



# **TECHNICAL SPECIFICATIONS**

for

**HI 1083**

(EASTERN APPROACHES TO FIRTH OF FORTH)

**HI 1071**

(CAPE WRATH TO SOLAN BANK)

**HI 1072**

(SOLAN BANK TO FAIR ISLE CHANNEL)

**TENDER REF. ????????**

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(Version 1.2)

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## **PART ONE - SCOPE OF WORK**

### **GENERAL**

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1. Comprehensive Multibeam Echo Sounder (MBES) surveys (Hydrographic Instructions 1083 – Eastern Approaches to Firth of Forth, 1071 – Cape Wrath to Solan Bank and 1072 – Solan Bank to Fair Isle Channel) of the areas specified herein is critical for the efficient routing and safe navigation of all types of shipping. The results of these surveys will be used in updating Admiralty Charts and associated navigational publications.

2. The contract will be let by the Maritime and Coastguard Agency (MCA) of the Department for Transport (DfT) as part of their obligation under the Safety of Life at Sea Convention (SOLAS) regulations with respect to the United Kingdom's (UK) responsibility to survey home waters and as a part of the Civil Hydrography Programme (CHP). The MCA, in partnership with the United Kingdom Hydrographic Office (UKHO) under a Memorandum of Understanding (MOU) administer the CHP and the UKHO are tasked to oversee the conduct of the contract and approval of the final deliverables.

3. Throughout this document, there are numerous requirements for technical details to be provided as part of the tender documentation. A full list of all tender deliverables will be provided at a **Tender Clarification Meeting on a date to be notified by MCA in the Tender Invitation letter**. In addition to these 'technical' deliverables and in order to achieve a meaningful assessment of all tenders, Tenderers are to provide the following information:

- a. Details of experience of area surveys for nautical charting purposes
- b. Curricula Vitae of key personnel
- c. Details of proposed data flow and management
- d. Details of quality assurance and quality control procedures and certification agencies
- e. Details of subcontractors

### **AREA**

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4. The areas which are to be fully surveyed to International Hydrographic Organisation (IHO) Order 1 Standard in accordance with these specifications are contained within the geographical positions listed at Annex A. The Contractor will be required to sub-divide the areas into convenient blocks which may be progressed either singly or in combination. Disproving searches (HQAI D.1.1) which might extend beyond the specified geographical limits are to be brought to the immediate attention of the UKHO overseer.

5. An officer from the United Kingdom Hydrographic Office will be nominated to oversee the work being conducted in accordance with the specifications. This officer, known as the Staff Officer Survey Planning, will have the authority to:

- a. Inspect the survey progress both ashore and afloat, including the preparation of fair records.
- b. Assess the methods and equipment used for the conduct of the surveys.
- c. Assess the quality of the data gathered.

- d. Advise the Contractor on all aspects of the survey to ensure that the work meets the standards required by MCA/UKHO.
- e. Discuss any difficulties which may arise in the interpretation of the specifications.

6. The UKHO overseer will act as the focal point between the Contractor and the UKHO and MCA on purely technical matters unless otherwise stated in these specifications.

The contact telephone number is 01823 723319

FAX is 01823 352509.

Email is [sosp@ukho.gov.uk](mailto:sosp@ukho.gov.uk)

7. The MCA will appoint a Project Manager who will act as contract manager on behalf of the MCA/UKHO. The Project Manager will have overall control of contractual issues including the certification of interim and final invoices.

The contact telephone number is 023 8032 9341

FAX is 023 8032 9204

Email is [rob\\_spillard@mca.gov.uk](mailto:rob_spillard@mca.gov.uk)

8. The Contractor is to offer every facility to the UKHO Overseer to enable him to inspect the survey results, to sea-ride the vessels undertaking the fieldwork and to visit any shore facility where data and records are gathered whenever he wishes. Such arrangements should be made mutually convenient and suitable accommodation appropriate to his status is to be made available on board each survey vessel at the Contractor's expense.

## SURVEY REQUIREMENT

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9. Detailed requirements are contained in Section Two. In summary, the entire area detailed at Annex A is to be fully sounded and insonified using MBES and side scan sonar (as necessary) at appropriate line spacing. A magnetometer will be required to be streamed at all times to assist in the detection and classification of wrecks. The scale of any analogue final fair records is to be 1:25 000. Conduct of the survey is to be in accordance with Hydrographic Quality Assurance Instructions for Admiralty Surveys (HQAs) (Edition 1/04) supplemented and amplified by the technical specifications contained in this document. Although HQAs are updated twice a year, Edition 1/04 may be used for the duration of the contract.

10. All wrecks and obstructions found during the survey are to be fully examined in accordance with HQAI. Seabed samples are to be obtained in accordance with these instructions.

11. The adequacy of the relevant Admiralty Charts, Sailing Directions and List of Lights which cover the area are to be examined and any shortcomings reported.

## DATA PROVIDED BY UKHO

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12. All tenderers will be provided with the following data:

- a. The text of this specification. (Any contract variations that are required will only

be issued after prior consultations with the contractor and will be numbered sequentially).

b. Relevant tidal information as required.

c. Details of all known wrecks (vide Annex B).

13. Hydrographic Quality Assurance Instructions for Admiralty Surveys (HQAI) (Edition 1/04)

14. On award of contract, unsuccessful tenders are to return the above documents to the MCA.

15. The successful tenders will be provided with copies of the following:

- |    |  |          |
|----|--|----------|
| a. | Views for Sailing Directions   | NP 140   |
| b. | Simplified Harmonic Method of Tidal Predictions.   | DP 560   |
| c. | Admiralty Tidal Handbook No 2.   | NP122(2) |
| d. | Copies of co-ordinates of geodetic stations and electronic fixing aid sites which have been established during previous hydrographic surveys can be supplied on request. |          |
| e. | Copies at chart scale of current Admiralty Charts that cover the area to be surveyed   |          |
| f. | Wreck cards for each known wreck in the area.  |          |
| g. | All necessary H forms (see part 2 paragraph 1.2)   |          |

16. All records and data and publications provided by UKHO in accordance with paragraph 15 are to be returned to the UK Hydrographic Office on completion of the contract.

#### OTHER DATA AVAILABLE

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17. Details of geodetic stations other than those supplied by MOD can be obtained free of charge from the Ordnance Survey Web site, [www.gps.gov.uk](http://www.gps.gov.uk)

#### ACCURACIES

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18. The following absolute accuracies are required for the survey (IHO Order 1):

- |    |  |  |
|----|--|--|
| a. | Horizontal accuracy of sounding on seabed (length of the semi-major axis of the 95% error ellipse) | 0m to 40m depth = 5m<br>>40m depth = 5m + 5% of depth (in m) |
| b. | Object detection   | 2m <sup>3</sup> in depths < 40m                              |

cube with sides of 10% of depth (in m)  
in depths >40m

- |    |  |       |
|----|--|-------|
| c. | Primary Geodetic Control   | 0.1m  |
| d. | Secondary Geodetic Control   | 0.5m  |
| e. | Tidepole Levelling   | 0.02m |
| f. | Automatic tide gauge heights   | 0.05m |
| g. | When reduced for tide, the error in absolute depth measurement should not exceed $[0.5^2 + (0.013 \times \text{depth})^2]^{1/2}$ |       |

## CONSTRAINTS

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19. Due account is to be taken of the effect of a rough sea state on the quality of the data being gathered. Work should not continue if frequent gaps or interference are created in the data because of operation in inappropriate sea states or if the sounding accuracy cannot be met.

20. The tenderer is to provide details of the maximum sea state and weather conditions in which the survey system can meet the stated specifications and standards of the survey

## VESSELS

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21. Tenderers shall provide the technical specifications of the vessels to be employed on the survey work, although MCA reserves the right of approval.

22. Each vessel employed in the survey work shall also be subject to approval by the MCA. Directly prior to a contract is placed, the Contractor shall inform the nearest MCA Office so that a MCA surveyor can carry out an inspection of the vessel(s). The purpose of the inspection shall be to ensure that each vessel is properly manned and equipped under the Merchant Shipping Acts.

23. The Contractor is to ensure that all vessels employed carry the latest editions of charts, corrected by Notice to Mariners, for the area of operation and passage to and from the working port.

24. If a vessel is required to commence work as a matter of urgency the MCA may, at its discretion, allow the vessel to commence survey work without an inspection. However arrangements shall be made for a MCA surveyor to visit the ship as soon as it is possible consistent with the survey programme.

25. A letter indicating the MCA's approval of each vessel shall be given to the master when the inspection is satisfactorily completed. The letter shall be produced to the UKHO Overseer at his request.

26. Once approved by MCA and UKHO no vessel is to be changed or substituted without the prior agreement of the UKHO Overseer.

27. British Flag or EU registered vessels are preferred. The term “British Flag” includes not only those vessels flagged in the UK but also within the scope of the Red Ensign Category 1 and 2 Registers:

<u>Category 1</u>	<u>Category 2</u>
Bermuda	Anguilla
Cayman Islands	British Virgin Islands
Gibraltar	Falkland Islands
Isle of Man	Guernsey
	Jersey
	Montserrat
	St Helena
	Turks and Caicos Islands

Note that, in the case of the Category 2 Register, a loadline limitation exists regulating the vessel size to 150grt displacement or 24m overall length.

The term “EU” includes the following European Union member states:

United Kingdom	Ireland	Greece
Austria	Germany	Italy
Belgium	Luxembourg	Denmark
Portugal	Finland	Spain
France	Sweden	Holland (The Netherlands)

The following countries will become European Member States on 1 May 2004:

Cyprus	Czech Republic	Estonia
Hungary	Latvia	Lithuania
Malta	Poland	Slovakia
Slovenia		

## EQUIPMENT

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28. Tenderers shall provide the technical specifications of the following equipments to be used, although UKHO/MCA reserves the right of approval:

- a. Position fixing systems.
- b. Motion Reference Unit (MRU).
- c. Single and Multibeam echo sounders.
- d. Survey data logging and processing systems.

- e. Side scan sonar systems.
- f. Sound velocimeters.
- g. Tide gauges and current measuring instruments.
- h. Instruments for the co-ordination of geodetic stations.
- i. Magnetometers.
- j. Seabed samplers.
- k. Cameras for photographic views.

29. Once approved, none of these equipments may be changed or substituted with equipment of differing specifications without the prior approval of the UKHO Overseer. Individual units of a system, when found to be defective, are to be repaired or replaced without delay with units of identical specifications and re-calibrated where necessary. All survey equipment shall be operated in accordance with the manufacturers recommendations.

#### SPARE EQUIPMENT

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30. Tenderers are to state their policy on equipment support, both ashore and afloat.

#### PERSONNEL

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31. The Contractor shall ensure that there are sufficient personnel to meet the requirements of the Merchant Shipping (Hours of Work) Regulations 2002.

32. The contractor shall ensure that:

a. Survey teams will include personnel with adequate experience both in charge of and in assisting with all aspects of surveys of large, complex offshore areas for nautical charting purposes, including office data compilation as well as fieldwork.

b. A charge Surveyor (Party Chief/Surveyor in Charge) is to be onboard at all times during survey operations. The Charge Surveyor is to be an IHO/FIG Category A qualified surveyor with a minimum of 5 years offshore surveying experience including surveying for Nautical Charting purposes.

c. Survey teams will include sufficient experienced personnel to operate a watch-keeping roster of no worse than 1 in 3. The length of each watch should normally be 4 hours, but 6 hour watches may be kept if desired. Survey Engineers are only to be used in their technical capacity and not as surveyors. When the survey vessel is kept on line by ship's officers they too must be in a watch-keeping roster of no worse than 1 in 3, but the length of their watch must not exceed 4hrs.

d. Where survey launches are to be used for work close inshore or around very shoal/drying features, the personnel are to have previous experience of this type of operation.

33. The Contractor will ensure that there is sufficient overlap of personnel when crew changes are planned to provide efficient continuity.
34. The Contractor will not change the manning levels without the prior agreement of the UKHO Overseer.
35. The Contractor will nominate a shore-based Project Manager (PM) with the authority and experience to make and implement operational decisions and whom the UKHO/MCA can contact regularly to assess progress and modify the survey plan if necessary. The PM's other duties and responsibilities are to be arranged such that they do not interfere with the management of the contract.

### SAFETY

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36. Vessels, equipment, survey personnel and crews provided by the Contractor for work in connection with the contract shall be the Contractor's responsibility at all times. The said vessels, equipment, survey personnel and crews and any loss, injury or damage suffered or caused by them shall be at the Contractor's risk throughout.
37. Details of the company safety policy and Safety Management Plan are to be supplied as part of the tender.

### DANGER AREAS

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38. The Contractor is responsible for deciding which naval or military firing and exercise areas affect the survey and for liaising with the appropriate authority in each case to avoid mutual interference. The responsibility for resolving disputes with these, or any other offshore operators who may restrict survey operations, rests solely with the Contractor. Where possible, details of naval/military liaisons applicable to each survey will be given but this in no way absolves the Contractor from his responsibilities above. PEXA charts and Admiralty Annual Notices to Mariners No 5 should be carefully consulted. The Contractor shall be liable for any form of survey operational interference, either physical or incorporeal; resulting from MOD or any other recognised authority discharging their legitimate obligations.

### FISHING INDUSTRY

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39. Liaison with, and compensation to, fishermen for loss/damage to fishing gear are matters which rest entirely with the Contractor. The Contractor is to liaise closely with NFFO, SEERAD and the appropriate local District Fisheries Inspectors well in advance of the commencement of fieldwork.

### PROHIBITED AREAS

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40. The Contractor must at all times keep clear of the 500 metre safety zone around fixed oil or gas production platforms and mobile drilling rigs. Charted offshore field Development Areas are not to be encroached upon. Admiralty Notices to Mariners Annual No 20 is to be studied carefully and adhered to. NAVAREA ONE radio navigational warnings and Section III of the Weekly Notices are to be read conscientiously to obtain the updated locations of mobile drilling rigs in, and adjacent to, the survey area.

41. The Contractor is to ensure that regulations with respect to Historic Wrecks are fully complied with.

#### PERMISSIONS AND PERMITS

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42. The Contractor shall obtain all necessary permissions and permits from landowners and appropriate authorities in order to establish survey equipment stations.

43. The Contractor shall ensure that relevant permissions and permits for systems that broadcast on any frequency are obtained.

#### REPORTS

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44. The Contractor is required to render to the MCA/UKHO Overseer a brief written report of the survey progress for each calendar month. The report is to include a brief statement of the Contractor's intentions for the following month and should reach the United Kingdom Hydrographic Office, Taunton, within 10 working days of the end of the period under report. The report is to be accompanied by a chartlet showing the areas completed for:

- a. Bathymetry.
- b. Sonar sweeping.
- c. Wreck and rock pinnacle investigations as well as wire sweeping/diver operations.

45. The Contractor will be required to render the final results of the survey in stages as the fieldwork in each area (as defined at Annex A) is completed. Each block of data must be supported by a Report of Survey (RoS). Details common to all sections of the survey which have been reported in the first report need not be repeated in later ones so long as reference is made to where they are recorded.

#### NOTIFICATION OF DANGERS TO NAVIGATION (HQAI Chapter 3, GSI D.5.1)

46. Reports of dangers to navigation are to be passed immediately to the UK Hydrographic Office, in accordance with HQAIs.

#### PRESS RELEASES

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47. Any publicity material generated by the scope of the work or done in connection with the contract will need MCA/UKHO approval before it is released by the Contractor.

#### HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS (HQAI)s [Return to Contents Page](#)

48. The Contractor shall be fully conversant with HQAIs and ensure all articles and cross references are studied most carefully. The UKHO Overseer is available for clarification of any queries that may arise.

## **PART TWO – TECHNICAL SPECIFICATIONS**

### **1. GENERAL**

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1.1 The survey shall be conducted to a minimum of IHO S44, Order 1 standard in every respect.

1.2 Throughout this document, reference is made to the recording of data on “H Forms”. These forms have been designed by UKHO to facilitate checking and validation of rendered data. They have also been designed for ease of data abstraction into UKHO databases. Only UKHO approved H Forms are to be used. Details of H Forms are to be found in HQAIs.

1.3 There are three distinct areas to be surveyed:

- a. HI 1083 – Eastern Approaches to the Firth of Forth
- b. HI 1071 – Cape Wrath to Solan Bank
- c. HI 1072 - Solan Bank to Fair Isle Channel

1.4 The Eastern Approaches to the Firth of Forth survey (HI 1083) has two separate sections. Area A is to be full surveyed in accordance with these Technical Specifications and Area B is a rocky ridge that only requires 100% bathymetry to define the least depths along the feature. Wreck investigation work has been conducted in a previous survey.

1.5 Priorities for completion of these Hydrographic Instructions and the geographic limits are as shown in Annex A.

### **2. TIME**

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2.1 A common time reference system is to be used throughout the survey. The use of either GPS time, UTC or GMT is acceptable and all survey systems and equipment are to be synchronized to this time reference system.

2.2 The Tenderer is to provide details of the time reference system to be used.

### **3. POSITIONING**

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3.1 Positioning of the ship/launches is to be determined by a continuous electronic positioning system. Position fixes are to be identified by date and time. The compounding of different navigation aids to provide a fix solution is not considered acceptable.

3.2 The positioning system used (in conjunction with the MBES processing system) is to be capable of providing a position for soundings on the seabed (throughout the whole area) such that the total error budget for the sounding meets the position accuracy requirements (95% confidence level) of:

- a. depths of 0 – 40 metres = 5m
- b. depths greater than 40 metres = 5m + 5% of depth

3.3 The positioning system is to be validated at the start and at the end of the survey season and at intervals of no more than 4 months during the survey season.

3.4 A full dynamic validation against a more accurate alternative fixing system should be conducted at the start of the season. This validation should last 30 to 45 minutes. The vessel should be navigated in a box pattern during the validation. The validation results should be reviewed graphically as well as evaluating the mean, maximum, minimum and Standard Deviation of the collected data set. This first validation should be carried out using the same reference stations intended for use during the survey and preferably within 500km of the survey ground. A second validation should be carried out at the end of the season; this may consist of a static validation only. In addition, a further static check should be carried out at intervals of no more than four months. If at any time during the survey any significant changes are made to the positioning equipment antenna or software then a full Dynamic validation should be repeated. If the Charge Surveyor is not sure that the system has been adequately validated, advice should be sought from SOSP at the UKHO before commencement of the survey.

3.5 Validation methods are to be approved by UKHO and the results of each validation are to be rendered to the UKHO as soon as practicable for verification.

3.6 Differential stations for GNSS systems are to be co-ordinated to an accuracy in accordance with HQAI, Chapter 3, Appendix 1 with respect to a homogenous datum or a derivation thereof such as ETRS89.

3.7 The positioning system is to log and provide a continuous indication of the quality of the position and is to be monitored throughout the survey.

3.8 The Tenderer is to provide precise details of the position fixing system to be used and how positional accuracy will be achieved. Details are to include:

- a. System to be used
- b. Method of validation
- c. Position/name of reference stations to be used
- d. Availability of alternative reference stations for comparison purposes
- e. Approximate distance of reference stations from the survey area
- f. Quality parameters to be monitored during the survey
- g. Rejection criteria to be applied to the position fixing system
- h. Method of determining the quality of the fix
- i. Policy for redundancy of reference stations and whole systems
- j. Any other details the tenderer deems pertinent.

#### **4. GEODETIC CONTROL**

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4.1 The survey is to be referred to the GRS80 Spheroid and ETRS89 Datum. Any graphics or grid co-ordinates are to be referred to the Transverse Mercator Projection, UTM Grid Zone 30 North (Central Meridian 3° West).

4.2 Details of previous Geodetic or Hydrographic Stations can, on request be provided by the Hydrographic Office. Co-ordinates and descriptions of Ordnance Survey stations must be obtained in accordance with Section 1, Paragraph 17.

4.3 Any extension of existing geodetic control and the establishment of new stations is to

be fully documented. The derivation of the co-ordinates of existing stations must be stated. Adjustment of all observations is to be by the method of Least Squares.

4.4 All geodetic stations must be fixed using dual frequency carrier phase Navstar GPS. The Contractor must state how they propose to co-ordinate stations. Where necessary, co-ordinate conversion must be conducted using the Ordnance Survey (OS) OSTN02 conversion program and an estimated final accuracy stated.

4.5 All geodetic stations established during the survey shall be described, photographed and permanently marked to assist their future recovery in accordance with HQAIs.

## 5. TIDE AND TIDAL STREAM OBSERVATIONS

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5.1 Soundings are to be reduced for tidal height and referred to Chart Datum (CD) and are to meet the sounding error budget requirements. The sounding error budget should not exceed:

$$[0.5^2 + (0.013 \times \text{depth})^2]^{1/2}$$

5.2 The connection between CD and Ordnance Datum (Newlyn) at certain points along the coast are known and can be supplied by the UKHO to the Tenderer.

5.3 Any relevant Ordnance Bench Mark (BM) data held by UKHO will be supplied to the tenderer. Full descriptions of any BM established or located should be forwarded with the Report of Survey (RoS).

5.4 Predicted tidal heights are not to be used for the tidal reduction of soundings.

5.5 In accordance with HQAIs, automatic tide gauges are to be calibrated against a tidepole for one complete tidal cycle (25 hours) at the beginning and the end of the survey and on re-establishment of the gauge should this prove necessary. Verification checks must be carried out on the gauge if there are concerns about the veracity of the data and at intervals no greater than monthly throughout the survey.

5.6 If a co-tidal model is used, it is to be verified by UKHO before surveying commences. During surveying, periodic checks are to be carried out (minimum of 4 per day) using Form H185 to confirm the co-tidal model accuracy. These checks are to be documented and commented on in the Report of Survey.

5.7 If off-shore tide gauges are to be deployed and used, the Tenderer is to provide details of offshore gauge sites and methods of Chart Datum transfer for each area and details of any co-tidal model that may be used.

5.8 Datum transfers are to be undertaken using Form H533 and guidance from ATH No2 - NP122(2).

5.9 Innovative solutions for the reduction of soundings for tide are welcomed. Tenderers are, however, to ensure that overall accuracies required by these specifications are achieved throughout the entire survey area at all states of the tide.

5.10 Tidal records to be rendered, as appropriate are to include:

- a. Form H143 – Tidal Observations
- b. Co-tidal factors used

5.11 Irrespective of the defined areas to be surveyed (Annex A), observations of the rate and direction of the tidal stream should be obtained at the following locations (ETRS89 Datum):

- a. HI 1083 – 56° 10'.0 N, 001° 30'.0 W (in approximately 50m depth)
- b. HI 1071 – 59° 00'.0 N, 005° 10'.0 W (in approximately 80m depth)
- c. HI 1072 – 59° 30'.5 N, 002° 50'.0 W (in approximately 60m depth)

5.12 Tidal stream observations are to be taken at 30 minute intervals on the hour and half hour for a minimum period of 50 hours conforming to Springs and should be obtained either:

- a. Using a downward looking Acoustic Doppler Current Profiler (ADCP), optimised to record tidal streams in a series of data 'bins' throughout the water column. Data at 5 metres below the surface, mid-water and 5 metres above the seabed should take priority, although it is appreciated that various commercially available systems will have differing recording parameters. These should be detailed in the Tender document.
- b. Using an upward looking Acoustic Doppler Current Profiler (ADCP), optimised to record tidal streams in a series of data 'bins' throughout the water column. Data at 5 metres below the surface, mid-water and 5 metres above the seabed should take priority, although it is appreciated that various commercially available systems will have differing recording parameters (see paragraph 5.13).
- c. Using a string of 3 current meters set at depths of 5 metres, mid-depth and 5 metres above the seabed. Meters should be set to log on the hour and half hour and at suitable intervals between.

5.13 If an upward looking seabed mounted ADCP system is proposed, the Tenderer is to provide full details of the limitations of the system to be used with respect to side lobe contamination of the surface zone observations and how these limitations are to be overcome.

5.14 All instruments are to be fully calibrated before use and tidal stream data is to be rendered on Form H183A.

5.15 The Tenderer is to provide precise details of how sounding reduction will be achieved in each area. Details are to include:

- a. The system/gauges to be used
- b. The intended position of tidegauge sites/stations for each area
- c. The frequency/distribution of co-tidal points to be used in a co-tidal model if appropriate
- d. The method of datum transfer if appropriate
- e. Any other details deemed pertinent

5.16 The Tenderer is to provide precise details of how tidal stream observations will be

achieved. Details are to include:

- a. The system/gauges to be used
- b. The format of digital data will be rendered
- c. Details of ADCP observation limitations

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## **6. MULTIBEAM ECHO SOUNDER AND MOTION REFERENCE UNIT (MRU)**

6.1 The MBES is to be hull mounted. The offsets between, and relative orientation of, the following equipment is to be derived by land survey techniques/metrology techniques. The accuracy with which these measurements are to be made is to be stated in the tender documentation:

- a. Ship's reference frame
- b. Transducer(s)
- c. Motion reference unit
- d. Heading sensor
- e. All antennae

6.2 The following minimum offset/alignment accuracies are to be achieved:

- a. Sonar Head
  - i. The vertical location of the acoustic centre of the sonar head to  $\pm 2\text{cm}$
  - ii. The horizontal location of the acoustic centre of the sonar head to  $\pm 5\text{cm}$
  - iii. The heading of the sonar head to  $\pm 0.25^\circ$
  - iv. The roll to  $\pm 0.025^\circ$
  - v. The pitch to  $\pm 0.25^\circ$
- b. Motion Sensor
  - i. Vertical location to  $\pm 10\text{cm}$
  - ii. Horizontal location to  $\pm 5\text{cm}$
  - iii. Align forward axis with the vessel's reference frame to  $\pm 0.25^\circ$
- c. Heading Sensor
  - i. To be aligned with x-axis of vessel's reference frame to  $\pm 0.25^\circ$
- d. Positioning System
  - i. Vertical location of antenna to  $\pm 2\text{cm}$
  - ii. Horizontal location of antenna to  $\pm 5\text{cm}$
- e. Water Line
  - i. Vertical distance to waterline to  $\pm 2\text{cm}$

6.3 The following calibrations are to be undertaken:

- a. Latency
- b. Pitch
- c. Roll
- d. Yaw
- e. Pitch/roll correlation (wobble test)
- f. Determination of optimum heave period for the MRU
- g. Stabilisation period of the MRU after rapid manoeuvres (eg vessel turns)

6.4 The MBES system is to be calibrated before surveying commences. Calibration methods are to be approved by UKHO/MCA and the results of the calibration (including raw and processed data) are to be rendered to UKHO within one week of the data being gathered for verification.

6.5 If statistical cleaning of MBES data is used, all settings used are to be rendered in the RoS. In areas where different parameters are used, these areas are to be indicated in the RoS.

6.6 A fully developed Error Budget is to be produced as a tender deliverable.

6.7 The Tenderer is to provide precise details of the MBES and MRU systems to be used. Details are to include:

- a. The system to be used
- b. How they are to be installed and set up
- c. Details of the Cartesian co-ordinate reference frame for the vessel
- d. How systems are to be calibrated and offsets measured
- e. The accuracy of the measurements of all offsets
- f. Methods of quality assurance (eg. Use of SBES/MBES comparison, bar check etc)
- g. Any other details deemed pertinent

## **7. BATHYMETRY AND OBJECT DETECTION**

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7.1 This is a MBES survey and 100% bathymetry is to be obtained in all areas.

7.2 All shoals, obstructions and wrecks are to be located and the least depth determined in accordance with the specifications.

7.3 Any charted shoals not discovered during the survey are to be fully disproved in order for corrective charting action to be taken.

7.4 The object detection criteria to be achieved are:

- a. In depths less than 40m - 2m<sup>3</sup> objects
- b. In depths greater than 40m - a cube whose sides are 10% of depth in metres

7.5 The MBES is to be set to record depths below the sea surface.

7.6 Knowledge of the sound velocity (SV) regime (both spatial and temporal) is a critical

element of MBES error estimation. The SV environment should, therefore, be investigated at the start and carefully monitored throughout the survey and a suitable SV probe/profiler is to be used to determine the SV profile of the water column. SV shall be measured at an interval consistent with the proposed error budget.

7.7 The depth of the transducer below the sea surface is to be known and any change in the vessel's draught is to be recorded and applied to the sounding solution.

7.8 Cross lines are to be run at right angles to the main lines at intervals of approximately 20 times the mean main line spacing in order to conduct crossline comparisons.

7.9 The MBES main line running plan is to be created with due regard to the following factors:

- a. Depth
- b. Sounding density
- c. Outer beam uncertainty
- d. 100% bathymetry requirement
- e. Sea State
- f. Sounding density criteria

7.10 An assessment of the accuracy of sounding is to be provided in the Report of Survey.

7.11 Depth data recorded shall be logged to two decimal places of a metre.

7.12 The Contractor shall render a colour coded chart of each survey area depicting 'pings' achieved per IHO Order 1 object as defined in paragraph 7.4. The colour banding interval is to be agreed with the UKHO. The Tenderer is required to demonstrate how the object detection criteria are to be met.

7.13 If object detection (in accordance with paragraph 7.4) is to be achieved bathymetrically by MBES, each object is to be detected by at least 3 valid 'pings' in the along-track direction and 3 valid 'pings' in the across-track direction.

7.14 If object detection (in accordance with paragraph 7.4) is to be achieved bathymetrically by MBES, the contractor shall perform the following test: Directly following mobilisation and calibration, the contractor shall run several multibeam passes at normal survey speed over a 2m cube in 35 to 40m water depth to demonstrate the object is detected with the required number of valid "pings" and that it can be detected using standard data processing and filtering settings. Any cubic target proposed by the contractor must be approved by the MCA prior to use. Five parallel detection lines must be run over the cube at equal offsets so as to insonify the cube with all sectors of the MBES swath. Standard online survey settings and processing settings must be used for this exercise. Alternatively, the contractor shall provide detailed documentation of a similar exercise being undertaken with similar equipment on a prior occasion.

7.15 If object detection (in accordance with paragraph 7.4) is to be achieved by SSS, each object is to be detected by at least 5 'pings' in the along-track direction. In this case, in addition to the SSS insonification, each object need only be insonified by MBES with 1 ping as well.

7.16 Bathymetric data is to be rendered as a processed Caris HIPS/SIPS project or Simrad

Neptune 'PROC' directories. As a minimum, each sounding is to have the following attributes:

- a. Position and depth
- b. Swath and beam number
- c. Backscatter intensity
- d. 95% statistical error estimation for position
- e. 95% statistical error estimate for depth

7.17 In order for UKHO to achieve verification/appraisal of the data, the fully processed file is to include all soundings (ie. un-thinned), including flagged invalid depths.

7.18 The Tenderer is to provide precise details of how they intend to achieve object detection. Details are to include:

- a. Whether objects are to be detected by MBES alone
- b. Whether objects are to be detected by single or multiple MBES swathes
- c. Any other details deemed pertinent

7.19 The Tenderer is to provide precise details of how they intend to achieve attainment of 100% bathymetry. Details are to include:

- a. The line running plan
- b. Cross-line plan
- c. Percentage overlap of adjacent MBES swathes
- d. Rejection criteria for outer beams
- e. SV observation plan
- f. Whether SSS is to be towed
- g. Details of any squat/settlement trials and how the information will be incorporated into the sounding solution
- h. Intended speed of advance to be used in all situations
- i. Sounding Error Budget
- j. Any other details deemed pertinent

## **8. WRECKS AND OBSTRUCTIONS**

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8.1 The vessel is to have the capability and personnel are to have experience of wire sweeping wrecks and obstructions in depths less than 40m.

8.2 Positions and status of all known wrecks and obstructions in the survey areas are provided at Annex B.

8.3 Every rock, wreck and other obstruction in the survey area shall be detected during investigation. The least depth over the feature shall be determined in accordance with HQAI and these instructions.

8.4 The above criteria apply to charted features as well as those discovered during the survey. Disproving searches shall be performed where a charted feature has not been found during the course of the survey. The extension of such searches beyond the limit of the survey will be at the discretion of the UKHO Overseer.

- 8.5 When sweeping wrecks and obstructions the following applies:
- a. Particular care must be taken to ensure that the whole area of the wreck is covered by the wire sweep, albeit in several laps, and that there are no gaps between the sweeps. It is not sufficient to cover only the areas which appear to be high points on the sonar images.
  - b. clear colour coded chart/large scale plan with key showing the depth at which the sweep was set, the reduced depth and whether the sweep was clear or foul, is to be inserted.
- 8.6 Any newly found dangers to navigation or significant changes to existing dangers must be reported immediately to the UK Hydrographic Office.
- 8.7 The MBES is to be used to define the extent of all wrecks.
- 8.8 In addition to paragraph 8.7, all wrecks and obstructions in a general depth of less than 60m are to be examined using side scan sonar. Side scan sonar records are to include the entire acoustic shadow zone.
- 8.9 All new wrecks and obstructions located, which are likely to be dangerous to navigation are to be fully investigated. The contact's position, least depth, height above the seabed, dimensions and orientation must be determined and reported upon, together with an opinion of its exact nature.
- 8.10 As an aid to identification of wreck position, a magnetometer capable of detecting deflections of 10 nano-Teslars from the background noise is to be towed throughout the areas.
- 8.11 When determining the extent of a wreck/obstruction by MBES, at least two swathes from different angles (close to right angles) are to be obtained at slow speed.
- 8.12 Wreck/obstruction data is not to be removed from the MBES data sets.
- 8.13 The Tenderer is to provide precise details of how they intend to achieve wreck/obstruction identification. Details are to include:
- a. Method of wreck/obstruction investigation
  - b. Equipment to be used and experience of wire sweeping
  - c. Method of plotting/visualizing magnetometer deflection data
  - d. Any other details deemed pertinent

## **9. NATURE OF THE SEABED**

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- 9.1 The nature of the seabed is to be determined.
- 9.2 High-resolution geo-referenced backscatter data or side scan sonar data capable of being processed by Caris HIPS/SIPS is to be used to provide a determination of the nature of the seabed. A high-resolution Geo TIFF image of mosaiced backscatter data or mosaiced side scan sonar data shall be rendered for each proposed survey area. The image shall show 100% insonification of the seabed.

9.3 In order to determine the nature of the seabed, seabed samples are to be obtained to 'ground-truth' the backscatter/SSS data. A regular grid of seabed samples is to be obtained to adequately describe the nature of the seabed. This grid is to be at intervals of no greater than 10,000m and is to include at least one sample from each seabed texture 'zone'. The Contractor is to ensure that seabed sampling operations do not damage or interfere with underwater cables and pipelines.

9.4 Approximately 10% of all seabed samples are to be retained, catalogued and forwarded with the fair records. The selection of retained samples must ensure that the samples chosen are spread evenly throughout the area. Samples are to be taken with the ship stopped in the water

9.5 Retained samples are to be forwarded to the UK Hydrographic Office as 'Fair Records'. Plastic screw top containers are to be used to preserve the samples an example of which may be available from the UK Hydrographic Office. The use of polythene bags for preserving retained samples is not acceptable.

9.6 The Tenderer is to provide precise details of how they intend to achieve seabed nature determination. Details are to include:

- a. Software to be used (eg. Backscatter processing, mosaicing, classification software etc)
- b. Criteria for increasing sample density (eg. Complexity of seabed)
- c. Any other details deemed pertinent

## 10 MISCELLANEOUS OBSERVATIONS

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10.1 The data gathered from SV probes used to calibrate the echo sounders is to be considered as oceanographic data and rendered with the survey records on form H635. SV data should be rendered in both analogue and digital format in accordance with HQAIs.

10.2 Photographs are required of all geodetic stations and benchmarks used during the course of the survey.

10.3 Digital cameras must be capable of sufficient resolution to meet the standards set out in NP 100. Resolution is to be a minimum of 3 million effective pixels.

10.4 The characteristics of navigational lights onshore, on structures fixed to the seabed and on floating marks visible from the survey area are to be carefully checked. They are to be compared with the entry in the current Admiralty List of Lights Volume A (NP74), amended to date. Light sectors are to be checked against the entry in the remarks column (column 8). Column 8 TE/(T)/(P) remarks shall also be confirmed or disproved, especially the more historic entries. Any amendments are to be noted in the Report of Survey. Significant changes which could lead to a danger to navigation are to be reported immediately to the UK Hydrographic Office.

10.5 Leading lines and recommended tracks along channels and into harbours and anchorages must be very carefully examined. They are to be fully sounded, searched with side scan sonar and wire swept if necessary. Their bearings, together with the characteristics of associated lights, are to be carefully checked and verified against the charted information and the Lights'

List.

10.6 The limits of any overfalls must be carefully determined on both the flood and the ebb, during calm weather, at spring tides.

10.7 The detail shown on each published chart of the survey area is to be critically examined and any errors, ambiguities or other defects are to be reported, on an annotated copy where possible.

10.8 Detailed amendments to the most recent edition of the Admiralty Sailing Directions, together with the latest Supplement and corrections in Section IV of weekly Admiralty Notices to Mariners, are to be rendered with the report of survey. Particular attention is to be given to the description of conspicuous and important navigational marks that may be located within sight of the survey area or visible during passage to the replenishment port.

10.9 Secchi Disc observations are required weekly.

10.10 The Tenderer is to provide precise details of how they intend to obtain and conduct miscellaneous observations. Details are to include:

- a. Equipment to be used
- b. Methodology of observations
- c. Any other details deemed pertinent

## **11. RENDERING OF DATA**

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11.1 The primary product of the survey is to be the digital bathymetric data set.

11.2 The following records are to be rendered in accordance with HQAIs and these instructions:

- a. Navaid Calibration/validation data
- b. MBES calibration data
- c. processed MBES data
- d. Raw MBES data (documented proprietary format)
- e. Digital Report of Survey (UKHO format)
- f. Ping density Plot (See Paragraph 7.11)
- g. Seabed Texture data
- h. High-resolution Geo TIFF image of mosaiced processed backscatter or mosaiced side scan sonar data
- i. Co-tidal factors
- j. Geodetic data
- k. Wreck records
- l. Tide and tidal stream records
- m. Amendments to sailing directions
- n. Amendments to Lights' List
- o. Photographic Views
- p. Seabed samples
- q. Sound Velocity records
- r. Miscellaneous observations records

11.3 All Fair Records required for Year 1 of this contract are to be rendered by 1 December 2004 at the latest and subsequent Fair Records in accordance with the Contract by 1 December 2005 at the latest. Contractors may consider rendering fair work in stages as the fieldwork in each area is completed. In this way data can be more rapidly evaluated in the UK Hydrographic Office and the final payment of account processed without undue delay. Each rendition however, will require to be accompanied by a dedicated Report of Survey and form H 68A. Further discussion with the UKHO Overseer is recommended following Contract award.

11.4 Field records are to be delivered to the UK Hydrographic Office when all points raised in the appraisal have been clarified. They are to be packaged and labelled using standard boxes and forms as supplied by the UK Hydrographic Office. Due notice should be given to the UK Hydrographic Office of intended despatch of fields records. Standard size boxes for the rendering of survey field records are available from the UK Hydrographic Office through the UKHO Overseer.

11.5 A digital Report of Survey is to be rendered. The UKHO-approved digital Report of Survey format is to be used and will be provided. The Report and all other rendered items shall bear a depiction of the MCA Logo

11.6 Digital MBES data is to be rendered as read-only on either DAT or DLT medium or, where appropriate, DVD.

11.7 Each item of digital data rendered is to be signed by the Charge Surveyor and bear a depiction of the MCA Logo.

11.8 Precise details and any difficulties in using any of the stated media should be discussed with the UK Hydrographic Office in advance of rendering data. All media should be uniquely identified (including Identification Number) and accompanied by a full description of the contents and format. A digital data sample should be submitted for approval to UK Hydrographic Office in advance of the full survey data.

11.9 All raw and processed digital records are to be retained and maintained by the Contractor for a period of 2 years from the date of the final contract payment. On completion of this two year period, the Contractor may seek permission from UKHO/MCA to dispose of the data as they so wish.

11.10 Where blocks of data adjoin, great care is to be taken to ensure agreement between adjoining data.

11.11 If it is not possible to provide any of the data in a digital format, agreement is to be made between the tenderer and UKHO as to an acceptable format.

11.12 When compiling survey records, the H Forms supplied with HQAI are to be used. These forms have been designed by UKHO to facilitate checking and validation of rendered data. They have also been designed for ease of data abstraction into UKHO databases. Only UKHO approved H Forms are to be used.

11.13 All data and accompanying documents and records, both working and fair, originating from the survey become the property of HM Government and must be handed over on demand.

Where appropriate, they are to carry the following official markings:

- a. CROWN COPYRIGHT 2004/5
- b. FOR OFFICIAL USE ONLY

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**GEOGRAPHICAL LIMITS (ETRS 89 DATUM)**

**HI 1083 - EASTERN APPROACHES TO FIRTH OF FORTH**

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**Area A**

<u>Point</u>	<u>Latitude</u>	<u>Longitude</u>
1)	56° 10'00 N	001° 56'60 W
2)	56° 10'00 N	000° 50'00 W
3)	55° 37'50 N	000° 50'00 W
4)	55° 55'85 N	001° 37'60 W
5)	56° 02'93 N	001° 37'60 W

**Additional Bathymetry Only Area**

<u>Point</u>	<u>Latitude</u>	<u>Longitude</u>
1)	56° 00'.76 N	002° 25'.88 W
2)	56° 03'.30 N	002° 06'.57 W
3)	56° 04'.05 N	002° 06'.90 W
4)	56° 01'.34 N	002° 27'.60 W

**HI 1071 CAPE WRATH TO SOLAN BANK**

**Area B**

<u>Point</u>	<u>Latitude</u>	<u>Longitude</u>
1)	58° 52'.00 N	004° 38'.00 W
2)	58° 36'.00 N	004° 38'.00 W
3)	58° 38'.00 N	004° 58'.00 W
4)	58° 38'.00 N	005° 16'.00 W
5)	58° 52'.00 N	005° 16'.00 W

**Area C**

6)	58° 52'.00 N	005° 05'.00 W
7)	58° 52'.00 N	005° 40'.00 W
8)	59° 00'.00 N	005° 40'.00 W
9)	59° 00'.00 N	005° 30'.00 W
10)	59° 08'.00 N	005° 30'.00 W
11)	59° 08'.00 N	005° 05'.00 W

**Area D**

1)	58° 52'.00 N	004° 38'.00 W
6)	58° 52'.00 N	005° 05'.00 W
11)	59° 08'.00 N	005° 05'.00 W
12)	59° 08'.00 N	005° 38'.00 W

**HI 1072 SOLAN BANK TO FAIR ISLE CHANNEL**

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**Area E**

<u>Point</u>	<u>Latitude</u>	<u>Longitude</u>
1)	59° 08'.00 N	005° 30'.00 W
2)	59° 20'.50 N	004° 17'.00 W
3)	59° 08'.00 N	004° 17'.00 W

**Area F**

2)	59° 20'.50 N	004° 17'.00 W
3)	59° 08'.00 N	004° 17'.00 W
4)	59° 00'.00 N	003° 50'.00 W
5)	59° 25'.20 N	003° 50'.00 W

**Area G**

4)	59° 00'.00 N	003° 50'.00 W
5)	59° 25'.20 N	003° 50'.00 W
6)	59° 30'.40 N	003° 20'.00 W
7)	59° 13'.70 N	003° 20'.00 W

**Area H**

6)	59° 30'.40 N	003° 20'.00 W
7)	59° 13'.70 N	003° 20'.00 W
8)	59° 28'.00 N	002° 49'.00 W
9)	59° 37'.00 N	002° 41'.00 W

Annex B to  
Technical Specifications

**WRECK DATA**

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1. A synopsis of the wreck/obstruction data held by UKHO for the area of HI 1083, 1071 and 1072 is provided in the following pages:

[Wreck Data has been removed from web-published version for copyright reasons]

Annex C to  
Technical Specifications

**GLOSSARY OF TERMS**

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ADCP	Acoustic Doppler Current Profiler
BM	Benchmark
CD	Chart Datum
CHP	Civil Hydrographic Programme
DfT	Department for Transport
EU	European Union
FIG	International Federation of Surveyors (Federation Internationale des Geometres)
GMT	Greenwich Mean Time
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HQAI	Hydrographic Quality Assurance Instructions
IHO	International Hydrographic Organisation
LAT	Lowest Astronomical Tide
MBES	Multibeam Echo Sounder (beam forming or interferometric)
MCA	Maritime and Coastguard Agency
MOD	Ministry of Defence
MOU	Memorandum of Understanding
NFFO	National Federation of Fisheries Organisation
PEXA	Practice and Exercise Area Charts
PM	Project Manager
RoS	Report of Survey
SBES	Single Beam Echo Sounder
SEERAD	Scottish Executive Environment and Rural Affairs Department
SOLAS	Safety of Life at Sea Convention
SSS	Side Scan Sonar
SV	Sound Velocity
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UTC	Universal Time Co-ordinated

Annex D to  
Technical Specifications

**TENDER EVALUATION CRITERIA**

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The following broad headings will form the basis of the Tender Evaluation.  
They are given in no particular order of priority

1. Track Record for SOLAS Charting Surveys
2. Quality Control Procedures
3. Quality Control Certificates
4. Evidence of Compliancy with IHO order 1.
5. Vessel suitability
6. Multibeam equipment
7. Ancillary Equipment
8. Tidal Reduction Methodology
9. Primary/Secondary Positioning Details
10. Calibration Procedures
11. Survey Line Spacing
12. Details of proposed Data Flow
13. Environmental Criteria for cessation of surveying
14. Details/Experience of Key Personnel
15. Details of Sub-contractors
16. Safety Management Plan
17. Price

Annex E to  
Technical Specifications

**PRICE SCHEDULE**

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The following are all inclusive prices for the survey of each area in accordance with the specification:

Area A ( <i>Including bathymetry only area</i> )	£ .....	+VAT
Area A+B	£ .....	+VAT
Area A+B+C	£ .....	+VAT
Area A+B+C+D	£ .....	+VAT
Area A+B+C+D+E	£ .....	+VAT
Area A+B+C+D+E+F	£ .....	+VAT
Area A+B+C+D+E+F+G	£ .....	+VAT
Area A+B+C+D+E+F+G+H	£ .....	+VAT

THE CONTRACT WILL BE AWARDED FOR WHICHEVER OF THE ABOVE COMBINATIONS OF AREAS IS WITHIN THE BUDGET FIGURE FOR THE PROJECT.

THE CONTRACT WILL COVER WORK TO BE CARRIED OUT OVER 2 YEARS AND WILL BE AWARDED IN 2 SECTIONS, THE FIRST SECTION WILL BE CARRIED OUT IN YEAR 1 (APRIL 2004 TO MARCH 2005) AND SECTION 2 WILL BE SURVEYED IN THE PERIOD APRIL 2005 TO MARCH 2006.

THERE CAN BE NO OVERLAP OF THE WORK FROM ONE FINANCIAL YEAR TO THE OTHER.

Annex F to  
Technical Specifications

**STAGE PAYMENTS**

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The following are the stages at which invoices may be submitted to MCA for payment subject to written agreement of MCA's Project Manager:

Mobilisation 2004 = 5%

Mobilisation 2005 = 5%

Completion of 100% of **Area A** fieldwork = 5%

Delivery of **Area A** Fair Records = 5%

Completion of 100% of **Area B** fieldwork = 5%

Delivery of **Area B** Fair Records = 5%

Completion of 100% of **Area C** fieldwork = 5%

Delivery of **Area C** Fair Records = 5%

Completion of 100% of **Area D** fieldwork = 5%

Delivery of **Area D** Fair Records = 5%

Completion of 100% of **Area E** fieldwork = 5%

Delivery of **Area E** Fair Records = 5%

Completion of 100% of **Area F** fieldwork = 5%

Delivery of **Area F** Fair Records = 5%

Completion of 100% of Area G fieldwork = 5%

Delivery of **Area G** Fair Records = 5%

Completion of 100% of **Area H** fieldwork = 5%

Delivery of **Area H** Fair Records = 5%

Final Payment on acceptance of whole survey =10%

This sequence of milestones assumes that the contract is awarded for all the areas, however if a lesser number of areas are to be surveyed the milestones will be varied pro-rata and agreed before the award of the contract.

When the MCA Project Manager certifies that a milestone has been reached, the contractor may submit an invoice for the amount owing. If the invoice is correct, MCA will pay the invoice within 30 days.

Invoices should be submitted to

Jean Whittaker  
MCA  
Bay 2/25  
Spring Place  
105 Commercial Road  
Southampton  
SO15 1EG