2.680 Intro to Blue Boats

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Small Scale USVs

- Rapid development and prototyping
- Littoral and near shore deployments
- Lower investment and operation costs

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1 Meter USVs

CHCNAV APACHE 3 $30K

Evo Logistics Sonobot 5 $60K

Ocean Alpha SL20 $48K

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Blue Robotics Blue Boat $5.5k

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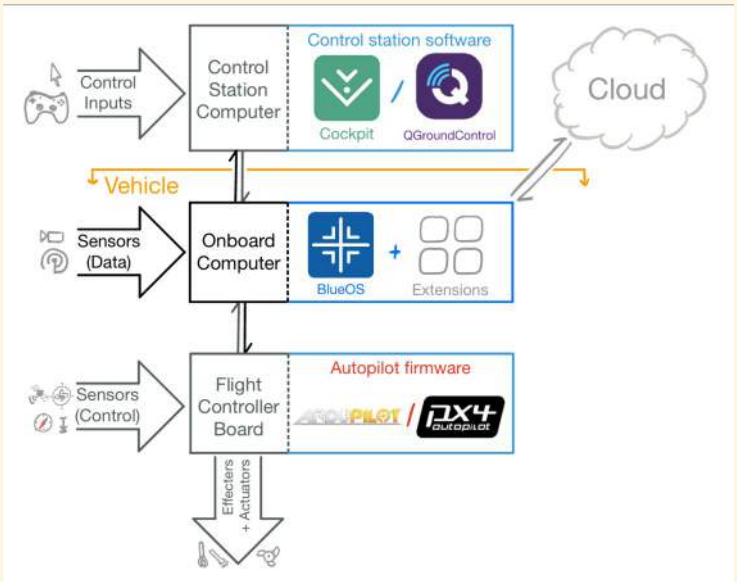
Default Software Stack



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What it is:

- "A hydrographer's pickup truck"
  - Side Scan Sonar
  - CTD Profilers
- Open Source
  - BlueOS
  - Ardupilot
- Low Cost
- Long Duration

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What it isn't:

- Collaborative Autonomy Ready
  - Short Range Comms
  - Limited mission capabilities

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Marine Autonomy Lab Upgrades

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Safety System Upgrades: Estop and Pilot Radio

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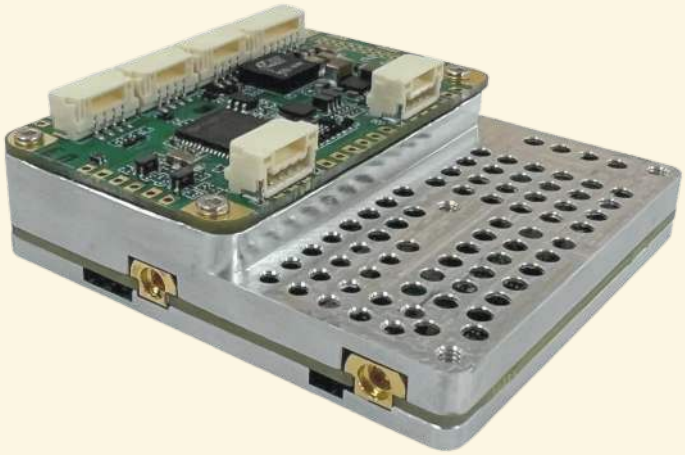
Doodle Labs Mesh Rider Radio



- High Power 2.4 Ghz or 900 Mhz bands
- Link monitoring capabilities
- Meshing radio
  - Node based, self healing network

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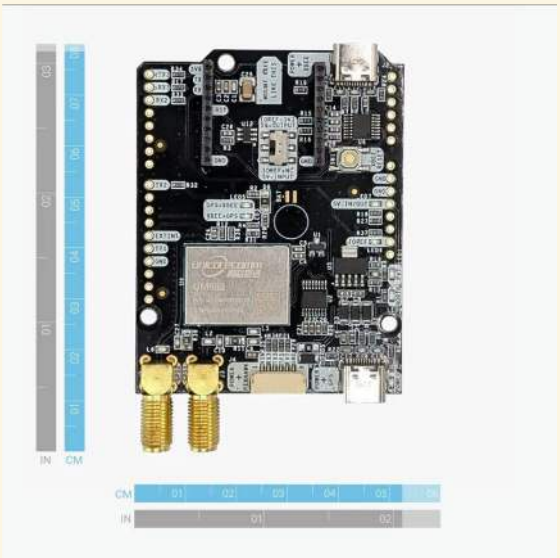
Ardusimple RTK3B Compassing GPS



- Dual antenna for precise heading
- Triple band capabilities
  - L1, L2, and L5
- RTCM / RTK corrections for centimeter level accuracy

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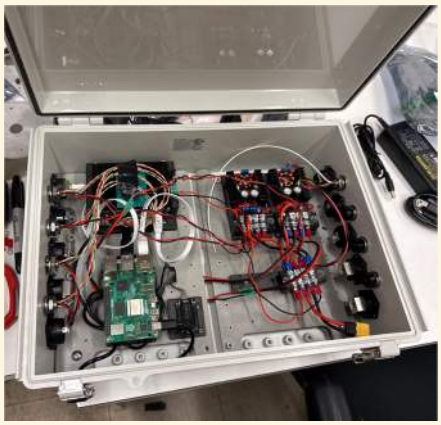
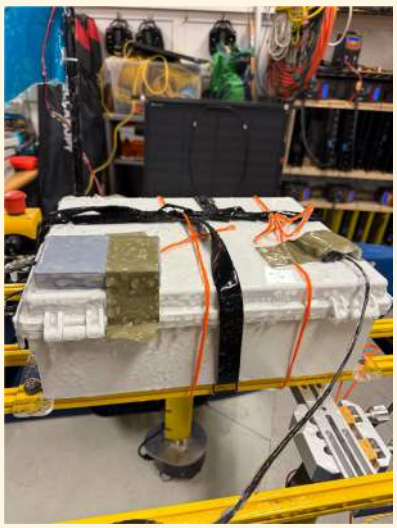
Advanced Payload Box





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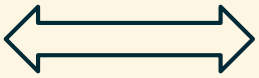
Moos-IvP Based Software Architecture

Front Seat Community
- iBBNavigatorInterface
- iRCReader
- iUnicoreGPS
- iFrontSeatBroker



UDP Packets

Backseat Seat Community
- pBB_DGPS_EKF
- pBB_Health
- pMarinePIDV22
- pThrustMix
- iBackSeatBroker
- **Your Code Goes Here!**

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Current Research Projects

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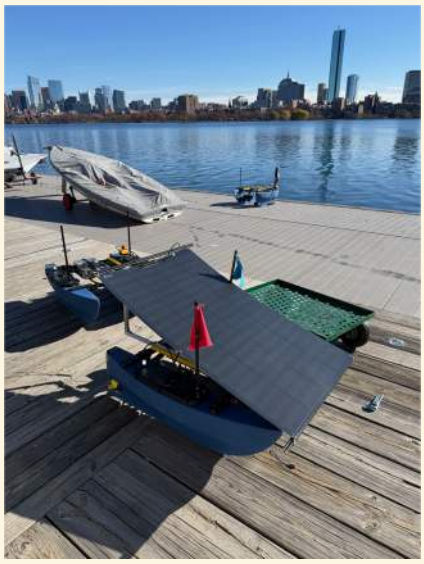
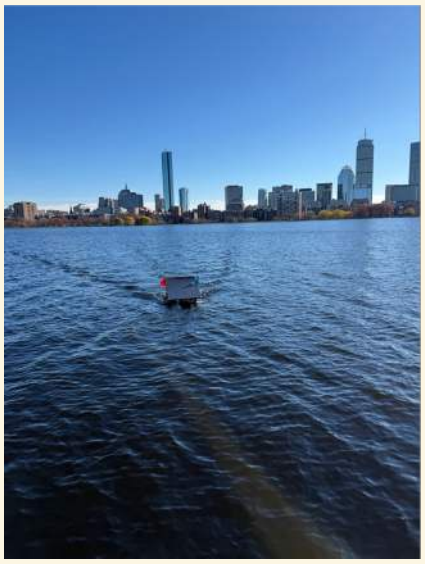
Solar Power: Optimal Orientation Behaviors





How can we extend the effective mission duration of a surface vehicle by altering speed setpoints and vehicle orientation to increase solar power input and reduce total motor power output?

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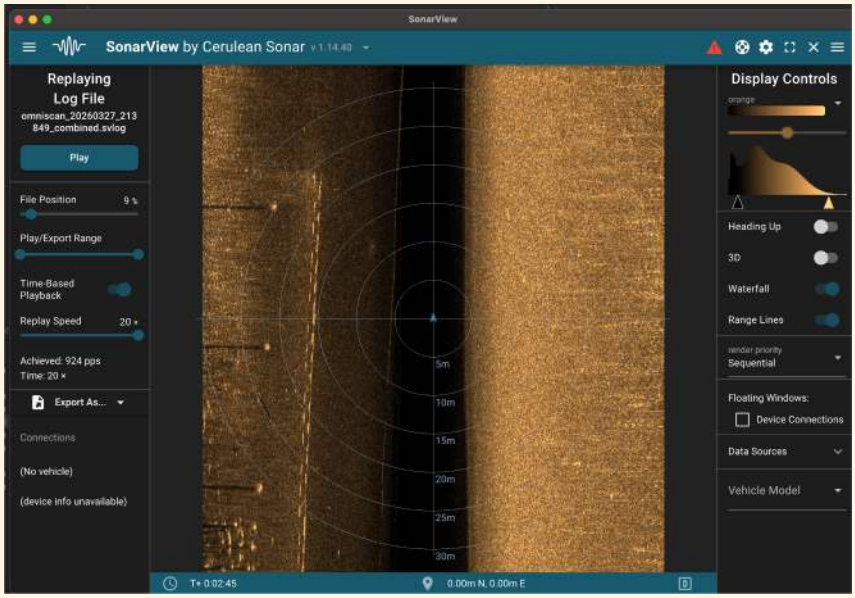
Omniscan 450 SS Integration



Integrating and debugging sensors on surface vehicles before they are implemented on underwater vehicles.

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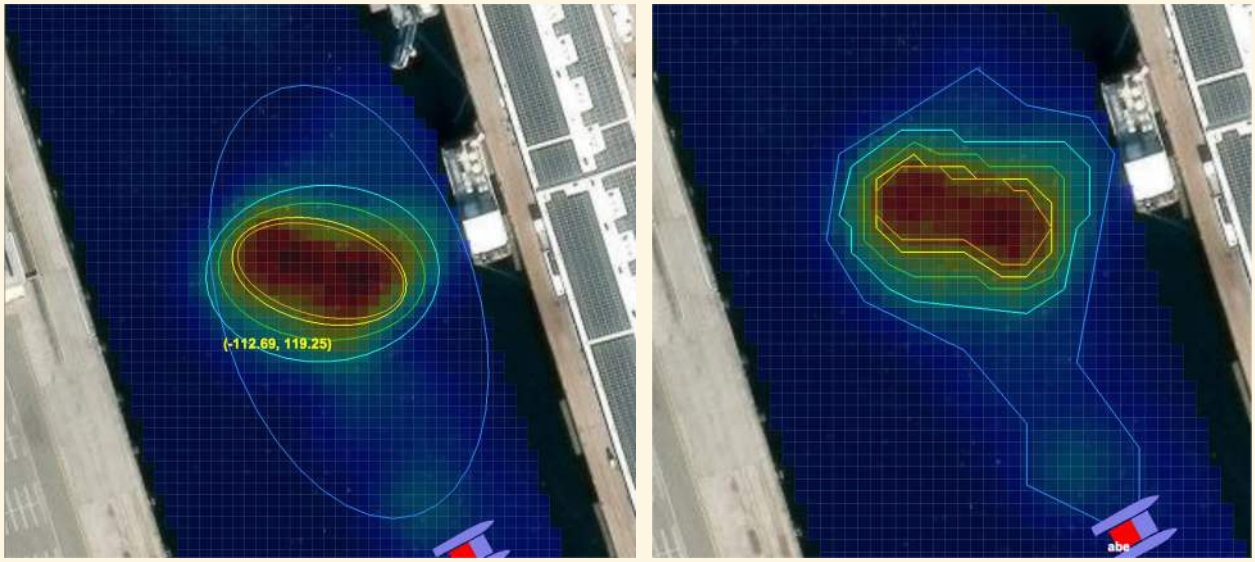
Plume Modeling



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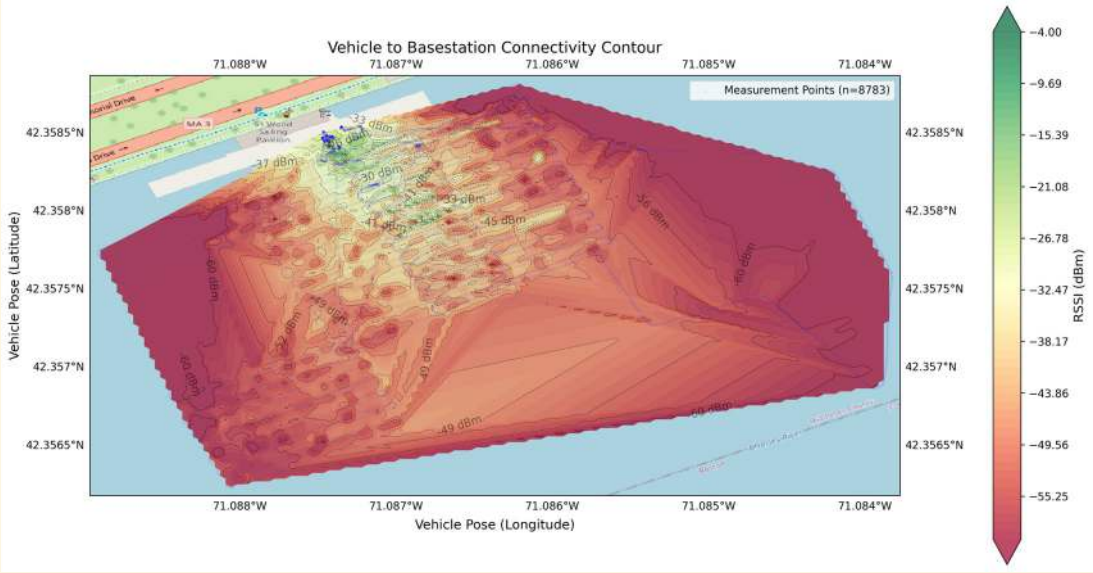
Comms Aware Autonomy



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Blue Boat App Appendix

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iBBNavigatorInterface

- Purpose: Flight Controller board interface. Manages PWM outputs for motors as well as reading ADC and AHRS values
- Subscriptions: DESIRED_THRUST_L, DESIRED_THRUST_R, ALL_STOP, RC_CONNECTED, RC_CH16
- Publications: AHRS Data (Roll, Pitch, Yaw, etc), Raw Voltage Readouts, Power Consumption, Thrust Setpoints

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iRCReader

- Purpose: Communicate with the RC Receiver via SBUS and publish channel values
- Subscriptions: NONE
- Publications: RC Channel values, RC_Connected

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iUnicoreGPS

- Purpose: Interface with the UM982 GPS module, parse position, velocity, and heading data, as well as handle RTCM messages
- Subscriptions: Optional RTCM_DATA
- Publications: NAV_LAT_GPS, NAV_LONG_GPS, NAV_SPEED_GPS, GPS_HEADING, GPS_HAS_LOCK, GPS_FIX_TYPE, GPS_HEADING_VALID

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iFrontSeatBroker

- Purpose: Handles sending data from the fronsteat community to the backseat community and publishes received backseat data to the frontseat MOOS DB.
- Subscriptions: any variables specified to send (commonly GPS and AHRS data)
- Publications: any variables received from the backseat (commonly thruster commands)

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iBackSeatBroker

- Purpose: Handles sending data from the backseat community to the frontseat community and publishes received frontseat data to the backseat MOOS DB.
- Subscriptions: any variables specified to send (commonly thruster commands)
- Publications: any variables received from the backseat (commonly GPS and AHRS data)

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pBB_DGPS_EKF

- Purpose: a 5 state EKF that filters and smooths GPS and Gryo data into a navigation solution
- Subscriptions: GPS_STATE, GYRO_LVL_Z, DESIRED_THRUST_L, DESIRED_THRUST_R
- Publications: NAV_X, NAV_Y, NAV_HEADING, NAV_SPEED, NAV_COG, NAV_LAT, NAV_LONG, NAV_STAT, MOOS_MANUAL_OVERRIDE

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pBB_Health

- Purpose: a system monitor interface that reports battery voltage and current, computer thermals, EKF and GPS quality, as well as RC state
- Subscriptions: NVGR_ROLLING_VOLTAGE, NVGR_ROLLING_CURRENT, RPI_TEMP, EKF_STATUS, GPS_STATE, RC_CONNECTED, RC_CH6, NAV_X, NAV_Y
- Publications: VIEW_CIRCLE, VIEW_RANGE_PULSE

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pMarinePIDV22

- Purpose: A simple PID controller that converts a desired heading and speed into a desired thrust and rudder command
- Subscriptions: NAV_X, NAV_Y, NAV_HEADING, NAV_SPEED, DESIRED_HEADING, DESIRED_SPEED
- Publications: DESIRED_THRUST, DESIRED_RUDDER

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pThrustMix

- Purpose: a gain scheduling, and thrust modification app that converts desired rudder and desired thrust commands into individual thrust left and thrust right commands
- Subscriptions: DESIRED_THRUST, DESIRED_RUDDER, NAV_SPEED, NAV_HEADING
- Publications: DESIRED_THRUST_R, DESIRED_THRUST_L

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