exail

SOLUTIONS FOR EARTH MONITORING

Gravimetry

Absolute Quantum Gravimeter
Turn-key transportable quantum gravity sensor for reservoir monitoring, hydrology, seismology and civil engineering

Rotational seismometry

blueSeis-3A
Portable 3-component broadband absolute rotational seismometer

blueSeis-1C
Portable 1-component very-low-noise broadband rotational seismometer

Seistans
Optical gyrocompass for seismic stations
True North orientation

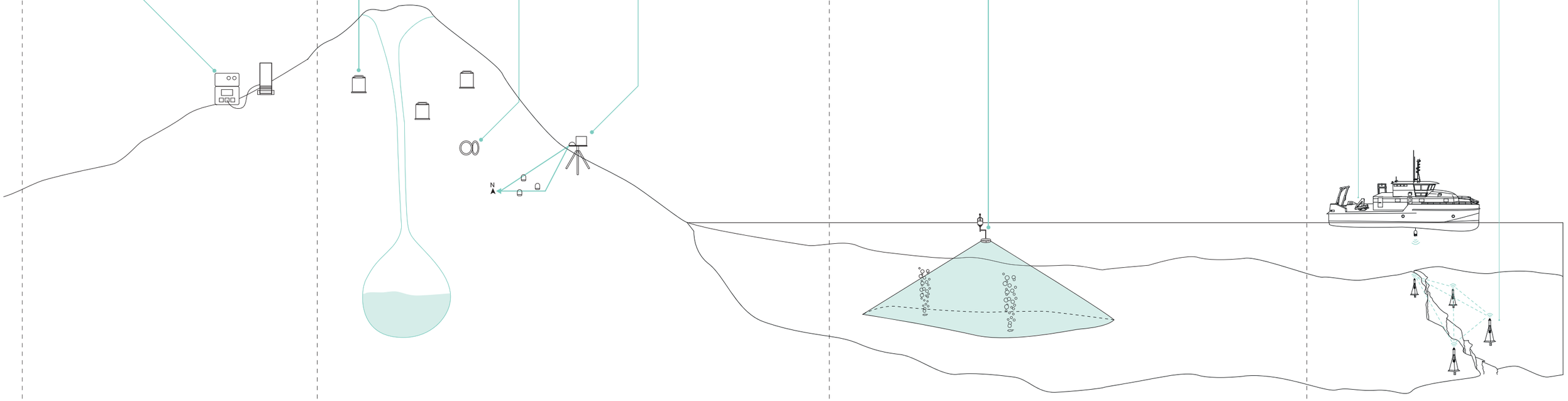
Volcanic degassing

SeapiX-R
3D sonar for underwater gas bubbling monitoring

Rift monitoring

Delph Subsea Positioning
Subsea operations supervision Software
+
Hydrins
High-grade Inertial Navigation System for hydrographic surveys
+
Gaps Series
USBL systems for subsea asset positioning and tracking

Canopus
Intelligent LBL transponders for rift monitoring
+
Ramses
Intelligent LBL transceivers with modem capabilities



GRAVIMETRY

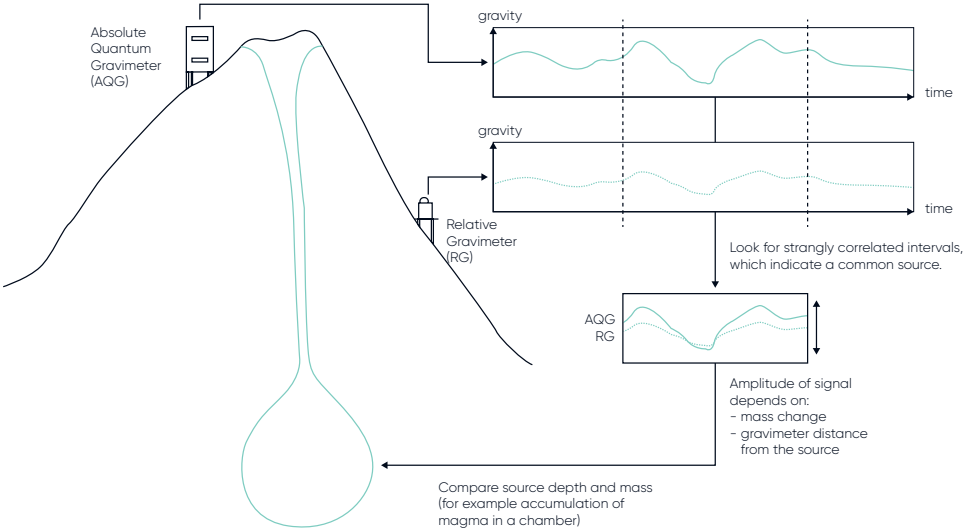
A FREE-FALL ABSOLUTE GRAVIMETER BASED ON LASER-COOLED ATOMS

Exail Absolute Quantum Gravimeter (AQG) is the first commercially available turn-key transportable quantum sensor for high-precision gravity measurements.

It offers very attractive features for high-precision gravity measurements:

- absolute gravity measurement at a level of 10^{-8} m/s^2 (1 µGal) in terms of sensitivity, stability and repeatability
- continuous data acquisition from a few seconds to several years
- transportable device allowing to perform surveys, time-lapse measurement of a network of reference stations or stationary measurements with the same instrument

This makes the AQG highly suitable for a wide range of applications such as geophysics reservoir monitoring, geodesy, metrology and sub-surface imaging for civil engineering.



Sensitivity (at quiet site)	50 µGal/Sqrt (t) 5 µGal in 1.5 min 2 µGal in 10 min 1 µGal in 40 min
Cycling frequency	> 1 Hz
Stability	< 1 µGal typically
Repeatability	≤ 2 µGal
Accuracy	few µGal

Continuous absolute measurements from a few seconds to several months. Data averaging time can be changed at will by the user depending on the application. Sub-µGal stability can be achieved with longer averaging time.

ROTATIONAL SEISMOMETRY

A UNIQUE AND RELIABLE PRODUCT LINE FOR ROTATIONAL SEISMOMETRY

Exail blueSeis series offers unique, reliable and portable solutions that are opening up a broad field of possibilities for geosciences. and Earth Monitoring. Based on the Fiber-Optic-Technology (FOG) technology, Exail blueSeis series now gives the possibility to explore rotational ground motions, thanks to rotational seismometers (1 to 3 axes). Long awaited by seismologists throughout the world, they truly revolutionize the seismology market by allowing complete measurement of a seismic wave: including translational and rotational movements of the ground.

Adopted by many institutes involved in earth physics and building monitoring, the blueSeis-3A proved its efficiency and robustness on the field.

A FIBER-OPTIC GYROCOMPASS FOR SEISMOMETER TRUE NORTH ALIGNMENT

A prerequisite for trustworthy 6-axis seismology measurements, Seistans is a fully strapdown gyrocompass and attitude reference system. It provides all necessary data to guarantee perfect sensors alignment to the true North. The Seistans can be used as a standalone system. Once adjusted on users own alignment device and plugged into a laptop, the user-friendly MMI helps orientate the system to the true North. It can be docked onto the blueSeis-3A.

blueSeis-3A

blueSeis -1C

Seistans

Axes	3 axes	monoaxe
Passband	Flat from DC to 50 Hz	Flat from DC to 200 Hz
Sensor Self Noise (without electronic acquisition system)	20 (25) from 10^{-2} to 50 Hz	5 (6) from 10^{-3} Hz to 200 Hz
Dynamic range	0.5 rad/s 125 dB LSB = 116 picorad/s 32 bit	0.1 rad/s
Operating / storage temperature	-10 to 50 °C / -40 to 80 °C	-30 °C to 80 °C / -40 to 80 °C
Power consumption	19W @12V	19W
Dimensions	h-335 x ø-318 mm	Height 48 mm Ext. ø 400 mm Int. free ø 260 mm
Weight	20 kg	3.5 kg

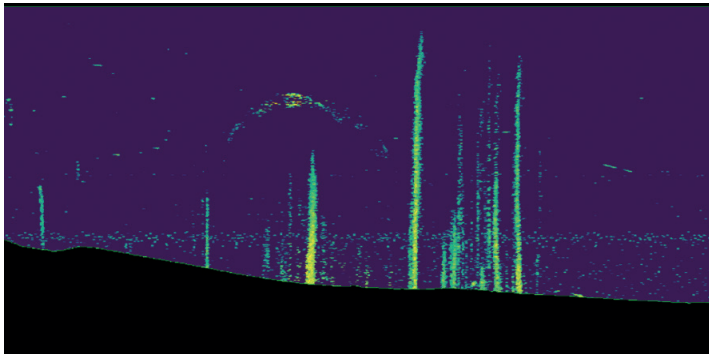
Precision pins laserline	± 0.25°
Heading accuracy	0.23 deg RMS secant latitude ‹–› 0.7 deg Maximum secant latitude
Settling time	< 30 mn (all conditions), 0.7 deg in 15 mn
Dynamic range	250 deg/s
Operating / storage temperature	-20 °C to 55 °C / -40 °C to 80 °C
Power consumption	10 W
Dimensions	160 (L) x 160 (W) x 113 (H) mm
Weight	2.8 kg

VOLCANIC DEGASSING

VOLUMETRIC SONAR FOR HIGH PRECISION FORECASTING OF UNDERWATER VOLCANIC ENVIRONMENTS

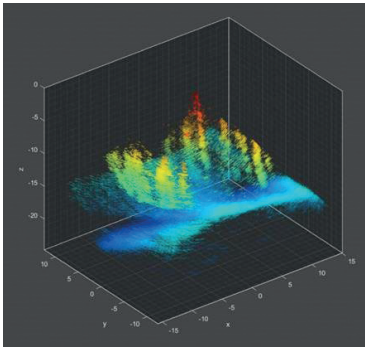
Seapix-R is a solid-state 3D multibeam sonar that provides accurate water column coverage and seabed mapping. It brings new insights to the scientific community for the evaluation and the monitoring of underwater volcanic environments.

Seapix-R Mills Cross configuration enables both arrays to alternately act as a transmitter and a receiver. Its steering capability scans, in real time, an entire volume of water column at 120°x120°. This enables full observation of the various elements found in the water column such as gas bubbling. As a static hydroacoustic monitoring platform, Seapix-R can act as a powerful early warning system for volcanic eruptions.



Gas flares from the Laacher See volcanic lake (Germany)

Applications	Gas bubbling - biomass monitoring
Frequency	150 Khz
Modulation	CW and CHIRP
Across track multibeam swath	64 channels, stabilized
Along track multibeam swath	64 channels, stabilized
Beam Stabilization	TX + RX, built-in MRU
Beam resolution	1.6° angular
Triple echograms from all swath	Adjustable from 1° to 120° each
Typical range	Biomass 400m, Bathymetry 600m
Volume resolution	0.6m³ @100m
Volume coverage	120° X 120°
Signal processing	SV, TS, NORM, calibrated



4D monitoring of gas flares using Seapix in static positioning

RIFT MONITORING

ADVANCED ACOUSTIC SYSTEMS FOR FAULTS MONITORING

Exail Canopus transponders offer high-accuracy acoustic positioning systems for long-term geodetic operations. Particularly suited for tectonic plates or crustal deformation monitoring, they enable better characterization of faults behaviors and give access to valuable information on seismic risks.

Placed on each side of the faults, they measure the travel-time to one another to precisely determine their mutual distance, and thus the fault's behavior. Featuring underwater acoustic communication between transponders, transceivers and surface equipment for advanced data retrieval, they also embed environmental temperature, pressures, sound velocity and inclinometer sensors.

Their capabilities (corrosion prevention, external sensor management, extended lifetime option) make it the best underwater fault monitoring solution in terms of accuracy, reliability, and ease of use.

Designed for geodetic applications:

- Extended life time option
  - Lithium battery pack for 4-year deployments
- Sensors management
  - Interface with high-accuracy external temperature sensor
  - Measurements synchronized with ranges
- Corrosion prevention
  - Anodes kit and appropriate materials for release hook and protective guards

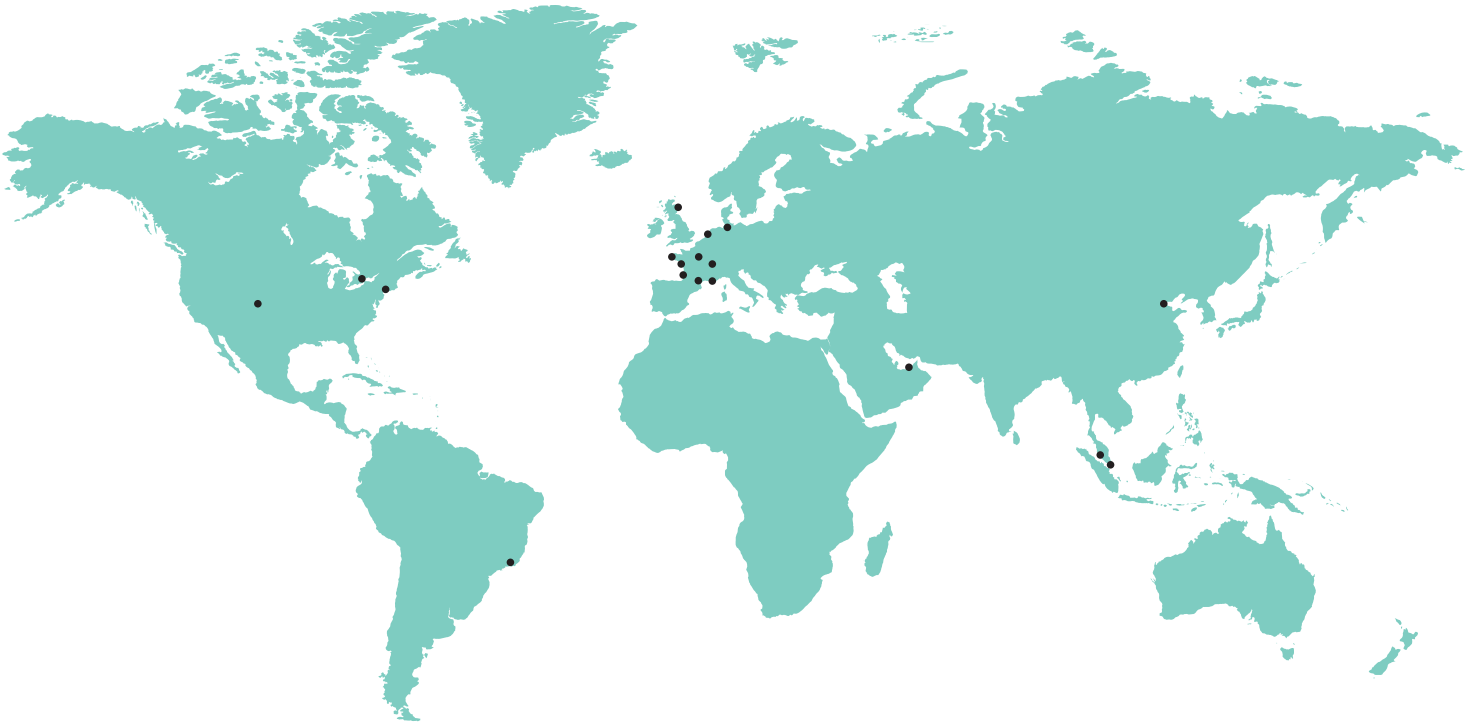
Ramses

Sparse-LBL transceiver

Canopus

Intelligent LBL tranponder

Depth rating	4,000 m	4,000 m
Accuracy (mm)	< 10	< 10
Autonomy (pings at max sound level)	n/a	2,800 000 (alkaline)
Transducer beam shape	Omnidirectional	n/a
Data telemetry	Yes	Yes
Data logging (Gb)	32	32



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