

JASCO APPLIED SCIENCES

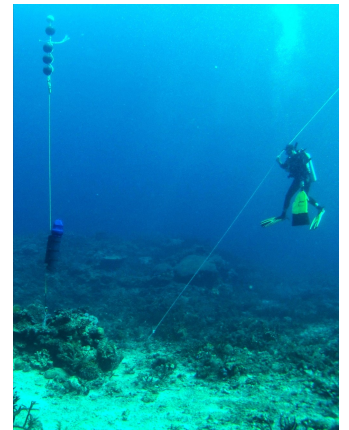
Collecting, analyzing, and assessing acoustic data since 1981

International services for all stages of environmental reviews and assessments of underwater noise for the oil and gas, marine construction, energy, fisheries, and defence sectors:

- Autonomous and real-time passive acoustic monitoring
- Sound Source Verifications (SSVs) and Characterizations (SSCs)
- Wide-area marine monitoring programs
- Acoustic data processing, interpretation, and reporting
- Environmental impact assessment of underwater sound
- Animal movement modelling and take analysis
- In-air and underwater acoustic modelling
- Stakeholder liaison

Acoustic Impact Assessment & Mitigation

JASCO provides scientific consulting for all stages of environmental reviews and assessments of underwater and in-air acoustics. We offer acoustic modelling, field measurements, impact assessment, reporting, and stakeholder liaison services to the oil and gas, marine construction, energy, fisheries, regulatory, and defence sectors.



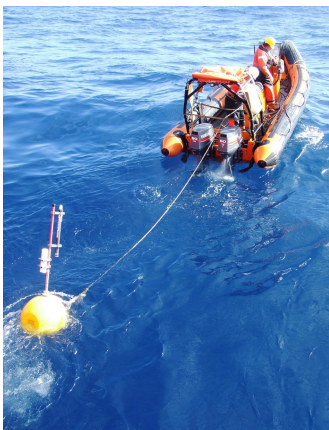
Acoustic Data Analysis

JASCO works with clients to provide actionable results, when they are needed:

- Preliminary interpretations of results during operations
- Fully analyzed and interpreted results in comprehensive reports
- Synthesis of multi-year results into comprehensive soundscape descriptions

Acoustic Measurements

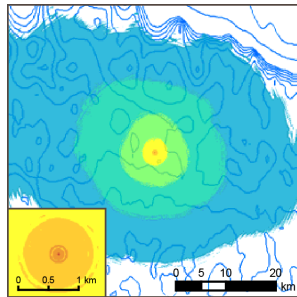
JASCO has performed over 700 acoustic recorder deployments since 2012, capturing up to 20 terabytes of data with each deployment. Our specially trained and experienced field scientists are committed to providing comprehensive and cost-effective acoustic monitoring services anywhere, under any conditions.



Acoustic Modelling

JASCO's numerical modelling reliably predicts long-range underwater sound propagation from industrial operations. Regulatory bodies are increasingly recognizing the power of these predictive tools and mandating their use in operational planning of operations. JASCO's benchmarked algorithms and proprietary software solutions enable us to numerically model sound from:

- Seismic survey sources such as airgun arrays, water guns, boomers, and vibroseis
- Active sonar and transducers such as sub-bottom profilers, multibeam sonar, and side-scan sonar
- Vessels such as survey vessels, icebreakers, tankers, tugs, and dynamic positioning thrusters
- Construction activities such as pile driving, drilling, blasting, dredging, rock dumping, and pipe laying
- Renewable energy sources such as wind and tidal turbines



Impact Assessment: Animal Movement Modelling

With the Marine Mammal Movement and Behavior (3MB) model and the Effect of Sound on the Marine Environment (ESME) workbench, we expose simulated marine animals (called animats) to our 3-D modelled sound fields to predict acoustic impacts. We determine the movement and behaviour parameters uniquely for each species from published studies on animal behaviour:

- Direction of movement
- Rates of lateral and vertical movement
- Time spent at the surface between dives
- Time spent at depth
- Time spent in and between behavioural states



We model the acoustic exposure for each animat and compare it to exposure criteria to determine the probability of animals encountering various levels of acoustic exposure. These exposure probabilities provide a measure of the potential environmental impact of an acoustic source.

AMAR G4

Autonomous Multichannel Acoustic Recorder
Generation 4

Underwater acoustic and oceanographic data recorder purpose-built for ultra-low power use and superior data quality

- Low power for long deployments
- 10 TB memory on removable SD cards
- Four 24-bit channels up to 512 ksp/s
- 4 oceanographic sensor channels
- Wi-Fi and Bluetooth enabled

Breakthrough design provides a low noise floor of -150 dB re FS at all sample rates.

Standard (500 m), Deep (2500 m), and Ultra Deep (full ocean depth) models.

Highly configurable duty-cycling and recording options.

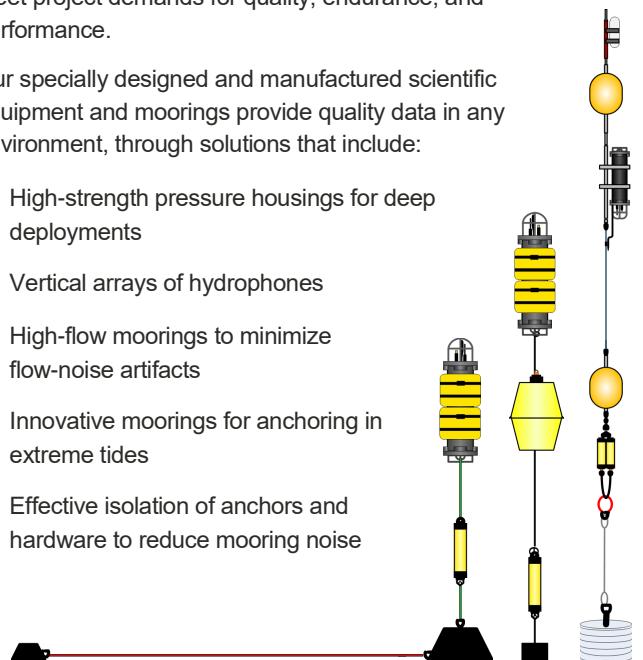


Innovative Solutions

JASCO designs, develops, and manufactures state-of-the-art data acquisition systems and rugged field equipment to meet project demands for quality, endurance, and performance.

Our specially designed and manufactured scientific equipment and moorings provide quality data in any environment, through solutions that include:

- High-strength pressure housings for deep deployments
- Vertical arrays of hydrophones
- High-flow moorings to minimize flow-noise artifacts
- Innovative moorings for anchoring in extreme tides
- Effective isolation of anchors and hardware to reduce mooring noise



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