

Sea Level Enclosure: Concept Generation & Evaluation

Project Manager/Client Contact: Aaron Hurley
Document Manager: Aron Chamberlain
Website Developer: Jesse Feustel
Budget Manager: Jeremy Lin

Project Description : Recap

- Client - NAU Swim Coach Andy Johns
- Air tight enclosure
- Sea level conditions from 3rd party company
- 2 lanes of pool for training purposes
- Quick assembly/disassembly
- Compact to store



Figure #1: Pool Bubble

Black Box Model

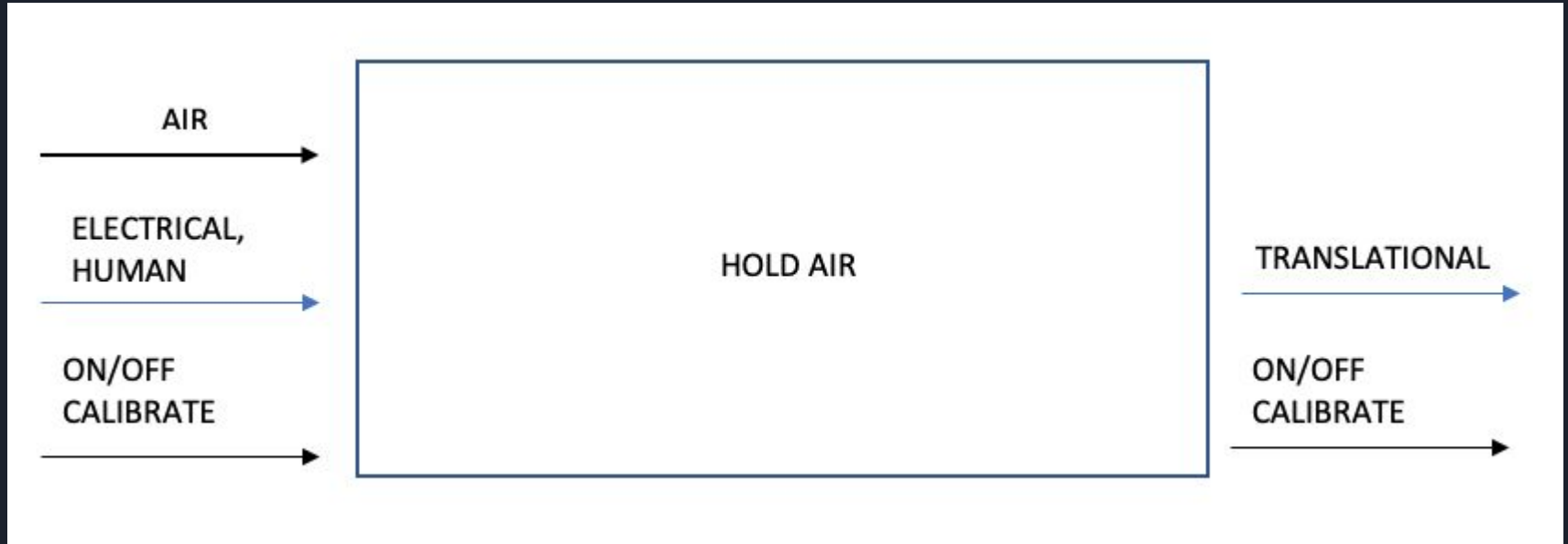


Figure #2: BlackBoxModel

Hierarchical Task Analysis

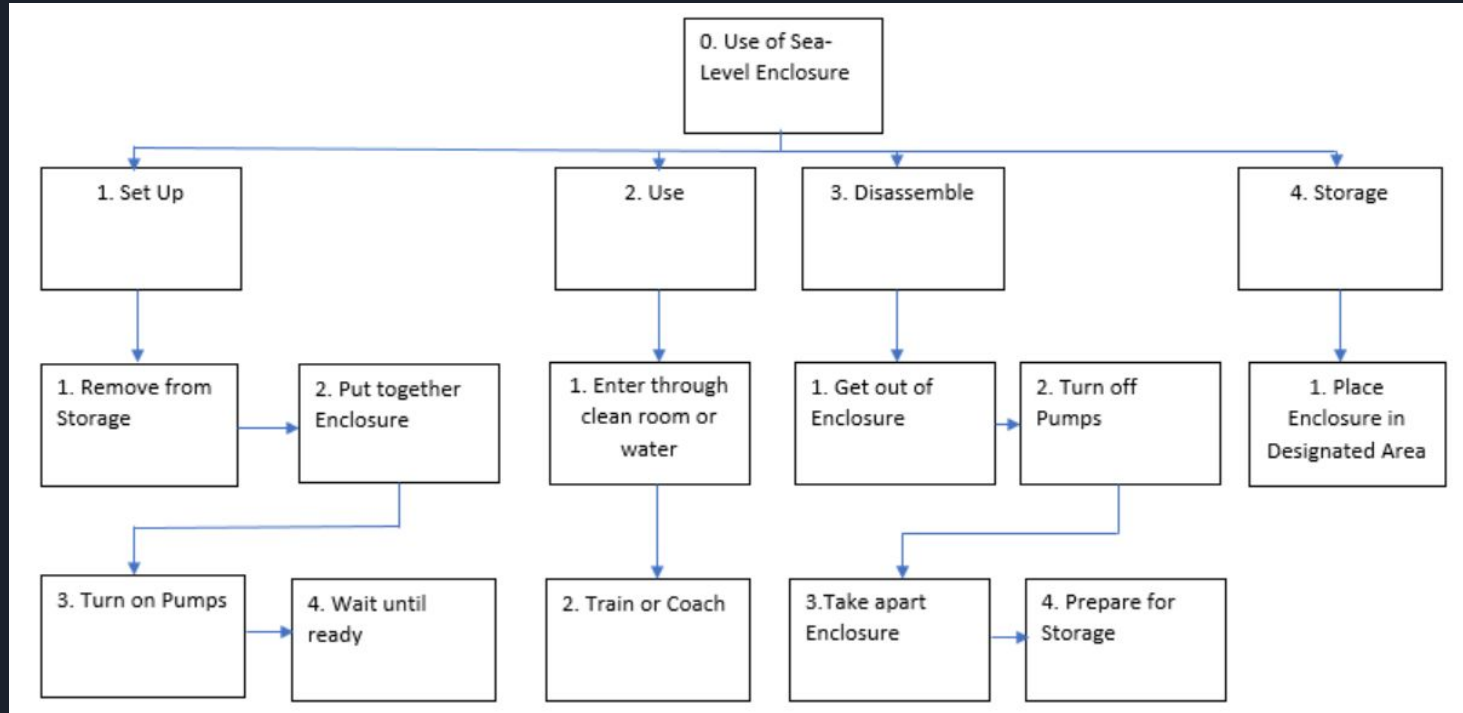


Figure #3: Hierarchical Task Analysis

Design Considered

Pros:

- Low setup time
- No additional storage space required

Cons:

- Not portable
- Excessive material
- Attaches to building existing structure

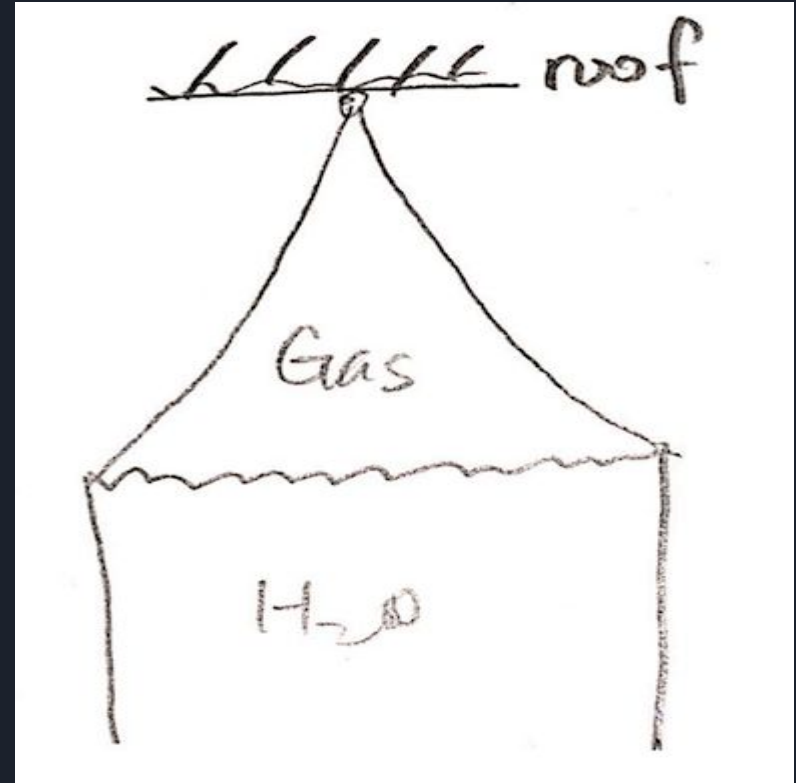


Figure #4: Circus

Design Considered (Cont.)

Pros:

- Lots of support
- Walkway for coach

Cons:

- Heavy weight
- High assembly/disassembly time

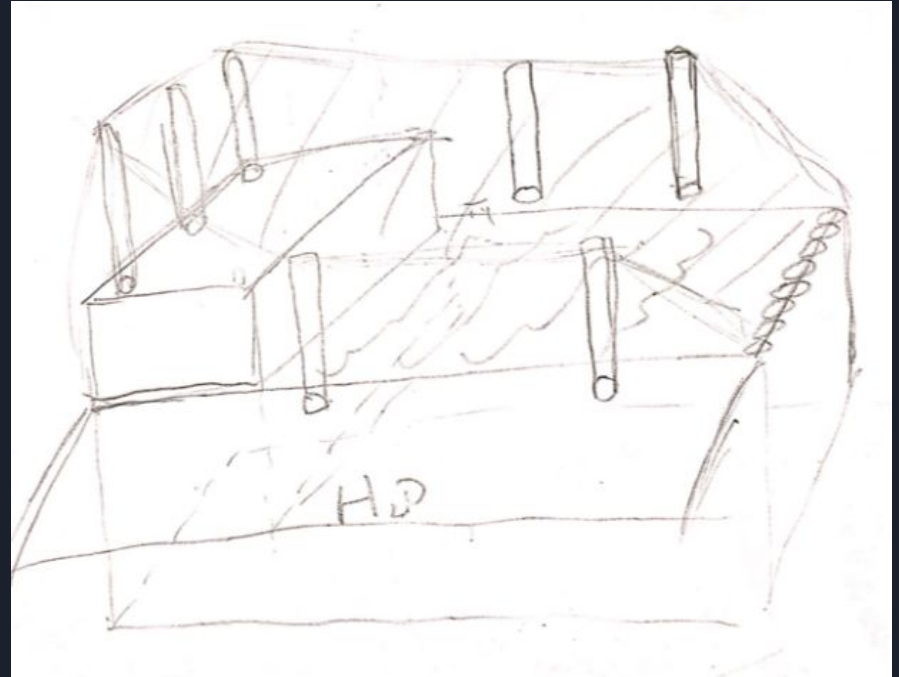


Figure #5: 7 Beam

Design Considered (Cont.)

Pros:

- Ample space
- Supports easy on material

Cons:

- High cost
- High storage volume

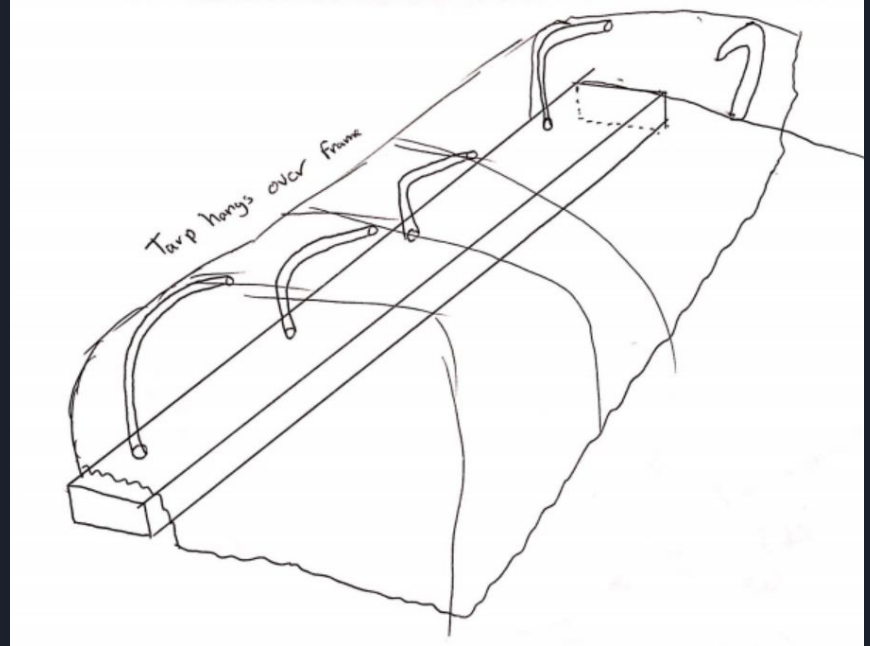


Figure #6: Hangover

Design Considered (Cont.)

Pros:

- Air beams
- Airlock
- Light weight

Cons:

- Seal capability
- Easy to puncture

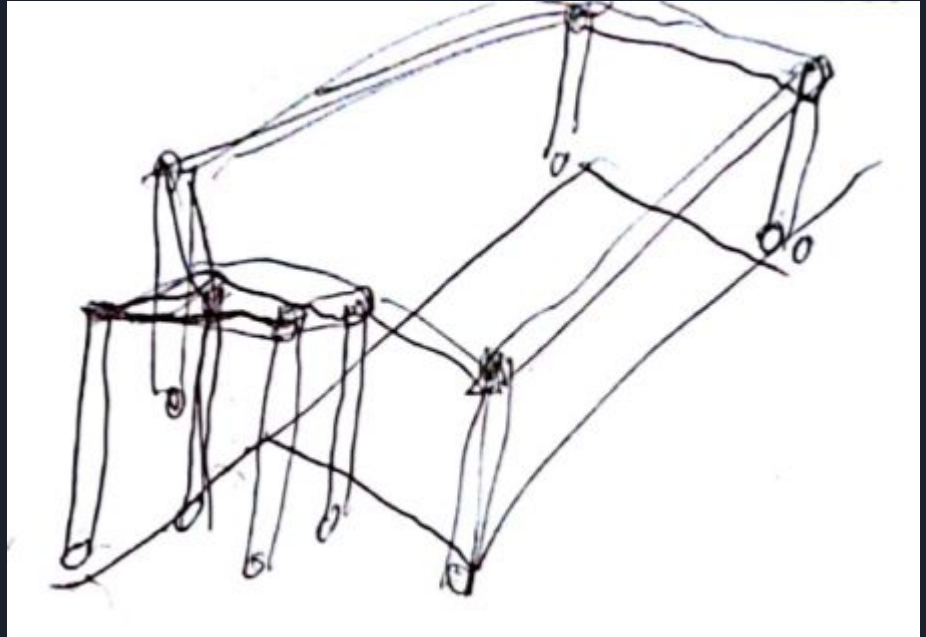


Figure #7: Spider

Pugh Chart

Table #1a: Pugh Chart

| concept | | | | | | | | | | |
|-----------------|--------|------------|-------------|-----------|-----|---------|--------|----------|--------|---|
| criteria | 7 Beam | Wheel Beam | Tent Weight | 4 Support | PVC | Curtain | Roller | Decender | Spider | |
| assembly time | - | S | - | d | S | + | + | + | - | |
| sea lvl altiude | S | S | S | | S | S | S | S | S | |
| clear design | S | S | S | a | S | S | S | S | S | |
| longevity | + | + | + | | + | S | + | + | + | |
| compactibility | - | - | - | t | + | S | + | + | - | |
| weight | - | - | - | | + | + | + | + | - | |
| cost | - | - | - | u | + | S | - | - | - | |
| $\Sigma (+)$ | | 1 | 1 | | | 4 | 2 | 4 | 4 | 1 |
| $\Sigma (-)$ | | 4 | 3 | 4 | m | 0 | 0 | 1 | 1 | 4 |
| $\Sigma (S)$ | | 2 | 3 | 2 | | 3 | 5 | 2 | 2 | 2 |

Pugh Chart (Cont.)

Table #1b: Pugh Chart

| 2 Land | Blanket | Ky | 2 Weighters | Circus | Hangover | Floaty | Plastic Wrap | Tree Friend |
|--------|---------|----|-------------|--------|----------|--------|--------------|-------------|
| + | + | + | S | + | - | + | + | S |
| S | S | S | S | S | S | S | S | S |
| S | S | S | S | S | S | S | S | S |
| - | + | + | S | + | + | + | + | + |
| + | + | + | - | + | - | + | + | - |
| + | + | + | - | + | - | + | + | - |
| + | S | - | - | - | - | + | - | - |
| 4 | 4 | 4 | 0 | 4 | 1 | 5 | 4 | 1 |
| 1 | 0 | 1 | 3 | 1 | 4 | 0 | 1 | 3 |
| 2 | 3 | 2 | 4 | 2 | 2 | 2 | 2 | 3 |

Design Selected

Customer Requirement (CR) :

- Quick Assembly/Disassembly
- Seal Level Altitude
- Clear Design
- Longevity
- Compact Space
- Weight

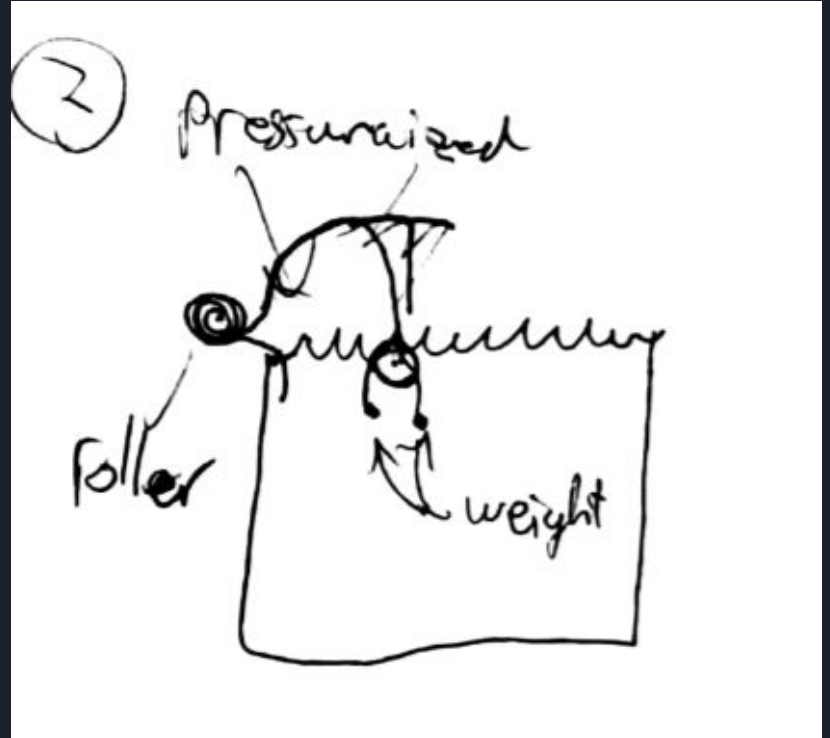


Figure #8: Roller

*Red indicates meets CR.

Design Selected (Cont.)

Customer Requirement (CR):

- Quick Assembly/Disassembly
- Seal Level Altitude
- Clear Design
- Longevity
- Compact Space
- Weight

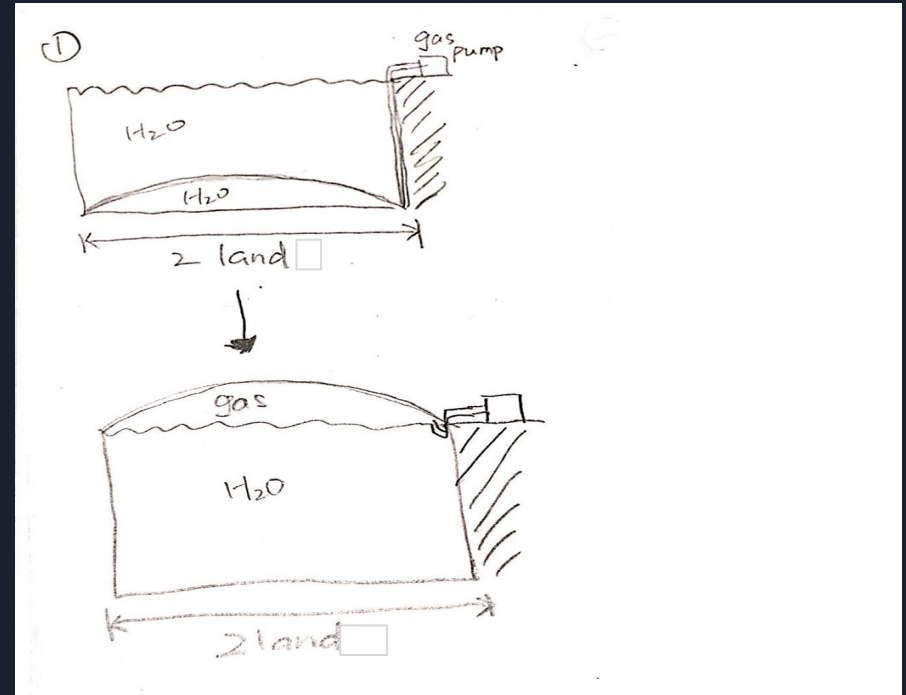


Figure #9: 2 Lands

*Red indicates meets CR.

Design Selected (Cont.)

Customer Requirement (CR) :

- Quick Assembly/Disassembly
- Seal Level Altitude
- Clear Design
- Longevity
- Compact Space
- Weight

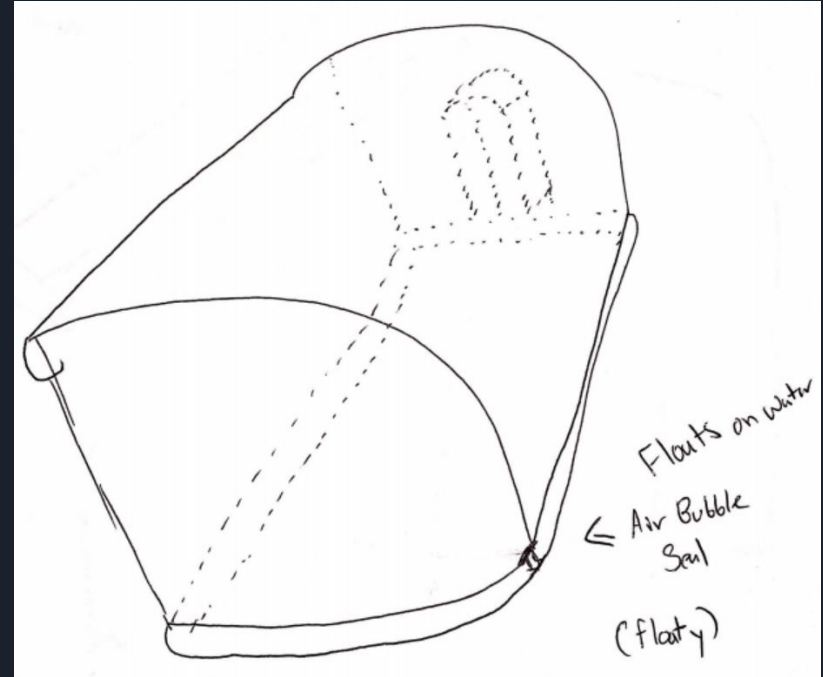


Figure #10: Floaty

*Red indicates meets CR.

Design Selected (Cont.)

Customer Requirement (CR) :

- Quick Assembly/Disassembly
- Sea Level Altitude
- Clear Design
- Longevity
- Compact Space
- Weight

*Red indicates meets CR.

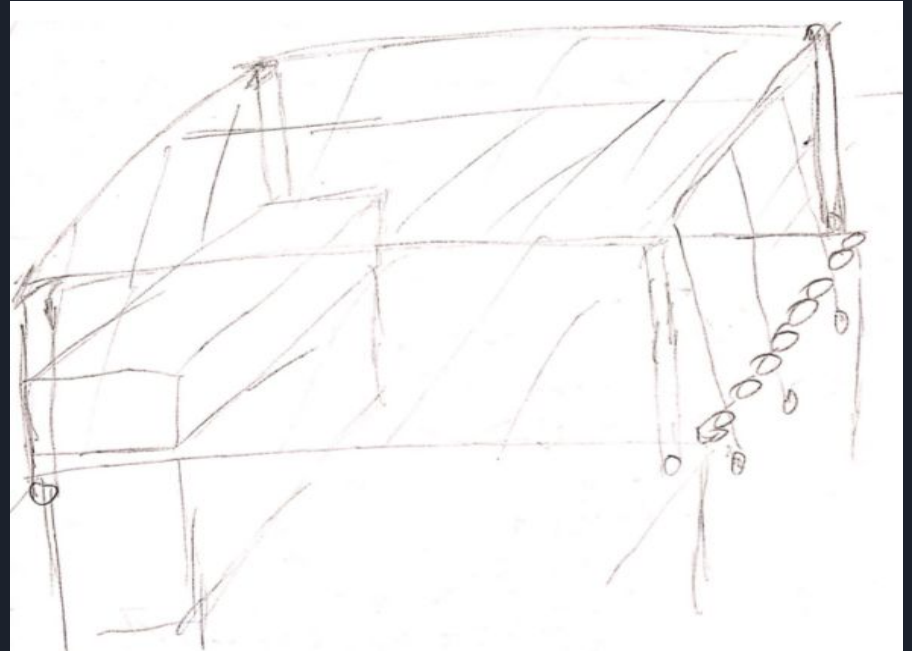


Figure #11: PVC

Decision Matrix

Table #2: Decision Matrix

| Criteria | Weight | Roller | | | 2 Lands | | | Floaty | | | PVC | | |
|--------------------|--------|--------|---|----------|---------|---|----------|--------|---|----------|-------|---|----------|
| | | Raw | - | Weighted | Raw | - | Weighted | Raw | - | Weighted | Raw | - | Weighted |
| Assembly Time | 0.154 | 90.00 | - | 13.86 | 80.00 | - | 12.32 | 80.00 | - | 12.32 | 70.00 | - | 10.78 |
| Sea Level Altitude | 0.193 | 95.00 | - | 18.34 | 95.00 | - | 18.34 | 95.00 | - | 18.34 | 95.00 | - | 18.34 |
| Clear Design | 0.115 | 90.00 | - | 10.35 | 90.00 | - | 10.35 | 90.00 | - | 10.35 | 90.00 | - | 10.35 |
| Longevity | 0.154 | 75.00 | - | 11.55 | 10.00 | - | 1.54 | 80.00 | - | 12.32 | 75.00 | - | 11.55 |
| Compactibility | 0.115 | 50.00 | - | 5.75 | 97.00 | - | 11.16 | 90.00 | - | 10.35 | 80.00 | - | 9.20 |
| Weight | 0.154 | 50.00 | - | 7.70 | 95.00 | - | 14.63 | 90.00 | - | 13.86 | 75.00 | - | 11.55 |
| Cost | 0.115 | 69.00 | - | 7.94 | 50.00 | - | 5.75 | 93.00 | - | 10.70 | 88.00 | - | 10.12 |
| | 1.000 | | | 75.48 | | | 74.08 | | | 88.23 | | | 81.89 |

Schedule



Figure #11: PVC



Budget

PVC Design:

- PVC Pipes = $10 * (\text{PCV Schedule 40 White, } \frac{1}{2}'' \text{ Diameter, 5-ft}) * \$22.5 = \$225$
- Cover = Polyethylene Transparent Tarp = $8294 \text{ ft}^2 / 48 \text{ ft}^2 * \$6.39 = \$1104$
- Total = \$1329

Floaty:

- Cover = Polyethylene Transparent Tarp = $8294 \text{ ft}^2 / 48 \text{ ft}^2 * \$6.39 = \$1104$
- Total = \$1104



Conclusion

- Outcomes of HoQ, Pugh Chart, Decision Matrix, and Engineering Bias
- Floaty - 88.23
- PVC - 81.89



Reference

- Garden, H., Yard, G., Shade, G., Shade, O., Details about Tarp, 6. and SELECT, Z. (2018). *Tarp, Polyethylene, Transparent, 6x8Ft ZORO SELECT 2ZJ68* | eBay. [online] eBay. Available at: <https://www.ebay.com/itm/Tarp-Polyethylene-Transparent-6x8Ft-ZORO-SELECT-2ZJ68/381016033996?hash=item58b6534acc:g:rQAAOSwbwJaBltb:sc:ShippingMethodExpress!86001!US!-1:rk:2:pf:0> [Accessed 17 Oct. 2018].
- Garden, H., Garden, O. and Inch), D. (2018). *Any Size Diameter PVC Pipe Sch. 40 or 80 (1/4"- 24" Inch)* | eBay. [online] eBay. Available at: <https://www.ebay.com/itm/Any-Size-Diameter-PVC-Pipe-Sch-40-or-80-1-4-24-Inch/131855688616?has h=item1eb33623a8:m:mJM5htKPofk72gMMxbNjUaw:rk:3:pf:0> [Accessed 17 Oct. 2018].



Questions?

