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SonarPoint™

The High-Capability Sound Recording & Localization Toolkit



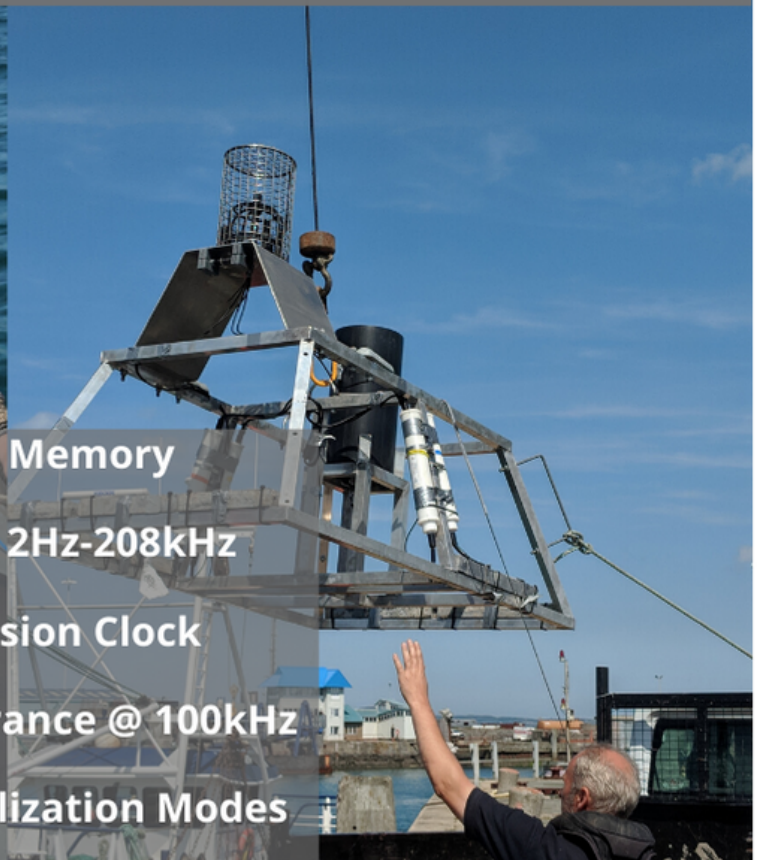
8000 GB Memory

Bandwidth 2Hz-208kHz

GPS Precision Clock

290 Day Endurance @ 100kHz

Multiple Localization Modes



Acoustic Monitoring & Localization

A couple hundred meters off the shore of Holyhead in North Wales, a new machine quietly glides through the ocean, racing in a figure-eight pattern, while posing some important questions. Just above a seabed depression at 80-100m depth, Minesto's Deep Green tidal kite is harnessing energy from natural ocean tides, paving a new path of reliable renewable energy for our society's future. It is here where those crucial questions will be answered, not only about our species stake in the world but also our relationship and impact on the environment. As Deep Green glides through the ocean, SonarPoint™ recorders sit clustered on low seafloor frames, passively monitoring the acoustics of the surrounding area. Sets of four precision synchronized recorders are linked to a tight tetrahedral hydrophone array of just 15cm baseline length. The question Minesto seeks to answer is this:

"What kind of impact and relationship will Deep Green have on local marine life?".

The recorder clusters deployed for Minesto's project yield intersecting 3D vectors to vocalizing dolphins, porpoises, and whales, thus illuminating their interaction with the gliding Deep Green kite. New systems like SonarPoint™ are, therefore, instrumental to verifying that future and current technologies work within the context of environmental protection.

This brochure is the story of how SonarPoint™ is advancing practical underwater acoustics monitoring, so why don't you come explore with us?

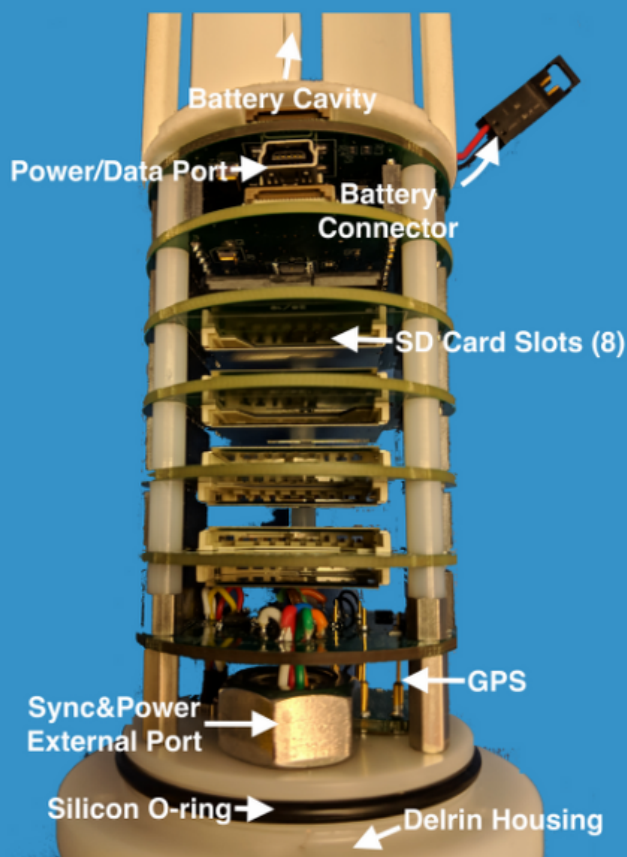


Tetrahedral arrays linked to four sub-sample synchronized SonarPoint recorder clusters localizes dolphin vocalizations while keeping the water volume around Minesto's flying turbine free of mooring strings.

SonarPoint™ Overview

SonarPoint™ is a modular system for sound recording and localization. Depending on your application, you may use non-localizing recorder(s) of the SR series. Or you may use the sound localizing SP system:

1. Multiple SonarPoint™ Recorders – SP300-2/SP300-8/SP1000-8
 2. Synchronization Pinger – Time sync underwater recorders, SPP1000-34/
 3. Surface Repeater – Radio or satellite transmitter w/ solar power, SRB
 4. Acoustic Releases – Remotely retrieve underwater systems, ARC-1XD
 5. Surface Station - Interrogate the ARC-1XD remotely
- External Battery Pack - SPB-350AH extends battery life by factor of 5



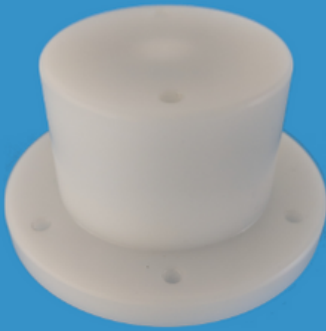
Model	Memory	Max Depth	Endurance ₁ @ 100kHz	Endurance ₁ @ 312.5 kHz	Endurance ₂ @ 416.7 kHz
SP300-2	2 SD's 2000 GB	300 m	16 days ₃	10 days ₃	6 days ₃
SP300-8 /SP1000-8	8 SD's 8000 GB	300 m / 1000m	60 days ₃ 290 days ₅	41 days ₃ 30 days ₄	23 days ₃ 111 days ₅

1: With Lexar Pro 512GB cards. 2: With SanDisk Extreme PRO 512GB cards (for > 312.5 kHz). 3: Wireless (acoustic) synchronized 4: Wire synchronized 'sample clock propagation' mode. 5: With SPB-350AH external battery pack in wireless synchronized mode. Memory limited at 416.6 kHz, battery limited at 100 kHz.

Hydrophones: Performance & Flexibility

SH33/SH125 - Endcap Integrated

HTI-99-UHF: Free field



SonarPoint combines very low noise and high sample rate analog to digital conversion with a choice of hydrophones that give you the best trade-off of low-noise performance, fidelity, bandwidth, ruggedness, and cost.

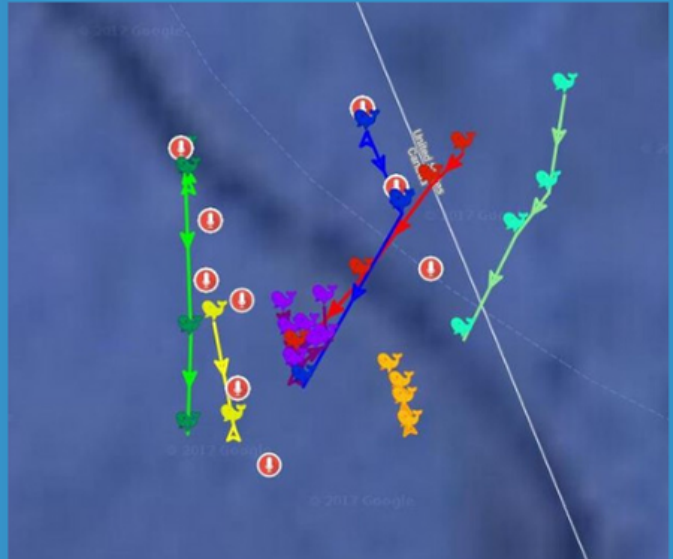
- **Cable connected** (free field) hydrophones offer the best sound fidelity and the lowest system noise. Placement of the hydrophone in isolation of the recorder means sound reverberations associated with endcap mounted hydrophones are avoided. Distance from electronics translates to the lowest noise.
- **Endcap integrated** hydrophones are available with bandwidths of 33 kHz (SH33) or 125 kHz (SH125). These make for very rugged and survivable recorder installation while offering a jumper and resistor/capacitor configurable pre-amplifier that provides excellent flexibility for frequency selection and sensitivity.

Model	Sensitivity	Freq. Response	Form	Price
HTI-99-UHF	Full scale 155 dB re. 1 μ Pa Noise 15 dB re. 1 μ Pa / $\sqrt{\text{Hz}}$	2Hz- 250kHz	Free- field	\$3,000
SH33	Full scale 130-240 dB selectable Noise 100-120 dB below FS.	2Hz- 33kHz	Endcap	\$700
SH125	Full scale 130-240 dB selectable Noise 100-120 dB Below FS.	2Hz- 125kHz	Endcap	\$700

Sound Source Localization

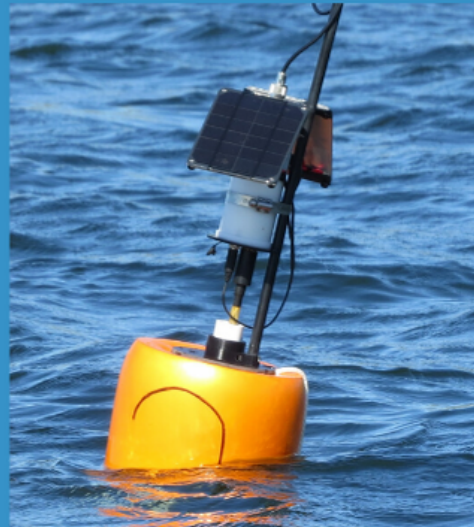
Sound source localization arrays work by obtaining precisely time-synchronized acoustic recordings from three or more hydrophone locations. SonarPoint offers you three synchronization options to cover a variety of applications.

An array of drifting recorders (red circles) resolves the tracks of seven migrating killer whales in the Strait of Juan de Fuca. Analysis by Bio-Waves Inc.



Submerged Mooring Array

A set of sub-surface moorings is deployed. Each recorder's internal GPS module sets then calibrates its high-precision oscillator prior to deployment. Observed clock drift is 0.25m – 0.5m signal run time equivalent per hour between recorders. This is sufficient for short deployments (hours). For extended deployments, a synchronization pinger is added to one mooring string. Recorders are re-synchronized with a ping emitted once per recording segment.



Drifting or Moored Array

Rapidly deploy a drifting array around a group of migrating animals, or use a moored array for permanent monitoring. Recorder is suspended below a SRB repeater buoy. The buoy provides GPS time synchronization, radio or satellite location & status reporting, and solar power.

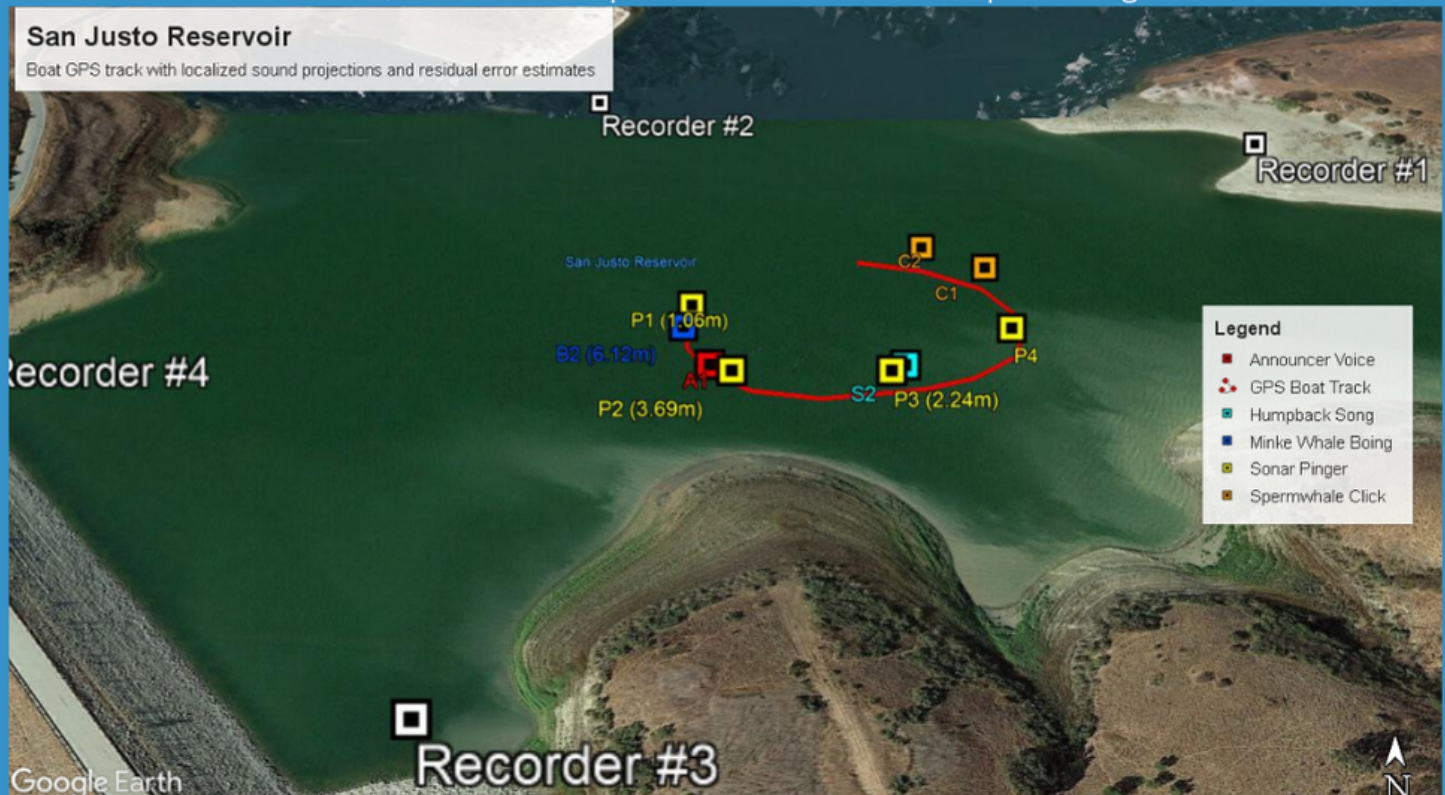


Wired Array

Cluster multiple recorders in a wired array. Sample clock propagation yields deep sub-sample synchronization. Clustering yields cumulative memory, power, fault tolerance and flexibility. Configure as tetrahedral arrays yielding intersecting 3-D vectors within an unobstructed water volume, or tow as a linear array.

SonarPoint™ Software

Long-term acoustic monitoring produces massive amounts of data (up to 8000 GB per SonarPoint recorder). The processing of these large datasets quickly becomes a time-consuming bottleneck. For this reason, SonarPoint emphasizes automated batch processing.



Processing Chain

Software Function	Name	Data Input	Data Output
Recorder Config	SP-DOCK	Config parameters	Recorder ready to deploy
File Recovery	SP-READ	Raw Data on SD cards	Single channel .wav
File Merge&Sync	SP-MERGE	Single-Channel .wav files	Time sync multi-channel .wav
Event Detection&Timing	SP-DETECT	Multi-Channel .wav files	.csv w/event times
Event Localization	SP-LOCALIZE	.csv w/ event times&hydrophone positions	.csv w/event location and vector

Analysis of SonarPoint Data

Bio-Waves Inc. brings decades of bioacoustics analysis experience for post-processing and analysis of data collected with the SonarPoint system. They can provide services for experimental and monitoring design, acoustic-based abundance estimation, manual and semi-automated signal detection classification and localization including advanced data analysis where leading-edge detection is not sufficient.

www.biowaves.net

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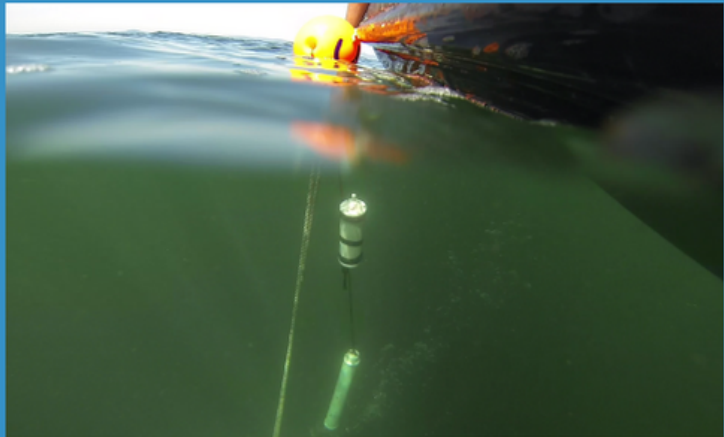


Retrieval by ARC-1XD Acoustic Release

A patented fusible link acoustic release is used to quickly and reliably retrieve submerged arrays or other scientific gear. Starting at the bottom end, a sub-surface mooring string is attached with a sacrificial weight (eg. sandbag), ARC-1XD, SonarPoint™, and sub-surface buoy for retrieval.

Deploy

A surface command is sent to trigger a release event. A fusible link is evaporated in fractions of a second, allowing the release lever to open.



Release

A surface command is sent to trigger a release event. A fusible link is evaporated in fractions of a second, allowing the release lever to open.

Retrieve

Upon release from the sacrificial weight the surface buoy floats the mooring string to the surface.



Equipment	Use	Qty	Price
ARC-1XD Acoustic Release Control 1 Extended Duration	Control of remote release events with patented fusible link.	1-9	\$1,995
		10-49	\$1,700
		50-99	\$1,600
		100+	\$1,550
STM-3 Surface Transponder Module v.3	Interrogation of ARC-1XD via remote surface commands.	Price	
		\$8,000	

- **Battery Endurance:** 50 release cycles and 2 years
- **Depth Rating:** 300-500m
- **Any anchor weight**
- **Lifetime:** 15-20 years
- **Non-corrosive titanium and delrin material**
- **Precision Ranging**

SonarPoint™ Pricing

Model	Price Hydrophone included - SH33/125
SP300-2	\$3,500
SP300-8	\$6,000
SP1000-8	\$7,000

Repeater Buoy & Synchronization Pinger

Equipment	Use	Specs	Price
Synchronization Pingers	Time synchronize multiple arrays for localization. Pinger tuned 1PPS signal for "true time" via satellite before submersion.	<ul style="list-style-type: none"> 192dB 1000m depth rating 34kHz ping frequency Battery endurance approx. 1 year Range approx. 600-2200m 	\$4,000
SPP1000-34			
SP1000-8		<ul style="list-style-type: none"> 8kHz ping frequency Range approx. 800-5300m 	\$6,000
Repeater Buoy	Position fix for tracking and retrieval of surface arrays. A-fixed with solar panels and transmitter.	<ul style="list-style-type: none"> GPS synchronizer Argos transmitter 100m tether&cable Argos ID not included Argos transmission fees not included 	\$5,000
SRB-SAT			
SRB-RFM		<ul style="list-style-type: none"> RF modem for local use No Argos transmitter 	\$4,500

ARC-1XD

Equipment	Use	Specs	Qty	Price
ARC-1XD Acoustic Release Control 1 Extended Duration	Control of remote release events with patented fusible link.	<ul style="list-style-type: none"> Battery Lifetime - 50 releases or 1 year Depth Rating - 500m Anchor weight - Any Flotation weight - 36kg Lifetime - 15-20 years 	1-9	\$1,995
			10-49	\$1,700
			50-99	\$1,600
			100+	\$1,550
STM-3 Surface Transponder Module v.3	Interrogation of ARC-1XD via remote surface commands.	<ul style="list-style-type: none"> Individual or broadcast release Over-the-side transducer Tablet included Software included ARC-1 spare parts 	Price	
			\$8,000	