OBSIP Instrument Functional Specifications

OBSIP Oversight Committee
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1. Broadband OBS

1.1. Science Targets

Lithospheric and asthenospheric structure; mantle dynamics; deep earth structure; earthquake studies; source physics; slow slip; noise studies; infragravity waves; tsunamis.

Science targets defined by community input require improved consistency in delivering low noise on horizontal channels, accurate timing, and on-scale (not clipped) recording. Examples of research currently limited by the functional capability of the 2015 era fleet: Any studies that require horizontal component data at teleseismic periods (Love wave studies, receiver functions, teleseismic shear wave splitting).OBS receiver function studies are not equal in quality to land studies. Mid-magnitude earthquakes located near instruments were clipped on broadband sensors during the Cascadia experiment.

1.2. Specification

Specification	Requirement	Justification/Notes
1. Fleet Size	a. 150 instruments	a. Allows for 1 large operating experiment (75 inst) b. Allows for simultaneous instrument refurbishment of 1 large experiment (75 inst)
2. Shielding	b. 75 unshielded instruments should be available and remotely deployable for normal deepwater experiments	a. Direct burial not required until cost effective installation and retrieval method developed

	c. 75 shielded instruments should be available and remotely deployable for experiments requiring low noise horizontals	b. Comparison of shielding options and at sea capability remains a priority study for the OBSIP facility
3. Trawl resistance	a. 25 (of 75 current shielded instruments) should provide trawl resistant shielding for operational depths of up to 500 meters	Shallow water depth capability needed for near-shore studies
4. Clock accuracy	a. Correctable accuracy to 0.1ms for the length of the deployment	Accurate timing is essential for earthquake source and tomography experiments
5. Clock operation duration	a. 24 months or greater	
6. Recovery	a. Acoustically commanded release b. Steel anchor left on seafloor is standard operating method c. Pop up buoy capable d. Fresh water release capable	a. Some specialized deployments may require that nothing be left on the seafloor, and PI/IIC/OBSIP communication and advanced planning on instrument modifications for those rare experiments could accommodate these instances
7. Recording duration	a. 18 months at 100 sps b. Extendable to 24 months with extended battery supply	24 months for slow slip studies, repeating earthquakes, etc.
8. Depth	a. Min 200 meters standard b. Min 50 meters - 25 instruments (trawl resistant instruments) c. Max 6000 meters standard d. Max 9000 meters - 10 instruments	Shallow depths for near-shore studies, continental shelf, margins Subduction zones 50 m – 5000 m. 6000m useful for much of ocean basin. 9000m for trenches in subduction zones

9. Broadband Seismometer	a. Required in all instruments b. Passband: flat to velocity from [240 or 120?] seconds to [35 or 50?] Hz. c. Self-noise: below NLNM 100 s to 10 Hz. d. Bandwidth: -3dB points at 240 s and 200 Hz e. Clip level: 26mm/s from 0.1Hz to 10Hz. Able to capture a M 5.5 earthquake at 50 km on-scale. High dynamic range needed.	
10. Strong Motion Sensor	e. No clipping on M8+ earthquakes at local distances f. Include on a subset (30-50%) of the instruments	a. Important in areas of high seismicity rates and aftershock sequences of large to great earthquakes
11. Absolute Pressure Sensor	a. Required in 50 instruments b. 0-10000 psia c. Passband: flat response between 1 Hz and DC.	a. For geodesy, tsunami studies, and surface wave corrections (DPG can be used for surface wave corrections, but APG needed for geodesy) b. Needs to be on a mix of shielded, unshielded, and trawl resistant instruments
12. Differential Pressure Gauge	a. Required in 50 instruments b. Standard OBSIP DPG or better	a. Cheaper solution that is quieter at some frequencies, but of limited usefulness without calibration
13. Hydrophone	a. Required in all instruments b. High Tech HTI-90-U or better	
14. Datalogger	a. 4 channels minimum: a. 3 Channels: Broadband seismometer: vertical and horizontals (Accelerometer capable)	

	b. 1 Channel: APG or DPG b. Expandable to 9 channels: a. 3 Channels: Accelerometer (co-located with Broadband Sensor) b. 1 Channel: APG or DPG c. 1 Channel: Hydrophone c. Frequency response: DC to 80 Hz @ 200 sps. d. Anti-aliasing FIR filter. Double Precision FIR Filter Causal/Acausal; >140 dB attenuation at output Nyquist e. Sampling rates: 1, 10, 20, 40, 50, 100, 200, 250, 500, 1000 sps f. Sampling rates configurable by channel g. Datalogger dynamic range and noise floor do not limit sensor performance h. Acquisition modes: continuous, triggered, time windows i. Extendable time synch to other dataloggers/systems	
15. Data delivery requirement:	a. DMC: SEED for all experiments, SEG-Y for active source	