



# Hybrid Aerial-Aquatic Vehicle for Large Scale High Spatial Resolution Marine Observation

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- 1 Introduction of Marine Observation
- 2 Vehicles nowadays
- 3 Design of HAAV
- 4 Field Tests & Simulations
- 5 Future Work



# Aim of our work



## Marine Observation



Large Scale



High Spatial Resolution

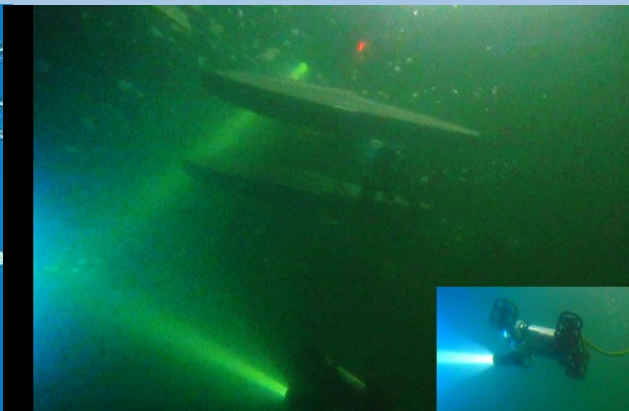


# Contemporary Vehicles for Marine Observation



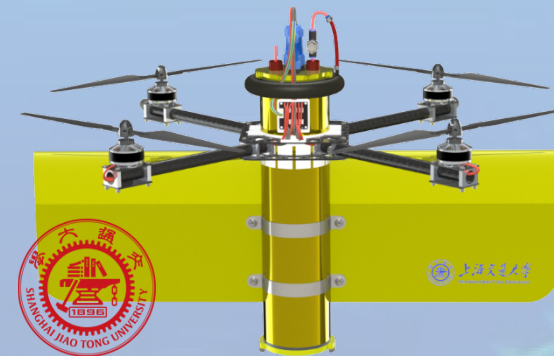
Underwater Glider

Energy-efficient  
Move slowly



Combined USV-ROV

Longer duration  
Spatially limited



HAUV

Move fast  
Limited duration

# Disadvantages of Contemporary Vehicles



Slow movement

Energy-consuming

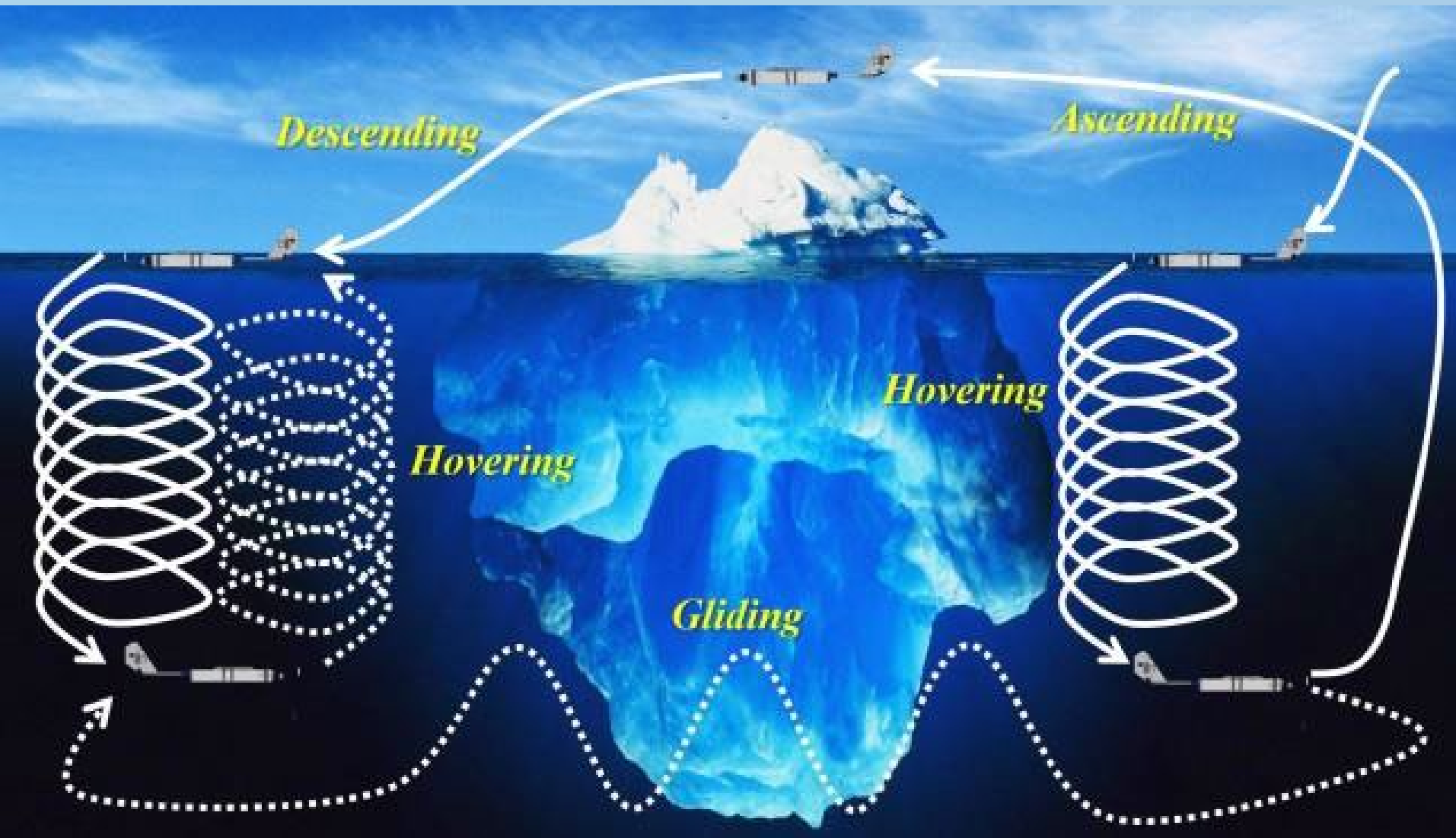
Spatially restricted

Difficult to deploy

Unable to sample quickly at multiple  
locations and bypass barriers

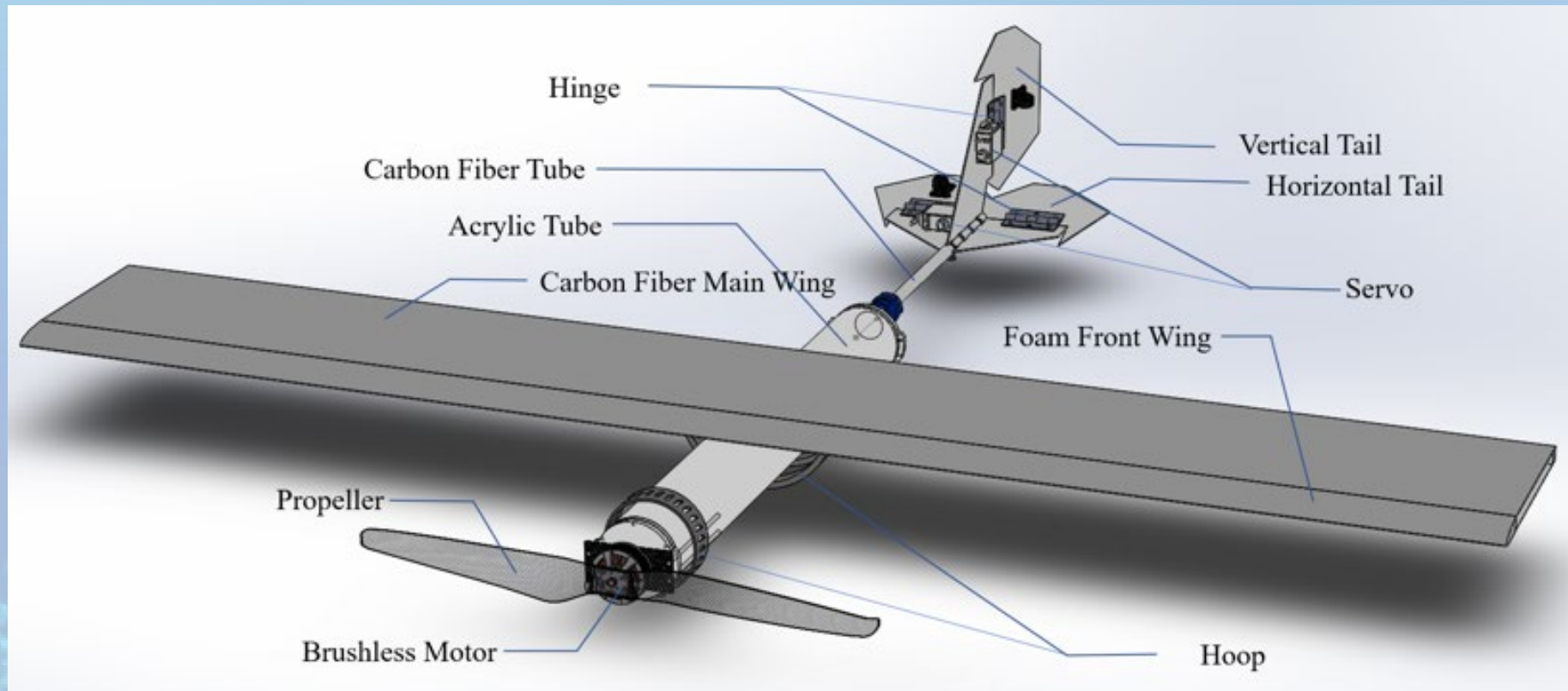


# Multi-location Water Column Sampling Schemes

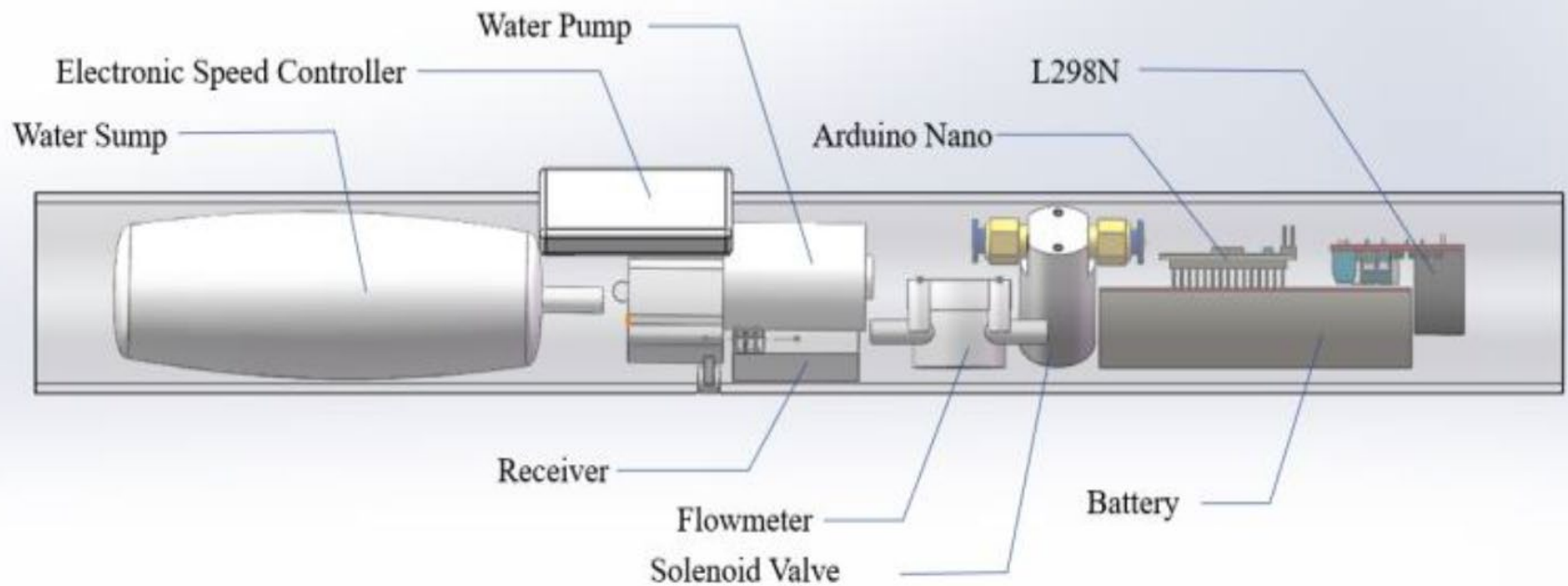




# Design of HAAV

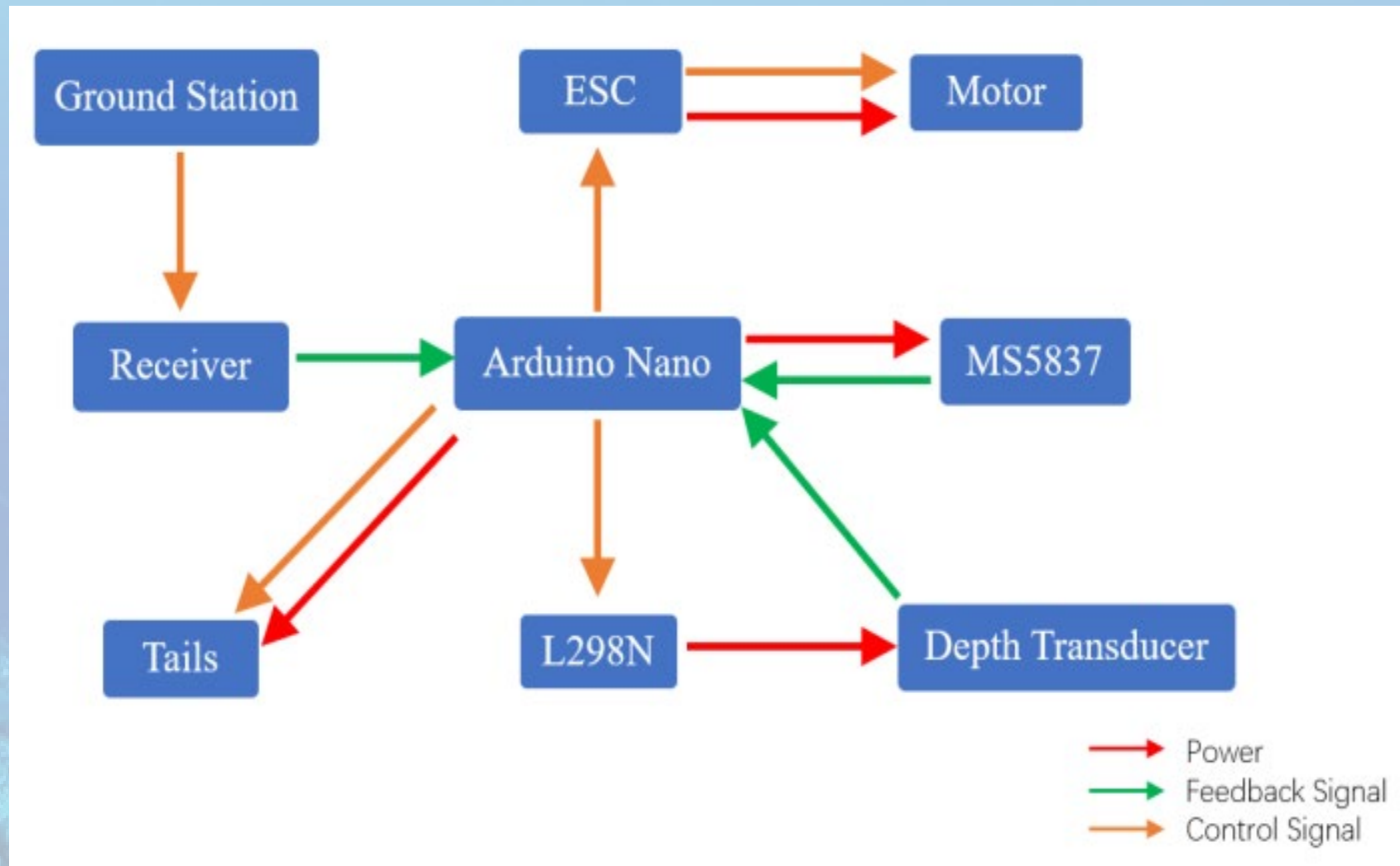


# Buoyancy System



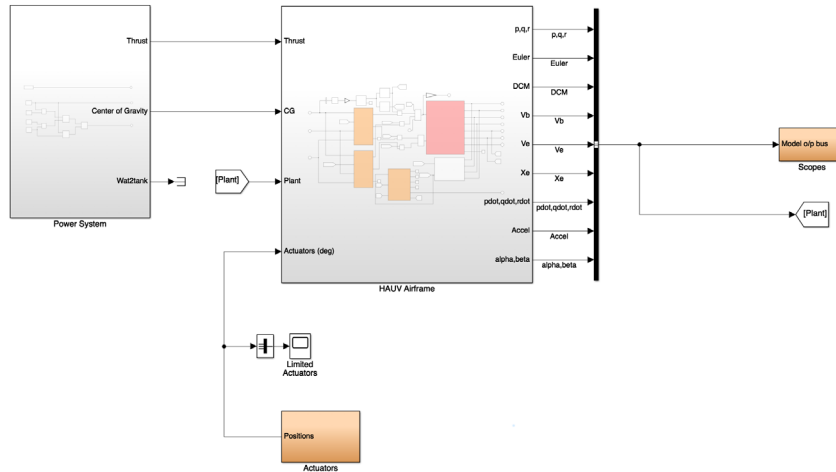


# The Flow Diagram of the Vehicle





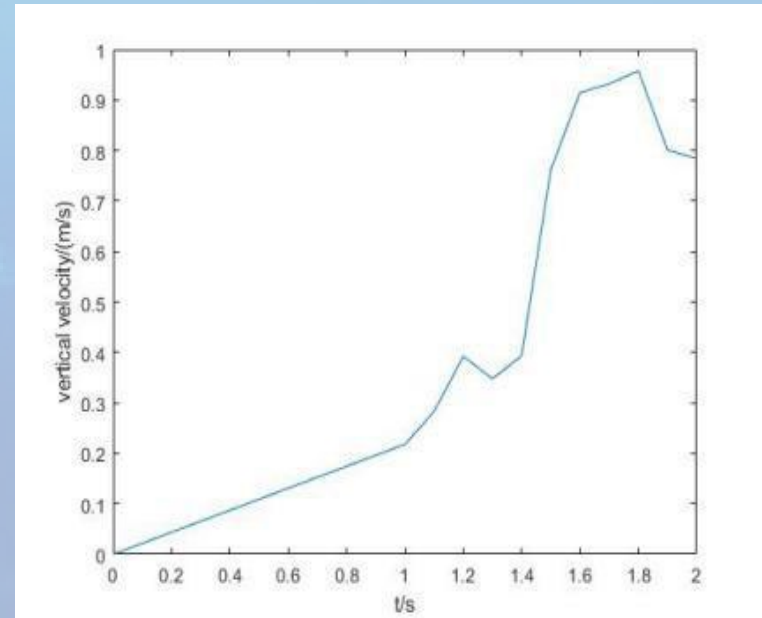
# Simulations & Field Tests



Simulink

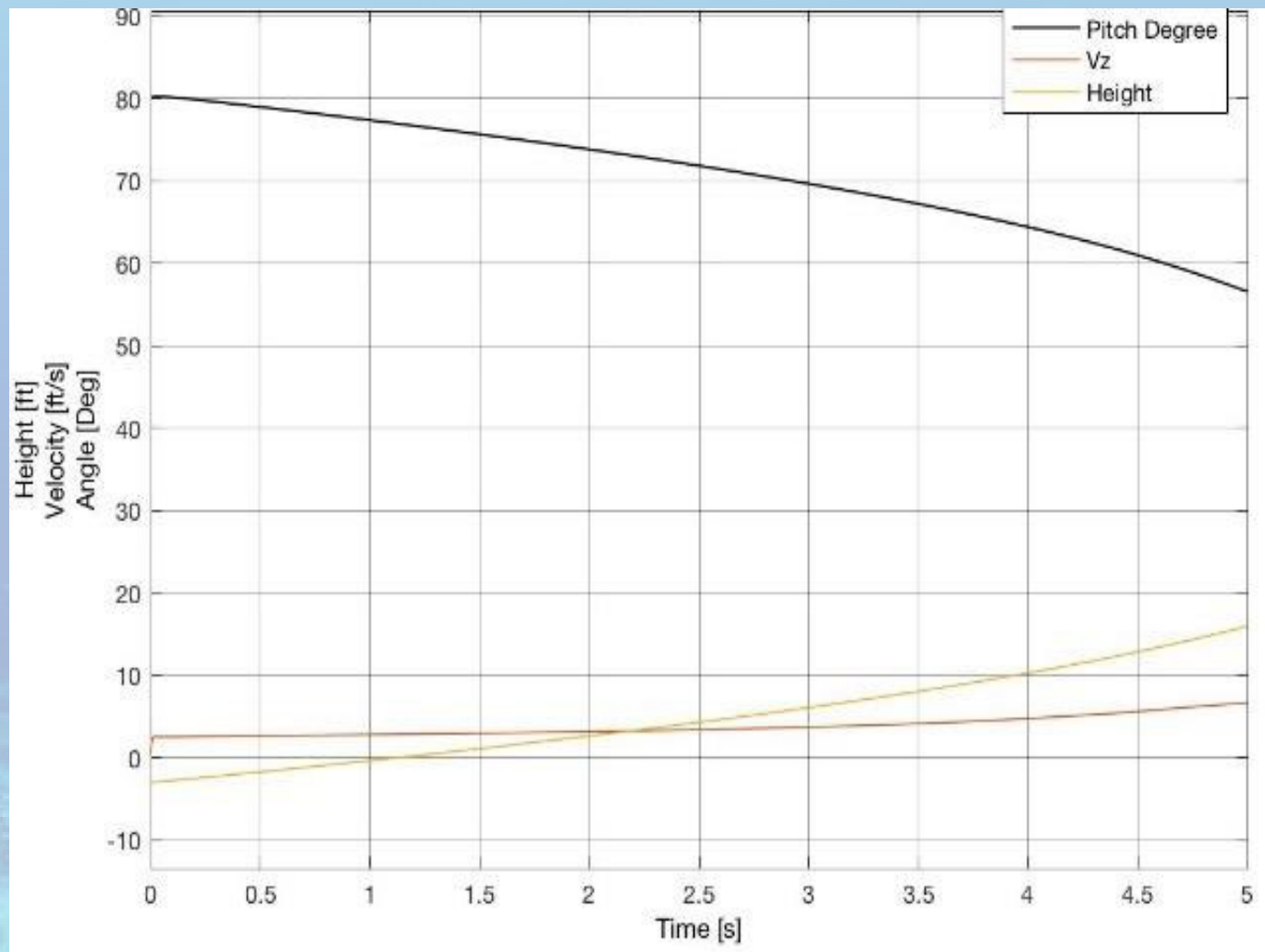
SJTU UEIC

# Egress—Field Test



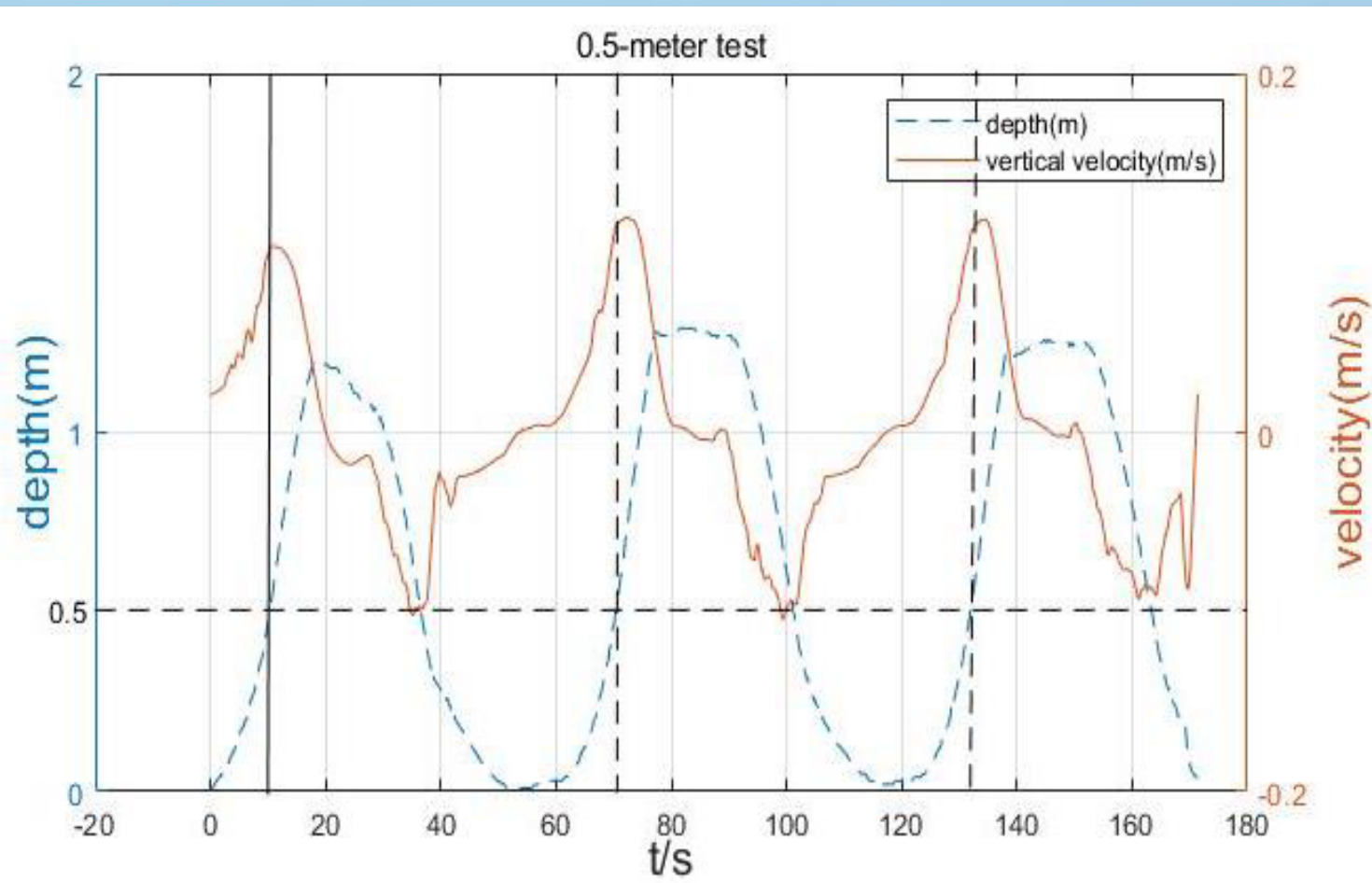
The corresponding vertical velocity from  $t=0\text{s}$  to  $t=2\text{s}$

# Egress—Simulation Results





# Gliding—0.5-meter Field Test (Zhiyuan Lake)

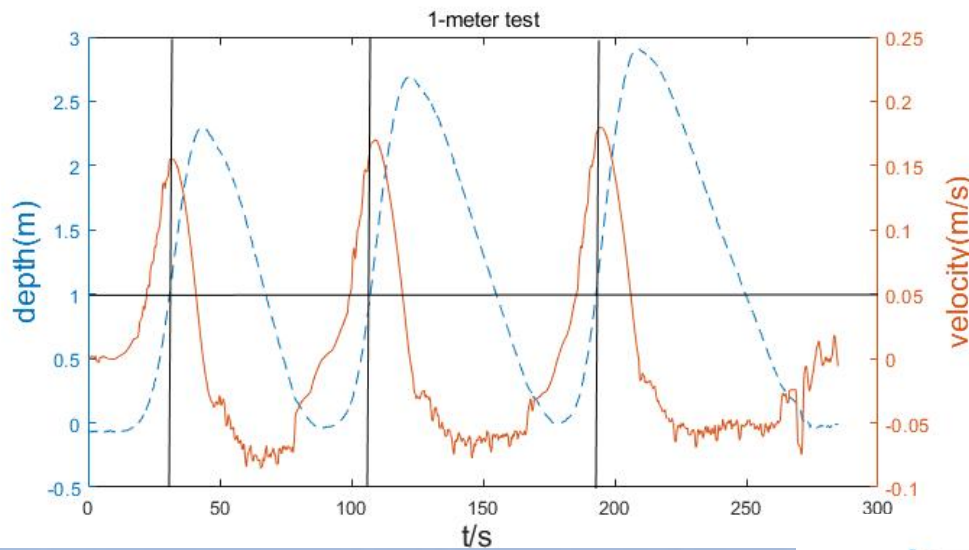


$$T \approx 56.67s$$

Max vertical  
Velocity=0.12m/s



# Gliding—1&2-meter Field Test (SJTU UEIC)

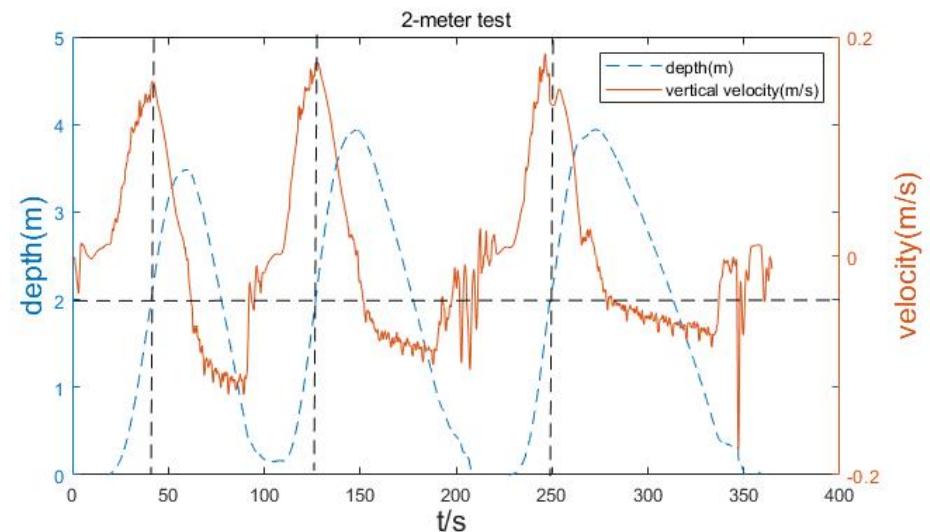


$T \approx 90.3s$

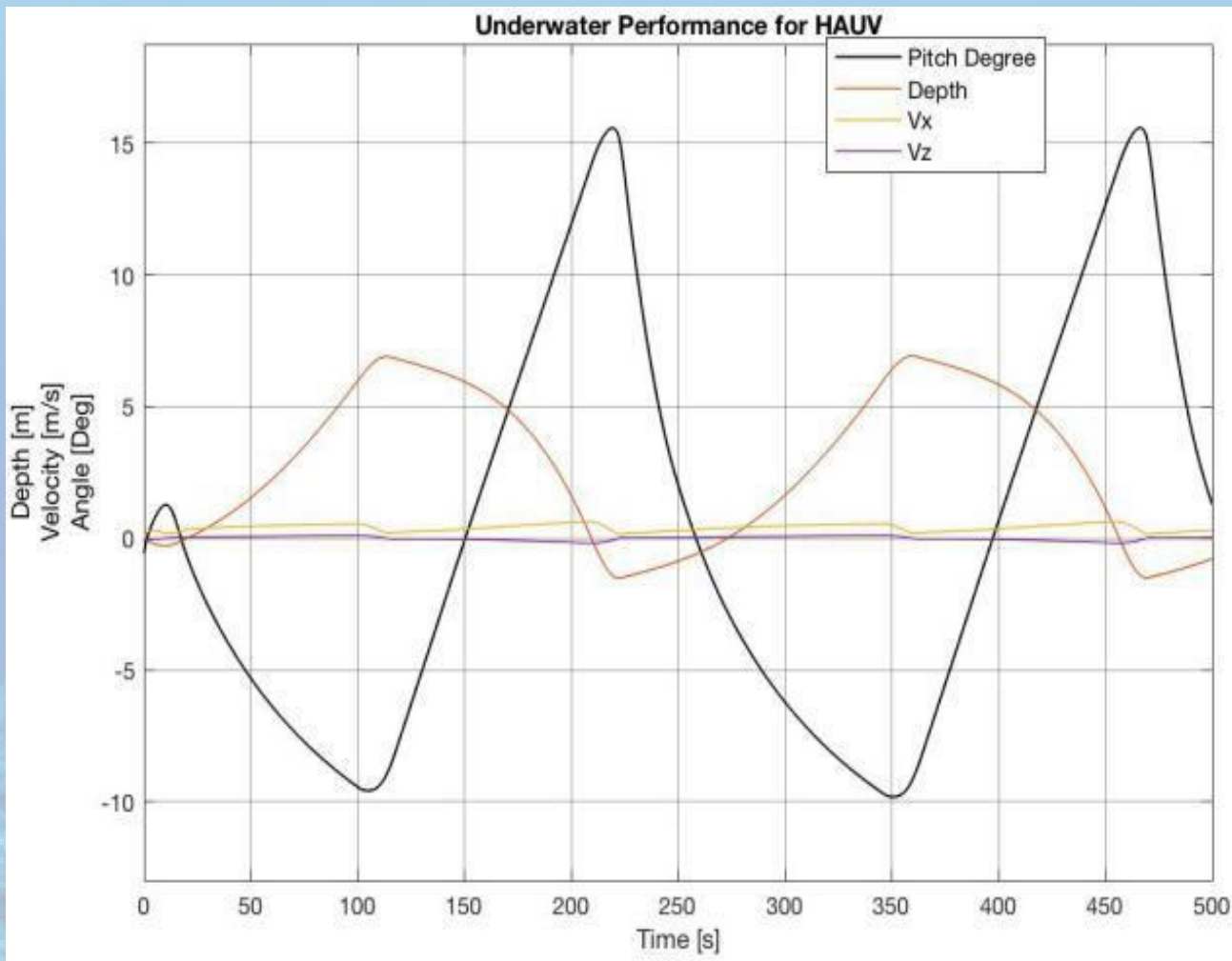
Max Vertical Velocity=0.18m/s

$T \approx 116.7s$

Max Vertical Velocity=0.19m/s



# Gliding——6-meter Simulation Test (Simulink)



$T \approx 250s$

# Future Work



## Improve the capacity of prototype

- increase its thrust, velocity and depth
- the robustness of system
- eliminate its weight and cost of energy

## Develop new functions

- install camera
- Global Positioning System
- remote underwater manipulation system



# THANKS!

