Variable Buoyancy Backboard
What is a backboard?
What’s wrong with current backboards?
Our Concept: Variable Buoyancy

• stage one: neutrally buoyant
  • easy to position under victim

• stage two: buoyant
  • once positioned, inflate bladder for easy rescue
Our Design

Features:

- Compressed CO$_2$ canisters loaded on backboard
- Inflatable semi-elastic bladder beneath rigid surface of backboard
- Ergonomic, intuitive inflation controls
Who needs our backboard?

• 270,000+ public pools in the United States
• All legally required to have a backboard

• Red Cross trains more US lifeguards than any other organization
Benchmarking

- Standard Backboards: $150 to $300

- Similar Patent: Neutral Buoyancy Recovery Device
  US Patent 6,352,460
  (not on market)
Feasibility of Variable Buoyancy

• What is our desired buoyancy?
• What bladder volume gives our desired buoyancy?
• Can this volume fit within the dimensions of a standard backboard?
• Can the backboard carry enough compressed CO$_2$ to displace this volume of water?
• Is a neutrally buoyant backboard still light enough to handle easily on land?
Feasibility of Variable Buoyancy

• What is our desired buoyancy?
  200 N (20 kgf or 45 lbf)

• What bladder volume gives our desired buoyancy?
  17 L displaces 17 kg of water
  (plus 3 kgf of initial buoyancy)

\[
\begin{align*}
3 \text{ kgf} & \quad + \quad 17 \text{ kgf} & \quad = \quad 20 \text{ kgf} \\
\text{Initial buoyancy} & \quad \text{H2O displaced} & \quad \text{Total buoyancy}
\end{align*}
\]
Feasibility of Variable Buoyancy
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- Can this volume fit within the dimensions of a standard backboard?
  
  Yes: current bladder dimensions of 167 cm x 36 cm x 3.2 cm

- Can the backboard carry enough compressed CO$_2$ to displace this volume of water?
  
  Yes: one 36-g canister of CO$_2$ provides necessary volume
Feasibility of Variable Buoyancy

• Is a neutrally buoyant backboard still light enough to handle easily on land?

Yes: projected weight of 7.5 kg (16.5 lbs)
Where Do We Go From Here?

• Separate bladder chambers for balance control
• Redundant controls
• Retractable, reconfigurable straps
• Even smaller initial backboard volume and weight