Variable Buoyancy
Backboard

Blue B
Concept: What is a Backboard?
Concept: Variable Buoyancy

- Standard Backboard
- Our Backboard
Concept: Critical Components

- Components:
  - Rigid board
  - Pneumatic system and controls
  - Inflatable bladder(s)
## Contract: Primary Needs

**Product Description:** Variable buoyancy backboard for spinal injury water rescue

**Intended Customers:** Certified Pool Operators and lifeguard training organizations

**Market:** Water safety and rescue

<table>
<thead>
<tr>
<th>Customer Need</th>
<th>Product Attributes</th>
<th>Units</th>
<th>Engineering Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is easily maneuvered by a lifeguard.</td>
<td>Mass on dry land</td>
<td>kg</td>
<td>Less than 7.5.</td>
</tr>
<tr>
<td>Can support victims of varying density.</td>
<td>Maximum buoyancy</td>
<td>N</td>
<td>At least 200.</td>
</tr>
<tr>
<td>Is easily positioned under victim during rescue.</td>
<td>Minimum buoyancy</td>
<td>N</td>
<td>Between 22 and 90.</td>
</tr>
<tr>
<td>Has intuitive and ergonomic controls.</td>
<td>Time for inexperienced user to activate</td>
<td>seconds</td>
<td>Less than 10.</td>
</tr>
<tr>
<td>Inflates quickly.</td>
<td>Inflation time</td>
<td>seconds</td>
<td>Less than 10.</td>
</tr>
<tr>
<td>Is quickly reset between usages.</td>
<td>Reset time</td>
<td>minutes</td>
<td>Less than 10.</td>
</tr>
<tr>
<td>Allows for x-ray of victim.</td>
<td>X-ray transparent</td>
<td>binary</td>
<td>Yes.</td>
</tr>
</tbody>
</table>
Contract: Cost

- Preliminary Cost Estimate:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom Bladder System</td>
<td>$200</td>
</tr>
<tr>
<td>CO₂ tank, valves, connectors, etc</td>
<td>$150</td>
</tr>
<tr>
<td>Top plate, runners, fasteners</td>
<td>$70</td>
</tr>
<tr>
<td>Labor</td>
<td>$50</td>
</tr>
<tr>
<td><strong>PROFIT</strong></td>
<td><strong>$130</strong></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$600</strong></td>
</tr>
</tbody>
</table>

- Benchmark comparison

<table>
<thead>
<tr>
<th>Pro-Lite Spine Board</th>
<th>Aquaboard</th>
<th>SKED Rapid Deployment</th>
<th>Flotation Assist Device</th>
<th>Our Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$250</td>
<td>$600</td>
<td>$1,164</td>
<td>$300 (add-on)</td>
</tr>
</tbody>
</table>
Risks

- Which bladder configurations are stable?

- Can we safely transfer CO$_2$ from a cartridge into a bladder with the push of a button?

- What barriers to market entry exist?
Findings

- Which bladder configurations are stable?

- Shifting distribution of air causes instability
Findings

- Which bladder configurations are stable?
- Shifting distribution of air causes instability
Findings

- Which bladder configurations are stable?
- Adding multiple bladders prevents air shifting within bladder
Findings

- Which bladder configurations are stable?

- If the bladders are filled quickly, air shifting will not occur
Findings

- Which bladder configurations are stable?
- Bladder Configurations:
  - 1
  - 2A
  - 2B
  - 4
  - 4CG
Findings

- Which bladder configurations are stable?
- Bladder Configurations: 4CG
Findings

- Can we safely transfer CO$_2$ from a cartridge into a bladder with the push of a button?
Findings

- Can we safely transfer CO$_2$ from a cartridge into a bladder with the push of a button?

- Disposable CO$_2$:
  - Slow inflation

- Reusable CO$_2$:
  - Regulator valve
Findings

- What barriers to market entry exist?
- FDA
  - Establishment Registration: $2000/yr
  - Premarket Notification: 510(k) form
- Market
  - Total Market: 10,000 backboards/yr
- Lifeguard Organizations
Thank You

For more information, please visit Blue B in the Pappalardo Lab!