Aquatic Gait Rehabilitation

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User Needs Summary
A method to provide external assistance for aquatic gait rehabilitation in paraplegic patients

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<th>Design Input</th>
<th>Validation</th>
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<td><strong>Constraints</strong></td>
<td><strong>Goals</strong></td>
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<tr>
<td>Device must work with 5th female to 95th male (5’ - 6’1” height)</td>
<td>Electromechanical portions of device must have zero exposure to water</td>
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<td>Device must support the weight of the patient (max 350lbs) and keep the patient in an upright position</td>
<td>Device requires only one therapist to supervise exercise</td>
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<td>The device must be affordable for physical therapy centers (under $100,000)</td>
<td>Device must simulate the appropriate angles of flexion at the hip, knee, and ankle to within 3 degrees for normative gait motion</td>
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<td>Device must be operable with no more than 2 assisting physical therapists</td>
<td>Device must demonstrate consistent operation and repeatability for the entire exercise from 10 minutes to 1 hour</td>
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**Design Output**
- Two footpads that move the feet in correct gait motion
- Independent vertical motion on each end of foot
- Hinged attachments allow for smooth movement
- Vertical motion motors attached to horizontal chains
- Chain will move forward and back at varying speeds
- Guide rails will allow moving parts to stay steady
- Counterweights prevent body weight from affecting device
- Tank will be filled with water to assist in weight bearing

**Force/Torque Calculations**
- Analysis of body weight on the device
- Required to determine the torque produced in the motor and strength of materials
- Helps to determine counterweight on device

**Torque-Speed Curve Analysis**
- Relatively large loads: Component and Leg weight
- Needs a gearbox to achieve torque/speed ratio
- Must produce correct motions in a timely manner

**Gait Motion Analysis**
- Video comparison of prototype and actual gait footage
- Analyze gait angles and adjust program until perfect
- If feet and ankles are moved in correct gait motion, it translates directly to motion of the leg