# Seismic Imaging for National and Economic Security

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**Background.** Seismic imaging is a fundamental method used to map and characterize the U.S. seabed and near-shore areas. Detailed marine geophysical data are foundational for planning infrastructure, understanding available economic resources in U.S. marine territory, and securing our coastlines from threats related to geohazards and global adversaries. The U.S. stands to continue to serve as a global leader in marine science with continued investment in seismic research and infrastructure.

**Maintaining global leadership in marine science.** The NSF's 2025–2035 Decadal Survey of Ocean Sciences (National Academies Press) underscores urgent needs for the U.S. to:

- Replace and enhance aging seismic **infrastructure**, particularly the R/V *Marcus G. Langseth*, part of the U.S. Academic Research Fleet (ARF) and a cornerstone of U.S. marine seismic research, and the Ocean Bottom Seismic Instrument Center (OBSIC).
- Maintain U.S. capability to conduct high-resolution subsurface studies essential for both scientific research and **practical applications**, including resource exploration and hazard assessment.
- Address emerging scientific and national security challenges through **innovation** and **modernization**, with opportunities to integrate cutting-edge technologies, improve operational efficiency, and expand research capabilities with investments in infrastructure.
- Expand the U.S. **workforce** supporting marine science research, including training and educational programs that equip the next generation of marine scientists and technicians.

**Assessing economic resources.** Marine seismic imaging is a critical tool for understanding sub-seafloor structures, which has direct implications for resource management. In December 2023, the U.S. government announced the outer limits of its **Extended Continental Shelf (ECS)**, extending U.S. sovereign rights over approximately one million square kilometers of seabed beyond the 200-nautical-mile Exclusive Economic Zone (EEZ) (CIRES).

- The U.S. EEZ, now including new ECS regions, is rich in **critical minerals** such as nickel, cobalt, copper, manganese, titanium, and rare earth elements that are essential for emerging technologies and defense applications.

- Seismic surveys have been used by industry for decades to assess hydrocarbon **energy resources**, and are necessary to identify gas hydrate, methane seeps, and offshore regions suitable for energy infrastructure.
- Identifying and characterizing marine resources supports U.S. **energy independence** and informs sustainable resource extraction.
- The ECS delineation underscores the need for advanced marine seismic imaging to accurately map and assess these newly claimed areas, ensuring responsible **resource management** and hazard mitigation.

**National security.** Seismic imaging is critical for mapping and characterizing seafloor faults and tectonic structures that directly impact:

- **Seismic hazard assessment.** Earthquakes, tsunamis, landslides, and volcanic eruptions threaten densely populated coastal areas and military bases. Seismic imaging data directly supports earthquake forecasting and risk mitigation strategies.
- **Security of bottom-mounted and seabed cable infrastructure.** Improved understanding of sub-seafloor structures aids in assessing seabed stability and risk to maritime and military infrastructure.
- **Military readiness.** Seismic imaging in the marine environment supports battlespace awareness, geoacoustic models, and can provide critical information in denied areas.

**Supporting U.S. priorities.** Executive Order "Unleashing America's Offshore Critical Minerals and Resources" signed on April 24, 2025 includes the following key provisions:

- **Accelerated seabed mapping and exploration.** Directs Federal agencies to expedite seabed mapping and exploration activities to identify and quantify critical resources.
- **Collaboration.** Engage in public-private partnerships and collaborate with allied nations to develop deep-sea resources and mining capabilities.
- **Technological advancement.** Invigorate U.S. investment in deep sea science for innovative mapping and technology solutions.