



Development of Unmanned Maritime Systems (UMS) Pilot Training

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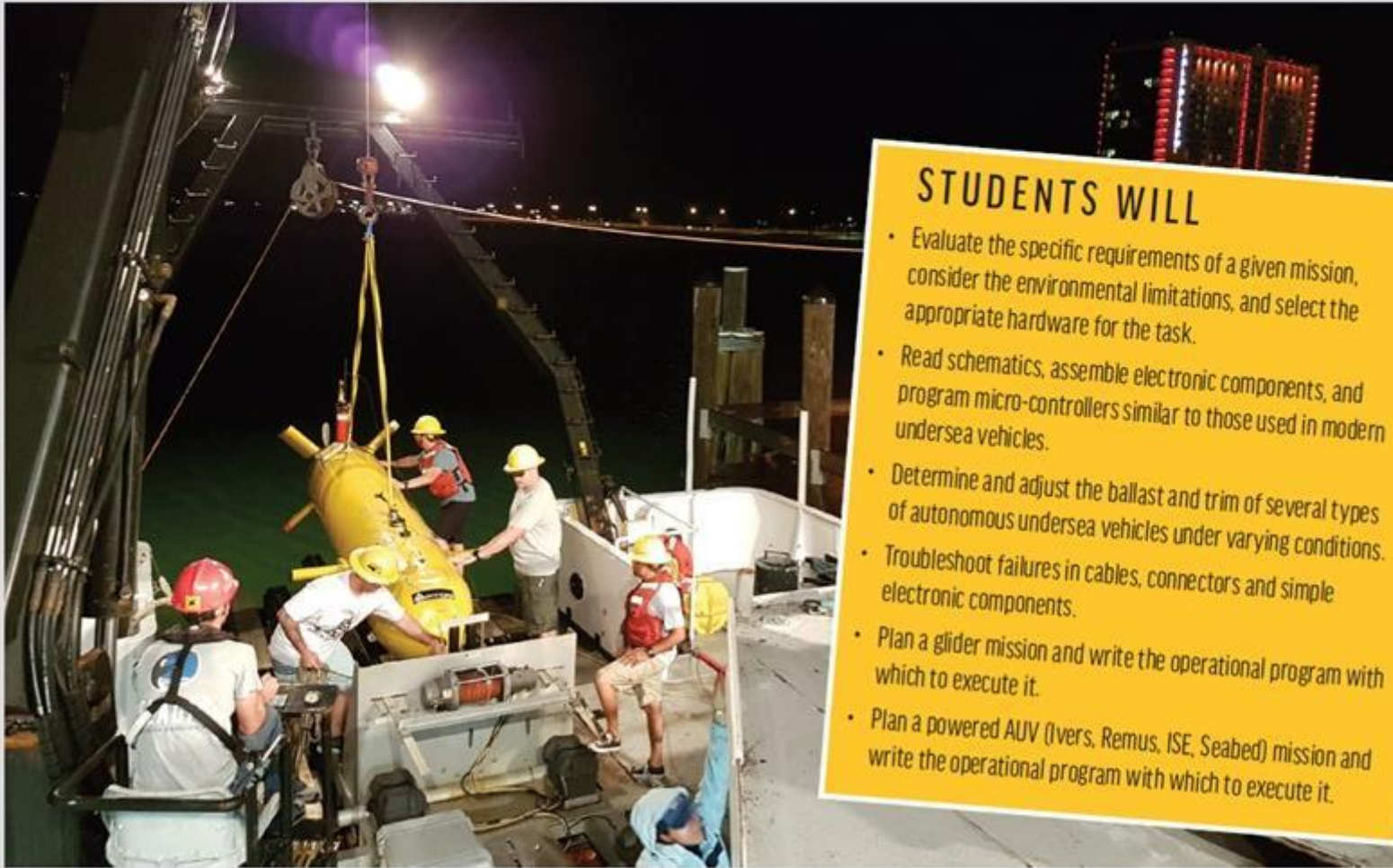
Agenda

- UMS Basic (Tier 1) Curriculum
- UMS Curriculum Structure
- UMS Pilot (Tier 2) Objectives
- Glider Simulator For Pilot Training

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UNMANNED MARITIME SYSTEMS

CERTIFICATE PROGRAM



STUDENTS WILL

- Evaluate the specific requirements of a given mission, consider the environmental limitations, and select the appropriate hardware for the task.
- Read schematics, assemble electronic components, and program micro-controllers similar to those used in modern undersea vehicles.
- Determine and adjust the ballast and trim of several types of autonomous undersea vehicles under varying conditions.
- Troubleshoot failures in cables, connectors and simple electronic components.
- Plan a glider mission and write the operational program with which to execute it.
- Plan a powered AUV (Ivers, Remus, ISE, Seabed) mission and write the operational program with which to execute it.

Basic Operator (Tier 1) Curriculum

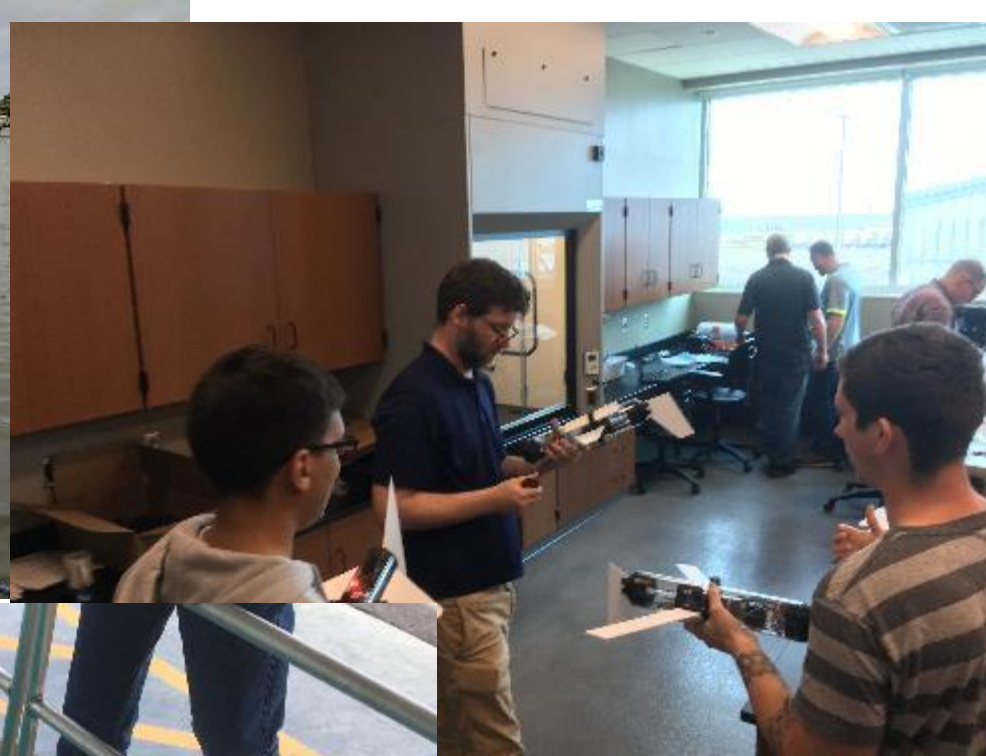
When: Five Week Course (USM
10 Credit hours)
2nd Half, Spring Semester

Where: Marine Research Center
(MRC), Port of Gulfport

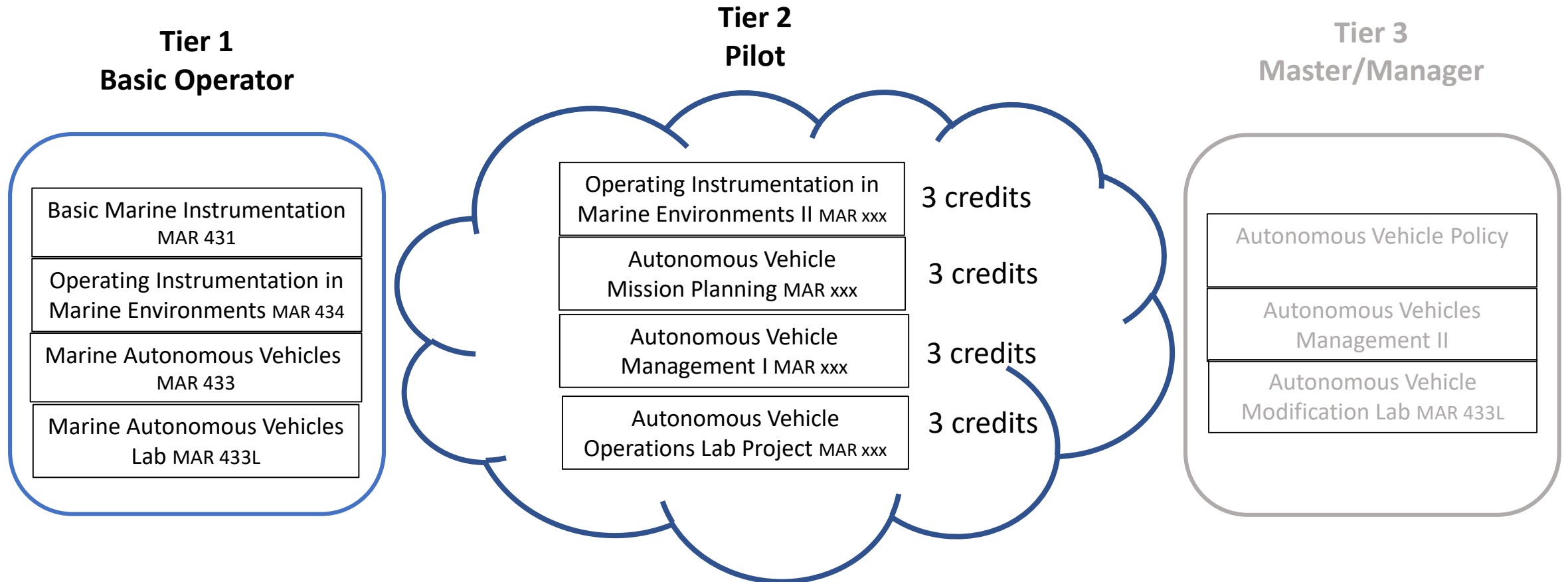
Who: Undergraduate (300-400
level) and Agency employees –
Navy, NOAA, USCG, Marine
Science and Engineering

Cost: Tuition + lab/field fee
(\$8k+\$840 out of state)

<https://www.usm.edu/school-ocean-science-and-technology/unmanned-maritime-systems-ums-certification>



UMS Curriculum Structure



UMS Pilot (Tier 2) Curriculum Objectives

- ☐ Ability to plan UMS missions to include analysis of matching task to vehicle; communications & control; data collection and protection; safety/risk;
- ☐ Understanding and ability to operate vehicles in the field, including preparation, deployment, monitoring, recovery, general troubleshooting, and data management.
- ☐ Understanding of UMS program management to include operating costs, preventive maintenance, repair, supplies, and system life cycle.
- ☐ Ability to optimize UMS capabilities including proficiency with command-control systems, modification of payloads, minimizing power consumption, integrating multiple systems, networking, and increased autonomy.



Glider Simulator for Pilot Training

- Gulf AUV Network and Data Archiving Long-term Storage Facility (GANDALF)
 - First-step aid to autonomous underwater vehicle (AUV) pilots operating in the Gulf of Mexico (<http://gandalf.gcoos.org/>)
 - Provides real-time vehicle positioning information via a maps-based interface
 - GCOOS adding new features and improvements for historical mission playback for glider mission case study analyses – key objective in UMS Pilot Tier-2 curriculum
- Ultimate Goal: Fully Dynamic Buoyancy Glider Simulator
 - Capability to input what-if glider attitude/path in model or historical water column to conduct What-If analysis and time-lapse playback
 - Test performance v. micro-, meso-scale ocean features
 - Test mission objectives v. equipment problems





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Questions

Previous USM UMS Projects



- Wave Glider: wave-propelled surface vehicle for Gulf of Mexico acidification
- Saildrone: wind propelled and solar powered surface vehicle in Gulf of Mexico and Bering Straits for cross shelf carbon and nutrient transport
- Teledyne-Webb and Kongsberg gliders: buoyancy propelled for upper ocean heat content and Ross Sea for krill concentration
- Eagle Ray and Mola Mola: propeller driven AUVs (Gulf of Mexico and Hudson Canyon)



Current USM UMS Projects

- Deep ocean glider for Gulf observations of oceanographic-atmospheric dynamics and glider pilot proficiency (NOAA-NGI)
- Ocean heat content monitoring with buoyancy gliders to improve hurricane forecasts (Shell, NOAA, NAVO)
- Engineering tests and mapping missions using the Saildrone enhanced with a new swath-mapping system and other positioning/communications sensors (NOAA-OCS)
- Develop standard operating procedures, establish training and certification guidelines, and explore integration of new technology utilizing L3 ASV C-Worker 5 to improve NOAA's use of unmanned systems for hydrographic surveying. (NOAA OCS)
- Use of man-portable UUVs (L3 OceanServer Iver) nearshore for covert deployment of payloads (ONR-USMC)
- Portable 4D ocean cube characterization in GOMEX for UMS testing and evaluation (NRL)

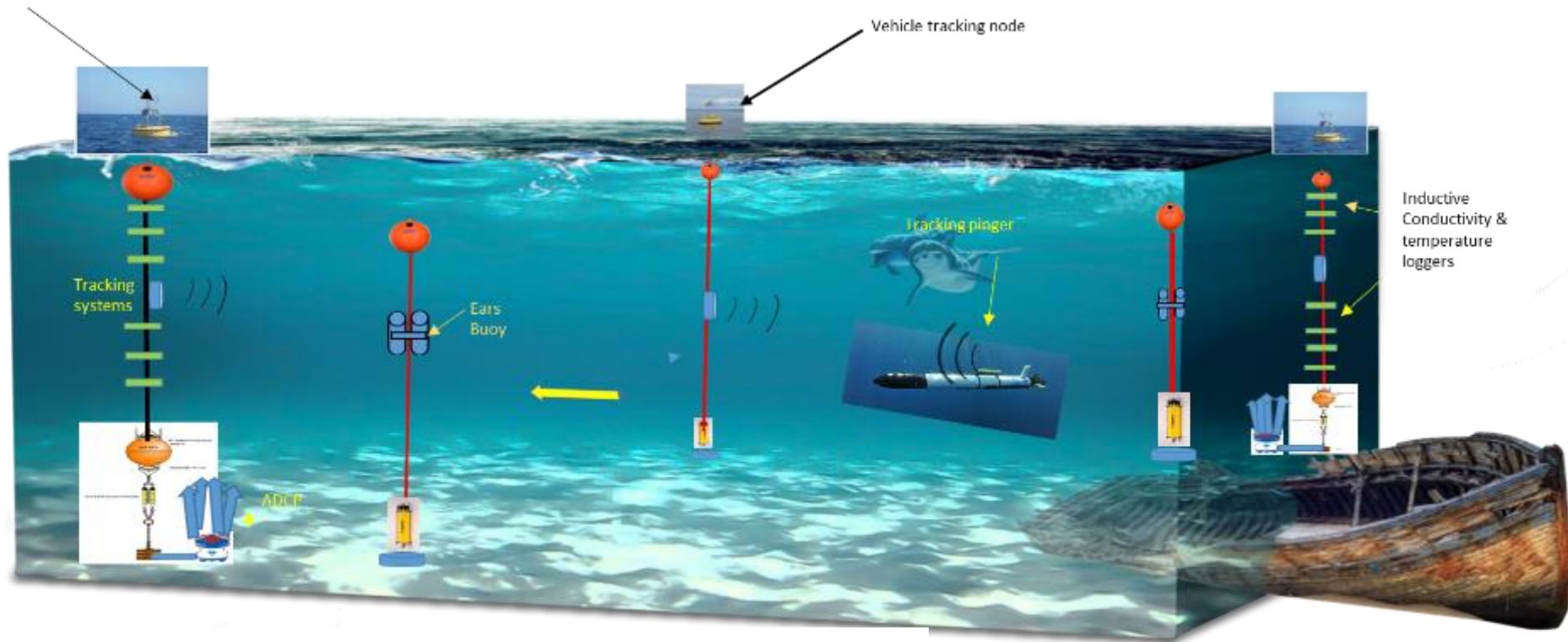


Water Space Characterization For Performance Evaluations Of Current And Emerging Unmanned Maritime Systems



Surface and subsurface environmental measurement nodes

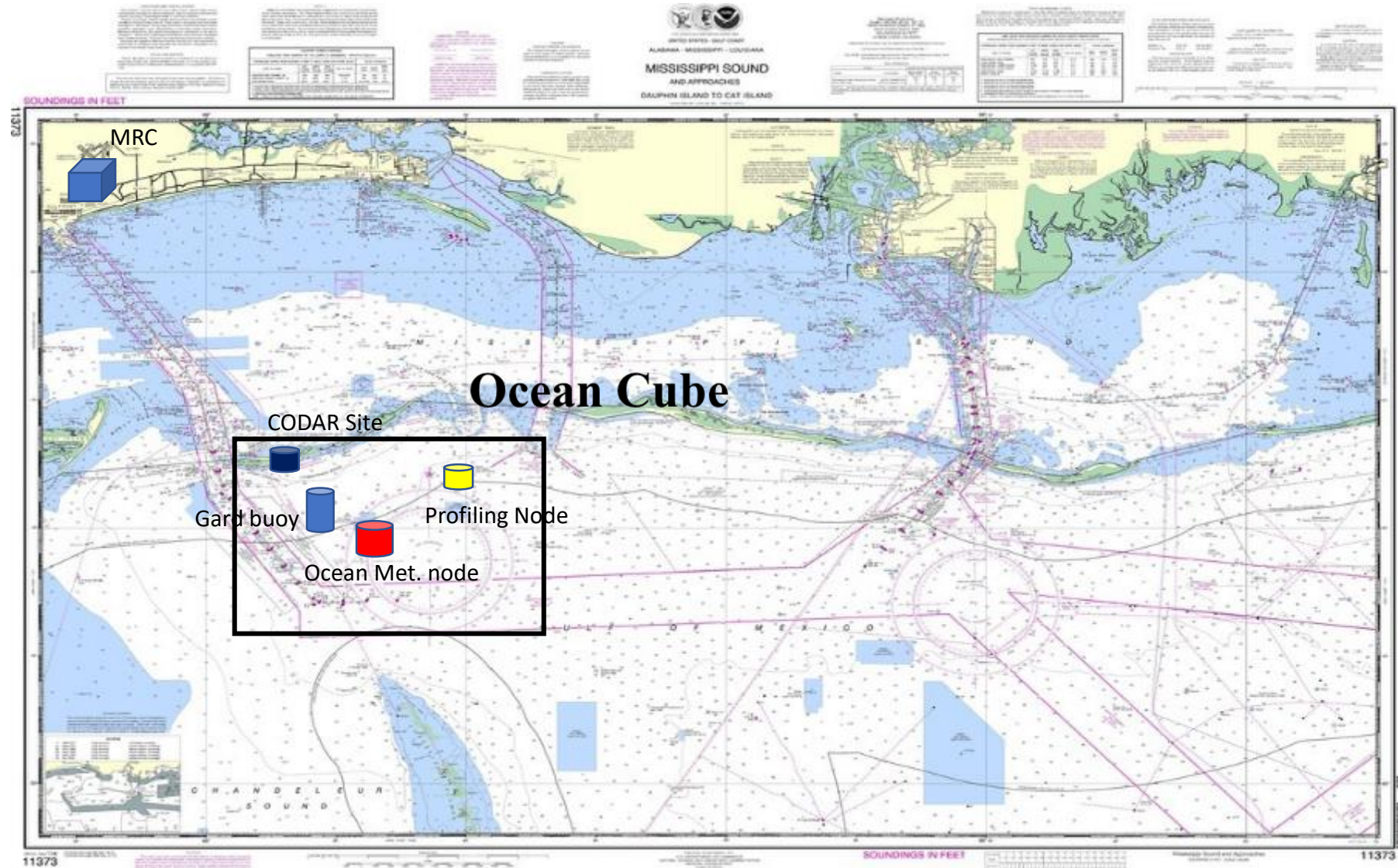
Vehicle tracking node



“4D Ocean Cube”



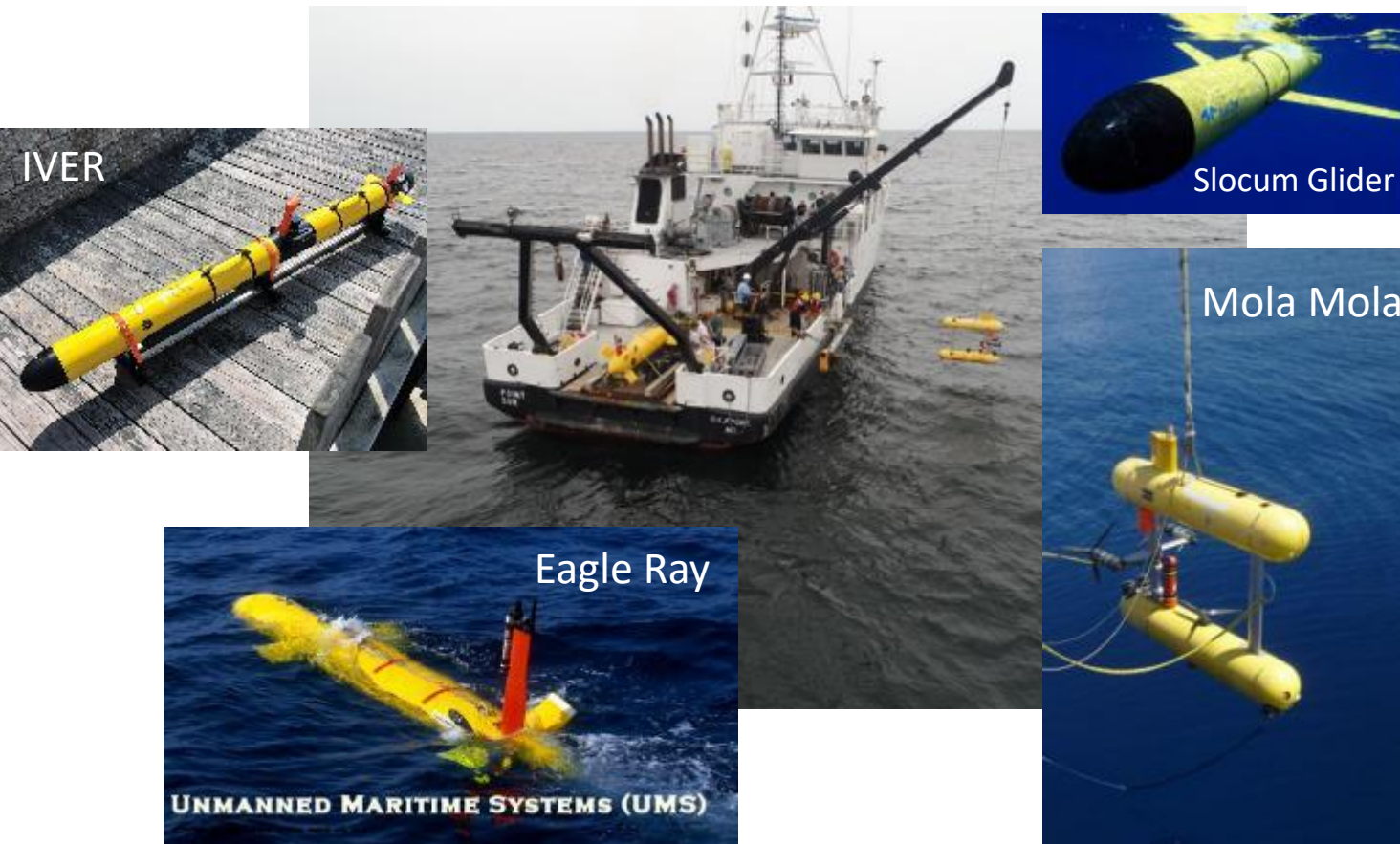
Water Space Characterization For Performance Evaluations Of Current And Emerging Unmanned Maritime Systems



USM Autonomous Vehicles

At the forefront of unmanned vehicle research

Autonomous Underwater Vehicles (AUV)



Autonomous Surface Vehicles (ASV)

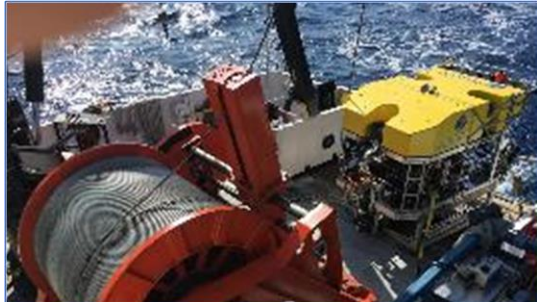
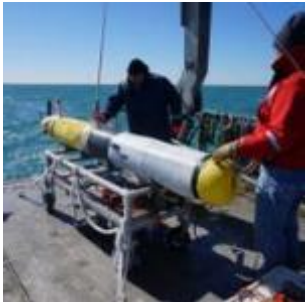


*ASV operated by SOSE's
Hydrographic Science researchers at Stennis*

Marine Research Center

R/V Point Sur

- USM's gateway to ocean at Port of Gulfport
- State-of-the-art facility for ocean science and engineering
- Home to cutting edge research
- Direct access to R/V Point Sur and other USM vessels
- Autonomous and remotely operated vehicle research and applications



Why an Ocean Enterprise Facility?

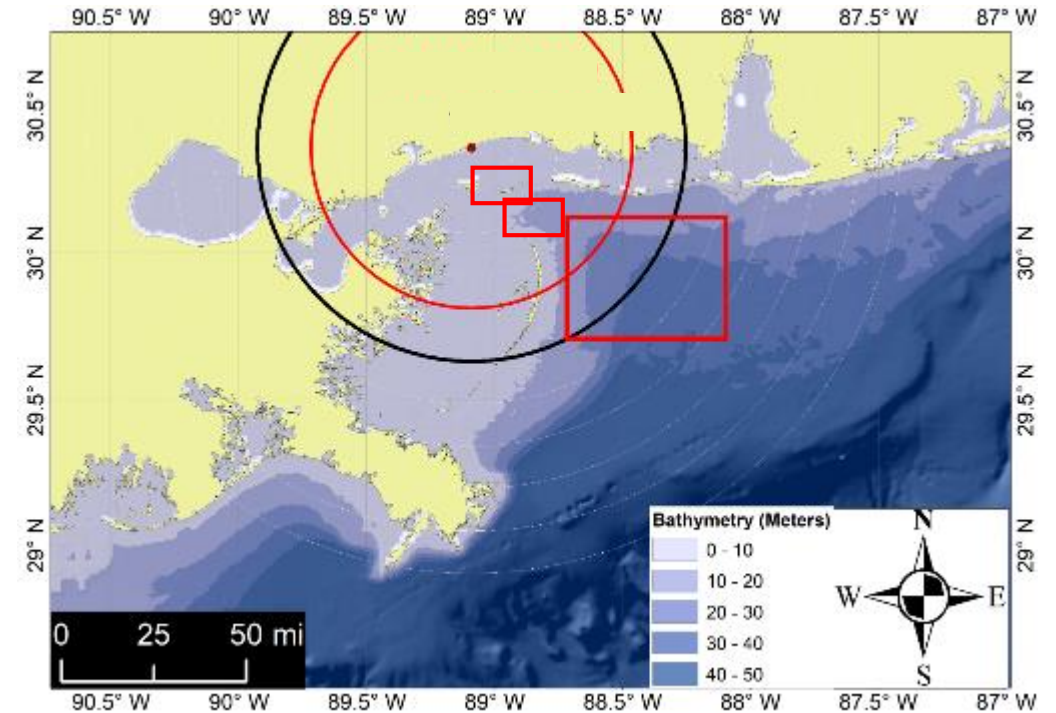


Harness the innovation power of **Federal-Industry-Academic** agencies in **physical presence** to develop dual-purpose technology and operating concepts.

- Tailored facility for pilot production and operation of Unmanned Maritime Systems and other technology
- Direct access to Gulf test and evaluation areas
- Training and Education capabilities for “force generation” to federal agencies

“Use this [commercial cloud] environment to allow our workforce to be more agile and innovative, as we reimagine traditional workflows to maximize efficiency.” - p. 15, CNO Design 2.0

Location - Port of Gulfport



- Security partition from commercial port - separate access road
- Pier slips, boat ramp or lift, covered slips

- Water access to Test & Evaluation areas
- Close proximity to USM Marine Research Center (MRC)

Two miles from NCBC Gulfport barracks, Sailor services