

Maritime Applications of Automated Vehicle Technologies for State Agencies

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Presentation Overview

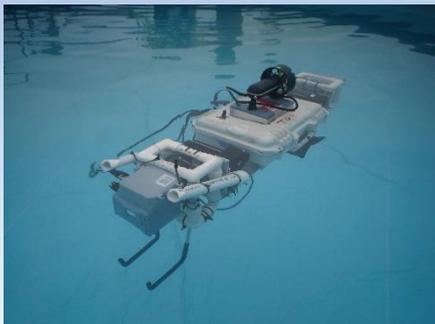
- Talent and Expertise at Florida Universities
- Sampling of Maritime Automated Vehicle Technology (on display tomorrow)
- The 3 Ds Guiding Application of Robotics
- Maritime Automated Vehicles as Sensor Platforms
- Opportunities for State Agencies

Florida Universities Resources (Talent and Expertise)

RoboBoat



RoboSub



RobotX



MARITIME ROBOTX

CHALLENGE

October 20 - 26, 2014
Marina Bay, Singapore



The Maritime RobotX Competition

- The largest collegiate robotics competition in history
- Sponsored by the Office of Naval Research (ONR) and the Association for Unmanned Systems International (AUVSI)
- 3 Teams selected from 5 Pacific-rim ally countries: US, Singapore, Japan, South Korea and Australia



The Maritime RobotX Competition

- Portable, fully autonomous vessel
- Array of sensors to perceive the environment
- On-board computation and navigation
- Boat reports sensed information
- No user intervention except to initiate and terminate autonomous operation



Competition Task 1: Navigate Speed Gate



Task 1 Video: Speed Gate



Competition Task 2: Locate Acoustic Pinger



Task 2 Video: Hydrophones Deploying



Competition Task 3: Dock in Designated Slip



The Technology – Sensors and Perception

32-beam scanning
laser rangefinder

Two USB cameras
for computer vision

Four quad-core
Pentium
computer

Differential GPS,
magnetometer
and inertial
guidance system

Multi-
level E-
stop

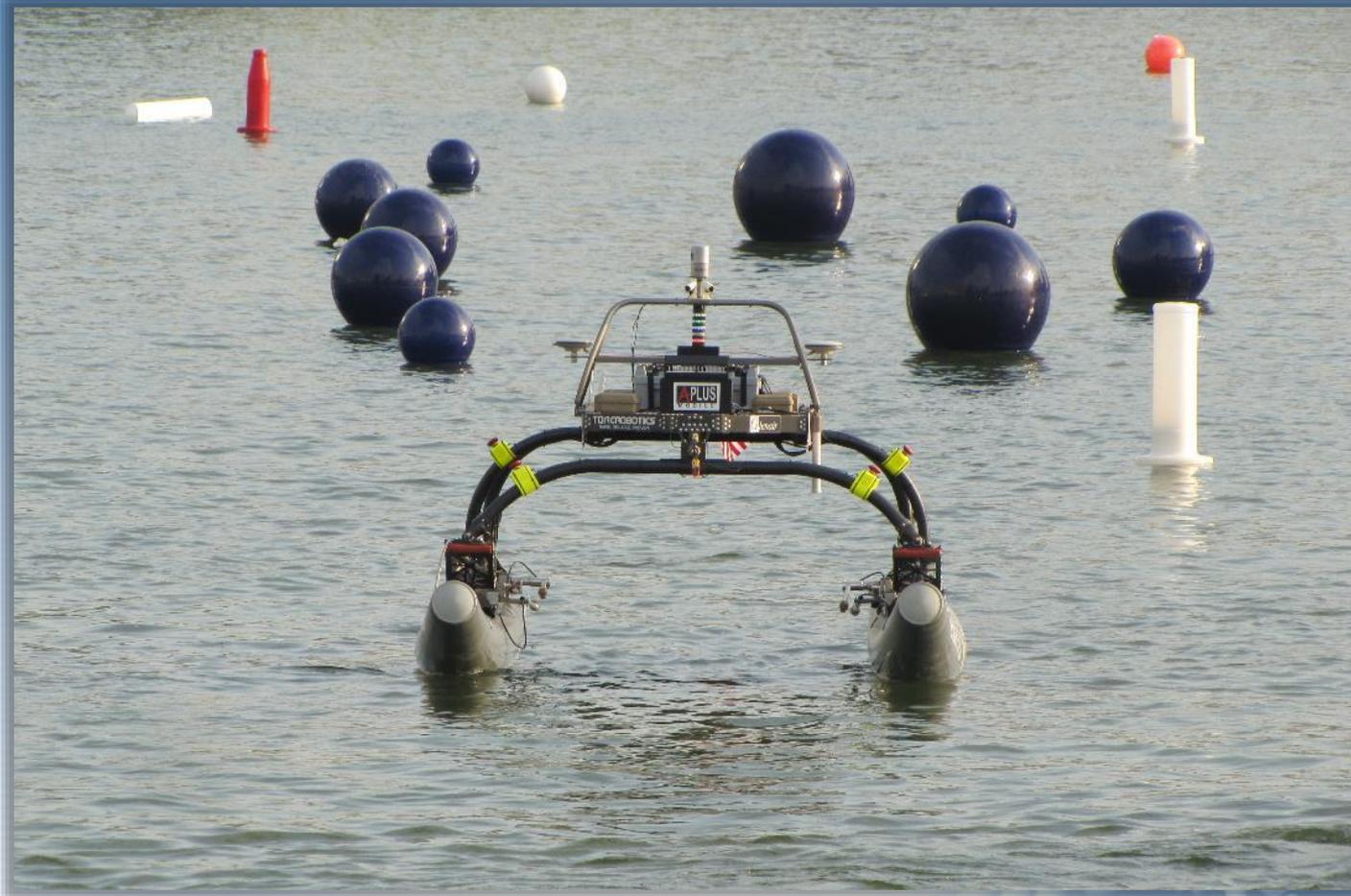
Multiple degree-of-
freedom WAM-V platform



Competition Task 4: Find Light Tower, Report Sequence



Competition Task 5: Navigate Obstacle Course



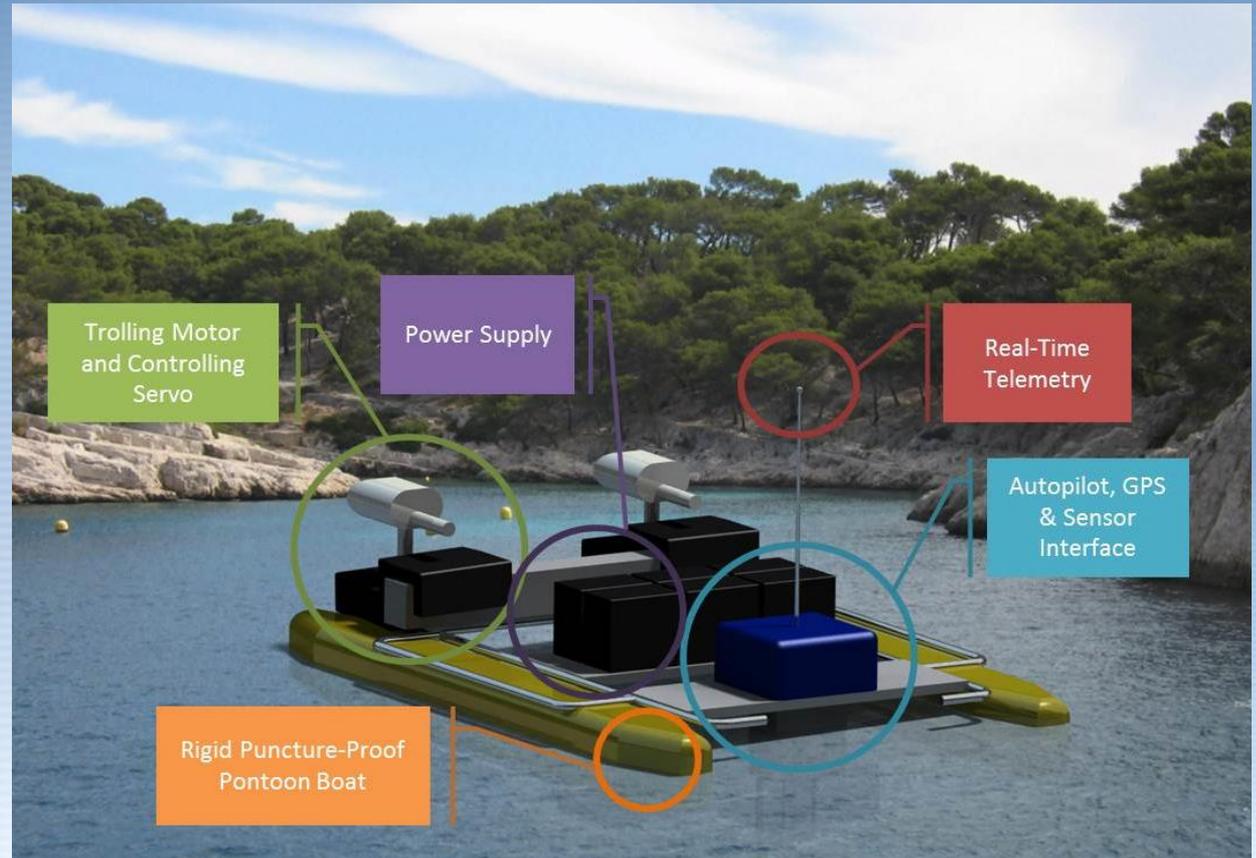
Task 5 Video: Obstacle Course Navigation



ERAU & University of Alaska Project :

Survey Troutman Lake to find military debris for cleanup

Troutman
Lake, St.
Lawrence
Island, 200
miles
southwest of
Nome,
Alaska



Troutman Lake Project Details

- Formerly Used Defense Site (FUDS), UXOs
- Detailed Bathymetry (lake bottom topography)
- Biological sampling of pH, temperature, conductivity and dissolved organic carbon
- Data logged with 6-inch CEP GPS position
- Live telemetry to verify data
- Remote and autonomous operation

The “3 Ds” Guiding Application of Robotics

Robots augment or replace humans for tasks that are:

- Dull (e.g., persistent environmental monitoring)
- Dirty (e.g., spraying herbicides on invasive plants)
- Dangerous (e.g., harbor security, foul-weather searches, hurricane wind and wave data)

Maritime Automated Vehicle Applications: Remote Sensing and Response

- Spill response and containment
- Seeking plumes of pollutants and runoff
- Bathymetry (underwater depth measurements)
- Sea grass surveys
- Biological monitoring
- Harbor safety and security
- Preserve and sanctuary monitoring



Florida Agencies that Could Benefit from Automated Maritime Systems

- Department of Environmental Protection
 - Indian river lagoon monitoring and restoration
 - Everglades restoration project (largest in the world)
 - Invasive species (e.g. Python) monitoring and capture
- Department of Law Enforcement
 - Smuggling
 - Harbor Security
- Department of Transportation
 - Effect of sea level rise on transportation infrastructure
 - Seaport bathymetry
 - Monitoring roadway lighting effects on nesting sea turtles
 - Wave data for bridge force analysis

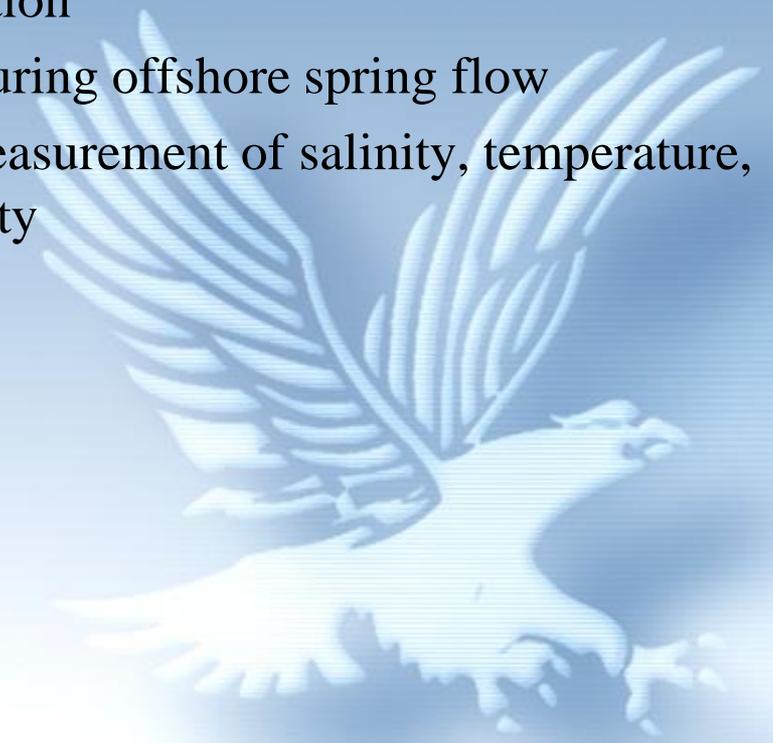


Florida Agencies that Could Benefit from Automated Maritime Systems

- **Division of Emergency Management**
 - Domestic security
 - Natural and technology hazard monitoring
- **Division of State Group Insurance**
 - Assessment of Hurricane-Induced Coastal Erosion
- **Fish and Wildlife Conservation Commission**
 - Manatee survey and marker boats
 - Lagoon sea grass monitoring and planting
 - Red tide monitoring and tracking
 - Sea grass, water quality and coral reef monitoring in Florida Keys Marine Sanctuary

Florida Agencies that Could Benefit from Automated Maritime Systems

- Florida Geological Survey
 - Natural and technology hazard monitoring
 - Side Scan Sonar system data collection
 - Acoustic Doppler Profiler for measuring offshore spring flow
 - Water quality loggers for on-site measurement of salinity, temperature, depth, pH, conductivity, and turbidity



Questions and Discussion

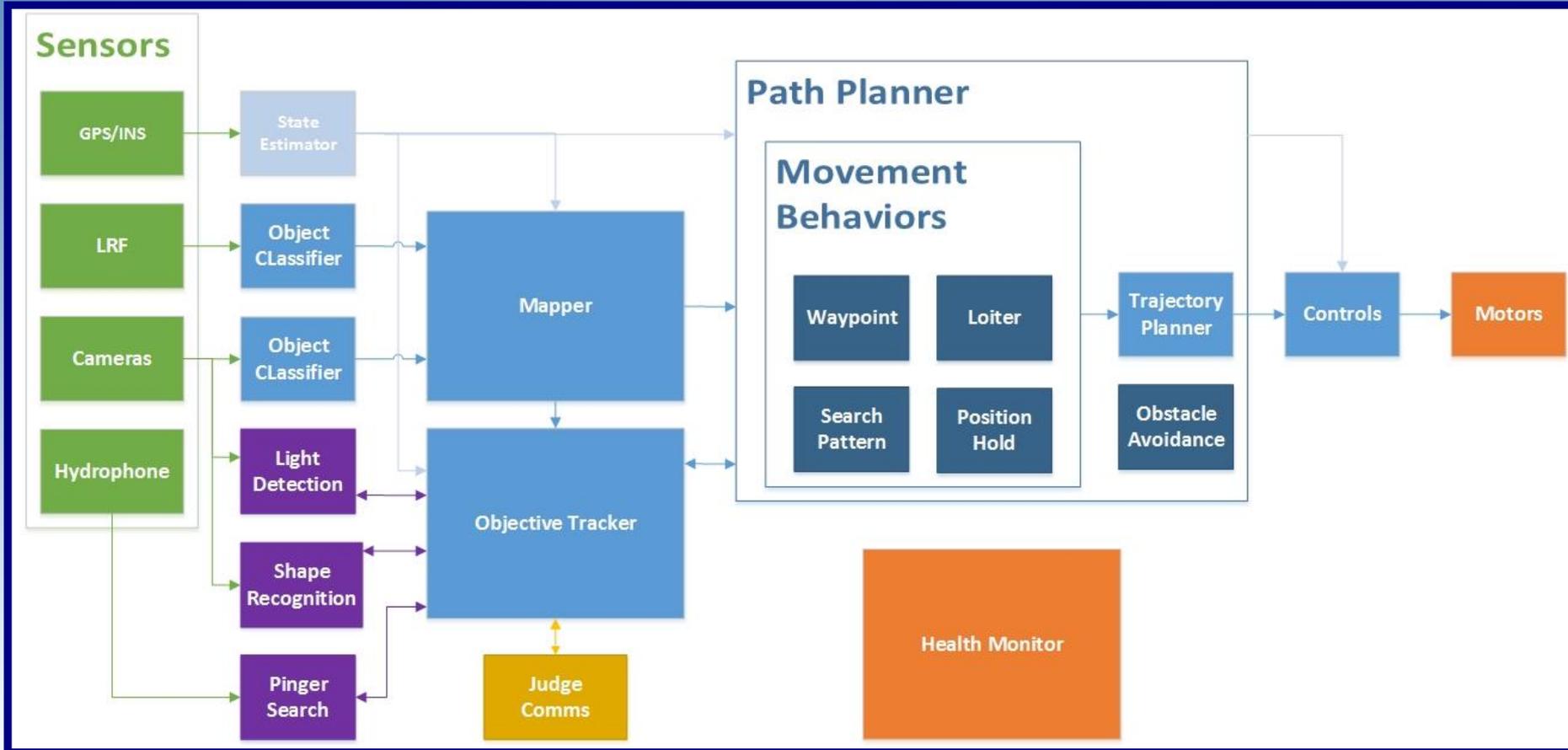


Propulsion: TorqueJET 4.5 140-48 RDP



Voltage (V)	48
Amperage (A)	93
Wattage (W)	4500
Weight (lb)	12.5
Thrust (lb)	140

Software Architecture



RoboX Finalists in Order of Finish

1. MIT-Olin
2. Team Angry Nerds (KAIST)
3. Team QUT Queensland University of Technology
4. Team Minion (Embry-Riddle Aeronautical University)
5. Team Sharky (National University of Singapore)
6. Osaka Union RobotX Team (Osaka University)