



DEVELOPMENT AND DEPLOYMENT OF A PAYLOAD AND NETWORK AGNOSTIC UNMANNED SURFACE VESSEL

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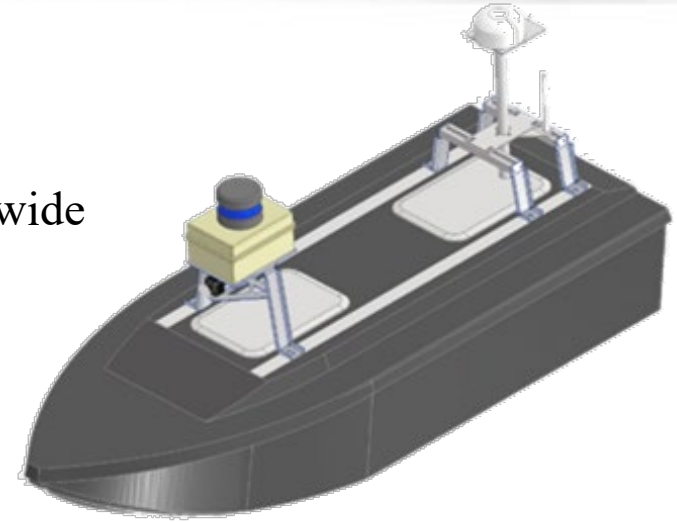
AGENDA

- **PROJECT OVERVIEW**
- **HARDWARE CHALLENGES**
- **SOFTWARE CHALLENGES**
- **MILESTONES**
- **OUTREACH**
- **CONCLUSIONS**
- **Q/A SESSION**

PROJECT OVERVIEW

Objectives

- Create a highly modular Unmanned Surface Vessel
- Ensure secure wireless communications
- Integrate onboard communications networks to enable wide range of sensors/onboard hardware
- Create valuable experiential learning opportunities for local students to work with established industry partners



SYSTEM OVERVIEW

- **Network:** A three-tiered network solution consisting of the SimIS 900 MHz telemetry band, a Transmission Control Protocol/Internet Protocol (TCP/IP) standard network communication suite, and an NMEA2000 onboard communication bus.
- **Power Distribution:** A power distribution system including the main power battery, multiple different voltage breakouts, and connections for power at the payload bay wall.
- **Propulsion:** A semi-modular swappable transom designed to integrate multiple propulsion nodes
- **Logic control:** A central embedded Linux control unit running a Robotic Operating System (ROS1) based state control node structure capable of interfacing with all onboard sensors and networked systems

HARDWARE CHALLENGES



Hardware Challenges

- POWER-DENSITY CONSTRAINTS LIMIT THE AVAILABLE POWER FOR PROLONGED OPERATION
- SMALL SIZE LEADS TO UNIQUE POWER TRANSMISSION CONSTRAINTS
- WIDE RANGE OF CUSTOMER REQUIREMENTS NECESSITATES MULTIPLE SWAPPABLE PROPULSION MODULES
- MANAGEMENT OF WEIGHT TO ENABLE DIFFERENT PAYLOADS WITHOUT UPSETTING BOAT PERFORMANCE
- WIDE VARIETY OF INDUSTRY STANDARD ELECTRICAL REQUIREMENTS
- ENSURING HARDWARE SECURITY THROUGH COUNTRY-OF-ORIGIN CONTROL

SOFTWARE CHALLENGES

- ENSURING PLUG AND PLAY FUNCTIONALITY
 - PROVIDE MULTIPLE ONBOARD WIRED COMMUNICATIONS LINES
- SECURITY OF RADIO NETWORKS
 - (FHSS AND NIST 800-30)
- MESHING OF COMMUNICATION NETWORKS
- INTEGRATION OF COLREGS COMPLIANT AUTONOMOUS NAVIGATION
 - ADVANCED AUTONOMOUS BEHAVIOR FACTORING IN DATA FROM MULTIPLE SENSORS

CYBERSECURITY MEASURES

- FHSS TECHNOLOGY EMBEDDED WITHIN 900MHZ “LOW LEVEL” COMMUNICATIONS

NETWORK

- Shared randomization seed between client and server radios which determines the random “destination” while hopping channels at a rate of every 20ms
- TCP/IP NETWORK PROTOCOL AND CLOSED LAN CONFIGURATION FOR DATA

TRANSFER NETWORK



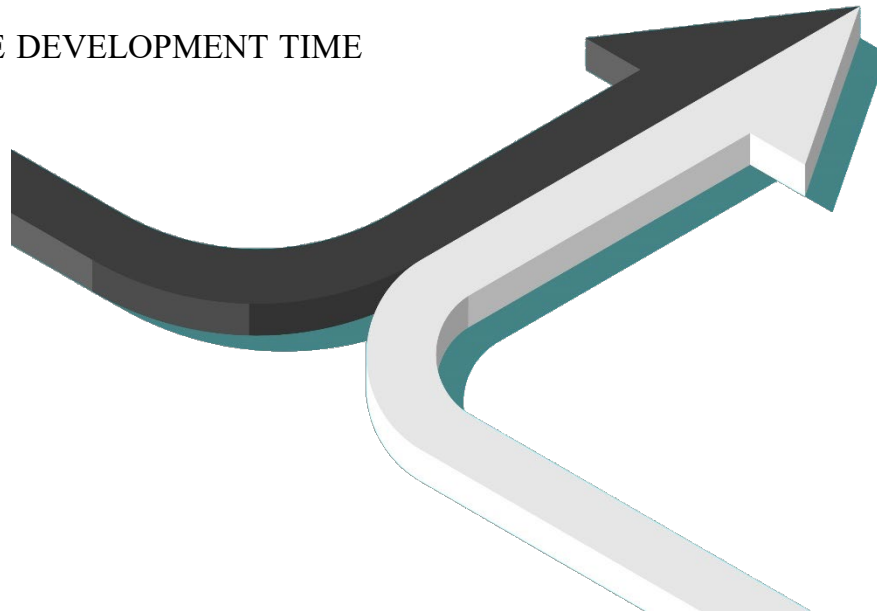
MILESTONES

- **SUCCESSFUL DEMO OF SWAPPABLE PROPULSION MODULE**
- **SUCCESSFUL RAPID IMPLEMENTATION OF PARTNER/CUSTOMER PAYLOAD**
- **SUCCESSFUL INTEGRATION OF MULTIPLE SECURE COMMUNICATIONS STRUCTURES**
- **SUCCESSFUL INTEGRATION OF MULTIPLE SENSORS AND OFFLOAD OF DATA TO SHORE BASE STATION**
- **SUCCESSFUL CYBERSECURITY EVALUATION THROUGH USN INCURSION ATTEMPTS OF 900MHZ AND 5G MANET**



OUTREACH STRATEGIES

- IN PERSON: ATTENDED VARIOUS INDUSTRY TRADE SHOW EVENTS TO DISCOVER POTENTIAL PAYLOAD MANUFACTURERS TO PARTNER WITHIN THE FUTURE AND GAIN EXPOSURE FOR THE USV
- VIRTUAL: UTILIZED CONNECTIONS FORMED VIA THE SIMIS BUSINESS DEVELOPMENT TEAM TO INTERFACE WITH INTERESTED COMPANIES ACROSS THE GLOBE AND WORK THROUGH INTEGRATION CHALLENGES
- PARTNERSHIPS: ESTABLISHED CONNECTIONS WITH PARTNERS ACROSS THE MARITIME AND AUTONOMY INDUSTRIES TO DECREASE DEVELOPMENT TIME



QUESTIONS?