4,000 Meter Hyperbaric Fish Trap Aquaria Respirometer

Larry E. Bird, mechanical engineer
Monterey Bay Aquarium Research Institute

Abstract – A major obstacle to the investigation of deep-sea biology is the lack of instrumentation to retrieve deep-sea organisms from their habitat alive and under extreme pressure. The Monterey Bay Aquarium Research Institute (MBARI) has undertaken the technically ambitious goal of building an instrumented high-pressure fish trap aquaria respiration system. The objectives of this project are to capture at depth deep-water fishes, return them to the surface alive at in situ pressure, and maintain them at pressure for up to 60 days. During this 60-day period the specimen can be studied in an environment with regulated pressure, temperature, and seawater chemistry. The key element of this project is an internal pressure vessel capable of containing 6,000 psi (42 MPa) within acceptable safety margins. This high pressure cylinder, 14 inches (35.6 cm) in diameter and 48 inches (122 cm) long, must reliably capture the specimen, close an internal door, seal at depth, and maintain pressure during ascent.

This presentation will deal specifically with the design, construction, testing, initial deployments, and success of this system. Design elements include the pressure cylinder, end caps, pressure compensation, instrumentation, flotation package, capture and internal door mechanisms. This system functions autonomously at depths to 4,000 meters and can be deployed on various vessels of opportunity.