# Group 1.4- AMERICAN SOLAR CHALLENGE

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Texas State University

TEXAS STATE UNIVERSITY

*The rising* STAR *of Texas*

## AMERICAN SOLAR CHALLENGE

The American Solar Car Challenge is hosted by the Innovators Educational Foundation. The race covers 2,000 miles across seven states. The ASC has two missions;

- The support and encouragement of bright young minds to succeed in the fields of engineering, the sciences, mathematics, business, in multi-disciplined experiential learning, and in subsequent careers.
- The creation of public awareness and enthusiasm, both for education excellence and engineering creativity itself, and for the technologies and practices that emerge from that excellence.

## OVERVIEW

This project involves the design and construction of an electrical system intended for a solar car so that Texas State University can compete in the American Solar Challenge. This electrical system will be responsible for monitoring power consumption of both the solar to battery charger, and the 120-volt backup charger for recharging the batteries during overcast conditions. Isolation circuitry will be implemented to reduce interference and protect logic circuitry.

## CONSTRAINTS

- 500 dollar budget set by course
- Project is to abide by guidelines set by the American Solar Challenge
- Full Project to be finished by end of Senior Design II (December 6, 2017)
- Monitoring System must be powered by power integration system or 12V battery system

American Solar Challenge

## PROJECT GOALS

System Capable of Monitoring:

- Battery Voltage, Current and Power
- Motor Temperature

Regulated Charging Unit

## SAFETY CONCERNS

- Battery pack not being charged efficiently
- Fried monitoring sensor
- Readings not within proper parameters
- How will the driver be alerted?

## STRECH GOALS

Data Acquisition

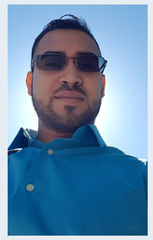
- Radio/Cell Tower Transmission

LCD Monitoring Display System

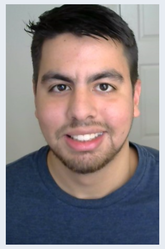
## ERROR HANDLING

- Incoming voltage transients will be suppressed through a resistor, capacitor, diode network
- Isolation circuitry will be implemented to protect logic from cross-system interference
- Additional fuses, or Zenner diodes, will be encorporated for further protection against high surge currents

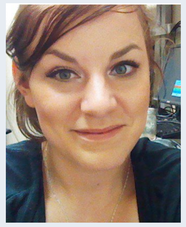
## TEAM MEMBERS



Adrian Servin-Martinez



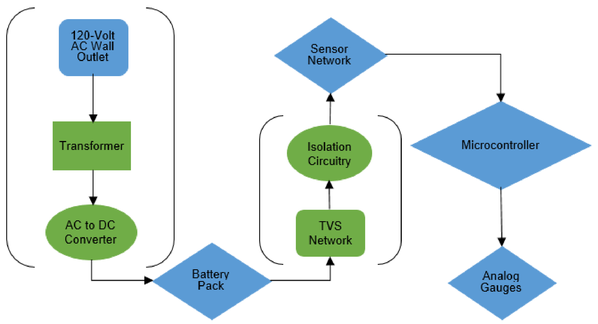
Anthony Beltran



Deborah Williams

Joshua Brown

## INTERFACES




## PERFORMANCE PARAMETERS

**Hardware Performance Parameters**

| Parameter | Minimum | Maximum | Units | How Tested |
|---|---|---|---|---|
| Battery Pack | 111 | 137.9 | V | DMM will be used to measure voltage across terminals of battery system after it has been removed. |
| AC to DC Converter Input | 110 | 130 | V | DMM used to measure DC voltage at output of converter to ensure proper translation. |
| DC to DC Converter Input | 100 | 260 | V | DC Power supply used to supply varying voltage levels within minimum and maximum parameters. |
| DC to DC Converter Output | 13.11 | 14.49 | V | Step down at output measured with a DMM. |
| Controller for Monitoring | >1 | 400 | A | DC Power supply used to supply varying current levels within minimum and maximum parameters. Shunt resistor along with DMM used to take readings. |

## WHY IS THIS A GOOD SENIOR DESIGN PROJECT?

- Requires knowledge of analysis techniques, concepts and implementation of components acquired through the core curriculum
- Provides some background in power engineering
- By participating in the American Solar Challenge, Texas State's Ingram School of Engineering will be able to expand its engineering recruiting pool and showcase the full potential of the education it provides. It will also reveal the college's ability to support and stay steadily involved in the engineering community.

## SEMESTER II PLANS

- Design/Assemble Regulated Charging Unit
- Design/Assemble TVS Circuitry
- Assemble Sensor Network
- Write Code to Translate and Interpret Incoming Signals
- Perform Periodic Testing to Ensure Project Success

## ROLES

| NAME | ROLE |
|---|---|
| Joshua Brown, Project Manager | • Conduct Meetings<br>• Weekly Reports<br>• Voltage Transient Suppression: Design & Testing<br>• Isolation Circuitry: Design & Testing |
| Adrian Servin - Martinez | • Regulated Charging Unit Design: Design & Testing |
| Anthony Beltran | • Microcontroller Code for Translation<br>• User Interface Configuration: Design & Testing |
| Deborah Williams | • Voltage Transient Suppression: Design & Testing<br>• Isolation Circuitry: Design & Testing |

## ACKNOWLEDGEMENTS

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