From: [redacted]
Sent: Thu, 19 Jun 2025 23:50:08 +0000
To: [redacted]
Cc: [redacted]
Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]
Attachments: AAD Whale Team advice to NOPSEMA - CGG Regia MSS Acoustic Monitoring_20Jun25.pdf

OFFICIAL

Hi [redacted]

As promised, please find the finalised version of the CGG acoustic monitoring advice. This latest finalised version contains some minor revised text (mainly to question 2), with recent revisions from [redacted] which hopefully sets it out in a clearer way, particularly regarding considerations around metrics relating to the passive sonar equation when evaluating efficacy of the systems.

Cheers
[redacted]

OFFICIAL

From: [redacted]
Sent: Thursday, 19 June 2025 5:03 PM
To: [redacted]@nopsema.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

Hi [redacted]

Thanks for your response. We will finalise the advice and can provide it Friday morning.
Cheers
[redacted]

From: [redacted]l@nopsema.gov.au>
Sent: Tuesday, 17 June 2025 3:10 PM
To: [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>

Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

OFFICIAL

Hi [redacted]

Thanks again for providing the revised advice. The extra clarification on specific performance measures has been useful and we can see how this builds upon AAD's previous advice.

Please could you finalise the red text and issue the document to us as final prior to Friday?

Many thanks.
[redacted]

[redacted]
Regulatory Operations | Geophysical Survey and Installation

NOPSEMA | Australia's offshore energy regulator

National Offshore Petroleum Safety and Environmental Management Authority
T: [redacted] | E: [redacted]@nopsema.gov.au | W: nopsema.gov.au

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OFFICIAL

From: [redacted]@aad.gov.au>
Sent: Friday, 13 June 2025 4:30 PM
To: [redacted]@nopsema.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]nopsema.gov.au>
Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

OFFICIAL

Hi [redacted]

Please find attached a revised draft advice that has hopefully addressed some of the feedback you raised in our meeting yesterday regarding clarification on specific performance measures. The revision has only been undertaken for question 2 that focuses on potential levels of performance to determine the effectiveness of the PAM/ADM as a detection method. The way the advice has been structured in this revised version has been to outline the information that would be required to demonstrate the effectiveness of the systems and the proposed approach using PAM/ADMs. Given CGG/Sercel are planning on providing a white paper that addresses the uncertainties with using the systems, the information provided in the advice is what should be expected to be covered in the white paper without an emphasis on field trials.

I am hoping the advice captures the request appropriately, although more than happy to provide further revised information or clarification.

Cheers
[redacted]

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From: [redacted]@nopsema.gov.au>
Sent: Wednesday, 11 June 2025 11:04 PM
To: [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

OFFICIAL

Hi [redacted]

Useful advice, thank you. Do you have availability some time tomorrow for a call to clarify a couple of points? After 10.30 (Perth time) would be preferable.

[redacted]
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National Offshore Petroleum Safety and Environmental Management Authority
T: [redacted] | E: [redacted]@nopsema.gov.au | W: nopsema.gov.au

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From: [redacted]@nopsema.gov.au>
Sent: Wednesday, 11 June 2025 7:06 PM
To: [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: Re: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

Hi [redacted]

Many thanks, confirming receipt.

I'll take a look this evening.

Kind regards,
[redacted]

From: [redacted]@aad.gov.au>
Sent: Wednesday, 11 June 2025 5:29 PM
To: [redacted]nopsema.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

OFFICIAL

Hi [redacted]

Please find attached a copy of the requested advice from AAD's Whale Team. Please let us know if you'd like any further information or to clarify anything within this document.

This response was developed by myself and [redacted], with further comment on the document by the wider team.

We hope this advice is helpful.

Regards,
[redacted]

[redacted]
Australian Antarctic Division | Science Branch | Southern Ocean Ecosystems Program
Whadjuk Noongar Country, Perth, Western Australia
Department of Climate Change, Energy, the Environment and Water
P [redacted] E [redacted]@aad.gov.au
DCCEEW.gov.au ABN 63 573 932 849

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OFFICIAL

From: [redacted]@nopsema.gov.au>
Sent: Monday, 9 June 2025 1:08 PM
To: [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

OFFICIAL

Thanks [redacted]

[redacted] and I are both available between 11.30 and 1pm tomorrow (AWST). Does a time in that window work for you?

Kind regards,
[redacted]

[redacted]
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NOPSEMA | Australia's offshore energy regulator

National Offshore Petroleum Safety and Environmental Management Authority
T: [redacted] | E: [redacted]@nopsema.gov.au | W: nopsema.gov.au

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From: [redacted]@aad.gov.au>
Sent: Monday, 9 June 2025 8:41 AM
To: [redacted]@nopsema.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

OFFICIAL

Hi [redacted]

Thanks for your response. I should think it would be fine to get the advice to you by Wednesday. I am more than happy to run through the advice over Teams today or tomorrow if you wanted to get an overview understanding on what our response will look like.

Cheers
[redacted]

OFFICIAL

From: [redacted]@nopsema.gov.au>
Sent: Thursday, 5 June 2025 3:39 PM
To: [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>

Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

OFFICIAL

Hi [redacted]

Thanks for letting us know.

If you need until Friday 13th, please can we set up a call to discuss your findings and advice on Wednesday 11th? We are currently available 9am – 11am AWST if that works for you?

Our time pressures have not changed so if you are able to provide it sooner than the 13th, it would be appreciated.

Kind regards,
[redacted]

[redacted]
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National Offshore Petroleum Safety and Environmental Management Authority
T: [redacted] | E: [redacted]@nopsema.gov.au | W: nopsema.gov.au

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OFFICIAL

From: [redacted]@aad.gov.au>
Sent: Thursday, 5 June 2025 1:00 PM
To: [redacted]@nopsema.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: RE: Draft request to AAD for scientific advice to support decision - Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

OFFICIAL

Hi [redacted]

My apologies for the late email, although it would be good to understand if there was the possibility for a slight extension for the requested advice on the CGG Regia MSS due Friday 6th June. The advice needs to undergo final approvals. If possible, an extension to Wednesday 11th June would be helpful, or even Friday 13th would be better although totally understand time pressures.

Cheers
[redacted]

OFFICIAL

From: [redacted]@nopsema.gov.au>
Sent: Monday, 19 May 2025 10:48 AM
To: [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: RE: Draft request to AAD for scientific advice to support decision -[SEC=OFFICIAL] Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

OFFICIAL

Thanks [redacted]

Finalised below with no changes. I'm not re-sending the attachments.

……..
This email outlines NOPSEMA's request for AAD advice, in particular to support NOPSEMA in deciding whether or not it can be reasonably satisfied that the EP demonstrates that environmental impacts will be of an acceptable level. The NOPSEMA EPBC Act Program includes commitments such as not accepting an EP that is inconsistent with a recovery plan for a threatened species. Recovery plans for the southern right whale and blue whale are relevant to the assessment of the Regia MSS EP and these include the following recovery actions which are key to our decision making and provide important content for defining what would constitute acceptable levels of impact:

- Action A.2.3. from the Blue Whale Conservation Management Plan: Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury, and is not displaced from a foraging area.
- Action A.5.2 from the National Recovery Plan for the Southern Right Whale: Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that it does not prevent any southern right whale from utilising the area or cause auditory impairment.
- Action A.5.2 from the National Recovery Plan for the Southern Right Whale: Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that the risk of behavioural disturbance is minimised.

During NOPSEMA's assessment of the EP to date, CGG's proposed whale detection strategy has been identified as a critical element to the Regia MSS being able to detect blue whales and southern right whales, such that control measure may be implemented and the survey activity may proceed in a manner that is not inconsistent with the above recovery plan requirements. NOPSEMA needs to be reasonably satisfied that the whale detection strategy will be effective in detecting blue whales and southern right whales.

This request to AAD for advice is in relation to the acoustic monitoring components of the detection strategy (comprising acoustic detection monitoring [ADM] deployments and passive acoustic monitoring [PAM]).

Please see NOPSEMA's requests for advice below.

As agreed, advice by Friday 6 June 2025 is requested, however should AAD be able to provide advice earlier that would be greatly appreciated.

Please also note, that for procedural fairness, AAD's advice may be provided to CGG for consideration.

Documents provided to AAD, 15 May 2025:

- Opportunity to Modify and Resubmit (OMR) documents:
    - Titleholder response – OMR - Itemised response: OMR Item 3.5 contains NOPSEMA's OMR letter point and the titleholder's response. Specifically, the bullet points highlighted in yellow relate to the acoustic detection effectiveness that AAD provided advice to NOPSEMA on previously.
    - Copy of previous AAD technical advice supporting the previous round of assessment (provided to CGG in addition to the OMR letter)
- EP documents for review in relation to CGG's response to OMR letter item 3.5:
    - Appendix C7 – Confidential Sercel technical memo document (~10 pages) providing further information on the performance of acoustic detection monitoring (ADM) devices. Please note that Appendix C7 has been provided to us as confidential and 'sensitive information'.
    - Appendix G2 – Fauna Management Plan – This includes some information on the proposed deployment locations of ADM's updated procedures for detecting blue whales and southern right whales, using a combination of pre-survey aerial surveillance acoustic detection monitoring deployments (including further information on deployment locations), marine fauna observers (MFOs) and passive acoustic monitoring (PAM) on board the seismic vessel, MFOs on a spotter vessel and coastal observers.
- EP documents also provided for relevant context are:
    - Appendix E7 – Impact assessment – underwater sound – Marine mammals (Section 8 and Section 9 in particular provide information relevant to understanding CGG's rationale behind activity design and whale detection measures; p.24-44)
    - Appendix F3 – Further impact assessment – Section 3.1 (SRWs) and 3.2 (Blue whales) (p.6-21) in particular.

Advice requested:

Based on information submitted by the titleholder and AAD's experience with similar acoustic monitoring methods:

1. Please advise on the likely effectiveness of the proposed ADM and PAM methods and whether, in AAD's view, they are likely to be able to detect the vocalisations of any blue whale/pygmy blue whale or any southern right whale over the proposed detection ranges during seismic

operations (up to 15 km for southern right whales and 23 km for blue whales/pygmy blue whales), including being able to discern vocalisations in the presence of seismic sound impulses?
2. If the information provided by CGG is not sufficient for AAD to provide scientific advice on point 1 above, or the information is not sufficient to demonstrate the methods proposed are likely to be effective in detecting vocalisations over the proposed detection ranges, please outline what factors are essential to be confirmed or require a level of performance to be specified, in order for detections to be effective.
3. Are the maximum detection distances of the ADM network and PAM system provided? Are the ADM deployments able to detect over longer distances than the proposed detection ranges, if required?
4. Based on the information submitted by the titleholder and AAD's experience with similar monitoring methods, please advise on whether, in AAD's view, telemetry of data from the ADM program would be able to be reliably transmitted, received and interpreted to enable timely decision-making for the implementation of control measures?
5. If the titleholder's trial of the ADM technology is unsuccessful and the ADM component of the detection strategy cannot proceed, please provide advice on the potential for the proposed PAM component alone to be sufficient to detect the vocalisations of any blue whale/pygmy blue whale or any southern right whale over the proposed detection ranges.

Kind regards,
[redacted]

[redacted]
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NOPSEMA | Australia's offshore energy regulator
National Offshore Petroleum Safety and Environmental Management Authority
T: [redacted] | E: [redacted]@nopsema.gov.au | W: nopsema.gov.au

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From: [redacted]@aad.gov.au>
Sent: Monday, 19 May 2025 10:30 AM
To: [redacted]@nopsema.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: RE: Draft request to AAD for scientific advice to support decision -[SEC=OFFICIAL] Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

Good morning [redacted]
We have no additional comments or queries, please go ahead and formalise the request.
Kind regards, [redacted]

From: [redacted]@nopsema.gov.au>
Sent: Thursday, 15 May 2025 5:28 PM
To: [redacted]@aad.gov.au>; [redacted]@aad.gov.au>; [redacted]@aad.gov.au>
Cc: [redacted]@nopsema.gov.au>; [redacted]@nopsema.gov.au>
Subject: Draft request to AAD for scientific advice to support decision -[SEC=OFFICIAL] Regia MSS marine mammal detection strategy [SEC=OFFICIAL]

Dear [redacted],

Thank you for your time over the last couple of weeks, discussing a potential NOPSEMA request for provision of scientific advice to support NOPSEMA's assessment and decision making on the Regia Marine Seismic Survey EP.

We have now decided to proceed with a request for AAD advice, in particular to support NOPSEMA in deciding whether or not it can be reasonably satisfied that the EP demonstrates that environmental impacts will be of an acceptable level. The NOPSEMA EPBC Act Program includes commitments such as not accepting an EP that is inconsistent with a recovery plan for a threatened species. Recovery plans for the southern right whale and blue whale are relevant to the assessment of the Regia MSS EP and these include the following recovery actions which are key to our decision making and provide important content for defining what would constitute acceptable levels of impact:

- Action A.2.3. from the Blue Whale Conservation Management Plan: Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury, and is not displaced from a foraging area.
- Action A.5.2 from the National Recovery Plan for the Southern Right Whale: Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that it does not prevent any southern right whale from utilising the area or cause auditory impairment.
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During NOPSEMA's assessment of the EP to date, CGG's proposed whale detection strategy has been identified as a critical element to the Regia MSS being able to detect blue whales and southern right whales, such that control measure may be implemented and the survey activity may proceed in a manner that is not inconsistent with the above recovery plan requirements. NOPSEMA needs to be reasonably satisfied that the whale detection strategy will be effective in detecting blue whales and southern right whales.

This request to AAD for advice is in relation to the acoustic monitoring components of the detection strategy (comprising acoustic detection monitoring [ADM] deployments and passive acoustic monitoring [PAM]).

Below, I've provided a summary of the documents attached to this email and have drafted the individual requests where we would appreciate your advice. Please advise if you have any comments or queries regarding the requests, otherwise we will formalise so that you can proceed.

As agreed, advice by Friday 6 June 2025 is requested, however should AAD be able to provide advice earlier that would be greatly appreciated.

Please also note, that for procedural fairness, AAD's advice may be provided to CGG for consideration.

Documents attached:

- Opportunity to Modify and Resubmit (OMR) documents:
    - Titleholder response – OMR - Itemised response: OMR Item 3.5 contains NOPSEMA's OMR letter point and the titleholder's response. Specifically, the bullet points highlighted in yellow relate to the acoustic detection effectiveness that AAD provided advice to NOPSEMA on previously.
    - Copy of previous AAD technical advice supporting the previous round of assessment (provided to CGG in addition to the OMR letter)
- EP documents for review in relation to CGG's response to OMR letter item 3.5:
    - Appendix C7 – Confidential Sercel technical memo document (~10 pages) providing further information on the performance of acoustic detection monitoring (ADM) devices. Please note that Appendix C7 has been provided to us as confidential and 'sensitive information'.
    - Appendix G2 – Fauna Management Plan – This includes some information on the proposed deployment locations of ADM's updated procedures for detecting blue whales and southern right whales, using a combination of pre-survey aerial surveillance acoustic detection monitoring deployments (including further information on deployment locations), marine fauna observers (MFOs) and passive acoustic monitoring (PAM) on board the seismic vessel, MFOs on a spotter vessel and coastal observers.
- EP documents also provided for relevant context are:
    - Appendix E7 – Impact assessment – underwater sound – Marine mammals (Section 8 and Section 9 in particular provide information relevant to understanding CGG's rationale behind activity design and whale detection measures; p.24-44)
    - Appendix F3 – Further impact assessment – Section 3.1 (SRWs) and 3.2 (Blue whales) (p.6-21) in particular.

Advice requested:

Based on information submitted by the titleholder and AAD's experience with similar acoustic monitoring methods:

1. Please advise on the likely effectiveness of the proposed ADM and PAM methods and whether, in AAD's view, they are likely to be able to detect the vocalisations of any blue whale/pygmy blue whale or any southern right whale over the proposed detection ranges during seismic operations (up to 15 km for southern right whales and 23 km for blue whales/pygmy blue whales), including being able to discern vocalisations in the presence of seismic sound impulses?
2. If the information provided by CGG is not sufficient for AAD to provide scientific advice on point 1 above, or the information is not sufficient to demonstrate the methods proposed are likely to be effective in detecting vocalisations over the proposed detection ranges, please outline what factors are essential to be confirmed or require a level of performance to be specified, in order for detections to be effective.
3. Are the maximum detection distances of the ADM network and PAM system provided? Are the ADM deployments able to detect over longer distances than the proposed detection ranges, if required?
4. Based on the information submitted by the titleholder and AAD's experience with similar monitoring methods, please advise on whether, in AAD's view, telemetry of data from the ADM

program would be able to be reliably transmitted, received and interpreted to enable timely decision-making for the implementation of control measures?

5. If the titleholder's trial of the ADM technology is unsuccessful and the ADM component of the detection strategy cannot proceed, please provide advice on the potential for the proposed PAM component alone to be sufficient to detect the vocalisations of any blue whale/pygmy blue whale or any southern right whale over the proposed detection ranges.

Kind regards,

[redacted]

[redacted]
Regulatory Operations | Geophysical Survey and Installation

NOPSEMA | Australia's offshore energy regulator

National Offshore Petroleum Safety and Environmental Management Authority
T: [redacted] | E: [redacted]@nopsema.gov.au | W: nopsema.gov.au

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20 June 2025

Advice: Acoustic monitoring components of the marine mammal detection strategy for CGG Regia 3D Marine Seismic Survey

Request for advice

The Australian Antarctic Division Whales Team has prepared advice on proposed acoustic monitoring components of the whale detection strategy for the CGG Services (Australia) Regia 3D Marine Seismic Survey (Regia 3D MSS) Environment Plan (EP) in response to the request by NOPSEMA on 15 May 2025.

Documents provided

Titleholder response – OMR 3.5
File Note – previous AAD advice to NOPSEMA
Regia MSS EP Appendix C7: Confidential Sercel Technical Memo on towed PAM and ADM
Regia MSS EP Appendix G2: Fauna Management Plan
Regia MSS EP Appendix E7: Marine mammals – underwater sound (particularly Section 8 & 9)
Regia MSS EP Appendix F3: Further Assessment of Key Environmental Values and Sensitivities

General recommendation

The proposed general hybrid approach of using a Sercel QuietSea™ towed PAM array (PAM) in combination with QuietSea™ Automatic Detection Monitoring (ADM) autonomous buoys with near-real time monitoring capabilities is to be commended for improving the status quo when using passive acoustic monitoring in marine seismic surveys (MSSs). In theory, detecting southern right whales and blue whales (e.g. appropriate detector algorithms, PAM localisation methods, and ADM real-time alert systems) may be achievable, although the efficacy of the approach using the PAM and ADM systems to conduct 24-hour monitoring of a 23 km and 15 km radius detection and observation zone for blue whales and southern right whales, respectively, has not been demonstrated.

The PAM and ADM each theoretically provide potentially useful features for acoustically monitoring cetaceans during MSSs. However, the documents do not include any evidence that the systems have been tested and determined suitable for blue whales, southern right whales, or any whales that make low-frequency calls. Further effort and evidence is still required to provide confidence in its application as a mitigation tool. A field trial of the ADM buoy is proposed, however, there remains a high degree of uncertainty regarding the efficacy of the approach for this field trial, let alone to reliably monitor over the ranges required for mitigation given the information provided to date.

Appendix E7 (section 9 of the Impact assessment) identifies the importance of a multi-faceted approach using multiple detection methods (including visual observers and aerial) to ensure the detection ranges are monitored. It is critical that following the ADM field trial, the subsequent white paper (or revised Environment Plan) clearly describes an approach for using the different detection methods that demonstrates the necessary spatial coverage required for monitoring over the proposed detection ranges throughout the operational area at any point in time is achieved.

The PAM and ADM is currently identified as the primary monitoring method beyond the visual detection range of shipboard MMOs. We are not aware of any published studies demonstrating that these particular PAM and ADM systems will provide suitable detection capability at such large ranges to enable requisite mitigations. Even if the system is capable of achieving requisite detection range, additional information and work would still be needed to quantify the reduction in risk/impact achieved by using the system. This additional information would include demonstrating that the residual risk/impact meet relevant regulatory criteria (e.g. ALARP).

Specific questions

1. **Please advise on the likely effectiveness of the proposed ADM and PAM methods and whether, in AAD's view, they are likely to be able to detect the vocalisations of any blue whale/pygmy blue whale or any southern right whale over the proposed detection ranges during seismic operations (up to 15 km for southern right whales and 23 km for blue whales/pygmy blue whales), including being able to discern vocalisations in the presence of seismic sound impulses?**

   The confidential technical memorandum provided by Sercel on the PAM and ADM buoys was helpful in providing further understanding of some of the technical specifications of the equipment (e.g. hydrophone operating frequencies, ADM data transmission, species acoustic detectors) to inform considerations of intrinsic factors influencing the systems performance.

   There are several potentially useful features in the equipment, including the internal quality control of the ADM to estimate detection range during operations. This capability could facilitate an adaptive management approach by quantifying the acoustic monitoring footprint and would help to provide an understanding of the likely detection range in the absence of whale detections. Similarly, fine-tuned species-specific detectors for southern right whales and pygmy blue whales are a critical component for improving the performance of the systems to detect the target species. However, the proponents have not provided evidence, or include sufficient details, demonstrating that these features have been tested and will work reliably in the study area nor provide quantitative measures indicating the species detectors will work well enough as part of the whole system to provide the requisite level of mitigation. Thus, the information provided does not demonstrate that the proposed ADM and PAM approach can effectively monitor over the proposed detection ranges during seismic operations (up to 15 km for southern right whales and 23 km for blue whales/pygmy blue whales). Fundamentally, the detection range of the systems used depends on more than just the noise levels at the hydrophone and detector performance. The detection range of a passive sonar also depends on the source levels and the transmission losses, both of which are not well characterised and can be quite variable.

   Furthermore, the ability to detect whales is a necessary criterion to demonstrate effectiveness of the systems, but alone is not sufficient to demonstrate efficacy for the mitigation of noise exposure to whales. The systems efficacy should be based on the systems capability to mitigate exposure of whales to seismic airgun noise. However, the provided documents focus solely on the systems potential for acoustically detecting a whale that is present and vocalising. Key factors relating the detection capability to mitigation efficacy include 1) the proportion of whales that are likely to be vocalising, 2) how often vocalising whales produce calls (i.e. call rate) and 3) how detectable the vocalisations are.

The provided documents indicate a field trial of the ADM is planned to be conducted in mid-2025 to address many of the uncertainties that exist regarding the performance of the ADM for the Regia MSS. Specifically, these uncertainties relate to understanding ambient noise levels in the area (particularly in the low frequency range < 200 Hz), shallow water propagation loss of whale vocalisations, and variability in species vocalisation patterns and detectability. To enable an evaluation of the effectiveness of the PAM and ADM to effectively mitigate over the proposed detection ranges, these uncertainties would need to be addressed for both systems (PAM and ADM) and both species (blue and SRW).

With regard to the ability to discern southern right whale and blue whale vocalisations in the presence of seismic airgun impulses, we note the PAM system was granted approval by NOPSEMA for use during the Bonaparte MC3D Marine Seismic Survey MSS in 2019. Examination of the Bonaparte 3DMC MSS Marine Fauna Report (EPI Report No. 1109) reveals a single possible pygmy blue whale acoustic detection (50 – 90 Hz; 72 Hz centre frequency) during the MSS which was localised to 2199 metres, indicating the capability of the PAM system to detect a likely pygmy blue whale to at least within visual range. This is a promising start, however, fundamentally the PAM and ADM systems have not demonstrated the ability to detect whales at the required detection ranges, particularly in the presence of seismic signals, which will likely be a greater challenge for southern right whales given lower source levels and likely low call rates (Matthews & Parks 2021; Webster et al. 2019; Ward 2020).

2. **If the information provided by CGG is not sufficient for AAD to provide scientific advice on point 1 above, or the information is not sufficient to demonstrate the methods proposed are likely to be effective in detecting vocalisations over the proposed detection ranges, please outline what factors are essential to be confirmed or require a level of performance to be specified, in order for detections to be effective.**

Based on the information provided to date, it has not currently been demonstrated that the proposed ADM and PAM approach can effectively monitor over the proposed detection ranges during seismic operations: up to 15 km for southern right whales (SRW) and 23 km for blue whales/pygmy blue whales (BW). The capability of the PAM and ADM systems to effectively monitor over these proposed detection ranges is dependent on two main components:

A. Effectiveness of the systems to detect vocalisations, both in the presence and absence of seismic signals.
B. Systems efficacy as a detection method and monitoring approach.

The development of effective mitigation and monitoring using passive acoustic monitoring during the MSS should follow best-practice standards (e.g. Nowacek et al. 2013; Van Parijs et al. 2021) and be supported by a PAM Plan that addresses these two main components.

A. <u>The effectiveness of the systems to detect vocalisations in the presence and absence of seismic signals</u>

The ability of a passive sonar to detect signals of interest is governed by the passive sonar equations (Lurton 2010). These equations relate the probability of detecting a call, p(d), to the signal to noise ratio (SNR), which in turn depends on the source levels (SL), transmission losses (TL), and noise levels (NL) such that:

$$SNR = SL - TL - NL$$

SL can be thought of as how much energy the source puts into the environment; TL as how sound attenuates as it travels from source to receiver; and NL as the energy contribution of any other signals not of interest (Lurton 2010). For a passive sonar, the probability of detection, p(d) is primarily a function of SNR such that:

$$p(d) \sim SNR$$

The technical specifications of the equipment (software and hardware) can provide some insight into theoretical performance of a system, so may be useful for design and comparative purposes. However empirical evidence, in the form of functional capability, is typically used to demonstrate performance of a real-world system in actual practice. Important specifications, metrics, and considerations for this particular application include:

- Quantifying passive sonar equation parameters: SL, TL, NL throughout the operating time and area to determine effective detection ranges.
    - This could be undertaken either in-situ (i.e. during a field trial) and ideally validated with independent (e.g. visual) data of the presence of whales or through modelling based on ambient NL and environmental conditions and TL in the area of operation.
    - Hydrophone/receiver operating frequencies and sensitivity should cover the frequency range of the marine mammal species of interest.
    - NL should include both environmental and internal system noise and noise from the moorings (e.g. from chain). Ideally, NL should not mask or impede detection of SRW and BW calls. It is particularly important there is low noise in the frequency range of whale calls given the large detection ranges required and likely subsequent low received levels encountered.
    - Detection performance should be evaluated over a range of locations that include, threshold distance, and under background noise levels that span the conditions likely encountered in the survey area.
- Ideally the proponents would provide a quantitative estimate of the probability of detection p(d) for each call type known to be produced by BWs and SRWs.
    - This could include intermediate metrics such as a precision and recall; false detection rate and missed detection rate.
    - A highly relevant metric here is probability of detection in the area, p_a. In published scientific literature, pa has been calculated using Monte Carlo type simulations based on the sonar equations. See for example: Helble et al (2013) and Castro et al (2024).
    - The appropriate metrics to report here will be somewhat determined by other considerations (see next section) but should demonstrate adequate capability to detect SRW and BW sounds in a manner that achieves suitable mitigation (see next section).

B. <u>The overall systems efficacy for mitigation</u>

Metrics to describe overall system efficacy should include an estimate of the reduction of impact/risk to whales afforded. The overall system performance, or mitigation efficacy, depends on the performance of the passive sonar component of the system (described above) in addition to other critical aspects of the overall system for monitoring and mitigation (described below). Additional information on the monitoring approach and overall systems

capability are essential to understand how acoustic detections will inform a decision-making process to mitigate exposure of whales to seismic airgun noise. Important types of additional information used to determine the overall system efficacy should be clearly stated, and would likely include:

- Species detection capability and effectiveness (e.g. p_a and/or p(d) as described above).
- Estimated number and distribution of whales in the area, and appropriate cue rates (e.g. proportion of individuals likely to call per unit time, and individual vocalisation rate per unit time).
- ADM placement and configuration that demonstrates spatial coverage of the survey area up to the required detection ranges, and effectiveness via integration with other detection methods (i.e. visual observations).
- Communication plan that outlines the frequency of ADM whale detection alert transmissions, the communication of detection information among MMO/PAM operators and how the information/detection will be used in real-time and the mitigation response based on pre-determined triggers.
- Report on the acoustic localisation capabilities of the proposed acoustic monitoring approach. This includes how the ADM will inform whale location data, and function beyond simply detecting whales, and how PAM and ADM acoustic detections are planned to be integrated to inform any necessary mitigation response.

There is likely more than one viable approach to demonstrate overall system efficacy. As such, we have tried not to be too prescriptive in our list above. Generally, we would expect one to use the above information in conjunction with a simulation framework similar to that described by Leaper, Calderan, and Cooke (2015), but replacing visual line transect detection distances with acoustic ones for the towed PAM system, and site-specific point transect detection radii for the ADM systems (Helble et al 2013; Castro et al 2024).

Currently, three ADMs are proposed to be moored in fixed positions at the northern edge of the survey area primarily aimed at monitoring the southern right whale 'reproduction' Biologically Important Area. This does not demonstrate how the southern boundary of the survey area will be adequately monitored.

Further considerations on the use and effectiveness of the systems and approach are:

- It could be possible to use the ADM buoys as a sound-source field validation of the acoustic modelling that has been undertaken to inform the effect ranges in the EP. If it is not feasible to have a comparative seismic array sound source during the field trial, it could at least be reported on during the MSS to validate the accuracy of acoustic model predictions.

- A real-world test of the ADM has been conducted in France using simulated southern right whale and pygmy blue whale calls and results on the performance of the detector are still being assessed but will be reported in a manufacturer's white paper following the ADM field trial. This should be highly encouraged given very little published information exists generally on the efficacy of PAM systems as a seismic mitigation measure. This test could describe the performance of the system to detect calls. The results could also inform a complete assessment of the survey management approach for reducing/limiting exposure of animals (which may not be vocalising) to sounds in a mitigation scenario.

3. **Are the maximum detection distances of the ADM network and PAM system provided? Are the ADM deployments able to detect over longer distances than the proposed detection ranges, if required?**

   The PAM towed array has a stated predicted detection ranges of 10 km in the technical memo, whereas the ADM has no stated detection range in the technical memo although a detection distance of ~14 km is stated in Appendix E7 (section 9.3.3.3). For both the PAM and ADM, it is not clear what (species) is being detected or the signal to noise ratio of this detection to understand the appropriateness to species of interest in the Regia MSS. Generically, it would seem feasible that the PAM array could localise out to ~10 km based on a detection range factor of x4 or x5 the maximum distance between receivers in an array (for which the PAM array is 2 km). The provided documents do not include sufficient information to determine if the ADM are able to detect over longer distances than the proposed detection ranges, although particularly for southern right whales this would be very unlikely given their likely lower source levels and low call production rates (Matthews & Parks 2021; Webster et al. 2019; Ward 2020).

4. **Based on the information submitted by the titleholder and AAD's experience with similar monitoring methods, please advise on whether, in AAD's view, telemetry of data from the ADM program would be able to be reliably transmitted, received and interpreted to enable timely decision-making for the implementation of control measures?**

   It is noted the ADM uses both Iridium Satellite and GPS iridium tracker interfaces for real-time data streaming/transmission of whale detections via email with capabilities for transmissions every 30 seconds. However, there is no information about how frequently transmissions are likely to be received, nor how they would be interpreted and incorporated into a decision-making framework. Given the location of the MSS survey area, it would be feasible that the telemetry data could be reliably transmitted and received. Ultimately, the efficiency of the system is largely related to engineering and cost factors. Data relay frequency can range from every minute, hour, to daily, depending on how quickly the information is needed for decision-making. How well it is integrated into the decision-making process is largely dependent on the compatibly and integration with their internal decision-making systems and protocols.

5. **If the titleholder's trial of the ADM technology is unsuccessful and the ADM component of the detection strategy cannot proceed, please provide advice on the potential for the proposed PAM component alone to be sufficient to detect the vocalisations of any blue whale/pygmy blue whale or any southern right whale over the proposed detection ranges.**

   If the trial of ADM technology is unsuccessful and cannot proceed, the PAM system alone does not appear to be capable of detecting southern right whale and blue whale vocalisations at the required distances. However, it is also unlikely that the ADM will be completely unsuccessful in detecting southern right whales or blue whales. A likely scenario is that the detection ranges of the ADM may not be as far as currently stated (i.e. 14 km) and consequently the number of ADMs will need to be re-assessed along with a revised spatial configuration.

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