Wind Energy-13

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Technical Analysis and CAD/Main Fraim

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Project Manager/ Control Theory

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Budget Liaison / Website Developer

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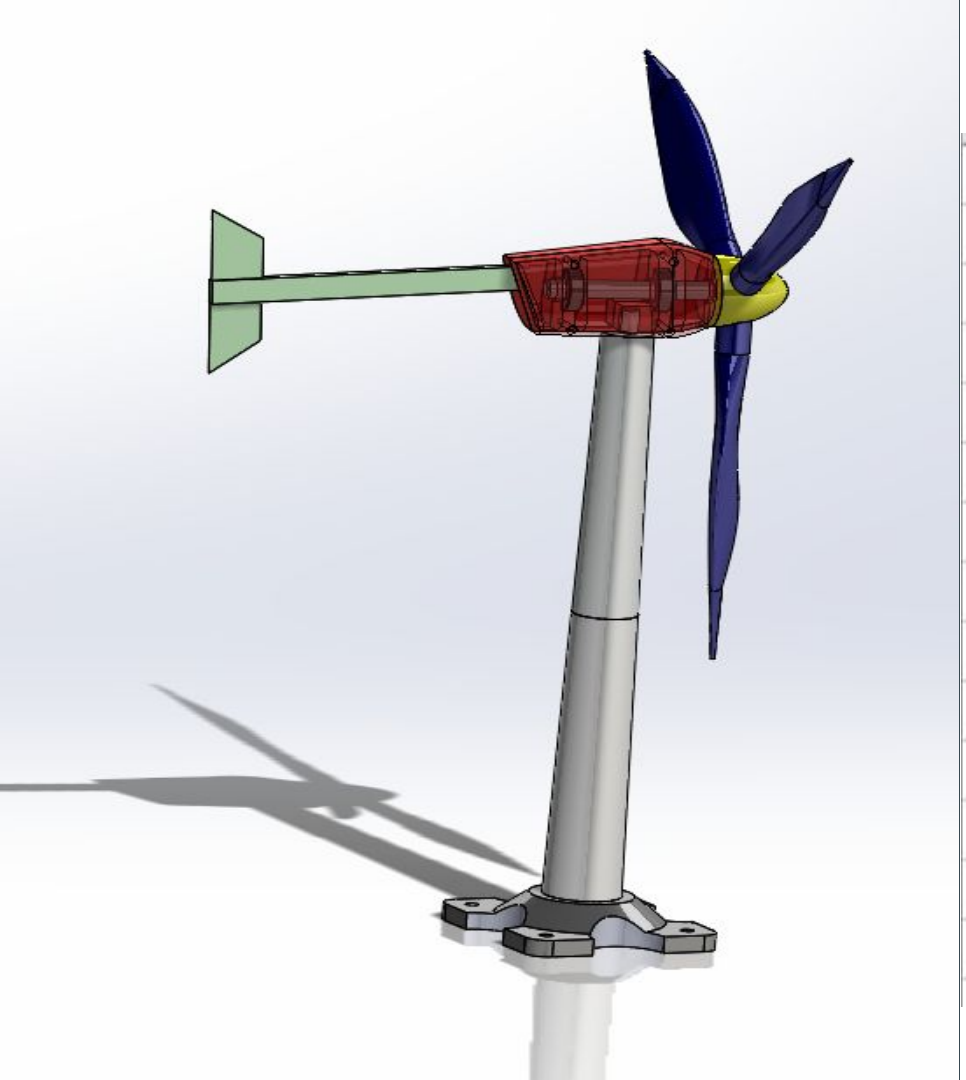
Blades design / secretarial support

Besongnsi Ntoung

Project Manager /Position: Technical Analyst and Researcher

Project Description

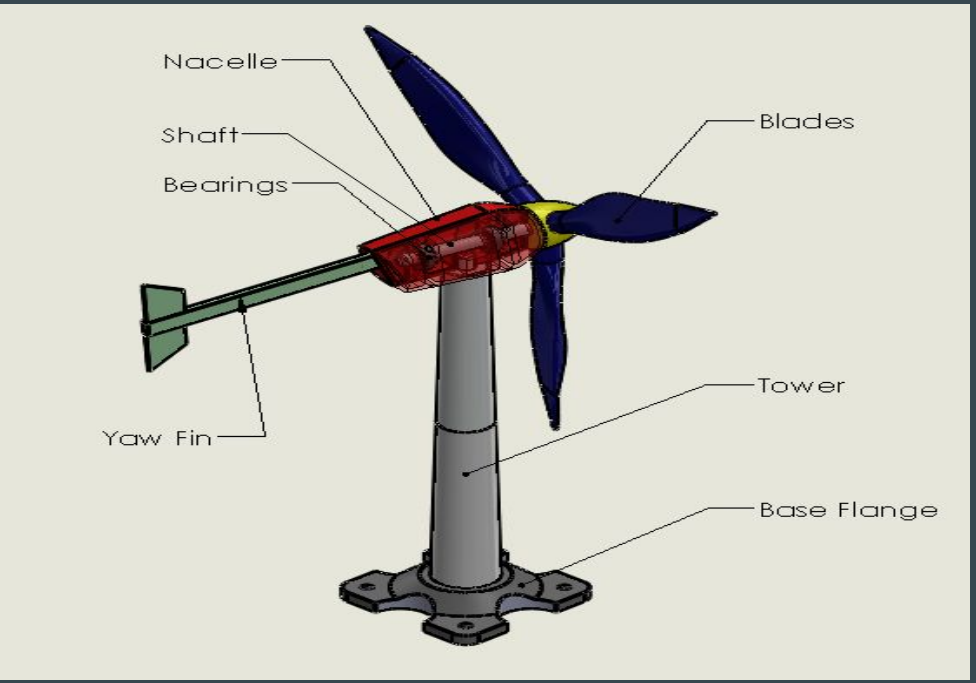
- Client: Instructor David Willy
- Goal: To design and build a fully functional and efficient wind turbine
  - Will be displayed and used on NAU campus
  - Guidelines based off of the Collegiate Wind Competition

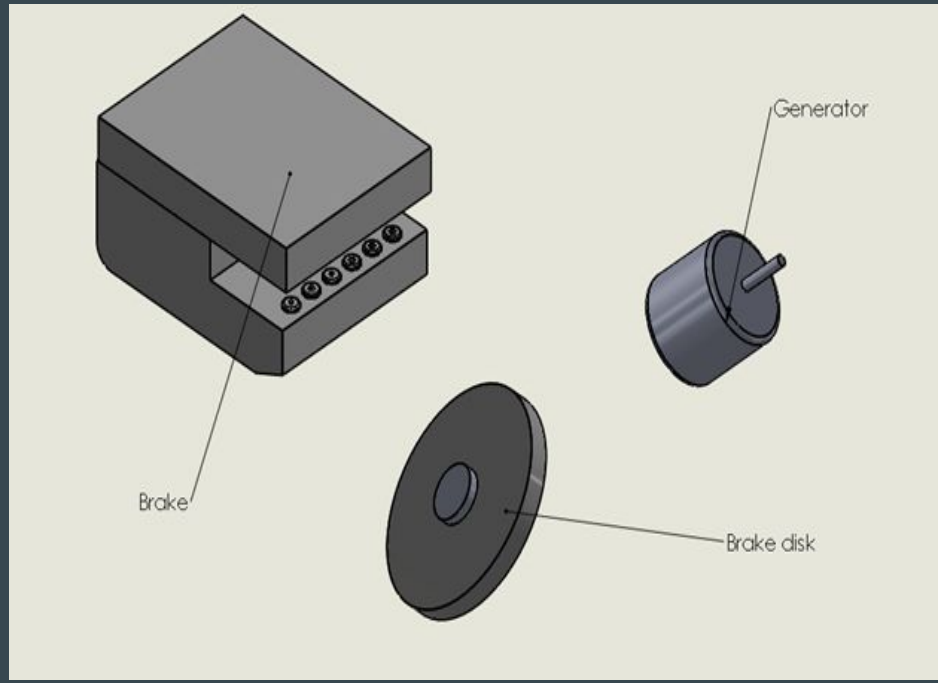


BOM

Bill of Material					
ITEM NO.	Material	Purchased	QTY.	COST PRICE	Manufacturer
1	Base Flange	X	1	$8.70	Grainger
2	Tower	X	1	$122.00	Amazon
3	Blades	X	3	$120.00	3D Printer
4	Nacelle	X	1	$21.00	3D Printer
5	Shaft	X	1	$4.21	LAX
6	Yaw fin	X	1	$28.00	3D Printer
7	Generator	X	1	$98.00	Amazon
8	Brake disk	X	1	$32.00	Amazon
9	Brake	X	1	$20.00	Students Home
10	Bearing	X	2	$48.00	Amazon
			Total Cost	$501.91	

Design description





How The Design Works

- Operate on a simple principle, the energy in the wind turns a three propeller-like blades around the rotor.
- When the blades start moving, they spin a shaft that leads to a generator
- Wind turbine convert the kinetic energy to mechanical power.

Design Requirements

Customer Requirements

- Effective Mechanical and Aerodynamic Wind Turbine
- Design can withstand max wind speeds
- Size Constraints
- Functional and Safe
- Efficient
- Low Cost

Engineering Requirements

- Max Wind Speed - 20 m/s
- Dimensions - 61 X 122 cm.
- Power > 5 Volt output
- Stability by choice of material
- Variable Wind Speeds 5 to 11 m/s
- Budget and BOM

Design Requirements Calculations

$$Re = \rho \frac{UL}{v}$$

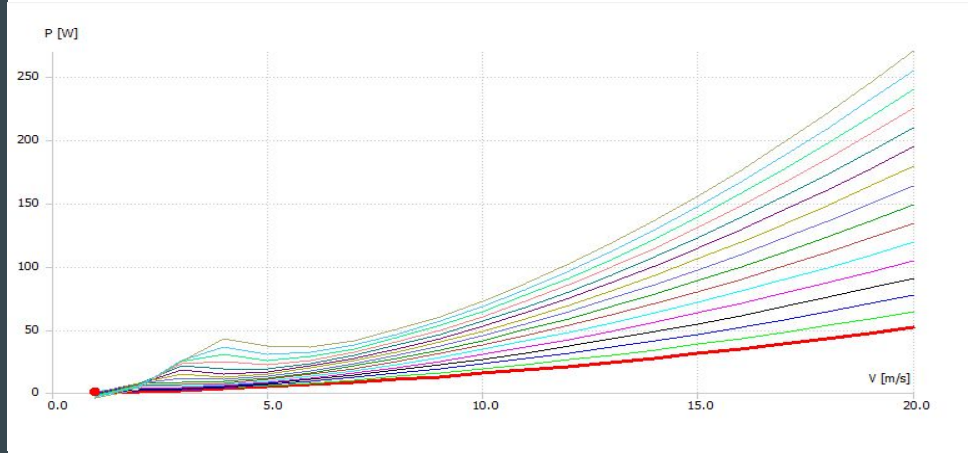
$$Ma = \frac{U}{c}$$

$$c = \sqrt{kRT}$$

$$P = \frac{1}{2}\rho A U^3$$

$$Cp = \frac{\text{Actual Electrical Power Produced}}{\text{Wind Power into Turbine}}$$

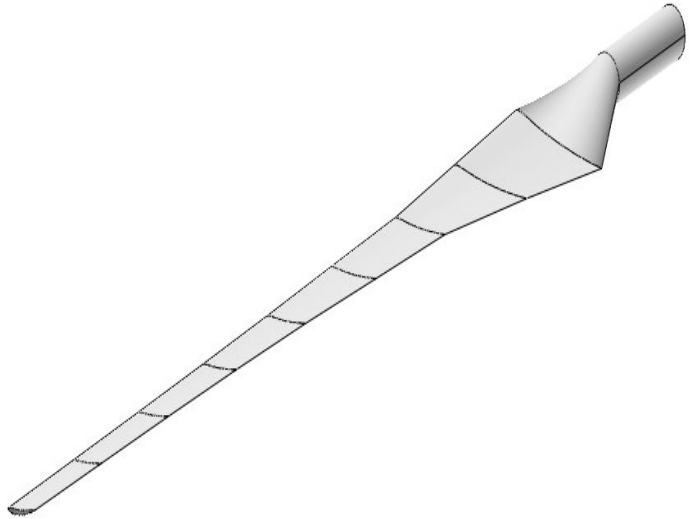
Figure 1. Collegiate Wind Competition [1]



Blade design

Aerodynamic Analysis

- Utilized Qblade [3]
- Declared Cp and Power
- Defined chord
- Angle of Twist
- Airfoil chosen NACA 2414 and NACA 6409 9% [4]



Budget

- Our Budget for this project is $550.00
- Funding Source: Team funded
- Estimated Cost:

Manufacturing ($150)

1- Blades

2- Nacelle

3- Yaw Fin

Materials ($350)

1- Towers

2- Gears

3- Shaft

4- bearing

5- Generator

6- Brake

Prototyping ($50)

Schedule

Wind Turbine Design for ME 476C

ACTIVITY	Begin Date	End Date	Assigned To	PERCENT COMPLETE
Final Reports	4/19/2018	4/29/2018	Team	40%
Final CAD Package	4/25/2018	5/2/2018	Ahmad and B	40%
Website 3 - Final Version	4/25/2018	5/2/2018	Fahad	70%
Peer Evaluation 3	5/3/2018	5/4/2018	Individually	0%

Wind Turbine Design for ME 486C

Final Proposal	6/2/2018	6/6/2018	Team	0%
Website Check 1	6/7/2018	6/13/2018	Fahad	30%
HR1 Summary and Peer Eval 1	6/14/2018	6/20/2018	Team	0%
Individual Analysis II	6/21/2018	6/27/2018	Individually	0%
Midpoint Report	6/28/2018	7/4/2018	Team	0%
HR2 Summary and Peer Eval 2	7/5/2018	7/11/2018	Team	0%
Drafts of poster and operation manual	7/12/2018	7/18/2018	Team	0%
Website Check 2	7/19/2018	7/25/2018	Fahad	20%
Final Poster and Operation manual	7/26/2018	8/1/2018	Team	0%
Final Report, Website, Peer Eval 3 and CAD Package	8/2/2018	8/7/2018	Team	0%

References

[1] https://nawindpower.com/doe-reveals-2018-collegiate-wind-competition-participants

[2] Wind Turbine Blade Analysis. (2018). [Available]. https://community.dur.ac.uk/g.l.ingram/download/wind_turbine_design.pdf

[3] Qblade. (2018). [Available]. https://sourceforge.net/projects/qblade/

[4] NACA 2414. (2018). Airfoil Tools. [Available]. http://www.airfoiltools.com/

Thank you

Questions?