Senior Capstone Design Project

One Person Lifter and Loader
Team Members

Jason Adams  Mechanical
Mohammed Altalib  Mechanical
Ryan Coker  Mechanical
Matt Elieff  Mechanical
Trevor Stephenson  Mechanical

Advisor: Dr. Watkins
Sponsor: Prototools Corp.
Background

- Prototools Corporation
  - Current Product
    - Rampage Lift
Background

- Problem
  - No single product that lifts and moves cargo into storage area of a truck/van.
Customer Requirements

- Lifting 1000 lbs
- Load time < 90 sec
- Weight < 450 lbs
- Materials cost < $1000
- Moves load into bed without human assistance
- Single person operation
Design Solution

- RENDERED IMAGE OF FINAL ASSEMBLY IN ISOMETRIC VIEW
Final Assembly
Components of The One Person Lifter and Loader

- **Winch**
  - Viper Max Winch MX 2500
  - 1500 load:
  - 14 ft/min Line Speed
  - 125 Amp Draw

- **Forks**
  - 3” x 2” x 3/16” x 48” Steel Rectangular Tubing
- **Vertical Carriage**
  - CF 18 Rollers
  - 3/8” Eye Bolt

- **Vertical Slider**
  - Angle Irons make up track
  - CF Roll on Track
  - Tabs on Top to prevent motion
- **Horizontal Carriage**
  - 1500 lb rated pulley
  - CF 18 and CF 20
  - Rolls on Horizontal Slider

- **Horizontal Slider**
  - Holds Support Beam

- **Base Extrusion**
  - Bolted into the Truck Bed (30 bolts)
  - Holds Winch and Horizontal Slider
Horizontal Slider and Base Extrusion
- **Support Beam**
  - Holds up horizontal Slider under high load

- **Bolts/Nuts/Washers**
  - 30 bolting locations on truck bed
<table>
<thead>
<tr>
<th>Requirement</th>
<th>Engineering Specification</th>
<th>Metric</th>
<th>Method/Device</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifts Sufficient Load</td>
<td>Weight</td>
<td>lb</td>
<td>Scale</td>
<td>1000</td>
</tr>
<tr>
<td>Load Time</td>
<td>Time</td>
<td>Seconds</td>
<td>Stopwatch</td>
<td>&lt; 90</td>
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<tr>
<td>Lift to Specified Height</td>
<td>Height</td>
<td>Inches</td>
<td>Tape Measure</td>
<td>≥ 37</td>
</tr>
<tr>
<td>Lift Parallel to Ground</td>
<td>Angle</td>
<td>Degrees</td>
<td>Angle Finder</td>
<td>5</td>
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<tr>
<td>Sizing Compatibility</td>
<td>Length x Width x Height</td>
<td>Inches</td>
<td>Tape Measure</td>
<td>≤ 78x42x38</td>
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<tr>
<td>Weight of Components</td>
<td>Weight</td>
<td>lb</td>
<td>Scale</td>
<td>&lt; 450</td>
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<tr>
<td>Weight of Heaviest Component</td>
<td>Weight</td>
<td>lb</td>
<td>Scale</td>
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<td>Reliable</td>
<td>Cycles</td>
<td>Cycles</td>
<td>Counter</td>
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</tr>
<tr>
<td>Quickly Installed or Removed</td>
<td>Time</td>
<td>Minutes</td>
<td>Stopwatch</td>
<td>&lt; 90</td>
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</table>
## Testing Results

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Metric</th>
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<th>Test Results</th>
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<tr>
<td>Lifts Sufficient Load</td>
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<td>Scale</td>
<td>1000</td>
<td>TBD</td>
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<tr>
<td>Load Time</td>
<td>Seconds</td>
<td>Stopwatch</td>
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<tr>
<td>Lift to Specified Height</td>
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<tr>
<td>Lift Parallel to Ground</td>
<td>Degrees</td>
<td>Angle Finder</td>
<td>5</td>
<td>TBD</td>
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<tr>
<td>Sizing Compatibility</td>
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<td>Tape Measure</td>
<td>≤ 78x42x38</td>
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<td>Modular Construction</td>
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<td>Reliable</td>
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<td>Counter</td>
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<td>20</td>
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<tr>
<td>Quickly Installed or Removed</td>
<td>Minutes</td>
<td>Stopwatch</td>
<td>&lt; 90</td>
<td>56 min 30 sec</td>
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</table>
Cost of Materials

- All sources of funding came from Prototools Corporation

Total: $994.92

- Steel
- Nuts, Bolts and Washers
- Winch and Pulleys
- Cam Rollers

$438.27
$173.88
$297.84
$84.93

Total Cost for 50 Runs

- Purchased Parts: $27,833, 13%
- Raw Materials: $21,914, 10%
- Engineering Labor: $57,704, 27%
- Fabrication Labor: $106,684, 50%
Problems Encountered

- Binding in the sliders → Lube
- Transporting trailer into Plumas plaza each day
- Finding a sufficient Counterweight
- Access to bolts holes due to trailer structure
- Design changes due to Fabrication
Suggestions for the Future

- Pulley Drum Behind the Winch
- Fabricate Support Beam to reduce cost
- Make Single Track for rollers
Conclusion

- Thank you Dr. Watkins
- Steve Eckhart for the Battery assembly and Testing assistance
- Frank Block and Prototools Corporation
Questions