Purpose

- All-terrain vehicle for the outdoor enthusiast
- Design
- Manufacture
- Test
- Promote

- Competing for shares in a large market against:
  - Polaris
  - Honda
  - Kawasaki
SAE BAJA Requirements

- Material strength $\geq$ 1018 Mild Steel
- Briggs and Stratton 10-hp engine
- Max width 64”
- 5 point safety harness
- 6 inch head clearance
- 3 inch shoulder clearance
- Full firewall
- Fuel drip pan
Budget

- Beginning Baja Account Balance: $24,000
- Total spending to date: $6,125.10
- Travel expenses: $7,961.10
- Fundraising goal per member: $1000
- Total amount fundraised to date: $7,680
- Total car cost: $14,086.20
<table>
<thead>
<tr>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Frame</td>
<td>8 days</td>
<td>Tue 1/9/18</td>
<td>Thu 1/18/18</td>
</tr>
<tr>
<td>Rear Frame</td>
<td>8 days</td>
<td>Thu 1/18/18</td>
<td>Mon 1/29/18</td>
</tr>
<tr>
<td>Weld Frame</td>
<td>3 days</td>
<td>Mon 1/29/18</td>
<td>Wed 1/31/18</td>
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<tr>
<td>Front Suspension</td>
<td>9 days</td>
<td>Mon 1/29/18</td>
<td>Thu 2/8/18</td>
</tr>
<tr>
<td>Rear Suspension</td>
<td>12 days</td>
<td>Thu 2/8/18</td>
<td>Fri 2/23/18</td>
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<tr>
<td>Frame Primary Member Rework</td>
<td>15 days</td>
<td>Tue 2/13/18</td>
<td>Mon 3/5/18</td>
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<tr>
<td>Weld Suspension Arms</td>
<td>2 days</td>
<td>Tue 3/6/18</td>
<td>Wed 3/7/18</td>
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<tr>
<td>Steering</td>
<td>9 days</td>
<td>Thu 3/8/18</td>
<td>Tue 3/20/18</td>
</tr>
<tr>
<td>Sheet metal members</td>
<td>30 days</td>
<td>Mon 3/12/18</td>
<td>Fri 4/20/18</td>
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<tr>
<td>Miscellaneous Paneling</td>
<td>7 days</td>
<td>Mon 4/16/18</td>
<td>Tue 4/24/18</td>
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<tr>
<td>Functional Assembly</td>
<td>5 days</td>
<td>Mon 3/12/18</td>
<td>Fri 3/16/18</td>
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<tr>
<td>Race Spec. Assembly</td>
<td>22 days</td>
<td>Mon 3/26/18</td>
<td>Tue 4/24/18</td>
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<tr>
<td>Functional Testing</td>
<td>13 days</td>
<td>Mon 4/9/18</td>
<td>Wed 4/25/18</td>
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<tr>
<td>Update Drawings</td>
<td>16 days</td>
<td>Mon 4/9/18</td>
<td>Mon 4/30/18</td>
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<td>IAC Presentation</td>
<td>0 days</td>
<td>Fri 4/27/18</td>
<td>Fri 4/27/18</td>
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<tr>
<td>Paint</td>
<td>7 days</td>
<td>Sat 4/28/18</td>
<td>Sat 5/5/18</td>
</tr>
<tr>
<td>Final Project Report</td>
<td>6 days</td>
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<td>Mon 5/7/18</td>
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<td>Final Project Report Due</td>
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<td>Mon 5/7/18</td>
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<tr>
<td>Race Ready Testing</td>
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<td>Mon 5/7/18</td>
<td>Tue 5/15/18</td>
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# Material Selection

<table>
<thead>
<tr>
<th>Material</th>
<th>Cost ($/ft)</th>
<th>Weight of Frame (lbs)</th>
<th>Bending Stiffness (lbs/in)</th>
<th>Bending Strength (lbs/in^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A513 (1&quot; OD x 0.120&quot;)</td>
<td>1.33</td>
<td>357</td>
<td>11,606,098.6</td>
<td>421,281.86</td>
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<tr>
<td>4130 Chromoly (1.25&quot; OD x 0.065&quot;)</td>
<td>2.77</td>
<td>320</td>
<td>11,845,399.6</td>
<td>643,625.05</td>
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</tbody>
</table>
Individual Members

- Cut all pieces to length using a chop saw
- Bend all pieces with a pipe bender and a 3” die
- Coped all ends with a 1” end mill
Frame Manufacturing

➢ Jig to locate critical members
➢ Tack welded once fit
Drivetrain

- CVT (Gaged Engineering)
- Composite Belt Drive
- Primary (Min: 2.05 in diameter, Max: 6.0 in diameter)
- Secondary (Min: 5.4 in diameter, Max: 8.0 in diameter)
- Starting Gear Ratio → 3.90:1
- Ending Gear Ratio → 0.90:1
Drivetrain

- Gearbox (Spicer H-12 FNR)
  - Forward gear ratio → 10.15:1
  - Neutral Equipped
  - Reverse gear ratio → 11.15:1

- Overall Velocity Ratio
  - Starting: $3.90 \times 10.15 = 39.585$
  - Ending: $0.90 \times 10.15 = 9.135$
  - $\Rightarrow$ Top Speed of 28.475 w/ 23 inch tall tires
Suspension

- Plate and tube jigs
  - Quick jig modifications
- Heim joints and inserts
  - Ready to weld in and go
Steering

- Purchased components:
  - Rack and pinion
  - Heim Joints
  - Steering Wheel
- Manufactured Components:
  - Tire rods
  - Steering shaft
  - Steering shaft mount
  - Rack mount
Tie Rods & Steering Shaft

- ½ in. 1020 cold rolled rod stock
  - Tie rods
    - Cut to length
    - ⅝ in. sleeve
    - C-shaped bracket
  - Steering Shaft
    - Cut to length
    - Splined end
    - Quick disconnect end
Miscellaneous

- Lathe working
  - Heim caps
  - Heim misalignments
  - Tie rod thread sleeves
- Plasma cutting
- Paneling
- Water Jet
  - Mounting tabs and gussets
  - Cut by KMT
Performance Testing Plan

➢ Acceleration/velocity
➢ Torque
➢ Suspension
➢ Maneuverability
➢ Possible through a strain gage
Lessons Learned

➢ Don’t take previous Baja projects words as valid reasoning
➢ Consider all systems of a design during the process
➢ Always document adjustments made when building the car
Questions?
Thank You!