Remote Controlled Vertical Axis Wind Turbine

The Aero Power Tower

SAN DIEGO STATE UNIVERSITY

Project Overview

Problem Statement

SDSU's Brawley campus requires a wind turbine tower capable of testing many different wind turbine designs. The tower shall be designed to mount both a horizontal axis wind turbine (HAWT) and a vertical axis wind turbine (VAWT) simultaneously while being able to accommodate a variety of turbines.

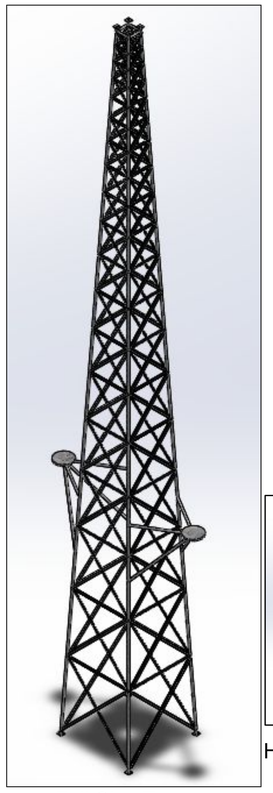
Sponsor

Dr. Asfaw Beyene
Professor of Mechanical Engineering, San Diego State University

Advisors

Greg Morris: SDSU structural engineering professor
Mike Lester: SDSU fabrication support for manufacturing
Dr. Scott Shaffar: Professor of Mechanical Engineering and senior design instructor

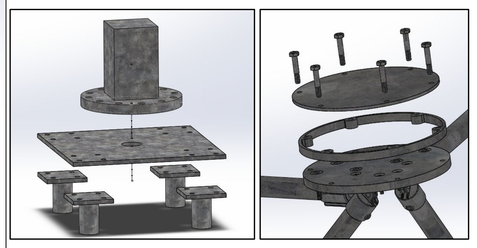
Design



Full Size Tower

Full Size Tower

- 60 feet tall
- Mirrored pratt brace pattern
- Accommodates two 1kW vertical Axis turbines or smaller
- Capable of holding up to a 2300 lb 10kW horizontal axis turbine
- Comprised of Galvanized Steel 2" SCH 40 pipes and 2x2x1/8" angle irons
- Designed in three twenty foot sections to allow for ease of manufacturing, assembly, and transportation

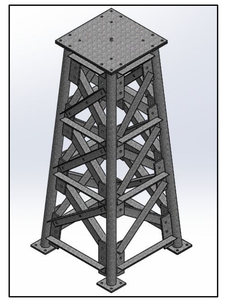


Horizontal Axis Turbine Mounting Interface (Left) and Vertical Axis Turbine Mounting Interface (right)

Subsection

Note: subsection is for testing purposes

- Top 5 feet of the full size tower
- A36 steel
- Completely manufactured in house



Control System

- Measures theoretical power output of a wind turbine
- Data collected through an arduino using the following sensors:
  - Anemometer
  - Thermometer
  - Barometer

Meet the Team

Team Name: Aero Power Tower

Jeffrey Burrows
Manufacturing Lead

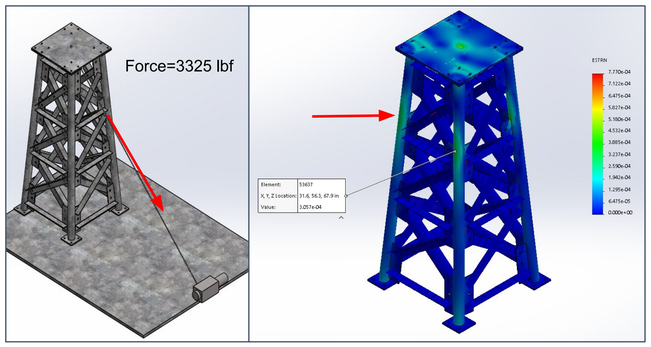
Daniel Elerding
Quality Engineer

Zachary Lang
Project Manager

August Stegman
Design Lead

Testing

Subsection Load Test / Measuring Strain



Tower is subjected to 3325lb of force. This force is measured with a load cell.

Then strain gauges are used to measure the strain experienced at specific areas of the tower (see red arrow on right picture above)

The strain measured by the gauges are compared to the FEA analysis to test the accuracy of the simulation in a real world situation.

Design Analysis

Loading Calculations

Performed loading calculations according to IEC 61400 Standards For Small Wind Turbines.

Bracing Pattern Optimization Study (FEA)

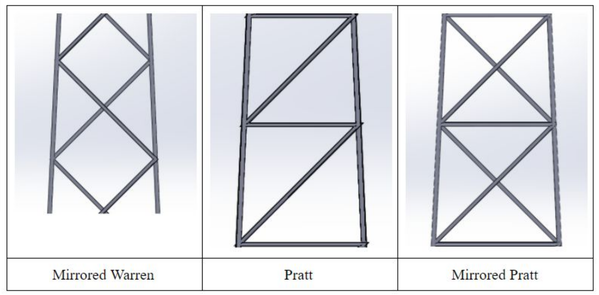
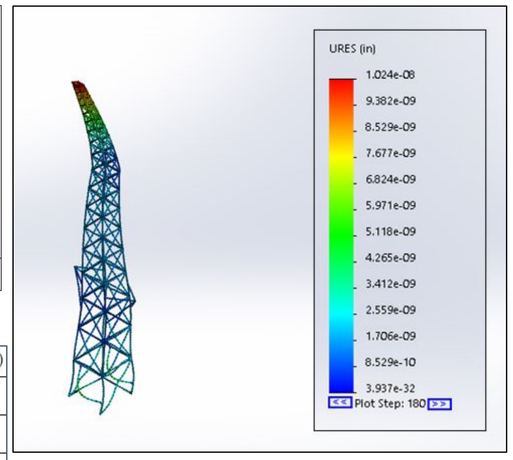


Table 1: Bracing Pattern Comparison FEA Study Results

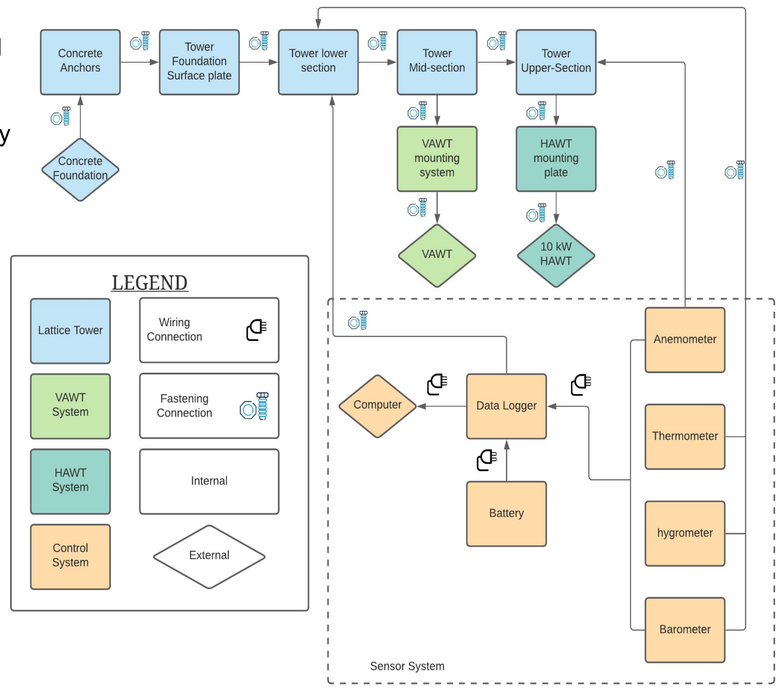
Pattern Type	Max Stress (psi)	Max Displacement (in)
Mirrored Warren	1.193×10^4	2.906
Pratt	1.194×10^4	2.955
Mirrored Pratt	1.202×10^4	2.689

FEA of Full Tower

- Forces acting on tower based on actual turbine specifications
- Tower deformation is within allowable Threshold with a desired factor of safety



System Level Diagram



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