ABSTRACT
This project aimed to create a highly fuel efficient vehicle to demonstrate a solution to the rising public concerns for environmental pollution, fuel prices, and the depletion of natural resources. By reducing the vehicle weight, rolling resistance, and aerodynamic drag, less strain will be placed on the motor leading to enhanced fuel economy.

BENCHMARKING
Identify areas for improvement:
• Weight of existing vehicle components
• Driver orientation & ease of entry/exit
• Wheel size & rolling efficiency
• Frontal area & overall aerodynamics

DESIGN EVOLUTION
Design Process:
• Review 2007 SAE competition rules
• Four vehicle configurations were considered & analyzed in a decision matrix
• All internal components were optimized for aerodynamics, weight, size, & strength
• Design aerodynamic fairing

TEST & ANALYSIS
The iterative design process included:
• Hand calculations
• MATLAB optimization
• SolidWorks modeling
• FEA analysis

PROTOTYPING & FABRICATION
Every component of the vehicle was designed, prototyped, optimized, and fabricated to meet the design objectives.

PERFORMANCE IMPROVEMENTS
Weight Reduction:
55% Weight Reduction!

Aerodynamic Enhancements:
• Frontal area reduced by 42.5%
• Maximum cross sectional area reduced by 40%
• Full body fairing designed and implemented

ROLLING RESISTANCE:
• 55% relative reduction achieved by:
  - High performance racing hubs
  - 27% reduction in wheel dia. & increased tire pressure which cause a smaller contact area

PHYSICAL EVALUATION
Compliance with competition requirements:
A) 20° roll stability
B) 50' turning radius
C) 250lb roll bar load capacity

ACKNOWLEDGMENTS
We would like to acknowledge the following people and recognize their contributions to our project:
Steve Laguette  Project Coordinator
Kirk Fields  Design Advisor
Dr. Keith Kedward  Composites Advisor
Dr. James Leslie  Composite Material Supplier
Nelson Bednersh  Fabrication Advisor
Andy Weinburg  Fabrication Advisor

Table 1. Weight comparison.

<table>
<thead>
<tr>
<th>Component</th>
<th>New (lbs)</th>
<th>Old (lbs)</th>
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</thead>
<tbody>
<tr>
<td>Baseboard</td>
<td>5.5</td>
<td>18.5</td>
</tr>
<tr>
<td>Rear Wheel Supports</td>
<td>0.66</td>
<td>7.5</td>
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<tr>
<td>Roll Bar</td>
<td>1.9</td>
<td>10.5</td>
</tr>
<tr>
<td>Wheels</td>
<td>6.4</td>
<td>10.6</td>
</tr>
<tr>
<td>Steering System</td>
<td>3.3</td>
<td>7.8</td>
</tr>
<tr>
<td>Motor</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Sprocket</td>
<td>1.8</td>
<td>4.4</td>
</tr>
<tr>
<td>Other</td>
<td>7.1</td>
<td>19.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>51.66</strong></td>
<td><strong>114.8</strong></td>
</tr>
</tbody>
</table>

Figure 1. 2006 Supermileage vehicle.
Figure 2. CAD model of final vehicle design.
Figure 3. FEA design validation of load bearing components.
Figure 4. Final vehicle assembly of optimized components.
Figure 5. Physical validation of competition requirements.
Figure 6. Prototype/mold of aerodynamic fairing.

Figure 5. Physical validation of competition requirements.