**INTRODUCTION**
- The Lever Drive Wheelchair (LDW) is based on standard push-rim wheelchair design, incorporating bike components for transmission of mechanical energy.
- Approximately 3.6 million US citizens are wheelchair bound.
- Long-term manual wheelchair use often leads to shoulder injuries & carpal tunnel syndrome.
- Greater than 70% of manual wheelchair users experience shoulder pain.
- Approximately 49-73% of manual wheelchair users experience carpal tunnel syndrome.

**OVERALL DESIGN REQUIREMENTS**
- Shall weigh fewer than 50 pounds.
- Shall be fewer than 30 inches wide.
- Shall support and fully function with a user weighing up to 400 pounds with a Factor of Safety of 2.0.
- Shall be capable of shifting into neutral to enable use of push rims at any speed.
- Shall be capable of moving in reverse.

**AXLE DESIGN**
- Calculations determined ideal materials for the axle.
- Designs prioritized strength and adjustability.

<table>
<thead>
<tr>
<th>Factor of Safety, η</th>
<th>Yielding</th>
<th>Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1040 CD Steel</td>
<td>0.82</td>
<td>0.86</td>
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<tr>
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<td>1050 CD Steel</td>
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<td>McMaster Carr Product</td>
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<td>Failure</td>
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<tr>
<td>High-Strength 300M Alloy Steel</td>
<td>2.10</td>
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</tbody>
</table>

**LDW FEATURES**
- Two lever arms for transmission of mechanical energy.
- Pinion gearbox for shifting between varying gearing ratios.
- Adjustable axles and lever arms.
- Parking brakes.
- Neutral to drive capability.
- Gearing ratio of approximately 312%.

**PLANS FOR TESTING**
- Testing and research will reveal the effectiveness of the LDW in preventing musculoskeletal disorders.
- Testing will involve the use of motion capture technology.
- Testing will also involve muscle activity analysis.

**NEXT STEPS**
- Test the LDW drivetrain & design.
- Full stress test completed by Lever Drive Team in order to find any design or manufacturing flaws.
- Finalize drivetrain design and assemble chair.
- Pursue patents on wheelchair design.

**REFERENCES**


**ACKNOWLEDGEMENTS**
- Dr. Victor Huayamave, Associate Professor of Mechanical Engineering, ERAU
- Dr. Patrick Currier, Associate Chair and Associate Professor of Mechanical Engineering, ERAU