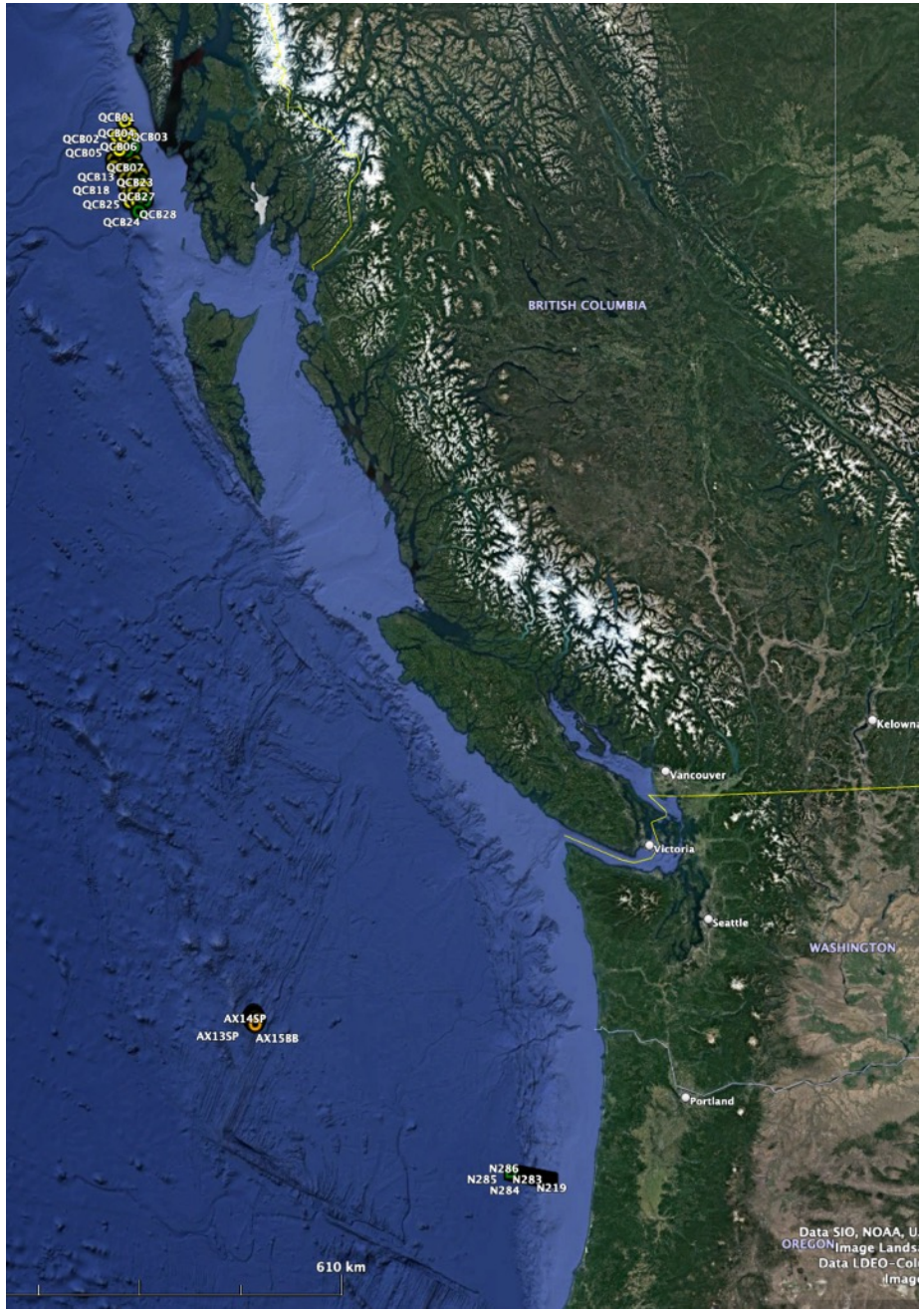
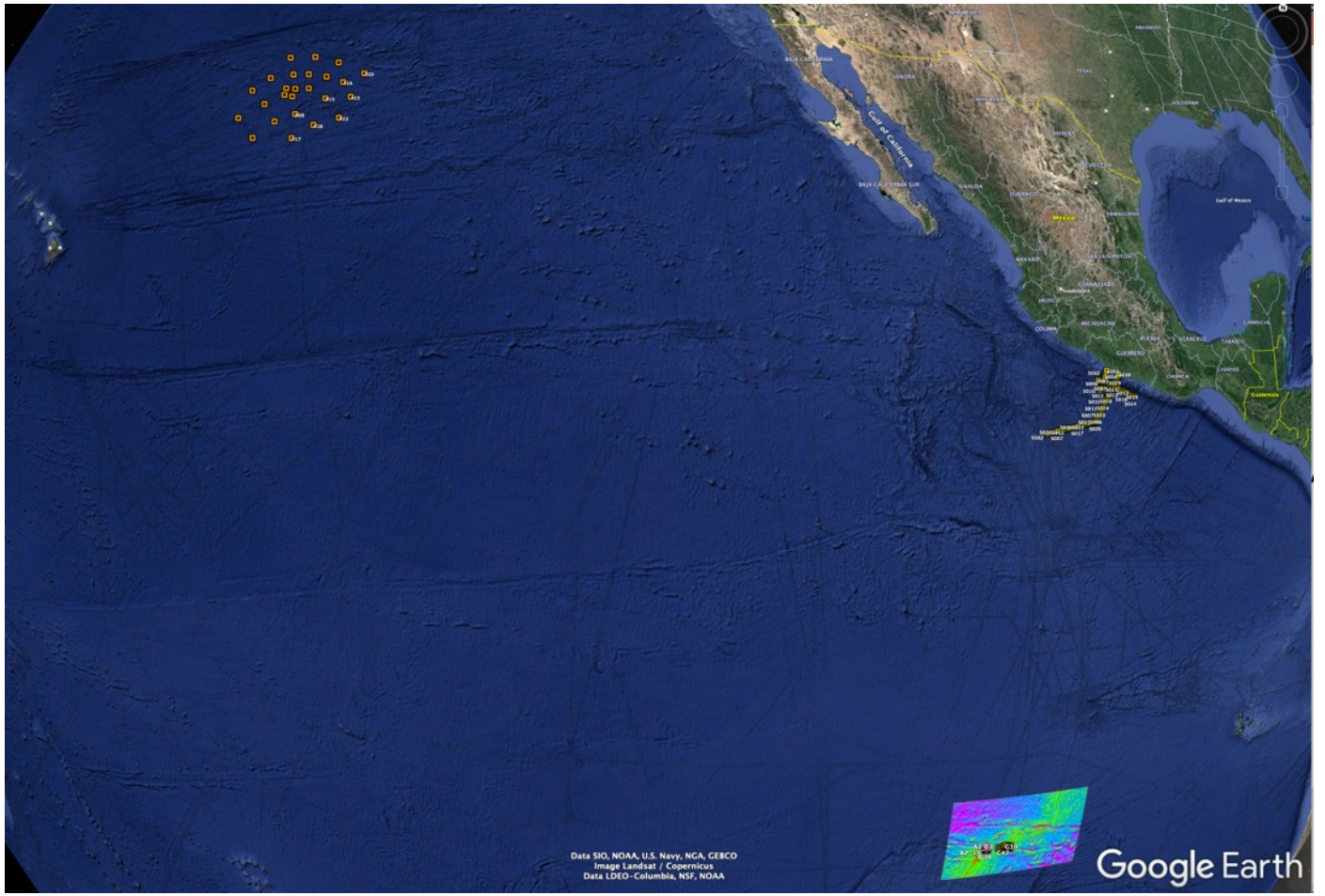
MSROC Meeting, Chicago, December 11, 2022

- General Update for last ~12 months
- COVID/Supply Chain Impacts
- New Instrument Testing
- Instrument Numbers and Types
- MSRI Instrumentation
- Rapid Response Capability
- OBSIC Data Metrics Hub

OBSIC Experiments 11/01/2021 – Present



- OHANA Deployment (25 BBOBS for 1 year; *G. Laske*)
- Gofar Year-2 Recovery; (51 SMOBS/BBOBS/SPOBS; *M. Boettcher*)
- Guerrero Gap, Active-Source (33 SPOBS; 134 drops; *A. Becel*)
- Axial Seamount (10 SPOBS; 5 BBOBS; *W. Wilcock*)
- Queen Charlotte Fault Passive-Source Recovery (28 BBOBS, *L. Worthington*)



Data Submissions

- Cascadia Active Source (*P. Canales*); Network Code: YR:2021; Assembled Data Set #: 21-008.
  Navy Redacted; All data at DMC in SEED and SEGY format.

- Queen Charlotte Fault Active-Source (*L. Worthington*): Network Code: YI: 2020-2022;
  Assembled Data Set #: 21-012.
  Data returned by Navy October 14. Opted not to redact. All data at DMC in SEED and SEGY format.

- Gofar Transform Fault (*M. Boettcher*); Network Code: 8A:2019-2022; Years 1 and 2 data at DMC.

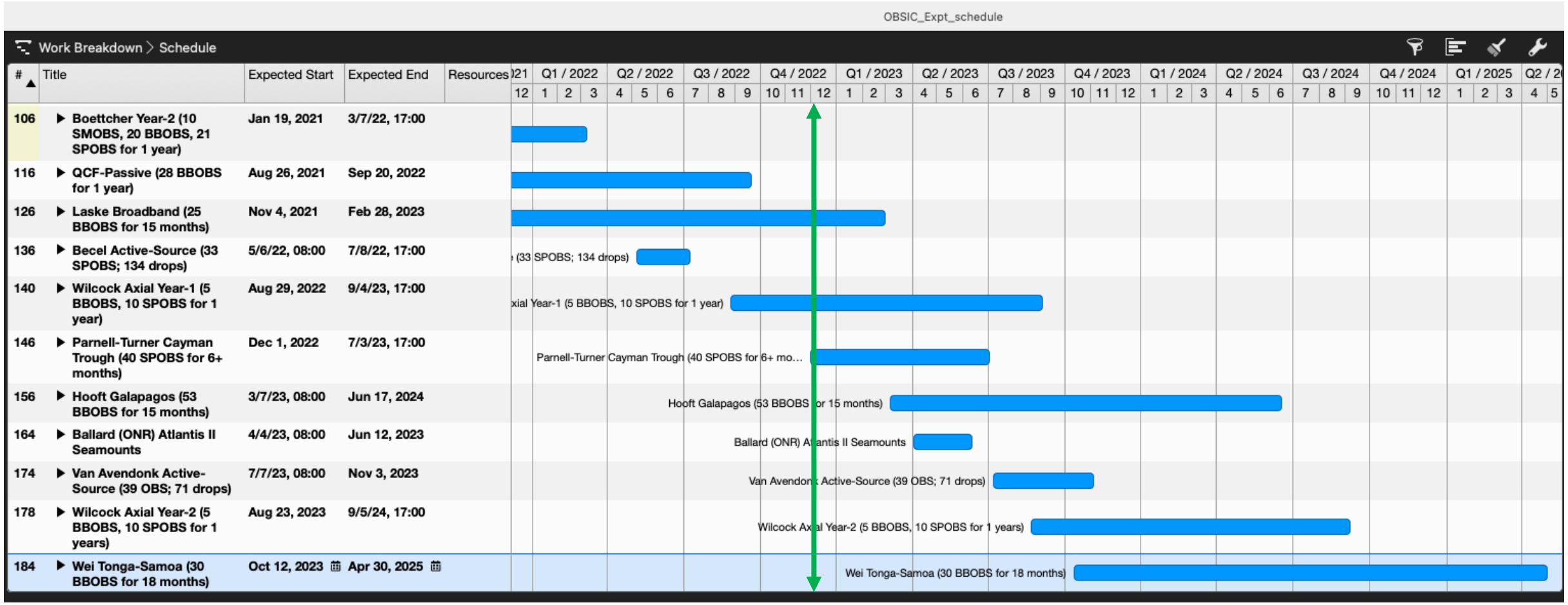
- Guerrero Gap (*A. Be*cel): Network Code: X4:2022; Assembled Data Set Number: 22-008.

- Queen Charlotte Fault Passive (*L. Worthington*):: Network Code: YI: 2020-2022;
  Data returned by Navy Nov. 1. Opted not to redact. Waiting for clock-corrected APG data.

Upcoming OBSIC Cruises 2022/2023

Parnell-Turner Cayman Rise Seismicity (Deployment) 11/30/2022 – 12/19/2022	SIO; 40 SPOBS for 6+ months R/V Langseth; Ponce, Puerto Rico/Tampa
Laske Pacific Anisotropy *(OHANA)* (Recovery) 01/19/2023 – 02/14/2023	SIO; 25 BBOBS for 15 months R/V Sally Ride; San Diego/San Diego
Hooft Galapagos Plume-Ridge (Deployment) 03/07/2023 – 04/14/2023	WHOI; 53 BBOBS for 15 months R/V Langseth; Panama/Galapagos
Ballard 3-D Acoustic Propagation at the Atlantis II Seamounts 04/04/2023 – 04/22/2023 (Deploy) 05/28/2023 – 06/12/2023 (Recovery)	WHOI; 3 SPOBS for 2 months R/V Armstrong (WHOI/WHOI) R/V Endeavor (WHOI/Narragansett, RI
Parnell-Turner Cayman Rise Seismicity (Recovery) 08/12/2023 – 08/30/2023	SIO; 40 SPOBS R/V Langseth; Norfolk/Jacksonville
Miller (USGS) Skilaq Lake (Kenai Penn.), AK	2 BBOBS
Van Avendonk Rift Dynamics Carolina Trough (Active Source) 10/09/2023 – 11/03/2023	WHOI/SIO; 39 SPOBS; 71 drops R/V Langseth; Jacksonville /Jacksonville
Wei Tonga-Samoa Interaction (Deployment) 10/08/2023 – 11/06/2023	SIO; 30 BBOBS for 18 months Suva, Fiji/Pongo-Pongo, American Samoa

OBSIC Recent and Upcoming Cruises



Newly Funded Experiments (Spring/Fall 2022)

- Zach Eilon (UC Santa Barbara)
  - *New Imaging of Mid-Ocean Ridge Systems at the Galápagos Triple Junction*.
  - Year-1 Deployment: 44 OBS for 430 days
  - Year-2 Deployment: 38 OBS for 430 days

- Samar Naif (Georgia Tech.) and Jim Gaherty (Northern Arizona Univ.)
  - *Quantifying melt in the mantle and controls on lithosphere-asthenosphere dynamics and intraplate magmatism: a joint electromagnetic and seismic investigation of the Cocos Plate*
  - 27 BBOBS for 1+ year

- Doug Wiens (Washington Univ., St. Louis); Fernando Martinez (Univ. of Hawaii)
  - *Geophysical Study of Ongoing Subduction Initiation Along The Matthew Hunter Trench*
  - 20 BBOBS for 15 months

Not enough OBS to do any of these experiments in 2023!!!!!

OBSIC Formal Instrumentation Requests (06/15/21–12/05/22)

# of short-period OBS requested	Total # of OBS deployments requested	Experiment Location
31	69	Caribbean

Requests for *short-period OBS* to support active-source experiments

# of broadband OBS requested	Data recording duration requested (months)	Experiment Location
10	15	Eastern Pacific
44 (year-1); 38 (year-2)	15 (year-1); 15 (year-2)	Equatorial Pacific
20	15	Western Pacific
30	12	Gulf of Mexico
21	15	South-Western Pacific
20	15	South-Western Pacific
27	12+	Eastern Central Pacific

Requests for *Broadband OBS*

# of strong-motion OBS requested	Data recording duration requested (months)	Experiment Location
5	18 (yr-1); 18 (yr-2); 18 (yr-3); 18 (yr-4);	Central North Atlantic

Requests for *strong-motion OBS* to support earthquake monitoring experiments

# of short-period OBS requested	Data recording duration requested (months)	Experiment Location
14	1	Central North Atlantic
3	1	Western North Atlantic
	12	Central North Atlantic

Requests for *short-period OBS* to support earthquake monitoring experiments

COVID/Supply-Chain Impact on OBSIC Operations

COVID

Two OBSIC cruises impacted by last-minute COVID infections.

- One tech. only to support the Boettcher Gofar OBS recovery cruise.
- One OBSIC tech asked to work on 2 consecutive cruises (Wilcock & Worthington)

Shipping

Increased domestic (>30%) and international costs (fuel costs, driver shortages)

Lithium Batteries

- *Electrochem:* prices up by about 13%; lead time stretched from 2 to 8 months.
- *Tadiran:* prices up by about 30%; lead times stretched out to close to 5 months.
- *"What I can tell you is Lithium was $92/Kilo last Nov and now it is at $483US/Kilo which we paid last week" (April,2022)*

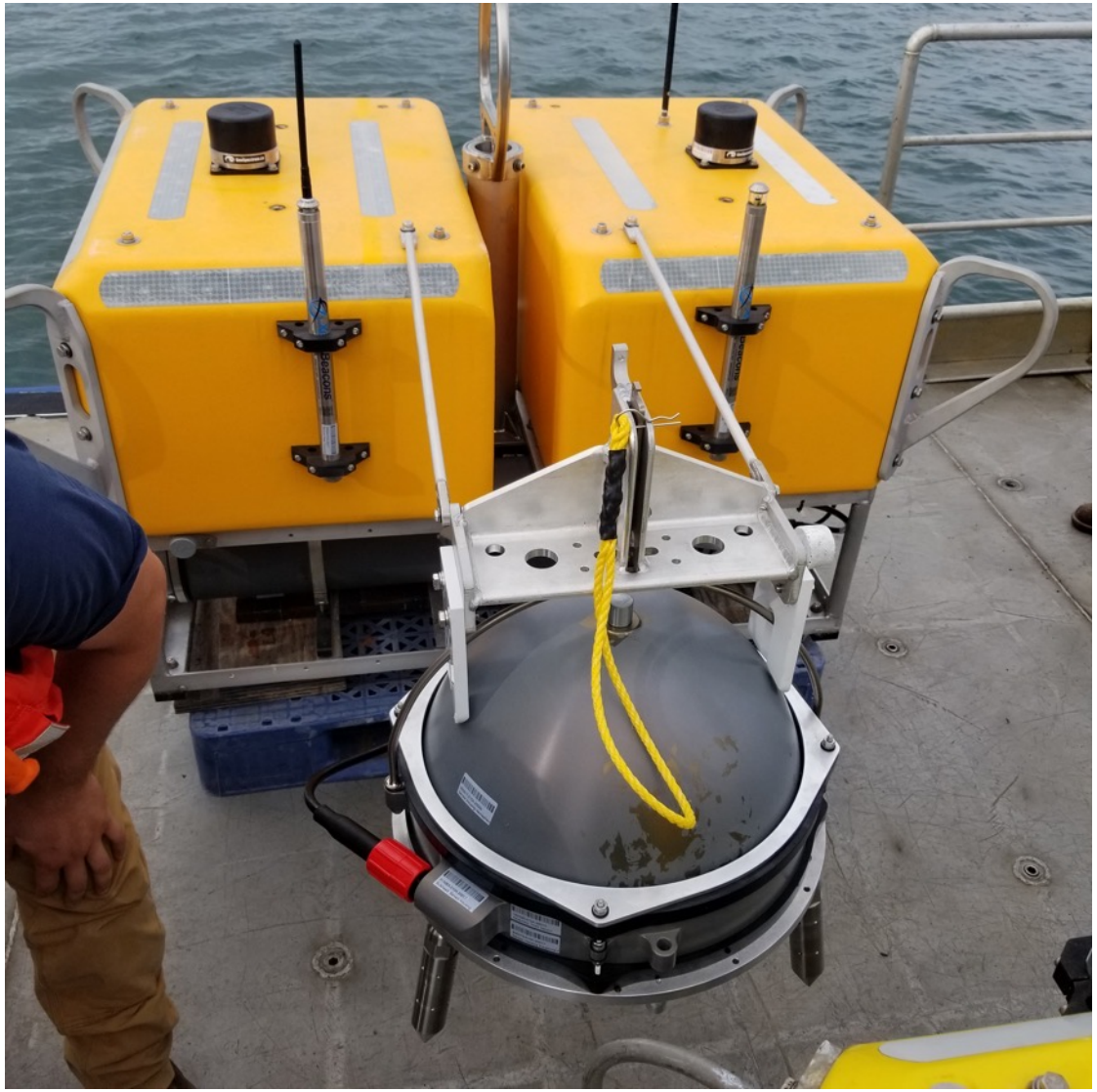
- *Electrochem:* supply chain issues & a slow recovery after letting second shift go during the pandemic.

- Raw lithium metal prices have increased nearly ten-fold since the start of the pandemic, and the supply cannot keep up with the demand driven in part by electric vehicles.

- Other metals important to battery manufacture have significant production in Russia, Ukraine.

New OBS (“Angler”)

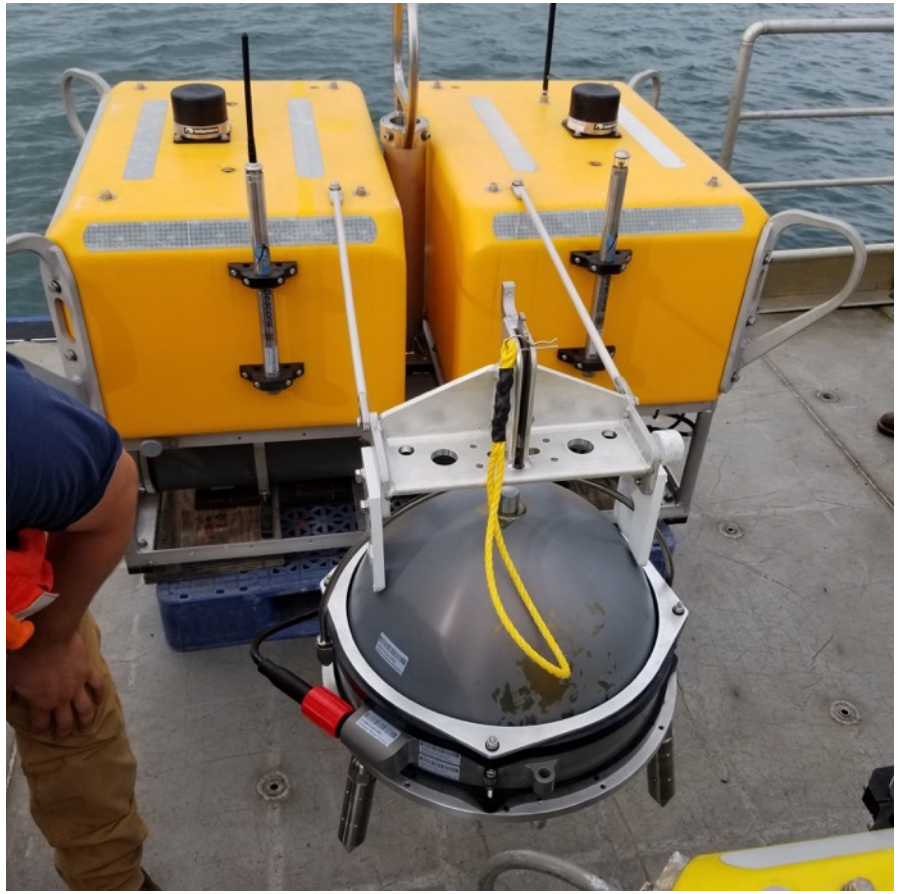
- Nanometrics T-240 seismometer in active levelling system
- Quanterra Q8 data Logger (smaller, lower power, higher sample rates)
- New clock board: Seascan with power-cycled Teledyne
- Old DPG preamp board eliminated
- Dual acoustic releases

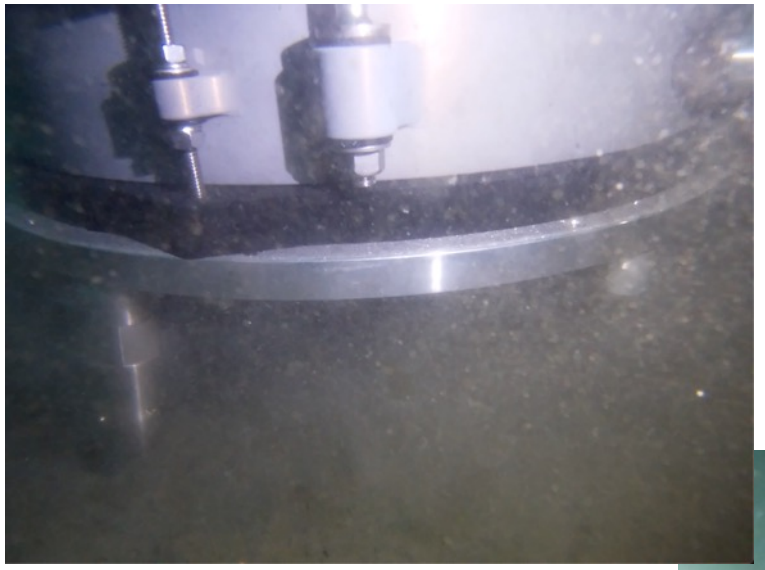


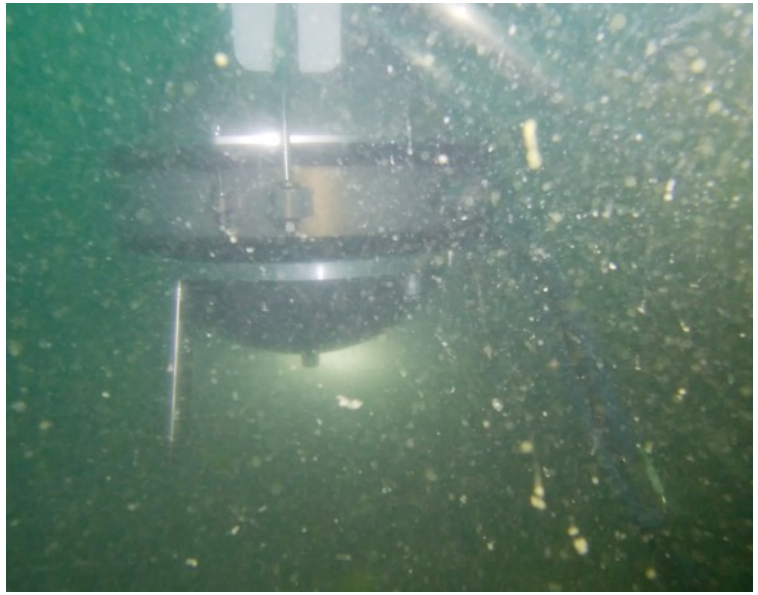
Angler Testing at the Weepeckets: August 11–15

- Deploy Angler, ARRA, and MicrOBS
- Divers for OBS Inspection, seismometer deployment, orientation, OBS lift-off, etc,

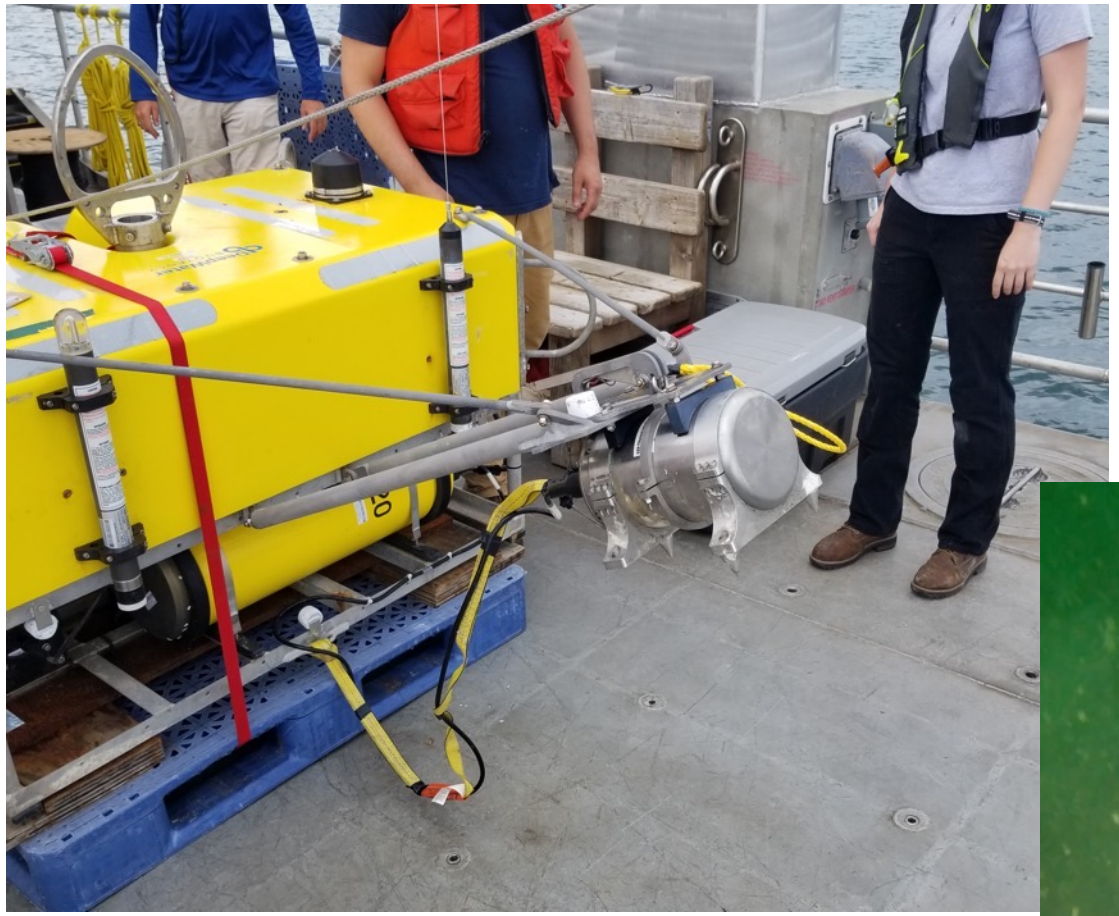
Angler Pics. from Weepeckets Test

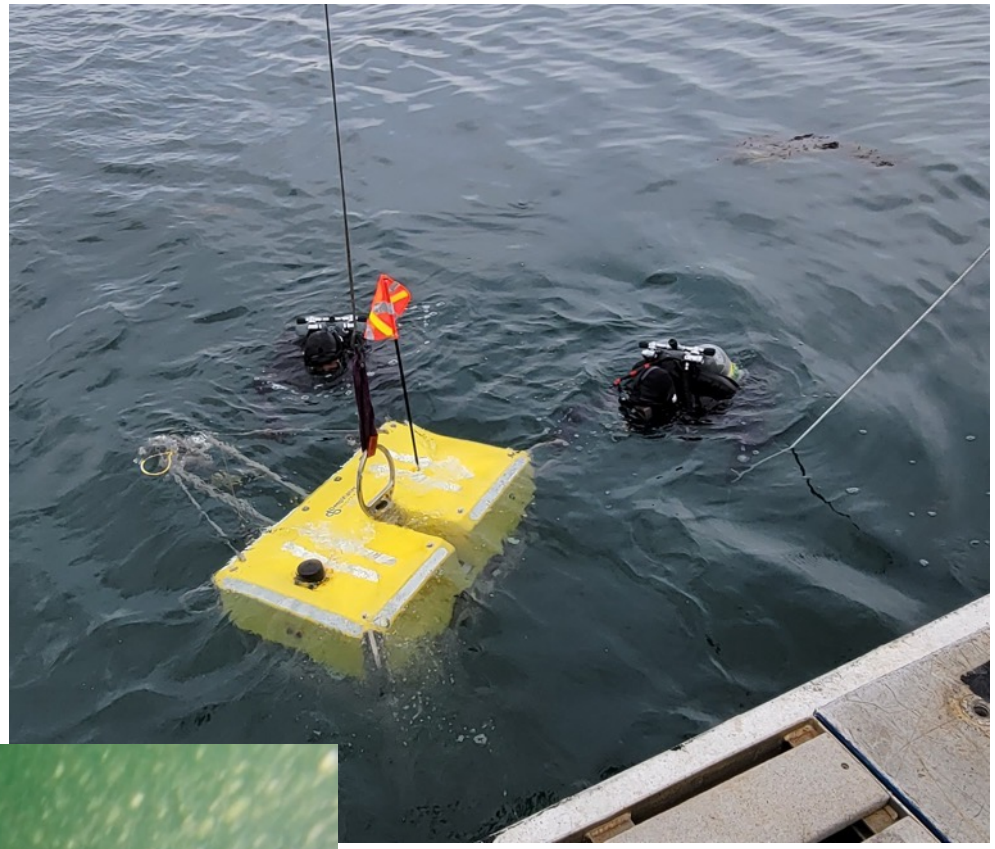






ARRA Pics. from Weepeckets Test





Current OBSIC Fleet

OBS Type	OBSIC Fleet
Short-Period OBS (WHOI "D2")	28
Unshielded Broadband OBS with Guralp CMG-3T seismometer and DPG pressure sensor (WHOI BBOBS)	29
Unshielded Broadband OBS with Guralp CMG-3T seismometer, Kinemetrics Episensor Strong-Motion Accelerometer and DPG (WHOI Keck OBS)	9
Unshielded Broadband OBS with Nanometrics Trillium Compact seismometer and DPG pressure sensor*	18
Unshielded Broadband OBS with Nanometrics Trillium Compact and APG pressure sensor **	6
Shielded Broadband OBS with Nanometrics Trillium Compact and DPG pressure sensor ***	12
Shielded Broadband OBS with Nanometrics Trillium Compact and APG pressure sensor ****	19
Broadband OBS with Nanometrics T-240 seismometer*****	10

WHOI ARRA; **LDEO "Deep"; * SIO Abalone; LDEO; **** "TRM"; ***** under construction by WHOI*

OBSIC: 103 Broadband OBS (7+ variants); 28 short-period OBS (1 variant)

Other: 41 SIO broadbands (28 x T-240; 7 x T-40); 16 LDEO broadbands ???; 72 SIO short-period (63 x conventional, 2 x flips, 7 x LPSPs

Instrumentation Worries

- WHOI's 40 CMG-3T seismometers are 15 – 18 years old.
- Have seen continuous 1+ year deployments since 2004
- Total of 290 on-bottom years.

- They are Failing!! Will they unlock?; Will they center?
- We test and repair multiple sensors prior to each cruise. Takes months (minimum 1 week on test slab, repair, repeat). Huge time sink for a skilled and expensive technican.

- Replace with something more reliable, simpler to operate (No centering, No lock/unlock), and less power hungry.

- Existing Options are: Trillium Compact (185 mW);
- New Nanometrics Development: 12" sphere; 230 mW; T-240 performance.

Assimilation of NSF-owned OBS at SIO and LDEO

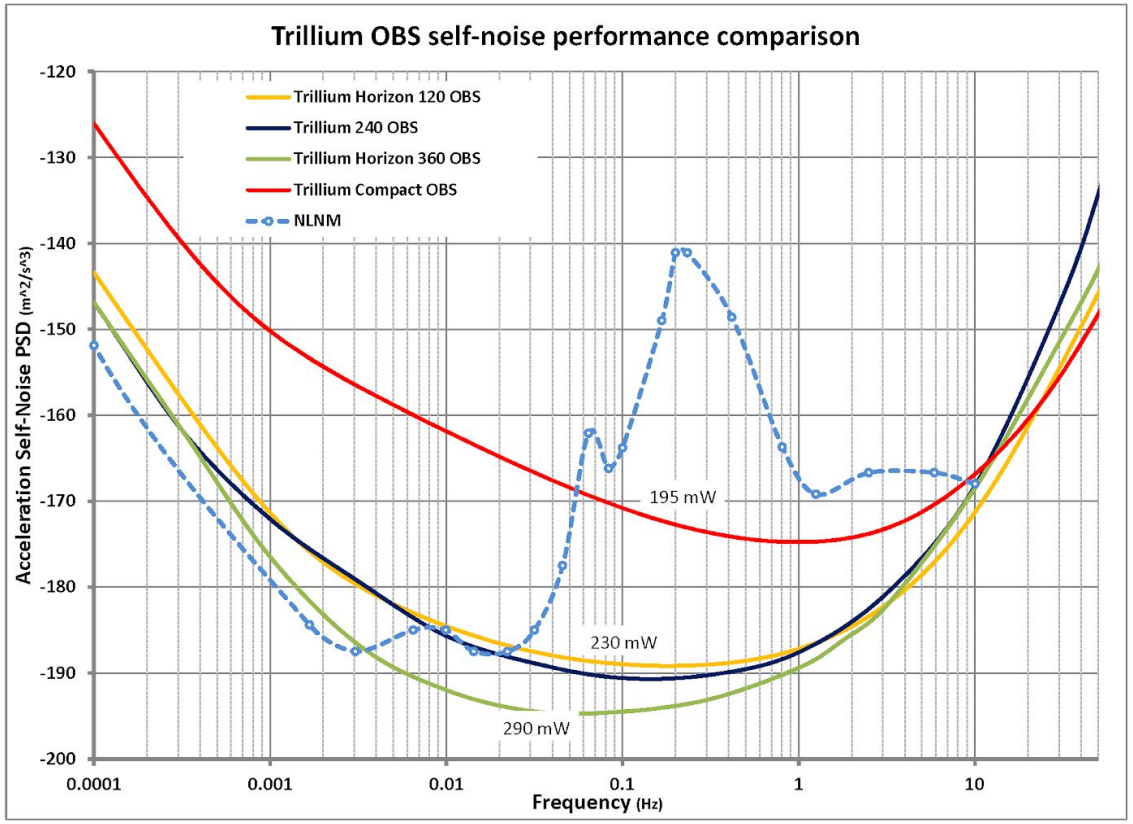
- 15 (now 12) Abalones, but SIO claim ownership of battery pressure housings, acoustic-release boards, and recovery aids. OBSIC is in the process of replacing data-loggers and housings, etc. Abalones were used in Year-1 (7) and Year-2 (6) Gofar experiment. Now back at WHOI awaiting upgrade.

- 8 (now 6) LDEO “Deep” OBS. All deployed at Queen Charlotte Fault (Worthington). Will use Trillium Compact seismometer to replace failing Guralp CMG-3T seismometers in WHOI BBOBS.

- 19 LDEO TRMs. Trillium Compact seismometers will be used to replace failing Guralp CMG-3T seismometers in WHOI BBOBS.

- Still waiting delivery of 6 Trillium T-240 ”OBS modified” seismometers from SIO. These sensors were deployed as part of Pacific Array. Are now on seafloor as part of the Laske experiment. Will be used on upcoming Wei experiment.

New Trillium 120 OBS Seismometer



Mid-Scale Research Infrastructure-1 Proposal and Award

- April, 2021: Submitted proposal to the NSF MSRI program, specifically to the *MSRI-1 Design Projects (M1:DP)* category.

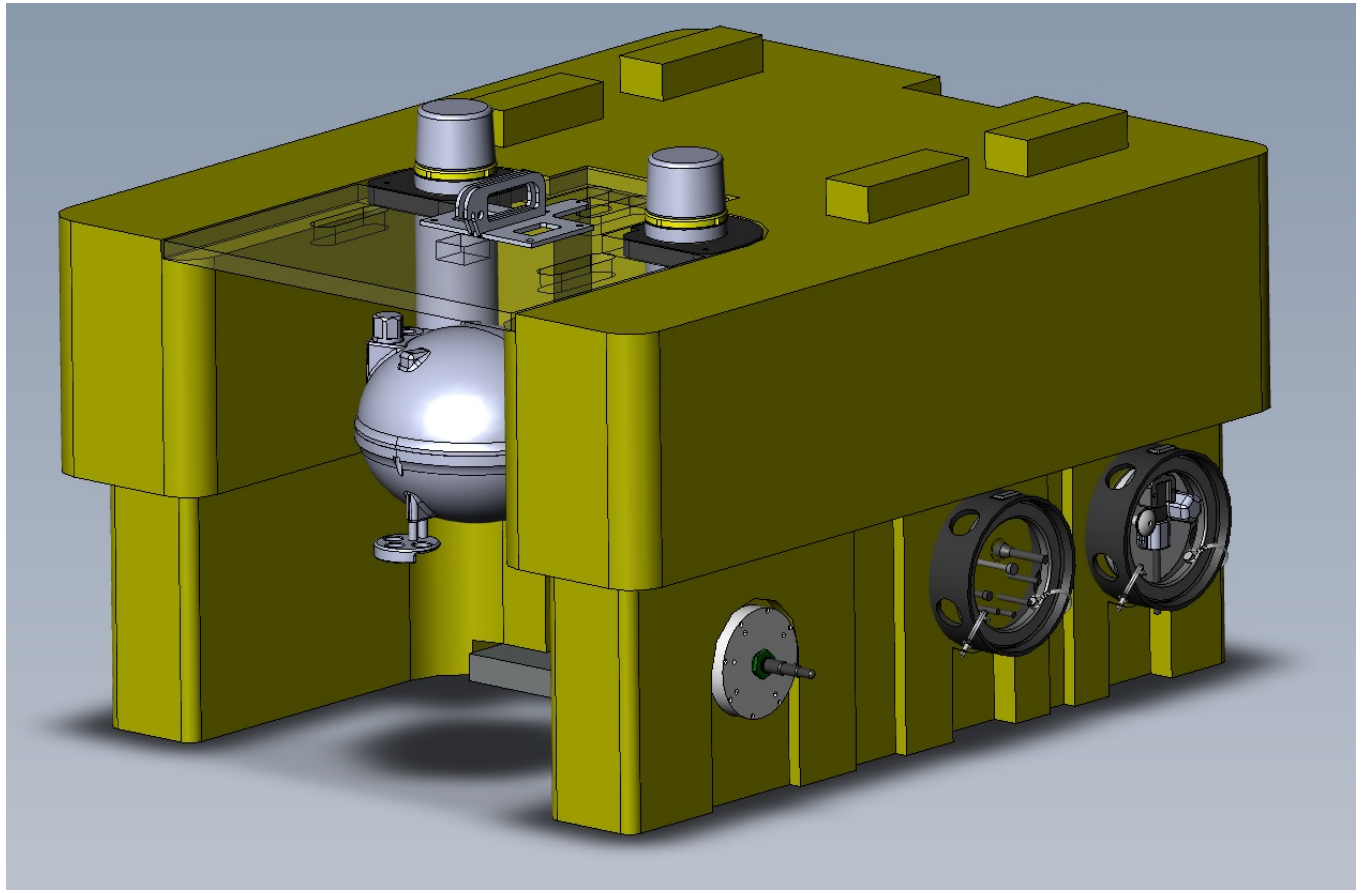
- Proposed to build 50 wideband OBS, 50 broadband OBS, and 100 active-source "node-like" OBS at a cost of $19,995,001.

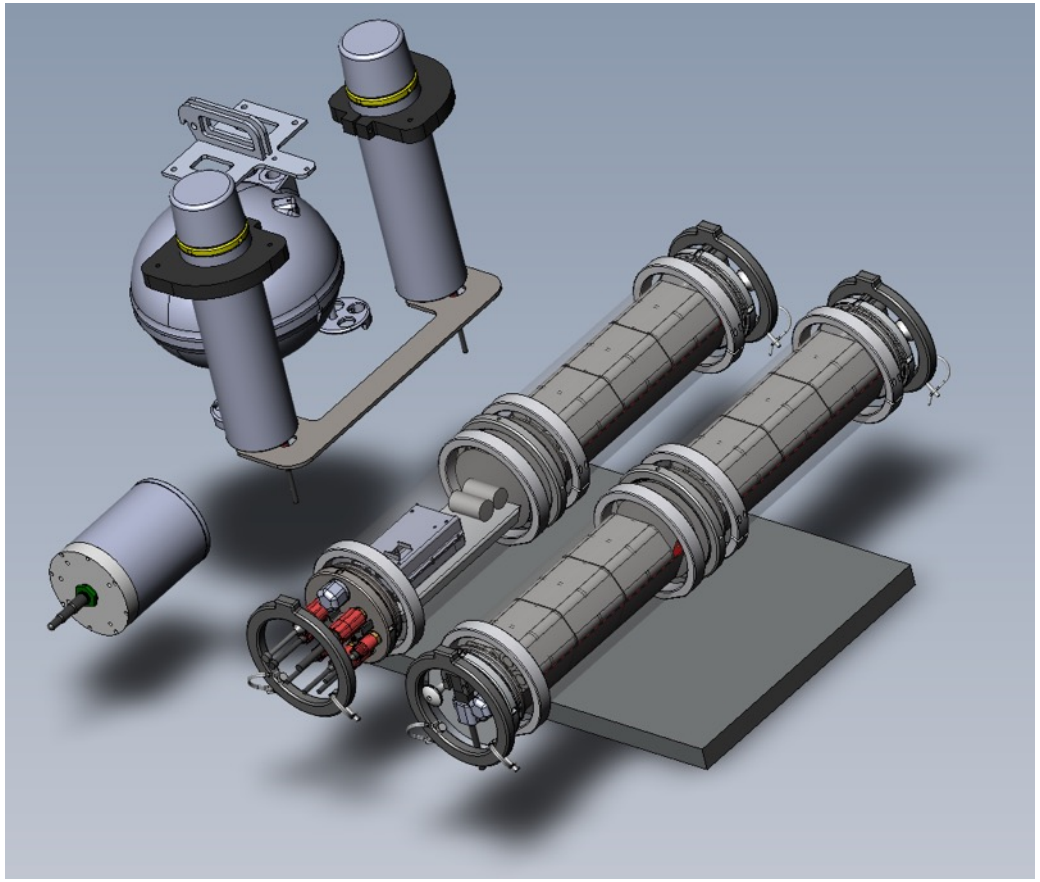
- August, 2021: Proposal funded at $6.5M. MSRI award but funded by OCE. Decided to propose 35+ wideband/broadband OBS only.

Specifications for broadband/wideband OBS

Seismometer	*Broadband*: Nanometrics Trillium 120 OBS in a Nanometrics-designed titanium pressure housing with a Nanometrics-designed active-leveling system. Trillium 120 OBS self-noise is below the seismic low-noise model from ~0.01 – 10 Hz. Power consumption is 230 mW. Clip level is 16 mm/s up to 10 Hz and 0.12 g above 10 Hz. No mass lock required. *Wideband*: Nanometrics Trillium Compact in a Nanometrics-designed titanium housing and a Nanometrics-designed active-leveling system. Power consumption for Compact is 195 mW. Clip level of Compact is 26 mm/s up to 10 Hz, and 0.17 g above 10 Hz. No mass lock required.
Pressure Sensor	Differential Pressure Gauge (DPG)
Data-Logger	Nanometrics Pegasus
Flotation	Syntactic Foam
Housings	Titanium
Clock	Seascan DTCXO with power-cycled CSAC (Teledyne)
Battery	Lithium Primary
Endurance	15+ months
Max. Depth	6,000 m
Release	Dual, Redundant Acoustic Burn-Wire Releases

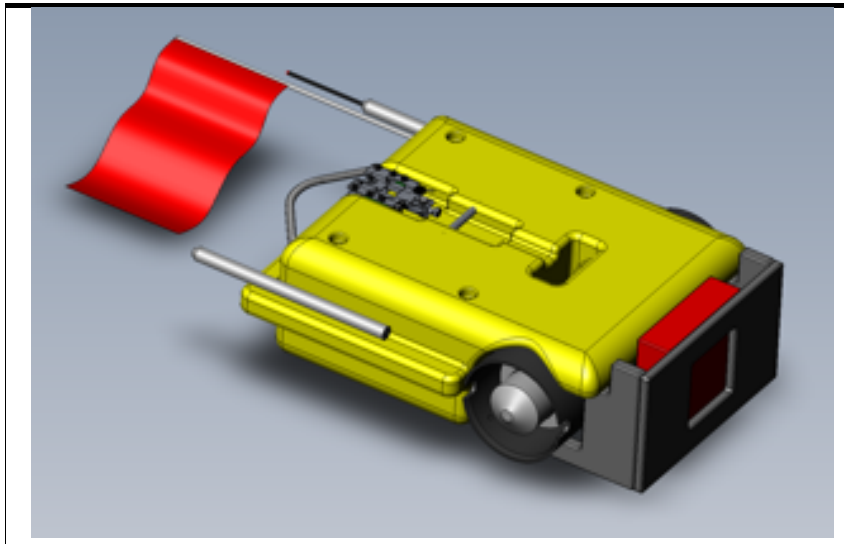
MSRI-1 Design Projects (M1:DP) Wideband/Broadband OBS

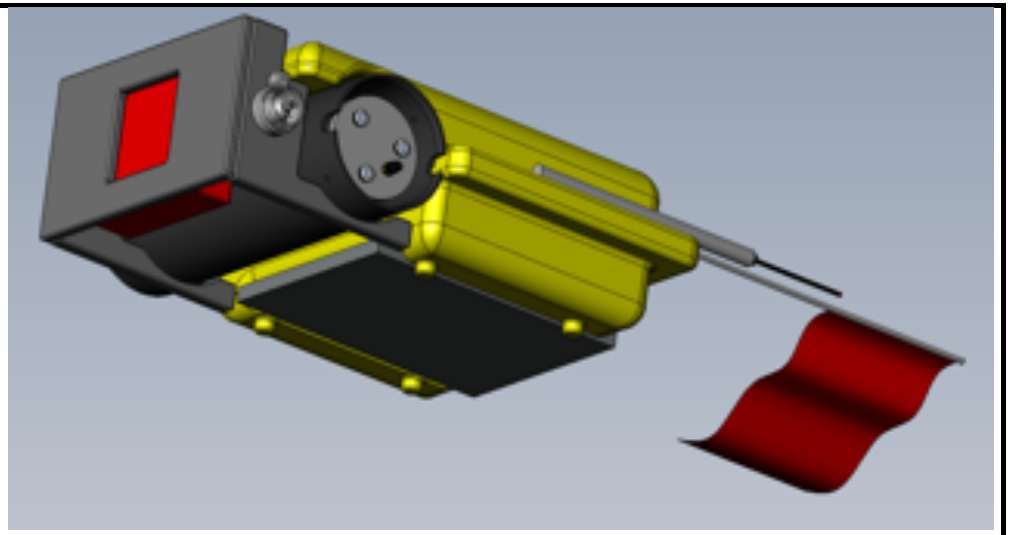




- 35+ Systems (approx. 50:50 wideband/broadband)
- Roto-Molded Frame
- Shield for OBS
- 2+ years on-bottom

100 active-source OBS nodes with shipboard infrastructure and centralized management system to live on Langseth replacement.





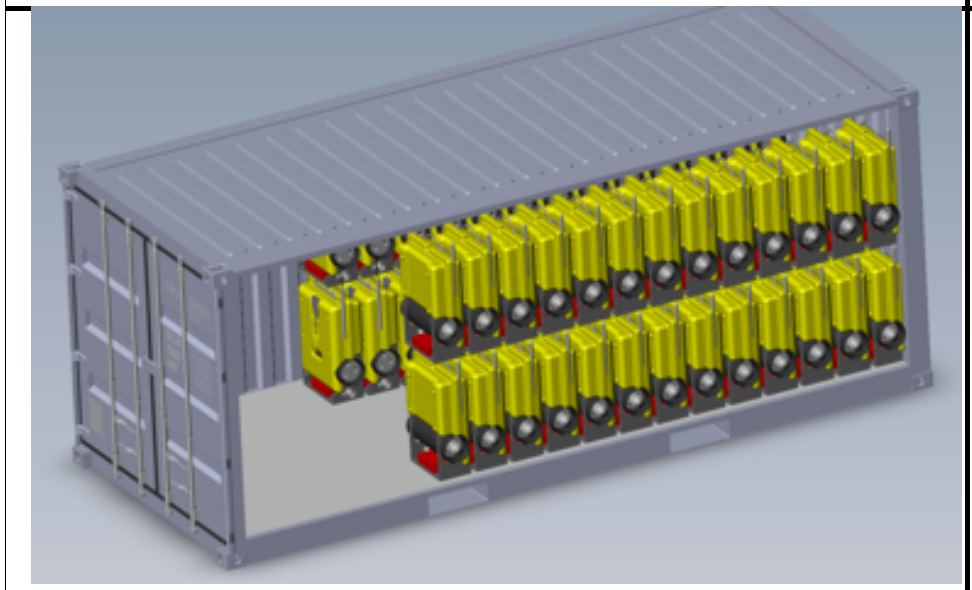


Figure 4. (top) A preliminary design for an OBS node capable of being deployed to 6,000 m, has an acoustic release, a re-chargeable battery with 2+ months recording capability, a 4.5 Hz geophone, a hydrophone, a titanium pressure housing, and syntactic foam flotation. The red-colored package is a pressure-tolerant external battery pack. The large gray-colored slab on the right-hand image is the anchor. (bottom) A view of the OBS deployed on racks in a 20' laboratory van. See the Special Information and Supplementary Documents section for more details.

Specifications for 100 active-source OBS

Seismometer	4.5 Hz geophone with leveling system *OR* Sercel MEMS accelerometer
Pressure Sensor	Hydrophone
Data-Logger	Nanometrics Pegasus *OR* InApril iA200 *OR* Sercel Data Logger
Flotation	Syntactic Foam
Housing	One-piece, low-profile titanium package containing geophone and data-logger. The potted, pressure-tolerant battery module is mounted external to the housing.
Clock	Seascan DTCXO
Battery	Li-ion Rechargeable
Endurance	2+ months
Max. Depth	6,000 m
Release	Single acoustic burn-wire release. PCB and transducer integrated into pressure housing.
Rise Rate	60+ meters/minute

New OBS for rapid-response experiments

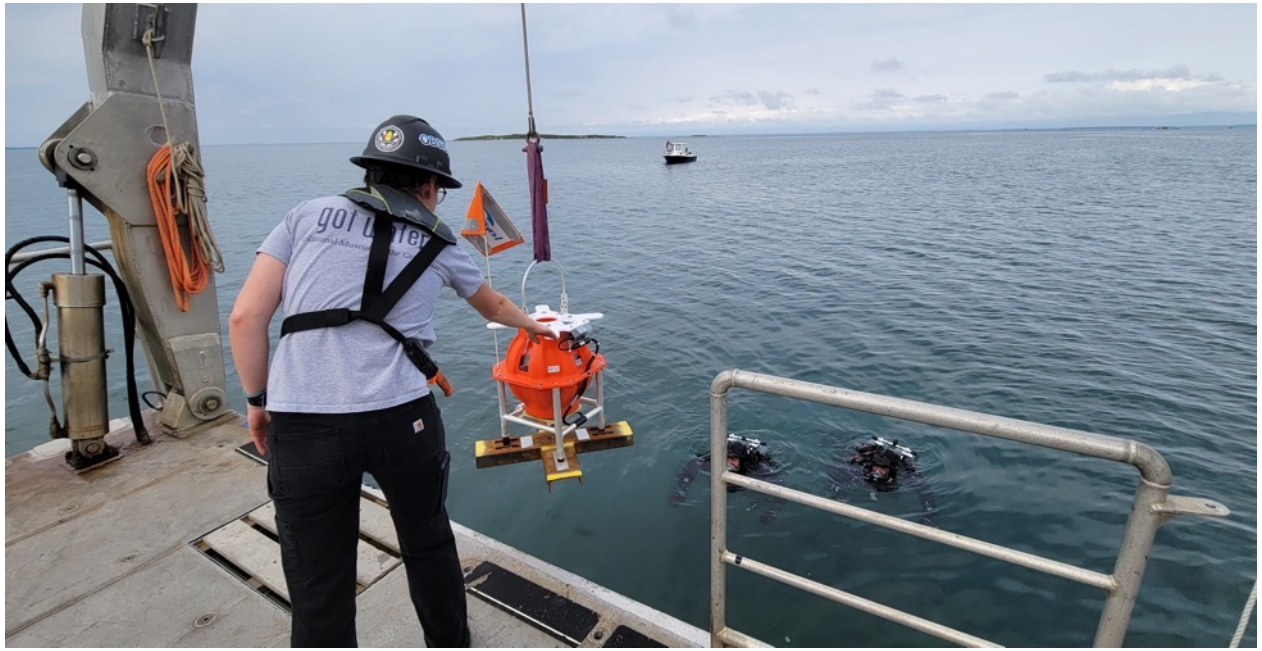
- 10 Sercel MicrObs delivered!

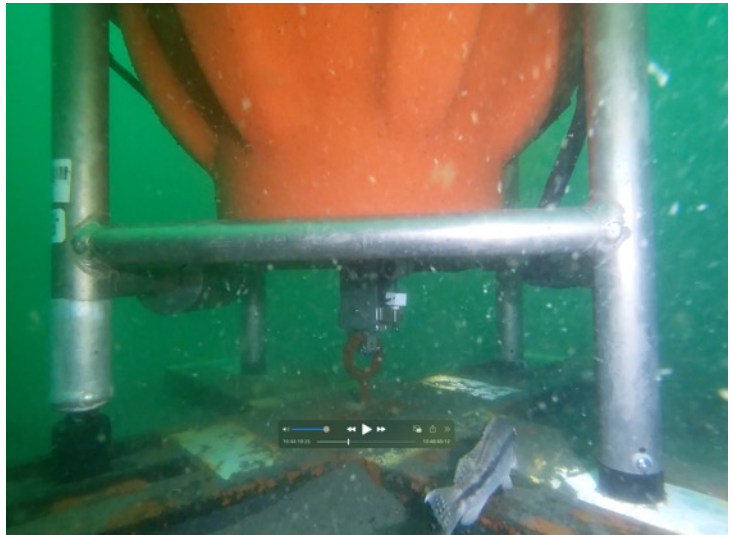
- 6,000 m capable
- Deployment duration on re-chargeable Li-ion battery: 50 days
- 4-components: 3-axis MEMS accelerometer and hydrophone
- Accelerometer self-compensates for tilt
- Accelerometer low-frequency performance better than a geophone
- Sercel Data Management System
- Dedicated storage container, with dedicated clocks, acoustic deck box, computers, etc.

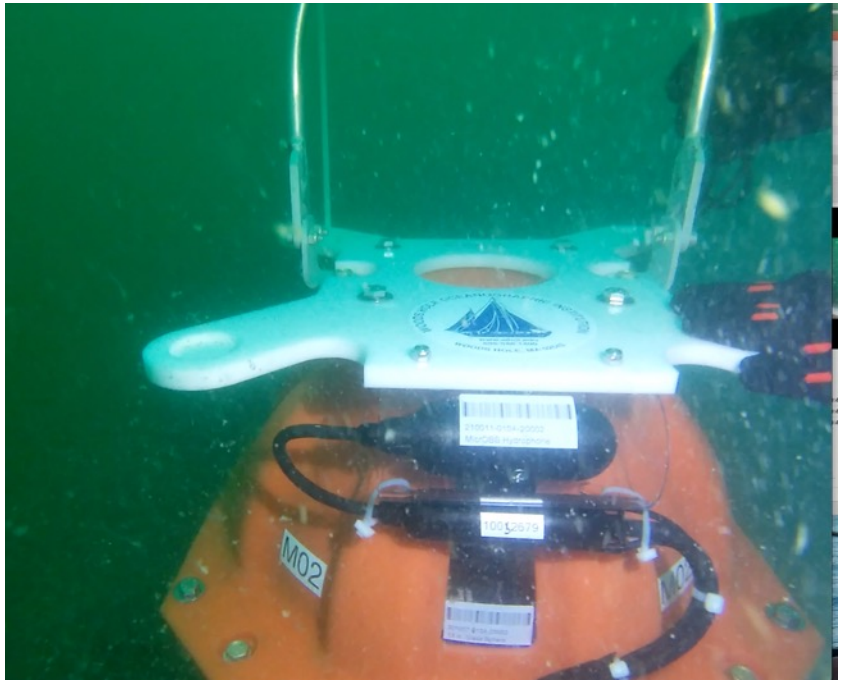
- Rapid-response only. (Not to be used for standard experiments.)

- Training and testing now, protocols for use under development.
- Ready for use in 2023

MicrOBS Pics. from Weepeckets Test







Hub for OBSIC experiment metrics and data products

https://obsic-metrics.whoi.edu

Andrew Barclay
OBSIC Staff Seismologist

OBSIC Metrics

OBSIC

Experiment Name	Network ID	Year	Status	Data return, %
AACSE	XO	2018	open	74
Pacific Array - Haxby	XE	2018	open	56
PacificORCA	7B	2019	open	80
Gofar_Transform_Fault	8A	2019	restricted	86

Notes

- Data return assessment is described here.

Experiment Metrics: Pacific Array - Haxby

OBSIC Home OBSIC Metrics

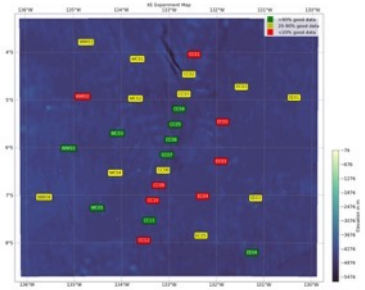
Experiment: Pacific Array - Haxby

Network Code: XE (IRIS MDA page)

Earliest Start: 2018-04-16 (2018106)

Latest End: 2019-05-26 (2019146)

Performance: 56% good data



Station	Instrument Type	Latitude	Longitude	Elevation	Deployed	Recovered	Orientation	Data Return, %
CC01	SIO_LP	-4.046	-132.475	-4768	2018114	2019143	335.8+/-3.6	25
CC02	SIO_LP	-4.465	-132.583	-4444	2018114	2019143	87.6+/-1.4	64
CC03	SIO_LP	-4.882	-132.689	-4739	2018114	2019134	120.9+/-2.8	36
CC04	SIO_LP	-5.194	-132.790	-4615	2018112	2019141	357.3+/-1.4	94
CC05	SIO_LP	-5.517	-132.873	-4798	2018111	2019141	124.5+/-2.0	97
CC06	SIO_LP	-5.839	-132.952	-4824	2018111	2019141	52.9+/-1.3	92
CC07	SIO_LP	-6.159	-133.046	-4628	2018111	2019140	107.6+/-2.0	93

Station Metrics: Pacific Array - Haxby, CC02

OBSIC OBSIC Metrics XE Metrics

Experiment: Pacific Array - Haxby

Network Code: XE (IRIS MDA page)

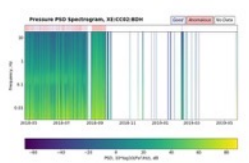
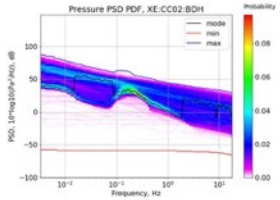
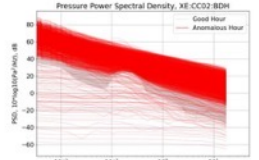
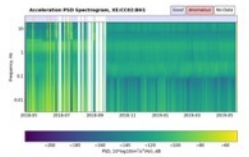
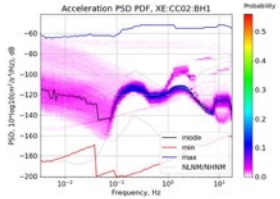
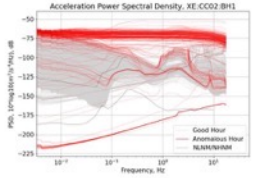
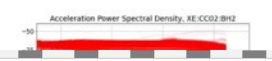
Instrument Type: SIO_LP

Station Start: 2018-04-24 (2018114)

Station End: 2019-05-23 (2019143)

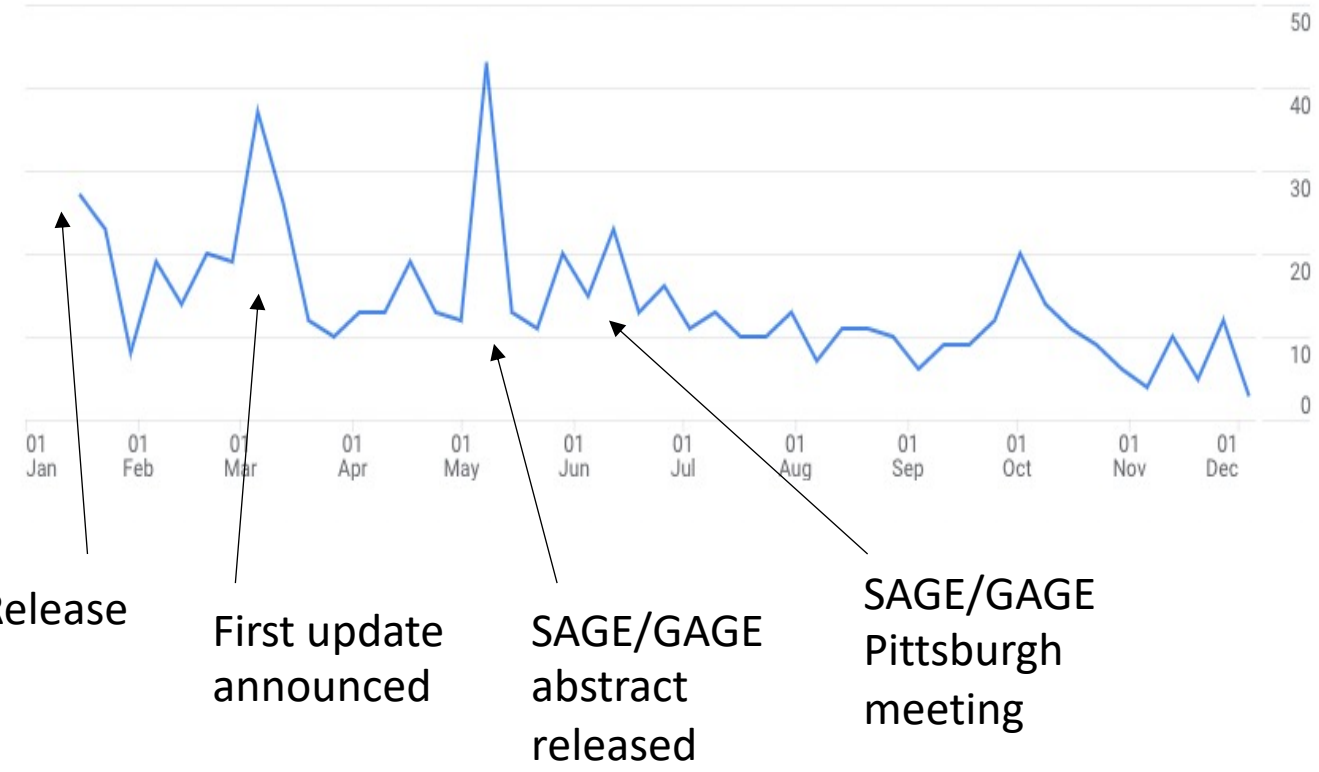
Performance: 64% data return

Channel	Good hours, %
BDH	11
BH1	80
BH2	77
BHZ	88

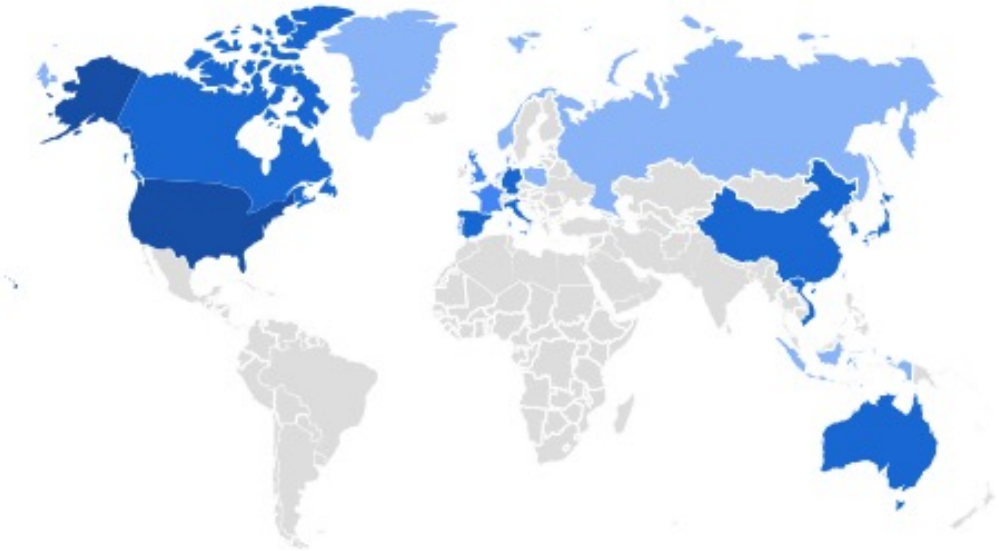
	Spectrograms	Psd Pdfs	Hourly Psds
BDH			
BH1			
BH2			

OBSIC Metrics Hub Engagement, Jan-Dec 2022

OBSIC Metrics Hub: Users per week (new and returning)



OBSIC Metrics Hub: New users by country



Google Analytics