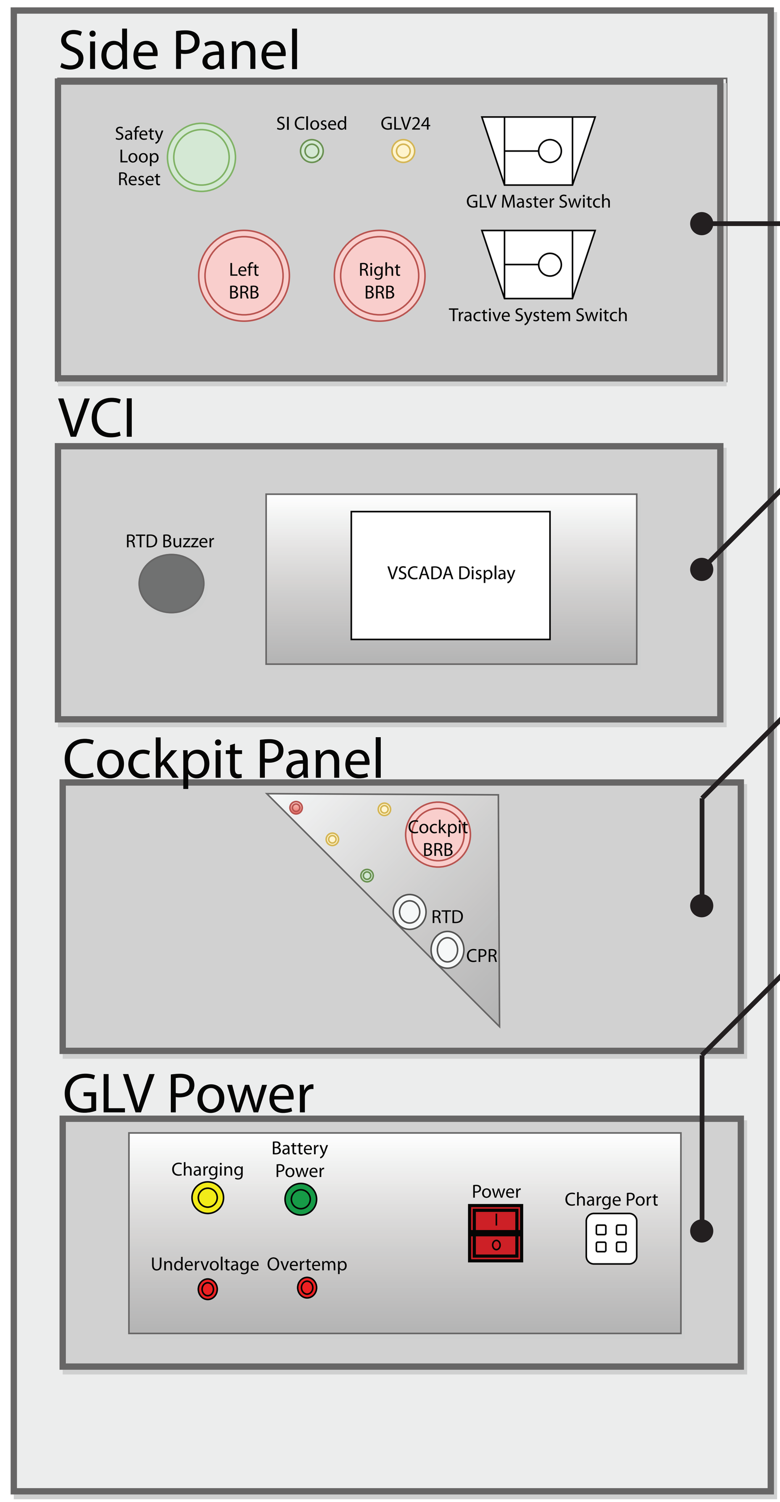
Formula Electric Vehicle - 2015

LAFAYETTE COLLEGE

GLV
Grounded Low Voltage



The GLV systems consists of four seperate subssytems: the safety loop, GLV power, the Vehicle Computer Interface (VCI), and the Tractive System Interface. These subsystems are responsible for maintaining safe operation of the vehicle, powering all non-tractive systems, and interfacing the otehr vehicle systems together.

The side panel contains most of the controls for the safety loop, including the master power switches, the external emergency stops, and the reset for the safety loop. The safety loop reset ensures that after a failure, the car cannot be restarted until the loop is manually reset.

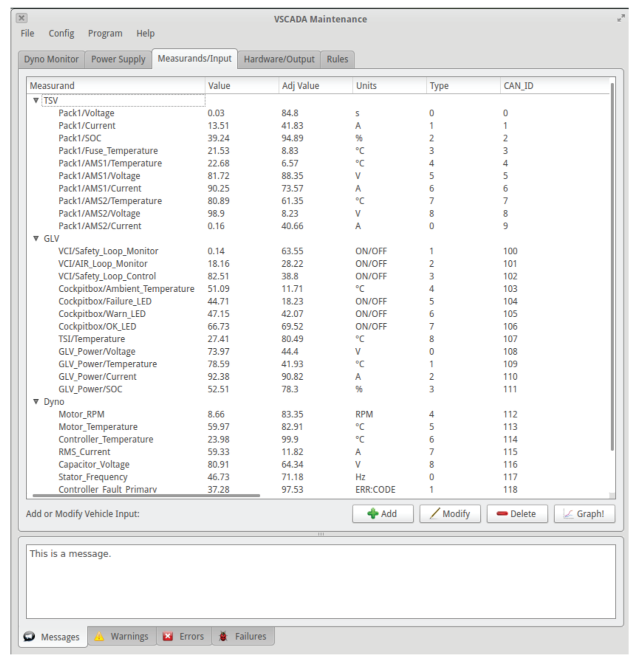
The VCI contains both the VSCADA computer hardware as well as the main safety loop control hub. The safety loop hardware contained here holds the safety loop in the "off" state until it has been reset from the side panel.

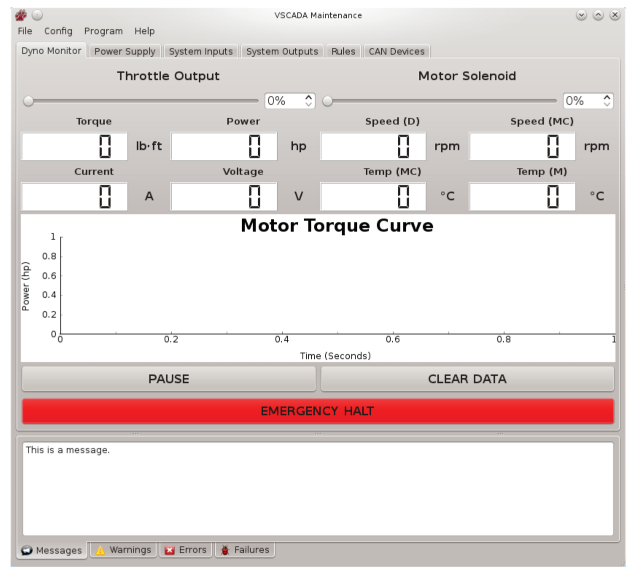
The cockpit panel contains the controls accessable to the driver of the vehicle, including an emergency stop and the main ignition button. There are also several indicator lights for the status of the safety loop and other systems.

The GLV power system provides 24 volts of power to all non-tractive components. The hardware includes a charging system and a battery management system.

The TSI is responsible for maintaining and checking the isolation between the high voltage tractive system and the rest of the low voltage systems. It also contains the main shutoff relay between the TSV packs and the motor controller.

VSCADA
Vehicle System Control and Data Acquisition





Specs:

Language:
Python

Interface:
Qt4

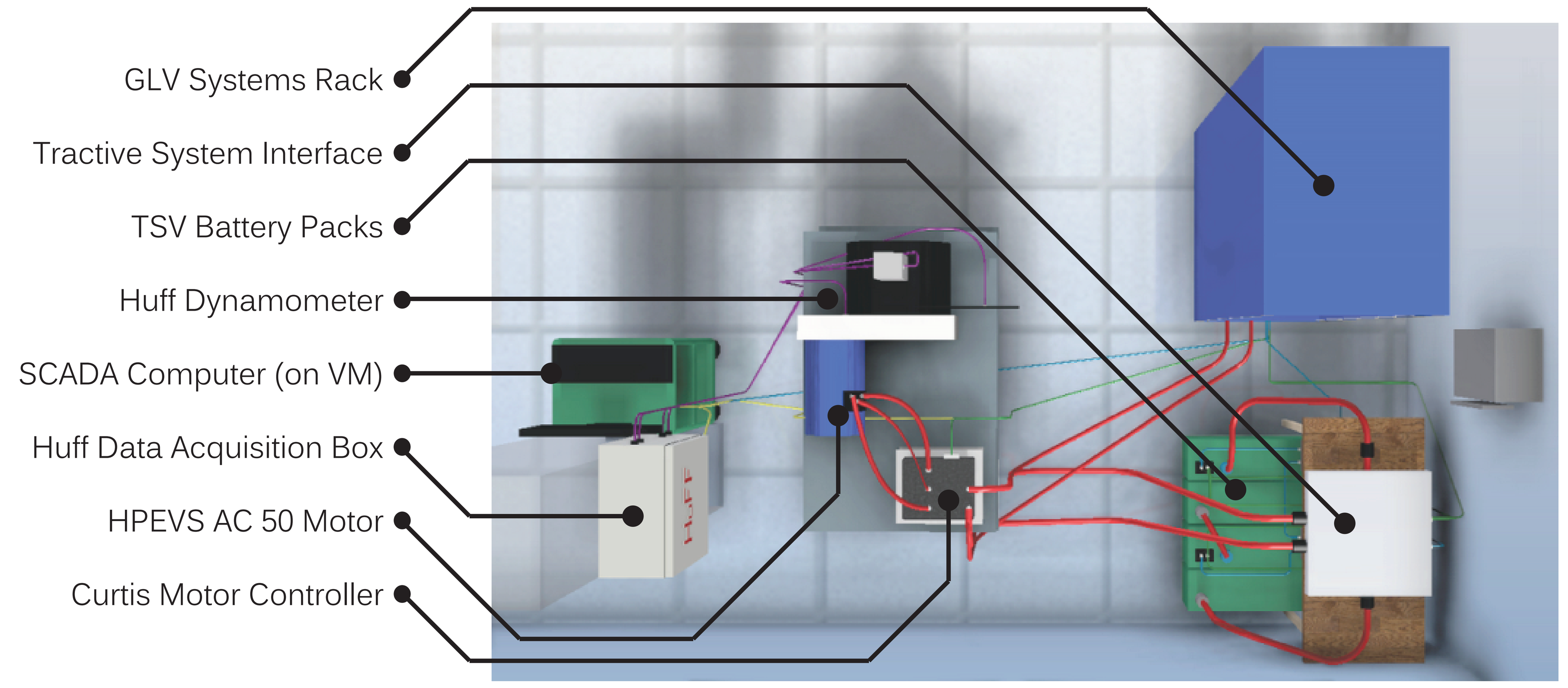
Database:
RDD Based

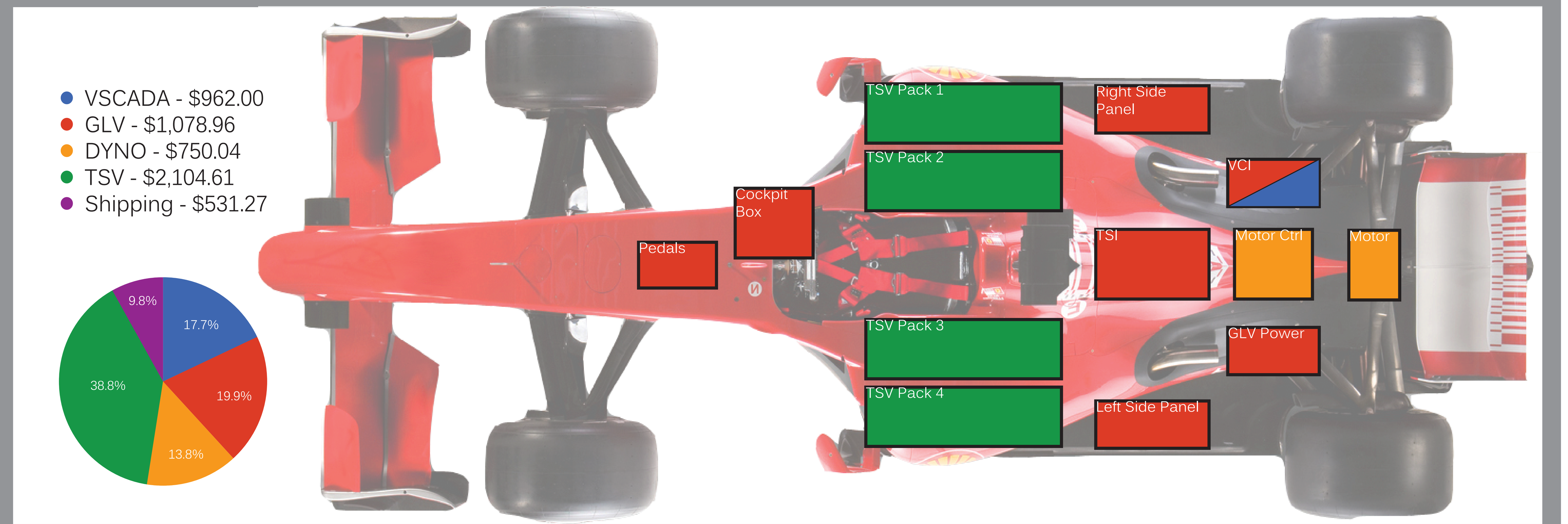
Sensors:
Dynamic Allocation

The VSCADA subsystem acts as the brain of the car, employing a software solution to collect, record, and display data from the various other vehicle subsystems. The software also controls the vechicle's relays and the motor controller.

The CANbus protocol is used to communicate with the TSV pack and the motor controller. CANbus is also used to communicate with VSCADA endpoints thoughout the vehicle. These endpoints consist of an Atmel microcontroller connected directly to sensors in the GLV system.

DYNO
The Motor and Dynamometer Systems





Overview:

The dynamometer systems are used to aquire data from the motor systems without the need to fully integrate the systems into the vehicle. The dynamometer measures the torque and velocity of the motor directly, and is integrated with systems to measure the motor and motor controller temperatures

These systems are controlled and monitered using software developed by the VSCADA team. This software is accessed using a remote desktop application to ensure safe operation from a computer outside of the testing area.

The motor controller is a Curtis 1238R, with an input voltage at 89.6 volts. This controller came preprogrammed to operate with the selected motor, the HPEVS AC 50.

The dynamometer selected is the Huff HTH-150. Data is pulled from the dynamometer via an included DAQ board that is controlled by the VSCADA systems, which also communicates with the motor controller over the built-in CANbus interface.

Specs:

RPM Range:
0-6500 RPM

Maximum Torque:
48.8 ft-lbs

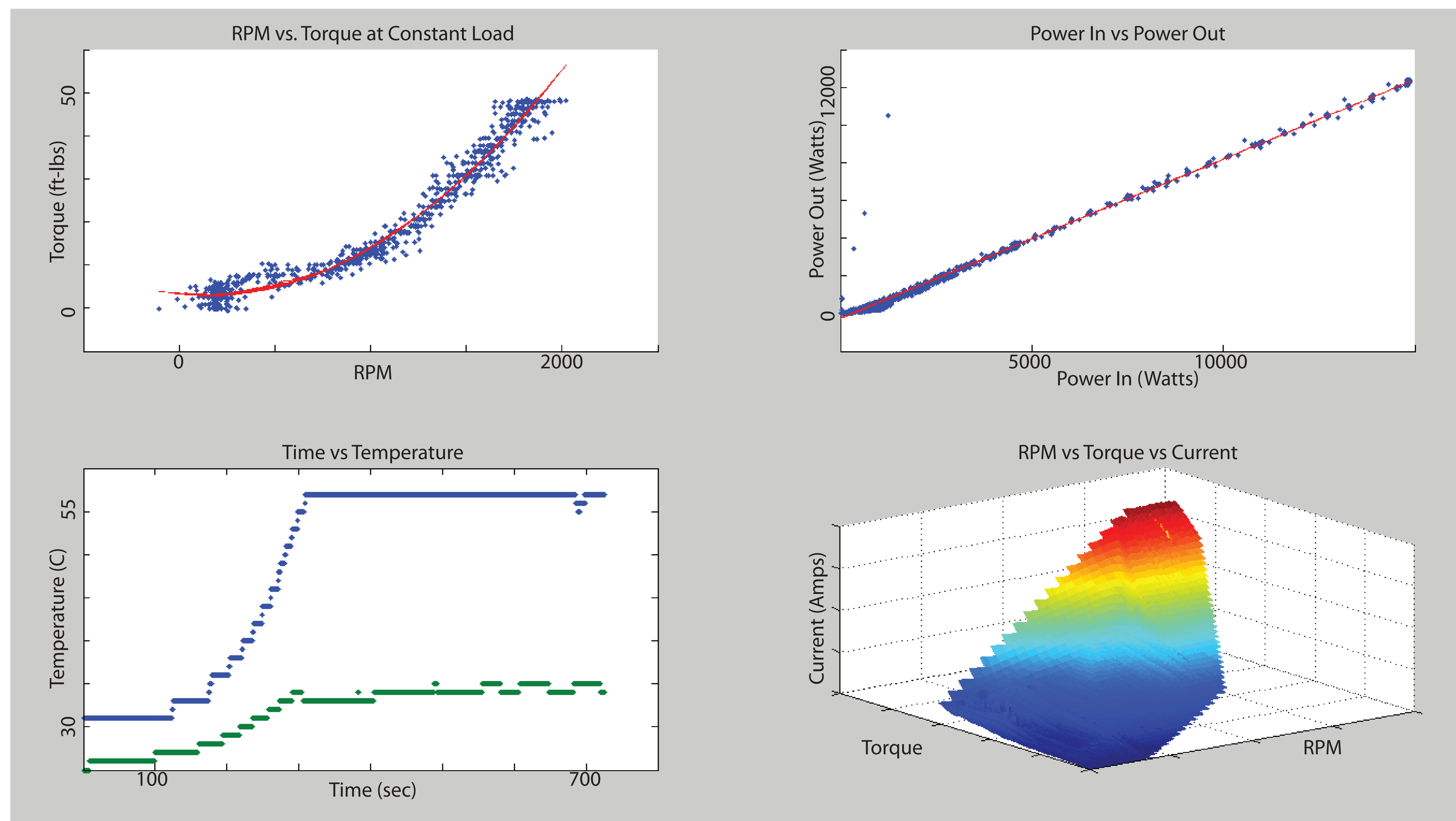
Power Usage: (Max)
18 kW

Power Output: (Max)
16.6 kW

System Efficiency:
84% Efficiency

Measurands:

RPM:	0-11000 RPM
Torque:	0-150 ft-lbs
Voltage:	0-110 volts
Current:	0-275 amps



TSV
Tractive System Voltage

Overview:

The Tractive System Voltage provides high voltage power to the motor controller to run the car. The TSV system will consist of 4 identical battery packs in the car, capable of providing 89.6 volts and over 200 amps. In vehicular terms, this is equivalent to 24 horsepower.

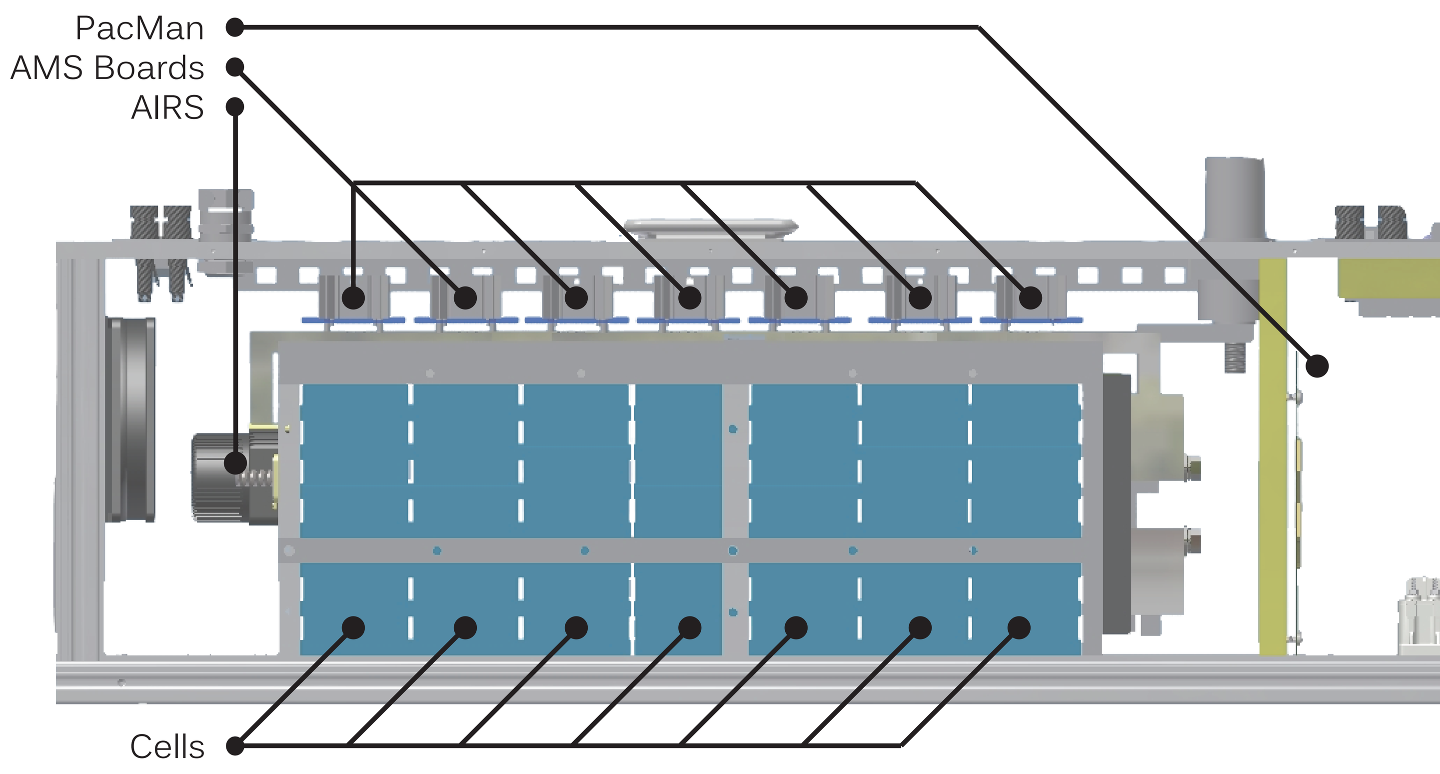
The 2015 team intended to use the 2014 pack design with a few bug fixes, but due to cost overruns, several design changes needed to be made. The most prominent change to the pack was the removal of the embedded computer. The 2014 PacMan had to be downsized from a linux-based system to an Atmel microcontroller.

PacMan:

Each TSV pack is controlled by the Pack Manager microcontroller (PacMan). The PacMan collects data from each of the AMS boards, and generates an estimate of the cell charge. The PacMan is also responsible for communicating with the VSCADA computer over an isolated CANbus interface.

AMS Boards:

Each cell in a TSV pack has a dedicated Accumulator Management System (AMS) to provide the PacMan with the cell voltage and temperature data. The AMS boards also automatically discharge the cells if communication with the PacMan has been lost.



Specs:

Pack Energy:
420 Amp-Hours

Pack Voltage:
22.4 Volts

Total Energy:
1640 Amp-Hours

Total Voltage:
89.6 Volts

Total Current:
200 Amps

Charge Time:
2 Hours