

Digital Twin of the USCGA Satellite Ground Station

1/c Richard Bew & 1/c Peyton Henderson

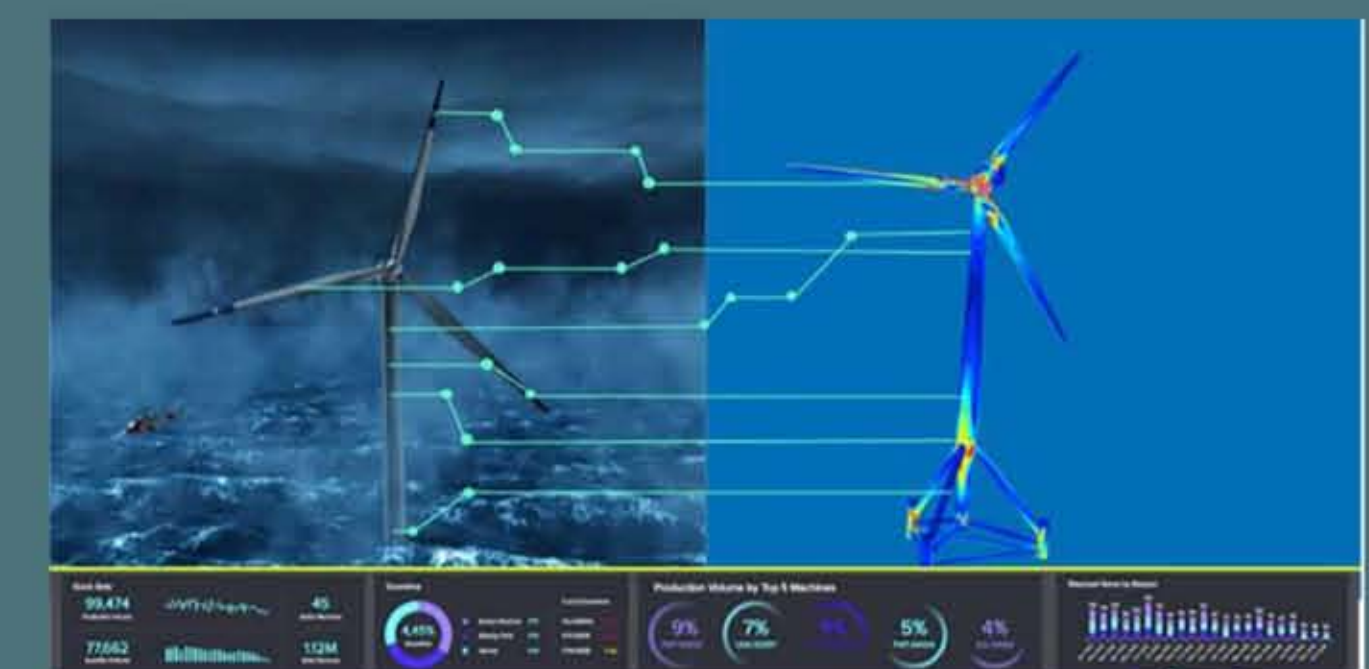
Project Advisors: CDR Lee Hartshorn & CDR Joseph Benin

Sponsors: USCG Research & Development Center & the University of Rhode Island

Background

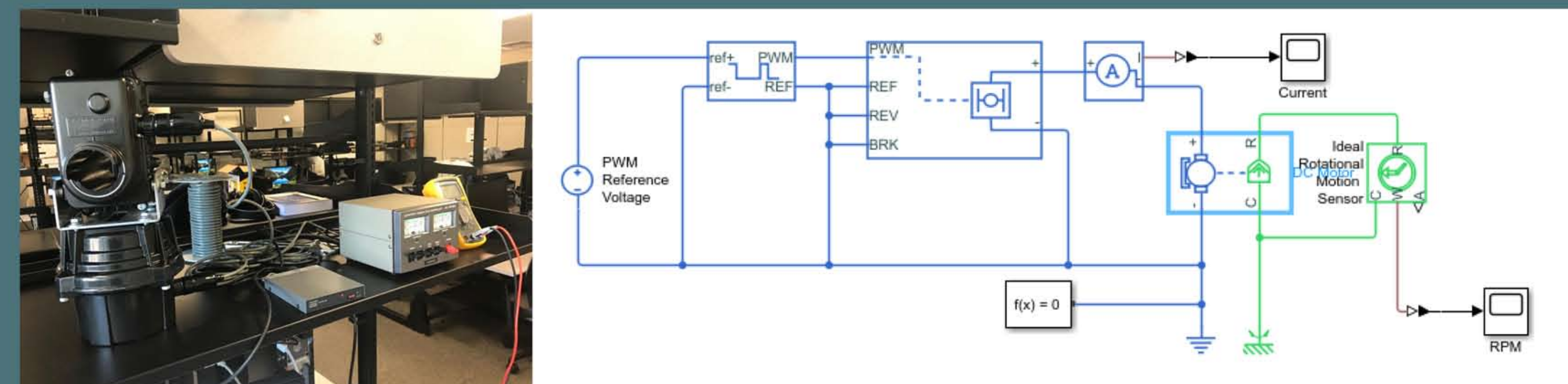
- A Digital twin is a merger between the digital and physical worlds and helps...

- Predict Life Expectancy
- Detect Anomalies
- Improve Performance
- Build Resilience



- Manufacturing and engineering enterprises currently use digital twins
- Incorporate sensors and real-time interoperability with physical system

Current Status

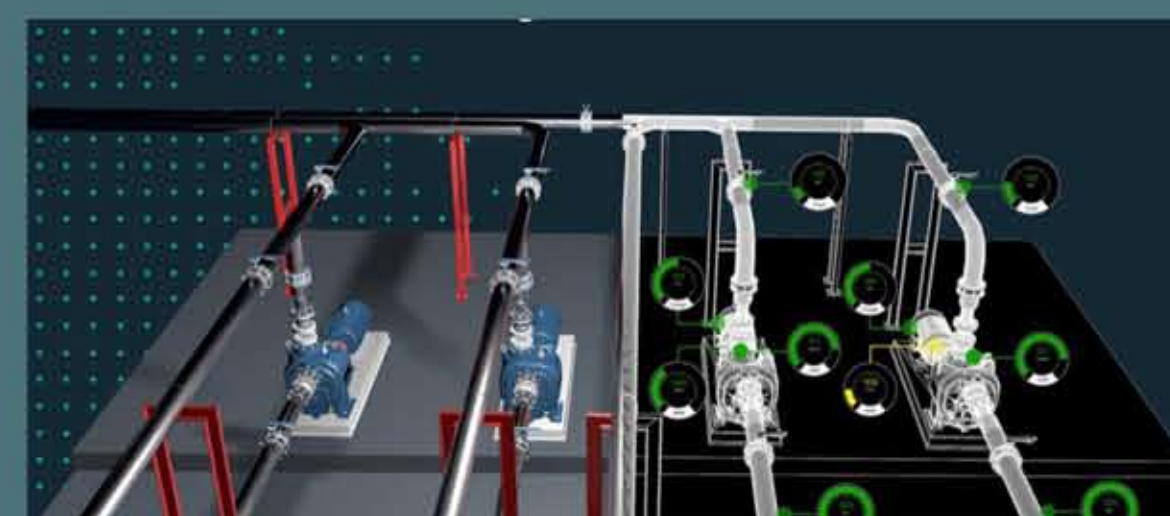


Future Plans

- Develop backend API for controlling/polling our motor
- Develop frontend for displaying statistics for both physical and digital twins
- Consider upscaling potential
- Force tag system failure scenarios



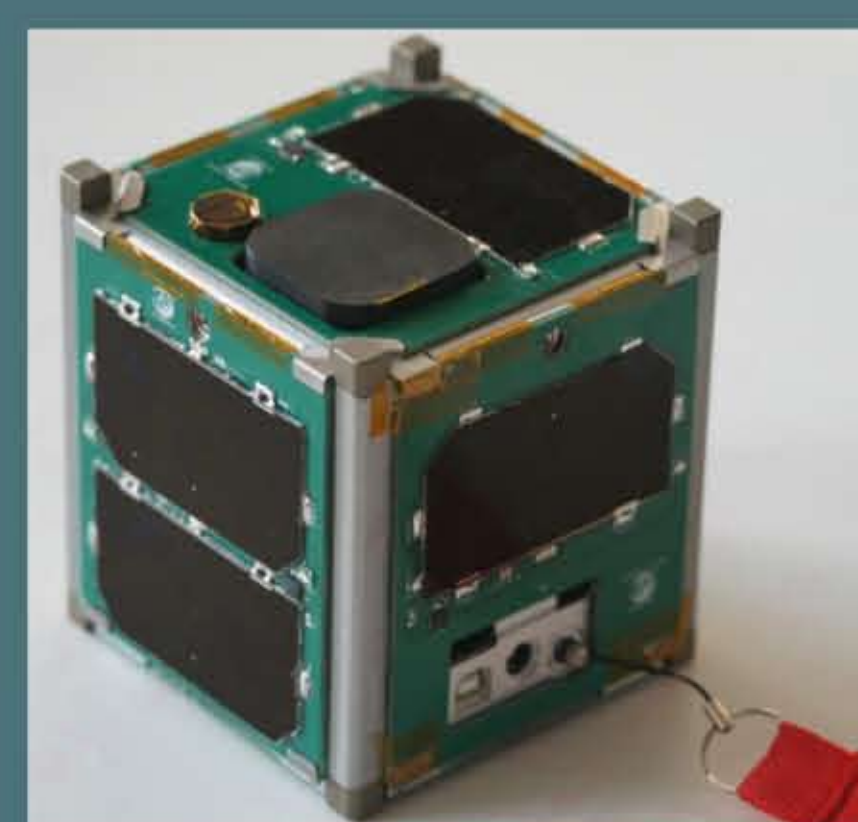
- The United States Coast Guard has a large amount of machinery and control systems
 - Prevalent
 - Critical to Operations
 - Expensive
- Sophisticated monitoring and predictive technology is available and on the leading edge of industry advances
- Keep the Coast Guard **ready, relevant, and responsive**



Physical Twin

- Many Options; Group Selected USCGA CubeSat Base Station

- Monitor Performance
- Augment Motor Control System
- Monitor Input and Output Signals
- Detect an Intrusion
- Provide Backup



Requirements

OR	FR	KPP	Priority	Thr/Obj
1	Adaptive GUI ...near or on ground station control. ...remote web access.	x	10 8 1	
2	Independent model and simulation.		7	
3	Provide feedback. Detect discrepancies.	x	10 7	
4	Twin has identical specifications I/O with Physical System	x	6 10	
5	Power Supply Model DC Motor Model		5 8	
6	Sensors weatherproofed and unreliant on natural light		4	
7	Requisite hardware for real-time I/O. Latency	x	4 10	< 5000ms
8	No separate manual required Adaptive warnings and color indicators. Email notifications.		2 4 1	
9	Sensors must be weather-proof. Sensors not reliant on natural light	x x	10 10	
10	High availability Physically durable		5 3	> %90

