PDR Presentation
Team Dyno(mite)
Acceptance Test Plan

● Sensors
  ○ 5 main metrics - Torque, speed, input voltage, output current, and system temperature
  ○ Will be tested by comparing results to manufacturers parameters

● Test Stand
  ○ Mostly physical design, including standards and safety measures

● Interfaces
  ○ Interfaces with every system
  ○ Testable assuming the respective system in complete

● Power Supply
  ○ Switchable sources with insulated connectors

● Safety
  ○ Safety loop fallback
  ○ Emergency stop button
ATP - Sensors

- **Torque**
  - Will be logged from the dynamometer
  - The basis for generating a torque curve

- **Speed**
  - Can be found in the motor encoder or controller frequency
  - Sources will be compared for redundancy

- **Motor Current**
  - Function of the motor controller for all three phases

- **Controller Input Voltage**
  - Function of the motor controller
  - Can be used to find the input current

- **System Temperature**
  - Measured at various points, including inside the controller
ATP - Test Stand

- Includes physical design considerations
  - checked by redundant inspection:

- Cable management
  - Based on the standards of GPR005

- MCS cooling system
  - Must operate, but not necessarily well

- Physical design safety
  - Shielded connector covers
  - cable insulation
ATP - Interfaces

● Assumes that the other half of the interface is complete

● VSCADA
  ○ Data regarding the sensor systems must be delivered accurately
  ○ Verified by comparing to the locally logged data

● GLV Power
  ○ Sensor systems
  ○ VSCADA interface system

● TSV Load Controller
  ○ Alternative power source

● Safety Loop
  ○ The GLV safety loop must be able to shut the motor down
ATP - Power Supply

● The power supply must allow the motor to spin
  ○ Current draw figures will be collected

● Power supply switching
  ○ The power supply must be swappable without contacting uninsulated wiring
ATP - Safety

● Operational safety concerns should stop the motor
  ○ Ground Fault
  ○ Overtemperature
  ○ Overspin
  ○ Overtorque

● Emergency stop must be hardwired into the test stand
  ○ Disconnects the power supply from the motor controller
Subsystem Hierarchy
Requirements Matrix - Formula Hybrid Competition Rules

- List of all relevant rules and requirements that are set forth by the Formula Hybrid Competition
  - Motor Parameters
  - Motor Controllers
  - Sensors
  - Safety Concerns
Requirements Matrix - VSCADA

- Discusses the interactions between the Dyno system and the VSCADA team
  - Sensor integration
  - Motor Controller
Requirements Matrix - Motor, Controller, and Dynamometer Test Stand

● All requirements set forth in the Statement of Work in section R005 about the motor system
  ○ Equipment Necessary
  ○ Motor Parameters
  ○ Independent Safety Loop
  ○ Sensor Integration
  ○ Power Supply
Requirements Matrix - Safety Loop / TSV Load Controller

- Proper cables and cabling practices shall be used to ensure safety when the motor is operational and to power the system from the load controller
System State Analysis

- VSCADA will have primary state machine
- In general, the motor control system will have two main states
  - On
  - Off
System State Analysis - “On” State

- The system enters the “On” state when the driver turns the car on and the car is ready to drive
- Forward or reverse acceleration is possible in this state
System State Analysis - “Off” State

- Idle state
- Triggered by the driver turning the car off
- Can also be triggered by certain safety conditions
  - Overtemp
  - Overspin
  - Overtorque
  - Ground Fault
  - Emergency Stop Button
## Cost Analysis

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<tr>
<th>Item</th>
<th>Quantity</th>
<th>Price</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>0 AWG (gage) wire - 50ft</td>
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<tr>
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<td>optical encoder - 102-1923-ND</td>
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<tr>
<td>A2D converter</td>
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**Total:** $249.75
Risk Assessment

- Biggest risk - team member(s) falling behind schedule.
- Late delivery of dynamometer manual
- Late delivery of remaining sensors purchased with dynamometer
  - Strain gauge, optical encoder, special data cable for feedback information regarding valve in motor to control oil flow rate.
- Late deliverables from TSV group regarding battery pack - could impact accuracy of models.
- Late deliverables from GLV regarding safety loop could cause delays in integrating our safety loop with theirs to make a comprehensive system.
# Work Breakdown Schedule

- **Weekly Milestones**
- **Student Tasks**
- **Measurable and specific**

<table>
<thead>
<tr>
<th>Week 2</th>
<th>Group</th>
<th>Steve</th>
<th>Alex</th>
<th>John</th>
<th>Brendan</th>
<th>Nate</th>
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<tbody>
<tr>
<td></td>
<td>Finish PDR and Present</td>
<td>Hierarchical Subsystem breakdown and semester task breakdown</td>
<td>Complete ATP</td>
<td>Risk Assessment and Cost Analysis</td>
<td>Requirement Analysis</td>
<td>System State Diagram</td>
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