



Unmanned
Surface Vessel

OUR TEAM



BARON YOUNG



WENJIN LI



DHRUV AGGARWAL



CAMERON BARRETT



MAXWELL JUNG

Contents

- Mission
- Technology
- Progress



Mission

- Map and survey coastline using an easily deployable unmanned surface vehicle
 - Erosion and coastal stability, disaster preparedness/response, maritime navigation and safety, military reconnaissance



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- Additional Challenge
 - Enable safe autonomous navigation to tolerate unreliable communication



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 - Enable safe autonomous navigation to tolerate unreliable communication
- Solution / Technology of Interest
 - Radar based SLAM (Simultaneous Localization and Mapping)
 - Relay telemetry (video/images/coastal topography)

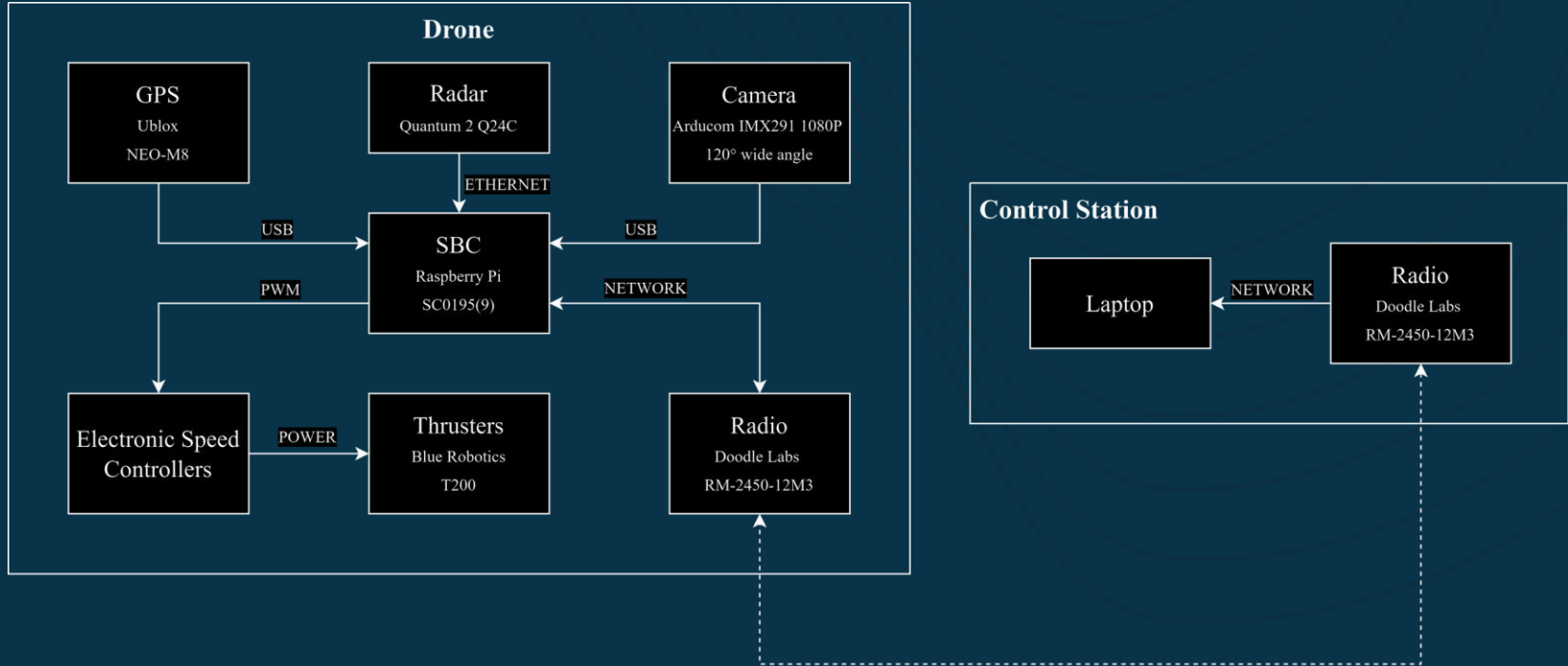


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 - Radar based SLAM (Simultaneous Localization and Mapping)
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- Why radar?
 - Newer solid state radar provides short to long range detection with lower power consumption
 - Functions in poor weather and is cheaper and more reliable than other systems (LIDAR)



Block Diagram

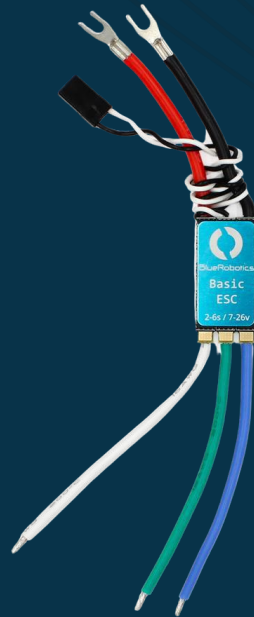
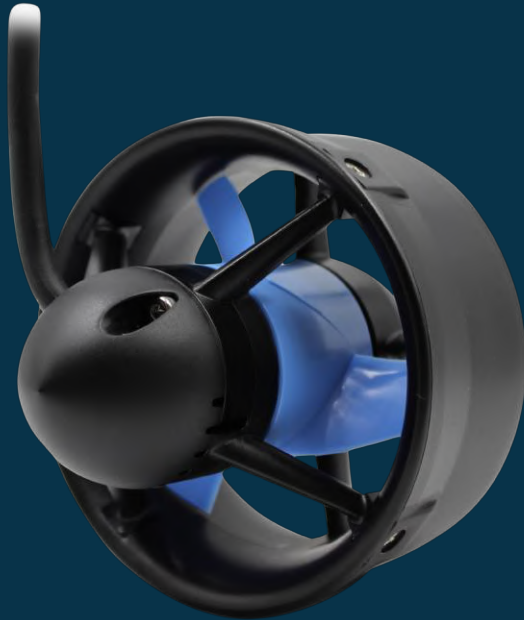


Propulsion



- Blue Robotics T200 Thruster
 - 2x counter-rotating
 - 23.2 lb ft
 - Nominal power: 400W
 - 17A @ 12V

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 - 2x counter-rotating
 - 23.2 lb ft
 - Nominal power: 400W
 - 17A @ 12V
- Blue Robotics Basic ESC
 - 30A limit
 - May need active cooling

Power



- Power elec. supply
 - 22.2 V, 22 Ah
 - Thrusters and radar
 - Expected 1 hr capacity

Power



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 - 22.2 V, 22 Ah
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- Auxiliary supply
 - 2x 12V, 3.8 Ah
 - Raspberry Pi, GPS, camera

Physical Design

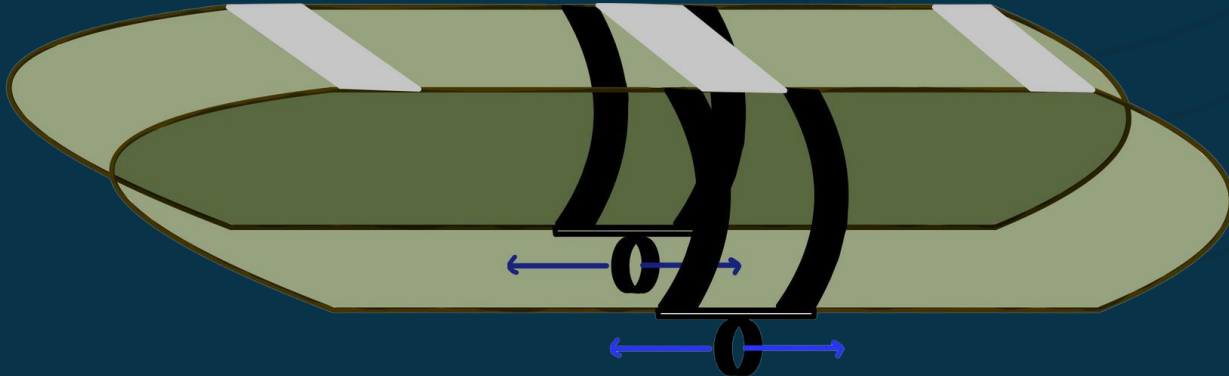


Physical Design

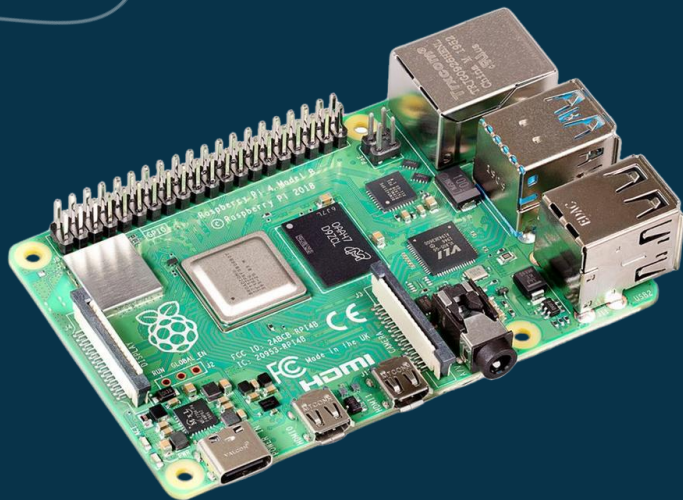


Physical Design

- Control
 - Differential thrust
 - Targeting 3 knots

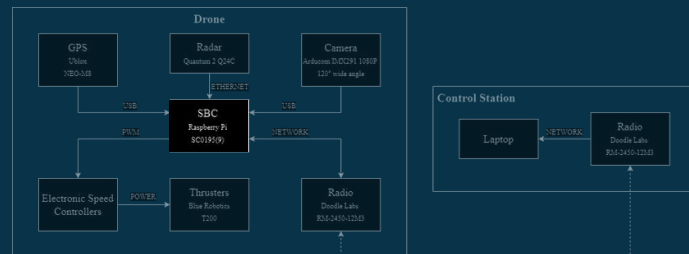


Working Components

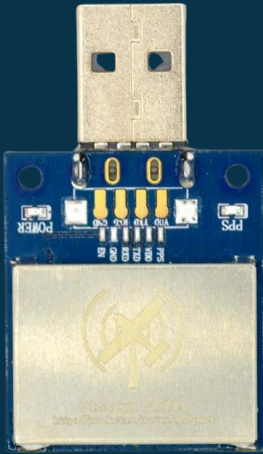


RASPBERRY PI 4B

- Runs ROS2 on Ubuntu Linux
- ROS packages include:
 - radar, radio, camera, and thruster
- Runs DHCP
 - Used to assign radar IP, connected via RJ45

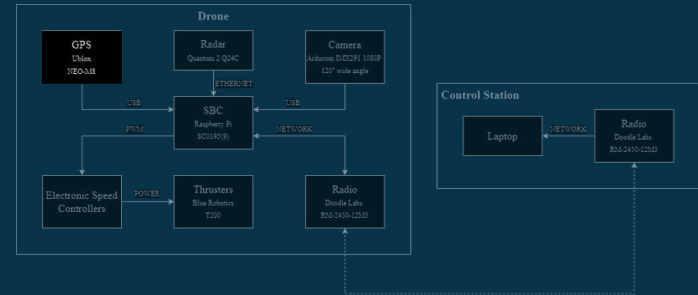


Working Components



NEO-M8 GPS

- Simple USB Connection
 - Accuracy Issues
- 2.5m theoretical resolution
- 15m practical resolution
- Issues Requires Line of Sight (LOS)

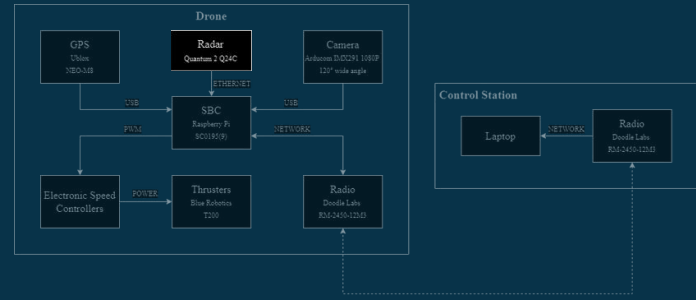


Working Components



QUANTUM Q24C RADAR

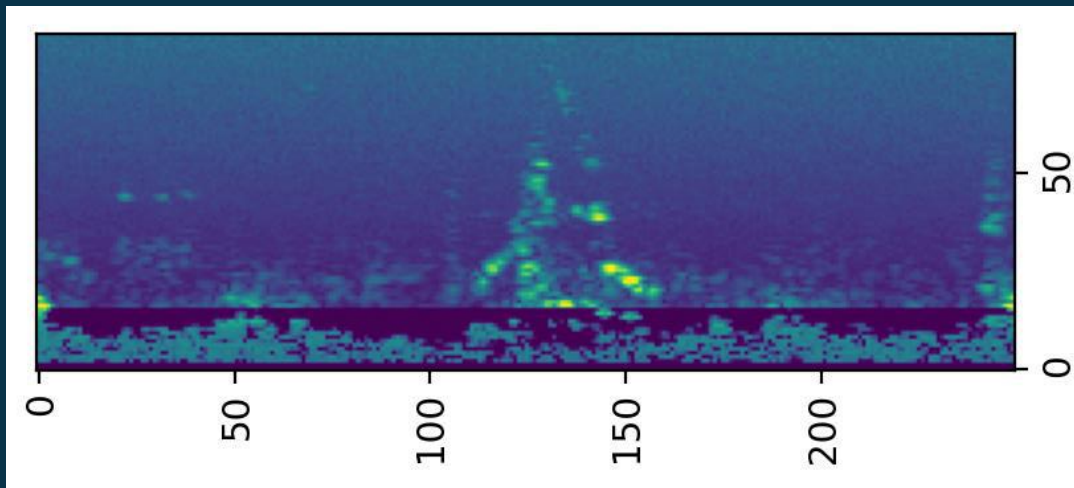
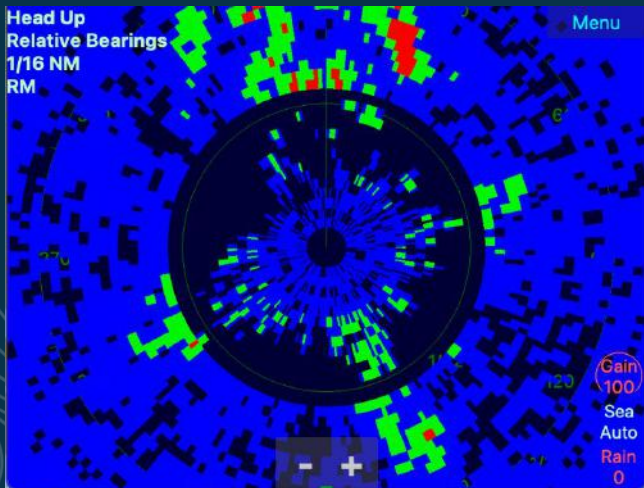
- Ethernet interface
 - UDP unicast
 - UDP multicast
- 250 spokes per scan
- ros2 run radar quantum
- Auto detect, keep alive



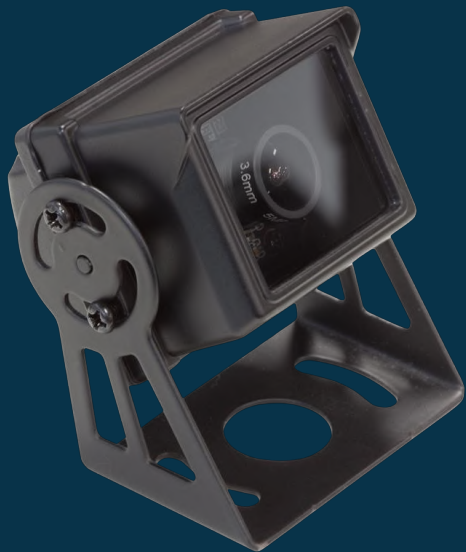
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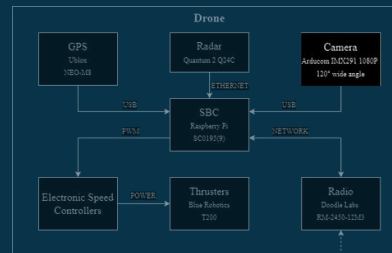


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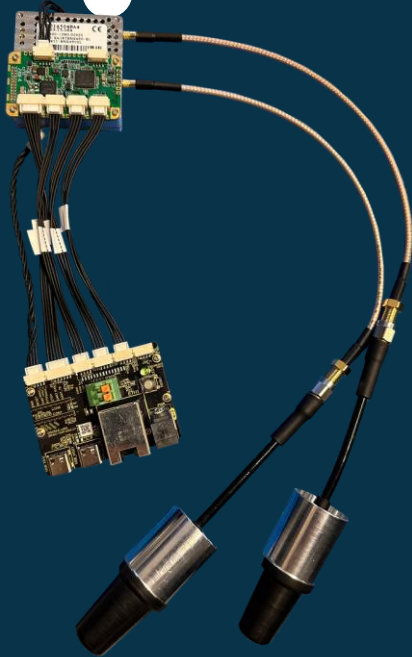


ARDUCAM 1080P

- Connects via USB
- 120° Wide Angle
- IP67 Certified
- `ros2 run video_stream video_publisher`

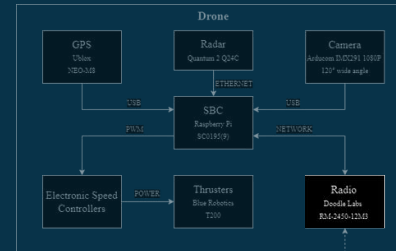


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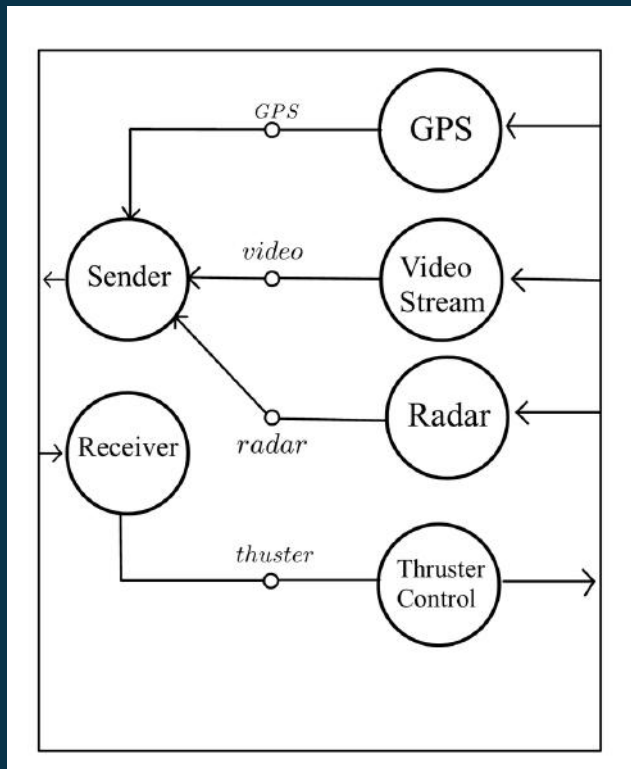


DL RM2450 MESH RADIO

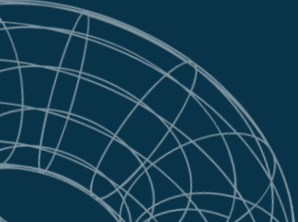
- USB-C / Ethernet Connection
- Duplex data stream
- 2.4 GHz Band
- Range ~10km @ 100 Mbps
- Successful at 2km, until loss of the LOS




ROS Graph



Progress Updates



Fall '23



- Hardware Acquisition
- Component Testing
- DevOps Setup
- Learning ROS

Progress Updates

Fall '23

Winter '24

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- UDP Communication
- Boat Assembly
- ROS Package Structure
- Control Station Design
- Hardware Mounting

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Winter '24

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Spring '24

- Refine ROS Nodes
- Control Station GUI
- SLAM
- Testing

ACKNOWLEDGEMENTS



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PHIL TOKUMARU - PROJECT ADVISOR
MATTHEW FEHL - ADVISING ENGINEER
RYAN FRIEDMAN - ADVISING ENGINEER