M1 – Formula SAE Fairing Components

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• **Customer Need** - Bobcat Racing competes in a national FSAE competition where teams build a racecar. A fairing that protects the driver from debris is required by the rules of the competition.

• **Project Scope** – Design and manufacture body components for the FSAE Bobcat Racing team’s racecar. Components must interface with existing frame design. Body components include:
  - Nose Cone
  - Side covers
  - Skid Plate

• **FSAE Requirements**
  - Nose cone must surround SAE impact attenuator with no modifications
  - No parts more than 27.6” in front of front tires
  - No exposed sharp edges (minimum 1.5” radius)

• **Target Specifications**
  - Parts must be aerodynamic (coefficient of drag less than 0.40)
  - Parts must encapsulate entirety of cockpit, from main roll hoop, forward
  - Parts made from strong/lightweight material preferred.

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**Final Design**

**Manufacturing Process**

Slice 3-D Model → Cut out Blocks → Create toolpaths for CNC → Mill blocks → Glue blocks together → Sand for final geometry → Cut sheets of carbon fiber → Vacuum Bagging

**Final Product**

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### Failure Modes and Effects Analysis

<table>
<thead>
<tr>
<th>Possible Failure</th>
<th>Effect</th>
<th>Ways to prevent</th>
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<tbody>
<tr>
<td>Fairing too small</td>
<td>Does not fit existing frame</td>
<td>Build slightly oversized</td>
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<tr>
<td>Mounting points fail</td>
<td>Fairing comes off</td>
<td>Minimize stress</td>
</tr>
<tr>
<td>Material breaks</td>
<td>Does not protect driver</td>
<td>Material selection is critical</td>
</tr>
<tr>
<td>Delamination of composite material</td>
<td>Weakens material deformation of parts</td>
<td>Do not speed up cure time with heat</td>
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### Material Selection

- Carbon Fiber Composite
  - Strong enough to protect driver from debris at speeds of 60mph
  - Lightweight enough so that it does not negatively impact performance of car

### CFD Analysis

Drag Coefficient = 0.36