## Milestone Review Flysheet

### Institution
Vanderbilt University

### Milestone
PDR

<table>
<thead>
<tr>
<th>Vehicle Properties</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Length (in)</td>
<td>102</td>
</tr>
<tr>
<td>Diameter (in)</td>
<td>5.5</td>
</tr>
<tr>
<td>Gross Lift Off Weigh (lb)</td>
<td>37.9</td>
</tr>
<tr>
<td>Airframe Material</td>
<td>carbon fiber</td>
</tr>
<tr>
<td>Fin Material</td>
<td>carbon fiber</td>
</tr>
<tr>
<td>Drag</td>
<td>0.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stability Analysis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Center of Pressure (in from nose)</td>
<td>75.2</td>
</tr>
<tr>
<td>Center of Gravity (in from nose)</td>
<td>64.6</td>
</tr>
<tr>
<td>Static Stability Margin</td>
<td>1.91</td>
</tr>
<tr>
<td>Static Stability Margin (off launch rail)</td>
<td>2.3</td>
</tr>
<tr>
<td>Thrust-to-Weight Ratio</td>
<td>12</td>
</tr>
<tr>
<td>Rail Size and Length (in)</td>
<td>144</td>
</tr>
<tr>
<td>Rail Exit Velocity</td>
<td>85</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motor Properties</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Manufacturer</td>
<td>Cesaroni</td>
</tr>
<tr>
<td>Motor Designation</td>
<td>L1720</td>
</tr>
<tr>
<td>Max/Average Thrust (lb)</td>
<td>438/387.4</td>
</tr>
<tr>
<td>Total Impulse (lbf-s)</td>
<td>832.5</td>
</tr>
<tr>
<td>Mass Before/After Burn</td>
<td>7.38/3.5</td>
</tr>
<tr>
<td>Liftoff Thrust (lb)</td>
<td>438</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ascent Analysis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Velocity (ft/s)</td>
<td>650</td>
</tr>
<tr>
<td>Maximum Mach Number</td>
<td>0.58</td>
</tr>
<tr>
<td>Maximum Acceleration (ft/s^2)</td>
<td>375</td>
</tr>
<tr>
<td>Target Apogee (From Simulations)</td>
<td>5300</td>
</tr>
<tr>
<td>Stable Velocity (ft/s)</td>
<td>45</td>
</tr>
<tr>
<td>Distance to Stable Velocity (ft)</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recovery System Properties</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Recover System Properties</td>
<td>Dogue Parachute</td>
</tr>
<tr>
<td>Manufacturer/Model</td>
<td>Fruity Chutes</td>
</tr>
<tr>
<td>Size</td>
<td>30&quot;</td>
</tr>
<tr>
<td>Altitude at Deployment (ft)</td>
<td>apogee</td>
</tr>
<tr>
<td>Velocity at Deployment (ft/s)</td>
<td>65</td>
</tr>
<tr>
<td>Terminal Velocity (ft/s)</td>
<td>69</td>
</tr>
<tr>
<td>Recovery Harness Material</td>
<td>Kevlar</td>
</tr>
<tr>
<td>Harness Size/Thickness (in)</td>
<td>0.5 (6000 lb)</td>
</tr>
<tr>
<td>Recovery Harness Length (ft)</td>
<td>25(11/16 W; 3000lb)</td>
</tr>
<tr>
<td>Harness/Airframe Interfaces</td>
<td>U-bolt and Quicklink</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Recovery System Properties</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery System Properties</td>
<td>Main Parachute</td>
</tr>
<tr>
<td>Manufacturer/Model</td>
<td>Fruity Chutes</td>
</tr>
<tr>
<td>Size</td>
<td>12 ft</td>
</tr>
<tr>
<td>Altitude at Deployment (ft)</td>
<td>700</td>
</tr>
<tr>
<td>Velocity at Deployment (ft/s)</td>
<td>69</td>
</tr>
<tr>
<td>Terminal Velocity (ft/s)</td>
<td>13.4</td>
</tr>
<tr>
<td>Recovery Harness Material</td>
<td>Kevlar</td>
</tr>
<tr>
<td>Harness Size/Thickness (in)</td>
<td>0.5 (6000 lb)</td>
</tr>
<tr>
<td>Recovery Harness Length (ft)</td>
<td>36</td>
</tr>
<tr>
<td>Harness/Airframe Interfaces</td>
<td>U-Bolt and Quick Link</td>
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<table>
<thead>
<tr>
<th>Recovery Electonics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Altimeter(s)/Timer(s) (Make/Model)</td>
<td>Startologger</td>
</tr>
<tr>
<td>Redundancy Plan</td>
<td>Two altimeters will be used for both main and drogue deployments</td>
</tr>
<tr>
<td>Pad Stay Time (Launch Configuration)</td>
<td>&gt;&gt;2 hrs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recovery Electonics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocket Locators (Make/Model)</td>
<td>16mW Big Red Bee</td>
</tr>
<tr>
<td>Transmitting Frequencies</td>
<td>433.91 Mhz</td>
</tr>
<tr>
<td>Black Powder Mass Drogue Chute (grams)</td>
<td>1.1</td>
</tr>
<tr>
<td>Black Powder Mass Main Chute (grams)</td>
<td>3.5</td>
</tr>
</tbody>
</table>
### Autonomous Ground Support Equipment (MAV Teams Only)

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Overview</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capture Mechanism</td>
<td>Overview</td>
<td>N/A</td>
</tr>
<tr>
<td>Container Mechanism</td>
<td>Overview</td>
<td>N/A</td>
</tr>
<tr>
<td>Launch Rail Mechanism</td>
<td>Overview</td>
<td>N/A</td>
</tr>
<tr>
<td>Igniter Installation Mechanism</td>
<td>Overview</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Payload

<table>
<thead>
<tr>
<th>Payload</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Payload 1</strong></td>
<td>Overview</td>
</tr>
<tr>
<td>The payload section of the rocket will house a fuel tank and fuel pressurization system. An on-board camera will be used to visualize the liquid sloshing during the subscale rocket flights. This tank is made of a clear material. This will allow us to verify a suitable design for slosh reduction. For the full scale flight and competition flight, a real fuel tank will be used, and fuel will be delivered to a monopropellant thruster. The thruster will serve as validation that fuel was successfully extracted.</td>
<td></td>
</tr>
<tr>
<td><strong>Payload 2</strong></td>
<td>Overview</td>
</tr>
<tr>
<td>The structural analysis systems of the payload have the goal of determining the forces encountered by the rocket in flight and confirming the accuracy of the finite element analysis model as a structural health predictor. The subscale rocket launch will be used to test the structural health monitoring systems in preparation for the full-scale launch.</td>
<td></td>
</tr>
</tbody>
</table>

### Test Plans, Status, and Results

<table>
<thead>
<tr>
<th>Test Plans</th>
<th>Status, and Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ejection Charge Tests</strong></td>
<td>Ground based ejection charge testing will be performed prior to all test launches. This testing involves assembling the whole rocket included live charges, shear pins, and properly packed parachutes. The charges are then detonated to ensure proper parachute deployment and rocket separation. Deployment tests before our first flight were successful, and the same procedures will be carried out before future launches.</td>
</tr>
<tr>
<td><strong>Sub-scale Test Flights</strong></td>
<td>One subscale flight is scheduled for November 14, 2015</td>
</tr>
<tr>
<td><strong>Full-scale Test Flights</strong></td>
<td>One full scale flight will be completed prior to competition. This flight is expected to take place in February 2016.</td>
</tr>
<tr>
<td>Institution</td>
<td>Vanderbilt University</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Additional Comments</td>
<td></td>
</tr>
</tbody>
</table>