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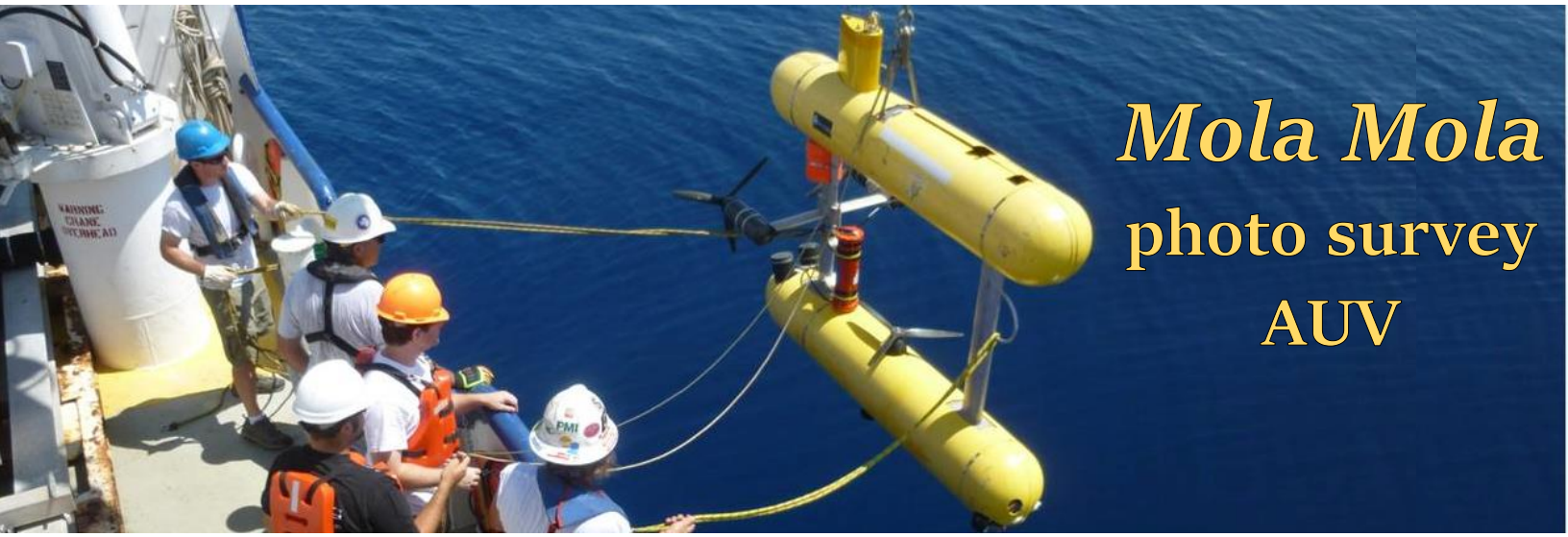
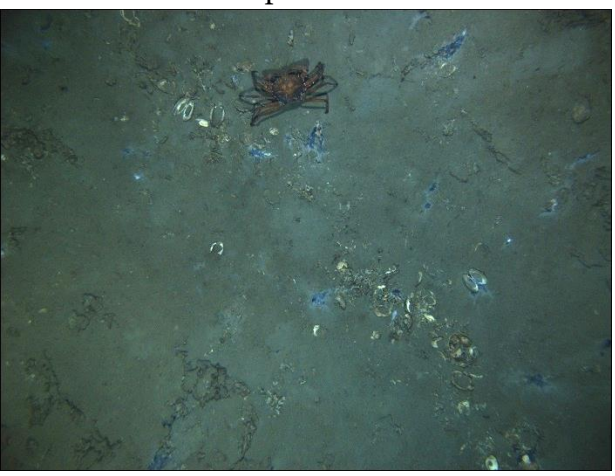


# *Mola Mola* photo survey AUV

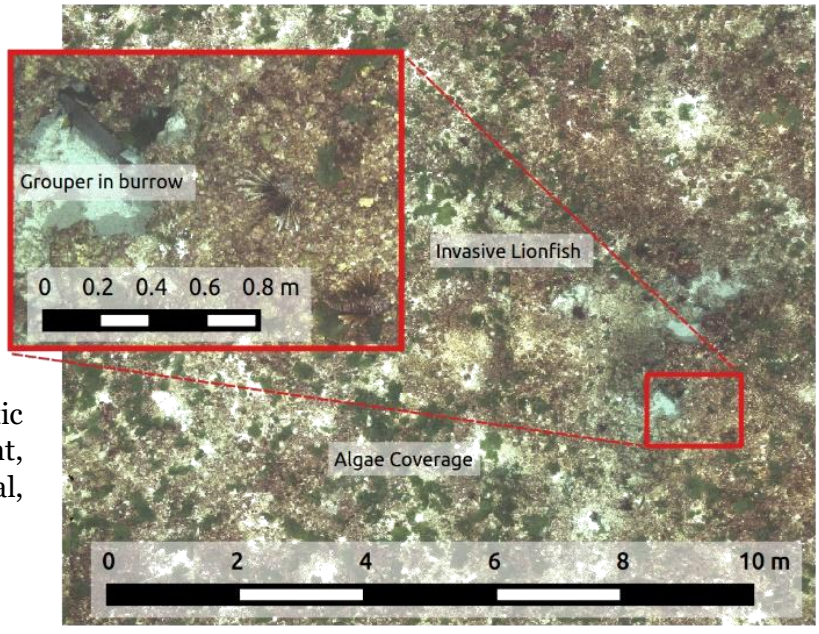
The *Mola Mola* autonomous underwater vehicle (AUV), given the scientific name of the Ocean Sunfish, is used to collect photos of the seafloor. It follows a pre-programmed mission plan untethered from its support ship as it conducts surveys to a depth of 2000 meters. *Mola Mola* has been used to study corals, geological features, deep-sea biological communities, and an 1800's shipwreck in the northern Gulf of Mexico.

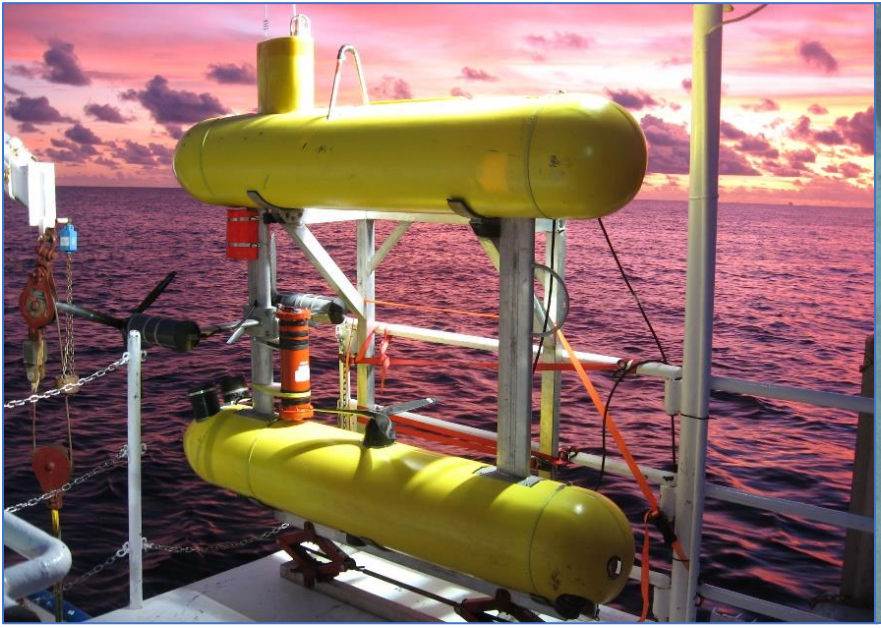


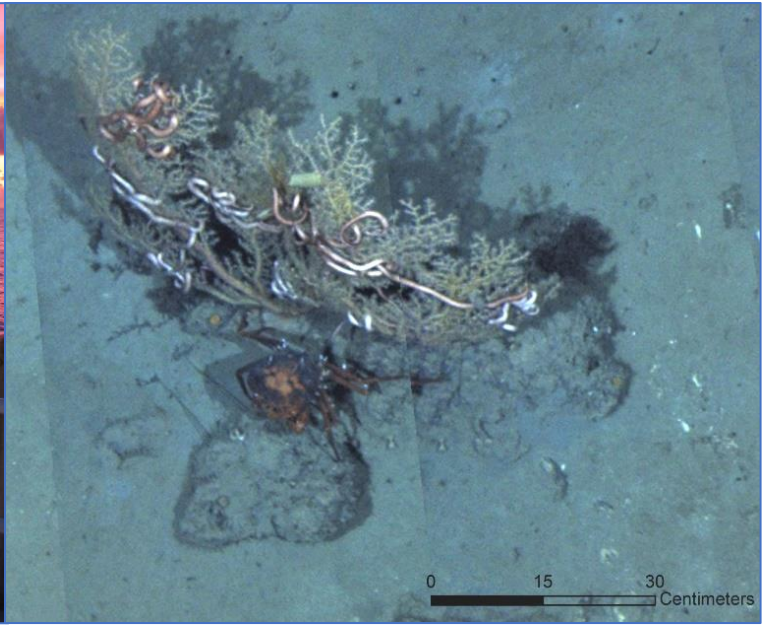
The primary sensor is the centrally mounted color camera. Uniform illumination is provided in the pitch-black deep-sea environment by fore and aft LED arrays. A laser line projector and secondary camera are used map the seafloor, producing complementary topographic data useful in interpreting the photo survey.

For deep dives, *Mola Mola* can be launched with an expendable drop weight. After reaching the seafloor, the vehicle travels to the area of interest and begins its low-altitude survey just 3 meters above the seafloor. At this height, the photo and bathymetry spatial resolution is below 2 mm. In a standard survey, *Mola Mola* maps a 60 by 60-meter block of the seafloor.

A processing pipeline was created to combine thousands of photos per mission with vehicle navigation to form a georeferenced photomosaic map. Data products from *Mola Mola* have been used to ground truth larger acoustic surveys, plan (and confirm) seafloor instrument placement, and to collect visual data over features of geological, biological, and archaeological interest.








Since taking delivery of its first AUV, *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 Mason* along with consortium partners. With thriving graduate and undergraduate degree programs, and specialist certificates offered in both hydrography and uncrewed maritime systems, facilities are located across the Mississippi Gulf Coast, including those at Stennis Space Center, the Marine Research Center at the Port of Gulfport, as well as the Gulf Coast Research Lab and Marine Education Center of Ocean Springs.

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Max. depth: 2000 m

Size: 2 m length, 1.5 m height

Mass: 225 kg

Endurance: up to 8 hours

Survey parameters: 3 m altitude, 1.7 m survey line spacing, 0.20 m/s

Launch and recovery: lift bail for crane or small-vessel A-frame

Scientific payload: 2G Robotics ULS-500 micro, consisting of a color still camera, fore and aft LED arrays, and a laser bathymetry system

Navigation: IXblue Phins III (inertial navigation system), Teledyne RDI 1.2 MHz Doppler velocity log, SOSI GPS receiver, Paroscientific depth sensor, Tritech forward-looking altimeter, acoustic position aiding via LBL beacons or telemetered corrections

Gas hydrate outcrop in the Gulf of Mexico

Maneuvering: Three magnetically coupled thrusters, electromagnet-operated descent weight system, passive stability in pitch and roll for uniformity of optical data

Comms & Tracking: *surface* – Freewave 900 Mhz serial modem, Novatech beacons (VHF, Argos, strobe) *submerged* – WHOI acoustic modem, LinkQuest USBL tracking transponder

Shipboard equipment: Laptops for vehicle operation and mission management, 1U-sized charger, cradle for deck storage and maintenance, WHOI modem transducer lowered on a line or pole, LinkQuest USBL transceiver on pole or hull-mount for tracking

Safety: Self-powered tracking transponders/ beacons, Terrain/obstacle avoidance system

Batteries: Pair of series-connected SWE SeaSafe Direct Li-ion modules 1.6 kWh at 60 V

**University of Southern Mississippi – Hydrographic Science Research Center**

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