## Target Catalog and Summary

The primary function of our project is to support and manage a battery pack for a hybrid vehicle. According to the functional decomposition, the main breakdown categories of this project are battery containment and battery management. The battery containment is broken down into four sub-functions. These include supporting external forces and battery load, integration into the vehicle chassis, configuration of the battery layout, and controlling the temperature of the battery pack. The battery management system is also broken down into three sub-functions. These include monitoring current flow, voltage level, and temperature, controlling power output, and charging of the batteries.

Critical targets and metrics include G-force of 2 g’s, impact resistance, battery cell temperatures less than 60 deg Celsius, max discharge current of 500 Amps, and power output of 30 kW. Our team considered previous work from last year’s formula hybrid team, benchmarking from other teams online, and the FSAE rulebook as guidelines for determining the important or critical metrics. The FSAE rulebook laid out bare-minimum parameters for battery cell temperature and power output to meet for a car to be eligible to compete. These were not only followed but exceeded with some degree of safety factor. Impact resistance and G-force values were benchmarked from other teams and previous work and have not yet been validated or tested by our team. Max discharge current was calculated roughly based on battery and motor estimations currently available to the team.

Testing methods for critical methods include CAD simulation of battery box design for G-forces and impact forces. This will require the use of CAD tools such as Creo Pro-E and SolidWorks. Applying external forces in CAD to a model should best simulate the durability and integrity of the design. Should further physical testing become necessary the team will develop additional test methods. Testing of battery cell temperatures, discharge rates, and power output will be tested under guidance of Dr. Moss using temperature probes to ensure the batteries are kept at a safe and optimal temperature. Charging rates and power output will also be measured using ammeters and basic math calculations of current and voltage to arrive at an appropriate power value for the system.

Table 2. *Targets and Metrics*

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| **Metric**  | **Target**  | **Unit**  |
| G-Force  | 2  | G’s  |
| Impact Resistance  | Yes  | N/A  |
| Battery Weight  | 8  | Lbs.  |
| Compact  | Yes  | N/A  |
| Battery Volume  | 216  | In^3  |
| Internal Box Temperature  | <60  | Celsius  |
| Max Discharge Current  | 500  | Amps  |
| Battery Pack Voltage Level  | 60  | Volts  |
| Battery Cell Temperatures  | <60  | Celsius  |
| Power Output  | 30  | kW  |
| Input Voltage to Battery  | 60  | Volts  |