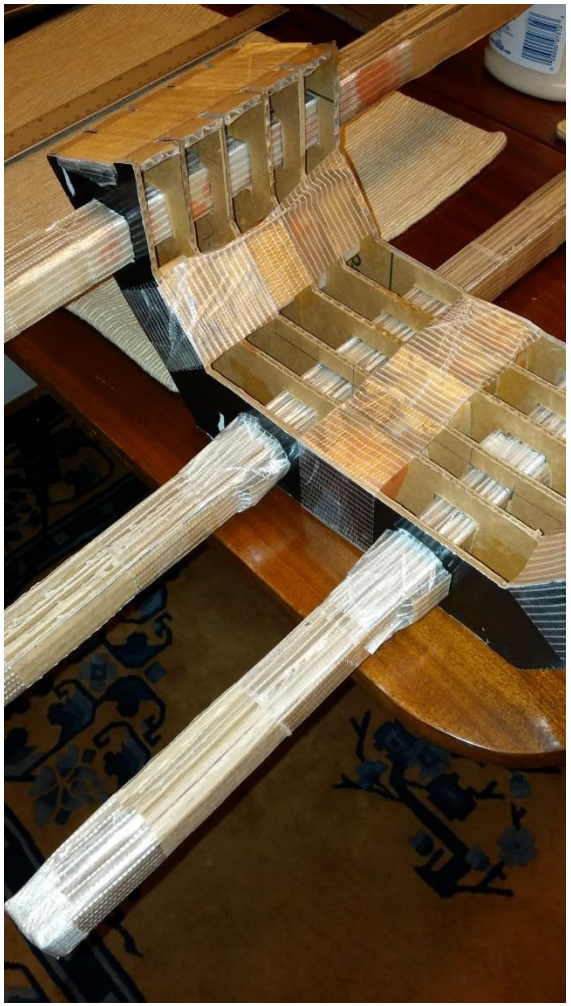
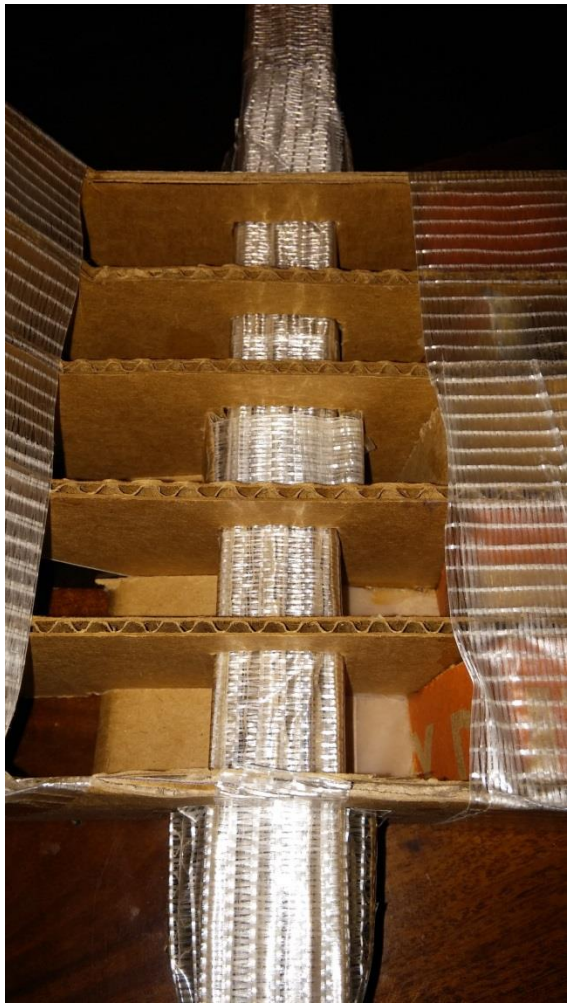
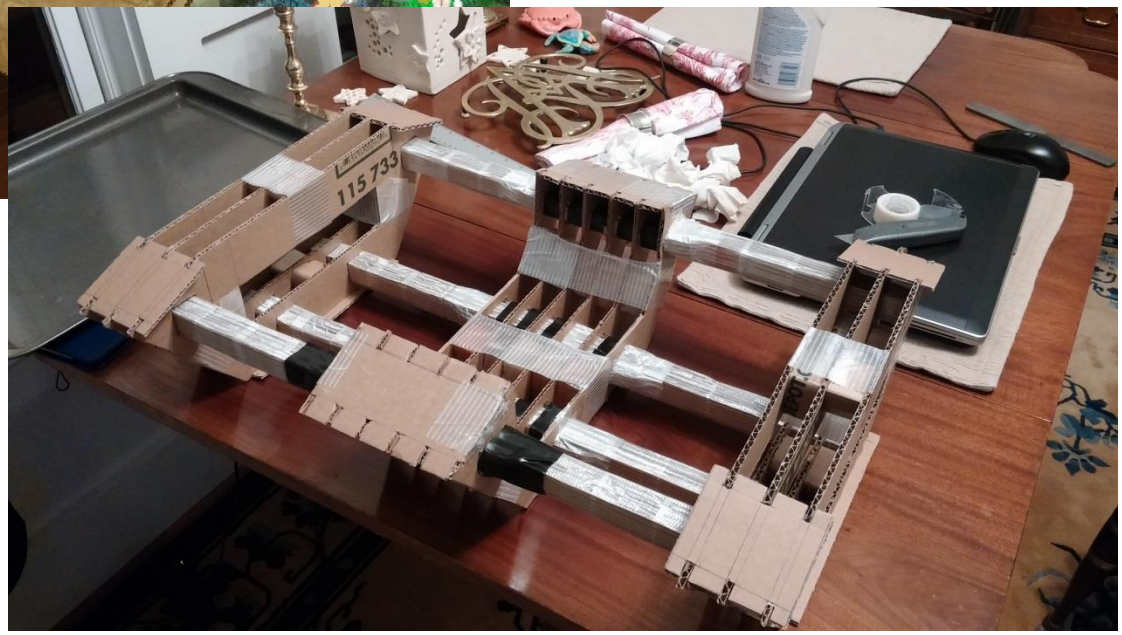




Construction Pics



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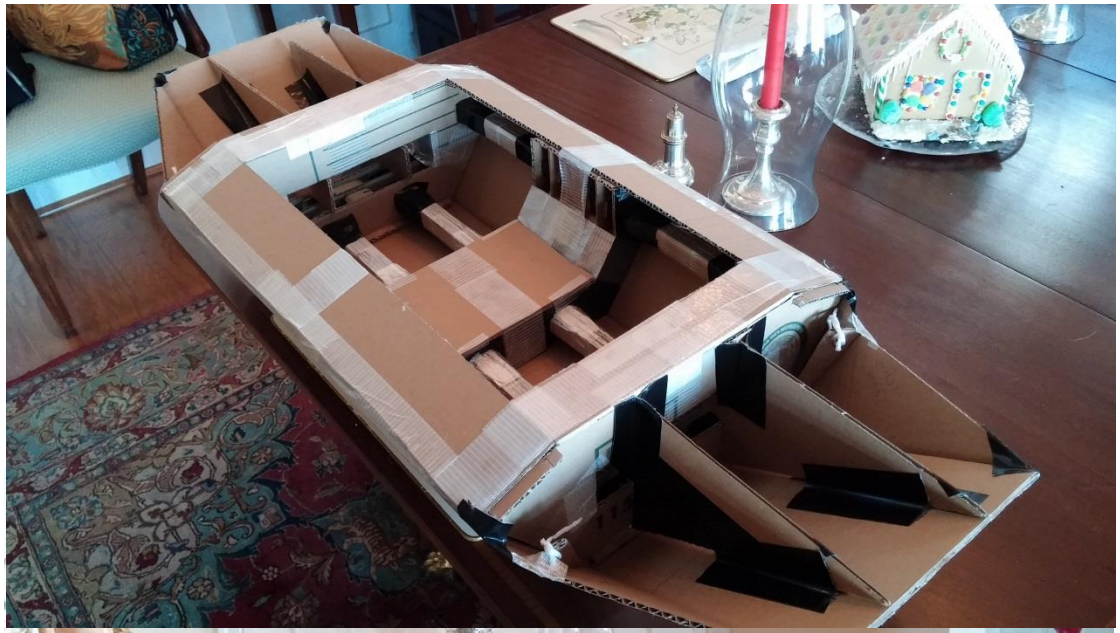
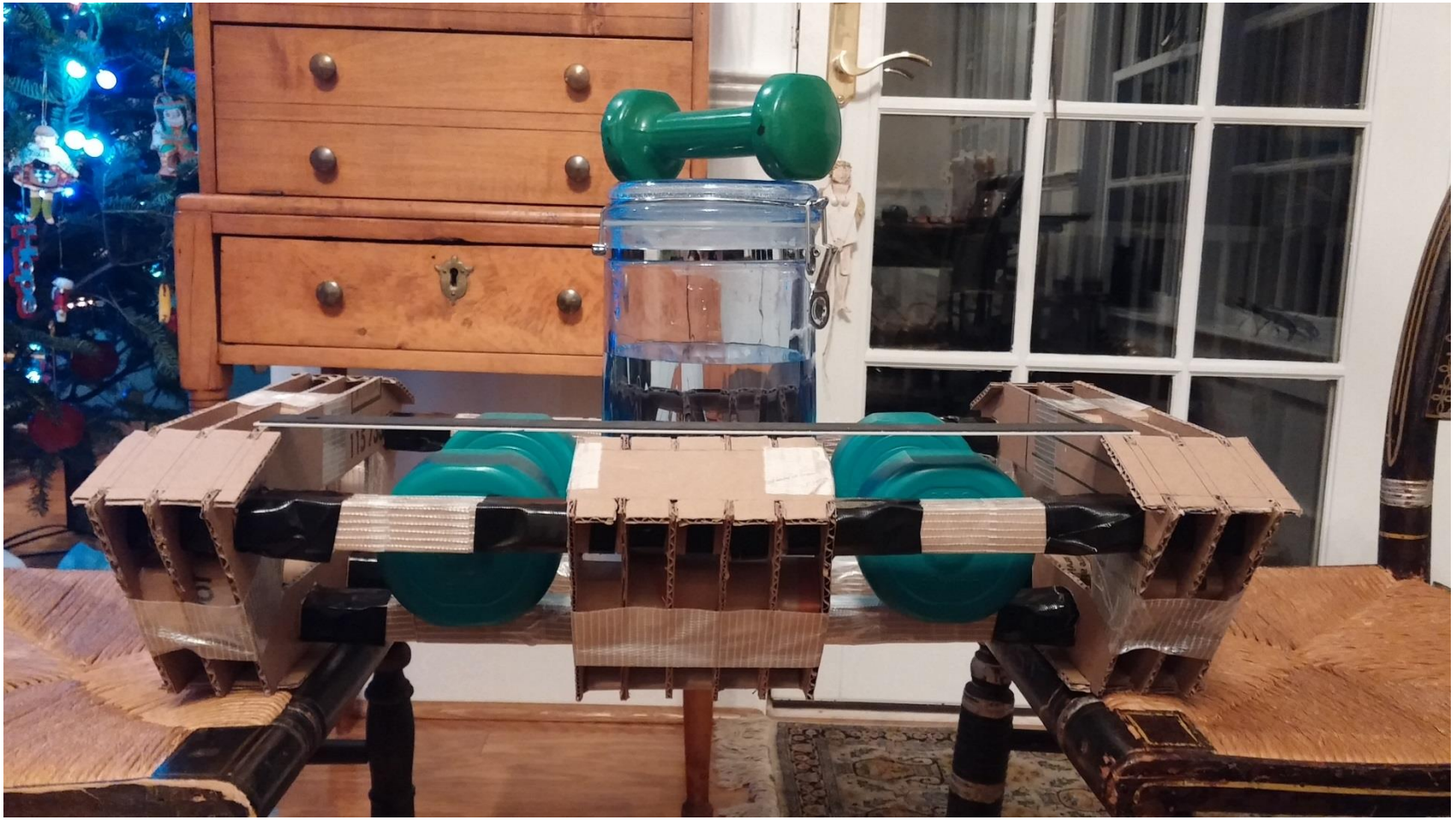


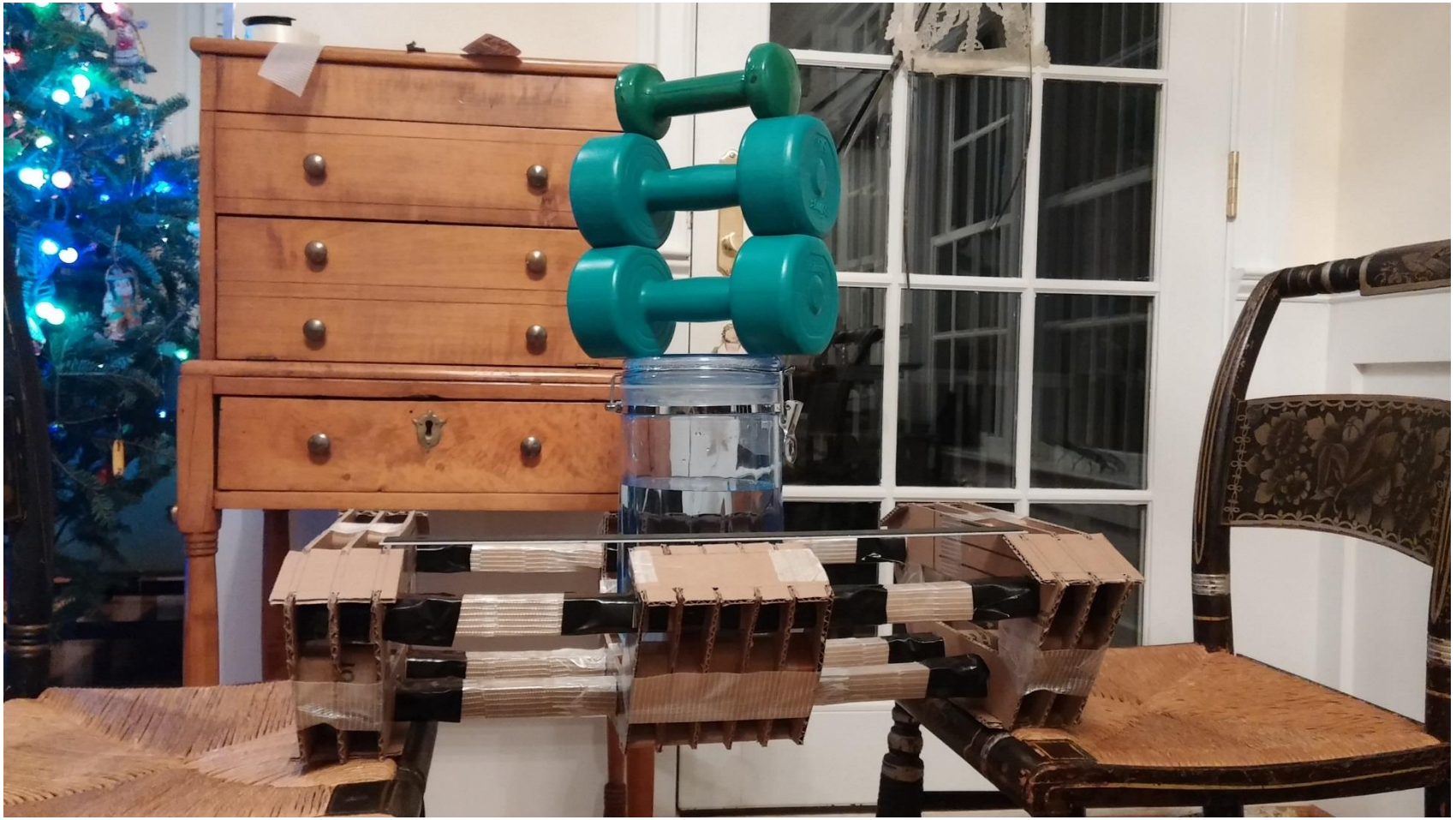
End Supported Load Test

Design Load (18 lbs.)



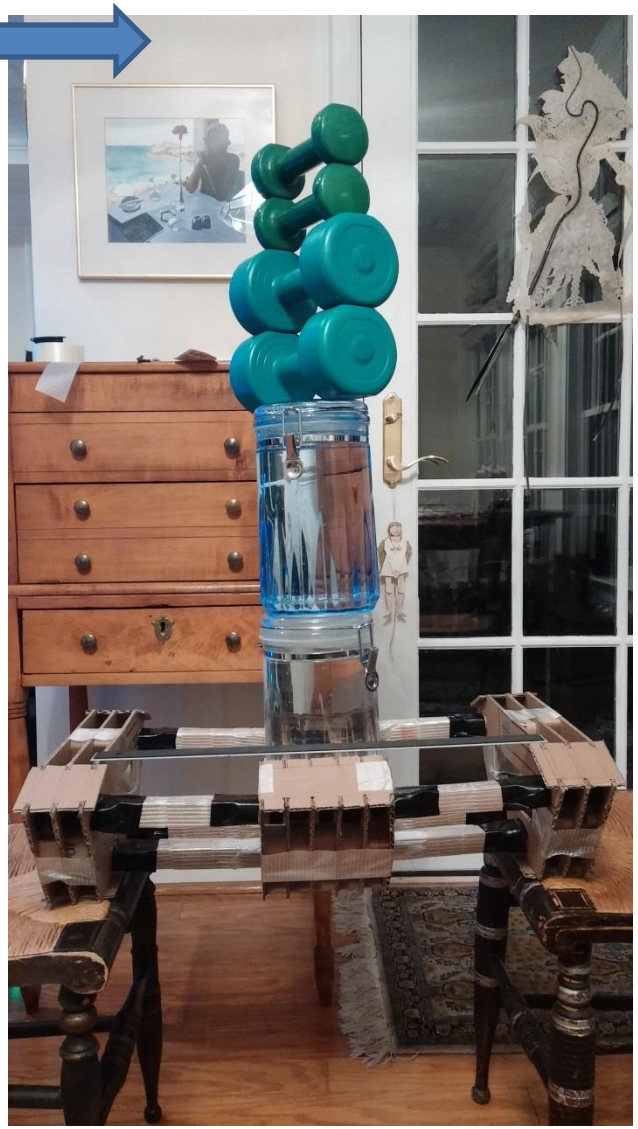
End Supported Load Test

Design Load (18 lbs.), Stacked



End Supported Load Test

- 1.66x design Load (30 lbs.), Stacked
- Probably could do 3-4x design load
  - Translates to 1.5 to 2x at full scale
  - Should d-test the model to verify…
- Stacked, end supported loading is conservative w.r.t. water loading
- Boat empty weight of 2.5 lbs.



In-Water Test

1x design load (18 lbs)

In-Water Test

In-Water Test

1.66x design load (30 lbs)

In-Water Test

- About 5 minutes in water under load
- No noticeable water inside hull
- Waterline close to expected location at 1x design load (18 lbs.)
- Positive lateral stability, but close to neutral (somewhat tippy)
  - Tried to get vertical load distribution correct…
  - Should try to quantify kayak metacenter location and match it…
- 1.66x design load tested without a problem