Structures Team

The University of Alabama

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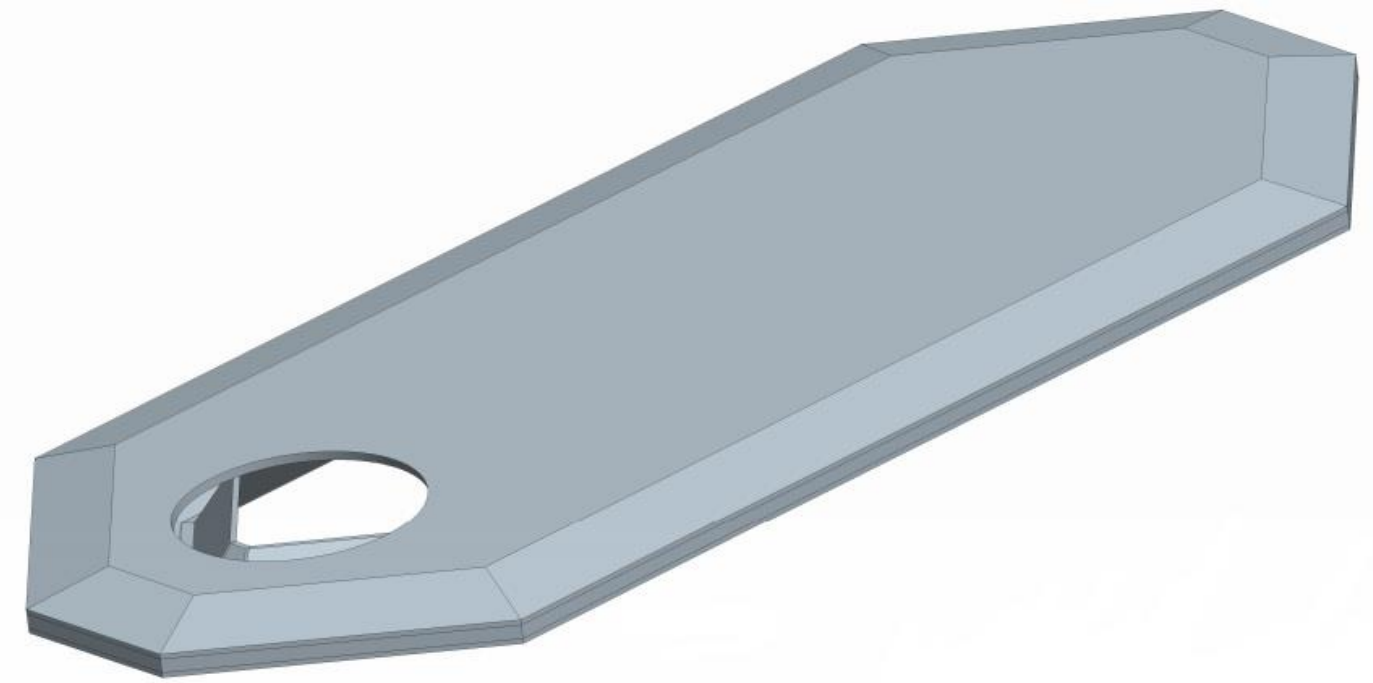
Hull Design

- Based on Chris Sorgatz's design
- Similar to 2013-2014 Hoverteam design
- 160.3 inches long (Approx. 13.35 ft.)
- 68.3 inches wide (Approx. 5.7 ft.)



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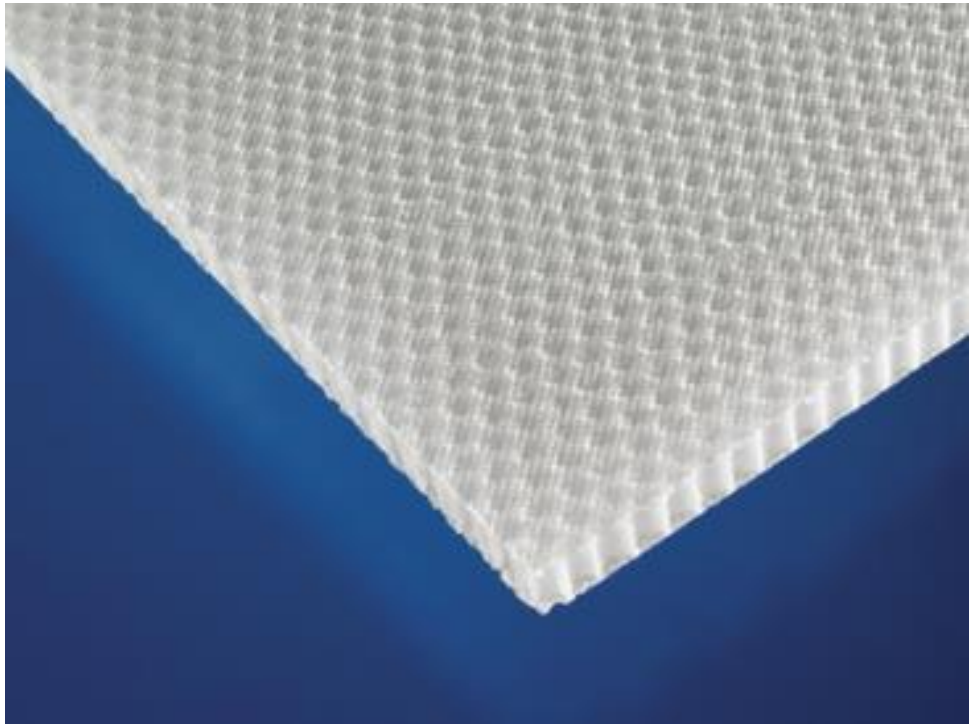
Materials

Hull Structure | Fiberglass | Resin | Other

- Polypropylene honeycomb material
  - 1” thickness – 3 sheets
  - 0.5” thickness – 9 sheets
  - Total of 384 ft^2 will be ordered
- Light (total of 35 lbs. to construct hovercraft)
  - Aids in flotation
- Cost effective
  - $55 per 1” sheet
  - $35.75 per 0.5” sheet
- Ease of use
  - Cuts smoothly



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Materials

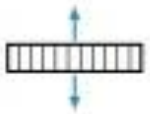
Hull Structure | Fiberglass | Resin | Other

PP Honeycomb Core Mechanical Properties

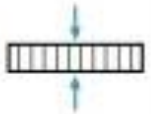
CORE	CELL SIZE		DENSITY				FLATWISE TENSILE[1]		BARE COMPRESSION[2]						PLATE SHEAR[3]							
			TYPICAL		MINIMUM		STRENGTH		STRENGTH				MODULUS				STRENGTH				MODULUS			
			TYPICAL		MINIMUM				TYPICAL		MINIMUM		TYPICAL		MINIMUM		TYPICAL		MINIMUM		TYPICAL		MINIMUM	
	(in)	(mm)	lb/ft³	kg/m³	lb/ft³	kg/m³	psi	MPa	psi	MPa	psi	MPa	ksi	MPa	ksi	MPa	psi	MPa	psi	MPa	ksi	MPa	ksi	MPa
PP1-5.0-N1-8	0.315	8	5	80.0	4.75	75.0	130	0.89	275	1.89	255	1.55	11.5	79.2	9.5	65.4	85	0.58	75	0.52	2.2	15.2	1.7	11.7
PP1-4.0-N1-10	0.395	10	4	64.0	3.8	60.0	120	0.83	180	1.24	140	0.96	10.5	72.3	8.5	58.5	60	0.41	55	0.38	2.0	13.8	1.5	10.3

The data provided is based on the testing of -01 (wall only) version of each core type.

[1] Flatwise Tensile
Tested per ASTM C 297



[2] Bare Compression
Tested per ASTM C 365



[3] Plate Shear
Tested per ASTM C 273

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Materials

Hull Structure | Fiberglass | Resin | Other

- Inquired about other types of honeycomb
  - Polycarbonate
  - Aramid fiber
- Contact at Plascore stated polypropylene is the type of honeycomb most widely used for laying up with fiberglass

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Materials

Hull Structure | Fiberglass | Resin | Other

- Both carbon fiber and fiberglass were considered
  - Carbon fiber costs 4-6 times as much
- Want to keep the craft light but strong
  - Previous team used 4 oz. E-Glass woven cloth
- This year, 4 oz. S-Glass woven cloth will be used

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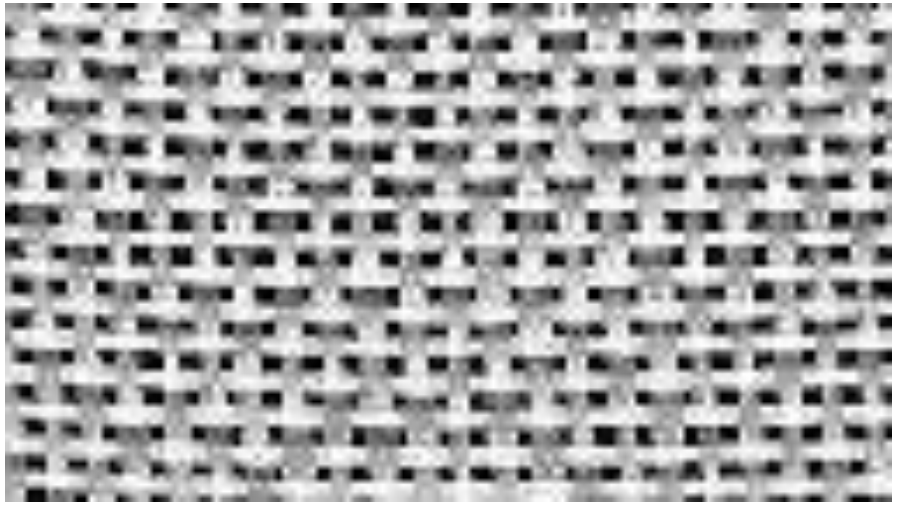
Materials

Hull Structure | Fiberglass | Resin | Other

- S-Glass is used when extra strength is needed and extra weight is not desired
  - 40% higher tensile strength
  - 20% higher modulus
  - Greater abrasion resistance
  - Same working qualities as standard E-Glass

- Considered using a heavier E-Glass cloth instead
  - More resin required
  - Increased weight of craft



Materials

Hull Structure | Fiberglass | Resin | Other

- Four brands of epoxy resin were compared
- West Systems 105 was chosen
  - Most widely used, reliable brand
  - Competitively priced with other resins of the same quality
- 4.35 gallon pail will be ordered

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Materials

Hull Structure | Fiberglass | Resin | Other

- West Systems 205 Fast Hardener
  - 9-12 minute working time
  - 6-8 hour drying time
- West Systems 206 Slow Hardener
  - 20-25 minute working time
  - 9-12 hour drying time
- Slow hardener will be used
  - Both have same cost
  - Increased working time is a plus
  - Increased drying time will not be an issue

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Materials

Hull Structure | Fiberglass | Resin | Other

Group Size	Resin Quantity	Hardener Quantity	Mixed Quantity	Saturation Coat - Porous Surfaces	Build-Up Coats Non-porous Surfaces	Tensile Strength (PSI)
C	WSY 105C - 4.35 Gal. (16.47 L)	205C or 206C - .94 Gal. (3.58 L)	5.29 Gal. (20 L)	1530-1785 sq. ft. (142-165 sq. m)	2040-2300 sq. ft. (190-213 sq. m)	105/205 - 7,846, 105/206 - 7,320

Materials

Hull Structure | Fiberglass | Resin | Other

- Fiberglass Shears
- Plywood
  - Create molds to piece together plenum chamber
- Heavy Duty Adhesive
  - Piece together plenum chamber before fiberglass is applied
- Paintbrushes

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Materials

Hull Structure | Fiberglass | Resin | Other

- Epoxy Pumps
  - Ensures correct ratio of resin to hardener
- Disposable Gloves
- Disposable Cups
  - For mixing resin and hardener
- Sandpaper

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Costs

Item	Cost
Plascore	$617.00
Fiberglass (500 sq. feet 4 oz. S-Glass)	$415.00
Epoxy Resin/Hardener (4.35 gal/1 gal)	$453.00
Resin Pumps	$12.00
Heavy Duty Adhesive (Three 28 fl. oz. bottles)	$25.00
Plywood (Three 4’x8’ sheets)	$25.00
Fiberglass Shears	$35.00
Other (gloves, cups, etc)	$100.00
Total Estimated Cost	**$1,682.00**

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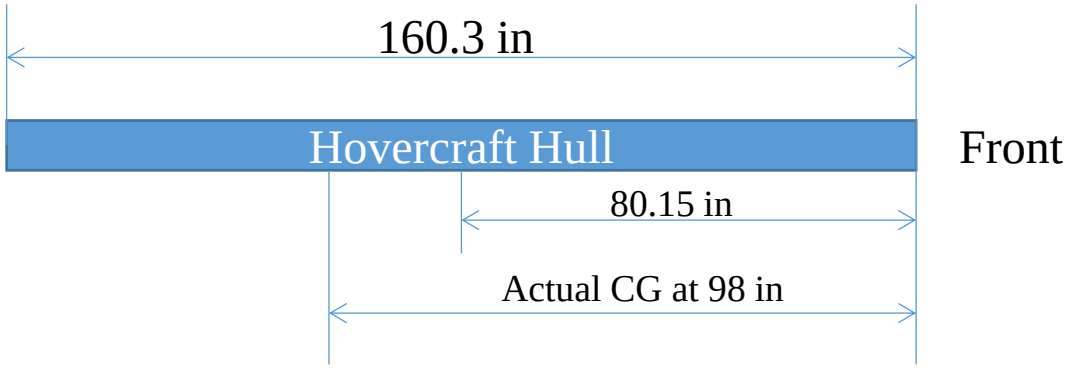
Improvements

Balance | Structural Weaknesses | Measure Twice, Cut Once

- 2014 racecraft is very back heavy
  - CG is not at optimum location
  - Driver had to lean forward to attempt to balance the craft while racing
- Lift duct was moved further toward back of craft than was originally designed
  - Contributed to CG being too far aft
  - 2015 racecraft lift duct will be moved back to original designed location

Side View of 2014 Racecraft



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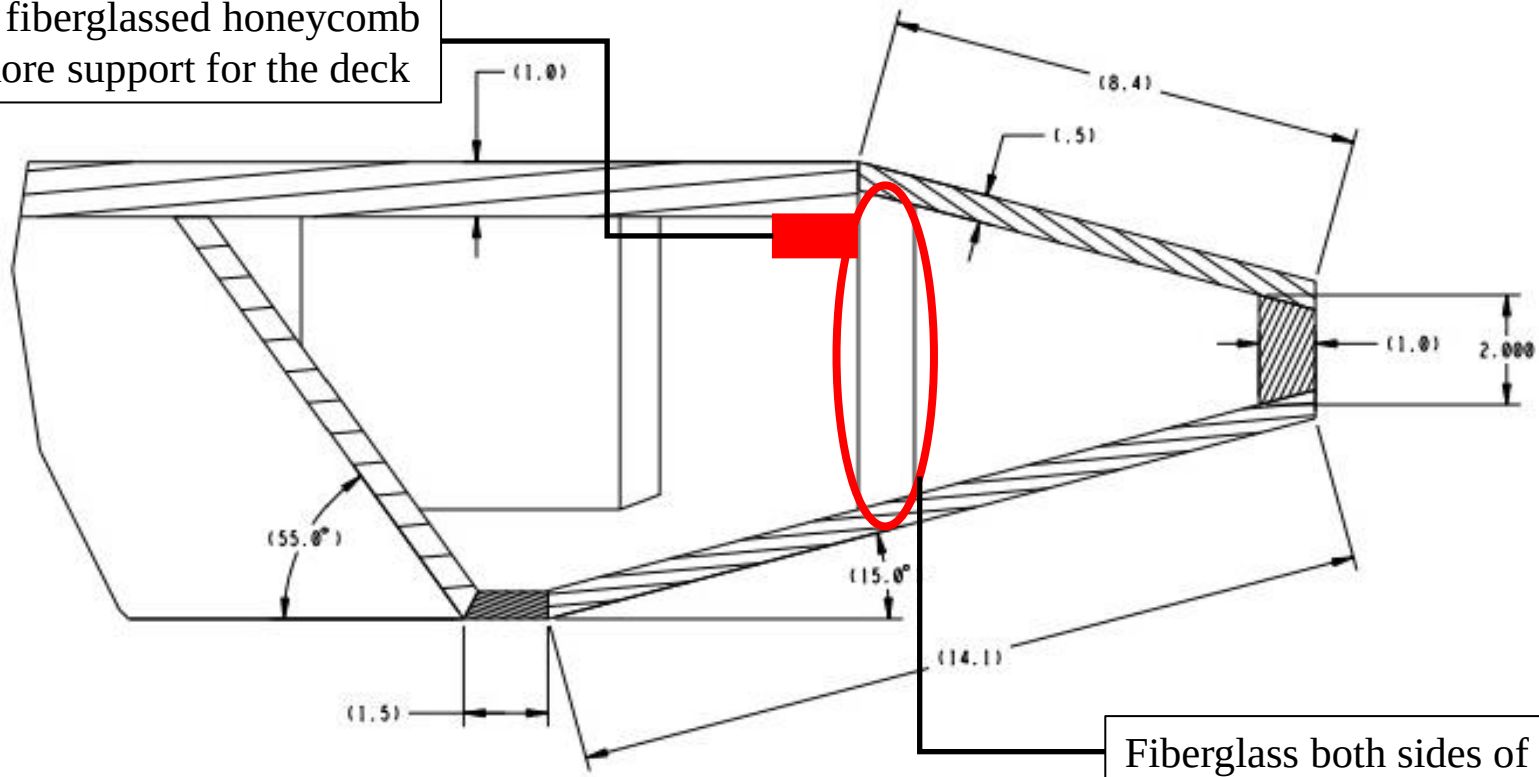
Improvements

Balance Structural Weaknesses Measure Twice, Cut Once

Addition of fiberglassed honeycomb lip to add more support for the deck



Fiberglass both sides of plenum chamber stiffener

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Improvements

Balance Structural Weaknesses Measure Twice, Cut Once

- 2014 Racecraft
  - Jigsaw used to cut all pieces of honeycomb
  - Cuts were not necessarily straight
  - Angles were not properly cut
  - Pieces didn’t fit together properly – gap fill used as a remedy

- 2015 Racecraft
  - Measure TWICE, cut ONCE
  - Tablesaw will be used, especially for larger pieces and to cut angles properly
  - Avoid using gap fill

Questions?

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