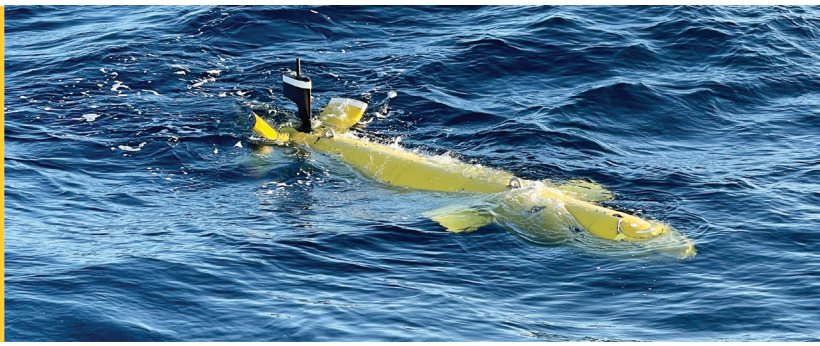
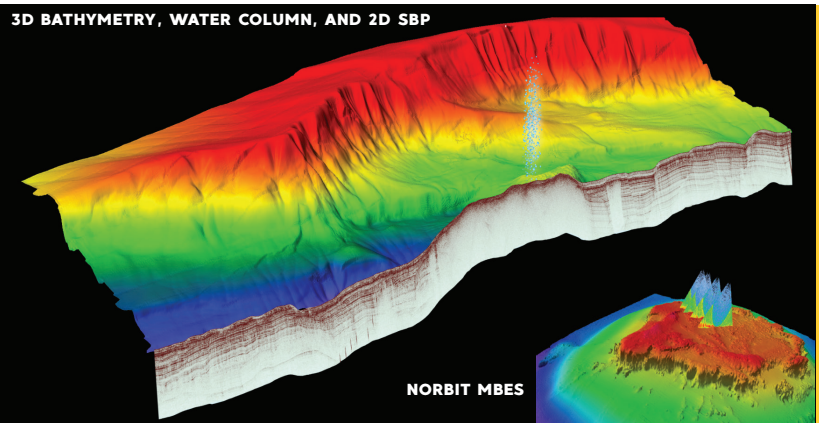
THE UNIVERSITY OF SOUTHERN MISSISSIPPI

EAGLE RAY

Deep Sea Mapping AUV

The EAGLE RAY autonomous underwater vehicle (AUV) follows a pre-programmed mission to map the seafloor independent of its support vessel. This AUV can reach depths of 3,000 meters and has mapped many regions off the U.S. east coast and northern Gulf of Mexico, surveying features of geological, biological and archaeological interest.

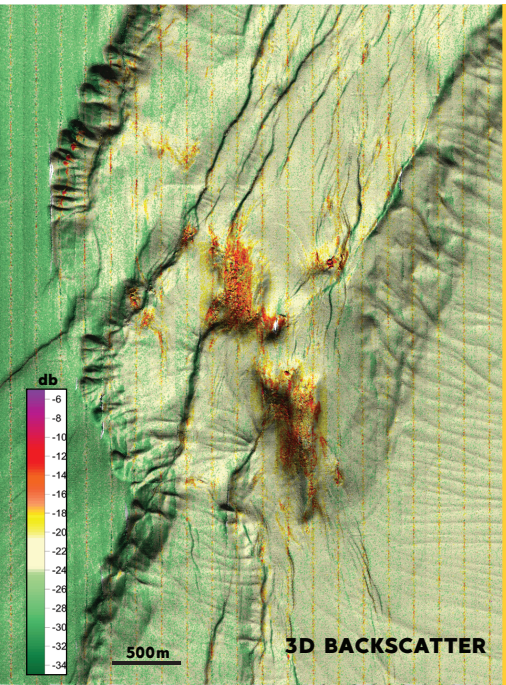




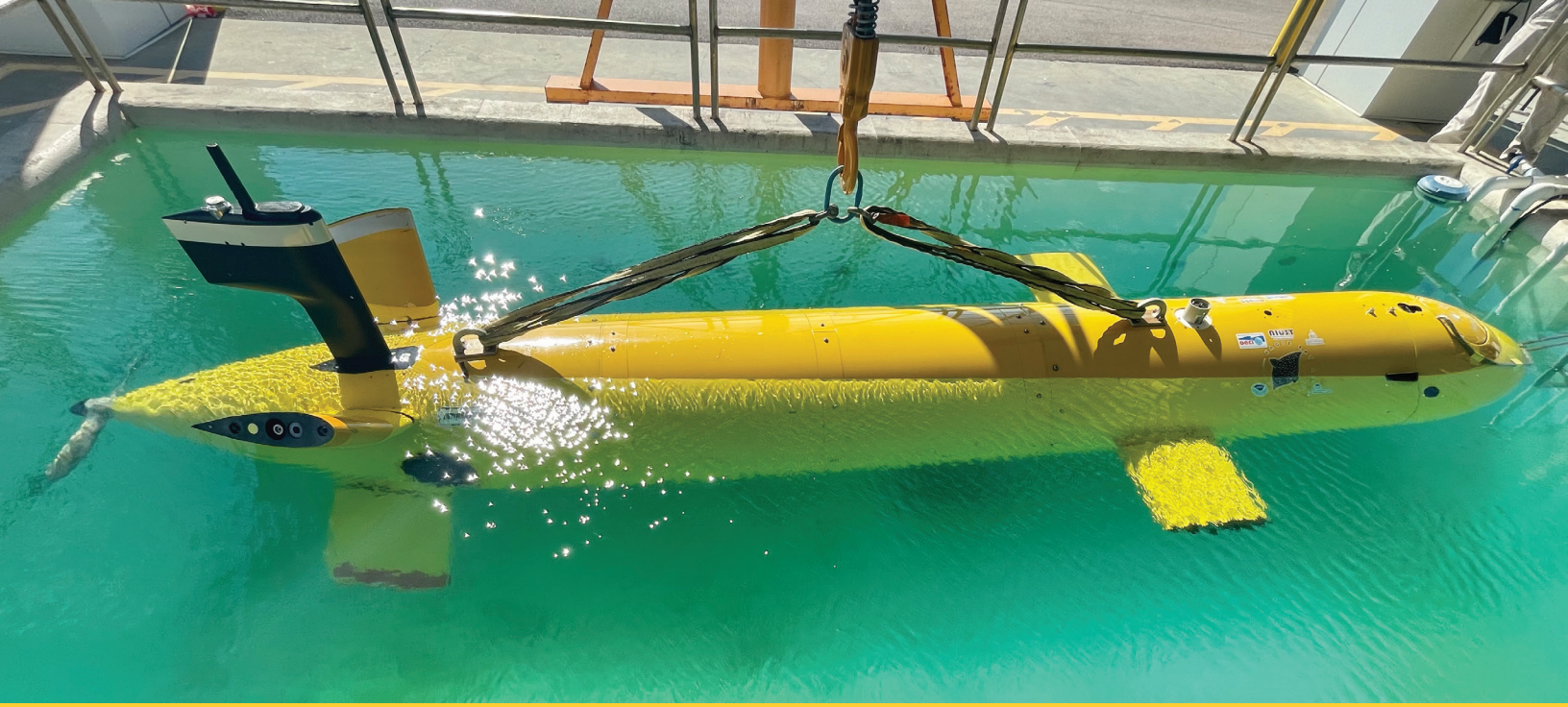
EAGLE RAY is equipped with a multibeam echosounder, which maps a stripe of the seafloor below it, obtaining full coverage by surveying in a back-and-forth pattern. This sonar also returns water column data along with the backscatter intensity of the bottom reflection, which is useful in assessing bottom type and for both geological surveys and habitat mapping. A subbottom profiler is used to look below the seafloor.

EAGLE RAY is launched from a support ship by an articulated ramp that extends off the stern and lowers the AUV into the water. At the surface, the vehicle navigates using GNSS and communicates over wireless ethernet or satellite for longer distances. These signals cannot pass through seawater, so once EAGLE RAY dives toward a survey target, it relies on slow, low-bandwidth, acoustic communication and inertial navigation aided by acoustic sensors. All data are recorded internally and downloaded upon recovering the vehicle while it charges for its next mission.

For a general overview survey, EAGLE RAY positions itself 50 meters above the seafloor and follows a grid pattern with line spacing from 150 to 180 meters, depending on roughness of the terrain. During the survey, EAGLE RAY can map approximately 25 square kilometers, with total coverage depending on varying conditions of this extreme environment.



At 50 meters above the seafloor, a resulting map is generally resolved to 1-meter blocks; dropping to a 25 meter altitude for a detailed survey increases this resolution to a half-meter. Tighter grids have been used for detailed subbottom studies, and lower altitude runs have been made during chemical surveys in areas of active hydrocarbon venting.



Since taking delivery of EAGLE RAY in 2006, The University of Southern Mississippi has developed an experienced team of engineers, geophysicists and hydrographers focused on AUV operations and data processing. The University of Southern Mississippi operates the research vessel *Point Sur* and will soon operate the upcoming regional-class research vessel, *Gilbert R. Mason*, along with consortium partners.

Max. depth: 2,200 m

Size: 5 m length, 0.7 m diameter

Mass: 900 kg

Endurance: up to 30 hours, 180 km

Typical survey parameters: 15 to 50 m altitude, 1.75 m/s speed

Launch and recovery: articulated stern ramp with rack and pinion drive and lifted by vessel's A-Frame, crane lift lugs, pop-off recovery float

Scientific payload: Norbit WBMS multibeam echosounder (512 beams, typical 400kHz, depth resolution <10mm), GeoAcoustics polarity-preserving chirp subbottom profiler (typical 3.5-12kHz), SeaBird FastCAT CTD, Ocean Floor Geophysics magnetometer, wet and dry space for additional payloads

Navigation: IXblue Phins C7 inertial navigation system, Nortek 500 kHz DVL, Masterclock GNSS receiver and time server, Paroscientific depth sensor, Kongsberg forward-looking altimeter

Maneuvering: Single thruster, fore planes and aft planes, allowing rapid pitched transit to survey altitude and stable heave-mode altitude-keeping while on survey

Communication/Tracking: *on surface* – Ubiquiti 2.4 GHz ethernet radio, Iridium satellite modem, Xeos combined Iridium tracking and strobe beacon *submerged* – Sonardyne AvTrak 6 combined USBL tracking transponder and acoustic modem

Shipboard equipment: Computer rack and multiple monitors for vehicle operation and mission management, deck-mounted launch and recovery system, optional 20' maintenance and charging container, Sonardyne Ranger 2 transceiver on pole or hull-mount for communications and tracking

Safety: Self-powered tracking hardware, ISE bottom avoidance routine, ISE fault response logic, emergency drop weight

Batteries: 30 kWh Li-ion from 18 Onyx 48V modules within the pressure housing

The University of Southern Mississippi – Hydrographic Science Research Center

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