



## Marine Facilities Advisory Board 28 March 2023

Professor Carol Robinson (UEA), Chair (CR)  
Dr Gay Bayrakci, National Oceanography Centre  
Dr Veronique Creach, Cefas  
Dr Eleanor Darlington (NOC) ED  
Dr Louise Darroch, NOC (LD)  
Emma Defew, MASTS (Ede)  
Dr Maaten Furlong, NOC (MF)  
Dr Kate Hendry (BAS) (KH)  
Dr Jo Hopkins (NOC) (JH)  
Dr Stephen Jones, University of Birmingham (SJ)  
Dr Chris McGonigle (Ulster University) (CM)  
Helen Oldridge (NOC) (HO)  
Dr Alex Phillips (NOC) (AP)  
Julie Pringle Stewart (NOC) (JPS)  
Leigh Storey, NERC (LS)  
Dr Natalie Powney, (NERC) (NP)  
Dr Tim Smyth, (PML) (TS)  
Dr Helen Snaith, (NOC) (HSn)  
Dr Gabrielle Stowasser, BAS (GS)

Jackie Pearson, NOC (JP) - Secretary

### Apologies

Dr Jörg Bialas, Adrian Baker, Dr Michelle Taylor, Professor Kerry Howell

### Item 1 Welcome and overview for new members

1.1 CR gave [presentation](#) on MFAB for the new members whom we welcomed today - Dr Gay Bayrakci, Dr Veronique Creach, Dr Stephen Jones, Dr Michelle Taylor and Dr Gabrielle Stowasser.

### Item 2 Actions from November 2022

1. Plan for a larger infographic that will cover all the TRM and is being updated with the new NOC branding so is a work in progress. **Action 1: MF**
- 3: HSn advised this comes under the updates with the Data Working Group. Action complete.
- 26: Action paused whilst the Upscaling Autonomy Working Group (UAWG) is active. Once the activities of UAWG are complete, MAS WG will restart.

### Item 3 [Update on Upscaling Autonomy Working Group](#) - Leigh Storey

- 3.1 LS thanked Carol Robinson and Mark Inall for their leadership of MFAB.
- 3.2 The remit of the UAWG is to present NERC with feedback from the community about upscaling the UK's autonomous capability. In NERC, there is an activity to write a business case to the UKRI Infrastructure Fund to access £250M - £350M to undertake the NZOC programme. The UAWG report will be timely for NERC.
- 3.3 LS mentioned the UAWG activities and asked for the link to be sent around MFAB - **Action 30 JP**

### Item 4 [Update of the Net Zero Oceanographic Capability \(NZOC\) Programme](#) – Leigh Storey

- 4.1 There is a scoping review about NZOC. NZOC has a Programme Board, Chaired by LS, which will meet in April 2023. The Board will focus on delivery of the programme. There is a Science Advisory Group, chaired by Professor Alex Rogers. Alex also sits on the Programme Board. The Advisory Group advises NERC and will feed into an oversight board which will be chaired at a higher level in NERC and will provide strategic oversight of the programme. The details are being finalised and LS would like to present again on this at the next MFAB. Details will be on the NZOC website **Action 31: JP**

### Current activities

- 4.2 BIO-Carbon is a NERC sponsored programme. There are two ship-based research expeditions planned for 2024. NZOC may fund scientists to consider how to do the BIO-Carbon activity without ships, just using autonomy which will help highlight where the technology gaps are, why there might be reticence to use autonomy and how to prioritise funding.
- 4.3 We hope to secure funding from UKRI to undertake a sensor call soon where the focus will be on BGC and possibly, biological sensors. Potentially, there may be funding for a large number of sensors.
- 4.3 There is a project where NOC is providing autonomous capability to feed into the Met Office supercomputer. We hope to explore using additional gliders to collect data that will also be used by the Met Office. Thus, this activity will involve multiple P.Is with different objectives. This will help us to think about the practicalities of sharing information collected in this way.
- 4.4 The Marine Facilities Planning (MFP) portal is important as we move towards using increasing numbers of autonomous platforms. How will these be coordinated across providers and users? The MFP probably provides the best solution. We are also funding some activity delivered by the British Antarctic Survey's A.I Laboratory which is considering ways to manage multiple requests for data and multiple gliders with options around sensors. Also under consideration is how to produce an outline programme that would go to ED and NP who would then decide how best to deliver the science.

## **Item 5 Update on Data Working Group (DWG) – Dr Helen Snaith (HSn)**

- 5.1 BODC now has in place a microservice that provides an end to end system, taking the delayed mode data off the ships after the end of the cruise, processing those data and delivering them through an API. This gives machine accessibility to certain underway variables - primarily the met. and surface ocean variables and the single beam bathymetry. Over this summer BODC will complete the exposure of those data so that it becomes a routine access route to all of the underway data after the end of cruises.
- 5.2 This is a parallel piece of work to what BODC we already have in place in collaboration with NMF, to synchronize the near real time ship data using an API, so we should have both near real time and the QC delayed mode data available through API endpoints. The NRT delivery stream is setup but suffering from some connectivity issues from the vessels meaning it's not yet operational.
- 5.3 BODC is also committed to providing a Python package so support onboard processing of the data. This is due to be completed later this year, potentially in October. This was held up by needing suitable test datafiles in the right formats, and the need to have a consistent framework in place for the scripting. These are now in place and BODC is in a position to complete this work.
- 5.4 For information, BODC has some additional funding through the NERC digital environment and UKRI digital research infrastructure to explore building data system in support of sensor networks, including work on how to use persistent identifiers for network sensors and instruments - a way of linking an individual instrument's 'tag' in its data stream to the information and the knowledge about that sensor. This will be further developed across the NERC Environmental Data service as part of the next NC project.
- 5.5 The next steps for the data working group will be to identify the types of data that we will want to be able develop processing chains for and how we prioritise these.

### **Possible options being considered:**

- Adding PCO<sub>2</sub> sensor data to the underway processing, to support new systems being installed on the vessels in support of BIOCARBON and other upcoming programmes. We could investigate adding those into the existing systems for delivering data from the vessels to BODC, along with the other underway data.
- Extending the capability to have for continuous multibeam bathymetry operation in support of the Seabed 2030 project and enhancing the GEBCO global maps.
- Developing a scheme for processing and accessing seismics data, given the recent investment in new hardware for seismics. This would support processing and access to data through BODC.

- *Post meeting comment from Dr Joerg Bialas: [NDI4EARTH](https://www.nfdi4earth.de) is a German consortium addressing digital needs for Earth System Science. Among others harmonizing seismic data headers and structures to enable long-term storage and accessibility. <https://www.nfdi4earth.de>*

BODC will also need to investigate potential sources of funding for developing any of these streams.

**5.6** CR asked HSn to provide some text for the minutes and the web site. CR asked who is on the Data Working Group and when is the next meeting will be. We should record that this WG is taking on comments from the user community. MFAB will report on this to the Cruise Programme Executive Board in October. HSn responded that she would check on the membership; she doesn't believe that the group meets on a regular basis so a lot of what the group does is on an informal basis. A formal meeting is overdue and potentially, the group's membership may need a refresh as we may now be moving beyond the underway data which was the original but now we are moving beyond that remit and need to look at the next data sets. CR asked for a meeting to be organised, to provide a list of the membership and refresh the membership, if needed **Action 32: HSn**

**5.7** GB mentioned the seismic group at NOC – perhaps someone from this group could join the DWG? GB happy to join or someone from the community.  
**Action 33: GB, JP**

## **6 Update on cruise opportunities – Eleanor Darlington**

**6.1** The NMF Marine Facilities Planning page was developed by NOC and NIOZ and is used by the US, across Europe and Australia. NMF has been setting up a portal of funded work that is either programmed or needs to be programmed. It will be possible to apply for a berth and NMF is trying to open up opportunities for people to join the ships. We are looking at 'tag on cruises' which is something that Australia does and NMF is trying to emulate. We have been talking to BODC about standardisation of location and this feeds into reporting. NMF is working to enhance visibility of **FindAScienceBerth** but trying to avoid the operational overhead.

### ***Post meeting comment from Dr Joerg Bialas***

*Dr Bialas raised a post-meeting question as to whether costs are included. Costs are not included at the moment. This is opportunity only and individuals need funds to cover travel and certification to join the ship.*

**6.2** Regarding NZOC, we are looking to get data about vessels and equipment. ED demonstrated an expedition and showed that applicants can add start and end locations of vessels which will generate information about time in each location and fuel consumption which is helping us understand carbon output. The software can also suggest changes in order of activities in order to optimise economy. For the 2024/25 programme, applicants will be asked to update their SME forms so that NMF will have a carbon budget for the coming year. Everyone, when completing an SME will be asked to do this in detail.

- 6.2 GS asked how much advanced notice will be given about the option to apply for a berth? ED: the programme is published every October and this year, the programme will be published up to March 2025. There is a six month window. GB asked if ED is in touch with anyone at BAS to include the RRS *Sir David Attenborough* (SDA). ED responded that the SDA can be on the programme and added that there are many other operators on this system.
- 6.3 HSn: there is discussion between NMF and BODC on how to link our systems better e.g. we are trying to generate the first draft of the cruise summary report to help streamline the process and are seeking funding to support this. This will save time for scientists. NMF has also been talking to the NERC Earth Observation Data Acquisition and Analysis Service (NEODASS) to see how NMF can better integrate elements of the National Marine Equipment Pool (NMEP).

## Item 7 [The ALR Costing Model for NERC Science](#) – Maaten Furlong

- 7.1 The Autosub Long Range (ALR) Autonomous Underwater Vehicle (AUV) has unique capability for the UK; it provides high power capabilities so goes a long way with a large payload capability. We have a 6,000m and 1,500m rated vehicles. It is a capable platform, long range and shore launched and is a key element of the NZOC ambition.
- 7.2 In 2019 the ALRs were operational and ready for science, however, these vehicles weren't yet part of the NMEP so weren't funded via National Capability Large Research Infrastructure funding. It was decided to use a Pay As You Go (PAYG) model which assumed there would be a limited number of deployments per year and would enable NOC to fund a minimal operational team to run the ALR. At the time, we expected one deployment per year. The PAYG premium would be paid via the science budget but this was only a stop gap and the ambition was to move the ALRs into the NMEP.
- 7.2 In April 2019, the PAYG model was proposed; in October 2020, the premium of £150k was agreed. In March 2020, it was going to be refined but this then stalled due to the pandemic. There are problems with the PAYG model. E.g. there are problems with scales; what happens when there are multiple deployments? What happens if there are two ALRs on one deployment? The model is also inconsistent – for NERC funded science, there is a £150K premium but for an EU-funded project, we can't charge £150K because the EU only pays direct costs which the premium isn't. It is also difficult because it puts the ALR out of range for a number of science campaigns so this is misaligned with the NZOC ambitions. NMF and NERC will review this model.
- 7.3 TS asked if the data from trials cruises could be made available for the community as a resource which would also help students. AP advised that most of the data should be in BODC with a couple of exceptions. TS also mentioned the forward look and asked if the chart could be colour-coded. MF mentioned we need to check the data is fully open access.
- 7.4 HSn explained that trials cruises don't have funding to support the data. BODC can release raw data on request but it won't have received any standardised processing. There isn't funding for this. We hope to use data to test the route for data from the ALR but currently, this would only be available,

on request. MF added that, by the next MFAB meeting, we will be able to clarify this model.

- 7.5 CR asked if it is possible for NMF to change the model so that the EU could pay some of this cost? MF: this needs to be explored but this issue may sit outside the NERC relationship. In this case, we would be contracted by the EU so we would need to follow their funding guidelines but it would be good to try to get support for this. NP added that if we change the model, this would need to be run past the CPEB. It won't be possible to do this in time for the upcoming CPEB but could go to the October CPEB. At the autumn MFAB, we can provide an update and confirm details after the October CPEB. It would be wise to look at the EU aspect of this. This can be discussed off-line and should be on the autumn MFAB agenda. **Action 34: NP, MF, JP**

## 8 Capital challenges. Helen Oldridge

- 8.1 NMF will use capital funding for trials, marine IT, licensing and hardware. NMF has a budget of £5m to 2028; £1.5m is already allocated, which leaves £3.5M over the next five years. The value of potential projects on our list totals around £6m so we need to prioritise. HO explained that items on the list of equipment that are in magenta are driven by a need for spares or the risk of something breaking. These items may have to be replaced when spares run out. SJ asked why the compressor replacement is in magenta? HO: there are no parts being manufactured for it and ultimately, we may not be able get parts so it will have to be replaced.
- 8.2 TS asked about the number of marine snow catchers. HO: this was an estimation of value and these are being overhauled at the moment. TS commented that the old ones were unsafe.
- 8.3 HO: the compressor can be used at 3,000 psi but this will affect the firing rate. SJ referred to high-cost items, to ask if NMF considers sharing items with other countries to spread cost? ED talked about the Ocean Facilities Exchange Group; there is a similar system in the US. Around seismics equipment, we have worked closely with the Spanish national Research Council (CSIC) so when NMF buys equipment, we ensure it is interchangeable with CSIC systems, extending our capability. This can create programming challenges though because of the associated coordination. HO asked whether, other than OFEG Tech, there is a database within the OFEG partners for capabilities for equipment that is being kept or being invested in? ED said no but NMF did start a conversation on this around towed bodies to see if NMF could work with other institutes. NOC is hosting OFEG next week so could discuss this.
- 8.4 HO said that if an item is 'green across the board', we assume we will buy it. If we continue to use, for example, multi-beam, we will replace when necessary. We work to maintain capability. If there is anything new or will advance capability, these would need discussion. NP commented that there are a couple of items in the list which would quickly use up the budget.
- 8.5 SJ asked whether equipment needing repair 'trump' items in yellow (advancement in existing capability) or blue (new capability)? In theory, items in

yellow or blue should be higher priority? HO answered that if something needs repair, this has priority as it will be fulfilling the programme. If the issue is less clear, there will be a discussion. NMEP capabilities were commissioned by NERC on a ten year programme so if we need to change them, this would need to be flagged to CPEB by MFAB. This is part of obsolescence management.

- 8.7 JH asked about large grants that have been funded and comments in the Technology Roadmap e.g. updated sensors. Is this funding acknowledged in this table? Some people are buying those sensors so these would be a good guide on costs. HO agreed and will discuss with JH off-line. **Action 35: HO, JH**
- 8.8 AP: the list shown by HO represents the Scientific Engineering portion of the capital and does not include the MARS element of the capital. Regarding the Scientific Engineering capital, we are being driven by hefty maintenance costs for the ROV which will take a significant proportion of the MARS capital over the next couple of years. Currently, we are waiting for a quote on the ten year maintenance cost for the deployment system. Last time, the quote was \$240,000 year and this time, we are expecting this to be substantially higher. We are thinking about new sensors. With the BIOCarbon programme, there is a shortage of sensors and we are looking to get more funding but it may not be possible to match the ambition of the community. HO commented that the split between Scientific Engineering and MARS is flexible. CR commented that it isn't only NERC that is buying equipment and sensors for the marine environment - there has just been a project funded by EPSRC so should we start to look broader than NERC and see if there are instruments or sensors are coming into some of the other UKRI funders? JP advised that Kola Akinola is the contact on this at NERC. NP offered to assist here. **Action 36: NP/JP**
- 8.9 CR asked that the table (which should go in the minutes) is considered at each MFAB meeting and should be provided in advance. Although MFAB ranks new items against each other, we don't rank them against the funds that are needed to maintain the existing pool. This table is useful to highlight tensions that may exist. **Action 37: HO/JP**
- 8.9.1 CR mentioned the papers for information. No feedback received. Post updated ToRs on-line. **Action 38: JP**
- 8.9.2 KH advised that there will be a report produced from the recent Autonomy in Biogeochemical research Workshop.

## 9 [Technology Roadmap](#) – Helen Oldridge & Alex Phillips

### Summary points

- Focus is around network upgrades which will mean that the ships' network status will comply with cyber essentials.
- UAC is happening for RRS *Discovery* now.
- PCO<sub>2</sub> tender is complete and installation on both ships is planned for 2023 and doesn't require refits.
- Scanfish is being recommissioned and will be on DY166 for trials and also onto ALR shortly afterwards.

- VNP connector – have been issues. Will overhaul this system to improve the capability.
- RVDAS – production versions due to be released shortly.
- JC252 - seismic trials Sept/October 2023 which will, for example, enable NMF to roll out the GI guns.

### **Post meeting note from Dr Joerg Bialas:**

GEOMAR operates GI guns at 2000 PSI, reducing cavity damages significantly.

### **Development highlights for next 12 months: DY166**

#### **Three focal points**

- 1.) Upgrades are planned for the Autosub control systems which will give more finesse over when sensors are turned on and off during missions which will save power, for example.
- 2.) Glider missions – getting ready for under ice missions
- 3.) Integration of additional payloads into each Autosub.

Each of these will be tested on DY166.

- We will switch payloads between missions on Autosub5.
- Looking at better integration of the eDNA sampler into Autosub.
- Gliders will be running back-seat drivers and we will be conducting simulated under ice missions.
- Will be supporting OTE's TechOcean programme in Gran Canaria, Mark 2024, two ALRs.
- We are trying to provide training for the glider teams to optimize the technical parties to free up berths for others to go.

#### **Forward look**

- Satcomms contract is under review and fundamental to a lot of the advancements we are hoping to achieve.
- Hope to be able to start streamlining large volumes of data to shore.
- We have set up a sampling group to focus (first meeting March 2023) on coring, trawls and dredging and colleagues are welcome to contribute. Please contact HO for details. This will tackle how we deal with samples and look at how we will progress to NZOC goals.
- SURFMET – suite on board has been reviewed. We will be able to consider a wider range of ocean variables than we can currently.
- Aiming to use the CTD frame to get ADCP serial data streamed during deployments.
- Investigating automated MBES data processing of bathymetry data.



- NMEP catalogue of kit and detail about capability etc. will ultimately be publicly available and is on a test system at the moment. Should be live in 2024.
  - TS mentioned the ADCP serial up the wire for the CTD – at what level is the processing, at the other end? HO will get back to you on that. **Action 39: HO**
  - CR Who is on the Sampling Working Group so we can see if there are any gaps? HO said it is focused on benthic sampling and agreed to consider if there are any gaps **Action 40: HO**
- 9.1 SJ asked about atmospheric measurements and sampling? HO: this is a good point, also made by NOC's Dr Margaret Yelland at the Ship Underway Users Group in which SJ is welcome to participate. Our priorities have been focused on surface data. ED advised that PML has Met Office equipment is on board RRS *Discovery* at the moment. University of Birmingham team was on cruise recently but their work was containerised in terms of what needed to be measured. A problem with monitoring atmospheric is the ship's exhaust fumes; also, the wind speed and direction is adjusted by the vessel movements so it is more complex than measuring underway data. SJ is happy to be involved in the SUWUG. **Action 41: JP**
- 9.2 TS: PML has a flux system on RRS *Discovery* and will be on the RRS *Sir David Attenborough* as well. It's not a release version yet. We are looking at the fluxes of CO<sub>2</sub>, methane, turbulent fluxes, momentum and heat transfer. This is a system PML has built and may be impenetrable to others. What we can do in terms of underway measurements in terms of the met side, the focus has so far been PCO<sub>2</sub> and CTD data but we will be progressing this.
- 9.3 CR thanked NMF for their work. Previously, drafts of the TRM have come to MFAB whose scientists have considered sections with their community who have helped to update the text. There can be updates before the final version goes on-line. Do we want to do this again? HO said it would be useful to have comments around the scientific drivers e.g. do they still make sense. Does anything else need to be added in which will help inform capital priorities? Also, any suggestions for advancement in those areas.
- 9.4 CR asked about timescale? Will a version go on the website before the next version that arrives in March 2024? HO explained that the TRM will be published around June 2023. CR agreed to create a table of sections of the TRM and ask the MFAB to look at sections and contact communities for amendments to the science drivers. It was noted there is a gap around links with atmospheric measuring community. CR asked that air sea exchange people bring in their counterparts in atmospheric. SJ agreed to talk to his colleagues on this. **Action 42: ALL**
- 9.5 HO: the TRM is organised into what NMF has versus what NMF is doing. Once the NMEP catalogue is active, this will help to streamline the document.
- 9.6 CM asked if analytics are available to show pages accessed and show who is interacting. He expressed the concern that only a sub-section of the community may be responding. Communications team to provide some stats on usage. **Action 43: JP**

9.7 CR agreed to encourage feedback from the Board so that comments would be ready by June/July. **Action 44: All**

### Any Other Business

1. JP mentioned Michelle Taylor's (MT) question about how the UK stores biological sampling which may now a topic for the NOCA. MT's concern that the UK is missing a catalogue of biological resources in the UK. There isn't a standardised way of knowing where biological samples are.
2. CR had contacted Dr Lou Darroch at BODC which doesn't normally inventory physical samples. MT is interested to find out to what extent a cataloguing process might be possible. MT talked about OBIS, the *Discovery* collections and International Generic Samples Number (IGSN) identifiers and standards. There is a now discussion between MT and BODC. As biological and sediment samples don't fit MFAB's remit so JP is talking to Prof Mark Inall, Chair of the NOCA, to see if the community, in collaboration with NERC, could find a way of funding and cataloguing.
3. HS<sub>n</sub>: the IGNS - geophysical records standards is being investigated and BOSCORF has plans to use this and is talking to BAS and BGS about consistency across NERC both for the cores and biological samples. Dr Suzanne MacLachlan, BOSCORF, is talking to Dr Tammy Horton, Discovery Collection about data bases and recognition so this is on-going.
4. GB advised that BAS has employed an RA to catalogue the frozen samples; VC mentioned the Cefas collection. CR: there needs to be a UK-wide catalogue. MT was interested in writing a proposal with the Natural History Museum to get funding. This could be a resource that NERC also supports. There needs to be one standard that links collections to create a unified catalogue which shows what has been collected and where it is.

### Summary Actions

#	Action	Who
1	Updated and rebrand larger infographic for TRM.	MF
30	LS asked for links about UAWG to be sent around MFAB.	JP
31	Invite LS to next MFAB to update on the board structures around NZOC.	JP
32	Arrange next meeting of the Data Working Group, list members and refresh membership, if needed.	HS <sub>n</sub>
33	Someone from seismic group at NOC to join the Data Working Group.	GB, JP
34	Discuss EU aspect of the ALR AUV funding model off line. Add as item to autumn MFAB agenda.	NP, MF JP
35	Discuss updated sensor costs off-line	HO, JH
36	Consider what instruments or sensors are coming into some of the other UKRI funders.	NP, JP
37	Ensure HO's table goes into the minutes and that subsequent versions are future agenda item and are made available in advance the meeting.	HO, JP
38	Post updated ToRs on-line.	JP

39	TS mentioned the ADCP serial up the wire for the CTD – at what level is the processing, at the other end? HO to get back to TS.	HO
40	Regarding the Sampling Working Group – check if any gaps?	HO
41	Invite SJ to join the SUWUG.	HO
42	CR asked air sea exchange people to bring in their counterparts in atmospheric to review the TRM.	All
43	Communications team to provide some stats on usage of the TRM.	JP
44	Encourage feedback from Board so comments ready by June/July.	CR