Site Investigation Schedule of Works
File Ref: FS007048
Date: 04/10/2019

[redacted]

1. Geophysical Survey.

a. Multibeam Echosounder.

Method: Bow or side pole mounted.
Indicative Equipment: *GeoAcoustics GeoSwath Plus interferometric echo sounder* (250 KHz operating frequency)/ *Kongsberg EM710* (300-500 KHz operating frequency sound pressure levels in the range of 200-228dB re1μPa at 1 metre range), Teledyne Reson SeaBat T50-R (190-420 KHz operating frequency) or similar
Vessel Size: Max Length 50-60m
Swath width: Approximately 6 times water depth depending on arrangement of equipment hardware.
Location: Inshore Cable Route Corridor and Proposed Wind Farm Area within the Foreshore Licence Area as shown on Drawing No. 002, Appendix 1.

b. Side Scan Sonar Survey.

Method: Vessel towing a submerged pod (Sonar Device).
Indicative Equipment: *GeoAcoustics 160 system (410kHz transducers), Klein Hydro Scan or similar.*

Vessel length: Max Length 50-60m.
Swath width: The swath width based on the water depth encountered. It is anticipated that the width of each swath will be approximately 25m with a 50% overlap between each swath.

Location: Inshore Cable Route Corridor and Proposed Wind Farm Area within the Foreshore Licence Area as shown on Drawing No. 002, Appendix 1.

c. Sub-Bottom Profiling Survey.

Method: Vessel towing a submerged pod (Pinger, sparker/boomer) or Side pole mounted.
Indicative Equipment: *GeoAcoustics 5430A profiling system, Edgetech 3100* or similar 'pinger' system, Ultra High Resolution Seismic (UHRS) (sparker/boomer) *Applied acoustics boomer plate AA251/AA301* or similar, Seismic Energy Source *Applied acoustics CSP-L or similar.* The frequencies for the UHRS could range from between 300Hz to 1.2kHz (300 –1,200Hz) with source levels of 226dB re 1μPa at 1 metre. Pingers operate in the range of 3.5kHz to 12kHz (3500 – 12,000Hz) with source levels of 200dB re 1μPa at 1 metre.

Vessel length: Max Length 50-60m.
Swath width: The normal swath width is 4-6 times the water depth.

Location: Inshore Cable Route Corridor and Proposed Wind Farm Area within the Foreshore Licence Area as shown on Drawing No. 002, Appendix 1.

d. Magnetometer Survey.

Method: Vessel towing a surface pod (Magnetometer).

Indicative Equipment: *Geometrics G-882 caesium vapour magnetometer, Seaspy or similar*

Vessel length: Max Length 50-60m.

Survey spacing: 25m centres, with additional runs if any magnetic signal is recorded

Location: Inshore Cable Route Corridor and Proposed Wind Farm Area within the Foreshore Licence Area as shown on Drawing No. 002, Appendix 1.

2. Geotechnical and Sediment Sampling.

The quantities given below relate to the requirements for the preliminary geotechnical campaign. Following completion of the preliminary geotechnical campaign, the locations for the completion geotechnical campaign will be determined. These will be forwarded on to the Foreshore Unit in advance.

a. 20 no. Boreholes.

Diameter: 100mm.
Depth: Up to 70m.
Indicative Equipment: Traditional API drill string or a triple corebarrel system (eg. GEOBORE/s) or similar
Location: Indicative sites shown on Drawing No. 003, Appendix 1. This map shows 69 potential borehole locations, only 20 Boreholes will be executed.

b. 30 no. Cone Penetration Testing

Diameter: 50-62mm.
Method: *in situ* Cone Penetration Test on sea bed frame (no. 30) and deck-push CPT (no. 100).

Depth: Up to 70m.

Location: Indicative sites shown on Drawing No. 003, Appendix 1. This map shows 69 potential CPT locations, only 30 CPTs will be executed.

c. 40 no. Vibro Core / Surface Grab

Method: Surface grab sample by box corer, grab sampler or similar or vibro core, core up to 6m depth, dia. 100mm. Expected sound pressure levels generated by vibrocore equipment would be approximately 187.4 dB 1μPa at 1 metre.

Location: Within radius of 250m of points shown on Drawing No. 003 Appendix 1. This map shows 69 potential vibrocore/grab locations, only 40 will be executed.

d. 30 no. Trial Pits
Method: Machine dug using an excavator (either from a boat or from land depending on access) up to 5 metres depth. Typically be 3m x 1m in size.

Location: On the beach at the location of the landfall site options. These are unknown at this stage, but it is envisaged that no more than 3 locations would be explored. At each location – up to 10 Trial Pits may be excavated from the lower shore to upper shore).

3. Environmental/Ecological Sampling

Exact survey methodologies to be agreed with NPWS prior to survey work commencing.

a. Intertidal

3 no. sets of,

- 3 no. Cylindrical hand cores (20cm deep, 15 cm dia) for faunal analysis;
- 1 no. 1kg sample from surface by hand trowel for Particle Size, TOC and/or contaminant analysis;

Location: On the beach in the intertidal zone of the cable route corridor, 1 no. set at a location in each of the upper, mid and lower shore. Intertidal assessments will be carried out at up to 3 landfall locations.

b. Subtidal

Combination of,

- 3 no. 0.1m^2 Day Grab or similar for faunal analysis;
- 1 no. 1kg sample from 0.1m^2 Day Grab or similar for Particle Size, TOC and/or contaminant analysis;
- Rallier du Baty dredge or similar for faunal analysis
- 3 no. Sediment Profile Images
- Drop-down video/ROV survey
- SCUBA dive survey

Vessel length: Approx. 20m, however if combined with geophysical surveys vessel up to 50-60m max. may be used.

Exact survey type required will depend on sediment type, habitat type and depth and sample locations will be based in part from the marine surveys and will be randomised across the area based on sediment type and depth.

Location: Within Cable Route Corridor and Potential Wind Farm Development Area as shown on Drawing No. 002. Locations will be randomised across the area based on sediment type and depth. Up to 100 locations maybe sampled.

c. Fisheries & Shellfish

Survey type and methods will be dictated by Sea Fisheries Protection Authority if they require a survey.

Location: Within Cable Corridor and Potential Wind Farm Development Area as shown on Drawing No. 002.

d. Marine Mammals/Reptiles & Seabirds
Combination of,

- Monthly Vantage Point Surveys from representative number of landfall sites;
- Monthly Boat-based surveys
- Breeding/Migration bird surveys

Vessel length: Approx. 20m, however if combined with geophysical surveys vessel up to 50-60m max. may be used.

Location: Within Cable Route Corridor and Potential Wind Farm Development Area as shown on Drawing No. 002.

e. Marine Mammals Acoustic Monitoring

- Up to 4 CPODs will be deployed at any 1 time across the site.
- A sound trap may be deployed alongside one of the CPODs for various durations throughout the monitoring campaign to obtain background noise measurements.
- The CPODs will be recovered every 3 months to download data and change batteries
- Upon each 3 month recovery they will be relocated so that over the 18-24 month monitoring period, CPODs will be deployed at a total of 32 locations across the site

Location: Within Inshore Cable Route Corridor and Offshore Survey Area. The exact locations of the CPODs has not being determined yet. Either 4 permanent sites will be selected or the 4 sites will be relocated every 3 months (during battery change) based on a 4x4km survey grid across the site. The strong currents in parts of the site may make some areas unsuitable for deployment. Drawing No. 004 in Appendix 1 shows 4 indicative CPOD locations. A CPOD and its mooring arrangements can be seen below in addition to a sound trap.

4. Oceanographic and meteorological

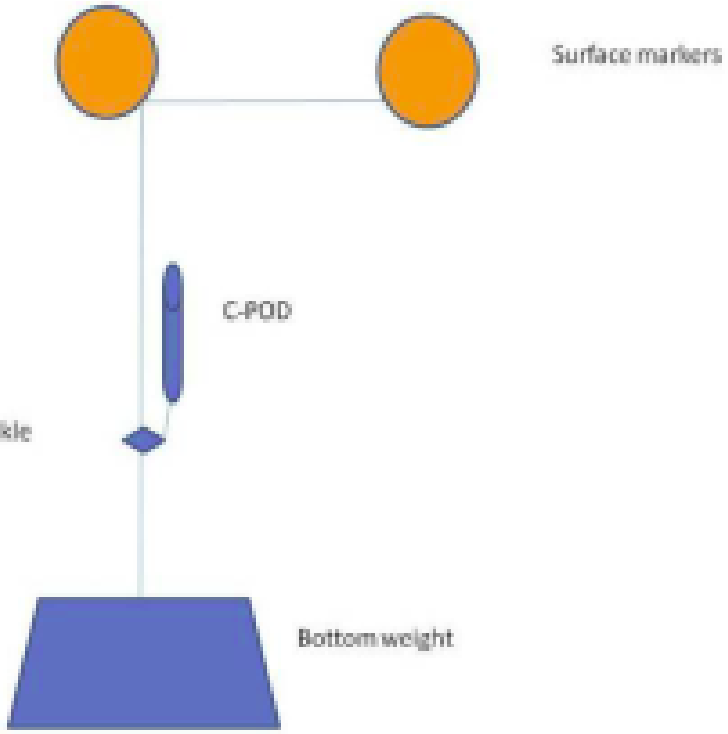
- Deployment of up to 4 ADCPs to measure currents and waves at four locations. Trawl resistant moorings and acoustic release will be employed (see example below).
- Deployment of a Seawatch / EOLOS wind lidar buoy, (including metocean capabilities) or similar at up to 3 locations. Given the low profile of this buoy it is intended to locate a 3m high marker buoy nearby. These will be moored to the sea bed with single point moorings, consisting of a combination of clump weight, chain and rope. Indicative examples of buoys and mooring arrangements can be seen below.

Location: Within Inshore Cable Corridor and Offshore Survey Area as shown on Drawing No. 004, Appendix 1.

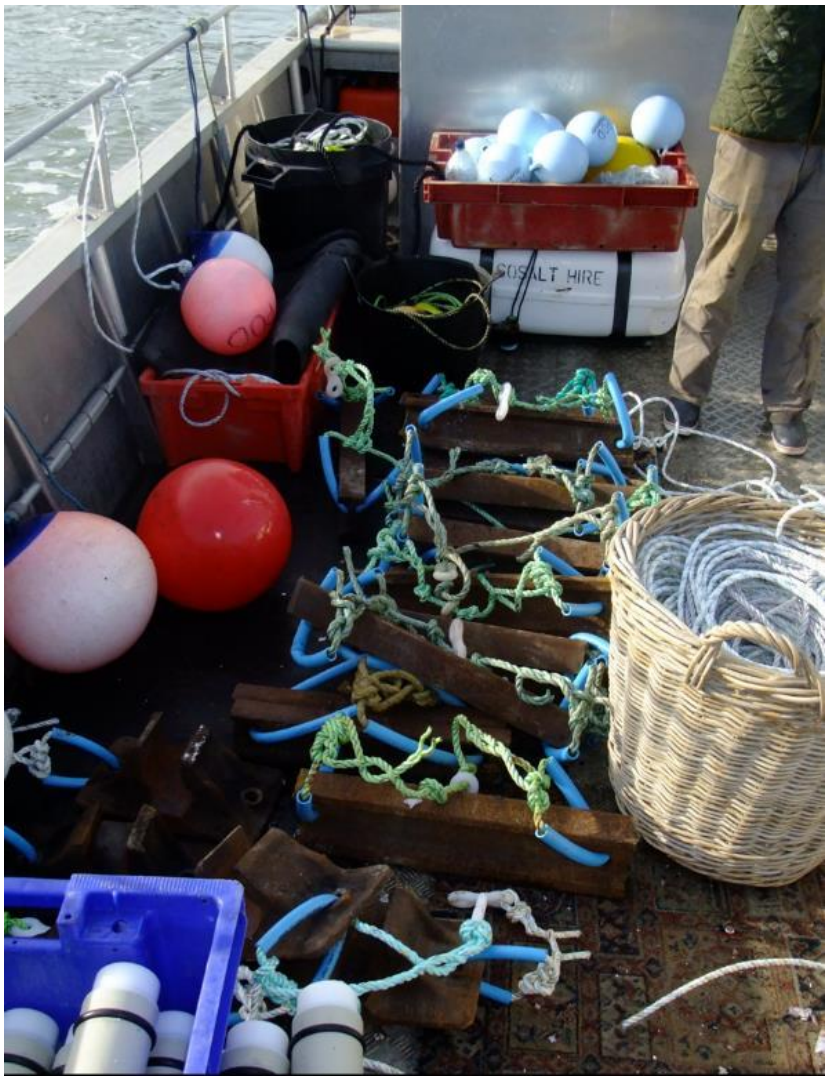
Standard devices, procedures and methods apply to all testing and sampling methods both land or water based and in accordance with submitted Method Statements.

Tests, procedures and methods will be in compliance with the Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters Published by DAHG, January 2014.

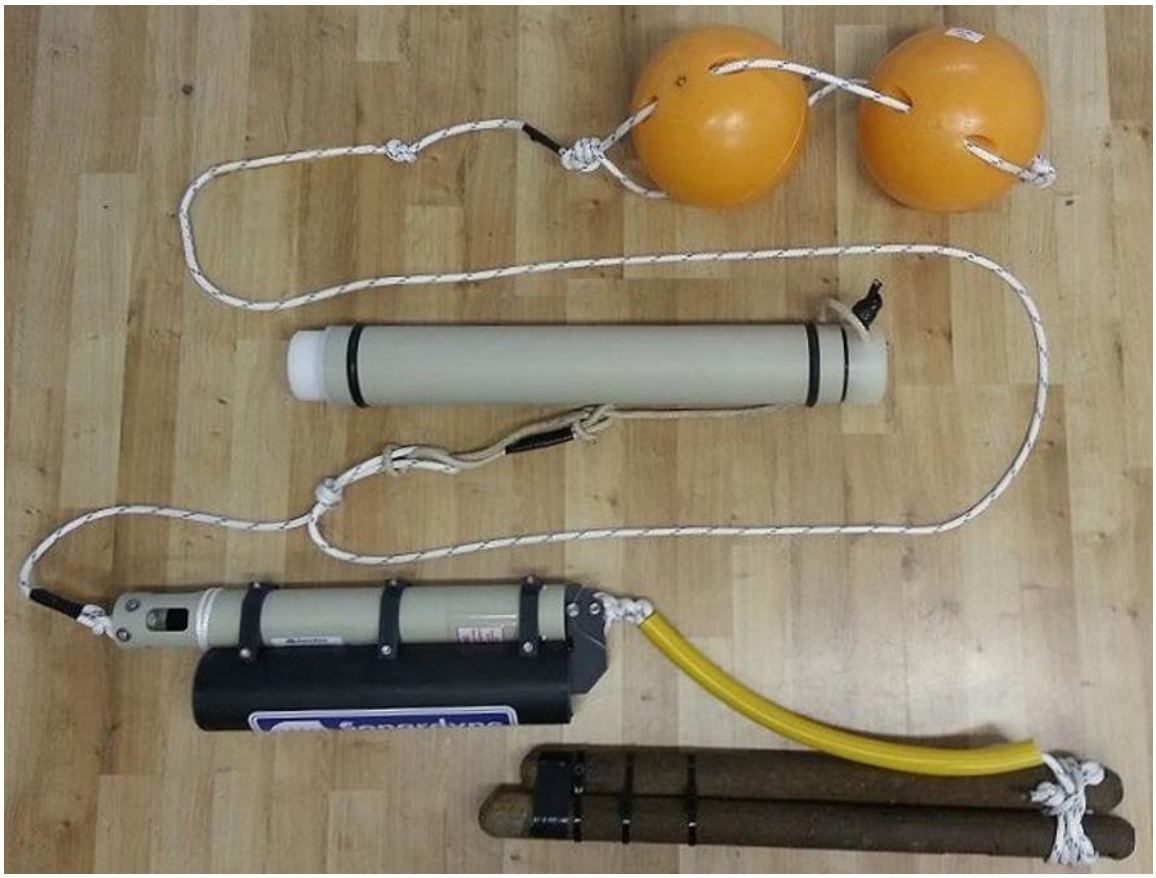
Where an anomaly is encountered, i.e. a feature that cannot be identified by any of the non-intrusive survey techniques, then, subject to water depth, a Remote Operated Vehicle (ROV) will be used to investigate the anomaly. If this is not possible or is not successful in identifying the anomaly then a dive survey would be carried out. For Archaeological anomalies, the exact method of investigation would be agreed with the Underwater Archaeological Unit of the Department of Culture, Heritage and the Gaeltacht.



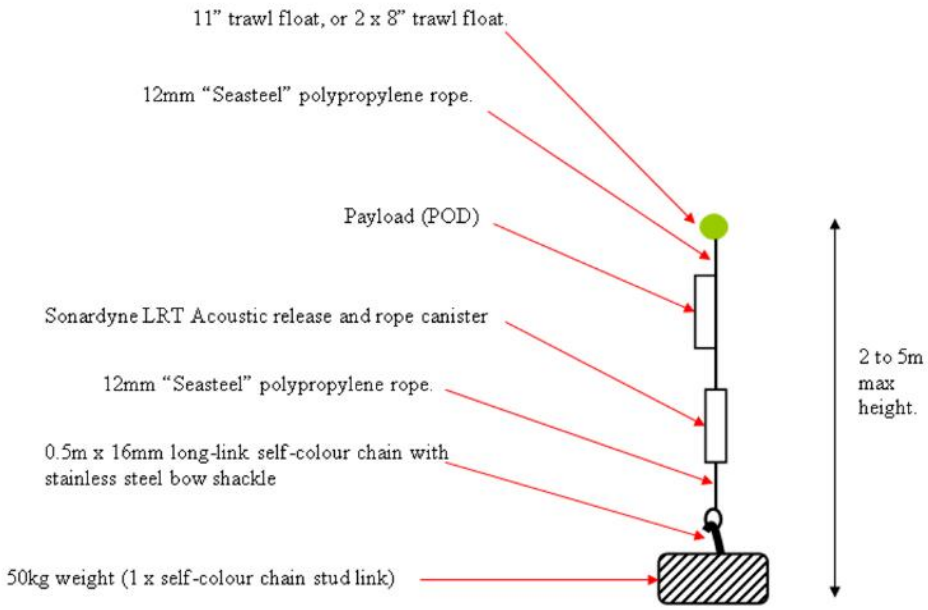
CPOD Mooring Arrangement with surface markers (Source: IWDG)



CPODs with bottom weights (Source: Chelonia.co.uk)



CPOD with Acoustic Release Arrangement (Source: Chelonia.co.uk)



CPOD Mooring Arrangement with acoustic release (Source: Barton, T.R. / Chelonia.co.uk)

OceanInstruments NZ

SoundTrap ST300 Digital Sound Recorders

STD & HF models

Key features:

- **Industry leading audio fidelity**
- **Very low self-noise**
- **60 kHz and 150 kHz bandwidth models**
- **Up to 13 days continuous recording on internal battery**
- **Up to 70 days continuous with optional external battery (3 x D cell)**
- **Simple operation with IR remote control**
- **Sealed, low maintenance, flood proof housing**
- **Fast USB offload**
- **Toothed whale Click detection (HF only)**

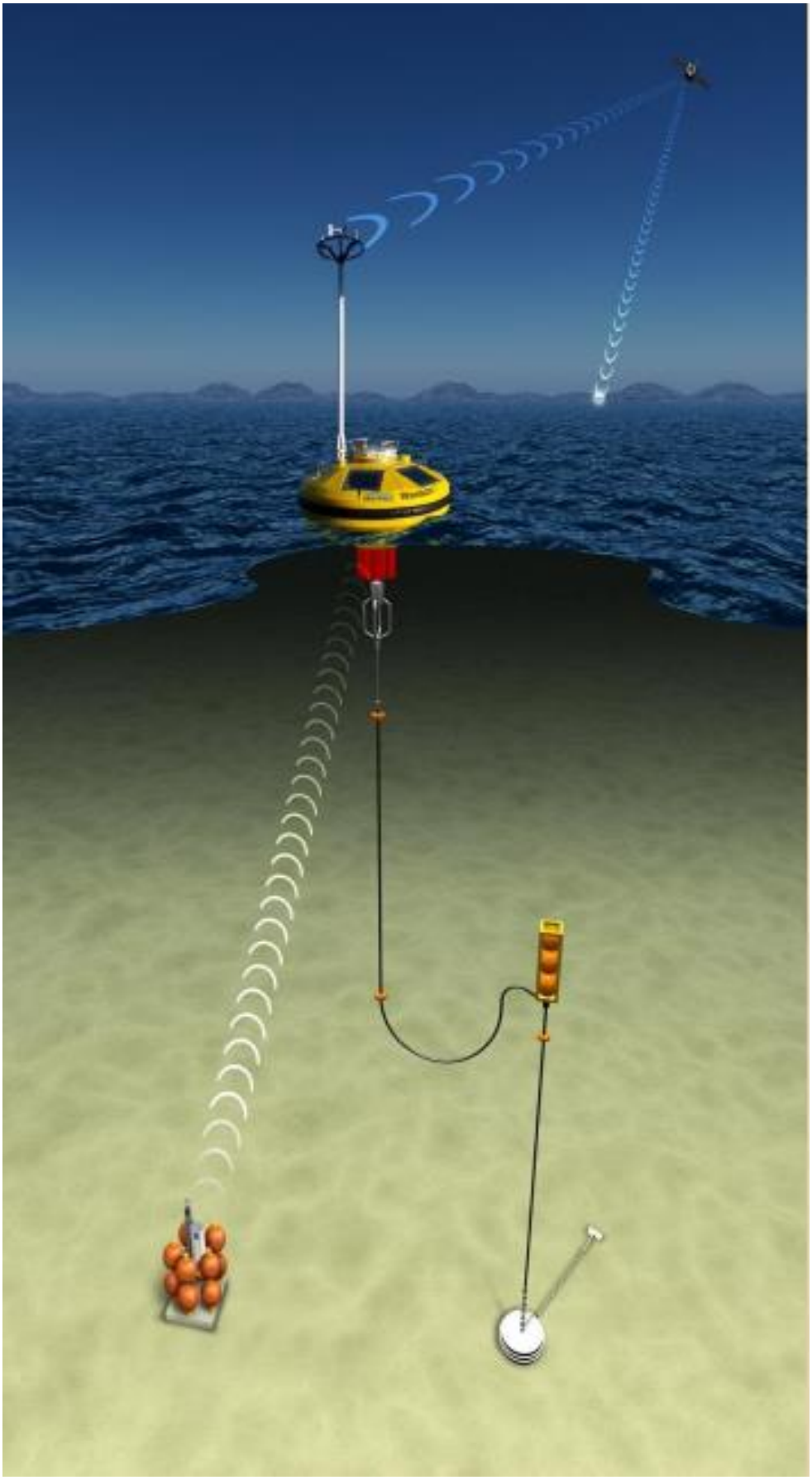
The SoundTrap 300 series are compact self-contained underwater sound recorders for ocean acoustic research. The STD model is intended for general purpose use with a working frequency range of 20 Hz to 60 kHz. While the HF model offers 20 Hz to 150 kHz bandwidth for higher frequency bioacoustic research. Both feature very low self-noise, ensuring beautiful recordings in even the quietest places.

An internal battery enables continuous recording for up to 13 days, or 56 days on a 10 minute per hour duty cycle. For longer deployments plug in the optional external battery pack for up to 70 days continuous recording. Up to 256 GB of internal memory coupled with lossless audio compression provides storage for up to 65 days continuous recording at 72 kHz.

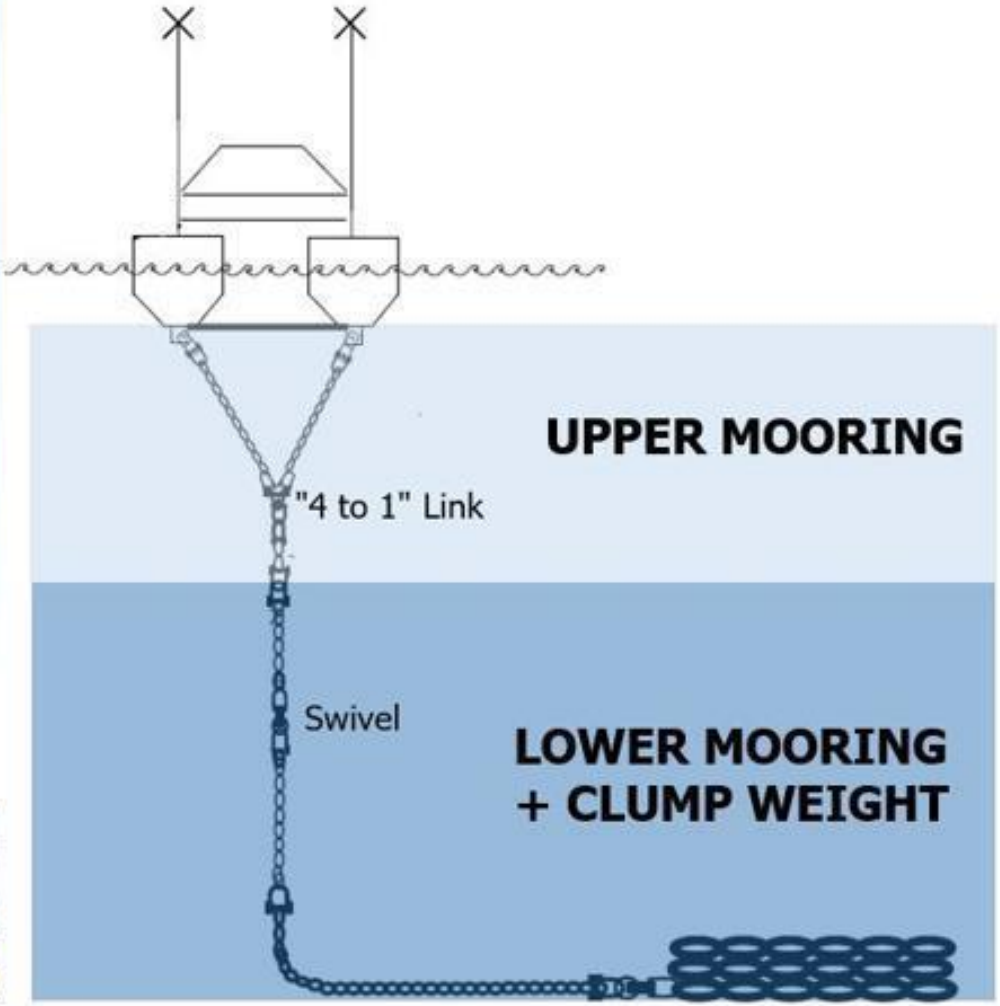
Data offload and battery recharge are done via a high quality wet plug. The housing therefore never needs opening eliminating the usual worries about o'ring maintenance and moisture ingress. Weighing less than 500 g in air, hydrophone deployment has never been so easy.

Output files are in the industry standard WAV format. Ancillary sensors are included for logging temperature and tri-axial acceleration. The included software offers flexible deployment options for sample rate, gain control, filtering, delayed start and duty cycle. Plus the included water proof IR remote control makes for convenient in-the-field ad hoc measurements. Each instrument is supplied with a calibration certificate and features self-calibration checks for confirmation of performance in the field.

Sound Trap ST300



Seawatch Mooring Arrangement (Source: Fugro.com)



EOLOS Mooring (Source: http://marine.gov.scot/sites/default/files/00536058.pdf)

Marker Buoy (Source: Hi-Sea)