

Characterizing Radio Communication Range for an Autonomous Surface Vessel

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Introduction

- Autonomous surface vessels (ASVs) are unmanned boats that operate on the surface of a body of water for applications such as scientific data collection or infrastructure monitoring.
- Low-cost ASVs rely on radio communication with limited range, which leads to a potential loss of vehicle control.
- Characterizing the range of the communication systems through testing allows for increased safety and more reliable mission planning.

Objectives

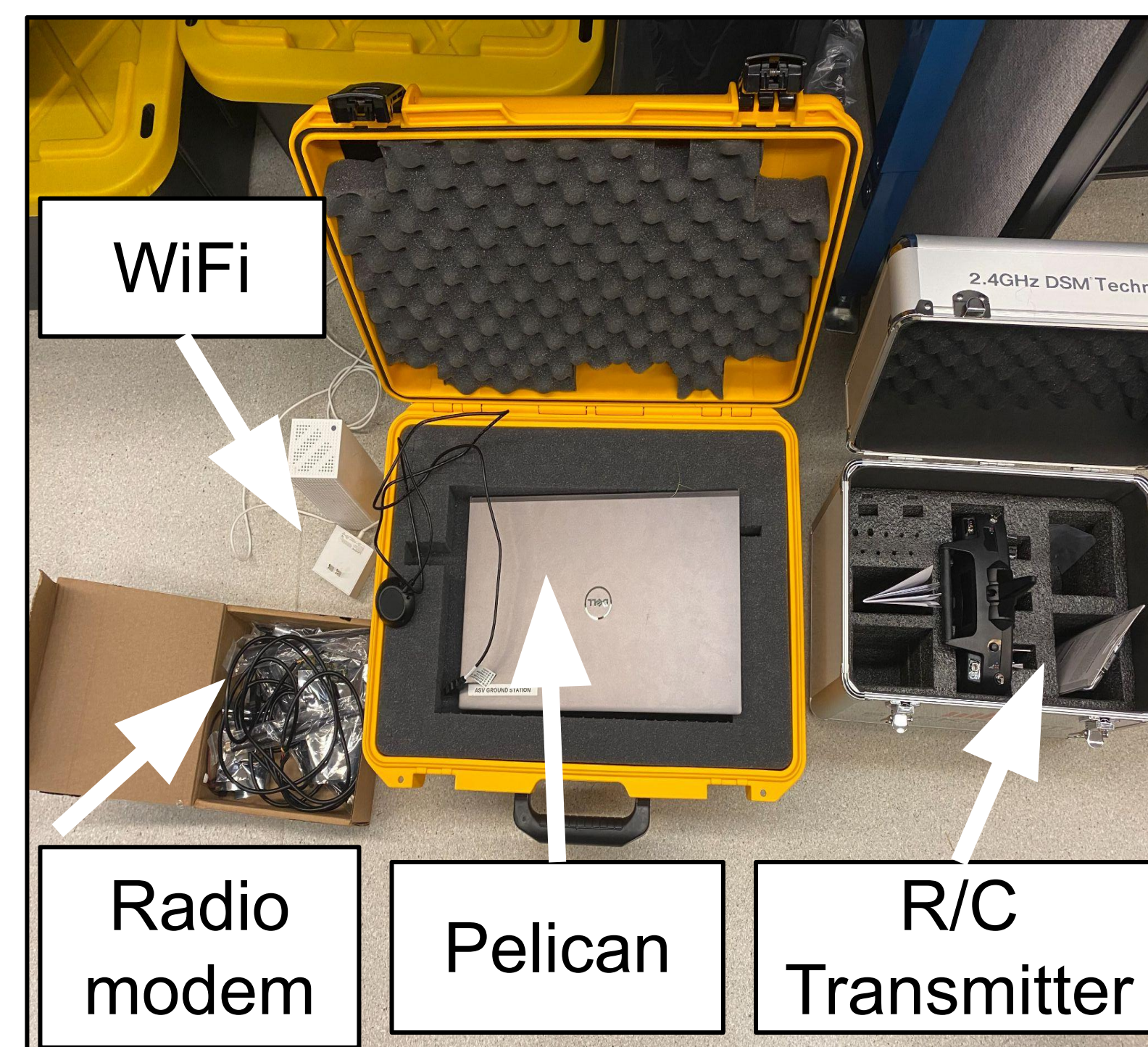
- To characterize the range and reliability of the radio-based communications systems utilized by a fleet of ASVs under development at UNC Charlotte..



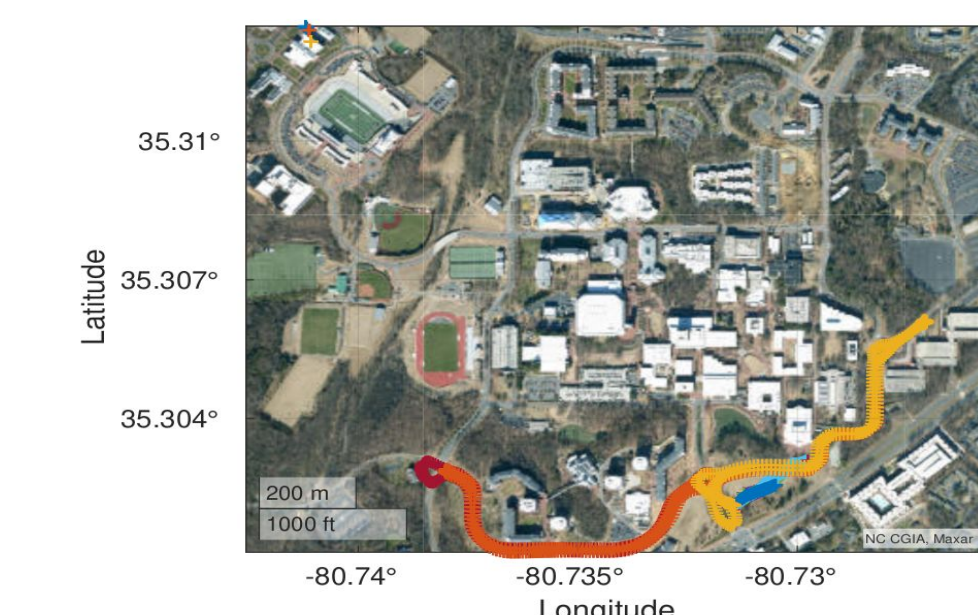
ASV during testing on UNC Charlotte's campus

Methods and Data Collected

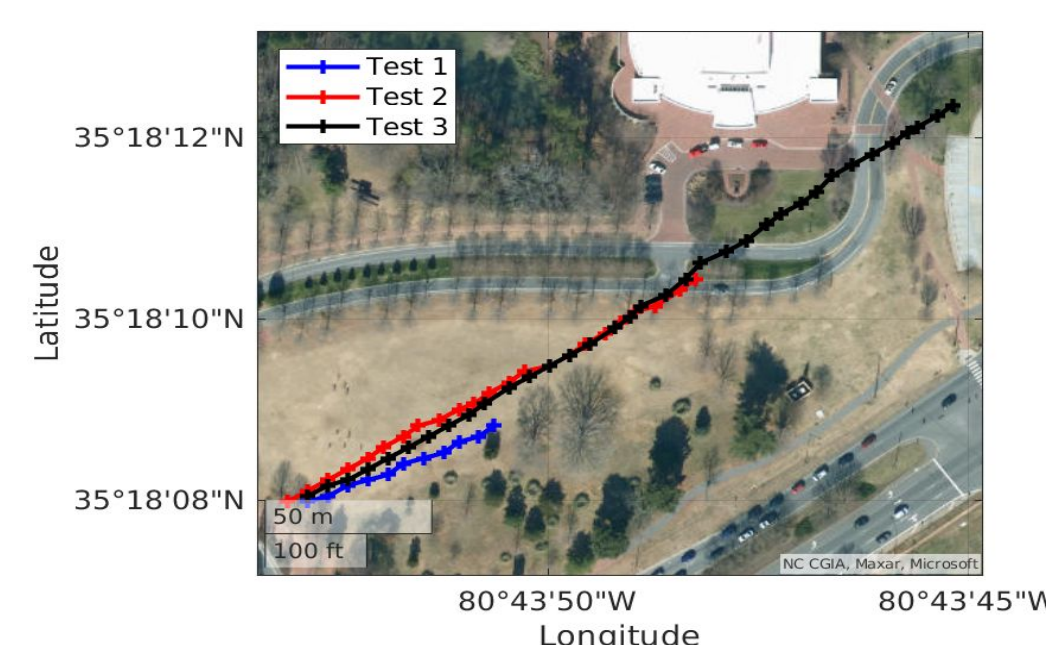
- Range testing was conducted at on UNC Charlotte's campus with three of the ASV's communication systems.
- The three communications systems are the following:



- RSSI (dBm) graphs from the Wi-Fi Router were generated through MATLAB while the transmitter/ receiver and RFD radio data was collected manually. Three tests were performed for each system.



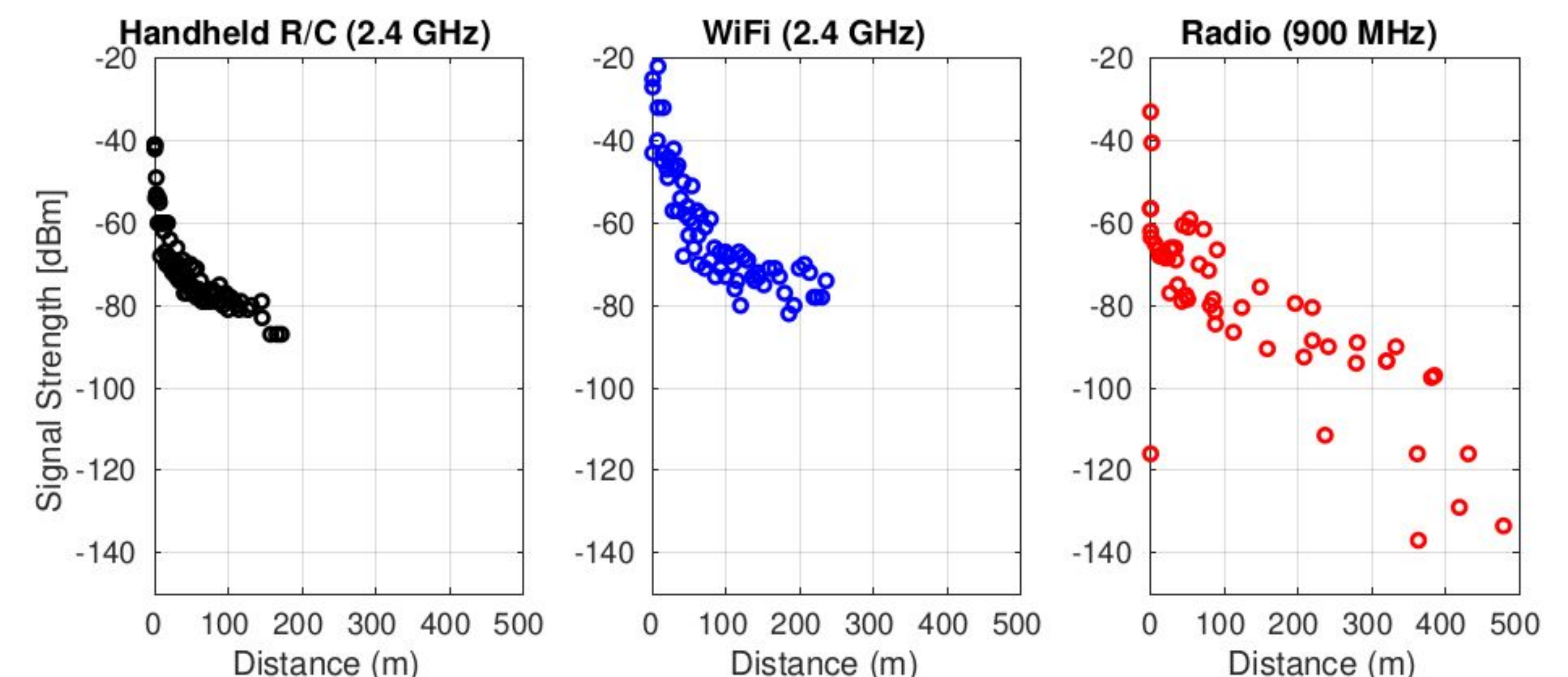
Path of radio modem RFD test



Path of R/C transmitter and Wifi test

Results

- GPS data was processed to obtain distance from test location.
- The graphs below represent the change in radio strength (measured in dBm) over distance.
- The graphs show that a range of -40 dBm to -90dBm for the transmitter, -20 dBm to -80 dBm for the WiFi, and -30 dBm to -120 dBm for the radio modem is suitable for reliable communication. The radio modem has the longest range of communication, which can be seen in the distance traveled for the RFD tests.



Discussion

- A sharp decrease in radio strength is evident across all three communication modes during the beginning of the experiment, but the decrease levels out during the end of the experiment.
- At around -70 to -80 dBm range, the signal strength became approximately constant for the R/C transmitter

Conclusion

- The communication range of the ASVs three communication modes was characterized experimentally by recording signal strength with distance
- Ongoing work aims to use the collected data in determining operating regions the ARSL ASVs can work in with reliable communication.

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