Order Form / Work Package Order

FROM

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Order Number	C20563
Order Date	24 August 2023

TO

Contractor	APEM Limited
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Address	Riverview A17 Embankment Business Park Heaton Mersey Stockport SK4 3GN

1. SERVICES REQUIREMENTS

Aerial Survey of Areas in the Southwest Celtic Sea for Seabird and Marine Mammal Species for the POSEIDON Project#2

(1.1) Services required:

Specification

This project is being commissioned under the Natural England Framework *Provision of Digital Aerial Surveys for Seabirds and Marine Mammals in English and Welsh Waters*

(Project 33532). This is a request for a quotation for the project detailed below, under the processes set out in that Framework.

1. Background

1.1 POSEIDON project and survey background

Natural England is the lead organisation for the POSEIDON (Planning Offshore Wind Strategic Environmental Impact Decisions) project. POSEIDON is a multi-partner, multi-year initiative funded by the Crown Estate through the Offshore Wind Evidence & Change (OWEC) programme.

The ultimate aims of POSEIDON are to:

1. Develop a clear understanding of the environmental risks and opportunities for future offshore wind developments (embedded into wider marine planning);
2. Provide information to support developers, advisors and decision-makers for current and imminent development rounds; and
3. Develop a comprehensive environmental baseline platform that maximises existing knowledge and allows targeted, efficient design of future baseline evidence requirements at plan and project scale.

The project is structured into six phases (0-5) which are linked to the three key project outputs: 1) new baseline data; 2) updated habitat and species models; and 3) integrated risk and opportunity map.

Under Phase 1, existing seabird and marine mammal data has been collated, appraised and acquired. Under Phase 2, the data collation was used to identify and prioritize areas for the collection of new seabird and mammal data through DAS. A set of metrics was applied to the collation of existing datasets (covering 2000 – 2022) to identify spatial and temporal evidence gaps.[1] Scores were then calculated for each ICES rectangle to identify priority areas and seasons with the least existing data within English and Welsh EEZ. The priority cells for this study are outlined in red in Figure 1 below.

The study seeks to understand abundances and distribution of key seabird and marine mammal species in these areas across seasons. Data should be provided on all animals observed during surveys, with species of specific interest shown in Table 1 below.

[1] Total distance covered by survey (higher values deemed better), Number of days covered by survey (higher values deemed better), Number of years covered by survey (higher values deemed better), Days from first to final survey (higher values deemed better).

Table 1: Species of Specific Interest

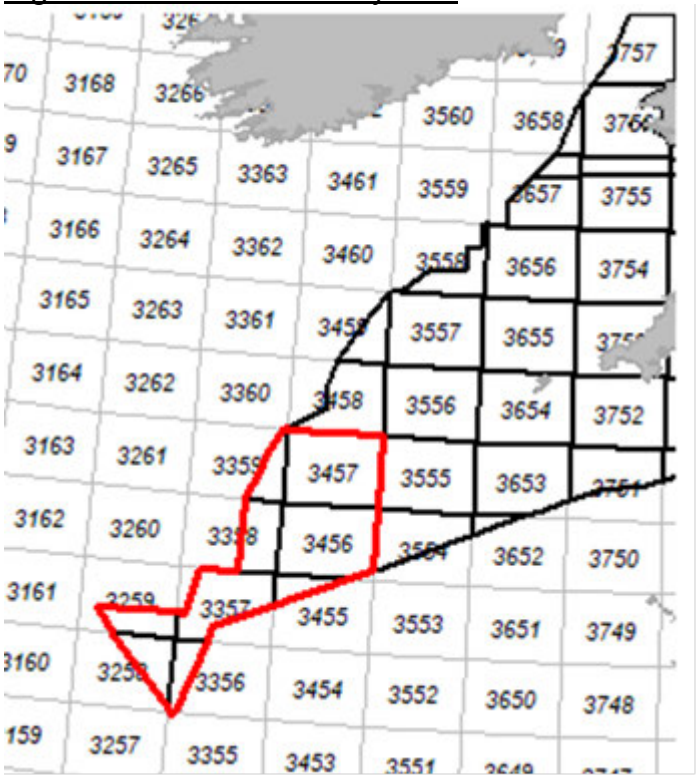
Cetaceans	Seabirds
Fin whale	Northern fulmar
Minke whale	European storm-petrel
Long-finned pilot whale	Black-legged kittiwake
Killer whale	Lesser black-backed gull
Risso's dolphin	Herring gull
Common dolphin	Great black-backed gull
White-beaked dolphin	Manx shearwater
Atlantic white-sided dolphin	Balearic shearwater
Bottlenose dolphin	Northern gannet
Harbour porpoise	European shag
	Common guillemot
	Razorbill
	Atlantic puffin
	Red-throated diver
	Common scoter
	Great skua
	Little gull
	Sandwich tern
	Common tern
	Arctic tern
	Roseate tern
	Great cormorant
	Great-northern diver
	Common eider
	Arctic skua
	Red-breasted merganser

Limited existing data is available in targeted areas for any species at any time of the year.

1.2 Study area

The priority areas identified for these surveys are shown in Figure 1 below. The survey area partially covers 9 ICES rectangles (outlined in red) in the Southwest Celtic Sea. For reference, a shapefile for ICES rectangles can be downloaded from https://gis.ices.dk/sf/index.html. In designing survey plans, suppliers should aim to collect whatever data are possible in rectangles outside the specified survey area that are visited as part of the main survey – for instance, on transit between base airports and the survey areas. Processing images collected outside the core study area is an **optional objective which may be pursued, dependent upon costs**. Framework suppliers are asked to quote separately for the cost associated with processing images collected outside the specified survey area.

Figure 1: Celtic Sea survey area



ICES reference numbers: 3457, 3456, 3455, 3359, 3358, 3357, 3356, 3259, 3258

2. Aims

Natural England is seeking a DAS framework contractor to design and carry out four digital aerial surveys of the prescribed study area (Figure 1), in each of the four seasons defined below. Each of the 9 ICES rectangles that comprise the study area will be surveyed at least once in each season. Seasons are defined as:

1) October – December 2023
2) January – March 2024
3) April – June 2024, and
4) July – September 2024.

The selected DAS framework contractor will use the most up to date digital aerial imagery (video or still) methods and process the resulting imagery to provide a comprehensive digital dataset from which robust estimates of the abundance and distribution of birds and marine mammals in survey areas can be derived.

The contractor will be required to design, organise and logistically coordinate the survey work, as well as process the resulting imagery and provide the imagery (or a sample TBC) and processed data in an agreed format to Natural England. Under this contract there will be no requirement to analyse the processed survey data to derive abundance estimates or produce density surface maps – the contract is solely for data collection, image processing and provision of resultant images, data and associated metadata compliant with required standards.

3. Objectives

The service required is provision of all aspects of digital aerial survey (including suitably qualified surveyors, appropriate digital camera equipment, and survey aircraft designed for offshore work over long durations), digital data processing, Quality Assurance and reporting to meet the requirements and objectives of the survey work, as detailed in this specification.

There are four **core objectives** for this contract. These are to:

a) Conduct four, seasonal[2], high precision digital aerial surveys of the study area in the southwest Celtic Sea. Survey data are to be collected using digital video or still imagery at a minimum of 2 cm Ground Surface Distance (GSD) to confidently capture and identify to the lowest taxonomic level possible all birds (in flight and on the water) and marine mammals within the surveyed area;

b) process imagery to identify **all** birds, marine mammals, and other objects of interest captured to the lowest taxonomic level possible;

c) Quality Assure results so that pre-agreed data standards are met (to meet MEDIN guidelines and JCDP data standards or equivalent) for archival in marine data repositories such as the Marine Data Exchange;

d) produce ArcGIS layers, associated metadata, accompanying .csv files, etc. and four brief reports (one for each of the survey seasons) detailing survey effort and observations for each individual survey within pre-agreed timeframes, likely to be within 6 – 8 weeks of data collection). Files provided should quantify locations, dates and times of surveys in a clearly communicated coordinate system and/or projection, regardless of whether animals were sighted or not.

There is no requirement to analyse data to produce e.g. abundance estimates or density maps – the contract is solely for data collection, image analyses and provision of data, imagery and associated files to required standards.

4. Methods

The contractor will need to develop an appropriate survey design to meet the project aims and objectives outlined above. Recognising the trade-off between coverage and cost, contractors are encouraged to consider a range of coverage options and to include costings and justification for each. Natural England recommend contractors consider and present costings for three potential options. These are 2%, 3% and 5% coverage each at a

[2] Whilst we recognise the challenges of surveying large areas to prescriptive timetables, we would suggest contractors aim for the middle month of survey seasons where practical, and limit as far as possible the total time required to survey the study area within a season. Where surveys have to take place at the beginning or end of seasons, Natural England would appreciate discussions to ensure seasons are separated to an acceptable degree.

resolution of minimum 2 cm Ground Surface Distance (GSD). Justification and costings for other appropriate options are also welcomed.

Survey design

Bidders should clearly indicate, and provide supporting evidence for their degree of confidence in:

a) The suitability of the proposed survey design to provide a dataset that can provide suitable data to characterise the study area;
b) The ability to identify as many of the species of interest to lowest possible taxonomic level; and
c) The suitability of the proposed survey design to maximise encounters with species of interest within the study area.

Bidders must also provide information on technical and procedural specifications, to include as a minimum, but not necessarily limited to:

- Camera specification, number deployed per aircraft, and type
- Camera performance in different environmental conditions (for example, comparison of bird and mammal detections during good versus poor light conditions, between different sea states and in variable cloud levels) and approaches to management of variable image quality with respect to environmental conditions (e.g. sea state, where possible turbidity, cloud cover, sun altitude and surface glare)
- Choice of survey design (e.g. transect or grid based, continuous or discontinuous image capture)
- Number of proposed transects to be surveyed or still images to be collected
- Transect or grid orientation and spacing and swathe / image width or still image area for plot-based surveys
- Survey altitude and image resolution (GSD)
- Methods for ensuring accurate georeferencing of survey images
- Time required to complete the survey and indicative survey plan; consideration should be given to whether it is appropriate to divide the survey area into zones that can be surveyed in a day, or whether the whole area could be surveyed in a day, using multiple planes, with repeat surveys visiting different offset transect lines within the season to provide the overall required coverage of the study area
- Proposed survey area extent in relation to the study area; information on any operational restrictions or other factors that justify excluding coverage of certain areas
- Proposed overall percentage analysed coverage of the survey area (including actual area surveyed and percentage of images to be analysed) and commentary on implications for confidence in final population estimates. It is recommended that costings are presented for 2%, 3% and 5% coverage. Costings and justification may also be presented for alternative coverage percentages should the bidder consider them achievable
- Approach to bird or marine mammal recognition and species attribution, including QA procedures
- Proposed output format of the raw data (including the fields/attributes that would be

included)
- An indication of the size of the raw data outputs from each of the seasonal surveys at different coverages

A suitable survey method should consider the following points and bidders are required to consider and address each of these points in their submission:

- Aerial survey(s) should be undertaken using digital high-definition video or high resolution still photography with a Ground Surface Distance of 2 cm or finer.

- Survey(s) should be designed to gain a representative sample of seabird and marine mammal populations across the study area to enable statistically robust estimates of their population sizes (and associated confidence intervals) and their distributions to be generated subsequent to this contract.

- Survey designs should aim to balance costs against survey coverage, image resolution and duration and frequency of survey. There will be a need to explicitly state the percentage coverage of the survey area for each seasonal survey and how this will be achieved reliably. Costs should be provided for various options of replicates and coverage considered appropriate to meet the requirements.

- Details of the camera specification and type, performance in different environmental conditions (for example, comparison of bird and mammal detections during good versus poor light conditions, between different sea states and in variable cloud levels) and approaches to management of variable image quality with respect to environmental conditions (e.g., sea state, cloud cover, sun altitude and surface glare) are important and information on these matters should be provided by bidders.

- Full details of logistic considerations for survey work should be provided in the tender e.g., operational restrictions, or other factors that may justify excluding coverage of certain areas and how these restrictions will be addressed.

- There are various risks that may constrain the ability to complete the survey and data extraction within the required timescales, considering factors such as weather, fuelling, airspace restrictions and COVID-19 etc. Bidders should describe the potential risks and provide details of relevant contingency measures.

- Natural England will require the framework contractor to pass copies of a sample of 1% of survey imagery to Natural England. Bidders should provide details of the process by and format in which this imagery will be transferred to Natural England and an estimate of the total storage capacity required.

5. Requirements

To enable successful delivery, the Contractor is expected to:

- Plan the survey design and submit these plans at tendering stage.

- Conduct the survey(s), including organisation and positioning of aircraft, crew and equipment and ensuring that all health and safety requirements, including Covid-19 requirements, are met.

- Process the acquired imagery.

- Quality Assure results so that pre-agreed data standards are met (e.g. to meet MEDIN standards and JCDP Data Standard for marine mammals or equivalent for archival in marine data repositories such as the Marine Data Exchange). Common identifiers must be used for sightings and GPS location to ensure the latter can be associated with the former. It is recommended that photograph files are used as the common identifier. This detail should also be provided when no animals are sighted. It is recommended that the GPS log includes environmental / conditions during surveys alongside the coordinates (turbidity, sea-state etc). For marine mammals, data should record which detections (images) were at the surface and which were not. A guide to the data format should be provided to define headings and guidance on how to interpret the data. (Note, that by the time this project is completed it is likely that Marine Scotland's *Digital Aerial Survey Data Standard Guidance Document,* which is currently in preparation, will have been finalised and published. This guidance will set out details of the data and metadata requirements needed for MEDIN compliance when reporting on digital aerial surveys and will provide templates for the provision of all necessary information in a standard format. It is likely that the framework contractor will be required to provide data and metadata relating to the surveys conducted under this project in accordance with this guidance, once finalised.)

- Submit ESRI ArcGIS 10.2 compatible shapefiles (clean of any topology errors) and .csv files showing survey effort (e.g. aircraft tracks and altitude) and observations of birds, marine mammals and other objects of interest (one per survey), including data fields and metadata to pre-agreed standard (see above). These to be submitted to pre-agreed public repository with accompanying metadata, within pre-agreed period following each survey. Point and polygon data should be supplied. Column headers and terminology must be consistent amongst files with identical words, spacing and case.

- Submit four brief technical reports in Microsoft Word format following each set of seasonal surveys (i.e. four reports covering surveys in each season), detailing pertinent survey information including: detailed description of, and rationale for, survey methods and design, maps of survey routes and coverage; details of surveys as actually flown (dates, time, weather conditions, sea state, crew, camera set up, etc.); details of data extraction and processing and associated challenges or limitations (e.g. around species identification). Reports will include species identification rates and the criteria used for species-specific identification rates (e.g., are they comprised of definite, probable or possible identifications). Beaufort Scale should be used to report sea states in addition to a (subjective) underwater visibility estimated at 15min periods and added directly to the survey route data as additional fields. The final report structure and content will be agreed with the nominated officer.

- Submit copies of all survey imagery and above files to Natural England.

Project deliverables

- Digital copies of a sample of the georectified original survey photographs or video stills – please indicate available formats.

- A copy of the camera calibration report for each survey.

- Quality assured datasets of validated and geo-referenced observations (for all species/species groups/other objects of interest recorded) – so that pre-agreed data standards are met (e.g. to meet MEDIN standards or equivalent for archival in marine data repositories such as the Marine Data Exchange) (see guidance at https://medin.org.uk/) and/or compliance with Marine Scotland's *Digital Aerial Survey Data Standard Guidance Document* (once finalised);

- ESRI ArcGIS 10.2 compatible shapefiles with attached metadata and clean of any typology errors and .csv files showing survey effort (e.g. aircraft tracks and altitude) together with log of conditions (sea state, visibility, cloud cover, glare, precipitation etc) during each survey. As above, sea state should be recorded using the Beaufort Scale and a (subjective) underwater visibility estimated at 15min periods and added directly to the survey route data as additional fields.

- ESRI ArcGIS 10.2 compatible shapefiles with attached metadata and clean of any typology errors and .csv files showing observations of birds, marine mammals and other objects of interest (one set per seasonal survey), including data fields and metadata to pre-agreed standard. Point and polygon data should be supplied. All datafiles to be submitted to pre-agreed public repository within pre-agreed period following each survey.

- Raw data files providing details of all the objects observed within each sample frame and subsequent identification. For each object detected, data fields to include, as a minimum, georeferenced position, date, time, number of individuals, assignment to identity (bird or mammal species and age/sex or broader category), confidence level in that categorisation, whether in flight or on the water surface and direction of travel. The locations of any objects such as vessels that might influence observed bird distributions should also be recorded within these data files. Positional and conditional information is required for photographs or video where animals were not seen.

- Four brief reports in Microsoft Word format; one following each survey season, each detailing pertinent survey information (dates, time, weather, sea state, crew, camera set up, incidents, species ID rates, etc.). (Reports do not need to contain any descriptive or analytical statistics or modelling). Reports will include the criteria used for species-specific identification rates (e.g., are they comprised of definite, probable or possible identifications).

All data provided must comply with Natural England metadata standards and GIS formats as

outlined at Annex A (below) and should additionally be in European Seabirds at Sea (ESAS) compatible format.

Data ownership, intellectual property rights and copyright

All data captured and produced shall be fully owned by and copyrighted to Natural England. This shall include any intellectual property rights that might otherwise impede on Natural England's usage and data sharing of the outputs. Natural England may share any project outputs with third parties including for the purposes of additional analyses outside the final scope of any contract awarded against this statement of requirements. Any data supplied by Natural England to potential bidders and the contractor are for use in this project only and should not be retained once the bidding process (for unsuccessful bidders) or project (for the contractor) has been completed. In addition, neither bidders nor the contractor must pass such data on to any third parties unless with explicit prior permission from Natural England. The contractor is responsible for ensuring that all products submitted are of a satisfactory standard. The Natural England Nominated Officer may undertake a QA review of all project deliverables, including image analyses, prior to approving subsequent payment for the work.

Milestones and payment schedule

Milestone	Date
Project inception meeting between contractor/sub-contractor, and Natural England	End September 2023
Contractor to finalise sampling design and provide to Natural England	Mid-October 2023
Contractor to produce final project plan and provide to Natural England (if different from that in tender documents)	Mid-October 2023
Natural England to agree survey design and project plan	End October 2023
Commencement of first seasonal surveys by contractor (Oct – Dec)	Mid-November 2023
Completion of first seasonal surveys by contractor	Mid-November 2023
MS Teams meeting to discuss first seasonal surveys	End November 2023
Submission of ArcGIS layers, other associated datasets, metadata and imagery and a brief report detailing survey effort and observations for the first seasonal surveys.	Early January 2024
Commencement of second seasonal surveys by contractor (Jan – March)	Mid-February 2024
Completion of second seasonal surveys by contractor	Mid-February 2024
MS Teams meeting to discuss second seasonal surveys	End February 2024
Submission of ArcGIS layers, other associated datasets, metadata and imagery and a brief report	Early April 2024

detailing survey effort and observations for each of the second seasonal surveys	
Commencement of third seasonal surveys by contractor (April – June)	Mid-May 2024
Completion of third seasonal surveys by contractor	Mid-May 2024
MS Teams meeting to discuss third seasonal surveys	End May 2024
Submission of ArcGIS layers, other associated datasets, metadata and imagery and a brief report detailing survey effort and observations for each of the second seasonal surveys	Early July 2024
Commencement of fourth seasonal surveys by contractor (July – September)	Mid-August 2024
Completion of fourth seasonal surveys by contractor	Mid-August 2024
MS Teams meeting to discuss fourth seasonal surveys	End August 2024
Submission of ArcGIS layers, other associated datasets, metadata and imagery and a brief report detailing survey effort and observations for each of the second seasonal surveys	Early October 2024

(1.2) Commencement Date: 29th September 2023

(1.3) Completion Date: 30th November 2024, with DAS completed by 30th September 2024.

There is the option to extend for up to a further six weeks, subject to availability of funds. To be confirmed by issue of a Contract Change Note (CCN). Any work undertaken after 30 11 2024 will be at Supplier's risk until a CCN is offered and accepted.

2. PERFORMANCE OF THE SERVICES [AND DELIVERABLES]

(2.1) Key Personnel of the Contractor to be involved in the Supply of the Services

[redacted]

(2.2) Performance Standards
Project deliverables

- Digital copies of a sample of the georectified original survey photographs or video stills – please indicate available formats.

- A copy of the camera calibration report for each survey.

- Quality assured datasets of validated and geo-referenced observations (for all species/species groups/other objects of interest recorded) – so that pre-agreed data standards are met (e.g. to meet MEDIN standards or equivalent for archival in marine data repositories such as the Marine Data Exchange) (see guidance at https://medin.org.uk/) and/or compliance with Marine Scotland's *Digital Aerial Survey Data Standard Guidance Document* (once finalised);

- ESRI ArcGIS 10.2 compatible shapefiles with attached metadata and clean of any typology errors and .csv files showing survey effort (e.g. aircraft tracks and altitude) together with log of conditions (sea state, visibility, cloud cover, glare, precipitation etc) during each survey. As above, sea state should be recorded using the Beaufort Scale and a (subjective) underwater visibility estimated at 15min periods and added directly to the survey route data as additional fields.

- ESRI ArcGIS 10.2 compatible shapefiles with attached metadata and clean of any typology errors and .csv files showing observations of birds, marine mammals and other objects of interest (one set per seasonal survey), including data fields and metadata to pre-agreed standard. Point and polygon data should be supplied. All datafiles to be submitted to pre-agreed public repository within pre-agreed period following each survey.

- Raw data files providing details of all the objects observed within each sample frame and subsequent identification. For each object detected, data fields to include, as a minimum, georeferenced position, date, time, number of individuals, assignment to identity (bird or mammal species and age/sex or broader category), confidence level in that categorisation, whether in flight or on the water surface and direction of travel. The locations of any objects such as vessels that might influence observed bird distributions should also be recorded within these data files. Positional and conditional information is required for photographs or video where animals were not seen.

- Four brief reports in Microsoft Word format; one following each survey season, each detailing pertinent survey information (dates, time, weather, sea state, crew, camera set up, incidents, species ID rates, etc.). (Reports do not need to contain any descriptive or analytical statistics or modelling). Reports will include the criteria used for species-specific identification rates (e.g., are they comprised of definite, probable or possible identifications).

All data provided must comply with Natural England metadata standards and GIS formats as outlined at Annex A and should additionally be in European Seabirds at Sea (ESAS) compatible format.

APEM Response:

Understanding the requirements

The Department for Environment and Rural Affairs (DEFRA), working with Natural England, requires a service provider to conduct four, seasonal digital aerial surveys across the Southwest Celtic Sea at a minimum Ground Surface Distance (GSD) of 2 cm to capture and identify all birds (in flight and on the water) and marine megafauna within the survey area. The chosen service provider will process the imagery, provide quality assurance to MEDIN and JCDP data standards or equivalent, and provide evidence within 6-8 weeks in the form of four brief reports (one per season) alongside ArcGIS layers, associated metadata and other supporting data.

APEM are perfectly positioned to deliver this service. We have more than 20 years' experience in delivering digital aerial surveys in a similar environment and have worked with Natural England and DEFRA throughout this period. Our team of skilled Ornithologists, Marine Mammal Consultants and Technical Engineers have the experience to confidently and accurately identify and quality check captured imagery and provide detailed and knowledgeable reports and advice on the survey area.

Survey methodology

Natural England require a robust survey design which will seamlessly and accurately collect imagery across the survey area and provide precise data on the quantity of birds and marine megafauna in the area. APEM's survey method collects multiple still images along the flight line corridors planned for each survey, providing an accurate footprint that allows very accurate abundance and density estimates to be modelled.

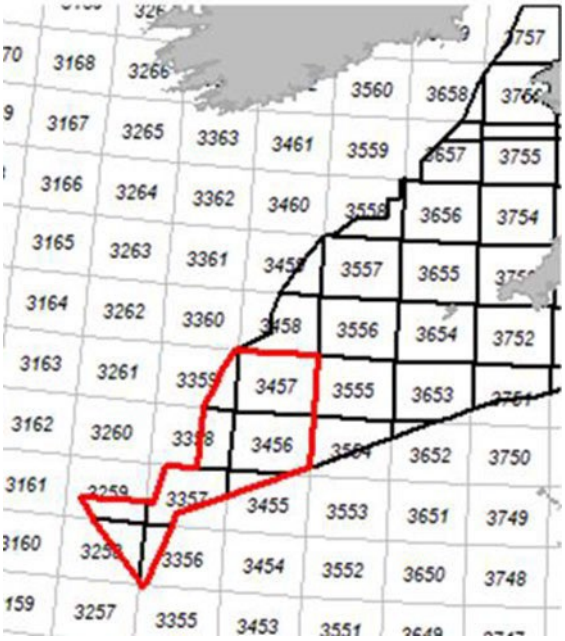


Figure 1: The survey area is shown in the red outlined area.

As provided within the RFQ, the survey area is shown in Figure 1, APEM have designed a survey methodology which will meet Natural England's requirements and provided additional options which will exceed requirements and provide a more robust dataset.

In accordance with the specification, APEM provide the following transect-based survey design options:

1. 2cm GSD, 2% coverage, 6 transect survey lines at 38km spacing. On task approximately 14 hours, two aircraft over one day (where weather allows).
2. 2cm GSD, 3% coverage, 8 transect survey lines at 30km spacing. On task approximately 14 hours, two aircraft over one day (where weather allows).
3. 2cm GSD, 5% coverage, 13 transect survey lines at 17km spacing. On task approximately 20 hours, two aircraft over two days.

Additionally, APEM provide additional survey design options:

4. 1.5cm GSD, 2% coverage, 7 transect survey lines at 35km spacing. On task approximately 14 hours, two aircraft over one day (where weather allows).
5. 1.5cm GSD, 3% coverage, 11 transect survey lines at 22km spacing. On task approximately 15 hours, two aircraft over once day (where weather allows).
6. 1.5cm GSD, 5% coverage, 16 transect survey lines at 13.5km spacing. On task approximately 21 hours, two aircraft over two days.

Due to the size of the survey area, and for safety reasons, transects will be orientated in an E-W direction.

APEM recommend a GSD of 1.5 cm, due to the level of detail captured in images of this resolution it is possible to identify most seabirds and marine megafauna to species level, which is not possible at 2cm GSD. Examples of the percentage ID of species listed in the RFQ, achieved at 1.5 and 2 cm GSD, can be seen in Table 1.

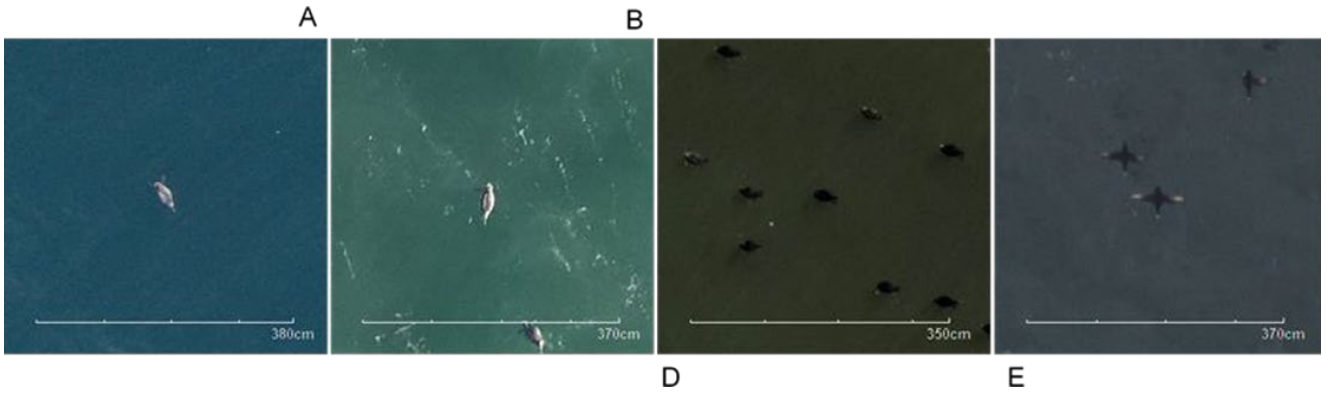


Figure 2: Example snags for identified red-throated diver, common scoter and little gull from surveys in European and America waters. A, and B: show Red-Throated Divers at 1.5cm GSD. D and E: show Common Scoter at 1.5cm GSD.

	2 cm GSD		1.5 cm GSD	
Seabirds	**% ID Flying**	**% ID sitting**	**% ID Flying**	**% ID sitting**
Northern fulmar	>99%	>95%	100%	100%
European storm-petrel	>75% to Petrel Species	<50% to Petrel Species	>90% to Petrel Species	>50% to Petrel Species
Black-legged kittiwake	>95%	>90%	>99%	>95%
Lesser black-backed gull	>99%	>90%	>99%	>95%
Herring gull	>99%	>90%	>99%	>99%
Great black-backed gull	>99%	>90%	>99%	>99%
Manx shearwater	>75% to Shearwater Sp.	>50% to Shearwater Sp.	>90% to Shearwater Sp.	>90% to Shearwater Sp.
Balearic shearwater	>75% to Shearwater Sp.	>50% to Shearwater Sp.	>90% to Shearwater Sp.	>90% to Shearwater Sp.
Northern gannet	100%	100%	100%	100%
Common guillemot	>90% in Summer, <50% in Winter	>90% in Summer, <50% in Winter	>95% Summer, <50% in Winter	>95% Summer, <50% in Winter
Razorbill	>90% in Summer, <50% in Winter	>90% in Summer, <50% in Winter	>95% Summer, <50% in Winter	>95% Summer, <50% in Winter
Atlantic puffin	>95%	>90%	>97%	>97%
Red-throated diver	>90%	>90%	>99%	>95%
Common scoter	>95%	>85%	>99%	>99%
Great skua	>90%	<50%	>95%	>90%
Little gull	>85%	>50%	>99%	>85%
Sandwich tern	>90%	<50%	>95%	>90%
Common tern	>95% to Commic Tern	<50% to Commic Tern	>99% to Commic Tern	>90% to Commic Tern
Arctic tern	>95% to Commic Tern	<50% to Commic Tern	>99% to Commic Tern	>90% to Commic Tern
Roseate tern	100% to Tern Species	90% to Tern Species	100% to Tern Species	100% to Tern Species
Great cormorant	>99%	>90%	>99%	>95%
Great-northern diver	>90%	>90%	>99%	>95%
Common eider	>95%	>90%	>99%	>99%
Arctic skua	>90%	<50%	>90%	>50%
Red-breasted merganser	>85%	>75%	>99%	>90%
Marine Mammals				
Minke whale	N/A	>95%	N/A	>99%
Risso's dolphin	N/A	>80%	N/A	>90%
Common dolphin	N/A	>75%	N/A	>85%
White-beaked dolphin	N/A	>80%	N/A	>90%
Bottlenose dolphin	N/A	>80%	N/A	>95%
Harbour porpoise	N/A	>50%	N/A	>75%

Table 1: Identification rates of key species listed in the RFQ at 1.5 and 2 cm GSD capture.

Additionally, APEM's natural flightpath will capture imagery within other ICES zones around the allocated survey area. We would be happy to discuss options of analysing, storing, and reporting on the additional data, if required.

APEM recommends that survey flights take place at a height of at least c.1,300 ft, which will avoid disturbance to birds and marine megafauna and optimises ground resolution and footprint. At 1.5 cm GSD resolution, the footprint of the Shearwater IV camera system consists of an image node 135 m in length and 656 m in width, which is a footprint of 88,560 m sq. APEM's method collects multiple images of this sized footprint along the lines planned for each survey.

Image acquisition would be with a bespoke camera and sensor system, the Shearwater IV, set up to acquire and save a series of digital still images based on the latest technology introduced in 2020. This state-of-the-art system was created by APEM to deliver world-leading, ultra-high resolution digital still imagery for easier analysis compared to other systems. At the same time, it also saves on costs by having an extremely large image footprint at all resolutions.

APEM plan to conduct the surveys for the project in the middle of each season period. If we deviate from this schedule due to weather conditions, we will alert Natural England of this and discuss your preferences of when to reschedule the survey.

We confirm our ability to conduct both surveys for the Central North Sea and Southwest Celtic Sea.

Data collection

Our state-of-the-art digital camera systems are integrated with custom flight planning software that allows each survey flight path to be accurately mapped out before the aircraft leaves the ground. Each image capture node is precisely defined, allowing the system to fire the camera exposures at exactly the right location. This ensures that each survey is flown with the same survey flight path orientation and the camera is triggered at the same position along each line within set tolerances. APEM's planning systems enable tolerances on flight path along survey lines to be set automatically aborting survey lines that drift away from the aircraft's planned flight line.

APEM collects and records additional data relating to each survey flight as standard, which is collated and provided as follows:

- Time – time of image capture, start / end time of whole survey and individual survey lines;
- Location of image – latitude / longitude or easting / northing in respect to UTM zone;
- Environmental conditions – including visibility, cloud cover, sun angle, wind speed, wind direction, air temperature, air pressure, precipitation, sea state and turbidity; and
- Anecdotal observations – for example, shipping observations made by the camera technician that may not be captured in the imagery.

All images collected would be securely saved and backed-up on mirrored disks during flight and then multiple servers at APEM to ensure data security. These data are then stored for five years as standard.

Data will be collated and provided in the form of ArcGIS Shapefiles and corresponding metadata and Microsoft Excel (.csv) spreadsheets, where applicable. Raw imagery will be in the form of Tiff files and will be transferred to Natural England via an external drive that would be billed at additional cost or can be transferred via a link.

Image analysis approach

The digital still imagery acquired by the aerial surveys will be analysed by APEM staff using bespoke image analysis software to determine species identification, raw counts, estimates of flight heights, flight direction, and other information relevant to seabirds and marine megafauna present within the Survey Area, including static fishing equipment (such as lobster pots) and fishing vessels. All possible information from the imagery is 'extracted' (including anthropogenic artefacts) and typically georeferenced to the WGS84 UTM projection unless otherwise requested.

Data collected and recorded as standard are as follows:

- Species-level identification of each animal observation, or, where not possible, the lowest taxon;
- Age, sex, length and wingspan of each animal observation where possible/applicable;
- Behaviour of each animal observation, e.g. sitting/flying/perching/diving for birds or submerged/surfacing for mammals;
- Flight height of flying birds where appropriate (see Size-Based Flight Height Provision**.** for more detail);
- Flight direction of flying birds;
- Date and time of each observation (e.g. animal/vessel/structure) recorded in the survey;
- Corresponding coordinates for each observation (with an accuracy of ±3 to 5 m); and
- Unique identifying numbers for each observation with reference to the corresponding image.

Image analysis quality assurance

APEM's team of image analysts are hand-picked for their existing skills and experience and then receive further ongoing training internally from our experienced Team Leads and QA Team providing excellent quality, making our data the best in the business. Our analysts receive on-going training in identification from APEM's QA Manager, [redacted] who is almost certainly the world's most experienced analyst of digital aerial images of seabirds. Our analysts also have access to the in-house Image Archive Library, which is regularly updated. This comprehensive guide is compiled from previously identified individuals in aerial images. Analysts also measure the body length and wingspan (for birds) as input parameters for species identification. On-going advances in digital imagery have removed many of the uncertainties in species

identification that have existed in the past (e.g., failure to differentiate species of auk) through poor resolution and image smear. Every survey goes through a quality assurance process, where a percentage of images are sampled by at least two members of staff to quality check the identification. Avian and marine mammal identifications are reviewed by in-house specialists with extensive experience in identifying birds from digital aerial still images. After the images have been analysed, 10% of the birds and marine megafauna recorded by each survey can be subject to external QA upon request by the client at an additional cost (not included in the costs provided in this tender). This is carried out by our QA partners, the British Trust for Ornithology (BTO) and the Sea Mammal Research Unit Marine (SMRU Marine). APEM have recently included its Senior Marine Mammal and Ornithology Consultants in the Quality Assurance process of all marine mammal images.

Where identification to species is not possible individuals will be assigned to taxonomic groups such as ‘black-backed gull sp.’ (lesser black-backed or great black-backed gull) or ‘gull sp.'

It is APEM’s experience that for equal resolution, still images give a superior quality image for bird and marine megafauna identification than to those acquired using video (See example of images in Figure 1). Due to the limitations associated with High Definition (HD), vertical digital stills cameras are adept at detecting marine species submerged in the surface of the water column that may not be seen by oblique video cameras, and multiple frames from video surveys does not improve identification of marine mammals. APEM’s bespoke camera systems also have a short focal length and are less zoomed at any given resolution in comparison to video cameras, providing better image quality and less motion blur for a better chance of species identification. Furthermore, the benefit of vertically mounted cameras is that they have an improved viewing angle over oblique video systems. This is because poorer sea states would have a negative impact on the detectability for objects of interest which may be obscured by waves and breaking surf. In addition, APEM can estimate its coverage captured more accurately whereas with angled video systems this is not the case. Using the methods described here, APEM can achieve identification accuracy of greater than 90% for a vast majority of avian species and 90% for harbour porpoise, common dolphins and bottlenose dolphins and over 85% accuracy for white-beaked dolphins.

Glare, weather risk, and challenges

To provide Natural England with certainty on costs, various risks that may constrain the ability to complete the survey and data extraction within the required timescales, considering factors such as weather, tides, airspace restrictions and COVID-19. APEM cover all risks (provided that the decision about when a survey goes ahead or not is also held by APEM). We are highly experienced in optimising surveys to make use of small weather windows and we fully expect to mitigate against weather risks. Should a survey attempt fail, we will try again at the next available opportunity at no cost to the client.

Weather windows are reviewed daily, and we have sufficient capacity of both aircraft and crew to be on task when the conditions are favourable. We have continual access to aircraft to be able to mobilise even at short notice. APEM has previously owned and operated three aircraft, meaning we are able to troubleshoot possible challenges with our aviation provider knowledgably. The surveys would be undertaken in weather conditions that have been acceptable to the UK statutory nature conservation advisers, namely: visibility greater than 5 km, wind speed of less than 30 knots, sea state of four or less (Beaufort 5 or 6), and no icing conditions. While it is possible to survey in less favourable conditions, our aim is to balance the number of possible survey windows, the safety of our aircrew and the quality of the data collected. On bright days, there is a risk of glare in the images that can make finding and identifying birds and marine megafauna more difficult. We mitigate for this by avoiding surveying for some two hours around midday and tasking our on-board technician with continuously monitoring the image quality and, if necessary, ceasing acquisition until suitable conditions return.

APEM has a forward planning process to ensure staff and resource availability for the duration of the project. Prior to each survey a ground check is undertaken of the camera systems as well as the aircraft to ensure they are in working order. We own multiple camera systems to enable us to survey if there are competing weather windows with other contracts we currently have. We have an arrangement with our aviation provider to have a number of aircraft available for use at our discretion.

APEM has a highly experienced Flight Operations team who coordinate APEM's operational logistics to ensure crew and systems are mobilised in multiple aircraft to survey seven days a week as suitable weather and sea conditions allow. As part of its operations, APEM have a global Duty Operations roster; a fleet of survey sensors mounted in manned survey aircraft; multiple aviation providers providing a large pool of aircraft, as mentioned above; survey pilots; and aviation engineering support. The systems are operated and maintained by APEM's own pool of Aerial Survey Task Specialists. With this configuration, APEM currently maintains five crews ready and available for Marine Wildlife Offshore surveys every day of the year except for Christmas Day and Boxing Day.

Size-based flight height provision

In addition, using a set of rules developed in-house, based upon trigonometry and more complex mathematics, we can estimate the flight height of birds with a range of error and confidence intervals, dependent upon image quality, size of the bird species and the size of the bird relative to the image. Size- based flight heights can be provided as an additional part of the data. It must be noted that we are unable to accurately estimate flight heights for birds that are diving or turning sharply, as these individuals are not fully stretched out and therefore their measured lengths are not comparable to the reference length of the relevant species. Typically, the proportion of flying birds that APEM provide flight height estimates for is between 15% and 25% of the total in each survey.

Reporting and deliverables

Four brief technical reports will be provided to Natural England in Microsoft Word format. These will include the following information:

- Description of the survey methodology.
- Maps showing GPS tracks and survey coverage.
- Survey information including survey date, times, weather conditions, sea state, aircraft and crew information, camera set up, incidents, species ID rates.
- Image analysis and QA methodology.
- Raw count tables of all birds and marine megafauna.
- Distribution map of bird and marine megafauna observations.
- Commentary on any other anthropogenic objects observed in the survey.
- Reports will include criteria used for species specific identification rates (e.g. are they comprised of definite, probable or possible identifications).

In addition to the four brief technical reports, APEM can provide:

- Digital copies of original survey photographs, in the form of Tiff files and will be transferred to Natural England via an external drive that would be billed at additional cost or can be transferred via a link. Disk size can vary per survey can be exceed 7.5TB per survey.
- A copy of the camera calibration report for each survey.
- Quality assured datasets of validated and georeferenced observations, following MEDIN standards.
- ArcGIS compatible shapefiles with associated metadata, showing survey effort together with a log of environmental conditions.
- ArcGIS compatible shapefiles for each survey, with associated metadata, showing all bird and marine mammal observations; notable additional observations will also be included, i.e. anthropogenic objects.
- Microsoft Excel spreadsheets (.csv) providing details of all the objects observed within each image, and subsequent identification achieved. For each identified object, data will include georeferenced position, time, date, number of individuals, assignment to identity (bird or mammal, and age/sex where applicable), confidence level in that categorisation, behaviour (i.e. in flight or on the water), and direction of travel. The locations of any vessels shall also be included within these data files.

(2.3) Location(s) at which Services are to be provided: Celtic Sea study area (Figure 1)

(2.4) Standards: Reporting to pre-agreed standards, see below Annex A

(2.5) Contract Monitoring Arrangements

Catch up call approximately every 8 weeks between NE Project Officer and Contractor's Project Manager. Some of these are additional to the meeting dates set out under project milestones. Namely:

29th September 2023 – Project Initiation Meeting

w/k beginning 16th October 2023

End November 2023 – MS Teams meeting to discuss conduct of first seasonal survey

w/k beginning 5th February 2024

End February 2024 – MS Teams meeting to discuss conduct of second seasonal survey

w/k beginning 6th May 2024

End June 2024 – MS Teams meeting to discuss conduct of third seasonal survey

w/k beginning 5th August 2024

End August – MS Teams meeting to discuss conduct of fourth seasonal survey

3. PRICE AND PAYMENTS

(3.1) Contract Price payable by the Authority excluding VAT, payment profile and method of payment (e.g. BACS))

£339,360 for 3% Coverage at 1.5cm GSD

Southwest Celtic Sea – 3% Coverage	**£**
Provide total cost (exc VAT) with the following breakdown:	[redacted]
Survey planning	[redacted]
Fuel cost	[redacted]
Flying hours required	[redacted]
Litres of fuel per flying hour	[redacted]
Fuel cost per litre, on date tender submitted	[redacted]

Image Analysis (Core study area. Framework Agreement suppliers are asked to quote separately for analysis of images collected outside the core study area).	[redacted]
QA of imagery/data/results so that pre-agreed data formats and standards (e.g. MEDIN compliance) are adhered to	[redacted]
Reporting (including provision of all associated deliverables)	[redacted]
Grand Total (excl. VAT)	£339,360

(3.2) Invoicing and Payment

Payments will be made in stages amounting to 25% of the contract value per season. For each season (total four) the below staged payments will be made:
7.75% of contract price, following seasonal survey flight(s) completion and Natural England approval of survey completion report, and
17.25% of contract price, following Natural England approval of reporting and data deliverables for each seasonal survey.
All payments made after receipt of detailed invoice and approval by Natural England Nominated Officer confirming satisfactory stage completion.

4. Invoicing Requirements

APEM Limited to quote Natural England purchase order number (TBC) and Atamis reference number C20563 in their invoice.

Invoice should be emailed to Accounts-Payable.neg@sscl.gse.gov.uk or posted to:
Shared Services Connected Limited
Natural England
PO Box 793
Newport
NP10 8FZ

BY APPROVING THIS ORDER FORM, THE CONTRACTOR AGREES to enter a legally binding contract with the Authority to provide to the Authority the Services specified in this Order Form, incorporating the rights and obligations in the Call-Off Contract that are set out in the Framework Agreement 'Provision of Digital Aerial Surveys for Seabirds and Marine Mammals in English and Welsh Waters' entered into by the Contractor and the Authority on 25th July 2022.

Electronic Signature

Acceptance of the award of this Contract will be made by electronic signature via 'DocuSign' carried out in accordance with the 2014 EU Regulation no 910/2014 on electronic identification and trust services for electronic transactions in the internal market (eIDAS Regulation) and the uk Electronic Communications Act 2000. Acceptance of the offer comprised in this Contract must be made within 7 days and the Agreement is formed on the date on which the Contractor communicates acceptance on the Authority's electronic contract management system ("Atamis"). No other form of acknowledgement will be accepted.

Signed for and on behalf of the **Supplier**	Signed for and on behalf of the **Authority**
[redacted]	[redacted]
Full Name: [redacted]	Full Name: [redacted]
Job Title/Role: [redacted]	Job Title/Role: Senior Category Officer
Date Signed: 25/09/2023	Date Signed: 25/09/2023.

ANNEX A

Natural England data requirements

This Annex provides high level guidance for contractors regarding Metadata and Geographic Information System deliverables. Final details of requirements for this project, with reference to section 5 of the Specification, will be agreed with the Nominated Officer.

Natural England reserve the right to check the quality of all digital data and reserve the right to return any data that does not meet these compliance requirements. If any part of this guidance is unclear, please make early contact with the Natural England Nominated Officer who will be able to provide clarification in consultation with data management colleagues.

Metadata

A generic MEDIN compliant discovery metadata record should be completed for the project outputs as a whole and for each GIS layer generated. By generating MEDIN compliant metadata, Natural England gain required compliance with both INSPIRE Directive and UK GEMINI 2.1 metadata requirements, while using term list vocabularies fit for marine purposes. There are a variety of mechanisms for generating MEDIN compliant metadata available at the following link along with a full description of the MEDIN standard, XML encoding, and guidance documentation: https://www.medin.org.uk/medin-discovery-metadata-standard. Metadata derived as part of this project must be submitted to Natural England in an XML file which Natural England will archive through Data Archive Centres (DACs). Guidance 'MEDIN Guidance for Contractors' can be provided to the winning contractor.

Beyond the discovery metadata requirement, it is essential that the final GI datasets are accompanied by a detailed 'readme.doc' describing the file structure within submitted outputs, and clearly outlining file associations (e.g. layer files for colours/ fill patterns).

Geographic Information data - format for deliverables

GIS products should be compatible with ArcGIS Desktop 10.2. Data will be supplied as a series of Feature classes in a File geodatabase (.gdb) to an attribute structure to be agreed between the contractor and Natural England on commencement of the contract. One or more ArcMap Document files (.mxd) must be provided to pull out data into distinct layers based on its attribution and these will apply appropriate layer styling.

Data in the Feature classes of File geodatabases will be supplied using the following coordinate system parameters:

Attribute	**Value**
Geographic Coordinate System	GCS_WGS_1984

Datum	D_WGS_1984
Prime Meridian	Greenwich
Angular Unit	Degree

For the purposes of this project ArcMap document files (.mxd) are to display WGS84 data projected from requested feature classes in Lambert Azimuthal Equal Area projection based on ETRS 1989, using an appropriate (eg Petroleum EPSG) transformation between WGS 1984 and ETRS 1989.