

Project NEREUS: Construction of a practical autonomous underwater gas analyzer

Camilli, R. and Hemond, H. F.
Massachusetts Institute of Technology
Cambridge, Ma.

Underwater operation of a mass spectrometer presents unique engineering challenges. Successful operation requires that the instrument be compact, autonomous, energy efficient, able to maintain high vacuum in the presence of high hydrostatic pressures, and preferably operate without reagents. We describe the design and construction of NEREUS, an underwater membrane inlet mass spectrometer (MIMS), that will measure dissolved gases from 2-100 AMU at depths exceeding 300m. It will consume less than 25 watts, weigh approximately 20 kg, and fit within half of a 17 inch Benthos pressure sphere. System innovations include a compact mass analyzer, a membrane interface that permits high sensitivity while withstanding ambient pressure, and a flexible control/data acquisition system. NEREUS is designed to operate onboard an Odyssey AUV and other submersibles as well as in a buoyed configuration. Gas sensitivities of approximately 10ppb are achievable, with instrument response time on the order of 10 seconds. Odyssey endurance, coupled with NEREUS sampling frequency, will permit the generation of approximately 43,000 data points during a 12 hour period, covering an equivalent linear distance of 60 km.