

# Acoustic Modelling Services



## Predicting Acoustic Footprints of Industrial Operations

Numerical modelling can reliably predict long-range underwater sound propagation from industrial operations. Regulators increasingly recognize the power of predictive models and mandate their use in operational planning. JASCO has the capability to model sound from:

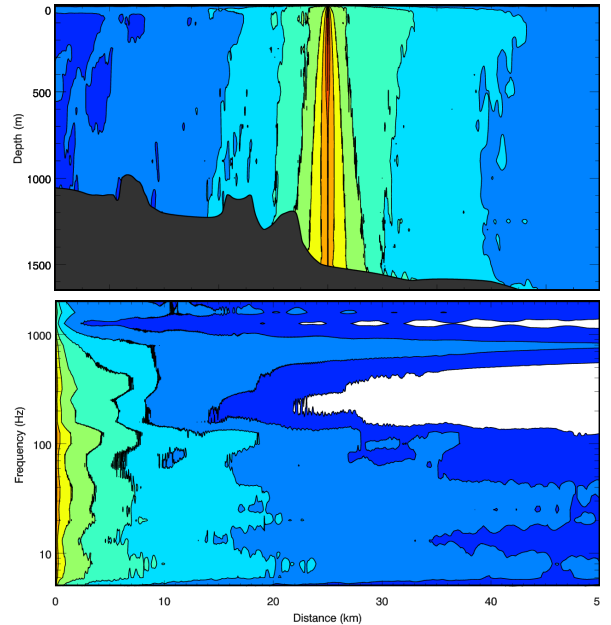
- **Seismic survey sources** such as airgun arrays, water guns, boomers, and vibroseis
- **Active sonar and transducers** such as sub-bottom profilers, multibeam sonar, and side-scan sonar
- **Vessels** such as icebreakers, tankers, tugs, survey and support ships, and vessels holding station using dynamic positioning thrusters
- **Construction activities** such as pile driving, drilling, blasting, dredging, rock dumping, and pipe laying

JASCO's acousticians understand the complex theory, underlying assumptions, and limitations of each method; by consistently applying the most suitable estimation approaches to each project, we avoid pitfalls that could invalidate the conclusions of a study.

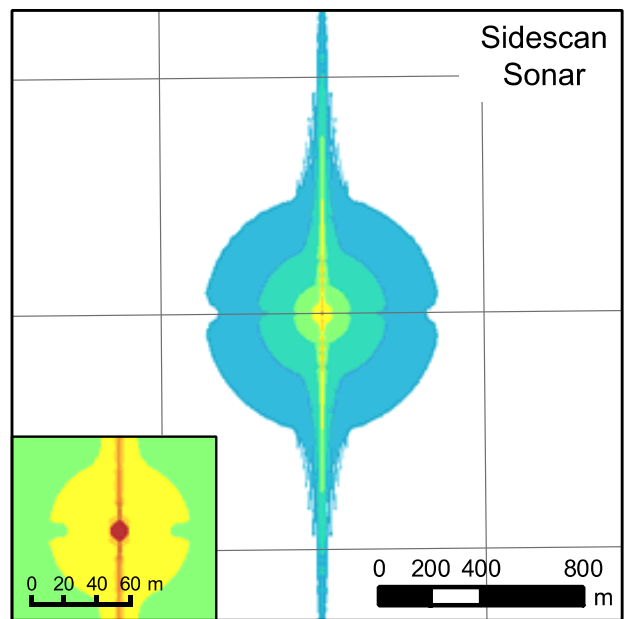
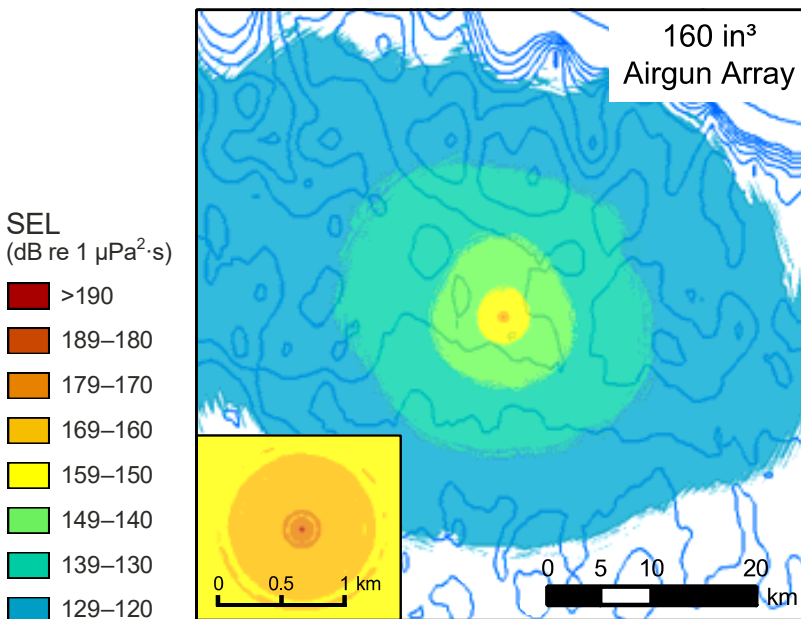
## Actionable, Understandable Results

Model results are explained in practical terms, directly related to your operations:

- Mitigation recommendations
- Effects on marine mammals, reptiles, and fish
- Exclusion zones for marine mammal observers
- Sound level maps of affected areas, easily interpreted by your stakeholders



Modelled sound exposure levels with (top) depth and (bottom) frequency



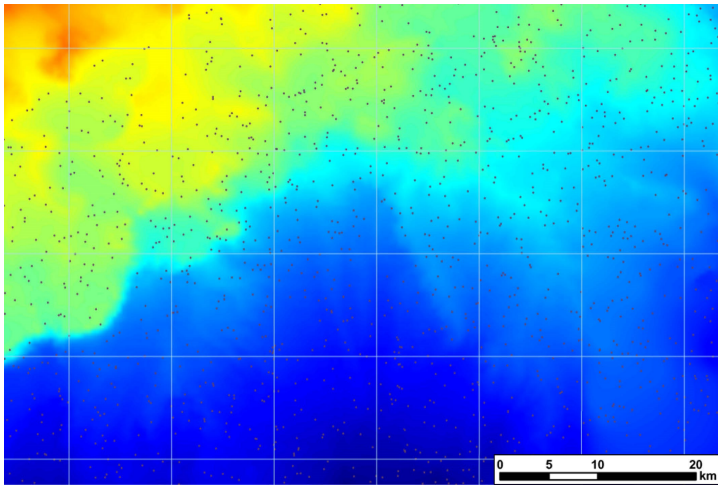
JASCO models sound exposure from all industrial sources of underwater noise

## Impact Assessment: Animal Movement Modelling

With the Marine Mammal Movement and Behavior (3MB) model and sound fields modelled by JASCO, simulated marine animals are exposed to 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:

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

We compare the acoustic exposure of each animal to response criteria to determine exposure probabilities, which quantify the potential environmental impact of the acoustic source.

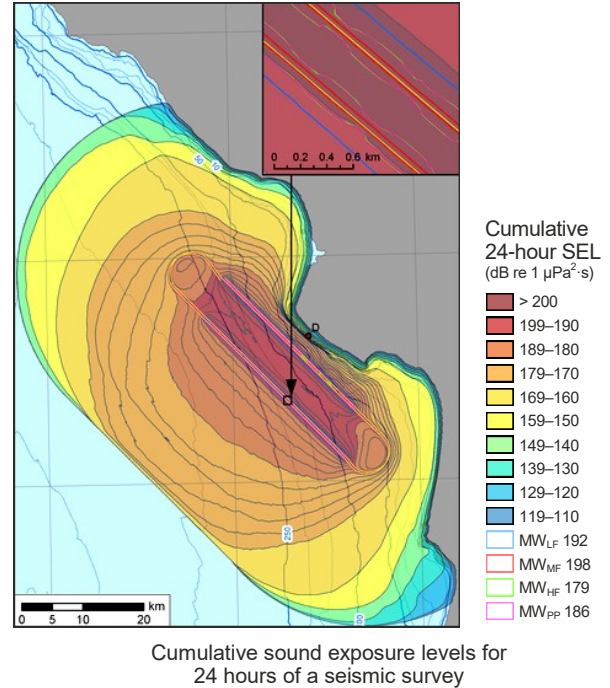


Seeding locations of sperm whale animals for impact assessment

## Exclusion Zones for Observers

Our model results include all regulatory exclusion zones for use by marine mammal observers during ongoing operations and sound level maps of affected areas that are easily interpreted by all project stakeholders.

## Cumulative Sound Exposure



## Advanced Modelling Algorithms

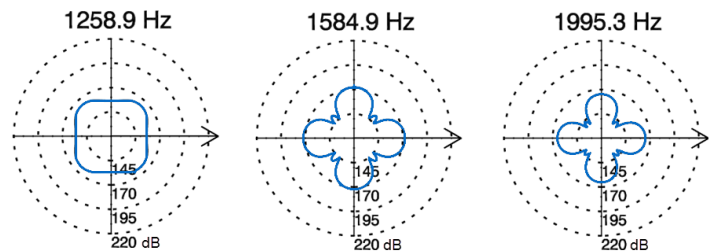
Our in-house numerical models have been applied to acoustic impact assessment and mitigation contexts worldwide. We continually develop and refine our acoustic models to uphold all recognized standards in underwater acoustic modelling:

- Sound propagation at low and high frequencies
- Acoustic signatures of industrial sources
- Full-waveform range-dependent propagation
- Accurately resolved close-range sound propagation and particle velocities

Our models draw from our extensive database of industrial noise measurements stemming from over 30 years of underwater acoustic data collection and analysis.



ISO 9001 Certified



Directivity of an airgun array at various frequencies

For more information, contact your nearest JASCO Applied Sciences office:

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