

Case Study:

MIT-WHOI VALIDATES ISS360 SONAR FOR REAL-TIME AUV SLAM NAVIGATION



Case Study Details

> LOCATION

Woods Hole Oceanographic Institution (WHOI) Iselin Pier, USA.

> PLATFORM

REMUS-100 AUV

> SENSOR

Impact Subsea ISS360 Mechanically Scanned Imaging Sonar (MSIS)

> PARTNERS

Massachusetts Institute of Technology (MIT) & Woods Hole Oceanographic Institution (WHOI) Joint Program.

SLAM for Structured Environments Using Mechanically Scanned Imaging Sonar



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ISS360 Sonar scale

Autonomous Underwater Vehicles (AUVs) are critical for monitoring subsea infrastructure like offshore wind farms and marine facilities.

Because water blocks GPS signals, AUVs rely on dead reckoning (integrating IMU and DVL data), which suffers from unbounded positional drift. High-end Inertial Navigation Systems (INS) can mitigate this but carry severe size, weight, power and cost (SWaP-C) penalties.

A landmark study by Andrew J. Motz at the MIT-WHOI joint program proved that the Impact Subsea ISS360 Imaging Sonar solves this problem.

By deploying the ISS360 on a REMUS-100 AUV, researchers developed an acoustic Simultaneous Localisation and Mapping (SLAM) pipeline that eliminated unbounded navigation drift, reducing absolute position error by over 90%.

This system achieved position accuracy comparable to a premium, cost-prohibitive factory INS, all while utilising the low SWaP-C footprint of the ISS360.



ISS360 Sonar (far left) Installed on the REMUS-100 AUV

Image adapted from SLAM for Structured Environments Using Mechanically Scanned Imaging Sonar by Andrew J. Motz, 2023, MIT-WHOI joint program. Used with permission.

ISS360 APPLICATIONS INCLUDE:

ROV & AUV Navigation | Target Identification | Diver Navigation |
Port Surveillance | Motion Reference | Search & Recovery |



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Real-world validation of the ISS360 SLAM pipeline was conducted at the WHOI Iselin Pier. Divers guided the ISS360-equipped REMUS-100 through consecutive laps at a depth of 10 meters, navigating around a dense grid of underwater support pilings. The environment featured low visibility (under 2 meters) and active tidal currents.



Iselin Dock with both WHOI ocean-going research ships docked

Image adapted from SLAM for Structured Environments Using Mechanically Scanned Imaging Sonar by Andrew J. Motz, 2023, MIT-WHOI joint program. Used with permission.

The ISS360 delivered exceptional acoustic clarity, achieving extraordinary benchmarks across more than an hour of continuous submerged deployment:

- **90%+ Error Reduction:** Across the mission, the average absolute position error was bound to a mere 3.4 meters, successfully arresting compounding dead reckoning drift.
- **Flawless Full SLAM:** Operating without a pre-existing map, the system recorded a nearly identical average error of 3.3 meters.
- **INS Parity:** The 3.3-meter average error achieved purely through the ISS360 SLAM pipeline is comparable to the expected accuracy of an expensive, heavy, factory-grade INS navigating the same course.

The MIT-WHOI study successfully demonstrates that subsea operators do not need to sacrifice size, power, or budget to achieve pinpoint, drift-free autonomous navigation. The Impact Subsea ISS360 Scanning Imaging Sonar delivers commercial and defense operators a high-fidelity, ultra-compact acoustic imaging solution that serves dual purposes.

Beyond delivering crisp 360° environmental visualisation, its rich data output enables modern edge computing architectures to execute real-time localisation and mapping.



Divers preparing to deploy the REMUS

Image adapted from SLAM for Structured Environments Using Mechanically Scanned Imaging Sonar by Andrew J. Motz, 2023, MIT-WHOI joint program. Used with permission.

By choosing the ISS360, AUV manufacturers and service providers can unlock elite navigation tracking and advanced structural autonomy at a fraction of the SWaP-C of traditional inertial sensors.