

Cardboard Boat

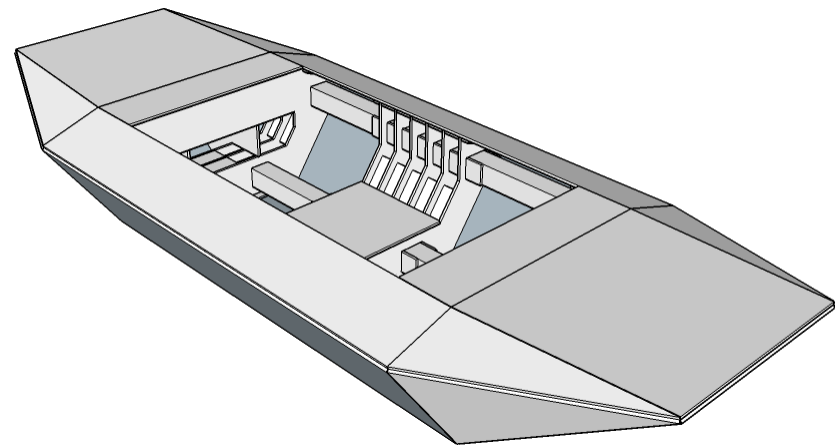
Config 1

Design

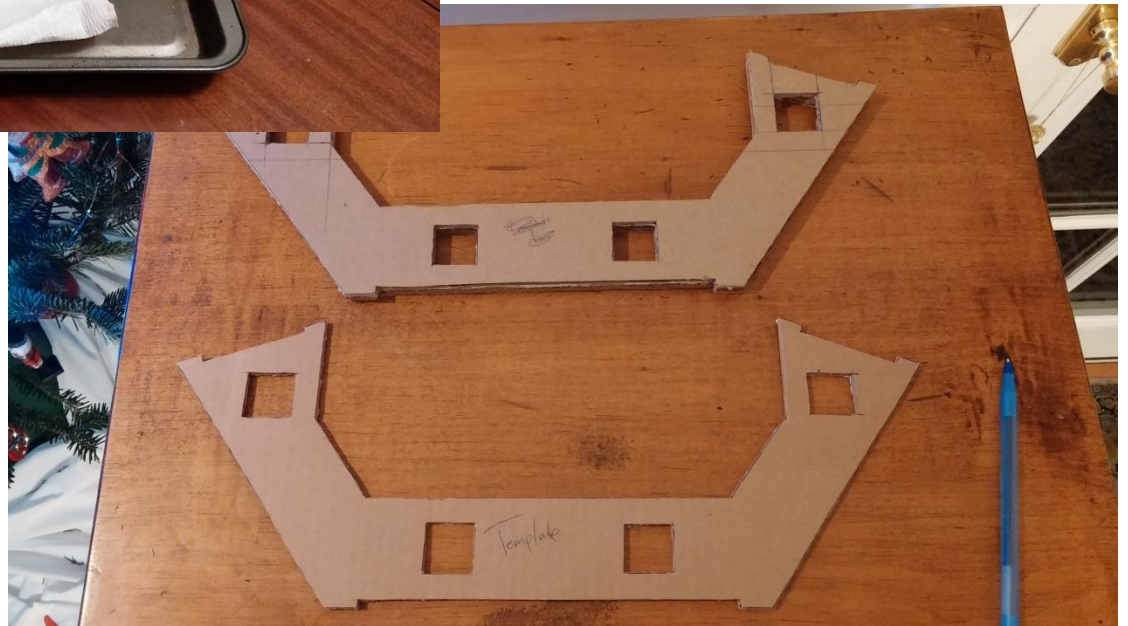
- Cage and skin structure
- Internal cage for longitudinal load distribution
 - Keeps hull skin from having to carry longitudinal bending moment and out-of-plane shear (boat won't fold up when wet)
 - Beams can be isolated from water (wrap in strapping tape)
 - Modular bay structure carries full load 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



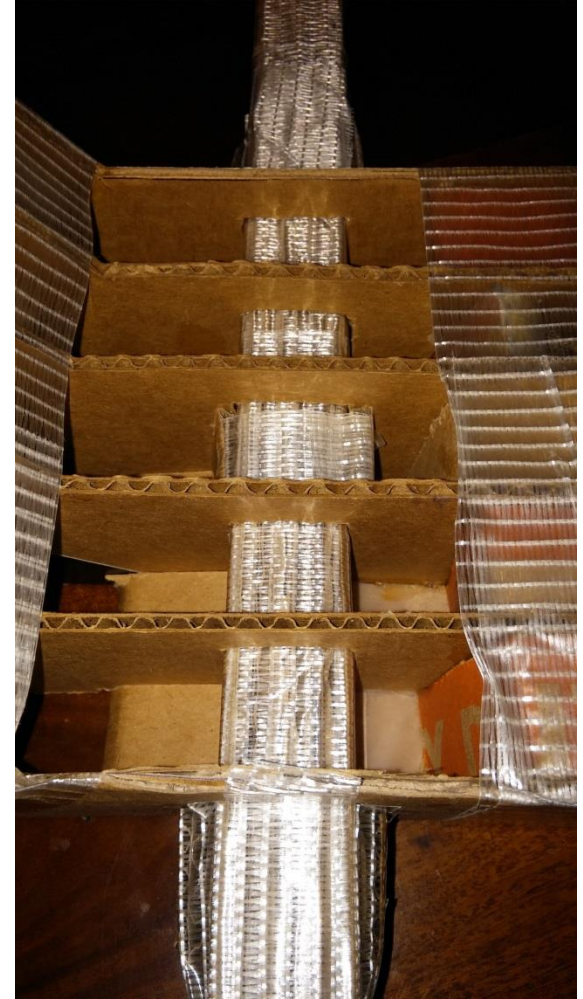
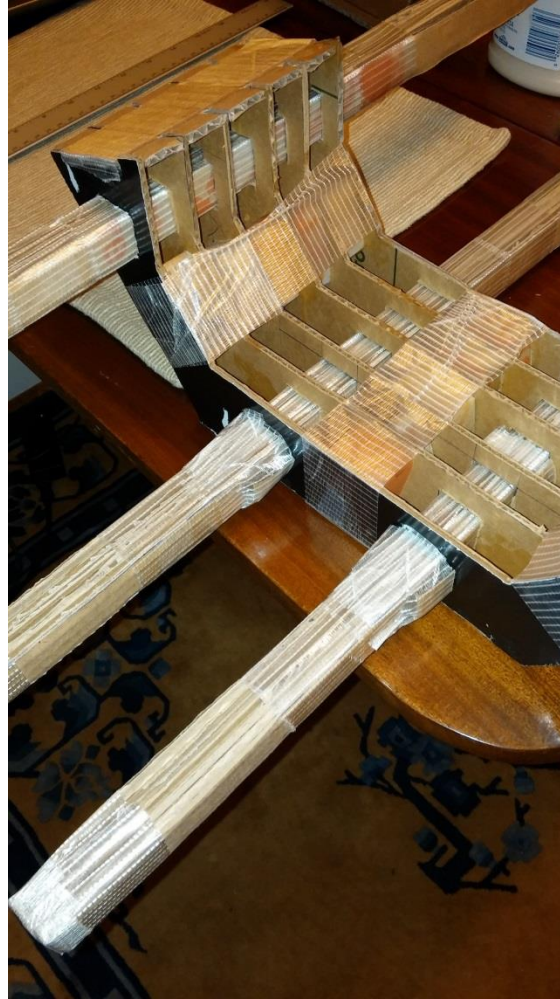
Construction Pics



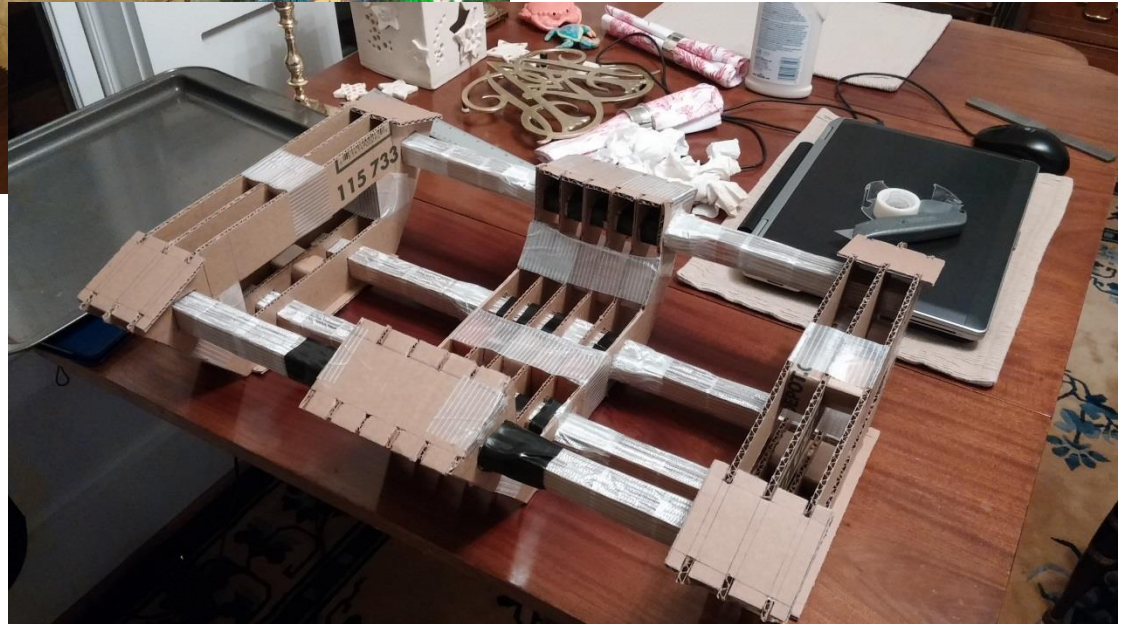
Construction Pics



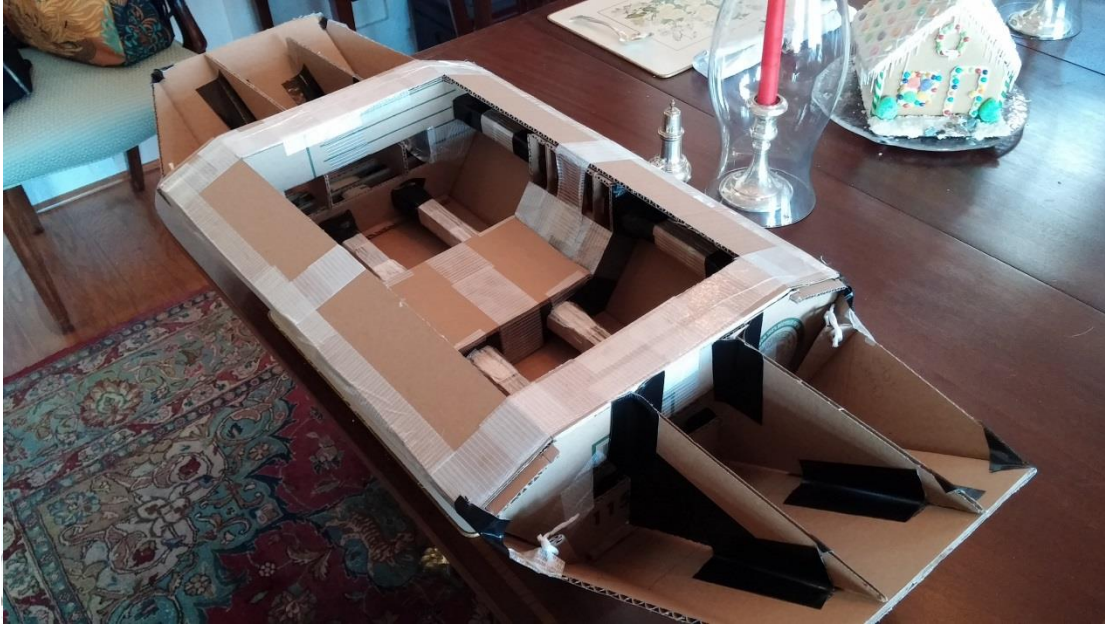
Construction Pics



Construction Pics

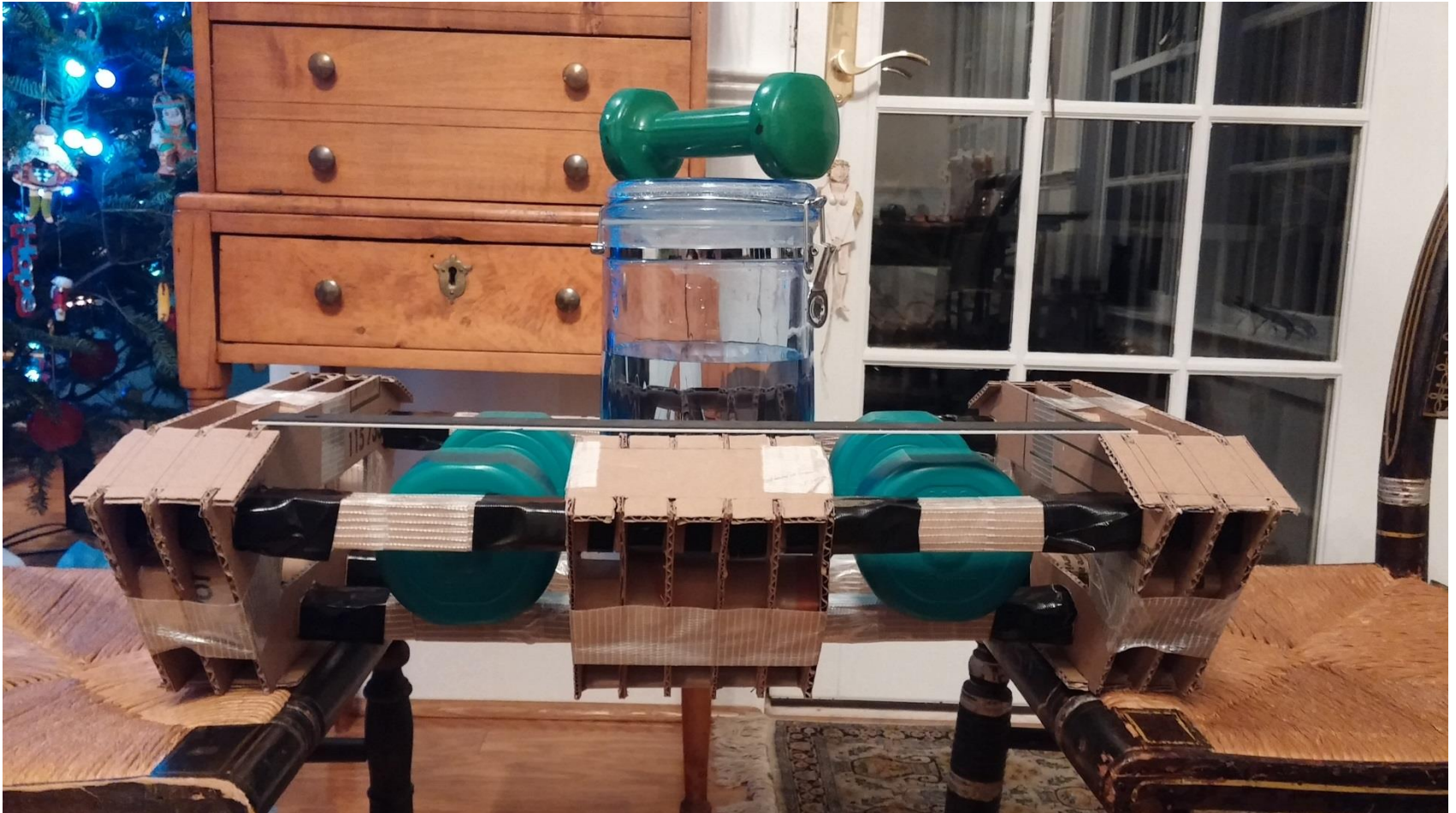


Construction Pics



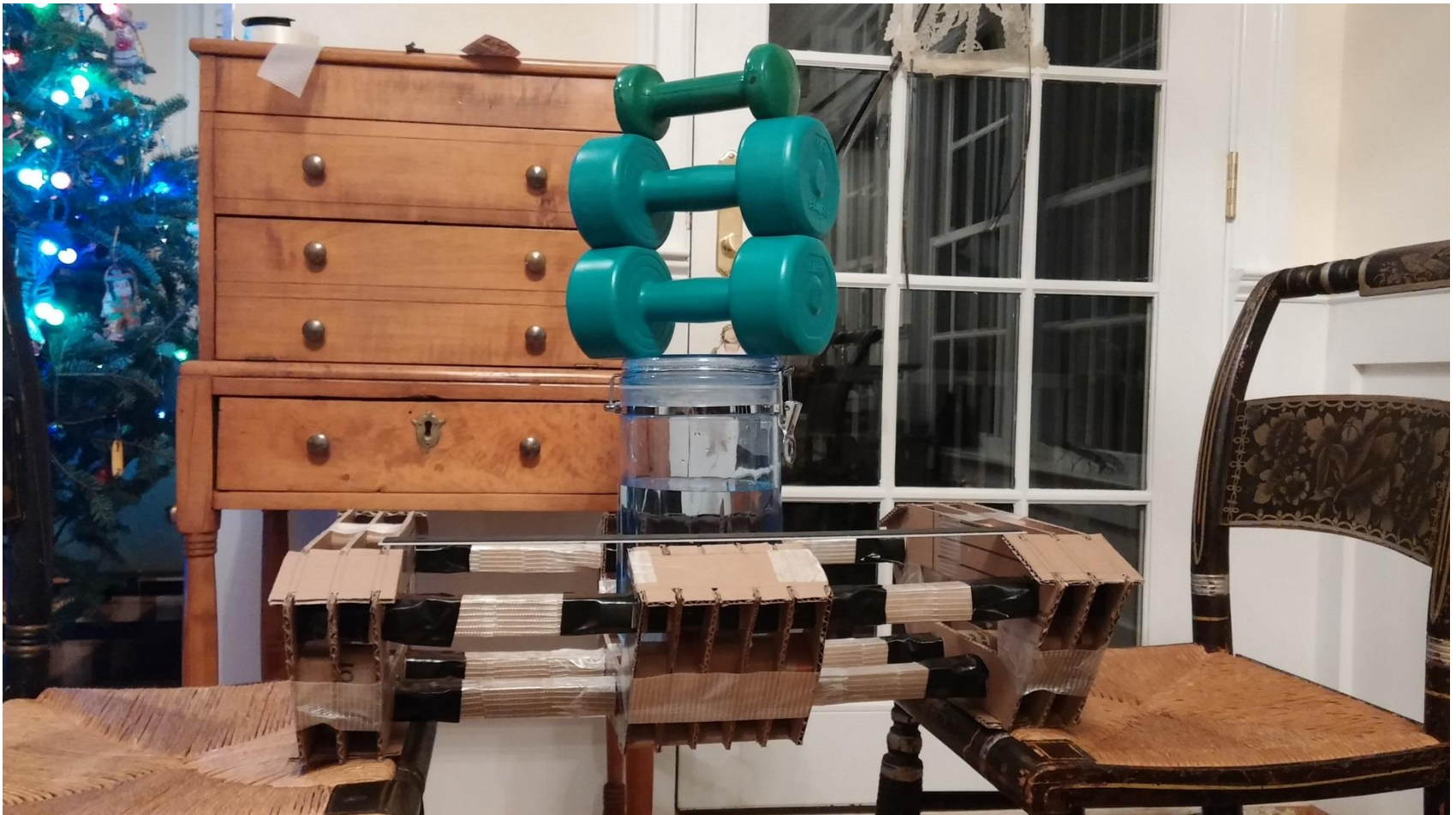
End Supported Load Test

Design Load (18 lbs.)



End Supported Load Test

Design Load (18 lbs.), Stacked



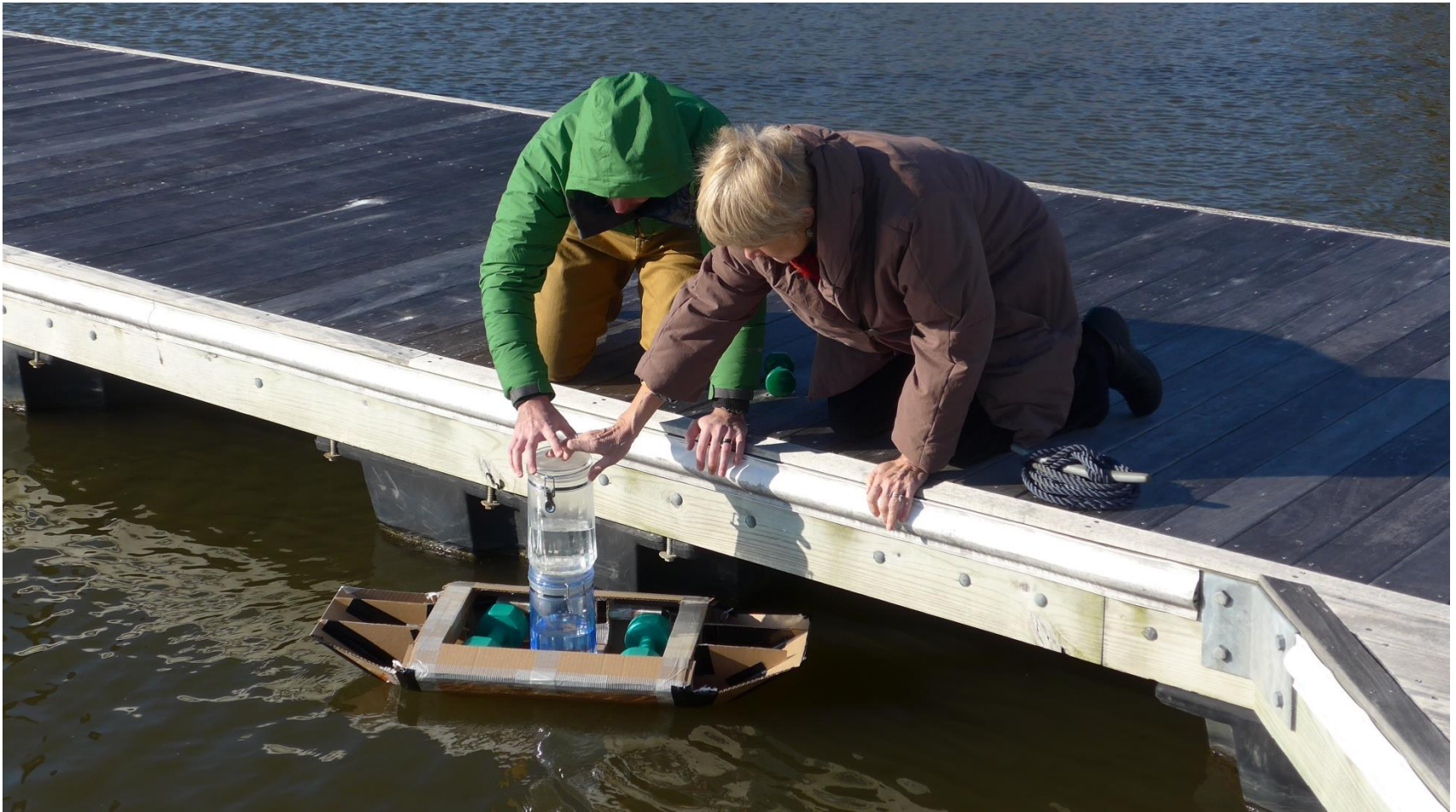
End Supported Load Test

- 1.66x design Load (30 lbs.), Stacked
- Probably could do 3-4x design load without a problem
 - Translates to 1.5 to 2x at full scale
- End supported load test is already conservative w.r.t. loading in water
- Gus approves...



In-Water Test

1x design load (18 lbs)



In-Water Test



Design Waterline @ 18 lbs

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

