Order Form / Work Package Order

Digital Aerial Surveys of The Solway Firth Special Protection Area

FROM

Authority	Natural England
Address	Foss House, Kings Pool, 1-2 Peasholme Green, York, YO1 7PX
Contact Ref:	[redacted] Phone: [redacted]05 Mobile: [redacted]70 Email: [redacted]@naturalengland.org.uk
Order Number	TBC
Order Date	13 December 2022

TO

Contractor	HiDef Aerial Surveying Ltd
For attention of:	Name: [redacted] Phone: [redacted]63 Email: [redacted]@hidefsurveying.co.uk
Address	Unit 2 Dobies Business Park Lillyhall Workington Cumbria CA14 4HX

1. SERVICES REQUIREMENTS

(1.1) Services [and deliverables] required:

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 **one** high precision digital aerial survey of the Solway Firth SPA in late winter (January/ early February 2023). Survey data are to be collected using digital video or still imagery at a suitable resolution (typically at least 2 cm Ground Sample 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 boundaries of the SPA;

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 (e.g. to meet MEDIN 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 a brief report detailing survey effort and observations for the survey within pre-agreed timeframes, likely to be within 6 – 8 weeks of data collection.

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.

There is also one **optional objective** which may be pursued dependent upon costs. Framework Suppliers are asked to quote separately for this. This is to:

e) extend the transects used to survey the Solway Firth SPA under core objective a) to cover sea areas out to 10km beyond the seaward limits to the Solway Firth SPA (area = 615km^2) and to report on and provide the resultant additional imagery and information to Natural England. (Note: **there will be no requirement to conduct image processing to identify objects within the areas covered under this optional objective** – simply to gather the imagery, archive it for future processing and make available to Natural England when required.*****

Methods

The successful Contractor will need to develop an appropriate survey design to meet the project aims and objectives outlined above.

Requirements

To enable successful delivery, the successful Contractor is expected to:

- Conduct appropriate preliminary analyses to demonstrate that the survey design/coverage will allow robust population abundance and distribution estimates to be derived from the survey data (after this project). **Those analyses are to be submitted at tendering stage**. For example, existing empirical survey data of each of the principal species of interest (from the visual aerial surveys between 2001 and 2006 or the digital aerial survey of the Solway Firth SPA in winter 2020/2021) or, failing that, simulated hypothetical distributions of the designated populations of each of the principal species of interest, could be used to explore the suitability of alternative survey designs/coverage etc. in terms of the resulting population abundance estimates, confidence intervals and costs.
- Plan the survey design and submit these plans at tendering stage.

- Conduct the survey, including organisation and positioning of aircraft, crew and equipment and ensuring that all health and safety requirements, including Covid-19 requirements, are met.
- Give as much advance warning of planned survey date and time to the nominated project officer to allow timely mobilisation of land-based volunteer counters to conduct simultaneous or near-simultaneous shore-based counts of the key species.
- Process the acquired imagery (for areas surveyed in line with core objective a) only). *****
- Quality Assure results 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). 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 (ABPmer in prep), will have been finalised and published. This guidance document is not currently available but 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 successful 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, 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 the survey. Point and polygon data should be supplied.
- Submit a brief technical report in Microsoft Word format following the survey, detailing pertinent survey information including: detailed description of, and rationale for, survey methods and design, maps of survey routes and coverage; details of survey as actually flown (dates, time, weather conditions, crew, camera set up, etc.); details of data extraction and processing and associated challenges or limitations (e.g. around species identification). 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.

*** note: following post-tender negotiations it has been agreed that the contractor will process the acquired imagery from the optional objective survey area as part of this contract (see section 3.1)**

(1.2) Commencement Date: 01 December 2022

(1.3) Completion Date: 31 March 2023

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 31 03 2023 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

(2.2) Performance Standards

Project deliverables

- Digital copies of all the geo-rectified original survey photographs – 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* (ABPmer in prep) (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 the survey.
- 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, 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 the 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 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.

- A brief report in Microsoft Word format detailing pertinent survey information (dates, time, weather, crew, camera set up, etc.). (Report does not need to contain any descriptive or analytical statistics or modelling).

All data provided must comply with Natural England metadata standards and GIS formats as outlined at Annex 1 and should additionally be in European Seabirds at Sea (ESAS) compatible format.

HiDef Response

1. Introduction

No budget figure for the works was provided so providing a cost-effective methodology isn't easy. However, we believe that what HiDef proposes is value for money and will provide a sound dataset. HiDef flew a very similar survey for Nature Scot in March 2021 with great success. Full details of the HiDef system were presented at the framework submission stage.

HiDef surveys provide an average identification rate of >95%, including difficult to differentiate species such as the auk family and diver species. Our seabird ID rates are not affected by sea conditions and wind speeds above Beaufort 3. Four factors contribute to HiDef's high identification rates:

- A commitment to producing the highest possible image quality from our surveys;
- The use of cameras angled from vertical;
- The availability of multiple images of each animal; and
- The employment of the best seabird and marine mammal survey experts.

Table 1 Identification rates of major bird and marine mammal taxa to species during recent HiDef digital aerial surveys, applicable to this Solway proposal

	Summer '19		Autumn '19		Early winter '19		Late winter '20	
	May - Jul		Aug - Oct		Nov - Jan		Feb - Apr	
Taxon	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
All auks	20675	97%	58875	95%	18431	90%	27783	91%
Cormorant / shag	43	95%	76	95%	169	91%	476	98%
Diver species	45	96%	73	89%	616	94%	1293	97%
Duck species	119	100%	919	99%	13510	99%	18715	100%
All gulls	5195	96%	10216	95%	13841	93%	11201	95%
Large auk	19611	98%	57625	96%	17762	91%	26840	92%
Large gull species	3315	96%	3420	94%	5032	92%	2898	95%
Small gull species	1800	98%	6419	98%	7655	94%	7759	96%

1.1 Surveys features

The use of digital video allows our review and identification teams to play and rewind video, highlighting the contrast between sea and target objects and is one of the major advantages of the video technique. HiDef accept all weather risk associated with the delivery of our surveys. The ability to fly in a wide envelope of conditions gives us the opportunity to survey across different sea states and therefore provides a robust picture of the species assemblages that are present under a wider range of meteorological conditions. One of the key reasons why digital video aerial surveys offer higher detection rates is that it is easier to detect objects when there are multiple images of the same object which appear static in footage relative to the patterns of waves. Using digital video means that we typically capture up to eight distinct images of each object identified, from a slightly differing angle in each capture, providing multiple opportunities for successful identification.

1.2 Video review

Once data has been delivered to the HiDef offices, the raw video data is converted into a format for further analysis on data review stations. The survey images are viewed by trained, experienced HiDef reviewers using high resolution viewing screens and an image management software package that allows the reviewer to adjust and control the appearance of the images. Reviewers are not required to identify objects but simply mark the images as requiring further analysis, with this spatial information providing an accurate record of an individual's (or object's) location. A sample of a minimum of 20% of material is subjected to a 'blind' re-review; if the agreement is less than 90% then a further review of the material, and re-training, is initiated as required.

1.3 Identification

Images that have been marked as requiring further analysis are passed to experienced marine ornithologists who have received training in the analysis of high-definition video imagery of birds, marine mammals and other vertebrates. Images can be managed using software to enhance their appearance and assist in identifying the object. For this project, the ornithologists will identify down to species level where possible and record any other information which is available (behaviour, flight or swimming direction, sex, age, etc.). For any marine mammals identified, their behaviour is also recorded, whether they occur at the surface or subsurface, and their direction of movement between the first and last frame in which they occur.

A randomly selected sample of at least 20% of material is identified independently by a separate group of expert ornithologists and this requires that there is no more than 10% disagreement with the first identification of birds and mammals. The outputs of these results are then compared, and any discrepancies reviewed by a further set of expert ornithologists. In the case of any significant discrepancies (i.e., more than 10% disagreement for the whole audit), then the images are re- reviewed by a third ornithologist who acts as an adjudicator in the process to decide on the correct observations.

While we utilise tools to assist in object identification, we do not automate species identification.

1.4 Proposed Survey Design

HiDef's survey design has been presented to NE through the framework process.

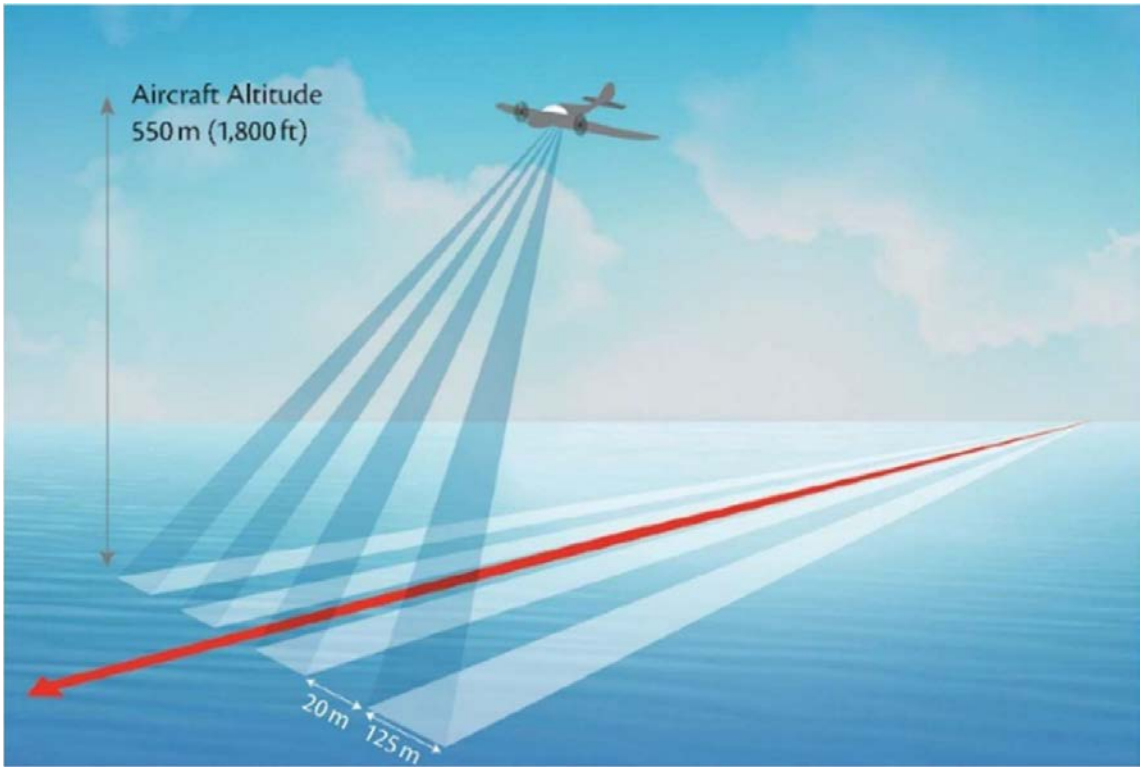
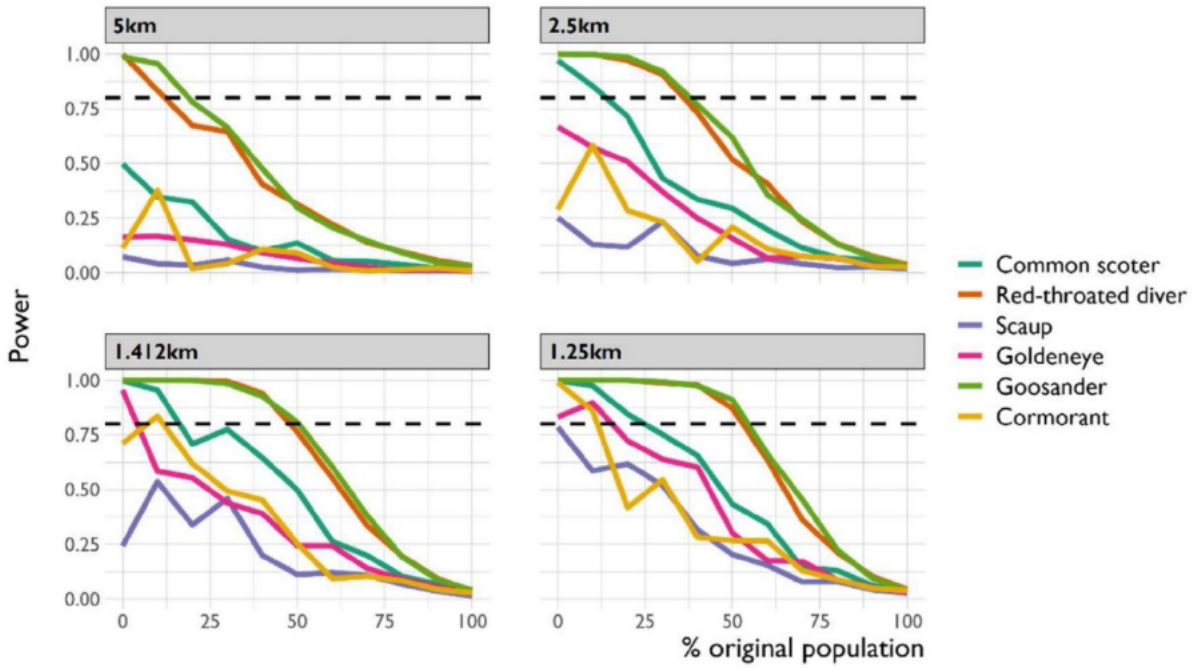


Figure 1 Illustration of the survey swathe for HiDef's bespoke camera rigs

HiDef is able to vary the amount of coverage of a study area by varying the number and spacing of transects flown and by altering the number of cameras it processes. The number of transects for a site such as this is dictated by ensuring a minimum level of sampling coverage is flown. HiDef uses a survey rig fitted with four separate cameras, each provides data for a 125m strip. Two cameras will be used for this survey, allowing redundancy. HiDef has performed an analysis study of population abundance and power to establish the requirements of the survey prior to presenting the survey method statement. Allowing further refinement of the proposed survey design, while ensuring it is of sufficient power to display robust trends/changes in species population estimates.

At 1.412km spacing, the 0.8 power threshold was met for key species for a 50% population decline. A test of autocorrelation found no spatial autocorrelation for either species at 1.412km. At this transect spacing, the coefficients of variation were 0.26 and 0.19 for Common scoter and red-throated diver respectively. The 0.16 CV threshold was not met, yet the power analysis demonstrates that the statistical power is met to detect a halving in the population.

Figure 2 Power analysis for existing data



Surveys need to be conducted on a single day because of risk of movement of birds through or within the site. This is considerably more likely to occur between days than within days, and the further apart those days are, the more likely that the survey results will be compromised. For example, birds might move from one side of the project area to the other and thus result in double counting.

To achieve this at larger sites, HiDef carries out surveys with multiple aircraft, and presently can deploy and co-ordinated four aircraft flying different parts of the study area. This is a not inconsiderable logistical feat to ensure all aircraft complete their surveys as required and to eliminate all risk of aircraft entering the same airspace.

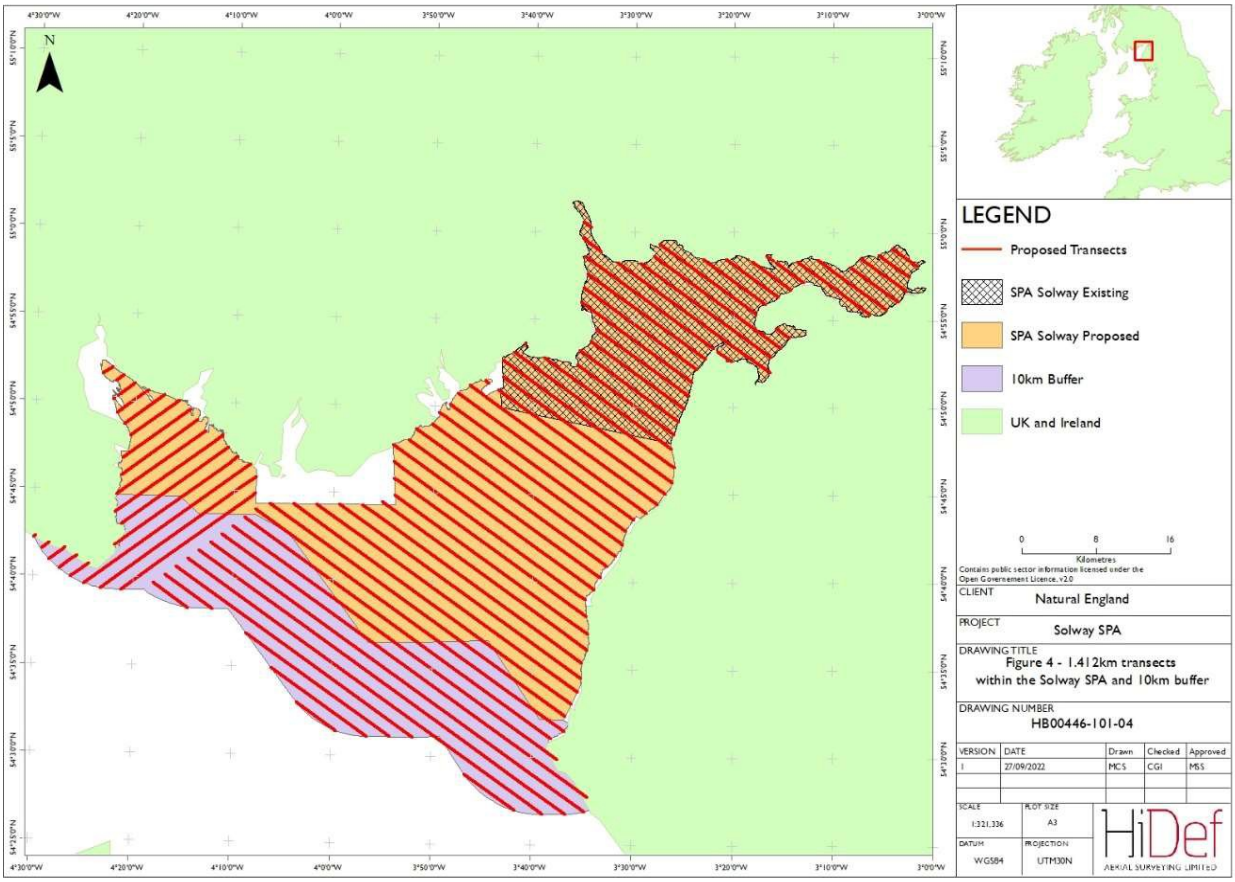
HiDef will 'bank' recorded data dependent on the selected options, but should optional data processing be required, the data can be processed for an additional charge.

Table 2 Survey metrics for Solway SPA proposals

	Site	Coverage %	Cameras processed	Transect spacing	No. of transects	Time on Task	Survey area (km2)
1	**Solway SPA** No Buffer, ~1.4km transects	17.68	2	1.4km	63	7.81 hrs	1356
2	**Solway SPA** 10 km Buffer, ~ 1.4 km transects	17.56	2	1.4kn	70	9.96 hrs	1972

A buffer is provided as an option to be applied to the prescribed target area, Shapefiles have been provided by the client, demonstrating the extents of the area.

Figure 2 Proposed survey design, 1.4km spaced transects of Solway SPA site



1.5 Camera and flight specification

The HiDef rig has been deployed at a large number of offshore surveys since first developed in 2012 and is described in Webb & Nehls (2019). The camera rig is designed specifically for high quality seabird and marine mammal surveys. The rig contains four extreme high-resolution digital video cameras. At ~500-550m (~1800 feet) altitude, the cameras and lenses each survey a strip of c. 125m, with a Ground Sample Distance image resolution of 2cm, resulting in a total potential strip width of 500m. A gap of c. 20m is maintained between the cameras. This has the benefit of ensuring no overlap between strips. Surveys are flown at a ground speed of 220 kph (c. 120 knots). These figures have been found to create the best imagery suitable for data collection without negatively impacting on birds from disturbance, but also by flying at a safe and legal height, reducing risk to air crew and client.

The cameras are designed so that fast shutter speeds, in excess of 1/10,000th second, are possible at low light levels, unlike off-the-shelf photogrammetry cameras. During the survey while the aircraft turns between transects, the camera rig is rotated to ensure that it is always pointed either forwards or backwards to an angle of 30˚ from vertical and away from the sun. This eliminates bias in animal detection rates caused by sun glare on the sea. This is a significant issue for digital stills camera systems which cannot be directed away from sun glare, especially in the summer months when the sun's angle is highest and causes significant data loss. Digital video imagery is recorded continuously to a solid-state hard drive for each

camera separately. Also recorded is the position of the aircraft at one second intervals from a differential GPS device (with two metre positional accuracy). At the end of each survey, hard drives are sent by courier to HiDef for post-processing and image analysis. HiDef will conduct the survey to provide the most appropriate resolution for the survey area at ~500-550m to produce a GSD of 2cm. This is the standard HiDef uses, and it continues to produce high identification rates.

2 Deliverables

2.1 Survey and data report and supply

We provide a detailed QHSSE survey completion report within ten (10) working days of the successful conclusion of the survey. This will provide the survey log, a brief description of the survey and any issues of interest or relating to health and safety.

2.2 Data provision: Reporting standards and deliverables

The reports will be accompanied by the data collected through the aerial survey programme, and will be provided in an agreed format, compliant with accepted industry standards.

- GIS items - All survey data and results will be presented as digital deliverables for integration into a Geographic Information System, as per the following specification:
  - All data are to be recorded in WGS84 projected in UTM30N.
  - All spatial vector data will be supplied in shapefile or ESRI File Geodatabase format. Shapefiles can be submitted in Winzip compressed files or if confidential, 7-Zip (password protected) compressed files.
  - Attribute table field data types will be defined by the information they contain. Fields that shall only contain numerical attributes shall be created as numerical fields.
  - All fields in the attribute table will be clearly described and explained in the metadata along with any coded entries they contain.
  - All GIS maps and drawings shall be supplied in both ESRI ArcGIS format (.mxd) and PDF. Shapefiles and ESRI File Based Geodatabases can be opened in QGIS, however, other project files (such as. mxd) would need to be converted or created in Q separately.
  - All data supplied will be assigned with Metadata conforming to the Marine Environment Data Information Network (MEDIN) discovery standard for metadata, *utilising the Digital Aerial Survey Data Standard Guidance Document* (if available).

(2.4) Standards: Reporting to pre-agreed standards, see below Annex 1

(2.5) Contract Monitoring Arrangements
Regular catch up/ progress calls between the contract managers acting on behalf of the Authority and the Contractor **in addition to the inception meeting and teleconference scheduled in the table of Milestones**. Proposed schedule of additional calls – i) early December 2022 (pre-survey), ii) early January 2023 (near survey), iii) end February 2023 (post survey). This schedule will ensure at least monthly communication between the contract managers acting on behalf of the Authority and the Contractor.

3. PRICE AND PAYMENTS

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

£56,680.38 as per below correspondence and commercial submission:

Date: 20/10/2022 20:54
Sent from User: [redacted]
Subject: Re: Re: Clarification of Commercial Calculation - Solway Firth survey
My Message
Dear [redacted]

Thank you for the explanation. As previously advised bids received were higher than expected, necessitating recourse to the funding department for additional resources.

This has been received favourably but they have enquired if it would be advantageous to include the task of processing the images gathered from the optional area HiDef have agreed to fly for [redacted]

Therefore, can you please submit a quote for our consideration to process the imagery collected from the additional survey area and a revised total costing to include this new element.

I would be grateful if you could provide this information by am Monday 24th October.

Regards

[redacted]
Broadcast Message: No

Date: 21/10/2022 18:03
Sent by: HiDef Ariel Surveying Ltd
Sent from User: [redacted]
Subject: Re: Re: Re: Clarification of Commercial Calculation - Solway Firth survey
Message
Good Afternoon [redacted]

We'd be pleased to provide a cost for the data processing of the optional area.

Noted that on review, HiDef does not intend to charge flight operations or fuel on this area and have marked as nil also.

Attached is a re-submission that includes this in the total costing.

Flight - Nil
Data processing - [redacted]
Reporting - Nil

Total Cost for optional area [redacted]

Kind regards,

[redacted]
Broadcast Message: No

Commercial Envelope Requirements:
Core objectives (see Specification):
Costings should be provided to carry out all planning, data collection, image and data processing and reporting to deliver the **core objectives** as detailed in *3. Objectives* of the Specification of this RFQ.

Provide total cost (exc VAT) with the following breakdown:	**£**
Survey planning (Full study area, no buffer)	[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	[redacted]
QA of imagery/data/results so that pre-agreed data formats and standards (e.g. MEDIN compliance) are adhered to	Included
Reporting (including provision of all associated deliverables)	[redacted]

Optional objective(s) (see Specification):
Any additional costs associated with conducting additional work to meet the optional objective e) as detailed in *3. Objectives* of the Specification of this RFQ **should be provided separately to the costings for the core objectives** to allow consideration of whether this optional objective can be included as part of this project. **Costs for the optional objective e) should be provided separately and will not form part of the evaluation**.

Provide total cost (exc VAT) with the following breakdown:	**£**
Survey planning (HiDef would be prepared to absorb the cost for flight and banked data of the optional objective, should NE wish to process the data HiDef would seek compensation for this element only)	Nil
Data Processing	[redacted]
Fuel cost	Nil

Flying hours required	[redacted]
Litres of fuel per flying hour	[redacted]
Fuel cost per litre, on date tender submitted	[redacted]
Reporting (including provision of all associated deliverables)	Nil

(3.2) invoicing and Payment

Full payment (100% contract value) will be made on receipt of detailed invoice following completion (to the satisfaction of the Natural England Nominated Officer) of all the milestones detailed above, and formal acceptance of the specified outputs.

4. Invoicing Requirements

HiDef Aerial Surveying Ltd to quote Natural England purchase order number (TBC) and Bravo reference number ECM 65969 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 entered into by the Contractor and the Authority on 27th July 2022.

Electronic Signature

Acceptance of the award of this Contract will be made by electronic signature carried out in accordance with the 1999 EU Directive 99/93 (Community framework for electronic signatures) 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 ("Bravo"). No other form of acknowledgement will be accepted.

ANNEX 1

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.