

**Marine Facilities Advisory Board
Monday 2 October 2023: 10:00 to 13:00**

Professor Carol Robinson (UEA), Chair (CR)

Dr Adrian Baker, dstl (AB)
Dr Gay Bayrakci, National Oceanography Centre (GB)
Dr Jörg Bialas, GEOMAR (JB)
Dr Veronique Creach, Cefas (VC)
Dr Eleanor Darlington (NOC) ED
Professor Ed Hill (NOC)
Dr Maaten Furlong, NOC (MF)
Dr Kate Hendry (BAS) (KH)
Dr Stephen Jones, University of Birmingham (SJ)
Dr Chris McGonigle (Ulster University) (CM)
Helen Oldridge (NOC) (HO)
Dr Alex Phillips (NOC) (AP)
Dr Natalie Powney, (NERC) (NP)
Dr John Siddorn (JS)
Julie Pringle Stewart (NOC) (JPS)
Dr Tim Smyth, (PML) (TS)
Dr Helen Snaith, (NOC) (HS)
Dr Gabrielle Stowasser, BAS (GS)

Jackie Pearson, NOC (JP) - Secretary

Apologies

Dr Michelle Taylor, Leigh Storey

Item 1 Welcome

1.1 CR welcomed Dr John Siddorn, NOC Director of Data, Science and Technology and noted apologies from Dr Michelle Taylor and Leigh Storey. Professor Ed Hill would be joining later. Leigh Storey had sent a presentation.

Item 2 Actions from March 2023

2.1 Action 1 – MF: recent updates to the Technology Roadmap (TRM) have potentially negated need for this infographic. CR asked that, for the next version of the TRM, we review whether an overview infographic is still needed.

Action 45: JP

2.2 Actions 32 & 33 – HSn advised that these would be covered later.

2.3 Action 34 – to be carried forward to Spring 2024 meeting.

- 2.4 Action 35 – HO will provide update at Spring 2024 meeting.
- 2.5 Action 36 – NP: this concerned gaining information about items of capital, relevant for MFAB, that might be funded through routes other than NERC-UKRI. There is no easy, low resource way to get this. A colleague had agreed to raise this at their cross-council capital group. CR: it would be helpful to have, for example, a box to tick on forms that would show when equipment is relevant to MFAB. NP: UKRI-NERC is developing a new system, the Funding Service, and it is unlikely that this can be changed now without an extremely strong case. Suggest return to this in a couple of years, once the Funding Service is operational.
- 2.6 Action 39. HO will contact TS after this meeting and will report at the Spring 2024 meeting. **Action 39: HO**
- 2.7 Action 40. HO – the next meeting of the Sampling Working Group will take place before Christmas. HO will report at the Spring 2024 meeting. **Action 40: HO**
- 2.8 Action 41: Completed. Dr Stephen Jones has accepted.
- 2.9 Actions 42 & 44: The TRM will be published in October 2023. HO commented that it would be helpful if colleagues could indicate when they have no comments.

Item 3 Update of the Net Zero Oceanographic Capability (NZOC) Programme

- 3.1 CR asked if there are any of the Board are also members of NZOC. MF is part of the FRMI delivery board. NP explained that the gateway stages concern assurance around major capital investments. JPS: [Gateway 0](#) makes the strategic case. The newly appointed Future Marine Research Infrastructure Board will oversee the investment and the production of the business case.
- 3.2 NP had attended the first meeting (September) of the FMRI Board and had given a talk on NERC's marine infrastructure. There was also discussion about international collaboration and communication. There will be meetings in February and May 2024.
- 3.3 MF: GROOM II is a European project to align glider infrastructure and long-ranged marine autonomous systems to provide simplified access on a European scale. The Upscaling Autonomy Working Group report and Technology Roadmap will feed into this. On the ship side, methanol-powered and ammonia-powered research vessels will be looked at. In essence, this is about green fuels.
- 3.4 CR: CSIRO, Ifremer, NOAA are the Australian, French and American components of their national research infrastructures, so presumably the Board is comparing and contrasting what the UK do with other countries. BIO-Carbon is a NERK/URKI funded biological carbon cycling program that has a

cruise next year where some funding will focus on autonomy linkage with ship-based science. CR asked NP to provide the FMRI's terms of reference to help explain the FMRI activities. MF: there is a delivery board underneath the FMRI Strategic Board which is focused on deliverable actions from FMRI's strategic plans. NP referred to the FMRI ToRs and listed the responsibilities of the board which include: -

- 1.) identifying and prioritizing opportunities and actions required to deliver the FMRI objectives.
- 2.) informing NERC Management Board decisions.
- 3.) identifying and defining required benefits to inform an FMRI business case.
- 4.) considering alignment across FMRI work streams and complementary UKRI- NERC initiatives.
- 5.) assuring strategic risks.
- 6.) acting as a champion etc.

Board objectives:

- 1.) Establishing environmentally and economically sustainable marine observation and experimentation infrastructure for current and future research.
 - 2.) Establish a marine infrastructure portfolio that leads to using innovations in measurements and platforms to push the frontiers of marine science.
 - 3.) Establish an approach that is outward looking and offers global leadership, collaboration opportunities and opening access to underrepresented groups.
- 3.7 CR: it would be helpful to know how MFAB will link with this. HSn wanted to know the timescale to start funding initiatives under FMRI. NP: there are conversations on-going and there will be a funding request to government in the future. There are conversations about smaller pots of money, (several millions over the next few years) to help progress along the FMRI pipeline. A proposal has been submitted to the UKRI Infrastructure Fund around sensors and there are capital conversations about whether NERC can provide investment for this over the next four to five years.

Item 4 Update on Data Working Group (DWG) – Dr Helen Snaith

The priorities for the DWG, have related to getting the underway data stream, i.e., the met data streams, surface-ocean variables, single-beam bathymetry through the system. There has been a lot of development in putting together comparable systems, in terms of the metadata capture on the ships and within BODC, both of which can talk to each other using API linkages, so we can synchronise information on board the vessels and at BODC. We also have delivery of the data back to BODC in delayed mode and a delivery mechanism which uses a system called ERDAPP which we are developing into a federated system that will allow delayed mode data to be pushed through automatically on release at the end of a cruise.

We have some firewall and infrastructure issues to resolve within BODC to make those data deliverable but the processing chain is in place.

A key development this year is that, on board the vessels, the metadata, that we have agreed with the Ship Underway Users Group is required in order to understand the data, is being captured internally on the board the vessels, are now being added into the NET CDF files. We can produce ASCII and Ocean Data View versions of those data files too. There are the raw data sets that are being tagged with the time stamping at the individual data stream collection times and also, an amalgamated NET CDF file of the underway data which is being generated on board the vessels. We still don't have the last part linked up, so the near-real time data aren't being delivered to BODC yet but is planned for later this year.

We received funding from the Digital Environment call and the UKRI Digital Research Infrastructure calls. A small element of that funding has been looking at more efficient ways of using persistent identifiers for instruments to allow us to transfer instrument and sensor metadata more effectively between the different data streams. Those programmes finish later this year and have allowed BODC to move further forward in terms of planning and this will underpin the underway data stream work.

An EU project, AMRIT (Advancing Marine Research Infrastructures Together) concerns, in part, improving interoperability within the system so funding within that proposal will allow BODC to implement some of the persistent identifier work, so allow us to some instrument metadata transfer between the BODC systems and the NMF instrument database. The larger project is about producing a combined European observational framework.

AB: what range of data types does this include? HS: This is around underway data streams: met data, surface ocean variables and single beam data. Multibeam data don't fall under this nor the CTD system. AB: would this be information in the ship's log? HS: it is the ship-fitted systems that are recording most of the time, i.e., the sensor-based systems, not the point observations but the sensor data.

At the moment, the membership includes Helen Snaith, Lou Darroch, Justin Buck, Juan Ward who leads on the NMF side and Alex Tate at BAS. Although the DWG doesn't have any scientific members, we have sort feedback from the UWUG's scientists. We may second a scientist from MFAB, when we are working on a particular data stream, to use them as primary input. At the last meeting, we discussed potential new data streams (e.g., seismics) and the investment made by NMF in the new PCO₂ systems. We would like to concentrate on adding the PCO₂ data into the underway data streams so that it comes with temperature, salinity and surface flux information so would like to ask for a member of MFAB with an interest in PCO₂ to be seconded to this group. TS volunteered at this point. CR asked if HS could write some text for the CPEB report. **Action 46 HS.**

Item 5 Comments on the papers for information

5.1 NP referred to the Upscaling Autonomy Working Group report and raised a query about the line in the report, "*gliders and AUV are costed with a different underlying model to UK research vessels*". Does this mean the ALRs? ED explained that on the Autonomous Deployment Form (ADFs), (ALRs and gliders), staff time is calculated as 'actual' staff time, but this is distinct from

the Ship-time and Marine Equipment applications (SMEs). NP: does this mean that a glider without a ship is more expensive than a glider with a ship? ED: No, if requesting a glider, on or off a ship, piloting time needs to be costed in. Under the ADF model, this cost is added onto the SME, however, on the SME, if the ROV is requested, for example, the time allocated for staff won't reflect staff time cost because this is dealt with elsewhere, however, ADFs reflect 'actual' staff time. NP suggested discussed further, off-line. There have been recent conversations about the ALR costing model and making them more accessible for the community. The sentence states that MAS projects are less favourable to NERC-funded science projects. If his is true, what can be done to change this?

- 5.3 AP – the point is at a higher level than the specifics of the costing. This is more about the fact that scientists see a higher proportion of the costs associated with autonomy than they do with ships, and it is this high-level message that was being commented on, rather than the specifics.
- 5.4 CR asked if this sentence needs to be clarified with Prof Mark Inall. JPS – the grant pays for the autonomy and related data whereas with ship and ship data, these costs are not seen. NOC has been in discussion with NERC's Iain Williams and Susan Waldron about the NC LRI commissioning and we are looking to avoid unintended consequences that may impact the use of autonomous vehicles.
- 5.5 CR: suggested that the sentence needs to be clarified to reduce this perception. JPS agreed to look at this with MF and contact Mark Inall. MF agreed – the proportion of total cost seen by scientists has led to this disparity. More of this cost is visible with the autonomous vehicles than with the ships. The funding model favours ships as opposed to favouring autonomy. **Action 47: JPS & MF** JP to let Mark Inall know the publication is delayed until the sentence has been clarified. JP agreed to hold off on publication until further notice. **Action 48: JP**
- 5.7 AB: is there a list of what MAS can do and what it might be able to do in the future? MF – yes, but it's harder to be specific, particularly within a time frame. The roadmap can't indicate within timeframes when we might be able to achieve new activities. AB: is the science community wary of giving up kit in case it is still needed in the future. MF: If certain technologies are less expensive, scientists will use them preferentially which makes the transition to new methods, e.g., the ALR, challenging. There is no incentive to transition to new methods. CR queried the context around the publication of the report. Should we highlight that readers need to review the report in conjunction with the NZOC report and the TRM? Either in the annex or acknowledgements? Should we feed this back to Mark? The group agreed. CR: this is a consultation and maybe we need to align the report with what might be possible and what might be possible. Discuss with Mark Inall. **Action 49: JP**

Item 6 Capital challenges - Helen Oldridge

- 6.1 HO: talked about how NMF is prioritising items for the NMEP. 'Green across the board' items will be funded if possible. Priority One means NMF is looking into this item at the moment. Priority Two is an item that NMF will plan for but depends on time and funding. Priority Three are items that NMF is not sure about at the moment or is equipment that is already in the pool but rarely requested and NMF is not sure if this capability should be maintained. Items with an exclamation mark will need to be addressed at some point. The compressors will have to be replaced eventually.
- 6.2 SJ talked about the high-cost items at the bottom of the list and whether NMF will need to buy these in the UK for our use or if this may change in the future? HO: the multibeam is part of the continuous underway monitoring and Seabed 2030 and we must deliver this to stay in line with the FMRI objectives. In terms of the compressors which support the seismic suite: whilst these don't support FMRI objectives, they do support 'discovery science' goals and, as such, NERC would need to make any decision around this.
- 6.3 SJ referred to the compressors and asked if the community needs to wait for these to break before they are replaced. HO: whilst it shouldn't come to this, (and if all four failed, this would certainly impact the science), all four aren't needed to run a seismic cruise. GB: Are we sure the new guns will work with the old compressor? HO: we are as sure as we can be.
- 6.4 NP: we have talked at previous CPEBs about the seismic suites and their investment plan. This needs to be mentioned in the paper that goes to CPEB. Have there been conversations with NERC (Nigel Bird) about the compressor and MBES replacement? JPS will check, adding that this highlighted the issue of the cross over between ship-fitted equipment and refit. Some items may be more aligned to ship-refit so need discussion. **Action 50: JPS & MF**
- 6.5 NP: suggested that CR highlights the top two items on HO's list for CPEB and include the fact that the bottom two items are unfunded. CR: has there been any additional funding for the top two items? HO: we have funding for the LEO trials from FMRI budget (£40k) but the airgun replacement will be funded from NMF's budget. Add this to the CPEB report. **Action 51: CR & JP**
- 6.6 AB: regarding the three which are progression of FMRI objectives - how do these related to the ones we are deciding to fund? NMF has new capabilities – but 'high' is indicated for recent use? HO advised this actually means 'high number of requests' and will change the heading in the table. **Action 52: HO**
- 6.7 AB: How is whether something related to FMRI objectives taken into account? HO: this relates to efficiency savings in terms of using the ships. CR: If this is part of the decision-making process, should we make this public for those who are applying for funding for capital equipment? i.e., that there will be prioritisation exercise relating to whether the equipment meets FMRI objectives? HO: although a good point, not everything in the NMEP remit will relate to FMRI objectives. NMF's priority remains repair/replace/obsolescence

management of the equipment in the pool before expanding it. If green on first two columns, if one meets the FMRI objective, that one will probably be chosen. HO agreed that this information should be shared although this isn't the primary reason for decision making. **Action 53: HO/JP**

- 6.8 AP: for MARS equipment, same colour coding has been used as in Helen Oldridge's spreadsheet. Autosub 5: need to get the pressure tolerant batteries UN tested which gives more options around shipping the vehicle. Gliders: the Slocum gliders are being upgraded from G2 to G2.5 which will make them more reliable and increase their lifetime. In terms of high priority, we will get additional sensors that are appropriate to fit to autonomous vehicles and we are trying to understand where the future need is around sensors. Glider fleet attrition: when we lose gliders, we would use NMEP capital funding to maintain the fleet at its current size, but we don't have sufficient funding to continue to increase the glider fleet. Pending upgrades: Autosub 5 thrusters; new polar containers for Autosub 5, on-going work to replace HyBIS with MPUS. NMF is looking to refurbish the ROV handling system (quote around £600K) which will become important in the next five-year period.
- 6.9 KH asked why Autosub5 isn't listed as meeting FMRI objectives. AP: whilst it's clear that the gliders fit FMRI objectives, i.e., in terms of the scaling up autonomy, items like the ROV and the AUVs are critical for science but are less clearly linked in terms of carbon. TS: lots of kit appears to be consumable rather than capital. JPS: NERC funds these out of its capital budget even though they may potentially be consumable. AP: For information about the (Modular Payload Underwater Systems) MPUS, contact David Turner at NOC.
- 6.9.1 CR: your annual budget is ~ £1.5m – how much has already been spent for the next couple of years? HO: NMF has ~ £7.5m, however, this does not, for example, take into account items that get broken. CR: we need to make decisions about high priority equipment and consider how they will fit into the budget. CR: there will be capital expenditure proposals to review before the spring 2024 meeting. CR asked if the hydrophone array proposal was project specific. HO advised that the funding hadn't been available in the time frame that the applicant needed. It would be useful to understand whether this is still a requirement so this will be followed up off line with the community who submitted the application. **Action 54: HO**

Item 7 Membership

- 7.1 This meeting would be the last for Carol Robinson, Adrian Baker, Chris McGonigle, and Kate Hendry. JP was pleased to announce that CR had agreed to stay on for the spring meeting. JP thanked those completing their final meeting and indeed, the whole Board. We need to look at how we encourage new members. JP thanked Jo Hopkins for her input. CR added her thanks to the Board too. CR: MFAB has delayed recruiting a new chair because of potential changes to the NERC's marine structure and governance. JP may still approach retiring members for help with the capital expenditure calls. NP thanked the group and CR thanked NP for her contributions too.

- 7.5 MF thanked the Board members for their help. At the last meeting, there was an AoB about building an inventory for marine biological samples. The BBNJ regulations may inform this requirement so this is a topic that we will return to. Advise Michelle Taylor. **Action 55: JP**

Item 8 Changes to NERC Marine Governance – Ed Hill (EH)

- 8.1 EH thanked CR for inviting him and was pleased to see so many on-line and welcomed the new joiners. EH wanted to explain some issues which have created uncertainty around where MFAB might be heading.
- 8.2 Leigh Storey had provided slides on the Net Zero project which led to the Future Marine Research Infrastructures (FMRI) programme which will involve looking at infrastructure, including equipment, both autonomous and non-autonomous, and ships that the UK will need in the future. Procurement of the next generation of ships will look to those which use greener fuels etc., This will be driven by developments in the maritime shipping industry.
- 8.3 The FRMI programme is looking to direct NERC investments into buying the kit that will prepare us for this transition. The FMRI has established a Scientific Advisory Group (SAG), chaired by Professor Alex Rogers. NERC has, therefore, raised the question as to whether this is what MFAB is already doing. NERC has asked whether these two groups should be brought together, merged so as not to duplicate effort. Similarly, NERC doesn't want two groups, each coming up with different sets of recommendations. NERC aims to maximise quality of advice and avoid duplication.
- 8.4 NOC has discussed this with NERC. NOC pointed out that we value the work that MFAB does because it also helps with shorter-term investments and advice on the NMF Technology Roadmap. As a major national capability provider, NOC also values stakeholders providing input on all aspects of what NOC does, including the provision of large infrastructure and development of the technologies, which flow through to operational use. Regardless of what NERC does, therefore, NOC wants to continue to work with stakeholders, possibly even broadening the range of advice that we receive. Previously, we've had international members and those from a commercial background and we feel that NOC needs a source of independent advice, regardless of what NERC does, because of our key role within the marine science community. JPS is exploring this with Leigh Storey (NERC), to see if we can revise the ToRs for the SAG to capture what MFAB does, to see if a merger would be possible. FMRI is a NERC project, and the programme board supports the NERC Science Director etc., and the SAG also feeds into this. It doesn't report to NOC. At the moment, MFAB reports to both the NERC Science Director and CEO of NOC. Depending on the governance of the SAG, NOC could be 'cut out of the loop' so this needs to be looked at.
- 8.5 There may scope for a merger and some partition of responsibilities. In the long term, there will be a continuing need for NOC to have independent advice, in the provision of its facilities, from its stakeholder community and to have a suitable breadth of representation. There will be something similar to MFAB

that will continue to support NOC.

- 8.6 EH does not want to lose access to the capability that we have on MFAB (existing and newly recruited members) and wants to maximise the way in which we use members to secure the advice we need. EH has no intention of disbanding MFAB and wants it to continue, certainly until we have a clearer idea as to what the partition would be between the remit of the SAG of FMRI and the stakeholder advisory structure that supports NOC. EH does not want to disband MFAB and CR has kindly agreed to stay on.
- 8.7 EH we should get some answers before the next MFAB meeting. There may be a reconfiguration of the mix of activities between SAG and MFAB but we will continue with a Board, whether it called MFAB or not. Iain Williams is not settled on the idea of merging the groups. If, however, it is unworkable to merge the two, NERC may just maintain the status quo but the duplication of effort would need to be resolved. Any feedback from MFAB members should go to Ed for NERC about what is distinctive about what it is that MFAB does vs the FMRI programme so that we can ensure we properly capture the feedback that needs to be fed into the discussion. **Action 56: All**
- 8.8 SJ – Regarding the Science Advisory Group and FMRI – this concerns Net Zero. Are all those who use the ships represented on SAG? There is no representation from those involved in sub-surface geology, geophysics or atmospheric chemistry. The aspiration with new ships depends on fuels of the future. Presently, ships produce a lot of emissions. At the last MFAB, we were talking about how to use marine infrastructure to fill this gap. This will inform what the fuels of the future might be.
- 8.9 EH: FMRI grew out of NZOC where net zero was the driver, however, NERC's thinking has evolved beyond this. The situation has been balanced by thinking about: science need, kinds of science, scale and type of equipment needed. The point made by SJ about representation and discipline coverage is valid. The equipment needs of different communities differ. This is why NOC wants the right mix of disciplines involved.
- 9.0 AB: regarding the difference between SAG and MFAB – usually, with acronyms with 'Future' in the title, there is a target date? MFAB looks at what do next year as well. Is SAG looking at the spectrum from now to the future or is it focused on a target date? EH – the UKRI target to net zero is 2040. SAG does have a shorter-term perspective and is looking to be informed on shorter term investments. We don't want to invest in items that won't make sense for activities in the future. There are some short-term investments around actual needs which MFAB deals with too. In these cases, SAG/FMRI will have less emphasis here. CR asked if this topic is on the CPEB agenda? NP: Iain Williams is going to communicate similar to EH. We will know more at the spring CPEB.
- 9.2 JPS: we had some comments earlier about how we look at the TRM and how we consider capital bids, how they fit FMRI and prioritisation and so the feedback from MFAB is that there **has** to be some form of join up.

- 9.3 TS: this group allows some form of accountability from technology so having presentations from MF, HO and AP gives the NMF team opportunity to explain what is being undertaken. If we lost this group in this form, this would need addressing.
- 9.4 EH: agree, it is good to have a system of reporting and this is one the reasons why NOC finds MFAB so valuable. EH would not want to lose see this kind of independent challenge from those who are using and planning to use equipment. There is also a separate issue for NOC – at the moment, we don't have a formal feed into the FMRI process. We do have a scientific representative on the SAG, but as operators and developers of a lot of kit, we do have a valuable input for the FMRI process - this needs to be resolved and currently, is a weakness in the mechanism at the moment.
- 9.5 CR: it is important for people to know that the discussions are going on. We should reflect on the terms of reference for MFAB and what we are aiming to achieve in our relationship with NOC. We need to ensure that none of that interaction is lost in any future development.
- 9.6 EH thanked CR for agreeing to see through this period of change. It remains important that NERC continues to receive the best advice in terms of informing their important investments and NOC's role in delivering those investments to the scientific community. It is important that we solve this issue without unintended consequences. CR commented on the value of interaction with MF and his team. It would be unwise to recruit a new chair at this stage without a better understanding of the future. EH thanked the members for their service.
- 9.8 CR mentioned that she and JP are writing the report that will go to CPEB next week so members may be approached for updates for that report. JP closed the meeting by expressing thanks to all the members, the NMF team, NP and Carol Robinson for being a wonderful chair. CR also thanked JP.

Summary actions

#	Action	Who
39	Contact TS after meeting and report at the Spring 2024 meeting.	HO
40	Next meeting of the Sampling Working Group will take place before Christmas. Provide report at the Spring 2024 meeting.	HO
45	For the next version of the TRM, review whether overview infographic is still needed.	JP
46	Write some text about the Data Working Group for the CPEB report.	HS
47	Review sentence queried by NP in the Upscaling Autonomy Working Group report.	JPS & MF
48	Let Prof Mark Inall know the publication is delayed until the sentence has been clarified so hold off publication until resolved.	JP
49	Re: Upscaling Autonomy Working Group report. Highlight to readers the need to review the report in conjunction with the NZOC report and the TRM. Include either in the annex or acknowledgements. Feed this back to Mark Inall.	JP

50	Check if there had been conversations about the compressor and MBES replacement with NERC. Regarding the cross over between ship-fitted equipment and refit - some items may be more aligned to ship-refit so need discussion.	JPS & MF
51	Highlight the top two items on HO's list for CPEB and include the fact that the bottom two items are unfunded. NMF has received funding for the LEO trials from FMRI budget (£40k) but the airgun replacement will be funded from NMF's budget. Add this detail to the CPEB report.	CR & JP
52	Regarding HO's spreadsheet – correct heading in table to show that 'high' means 'high number of requests'.	HO
53	Share information about how the equipment is prioritised in the NMF table, in relation to FMRI objectives.	HO & JP
54	Check with community if the hydrophone array proposal is still a requirement.	HO
55	Item about building an inventory for marine biological samples – note this as a future agenda item and update Michelle Taylor.	JP
56	Board members invited to provide feedback to Prof Ed Hill for NERC about what is distinctive about what it is that MFAB does vs the FMRI programme.	All