Kartik Naik

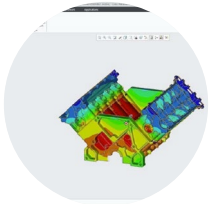
Research engineer

Why research?

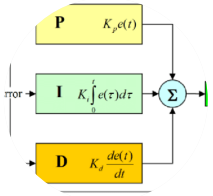
Research enables both, development of novel technology to help solve problems at a global level, and answer fundamental scientific questions on a personal level.

Core areas of interest

Prototyping and experimental testing



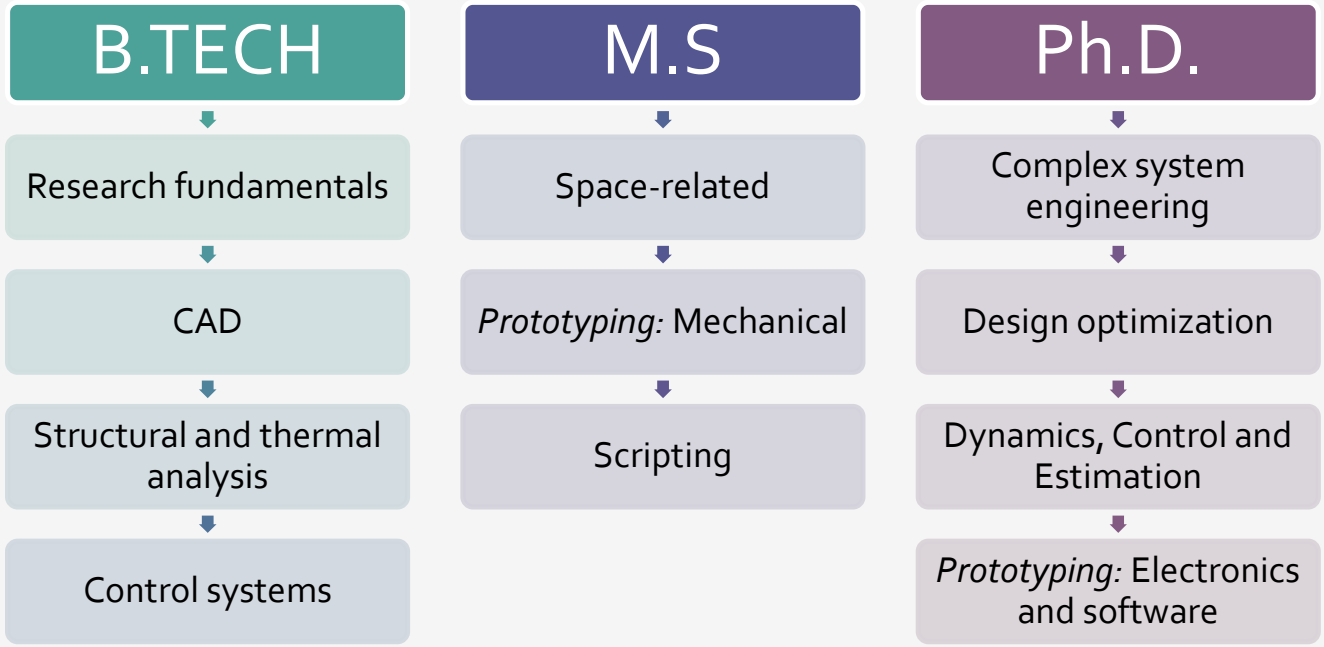
Mechanical and thermal design and optimization



Dynamic modeling, controls and estimation

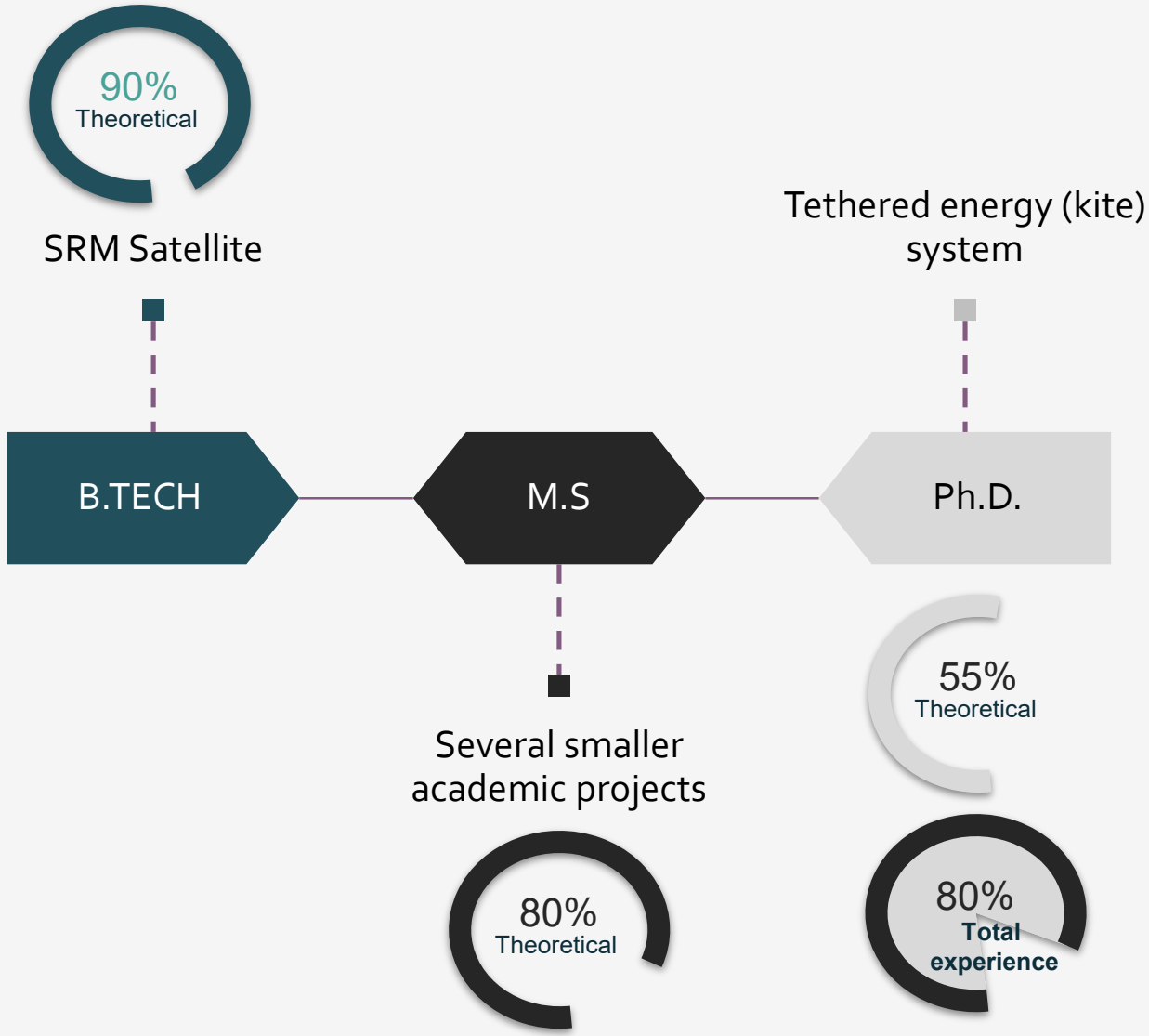
Academic timeline

Research experiences and relevant skill development at each academic stage.



Projects

While projects during my bachelor's and master's enriched theoretical research capabilities, my doctoral research projects were far more practical and complex. Thus, I will focus on projects from my doctoral work in this portfolio.



At a glance: B.Tech

Mechanical Engineering
SRM University, India

B.TECH | Research fundamentals | CAD | Structural and thermal analysis | Control systems

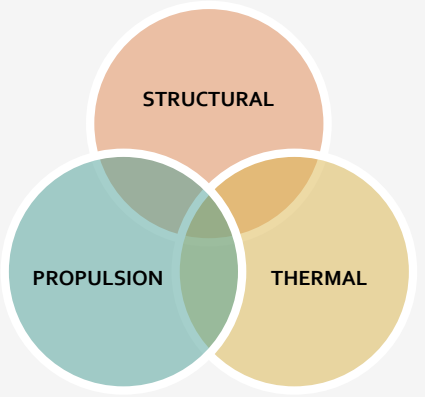
SRMSAT

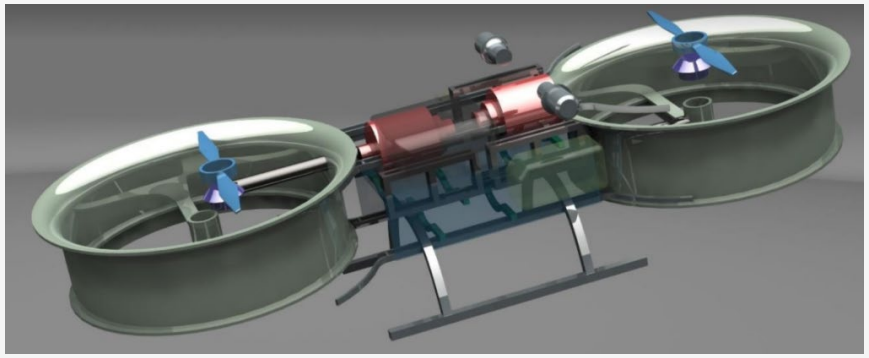
Goal: Design a satellite mission to a Low Lunar Orbit (LLO)

- Led the mechanical systems team
- Software used: Solidworks, Siemens NX, Systems Tool Kit (STK)

Outcomes

- Presented design report to Indian Space Research Organization to secure funding
- Relevant publications





ACADEMIC THESIS

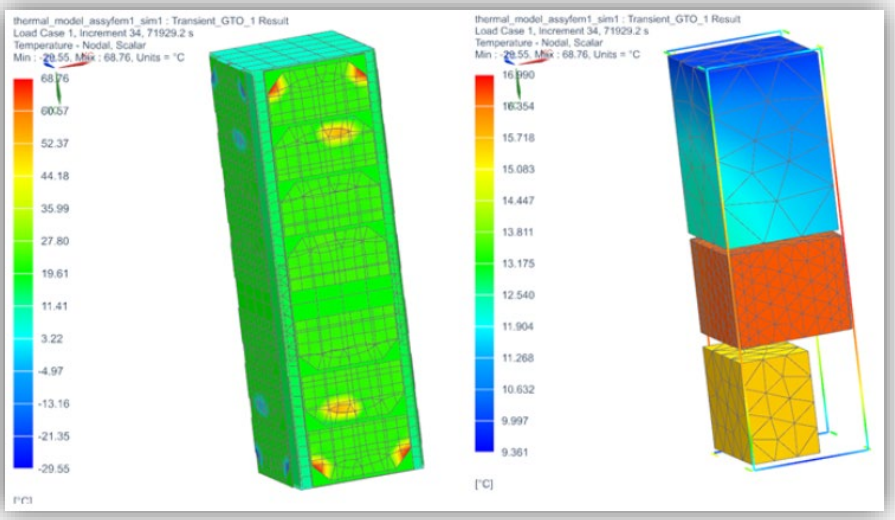
Title: Design of a 2-rotor hoverbike.

Tasked with structural frame, transmission and control design.

At a glance: M.S

M.S | Space-related | Prototyping | Scripting

Aerospace Engineering
- Lulea University, Sweden
- University of Wurzburg, Germany
- Aalto University, Finland



ACADEMIC PROJECTS

- Floating satellite project

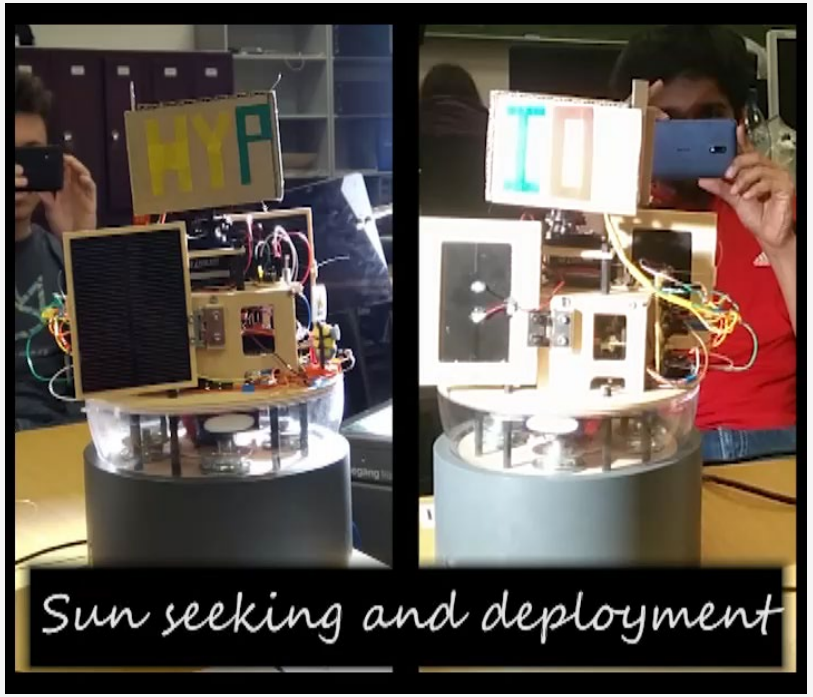
Goal: Prototype and test a satellite concept on a floating bed
Control reaction wheel to face light source.

- Mars mission design project

- European Space Agency's concurrent engineering project

ACADEMIC THESIS

A Thermal Investigation and Comparative Study of the Foresail missions (high earth orbital satellite).



Video link

In depth: Ph.D.

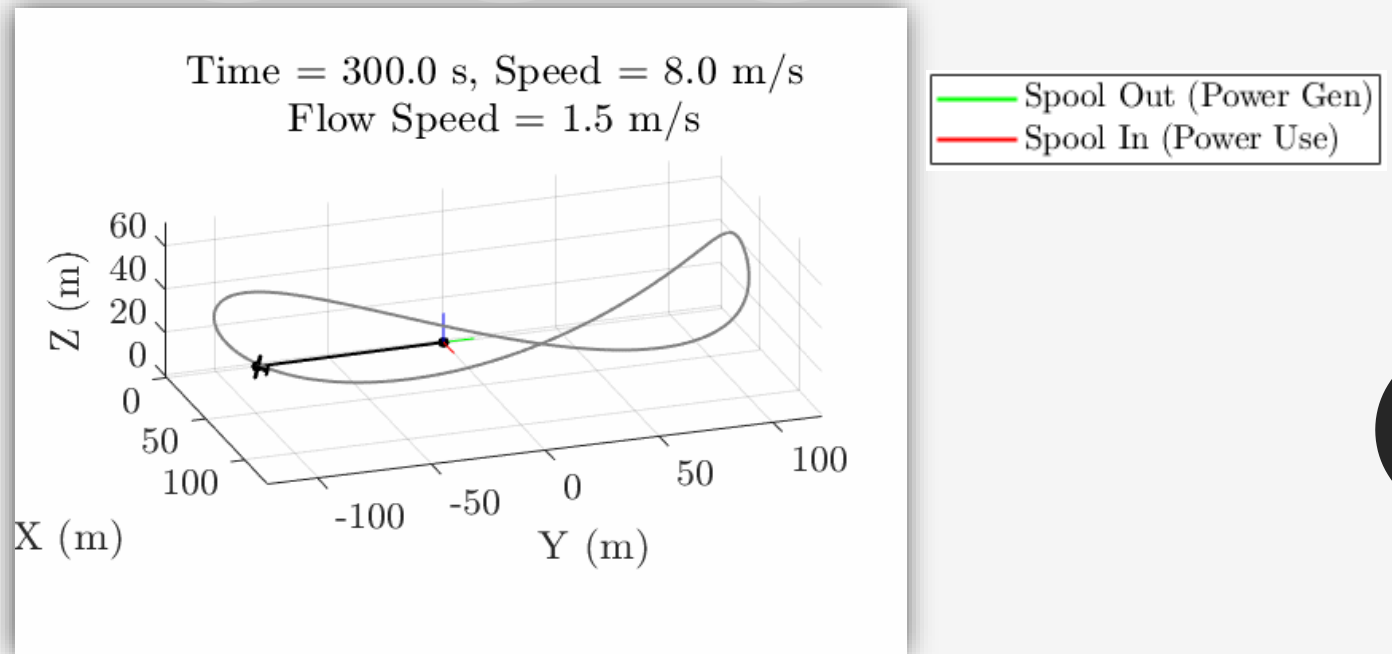
Mechanical & Aerospace Dept.
NC State University, US

What are tethered energy systems?

- Harvest a flow resource (like wind or ocean current)
- Better than turbines
- Kite (plane-like) at the end of tether

Control figure-8 flight → High tether tension → Spool in and out → Generate power at spool

$P_{generated} \gg P_{used}$
$\Rightarrow$ Net Positive Power

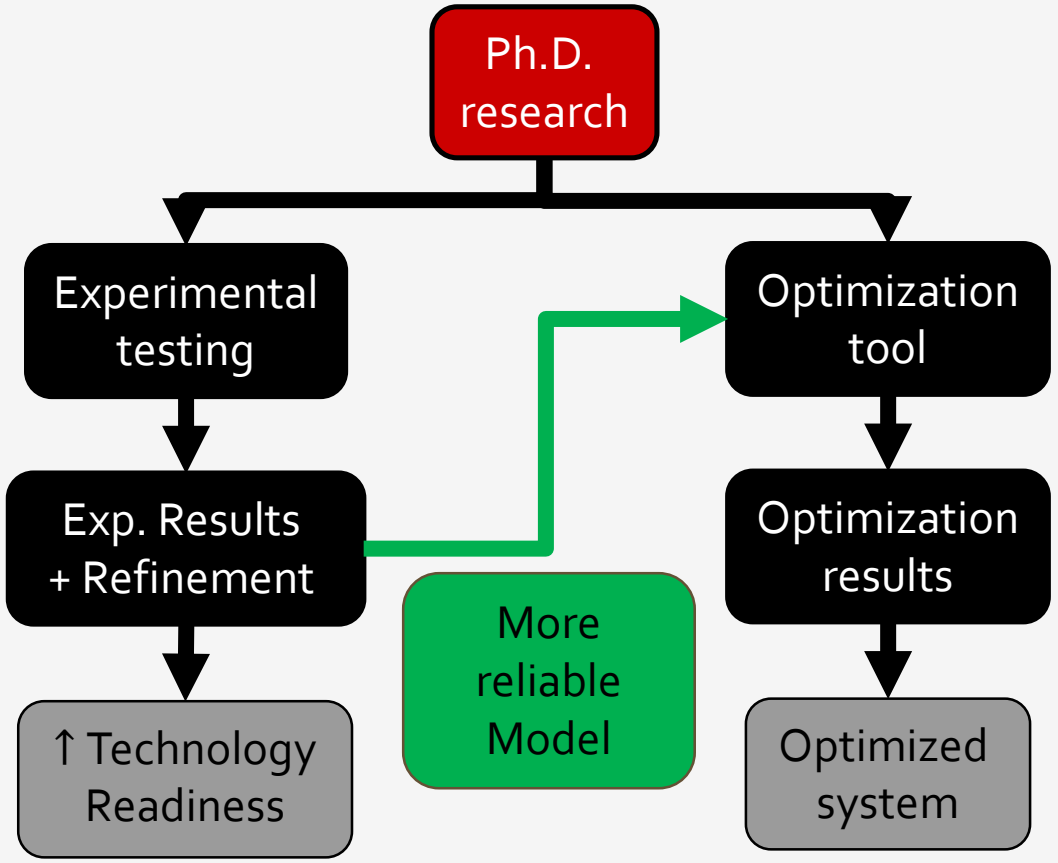


Animation link: Simulated with high fidelity Dynamic model developed in MATLAB

Experimental Prototyping
(next slides)

#Problem 1
Less reliable Dynamic model

#Problem 3
Low TRL

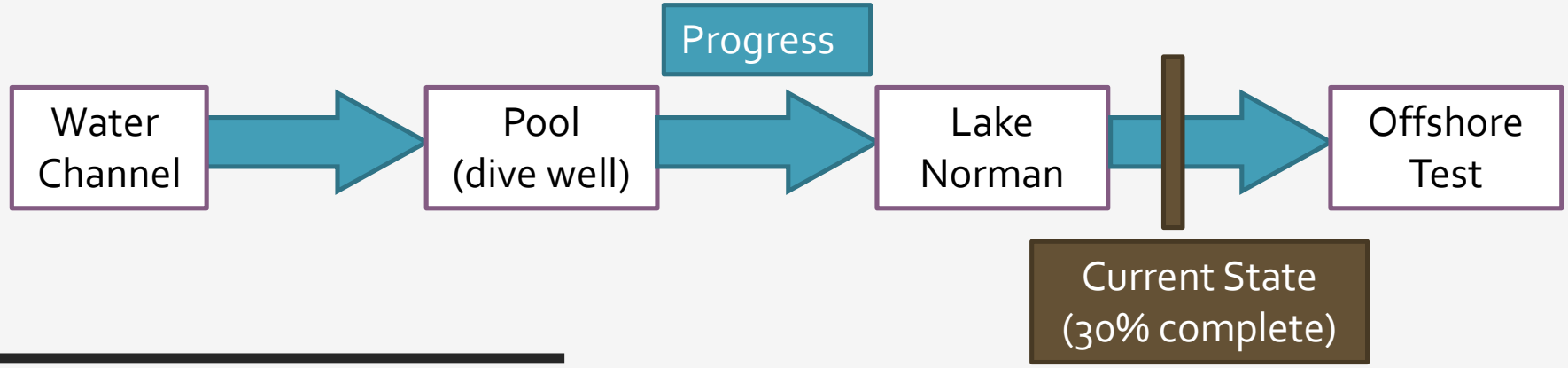


Fundamental Research
(publications)

#Problem 2
Optimizing complex dynamic system

Road to ocean deployment

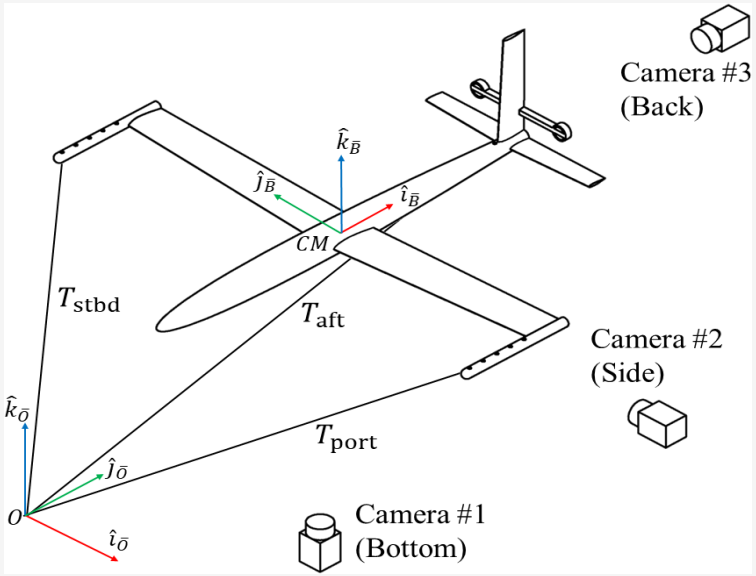
	Water Channel	Swimming Pool	Lake Norman
System Scale	15/1000	1/10	1/10
Kite actuation	3 tether spooling	Control surfaces	Control surfaces
Flow emulation	Motor to move water through test section	Raft actuation in pool	Boat moving in lake
Scientific validation	Dynamic model	Dynamic model + Flight controller	Flight controller + Spooling controller
Max. tether length	50 cm	2.6 m	15 m

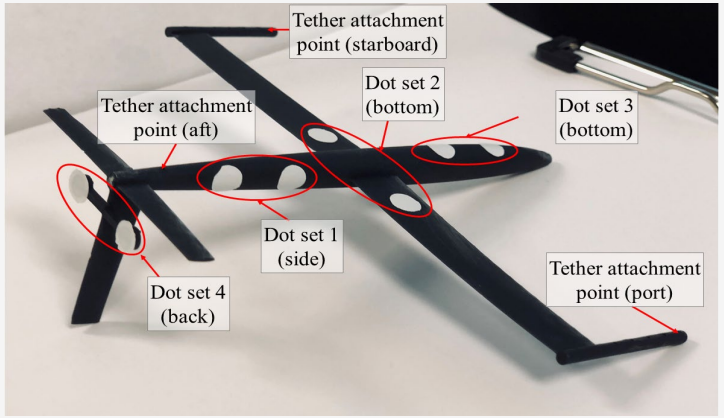


Water channel testing

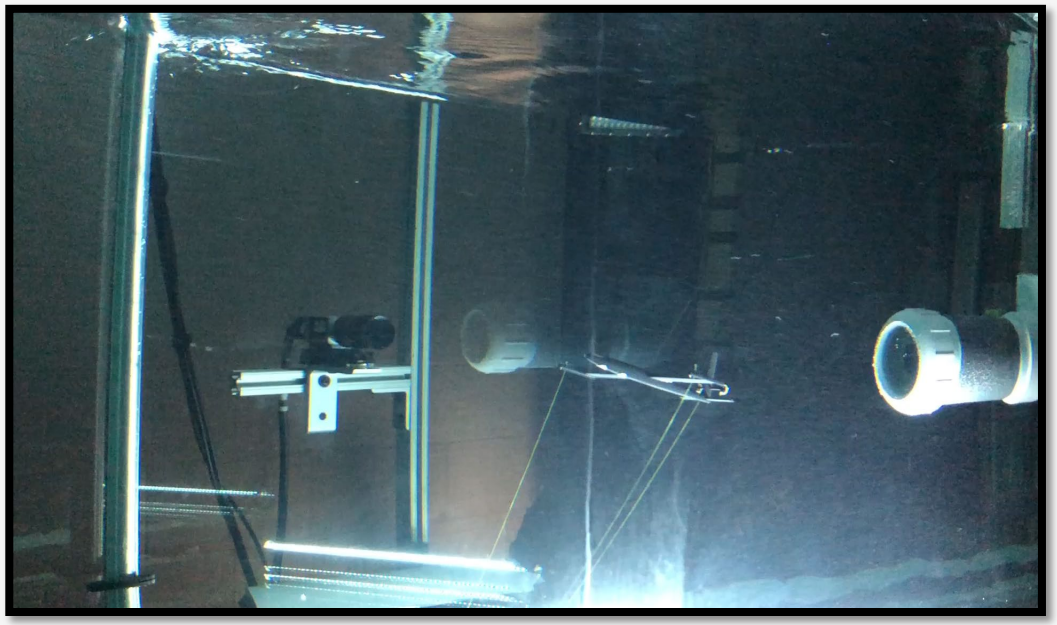
Dynamic model validation

Kite 3D printed with form 3!





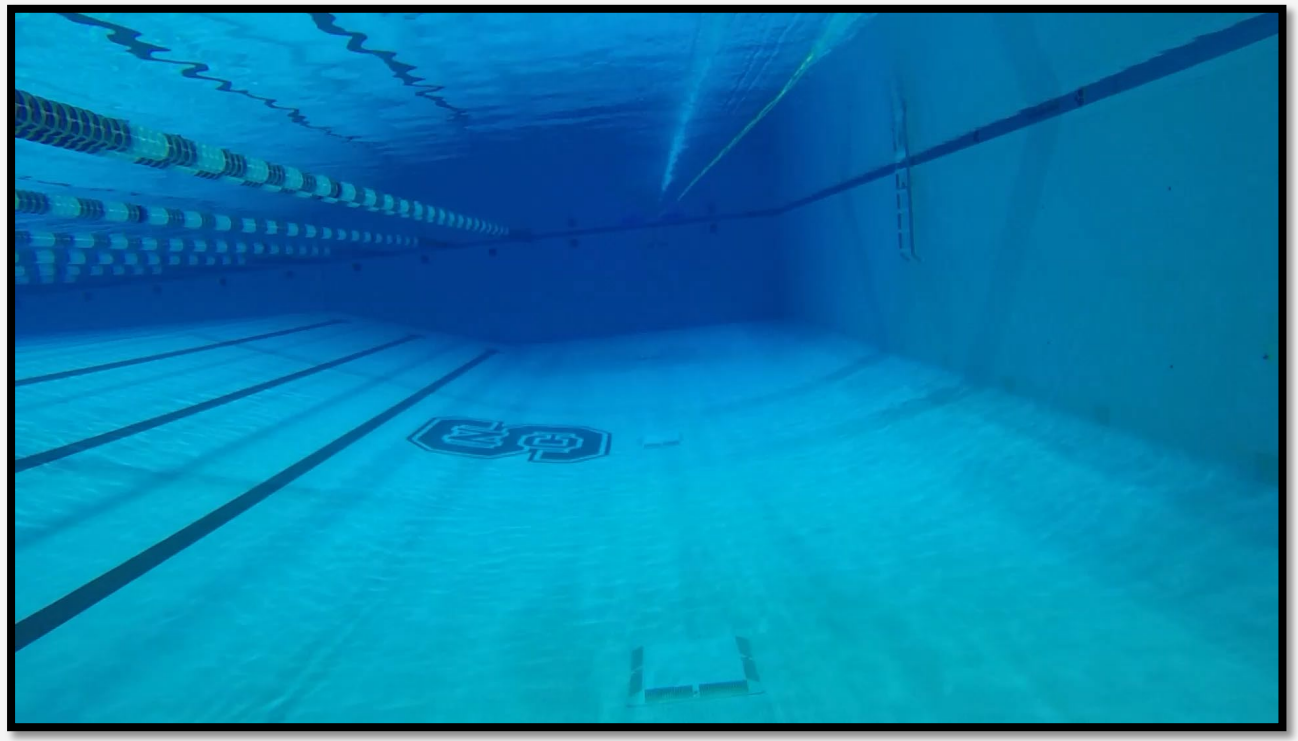
Cameras track dots to estimate position for real-time control



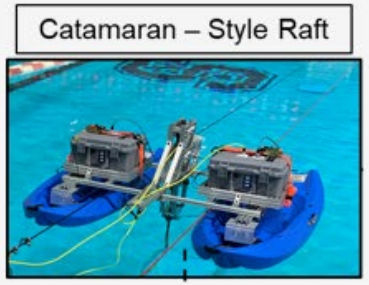
Video link

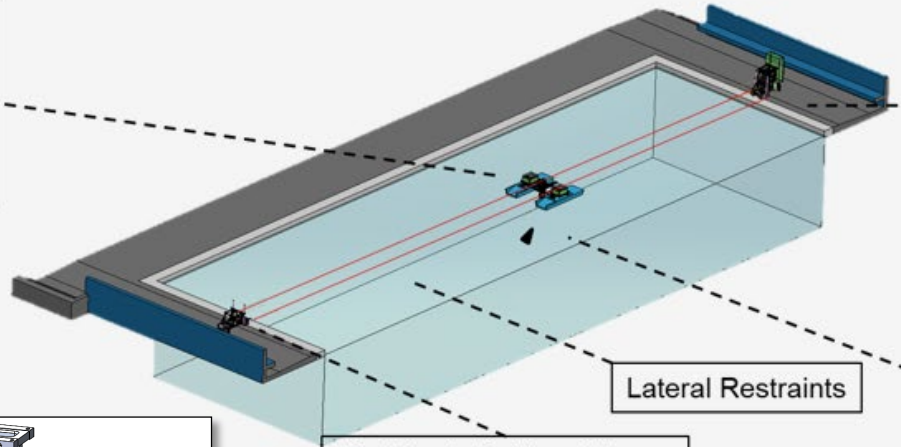
Pool testing

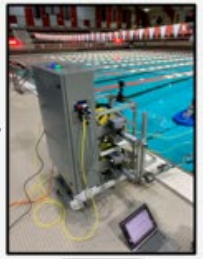
Automatic flight controller deployment + validation

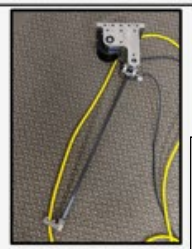


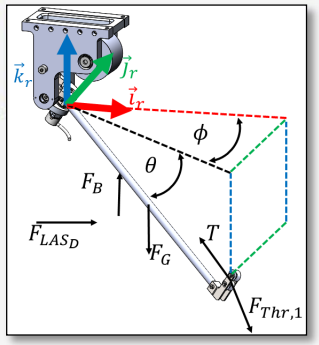
Video link

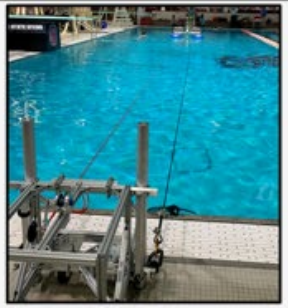


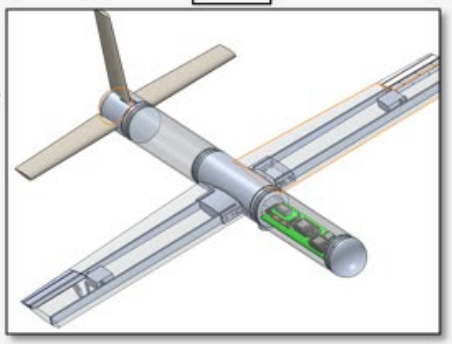


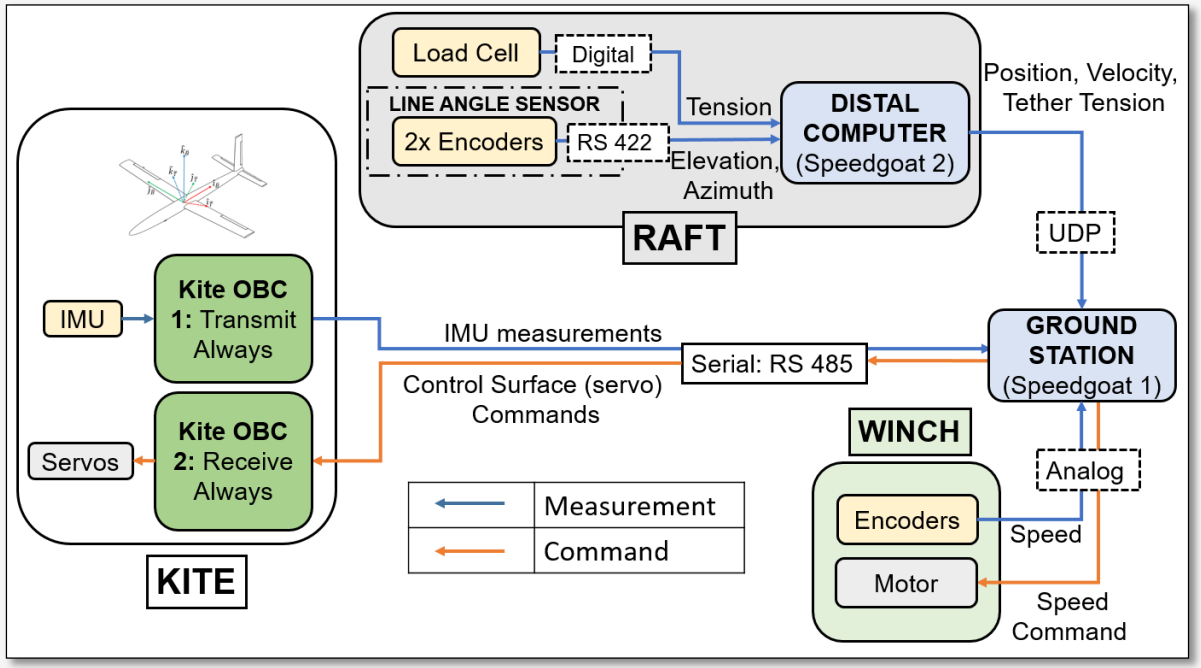










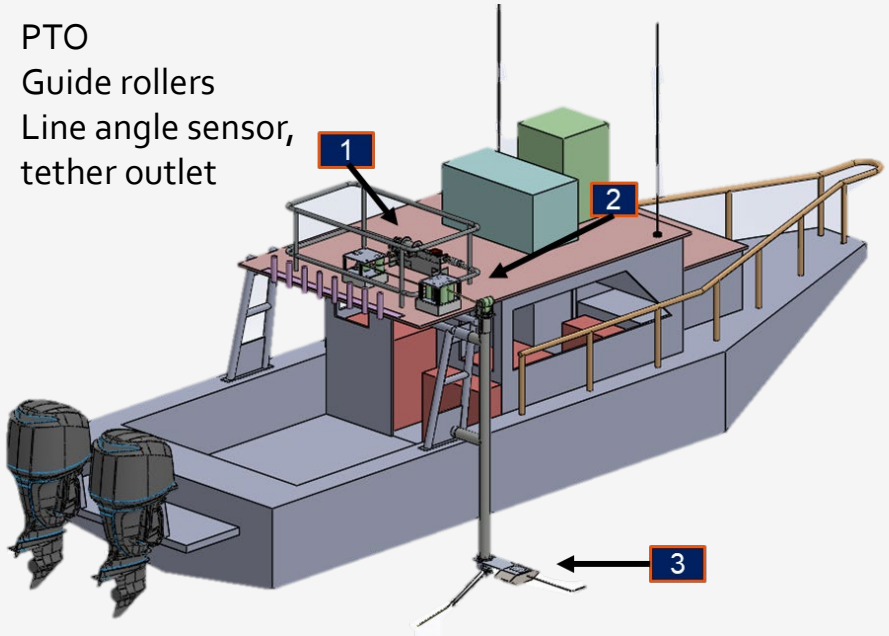


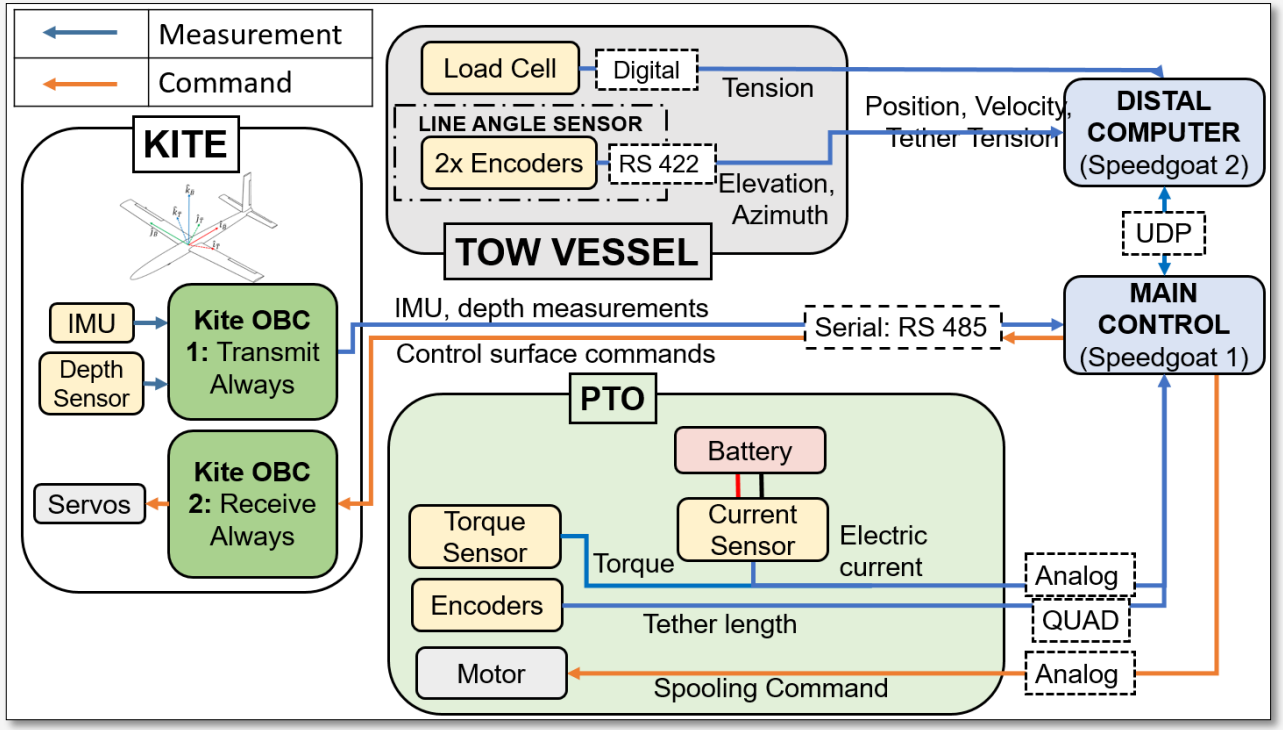
- ***Kite:*** *IMU + 4 servo motor (wing actuation)*
- ***Tow frame:*** *Motor (pull raft between ends)*
- ***Line Angle Sensor:*** *Measure position in spherical co-ordinates*

Lake testing

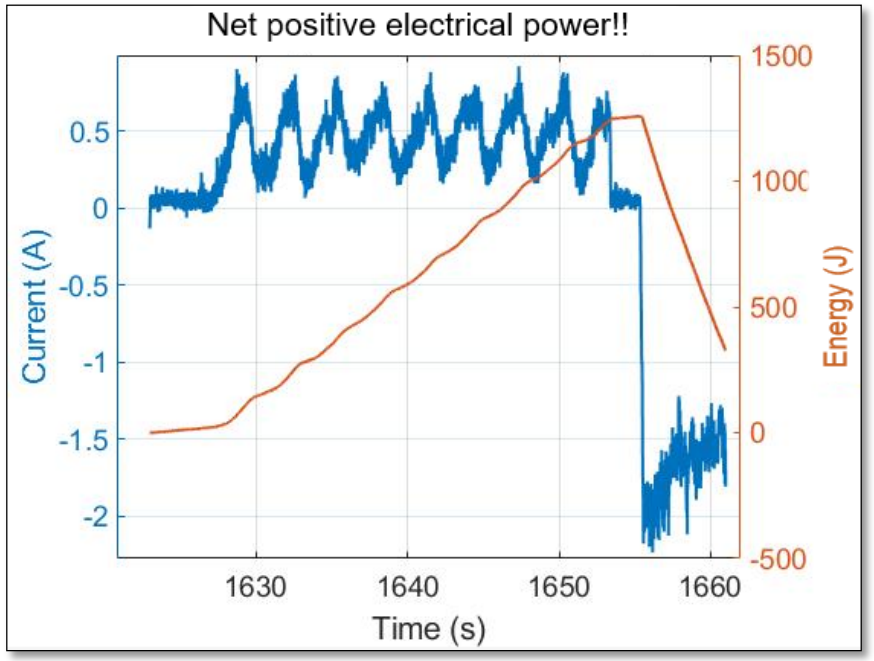
Robust flight + spooling controller operation + validation

1. PTO
2. Guide rollers
3. Line angle sensor, tether outlet

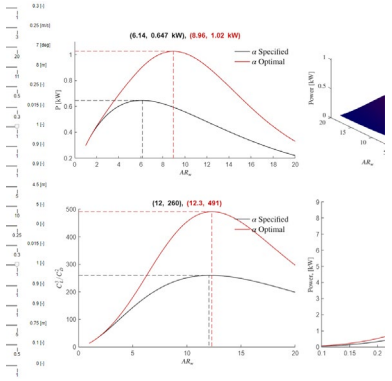




Highlights

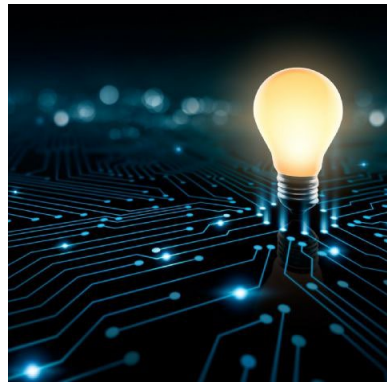


Let there be light.



Optimization tool (Matlab app)

All 3 experimental campaigns successful



Power generated!! (Lake testing)

Multi-disciplinary technical skills

Team management skills

Awards and recognition

Bachelors: Academic scholarship

Masters: ERASMUS+ academic scholarship

Masters: 1st place in Mars society international competition

Ph.D: ACC Publication related award

High school: 1st place in nationwide eco-competition