

# Advanced Development of Unmanned Surface Vehicle for Hydrographic Surveys – The Côté Cruiser 2.0



Skandha Rajnarayanan | Dr. Stephen Weis

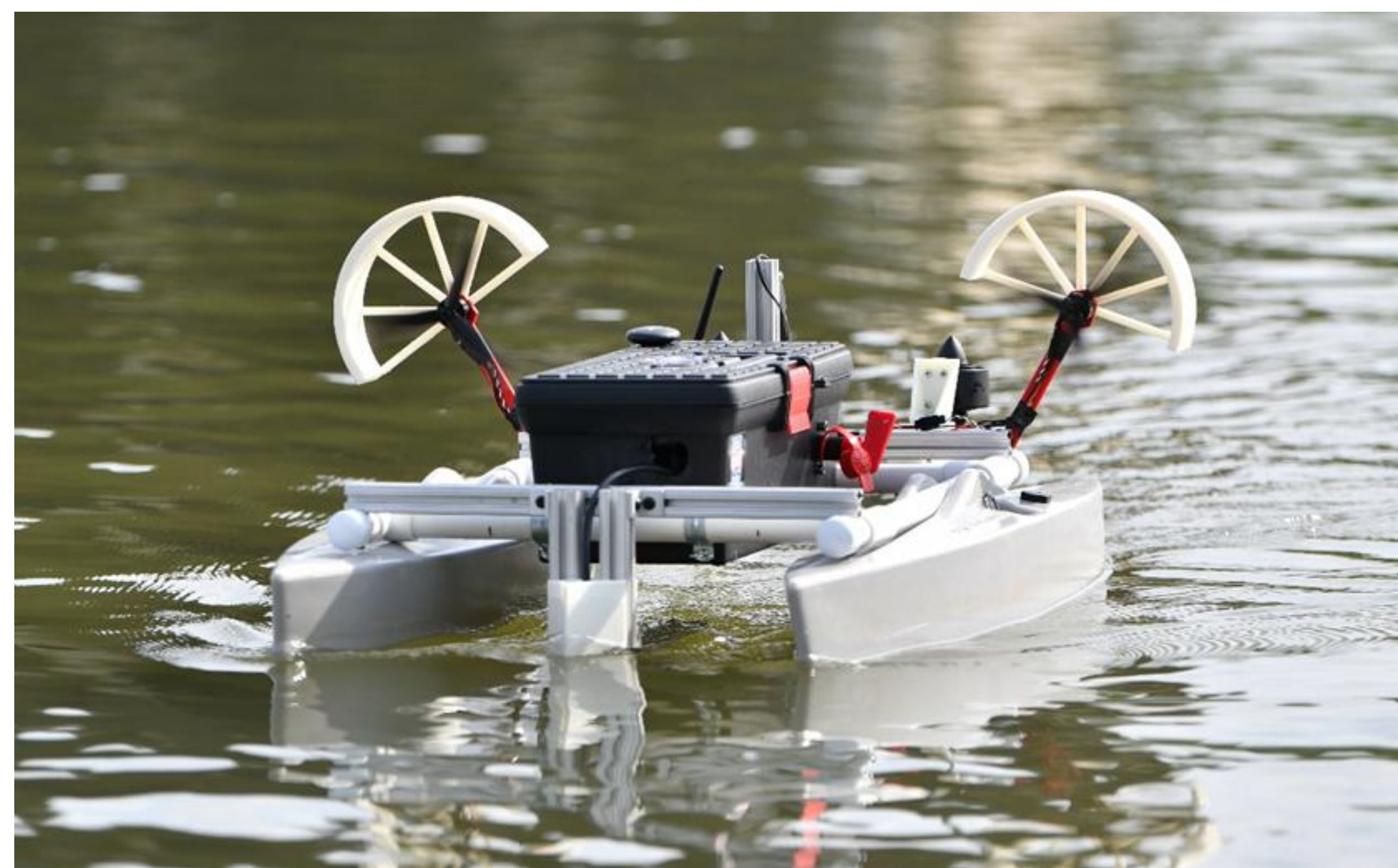
Department of Engineering, Texas Christian University, Fort Worth, TX

## Introduction

- The Côté Cruiser is an autopiloted Unmanned Surface Vehicle (USV) developed for sonar surveys.
- The second iteration aims to enhance the craft's power and real-time diagnostic capabilities.
- These upgrades along with a forward-facing sonar provide a significant use case for the project sponsor, Freese and Nichols Inc.
- In San Antonio, frequent underwater structural surveys of the river could potentially save the city nearly \$2 million in damage funds.

## Goals

1. **Increase speed:** Côté has a maximum speed of 2m/s in ideal conditions. Some surveys are carried out on days with high winds and strong currents - the boat needs to go faster.
2. **Increase resolution:** It is currently equipped with a Lowrance 3-in-1 side-scan imaging sonar. However, increasing the frequency will improve resolution.
3. **Employ forward-facing sonar:** It sends soundwave pings directly ahead of the transducer – useful to see objects underwater like baffles and bridge pillars.
4. **Live broadcast:** Establish a livestream of the sonar so surveys can involve more stakeholders that aren't on-site



## Development – The Three Phases

1. Upgrade motors and increase power delivered to them.

2. How to see objects at finer resolution underwater? Use a forward-facing sonar with high frequency pings.

3. How to get a live feed of the sonar on the other side of the world? Connect to the Sonar module's Wifi and route it through VPN.

## Results

- Variation in the abundance of individual gut bacteria was not strongly associated with reduced *Serratia marcescens* infection in bumble bees.
- Bumble bees also did not show evidence of preferentially foraging for pollen containing *Gilliamella bombi*.
- These results indicate that single microbial taxa may have limited effects on pathogen resistance and highlight the need to examine broader microbiome dynamics when studying pollinator health.

## Future

These findings suggest that resistance to infection in bumble bees may depend on interactions among multiple microbial taxa rather than the presence of single symbionts. Behavioral results further indicate that bees are unlikely to actively acquire protective microbes through selective foraging.

Overall, microbiome-mediated defense in pollinators appears to be a community-level phenomenon. Disruptions to microbial diversity caused by environmental stressors may therefore increase disease susceptibility and contribute to pollinator declines.

## References

1. Nelson, A. S., Larson, M. J., & Hammer, T. J. (2025). *Journal of Animal Ecology*, 94, 985–998. DOI: 10.1111/1365-2656.70029

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