Natural Environment Research Council

University of St Andrews

Development of a sensor platform for marine mammal tracking

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Thanks…

Scot. Gov. steering group: Elaine Tait (MSPaP), Paul Thompson (UoA), Kelly Macleod (JNCC), Janelle Braithwaite (MSPaP), Roger May (MSLOT), Ian Davies (MSS), Ross Culloch (MSS), Ross Gardiner (MSS), John Armstrong (MSS), Jared Wilson (MSS), Ewan Edwards (MSS), Denise Risch (SAMS), George Lees (SNH), Erica Knott (SNH), Chris Eastham (SNH), Karen Hall (SNH), Cara Donovan (Atlantis), and Lily Burke (MSPaP);

NERC steering group: Cara Donovan (Atlantis), George Lees (SNH), Elaine Tait (MSPaP), Ceri Morris (NRW), Ross Culloch (MSS), and Caroline Carter (SNH);

Simon Moss, Steve Balfour, and Matt Bivins (SMRU);

Benjamin Williamson (ERI/UoA);

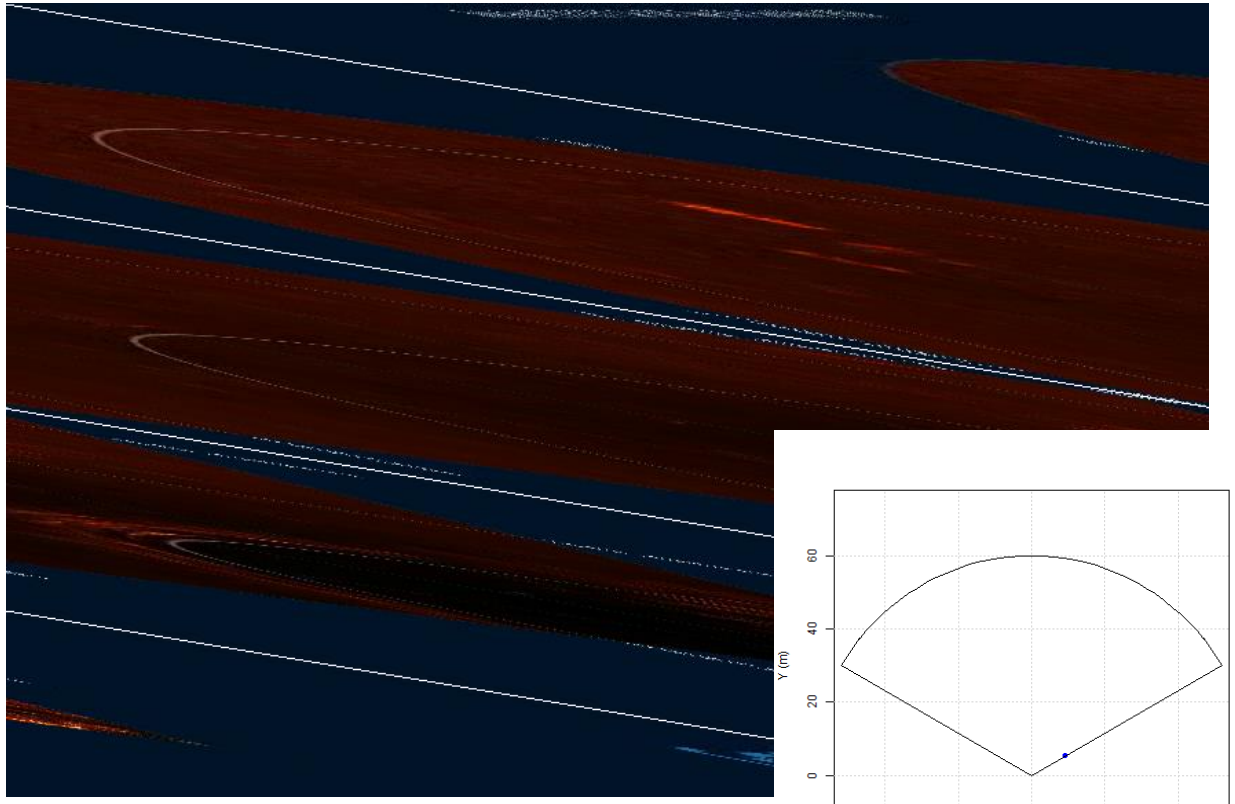
Fraser Johnson, Rowan Boswood, Bruce Mackay, and Lorna Slater (Atlantis/MeyGen);

Marine mammal tracking: project aims

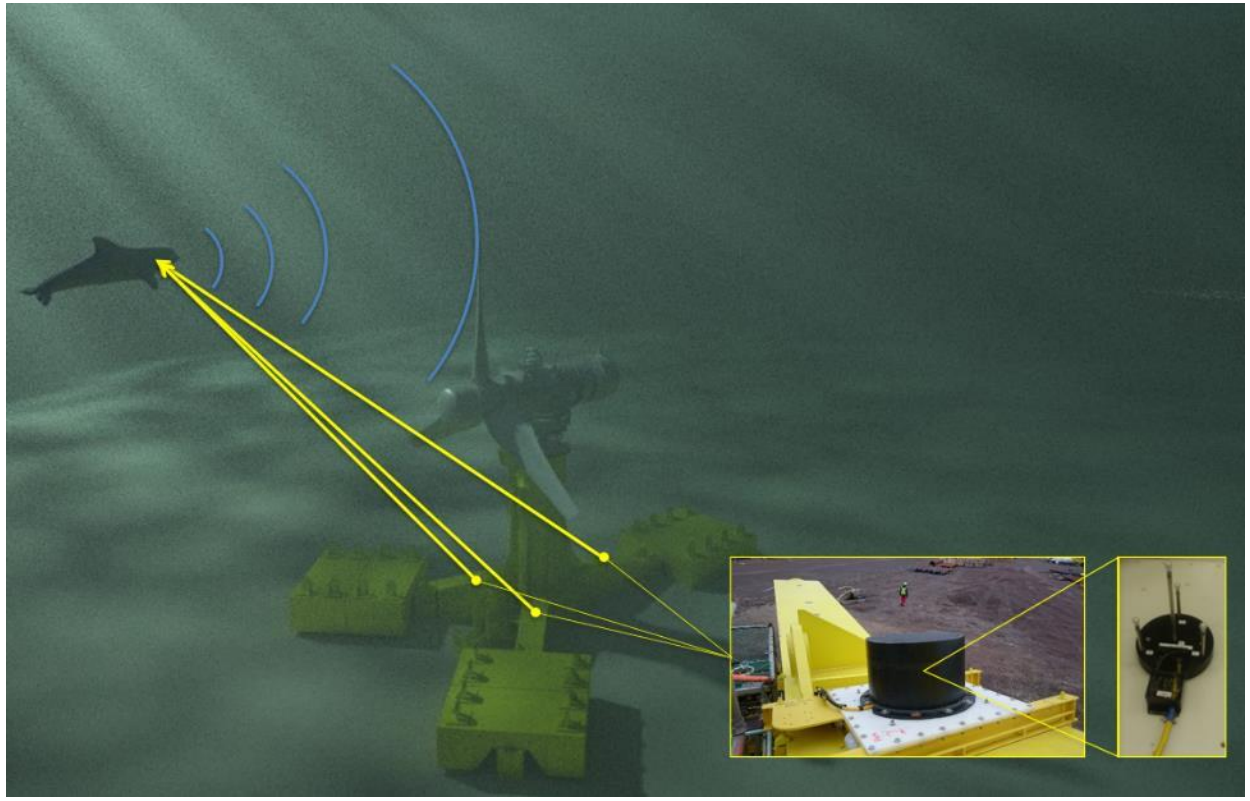
- Measure the movements of marine mammals in high resolution close to operational turbines;
- Integrate our marine mammal monitoring systems;
- Standardise data collection and analyses;
- Produce open source system;

Marine mammal tracking: Some techniques

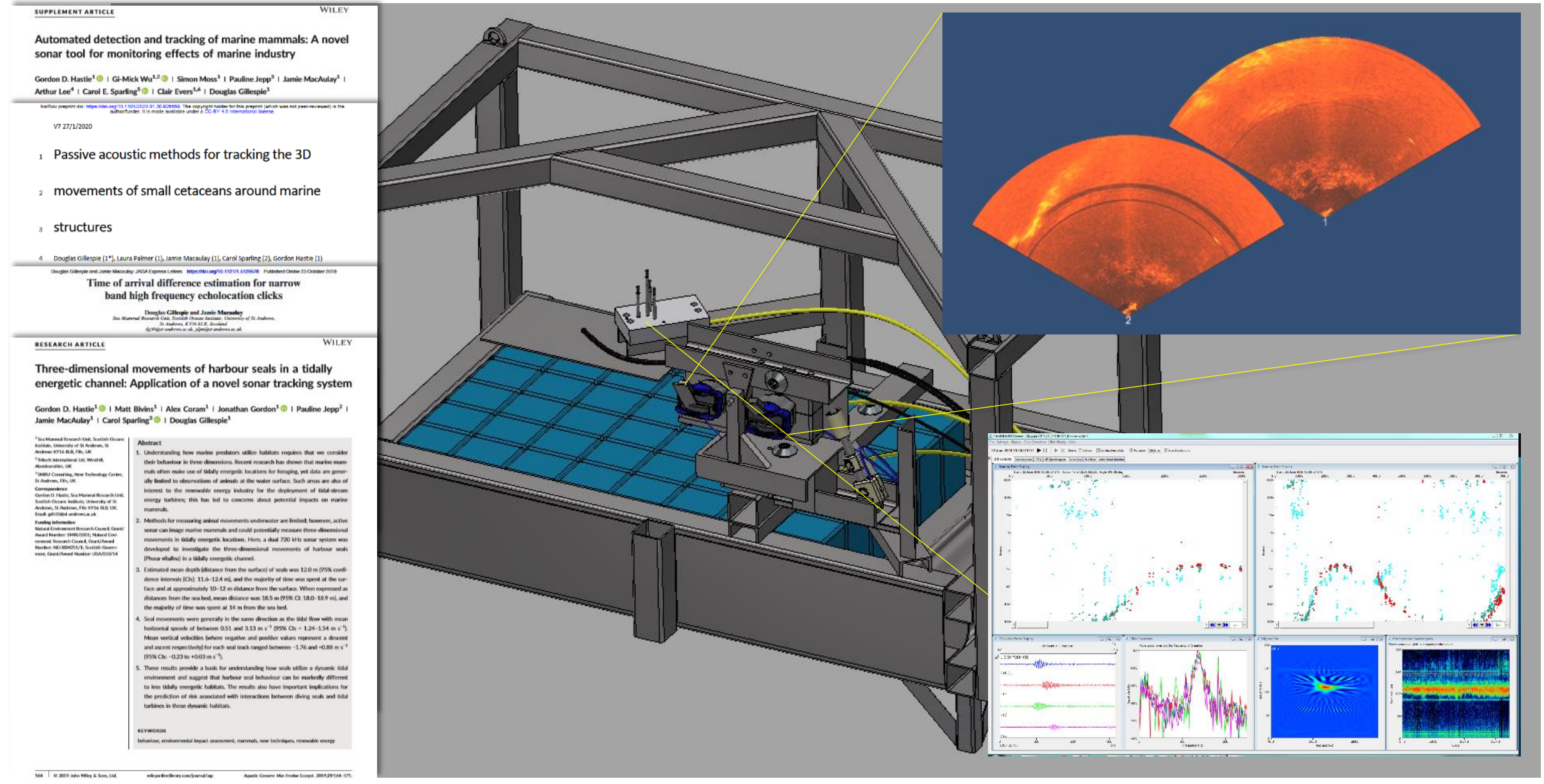
Active acoustic tracking



Passive acoustic tracking



Marine mammal HiCUP: **Hi**gh **C**urrent **U**nderwater **P**latform



SUPPLEMENT ARTICLE

WILEY

Automated detection and tracking of marine mammals: A novel sonar tool for monitoring effects of marine industry

Gordon D. Hastie[1] | Gi-Mick Wu[1,2] | Simon Moss[1] | Pauline Jepp[3] | Jamie MacAulay[1] | Arthur Lee[4] | Carol E. Sparling[5] | Clair Evers[1,6] | Douglas Gillespie[1]

V7 27/1/2020

1 Passive acoustic methods for tracking the 3D

2 movements of small cetaceans around marine

3 structures

4 Douglas Gillespie (1*), Laura Palmer (1), Jamie Macaulay (1), Carol Sparling (2), Gordon Hastie (1)

Douglas Gillespie and Jamie Macaulay: JASA Express Letters https://doi.org/10.1121/1.5126678 Published Online 23 October 2019

Time of arrival difference estimation for narrow band high frequency echolocation clicks

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RESEARCH ARTICLE

WILEY

Three-dimensional movements of harbour seals in a tidally energetic channel: Application of a novel sonar tracking system

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Funding Information
Natural Environment Research Council, Grant/Award Number: SMRU1001; Natural Environment Research Council, Grant/Award Number: NE/J004251/1; Scottish Government, Grant/Award Number: USA/010/14

Abstract

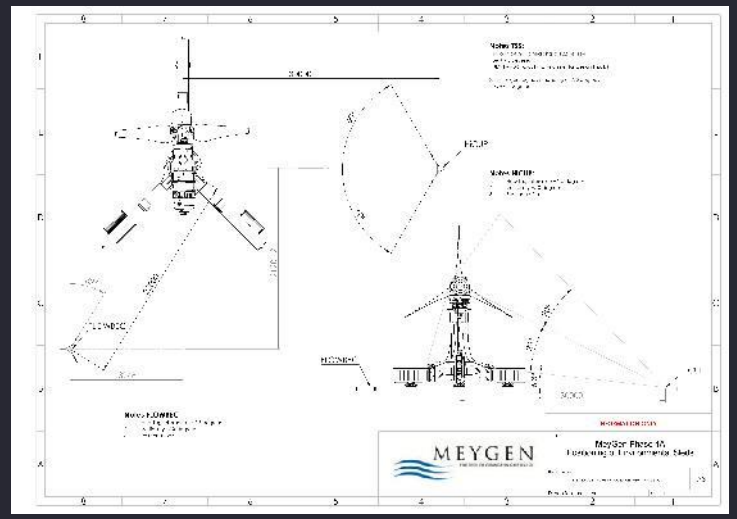
1. Understanding how marine predators utilize habitats requires that we consider their behaviour in three dimensions. Recent research has shown that marine mammals often make use of tidally energetic locations for foraging, yet data are generally limited to observations of animals at the water surface. Such areas are also of interest to the renewable energy industry for the deployment of tidal-stream energy turbines; this has led to concerns about potential impacts on marine mammals.
2. Methods for measuring animal movements underwater are limited; however, active sonar can image marine mammals and could potentially measure three-dimensional movements in tidally energetic locations. Here, a dual 720 kHz sonar system was developed to investigate the three-dimensional movements of harbour seals (*Phoca vitulina*) in a tidally energetic channel.
3. Estimated mean depth (distance from the surface) of seals was 12.0 m (95% confidence intervals [CIs]: 11.6–12.4 m), and the majority of time was spent at the surface and at approximately 10–12 m distance from the surface. When expressed as distances from the sea bed, mean distance was 18.5 m (95% CI: 18.0–18.9 m), and the majority of time was spent at 14 m from the sea bed.
4. Seal movements were generally in the same direction as the tidal flow with mean horizontal speeds of between 0.51 and 3.13 m s^{-1} (95% CIs = 1.24–1.54 m s^{-1}). Mean vertical velocities (where negative and positive values represent a descent and ascent respectively) for each seal track ranged between −1.76 and +0.88 m s^{-1} (95% CIs: −0.23 to +0.03 m s^{-1}).
5. These results provide a basis for understanding how seals utilize a dynamic tidal environment and suggest that harbour seal behaviour can be markedly different to less tidally energetic habitats. The results also have important implications for the prediction of risk associated with interactions between diving seals and tidal turbines in these dynamic habitats.

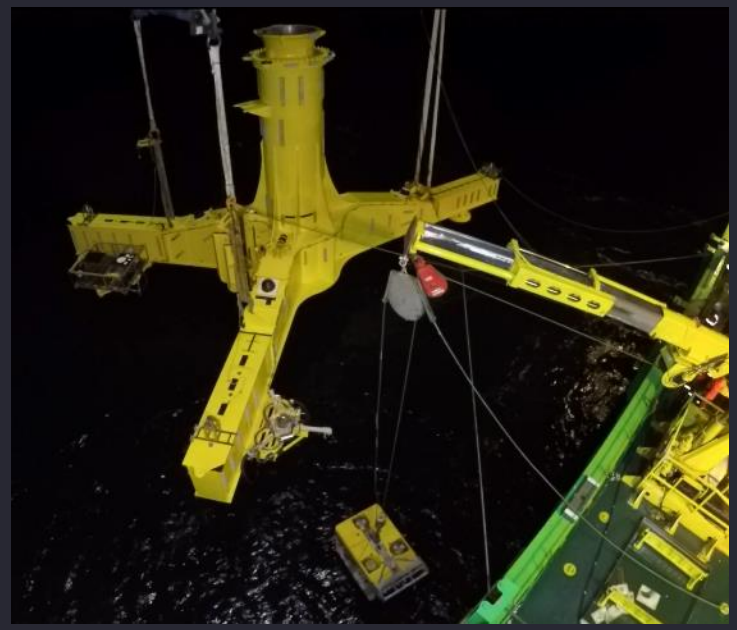
KEYWORDS
behaviour, environmental impact assessment, mammals, new techniques, renewable energy

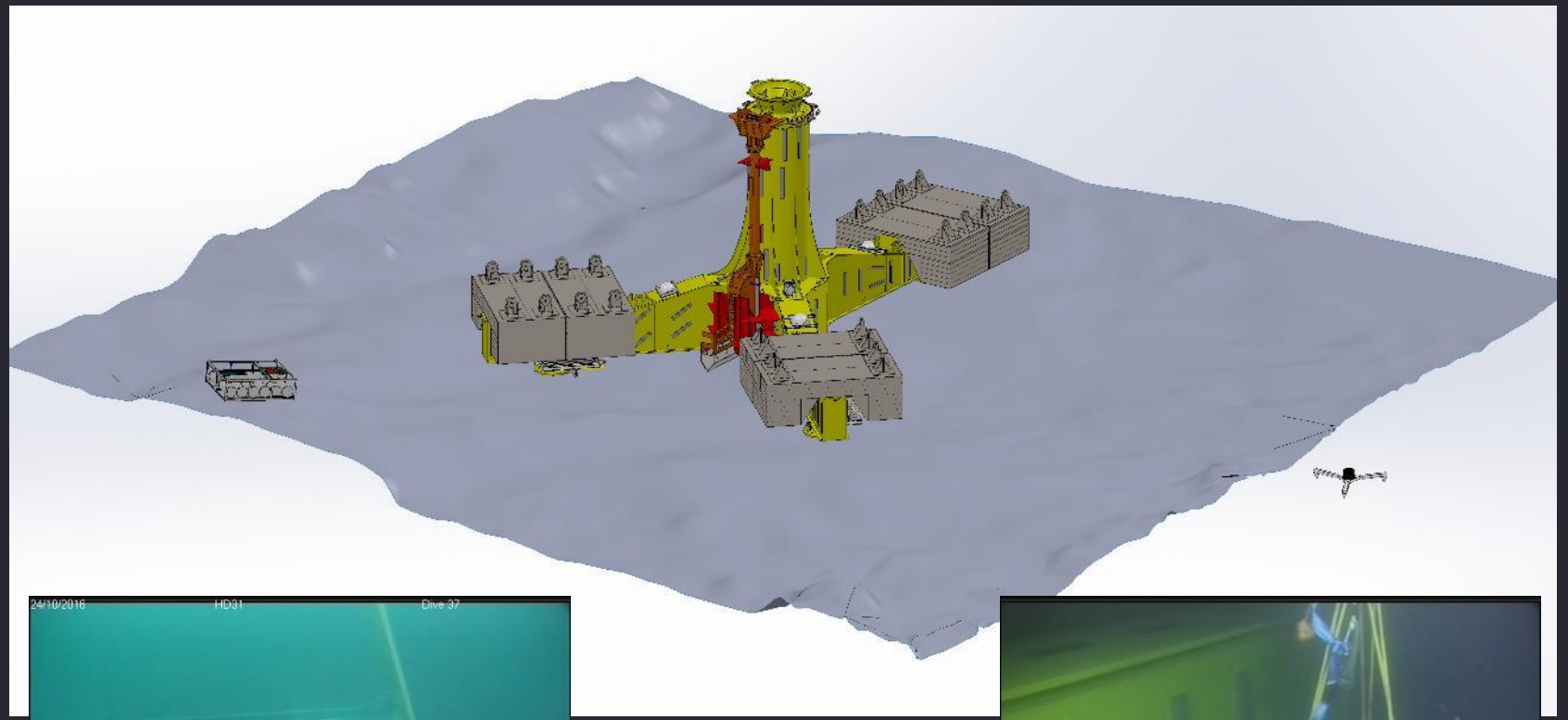
Marine mammal HiCUP: lessons learned

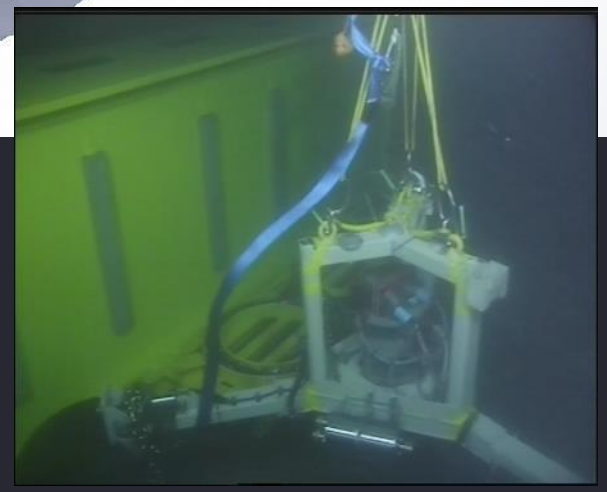
MeyGen – Phase 1A environmental monitoring

SIMEC ATLANTIS ENERGY

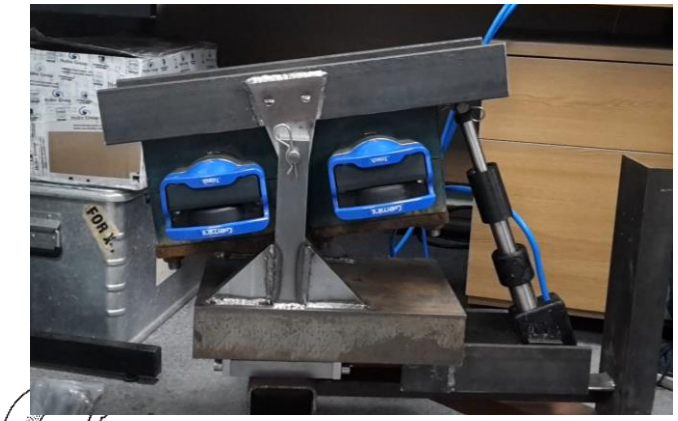






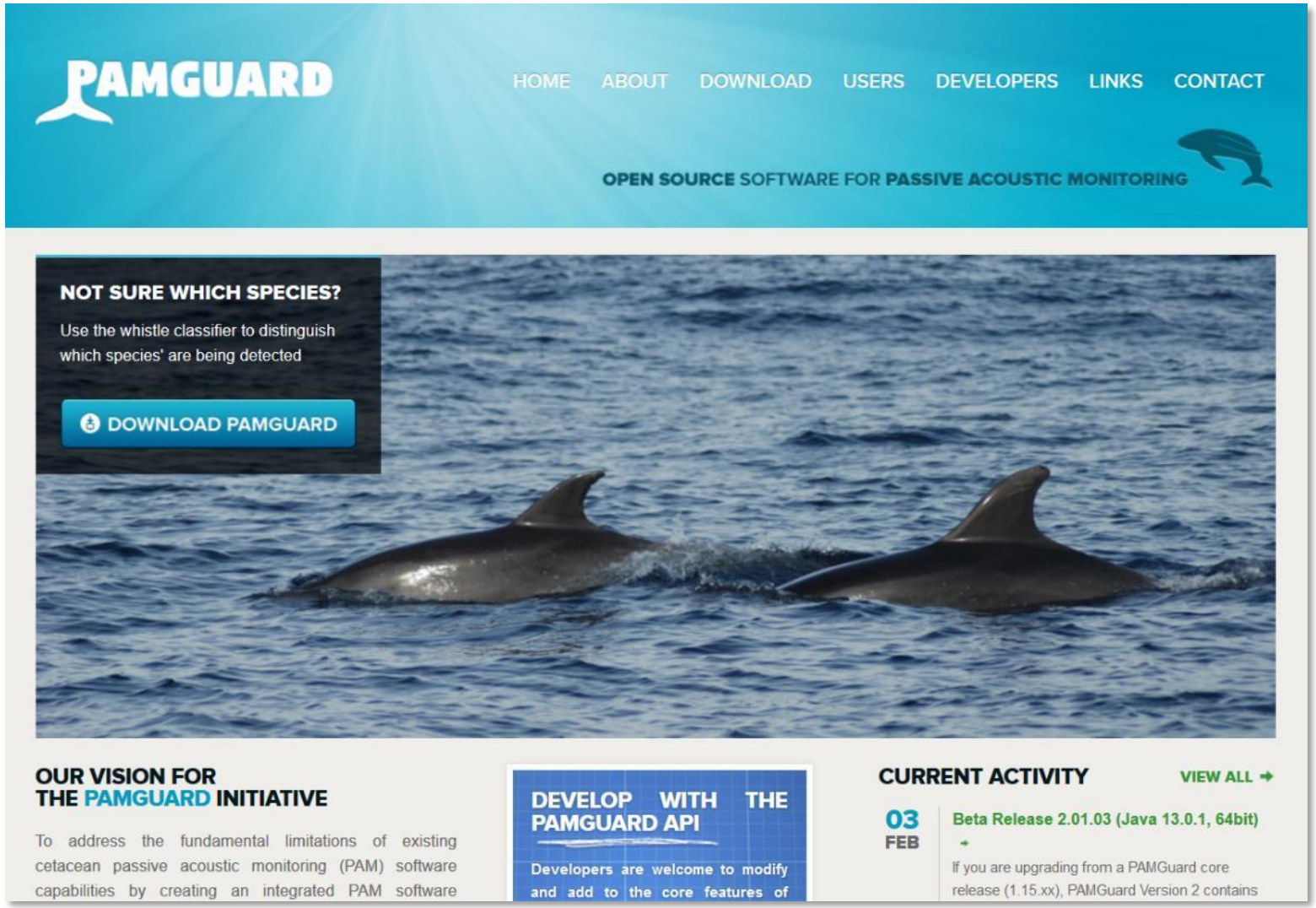


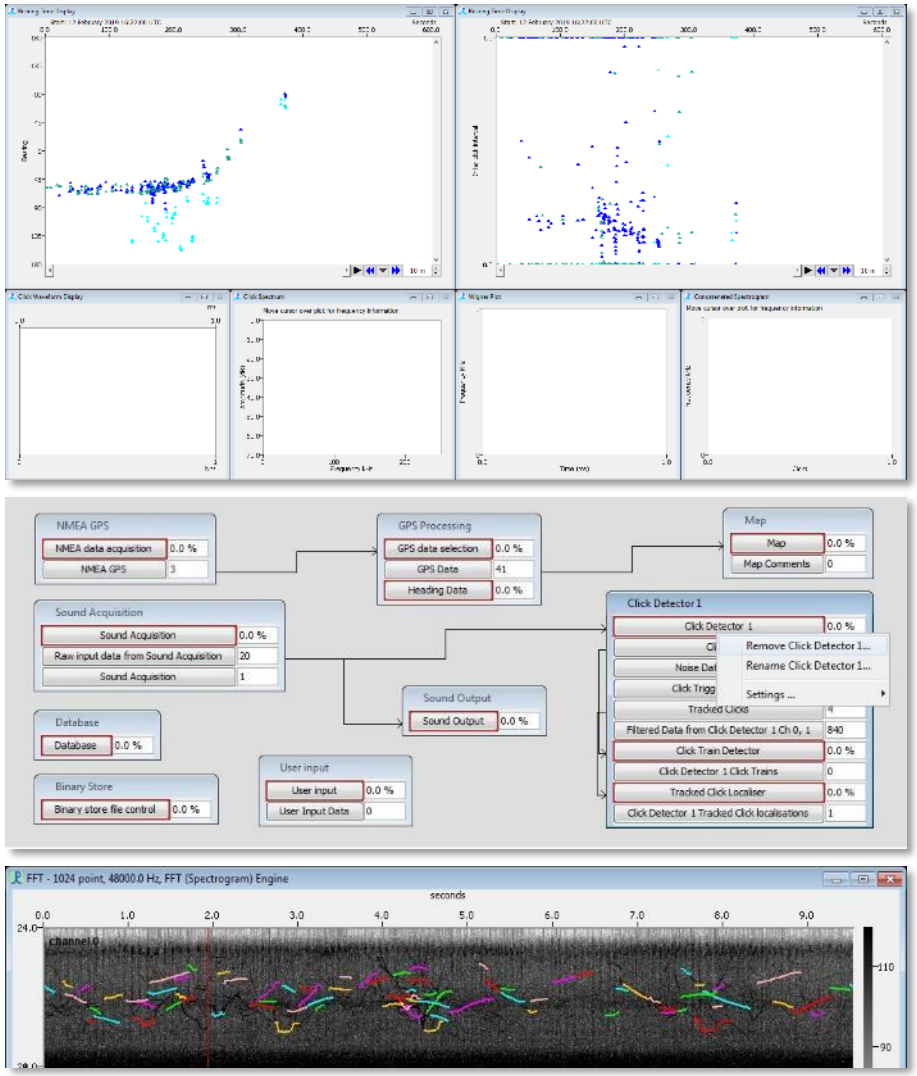
Marine mammal HiCUP: progress



- Field tests of combined tracking with passive and active acoustics;
- Tank tests of long-term stability and to synchronise AAM and PAM data timings.
- Design complete and finalising construction

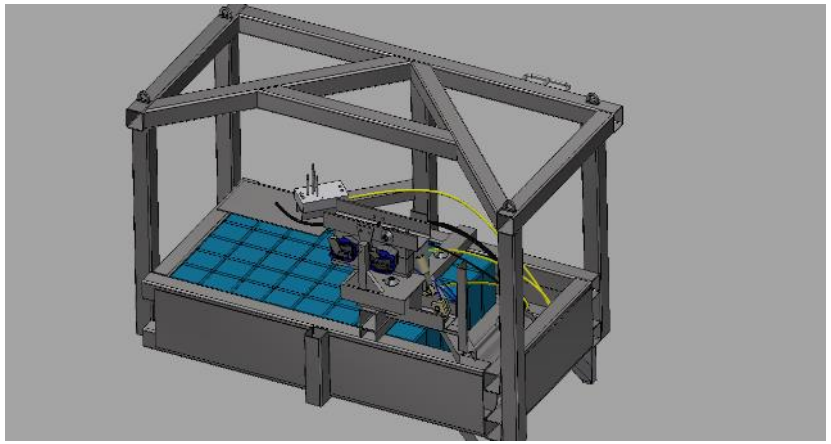
PAMGuard: open source software



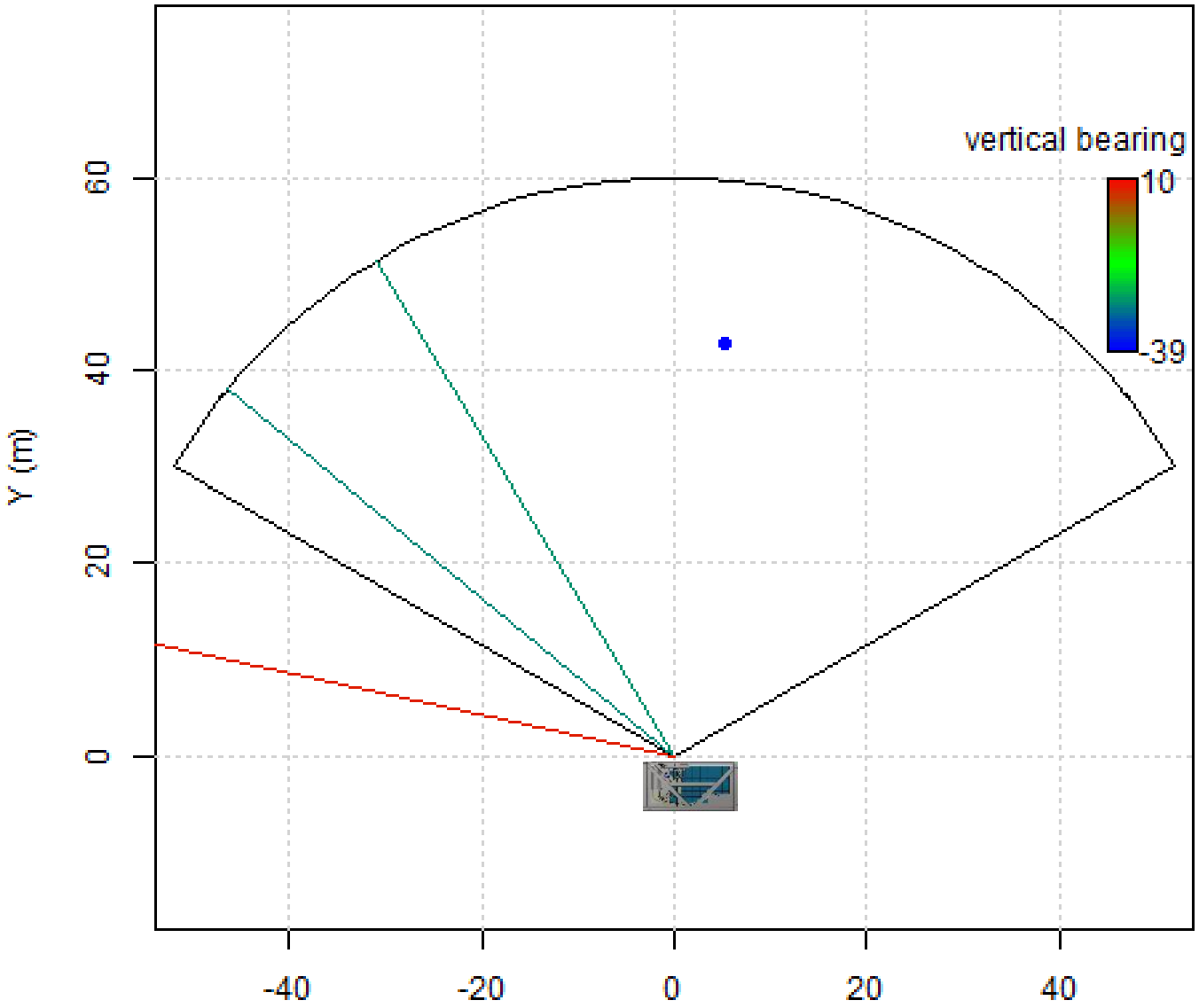


www.pamguard.org

Marine mammal HiCUP: example data



Porpoise track on sonar + echolocation bearings

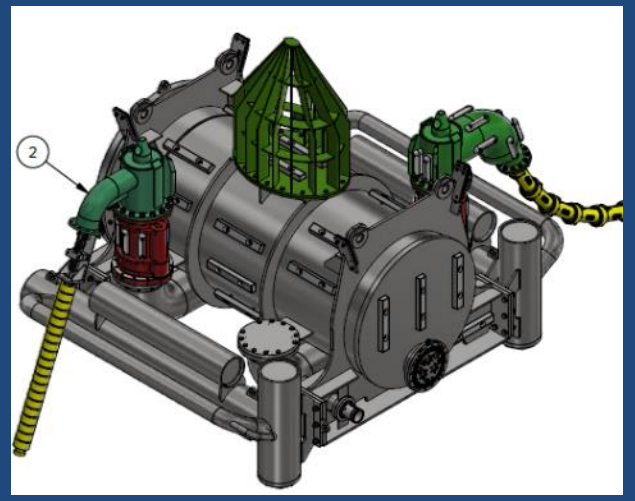


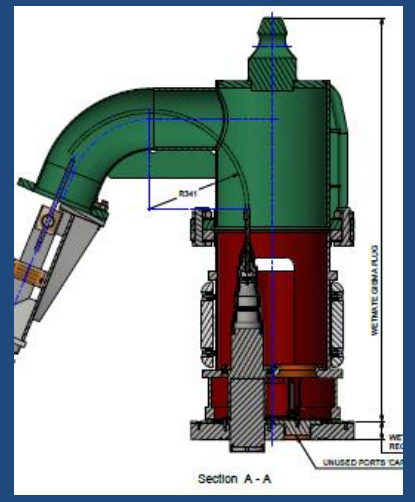
Next steps: deployment around operating turbine…

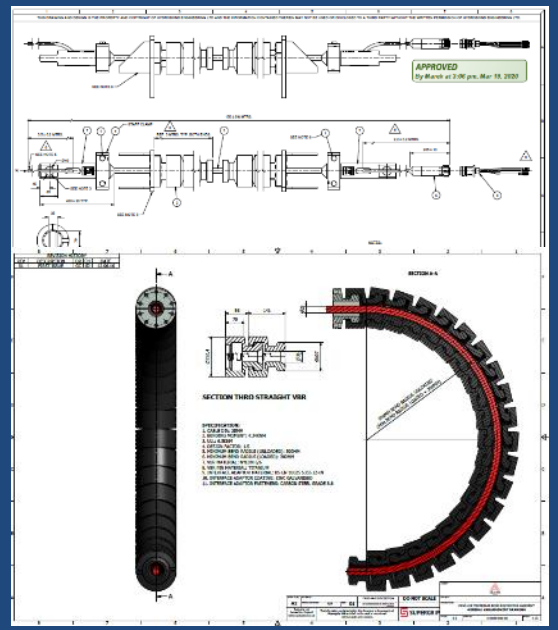
MeyGen – Environmental monitoring design strategy

SIMEC ATLANTIS ENERGY

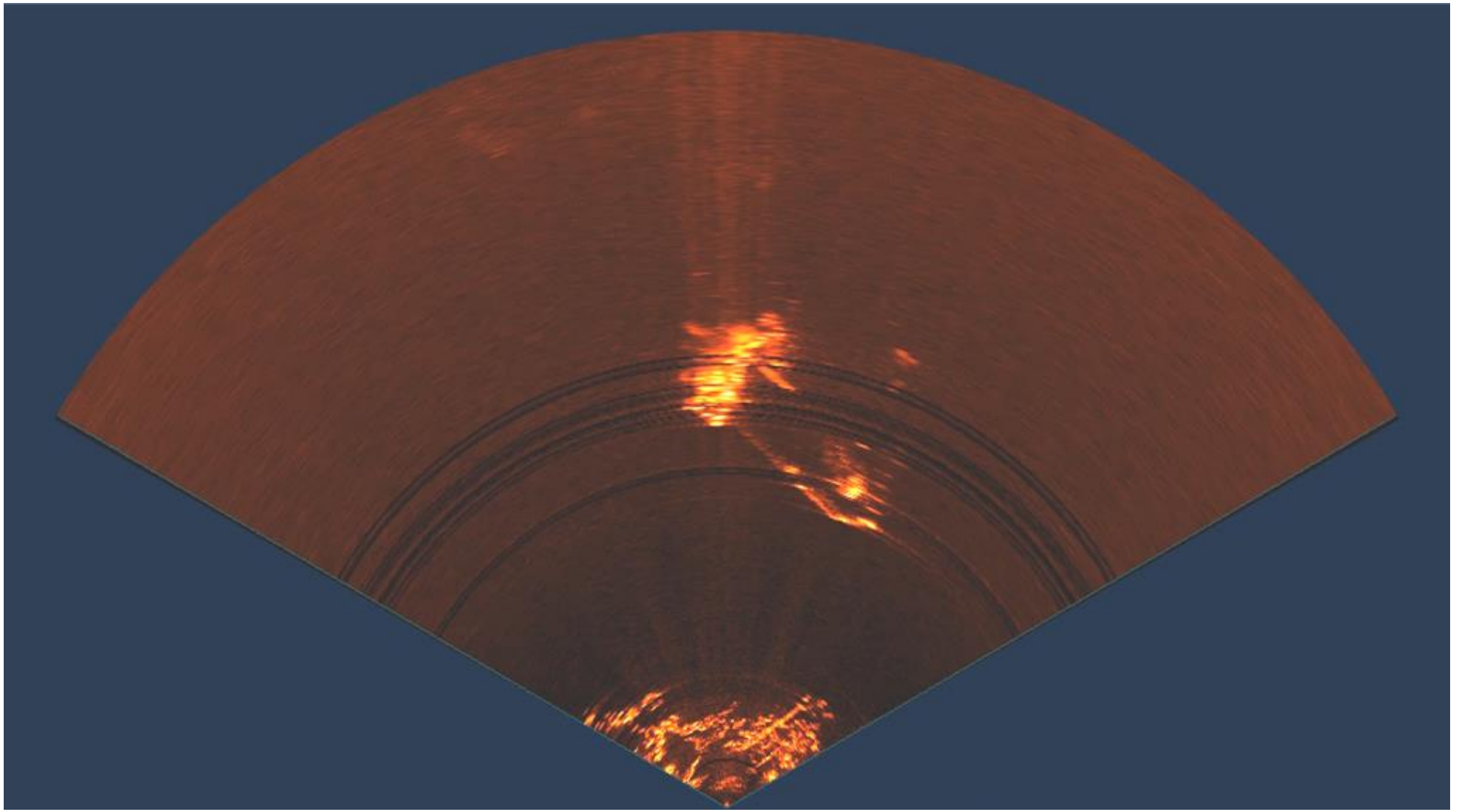
- The environmental platforms and equipment deployed during Phase 1A was not wholly successful.
- Lessons learnt from the successes and failures has been fed into the next generation platform.
- Fundamental design principles:
  - Continuous collection of data;
  - Integration into the tidal turbine systems with the provision of auxiliary power and dedicated fibre optics for data transfer ashore;
  - Use of high-grade connection design of a standard equal to that used for the turbine systems;
  - Use of steel armoured cable for the umbilical;
  - Use rock bags to provide cable stabilisation of the umbilical to protect against fretting or damage during long term deployment;
  - Ability to connect the platform into the turbine system while the platform is on the installation vessel to perform final commissioning checks prior to installation;







Next steps: deployment around operating turbine…



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Marine Alliance for Science and Technology for Scotland

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