

NP145

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS FOR ADMIRALTY SURVEYS (HQAls)

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**HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS
for
ADMIRALTY SURVEYS**

Edition 1/03

The Edition 2/02 of NP145 Hydrographic Quality Assurance Instructions for Admiralty Surveys, (HQAs), is hereby replaced by Edition 1/03.

HQAs Edition 1/03 is issued only on CD in PDF format. For UKHO use, HQAs are located on the NOS system in PDF format.

These instructions are not to supersede other orders issued by higher authorities, but to supplement them. Any which appear to conflict with instructions issued by other authorities are to be drawn to the attention of the Royal Navy Technical Author at the UKHO without delay.

C B H Stevenson BSc
Commodore Royal Navy
Director Naval Surveying Oceanography
and Meteorology

D W Williams
Chief Executive & National Hydrographer

Preface

The execution of a surveying operation, from its inception to the final submission of the results, is a continuous process, all parts of which must be methodically and meticulously carried out if full value is to be gained from it. The most accurate and carefully gathered data will be wasted if they are not processed carefully and collated and rendered in a clear and understandable manner.

Whether the work be a hydrographic survey or an oceanographic, geophysical or meteorological study, order and method are essential. All information must be gathered, validated, checked and rendered in a logical and uniform manner using terms in accordance with *The Mariner's Handbook* so that the data may be recovered and understood both immediately after the survey and in the future.

The use of sophisticated computer systems and instrumentation in all areas has not lessened the surveyor's responsibility. The need for rigorous quality management is as essential now as ever, but made the more difficult by the rapidly increasing volume and complexity of data gathered. The surveyor must understand the principles of the equipment he controls, be meticulous in ensuring that any data input are entirely correct and examine with care the data output before they are passed to the next stage. Only by these means will the data rendered be of the highest quality and be able to fulfill its needs until the task can be repeated perhaps decades, if not centuries, later.

Record of Changes and Amendments

[illegible]

NP145 Hydrographic Quality Assurance Instructions for Admiralty Surveys

Change Summary 1/03

Title Page	Edition number change.
Authorisation Page	New page.
Record of Changes and Amendments	New page.
Change Summary	Change Summary gives the amendment summary and hyperlink to the reference.
0302	Inclusion of environmental data and observations for data bases in Passage Observations.
0303 - 0306	Add references to FLOO 13202 and 13222.
0303.11	Introduction of Form H631 for secchi disc observations.
0303.14 a&b	Removal of references to forms H568, 569 and 584.
0306.1&2	Observations for magnetic variation afloat.
3-A1-3, 3-A1-4	Correct typing error.
GSI Index Page C	Changes to C1.1, C1.4
GSI C1.1	Correct typing error.
GSI C1.4	Add reference to FLOO 13222
GSI D1.1	Correct typing error.
GSI Index Page G	Change to G5.1
GSI G5.1	Include 'Miscellaneous tracing' as Fair Graphic under Data Management.
GSI H5.2	Correct typing error.
4 App 1 Annex E	Remove paras E.3 – E.5 to reflect removal of H92 and H531. Add new E.3 for new H635 and reword footnote.
5 App 1-5	Geodetic Control Station sections: add details of reference to which heights on Fair Graphics should be referred.
Annex A	Up date to list of Hydrographic Forms.
H489	New H form: Ashore Magnetic Observations.
H638	Deep Scattering Layer reporting digital format.
H183A	New digital form.
H159	New digital form.
H159A	Removed.
H102	New digital forms.
H102A	New digital forms.
H102B	New digital forms.
H631	Secchi Disc Observations reporting form.
H Form list	Master H Form Index included in Forms & Annexes directory
Part 2Title Page	Edition number change.
Record of Changes and Amendments	New page.
Ashtech Static Processing SOP	2.1.1 paras 3ci: change Desired Project Accuracy: 0.01m + 5 ppm and 3cii: change Blunder detection: 10 mins.
Ashtech Static Processing SOP	2.2.1 paras 10 to 12.
Ashtech Static Processing SOP	3.1.3 para 9 line 2: change 20 mins to 10 mins.
Ashtech Static Processing SOP	3.3.1 para 5a: change to read Observation Information.

NP145 Hydrographic Quality Assurance Instructions for Admiralty Surveys

Change Summary 1/03

Ashtech Kinematic Processing SOP	2.2.1 paras 10 to 12.
Wild T2 Theodolite SOP	2.1.1 para 3bii, 3biii and 3bv. Amend: 'clockwise' to read 'anti-clockwise'.
Wild T2 Theodolite SOP	2.2.1 QA Task 1. Amend: 'right' to read 'left'.
Digibar SOP	3.1.2 para 4: correct typing error.
MORS Probe SOP	3.1.1 para 7: change to include requirement to use local values not defaults.
MORS Probe SOP	3.1.4 para 2: correct typing error.
Valeport SOP	1.1.2 para 7: addition to check logger mode.
Valeport SOP	1.1.3 para 6: highlight onscreen message; para 11: alter burst time and highlight requirement to set radio link when using telemetric link.
Valeport SOP	1.2.2paras 4 to 15: amendments to calibration routine.
Ashtech Static Surveying SOP	SOP up dated to V2.5
SAPS SOP	SOP up dated to Classiphi version.
AUASS	New SOP
Elsec Magnetic Observations	New SOP
GPS Receiver DL4	New SOP V1.130
Neil Brown CTD Probe	New SOP
Starfix - MRDGPS	New SOP
Sonardyne ORT	New SOP
TSS 320B	New SOP
Simrad Neptune	Various amendments and SOPs re-numbered
SDA	New SOP
Atlas Deso 25	New SOP

EDITION 1/03 OF NP145 HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

1. The following page amendments should be made to NP145 Edition 2/02. All pages to be inserted include all previous changes affecting these pages.

Part 1

Remove

Cover page
Authorization page
Record of Change and Amendments page
Contents Part 1 page 1
3-2 to 3-9
3-A1-3
3-A1-4
GSI C Index Page
GSI C1.1
GSI C1.4
GSI D1.1
GSI G Index Page
GSI G5.1
GSI H5.2
4 - A1 - 18
4 - A1 - 19
5 App 1-5
5 App 1-6
A-5 – A7
-
-
-
-
H159
H159A
H102
H102A
H102B
-

Insert

Cover page
Authorization page
Record of Change and Amendments page
Contents Part 1 page 1
3-2 to 3-9
3-A1-3
3-A1-4
GSI C Index Page
GSI C1.1
GSI C1.4
GSI D1.1
GSI G Index Page
GSI G5.1
GSI H5.2
4 - A1 - 18
4 - A1 - 19
5 App 1-5
5 App 1-6
A-5 – A7
Master H Form list
H183A
H489
H638
H159
-
H102
H102A
H102B
H631

Part 2

Remove

Cover page
Record of Change and Amendments page
Contents Page

Ashtech Static Processing

SOP Index
2.1.1
2.2.1
3.1.3
3.3.1

Insert

Cover page
Record of Change and Amendments page
Contents Page

SOP Index
2.1.1
2.2.1
3.1.3
3.3.1

Ashtech Kinematic Processing

2.2.1

2.2.1

Wild T2 Theodolite

SOP Index

2.1.1

2.2.1

SOP Index

2.1.1

2.2.1

SAPS

SOP Index

1.1.1

1.2.1

1.2.2

1.2.3

1.3.1

1.3.2

1.3.3

1.3.4

1.3.5

1.3.7

3.1.1

3.1.2

3.1.3

3.1.4

3.2.1

3.2.3

SOP Index

1.1.1

1.2.1

1.2.2

1.2.3

1.3.1

1.3.2

1.3.3

1.3.4

1.3.5

1.3.7

3.1.1

3.1.2

3.1.3

3.1.4

3.2.1

3.2.3

Digibar Sound Velocity Probe

3.1.2

3.1.2

MORS Probe

SOP Index

3.1.1

3.1.4

SOP Index

3.1.1

3.1.4

Valeport Tidegauge

SOP Index

1.1.2

1.1.3

2.1.2

SOP Index

1.1.2

1.1.3

2.1.2

Ashtech Static Surveying

-

V2.5 SOP in total

AUASS

-

V4.15B SOP in total

Elsec Magnetic Observations

- SOP in total

GPS Receiver DL4

- V1.310 SOP in total

Neil Brown CTD Probe

- SOP in total

Starfix – MRDGPS

- SOP in total

Sonardyne ORT

- SOP in total

TSS 320B Heave Compensator

- SOP in total

Kongsberg Simrad Neptune

SOP in total SOP in total

Survey Decision Aid

- SOP in total

Atlas Deso 25

- SOP in total

Contents

Authorisation Page

Preface

Record of Changes and Amendments

Summary of Changes 2/02

Chapter 1

Admiralty Surveys

- 0101 Introduction
- 0102 Admiralty Surveys
- 0103 Definitions
- 0104 The Principles of Hydrographic Surveying
- 0105 The General Requirements of a Hydrographic Survey
- 0106 The Survey Process
- 0107 General Responsibilities for the Quality of Admiralty Surveys
- 0108 Orders for the Conduct of Surveys
- 0109 Collection, Collation and Checking of Data
- 0110 Rendering the Survey
- 0111 Custody and Security of Survey Data
- 0112 Action on Completion of a Survey
- 0113 Transmission of Survey Records to UKHO
- 0114 Requests for Copies of Surveys

Chapter 2

Management of the Hydrographic Quality Assurance System

- 0201 Policy
- 0202 Principles of the Quality Assurance System
- 0203 The Total Quality Management Approach
- 0204 The National Hydrographic Programme
- 0205 The Defence Hydrographic Programme
- 0206 Requirements and Products
- 0207 General Survey Instructions (GSIs)
- 0208 Survey Standards
- 0209 Standard Operating Procedures (SOPs)
- 0210 Quality Assurance Model
- 0211 Survey Standards and Requirements Feedback
- 0212 Surveying Process Feedback
- 0213 Training Feedback
- 0214 Equipment Feedback

Chapter 3 General Survey Instructions

0301	General Surveying Instructions (GSIs)
0302	Passage Observations
0303	Types of Passage Observations
0304	Satellite Derived Positions Alongside
0305	Magnetic Observations Ashore
0306	Observations for Magnetic Variation Afloat
0307	Searches for Reported Dangers, Shoals or Vigias
0308	Names and Orthography

General Surveying Instructions

Part A	Geodetic Control
Part B	Positioning at Sea
Part C	Bathymetry
Part D	Sonar, Seabed, Wrecks and Obstructions
Part E	Tidal Heights
Part F	Tidal Streams
Part G	Coastline and Topography
Part H	Navigation Aids

Appendix 1 Survey Standards Tables

1. Horizontal Accuracy of Soundings and Geodetic Data
2. Differential GPS – Positioning at Sea
3. GPS Ashore and Field Survey Standard Errors
4. Bathymetry
5. Sonar, Seabed Hazards and Seabed Sampling
6. Sonar Sweep Categories
- 7A. Tide Height Observations
- 7B. Tidal Stream and Current Observations
8. Physical Oceanography Data
9. Oceanographic Data – Fluorescence and Luminescence
10. Sub Bottom Profiler
11. Meteorological Data

Chapter 4 Report of Survey Content and Format

0401	The Report of Survey
0402	Geodetic Data

Appendix 1 The Report of Survey

- Part 1 Descriptive
- Part 2 Technical

Chapter 5 Standard Graphic Formats

0501	Draughtsmanship
0502	General Principles
0503	Ozatex
0504	Working Tracings
0505	Identification Number
0506	Security and Privacy markings
0507	Symbols and Colours to be Used
0508	Styles of Lettering
0509	Computer Drawn Graphics
0510	The Border
0511	Geographical and Grid Intersections
0512	The Title
0513	Scales
0514	Names and Legends
0515	Tidal Information
0516	Horizontal Datum, Spheroid, Projection and Grid
0517	Depths
0518	Checking of Graphics
0519	Names of Draughtsmen and Checker
0520	Approval of the Survey

Appendix 1	Colours & Symbols to be Used on Bathymetric Sheets and Accompanying Tracings.
Appendix 2	Symbols for Use on Bottom Texture Tracings
Appendix 3	Quality of the Seabed – Abbreviations to be used on Bottom Texture Tracings

Annexes

A.	Documents, Books, Stationery and Forms
	Table 1 - The Survey Library
	Table 2 - List of H Forms
B.	Survey Instruments and Equipment
C.	Miscellaneous Information - Hydrographic Returns
	Points of Contact
D.	IHO Standards for Hydrographic Surveys, S-44

STANDARD OPERATING PROCEDURES

(Issued on NP145 Pt 2. CD)

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 1

THE ADMIRALTY SURVEY

Contents

- 0101 Introduction
- 0102 Admiralty Surveys
- 0103 Definitions
- 0104 The Principles of Hydrographic Surveying
- 0105 The General Requirements of a Hydrographic Survey
- 0106 The Survey Process
- 0107 General Responsibilities for the Quality of Admiralty Surveys
- 0108 Orders for the Conduct of Surveys
- 0109 Rendering the Survey
- 0110 Custody and Security of Survey Data
- 0111 Collection, Collation and Checking of Data
- 0112 Action on Completion of a Survey
- 0113 Transmission of Survey Records to UKHO
- 0114 Requests for Copies of Surveys

0101 Introduction

1. Since the early part of the nineteenth century the Royal Naval Surveying Service has established an enviable reputation for its professionalism, zeal and the quality of its work. This has been shown by the trust the mariner has placed in the Admiralty Chart for safe navigation and the vital contribution made by the Surveying Service to the support of naval operations.
2. Throughout its history the Surveying Service has been innovative and ready to exploit the challenges that new technology or organisational methods bring so that the needs of the Royal Navy and other mariners can be met effectively and efficiently. One new method is 'total quality management'; a management concept that has been developed in both the public and private sectors over the past decade. Hydrographic Quality Assurance Instructions, (HQAls), are one outcome of the TQM approach to assuring the quality of Admiralty Surveys; an approach that should be seen as building on the past reputation of the Surveying Service earned by the dedication and hard work of its surveyors. The purpose of HQAls is to provide the instructions and procedures for the conduct of Admiralty Surveys.
3. In this book, both the terms 'Admiralty Surveys' and 'hydrography' are given a wide interpretation. They include not only the surveys conducted for the improvement of navigation charts and publications but all the hydrographic, oceanographic and geophysical data needs of the Fleet. A classified addendum to HQAls, issued separately, includes instructions and procedures for surveys conducted to support amphibious operations, mine-warfare, rapid environmental assessment, geophysical and oceanographic observations.
4. Policy for the Surveying Service is set by the Director of Naval Surveying, Oceanography and Meteorology (DNSOM), with technical advice from the National Hydrographer/Chief Executive UKHO. They are the joint sponsors of this publication.

0102 Admiralty Surveys

1. The UKHO accepts data from many varied sources; however, Admiralty Surveys are treated in a different manner to others. It is, therefore, important to understand what makes a hydrographic survey an Admiralty Survey and, above all, the fundamental relationship that exists between the National Hydrographer and the Charge Surveyors of the Royal Naval Surveying Service.
2. In an Admiralty Survey:-

The National Hydrographer determines the Admiralty Survey Specification and approves surveying standards:-

The requirements and standards for Admiralty Surveys are described in HQAls. These instructions are developed by DNSOM and UKHO to ensure that the defence and civil requirements for hydrographic and oceanographic products can be met. HQAls contains General Survey Instructions (GSIs) and Standard Operating Procedures (SOPs). The Hydrographic Instruction, (HI), states the 'Order of Survey', scale, geographic limits and any special instructions to modify GSIs for a particular survey. Normally, HIs are prepared by UKHO, as requested by DNSOM, in accordance with the survey programme determined by the Defence Maritime Geospatial Board, (DMGB). GSIs as modified by the HI form the Admiralty Survey Specification for a particular survey. The HI is issued by the National Hydrographer to the Captain Hydrographic Surveying Squadron who will allocate it to a survey unit for prosecution.

Hydrographer of the Navy grants Charge Surveyor status:-

Charge Surveyor status is granted by Hydrographer of the Navy, on the advice of his senior hydrographic surveyors, only to those Royal Navy warfare officers, of the HM specialisation, who have the necessary character, experience, training and skill to plan, conduct and render Admiralty Surveys independently, and achieve the high standards required, without further direction. Hydrographer of the Navy's knowledge of an HM officer's ability in surveying is established through reports by experienced Charge Surveyors and a detailed appraisal of each survey.

DNSOM co-ordinates the customer's survey requirement and tasks the UKHO to fulfill the requirement.

Under the chairmanship of DNSOM, the DMGB acts on behalf of all defence customers to co-ordinate, and set priorities for, defence hydrographic and oceanographic surveys, products and services, and provides expert advice in these areas. The DMGB determines the Defence Survey Requirement (DSR) as part of a three year rolling programme. DNSOM also sponsors the National Hydrographic Programme on behalf of HM Government. DNSOM approves GSIs for use in the Royal Naval Surveying Service, as advised by the National Hydrographer, to meet the requirements of the DSR and NHP.

DNSOM approves survey equipment and procedures for use in Admiralty Surveys.

As an essential element of assuring the quality of Admiralty Surveys, all survey equipment, and the methods of operation, must be approved before they are used. This approval is only granted by DNSOM after rigorous trials have been carried out, under realistic survey conditions, following Standard Operating Procedures, (SOPs) and when the final trials data has been analysed and confirmed as suitable for use.

The Charge Surveyor conducts the survey.

The Charge Surveyor plans and conducts the survey in accordance with HQAIs and the HI, to ensure that the Admiralty Survey Specification is met as efficiently as possible with the resources available. All survey data rendered to the National Hydrographer carries the personal approval of the Charge Surveyor which implies that the data is suitable for the improvement of charts and publications. In making recommendations in his Report of Survey, the Charge Surveyor uses his skills as a seaman, navigator, surveyor and warfare officer. These recommendations are, therefore, firmly based on the experience of the officer responsible for the safe conduct of his vessel in the survey area. The Charge Surveyor will be held accountable for the quality of his survey and is accountable to the National Hydrographer for the quality of the data. Survey data which has been approved by the Charge Surveyor may not be altered without his agreement.

The National Hydrographer and Chief Executive, UKHO, appraises Admiralty Surveys.

All hydrographic data which is received at the Hydrographic office is assessed; where appropriate it is validated to judge its quality and decisions are made as how best to use the data for the improvement of charts and publications by comparison with existing data and the needs of the mariner. However, Admiralty Surveys are also appraised. This is a far more detailed examination of the data by the chart and specialist branches of UKHO. Firstly, it is an essential element of the quality assurance system to ensure that any errors in the rendered data are found and that the survey has met the Admiralty Survey Specification. All errors are referred back to the Charge Surveyor for explanation and amendment if required. Secondly, it provides essential feedback on survey equipment, procedures and training. Finally, it allows Hydrographer of the Navy to have an informed opinion as to the ability of Charge Surveyors.

The National Hydrographer, with advice from the Hydrographer of the Navy, accepts the survey at 'the Work'.

When the survey has been appraised, and any problems with the rendered data have been satisfactorily resolved by the Charge Surveyor, it is presented to the National Hydrographer at 'the Work'. It is at this stage that the National Hydrographer accepts the survey. Admiralty Surveys are shown on chart Q6090 in home waters and in the source diagrams of charts and other hydrographic products. Admiralty Survey data, including some field data, is archived at UKHO as the permanent public record.

0103 Definitions

Hydrographic Instruction	A specification for a hydrographic survey issued by the National Hydrographer. The instruction is prepared by UKHO staff and will contain the area to be surveyed, details of some existing data, the 'Order of Survey' and any modifications to GSIs. The combination of GSI, SOP, modifying special instructions, the area to be surveyed, scale and order of survey forms the Admiralty Survey Specification for a particular Hydrographic Instruction.
Hydrographic Product.	A hydrographic product is a digital or analogue set of hydrographic data normally produced by the UKHO to satisfy a customer requirement. In combat hydrography, products may be supplied directly from survey units. The quality of hydrographic products is managed by UKHO.
Hydrographic Requirement.	The need for a user to have hydrographic data. There is a defence and a civil hydrographic requirement. The requirement is stated in terms of type of data, area coverage, data density, quality and format. The defence hydrographic requirement is managed by DNSOM through the Defence Maritime Geospatial Board. The civil requirement is co-ordinated through the Department of the Environment, Transport and the Region's Committee on Shipping Hydrography, where DNSOM and the National Hydrographer provide technical advice.
Survey Product.	A survey product is a digital or analogue set of hydrographic data produced by survey units to satisfy a customer requirement. The details of survey products are contained within General Survey Instructions, but may be modified under special instructions in the HI.
Survey Requirement	The survey requirement is managed by DNSOM and is a statement of what hydrographic data needs to be observed and rendered to enable the compilation and production of hydrographic products.
General Survey Instructions	General Survey Instructions, (GSI), describe the requirements for survey data. The instructions include standards for hydrographic survey observations and processed data, details of the format of rendered data and the quality assurance methods to be employed. GSIs are derived from general hydrographic requirements, using the principles of surveying, and further developed to satisfy the survey requirement as determined by DNSOM on the advice of the National Hydrographer.
Survey Standard.	The standards to be achieved by the Charge Surveyor for rendered hydrographic data. Normally stated in terms of accuracy, precision and data coverage.
Standard Operating Procedures	Standard Operating Procedures, (SOPs), describe how every survey instrument is to be used. More than one method may be available with the same instrument. SOPs are developed during survey equipment trials and through equipment life so that the performance of an instrument and the procedure can be assured.

0104 The Principles of Hydrographic Surveying:**1. The Charge Surveyor should :-**

- a. Render to the National Hydrographer only data which is known to be fit for purpose in line with Quality Control and make certain that where no dangers are charted, none in fact exist.
- b. Possess an unlimited capacity for taking pains and conscientious devotion to detail so as to ensure that the prudent mariner's trust in the chart is not misplaced.
- c. Completely satisfy the requirements of the Admiralty Survey Specification as laid down in the Hydrographic Instruction with the resources available in an effective and efficient manner.
- d. Not pursue accuracy for its own sake; rather conduct the survey using known methods so that he can prove the quality of the data achieves the standard required.
- e. Not be bound by instructions, but use all his skill, imagination and experience, without further direction, to enhance the safety of marine navigation and meet the hydrographic, oceanographic and geophysical requirements of the Fleet.

0105 The General Requirements of a Hydrographic Survey**1. Geodetic Control**

Survey data must be positioned relative to the co-ordinate reference frame specified in the Hydrographic Instruction. Geodetic control observations may be required ashore to provide reference stations for satellite positioning systems, to provide co-ordinated points for photogrammetry, electronic or visual position fixing or to enable fixing of the coastline and topography. If control stations are established ashore they must be permanently marked and described.

2. Bathymetry

The entire water area seaward of the high water line should be sounded. No irregularities in the depth must be overlooked and sounding density must be sufficient to discover shoals. Sounding should be extended until agreement with the existing chart is obtained. If shoals are discovered then they must be investigated, by interline sounding, to determine their likely extent. Leading lines must be sounded along and a detailed examination undertaken by side scan sonar. All soundings must be reduced to Chart Datum by applying tidal heights, adjusted if required by co-tidal corrections.

3. Sonar and Seabed

The whole area must be swept by high frequency side scan sonar to ensure that no danger exists between lines of single beam echo sounding. Side scan sonar is also required to support the elimination of spurious depths in multi-beam surveys. Every significant sonar contact must be investigated by sonar interlines and crosslines to determine if a danger to navigation exists and to plan a full examination if required. The nature of the seabed must be determined at regular intervals with additional observations made in anchorages and on shoals. For defence surveys extra detail must be gathered from side scan sonar to describe the nature and form of the seabed and locate every mine like object, whether man made or not.

4. Shoals, Wrecks, Obstructions and other Dangers to Navigation

The position of, and least depth over, every shoal, rock, bank, wreck and other obstructions that are a danger to safe navigation must be determined by close examination. The minimum depth is found by total insonification supported by high definition side scan sonar. If necessary, in depths shoaler than 40 metres, wrecks and obstructions are swept by wire to ensure a safe clearance depth. All dangers discovered during previous surveys or reported by other means must either be found and examined or positively disproved by an extensive and rigorous search.

5. Tide and Tidal Streams

Observations of the rise and fall of the tide should be made both to reduce soundings to a common datum as well as to enable analysis to be undertaken for the predictions used in the production of tide tables. Benchmarks should be established and connected to the land datum where possible so that

chart datum can be recovered in the future. Measurements of the tidal stream and current will be required throughout the survey area.

6. Coastline & Topography

The position of the high and low water lines must be fixed and the nature of the foreshore described. All topographic features and conspicuous objects of any interest to the mariner that help him recognise the coast and determine his position must be carefully fixed. The heights of such objects must also be determined. Names must be ascertained of towns, villages, rivers, streams, points, hills, shoals, rocks and islands, and of any prominent and important features of the coast. The position of breakers, tide-rips, eddies, weed and all other objects of interest to the navigator should be fixed and described for inclusion in Sailing Directions.

7. Navigation Aids

All aids to navigation, both fixed and floating, must be fixed and described.

8. Oceanographic, geophysical and other survey requirements in support of maritime operations are included in the classified addendum to HQAIs.

0106 The Survey Process

1. The surveying process is divided into five major stages; these stages are common to GSIs and SOPs. Each stage is divided into a number of groups of instructions or procedures. GSIs describe the requirements of an Admiralty Survey. SOPs describe how every survey instrument is to be used to obtain a uniform quality of observation. The Charge Surveyor's task is to match the GSI with an appropriate instrument and SOP taking into account the resources available, the abilities and experience of the assistant surveyors and then manage the surveying process as effectively and efficiently as possible.

Stage	Group	Instruction or Procedure
Preparation	Planning	To extract data from existing sources and plan observations.
	Calibration	To eliminate systematic errors from survey instruments prior to observations.
Data Gathering	Verification	To ensure that instruments are gathering data to the correct standard during survey operations by comparison with proven mathematical models and other instruments.
	Observation	To make observations and check them on the survey line or in the field
	Data Logging	To store observed data and transfer to a data processing system
Data Processing	Editing	To ensure the removal of invalid data
	Calculation	To calculate or assign values from valid observations
	Selection	To select values from valid data for further processing or rendering
	Data Storage	To store selected processed data in analogue or digital formats
Data Analysis	Quality	To determine the quality of surveyed data and compare it to the required standard
	Coverage	To determine that sufficient valid data has been surveyed
Data Rendering	Reports	To report dangers before the completed survey is rendered
	Plots	To render data as graphics as directed
	ROS	To write the Report of Survey
	Digital Data	To render digital data
	Field Records	To render field records

0107 General responsibilities for the quality of Admiralty Surveys

1. Hydrographic products are produced to satisfy a defence or civil requirement; the quality of these products is assured by the National Hydrographer at the United Kingdom Hydrographic Office. The hydrographic products are compiled from data supplied, in part, from Admiralty Surveys as 'survey products'. The specifications for survey products are approved by DNSOM, taking advice as appropriate, to meet the needs for compilation and production of the required product.
2. The principle authorities responsible for the quality assurance of Admiralty Surveys are:-

The National Hydrographer and Chief Executive, United Kingdom Hydrographic Office

Advises DNSOM on survey requirement for hydrographic products
 Has overall responsibility for the standards of Admiralty Surveys
 Assists in production of Hydrographic Instructions by providing data and advice
 Issues Hydrographic Instructions, as advised by DNSOM
 Conducts appraisal of Admiralty Surveys and reports on the quality of survey to the customer
 Accepts Admiralty Surveys at 'the Work' with the Charge Surveyor
 Accepts liability for UKHO hydrographic products on publication

The Hydrographer of the Navy

The advisor to the Navy Board and the National Hydrographer on all surveying matters
 Advises National Hydrographer at the Work
 Grants Charge Surveyor status to selected officers

Director Naval Surveying Oceanography and Meteorology

Has overall responsibility for policy matters in Royal Naval Surveying Service
 Rationalisation and co-ordination of defence and civil customer requirements for hydrographic products
 Strategic management of the quality assurance system.
 Approval of surveying equipment, procedures and survey product specifications in RNSS
 Manages payment to UKHO for HI drafting and survey appraisal

Captain (HM)

Operational efficiency and effectiveness of surveying ships and units
 Allocates Hydrographic Instructions to survey units
 Reviews Operational Performance Standards for HM Branch and Survey Recorders
 Provides co-ordinated feedback from survey squadron to DSOF CG on standards and procedures

The Charge Surveyor

Plans and conducts Admiralty Surveys in accordance with HQAI and the Hydrographic Instruction so that the Admiralty Survey Specification is met
 Is accountable to the National Hydrographer for the quality of the survey
 Personally approves that all survey data rendered to UKHO are fit for purpose

0108 Orders for the Conduct of Surveys

1. Instructions and guidance to surveyors for carrying out surveys are issued in a number of ways, and all personnel concerned with the ordering and execution of any kind of surveying are to be entirely familiar with the instructions currently in force. It should be the practice of all surveyors to refer regularly to the appropriate volumes before starting a new operation or activity. If in any doubt, or if ambiguity exists,

over matters of principle which cannot be resolved on board, higher authority should be consulted.

2. When a surveyor joins a new ship or unit, he is to read, and ensure that he understands, all orders of a surveying nature issued locally (e.g. in ship's orders) in amplification of more general instructions issued by other authorities. If he has not been directly involved with surveying in his previous appointment, he is to review the documents listed below to ensure that no amendments have been issued of which he is unaware.
3. Surveying instructions and guidance are issued through the following publications:
 - a. Hydrographic Quality Assurance Instructions for Admiralty Surveys (HQAIs);
 - b. Admiralty Manual of Hydrographic Surveying (AMHS Vol 1 & Vol2);
 - c. Surveying Service Orders (SSOs);
 - d. Hydrographic Surveying Squadron Standing Orders (HSSSOs);
 - e. Hydrographic Instructions (HIs);

0109 Rendering the Survey

1. The end product of any period of surveying is a quantity of field records in many different forms which need to be collated in a methodical manner for despatch to UKHO. The way in which these data are to be rendered to UKHO is described in this chapter, which Charge Surveyors should use as guidance whenever the results of surveys are being processed.
2. The care and attention devoted to work in the field must be extended to all aspects of preparing the fair data, and to the careful and legible annotation of all original material. The underlying principle to be observed in compiling records of any survey is that they must be entirely intelligible to any person having a sound knowledge of the type of survey concerned, and who may be required to process either the fair, or the original field, data in UKHO. The preparation of all data in the established manner, neatly, concisely and accurately, is absolutely vital. Terminology should be in accordance with the definitions in The Mariners Handbook. If records are incomplete, ill checked, poorly compiled or illegible, they may cause nugatory work, or even dangerous decisions, when charts or publications come to be amended; they will often result in unnecessary work in UKHO to check and correct errors; they will certainly cause a lot of needless correspondence, and will reflect badly on those who prepared, checked and approved the data in the first place.
3. The Charge Surveyor has a prime and very personal responsibility to ensure that the records being prepared by his subordinates are compiled in accordance with established practices, that they are fully and independently checked by personnel who are entirely familiar with those practices, and that they are accurate and legible. The Charge Surveyor's signature on the Report of Survey is the principal means by which he confirms that he has personally approved the content of ALL survey records, and by so doing accepts that they are of a sufficiently high standard to be processed in the UKHO and subsequently published for use by mariners. Although all survey records are important, the primary records of a survey are the Report of Survey, the Bathymetric Sheet, in a non-digital survey, and, in a digital survey, the DEM, DTM or equivalent. The fact that the Charge Surveyor cannot sign digital records directly in no way dilutes the fact that when he signs the Report of Survey, he is stating that he has personally approved all such data. Other material which does not require his signature must also be prepared to the same standards, and the fact that it is being forwarded under cover of a Report of Survey or similar document carries the same implications.

0110 Custody and Security of Survey Data

1. Original survey data collected by a ship, and the fair records and reports prepared from them, are the primary reason for her existence and for the labours of her company. It follows that this material must be afforded the highest degree of security at all times, for to lose a part or all of it would clearly be very expensive in time, effort and material.

2. Charge Surveyors are to arrange that there are positive measures in force, through ships' orders, to ensure the safe custody of all original data in whatever form, and that there is an organisation whereby the data will be taken to a place of safety should the compartments on board or in shore drawing offices be threatened by fire or other damage.
3. In the case of classified data, the Joint Service regulations for security, custody and mustering apply. Classified survey data is to be recorded in a register separate from that for the ship's Crypto and CBs. It is particularly important that proper measures are taken to safeguard automatic data logging cartridges which carry classified data, and to ensure that the appropriate classification is input on the tape itself and also displayed externally.

0111 Collection, Collation and Checking of Data

1. The use of automatic methods of collecting and recording information, in place of laborious manual methods, has greatly increased the amount of data that can be collected, but has also made the checking of it very much harder. Whereas it is possible, and essential, to check in retrospect that manuscript records of every type are free from errors of calculation and transcription, this is almost impossible on board with data recorded on cartridge, and the checking process must take place concurrently with the data collection. For this reason, it is essential that all operators of electronic data gathering systems be constantly aware of the possibilities for incorrect recording and for themselves inserting inaccurate data. They, and the Charge Surveyor, must establish a regular routine for checking that the electronic data gathering system is recording the same figures that are being displayed on peripherals such as nav aids, echo sounder recorders and geophysical instruments. They must ensure that automatic plotters are also recording the data correctly and, perhaps most important of all, they must be positive that the manual inputs (such as changes in nav aid corrections) are inserted accurately.
2. As data are recorded, whether automatically or manually, the surveyor must be constantly monitoring whether they appear consistent with adjacent data already collected. Any apparent inconsistency must be investigated promptly, as it is often better to repeat an observation, or part of a survey, straight away rather than be obliged to return later. Whenever records are transposed into another form by calculation or transcription, it is essential that they be fully checked by an independent surveyor. The Charge Surveyor must ensure that foolproof arrangements exist for such checking processes. In particular, when the final fair records of the survey are being prepared, whether as graphics, reports or forms, it is vital not only that the physical transcription should be checked but that all related documents are examined for consistency and accuracy. It is frequently the case that a single item of information (such as the position of a wreck) will appear in four or five different documents. If it is found in Office that these are not consistent, doubt is bound to be thrown on other aspects of accuracy throughout the survey.
3. The work of the checker is no less important - and in many cases is much more important - than that of the draughtsman or collator. When allocating tasks in the process of data rendering, the Charge Surveyor should endeavour to employ experienced surveyors for checking and must, himself, carefully examine all material before it is finally despatched from the ship. It is often the experienced eye of the Charge Surveyor which detects a discrepancy not noticed by those less experienced.
4. In preparing survey records, the following general considerations should be borne in mind:
 - a. Much of the fair data will be unique, will form the basis for amending and maintaining charts and publications until the area is resurveyed (probably very many years in the future), and will become part of the nation's archives as public records;
 - b. Graphics will generally be photocopied in UKHO and will often be photo-reduced when being used for chart compilation. It is essential that all detail is neat, clear and sufficiently bold to be capable of photo-reduction without loss of clarity. If, with manually produced records, the soundings have to be severely reduced in size to depict an area satisfactorily, it may be better to enlarge the scale to provide a clearer picture;
 - c. Where practicable, 'field' records should be rendered as 'final' records, this will only be possible if they have been neatly prepared in the first place, and can be presented in the form required with all necessary additional information inserted. Copying from one form to another for the sake of slightly improved neatness, or typing a form which, in manuscript, was sufficiently clear already, should not normally be necessary and introduces the possibility of transcription errors;

- d. The number of graphics should be kept to the minimum necessary; normally only a Seabed Texture Sheet and, if necessary, a miscellaneous sheet should be rendered.
- e. In so far as is possible, the compilation of all kinds of survey data should be progressed concurrently with the field work, so that they can be rendered as soon as possible after it is finished;
- f. All Reports of Survey must be comprehensive and detailed. Whilst other forms of data may be to some extent circumscribed, the Report of Survey is the vehicle whereby the Charge Surveyor can explain in the fullest detail all aspects of the survey which would not otherwise be clear.
- g. The various records of a survey are split among Branches in the Hydrographic Office and some may be passed to outside authorities. It is desirable that individual documents should stand alone as far as is practicable, accepting that some duplication of data will be necessary.

0112 Action on Completion of a Survey

- 1. An original Form H68A is to be forwarded, without delay, with a chart cutting showing the area surveyed. It must draw attention to any shortcomings and recommend the category into which the survey should be placed in accordance with the Table at Chapter Four Appendix 1 para 1.5. From this form, SOSP should be able to assess, in advance of receiving the survey itself, whether further work will be necessary in the area in the near future, and so prepare or adjust the appropriate HIs.
- 2. In addition, although dangers discovered during the course of the survey should have been reported at the time, it is important that the Charge Surveyor should review the results of the survey at its completion and decide whether any other items should be reported in advance of the expected date of rendering. Frequently such a review will reveal features which, on reflection, the Charge Surveyor feels should be brought to UKHO's attention without further delay; it also provides the opportunity for a final check that no significant aspects of the survey have been left incomplete.

0113 Transmission of Survey Records to UKHO

- 1. The data resulting from any survey represent a considerable outlay in financial terms and in the effort expended by a large number of people. The transmission of these data to UKHO must therefore be by reliable and secure means, and acknowledgement of receipt there is to be obtained on Form H28.
- 2. Material to be rendered may be classified or unclassified, bulky or easily transmitted, unique or able to be copied, and may be sent from abroad or from Home Waters; different considerations must be applied in deciding how best to send particular items, including the degree of urgency necessary. The following factors should be borne in mind:
 - a. Classified material must not be sent by a means less secure than its classification demands;
 - b. If copies of material can be made and retained on board, the original may be despatched by mail if it is not too bulky. This will only apply to letters, forms, hydrographic notes and small tracings;
 - c. Data from ships in Home Waters which cannot be sent by mail, or by the appropriate secure means, are to be accompanied by an officer or senior rating;
 - d. Data from overseas which must be forwarded before the ship's return to UK, and which cannot be copied and sent by mail, should be despatched by the most secure means available. Choices include diplomatic channels, passage in another HM ship or RAF aircraft, or in the custody of the Master of a British merchant ship or of the Pilot of a British aircraft. If the Commanding Officer is not satisfied that the means of transit is sufficiently safe, the material should not be sent. Despatch of data from overseas by any of these means is to be reported by signal to HYDROUK TAUNTON stating its destination and ETA, whence arrangements will be made to collect it;
 - e. Magnetic tapes or cartridges may need special treatment, especially if being despatched from overseas by air, as they can be affected by electronic security arrangements at airports. Any person handling these tapes or cartridges in transit must be warned of this risk, and arrangements made to avoid such damage.

3. All survey documents, records and digital data should be delivered to the Hydrographic Data Centre. At least two working days' notice is to be given to HDC (Ext 3465).
4. Boxed Survey Field Data and Seabed Samples are to be delivered to the Hydrographic Data Centre in Dalrymple Block, giving three working days' notice to HDC (Ext 3465).
5. Geophysical Data for SOS are to be delivered to Vidal Block, giving at least two working days' notice to SOS (Ext 3263).

0114 Requests for Copies of Surveys

1. Copies of defence survey data are not to be supplied to other authorities without the express permission of the National Hydrographer, through SOSP, and DNSOM.
2. If requests for data are received from Service, or non-service, authorities, they should generally be referred to the National Hydrographer. If the requirement is not urgent, it will be usual for UKHO staff to consider the request, and arrange for supply, after the survey has been rendered to UKHO.
3. If supply of data is authorised before the survey has been rendered to UKHO, it is to carry the appropriate classification or privacy marking and, in addition, the following notice, in conspicuous lettering, which is to be signed by the Commanding Officer:

Copy of a survey by HMS...../NP.....

Date

Supplied by permission of the National Hydrographer for the official use of

This copy is supplied for the use of the above named person/authority only, on condition that it is not reproduced, published or issued to any other person. It has not been fully checked for errors or omissions, and the National Hydrographer accepts no responsibility for the information shown.

*Signed
Commanding Officer*

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 2

MANAGEMENT OF THE QUALITY ASSURANCE SYSTEM

Contents

- 0201 Policy
- 0202 Principles of the Quality Assurance System
- 0203 The Total Quality Management Approach
- 0204 National Hydrographic Programme
- 0205 Defence Hydrographic programme
- 0206 Requirements and Products
- 0207 General Survey Instructions (GSIs)
- 0208 Survey Standards
- 0209 Standard Operating Procedures (SOPs)
- 0210 Quality Assurance Model
- 0211 Survey Standards and Requirements Feedback
- 0212 Surveying Process Feedback
- 0213 Training Feedback
- 0214 Equipment Feedback

0201 Policy

1. The policy for the management of the hydrographic quality assurance system is set by Directorate of Naval Surveying, Oceanography and Meteorology, (DNSOM), and discussed and amended through the Defence Surveying and Oceanography Functional Customer Group (DSOFCG). The policy is published as the first two chapters of HQAI and issued under the joint authority of DNSOM and the National Hydrographer.

0202 Principles of the Quality Assurance System

1. The Royal Naval Surveying Service has adopted the principles of Total Quality Management for the quality assurance of its survey data. Total Quality Management, (TQM), is 'an organisational approach for meeting customer needs and expectations that involves all managers and employees in using quantitative methods to improve continuously the organisation's processes, products and services'. Quality in this context means consistently meeting the customer's requirement. TQM is a method of managing a process so that every task is completed correctly, consistently and on time. It involves everyone in the organisation by reducing human error through prevention rather than detection. Processes are brought under control by collecting and analysing data, and not by making decisions on hastily formed impressions or unsubstantiated opinions.
2. The aim is to achieve no 'defects' in the final survey product by having no defects at each survey stage. Quality cannot be 'inspected in' at the final stage of a survey; this is not quality assurance but detection of error. Thus quality assurance consist of all those planned and systematic actions necessary to provide adequate confidence that survey data will satisfy the stated requirements for quality.

0203 The Total Quality Management Approach

1. The TQM approach is to ensure that survey tasks are capable of being done correctly by proper design of the process with clearly defined products, standards and procedures, ensuring that personnel have the necessary ability through selection and training, that equipment is provided, calibrated, maintained and used correctly and that the process is monitored. In essence, the TQM approach to the surveying service involves four areas of quality:-

Quality of organisation.	An overall management philosophy that ensures continuous improvement of personnel, equipment and procedures to ensure that the survey requirements are satisfied efficiently and effectively.
Quality of survey product design.	Ensuring that survey products are designed and survey specifications are defined to meet the requirements for compiling hydrographic products. Survey products are designed to reduce the possibility of making errors. Survey products and standards are described using GSIs.
Quality of conformance to design.	Ensuring that hydrographic training standards, equipment specifications and surveying procedures can meet the survey product design requirements. This requirement is met by quality assurance loops which provide accurate and timely feedback on performance.
Quality assurance.	Ensuring that survey products meet the design standards by systematic activities to gather and analyse performance data and provide feedback to modify system inputs and processes rather than correcting outputs. This requirement is met by using SOPs.

0204 National Hydrographic Programme

1. The National Hydrographic Programme covers those information services which form the minimum level of activity required to be undertaken by the national hydrographic office of a government contracted to the International Convention for the Safety of Life at Sea. The National Hydrographic Programme meets the hydrographic needs of the nation and represents a major contribution to maritime safety, the protection of the marine environment and the development of maritime trade.
2. Under the National Hydrographic Programme the UKHO, through the National Hydrographer, is the Government's centre of expertise in hydrographic matters and provides the national policy for hydrographic surveying and charting standards and procedures. The NHP encompasses elements of the UK Civil Survey Programme, sponsored and funded by the Department of the Environment, Transport and the Regions through DNSOM.

0205 Defence Hydrographic Programme

1. The UKHO maintains the defence navigation and marine science databases and provides hydrographic and oceanographic products and related advice to MoD customers. The MoD customer requirement is co-ordinated by DNSOM through the Defence Maritime Geospatial Board (DMG). This group is supported by a number of Functional Customer Groups, some of which also have working groups.

0206 Requirements and Products

1. Hydrographic products satisfy the requirements of the defence and civil programmes. In general, hydrographic products are compiled from various sources, including Admiralty Surveys, and are produced by UKHO. Hydrographic products may be a standard nautical chart or, for example, more complex geophysical data to populate a command system database. The specifications for these products are set by the customer in consultation with UKHO and DNSOM. Survey products satisfy survey requirements and not, directly, hydrographic requirements. For Admiralty Surveys DNSOM sets the specifications for survey products, in consultation with UKHO, in order to meet the compilation requirements for hydrographic products.

0207 General Survey Instructions (GSIs)

1. It is important that the survey product is compatible with hydrographic product compilation, e.g. that digital sonar data can be validated, appraised and readily imported into UKHO databases. The quality assurance loops provide equipment and survey procedure feedback mechanisms through a functional customer group, (FCG), to DNSOM whereby survey requirements can be matched to hydrographic product requirements. The specifications for a survey product are described in GSIs which form Chapter 3 of HQAIs. GSIs are in a common format and include the requirements for each of the five major stages of the surveying process and the standards to be achieved.

0208 Survey Standards

1. Standards for hydrographic surveying should:-
 - a. Be relevant. Relate to a specific survey product requirement and not just be driven by the technology available.
 - b. Be measurable. An important principle in quality assurance within a TQM system is the provision of quantified metadata to monitor performance for all tasks.
 - c. Be achievable. Although standards should not be set just because the technology allows it, they must be capable of being achieved with the equipment provided.

2. Most standards in the IHO Special Publication S - 44 are stated in terms of precision at the 95% confidence level. They are minimum standards and generally meet the UK civil hydrographic requirement. MoD customers may have different requirements. In most cases hydrographic surveys can provide at least some data for both the defence and civil requirement, therefore, the policy has been established that the minimum standards to be adopted will be the better of the civil and defence requirement; thus there is only one set of standards for Admiralty Surveys.
3. However, precision alone cannot describe the quality of a survey product. In addition, all systematic errors should be removed by instrument calibration, calculation of corrections or cancellation through observing procedures. Therefore, the elimination of systematic error by using proven procedures is essential and the Standard Operating Procedure becomes a part of the survey standard. The reliability of data, that is the ability to detect an error and its effect, is an essential part of survey analysis. The quality of all survey observations will be judged against standards using stochastic and deterministic error models and statistical reliability analysis.

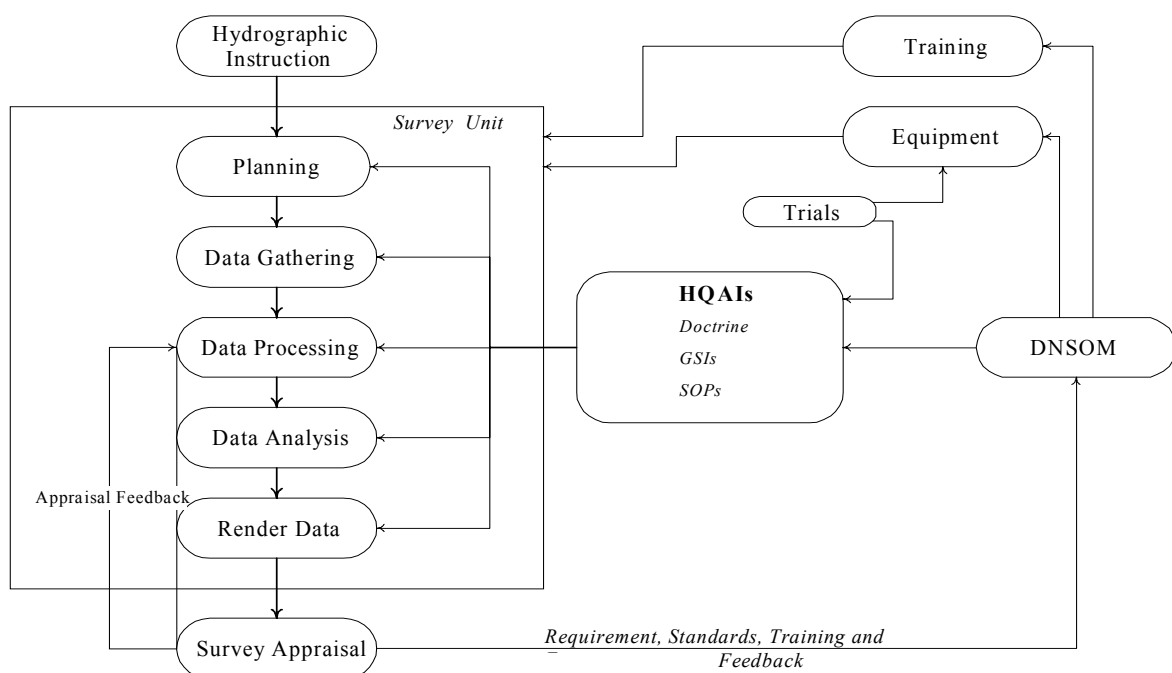
0209 Standard Operating Procedures

1. Standard Operating Procedures provide a uniform method of planning, collecting, processing, analysing and rendering survey data. They are designed to assure the quality of data by describing in detail how a particular instrument is to be operated or task carried out. In addition, SOPs describe the quality assurance methods to be employed at unit level. By using SOPs each survey task and observation can be designed to prevent error. SOPs are designed and tested during rigorous trials of survey equipment and procedures. SOPs are published in Part B of HQAIs.

0210 Quality Assurance Model

1. Quality management systems depend on accurate timely feedback on performance so that corrective action can be taken to rectify problems and prevent the same types of problems reoccurring. The key to the success of these quality assurance feedback loops is data provided during the extensive survey appraisal process at UKHO. Four quality assurance loops form the Hydrographic Quality Assurance System Model:-

- a. Survey Requirement and Standards - GSIs and SOPs;
- b. Survey Process - Charge Surveyor control of survey quality;
- c. Personnel - Training Feedback and SOPs;
- d. Equipment - Equipment performance feedback and SOPs.



0211 Survey Standards and Requirements Feedback

1. This quality assurance loop is an overall organisation level method of monitoring and improving survey standards, requirements and procedures to ensure they meet the customer's requirement.
 - a. The survey requirement is generated from the hydrographic requirement. It can be considered in two parts. Some requirements will be common to many surveys; this is the general survey requirement and forms the basis of GSIs in HQAI. GSIs are managed by DNSOM through the Defence Survey Oceanographic Functional Customer Group on behalf of the DMG. The second type of requirement is part of a particular survey specification and this forms the basis of the Hydrographic Instruction.
 - b. The surveyor conducts the survey in accordance with GSIs and the HI, this is the Admiralty Survey Specification.
 - c. When the survey is rendered, UKHO conducts a thorough appraisal. This includes procedures that ensure that the survey satisfied the survey specification. The RN Technical Author, the TQM system quality manager, monitors survey appraisal reports and provides factual information on the standards of rendered survey data.
 - d. RNTA collates the information for a six monthly report to the DSOF CG where standards can be discussed and amended if required to meet the customer's requirement. Following full consultation proposed amendments to HQAIs are forwarded to DNSOM for approval. The amendments to survey standards are issued as amendments to GSIs.
 - e. In a similar manner RNTA also monitors Standard Operating Procedures and, if necessary, will propose changes to SOPs. Generally, changes to SOPs will undergo trials and extensive consultation with UKHO, Captain (HM) and the Royal Naval HM School (Drake) before amendments are placed before the DSOF CG for approval.

0212 Surveying Process Feedback

1. This is the survey unit level quality assurance feedback loop.
 - a. The Hydrographic Instruction and supporting documentation is received onboard and with GSI forms the survey specification. The survey is planned so as to meet the specification as effectively and as efficiently as possible with the resources available.
 - b. Hydrographic data is collected in accordance with Standard Operating Procedures. Included in all SOPs is the requirement to remove systematic errors through calibration, correction or calculation. Survey observations are verified by comparison with the expected error model to ensure that data of a sufficient quality is being gathered as the survey progresses. If data is not of sufficient quality further observations are planned.
 - c. The observations are processed in accordance with Standard Operating Procedures. Some data may be found unsuitable for processing so further observations are planned.
 - d. The next stage of processing is to analyse the data. Firstly the accuracy and coverage are assessed and compared with the survey specification. This process provides the metadata of the survey. Again, further observations may be required.
 - e. The iterative process of planning, data gathering, processing and analysing continues until the Charge Surveyor is satisfied that the survey specification has been met as far as possible with the resources available. Any shortcomings in the specification are carefully documented.
 - f. The data is rendered to the National Hydrographer in accordance with GSIs using SOPs.
 - g. A rigorous survey appraisal is undertaken at UKHO by the Chart and specialist branches. If errors are found in the rendered data they are referred back to the Charge Surveyor for comment or correction. Finally, the fully appraised survey is presented to the National Hydrographer at 'the Work' where it is accepted into the archive as an Admiralty Survey.

0213 Training Feedback

1. This is the organisational loop that monitors and assists continual improvement in personnel surveying skills.
 - a. At the end of the survey appraisal, the Staff Officer Survey Planning reviews the errors found and considers those which may be caused by weaknesses in training. A report is prepared every six months, for the DSOFCG, which provides factual evidence to support proposed changes to Standard Operating Procedures.
 - b. Feedback on approved Standard Operating Procedures is provided by the DSOFCG to Captain (HM) and the Royal Naval HM School (Drake). This allows a long term change to Operational Performance Statement and short term changes to emphasise current surveying problems during hydrographic courses.
 - c. Revised Standard Operating Procedures also form the backbone of On-job Training to ensure that surveying methods are kept up to date and bad practice is eliminated.

0214 Equipment Feedback

1. This loop provides feedback on equipment performance.
 - a. Before any survey equipment is used in Admiralty Surveys it must undergo trials to establish its performance. The outcome of all trials will be an error model and a set of Standard Operating Procedures. Changes may also be proposed to General Survey Instructions, particularly where a new capability is established.
 - b. Trials must be conducted under realistic surveying conditions if they are to provide the data for the Charge Surveyor to make informed decisions. In particular equipment must be tested at the limit of its operating envelope and error models developed for worst case scenarios.
 - c. Once the equipment has been accepted for service it is supplied to survey units with appropriate training and SOPs are promulgated through HQAs. Equipment should also be provided to RNHMS(DRAKE) to allow career training to match the current equipment fits in the squadron.
 - d. When surveys are appraised RNTA will prepare a six monthly report highlighting any equipment weakness. This report will be presented to the DSOFCG which will provide feedback to DNSOM/PM. RNTA will also provide a current issues report to the Survey Equipment Liaison Committee, (SELC).

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 3

GENERAL SURVEYING INSTRUCTIONS

Contents

- 0301 General Surveying Instructions
- 0302 Passage Observations
- 0303 Types of Passage Observations
- 0304 Satellite Derived Positions Alongside
- 0305 Magnetic Observations Ashore
- 0306 Observations for Magnetic Variation Afloat
- 0307 Searches for Reported Dangers, Shoals or Vigias
- 0308 Names and Orthography

General Surveying Instructions

- Section A Geodetic Control
- Section B Positioning at Sea
- Section C Bathymetry
- Section D Sonar, Seabed, Wrecks and Obstructions
- Section E Tidal Heights
- Section F Tidal Streams
- Section G Coastline and Topography
- Section H Navigation Aids

- Appendix 1 Survey Standards' Tables

0301 General Surveying Instructions (GSIs)

1. GSIs for surveying operations have been divided into the following areas which make up a complete hydrographic survey:
 - a. Geodetic Control;
 - b. Positioning at Sea;
 - c. Bathymetry;
 - d. Sonar, Seabed, Wrecks and Obstructions;
 - e. Tide Heights;
 - f. Tidal Streams;
 - g. Coastline and Topography;
 - h. Navigation Aids.
2. Each GSI section conforms to the same pattern of describing surveying functions in the order:
 - a. Preparation;
 - b. Data Gathering;
 - c. Data Processing;
 - d. Data Analysis;
 - e. Data Rendering.
3. GSIs follow through the stages of a survey indicating tasks that are to be carried out or points for consideration. GSIs are not equipment specific thus reference will often be made to equipment Standard Operating Procedures for further amplification of how a task is to be conducted.
4. Ancillary observations, not covered by GSIs, are contained in the following paragraphs.

0302 Passage Observations

1. When surveying ships are not directly engaged on specific surveys or operations, no opportunity should be lost for obtaining data which may be useful to the UKHO for improving charts, publications and data bases. Confirmation that a port, stretch of coastline or passage appears to be correctly depicted on a chart, or that there are no apparent errors in the associated publications is very often extremely valuable to the UKHO and to those concerned with the compilation of new or revised charts and chart schemes.
2. Commanding Officers are to take positive steps to encourage all surveyors and chart users, both on board and when detached, to be critical of charts and navigational publications and to propose changes and additions whenever these are thought to be justified. Reports on the adequacy or otherwise of published information should be forwarded by letter or Hydrographic Note whenever appropriate. They will be especially welcome after visits to ports or areas not often visited by surveying ships, or from which it may be expected that the UKHO rarely receives information, this is of particular importance with the reduction in hulls and the expansion in operating theatres worldwide now evident.
3. As a matter of routine, ships are, where possible, to carry out the passage observations set out in 0303. Tracks are to be planned to take full advantage of their presence in an area to obtain new data and investigate charted anomalies, particularly the full spectrum of environmental data, which in many areas of the world is almost non-existent.

0303 Types of Passage Observations

1. Passage Bathymetry. See GSI Section C Bathymetry.
2. Investigation of Vigias. See 0307
3. Passage Geophysics. When on passage, gravity and magnetic data are to be recorded if practicable in accordance with FLOO 13202. The latter is less important but the former will in any case be available as continuous operation of the gravimeters is necessary between the survey ground and ports where base connections are made.
4. Published chart. When examining the detail on a published chart, particular attention should be paid to whether land features are visible from seaward (or even whether they still exist), to the prominence or otherwise of objects described or depicted as 'conspicuous' and to whether major changes have taken place in built-up areas.
5. Sailing Directions.
 - a. The information and illustrations contained in Sailing Directions should be checked as a matter of course when on passage, and all changes reported. The surveyor should assess whether the Sailing Directions contain all that it is useful for the mariner to know concerning the coast and ports, and is to report any improvements which should be made. Where possible, the necessary new information should be obtained locally, or arrangements be made for it to be forwarded to the UKHO. Ports and harbours visited must be fully described, using Form H102A as an aide mémoire. To avoid unnecessarily long descriptions of large ports it will often suffice if copies of the port brochures and regulations are obtained and forwarded to UKHO.
 - b. Amendments to the Sailing Directions are to be rendered in accordance with Chapter 4 Appendix A Annex N to the Report of Survey.
 - c. The requirements for photographs to illustrate Sailing Directions are fully described in The Mariner's Handbook (NP 100) together with methods to be employed, helpful techniques, and methods of annotating and rendering the data. See also NP140 – Views for Sailing Directions.
6. Admiralty List of Lights. The Admiralty List of Lights should be checked whilst on passage, and a careful watch maintained for new light structures, altered characteristics, and the non-existence of charted or listed lights. In particular information concerning the continuing relevance of any temporary amendments shown in column 8 of the List of Lights would be appreciated. In many parts of the world it is only from such reports that Light Lists can be kept up to date. Any correspondence concerning a light must refer to the Light List volume and the International Number of the light.
7. Admiralty List of Radio Signals The contents of all the Admiralty List of Radio Signals Volumes should be checked, not only whilst on passage but, with particular reference to volume 6, during any visit to a port or harbour. The opportunity to verify or obtain new and/or additional information on any Ship Reporting System (VTS, VTM, etc) should not be missed. Similarly, the verification of radio navigational aids (Radar Beacons, Radio Beacons, etc) in areas of little or no coverage is of some importance to the overall adequacy of the charts and publications in many areas of the world. Information can be forwarded on the report form heading section VI of the Weekly Admiralty Notices to Mariners or fronting each ALRS volume.
8. XBT and XSV observations Observations and reports are to be obtained and rendered in accordance with BR4023(4) Chapter 12, Section 2 – Oceanographic Reports, Training and Forecasts.
9. Meteorological observations See the Marine Observers Handbook and FLOOs
10. Deep scattering layer The deep scattering layer is the name given to a biological layer, consisting of plankton, and other small marine organisms, and the larger fish that feed on them. Certain of these have swim bladders which respond to echo-sounder and sonar transmissions, causing scattering of the sound waves, which may have considerable effect on sonar operations. Reports on the phenomenon are therefore important and should be rendered, on H638, in accordance with FLOO 13202 and BR4023(4) Chapter 12, Section 2 – Oceanographic Reports, Training and Forecasts.

11. Marine bioluminescence Bioluminescence is caused chiefly by marine animals varying in size from microscopic organisms to quite large fish, squid and jellyfish. It is more commonly encountered in warm waters than in cold, and is of considerable interest to marine biologists and military scientists. Reports on the phenomenon are therefore important and should be rendered in accordance with FLOO 13202 and BR4023(4) Chapter 12, Section 2 – Oceanographic Reports, Training and Forecasts. For further details, see NP100 (sections 4.46, 4.47 and 8.28). Observations should be included in Reports of Survey where appropriate, or should be forwarded by Hydrographic Note (Form H102). If samples are taken the observations are to be rendered on Form H635. Where secchi disc observations are taken and it is deemed the use of Form H635 is inappropriate, the data should be rendered on form H631, however this should be the exception.
12. Discoloured Water Areas of discoloured water are generally recognised to be almost always biological in origin. Water samples from such areas are of considerable interest and should be obtained and reported as for Marine Bioluminescence, see paragraph 11 above.
13. Whales, Marine Life and Fishing Activity
 - a. Whale movements and those of other marine species are of considerable interest in ASW. They are to be reported in accordance with FLOO 13202 and BR4023(4) Chapter 12, Section 2 – Oceanographic Reports, Training and Forecasts. For reference see SLB 56 (British Whales, Dolphins and Porpoises) and SLB 57 (British Turtles).
 - b. The presence of commercial fishing activity is of importance as the sound generated by engines and deployed fishing gear may significantly affect ambient noise levels. Also the occurrence of a fishing fleet may indicate the presence of large fish populations. Sound scattering caused by shoals of fish may inhibit sonar performance. Sightings should be included in Annex S of the Report of Survey on Form H637 where appropriate, or should be forwarded to the UKHO by Hydrographic Note (Form H102), marked 'for the attention of MEIC'. Details on H637 should include:
 - i. Ship's name;
 - ii. Position;
 - iii. Date;
 - iv. Time (Zulu);
 - v. Number of vessels sighted, description of activity e.g. "no gear deployed", "trawling" ;
 - vi. Direction of movement.
14. Current Observations
 - a. In accordance with FLOO 13202, ships on passage should observe the effects of ocean currents by comparison of DR and reliable fixes, particularly in waters where data are sparse. Results are to be rendered digitally in spreadsheet format to MEIC at UKHO, Taunton.
 - b. An estimate of the current profile at an oceanographic station may be made by the use of two S4 current meters (set to read in real time), one of which is kept at the surface (or 1-2 metres deep) and the other lowered and read, after settling, at discrete depths. The method is much improved if the ship's position can be fixed at frequent intervals and her drift thus measured, but it is, at best, crude by comparison with the preferred method of mooring a string of several internally-recording current meters at various depths for a period of several weeks, or even months. If S4s or other recording current meters are used, the recovered data, after checking, should be rendered on disk to MEIC at UKHO, Taunton, for processing, with a covering note giving station number, depth of water and location details.
 - c. A number of different types of instrument specifically designed to measure current shear (or profile) are now becoming available for general use; HIs requiring the use of such instruments will include specific directions for their handling, data to be rendered, etc.
15. Ornithology
 - a. Bird watching, and the recording of observations, is of considerable interest and value, as movements and population fluctuations may be connected with changing oceanographic conditions.
 - b. If an ornithological enthusiast is borne, a log should be maintained at sea to record all sightings of

birds, and whether any land on board. The Royal Naval Bird Watching Society issues the following forms on request:

- i. Sea Report Sheets (land and sea birds);
 - ii. Census sheets;
 - iii. Report of Bird Examined in the Hand.
- c. Reports are analysed by experts who may query discrepancies and ask for additional information. Any birds examined in the hand should be measured in accordance with the form iii., above and, where possible, photographs should be taken from above, below and the side to assist in identification.
- d. Forms may be obtained from:
- C A R Bailey,
8 Grange Close,
Gosport,
Hants
P012 3DX.
- e. Copies of completed forms are to be forwarded to UKHO attn MEIC, original forms, photographs and general enquiries about birds should be addressed to:

The Editor, SEA SWALLOW
Dene Cottage
West Harting
Petersfield
Hants
GU31 5PA

0304 Satellite Derived Positions Alongside

1. A valuable determination of geographical position may be obtained by use of the ship's satellite navigation system(s). The connection between the local horizontal datums and WGS 84 Datum has not been established for a number of BA charts and many carry a cautionary note beneath the title stating that positional discrepancies between the chart and WGS 84 Datum positions may be significant to navigation.
2. The following points should be considered when undertaking such observations:
 - a. Observations:
 - i The position output by the ship's receiver must be referred to the WGS 84 Datum. Any automatic transformations carried out by the receiver to give a position referred to a local or chart datum should be disabled.
 - ii The best results will be obtained if the ship is firmly secured alongside in a sheltered berth.
 - iii The position of the antenna should be fixed with respect to charted features as accurately as possible. Where possible a 3D connection should be made to a known geodetic control.
 - iv GPS observations, data should be gathered over a period of 30 minutes with preferably 4 satellites in view above 10° and PDOP less than 10.
 - b. Minimum data required:
 - i Locality (name of harbour, port, island, etc);
 - ii Cutting/copy of BA chart showing chart number, date of latest edition, and charted position of antenna.
 - iii Date and time of observations.
 - iv GPS observations for Latitude, Longitude, and Height should be recorded at regular intervals of no more than 2 minutes.

- c. The following additional data should be forwarded if available:
- i Height of antenna above mean sea level.
 - ii Details of connection to local geodetic control.
 - iii Whether berthed alongside or at anchor, including weather and tidal conditions.
 - iv Estimated movement of vessel during observations, if any.
 - v Ship's vertical motion during the observations related, by tide readings, to local land survey datum.
 - vi Details of Receiver and serial number.
 - vii The initial reference position (Latitude, Longitude and Height above mean sea level).
 - viii The Spheroidal or Geoidal Height used in the computation and the Geoid/Spheroid separation applied (as well as the source), if used.

0305 Magnetic Observations Ashore

1. Magnetic observations ashore will normally be ordered in the HIs, and the instruments issued to ships as necessary. As magnetic observations are infrequently made, the officer nominated to conduct them will receive instruction at the Royal Magnetism Observatory, Hartland Point.
2. When a ship is fully equipped to carry out magnetic HIs ashore, the opportunity should be taken to observe not only at stations ordered but at others at which there have been previous observations. Because of the considerable time lapse likely since the last occupation of such a station, the proof of its existence is useful even if a full set of observations cannot be undertaken.
3. Details of the instruments used, the methods of operating them, and of calculating and rendering the results will be provided to the ships concerned.

0306 Observations for Magnetic Variation Afloat

1. Worldwide satellite coverage has reduced the requirement to conduct observations for magnetic variation afloat. However in areas where a local magnetic anomaly or incorrect modelled values are suspected then results obtained from running the procedure detailed below would be of considerable benefit.
2. Whenever time allows, if isogonals are considered to be incorrect, and in waters of suitable depth, observations for magnetic variation should be obtained and reported in accordance with FLOO 13202; the procedure below should be run to confirm the data. When variation cannot be measured ashore due to local magnetic anomalies, it may be measured at sea nearby if depths of more than 100 metres can be found.
3. The ship should be steamed slowly in a wide circle both to port and starboard, and observations of the sun, or another heavenly body, made with the standard compass on 8, or (preferably) 16, equidistant points during each circle. The ship should be steadied on each heading for at least a minute before the observation to allow the sub-permanent magnetism, resulting from the last course, to disappear.
4. In a survey area within sight of land, it may be possible to fix the ship by conventional means during the swing and use a distant land object, which has already been fixed, as the reference. The position of each fix should then be plotted or computed, and the magnetic bearing calculated for comparison with that observed.
5. No special precautions are necessary in respect of normal DG installations, and it is usual to make these observations with DG off. The method of observing is intended to remove the effects of the ship's magnetic field as far as possible, and the mean figure for the two circles will provide the best value for variation possible by this means. It is inadvisable, however, to make observations within a week of 'deperming' or 'wiping' operations.
6. Results are to be rendered to the UKHO on Form H488.

0307 Searches for Reported Dangers, Shoals or Vigias

1. Reported dangers in the oceans are often referred to as 'vigias'. Charge Surveyors are to take positive steps to identify any which lie in the vicinity of the survey ground or within a reasonable distance of their tracks when on passage, and are to investigate these whenever the opportunity allows. The examination of vigias is a 'surveying activity' for which diplomatic clearance must first be obtained if undertaken in foreign territorial waters.
2. When a specific HI is issued to investigate a vigia or vigias, a scale for the survey may be ordered; in other cases, Charge Surveyors should, using their discretion, conduct the search to suit the particular circumstances prevailing. Seamounts or shoals revealed by these searches are to be fixed by the most accurate methods available and their least depth obtained. The extent of the feature should be established by sounding until agreement with charted depths has been reached. Bottom samples should be obtained on the crest and, if depths are not extreme, near the base also.
3. When planning such investigations it is important to evaluate the accuracy and reliability of the original report. Guidance for this is given in AMHS Vol II, Chapter 3. The extent of the area to be searched will depend upon the assessed accuracy of the reported position and to a lesser extent on the accuracy of the position of the searching vessel. There will generally be three considerations when planning the examination: the radius of the area to be searched, the spacing between lines of sounding and the time which should be allocated to the search. Hard and fast rules have no place in this planning process where there is no substitute for experience, common sense and the proper knowledge of both present equipment and that in use at the time of the original report.
4. The radius of the search for a reported danger will depend upon a reliable assessment of the positional accuracy of the original report. If the position is reliable, the radius of the circle of search should be 2.5 times its accuracy, expressed as a standard error (σ). When acceptable data on the accuracy of position is not available, the following criteria apply:
 - a. When within sight of a well defined land area, the radius should be taken as a minimum of 1.5 nautical miles, although 2.5 miles should be used if time permits.
 - b. When out of sight of a well defined land area the date of the report of the danger will have a significant effect on the area to be searched. A table of the likely accuracies has been devised from assessments made in the UKHO and elsewhere of the aids available for ocean navigation.

Date of report of danger or shoal sounding	Standard error in position (minimum search radius) in nautical miles	
	On continental shelf	Off continental shelf
pre 1830	18	20
1850	18	20
1895	17	19
1905	15	17
1915	13	15
1925	11	13
1935	9	11
1945	7	9
1955	5	7
1965	3	5
1975 and after	3	5

5. It should be noted that these are the probable positional errors and are the minimum radii to be searched if time does not permit a more thorough examination. In order to disprove a reported danger or shoal fully, the radius of the area to be surveyed should be up to 2.5σ (97% probability). Whilst this may appear to constitute an inordinate amount of work, it should be noted that the lines of sounding may be opened out considerably in accordance with the following paragraphs.
6. The Charge Surveyor is to determine what search radius is to be used, but it should be remembered that it is better to examine a small area thoroughly than a large one superficially.

7. The density of data acquisition (line spacing) will depend upon the general depth of water, the beam-width of the echo-sounder in use and the repeatability of the search vessel's positioning system.
8. In general depths between 0 and 200 metres, the guidance provided by GSI Section C Bathymetry should be followed; sidescan sonar (if available) should invariably be used and the use of hull mounted sonars, gravimeters and magnetometers should also be considered. It will be up to the Charge Surveyor to assess the category of sonar sweep achievable in the time available, however a Category A search should if at all possible be attempted.
9. In general depths over 200 metres, the guidance given in AMHS Vol II Chapter 3 figure 3-55 can generally be followed. It can be shown that line spacing may be derived theoretically from the following formulae:

$$\begin{array}{ll} \text{200-2000 metres:} & I = 2H (\tan(\alpha/3) + 0.29) - 2E_s \\ \text{Over 2000 metres:} & I = 2H (\tan(\alpha/3) + 0.0002H) - 440 - 2E_s. \end{array}$$

Where:

- I is the line spacing in metres;
- H is the general water depth or depth found on adjacent lines;
- α is the apex angle of the cone of insonification of the echo-sounder (-3 dB) or half power down points;
- E_s is the repeatability of the positioning system in use.

These formulae should not be followed dogmatically. Common sense should dictate line spacing, and the graph given in AMHS Vol II will suffice for most searches. Ships fitted with a swath sounding system should use the formulae quoted above, or produce their own graph of seabed gradients versus line spacing.

10. Evidence suggests that gradients in excess of 30° exist near mid ocean ridges, large fracture zones, escarpments and trenches. Line spacing must, therefore, be reduced in these areas and the graph in AMHS Vol II should be used with great caution. In cases of doubt, advice on the geological nature of the seabed should be sought from the UKHO. GEBCO 5th edition sheets should be consulted if available.
11. Cross lines should be run at intervals not greater than 10 times the intended line spacing. Line spacing may be increased moderately when the geology of the seabed is well known and does not support the probability of the existence of the reported anomaly.
12. The chances of detection would be considerably enhanced if either gravity or magnetic observations, or both, can be run concurrently, as dangers and shoals in ocean areas usually give rise to considerable geophysical anomalies.

Reports

13. The IHO has produced a standard report form for the search for doubtful data. Some of the information required can only be provided by the UKHO. Ships are to submit a Report of Survey as follows:
 - a. Narrative description of the search, including weather and sea conditions, and other observations (e.g. discoloured water); any local information obtained; criteria used to determine the basis of the search, including an estimate of the standard error in the reported positions; the dimensions of the area searched and the line spacing interval; the speed of advance; scale of the survey; geodetic reference system; and tidal corrections used.
 - b. Technical details should be provided specifying the following:
 - (1) The positioning system used, together with its standard error and relative accuracy;
 - (2) Details of echo-sounders and sonars used together with beam angles, frequencies and calibration data;
 - (3) Use made of wire sweeps, bottom samplers and geophysical equipment.

The results of the search are to include a definitive statement from the Charge Surveyor confirming or disapproving the existence of the danger, together with his justification for this statement. If the feature was found, its least depth and position are to be given together with a statement of how these were determined, and whether bottom samples were obtained.

14. Charting action to remove doubtful data will generally only be taken if the following statements can be justified:
 - a. The area of search covered the probable position of the reported hazard.
 - b. The line density was sufficient to have ensured detection of the feature.

0308 Names and Orthography

1. Names should be accepted from the latest maps (or charts) of an area, where these are published by an authoritative source. Names and spelling from maps are usually accepted for features above MLWS.
2. In areas where there are no modern maps or charts, every effort must be made to ascertain the correct names and spelling from local authoritative sources. The source from which names have been obtained is essential information and should be given in the Report of Survey. If any modern land mapping is obtained locally and used to confirm names, copies should be forwarded with the Report of Survey.
3. Often the greatest impediment to accurate recording of place names is the double difficulty of ensuring that the informant understands what is being asked and that the reply is correctly interpreted topographically. Different people can view the land and their physical surroundings in different ways according to their needs and mode of life, and consequently have different naming habits. Names should, if possible be checked with two or more independent informants, whose status is to be reported.
4. Within territorial waters, it is the policy to follow the names used by the country having sovereignty over the area for both the proper name and the generic term associated with it, Mariner's Handbook (NP100) Sections 1.135 to 1.148. Names in languages not using the Roman alphabet are transliterated according to standard systems of transliteration agreed by the Permanent Committee on Geographical Names for British Official Use (PCGN). The source from which transliterated local names are obtained must be quoted by the surveyor in order that the transliteration can be checked in UKHO with PCGN rulings. Names should be obtained in the local alphabet as well as Roman transliteration. On older charts, it may be found that many names are not in agreement with the above policy, but the modern name should be used by the surveyor with the old charted name in brackets following. Names already established should not be altered by the surveyor without making proposals and giving reasons for the alteration. It is also important to ensure that the correct form of any generic term is obtained. In some languages, the translation of words such as Bay or Channel may have several different forms with different endings depending on the gender or other grammatical features of the governing name.
5. New names for features above MLWS should not be invented without reference to local authorities. This ruling also applies to newly found underwater features when these lie within national limits, as although the feature may be hitherto apparently undiscovered, local fishermen may well have names for them. The generic term used in the name should be that in the local language. The names of any newly located underwater features for which names cannot be discovered locally may be proposed and used in the survey. The Report of Survey is to indicate proposed names and brief reasons for choosing them. However surveyors should be aware that the Ordinance Survey and the Hydrographer are responsible for the naming of feature above and below MLWS respectively around the UK. There are other national organizations around the world with similar responsibilities, additionally the Antarctic Place Names Committee is responsible for features above MLWS in the Antarctic area. Surveyors are encouraged to submit names for new features, above and below MLWS, that are discovered during the course of a survey but it should be remembered that the final decision lies solely with the above authorities, who will approve and publish new names as required.
6. It is undesirable to have too many names. The need to name a feature depends primarily on its significance to the mariner and navigation and new names should not be proposed for minor or insignificant features.

GENERAL SURVEY INSTRUCTION

A - GEODETIC CONTROL

SURVEY STAGE	GROUP	REQUIREMENT	STANDARD TABLE	GSI	ISSUE DATE
Preparation	Planning	Identify existing control	1	A.1.1	31 Mar 01
		Datum, Projection & Grid			
		Transformation of Co-ordinates	1		
		Network Analysis			
		Geodetic GPS		A.1.2	31 Mar 01
	Calibration	Equipment Calibration		A.1.3	31 Mar 01
Data Gathering	Validation	Existing Stations	1	A.2.1	31 Mar 01
		New stations	1		
	Observations	Angular	3	A.2.2	31 Mar 01
		Distance	3	A.2.3	31 Mar 01
		Geodetic GPS	3	A.2.4	31 Mar 01
Data Processing	Editing	Angular Observations	3	A.3.1	31 Mar 01
		Distance Observations	3		
		Geodetic GPS	3		
	Calculation	Reduction of Observations		A.3.2	31 Mar 01
		Geodetic Position		A.3.3	31 Mar 01
Data Analysis	Quality	Position	1	A.4.1	31 Mar 01
Data Rendering	Plots	Bathymetric Sheet		A.5.1	1 Aug 02
		Tracings to Accompany			
		Diagram of Control			
	Reports	Geodetic Data		A.5.2	31 Mar 01
		Report of Survey			
		Field Records		A.5.3	31 Mar 01

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – PREPARATION – PLANNING
A.1.1	

REQUIREMENT
To identify relevant geodetic control and to plan extension of control.

INSTRUCTION
<ol style="list-style-type: none"> 1. Identify from geodetic data received from UKHO relevant control stations of an accuracy to support the order of survey stated in the HI. Request additional data from UKHO if necessary. 2. Check co-ordinates for stations selected are on the datum, projection and grid specified in the HI. If necessary transform co-ordinates by using the approved computer program or refer the stations to the UKHO Geodesy section for transformation. Verify transformed co-ordinates meet the standard of the order of survey. 3. Identify any gaps in the geodetic control network and any extensions required. 4. For GGPS, observation networks should include at least two existing control stations where the WGS84 Datum co-ordinates are known or can be determined. In UK, these sites should be at least second order, preferably first order, OS sites. When observing outside of UK advice should be sought from UKHO, Geodesy section. 5. For non GPS methods of observing, plan extensions and additions to the control network using the approved computer program ensuring that any planned new stations meet the standard for the order of survey. 6. Verify any geodetic data obtained from local sources, at home and abroad, to ensure that positional accuracy meets the specification for the order of survey. If doubt exists regarding local data seek early advice from UKHO Geodesy section before use. 7. The requirement to determine the heights of geodetic stations and objects is to be identified. Items for which heights are required include geodetic control stations, summits visible from seaward, lighthouses, beacons and other navigational aids, cliffs, islands, rocks and jetties.

STANDARD
All relevant geodetic control identified and confirmed on the correct datum, projection and grid. New control planned and assessed at the correct specification.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.1.1

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL - PREPARATION – PLANNING - GGPS
A.1.2	

REQUIREMENT
To conduct observation planning for GGPS

INSTRUCTION
<ol style="list-style-type: none"> 1. Define and organise the file management structure before observing. This is essential if data is not to be lost or overwritten at the post processing stage. File management notes are included in the relevant equipment SOP. 2. Allocate site names to selected control stations. See specific SOP for details. 3. Identify the optimum observing periods, using the Mission Planning software, to achieve the order of standard for the survey. 4. Produce an observing programme. See specific SOP for details. 5. Prepare observer's briefing sheet to ensure that observers gather simultaneous data at all stations to be co-ordinated during a session. Briefing sheets should be provided for each station.

STANDARD
To produce an observing plan that meets the order of standard for the survey.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
a. Observing Plan	NA	Geodetic data File	NA
b. Observing brief			

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.1.2

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETTIC CONTROL – PREPARATION – CALIBRATION – EQUIPMENT CALIBRATION
A.1.3	

REQUIREMENT
To determine the equipment required for geodetic control observations. Calibrate equipment.

INSTRUCTION
<ol style="list-style-type: none"> 1. Determine the equipment required to obtain observations of the appropriate type and standard for the establishment of any new control. 2. Calibrate all equipment in accordance with the relevant SOP. 3. Record calibration details for inclusion in the Report of Survey.

STANDARD
All systematic errors removed.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	Geodetic data File	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.1.3

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – DATA GATHERING – VALIDATION – EXISTING AND NEW STATIONS
A.2.1	

REQUIREMENT
To confirm the validity of established stations and to confirm the suitability of old and new station sites.

INSTRUCTION
<p><u>A. Established Control Stations</u></p> <ol style="list-style-type: none"> Each station selected for use to be visited and carefully checked against the station description. Confirm distances to fixed reference points to determine if the station marker has been displaced. Check for any suspected scale error in the original control by measuring several lines in the original control scheme. Apply correction. Re-observe for position, before use, any station whose position is in doubt. Record any station either suspect, destroyed or of no further use. Record in the Geodetic Data file on Form H159a and the Report of Survey. <p><u>B. New Control Stations</u></p> <ol style="list-style-type: none"> For GGPS stations the following site selection criteria apply: <ol style="list-style-type: none"> Station free of obstructions above 10 deg elevation around the site; Station clear of reflecting surfaces such as overhead cables, bridges, etc Station clear of overhanging vegetation; Stations need not be inter-visible. For conventionally observed stations check suitability of station position for inter-visibility to survey area and other stations. New stations should be linked to three established stations. The use of eccentric stations should be avoided. Any such station should be properly co-ordinated as part of the control network. If, exceptionally, any measurements are obtained using a magnetic compass, they should be carefully made and correction for magnetic variation accurately applied. Amendments to the planned scheme due to unsuitability of sites should be re-analysed to ensure that the standard for the order of survey is being met before observations are made. Mark and describe stations before observing at or to them.

STANDARD
That all chosen established stations and planned new stations meet the standard for the given order of survey.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Station Description	NA	H159/H159a Station Description	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.2.1

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL - DATA GATHERING – OBSERVATIONS – ANGULAR
A.2.2	

REQUIREMENT
To obtain angular measurements for geodetic control.

INSTRUCTION
<p><u>Horizontal Observations</u></p> <ol style="list-style-type: none"> Determine angular measurements to be taken at each station and the standards required. Set up and operate previously calibrated observing instrument as laid down in the relevant SOP. Record observed angular measurements in H7, Field Book. Before moving the observing instrument verify data recorded to ensure observations are to the standard required. If standards are not met re-observe. Repeat until standards are met. <p><u>Vertical Observations</u></p> <ol style="list-style-type: none"> All newly co-ordinated stations, and all established stations for which heights are not known, are to have their heights determined and recorded on form H159. When determining heights by angular measurement reciprocal heighting is to be used whenever possible. Set up and operate previously calibrated observing instrument as laid down in the relevant SOP. Record observed angular measurements in H7, Field Book. Before moving the observing instrument verify data recorded to ensure observations are to the standard required. If standards are not met re-observe. Repeat until standards are met.

STANDARD
Angular measurements obtained to the standards in HQAs Chap 3 Appendix 1

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H7 Field Book	NA	H157 Record of Horizontal and Vertical Angles	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.2.2

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL - DATA GATHERING – OBSERVATIONS – DISTANCE
A.2.3	

REQUIREMENT
To obtain distance measurements for geodetic control.

INSTRUCTION
<ol style="list-style-type: none"> 1. Determine distance measurements to be taken at each station and the standards required. 2. Set up and operate previously calibrated observing instrument as laid down in the relevant SOP. 3. Record observed distance measurements in accordance with the relevant SOP 4. Before moving the observing instrument verify data recorded to ensure observations are to the standard required. 5. If standards are not met re-observe. Repeat until standards are met.

STANDARD
Distance measurements obtained to the standards in HQAIs Chapter 3 App 1

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
See para 3 above	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.2.3

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – DATA GATHERING – OBSERVATIONS –GEODETIC GPS
A.2.4	

REQUIREMENT
To obtain GGPS observations for geodetic control.

INSTRUCTION
<ol style="list-style-type: none"> 1. Set up and operate GGPS system in accordance with the SOP and prepared observing plan. 2. Heights of geodetic control stations are to be determined using GGPS whenever possible.

STANDARD
Geodetic GPS observations obtained to the standard in HQAIs Chapter 3 App 1

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
As required by SOP	NA	As required by SOP	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.2.4

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – DATA PROCESSING – EDITING – ANGULAR/DISTANCE/GGPS
A.3.1	OBSERVATIONS

REQUIREMENT
To inspect observed data and reject invalid data.

INSTRUCTION
<p><u>A. Angular Measurements</u></p> <ol style="list-style-type: none"> 1. Transcribe observed data from Field Book to H157, Record of Horizontal and Vertical Angles. 2. Verify that data has been transcribed correctly and that observations conform to the required standard. Reject any doubtful or invalid data. <p><u>B. Distance Measurements</u></p> <ol style="list-style-type: none"> 1. See SOP for system in use. 2. Transcribe observed data on to form H31A, one for the measurement of each line. All observed distances are to be recorded, including any not used in the field adjustment, to permit later, more rigorous, UKHO adjustment. <p><u>C. GGPS</u></p> <ol style="list-style-type: none"> 1. See SOP for system in use.

STANDARD
All observed data accurately recorded and invalid data rejected

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	<ol style="list-style-type: none"> 1. H157 2. H31a 3. GGPS as per SOP 	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.3.1

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – DATA PROCESSING – CALCULATION – REDUCTION OF OBSERVATIONS
A.3.2	

REQUIREMENT
To reduce observed data to the grid.

INSTRUCTION
<p>1. Verified final angular and distance observations should be adjusted to the grid as appropriate for each type of observation by using the approved computer program.</p>

STANDARD
Observations correctly reduced and verified for final computation of geodetic positions.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	H157	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.3.2

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – DATA PROCESSING – CALCULATION – GEODETIC POSITION
A.3.3	

REQUIREMENT
To compute geodetic control station positions.

INSTRUCTION
<p><u>A. Non GPS Control Observations</u></p> <p>1. Use the approved computer program to compute the Most Probable Position and Error Ellipse data.</p> <p><u>B. Static GPS</u></p> <p>1. See SOP for system in use.</p>

STANDARD
Station position meet the accuracy set down in the HI and the order of standard required.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	Geodetic Data File	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.3.3

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – DATA ANALYSIS – QUALITY - POSITION
A.4.1	

REQUIREMENT
To analyse the quality of the final positional data.

INSTRUCTION
<ol style="list-style-type: none"> 1. The error ellipse of each new station position should be carefully examined to determine the quality of the final position. 2. If a rigorous adjustment produces large residuals but the correct observing technique has been used and observations are within rejection criteria, the following should be checked before seeking more complex explanations: <ol style="list-style-type: none"> a. Observations may be either incorrectly weighted (where mixed observations are being adjusted) or incorrectly reduced. b. Observations may have been made to/from incorrect marks. c. Incorrect co-ordinates may have been used for the fixed stations. d. The instrument may have been incorrectly centred or the height may have been poorly measured. 3. Network analysis for non GPS control networks should be conducted using the approved computer program. For GGPS networks refer to the SOP. 4. For GGPS schemes, only one known point should be held fixed in the adjustment process. Where further points in the scheme are known points, a comparison should be made between the computed co-ordinates as a result of the adjustment and the original known co-ordinates. 5. Verify that positional accuracy conforms to the requirement laid down in the HI and in the RN Surveying Standards Table at Chapter 3 Appendix 1 Table 1.

STANDARD
Positional accuracy conforms to the requirement laid down in the HI and in the RN Surveying Standards Table, Table 1.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	Geodetic Data File	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.4.1

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – DATA RENDERING - PLOTS
A.5.1	

REQUIREMENT
To show all geodetic control in graphic format if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<p>A. <u>Bathymetric Sheet</u></p> <ol style="list-style-type: none"> Stations to be plotted in accordance with HQAIs Chapter 5, Appendix 1. Independently verify station positions plotted correctly and station letters/symbols shown correctly. <p>B. <u>Tracings To Accompany</u></p> <ol style="list-style-type: none"> Stations to be plotted in accordance with HQAIs Chapter 5, Appendix 1. Independently verify station positions plotted correctly and station letters/symbols shown correctly. <p>C. <u>Diagram Of Control</u></p> <ol style="list-style-type: none"> To be prepared in accordance with instructions at page 4 – A1 – 6. Independently verify station positions, observations, letters and symbols are shown correctly.

STANDARD
All geodetic control accurately and correctly recorded on fair graphics.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	Geodetic Data	As above.

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
2/02

Date
1 Aug 02

GSI Number
A.5.1

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – DATA RENDERING – REPORTS
A.5.2	

REQUIREMENT
To render a full and comprehensive report on the geodetic control.

INSTRUCTION
<ol style="list-style-type: none"> 1. Geodetic data is to be rendered following the instructions at HQAs Chapter 4. 2. The record of geodetic data is a vital document in assessing the overall quality and accuracy of the survey. Every care should be taken over it's preparation and checking before rendering to UKHO.

STANDARD
Details of all geodetic observations, computations and supporting documentation accurately rendered.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	As above	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.5.2

GENERAL SURVEY INSTRUCTION

GSI Number	GEODETIC CONTROL – DATA RENDERING – REPORTS - FIELD RECORDS
A.5.3	

REQUIREMENT
To render field records to UKHO.

INSTRUCTION
<ol style="list-style-type: none"> 1. The original working, or field, records form an integral part of any survey. They are to be carefully preserved on board and are to be rendered to UKHO at the earliest opportunity after receipt of the 'Survey completed letter'. 2. All records must be clearly and correctly annotated before despatch to UKHO. 3. Records should be forwarded to UKHO in standard boxes provided by UKHO and clearly labelled. One form H658 is to be attached to the H28 and a second copy packed within the box. Records that will not fit in the standard boxes should be packed in alternative suitable packaging. 4. Records from different surveys are not to be packed together. Data classified Restricted or above is to be packed separately from unclassified material. 5. The following is a list of records to be forwarded: <ol style="list-style-type: none"> a. Field books; b. EDM field sheets; c. Original and other documents supplied on loan from UKHO; d. Computer printouts. 6. Rough drafts of fair records submitted to UKHO are not required by UKHO and may be destroyed one year after completion of the survey.

STANDARD
Field records correctly rendered to UKHO

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
A.5.3

GENERAL SURVEY INSTRUCTION

B - POSITIONING

SURVEY STAGE	GROUP	REQUIREMENT	STANDARD TABLE	GSI	ISSUE DATE
Preparation	Planning	GPS	1 & 2	B.1.1	31 Mar 01
		EPF			
	Calibration	EPF	2	B.1.2	31 Mar 01
Data Gathering	Verification	GPS	2	B.2.1	1 Feb 02
		EPF	2	B.2.2	1 Feb 02
		Survey System			
	Observations	EPF Systems	1 & 2	B.2.3	1 Feb 02
		GPS System			
	Logging	Survey Systems		B.2.4	1 Feb 02
Data Processing	Editing	Track Editing		B.3.1	31 Mar 01
Data Analysis	Quality	Position statistics	1 & 2	B.4.1	31 Mar 01
	Coverage	Edited Track		B.4.2	31 Mar 01
Data Rendering	Plots	Track Plot		B.5.1	1 Aug 02
	Reports	Report of Survey		B.5.2	31 Mar 01
		Field Records			
	Digital Data	Track and Profile Data		B.5.3	31 Mar 01

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – PREPARATION - PLANNING – GPS -EPF
B.1.1	

REQUIREMENT
To plan the use of the position fixing system ordered in the HI.

INSTRUCTION
<ol style="list-style-type: none"> Details of the deployment of the EPF system ordered in the HI are contained within the relevant SOP. Frequency clearance is not required for microwave EPF systems. Mutual interference with other users is possible and a close liaison with other users should be maintained to counter such problems. When planning the use of microwave EPF systems to validate GPS positional data care is to be taken to ensure that established stations are all on a common datum. Doubts regarding datums are to be referred to UKHO at the earliest opportunity. The theoretical GPS coverage should be reviewed for the survey location and anticipated period of surveying. Any periods of potential poor coverage should be relatively rare now the full constellation is active but it should be reviewed at the planning stage, and noting any that do exist.

STANDARD
Deployment of the EPF system planned to meet the requirement of the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 3 & 4	Annexes B & D

Issue Number
1/02

Date
31 Mar 01

GSI Number
B.1.1

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – PREPARATION - CALIBRATION - EPF
B.1.2	

REQUIREMENT
To calibrate the EPF system.

INSTRUCTION
<ol style="list-style-type: none"> 1. Systems are to be calibrated at the start and end of each survey. Notable differences between pre-survey and post-survey calibrations are to be highlighted and their likely effect on the positional accuracy of the survey is to be noted in the RoS. 2. If the system units are changed for uncalibrated ones or the positioning QC indicates poor performance of the EPF system then re-calibration is to be conducted. 3. Systems are to be calibrated in accordance with the relevant SOP. Results of the calibration are to be included in the RoS.

STANDARD
Calibration of the EPF system maintained throughout the survey.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Calibration Sheets	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 3 & 4	Annex D

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
B.1.2

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA GATHERING – VERIFICATION – GPS
B.2.1	

REQUIREMENT
To verify that positional data is both valid and logged correctly.

INSTRUCTION
<p><u>GPS</u></p> <ol style="list-style-type: none"> As the Global Positioning System (GPS) cannot be calibrated by an individual user, it is essential that the system be validated by comparison with an alternative precise positioning system. The two principle types of validation that can be performed are Static validation and Dynamic validation. A static validation is a simple comparison of the vessels GPS antenna (or Reference point) position derived by the vessels DGPS and that derived by an alternative precise positioning technique. A Dynamic validation should be carried out with the vessel underway in a "Survey" type environment and provides a more rigorous comparison of the DGPS and vessel Survey System against an alternative precise positioning system. Minimum Validation requirements are: <ol style="list-style-type: none"> A full Dynamic validation at the start of the survey. The validation should last between 30-45 minutes. The vessel should be navigated in a Box pattern during the validation; this will then highlight any errors in the survey system such as layback model errors. 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 further validation should be carried out at the end of the survey period; this may consist of a Static validation only. If at any time during the survey any significant changes are made to the positioning equipment antennas or software then a full Dynamic validation should be repeated. If in doubt as to the significance of the changes then please seek clarification from HDC (Geodesy) at the UKHO. It is envisaged that where a unit mobilises to survey for a season the Dynamic validation will take place on mobilisation and the final static validation will take place at the end of the season. In addition a further static check should be carried out at an interval of no more than four months. The practice of carrying out static checks on a more regular basis as the survey progresses is good general surveying practice.

STANDARD
Positional data verified as valid and logged correctly.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
See SOP	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 4	Annex B

Issue Number
1/02

Date
01 Feb 02

GSI Number
B.2.1

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA GATHERING – VERIFICATION – EPF – SURVEY SYSTEM
B.2.2	

REQUIREMENT
To verify that positional data is both valid and logged correctly.

INSTRUCTION
<p><u>EPF</u></p> <p>1. Where possible EPF calibrations are to be periodically validated by conducting baseline crossings between pairs of EPF stations. The sum of the ranges being equal to the baseline length. All such verifications and their results are to be included in the RoS. See relevant system SOP.</p> <p><u>SURVEY SYSTEM</u></p> <p>1. Details of logging rates and logging verification are given in the relevant SOP.</p>

STANDARD
Positional data verified as valid and logged correctly.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
See SOP	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 4	Annex B

Issue Number
1/02

Date
01 Feb 02

GSI Number
B.2.2

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA GATHERING – OBSERVATIONS – EPF - GPS
B.2.3	

REQUIREMENT
To gather positional data accurately and efficiently.

INSTRUCTION
<ol style="list-style-type: none"> Laybacks are to accurately deduced and verified as correct in the survey processing system. Positional data is to be gathered in accordance with the SOP for the equipment in use. <p><u>GPS</u></p> <ol style="list-style-type: none"> The use of DGPS should be in accordance with the 'Guidelines for the Use of Differential GPS in Offshore Surveying' issued by the UK Offshore Operators Association (UKOOA). This document provides the essential guidance, explanation, and definition concerning the quality control measures required for the best use of DGPS. The specific settings to use in the Quality Control menus of the DGPS system in use are specified in the relevant SOP.

STANDARD
Positional data gathered to the order specified in the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Data Logging Files	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 3 & 4	Annex B

Issue Number
1/02

Date
01 Feb 02

GSI Number
B.2.3

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA GATHERING – LOGGING – SURVEY SYSTEMS
B.2.4	

REQUIREMENT
To log positional data for transfer to the processing system.

INSTRUCTION
<ol style="list-style-type: none"> Fix interval and logging intervals are to be set as required by the scale of the survey and the SOP for the survey processing system in use. Fix intervals are to be set such that fixes are at least 25 mm apart on paper at the scale of the survey Positional data is to be logged in accordance with the SOP for the equipment in use. See also GSI C.2.3.

STANDARD
All positional data correctly logged.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Data Logging Files	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 3	Annex B

Issue Number
1/02

Date
01 Feb 02

GSI Number
B.2.4

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA PROCESSING – EDITING – TRACK EDITING
B.3.1	

REQUIREMENT
To remove invalid observed positional data to produce a valid track record.

INSTRUCTION
<p>1. Positional data is to be inspected and edited in accordance with the SOP for the survey processing system in use and the specifications set out in Chapter 3 Appendix 1.</p>

STANDARD
All invalid positional data removed from the track record.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 3	Annex B

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
B.3.1

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA ANALYSIS – QUALITY – POSITION STATISTICS
B.4.1	

REQUIREMENT
To assess the quality of positional data.

INSTRUCTION
<ol style="list-style-type: none">1. Positional data is to be assessed in accordance with the SOP for the positioning and survey processing systems in use.2. Areas where it is considered that the positional specifications for the survey have not been met, or are at all suspect, are to be resurveyed.

STANDARD
Positional data assessed to ensure that observed data meets the survey specification.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 4	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
B.4.1

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA ANALYSIS – COVERAGE – EDITED TRACK
B.4.2	

REQUIREMENT
To examine edited track data to ensure that the survey area has been covered as required by the specification ordered in the HI.

INSTRUCTION
<p>1. Edited track plots are to be carefully inspected to determine:</p> <ul style="list-style-type: none"> a. Along track gaps in soundings from SBES; b. Across track and along track gaps in bottom coverage for MBES; c. Across and along track gaps in sonar coverage.

STANDARD
Survey area covered at the minimum required sounding and sonar line interval.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Track Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 4,5 &6	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
B.4.2

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA RENDERING – PLOTS – TRACK PLOT
B.5.1	

REQUIREMENT
To show positional data in graphic form if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<p>1. See GSI C.5.5 (Sounding Track Plot) and GSI D.5.3 (Sonar Track Plot)</p>

STANDARD
Track data plotted in graphic form and verified as correct in accordance with the instructions set out in Chap 5, Standard Graphics Formats.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	a. Sounding Track Plot b. Sonar Track Plot	NA	a. Sounding Track Plot b. Sonar Track Plot

REPORT OF SURVEY	
PART 1	PART 2
NA	Annex A

Issue Number
2/02

Date
1 Aug 02

GSI Number
B.5.1

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA RENDERING – REPORTS – REPORT OF SURVEY – FIELD RECORDS
B.5.2	

REQUIREMENT
To render a full and accurate report on the positional aspects of the survey. To manage the rendering and disposal of field records.

INSTRUCTION
<ol style="list-style-type: none"> 1. Positional data is to be rendered in accordance with the instructions at HQAs Chapter 4. 2. The original working, or field, records form an integral part of any survey. They are to be carefully preserved on board and are to be rendered to UKHO at the earliest opportunity after receipt of the 'Survey completed letter'. 3. All records must be clearly and correctly annotated before despatch to UKHO. 4. Records should be forwarded to UKHO in standard boxes provided by UKHO and clearly labelled. One form H658 is to be attached to the H28 and a second copy packed within the box. Records that will not fit in the standard boxes should be packed in alternative suitable packaging. 5. Records from different surveys are not to be packed together. Data classified Restricted or above is to be packed separately from unclassified material. 6. Positional field data to be forwarded to UKHO is listed in the SOP for the relevant system. 7. Rough drafts of fair records submitted to UKHO are not required by UKHO and may be destroyed one year after completion of the survey.

STANDARD
Details of the positional aspects of the survey fully and accurately rendered. Field records correctly rendered to UKHO.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
All	All	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 3 & 4	Annexes A, B, D & G

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
B.5.2

GENERAL SURVEY INSTRUCTION

GSI Number	POSITIONING – DATA RENDERING – DIGITAL DATA – TRACK AND PROFILE DATA
B.5.3	

REQUIREMENT
To render positional data in digital form.

INSTRUCTION
<p>1. Digital data are to be rendered in accordance with the SOP of the positional system used.</p>

STANDARD
Positional data correctly rendered in digital form.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	Digital records as required	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 3	Annex B

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
B.5.3

GENERAL SURVEY INSTRUCTION

C - BATHYMETRY

SURVEY STAGE	GROUP	REQUIREMENT	STANDARD TABLE	GSI	ISSUE DATE
Preparation	Planning	General Considerations	4 & 6	C.1.1	1 Feb 03
		Inshore Surveys	4	C.1.2	31 Mar 01
		Offshore Surveys	4	C.1.3	31 Mar 01
		Passage Sounding		C.1.4	1 Feb 03
	Calibration	SBES		C.1.5	1 Feb 02
		MBES		C.1.6	1 Feb 02
Data Gathering	Verification	SBES		C.2.1	31 Mar 01
		MBES			
		Validate Motion Sensing			
	Observations	Survey System Bathymetry	4 & 5	C.2.2	1 Feb 02
		SV On-line Observations	8		
		Bathymetric Coverage	4 & 5		
		Passage Sounding		C.2.3	1 Feb 02
	Data Logging	Bathymetric Data		C.2.4	1 Feb 02
Data Processing	Editing	Soundings		C.3.1	31 Mar 01
		Parameter Checks			
		Tide Application			
		Passage Sounding		C.3.2	1 Feb 02
	Selection	Sounding Selection		C.3.3	1 Feb 02
	Plotting	Manual Soundings		C.3.4	1 Feb 02
		Contours		C.3.5	1 Feb 02
	Storage	Digital Data		C.3.6	1 Feb 02
		Analogue Data			
Data Analysis	Data Quality	Error Models		C.4.1	31 Mar 01
		SBES Crossover			
		SBES/MBES Comparison			
		MBES/MBES Comparison			
		Grid Cells Statistics			
	Data Quality	Sounding Error Budget		Annex A	1 Aug 02
	Data Quantity	Sounding coverage		C.4.2	31 Mar 01
Data Rendering	Interim Reports	Signal Reports		C.5.1	1 Feb 02
		Hydrographic Notes			
	Plots	Bathymetric Sheet		C.5.2	1 Aug 02
		Bathymetric Colour Banded Unweeded Tracing		C.5.3	1 Aug 02
		Contour Tracing		C.5.4	1 Aug 02
		Sounding Track Plot		C.5.5	1 Aug 02
		3D Views		C.5.6	31 Mar 01

GENERAL SURVEY INSTRUCTION

SURVEY STAGE	GROUP	REQUIREMENT	STANDARD TABLE	GSI	ISSUE DATE
		Passage Sounding		C.5.7	1 Feb 02
	Reports	Report of Survey		C.5.8	1 Aug 02
	Digital Data	Digital File Quality		C.5.9	1 Aug 02
		File Listing			
	Records	Field Records		C.5.10	1 Feb 02

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - PREPARATION – PLANNING –GENERAL CONSIDERATIONS
C.1.1	

REQUIREMENT
Extract bathymetry data from existing charts and surveys. Identify critical and controlling depths. Plan survey lines and calibration regime.

INSTRUCTION
<ol style="list-style-type: none"> By examining the largest scale charts of survey area and previous surveys locate all critical or controlling depths and prepare sounding comparison overlay. Inspect the HI limits and those of adjacent modern surveys to ensure that there are no gaps between them. Plan main survey line spacing, direction and sounding speed in accordance with Chap Three App 1 Table 4. For SBES, where possible, lines should be perpendicular to general direction of contours but see GSI D 1.2. Crosslines, perpendicular to the main sounding, are to be run i.a.w. Chap Three App1 Table 4. Determine likely spatial or temporal changes in sound velocity regime and plan initial sv probe coverage. Determine sounding error budget and compare to HI requirement. See Annex A to GSI C for example. Sounding speed is to be assessed for the expected range of depths in the survey area and the type of ES in use. Compare sounding speed with speed required for towing sonar (Chap Three App 1 Table 6) to determine optimum and maximum survey speed. See relevant SOP for speed/depth tables.

STANDARD
All known critical depths located and primary bathymetry planned to meet survey specification. All main survey lines planned and database created.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
a. Line Database b. SV Regime Plan	Sounding Comparison Overlay	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 3 & 5	Annexes B & E

Issue Number
1/03

Date
1 Feb 03

GSI Number
C.1.1

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - PREPARATION – PLANNING – INSHORE SURVEYS
C. 1. 2	

REQUIREMENT
To produce a sounding plan to adequately survey the inshore area.

INSTRUCTION
<ol style="list-style-type: none"> For SBES surveys additional lines should be run at standard spacing at right angles to the contours from the 10m contour into the shore in order to determine the 5m, 2m contours and drying line. Additional lines are to be run parallel to a jetty or wharf at 2m, 5m and 10m off. When sounding over sandwaves sounding should take place following periods of calm weather and neap tides when sandwave amplitudes are greatest. Where possible re-surveys of sandwave areas should follow the same tracks to detect changes in sandwave profiles. If the survey scale is not appropriate to show all the inshore detail clearly, consideration should be given to sounding at closer intervals or enlarging the scale in critical areas. Care should be taken delineating the drying line, particularly with regard to offlying banks, rocks and shoals, as the position of such features may have international legal implications. When surveying within harbours and boat havens, drying heights and the location of foul ground, in areas where small craft anchor or take the ground, are to be accurately delineated. Lines of sounding are to be planned and run along recommended tracks, leading lines, in possible anchorages and off headlands passed close to hand by vessels on normal passage.

STANDARD
Sounding plan produced to adequately survey the anticipated nature of the inshore area.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Line Database	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 5	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
C. 1. 2

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - PREPARATION – PLANNING – OFFSHORE SURVEYS
C. 1. 3	

REQUIREMENT
To produce a sounding plan to adequately survey the offshore area.

INSTRUCTION
<ol style="list-style-type: none"> Particular attention is to be paid to the sounding of depths <40m, where the least depth must be obtained over all seabed features. Interlines are to be run in depths <40m unless the seabed is flat and featureless and no dangers are shown to exist by complete coverage by high definition towed sidescan sonar. A full explanation is to be given in the RoS when areas <40m are not interlined. Lines of sounding are to be planned and run along recommended tracks and leading lines, in possible anchorages and off headlands passed close to hand by vessels on normal passage. When sounding over sandwaves sounding should take place following periods of calm weather and neap tides when sandwave amplitudes are greatest. Where possible re-surveys of sandwave areas should follow the same tracks to detect changes in sandwave profiles.

STANDARD
Sounding plan produced to adequately survey the anticipated nature of the offshore area.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Line Database	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 5	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
C. 1. 3

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - PREPARATION – PLANNING – PASSAGE SOUNDING
C.1.4	

REQUIREMENT
To produce a sounding plan to cover the requirement for passage sounding.

INSTRUCTION
<ol style="list-style-type: none"> Whenever a surveying ship is on passage, both on the continental shelf and in oceanic depths, soundings are to be obtained, plotted and rendered to UKHO. Commanding Officers are to adjust tracks as necessary to pass through areas where bathymetry appears to be sparse (FLOO 13222). When passing through foreign territorial waters due consideration is to be given to the legality of obtaining data in these waters. Nevertheless, when on such passage, details of any features observed on the echo-sounder which do not agree with the published chart should be forwarded to the UKHO. Particular attention is to be paid to soundings obtained at the edge of the continental shelf and during its descent to oceanic depths as such areas are not only of interest to scientists but are increasingly important nationally in connection with the limits of maritime jurisdiction. The UKHO maintains a series of Ocean Sounding Charts, at a scale of 1:1 million, showing where passage soundings in oceanic depths already exist. Copies of relevant sheets can be supplied on request to allow Commanding Officers to plan their passages gainfully. The modern metric series of 1:3½M and 1:10M small scale international and mid-ocean charts also give an indication of the density of existing bathymetric data in ocean areas. Sounding data shown on 1:1M ocean plotting sheets are predominantly random lines of soundings from a variety of sources - survey ships, research vessels, naval ships, merchant ships etc. Soundings currently shown have been fixed by astro observations and the average positional error of such data is considered to be about 8 miles. Many charted seamounts are often derived from only one or two random lines of passage soundings: lines of soundings should therefore, where possible, be run across charted seamounts to help to establish their position more accurately and their least depth and extent. The UKHO should be signalled prior to the investigation of any charted seamount to ensure that it has not already been adequately surveyed.

STANDARD
Passage sounding plan produced to adequately fulfil the requirement.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
1/03

Date
1 Feb 03

GSI Number
C.1.4

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - PREPARATION – CALIBRATION - SINGLE BEAM ECHO SOUNDER
C. 1. 5	

REQUIREMENT
To eliminate systematic error in sounding observations by calibration of echo sounders.

INSTRUCTION
<ol style="list-style-type: none"> SBES are to be set to read depth below the sea surface, and never to depth below the keel or transducers. The draught and index error of a single beam echo sounder are to be set by bar check. See relevant SOPs for bar check methods for specific SBES. Bar check lowering lines are to be measured at regular intervals and at periods not exceeding 3 months. Sound velocity may be determined by SV probe, calculated from temperature measurements or from a bar check plotted graphically. An estimate of the accuracy is to be made at each observation and recorded. SBES should be adjusted for SV as follows: <ol style="list-style-type: none"> 0 – 30 m, by bar check. If accurate bar checking is impossible then SV should be set by SV probe or calculated from an XBT and an assumed salinity value. 30 – 200 m, a mean SV for the average depth of the survey area should be calculated from values observed at regular depth intervals. > 200 m, standard SV of 1500 m/sec is to be used with soundings corrected using NP139. SV is to be determined by: <ol style="list-style-type: none"> SV probe, permanent or expendable. Where a mean SV is calculated automatically the SV profile obtained is to be examined to confirm the validity of the mean value. SV observations should be taken from the echo sounder transducer depth to avoid shallow water effects. Computation from XBT temperature observations and an assumed salinity value obtained from Underwater handbooks, Environmental Briefing Guides or ocean climatology products. Where possible a second independent method of determining SV is to be used as a comparator and check against gross error. Observations for draught, index error and sound velocity are to be taken at sufficient intervals, both temporal and spatial, to ensure that the resulting sounding error meets the required specification. Observations for settlement and squat must be made on all survey vessels involved in Order 2 surveys and higher. Corrections are to be applied and reported. Observations are to be made before the commencement of the survey. A record is to be kept in graph form of all SV and draught settings, sudden changes must be explained.

STANDARD
All systematic errors removed.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Bar Check Graph SV and Draught Records	NA	RoS	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 5	Annexes E and G

Issue Number
1/02

Date
1 Feb 02

GSI Number
C. 1. 5

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - PREPARATION – CALIBRATION - MULTIBEAM ECHO SOUNDER
C. 1. 6	

REQUIREMENT
To eliminate systematic error in sounding observations by calibration of echo sounders.

INSTRUCTION
<ol style="list-style-type: none"> 1. A full calibration for transducer offsets must be carried out in accordance with and at the time interval specified by the relevant SOP. 2. Draught is to be set by observation of the ship side datum marks and confirmed by comparison with single beam echo sounding. These results are to be included in the RoS. 3. Regular observations for draught are to be taken to ensure that the sounding error remains within the required survey specification. 4. SV is to be determined by: <ol style="list-style-type: none"> a. SV probe, permanent or expendable. Where a mean SV is calculated automatically the SV profile obtained is to be examined to confirm the validity of the mean value. b. Computation from XBT temperature observations and an assumed salinity value obtained from Underwater handbooks, Environmental Briefing Guides or ocean climatology products. 5. Where possible a second independent method of determining SV is to be used as a comparator and check against gross error. 6. A record is to be kept in graph form of all SV and draught settings, sudden changes must be explained in the RoS.

STANDARD
All systematic errors removed.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Bar Check Graph SV and Draught Records	NA	RoS	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 5	Annexes E and G

Issue Number
1/02

Date
1 Feb 02

GSI Number
C. 1. 6

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA GATHERING – VERIFICATION – SBES AND MBES
C. 2. 1	

REQUIREMENT
To verify that gathered bathymetry is valid.

INSTRUCTION
<ol style="list-style-type: none"> The principle method of verification is to compare adjacent lines of processed data. Sounding cross lines are to be run at the start of the survey, preferably in good sea conditions, in accordance with Chap Three App 1 Table 4. Sounding crossovers are to be compared as the survey progresses as a check against gross errors, co-tidal modelling error or equipment malfunction. When using MBES a full test patch verification is to be conducted at intervals no greater than 7 days. When using MBES full use is to be made of on-line displays to verify repeatable performance of sounding by monitoring adjacent swathe. A daily 'reverse line' check of at least 500m is to be conducted.

STANDARD
All gathered bathymetric data is valid.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Sounding Crossline Comparison Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 5	Annex G

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
C. 2. 1

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA GATHERING - OBSERVATIONS
C. 2. 2	

REQUIREMENT
To gather bathymetry data accurately and efficiently

INSTRUCTION
<ol style="list-style-type: none"> 1. Sounding is to be conducted in discrete areas. Each area should be fully surveyed before moving onto the next. 2. Regular time checks are to be made between the echo sounder, the data logging system and positioning system. This check is to be conducted at SOL, EOL and at intervals not exceeding 30 mins. The check is to be noted on the echo sounder trace and in the Bridge Record. 3. The depth between the echo sounder digital readout, echo trace and data logging system is to be checked at the SOL, EOL and at intervals not exceeding 30 mins. The check is to be noted on the echo sounder trace and in the Bridge Record. 4. The Sound Velocity and draught set is to be checked at the SOL and at intervals not exceeding 1 hour. 5. The Officer of the Watch is to compare the survey depths with the navigational chart and sounding comparison overlay, making due allowance for predicted tides. 6. All sounding crossovers are to be examined as they occur to provide a gross error check. 7. The echo sounder is to be operated at the maximum ping rate and range scale commensurate with the depth of water. See relevant SOP. 8. When using MBES a check is to be maintained using real time displays to ensure that the coverage required by the Order of Survey, Chap Three, App 1, Table 4, is being maintained. Additional lines are to be run to fill any gaps in MBES coverage. 9. When using SBES additional lines of sounding are to be run to delineate shoals and where the line keeping error >25% of line spacing. 10. A comprehensive record, using H441 SIPS Line Data Log Sheet, is to be kept of all events that may effect the quality of bathymetry data. 11. Echo sounder rolls are to be annotated with standard field record labels at both ends.

STANDARD
Bathymetry data gathered to the order specified in the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H441 Echo Traces & Data Tapes	Bridge Track Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 5	Annex G

Issue Number
1/02

Date
1 Feb 02

GSI Number
C. 2. 2

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA GATHERING – OBSERVATIONS - PASSAGE SOUNDING
C. 2. 3	

REQUIREMENT
To gather passage sounding data accurately and efficiently

INSTRUCTION
<p>1. In the event of a seamount being discovered, it is desirable that sounding profiles should be obtained right across the feature in at least two directions continuing until the general depth of the ocean is regained. Plotting on a scale of 1:¼M is recommended.</p>

STANDARD
Passage bathymetric data gathered to the order specified in the HQAI Chap3 App 1.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Echo Traces & Data Tapes	Bridge Track Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
1/02

Date
1 Feb 02

GSI Number
C. 2. 3

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA GATHERING – DATA LOGGING – BATHYMETRIC DATA
C.2.4	

REQUIREMENT
To log bathymetry data for transfer to the processing system.

INSTRUCTION
<p>1. Bathymetry and associated data, e.g. SV, draught and motion sensing parameters are to be stored on the data logging system at a rate of at least 1 per second for a SBES and every ping for MBES. See also B.2.3.</p>

STANDARD
All bathymetry and associated data logged at the correct data rate.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H441 Data Tapes	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 3 & 5	Annex B

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.2.4

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA PROCESSING – EDITING
C.3.1	

REQUIREMENT
To apply corrections to, and remove invalid soundings from, observed digital bathymetric data.

INSTRUCTION
<ol style="list-style-type: none"> 1. In accordance with the relevant SOP: <ol style="list-style-type: none"> a. Apply co- tide adjusted tidal corrections. b. Apply corrections to SV profiles. 2. In accordance with the relevant SOP identify and remove invalid soundings. If automatic filters are used the parameters must be recorded and reported in the RoS. 3. Excessive filtering is to be avoided. The maximum unfiltered spike is to be noted in the RoS.

STANDARD
Corrections applied to remove or correct systematic errors. All invalid soundings identified and removed.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Digital Record Files	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 3 & 5	Annex B

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
C.3.1

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA PROCESSING – DATA EDITING – PASSAGE SOUNDING
C.3.2	

REQUIREMENT
To process ocean bathymetric data to form the final product.

INSTRUCTION
<p>1. Passage soundings are to be obtained in metres. In depths greater than 200 metres, they are to be corrected by use of NP139 (Echo Sounding Correction Tables 3rd Edition). In depths of less than 200 metres, echo-sounders are to be adjusted to the correct speed of sound in water, and reduced by use of predicted tides and co-tidal corrections where appropriate. If this means of tidal reduction is not possible, an arbitrary amount equivalent to the estimated range of the tide should be subtracted from soundings. In the case of an area which is predominantly greater than 200 metres but with a small area less than 200 metres, the latter should be corrected by use of NP139 to preserve consistency with the deeper soundings. Where possible, however, an SV measurement is to be taken and recorded with the data, and the appropriate tidal correction determined so that a true least depth can be calculated as required.</p>

STANDARD
Bathymetric data correctly processed to form the final product.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Digital Record Files	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.3.2

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA PROCESSING – DATA SELECTION
C.3.3	

REQUIREMENT
To select from edited bathymetry data to form the final product.

INSTRUCTION
1. Bathymetric data is to be selected in accordance with the SOP for the equipment used.

STANDARD
Bathymetric data correctly selected to form the final product.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Digital Record Files	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 3 & 5	Annex B

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.3.3

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA PROCESSING – MANUAL SOUNDINGS
C.3.4	

REQUIREMENT
To manually ink in soundings.

INSTRUCTION
<ol style="list-style-type: none"> When manually inking in soundings the greatest care is to be taken to ensure that soundings are precisely positioned. Fixes should be between 1 and 2 cm apart on paper and never more than 2.5 cms. Spacing should, where possible allow an odd number of soundings to be inserted between them. Soundings are to be inked-in to a density of about 4 per centimetre along the line. Soundings are to be read from the echo trace with care and precision particularly with respect to that part of the zero line from which the tidal reduction should be drawn and the correct measurement of any drying heights. Inexperienced personnel reading out are to be closely supervised. Soundings less than 31 metres are to be inked-in to the nearest decimetre. Soundings of 31 metres or greater are to be rounded to the nearest whole metre shoaler unless the fractional part is 7 decimetres or more when the sounding is to be rounded to the next whole metre deeper. All significant features, e.g. pinnacles, are to be precisely positioned. Once significant features have been inked-in, representative soundings should be inserted to provide an accurate depiction of the seabed topography.

STANDARD
Soundings accurately inked-in by hand.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Echo sounder trace	Sounding Collector Tracing	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 5	Annex G

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.3.4

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA PROCESSING - CONTOURS
C.3.5	

REQUIREMENT
To derive bathymetric contours from the colour banded unweeded sounding plot.

INSTRUCTION
<p>1. A depth contour represents the line which, in the opinion of the Charge Surveyor, is followed by the isobath of the depth concerned. It is thus exactly analogous to a height contour on a land map. The following contours are to be derived from the unweeded colour banded plot:</p> <p style="padding-left: 40px;">0, 2, 5, then every 5 metres to 75, 80 then every 10 metres to 200, 500, 1000 metres.</p> <p>2. In intricate areas, some contours (not the shoalest) may be omitted in the interest of clarity.</p> <p>3. Depth contours additional to those in 1. above may be inserted at the Charge Surveyor's discretion, if this assists in the graphic depiction of a generally featureless seabed, or in sandwave areas, to clarify the sandwaves' shape, size and direction.</p> <p>4. Contours should generally be drawn as smooth curves broken as necessary as they pass written soundings. They should not be drawn on the 'deep' side of a sounding of exactly the value of the contour lying on a slope otherwise the contour can be badly distorted. The depth represented is that for the position of the 'centre of gravity' of the plotted figures, and the contour of this depth should aim to pass through this position.</p> <p>5. The exception to 4. above is a 'spot' shoal with a value exactly the same as a contour. This must be indicated by the contour, or danger line, surrounding the shoal sounding. Where a contour cannot be satisfactorily represented by following the precise line of the isobath, the Charge Surveyor must use professional judgment. A similar 'spot' deep should not have a contour.</p> <p>6. Where a contour passes between two soundings, its line is to be biased towards the sounding nearest in value to it. Preliminary contours may zig-zag between lines of soundings as a result of minor variations in individual soundings. With automated data processing systems, amendments to the digital sounding data files are not acceptable, but it is acceptable for the Charge Surveyor to indicate his assessment of where the contour lies by drawing a smooth line that passes on the wrong side of some soundings. Under these circumstances, the error between the contour and the soundings should never exceed the 2σ precision quoted in Annex G of the Report of Survey. In cases of ambiguity, reference should be made to the echo trace to obtain the precise point at which the contour was crossed.</p>

STANDARD
Contours correctly derived for the specified contour interval

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Contour Collector Tracing	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 5	Annex G

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.3.5

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA PROCESSING – DATA STORAGE – DIGITAL AND ANALOGUE
C.3.6	DATA

REQUIREMENT
To store processed digital and analogue bathymetric data.

INSTRUCTION
<ol style="list-style-type: none"> Digital data, raw and processed, is to be backed up with the back up copies stored in a separate and secure location. Echo rolls and graphics plots, all correctly annotated, are to be stored in a location away from the primary digital record.

STANDARD
Digital and analogue records copied and stored securely.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
All	All	All	All

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.3.6

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA ANALYSIS – DATA QUALITY
C.4.1	

REQUIREMENT
To assess the quality of bathymetric data and compare to expected sounding error budget.

INSTRUCTION
<ol style="list-style-type: none"> Both SBES and MBES data are to be compared with SBES crossline data. A statistical plot is to be produced; any crossover with a difference $> \sqrt{2}$ x sounding error budget is to be investigated and if unresolved noted in the RoS. If grid cell statistics are available they should be used to assist the assessment of the quality of soundings obtained. All sources of finally assessed error are to be rigorously examined and compared to the predicted error budget. Surveyed depths are to be checked against charted depths and vice versa. Differences are to be examined. Where necessary additional lines of sounding are to be run to confirm the surveyed depth or disprove the charted depth.

STANDARD
Bathymetric data assessed to ensure that observed data meets the survey specification.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	1.Sounding Collector 2.Crossline Comparison Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
C.4.1

A0101 Sounding Error Budget Calculation Example

1. Scenario:

Survey	Continental Shelf 50 miles offshore
Depths	50 to 200 metres
Equipment	CSV fitted with SIPS – 790 echo sounder and digitiser – heave compensator.
Tidal Data	Good tide gauge and adjacent pole available at nearest standard port 100 miles from most distant corner of survey area – semi diurnal – 7 m range at springs – Tidal Branch advise that contours shown on published co-tidal chart may be considered to have an accuracy of $\pm 0.5\text{m}$ for Mean Spring Range and ± 30 min. for Mean High Water Interval – Maximum Spring Range in survey area 4.5m. Maximum height predicted to occur at gauge site during survey 7.5m.
Environmental	UK spring/summer – area usually affected by heavy swell.

2. Error Sources at the 2σ level:

- a. Echo sounder transmission mark setting. - Bar Check at least once every 5 days. $\pm 0.1\text{m}$
- b. Variation off transmission mark setting with time. - Sufficient data held to be able to calculate changes to $\pm 0.05\text{m}$ from fuel and water usage for up to 10 days after Bar Check. Draught setting in use to be reassessed daily.
- c. Sound velocity (SV) measurement. - SV Probe at least every other day in current work area, 6 hourly XBT observations will be used to monitor changes. $\pm 2\text{m/s}$ ($\pm 0.0013\text{d}$)
- d. Spatial variation in SV. - Not expected to be a problem but will be confirmed early in the survey by a series of SV probe dips spread throughout the area taken within 24 hours. The need to adjust SV with changes in depth will be assessed from these observations. $\pm 1\text{m/s}$ ($\pm 0.0007\text{d}$)
- e. Temporal variation of SV. - No short term variations expected, planned SV probe observations should be adequate to maintain $\pm 1\text{m/s}$ ($\pm 0.0007\text{d}$) but frequency will be adjusted if rate of change of SV indicates that it will be necessary.
- f. Application of measured SV. $\pm 1\text{m/s}$ ($\pm 0.0007\text{d}$)
- g. Depth measurement (Instrumental Accuracy). $\pm 0.1\text{m}$
- h. Depth measurement (Trace Resolution). $\pm 0.1\text{m}$
- i. Heave. $\pm 0.5\text{m}$, without the heave compensator this would be a major source of error of probably 10 times this magnitude.
- j. Ship squat. Data held indicates squat is less than 0.1m at all speeds in over 25m of water. $\pm 0.1\text{m}$
- k. Roll, Pitch and Seabed Slope. Effect negligible compared with positioning accuracy.

- l. Tidal measurement. Tide gauge will be calibrated by 25 hours gauge/pole comparisons and checked daily, expected precision $\pm 0.05\text{m}$ for height and ± 1 min for time. Time error is equivalent to a height error of $\pm 0.3\text{m}$ at half tide. Combined error $\pm 0.06\text{m}$
- m. Co-tidal correction. Worse case height error will occur when the height factor and the height of tide are both greatest. The maximum height factor is:

$$\frac{\text{Max MSR in Survey Area}}{\text{MSR at Gauge}} = \frac{4.5}{7.0} = 0.64$$

If the maximum error in the contours of mean spring range is present the height factor should be:

$$\frac{4.5 \pm 0.5}{7.0} = 0.71 \text{ or } 0.57$$

When the height of tide is 7.5m the maximum height of tide in the survey area calculated from the charted contours would be:

$$7.5 \times 0.64 = 4.8 \text{ metres}$$

Using the correct height factor, the height of tide in the survey area would be:

$$7.5 \times 0.71 = 5.33 \text{ metres}$$

or

$$7.5 \times 0.57 = 4.3 \text{ metres}$$

The larger difference of 0.53m between the two heights represents the maximum error in the co-tidal correction due to the precision of the Mean Spring Range contours.

The worst case time error will occur when the rate of change of tidal height is greatest. For this example it is assumed that the tidal curve is sinusoidal with a maximum rate of change of 2% of the range in 5 minutes. The height error resulting from a time error of 30 minutes would be:

$$7.5 \times 12\% = 0.9 \text{ metres}$$

But this height would be scaled by the height factor before being used to reduce soundings therefore the error in the survey area would be:

$$0.9 \times 0.64 = 0.58 \text{ metres}$$

The two types of error will not both be at a maximum simultaneously therefore it would be reasonable to combine them as if they were independent random errors. The combined error would be:

$$\sqrt{0.53^2 + 0.58^2} = 0.79 \text{ metres}$$

To maintain errors from interpolation below 20% of this figure, height factors will be recorded to 2 decimal places and time differences to the nearest 5 minutes (ie $\pm 2\frac{1}{2}$ mins.). The SIPS co-tidal algorithm is expected to be capable of better precision than this.

- n. Application of tidal reduction. $\pm 0.01\text{m}$

o. Trace reading. Not applicable.

3. Sounding Error Budget:

Depths to be considered:

50m - shoalest
100m - intermediate
200m - deepest

Source of Error	at 200 metres	at 100 metres	at 50 metres
a	0.1	0.1	0.1
b	0.05	0.05	0.05
c	0.27	0.13	0.07
d	0.13	0.07	0.03
e	0.13	0.07	0.03
f	0.13	0.07	0.03
g	0.1	0.1	0.1
h	0.01	0.01	0.01
i	0.05	0.05	0.05
j	0.1	0.1	0.1
k	0	0	0
l	0.06	0.06	0.06
m	0.79	0.79	0.79
n	0.01	0.01	0.01
o	0	0	0
Combined Total	0.89	0.83	0.82
Requirement	1.87	1.03	0.67
Standard Met?	Yes	Yes	No

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA ANALYSIS – DATA QUANTITY
C.4.2	

REQUIREMENT
To examine processed bathymetry to ensure that sufficient has been observed to fulfil the HI.

INSTRUCTION
<ol style="list-style-type: none"> 1. Confirm the following: <ol style="list-style-type: none"> a. No bathymetry is included from tracks where positional data is invalid. b. Interlines have been run where required. c. Examinations have been conducted as required. d. With MBES full bottom coverage in accordance with the HI and Chap 3 App 1 Table 4 has been achieved. See GSI B.4.2 e. Soundings reach the outer edge of the survey area and where necessary overlap and agree with previous survey work (0.5 cm on paper at the scale of the survey, approximately 2 – 3 soundings). Any overlapping contours are to be identical. NB. This may not be possible in mobile areas or where the previous survey was a long time ago. See GSI B.4.2 f. Soundings are in agreement with the published chart and differences reported. See GSI C.5.1 for guidance. 2. Where sandwaves have been detected in the survey area additional sounding lines are to be run perpendicular to the line of the crests. 3. Weeded bathymetric plots will often show gaps where overlapping soundings have been weeded out. The Charge Surveyor is to ensure that any such gaps are not the result of missing data and that no significant soundings have been omitted. The fact that this check has been conducted is to be confirmed in the RoS. 4. It is the sole responsibility of the Charge Surveyor to ensure that all dangers are fully examined, and that charted shoals are verified or disproved. No survey can be considered complete until all such shoals and dangers have been examined. Shoals which project outside of the survey area are to be fully surveyed. Failure to find a charted shoal and the recommendation for charting are to be reported in the RoS.

STANDARD
Bathymetric coverage conforms to the requirement stated in the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Sounding Collector Contour Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 5	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
C.4.2

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA RENDERING - INTERIM REPORTS – SIGNAL REPORTS AND HYDROGRAPHIC NOTES
C.5.1	

REQUIREMENT
To render interim reports on changes to charted depths.

INSTRUCTION
<ol style="list-style-type: none"> 1. Newly discovered dangers to navigation or significant changes to the published chart, which are found during the course of a survey or whilst on passage, must be reported without delay. 2. The criteria used in UKHO for the promulgation of Notices to Mariners is: <ol style="list-style-type: none"> a. In depths 0 to 10 m list depths shoaler than charted by at least 0.5m b. In depths 10 to 31m list depths shoaler than charted by at least 1m c. In depths 31 to 200m list depths shoaler than charted by 5% or more d. In depths 200 to 800m list depths shoaler than charted by 10% or more 3. In high-risk areas where vessels operate regularly with minimum under-keel clearance, any shoaling of critical or controlling depths should be listed. Examples of such high-risk areas are: the Dover Strait TSS; Southern North Sea Deep Water Routes; within and adjacent to main channels in port areas and their approaches. 4. Details of any new depth less than 750 metres (400 fathoms) in ocean areas, rising from substantially greater charted depths, should be reported immediately by signal, followed by a Hydrographic Note with full details of position fixing and a fully annotated echo sounding trace. 5. Interim reports should be rendered as follows: <ol style="list-style-type: none"> a. <u>Signalled Reports</u>. Signalled reports of dangers found during the course of survey are to quote the HI number and geographical coordinates with the horizontal datum specified. Particular care is to be taken to ensure that signalled information is correct. Signals should be sent to the following addresses: <ol style="list-style-type: none"> i. HYDROUK TAUNTON (using SIC JPL) ii. FOSF, FOSM, COMRFA iii. CINC Fleet iv. If in, or near, exercise areas: FOSNNI or FOST v. Local harbour/port authority (HM Naval Base: NBC for QHM), and/or national maritime authority. b. <u>Hydrographic Notes (HNs)</u>. HNs are to be forwarded to confirm and supplement signalled reports and to report information of lesser importance which UKHO should be aware of in advance of the final rendered survey. HNs are to include the HI number and DTG of any signal relating to the HN. HNs are to be completed in accordance with NP100, The Mariner's Handbook.

STANDARD
Significant changes in depth hazardous to navigation reported swiftly and accurately to UKHO and allied authorities.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	1. Signal 2. Hydrographic Note	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	Annex T

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.5.1

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – DATA RENDERING – PLOTS – BATHYMETRIC SHEETS
C.5.2	

REQUIREMENT
To show weeded bathymetric data in graphic form if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<ol style="list-style-type: none"> 1. The weeded bathymetric DEM is the primary product for all hydrographic surveys. Its main purpose is to show the bathymetry and is not to be congested with, or overwritten by, other information, e.g. names in the water area, which should be depicted on an accompanying tracing. 2. However any bathymetric sheet is to be rendered as a 'weeded' sheet at an appropriate scale at the Charge Surveyor's discretion. It is to show: <ol style="list-style-type: none"> a. Weeded bathymetry; b. Contours, in red, at 2, 5, 10, 15, 20, then every 10 metres to 200, 500, 1000 metres; c. Low water line (0 metre contour) see Chap 5 App 1; d. High water line see Chap 5 App 1; e. Wrecks and obstructions – see GSI D.5.2; f. Positions of any topographic features surveyed in the field. 3. Contours additional to those at 2b. may be inserted at the Charge Surveyor's discretion, if this assists in the graphic depiction of a generally featureless seabed, or in sandwave areas, to clarify the sandwaves' shape, size and direction. 4. Soundings are to be in black ink except for any soundings added to the bathymetric sheet by hand (i.e. not contained in a digital file) which are to be drawn in violet ink. These may include boatwork and soundings to support an isolated deep contour. As much digitisation of boatwork as time allows should be completed with priority given to the smaller areas. Boatwork investigations within the area surveyed by the ship must always be digitised. 5. Detailed instructions for the production of the bathymetric sheet, including title, graduation, grid and geographical intersections, etc, are contained in the Survey Processing System SOP. 6. Final fair graphic checked and verified as correct. See Chapter 5 – Checking of Graphics.

STANDARD
Bathymetric data plotted in graphic form and verified as correct.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	Bathymetric Sheet

REPORT OF SURVEY	
PART 1	PART 2
Section 5	Annex A

Issue Number
2/02

Date
1 Aug 02

GSI Number
C.5.2

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA RENDERING – PLOTS – BATHYMETRIC COLOUR BANDED
C.5.3	UNWEEDED TRACING

REQUIREMENT
To produce a colour banded unweeded sounding tracing if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<ol style="list-style-type: none"> 1. A tracing to fit the bathymetric sheet showing <u>all</u> soundings from the DEM file by colour banding is to be produced. 2. Detailed instructions for the production of the colour banded unweeded sounding tracing, including title, graduation, grid and geographical intersections, etc, are contained in the Survey Processing System SOP. 3. Final fair graphic checked and verified as correct. See Chapter 5 – Checking of Graphics.

STANDARD
Colour Banded Unweeded Tracing produced and verified as correct.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	Colour Banded Unweeded Tracing

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 5	Annex A

Issue Number
2/02

Date
1 Aug 02

GSI Number
C.5.3

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA RENDERING – PLOTS – CONTOUR TRACING
C.5.4	

REQUIREMENT
To produce a bathymetric contour tracing if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<ol style="list-style-type: none"> 1. For surveys within the 200 metre line, a separate contour tracing is to be rendered. This is additional to the requirement to insert contours on the bathymetric sheet. 2. The following contours are to be shown: <ol style="list-style-type: none"> a. 0 – 75 metres at 5 metre intervals; b. 80 – 200 metres at 10 metre intervals. 3. Contours are to be drawn in black and labelled sufficiently for each contour to be identified. Annotations should follow the line of the contour and be oriented so that they can read when facing up the slope. 4. On steep slopes, contours may be broken to preserve clarity but the shoalest and deepest contours should be continuous. 5. In areas of very flat profile, a contour tracing may be dispensed with provided that all relevant contours can be shown on the bathymetric sheet without detracting from the clarity and legibility of the soundings. A separate contour tracing should always be rendered if a bottoms texture tracing is rendered for the same area. 6. Detailed instructions for the production of the contour tracing, including title, graduation, grid and geographical intersections, etc, are contained in the Survey Processing System SOP. 7. Final fair graphic checked and verified as correct. See Chapter 5 – Checking of Graphics.

STANDARD
Bathymetric contour tracing produced and verified as correct.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	Bathymetric Contour Tracing.

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 5	Annex A

Issue Number
2/02

Date
1 Aug 02

GSI Number
C.5.4

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA RENDERING – PLOTS – SOUNDING TRACK PLOT
C.5.5	

REQUIREMENT
To produce a Sounding Track Plot if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<ol style="list-style-type: none"> 1. A Sounding Track Plot showing all tracks followed whilst gathering bathymetric data is to be rendered. This tracing will duplicate the Sonar Track Plot where sounding and sonar data were gathered simultaneously. 2. Where sidescan sonar was deployed on all lines run during a survey, and therefore the sounding track plot would duplicate all tracks on the sonar track plot, a separate sounding track plot is not required. In this case, an appropriate comment should be made in the Report of Survey. 3. Detailed instructions for the production of the sounding track plot, including title, graduation, grid and geographical intersections, etc, are contained in the Survey Processing System SOP. 4. Final fair graphic checked and verified as correct. See Chapter 5 – Checking of Graphics.

STANDARD
Sounding Track Plot produced and verified as correct

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	Sounding Track Plot

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 5	Annex A

Issue Number
2/02

Date
1 Aug 02

GSI Number
C.5.5

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA RENDERING – PLOTS – 3D VIEWS
C.5.6	

REQUIREMENT
To produce 3D views from digital bathymetric data

INSTRUCTION
<ol style="list-style-type: none"> 1. A three dimensional (3D) view is to be produced for each bathymetric sheet to serve as a final check on the presence of tidal anomalies and spurious data in the DEM. 2. 3D views are to be plotted on paper no larger than A3 size and included in the Report of Survey. The title for each view is to include the horizontal and vertical scales, the viewing azimuth and the title of the respective bathymetric sheet. 3. Guidelines for creating 3D views are contained in the SIPS SOP.

STANDARD

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	3D View

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 5	Annex H

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
C.5.6

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA RENDERING – PLOTS – PASSAGE SOUNDING
C.5.7	

REQUIREMENT
To render passage bathymetric data.

INSTRUCTION		
1. Passage soundings should be plotted on the following scales, depending on the largest scale of published chart for the area:		
Scale of Published Chart	Scale of Plotting	Method of Rendering
Larger than 1:1 million	Chart Scale	Tracing to fit chart
Smaller than 1:1 million	1:1 million	1:1 million plotting sheet
2. <u>Navigational control</u> . Central to any passage observations, and necessary for all of them, is a full account of the navigational control, together with a Master Track Plot. This is to be on the scale appropriate to the work as laid down in GSI C.5.7. A fair copy of this plot is not required providing the working plots are neat and contain all necessary information. When plotting sheets of the 5331-5349 series are used, the limits are to be chosen to conform with those shown on Chart 5330; the appropriate latitude and longitude bands are to be joined up and those not in use ruled through. Dates and times are to be in GMT. As a wide variety of fixing control may be employed when on passage, it is important that the navigational annex explains fully the methods used, assumptions made, corrections and adjustments applied, and the Officer-in-Charge's opinion as to the probable accuracy of the final track.		
3. <u>Bathymetry</u> . Soundings are to be rendered in metres, GSI C.3.2. Figures are to be inked in at right angles to the track, readable, in so far as possible, from the southern edge of the sheet. Significant peaks and troughs are to be recorded with representative soundings between them spaced at about four per centimetre on paper. The tracing is to be accompanied by the echo sounder/PDR rolls, fully annotated, and notebooks containing full details of fixes (whether from shore marks, astro, Satnav, or electronic navaid) together with any corrections applied, and all changes in course or speed. Depths should be recorded in the notebook uncorrected, with the sounding corrected (by tidal reduction or NP139, 3rd Edition, as appropriate) in an adjacent column, and in a contrasting colour. Bathymetric sheets are to have a title in accordance with HQAI 0512, and must include the type of echo sounder used, the assumed velocity of sound in seawater, and whether (and how) corrected.		

STANDARD

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.5.7

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – REPORTS – REPORT OF SURVEY
C.5.8	

REQUIREMENT
To render a full and accurate report on the bathymetric aspects of the survey.

INSTRUCTION
<ol style="list-style-type: none"> Survey data obtained in relation to an HI is to be rendered in accordance with the instructions at HQAIs Chapter Four. When forwarding passage sounding observations not related to an HI, a report should accompany them commenting on aspects of the work in a manner similar to a Report of Survey; as the different tracings will be processed in different branches in UKHO, detailed remarks on navigation and bathymetry are to be included in separate annexes to the report. See IHO publication S-44 'IHO Standards for Hydrographic Surveys', Annex A, for classification of ocean soundings.

STANDARD
Details of all bathymetric data fully and accurately rendered.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.5.8

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY – REPORTS – DIGITAL DATA
C.5.9	

REQUIREMENT
To render bathymetric data in digital form.

INSTRUCTION
<ol style="list-style-type: none"> Digital data are to be rendered in accordance with the SOP for the combination of echo sounder and data logging system in use and HQAIs Chapter 5. The weeded bathymetric DEM is the primary product for all hydrographic surveys. Its main purpose is to show all bathymetry in an uncongested form, therefore great care is required in its creation, saving and rendering.

STANDARD
Bathymetric data correctly rendered in digital form.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	Digital records as required.	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 3 & 5	Annex B

Issue Number
2/02

Date
1 Aug 02

GSI Number
C.5.9

GENERAL SURVEY INSTRUCTION

GSI Number	BATHYMETRY - DATA RENDERING – RECORDS – FIELD RECORDS
C.5.10	

REQUIREMENT
To render field records to UKHO.

INSTRUCTION
<ol style="list-style-type: none"> 1. The original working, or field, records form an integral part of any survey. They are to be carefully preserved on board and are to be rendered to UKHO at the earliest opportunity after receipt of the 'Survey completed letter'. 2. All records must be clearly and correctly annotated before despatch to UKHO. 3. Records should be forwarded to UKHO in standard boxes provided by UKHO and clearly labelled. One form H658 is to be attached to the H28 and a second copy packed within the box. Records that will not fit in the standard boxes should be packed in alternative suitable packaging. 4. Records from different surveys are not to be packed together. Data classified Restricted or above is to be packed separately from unclassified material. 5. Field data to be forwarded to UKHO is listed in the SOP for the relevant system. 6. Echo sounder traces are to be clearly marked, on the outer surface at each end, with the typewritten information indicated in the relevant SOP. 7. Rough drafts of fair records submitted to UKHO are not required by UKHO and may be destroyed one year after completion of the survey.

STANDARD
Field records correctly rendered to UKHO

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
1/02

Date
1 Feb 02

GSI Number
C.5.10

GENERAL SURVEY INSTRUCTION

D - SONAR,WRECKS & SEABED

SURVEY STAGE	GROUP	REQUIREMENT	STANDARD TABLE	GSI	ISSUE DATE
Preparation	Planning	Existing dangers		D.1.1	31 Mar 01
		Line Planning	6	D.1.2	1 Feb 02
		Survey Lines Database	6		
		Seabed Sampling	5	D.1.3	31 Mar 01
	Verification	Sonar Verification		D.1.4	31 Mar 01
Data Gathering	Observations	Seabed Sampling	5	D.2.1	31 Mar 01
		Sonar Area Sweep	6	D.2.2	31 Mar 01
		Magnetometer Area Sweep			
		Wreck Examination	5	D.2.3	31 Mar 01
		Wire Sweeping	5	D.2.4	31 Mar 01
Data Processing	Values	Sonar Contacts	5	D.3.1	31 Mar 01
		Seabed Texture		D.3.2	31 Mar 01
Data Analysis	Quality	Sonar	5, 6	D.4.1	31 Mar 01
		Examinations	5, 6	D.4.2	31 Mar 01
Data Rendering	Interim Reports	Signal Reports		D.5.1	31 Mar 01
		Hydrographic Notes			
	Plots	Bathymetric Sheet		D.5.2	1 Aug 02
		Sonar Track Plot		D.5.3	1 Aug 02
		Seabed Texture Tracing		D.5.4	1 Feb 02
		Area Swept by Wire		D.5.5	31 Mar 01
	Reports	ROS		D.5.6	31 Mar 01
		Wreck Data		D.5.7	1 Aug 02
		Seabed Samples		D.5.8	31 Mar 01
		Field Records		D.5.9	31 Mar 01

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – PREPARATION - PLANNING – EXISTING DANGERS
D.1.1	

REQUIREMENT
To identify and plot all existing wrecks, fouls, obstructions, reported sonar contacts and shoal areas.

INSTRUCTION
<ol style="list-style-type: none"> 1. Inspect the Wreck List supplied with the HI and identify those with positions listed as approximate and thus requiring disproving searches or special attention. 2. Items in the Wreck List requiring a disproving search should be searched for out to a radius of to 2.5 miles from the Wreck List position. The limit of the area of this search may extend outside the given limits of the HI. Such an extension is essential, however, to avoid the anomaly of having a PA wreck which has not been fully disproved lying inside an area otherwise considered to be classified 1SC. See GSI D.2.2 3. Plot positions of items in the Wreck List along with other dangers and depth contours from the published chart and/or original surveys on bridge track plots. Label wrecks with identifying number and required action. 4. Plot positions of items in the Wreck List on the Seabed Texture Collector Tracing and Master Sonar Contact Plot. Label wrecks with identifying number. 5. When surveying in or near oilfields or exploration areas careful note is to be taken of 500 metre safety zones, seabed installations and possible pipelaying operations to ensure the safety of the sonar towfish.

STANDARD
Positions of essential data for the area Sonar Search correctly transferred to overlays. Disproving search areas identified and plotted.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Bridge Overlays	Seabed Texture Collector	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.1.1

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – PREPARATION – PLANNING – LINE PLANNING AND DATABASE
D.1.2	

REQUIREMENT
To plan and produce the Survey Lines Database

INSTRUCTION
<ol style="list-style-type: none"> 1. The Sonar Sweep Type will be ordered in the HI. Parameters for each type of search are at Chapter 3 Appendix 1 Tables 5 & 6. 2. Inspect the HI limits and those of adjacent modern surveys to ensure that there are no gaps between them. 3. When the sonar sweep and sounding are being conducted concurrently, the Charge Surveyor must balance the conflicting requirements of each. Every effort must be made to ensure that there are no gaps in the sonar sweep, therefore, it will generally be necessary to subordinate the needs of bathymetry to those of sonar. Additional sounding only lines may be required to assist with the delineation of contours and critical features. 4. Sonar lines should be run within 20 degrees of the prevailing tidal stream or current. In areas of strong tidal flow, a direction much less than 20 degrees may have to be adopted to ensure that the sonar towfish follows the ship's track closely. See Chapter 3 Appendix 1 Table 6, Sonar Sweep categories. 5. The sonar line spacing is stated in Chapter 3 Appendix 1 Table 6, Sonar Sweep categories. 6. Produce the line database according to the data processing system in use according to the line spacing and direction derived. Ensure that any disproving search areas lying on the outer edge of the survey area are covered. Additional lines are to be planned to run outside the area in order to ensure complete insonification of the area, with appropriate overlap. See GSI D.1.1. 7. Whenever a survey includes a channel, recommended track or leading line in restricted waters it should be swept by sonar. When planning such sweeps allowance should be made to accommodate the largest vessels likely to use these tracks paying particular attention to turning areas and where a track changes course.

STANDARD
Line database planned and produced in accordance with the standard ordered, prevailing tidal streams and special conditions set by the survey area and the Wreck List.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Line Database	Line Database Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 6	NA

Issue Number
1/02

Date
1 Feb 02

GSI Number
D.1.2

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – PREPARATION – PLANNING – SEABED SAMPLING
D.1.3	

REQUIREMENT
To determine the necessity for seabed sampling.

INSTRUCTION
<ol style="list-style-type: none"> 1. Seabed samples are to be obtained at regular intervals throughout the entire survey area. A regular grid at 5 cms spacing on paper at the scale of the survey is the minimum requirement. See Chapter 3 App 1 Table 5. 2. Seabed samples should also be taken in the following circumstances: <ol style="list-style-type: none"> a. In all likely anchorages; b. On all banks, shoals and seamounts, particularly where these are likely to be unstable, and in the channels between them; 3. Of the samples obtained 10% should be retained for rendering to the UKHO. From the planning in paras 1 & 2, and allowing a margin for additional samples, a sufficient number of plastic screw-top containers, and their special cases should be demanded from the Hydrographic Instrument Store, Devonport, giving as much notice as possible.

STANDARD
To ensure sufficient seabed samples are planned for the survey

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Bridge Seabed Sampling Plot	Bridge Seabed Sampling Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.1.3

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – PREPARATION – VERIFICATION - SONAR
D.1.4	VERIFICATION

REQUIREMENT
To verify that the towed sonar is performing to the required standard.

INSTRUCTION
<p>1. In conjunction with the relevant SOP and before using the towed sonar to obtain survey data its ability to detect targets at its planned maximum range, on both channels, should be verified by towing it past a well defined object on the seabed, such as a wreck, whose position is known. Checks are to be conducted:</p> <ol style="list-style-type: none"> On first streaming the sonar. At least once a day when operating in areas of featureless seabed. After maintenance or repair to any part of the sonar system. After changing towfish or fins. If in any doubt about the performance of the sonar system. <p>2. If it appears that the sonar system is not working to its a maximum range, due either to water conditions or to material inadequacies which cannot be rectified, the sonar sweep should be modified to ensure complete coverage. An inadequate sonar search on the continental shelf will result in the survey being assessed as incomplete.</p>

STANDARD
Verified that the sonar is performing correctly out to the maximum range. Sonar sweep amended to cover any inadequacies detected.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 6	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.1.4

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA GATHERING - OBSERVATIONS – SEABED
D.2.1	SAMPLING

REQUIREMENT
To obtain seabed samples throughout the survey area.

INSTRUCTION
<p>1. Seabed samples should be obtained throughout the survey area before commencing the area sonar sweep. Whilst an indication of bottom texture can be deduced from good sidescan sonar traces it requires supporting evidence obtained from samples of the seabed. See also GSI D.3.2(5) and D.1.3(3).</p>

STANDARD
Samples obtained to the order of standard in Chapter 3 App1, Table 5.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H575 Rough	Seabed Texture Collector	H575	Seabed Texture Tracing

REPORT OF SURVEY	
PART 1	PART 2
Sections 7 & 8	Annex L

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.2.1

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA GATHERING – OBSERVATIONS – SONAR & MAGNETOMETER AREA SWEEP
D.2.2	

REQUIREMENT
To conduct the area sonar and magnetometer sweep.

INSTRUCTION
<ol style="list-style-type: none"> 1. Magnetometer and sonar instruments to be calibrated, tested, streamed and operated in accordance with the relevant SOP. A magnetometer is to be deployed throughout the basic sonar sweep, to provide additional evidence of the existence of ferrous metal on or below the seabed. 2. It is of the utmost importance that the Charge Surveyor ensures that the sweep is thorough, that no gaps appear in it, and that every significant seabed feature or artificial obstruction is located. 3. Charge Surveyors should note the requirement to report the existence of ripples on the seabed within the survey area. As such ripples are generally transverse to the main tidal streams sonar cross lines should be run at the optimum state of the tidal stream. Sufficient sonar information from crosslines is to be gathered to enable a statement to be made in the RoS of the extent of such sand ripples in the area, and their direction. 4. For an object charted PA the sonar search should be conducted in 2 directions at right angles and extend to at least 2.5 miles from the datum position. If the Charge Surveyor is confident that the initial search in one direction was entirely thorough and that the sonar equipment was operating satisfactorily, consideration may be given to dispensing with the search in the second direction. 5. Objects whose positions have been previously established, but which cannot be found during the Survey, need a very detailed investigation to disprove them. Where such objects fall within the survey area and a category A2 sonar search is completed to a radius of ½ mile around the listed position, this will be considered sufficient. A magnetometer should also be deployed. When there is no doubt about the geographical position of a wreck after many repeat surveys, the above radius may be reduced at the discretion of the Charge Surveyor. Consideration should always be given to the use of a wire sweep. 6. Confidence checks on the magnetometer and sonar should be conducted in accordance with GSI D.1.4

STANDARD
Survey area fully swept by magnetometer and sonar.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Sonar Track Plot	NA	Sonar Track Plot

REPORT OF SURVEY	
PART 1	PART 2
Sections 6 & 8	Annex L

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.2.2

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA GATHERING - OBSERVATIONS – WRECK
D.2.3	EXAMINATION

REQUIREMENT
To conduct examination of all wrecks, foulds, obstructions and sonar contacts.

INSTRUCTION
<ol style="list-style-type: none"> 1. All significant sonar contacts identified at D.3.1 are to be examined. 2. Each contact should be closely examined using sidescan sonar. Should the contact be confirmed its position and least depth by close sounding should be established to the standards laid down in Chapter Three Appendix 1, Table 5. 3. Examinations are best conducted using the 150 metre range scale. Speed over the ground should be about three knots to reduce record distortion. The towfish should be at a height of 25 metres above the seabed and 50 – 100 metres from the contact. A minimum of four good runs (comprising 2 perpendicular pairs) is to be achieved. In the case of wrecks, one pair of tracks should be parallel to the axis of the wreck and one pair perpendicular to it. 4. Data regarding the contact can be obtained from use of sonar, echo sounder, magnetometer, wire sweeping, diver or a combination of these. Each contact should have the following detail, in addition to that in Chapter Three Appendix 1, Table 5 established: <ol style="list-style-type: none"> a. position; b. least depth; c. nature of the object; d. length, breadth and orientation; e. depth, length and orientation of scour; f. debris field length and orientation. g. Strength of magnetic field. 5. Examination of the wreck list may aid identification of the object. Caution should be exercised in too freely linking newly discovered wrecks with those contained in the wreck list. Disproving searches may still be necessary in charted positions. 6. The use of divers may be helpful in identifying wrecks and reporting their state and attitude. In particular, they may be able to locate high points which may not have been distinguishable on echo sounder or sonar traces.

STANDARD
All wrecks and obstructions examined to the standards laid down in Chapter Three Appendix 1.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Rough H525/H525A	Sonar Contact Plot Investigation Plot	H525/H525A	Bathymetric Sheet Bottom Texture Sheet

REPORT OF SURVEY	
PART 1	PART 2
Section 11	Annex I

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.2.3

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA GATHERING - OBSERVATIONS – WIRE SWEEPING
D.2.4	

REQUIREMENT
To determine the necessity to wire sweep wrecks and obstructions.

INSTRUCTION
<ol style="list-style-type: none"> 1. The Charge Surveyor must establish the least depth over wrecks and obstructions in accordance with Chapter 3 Appendix 1 Table 5. In certain circumstances this will require the use of wire sweeping. Wire sweeping should be conducted after the position, size, orientation and probable least depth have been determined by sonar and echo sounder 2. Details for the use of wire sweeps are in the relevant SOP. 3. Wire sweeping should be considered in the following circumstances: <ol style="list-style-type: none"> a. As directed in the HI for specific wrecks; b. If the least depth is likely to be less than 40 metres; c. Where depths around the wreck are significantly different from those charted; d. When salvage/dispersal work has taken place since the last survey; e. Sonar indication of protruding masts and structures; f. Areas charted as foul within an anchorage; g. Wrecks in areas of strong tidal streams and seabed mobility; h. Where the position of the wreck is significantly different from that charted. 4. Care should 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 sonar traces.

STANDARD
Necessity to wire sweep wrecks and obstructions accurately determined.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 11	Annex I

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.2.4

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA PROCESSING - VALUES – SONAR CONTACTS
D.3.1	

REQUIREMENT
To list from inspection of the magnetometer and sonar traces all significant contacts.

INSTRUCTION
<ol style="list-style-type: none"> 1. Wreckage or artificial obstructions which stand proud of the surrounding seabed may constitute a hazard to shipping or to submarines navigating over continental shelf areas. All must be located, examined and recorded. 2. During the basic sonar sweep of an area, sonar traces must be carefully examined, by two people independently, and all contacts likely to represent obstructions carefully noted on the sonar trace and recorded in the Sonar Contact Log. 3. Contacts should be recorded in the Sonar Contacts Log under the following headings: <ol style="list-style-type: none"> a. Sonar trace number and associated echo roll. b. Julian day and time c. Contact number – consecutively through the survey. d. Fix details. e. Port/Starboard. f. Slope range. g. Layback. h. Height of fish above seabed. i. Assessment of contact e.g. shadow, cross-talk, intensity, initial classification. j. Further action e.g. investigate (INV), interline (IL), quick look (QL), no further action (NFA) 4. All contacts are to be carefully plotted on the Master Sonar Contacts sheet and independently checked. 5. The magnetometer and echo sounder traces are also to be examined to provide supporting evidence to sonar contacts.

STANDARD
To ensure all significant sonar contacts are identified, accurately recorded and plotted.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Sonar Contact Log	Master Sonar Contact Sheet	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.3.1

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA PROCESSING - VALUES – SEABED TEXTURE
D.3.2	

REQUIREMENT
To deduce from the sonar trace the texture of the seabed.

INSTRUCTION
<ol style="list-style-type: none"> 1. The texture deduced from the sonar trace is plotted onto the Seabed Texture Collector tracing. Whilst plotting the bottom texture the Sonar Track Plot will be aligned beneath this sheet and the Contour Plot beneath that to give the full picture to the compiler. 2. Plot detail from the echo sounder trace onto the Seabed Texture Collector. This detail will include the crests of sandwaves with their height, the positions of obstructions sounded over and their height, and the start and end of rock outcrops and pinnacles. 3. Plot the texture detail from the sonar trace to define the limits of texture boundaries. Boundary limits will often be the mean position from adjacent lines due to the uncertainty of the position of the towfish. Details of symbols and nomenclature are at Chapter 5 Appendix 2. 4. In areas where more than one ship is working, the Charge Surveyors are to ensure uniformity of agreement between adjacent sheets. Where surveys adjoin previously surveyed areas the Charge Surveyor should attempt to produce conformity between surveys. 5. When interpreting sonar traces instances will occur when additional seabed samples are required to clarify complex seabed texture areas. Sufficient additional seabed samples should be obtained until the Charge Surveyor is satisfied that the seabed has been accurately classified.

STANDARD
To ensure that bottom texture detail has been correctly deduced and plotted.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Echo, Sonar and Magnetometer traces	Seabed Texture Collector	RoS	Seabed Texture Sheet

REPORT OF SURVEY	
PART 1	PART 2
Section 8	Annex L

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.3.2

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA ANALYSIS – QUALITY - SONAR
D.4.1	

REQUIREMENT
To analyse the quality and totality of the sonar coverage.

INSTRUCTION
<p>1. The quality and totality of sonar coverage should be determined by inspection of the following:</p> <ol style="list-style-type: none"> <u>Sonar Track Plot</u>. This should be inspected to determine gaps in coverage due to poor line keeping. Gaps should be marked and lines run along the central axis of the gap. The track should be visually inspected to detect short periods of high towing speed that might be in excess of the allowed maximum. Excessive speed should be investigated and lines re-run if necessary. See GSI B.4.2 <u>End of Line Quality Control Data</u>. This should be inspected to ensure that the maximum speed made good along the line did not exceed the maximum permitted towing speed. Excessive speed should be investigated and lines re-run if necessary. <u>Sonar Traces</u>. Sonar traces should be inspected to ensure that the towfish was held at the correct height above the seabed and that good data was being recorded. Sections of excessive towfish height or poor recording of data should be re-run.

STANDARD
To verify that the quality and totality of data collected meets the order of standard for the survey.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	RoS	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 6	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.4.1

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA ANALYSIS – QUALITY – EXAMINATIONS
D.4.2	

REQUIREMENT
To ensure that examinations have been completed to the required standard.

INSTRUCTION
<ol style="list-style-type: none"> 1. On completion of an examination the Charge Surveyor should inspect the resulting records to ensure that the examination has been conducted thoroughly. It is the Charge Surveyor's responsibility to give a firm opinion as to the status of each obstruction located. 2. When assessing examination results the Charge Surveyor should keep the following points in mind: <ol style="list-style-type: none"> a. As long as a wreck, foul or obstruction continues to be a hazard to navigation or other marine activity, e.g. anchoring or fishing, it must appear on the chart; b. In addition to wrecks, fouls and obstructions which are charted, any objects which have been described as giving 'nonsub' echoes or which may constitute a 'foul' on the seabed must be found, classified, fixed and recorded in Office records, whether dangerous to shipping or not; or they must be disproved; c. The onus is on the Charge Surveyor to classify or disprove every charted wreck, foul, obstruction or contact previously described as 'non-sub'. Unless disproved beyond doubt, they must remain on the chart. 3. The satisfactory examination of every significant object located during a survey is a major factor in deciding whether an area has been fully surveyed, thus the Charge Surveyor is to ensure that all significant objects have been fully examined before declaring the survey complete.

STANDARD
Verified that examinations have been conducted to the required standard.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 11	Annex I

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.4.2

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA RENDERING - INTERIM REPORTS
D.5.1	

REQUIREMENT
To render interim reports on hazards to navigation.

INSTRUCTION
<p>1. Interim reports are to be rendered, without delay, for newly discovered dangers to navigation or significant changes to those already charted. Dangers include those affecting both surface vessels and known submarine operating areas such as submarine exercise areas and the deep water approaches to the UK seaward of the 40 metre contour.</p> <p>2. Interim reports should be rendered as follows:</p> <p>a. <u>Signalled Reports</u>. Signalled reports of dangers found during the course of survey are to quote the HI number. Positions are to be quoted as geographical coordinates with the horizontal datum specified. Particular care is to be taken to ensure that signalled information is correct. Signals should be sent to the following addresses:</p> <ul style="list-style-type: none"> i. HYDROUK TAUNTON (using SIC JPL) ii. FOSF, FOSM, COMRFA iii. CINC Fleet iv. If in, or near, exercise areas: FOSNNI or FOST v. Local harbour/port authority (if HM Naval Base: NBC for QHM), and/or national maritime authority. <p>b. <u>Hydrographic Notes (HNs)</u>. HNs should be forwarded to confirm and supplement signalled reports and to report information of lesser importance which UKHO should be aware of in advance of the final rendered survey. Hydrographic Notes should include the HI number and DTG of any signal relating to the HN. HNs are to be completed in accordance with NP100, The Mariner's Handbook.</p>

STANDARD
Significant hazards to navigation to be reported swiftly and accurately to UKHO and allied authorities.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	Signal/HN	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 11	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.5.1

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA RENDERING – PLOTS – BATHYMETRIC SHEET
D.5.2	

REQUIREMENT
To show wrecks, fouls and obstructions on the bathymetric sheet if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<ol style="list-style-type: none"> 1. The position and least depth of each wreck or obstruction located is to be inserted on the bathymetric sheet. If it has not been possible to examine it fully, a danger circle in black is to be inserted with the legend 'Wk(NFS)'. Depths are not to be inserted in the circle as this may be mistakenly treated as the least depth during subsequent processing. 2. Independently verify that positions are correctly plotted, show the correct depth and symbol. 3. Independently verify that positions of items inserted on the Bathymetric sheet agree with other rendered records and graphics.

STANDARD
Data plotted and verified as correct.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	Bathymetric Sheet

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
2/02

Date
1 Aug 02

GSI Number
D.5.2

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA RENDERING – PLOTS – SONAR TRACK PLOT
D.5.3	

REQUIREMENT
To produce the Sonar Track Plot if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<p>1. A tracing on the same scale as the bathymetric sheet, carrying a clear and comprehensive key to the symbols used, is to be prepared to show the following data:</p> <ol style="list-style-type: none"> <u>The ship's track</u> is to be shown as a black line between black crosses at the fixes. Sufficient of the fixes are to be identified for future use, and abbreviated times annotated except at ends of line, when the full time is to be annotated. <u>The limits of the area searched</u> by sidescan sonar are to be shown by a magenta line. This limit should only enclose the area fully insonified in accordance with the criteria for the sweep ordered. <u>Areas of intensive search</u> are to be shown by a blue outline with the result in manuscript, or a reference to another record. <u>Areas swept by wire</u> are to be shown by a red outline and hatching, with the clearance depth in manuscript where appropriate. This should be used for area sweeps only, and is not required for the immediate vicinity of a swept wreck, for which details will appear on the large scale sweeping plot (GSI D.5.5) Listed wrecks are to be shown using the non-dangerous wreck symbol (Chart 5011 symbol IK29) in black with the Wreck List number. <u>Located wrecks</u> are to be shown using symbols at Chap 5 App 1 with the number of the relevant Form H525/H525(a). <p>2. Sonar track plots are not to be combined with other tracings accompanying the bathymetric sheet. Detailed instructions for the production of the Sonar Track Plot, including title, graduation, grid and geographical intersections, etc, are contained in the Survey Processing System SOP.</p> <p>3. Independently verify that all data is correctly plotted, depicted and carefully cross checked with other tracings, forms and reports in which wrecks are included. Any corrections made to the sheet are also to be independently verified.</p>

STANDARD
Sonar Track Plot produced and verified as correct.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	Sonar Track Plot

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
2/02

Date
1 Aug 02

GSI Number
D.5.3

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA RENDERING – PLOTS – SEABED TEXTURE TRACING
D.5.4	

REQUIREMENT
To produce the Seabed Texture Tracing.

INSTRUCTION
<ol style="list-style-type: none"> Whenever sidescan sonar is used during a survey, a tracing on the same scale as the Bathymetric sheet is to be rendered showing the surveyor's interpretation of the constitution of the seabed deduced from sidescan sonar traces and samples of the seabed unless otherwise instructed in the HI. Data to be shown, symbols and descriptions used in this tracing are at Chap 5 App 2. Large areas composed of the same seabed material may be indicated by a ribbon of the appropriate symbol around the perimeter of the area. It is important that as much detail be provided as possible. Each contact with a dimension >1m should be plotted and described with height, extent and assessment of whether it is natural or man-made. The descriptions should be listed in the Report of Survey to avoid cluttering the Tracing. Any difficulties in obtaining this detail are to be clearly explained in the Report of Survey. Washes are not to be used, nor are symbols to be inserted in colours other than black. Contours are not to be inserted on this tracing, see GSI C.5.4. The type and modification state of sonar used, particularly the recorder, is to be quoted in the title. This tracing is also to show the qualities of the seabed obtained by sampling, and the positions of the retained samples, which should be correlated with the list in Annex L to the Report of Survey. Only the abbreviations shown in Appendix 3 of Chapter 5 are to be used for describing samples of the seabed. If sidescan sonar has not been used, and samples have been obtained but not retained, the qualities of the seabed may be inserted on another subsidiary tracing. Areas of mobile seabed characterised by sandwaves are to be indicated with the limits of the area shown by a black pecked line, and the appropriate symbols and descriptions in black within it. Crest lines of individual sandwaves are to be shown. The seabed texture tracing is to show each wreck located, as an orientated 'non-dangerous' wreck symbol drawn boldly and orientated to the line of wreck as surveyed. Positions are to be correlated with other records. Wreckage forms an integral part of the seabed's texture and, as such, is important to those requiring the information contained on this tracing. Detailed instructions for the production of the Sonar Texture tracing, including title, graduation, grid and geographical intersections, etc, are contained in the Survey Processing System SOP. Independently verify that all data on the Seabed Texture Plot is correctly plotted and depicted. Any corrections made to the sheet are also to be independently verified.

STANDARD
Seabed Texture Tracing produced and verified as correct.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	Seabed Texture Tracing

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
1/02

Date
1 Feb 2002

GSI Number
D.5.4

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA RENDERING – PLOTS – AREA SWEEP BY WIRE
D.5.5	

REQUIREMENT
To produce a plot of the area swept by wire

INSTRUCTION
<p>1. If an object has been swept by wire, a large-scale tracing is to accompany the report illustrating the sweeping operation. This tracing may be the original field plot if sufficiently clear; it should be folded to A4 size and show:</p> <ol style="list-style-type: none"> The name of the ship, HO No., survey and date; The path covered by each sweep; The position of each foul; The scale of the plot, and a meridian. A colour coded key is to be inserted showing the depth at which the sweep was set, the reduced depth and whether the sweep was clear or foul. <p>2. Independently verify that all data is correctly plotted, depicted and carefully cross checked with other tracings, forms and reports in which wrecks are included. Any corrections made to the sheet are also to be independently verified.</p>

STANDARD
Plot of the area swept by wire produced and verified as correct.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	Area Swept By Wire

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.5.5

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA RENDERING – REPORTS - REPORT OF SURVEY
D.5.6	

REQUIREMENT

To render a full and comprehensive report on the sonar, wrecks and nature of the seabed aspects of the survey.

INSTRUCTION

1. Data is to be rendered in accordance with the instructions at Chapter 4.

STANDARD

Details of all sonar, wreck and natures of the seabed observations along with supporting documentation accurately rendered.

DATA MANAGEMENT

Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY

PART 1	PART 2
Sections 6, 7, 8 & 11	Annexes I & L

Issue Number

Edition 1

Date

31 Mar 01

GSI Number

D.5.6

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA RENDERING – REPORTS - WRECK DATA
D.5.7	

REQUIREMENT
To render full and comprehensive wreck records.

INSTRUCTION
<ol style="list-style-type: none"> 1. Data obtained on wrecks and obstructions originally listed in the HI, and for which Wreck Detail Cards, Wreck Card, were supplied, should be rendered using form H525 and attached to the original Wreck Card. If a wreck is not located, this is to be stated on form H525, together with recommended chart action. Details of new wrecks, fouls and obstructions located are to be rendered on form H525. In each case as much detail as possible is to be included on and with the forms. 2. Each H525 is to be accompanied by the following original items which should be inserted in the paper wallet attached to the Wreck Card: <ol style="list-style-type: none"> a. All echo sounder and sonar traces obtained during the investigation, echo sounder traces to be reduced for tide; b. Representative sample of the magnetometer trace; c. Fully annotated section of sonar trace giving greatest shadow height; d. Fully annotated section of echo sounder trace, reduced for tide, showing least depth; e. Sounding and investigation plots. 3. All records to be annotated with the unit's name, HI number and name of survey, identifying fixes bracketing the contact, course and speed made good. For sonar records, the true course of the towing vessel and the layback. 4. Positions on H525s are to be quoted to 0.001 minutes. 5. Independently verify all data contained in and with H525s. 6. Cross check positions, least depths and symbols of wrecks and obstructions on forms H525 with the Report of Survey, Fair Seabed Texture Tracing and, if directed to be rendered or if deemed appropriate by the Charge Surveyor, Bathymetric sheet and Fair Sonar Track plot.

STANDARD
All wreck and obstruction data accurately and correctly recorded on fair graphics.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	As above

REPORT OF SURVEY	
PART 1	PART 2
Section 11	Annex I

Issue Number
2/02

Date
1 Aug 02

GSI Number
D.5.7

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA RENDERING – REPORTS - SEABED SAMPLES
D.5.8	

REQUIREMENT
To render seabed samples and records to UKHO.

INSTRUCTION
<p>1. The following seabed samples are to be rendered to UKHO in the special plastic containers (GSI D.1.3):</p> <ol style="list-style-type: none"> a. Those obtained in all likely anchorages; b. Those obtained on banks, shoals and seamounts and in the channels between them; c. Ten per cent of those obtained on the regular grid in the survey area. <p>2. H575, Record of Seabed Samples, is to be rendered for all retained samples. The original from H575 are to be rendered with the Report of Survey. The duplicates are to accompany the samples themselves. Samples are to be clearly marked with the following information:</p> <ol style="list-style-type: none"> a. Survey; b. Ship; c. Date; d. Latitude and longitude; e. Serial number; f. Depth in metres; g. Equipment used; h. Geological description. <p>3. All samples, and surplus containers, are to be forwarded in the boxes provided to UKHO with the remainder of the field survey records.</p>

STANDARD
Seabed samples and records correctly rendered to UKHO

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
As above	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Sections 7 & 8	Annex L

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.5.8

GENERAL SURVEY INSTRUCTION

GSI Number	SONAR, WRECKS AND SEABED – DATA RENDERING – REPORTS - FIELD RECORDS
D.5.9	

REQUIREMENT
To render field records to UKHO.

INSTRUCTION
<ol style="list-style-type: none"> 1. The original working, or field, records form an integral part of any survey. They are to be carefully preserved on board and are to be rendered to UKHO at the earliest opportunity after receipt of the 'Survey completed letter'. 2. All records must be clearly and correctly annotated before despatch to UKHO. 3. Records should be forwarded to UKHO in standard boxes provided by UKHO and clearly labelled. One form H658 is to be attached to the H28 and a second copy packed within the box. Records that will not fit in the standard boxes should be packed in alternative suitable packaging. 4. Records from different surveys are not to be packed together. Data classified Restricted or above are to be packed separately from unclassified material. 5. The following records are to be forwarded: <ol style="list-style-type: none"> a. Sidescan sonar traces; b. Wreck cards sorted in latitude order in their original binders; c. Original and other documents supplied on loan from UKHO; d. Computer printouts; e. Sonar 2094 JAZ discs. 6. Echo sounder and sonar traces are to be clearly marked, on the outer surface at each end, with the following typewritten information indicated in the relevant SOP. 7. Rough drafts of fair records submitted to UKHO are not required by UKHO and may be destroyed one year after completion of the survey.

STANDARD
Field records correctly rendered to UKHO

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
D.5.9

GENERAL SURVEY INSTRUCTION

E - TIDAL HEIGHTS

SURVEY STAGE	GROUP	REQUIREMENT	STANDARD TABLE	GSI	ISSUE DATE
Preparation	Planning	Datums and Observations	7A	E.1.1	31 Mar 01
		Site Selection		E.1.2	31 Mar 01
		Co-tidal Corrections		E.1.3	31 Mar 01
	Installation and Calibration	Tidal Station Establishment	7A	E.1.4	31 Mar 01
Data Gathering	Verification	Tide Pole/ Gauge Daily Checks		E.2.1	31 Mar 01
	Observations and Data Logging	Tide Gauge Data	7A		
Data Processing	Editing	Tide Pole Reduction		E.3.1	31 Mar 01
		Tide Gauge Reduction			
Data Analysis	Quality	Tidal Data Quality		E.4.1	31 Mar 01
	Coverage	Tidal Data Coverage			
Data Rendering	Models	Fairs Records		E.5.1	1 Aug 02
	Reports	ROS Part 1		E.5.2	31 Mar 01
		ROS Part 2			
		Fair Tidal Records			
		Field Records		E.5.3	31 Mar 01

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL HEIGHTS – PREPARATION - PLANNING – DATUMS AND OBSERVATIONS
E.1.1	

REQUIREMENT
To determine the sounding datum to be used for the survey and tidal observations required.

INSTRUCTION
<ol style="list-style-type: none"> 1. The datum to which depths are to be reduced is fundamental to any bathymetric survey and the HI will contain full details of how this is to be established together with details of established benchmarks. 2. If the datum is not defined in the HI, the existing Chart Datum should be used if at all possible. If full details are not shown, they should be requested from UKHO. 3. The necessity to either establish a new datum or to transfer datum should be carefully considered. Any new or transferred datum must be related to the local survey datum through existing or newly established benchmarks. 4. The full requirement for tidal observations, specified in the HI, should be assessed and allowed for in the planning for the survey. 5. Newly established benchmarks are to be chosen for their recoverability and longevity, minimum of ten years. 6. For surveys in rivers and river estuaries reference is to be made to the guidance in Admiralty Tidal Handbook Vol 2.

STANDARD
Planned sounding datum and observations meet the requirements of the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 9	Annex F

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
E.1.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL HEIGHTS – PREPARATION - PLANNING – SITE SELECTION
E.1.2	

REQUIREMENT
To identify suitable sites for the positioning of tide gauges and tide poles.

INSTRUCTION
<ol style="list-style-type: none"> 1. Using the data supplied with the HI the possible location for a tidal station should be determined having regard to the following factors: <ol style="list-style-type: none"> a. Proximity of the survey area. The tide station must be in or close to the survey area. The transfer of datum may be required. b. Ease of installation c. Ease of reading the tide pole d. Tide poles should be erected in a position free from the adverse effects of sea and swell e. The zero of the tide pole and tide gauge pressure sensor should not dry out. If this is unavoidable a secondary pole and gauge should be planned f. Stations should be selected clear of impounded water g. The site and associated equipment should be secure to prevent tampering or accidental damage h. Stations should be close to established benchmarks to avoid long levelling runs. i. Accessibility by the tide watcher 2. If a resurveying an area, the tide station should be established in the position of the old station if at all possible. 3. If more than one tide station is required for a survey the distance apart of each station should be in accordance with the standards set out in Chapter 3 App1 Table 7A. 4. Offshore tide gauges should be positioned in accordance with the HI. See also relevant SOP.

STANDARD
Suitable site selected for the establishment of the tide station.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 9	Annex F

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
E.1.2

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL HEIGHTS – PREPARATION - PLANNING – CO-TIDAL CORRECTIONS
E.1.3	

REQUIREMENT
To produce co-tidal and co-range lines.

INSTRUCTION
<ol style="list-style-type: none"> Using the values given in the Tidal Data Appendix and the relevant Admiralty co-tidal and co-range chart the lines for the survey area should be produced and plotted on the bridge overlays at the scale of the survey. Advice should be sought from UKHO with any difficulty in resolving complex or ill defined co-tidal areas before commencing the survey. Values of Mean Spring/Neap range should be taken from the latest edition of Admiralty Tide Tables, but values of Mean High/Low Water Interval will be specified in the HI.

STANDARD
Co-tidal and co-range curves correctly calculated and plotted.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Bridge overlay	NA	Miscellaneous Tracing

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 9	Annex G

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
E.1.3

GENERAL SURVEY INSTRUCTION

GSI Number	TIDE HEIGHTS – PREPARATION – INSTALLATION AND CALIBRATION – TIDAL STATION
E.1.4	ESTABLISHMENT

REQUIREMENT
To calibrate, install and connect tidal station equipment to sounding datum.

INSTRUCTION
<ol style="list-style-type: none"> 1. Tide poles and gauges should be calibrated and installed in accordance with the relevant SOP. 2. The tide pole, once installed is to be connected to the sounding datum, via the land levelling system, by levelling to at least two known benchmarks. Once the tide pole has been levelled witness marks should be installed as a means of quick visual check on the integrity of the pole. Standards for levelling are set out in Chapter 3 App1 Table 7A. 3. If benchmarks are inconvenient, those close to the tidal station have been destroyed, or local intelligence suggests that they may have been disturbed, at least two new marks should be made and levelled to the nearest known land datum point. Standards for levelling are set out in Chapter 3 App1 Table 7A. 4. A comparison of tide pole and tide gauge readings (to two decimal places of a metre) over a 25 hour period should be taken to both establish sounding datum on the gauge and to ensure its correct operation. Thereafter checks on the gauge should be conducted in accordance with the relevant SOP. 5. Transfer of datum should be conducted in accordance with the instructions in NP 122(2), Admiralty Tidal handbook No.2, paragraphs 4 – 8. Full details of all transfers are to be forwarded to UKHO, with the relevant tidal observations, as soon as completed. Where tides are mainly diurnal transfer data is to be transmitted to UKHO for analysis. 6. When an established gauge is used, the setting must always be checked independently to ensure that the zero corresponds to the stated figure. 7. When using an offshore tide gauge, each 30 day period of continuous tide readings should be transmitted to UKHO for analysis to establish sounding datum. See the relevant SOP for full details.

STANDARD
To ensure that the tidal station is established to meet the requirement specified in the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H7 Field Book	White Wash Book	H533	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 9	Annex G

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
E.1.4

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL HEIGHTS – DATA GATHERING – VERIFICATION AND OBSERVATIONS – TIDE
E.2.1	POLE/GAUGE CHECKS – TIDE GAUGE DATA

REQUIREMENT
To obtain adequate tidal data.

INSTRUCTION
<ol style="list-style-type: none"> Observed tidal data should be inspected each day to ensure that the observations meet the minimum or any special requirement of the HI. Whenever possible continuous tide readings should be obtained for the entire duration of the survey. Where continuous tide readings are not obtained, care should be taken at the start and end of each survey period with co-tidal time differences to ensure that tidal data covers sounding operations. Tidal observations are to be obtained and digitally recorded where able, at intervals specified in Chapter 3 App 1 Table 7A. See also the SOP for the tide gauge in use. Tidal observations are to be obtained and recorded to two decimal places of a metre.

STANDARD
Tidal data observed and recorded for the period of the survey in compliance with the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
<ol style="list-style-type: none"> H 148 Record of Tidal Observations Tide gauge digital record H516 Summary of Checks on Automatic Tide gauge 	NA	<ol style="list-style-type: none"> H143 Record of Tidal Observations PC spreadsheet 	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 9	Annex G

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
E.2.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL HEIGHTS – DATA PROCESSING – EDITING – TIDE POLE AND GAUGE
E.3.1	REDUCTION

REQUIREMENT
To reduce observed tidal data to sounding datum.

INSTRUCTION
<ol style="list-style-type: none"> Observed tide gauge and pole readings should be reduced to sounding datum at the tide station using the values obtained for each when they were installed, see GSI E.1.4. Apply co-tidal time and range factors to reduce observed tide to the values at the survey area. When using an offshore tide gauge, each 30 day period of continuous tide readings should be transmitted to UKHO for analysis to establish sounding datum. See the relevant SOP for full details.

STANDARD
Tidal observations correctly and accurately reduced to sounding datum.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	H185 Tidal Reduction Form	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 9	Annex F

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
E.3.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL HEIGHTS – DATA ANALYSIS – QUALITY AND COVERAGE – TIDAL DATA
E.4.1	COVERAGE AND QUALITY

REQUIREMENT
To analyse observed tidal data.

INSTRUCTION
<ol style="list-style-type: none"> 1. A daily comparison of the tide gauge and tide pole is to be carried out by comparing simultaneous readings. After reduction to sounding datum simultaneous tide pole and tide gauge readings should be compared to ensure that the tide gauge was recording correctly. 2. Reduced tide gauge readings should be plotted, either graphically or using a PC spreadsheet and the resulting tide curve compared to the predicted curve at the tide station to ensure consistency of data and to ensure that the tide gauge was recording correctly. 3. Unless 'steps' in tides are expected, curves may be smoothed by the Charge Surveyor. Large or repetitive steps should be noted in the RoS and the tide gauge checked for any malfunction. 4. When using telemetry links with established gauges a comparison of actual gauge and telemetry values is to be conducted during the 25 hour pole gauge comparison and at intervals throughout the survey.

STANDARD
To ensure that all observed tidal data is valid and consistent.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H516 Summary of Checks on Automatic Tide gauge	H160 Tidal Diagrams	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 9	Annex F

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
E.4.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL HEIGHTS – DATA RENDERING – MODELS – FAIR RECORDS
E.5.1	

REQUIREMENT
To provide full and accurate details of zone boundaries, contours and data points of all sounding datums and co-tidal models used in the reduction of soundings.

INSTRUCTION
<ol style="list-style-type: none"> Normally details of sounding datum, co-tidal corrections, the zone boundaries, contours or data points should be rendered in section 9 and Annexes F and G of the ROS (GSI E.5.2). The rendering of printouts of data points and their values directly from the data processing system is encouraged as this will minimize transcription errors. If deemed appropriate by the Charge Surveyor, the data can be rendered as an accompanying A3/A4 plot, which should be an Appendix to Annex F. Details shown on the accompanying plots must be correlated with all other tidal records.

STANDARD
All tidal data correctly and accurately recorded on fair records.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	ROS section 9 and Annexes F & G	Plot as an Appendix to Annex F

REPORT OF SURVEY	
PART 1	PART 2
Section 9	Annex F & G

Issue Number
2/02

Date
1 Aug 02

GSI Number
E.5.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL HEIGHTS – DATA RENDERING - REPORTS
E.5.2	

REQUIREMENT
To render a full and accurate report on the tidal aspects of the survey.

INSTRUCTION
<p><u>Report of Survey</u></p> <p>1. Data is to be rendered in accordance with the instructions at Chapter 4.</p> <p><u>Tidal Records</u></p> <p>1. H143 is to be used for rendering fair records of tidal observations. Pages 1 and 4 are to be completed in full whilst tidal heights and times may be rendered in digital form using a PC spreadsheet supported by a hard copy. Times and heights are to be recorded every hour. Heights are to be rendered to two decimal places of a metre.</p> <p>2. Details on H143 page 1 are to include time zone kept, benchmarks, other fixed reference marks and connections between the zero of the tide pole or gauge and benchmarks, sounding datum and the land levelling system (e.g. Ordnance Datum, Newlyn). These connections should be given to three decimal places of a metre. The grid references of the benchmarks are to be given where known. Except where positions are self evident, the descriptions should be accompanied by detailed sketches.</p> <p>3. When observations have been taken from a permanent automatic tide gauge, only H143 page 1 and, if necessary, page 4 should be completed. The address of the authority which operates the gauge should be noted on page 1.</p> <p>4. If predicted tides have been used for the reduction of soundings, the predicted hourly heights may be rendered either on H143, clearly annotated 'Predicted Tides' or as a copy of the print out.</p> <p>5. H143s are not required for observations obtained from offshore tide gauges.</p>

STANDARD
Details of all tidal observations and levelling connections fully and accurately rendered.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	1. H143 Record of Tidal Observations 2. PC spreadsheet	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 9	Annexes F & G

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
E.5.2

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL HEIGHTS – DATA RENDERING – FIELD RECORDS
E.5.3	

REQUIREMENT
To manage and dispose of field records.

INSTRUCTION
<p>1. Original records of observations including tide gauge records, Forms H148(Tide Pole Records), H185 (Tidal Reduction Form), H160 (Tidal Diagrams) and H516 (Tide Gauge Check Sheets) need not be forwarded to UKHO and may be destroyed one year after the survey fair records are rendered.</p>

STANDARD
Field records correctly managed.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
All tidal records	All tidal records	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
E.5.3

GENERAL SURVEY INSTRUCTION

F - TIDAL STREAMS

SURVEY STAGE	GROUP	REQUIREMENT	STANDARD TABLE	GSi	ISSUE DATE
Preparation	Planning	Observations		F.1.1	31 Mar 01
	Calibration	Current meters			
		Logship			
Data Gathering	Observations	Current meters		F.2.1	31 Mar 01
		Logship			
		Informal Tidal Stream data			
Data Processing	Values	Current meters		F.3.1	31 Mar 01
		Logship			
Data Analysis	Quality	Current meters		F.4.1	31 Mar 01
		Logship			
Data Rendering	Plots	Miscellaneous Tracing		F.5.1	1 Aug 02
	Reports	Report of Survey		F.5.2	31 Mar 01
	Records	Field and Fair Records		F.5.3	31 Mar 01

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL STREAM – PREPARATION - PLANNING OBSERVATIONS AND EQUIPMENT
F.1.1	CALIBRATION

REQUIREMENT
To determine the tidal stream observations required as directed by the Hydrographic Instruction. Select, test and calibrate equipment.

INSTRUCTION
<ol style="list-style-type: none"> 1. The direction and rate of the tidal stream is to be observed wherever it is of navigational significance and where there is no evidence that observations have been made previously. Positions, and full requirement, for observations will be given in the HI, but Charge Surveyors are to include additional stations if they consider this necessary. 2. Observations should be made using a current meter, current profiler or a floating log-ship. Observations are to be made at a depth appropriate to the average draught of shipping using the area or as directed by the HI. 3. The equipment selected for tidal stream observations should be operated in accordance with the relevant SOP. All equipment is to be tested and calibrated before the commencement of surveying operations.

STANDARD
Observations planned to meet the requirement of the HI. Equipment selected, tested and calibrated ready for observing.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 10	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
F.1.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL STREAM – DATA GATHERING – OBSERVATIONS
F.2.1	

REQUIREMENT
To obtain adequate tidal stream data.

INSTRUCTION
<ol style="list-style-type: none"> Observations are to be taken using the prescribed equipment and in accordance with the relevant SOP. In Home Waters and other areas where the tide is predominantly semi-diurnal, observations are to be obtained over a single period of 25 hours at Springs. In areas where the diurnal equality is large, 30 days observations using a current meter to enable a harmonic analysis to be conducted are required. Should it not be possible for such protracted observations to be taken then sufficient measurements are to be obtained to enable a description to be inserted in Sailing Directions, and tidal stream arrows to be shown on the chart. Observations are not to be taken during abnormal weather conditions. From short period observations, the behaviour of the tidal stream is calculated, the residual movement of the current analysed, and deductions made about the total water movement under various combinations of astronomical conditions. All observations must therefore be made with great care, for inaccurate observations may result in wholly erroneous deductions. In addition to standard observations, information of a less formal nature may be available from local sources, especially if it may affect low-powered vessels or yachts. Data obtained should include the estimated maximum rates at Springs and the directions of tidal streams assessed by the best possible means. In areas of strong tidal stream, especially in the vicinity of banks, rock shelves and in narrow passages, eddies and overfalls may occur which can be of considerable significance especially to small, or under-powered craft. The limits of these phenomena are to be fixed, at Springs, on both directions of the tidal stream.

STANDARD
Observations obtained to meet the requirement of the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H183	NA	H183A	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 10	Annex J

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
F.2.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL STREAM – DATA PROCESSING – VALUES – CURRENT METERS AND LOGSHIP
F.3.1	

REQUIREMENT
To reduce observed tidal stream data.

INSTRUCTION
<p>1. Observational data is to be reduced in accordance with the SOP for the equipment used to obtain the data. Analysis of tidal stream observations for inclusion on BA Charts will be conducted by the UKHO.</p>

STANDARD
Tidal stream observations correctly and accurately reduced.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H183	NA	H183A	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 10	Annex J

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
F.3.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL STREAM – DATA ANALYSIS – QUALITY - CURRENT METERS AND LOGSHIP
F.4.1	

REQUIREMENT
To analyse observed tidal stream data.

INSTRUCTION
<ol style="list-style-type: none"> Where previous tidal stream data exists the new observations should be compared to ensure continuity and consistency. Where no previous data exists observations should be inspected to ensure that they are in agreement with tidal streams experienced during the survey. The analysis of all observed tidal stream data for inclusion on BA charts will be conducted by the UKHO.

STANDARD
To ensure that all observed tidal data is valid and consistent.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H183	NA	H183A	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 10	Annex J

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
F.4.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL STREAM – DATA RENDERING – PLOTS – MISCELLANEOUS TRACING
F.5.1	

REQUIREMENT
To show tidal stream data in graphic format, if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<ol style="list-style-type: none"> Positions and full details of tidal stream observations are normally to be given in the ROS at section 10 and Annex J (GSI F.5.2). If deemed appropriate by the Charge Surveyor, positions of tidal stream observations can be shown on a miscellaneous tracing as lettered diamonds. Limits of eddies and overfalls are to be shown on a miscellaneous tracing.

STANDARD
All tidal stream data correctly and accurately managed.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	ROS section 10 and Annex J	1. Miscellaneous Tracing

REPORT OF SURVEY	
PART 1	PART 2
Sections 10 and 16	Annexes J & N

Issue Number
2/02

Date
1 Aug 02

GSI Number
F.5.1

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL STREAM - DATA RENDERING – REPORTS – REPORT OF SURVEY
F.5.2	

REQUIREMENT
To render a full and accurate report on the tidal stream aspects of the survey.

INSTRUCTION
1. Data is to be rendered in accordance with the instructions at Chapter 4.

STANDARD
Details of all tidal stream observations fully and accurately rendered.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	RoS	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 10 and 16	Annex J

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
F.5.2

GENERAL SURVEY INSTRUCTION

GSI Number	TIDAL STREAM – DATA RENDERING – RECORDS - FIELD AND FAIR RECORDS
F.5.3	

REQUIREMENT
To render fair records and manage the disposal of field records.

INSTRUCTION
<ol style="list-style-type: none"> Observed tidal stream data are to be rendered on Form H183a as Annex J to the Report of Survey. Form H183, Rough Work Book, may be destroyed one year after the fair survey records are rendered.

STANDARD
Fair records fully and accurately rendered. Field records correctly managed.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H183	NA	H183A	NA

REPORT OF SURVEY	
PART 1	PART 2
Paragraph 10	Annex J

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
F.5.3

GENERAL SURVEY INSTRUCTION

G - COASTLINE & TOPOGRAPHY

SURVEY STAGE	GROUP	REQUIREMENT	STANDARD TABLE	GSI	ISSUE DATE
Preparation	Planning	Existing Data Sources	1	G.1.1	31 Mar 01
		Geodetic Control	1	G.1.2	31 Mar 01
		Photogrammetry	1	G.1.3	31 Mar 01
Data Gathering	Field Observations	Coastline and Foreshore	1	G.2.1	31 Mar 01
		Topography	1	G.2.2	31 Mar 01
		Photo plot		G.2.3	31 Mar 01
		Marine Facilities		G.2.4	31 Mar 01
Data Processing	Values	Coastline & Foreshore	1	G.3.1	31 Mar 01
		Topography	1		
		Marine Facilities			
Data Analysis	Quality	Coastline & Foreshore		G.4.1	31 Mar 01
		Topography			
		Marine Facilities			
	Coverage	Coastline and Foreshore		G.4.2	31 Mar 01
		Topography			
		Marine Facilities			
Data Rendering	Plots	Coastline and Topographic Detail		G.5.1	1 Feb 03
	Reports	ROS and Miscellaneous		G.5.2	31 Mar 01
		Photogrammetry		G.5.3	31 Mar 01
		Field Data		G.5.4	31 Mar 01

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – PREPARATION - PLANNING – EXISTING DATA
G.1.1	SOURCES

REQUIREMENT
To identify existing data and plan further observations.

INSTRUCTION
<ol style="list-style-type: none"> 1. The requirement for mapping of the coastline and other topography will be defined in the HI. 2. The High Water line shown on maps of the Ordnance Survey of England, Wales and the Ordnance Survey of Northern Ireland is the HWMMT and cannot be accepted as the coastline for hydrographic surveys. Maps of the Ordnance Survey of Scotland show the line of Mean High Water Springs, and therefore can be accepted as the coastline for hydrographic surveys unless the Charge Surveyor has reason to consider that it is inaccurate. 3. Using maps and any photo plots supplied with the HI, identify those areas adequately covered by existing mapping and those requiring additional work. Where no modern maps or air photo plots exist, all coastline and topographic detail which will be of use to the mariner must be fixed accurately. 4. When operating out of UK waters, attempts should be made to obtain copies of any relevant modern maps and geodetic data additional to those supplied with the HI. Any such data should be rendered to the UKHO at the end of the survey. 5. Determine the means of mapping inadequate areas and identify equipment to be used to define such areas appropriate to the scale of the survey. 6. Calibrate all equipment assigned for coastline and topography observation in accordance with the relevant SOP.

STANDARD
All coastline and topography to be mapped identified. Equipment required for mapping selected and calibrated.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 13	Annex M

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.1.1

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – PREPARATION – PLANNING – GEODETIC CONTROL
G.1.2	

REQUIREMENT
To identify geodetic control required for coastlining and photogrammetric work.

INSTRUCTION
<ol style="list-style-type: none"> 1. Having regard to GSI Section A (Geodetic Control) and the equipment identified to map the coastline, determine sites for geodetic control. Install new geodetic control in accordance with GSI Section A. 2. <u>Air Photography</u>. In addition to the main geodetic scheme, the HI may order the establishment of special points for the conduct of air photo operations in the area. Such control should be planned using the instructions contained in the HI and conform to the instructions in GSI Section A and the standards set out in Chapter 3 Appendix 1. The HI may also detail particular ground control points and levelled heights which must be included specifically for subsequent mapping processes. Guidance on control stations is also given in NP 137 'Helicopter Survey Photography – A Practical Handbook'.

STANDARD
All relevant geodetic control identified and confirmed on the correct datum, projection and grid. New control planned and assessed at the correct specification.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 2	Annex C

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.1.2

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – PREPARATION – PLANNING – PHOTOGRAMMETRY
G.1.3	

REQUIREMENT
To identify and plan for required photogrammetric work.

INSTRUCTION
<ol style="list-style-type: none"> 1. Air photography is generally ordered to fulfil the following objectives: <ol style="list-style-type: none"> a. Vertical photography for charting purposes; b. Oblique photography for use in Sailing Directions and to assist in identification on vertical photographs; c. Occasional photography of both kinds for scientific purposes including tidal stream studies, animal/bird counts and glaciological research. 2. Air Photographic instructions will contain details of the tracks to be flown, the required flying height, and the appropriate lateral and fore-and-aft overlaps to be obtained (usually 30% and 80% respectively), together with other considerations relevant to particular tasks, including the tidal 'window' within which coastal photography should be flown. 3. Recommended flight plans will normally be included with the Air Photographic instructions, but these may be amended, if necessary, to suit flying conditions at the time. 4. If vertical photography is being obtained on an opportunity basis, flight plans should be prepared locally, taking into account the purpose for which the photography is expected to be used. 5. The need for oblique photography to illustrate Sailing Directions within the area of an HI will usually be for the Charge Surveyor to assess, bearing in mind the topography, prominent features and the use made of the area by shipping, together with the age of the illustrations already published in the Sailing Directions concerned. Specific instructions will be issued with individual HIs, or as a special Views Photographic Instruction for a stretch of coast connected with another HI. UKHO Sailing Directions staff are available for advice regarding views. 6. Whenever air photography is taking place, oblique photographs of important features of charting interest, and of photogrammetric control points, are to be taken as these can be of great value both to the cartographer, and to the photogrammetrist, in assisting the identification of small or complex features on vertical photography or maps. 7. When planning photographic sorties, reference should be made to NP137 (Helicopter Survey Photography - A Practical Handbook), to NP100 (The Mariners' Handbook) and to AMHS Vol II Chapter 6, in order that all aspects of the task may be fully taken into account and due economy exercised.

STANDARD
Air photographic sorties planned to meet the requirement of the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 16	Annexes O and S

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.1.3

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – DATA GATHERING - FIELD OBSERVATIONS –
G.2.1	COASTLINE AND FORESHORE

REQUIREMENT
To define and describe the coastline and foreshore.

INSTRUCTION
<ol style="list-style-type: none"> 1. The entire length of the coastline and foreshore is to be walked, mapped and graphically described in accordance with the HI and HQAI Chapter 3 Appendix 1 Table 1. The coastline is the line reached by Mean High Water Spring tides. 2. The delineation of the drying line is of particular importance due to its status in law. The drying line of the mainland, islands and all drying features, is to be fully defined. 3. The whole foreshore is to be walked at least once at low water in order to detect inter tidal features not detected whilst sounding. 4. At Low Water Springs delineate and height rocks and other isolated danger exposed by the tide.

STANDARD
Coastline and foreshore mapped as required by the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
1. H7 Field Book	Coastline Collector Tracing	ROS	Bathymetric Sheet
2. Digital Record			

REPORT OF SURVEY	
PART 1	PART 2
Section 13	Annex M

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.2.1

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – DATA GATHERING – FIELD OBSERVATIONS -
G.2.2	TOPOGRAPHY

REQUIREMENT
To define and describe the topography and topographic features.

INSTRUCTION
<ol style="list-style-type: none"> Topography shown on the largest scale chart is to be checked in the field, to update detail which is not normally shown on maps and which may not be visible on air photographs, in particular coastal detail such as beacons, flagstaffs, groynes, outfalls, etc. Objects visible from seaward which may be hidden from above, e.g. by overhanging trees, are to be recorded. Charted objects which no longer exist are to be recorded as deletions on a copy of the published chart. When checking air photo plots the colours of objects, where relevant, are to be recorded as most aerial photography is carried out in monochrome. All features that may be used to fix a vessel's position, whether visually or by radar, should be plotted and where practicable, co-ordinated. Topographic detail of no direct value to the mariner, or which is not visible from seaward should be disregarded. On arrival in the survey area objects appearing either conspicuous or prominent are to be noted and checked against the published chart with differences quoted in the RoS. Conspicuous objects are natural or artificial marks which stand out, are easily identifiable and clearly visible to the mariner over a large area of sea in varying conditions of light. Prominent objects are those which are easily identifiable, but do not justify classification as conspicuous. Irrespective of the limits of the HI, in areas where charting is poor the Charge Surveyor should be prepared to follow the courses of rivers beyond HI limits whenever time allows and their commercial or communications value suggest this would be useful. See Chapter 3 Appendix 1 Table 5.

STANDARD
Topography mapped as required by the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
1. H7 Field Book	Coastline Collector Tracing	ROS	Bathymetric Sheet
2. Digital Record			

REPORT OF SURVEY	
PART 1	PART 2
Section 13	Annex M

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.2.2

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – DATA GATHERING – FIELD OBSERVATIONS –
G.2.3	PHOTO PLOT

REQUIREMENT
To verify the air photo plot of the survey area.

INSTRUCTION
<ol style="list-style-type: none"> 1. The photo plot is to be thoroughly checked in the field by walking the area covered by the plot and verifying the interpretation of the photographs. The Charge Surveyor is to make a thorough check of the plot to ensure that detail of importance to the mariner has not been missed. 2. Difficulties experienced in photo plot compilation, and discrepancies with existing data, will be highlighted in a photo plot report that will accompany the plot. Special attention must be given to resolving these difficulties. 3. It should be noted that the waterline derived from air photographs rarely coincides precisely with chart datum, especially in areas of gently shelving beaches.

STANDARD
Photo plot verified by field observation.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H7 Field Book	Photo Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 13	Annex M

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.2.3

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – DATA GATHERING – FIELD OBSERVATIONS –
G.2.4	MARINE FACILITIES

REQUIREMENT
To define and describe all shore facilities of use to the mariner.

INSTRUCTION
<p>1. All shore facilities of use to the mariner are to be defined and described. The following items are of particular relevance:</p> <ul style="list-style-type: none"> a. <u>Measured Distances</u>. Measured distances within the survey area are to be checked, from both landward and seaward, and new ones co-ordinated. The positions of beacons and recommended tracks are to be determined and recorded. b. <u>Landing Place, Ramps and Slipways</u>. Where ramps, slipways and beaches free from obstructions exist, and are suitable for beaching boats and/or hovercraft, details including: dimensions, access, gradient and trafficability are to be recorded. This information is particularly important if the coast is otherwise inhospitable due to heavy surf, steep cliffs, mangroves, etc. c. <u>Jetties and Harbour Facilities</u>. During the course of the survey all jetties and harbour facilities are to be fully delineated and described. d. <u>Small Craft Facilities</u>. When conducting inshore surveys in Home Waters details of all facilities useful for small craft operations are to be determined and recorded. <p>2. Charge Surveyors are to consult Harbour masters and marina managers to obtain ancillary information including published instructions and pamphlets issued locally to mariners.</p>

STANDARD
All shore facilities of use to the mariner defined and described.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H7 Field Book	Coastline Collector Tracing	ROS	Bathymetric Sheet

REPORT OF SURVEY	
PART 1	PART 2
Section 13	Annex M

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.2.4

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – DATA PROCESSING – VALUES – COASTLINE AND FORESHORE – TOPOGRAPHY – MARINE FACILITIES
G.3.1	

REQUIREMENT
To plot the results of coastline and topography work.

INSTRUCTION
<ol style="list-style-type: none"> The data obtained from coastlining work is to be plotted, at the scale of the survey, using the means appropriate to the way in which the data was obtained. For GGPS methods refer to the SOP for the equipment used. Symbols used to produce the coastline compilation tracing are listed in HQAI Chapter 5.

STANDARD
To ensure that coastline and topographic detail has been correctly plotted.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
<ol style="list-style-type: none"> H7 Field Book Digital Record 	Coastline Collector Tracing	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.3.1

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – DATA ANALYSIS – QUALITY - COASTLINE AND FORESHORE – TOPOGRAPHY – MARINE FACILITIES
G.4.1	

REQUIREMENT
To ensure that the coastline and topography have been mapped to the required standard.

INSTRUCTION
<ol style="list-style-type: none"> 1. The final coastline and topography collector tracing is to be overlayed onto existing data sources at the same scale to check for gross errors and omissions in the field work. 2. Ensure that the limits of areas match the existing data or determine why this is not the case and comment in the ROS.

STANDARD
To verify that the quality and totality of data collected meets the requirement of the HI.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Coastline Collector Tracing	NA	Bathymetric Sheet

REPORT OF SURVEY	
PART 1	PART 2
Section 13	Annex M

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.4.1

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – DATA ANALYSIS – COVERAGE - COASTLINE AND
G.4.2	FORESHORE – TOPOGRAPHY – MARINE FACILITIES

REQUIREMENT

To ensure that the area requiring mapping has been adequately covered.

INSTRUCTION

1. The final coastline and topography collector tracing is to be overlayed onto existing data sources at the same scale to ensure that the area(s) required to be mapped has been completed.

STANDARD

Survey area covered as instructed in the HI.

DATA MANAGEMENT

Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Coastline Collector Tracing	NA	NA

REPORT OF SURVEY

PART 1	PART 2
Section 13	Annex M

Issue Number

Edition 1

Date

31 Mar 01

GSI Number

G.4.2

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – PLOTS – COASTLINE AND TOPOGRAPHIC DETAIL
G.5.1	

REQUIREMENT
To show coastline and topographic detail in graphic form, if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<ol style="list-style-type: none"> No coastline or topographic detail is to be rendered unless it has been surveyed in the field. Newly surveyed detail should be rendered on the miscellaneous tracing. Coastline and topographic detail should be shown on bathymetric sheets, only if its omission would impact on the clarity and comprehension of the rendered bathymetric data. Data from the photo plot should not be shown on the bathymetric sheet unless it is absolutely necessary in order to complement other data.

STANDARD
Data plotted and verified as correct in accordance with the instructions set out in Chapter 5, Standard Graphics Formats.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	Bathymetric Sheet or Miscellaneous tracing

REPORT OF SURVEY	
PART 1	PART 2
Section 13	Annex M

Issue Number
1/03

Date
1 Feb 03

GSI Number
G.5.1

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – REPORTS - REPORT OF SURVEY AND
G.5.2	MISCELLANEOUS

REQUIREMENT
To render a full and comprehensive report on the coastlining and topographic aspects of the survey.

INSTRUCTION
<ol style="list-style-type: none"> 1. Data is to rendered in accordance with the instructions at Chapter 4. 2. Hydrographic Notes are to be rendered in accordance with NP100, The Mariner's Handbook, for any significant item requiring immediate chart action. 3. H102A, Port Information Sheet, is to be rendered in accordance with NP100, The Mariner's Handbook for each port and harbour within the survey area.

STANDARD
Details on the coastlining and topographic aspects of the survey fully and accurately rendered.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 13	Annex M

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.5.2

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – REPORTS - PHOTOGRAMMETRY
G.5.3	

REQUIREMENT
To record amendments to supplied photo plots and photographs.

INSTRUCTION
<ol style="list-style-type: none"> 1. Amendments to the photo plot must be shown by marking corrections on the dyeline copy or second full colour copy. 2. Where required, the air photographs supplied with the plot are to be marked, by pricking through and identification on the reverse side, to show additional control established for the survey. 3. A list of amendments and those differences between the photo plot and other existing data which have been resolved in the field is to be included in the ROS. 4. Where geodetic stations have been recovered or new ones observed, station description forms H159/159A must be rendered, making particular reference to features in the immediate vicinity which can be easily identified from the air. 5. The original air photo plot, copies and photographs are to be returned to UKHO when the survey is rendered

STANDARD
Amendments to the photo plot correctly reported.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Photo Plot	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 13	Annex M

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.5.3

GENERAL SURVEY INSTRUCTION

GSI Number	COASTLINE AND TOPOGRAPHY – DATA RENDERING – FIELD DATA
G.5.4	

REQUIREMENT
To manage and dispose of field records.

INSTRUCTION
<p>1. All field records relating to coastlining, topography and photogrammetry are to be retained for one year from the date the survey was rendered after which they may be destroyed.</p>

STANDARD
Field records correctly managed.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
All	All	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
G.5.4

GENERAL SURVEY INSTRUCTIONS

H - NAVIGATION AIDS

SURVEY STAGE	GROUP	REQUIREMENT	STANDARD TABLE	GSI	ISSUE DATE
Preparation	Planning	Data extract		H.1.1	31 Mar 01
		Geodetic control planning	1		
		Navaid fix and check			
Data Gathering	Field observations	Fixed Nav aids	1	H.2.1	31 Mar 01
		Floating Nav aids	1	H.2.2	31 Mar 01
Data Processing	Values	Navaid Position		H.3.1	31 Mar 01
		Light Sectors	1		
Data Analysis	Quality	Navaid Position	1	H.4.1	31 Mar 01
		Navaid Description			
	Coverage	Nav aids		H.4.2	31 Mar 01
Data Rendering	Interim Reports	Signal Reports		H.5.1	31 Mar 01
		Hydrographic Notes			
	Plots	Nav aids		H.5.2	1 Aug 02
	Reports	ROS		H.5.3	31 Mar 01
		Field Records		H.5.4	31 Mar 01

GENERAL SURVEY INSTRUCTIONS

GSI Number	NAVIGATION AIDS – PREPARATION – PLANNING – DATA EXTRACT - GEODETIC
H.1.1	CONTROL PLANNING - NAVAID FIX AND CHECK

REQUIREMENT
Identify fixed and floating navigational aids and produce a plan to determine their positions and characteristics.

INSTRUCTION
<ol style="list-style-type: none"> Using the largest scale chart(s) of the survey area, Admiralty List of Lights and Admiralty List of Radio Signals identify all fixed and floating navigational marks and aids. From a reconnaissance of the survey area identify all uncharted fixed and floating navigational marks. Plot floating navigational marks on the Bridge Overlay. New, fixed, navigational marks and those suspected of being out of their charted position are to have their positions co-ordinated. An observing plan is to be developed using GSI Section 1, Geodetic Control, and Chapter Three Appendix 1 Table 1. All floating navigational marks are to have their positions checked, at full ebb and full flood. Positions are to be established to the standards set down in Chapter Three Appendix 1 Table 1. Equipment selected for the positioning of nav aids should be checked and calibrated in accordance with the relevant SOP.

STANDARD
All fixed and floating nav aids identified. Control plan produced and assessed at the correct standard.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Bridge Overlay	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 12	Annexes K & P

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
H.1.1

GENERAL SURVEY INSTRUCTIONS

GSI Number	NAVIGATION AIDS – DATA GATHERING – FIELD OBSERVATIONS – FIXED NAVAIDS
H.2.1	

REQUIREMENT
To determine the position and characteristics of all fixed navigational aids.

INSTRUCTION
<ol style="list-style-type: none"> 1. The position of each new, fixed, navigational mark and any suspected of being out of their charted position is to have its position determined using the geodetic observing plan from A.1.1(3). The permission of the relevant authority is to be obtained before attempting to gain access to navigational structures and marks. 2. For lit navigational aids the height of the focal plane of the light is to be determined. See Chapter Three Appendix 1 Table 1. 3. Light and sound characteristics are to observed and recorded. 4. Light sectors and obscured arcs are to be measured. 5. The structure, shape, colour and topmark/colour of all fixed nav aids to be described. 6. Colour photographs of navigational aids are to be taken for inclusion in Sailing Directions. See NP100, Mariner's Handbook, Section 8.34. 7. Harbour authorities should be consulted over changes found to nav aids to determine if such changes are permanent or temporary. Details of any planned changes to nav aids should also be obtained. 8. The details of port radio operations, including Ship Reporting Systems (VTS, VTM, VTIS, etc), radio pilot services, radio navigational aids (including (Aero) radio beacons, radar beacons, etc), coast radio station services (e.g. public correspondence details, navigational warnings and weather information broadcasts, schedules, etc), GMDSS facilities, together with Search and Rescue procedures, are to be obtained.

STANDARD
Observations for position obtained to the standard set out in Chapter 3 Appendix 1. Light sectors and characteristics accurately determined. Structure details accurately recorded. Photographs of nav aids obtained iaw NP100.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H7 Field Book	Miscellaneous Collector Tracing	NA	Collector Tracing

REPORT OF SURVEY	
PART 1	PART 2
Section 12	Annexes K & P

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
H.2.1

GENERAL SURVEY INSTRUCTIONS

GSI Number	NAVIGATION AIDS – DATA GATHERING – FIELD OBSERVATIONS – FLOATING NAVAIDS
H.2.2	

REQUIREMENT
To determine the position and characteristics of all floating navigational aids.

INSTRUCTION
<ol style="list-style-type: none"> 1. All floating navigational marks are to have their positions determined to the standard set out in Chapter Three Appendix 1 Table 1. The positions at full ebb and full flood are to be observed. 2. Light and sound characteristics of each mark are to be determined. 3. The structure, shape, colour and topmark/colour of all floating navigational marks to be described. 4. Colour photographs of navigational aids are to be taken for inclusion in Sailing directions. See NP100, Mariner's Handbook Section 8.34. 5. Harbour authorities should be consulted over changes found to nav aids to determine if such changes are permanent or temporary. Details of any planned changes to nav aids should also be obtained.

STANDARD
Observations for position obtained to the standard set out in Chapter 3 Appendix 1. Light characteristics accurately determined. Structure details accurately recorded. Photographs of nav aids obtained iaw NP100.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
H7 Field Book	Miscellaneous Collector Tracing	NA	Miscellaneous Tracing

REPORT OF SURVEY	
PART 1	PART 2
Section 12	Annexes K & P

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
H.2.2

GENERAL SURVEY INSTRUCTIONS

GSI Number	NAVIGATION AIDS – DATA PROCESSING – VALUES - NAVAID POSITION AND LIGHT SECTORS
H.3.1	

REQUIREMENT
To calculate the position of nav aids. To plot light sectors.

INSTRUCTION
<ol style="list-style-type: none"> 1. Observations for position of fixed nav aids and their sectors are to be calculated from observations in accordance with GSI A Geodetic Control. 2. Using observed values plot the light sectors on the Accompanying Tracing. 3. The mean position of floating nav aids is to be calculated from the observed ebb and flood positions.

STANDARD
Derived position of the nav aid meets the standard at Chapter Three, Appendix 1, Table 1.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Miscellaneous Collector Tracing	Geodetic Data File	Miscellaneous Tracing

REPORT OF SURVEY	
PART 1	PART 2
Section 12	Annexes K & P

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
H.3.1

GENERAL SURVEY INSTRUCTIONS

GSI Number	NAVIGATION AIDS – DATA ANALYSIS – QUALITY – NAVAID POSITION AND DESCRIPTION
H.4.1	

REQUIREMENT
To analyse the quality of observations for nav aids.

INSTRUCTION
<ol style="list-style-type: none"> 1. The position, characteristic, sectors and physical description of each fixed navaid is to be compared against the published chart, the relevant Admiralty List of Lights and the relevant Sailing Directions as a gross error check. 2. Verify that derived positions for nav aids meet the standards set out in Chapter Three, Appendix 1, Table 1. 3. The position, characteristic and physical description of each floating navaid is to be compared against the published chart, Admiralty List of Lights and the relevant Sailing Directions as a gross error check.

STANDARD
To verify that the quality of data collected meets the order of standard for the survey.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	ROS	Miscellaneous Tracing

REPORT OF SURVEY	
PART 1	PART 2
Section 12	Annexes K & P

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
H.4.1

GENERAL SURVEY INSTRUCTIONS

GSI Number	NAVIGATION AIDS – DATA ANALYSIS – COVERAGE – NAVAIDS
H.4.2	

REQUIREMENT
To confirm that all nav aids within the survey area have been checked.

INSTRUCTION
<p>1. The list of fixed and floating nav aids observed for and checked within the survey area is to be compared with the original listing determined at GSI H.1.1, the published chart(s), Admiralty List of Lights and the Sailing Directions to ensure complete coverage of all nav aids.</p>

STANDARD
To verify that and that nav aids within the survey area have not been missed from the observation plan.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 12	Annexes K & P

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
H.4.2

GENERAL SURVEY INSTRUCTIONS

GSI Number	NAVIGATION AIDS – DATA RENDERING – INTERIM REPORTS – SIGNALS AND HYDROGRAPHIC NOTES
H.5.1	

REQUIREMENT
To render interim reports on changes to nav aids.

INSTRUCTION
<ol style="list-style-type: none"> 1. Interim reports are to be rendered, immediately, to report changes to fixed and floating nav aids affecting the safety of navigation. 2. Interim reports should be rendered as follows: <ol style="list-style-type: none"> a. <u>Signalled Reports</u>. Signalled reports of significant differences found during the course of survey are to quote the HI number. Positions are to be quoted as geographical coordinates with the horizontal datum specified. Particular care is to be taken to ensure that signalled information is correct. Signals should be sent to the following addresses: <ol style="list-style-type: none"> i. HYDROUK TAUNTON (using SIC JPL) ii. FOSF, FOSM, COMRFA iii. CINC Fleet iv. If in, or near, exercise areas: FOSNNI or FOST v. Local harbour/port authority (if HM Naval Base: NBC for QHM), and/or national maritime authority. b. <u>Hydrographic Notes (HNs)</u>. HNs should be forwarded to confirm and supplement signalled reports and to report information of lesser importance which UKHO should be aware of in advance of the final rendered survey. Hydrographic Notes should include the HI number and DTG of any signal relating to the HN. HNs are to be completed in accordance with NP100, The Mariner's Handbook. 3. All reports concerning terrestrial and floating lights are to be referenced to the relevant Admiralty List of Lights Volume and Light Number (International Light Number).

STANDARD
Significant changes hazardous to safe navigation swiftly and accurately reported to UKHO and allied authorities.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
Signal	NA	Hydrographic Note	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 12	Annex T

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
H.5.1

GENERAL SURVEY INSTRUCTIONS

GSI Number	NAVIGATION AIDS – DATA RENDERING – PLOTS
H.5.2	

REQUIREMENT
To show navaid data in graphic form, if directed to be rendered or if deemed appropriate by the Charge Surveyor.

INSTRUCTION
<ol style="list-style-type: none"> The positions, characteristics, sounds and sectors (if applicable) of all co-ordinated navais are to be shown on the Accompanying Tracing if the Charge Surveyor considers that the data cannot be portrayed in any other form. Normally the data should be reported in full in the ROS at section 12 and Annexes K and P(GSI H.5.3). See Chapter 5, Standard Graphics Formats, for details. If the scale of the survey permits then the ebb, flood and mean positions of floating navais are to be shown.

STANDARD
Data plotted and verified as correct in accordance with the instructions set out in Chapter 5, Standard graphics Formats.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	Miscellaneous Collector Tracing	NA	Miscellaneous Tracing

REPORT OF SURVEY	
PART 1	PART 2
Section 12	Annexes K & P

Issue Number
2/02

Date
1 Aug 02

GSI Number
H.5.2

GENERAL SURVEY INSTRUCTIONS

GSI Number	DATA RENDERING – REPORTS – REPORT OF SURVEY
H.5.3	

REQUIREMENT
To render a full and comprehensive report on all navaid within the survey area

INSTRUCTION
1. Data is to be rendered in accordance with the instructions at Chapter 4, Report of Survey.

STANDARD
Details of all navaid observations, along with supporting documentation, within the survey area accurately rendered.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
NA	NA	ROS	NA

REPORT OF SURVEY	
PART 1	PART 2
Section 12	Annexes K,P & T

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
H.5.3

GENERAL SURVEY INSTRUCTIONS

GSI Number	NAVIGATION AIDS – DATA RENDERING – REPORTS – FIELD RECORDS
H.5.4	

REQUIREMENT
To manage and dispose of field records.

INSTRUCTION
<ol style="list-style-type: none"> Geodetic observation records are to be rendered in accordance with GSI A.5.3. Miscellaneous field records relating to navaid observations may be destroyed on receipt of the survey completed letter.

STANDARD
Field records correctly managed.

DATA MANAGEMENT			
Field Record	Working Graphic	Fair Record	Fair Graphic
All navaid records	All navaid records	NA	NA

REPORT OF SURVEY	
PART 1	PART 2
NA	NA

Issue Number
Edition 1

Date
31 Mar 01

GSI Number
H.5.4

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 3

APPENDIX 1

RN STANDARDS FOR HYDROGRAPHIC SURVEYS

LIST OF TABLES

1	Horizontal Accuracy of Soundings and Geodetic Control
2	Differential GPS – Positioning at Sea
3	GPS Ashore and Field Survey Standard Errors
4	Bathymetry
5	Sonar, Seabed Hazards and Seabed sampling
6	Sonar Sweep Categories
7A	Tide Height Observations
7B	Tidal Stream And Current Observations
8	Physical Oceanographic Data
9	Oceanographic Data – Fluorescence and Luminescence
10	Sub Bottom Profiler
11	Meteorological Data

Hydrographic Survey Standards

1. The standards for surveys shown in the tables overleaf are derived from IHO SP44 Edition 4 and the current DHSPRG Strategy Paper.
2. The standards in the tables are generally stated in terms of precision, at the 95% confidence level:-
 - a. Bivariate distributions, eg horizontal position $\sigma_{95\%} = 2.447 \times \sigma$
 - b. Single variant distributions, eg depth $\sigma_{95\%} = 1.96 \times \sigma$
3. Hydrographic survey standards assume that all systematic errors and mistakes have been removed from observations. This means that Standard Operating Procedures must be followed in order to:-
 - a. Remove modelled systematic errors by:-
 - i. Calibration of instruments
 - ii. Calculation of corrections using approved formulae
 - iii. Cancellation through observing procedure
 - b. Identify mistakes and non-modelled systematic errors by:-
 - i. Verification of system performance before survey operations commence
 - ii. Redundant and/or check observations during survey operations
 - iii. Appropriate statistical tests during data gathering and post-processing
 - iv. Quality Control procedures
4. Survey records from items 3a and 3b above form the core of the survey metadata. The specifications for metadata are contained within GSIs.
5. Graphical survey products retain the requirement that there should be no 'plottable error'; however, the tables overleaf take precedence where appropriate. It is assumed that a point can be plotted with an accuracy of 0.2mm, a shape with 0.5mm sides and a 2 figure depth contained within an outline of 2mm by 3mm. Examples, at typical scales, are:-

Scale	1 : 10 000	1 : 25 000	1 : 50 000
Point (0.2mm)	2 metres	5 metres	10 metres
Shape (0.5mm)	5 metres	12.5 metres	25 metres
Depth (2 × 3 mm)	20 × 30 metres	50 × 75 metres	100 × 150 metres

Orders of Survey

6. IHO SP44 Edition 4, (April 1998), introduced the concept of Orders of Survey for Hydrographic Surveys. Examples of some defence requirements have been added.
 - a. SPECIAL ORDER
 - i. Restricted to specific critical areas with minimum under keel clearance
 - ii. Areas have to be explicitly designated by authority responsible for survey quality
 - iii. Civil - Harbours, berthing areas, critical channels
 - iv. Defence - MW Routes, Amphibious Landing Sites
 - v. Typical scales 1 : 5000 to 1 : 10 000
 - b. ORDER 1
 - i. Depths to 100 metres
 - ii. Civil - Harbours, Harbour approach channels, recommended tracks, coastal survey
 - iii. Defence - MW Route planning, Amphibious Landing Approach, Sub Op Areas
 - iv. Typical scales 1 : 10 000 to 1 : 25 000
 - c. ORDER 2
 - i. Depths to 200m
 - ii. Offshore Surveys
 - iii. Typical scales 1 : 25 000 to 1 : 50 000
 - d. ORDER 3
 - i. Depths greater than 200m
 - ii. Ocean Surveys
 - iii. Typical Scales \geq 1 : 50 000

Table 1. Horizontal Accuracy of Soundings and Geodetic Control

ITEM	SPECIAL ORDER	ORDER 1	ORDER 2	ORDER 3	Remarks
Horizontal Accuracy of Soundings	2m	5m (0 to 40m depth) 7m (40 to 100m depth)	15m (0 to 40m depth) 22m (40 to 200m depth)	150m	All are position of soundings on seabed except for order 2 & 3 surveys using SBES where it refers to the position of the transducer. See note 2.
Primary Control	0.1m				Height 0.3m
Secondary Control	0.5m				Height 0.8m
Fixed Navigation Aids	2m	2m	5m	5m	Height 1m. See note 3.
Conspicuous Features	2m	2m	5m	5m	Height 2 m
Natural Coastline	10m	20m	20m	20m	
Floating Aids	10m	10m	20m	20m	
Other Topographic Features	10m	20m	20m	20m	Height 5m

Notes:

1. Horizontal accuracies determined by the length of the semi-major axis of the 95% error ellipse.
2. Single beam echo sounder, (SBES), accuracy on seabed can only be achieved if attitude and motion sensors are fitted.
3. For lit navigational aids it is the height of the focal plane of the light.

TABLE 2. DIFFERENTIAL GPS – POSITIONING AT SEA

Primary Solution	Network 3D+DH	Stations balanced in azimuth
Secondary Solution	Primary Station 3D+DH	At least one non-networked solution must be monitored
Tertiary Solution	Primary station no height aiding	At least one non-height aided solution must be monitored
Unit Variance – F test	< 2.5 (when at least 6 satellites in use)	
Outliers – W test	< 2.5 (when at least 6 satellites in use)	normally switched off
HDOP	< 3 (< 4 for short periods if other parameters within limits)	
Minimum number of satellites	4	
Elevation Mask	10°	
Age of differential corrections	< 12 secs	See equipment SOP for further details.
Range Rate correction	< 0.6ms ⁻¹ (normally < 0.3ms ⁻¹)	
Differential Atmospheric Correction	Should be used if available	
Weighting of pseudo ranges for elevation	Should be used if available	
Distance offset	500km	Increase if nearest reference station is further
Distance Factor	500km	

Notes:

1. Parameters to be used in setting up dGPS equipment is covered in the relevant SOPs.
2. Positional accuracies are defined with reference to the relevant data, eg bathymetry, and not the positioning system.

TABLE 3. GPS ASHORE AND FIELD SURVEY STANDARD ERRORS

Static GPS L1 < 20 km	a = 0.02m b = 2 ppm			
Static GPS L1 & L2 < 50 km	a = 0.01m b = 1 ppm			
Static GPS - Satellite Configuration	>= 4 Satellites	>15° elevation	PDOP < 5	
Static GPS observing Time L1 only 5 or more sats	1 hr + 1 min / km baseline length			
Static GPS observing Time L1 only 4 sats	(1 hr + 1 min / km baseline length) x 1.2			
Static GPS L1 & L2 processed in dual frequency mode (baseline operation period)	Minimum of 20 mins or (baseline length km + recording interval in secs) x 0.5 mins if greater			
Static GPS Network - existing stations	at least 2 referred to WGS 84			
Static GPS Network - new stations	minimum 2 independent baselines at different epochs			
Satellite Derived Positions - Alongside	4 or more satellites, elevation > 10°, PDOP < 5, observing time > 30 mins			
ASHTEC SNAP - Standardised Residual	< 3			
Horizontal Angle - 1" Theodolite - 2 Rounds	6"			
Horizontal Angle - 1" Theodolite - 4 Rounds	4"			
Direction - 1" Theodolite - 2 Rounds	4"			
Direction - 1" Theodolite - 4 Rounds	3"			
Vertical Angle – mean of 3 sets FL/FR	10"			
EODM Distance	a = 0.03m b = 5 ppm			
EDM Distance	a = 0.05m b = 5 ppm			

TABLE 4. BATHYMETRY

ITEM	SPECIAL ORDER	ORDER 1	ORDER 2	ORDER 3	Remarks
Sounding depth accuracy	$a = 0.25\text{m}$ $b = 0.0075\text{m}$	$a = 0.5\text{m}$ $b = 0.009\text{m}$	$a = 0.5\text{m}$ $b = 0.023\text{m}$	$a = 1.0\text{m}$ $b = 0.023\text{m}$	See note 1.
Maximum single beam line spacing	$0.0025\text{m} \times \text{scale}$	$0.005\text{m} \times \text{scale}$	$0.005\text{m} \times \text{scale}$	$0.005\text{m} \times \text{scale}$	For order 2 & 3 lines may be double spaced in flat, featureless areas as long as sonar sweep is complete and depth is $>100\text{m}$.
Maximum multi-beam line spacing	100% overlap	100% overlap	25% overlap	10% overlap	Line spacing depends on maximum effective swathe width and overlap requirement
SBES Interlining	n/a	depths $< 40\text{m}$	depths $< 40\text{m}$	depths $< 40\text{m}$	See Note 2.
Sounding Crosslines	15 x line spacing	15 x line spacing	20 x line spacing	30 x line spacing	See Note 2.
Bathymetric Model	n/a	$a = 1.0\text{m}$ $b = 0.026\text{m}$	$a = 2.0\text{m}$ $b = 0.05\text{m}$	$a = 5.0\text{m}$ $b = 0.05\text{m}$	See Note 3.
Speed whilst sounding	5 pings per 1 metre target	5 pings per 1 metre target	5 pings per 2 metre target	n/a	Normally constrained by sonar requirements

Notes:

1. NB Depth accuracy calculated using $\left(a^2 + (b \times \text{depth})^2\right)^{\frac{1}{2}}$
2. Additional interlines and crosslines may also be required to delineate shoals and where line keeping error $> 25\%$ line spacing in SBES.
3. Bathymetric model accuracies are used for derived soundings where 100% insonification is not achieved

TABLE 5. SONAR, SEABED HAZARDS AND SEABED SAMPLING

ITEM	SPECIAL ORDER	ORDER 1	ORDER 2	ORDER 3	Remarks
Sonar Sweep	A1	A2	A2	B	See table 6
Object Detection	1m Cube or 0.5m × 2m cylinder	>1m Cube	>2m Cube 0m to 100m 2% depth 100m to 200m	Not Applicable	
Seabed Hazards Least Depth accuracy	a = 0.25m b = 0.0075m	a = 0.5m b = 0.009m	a = 0.5m b = 0.009m	a = 0.5m b = 0.023m	
Seabed Hazard Examination Criteria	> 1m	>1m	>2m depths 0m to 100m 2% depth 100m to 200m	5% of depth	See Note 1
Wire Sweep Separation	0.3 m	0.3m to 31m then 0.5m to 40m	0.3m to 31m then 0.5m to 40m	Not Applicable	
Seabed Sampling	0.05m grid	0.05m grid	0.05m grid	Not Applicable	See Note 2

Notes:

1. Least depth must be obtained by total insonification or wire sweeping if hazard greater than this figure above general depth in immediate vicinity.
2. Additional samples required to delineate texture boundaries, in anchorages and on significant shoals.

TABLE 6. SONAR SWEEP CATEGORIES

Sonar Sweep Type	A1	A2 0m to 15m depth	A2 15m to 200m depth	B	Remarks
Area Search Insonification	240%	240%	240%	see Note 2	See Note 3
Sonar Line Direction	<20° of tidal stream	<20° of tidal stream	<20° of tidal stream	<20° of tidal stream	
Sonar Line Spacing	62.5 m	62.5m	125m	see Note 2	(line spacing may vary slightly due to equipment) See Note 3
Sonar Range Scale	75m	75m	150m	300m	(scales may vary slightly due to equipment) See Note 3
Sonar Frequency	High	High	Low	Low	
Sonar Pulse Length	Short	Short	Long	Long	If selectable
Maximum speed	4.5kts	4.5kts	6.5kts	6.5kts	Over the ground

Notes:

1. During investigations and examinations frequency should be high, pulse length short and the ranges chosen to give maximum detail of wreck and shadow.
2. The minimum overlap in metres in deep water is given by $(\text{Depth} \times 50) / (X + 15)$; where X is the maximum towing depth.
3. % Insonification = $[2 * \text{Maximum Effective Sonar Range} \div \text{Line Spacing}] * 100$.

TABLE 7A. TIDE HEIGHT OBSERVATIONS

ITEM	SPECIAL ORDER	ORDER 1	ORDER 2	ORDER 3	Remarks
Tidal Observations	0.05m	0.05m	0.1m	0.1m if applied	Error at gauge.
Tide Pole Observations normal interval	every 30 mins				When used without a tide gauge
Tide Pole Observations at large range	every 10 to 15 mins				When used without a tide gauge
Tide Pole Observations at HW/LW	every 10 mins				When used without a tide gauge
Tide Gauge Observations normal interval	every 10 mins				
Interval between tide scales	< 10 miles				
Tidepole Levelling	0.02m				0 of pole relative to land datum

TABLE 7B TIDAL STREAM AND CURRENT OBSERVATIONS

ITEM		Remarks
Current Meter	hourly intervals for 15 days	at 3m and 10 m; 29 days if possible
Water flow rate	0.1ms^{-1}	
Water flow direction	5°	
Logship	0.1 knot, 10° direction	

Note. Also see current velocity in UOR profiler at Table 8.

Table 8. Physical Oceanographic Data

Parameter	Units	Range	Resolution	Accuracy	Remarks
UOR Temperature	°C	-2 to 35	0.01	0.02	Vessel Underway - continuous data Undulating profile 0 to 500m
UOR Conduct	mmho/cm	1 to 70	0.01	0.01	
UOR Pressure	dbar	0 to 600	0.1	0.2	
UOR Current Velocity	ms ⁻¹	0 to 5	0.1	0.1	
Xprobe Depth	m	0 to 2000	1	5m or 2% of depth	Vessel Underway – spot data
Xprobe Temperature	°C	-2 to 35	0.1	0.1	
Xprobe Sound Velocity	ms ⁻¹	1405 to 1560	0.1	0.25	
Xprobe Conductivity	mmho/cm	20 to 75	0.01	0.03	
Vprobe Depth	m	0 to 6000	1	1m or 0.1% of depth	Vessel hove to – spot data
Vprobe Temperature	°C	-2 to 35	0.001	0.005	
Vprobe Sound Velocity	ms ⁻¹	1405 to 1560	0.1	0.1	
Vprobe Conductivity	mmho/cm	1 to 70	0.001	0.005	

TABLE 9. OCEANOGRAPHIC DATA – FLUORESCENCE & LUMINESCENCE

Parameter	Unit	Range	Min Discernible Signal	Resolution
Fluorescence 360nm	gm cm ⁻³ Carbazole	10 ⁻¹² to 10 ⁻⁸	10 ⁻¹²	1% of reading or min signal
Fluorescence 440nm	gm cm ⁻³ Perylene	10 ⁻¹² to 10 ⁻⁸	10 ⁻¹²	1% of reading or min signal
Chlorophyll-a 685nm Fluorescence	gm cm ⁻³ Chlorophyll-a	10 ⁻¹¹ to 10 ⁻⁷	10 ⁻¹¹	1% of reading or min signal
Bioluminescence	Peak wavelength 470nm Bandpass (FWHM) 25nm	Sensitivity 10 ⁵ photons cm ⁻²		Fullscale 10 ⁸ photons cm ⁻²

Notes.

1. The capability (Sonar 2081 or its equivalent) to record the parameters above is required in the UOR, hull mounted sensor and in the vertical profiler.

TABLE 10. SUB BOTTOM PROFILER

Parameter	Requirement	Remarks
Seabed Penetration	100m penetration in clay sediment with vertical resolution better than 20cm	In depths of 5000m
Sub bottom vertical resolution	0.20m	
Seabed roughness period accuracy	0.38m	
Seabed roughness amplitude accuracy	0.15m	
P & S Wave Velocity	10ms^{-1}	depth increments of 10m
Attenuation P & S waves	to be determined to an accuracy of 0.01 db/acoustic wavelength to max 2 kHz	depth increments of 10m
Density	10%	depth increments of 10m

TABLE 11. METEOROLOGICAL DATA

Parameter	Units	Range	Resolution	Accuracy	Remarks
ASMP Wind Speed	ms ⁻¹	0 to 50	0.1	0.5	
ASMP Wind Direction	deg	0 to 360	5	5	
ASMP Pressure	hPa	600 to 1100	0.1	0.5	
ASMP Temperature	°C	-40 to 70	0.1	0.2	
ASMP Humidity	%	0 to 100	1%	1%	
AUASS Wind Speed	ms ⁻¹	0 to 100	0.1	0.5	
AUASS Wind Direction	deg	0 to 360	1	5	
AUASS Pressure	hPa	-3 to 1060	0.1	0.5	
AUASS Temperature	°C	-90 to 60	0.1	0.2	
AUASS Humidity	%	0 to 100	1%	5%	

Notes:

1. ASMP – Automated Surface Meteorological Package
2. AUASS – Automated Upper Air Sounding System

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 4

REPORT OF SURVEY

Contents

0401 The Report of Survey

0402 Geodetic Data

Appendix 1 The Report of Survey

0401 The Report of Survey

1. When survey material of any sort is rendered to UKHO, it must be accompanied by a report, in some form or other, of how it was obtained. In a few cases, such as Hydrographic Notes, this may be relatively brief, but in the vast majority of cases, the Report of Survey forms the core of the survey data, and should remark on every aspect of the survey and on all other data being rendered with it. For conventional bathymetric surveys, it is to be divided into two parts; details of their contents are contained in Appendix 1 to this chapter. The format and content of the Report of Survey for an Oceanographic, Geophysical or special survey will be described in the HI.
2. The Report of Survey is the principal means by which the Charge Surveyor approves the content of ALL survey records and is thus a very important document, and the Charge Surveyor must take considerable care in its presentation. It must give a clear and comprehensive account of how the survey was carried out, the results achieved, the difficulties encountered and the shortcomings. Emphasis within Part 1 should be placed on the analysis of achieved accuracies and whether the specifications called for in the HI and Chapter Three Appendix 1, Survey Standards Tables, have been met. Part 2 is to contain the necessary technical discussion to support opinions expressed in Part 1. It should be borne in mind that it is often just as important to say what was not done and why, as to say what was done and how.
3. A thorough Report of Survey can reduce the need for subsequent correspondence between UKHO and ship, which otherwise may be necessary to elucidate points which have not been covered in a less exhaustive report. Appendix 1 provides an outline of the material that is to be included and the format to be adopted for all conventional bathymetric surveys. To facilitate the prompt distribution of the working copy of the report to the various departments in the UKHO it is essential that the numbering system be maintained. Any paragraphs in Part 1 or Annexes in Part 2 which are not applicable to a particular survey should contain a brief statement of the form 'No..... observations were conducted'.
4. The Report of Survey is as much a fair record of the survey as the fair graphics, and must be compiled and presented with as much care, neatness and accuracy. It is to be presented in a hard-covered binder to provide protection and to ensure a seemly and professional appearance. Standardized A4 sized binders (H58) are available. The binders should not have title sheets attached to their front cover. The details shown on the inside first page are to be in the format indicated in the Appendix to this Chapter.
5. The report should be printed on white cut sheet A4 paper, one side only (continuous stationery with perforations along the sides is not acceptable). The report should be printed in either Univers or Times Roman. Two copies are to be rendered to UKHO, one copy bound, the second unbound but with its binder, in a secure loose-leaf manner. Page numbering is to be used in Part 1 and in any Annex in Part 2 that comprises more than a single page.
6. DNSOM requires an unbound copy of Part 1 only and the sections from Part 2 which the Charge Surveyor considers would benefit DNSOM. In particular, 3D views from Annex H that illuminate the discussion of the seabed should be forwarded with these copies. Captain (HM) requires the Report of Survey in full to assess field experience and to develop policy guidelines.

0402 Geodetic Data

1. Geodetic data in the full form at RoS Annex C should be rendered whenever new main or secondary Hydrographic stations are established. If the establishment or recovery of geodetic control has formed a minor part of survey operations, an abbreviated Annex C may be rendered.
2. Where the Charge Surveyor considers that there is sufficient quantity of Geodetic Data to merit a separate report two copies of the Geodetic Report are rendered to UKHO in the standardized A4 binders (H58) that are available. The binders should not have title sheets attached as they detach when placed on shelves. Forms may be completed in black ink in manuscript; all other records are to be prepared in typescript on one side of the paper only. The duplicate Form H159 is to be a form proper, and NOT a photocopy, so that diagrams and photographs may be inserted in the pocket.
3. Where digital data, such as from geodetic GPS observations, is obtained, only one copy of the data and processed files listed below is to be rendered to UKHO. One copy should be retained on board until the 'final' appraisal letter has been received.

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 4 APPENDIX 1

REPORT OF SURVEY

ENGLAND, SOUTH COAST
APPROACHES TO DEEPWATER SOUND
HM SURVEYING SHIP "ROEBUCK"
SURVEYED BY LIEUTENANT COMMANDER W F W OWEN FRICS, ROYAL NAVY
1 May to 1 September 2000
1:25,000

REPORT OF SURVEY

266/999
31 October 2000

HI 999
(HH 090/999/01)

CONTENTS

PART 1 - DESCRIPTIVE

Section

1. Introduction
2. Geodetic Control
3. Digital Surveying System
4. Nav aids
5. Bathymetry
6. Sonar
7. Seabed Sampling
8. Seabed Topography and Textures
9. Tides and Sounding Datum
10. Tidal Streams
11. Wrecks and Obstructions
12. Lights and Buoys
13. Coastline, Topography, Measured Distances, Conspicuous Objects and Marks
14. Sailing Directions and Nomenclature
15. Radio Stations
16. Ancillary Observations
17. Miscellaneous

PART 1**1. Introduction**

- 1.1 Give start and finish dates. Remark on any general service activities which interrupted the progress of the survey.
- 1.2 Give a general statement on the weather, including the seasonal climate and variations experienced. Comments on weather are essential when surveying unstable, critical areas which require optimum hydrodynamic conditions to determine the absolute minimum depth over each feature. Comments are also required on how the weather affected the quality of the data – e.g. ship motion and heave compensator performance, degradation of sonar search, stability of navaid in storms, effect of sea conditions on sandwave heights.
- 1.3 Comment on any extraneous activities (e.g. firing ranges or saturation fishing) which affected the conduct of the survey. Mention whether the strength of the tidal stream caused any particular difficulties. Mention any logistic problems.
- 1.4 Give the Charge Surveyor's overall opinion of the completeness of the survey and a statement of the Survey Category. Identify any areas which require further investigation.
- 1.5 Give recommendation of surveying category.

Class	Suffix	Survey Description	Q6090
I	SC	Scale \geq 1:50,000, sidescan sonar swept, no further surveying required	Dark Pink
	SN	As I (SC), but further surveying necessary	Medium Pink
	H	Scale \geq 1:50,000, hull mounted sonar swept	Medium Pink
II	SC	As I (SC), but scale<1:50,000	Dark Pink
	SN	As II (SC), but further surveying necessary	Medium Pink
	H	Scale<1:50,000 hull-mounted sonar swept	Pale Pink
III	-	Scale>1:100,000. No sonar sweep	Dark Brown
IV	-	Open-spaced or test lines. No sonar sweep	Pale Brown

2 Geodetic Control

- 2.1 State how much existing geodetic control was used and explain how any new control was established; give a general statement on the degree of accuracy achieved and outline any difficulties encountered in linking to existing control.

3 Digital Surveying System

- 3.1 State which systems and issues of software were used, if appropriate. Comment on any enhancements implemented during the survey, giving dates when installed.
- 3.2 Mention any major difficulties experienced or defects that had a significant impact on the progress or quality of the survey and venture an opinion of the effectiveness of the systems used. There is no requirement to include details of minor defects.
- 3.3 A statement is to be made to the effect that all significant depths detected by the echo sounder are represented on the digital records, indicating how this has been achieved. Reasons must be given if this check has not been carried out.

4 Nav aids

- 4.1 State the type and operating modes of the systems used.
- 4.2 Where a DGPS solution utilises a network of reference stations, comment upon the reference station network geometry and reference station ranges, with respect to the survey area. If a single reference station DGPS solution is used in preference to a network solution state why.
- 4.3 Describe how and when the systems were calibrated and/or validated.
- 4.4 Give the Charge Surveyor's opinion of the quality and reliability of the equipment, and the accuracy's achieved. Comment upon any periods of poor positioning quality observed. Include details of any GPS reference station failures or incidences of abnormally high latency in the delivery of pseudo range corrections.

5 Bathymetry

- 5.1 State the type of echo-sounder used and its transmission frequencies, especially where dual frequency sets are used. State the result of ship squat trials conducted. State the type of heave compensation used and give a brief summary of its performance.
- 5.2 State the method of obtaining sound-velocity (SV) and the frequency of SV and bar-check observations; give an opinion of their accuracy. Quote the mean SV used, if appropriate.
- 5.3 State the sounding line direction, line spacing and average SOA. For shoal investigations etc, quote the density of the sounding lines and the seabed footprint of the echo sounder beam.
- 5.4 Describe any Leading Lines or Recommended Tracks.
- 5.5 Give the Charge Surveyor's estimation of the overall accuracy of the soundings, drawing attention to reasons why the desired accuracy standard may not have been met. Include an opinion of the thoroughness of the survey with regard to the line density.

(See also paragraph 8 (Seabed Topography and Texture - Comparison with Previous Surveys) and paragraph 9 (Tides and Sounding Datum - Scrutiny of Cross-line intersections); these will have a bearing on the estimated accuracy of the sounding, the assessment of the accuracy of the co-tidal chart, and on the Charge Surveyor's general opinion of the completeness of the bathymetry and assessment of further work necessary).

6 Sonar

- 6.1 State the type of sonar used and its transmission frequency.
- 6.2 Mention the type and frequency of confidence checks carried out. Include the Charge Surveyor's opinion of the quality and reliability of the sonar equipment.
- 6.3 State the choice of sonar line direction, line spacing, sonar range, and mean SOA. Give an estimate of the effect of tidal streams on the lateral position of the towfish and describe any precautions taken to ensure complete sonar coverage.
- 6.4 State the allowance made for sonar layback at the ends of lines and whether the extra line was run outside the required survey area limits to achieve the sonar search specified in the HI (Chapter 3 Appendix 1 Table 5).
- 6.5 Give the Charge Surveyor's opinion of the thoroughness of the sonar coverage and a definitive statement of the extent of the search achieved.

7 Seabed Sampling

- 7.1 State the sampling interval and comment upon any particular samples obtained on interesting features. Describe any reservations the Charge Surveyor may have concerning the distribution of sediments as portrayed by the samples obtained. Quote the number of samples retained.
- 7.2 State the method of sampling used and mention any problems with the equipment.

8 Seabed Topography and Texture

- 8.1 Give a brief thumb-nail sketch description of the seabed topography of the surveyed area. State the Charge Surveyor's opinion of all significant features, their nature and distribution throughout the survey area. Comment on any difficulties experienced in interpreting the sonar trace when preparing the textures tracing.
- 8.2 State the reason if unable to investigate a shoal as thoroughly as desired and estimate the reliability of the least depth obtained; identify the extra work needed to ascertain the absolute least depth:

e.g.: 'the shoal was thoroughly examined by echo sounder but due to the likelihood of a rock pinnacle, it should be wire swept to guarantee obtaining the least depth. Adverse weather prevented this being completed during the survey.'
- 8.3 Comment on any areas of less than 40 metres depth which were not interlined.
- 8.4 Mention dredging activities and spoil grounds.
- 8.5 Comment on any movement of sandwaves when compared with previous surveys.
- 8.6 Give the Charge Surveyor's opinion of the comparison with previous surveys and any doubts about the detection of all existing shoal depths, or recommendations for retaining previously surveyed depths. If it has not been possible to check and confirm or disprove every charted feature in the survey area, explain why.
- 8.7 Where it has proved impossible to sound a stretch of shoreline because breakers appear to be a permanent feature this is to be noted in Annex N. See Chapter 5 Appendix 1, Breakers.

9 Tides and Sounding Datum

- 9.1 State where the tidal station was sited and how Sounding Datum was established. For an established gauge, describe how the setting of the zero was checked.
- 9.2 Describe any transfer of datum involved and any use made of co-tidal charts. (GSI E.1.4)
- 9.2 Describe any adjustment to the level of the Sounding Datum found necessary during the course of the survey (GSI E.1.4).
- 9.3 State the types of tidegauge and/or tidepole used; state over what period observations were made and whether they were analysed.
- 9.4 Mention any tidegauge malfunctions and any difficulties in obtaining tide readings such as impounding or surging.
- 9.5 Quote the Standard Port used for predicted tides, or explain the use made of harmonic constants to derive tidal predictions, either in conjunction with NP158 or an identified computer program.
- 9.6 Give the Charge Surveyor's opinion of the accuracy of the levelling used to establish Sounding Datum and the accuracy of the tidal data in terms of both height and time. State the assessment, from careful scrutiny of cross-line intersections, of the accuracy of the tidal reductions after co-tidal corrections have been applied. (see paragraph 5).

10 Tidal Streams

- 10.1 State where, when and how, tidal stream observations were carried out. Mention any problems with the equipment.
- 10.2 Explain why a required tidal stream station was not observed or was observed in a different position from the one ordered.
- 10.3 If the observations were not taken at Springs, explain why not and estimate the consequential effect on the quality of the data rendered. State what analysis has been carried out.
- 10.4 Give a brief synopsis of the observations obtained and the Charge Surveyor's opinion of the accuracy of the observations and the effects of the weather on the quality of the data.
- 10.5 If no observations were carried out, give a brief qualitative assessment of the tidal streams derived from experience of handling the ship on sounding lines, or from fishermen or others with local knowledge.

11 Wrecks and Obstructions

- 11.1 State the method of investigating wrecks and obstructions, including the techniques used for wire-sweeping and the number of wrecks/obstructions which were wire-swept.
- 11.2 Comment on any problems encountered with obtaining the least depths,

e.g. 'could not wire drift sweep because the wreck was at a nodal point'; or 'the weather was too rough for wire sweeping but least depth obtained by echo sounder was considered sufficient'.

11.3. Provide a general statement on details obtained from fishermen or others with local knowledge. If possible, provide a summary of the effect that certain weather conditions have on wrecks and obstructions.

11.4. Explain why a particular ordered wire-sweep was not carried out.

12 Lights and Buoys

12.1 Described how lights were checked and were fixed. If any new light has been established, it should be fully described using the format in the Light List, and the method of determining its position stated. (Details of the observations for position should appear in the Geodetic Data).

12.2 Whenever possible, the Authority responsible for establishing any new light or buoy should be quoted.

12.3 Describe how the position of each buoy was fixed on the flood and the ebb and quote the spread of position about the final accepted mean.

12.4 Give the Charge Surveyor's opinion on the accuracy of the observations to determine light sectors and positions of navigational buoys. Give a positive statement to confirm the light characteristics shown on all the published charts that cover the survey area (Art 0309).

13 Coastline, Topography, Measured Distances, Conspicuous Objects and Marks

13.1 State whether the coastline was fixed in the field and if so by what method, or whether accepted from:

- a. aerial photo plot - give details
- b. maps - give details

13.2 State how heights were observed. Comment on any significant changes such as foreshore erosion or significant soft sediment build up.

13.3 Comment on any new man-made facilities such as marinas or jetties (which are also to be included in amendments to Sailing Directions).

13.4 Comment on any measured distances and marks indicating clearing lines, leading lines or recommended tracks, either found, or charted but no longer usable. Include full details in the amendments to the Sailing Directions and Annex M.

13.5 Remark on those objects considered to be conspicuous and objects charted as conspicuous but no longer worthy of the description. Include these in amendments to Sailing Directions and in Annex M.

13.6 Where an Aerial Photo Plot was provided, describe the way in which the data was checked in the field and draw attention to any major discrepancies found. Comment on the general utility of the plot (GSI G.1.1/G.1.2)

14 Sailing Directions and Nomenclature

- 14.1 Comment that amendments were not needed, or that they are contained in Annex N. Draw attention to any major inaccuracies in the current Sailing Directions. Remark on photographs taken and the accuracy of those currently published in the Sailing Directions. State whether or not charted names have been checked, in so far as this is practicable, giving details of how this was done. When one set of amendments covers two or more surveys, or a survey rendered in two or more parts with separate reports, a reference is to be included in each report indicating where the Amendments to Sailing Directions may be found.
- 14.2 Remark on any new names proposed.
- 14.3 List copies of port handbooks, guides etc obtained during the course of the survey and forwarded with the Report of Survey.

15 Radio Signals

- 15.1 Provide a general statement on the accuracy of data contained in ALRS that applies to the area surveyed and ports visited.

16 Ancillary Observations

- 16.1 Describe the observing techniques and venture opinions on the thoroughness of the observations used for any of the following:
 - a. Fresh Water Springs;
 - b. Overfalls, Tide Rips and Eddies;
 - c. Any special scientific observations ordered (e.g. magnetic variation).

17 Miscellaneous

- 17.1 Comment on any other facets of the execution and results of the survey which may be of value to the Hydrographic Office or of historic interest when reviewed in future years.

W F W Owen
Lieutenant Commander, Royal Navy
In Charge of Surveys

CONTENTS

PART 2 - TECHNICAL

A	Accompanying Documents
B	Digital Surveying System
C	Geodetic Data
D	Navaid Calibrations and C-O Corrections
E	Sound Velocity and Bar-Check Observations
F	Levelling and Tidal Observations
G	Accuracy of Soundings
H	Comparison with Published Chart
I	Wrecks and Obstructions
J	Tidal Stream Observations
K	Light Sectors and Buoys
L	Seabed Textures, Natures of the Bottom and Retained Seabed Samples
M	Topographical Features, Conspicuous Objects and Marks
N	Sailing Directions Amendments and Nomenclature
O	Views
P	Light List Amendments
Q	Radio Signals Amendments
R	Underwater Handbook Amendments
S	Ancillary/Miscellaneous Observations
T	Reports of Dangers and Hydrographic Notes
U	Personnel
V	Diary of Notable Events
W	Summary of Surveying Activity

Additional annexes, e.g. copies of communication with UKHO, may be added as required.

**ANNEX A TO HMS ROEBUCK'S
266/999 dated 31 October 2000**

Accompanying Documents

A.1. List all the documents and records accompanying the Report of Survey:

- a. Bathymetric Sheet;
 - b. Seabed Texture Tracing;
 - c. Sounding Track Plot
 - d. Sonar Track Plot;
 - e. Contour Tracing;
 - f. Unweeded, Colour-banded Sounding Tracing (SIPS only);
 - g. Miscellaneous Tracing(s) - (For Navaid Calibrations (except microwave), Co-tidal Corrections, Floating Navigational Marks, Names, etc);
 - h. Wreck Cards/Records;
 - i. SV Probe Data Tapes.
- etc

A.2. Provide a statement on the neatness and accuracy of tracings if appropriate. If several staff have been employed on a particular tracing, the division of labour is to be described.

**ANNEX B TO HMS ROEBUCK'S
266/999 dated 31 October 2000**

Digital Surveying System

B.1. Include a brief description of:

- a. System hardware;
- b. Software version number;
- c. Main software functions;
- d. Applications of software;
- e. Any major difficulties encountered.

B.2. When using SIPS, the following should be included:

- a. Diary of all defects that had a significant impact on the conduct of the survey;
- b. Details of the variables and parameters used during logging and processing:
 - I. Navigation cycle time; (normally 2 seconds)
 - II. Depth cycle time; (normally 1 second)
 - III. Logging interval; (normally 10 seconds)
 - IV. Standard Error for each LOP;
 - V. A diagram illustrating all laybacks;

B.3. If INSQC predictions were used in the determination of position instead of accepting the position determined directly from the raw radio navaid data, then an explanation is required.

B.4. The total number of DATA files created is to be stated. If any file was not rendered, e.g. because it was corrupted. a brief explanation is to be given.

B.5. Processing (Track)

- a. A statement that no recalculation of position was undertaken or details of any lines where recalculation of position was necessary;
- b. Details of any major track editing - other than the removal of the occasional spurious position;

B.6. Processing (Depth)

Stage 1

- a. Half-gate width
- b. Filter time constant
- c. Minimum number of returns (normally 2)
- d. Minimum expected depth

Stage 2

- e. Selection by Highs and Lows or Fixes - if fixes state reason.
- f. Window Size.

Stage 3

- g. Annotation Size
- h. Annotation Azimuth
- i. White space factor
- j. Scale

If any of the above parameters were varied during the survey the maximum and minimum values used are to be quoted. Full details will be extracted from forms H442 if required.

B.7. DEM

- a. Name
- b. Origin
- c. Azimuth
- d. Height and width
- e. Bandwidth and number of bands
- f. Character size used in weeding
- g. Confirmation that 'selected soundings only' have been used to form the DEM.
- h. Details of any polygon clipping used to plot the DEM to the bathymetric sheet.

B.8. Grid

- a. Name
- b. Origin
- c. Height and width
- d. Number of squares, square size and search distance

B.9. If any variations from standard procedure were adopted they are to be described in detail. In particular, the following should be noted.

- a. The manual adjustment of any selected depths in QPFs. Also to be recorded on forms H442. Any major manual reselection of the soundings selected by the automatic sounding selection process.
- b. The addition of any depths to the bathymetric sheet which are not included in the DEM. A list of all individual depths or the co-ordinates of the limits of blocks of manual data are to be provided.
- c. The editing out of any invalid depths from the DEM. If possible, the DEM should be reformed without the rogue soundings.

- B.10. Forms H441 and H442 raised are not to be included in this Annex but rendered with the digital data.
- B.11. Print-outs of ALL Job Configurations used during survey are to be forwarded at this Annex. Job Configurations are not to be typed but should be direct SIPS printouts or photocopies of the printout.

**ANNEX C TO HMS ROEBUCK's
266/999 dated 31 October 2000**

Geodetic Data

Section 1 - Description of Observations.

- C.1.1 This is to be a comprehensive description of the methods and instruments used for observing the control. The type of equipment and the mode in which it was used is to be carefully described. The name and versions of any computer programs used for the reduction of observations, or any other type of processing or transformation are to be detailed. Difficulties encountered and how overcome, together with remarks on accuracy achieved should be included.

Section 2 - Horizontal Datum, Spheroid, Projection and Grid Details; List of Coordinates

- C.2.1 Horizontal datum, projection and grid details will normally have been stated in the geodetic appendix to the HI. These should be repeated at the beginning of this section, using a form of words similar to:

'All control is referred to World Geodetic System 1984 Datum, World Geodetic System 1984 Spheroid; grid coordinates are given in terms of the Transverse Mercator Projection, UTM Grid Zone 21 South (Central Meridian 057°W).'

or

'All control is referred to ETRS89 Datum, GRS80 Spheroid; grid coordinates are given in terms of the Transverse Mercator Projection, UTM Grid Zone 31 North (Central Meridian 003°E).'

Exceptionally, where no suitable horizontal datum is already established, the details required are to be stated in full.

- C.2.2 Stations are to be listed, in tabular form as an Annex to the Report of Survey, see example at the end of this outline Annex. For each station, the information required is:
- Distinguishing letter;
 - Full name;
 - Field name and/or GPS SITE number;
 - Source for old stations. Estimated error for new or re-occupied stations. If the sources for horizontal position and height are different, both should be quoted;

- e. Geographical co-ordinates. Coordinates should not be quoted to a greater precision than that justified by their estimated error. Coordinates accepted from other sources should be in bold and underlined.
- f. Grid coordinates. Coordinates should not be quoted to a greater precision than that justified by their estimated error. Coordinates accepted from other sources should be in bold and underlined.
- g. Spheroidal height in metres;
- h. Orthometric height in metres.

C.2.3. Stations determined independently of the main control network are to be clearly distinguished, and their source stated. They are to be listed separately in a table using the format at Annex A.

C.2.4. Any heights observed should be clearly tabulated and their source stated. The vertical datum used is to be stated together with details of the method used, whether the heights are orthometric or spheroidal and the geoid/spheroid separation used, together with its source.

Section 3 - Descriptions of Stations

C.3.1. List any known geodetic stations which no longer exist and explain why.

C.3.2. Descriptions of stations are to be rendered for all recoverable stations, on Forms H159; amendments found to be necessary to descriptions of previously established stations are to be rendered on Forms H159A. (If a previously established station cannot be recovered, this is to be stated on Form H159A giving suggested reasons for the problem.) The descriptions of the station mark itself, its immediate locality and the general area are to be as thorough and detailed as possible, to enable the station to be both identified on aerial photography, and also recovered on the ground.

C.3.3. Aerial photographs of the general locality, on which stations have been very accurately pricked through, should be supplied where possible. Ground, or preferably low aerial, photographs should also be used to illustrate the stations themselves. One print of each photograph is to be included with each copy of Form H159; the negatives should be placed in an envelope in the pocket at the back of the original copy of the geodetic data.

C.3.4. Pre-marked control points for air photography are to be photographed at altitude intervals of 1000 feet up to 4000 feet. This may be achieved by either air survey cameras or a hand held camera. At least two shots at each altitude from different positions as near vertical as possible should be taken. At least one pair of photographs should include some coastline, if possible. All control photography should be recorded with a Photographic Reconnaissance Report with H159. Prints made of control photography should be full frame, if possible.

C.3.5. All diagrams and photographs are to be black and white, and are to be drawn or selected with a view to their legibility when reproduced. Views should be annotated with: HI number; station name and letter; date and reference to Report of Survey. If labels are used, they should be stuck on the reverse.

Section 4 - Abstract of observations

C.4.1. The following sub sections are to be completed where appropriate.

- a. Angles - This section is to contain a set of Forms H157, one (or more) for each station occupied. All observed horizontal angles are to be recorded, including any not used in the field adjustment, to permit later, more rigorous, Office adjustment. All appropriate columns on the forms are to be completed. An estimate of the error in each final reduced grid circle reading is to be entered in the 'Remarks' column. Corrections for t-T are to be shown for each ray, including that to the RO. Vertical angles are to be shown separately, below the horizontal angles.
- b. Distances - This section should contain full details for the measurement of each line. All observed distances are to be recorded, including any not used in the field adjustment, to permit later, more rigorous, UKHO adjustment. In all cases, the derivation of the final reduced grid distance from the raw instrument readings must be clear and unambiguous. Care must be taken that the scale factors are applied the correct way round. An estimate of the error in the result should be included. Full details of the methods used, and the corrections applied, are to be given in the case of distances measured by other means. Details of computer programs used to reduce the observations to the grid are to be included, together with copies of any printer output.
- c. Geodetic GPS This section is to contain the following data:
 - (1) List of baselines observed including: Date and Julian Day No, Session Letter, Stations Observed.
 - (2) List of antenna heights for each observation (stating whether slope, vertical or offset height).
 - (3) Printout of ALL post processed GPS vector files used to determine coordinates;
 - (4) CD or floppy disk containing raw observational data;
 - (5) CD or floppy disk containing all post processed GPS files and network adjustment files as detailed in the respective SOPs. A backup copy of all data is to be retained onboard until the survey has been fully appraised by UKHO.

Section 5 - Description of Adjustment

C.5.1. A comprehensive description of the methods used for adjusting the control is required. Items to be rendered and their format are detailed in the relevant SOP.

C.5.2. For geodetic GPS schemes, only one known point should be held fixed in the adjustment process. Where further points in the scheme are known points, a comparison should be made between the computed coordinates as a result of the adjustment and the original known coordinates.

Section 6 – Transformation of Co-ordinates

C.6.1. Give full details of any transformations of co-ordinates that were undertaken. This should include the actual transformation parameters used and the software platform on which the calculations were performed.

Section 7 – Correspondence with other Surveying Authorities

C.7.1. Copies of all correspondence with local surveying authorities regarding geodetic control are to be included in the Report of Survey.

Diagram of Control

1. A Diagram of Control should only be produced manually when the software used to adjust the network does not have the facility to produce a network diagram. The Diagram of Control is to be drawn on good quality paper and bound as Annex B to the Report of Survey. The size of the diagram should be sufficient to allow all observations to be distinguished easily and with the station names shown clearly. Its folded size should preferably not exceed A4; areas of dense control may be shown as larger scale insets, or separately, to aid clarity. A scale and a graticule are to be inserted. Stations accepted from previous work are to be shown in red, and all others in black. Station symbols and sizes are at Chapter 5 Annex A.
2. The types of observations are to be clearly distinguishable. For example, observed angles are normally indicated by small arcs joining the defining rays; observed distances are indicated by doubled rays; GPS vectors are indicated by red lines.

LIST OF CO-ORDINATES AND HEIGHTS

SITE (Letter)/Full Name/[Field Name] [GPS Number]	Source for old stations. Estimated error for new or re-occupied stations	WGS 84 Datum, UTM grid zone 21 South, Central Meridian 57° West					
		Latitude (South)	Longitude (West)	Eastings (metres E)	Northings (metres N)	Spheroidal Height (metres)	Orthometric Height (metres)
(A) Mount Round [ROUND] [2502]	FI 360 E FL/5-P22	51° 36' 08".6352	57° 58' 54".0517	432012.40	4282726.15	168.80	155.48
(B) Mount Brisbane [BRISBANE] [2501]	FI 360 E FL/1-P26	51° 29' 22".000	57° 55' 58".372	435231.84	4295332.16	187.50	173.88
(C) Port Long [LONG] [2503]	< ± 0.1 (1σ) metre	51° 33' 24".124	58° 25' 34".678	425025.37	4299045.83	22.45	20.43
(D) Icy Point [ICY] [2504]	< ± 0.1 (1σ) metre	51° 36' 36.016	58° 57' 54".879	425609.24	4300005.67	38.91	18.22

**ANNEX D TO HMS ROEBUCK's
266/999 dated 31 October 2000****Navaid Calibration and Validation**

- D.1. State types of navaid, frequencies and operating modes.
- D.2. If using differential GPS, state which reference stations were used and give details.
- D.3. Describe the calibration and validation methods used.
- D.4. List all the navaid calibration / validation results including any computer printouts (if available) for all calibrations / validations carried out before, during and after the survey.
- D.5. Where a precise navaid such as Trisponder is used to validate a DGPS navaid, full details of the calibration of the reference navaid should be included as well as details of the validation. Where a second DGPS navaid is used to validate the primary DGPS navaid it should be as fully independent a system as possible. The preferred method is to use post processed or real-time kinematic GPS for validations of DGPS nav aids.
- D.6. When using SIPS, the printout showing the navaid and system configuration is to be included as an Appendix. Whenever there are changes to this, they are to be recorded and a new printout obtained for record purposes. A statistical summary is to be derived from the End-of-Line navaid LOP statistics, and included.

**ANNEX E TO HMS ROEBUCK's
266/999 dated 31 October 2000****Sound Velocity and Bar-Check Observations**

- E.1. List the dates and results obtained for each observation.
- E.2. When mean sound velocities have been calculated from XBT observations, the consecutive numbers of the XBT observations and the assumed salinity values used must be included.
- E.3. H635 (Oceanographic Observations).

(NB A copy of the completed digital form should accompany the magnetic data tapes which are to be rendered to Office with the Report of Survey).

**ANNEX F TO HMS ROEBUCK's
266/999 dated 31 October 2000****Levelling and Tidal Observations**

- F.1. Quote the levelling results in the form of a diagram, and state clearly the value of Sounding Datum established.
- F.2. Include Forms H 143 (Record of Tidal Observations) fair copy required of H533 (Transfer of Sounding Datum) - where appropriate.
- F.3. Record of Daily Tidegauge Checks on H516.
- F.4. Results of 25 hour pole – gauge.

- F.5. When using an offshore seabed tidegauge data is to be rendered after each 30 day period of recording for analysis by UKHO. It is only necessary, therefore, to render a summary of observations in the following format:

Tidegauge Address	Position	Recording Period	Date Rendered	UKHO Reduction Figure

**ANNEX G TO HMS ROEBUCK's
266/999 dated 31 October 2000**

Accuracy of Soundings

- G.1. State depth variation throughout the survey area and indicate the acceptable standard error which accrues.
- G.2. List techniques adopted and the assessment of the standard errors achieved under each of the headings listed in the table below.
- G.3. Set out, as in the table below, a listing of the standard error assessments for each of the tested criteria at the shoalest and deepest depths encountered and any intermediate depths where the error assessments change markedly. The example in Annex A to GSI C gives useful guidance. A brief explanation should be given for the assessment of each standard error.

Source	At Deepest Depth	At Intermediate Depth(S)	At Shoalest Depth
Echo Sounder TX Mark Setting			
Variation in TX mark setting			
SV Measurement			
Spatial Variation in SV			
Temporal Variation in SV			
Application of Measured SV			
Instrumental Accuracy			
Trace Resolution			
Heave			
Settlement and Squat			
Roll, Pitch and Seabed Slope			
Tidal Measurement			
Co-tidal Corrections			
Application of Tidal Reduction			
Trace Reading			
Combined Error = $\sqrt{\sum(x)^2}$			
Requirement = $\sqrt{\pm(0.5)^2} \pm$			
Standard Met (Yes/No)			

**ANNEX H TO HMS ROEBUCK's
266/999 dated 31 October 2000****Comparison with Published Chart**

- H.1. Draw attention to depth changes which may warrant promulgation by Notices to Mariners:
- a. In depths 0 to 10 m list depths shoaler than charted by at least 0.5m
 - b. In depths 10 to 31m list depths shoaler than charted by at least 1m
 - c. In depths 31 to 200m list depths shoaler than charted by 5% or more
 - d. In depths 200 to 800m list depths shoaler than charted by 10% or more
- H.2. In high-risk areas where vessels operate regularly with minimum under-keel clearance, any shoaling of critical or controlling depths should be listed. Examples of such high-risk areas are: the Dover Strait TSS; Southern North Sea Deep Water Routes; within and adjacent to main channels in port areas and their approaches.
- H.3. In the following areas, no more than a general description of the changes is required. However, the controlling depths must be clearly identified.
- a. Areas of unstable seabed, where significant movement of features has occurred;
 - b. Complex areas, such as rocky seabeds;
 - c. Areas where new surveyed depths are shoaler than charted over a significant part of the survey area (even if the differences fall within the criteria in H.1. above).
- H.4. It is important to give a firm recommendation on the charting action to be taken for charted dangers which have not been found during the survey. A danger will not be removed from the chart unless the recommendation is based on a full examination.
- H.5. The horizontal reference datums of the positions of surveyed and charted features should be stated. Ideally these should correspond to the datums of the survey and chart, respectively.
- H.6. Any 3D views created using SIPS should be included in this annex. Each view is to be printed on A3 paper folded to fit within the A4 binders and is to have a title block showing:
- a. The title of the respective bathymetric sheet;
 - b. Horizontal and vertical scales;
 - c. Viewing azimuth and altitude

**ANNEX I TO HMS ROEBUCK's
266/999 dated 31 October 2000****Wrecks and Obstructions**

- I.1. List all wrecks located and examined under two separate headings:
- a. 'Known Wrecks' (by name, where appropriate and position)
 - b. 'New Wrecks' (by position) and cross reference to H525 and H525a rendered with the accompanying wreck cards.
- I.2. Comment on all wrecks listed in the HI that were not located during the survey, and offer opinions as to why they were not found.

- I.3. Charted wrecks, obstructions or other dangerous features, which have not been located and examined during a survey must be disproved if at all possible. They will not be removed from the chart without a positive statement from the Charge Surveyor that this is justified.
- I.4. Whatever the outcome of the search, whether as part of a larger survey or as an individual examinations, the Charge Surveyor must report the findings in full, in an appropriate manner, and with supporting traces as necessary, together with a positive recommendation as to future charting action.
- I.5. See Chapter 3 Appendix 2 for searches for the elimination of doubtful data.
- I.6. For any 'not fully surveyed' (NFS) wrecks, a brief statement of the additional work required, e.g. 'to be wire swept'.
- I.7. List all seabed obstructions (including wellheads) located, as well as those which were not found (and why).
- I.8. List all fisherman's fasteners, stating whether any have been searched for and found, and whether correlation is possible with other features. Any information obtained in confidence is to be identified.

**ANNEX J TO HMS ROEBUCK's
266/999 dated 31 October 2000**

Tidal Stream Observations

- J.1. Include only Forms H 183A (Record of Tidal Stream/Current Observations)

**ANNEX K TO HMS ROEBUCK's
266/999 dated 31 October 2000**

Light Sectors and Buoys

- K.1. Give details of how all light sectors were observed, and list the final accepted sectors. Check these against Annex P (Amendments to Light List).
- K.2. List all buoys by name, number (where appropriate), characteristics and position (mean of flood and ebb fixes).

**ANNEX L TO HMS ROEBUCK's
266/999 dated 31 October 2000**

Seabed Textures, Natures of the Bottom and Retained Seabed Samples

- L.1. Give a general description of the nature and texture of the seabed, draw attention to any special features found and state the extent and direction of any areas of sand ripples.
- L.2. List position, height, extent and assessment of any contacts with a dimension of > 1 m.
- L.3. Forms H575 (Record of Seabed Samples and Cores).

**ANNEX M TO HMS ROEBUCK's
266/999 dated 31 October 2000**

Topographical Features, Conspicuous Objects and Marks

- M.1. List all topographical features currently charted or mentioned in the Sailing Directions as conspicuous or prominent by name, position and relevant paragraph in Sailing Directions with comment on whether conspicuous or prominent.
- M.2. Provide a separate list of features considered conspicuous or prominent but not formerly charted as such.
- M.3. The lists should include photographs and not be confined to features within, or visible from the survey area but should include features nearby that have been assessed when on passage to and from the replenishment port.
- M.4. Provide full details of measured distances either found, or charted but no longer usable.
- M.5. Provide full details of all marks used to indicate clearing lines, leading lines and recommended tracks either found, or charted but no longer usable.

**ANNEX N TO HMS ROEBUCK's
266/999 dated 31 October 2000**

Sailing Directions Amendments and Nomenclature

- N.1. During the course of any survey, the relevant Sailing Directions are to be carefully examined and suitable amendments formulated. Notes for these amendments must be kept throughout the survey, as the need for them is realised, and the revised text should be compiled immediately after the completion of work in the field, when every essential point is still fresh in the mind. It is not possible to write Sailing Directions solely from study of the bathymetric sheet.
- N.2. The annex should clearly indicate which paragraphs of Sailing Directions have been verified.
- N.3. Sailing Directions are written by the surveyor as information supplementary to the bathymetric sheet, but should be applicable, if possible, to the existing published chart as well. It should be borne in mind that the editors of Sailing Directions do not normally see the bathymetric sheet and will use the published chart when examining the surveyor's proposed text. Consequently reference objects should, whenever possible, be common both to chart and bathymetric sheet.
- N.4. As a general rule, the Sailing Directions applicable to a survey will be covered by only a few pages in the published book, but care must be taken to check the general information in Chapter 1 as well as that in any of the appendices which may be relevant to the area being surveyed or to adjacent localities.
- N.5. The most useful format for minor amendments is to list required changes e.g.
 - a. delete to
 - b. add between and
 - c. amend to to read

In each case, the position of the amendment should be identified by page number, column left or right, and line number or for Sailing Directions in Continuous Revision by page, paragraph number, sub paragraph number and line. When writing large amendments, these should be compiled in the style of

the book being amended. The surveyor should always be prepared to be more expansive in his text than is likely to be necessary for the published book. The editor will then be able to get a fuller picture of the area and will be able to condense, or *précis*, the proposed amendments with more authority. It is particularly important that if any detail is to be deleted from a large section being rewritten, a positive statement to the effect, with background detail if appropriate, should be included. Merely omitting a point leaves the editor in doubt as to whether the omission is deliberate or an oversight.

N.6. Whenever possible, any structure specifically mentioned in Sailing Directions should be illustrated by colour photographs, and general views (colour photography or manuscript) provided wherever these would be useful. These are especially valuable in the approaches to ports, and along recommended leading lines. See *The Mariner's Handbook* for guidance.

N.7. In particular the following features should be described or reported:

Anchorage	If extensive or complicated, they should be included on a tracing accompanying the bathymetric sheet.
Berths	To be fully described
Breakers	Details of areas of breakers and inhospitable coasts are to be given.
Bridges	To be fully described. Where a bridge moves to allow shipping to pass the width of the channel formed is to be reported.
Clearing Lines	To be fully described, mentioning (if a transit) the rear mark first and then the front mark.
Cliffs	Where their colour is significantly different from the surroundings, and this fact would be useful to the mariner, it is to be reported.
Danger Areas	If extensive or complicated, they should be included on a tracing accompanying the bathymetric sheet.
Dolphins	To be fully described
Eddies	Comment as to whether the feature is dangerous or not.
Ferries	To be fully described
Floating Bridges	To be fully described
Fresh water Springs	To be fully described
Groynes	To be fully described
Harbour Facilities	To be fully described using H102A as an aide mémoire. To avoid unnecessarily long descriptions of large ports it will often suffice if copies of the port brochures and regulations are obtained and forwarded with the Amendments to the Sailing Directions.
Jetties	To be fully described
Kelp	Areas of kelp, its existence and extent of its effect are to be fully described
Leading Lines	To be fully described, mentioning (if a transit) the rear mark first and then the front mark.
Light Sectors	If sectors are different from those already charted, details are to be given.

Locks	To be fully described. The maximum depth over the sill is to be reported
Measured Distances	To be fully described.
Offshore Installations	To be fully described
Outfalls	To be fully described
Overfalls	Comment as to whether the feature is dangerous or not.
Overhead Lines	Where they pass over a navigable channel, the safe clearance above MHWS (or MHHW) is to be reported together with the names of the authority responsible and their contact officer. Some overhead lines are conspicuous to radar and may appear as a contact on a steady bearing. When this is the case, the effect should be described.
Port Facilities	To be fully described using H102A as an aide mémoire. To avoid unnecessarily long descriptions of large ports it will often suffice if copies of the port brochures and regulations are obtained and forwarded with the Amendments to the Sailing Directions.
Recommended Tracks	To be fully described, mentioning (if a transit) the rear mark first and then the front mark.
River bar	If the bar is liable to change, the fact is to be stated.
Sandwaves	Limits, orientation, distance between crests, and maximum height from trough to crest are to be given.
Sewers	To be fully described
Slipways	To be fully described
Spoil Grounds	To be fully described.
Tide-rips	Comment as to whether the feature is dangerous or not.
Well-heads	To be fully described
Wharves	To be fully described

N.8. Give the Charge Surveyor's recommendations for pilotage through the survey area (if appropriate).

N.9. All charted names should be checked. If a name different from that charted is found to be in general use locally the authoritative source of the information is to be reported. List separately any new names proposed, with full explanation of the reasoning behind the need to name the feature (except in unexplored areas when this is self-evident) and the selection of the proposed names.

N.10. Any local mapping obtained should be forwarded with the Report of Survey and identified in this annex.

**ANNEX O TO HMS ROEBUCK's
266/999 dated 31 October 2000****Views**

- O.1. There is a continuing need for photographs to illustrate Sailing Directions. In general photographs over 10 years old are not used, therefore every opportunity should be taken to re-photograph existing views, and provide new views.
- O.2. The compiler of a chart and the editor of Sailing Directions can be greatly helped if they can visualise the area with which they are dealing. One of the best ways of providing this visual input is by the use of photographic views. Good quality colour photographs, particularly aerial obliques, are preferred.
- O.3. The requirements for photographs to illustrate Sailing Directions are fully described in The Mariner's Handbook (NP 100) Sections 8.35 to 8.51 together with methods to be employed, helpful techniques, and methods of annotating and rendering the data. This reference should be carefully studied before a programme of view photography is contemplated.
- O.4. The surveyor should take steps to illustrate the Report of Survey and the Amendments to the Sailing Directions as fully as possible. Even if only a few of the pictures forwarded are eventually published, they will all have been examined in UKHO and will have allowed those processing the survey to see the area, in part at least, as the mariner sees it.

**ANNEX P TO HMS ROEBUCK's
266/999 dated 31 October 2000****Light List Amendments**

- P.1. List all discrepancies found between the detail shown in the relevant Light List and published charts (including Ts and Ps) and those observed.

**ANNEX Q TO HMS ROEBUCK's
266/999 dated 31 October 2000****Radio Signals Amendments**

- Q.1. List amendments for the appropriate ALRS Volume covering the survey area and ports visited. Describe details of vessel traffic services, ship reporting systems, maritime safety information broadcasts, radio pilot services, port operations, radio navigational aids, radio and radar beacons, coast radio station services and search and rescue procedures.

**ANNEX R TO HMS ROEBUCK's
266/999 dated 31 October 2000****Underwater Handbook Amendments**

- R.1. List amendments.

**ANNEX S TO HMS ROEBUCK's
266/999 dated 31 October 2000****Ancillary/Miscellaneous Observations**

- S.1. Provide details in the form required by the HI or, if not mentioned therein, in as clear and concise a format as possible (preferably tabular). Include in this Annex; corrections to the Air Photo Plot, Spoil Grounds and Dredged Areas, Freshwater Springs, and details of any Oceanographic or Geophysical Observations undertaken.

**ANNEX T TO HMS ROEBUCK's
266/999 dated 31 October 2000****Reports of Dangers and Hydrographic Notes**

- T.1. List all signalled, faxed or e-mail reports and refer to Forms H102 and H102A submitted in respect of the area surveyed.

**ANNEX U TO HMS ROEBUCK's
266/999 dated 31 October 2000****Personnel**

- U.1. Provide a nominal list, with relevant dates, of all Surveying Officers and Senior Rate Surveyors involved with the survey (as currently on Form H68).

**ANNEX V TO HMS ROEBUCK's
266/999 dated 31 October 2000****Diary of Notable Events**

- V.1. List all significant events (with their dates) which have influenced the conduct of the survey. These may include:
- a. Establishing control;
 - b. Survey navaid calibrations;
 - C. Start of fieldwork;
 - d. Port calls and leave periods;
 - e. Operational Sea Training, Naval Exercises or other General Service activities;
 - f. Serious breakdowns (ship or equipment);
 - g. Completion of fieldwork;
 - h. Post-survey navaid calibrations.

**ANNEX W TO HMS ROEBUCK's
266/999 dated 31 October 2000**

Summary of Surveying Activity

W.1. Provide a table, extracted from Form S2041, giving the breakdown of the days covering the period of the survey (between the dates quoted on the front cover of the Report of Survey). 'Downtime' is to be calculated in days derived from aggregated hourly periods. Harbour days are to be entered in the column that represents the primary activity for each day. The sum of the individual columns should equal the total shown in the first column. Column headings are as follows:

TOTAL	SEA				Harbour (whilst operational iaw BR 1313)		
Calendar Days	Surveying	Days Lost			Maintenance AMP/SMP Emergency Repair	Long Leave	Visits including SWEL and logistic stops
		Weather, Ship and Equipment Downtime	Passage	General Service Duties			

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 5

STANDARD GRAPHICS FORMATS

Contents

0501	Draughtsmanship
0502	General Principles
0503	Ozatex
0504	Working Tracings
0505	Identification Number
0506	Security and Privacy Markings
0507	Symbols and Colours to be Used
0508	Styles of Lettering
0509	Computer Drawn Graphics
0510	The Border
0511	Geographical and Grid Intersections
0512	The Title
0513	Scales
0514	Names and Legends
0515	Tidal Information
0516	Horizontal Datum, Spheroid, Projection and Grid
0517	Depths
0518	Checking of Graphics
0519	Names of Draughtsman and Checker
0520	Approval of the Survey

- Appendix 1 Colours & Symbols to be Used on Bathymetric Sheets & Accompanying Tracings.
- Appendix 2 Symbols for Use on Seabed Texture Tracings
- Appendix 3 Quality of the Seabed – Abbreviations to be Used on Accompanying Tracings

0501 Draughtsmanship

1. Draughtsmanship is the art of drawing; it is the ability of the draughtsman to draw neatly, clearly and accurately. Whilst the draughtsman may not necessarily be responsible for the compilation of the data being transcribed, the transcription must not only be accurate and neat but also be carried out with intelligence. The data should be questioned by the draughtsman whenever it appears to be illogical, inconsistent or in any way erroneous. The rules of draughtsmanship apply equally to the production of graphics using computer methods; here also the requirement is to produce a graphic that is clear, accurate and easy to read.
2. The standard symbols and styles of lettering must be carefully followed, and unnecessary embellishments should be avoided. There are few short cuts in the production of a bathymetric sheet or accompanying tracing - accuracy and legibility are the key factors.
3. A careless approach to the rendering of survey data, a part of which is still graphical, is often indicative of careless data gathering, and both are equally dangerous.

0502 General Principles

1. Almost all the data resulting from surveys carried out by Royal Naval surveyors will be permanently retained Public Records. The UKHO is a Place of Deposit for Public Records and unclassified records over 30 years old may be referred to by any member of the public. Therefore the aim of the draughtsman must be to produce a document which:
 - a. Is clear and legible. It can be used with confidence and without ambiguity by anyone who may need to consult it, either immediately it is rendered or in the future;
 - b. Is meticulously accurate. Incomplete or inaccurate data are valueless unless the measure of imprecision is known. Any detail which appears on a graphic must be plotted to as high a degree of accuracy as possible. Haste breeds inaccuracy and should be avoided. Original sources of information must be referred to if the draughtsman doubts the accuracy of any detail he is transcribing;
 - c. Has been very carefully checked. The checker is responsible not only for checking that the data have been transcribed correctly but also that there are no apparent errors of fact in the data displayed. Where the same data appear in other forms, such as tidal or wreck records, the checker must be satisfied that all agree;
 - d. Is suitable for photographic reproduction and reduction. The correct materials and inks must be used, and a reasonably bold style cultivated within the guidelines imposed by later articles in this section. Weak or uneven penwork must be avoided, as must the temptation to use fine lines with insufficiently dense ink. Details of subsidiary importance must not be allowed to interfere with the portrayal of data of greater significance. In this connection it must be remembered that what may be clearly distinguishable on a polychromatic graphic can well become cluttered or illegible on a monochromatic dye-line copy or on a photo-reduction. It is here that the skill, or lack of it, of the draughtsman will become particularly apparent;
 - e. Is pleasing in appearance. A graphic sheet which has been well laid out, is neatly drawn with an even and regular style throughout, and which has been carefully checked, corrected and finished by cleaning and unobtrusive lacquering, is not only highly satisfying to the draughtsman and to all who were involved in the original survey, but is also a document which will be used with confidence by the cartographer in Office, and displayed with pride to others who need to use it.

0503 **Ozatex**

1. Ozatex is a double matt transparent plastic film, supplied as A0 sheets 0.004" thick, and is the principal medium used for a wide variety of drawing purposes. The matt surface is provided by an additional coating, into which waterproof inks etch slightly. The following remarks are intended as guidance for both the novice and experienced draughtsman:
 - a. Use and economy. Ozatex should generally be used for all graphic sheets which are to be rendered to UKHO. It should be remembered that Ozatex is very much more expensive than ordinary tracing paper and should only be used when stability is a requirement; for short-term copying requirements, tracing paper should be used;
 - b. Cleaning. Inks will not take to the surface satisfactorily if it is greasy or sweaty, and it is important that the working surface should be carefully treated at all times; it is best to cover any area not in use, and have protective paper under the hands when using the graphic. The surface may be cleaned with proprietary cleaners; one of the most satisfactory is photographic film cleaner. See also f. below for cleaning prior to lacquering;
 - c. Ink-work. Rotring waterproof inks are supplied for use with Ozatex and these etch slightly into the surface of the material so that they cannot be erased accidentally after drying. The inks generally reproduce well photographically so long as they are sufficiently intense and opaque; it is often wise to shake the ink bottle if it has not been used recently; this is especially true of green ink. If, however, ink is applied too thickly, a proportion of it cannot be absorbed into the surface of the Ozatex, and it will not dry properly. This will also happen if the surface is greasy, and smearing may occur long after the ink should have dried. Proper surface preparation will always pay dividends;
 - d. Pencil-work. For normal pencil-work, grades H to 3H are usually the best. Softer pencils tend to smudge and prove hard to erase, whilst harder grades cause scores in the soft surface film which it is sometimes difficult to eradicate completely;
 - e. Erasing. Erasing must be done with great care if the surface is not to be damaged; if the soft matt drawing surface is removed and the hard base medium is exposed, neither ink nor pencil will take satisfactorily. Soft, technical-drawing rubbers (e.g. Faber Castell Magic Rubber or Staedtler Mars Plastic Rubber) should be used dry to erase pencil-work and slightly damp to erase ink. An erasing screen should be used to avoid damage to neighbouring detail. The use of a scraper should be treated as a last resort, if further drawing is to be done in the area, although it may be useful to remove minor blemishes and to trim ink-work;
 - f. Lacquering.
 - i. All work drawn on Ozatex is to be lacquered before being rendered to UKHO. This provides a considerable amount of protection, so long as all parts of the tracing have been covered, and the lacquer has been applied properly.
 - ii. Before lacquering, the sheet must be very thoroughly cleaned to remove all pencil guidelines, dirt and grease. It is best to prop the sheet at an angle and, using Letracote 053 (Matt) lacquer, spray the sheet carefully from a range of at least 30 cm.
 - iii. The lacquer must not be applied too thickly as its appearance will be markedly inferior and the surface of the lacquer will be damaged more easily subsequently. Two or three coats applied very thinly, and succeeding coats only after the earlier ones have completely dried, will provide a strong waterproof covering which will be barely discernible, and will not mar the sheet's appearance. Lacquering is best done when little other activity is taking place nearby, as any dust in the air is readily attracted to the damp lacquer and cannot be removed. Before rendering, all sheets should have the corners rounded off using a radius of 2 to 3 cms.

- iv. If, after lacquering, additional pen-work is found to be necessary, it is possible to remove the lacquer with film cleaner if great care is used. If, however, the addition is small, it is usually possible to make the insertion on top of the lacquer, especially if it has been applied thinly. A further coat of lacquer should be applied in the area after the ink has dried.
- g. Damage and stowage. The drawing surface of Ozatex is comparatively soft and will be damaged by buttons, cufflinks and rings on the upper surface, and by grit, dirt and grease underneath. Fair graphics should always be protected by paper when not in use, and may be stowed flat or rolled. Creasing of the material should be avoided at all costs, as the effect is impossible to eliminate completely and greatly mars the appearance of the sheet.

0504 Working Tracings

1. Working tracings are to be prepared, upon which all detail of the survey will be collated in preparation for transfer to the bathymetric sheet or other graphics. These tracings are to be drawn by survey processing system. A full set of grid intersections should be plotted and sufficient should be labeled to permit accurate fitting together when required. Every tracing is to be identified fully by the name of the survey, HI number, scale, ship's name, any other subsidiary identification, and the year. The size of the tracings need be governed only by convenience of handling and ease of stowage. They should have their corners rounded and care is to be taken with them whenever they are handled.
2. Soundings should be plotted directly onto the sounding tracings. Coastline, natures of the bottom, positions of buoys, etc. should be plotted first on the field board and then transferred to the relevant tracing.
3. Once the detail on any sounding, coastline or other subsidiary tracing has been transferred to the relevant fair graphic, and the transfer fully checked, the original tracing should be carefully cleaned and stored ready for rendering to UKHO with other field records after the survey has been accepted.

0505 Identification Number

1. All sheets are to show, in bold Univers lettering at the right hand side of the wide margin, the HI Number and the UKHO File Number, (e.g. HI 493 – HH090/493/01).

0506 Security and Privacy Markings

1. If a survey is classified, this will be stated in the HIs and all documents relating to the survey are to carry the appropriate markings. For computer data media, each item is to carry the classification as part of the LABEL input at the beginning of the file, as well as externally. Security headers are to be included on discs and tapes and marked in red on the magnetic material label.
2. Surveys which carry no security classification above 'Unclassified' are nevertheless the property of the Ministry of Defence or the Maritime Coastguard Agency and may not be released to outside authorities without permission. All documents relating to 'Unclassified' surveys are therefore to carry the privacy marking 'For Official Use Only'.
3. Security and Privacy Markings are to be shown, in bold Univers lettering, centrally placed outside the North and South borders. Unless instructed otherwise in the HI, all sheets are to be marked: **FOR OFFICIAL USE ONLY** and the seabed texture tracing is to be classified: **RESTRICTED**. Markings should be over-sprayed with Letracote to ensure permanence.

0507 Symbols and Colours to be Used

1. The majority of data on graphics is to be drawn in black using the appropriate symbols from Chart 5011. A guide to symbols and colours is at Chapter Five Appendix 1 with seabed texture symbols at Appendix 2.
2. With all penwork, a good density of line must be maintained; ink which looks faded or washed-out will not reproduce properly. Over-heavy inkwork, on the other hand, may not dry out fully. Washes are not to be used as they obscure detail when photocopied.

0508 Styles of Lettering

1. Styles should be used as follows:
 - a. *TIMES UPRIGHT CAPITALS* - for important names on the land;
 - b. *Times Upright* - for less important names on land;
 - c. *UNIVERS UPRIGHT CAPITALS* - for mountain ranges, important peaks and important fixing marks; may be used instead of Times Upright Capitals with stencils;
 - d. *Univers Upright* - for all legends and descriptive writing and for minor and unimportant names in general on land; for any general notes or remarks on accompanying tracings and other graphics; for the names of beacons, light-vessels and fixing marks; for the characteristics of lights on shore and for the colour of buoys; may be used instead of Times Upright with stencils;
 - e. *TIMES SLOPING CAPITALS* - for important names of deep areas in the sea;
 - f. *Times Sloping* - for less important names of deep areas in the sea;
 - g. *UNIVERS SLOPING CAPITALS* - for important names of shoal areas in the sea; may be used instead of Times Sloping Capitals with stencils;
 - h. *Univers Sloping* - for less important shoal names; for the names of buoys and their characteristics; for wrecks' names; for unimportant names in the sea, or of views; for nature of the sea bed and of the foreshore; may be used instead of Times Sloping with stencils;
2. Not all survey processing systems will be able to reproduce the above styles; the nearest style provided by the system software should be employed.

0509 Computer Drawn Graphics

1. Detailed guidance for the preparation of graphics using the surveying processing system is contained in SOPs.

0510 The Border

1. All borders produced using survey processing systems are to have a full Admiralty style border. It assists checking if the corner dimensions are coincident with whole numbers of marked divisions.
2. Where a graduated border does not contain two full minute ticks, the 30 second or other appropriate ticks are to be numbered.
3. Exceptionally, where a graphic sheet is so small that a full minute of latitude cannot be shown, it is not to be graduated. In this case a true meridian is to be drawn in, in red with an arrow head at the north end, passing through a co-ordinated point or geographical intersection, and a scale is to be shown. See 0513.

4. The dimensions of the sheet's inner border (to one place of decimals of a millimetre) are to be inserted, at the eastern end of the southern border, thus:

1121.2 mm
 977.2 mm 977.2 mm
 1127.9 mm
5. Nothing else should appear between the outer and inner borders.
6. Where the borders of two or more sheets abut, the common borders on each sheet may be reduced to a single line with graduation ticks and no outer thick border, so that there will be the minimum of interference when the sheets are laid over each other. When making use of this facility, one latitude border and one longitude border on each sheet are always to be fully drawn.
7. Where borders drawn using survey processing systems do not comply exactly with the above specification, there is no requirement to alter them to conform.

0511 Geographical and Grid Intersections

1. The basic framework of a graphic sheet consists of geographical and grid intersections shown as follows:
 - a. Geographical. The border is to be drawn in accordance with Art 0510 and the relevant SOP. The remaining intersections are to be drawn in accordance with Chap 5 Appendix 1. Except in extreme cases, the number of minutes of longitude separating the meridians should equal the number of the minutes of latitude separating the parallels. The longer side of the rectangles so formed should not usually exceed 20 cms. Those falling within the title are not to be plotted.
 - b. Grid. Grid intersections should be spaced not more than 20 cms apart. They are to be drawn in accordance with Chap 5 Appendix 1. The co-ordinates of the four intersections which form the largest rectangle which can be contained within the geographical border of the sheet are to be indicated against two which are diagonally opposed, in Univers Upright figures, with the units indicated.

0512 The Title

1. Every graphic must have a title by which it can be clearly identified. The absolute minimum, without which no graphic can be considered complete, must contain:
 - a. Title of the survey;
 - b. Name of the ship or unit;
 - c. Dates between which the survey took place;
 - d. Description of what the tracing shows;
 - e. Units of the data being displayed;
 - f. A key for any non-standard symbols used;
 - g. Scale of the survey;
 - h. Reference to the Report of Survey or covering letter.
2. Between the minimum above and the Full Title as set out below, the contents of titles for particular graphics must be left largely to the discretion of the Charge Surveyor, bearing in mind that each sheet should be able to be understood and used when separate from its Report of Survey.

3. Bathymetric sheets are to carry a full title, which is to include:
- General area;
 - Title of survey;
 - Name of the Officer-in-Charge;
 - Name of the ship or unit;
 - Dates between which the survey took place;
 - Units and datum for heights;
 - Units of depth;
 - Horizontal datum, spheroid, projection and grid;
 - Scale of the survey;
 - Reference to the Report of Survey;
 - A note, if required, of any important points which qualify in any way the authoritative nature of the sheet or tracing as a single document (e.g. reference to incomplete examinations).
4. When a survey is rendered on two or more sheets, the second and subsequent sheets may carry an abbreviated title. The identification of each sheet must be simple and logical. If only two sheets are involved, they may be described by unambiguous words if desired (e.g. 'Northern' and 'Southern'), but if more than two sheets are used, they are to be numbered. In either case the sheet identifier is to appear immediately under the main title line on all sheets. The abbreviated title is to contain:
- General area;
 - Title of the survey;
 - Sheet name or number;
 - Name of the ship or unit;
 - Dates between which the survey took place;
 - Units of depth;
 - Scale of the survey;
 - Reference to the Report of Survey.
5. The full title of a bathymetric sheet should be laid out as follows,:
- GENERAL AREA
 - TITLE LINE**
 - SURVEYED BY.....
 - HM. SURVEYING SHIP "....."

- e. Date
- f. Heights are shown in Metres above Mean High Water Springs
- g. DEPTHS IN METRES
- h. (Under 31 in Metres and Decimetres)
- i. reduced to ... below a benchmark (↑) cut in
- j. ETRS89 Datum, GRS80 Spheroid
Transverse Mercator Projection,
UTM Grid Zone 31North (Central Meridian 003° E)
- k. 'Scale 1:.....
- 1. See H.M.S..... s Report of Survey No ... dated..

6. The layout of the title is to be centred on the middle line of the title. The letterpress may be left justified.

7. All lettering on graphic sheets drawn using SIPS is to be in Univers style. See 0519 for checker name.

0513 Scales

1. On large-scale ungraduated plans, a single scale of metres is to be inserted horizontally, never vertically, in the style shown on Chart D6695. The legend 'Metres' is to be inserted at either end of the bar in line with the numerals over the graduation, and 'Scale of Metres' placed centrally over the scale; both should be in Univers Sloping.

0514 Names and Legends

1. Names of features and descriptions are to be inserted on Accompanying Tracings and not on the bathymetric sheet. All names, legends and descriptive writing are to be in black, except 'Areas surveyed on another scale' (See Chapter Five Appendix 1) which is to be in red.
2. Where names are written on a curve, the curvature should be moderate and regular, and should either follow the shape of the feature or should trend away from the object towards the horizontal. Where names or legends are written in a straight line they should be horizontal, unless written along a channel whose axis is straight, e.g. in a narrow dredged area, along a leading line, or recommended track.
3. Important detail must never be obscured by names or legends, and it must be remembered that what may be marginally legible on a graphic will almost certainly be illegible on dyeline copies or photo reductions.
4. Punctuation should be simplified as follows:
 - a. Apostrophes should be inserted in the title only;
 - b. Full stops should be used with abbreviations only where necessary for clarity. They are not necessary with natures of the bottom or foreshore, and are never to be shown in the waterwork (except in light characteristics) as they can be confused with a sounding on the drying line;
 - c. See Chapter Five Appendix 1 regarding light characteristics.

0515 Tidal Information

1. Information concerning sounding datum must be shown on the bathymetric sheet, in sufficient detail to enable the survey to be compared with past or future surveys solely by reference to the bathymetric sheet. The positions of the benchmarks used are to be shown, if they lie within the area of the bathymetric sheet, using symbol 'IB23' in Chart 5011.
2. The connections between sounding datum and at least one benchmark and, where possible, the local land levelling system, are to be inserted under the title. Values are to be given in metres to two places of decimals. In the United Kingdom, the grid reference and the elevation above OD(N) are to be included as part of the description of any Ordnance benchmark used. If further amplification is necessary, it should be included in the Report of Survey. Vague phrases such as 'Reduced to Chart Datum', 'Reduced to Mean Low Water Springs', 'Reduced approximately to Indian Spring Low Water' etc. should not be used.
3. In deep water and for offshore soundings, approximate methods of reducing soundings are sometimes justified, and in such cases the method used must be given.
4. The following are examples of the styles to be used:

- a. 'Reduced to 3.67 m below Ordnance Datum (Newlyn) or 5.49 m below Ordnance BM (6.82m) (TR 3193.4074) flush bracket No G4868 on NW face of Lifeboat House near Prince of Wales Pier, Dover.'

N.B. If all the required data is not available, the style may be reduced but as much detail as possible is to be given.

- b. 'Reduced to Chart Datum (LAT) using observations at Dover and Co-tidal Chart No 5057 Edition dated 20 May 2002.'

N.B. In addition, the full description of the datum should appear in the Report of Survey as follows:

'Tidal observations were obtained at Dover for the reduction of soundings. Chart Datum (LAT) at Dover is 3.67 m below ...' (see a. above). The following may also sometimes be necessary in the title 'For co-tidal corrections used, see the tracing accompanying this bathymetric sheet'.

- c. Reduced to Chart Datum (LAT) using predictions for Dover and Co-tidal Chart No 5057 Edition dated 20 May 1994.'
- d. 'Corrected for the velocity of sound in sea water using NP139, 3rd Edition. No tidal reductions have been applied.'

0516 Horizontal Datum, Spheroid, Projection and Grid

1. In this section of the title, sufficient information must be given to allow the sheet to be related accurately to other charts, maps and co-ordinate lists. The geodetic datum, spheroid projection and grid data from which the sheet has been constructed must be concisely described using the format 'Datum, Spheroid; Projection, Grid'. The following examples are given for guidance.

'All control is referred to World Geodetic System 1984 Datum, World Geodetic System 1984 Spheroid; grid coordinates are given in terms of the Transverse Mercator Projection, UTM Grid Zone 21 South (Central Meridian 057°W).'

or

'All control is referred to ETRS89 Datum, GRS80 Spheroid; grid coordinates are given in terms of the Transverse Mercator Projection, UTM Grid Zone 31 North (Central Meridian 003°E).'

2. Terms may be abbreviated on bathymetric sheets when the abbreviation is in very general use outside as well as within the Hydrographic Service.

0517 Depths

1. Surveys will normally be carried out in metres. In water shoaler than 31 metres, depths are to be given in metres and decimetres, the decimetres figure being shown as a suffix to the metres figure, and written smaller; depths of 31 metres or more should be given in metres only; drying soundings should be given in metres and decimetres, with the metres figure underlined.
2. Depths are to be drawn in the Univers Sloping style, that is with lines of even thickness and without serifs. They should be reasonably bold with about four to the centimetre in general sounding and about five to the centimetre where examinations have taken place.
3. It is most important that all soundings be shown with clarity; they are the most important features shown on the bathymetric sheet, and other details are not to interfere with them. In particular, it should be remembered that other symbols which may be in contrasting colours on the bathymetric sheet, will appear in monochrome on dyeline copies and photo-reductions, and may obscure soundings thereon.
4. Care should be taken that no positional errors occur during transfer of soundings, and also that the decimetre suffix appears in the correct position relative to its principal. The position of such a sounding is the 'centre of gravity' of the combined value, not of the metre figure alone as it would be if there was no suffix. When drawing decimetre suffixes, especially in areas crowded with soundings, it is important that they should not be mistaken for separate, 'whole metre', soundings. Soundings obtained on the drying line are to be depicted by a dot.
5. When depths of 31 metres or deeper are so regular that it is possible to show a sequence of more than five of the same depth, only the terminal soundings at each end need be inserted and, provided the record is continuous, they may be joined by a firm black line which must follow the ship's track. Where large areas of such even depths exist, the device is a clear indication of the bland nature of the seabed.
6. During ocean bathymetric and geophysical surveys, when the majority of the lines are in an east/west direction, depths are to be drawn at an inclination of 45° to the track so that they may be read from the southern edge of the sheet, yet still maintain a spacing of about four soundings to the centimetre.
7. For passage soundings, figures should be inked-in at right angles to the track readable from the southern edge of the sheet. This form of drawing soundings may also be used in normal surveys in areas where the depth of water is greater than 500 metres and where a significant number of lines run east/west.

0518 Checking of Graphics

1. The checking of bathymetric sheets, accompanying tracings and other graphics is one of the most important aspects of data rendering. Not only must the physical transfer of data from working to fair tracings be checked for accuracy, but the data displayed must also be checked for consistency with all other records or reports where reference to them may appear.
2. The checking process must be carried out by experienced surveyors or senior recorders who should, preferably, have drawn or helped to collate similar tracings in the past. An inexperienced officer or rating cannot be expected to detect every error of fact or implication, or have the knowledge to suspect anomalies in the data before him, or to realise that essential data is missing.
3. Checking is to be completed, errors corrected and counter-checking of the corrections carried out, before any data is presented to the Charge Surveyor for perusal and approval. It is usual to show the latter what corrections were necessary and how they were effected.
4. Whilst most surveyors have their own system for ensuring that no detail is missed during checking, it is best to have a check-off listing to follow a pattern. The following list, although by no means exhaustive, is a guide to the aspects of bathymetric sheets and other tracings which must be examined:

- a. Throughout, all detail displayed must be accurately positioned, clear, legible, sufficiently bold and with ink sufficiently dense to undergo copying in the UKHO;
- b. All pencilled guidelines and notes must have been removed and other blemishes and marks erased; after lacquering, this will be impossible.

The following items of detail should be checked:

- c. Accurate plotting of border, geographical and grid intersections, and geodetic stations; the symbols of all to be of the appropriate size and style;
 - d. The border to be of the correct style, fully subdivided and annotated;
 - e. Dimensions correctly calculated; names of draughtsman and checker inserted;
 - f. Title complete and spelling correct; quoted positions accurate; tidal references confirmed;
 - g. Scales (on ungraduated plans) accurately plotted and annotated;
 - h. Depths correctly positioned and accurately transcribed; any that are anomalous checked to origin;
 - i. Depth contours inserted in accordance with Chapter Five Appendix 1; confirmed that none are missing and that isolated drying soundings have correct washes and symbols;
 - j. Wreck details and symbols inserted correctly and cross-checked with other tracings, forms and annexes;
 - k. Qualities of the seabed symbols correct and checked against records of retained samples;
 - l. Coastline accurately drawn, foreshore and offshore inter-tidal areas correctly described, drying heights inserted;
 - m. Details of lights, navigational marks, buoys, measured distances etc, correctly inserted and checked against other records;
 - n. Topographic detail accurately transcribed from field records, air photo plots etc; correct symbols and colours used;
 - o. Conspicuous objects inserted and checked against Report of Survey;
 - p. Heights correctly calculated, inserted and checked against other data;
 - q. Tidal stream data, both diamonds and arrows, shown, together with symbols e.g. eddies, overfalls;
 - r. Names and descriptions inserted clearly and spelled correctly;
 - s. Positions, names, and other details, quoted anywhere in accompanying reports and forms must be checked against the appropriate tracing; these include wreck records, lists of significant depths, amendments to Sailing Directions and Light Lists etc;
 - t. As a final check that no aspect of the graphic has gone unexamined, it is often prudent to check through GSIs to see whether any have been missed.
5. When the checker is satisfied, his or her name is to be inserted on the graphic sheet, and in the signature block on H Forms and other survey documents.

0519 Names of Draughtsmen and Checker

1. If more than one draughtsman has been employed on a document, all their names should be shown and the Charge Surveyor is to indicate in the Report of Survey, in reasonably precise terms, the division of work.
2. Sheets drawn using SIPS are to carry, below the title, the statement.

Processed using SIPS S/B/NT

Supervised by.....

Checked by

0520 Approval of the Officer-in-Charge of Surveys

1. All bathymetric sheets and tracings which display original work, also a number of other reports and forms, are to carry the signature of the Officer-in-Charge as approving the data.
2. In signing these data, the Officer-in-Charge implies satisfaction with all aspects of their presentation, and that they may be rendered to UKHO and used to improve charts and publications. If not satisfied with any part of the data, doubts and reservations are to be recorded in the Report of Survey so that this part may be treated with any necessary caution in UKHO.
3. Any major material shortcomings in the data shown on the bathymetric sheet or an accompanying tracing are also to be noted under the title of the sheet concerned.
4. Officers below the grade of Charge Surveyor undertaking independent surveys will normally be under the direction of a Charge Surveyor. The records of such surveys are to be submitted to the Charge Surveyor for approval and are also to carry a signature block for the officer submitting the survey.
5. In cases where officers below the grade of Charge Surveyor are conducting surveys without the direction of a Charge Surveyor, special guidance will be given according to the circumstances.
6. The approval of the Officer-in-Charge is to be given in a convenient place on the graphic as follows:

Approved:

J. Smith (signature)

Commander, Royal Navy,
In Charge of Surveys.

7. In the case where the survey has been carried out by an officer acting under the direction of a Charge Surveyor, the word 'Submitted:', followed by the signature and rank of the officer who actually carried out the work is to appear immediately before the approval of the Officer-in-Charge.
8. If no Charge Surveyor has been appointed to take charge of the survey, only the rank of the officer conducting the survey is to be given thus:

Approved:

D. Jones (signature)

Lieutenant, Royal Navy.

9. The insertion of the 'Approved' signature indicates that the officer concerned is entirely content with the accuracy, clarity and validity of all data shown, or has explained any shortcomings fully in the Report of Survey. It should not be appended until all errors of commission or omission have been made good

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 5

APPENDIX 1

STANDARD GRAPHICS FORMATS

COLOURS & SYMBOLS TO BE USED ON BATHYMETRIC SHEETS & ACCOMPANYING TRACINGS

Object	Colour	Chart 5011	Remarks
Airfields			See Airports.
Airports	Red/Black	ID17	Where the scale is suitable, the principle buildings and structures (eg control tower, terminal buildings, hangars, windsocks, radio and radar aerials, etc) if visible from seaward, should be shown on an accompanying tracing in red or black as appropriate, if fixed in the field. Where the airport's identifying Air Light can be seen from the sea, this should be shown using the symbol IP60.
Anchorage	Black		If extensive or complicated anchorages, danger areas, etc should be included on a tracing to accompany, otherwise included in the Report of Survey Annex N.
Areas Surveyed on Another Scale	Red		The limits of areas surveyed on a scale different from that of the bathymetric sheet are to be indicated with pecked lines & the legend in Univers: <p style="text-align: center;">"See sheet (name of Survey), (name of ship or unit), (year) Scale 1:"</p> <p>The symbol should not be used to indicate adjoining sheets or surveys on the same scale.</p>
Beacons	Black	IQ 80 - 126	Beacons are to be shown with as much detail as possible as to colour, top-marks and light characteristics.
Benchmarks	Black	IB23	
Berths			See Wharves
Breakers	Red/Black	IK17	A danger which shows itself by breakers should carry the legend 'Breaks', 'Breaks at half-tide', 'Breaks in heavy weather' etc, should be inserted against the position of such dangers in black on an accompanying tracing. Where it has proved impossible to sound an area because breakers appear to be a permanent feature, the breaker symbol should be inserted in red.
Bridges	Black	ID 20 - 24	Bridges are to be shown on an accompanying tracing. Where a bridge moves to allow shipping to pass, it should be shown in the open position to indicate the width of the channel through it. Bridges should generally be drawn just large enough to depict the symbol, unless the scale is sufficiently large that the actual dimensions can be depicted. When a bridge crosses a navigable waterway, the clearance height above the HW datum (MHWS or MHHW) is to be shown, in red.
Buildings	Red	ID5	Buildings, towns & villages are only to be shown when they have been surveyed in the field. Individual buildings are drawn in red outline or as a solid red block. Buildings forming part of the coastline, that part of the structure is to be drawn in black; the remainder in red. When particular features on buildings are visible from seaward, they should be shown as small black circles with an appropriate legend (e.g. 'FS', 'Cup') in black Univers Upright.

Object	Colour	Chart 5011	Remarks
Buoys	Black	IQ	<ol style="list-style-type: none"> 1. Buoys, light floats & light vessels whose positions were fixed on the flood & ebb are to have these positions shown on an accompanying tracing otherwise the mean position only is to be shown. 2. Buoys should be drawn in black outline, with green & black buoy symbols infilled completely with black ink. Buoys of all other colours are to be unshaded & all buoys are to have their colours shown under them in Univers Upright. Topmarks are to be shown. As far as possible, the different kinds of navigational buoy and mooring buoy, Lanby, lightfloat etc, should be indicated by the appropriate symbol, or its purpose described by a legend. Names (if any) should be written for Light vessels in Univers Upright, for Light floats in Univers Sloping and for Buoys in Univers Sloping. 3. Where the position of a buoy's ground tackle has been established either by observation, by sonar or diver, or by reference to the appropriate local authority, it is to be shown on an accompanying tracing accompanying using the symbol IQ42.
Bushes	Black	IC31.1	See Vegetation
Cables, overhead	Red	ID 25 – 27	Overhead cables (power, telephone, etc), where they pass over a navigable channel, are to be shown with the clearance above MHWS or MHHW in brackets beside the symbol. An appropriate legend, e.g. 'Power', should be inserted where appropriate in black Univers.
Cables, submarine	Red	IL30 – 32	Submarine cables, whose positions have been fixed, are to be shown on an accompanying tracing.
Canals	Blue		
Churches	Red/Black	IE10 - 19	On large scales, churches & other places of worship, if prominent & fixed during the survey, should be shown as buildings, with a small black circle representing the tower, spire or other fixing mark, & with a descriptive legend. On small scales, the appropriate symbol from IE10 – 19 should be used in black.
Clearance Heights			
Clearing Lines	Red	IM2	See Leading Lines.
Cliffs	Black	IC3	<ol style="list-style-type: none"> 1. Care should be taken that cliffs are properly shown, as they are sometimes inaccurate on land maps. They should only be shown if they have been surveyed in the field. 2. The symbol is to be sited so as to indicate to the mariner the position of the most significant feature of the cliff. On the coast, the bottom of the cliff should be precisely plotted and, in order to show the symbol clearly, the top may have to be plotted inshore of its true position. For cliffs further inland, the mariner is more likely to be interested in the top of the feature and it is this that should be precisely positioned. 3. The elevation of cliffs should, if possible, be given as spot heights above MHWS; if this is impractical, the actual height of the cliff may be shown as a legend ('Cliffs about 65 m in height') in black. Where their colour is significantly different from the surroundings, and this fact would be useful to the mariner, this, too, should be shown as a legend in black Univers. 4. Quarries, ravines and similar features should be shown with the cliff symbol and a legend in black Univers.

Object	Colour	Chart 5011	Remarks
Coastline	Black		The coastline should be shown by a continuous line of even width if surveyed in the field. In other cases, it is to be a pecked line, e.g. if taken from a map, air photo plot, unconfirmed sources, or if it is the seaward edge of mangrove or saltings, and imperfectly known. It is always to be shown in black, except where the line fixed is an ice edge. In the latter case, a red firm line, if surveyed or checked in the field, or a red pecked line, if unconfirmed, is to be used.
Conspicuous Objects	Black	IE2	Objects which are considered to be conspicuous are to be identified on an accompanying tracing with the names (if any) in Times Upright & the description of the object (eg tower, spire, etc) added in Univers Upright Capitals. Other features, whose positions are accurately known, & are suitable for use as marks but are not considered conspicuous, are to be named & described in Univers Upright; in most cases the description ('Mast', 'Spire', 'Chy'), without a name, will be sufficient.
Contours, depth			See GSI C.3.4
Contours, Height	Black		Height contours surveyed in the field are to be drawn as continuous black lines. The spacing of contours is at the discretion of the Charge Surveyor, and will depend on the steepness of the land and scale of the survey. Contours are to be labelled in metres in black. Figures should be right way up when looking up the slope, and preferably, but not necessarily, readable when viewed from the southern edge of the chart.
Coral, drying	Red	IJ22	See LW line.
Cultivation	Black		Outline of fields and other cultivated areas.
Danger Areas			See Anchorages.
Dolphins			See Wharves
Drying Heights	Black		<ol style="list-style-type: none"> Any feature whose top lies above the LW line but below the HW line or Coastline is described as 'drying', and its height is related to Sounding Datum. On the foreshore, or on detached drying banks, extensive areas will be depicted by drying soundings. Isolated features, such as pinnacle rocks, should be depicted by the appropriate symbol and the drying height in brackets in the waterwork beside it. The legend '(Dries ...m)' should only be used if there is plenty of room and it can be inserted with clarity or where, as in the case of a large wreck, individual features can be more easily pinpointed in this way. Drying heights taken from air photo plots should only be inserted on the bathymetric sheet if they have been verified in the field. They are not necessarily related to the survey datum and may require adjustment.
Drying Line	Red		See LW line.
Eddies	Red	IH45	See Overfalls.
Enclosed Basins	Blue		

Object	Colour	Chart 5011	Remarks
Ferries & Floating Bridges	Black	IM 50 - 51	The track of a floating bridge is to be shown on a tracing accompanying the bathymetric sheet as a pecked red line with a legend in black Univers, as the wires or chains may constitute a hazard. Ferries having no physical connection with the shore are not to be shown. Ferry terminals should be shown where appropriate.
Fishing Stakes & Traps	Red	IK44/45	Show on separate tracing.
Foreshore	Black		Rock or coral symbols or pecked lines used to separate one type of foreshore from another.
Fresh Water Springs	Black	IJ 15	Where the positions of Fresh Water Springs have been established by observation, they are to be shown, in black on a tracing accompanying the bathymetric sheet.
Geodetic Control Station GPS Station	Red	IB21	When observations are made to obtain geographical positions ashore using GPS pseudo-range techniques, such that the accuracy is likely to be better than $\pm 1\text{m}$ (1σ), the observation spot is to be shown in red on the bathymetric sheet using symbol IB21. For charting purposes station distinguishing name and height above MHWS (or MHHW, where the tide is diurnal) or where MHWS is not known, referred to MSL is to be inserted in red Univers Upright. The centre of the circle is to be marked or 'pricked through'. Circles and triangles are to be broken where they cross the HW line, or other important detail, to avoid confusion on photographic copies.
Geodetic Control Station Primary	Red		To be shown on an accompanying tracing as a 6mm diameter circle surrounding an equilateral triangle centred on the station position. For charting purposes station distinguishing name and height above MHWS (or MHHW, where the tide is diurnal) or where MHWS is not known, referred to MSL is to be inserted in red Univers Upright. The centre of the circle is to be marked or 'pricked through'. Circles and triangles are to be broken where they cross the HW line, or other important detail, to avoid confusion on photographic copies.
Geodetic Control Station Secondary	Red		To be shown on an accompanying tracing as a 4.5mm diameter circle centred on the station position. The centre of the circle is to be marked or 'pricked through'. For charting purposes station distinguishing name and height above MHWS (or MHHW, where the tide is diurnal) or where MHWS is not known, referred to MSL is to be inserted in red Univers Upright. Circles and triangles are to be broken where they cross the HW line, or other important detail, to avoid confusion on photographic copies.
Geodetic Control Station Sounding Mark	Red		To be shown on an accompanying tracing 3.0mm diameter circle centred on the station position. The centre of the circle is to be marked or 'pricked through'. For charting purposes station distinguishing name and height above MHWS (or MHHW, where the tide is diurnal) or where MHWS is not known, referred to MSL is to be inserted in red Univers Upright. Circles and triangles are to be broken where they cross the HW line, or other important detail, to avoid confusion on photographic copies.
Geographical Intersections	Black		3mm diameter circle with 3mm radial arms aligned to true north.
Grid Intersections	Black		3mm diameter circle with 3mm radial arms aligned to grid north.
Groynes	Black	IF 6	Any portion of the groyne uncovered at HW is to be pecked. Legends, where necessary, are to be in black Univers.

Object	Colour	Chart 5011	Remarks
Hand Drawn Soundings – SIPS	Violet		Hand drawn soundings on SIPS sheets only.
Harbour facilities			See Wharves
Heights	Black		<ol style="list-style-type: none"> 1. Heights are to be given in metres above Mean High Water Springs (or Mean Higher High Water, where the tide is diurnal) or where MHWS is not known and in non-tidal waters, referred to MSL. 2. Heights are to be written in black Unvers upright, except that where they occur as part of a legend, their style is to conform to the remainder of the legend. If the height figures are written in the water (other than as part of a legend), they are to be enclosed in brackets. Writing heights in the water should be avoided wherever possible. Heights of offshore rocks which would otherwise obstruct soundings should be shown on an accompanying tracing. 3. When a height has been measured accurately, it should be given to the nearest decimetre (e.g. 8.7), but in most cases it will be sufficient to give heights of summits, etc, to the nearest metre, a dot indicating a summit or spot height. Heights are only to be shown where they have been explicitly determined during the survey. 4. Where the height is given to the tops of trees, a short line is to be added over the figure, in brackets if shown in the water. 5. Where a height is approximate, the word 'about' should be included in the legend (eg 'Cliffs about 70 m'). No dot should be shown. 6. When, for some reason, the height of a structure above ground is known, but not above MHWS, it should be written thus: 'Mast 74 m in height'. 7. Particular care is necessary to ensure that all heights are clearly legible, as the bathymetric sheet or accompanying tracing is the only permanent record of them. 8. See also Clearance Heights.
High Water Line	Black		Pecked if unsurveyed. Red if ice edge.
Houses	Red	ID5	See Buildings
Ice Edge	Red		Where ice forms the coastline depict as a firm line if surveyed, pecked if unsurveyed.
Jetties			See Wharves
Kelp	Black	IJ 13.2	Areas of kelp are to be shown on an accompanying tracing.
Lakes	Blue	1C23	

Object	Colour	Chart 5011	Remarks
Leading Lines	Red	IM1 - 6	<ol style="list-style-type: none"> 1. Leading lines and recommended tracks are to be shown on an accompanying tracing only if they have been sounded over, or swept, and are considered safe. Clearing lines useful for keeping away from unmarked dangers are to be shown if their safety has been confirmed. If charted lines of this kind have not been sounded over and their suitability confirmed, this is to be stated, with reasons, in the Report of Survey, and proposed charting action recommended. 2. On the accompanying tracing, the lines are to be drawn in red. A firm line represents a leading line to be used by shipping and marked by a transit or a line of bearing to a fixed mark; a bold pecked line represents a recommended track not marked by a transit or a marked line of bearing; and a fine pecked line represents a transit or bearing, or part of a transit or bearing, not intended to be used by shipping, including a clearing line. Where a recommended track is to be used by shipping in one direction only, this is to be indicated by arrows. 3. Legends describing these lines should follow the principles shown by symbols IP20 - 21. Bearings should be from seaward & to the nearest minute of arc if known.
Lights	Black	IP	<ol style="list-style-type: none"> 1. Light characteristics and sectors are to be shown on an accompanying tracing using symbols in Chart 5011 Section IP. Flares are to be omitted. Names of lighthouses, where known, are to be inserted in Times Upright. 2. Light characteristics are to be shown with the standard abbreviations. Full stops are to be omitted after: s (seconds) m (height in metres) M (Nominal range in Miles) () (number of flashes or eclipses) and at the end of the description. Full stops are to be inserted at the end of (not between) all characteristics and all colours, except where covered by the rules of omission above. For example: F.R. F.R.8M Oc.16m Fl(2) 25s 46m 18M FFI.WRG.5s 18m 10-7M
Limits of Areas at Sea. (Dredging, other surveys, etc)	Red	IN1.1	Pecked line annotated in Univers Sloping.
Low Water Line	Red/Black	IJ20 – 22	The LW line (0m contour) is to be shown by the rock symbol, in black, in rocky areas; by the coral symbol, in black, in coral areas, & otherwise by a continuous red line. If the LW line cannot be fixed accurately, a pecked line should be used. A pecked black line, or, where appropriate, the symbols of rock or coral edges, may be used to separate one types of foreshore where this is important.
Measured Distances	Red	1Q122	To be shown on separate tracing. Pecked red line along track, dotted red lines along transits, beacons shown in appropriate symbol.
Moraines	Black		Small irregular quadrilaterals.
Mosques	Black/Red	IE10 - 17	See Churches
Nature of the Foreshore	Black		Abbreviations as for the nature of the seabed are to be used, and are inserted as often as is required to make clear the different constituents of the foreshore, or drying area. A legend may be used if the symbols are not sufficiently descriptive.

Object	Colour	Chart 5011	Remarks
Nature of the Seabed	Black		<ol style="list-style-type: none"> Abbreviations indicating the nature of the seabed from samples should appear in all possible anchorages, and on all shoals, banks, seamounts and the channels between them. They should also be shown at intervals to indicate changes in texture; where there are no other constraints, an interval of about 5 cms at the scale of the survey is to be used as a guideline. They should be drawn on an accompanying tracing, usually the Seabed Texture Tracing (Art 0933), if this is also being prepared, but they must not be inserted on the bathymetric sheet. If for any reason, it is considered that the abbreviations shown do not portray adequately the distribution of bottom sediments, an explanation is to be included in the Report of Survey. The abbreviations to be used are those given in Appendix 3 to Chapter 5 (page 5-A3-2). In particular, the following points should be noted: <ol style="list-style-type: none"> They should be drawn in black Univers Sloping; Full stops should not be used; Adjectives (f, sm, etc) always begin with a lower case letter, nouns (M, Sh. etc) with a capital letter; The colour(s) of seabed samples are not to be shown on graphics, but are to be included in the full descriptions required for retained samples.
Oil & Gas Platforms at Sea	Red & Black	IL2	The positions of all offshore installations & structures associated with them should be shown on an accompanying tracing. Fixed structures at sea should be indicated by small red squares with a central dot, or, if the scale is large enough, by the shape of the structure in red pen-work. Any prominent feature such as a flare should be indicated by a small black circle with an appropriate legend in Univers. If the name of the structure is known, this should be inserted in Univers Upright.
Oil Derricks on Land	Black		As for fixing marks.
Oil Tanks	Red		As Buildings
Overfalls	Red	IH 44 – 45	To be shown on an accompanying tracing. Overfalls & tide rips share the same symbol.
Pipelines, Submarine	Red	IL40 – 44	Submarine pipelines, whose positions have been fixed, are to be shown on an accompanying tracing. Legends are to be in black Univers.
Pools, below HW Line	Red		Show as drying line surrounding 'wet' sounding.
Quarries			See Cliffs.
Radar Beacons & Stations	Black	IE 30 – 31 IS 1 - 16	See Radio Beacons & Stations.
Radio Beacons & Stations	Black	IE 30 – 31 IS 1 - 16	Radio and Radar Beacons and Stations are to be denoted by the recognised abbreviations written in Univers Upright. The exact position of the transmitting aerial of such stations should be given by a small black circle.

Object	Colour	Chart 5011	Remarks
Radio Masts & Towers	Black	IE 28 - 29	The term 'Radio Mast' describes a mast of uniform thickness, usually supported by guys. The term 'Radio Tower' means a self-supporting structure of the 'Eiffel Tower' type. The term 'Lattice Tower' may be used for this type when its purpose is unknown, or is other than for radio.
Recommended Tracks	Red	IM1 – 6	See leading Lines.
Reefs	Red	IK05 – 16	See Coral
River Bar	Black		The best course over a bar, when ascertained, is to be shown on an accompanying tracing.
Rivers	Black/Blue	IC20	Rivers are to be shown with the same symbols as for the sea up to the limits of sounding. Above this, they should be shown in the same way as canals, lakes and other enclosed basins with a blue outline.
Rocks	Black	IK 11 – 12	<ol style="list-style-type: none"> 1. Rock pinnacles which do not uncover should be shown as a sounding (with a swept symbol if appropriate) with the legend 'R', and the appropriate contour. If the exact depth is not known, but the pinnacle is considered dangerous, the symbol for a rock with less than 2 metres over it is to be used, with the danger circle in red. 2. Rocky ledges or reefs over which soundings are uncertain, but which are known to be less than 2 metres in general, should be depicted by a series of small crosses and the area surrounded by a dotted danger line in red. The crosses, in this case, are not intended to represent individual rocks. 3. The cross symbols referred to above should be boldly drawn in black and be of a size similar to neighbouring soundings. 4. The symbol for a rock 'awash' should be used only for one whose highest part lies within 0.3m above or below Chart Datum. 5. The symbol for a drying rock should only be used for a rock of small extent and its drying height should be shown in brackets beside it. Larger areas of drying rock should be shown in the appropriate symbol in black penwork, and with significant drying heights shown in their fixed positions.
Sandwave Area			<ol style="list-style-type: none"> 1. Areas of mobile seabed characterised by sandwaves are to be indicated on the Seabed Texture Tracing (GSI D.5.4). The limits of the area are to be shown by a black pecked line, and the appropriate symbols and descriptions from Chapter 5 Appendix 2 drawn in black within it. 2. Experience has shown that it is not difficult to identify the limits of sandwave areas on echo sounder and sonar traces, but care must be taken not to confuse areas of sandwaves with general areas of sandy bottom containing sand banks and/or sand ridges. 3. Sandwave areas should be included on the seabed texture tracing showing, as precisely as possible, the positions of individual crest-lines. 4. Information on sandwave areas is to be included in the Report of Survey and in the Amendments to the Sailing Directions; limits, orientation, distance between crests, and maximum height from trough to crest are to be given.
Sewers & Outfalls	Black	IK 40 - 43	The diffuser at the end of a sewer, if significantly different from the rest of the feature, is best shown as an obstruction. A least depth should be shown over it if known. Any beacons or buoys marking the seaward ends of these structures are to be shown on an accompanying tracing together with the appropriate symbol for the structure.

Object	Colour	Chart 5011	Remarks
Slipways	Black	IF 23, IU 5	Any portion of the slipway uncovered at HW is to be pecked. Legends, where necessary, are to be in black Univers.
Spoil Grounds	Black		Shown on an accompanying tracing. Spoil ground buoys are to be shown on the same tracing as other floating navigational aids.
Streams	Blue	IC20	Single firm line.
Temples	Black/Red	IE10/13	See Churches
Tidal Stream Arrows	Red	IH40/41	To be shown on an accompanying tracing.
Tidal Stream Diamond	Red	IH46	To be shown on an accompanying tracing, drawn upright in red with reference letter in red Univers Upright Capitals.
Tide Rips	Red	IH44	See Overfalls.
Topography			Topographic detail is not to be shown unless it has been surveyed in the field. The appearance of topography on a rendered graphic indicates to the cartographer that the surveyor is satisfied that it may be used for charting. Any newly surveyed detail must be included, but undue time and trouble should not be expended on detail which is either of no practical use to the mariner or which is readily available to the Office from other sources.
True Meridian	Red		Show on ungraduated tracings only.
Vegetation		IC31 - 32	<ol style="list-style-type: none"> 1. Fields, woods, marshes, etc, should be shown only where a particular natural feature has navigational significance. 2. Deciduous trees should be drawn rather in the shape of oaks, with a short trunk and a wide, squat outline in black. With conifers, a taller, thinner outline is best. Casuarina trees require a light touch to retain a feathery appearance - they can too easily be made to look like a cactus. Palms are usually drawn in pairs, the trunks convex towards each other. Bushes, if significant from a navigational point of view, should be drawn as deciduous trees but without trunks. 3. Mangroves are drawn entirely in black.
Wellheads	Red	IL c – e	Located wellheads are to be shown on an accompanying tracing with a red dotted danger circle with legend and clearance depth, if known, in black.

Object	Colour	Chart 5011	Remarks
Wharves	Black	IU IF	<ol style="list-style-type: none"> 1. Wharves, jetties, etc are to be delineated with a firm black outline. Where the scale allows, the berthing facilities in a port or harbour should be shown in as much detail as possible. 2. Where a berth, or part of a berth, consists of dolphins, these are to be represented by small squares which are to be drawn in their true orientation. 3. It is important to distinguish between structures against which ships can berth and those where they may not, and this can often be indicated by the depths obtained alongside. Which should always be shown on the bathymetric sheet. Where soundings have not yet been obtained, and it is not safe to berth, a dotted danger line in red is to be inserted to seaward of the structure concerned. 4. Where locks are shown, the maximum depth over the sill at Chart Datum should be indicated as a legend. 5. In Home Waters, features useful to small craft operations are being included on large scale charts (e.g. Chart 2793 (Cowes)). Any information of this nature which has been gathered should be rendered as an annotated copy of the published chart using the symbols from the table of Small Craft Facilities in Chart 5011 Section IU. If a chart on a suitable scale is not published, the information should be shown on an accompanying tracing.
Works in Progress	Red & Black	IF30-32	Black pecked fine line on land, red below HW line, legend in black.
Wrecks	Black	IK 20 – 31	<ol style="list-style-type: none"> 1. A stranded wreck (having part or all of the hull above Chart Datum) is to be shown by the symbol (IK24) in black, heading west, with a legend giving the height or drying height. Where only the mast or other structures shows above Chart Datum, this should be indicated by a small black circle with a legend and its height or drying height. If the scale is sufficient for the outline of a wreck to be shown, it is to be indicated by a black pecked line if the least depth is below MHWS. The outline of a wreck, the highest point of which is above MHWS, i.e. it is visible at all states of the tide, is to be drawn in a firm line. 2. Wrecks or obstructions which do not show above Chart Datum should be indicated by a sounding of the least depth over them (with a 'swept' symbol where appropriate), a black dotted danger circle, and the legend 'Wk', 'Obstn' or 'Foul' as appropriate. If a clearance sweep has been run over a wreck, a large scale diagram of the sweeping operation is to be forwarded and if the area swept is large enough to be plotted on the scale of the survey, it is to be shown on the Sonar Track Plot. 3. On large scales, the outline of a submerged wreck is to be shown in a black pecked line, with depths inserted and the appropriate legend in black. 4. Wrecks which have not been fully surveyed are to be shown as a black dotted circle without a depth, and with the legend, in black, 'Wk (NFS)' – (not fully surveyed). It is essential that no depth be inserted on these occasions, as it highlights the incompleteness of the wreck examination, and if a depth is shown it may, incorrectly, be treated as the least depth. 5. The positions of all wrecks located are also to be indicated on the seabed texture tracing using a bold wreck symbol (IK29), angled to indicate the orientation of the wreck where this has been established, otherwise orientated east-west.

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 5

APPENDIX 2

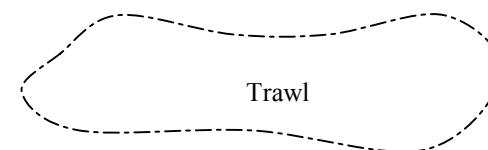
STANDARD GRAPHICS FORMATS

SYMBOLS FOR USE ON BOTTOM TEXTURE TRACINGS

Description

Symbol

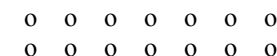
Area of concentrated trawl scours



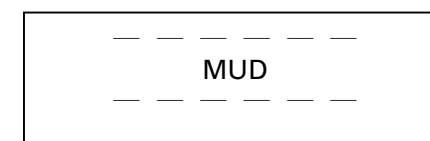
Foul or obstruction, with classification if appropriate



Gravel



Mud



Patch of highly reflective seabed without significant height or extent



Pipeline

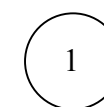


Pockmark



Position of seabed sample with abbreviated description & indentifying number if retained

mS bk Sh G



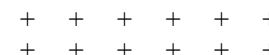
Description

Symbol

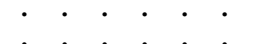
Prominent trawl scour



Rock exposure



Sand

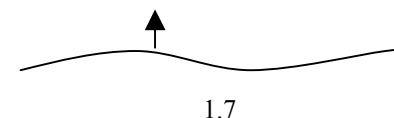


Sandwave areas with height, orientation, wavelength and symmetry with direction of steep slope, e.g. SE south east; A = Asymmetrical; S = Symmetrical



1m 050° - 230° 90m A SE

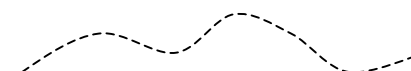
Sandwave crest with crest to trough height in metres, symbol denotes direction of steepest side



Seabed texture boundary - clearly defined



Seabed texture boundary – ill defined



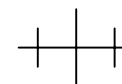
Significant sonar contact



Submerged well



Wreck, orientated as appropriate, with direction & extent of scour



090/50m

DESCRIPTIONS FOR USE ON SEABED TEXTURE TRACINGS

<u>Description</u>	<u>Definition</u>
Bank	Usually of sand or gravel, but may be of rock. A rise in the seabed over a relatively small area, but fairly prominent in relation to its surroundings. When formed of sediment it is often orientated along the tidal flow.
Broad/Narrow	Used to express width when qualifying such features as sand ribbons. Broad should only be used for ribbons over 150m wide, narrow for less than 10m wide.
Featureless	Applied normally to either a flat or smooth seabed where the featureless aspect is either unusual or of considerable extent.
Flat	Must only be used to describe level surfaces (i.e. no significant gradient)
Furrows and Ridges	Longitudinal bed-forms in gravel, sand or mud, some of which can be 9kms long and up to 14m wide. They may be solitary, but more usually occur in groups. They are generally parallel to the prevailing currents.
Gentle	Gradual, slowly changing.
Gravel/Sand/Mud Patches	Thinly spread patches of gravel, sand or mud no more than 100m across and commonly less than 2m thick. May be depositional and subject to movement. Shape may be determined by the relief of the underlying seafloor.
Irregular	Used to qualify a series of features which are not uniform but do have a specific entity, e.g. sandwaves. Can also be used to describe an area of rock where no regular structure is evident.
Large/Small	Preferred to big, great, high/little, slight, mini, etc.
Ledge	A rock outcrop with length in excess of 300m and relatively narrow in comparison. Often found in groups, with similar direction and extent.
Pinnacle	A rock of limited horizontal extent with height considerably greater than surrounding rocks.
Prominent	Used to describe a feature or series of features which is or are very obvious in relation to their general surroundings.
Regular	Used to qualify a series of features which are uniform in amplitude and wavelength, e.g. sandwaves, ridges.
Ripples	Small ridges of sand, similar in shape to sandwaves but with a height of less than 1 metre. Usually orientated transverse to the flow, with wavelength less than 15 metres. May not be detectable by echo-sounder.

DESCRIPTIONS FOR USE ON SEABED TEXTURE TRACINGS

<u>Description</u>	<u>Definition</u>
Rock Outcrop	A patch of rock covering a small area. Refers to a cohesive group, not a collection of boulders.
Sand Ribbons	Normally apparent overlying a coarser type of seabed. Most are straight and parallel with currents. Can be up to 15km long, 200m wide and are generally only a few cm thick. Typically they have a 'laddered' appearance due to the presence of ripples.
Sandwaves	Straight or sinuous ridges of sand, commonly aligned across the dominant tidal stream or current. Minimum height is 1m. Crest separation (wavelength) can be up to 1000m with heights reaching 20m. May be symmetrical or asymmetrical, and may have ripples on them.
Sloping	Refers to any area where there is a general trend in the depth of the seabed, i.e. a bottom gradient. A sloping seabed may be smooth but cannot be flat.
Smooth	Preferred to even or level, and may refer to seabeds that are either flat or sloping. Will usually refer only to mud.

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

CHAPTER 5

APPENDIX 3

STANDARD GRAPHICS FORMATS

QUALITY OF THE SEABED ABBREVIATIONS TO BE USED ON ACCOMPANYING TRACINGS

QUALITY OF THE SEABED - ABBREVIATIONS TO BE USED ON ACCOMPANYING TRACINGS

Descriptive Adjective			Colour & Shade		General Description		Name		Limits in mm	Remarks
For use with Gravel only	large	l	black	b	Mud	M	Clay	< - 0.002	When dried on hand will <u>not</u> rub off easily	
	small	sm	blue	bl		Silt	0.002 - 0.063	When dried on hand will rub off easily		
For use with Sand only	fine	f	grey	gy	Sand	fS	very fine sand	0.063 - 0.125	Use Comparator Disc	
	medium	m	white	w		fine Sand	0.125 - 0.250			
	coarse	c	brown	br		mS	medium Sand	0.250 - 0.500		
	broken	bk	green	gn		cS	coarse Sand	0.5 - 1.0		
	sticky	sy	red	rd		very coarse Sand	1.0 - 2.0			
Consistency terms	soft	so	yellow	y	Gravel	smG	Granules	2.0 - 4.0	Thickness of standard pencil to small pea size	
	stiff	sf	light	lt		P	Pebbles	4.0 - 64.0	Small pea size to clenched fist size	
	hard	h	dark	d		IG	Cobbles	64.0 - 256.0	Clenched fist size to man's head size	
	volcanic	v	speckled	sk	Rock	R	Boulders	> - 256.0	Larger than a man's head size	
							Rock			

Notes:

- Other descriptive nouns that may be used are: Co - Coral & Coralline Algae; Wd - Weed (including kelp, etc); Sh - Shell (Skeletal remains)
- Bottom quality abbreviations are used together if underlying material is known to differ from the surface layer. The nature of the surface layer is given first, followed by the lower layer. For example S/M indicates Sand over Mud.
- If a hard bottom is not positively identified as Rock, the abbreviation h for Hard is to be used.

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

ANNEX A

DOCUMENTS, BOOKS, STATIONERY AND FORMS

Contents

- A0101 UKHO Survey Documents
- A0102 The Survey Library
- A0103 Hydrographic Books, Forms and Diagrams
- A0104 Stationery

A0101 UKHO Survey Documents

1. Survey documents such as maps, copies of Original Documents, copies of Geodetic Data, etc, will be supplied by the Hydrographic Office as supporting documentation for the HI. They are colloquially known as Other Documents, and are supplied on form H109B. As far as possible all necessary documents are supplied without demand when the Hydrographic Instructions are issued; any others which may be deemed necessary should be demanded from the Hydrographic Office.
2. Other Documents will be supplied either 'on loan' or 'for retention'. A return is to be rendered to the Hydrographic Office on 1 February each year listing all Other Documents held on loan. A NIL return is not required and no return is required for Other Documents issued for retention. Other Documents issued on loan are to be returned to the Hydrographic Office as soon as they can be spared, under cover of Form H28. Other Documents issued for retention may be destroyed when no longer required on board. No destruction note is necessary unless the documents are classified. Where Other Documents are being returned to the Hydrographic Office and there may be a requirement to hold them in Office pending re-issue then this fact should be highlighted in a covering letter.

A0102 The Survey Library

1. The Survey Library comprises BRs, NPs and Survey Library Books (SLBs). SLBs are commercial books and publications supplied to ships and other surveying units in accordance with the table below. The library provides data and background theory to assist surveyors in conducting their tasks.
2. SLBs are to be taken on charge and mustered with the periodical muster of instruments. Care is to be taken that loss or damage to books of the survey library does not occur. Many of the older books are out of print and cannot be replaced.
3. Books in addition to the allowances will be supplied on demand if they are available, and are needed for the work being undertaken. The Hydrographic School is tasked to review regularly the list of SLBs; any proposals for additions should be made, in the first instance, to the Commander, Royal Naval HM School (Drake). The RNHMS(Drake) Library may also be consulted by surveying personnel, however, books from this library cannot be issued on loan.
4. BRs for the library should be demanded through Naval Stores; NPs are to be demanded from the Hydrographic Office on Form H262B (Order for Hydrographic Publications) and SLBs are to be demanded from the Hydrographic Instrument Store, Devonport.

THE SURVEY LIBRARY

Book No	Title	OSS	CSV NPs	IPS	SML
BR 45(1)	Admiralty Manual of Navigation Vol I (1987)	1	1	1	1
BR 45(2)	Admiralty Manual of Navigation Vol II	1	1	1	1
BR 45(3)(1)	Admiralty Manual of Navigation Vol III part 1 (1987) Radio Aids to Navigation	1	1	1	1
NP 120	Admiralty Manual of Tides	2	1	1	1
NP 122 (1, 2, 3 and A)	Admiralty Tidal Handbooks Vol I, II, III and binder.	2	1	1	1
NP 134A	Admiralty Manual of Hydrographic Surveying Vol I	6	3	3	2
NP 134B	Admiralty Manual of Hydrographic Surveying Vol II	6	3	3	2
NP 145	Hydrographic Quality Assurance Instructions for Admiralty Surveys	8	4	4	2
SLB 1	A Textbook of Topographical Surveying	1	1	1	

THE SURVEY LIBRARY

Book No	Title	OSS	CSV NPs	IPS	SML
SLB 4	Manual of Map reading, Photo reading and Field sketching (HMSO)	1	1	1	
SLB 5	Plane and Geodetic Surveying (Clarke) Vol I	1	1	1	
SLB 6	Plane and Geodetic Surveying (Clarke) Vol II	1	1	1	
SLB 7	Geodesy (Bomford)	1	1	1	
SLB 8	Air Photography Applied to Surveying (Hart)	1	1	1	
SLB 10	Alphabets of Foreign Languages (Gleichen)	1	1	1	
SLB 12	An Introduction to Charts and their Uses (Chriss and Hayes)	1	1	1	
SLB 14	A Surveyors Guide to Electronic Distance Measurement	1	1	1	
SLB 23	Constants, etc, used in Transverse Mercator Projections (OS)	1	1	1	1
SLB 30	Star Almanac for Land Surveyors				
SLB 33	International Oceanographic Tables (NIO & UNESCO)	1			
SLB 34	Handbook of Oceanographic Tables (USNOO Pub No SP 68)	1			
SLB 35	Introduction to Marine Geology (Keen)	1	1	1	
SLB 36	The Earth Beneath the Sea (Shepard)	1	1	1	
SLB 37	Handbook or Instruction to Collectors (Invertebrates) (BM)	1	1	1	
SLB 40	Elements of Physical Oceanography (McLellan)	1			
SLB 41	Oceans (NIO) (Deacon)	1			
SLB 42	Physical Oceanography (Defant) Vol I	1			
SLB 43	Physical Oceanography (Defant) Vol II	1			
SLB 44	Oceanography for Geographers (King)	1			
SLB 45	An Introduction to Physical Oceanography (Von Arx)	1		1	
SLB 46	The Ocean (Ommanney)	1			
SLB 47	Observing and Forecasting Ocean Waves (USNOO Pub No 603)	1			
SLB 48	Instruction Manual for Oceanographic Observations (USNOO Pub No 607)	1			
SLB 49	A Biography of the Sea (Carrington)	1			

THE SURVEY LIBRARY

Book No	Title	OSS	CSV NPs	IPS	SML
SLB 50	Frontiers of the Deep (Cowen)	1			
SLB 53	The Open Sea (Hardy) (Vol I - World of Plankton)	1			
SLB 54	The Magnetism of the Earth (USC&GS Pub No 40-1)	1			
SLB 55	Encyclopaedia of Oceanography (Fairbridge)	1			
SLB 56	British Whales, Dolphins and Porpoises (BM)	1	1	1	
SLB 57	British Turtles (BM)	1	1	1	
SLB 58	Glossary of Oceanographic Terms (USNOO Pub No SP 35)	1	1		
SLB 71	Sonographs of the Sea Floor (Elsevier)	1	1	1	1
SLB 72	Operating Instructions for Tide Gauges on the National Network	1	1	1	1
SLB 73	Practical Field Surveying and Computations (Allen et al)	1	1	1	1
SLB 74	Illustrating Basic (Alcock)	1	1	1	1
SLB 82	Tides, Surges and Mean Sea Level (Pugh)	1	1	1	1
SLB 90	Sphere. Spheroid and Projections for Surveyors (Jackson)	1	1	1	1
SLB 91	Plate Tectonics (Heather)	1	1	1	1
SLB 92	Hydrography for the Surveyor and Engineer (Ingham)	1	1	1	1
SLB 93	Hydrographic Dictionary (IHO)	1	1	1	1
SLB 94	Descriptive Physical Oceanography (Pickard and Emery)	1		1	
SLB 95	Draughtsmanship (Frazer Reekie)	1	1	1	1
SLB 96	Introduction to Geophysical Exploration (Kearey and Brooks)	1			
SLB 97	Satellite Surveying (Magnavox)	1	1	1	1
SLB 98	Guide to GPS Positioning (Wells)	1	1	1	1
SLB 99	Everyman's Guide to Satellite Navigation (Thompson)	1	1	1	1

A0103 Hydrographic Books, Forms and Diagrams

1. The Hydrographic Books, Forms and Diagrams required for the many aspects of surveying, and its support, are listed in the table below.
2. For printed forms the recommended stock level is listed for ships and units to cover a year's normal usage. These should not be regarded as rigid stock levels and Officers-in-Charge expecting to undertake operations which will require additional stocks, are to make the necessary demands, using H262b and H262c, giving as much notice as possible. In normal circumstances, stocks should be brought up to establishment annually, although emergency supplies will be made at any time on request.
3. Copies of H Forms listed as being MS Word format may be viewed by clicking on the H Form number. Hard copies can be printed from the screen image if required. Alternatively the digital version may be downloaded from NP145 Part 1 CD.
4. It is often the custom for units to produce H Forms in digital format for their own use. This practice is to be discouraged in favour of using the standard forms contained in HQAIs. Where improvements and amendments are found necessary they should be proposed to UKHO, attention RN Technical Author, for inclusion in the next edition of HQAIs.

LIST OF HYDROGRAPHIC BOOKS, FORMS AND DIAGRAMS FOR FIELD USE

H Form	Title	SVHO	CSV NPs	Endurance	Gleaner
7	Field Book	24	12	24	9
13	Sounding Book	36	24	24	12
22	Hydrographic Equipment Defect Report Form	MS Word Master version			
28	Supply and Receipt Voucher				
50R	Hydrographic Equipment Return Note				
50S	Hydrographic Equipment Supply Note				
50T	Hydrographic Equipment Transfer Note				
56	Surveying Contingent Account				
58	Binder for Report of Survey/Geodetic Data	12	6	12	6
68	Annual Return of Survey	MS Word Master version			
68A	Return of Survey				
102	Hydrographic Note				
102A	Port Information Sheet				
102B	GPS Observations Sheet				
143	Record of Tidal Observations (Fair)	MS Excel Master version			
148	Record of Tidal Observations (Working Book)	12	12	12	6
157	Record of Horizontal and Vertical Angles	50	25	50	25
159	Description of Geodetic Control Station	MS Word Master version			
160	Tidal Diagrams (Book)	4	3	4	2

LIST OF HYDROGRAPHIC BOOKS, FORMS AND DIAGRAMS FOR FIELD USE

H Form	Title	SVHO	CSV NPs	Endurance	Gleaner
183	Record of Tidal Stream/Current Observations (Working Book)	3	2	2	2
183A	Record of Tidal Stream/Current Observations (Fair)	MS Excel Master version			
185	Co-tidal Reduction Form				
185A	Co-tidal Reduction Form				
262B	Order Form for Hydrographic Publications (Pad)	1	1	1	1
262C	Order Form for Hydrographic Charts (Pad)	1	1	1	1
272	SAPS Cable Out Tote	MS Word Master version			
273	SAPS Processing Log Sheet				
274	SAPS Sonar Class Register				
275	SAPS Sonar Class Map				
303	Definition of Gravity Station	MS Excel Master version			
304	Vertical Gravity Gradient				
305	Calculation of Gravity Value				
306	Bell Gravimeter Drift Calculation				
408A	Beach Gradient Diagram (Pad)	2	1	1	1
408B	Beach Gradient Diagram (ex graticule) (Pad)	1	1	1	
441	SIPS TRAC Line Data Log Sheet	MS Word Master version			
442	SIPS CHART Data Processing Log Sheet				
443	SIPS DEM Log				
444	SIPS Drawn Fair Graphic Log				
488	Record of Observation for Variation	10	10	10	
489	Ashore Magnetic Observations	MS Excel Master version			
493	Record of Observations of Magnetic Declination ("Variation")	10	10	10	
516	Summary of Checks on Automatic Tide Gauge	MS Word Master version			
525	Report on Wreck Examination or Sweeping				
526	Particulars of Surveying Ships				
532	Levelling Reduction Form	MS Excel Master version			
533	Transfer of Sounding Datum				
572A	BGM3 Daily Check List (Pad)	4			
572H	BGM Gravity Drift (Pad)	2			

LIST OF HYDROGRAPHIC BOOKS, FORMS AND DIAGRAMS FOR FIELD USE

H Form	Title	SVHO	CSV NPs	Endurance	Gleaner
575	Record of Seabed Samples & Cores	MS Excel Master version			
579	Julian Day Calendar (Leap Year)	MS Word Master version			
579A	Julian Day Calendar				
631	Secchi Disc Observations				
635	Oceanographic Observations	UKHO Software on NP145 Part 2 CD			
636	Marine Bioluminescence Observations Reporting Form	MS Word Master version			
637	Marine Life/Fishing Activity Reporting Form				
638	Deep Scattering layer Reporting Form				
639	Hourly Weather Log				
658	List of Survey Field Data				
NP689	Sea Surface Temperature and Salinity Observations (Pad)	6	3	3	

A0104 Stationery

- Most items of stationery required for surveying purposes are from the HMSO standard range and are obtainable from Ministry of Defence (OS(S)1) in accordance with BR 756.
- Below is a list of special items which may only be obtained from the Hydrographic Instrument Store. Demands are to be placed annually taking care that demands are restricted to quantities actually required for the following year. Supplementary demands may be forwarded as necessary but should be restricted to items required to meet immediate needs.

SPECIAL STATIONERY

The following items of stationery may be obtained from the Hydrographic Instrument Store.

Drawing Boards, Saunders, hot pressed A1
 Erasers, Magic-rub
 Erasing Shield
 Lacquer, Letracote Matt 103 (aerosol cans)
 Lettering Guides 201 (Univers sloping) and 203 (Univers upright) various sizes
 Lettering Pens, 51, 52, 53, 54, 55, 56, 58, 510, 514 and 516, Nibs and holders
 Ozatex, 0.005", A0 sheets, pack of 50
 Ozatex, 0.003", A0 sheets, pack of 125
 Pencils, drawing, 5H and 6H
 Pen cleaning unit
 Pen cleaning concentrate (in sachets)
 Rotring Inks, black, blue, yellow, red, green, violet.
 Sectional Pad, metric, A3 and A4
 Tape, 3M, Double Sided, ¼", ½", 1" and 2"
 Tape, 3M, Invisible

H FORM MASTER LISTING

H Form No.	Title	Issue Date	Digital	
			Y	N
7	Field Book			√
13	Sounding Book			√
22	Report of Defective Material or Design in Hydrographic Equipment		√	
28	Supply and Receipt Voucher		√	
50R	Hydrographic Equipment Return Note		√	
50S	Hydrographic Equipment Supply Note		√	
50T	Hydrographic Equipment Transfer Note		√	
56	Surveying Contingent Account Voucher		√	
58	Binder for Report of Survey/Geodetic Data			√
68	Return of Survey		√	
68A	Return of Survey		√	
102	Hydrographic Note		√	√
102A	Port Information Sheet		√	√
102B	Form for Recording GPS Observations and Corresponding Chart Positions		√	√
143	Record of Tidal Observations (Fair)		√	
148	Record of Tidal Observations (Working Book)			√
157	Record of Horizontal and Vertical Angles			√
159	Description of Geodetic Control Station		√	
160	Tidal Diagrams (Book)			√
183	Record of Tidal Stream/Current Observations (Working Book)			√
183A	Record of Tidal Stream/Current Observations (Fair)		√	
185	Co-tidal Reduction Forms		√	
185A	Complex Co-tidal Reduction Form		√	
262B	Order Form for Hydrographic Publications (Pad)			√
262C	Order Form for Hydrographic Charts (Pad)			√
272	SAPS Cable Out Tote		√	
273	SAPS Processing Log Sheet		√	
274	SAPS Class Register		√	
275	SAPS Class Map		√	

H FORM MASTER LISTING

303	Definition of Gravity Station		√	
304	Vertical Gravity Gradient		√	
305	Calculation of Gravity Value		√	
306	Bell Gravimeter Drift Calculation		√	
408A	Beach Gradient Diagram (Pad)			√
408B	Beach Gradient Diagram (ex graticule) (Pad)			√
441	SIPS TRAC Line Data Log Sheet		√	
442	SIPS CHART Data Processing Log Sheet		√	
443	SIPS DEM Log		√	
444	SIPS Drawn Fair Graphic Log		√	
488	Record of Observations for Variation			√
489	Ashore Magnetic Observations		√	
493	Record of Observations of Magnetic Declination ("Variation")			√
516	Summary of Checks on Automatic Tide Gauge		√	
525	Report on Wreck Examination or Sweeping		√	
526	Particulars of Surveying Ships		√	
532	Levelling Reduction		√	
533	Transfer of Sounding Datum		√	
572A	BGM5 Daily Check List (Pad)			√
572H	BGM Gravity Drift (Pad)			√
575	Record of Seabed Samples and Cores		√	
579	Julian Day Calendar – Leap Year Edition		√	
579A	Julian Day Calendar		√	
631	Secchi Disc Observations		√	
635	Oceanographic Observations		√	
636	Marine Bioluminescence Observations Reporting Form		√	
637	Marine Life/Fishing Activity Reporting Form		√	
638	Deep Scattering Layer Reporting Form		√	
639	Hourly Weather Log		√	
658	List of Survey Field Data		√	
NP689	Sea Surface Temperature and Salinity Observations (Pad)			√

HYDROGRAPHIC EQUIPMENT DEFECT REPORT FORM

From:

To: DNSOM Equipment Store
Shackleton Building
Morice Yard
HM Naval Base
Plymouth PL1 2BG
Tel : +44 (0) 1752 552104
Fax : +44 (0) 1752 552708

Date:

Defect Report No:

Item:

Serial No.:

Full Defect Report

Date	Signature	Print Name

SUPPLY AND RECEIPT VOUCHER

No:

for data rendered to the United Kingdom Hydrographic Office.

From:

Date:

The following data arising from HI **No.** (**Name**) is rendered:

Received the above

for CE/UKHO

Date:

HYDROGRAPHIC EQUIPMENT RETURN NOTE

From:

To: DNSOM Equipment Store
 Shackleton Building
 Morice Yard
 HM Naval Base
 Plymouth PL1 2BG
 Tel : +44 (0) 1752 552104
 Fax : +44 (0) 1752 552708

Date:

Return Note No:

Description of Instruments	Serial No.	P/C	Qty	Defective Yes / No (see note below)	Replacement Yes / No

	Date	Signature	Print Name
Returned:			
Received:			

Note: When returning defective equipment form H22 Hydrographic Equipment Defect Report is to be completed, giving as much information as possible, and forwarded together with the equipment and H50R Hydrographic Equipment Return Note.

HYDROGRAPHIC EQUIPMENT SUPPLY NOTE

From: DNSOM Equipment Store
Shackleton Building
Morice Yard
HM Naval Base
Plymouth PL1 2BG
Tel : +44 (0) 1752 552104
Fax : +44 (0) 1752 552708

To:

Date:

Supply Note No:

Description of Instruments	Serial No.	P/C	Qty	Value

	Date	Signature	Print Name
Received:			

PLR action required:

HYDROGRAPHIC EQUIPMENT TRANSFER NOTE

From:

To:

Date:

Transfer Note No:

Description of Instruments	Serial No.	P/C	Qty	Replacement Yes / No

	Date	Signature	Print Name
Transferred:			
Received:			
Actioned by Store			

Notes:

1. Supply unit to raise 4 copies. 3 copies forwarded to the Receiving Unit and 1 copy retained for own records.
2. Receiving Unit to sign all 3 copies, forwarding 1 copy to DNSOM Equipment Store, 1 copy to Supply Unit and 1 copy retained for own records.
3. Both Supply and Receiving Units are to action their PLR's accordingly.

SURVEY CONTINGENT ACCOUNT

From:

To: 1. Ship's copy*
2. Main Cash Account copy*
3. DNSOM/RM copy*
4. DNSOM/EM2 copy*
* Delete as appropriate

Date:

Voucher No:

Particulars of Payments including rates and quantities as appropriate.	Value
<div>Total</div>	

Approved. The above expenses were incurred by my order.

Signed

Commanding Officer

HMS

Dated:

ANNUAL RETURN OF SURVEY

FOR THE FINANCIAL YEAR yyyy - yyyy

H.M.Surveying Ship

Displacement

Tonnes

Officer in Charge of Survey

Naval Surveying Assistants borne (Ranks)(Names)(Grades)	Dates	
	From	To
Senior Surveying Recorders borne (Rate)(Name)	From	To

Average Total Number of Surveying Recorders borne

Average Total Complement (including Officers)

1.A.	Period of Report	From	To	=	Days
B.	Refits and Seasonal Leave Periods				
	Place	From	To	=	Days
	Place	From	To	=	Days
	Place	From	To	=	Days
C.	Days on which no active surveying was carried out due to:				
	i. Bad Weather			=	Days
	ii. Passage			=	Days
	iii. Other reasons			=	Days
D.	Number of Working Days = A – (B + C)			=	Days
	Total Distance Steamed During the Period		Miles		

Note: This form is to be rendered in accordance with HQAI Art C0102.

2. Brief description of the proceedings for the year.

3. Hydrographic Instructions not completed/not started.

HI No.	Title	Estimated time required to complete and remarks

4. Localities observed which appears to require surveying or re-surveying giving Authorities and reasons.

5. Previous forms H68A rendered during the period under report

No.	Date Rendered	Remarks

RETURN OF SURVEY

H.M. Surveying Ship:

Serial No:

Officer in Charge of Survey:

Date:

HI No:

Title:

Scale:

UKHO Ref. HH/***/***/**

SURVEY SUMMARY

1. Dates of Survey

Date on which survey was started:

Date on which survey was finished:

Number of days from start to finish: (A)

2. Survey Category

- a. Single Beam Echo Sounder Used:
- b. Multi Beam Echo Sounder Used:
- c. Sonar Used:
- d. Recommended Survey Category When Completed:

3. General Statistics

When days fall into two categories, that which is more representative of the days activity is to be used. Consistency is to be retained with form S2040.

a. Sea days:

- i. Ship only surveying
- ii. Boat only surveying (excluding detached boat parties)
- iii. Ship and boat surveying (excluding detached boat parties)
- iv. Ship days lost to weather or equipment failure
- v. Passage
- vi. Days on which no surveying was conducted due to other reasons

Total (B)

b. Harbour days:

- vii. Shore survey activity (e.g. deploying nav aids)
- viii. Maintenance Periods
- ix. Visits
- x. Other Activities
- xi. Long leave (but not if already counted in viii. to x.)

Total (C)

Total (A) must equal (B) + (C)

c. Detached boat parties:

Number of days detached

3. Data for Equivalent Square Miles

- a. Area of sounding and sonar sweeping at standard interval
- b. Area of open sounding and sonar sweeping
- c. Area of interlined sounding and sonar sweeping
- d. Area of standard sounding only
- e. Area of shoal investigation sounding only
- f. Number of wreck investigations by close sounding
- g. Number of disproving searches of 2.5 nautical mile radius
- h. Number of wrecks / obstructions swept by wire
- i. Number of contact investigations using sonar
- j. Number of seabed samples obtained when ship stationary
- k. Number of buoys fixed by ship and / or boat
- l. Number of ship hours spent setting up or calibrating nav aids
- m. Number of ship hours spent setting up or calibrating MBES
- n. Number of 25 hr tidal stream observations by ship
- o. Number of bar checks
- p. Number of CTD probe observations and average time

4. Miscellaneous

a. Tidal:

- i. No. of continuous days tidal observations in position: * days dd° mm' ss" N/S ddd° mm' ss" E/W
 * days dd° mm' ss" N/S ddd° mm' ss" E/W

- ii. Positions of tidal stream stations (25 hour observations) dd° mm' ss" N/S ddd° mm' ss" E/W
 dd° mm' ss" N/S ddd° mm' ss" E/W

b. Wrecks:

Serial Number	Name	Swept Y N		Serial Number	Name	Swept Y N	

c. Coastline

- a. Length of coastline surveyed (in km)
- b. Scale
- c. Method used

d. Oceanographic / Geophysical Observations (See Note 3)

Locality / Position	Date	Type of Observations

e. Passage Work

Locality / Position	Date	Type of Observation

5. Remarks

Brief remarks on the general completeness of the survey (e.g. areas unsurveyed, wrecks required to be swept) which is to include a statement as to when the Fair Records of the survey will be rendered to UKHO:

Notes:

1. This form is to be completed and rendered in accordance with HQAI Art C0104 at the end of the month in which work on the survey ceased for the current season.
2. A tracing of a chart or chart cutting is to accompany this form showing the area of the survey completed.
3. This section should not include sound velocity observations taken during surveys on the Continental Shelf.

H.102 (1 Feb 2003)

Issue 1.0

HYDROGRAPHIC NOTE

(FOR INSTRUCTIONS, SEE BELOW)

Date.....

Ref. No.

Name of ship or sender.....

Address:.....

.....

General Locality.....

Subject.....

Approx. Position. Lat.....Long.....

British Admiralty Charts affected.....

Latest Notice to Mariners held.....

Publications affected (Edition No.).....date of latest supplement, page & Light List No. etc)

.....

Details: -

A replacement copy of Chart No.....is required, but see 4 overleaf

Signature of observer/reporter.....

HYDROGRAPHIC NOTE

Forwarding information for British Admiralty Charts and Hydrographic Publications

INSTRUCTIONS:

1. Mariners are requested to notify the Hydrographer of the Navy, Ministry of Defence, Taunton, Somerset, TAI 2DN, United Kingdom, when new or suspected dangers to navigation are discovered, changes observed in aids to navigation, or corrections to publications seen to be necessary. The Mariner's Handbook (NP 100) Chapter 8 gives general instructions. The provisions of international and national laws should be complied with when forwarding such reports.
2. This form and its instructions have been designed to help both the sender and the recipient. It should be used, or followed closely, whenever appropriate.
Copies of this Form maybe obtained gratis from the Hydrographic Office at the above address, or front Chart Depots or principal Chart Agents (see Notice to Mariners No. 2, published annually).
3. When a **position** is defined by sextant angles or bearings (true or magnetic being specified) more than two should be used in order to provide a check. Distances observed by radar and the readings of Loran, Decca, etc., should be quoted.
Latitude and longitude should only be used specifically to position the details when they have been fixe d by astronomical observations or G.P.S. and a full description of the method and equipment used should be given.
4. A cutting from the largest scale chart is the best medium for forwarding details ,the alterations and additions being shown thereon in red. When requested, a new copy will be sent in replacement of a chart that has been used to forward information, or when extensive observations have involved defacement of the observer's chart. If it is preferred to show the amendments on a tracing of the largest scale chart (rather than on the chart itself) these should be in red as above, but adequate details from the chart must lii traced in black ink to enable the amendments to be fitted correctly.
5. When **soundings** are obtained The Mariner's Handbook (NP 100) should be consulted. The echo sounding trace should be marked with times, depths, etc., and forwarded with the report. It is important to state whether the echo sounder is set to register depths below the surface or below the keel; in the latter case the vessel's draught should be given. Time and date should be given in order that corrections for the height of the tide may be made where necessary. The make, name and type of set should also be given.
6. Modern **echo sounders** frequently record signals from echoes received back after one or more rotations of the stylus have been completed. Thus with a set whose maximum range is 500m, an echo recorded at 50nt may be from depths of 50th, 550rtt or even 1050m. Soundings recorded beyond the set's nominal range can usually be recognised by the following:
 - (a) the trace being weaker than normal for the depth recorded,
 - (b) the trace passing through the transmission line,

(c) the feathery nature of the trace.

As a check that apparently shoal soundings are not due to echoes received beyond the set's nominal range, soundings should be continued until reasonable agreement with charted soundings is reached. However, soundings received after one or more rotations of the stylus can still be useful and should be submitted if they show significant differences from charted depths.

7. Reports which cannot be confirmed or are lacking in certain details should not be withheld. Shortcomings should be stressed and any firm expectation of being able to check the information on a succeeding voyage should be mentioned.
8. Reports of **shoal soundings**, uncharted dangers and navigational aids out of order should, at the mariner's discretion, also be made by radio to the nearest coast radio station. The draught of modern tankers is such that any uncharted depth under 30 metres or 15 fathoms may be of sufficient importance to justify a radio message.
9. **Port information** should be forwarded on Form H. 102a together with Form H.102. Form H.102a lists the information required for Admiralty Sailing Directions and should be used as an aide memoire. Where there is insufficient space on the form an additional sheet should be used.
10. Reports on ocean currents should be made on Form H.568 (Sea surface current observations) in accordance with The Mariner's Handbook. This form is obtainable from the Hydrographic Office, Taunton, or principal chart agents.

Note. - An *acknowledgement* or receipt will be sent and the information then used to the best advantage which may mean immediate action or inclusion in a revision in due course. When a Notice to Mariners is issued, the sender's ship or name is quoted as authority unless as sometimes happens the information is also received in a foreign Notice to Mariners. An explanation of the use made of contributions from all parts of the world would be too great a task and a further communication should only be expected when the information is of outstanding value or has unusual features.

HYDROGRAPHIC NOTE FOR PORT INFORMATION

(To accompany Form H.102)

Name of ship or sender:.....

Address:..... Ref. No.....

..... Date:.....

1. NAME OF PORT	
2. GENERAL REMARKS Principal activities and trade. Latest population figures and date. Number of ships or tonnage handled per year. Maximum size of vessel handled. Copy of Port Handbook if available.	
3. ANCHORAGES Designation, depths, holding ground, shelter afforded	
4. PILOTAGE Authority for requests. Embark position. Regulations.	
5. DIRECTIONS Entry and berthing information. Tidal streams. Navigational aids.	
6. TUGS Number available and max. hp.	
7. WHARVES Names, numbers or positions. Lengths. Depths alongside. Heights above Chart Datum. Facilities available	
8. CARGO HANDLING Containers, lighters, Ro-Ro etc.	

9. CRANES Brief details and max. capacity	
10. REPAIRS Hull, machinery and underwater. Ship and boat yards. Docking or slipping facilities. Give size of vessels handled or dimensions. Hards and ramps. Divers.	
11. RESCUE AND DISTRESS Salvage, lifeboat, Coastguard, etc.	
12. SUPPLIES Fuel with type and quantities available. Fresh water with rate of supply. provisions	
13. SERVICES Medical. De-ratting. Consuls. Ship chandlery, compass adjustment, tank cleaning, hull painting.	
14. COMMUNICAITIONS Road, rail and air services available. Nearest airport or airfield. Port radio and information service with frequencies. And hours of operating.	
15. PORT AUTHORITY Designation, address and telephone number.	
16. SMALL CRAFT FACILITIES Information and facilities for small craft (e.g. yachts) visiting the port. Yacht Clubs, berths, etc.	
17. VIEWS Photographs (where permitted) of the approaches, leading marks, the entrance to the harbour etc. Picture postcards may also be useful.	

Signature of observer/reporter.....

FORM FOR RECORDING GPS OBSERVATIONS AND CORRESPONDING CHART POSITIONS

Name of ship/observer:

Address:

Time/Date of Observation(s)	BA Chart in use (SEE NOTE 1)		Lat/Longitude of position read from Chart (SEE NOTE 2)	Lat/Long of position read from GPS (on WGS 84) (SEE NOTE 3)	Additional Information/Remarks (SEE NOTE 4)
	Number	Edition Date			

Notes:

1. It is essential that the chart number, edition date and its correctional state (latest NM) are stated.
2. Position (to 2 decimal places of a minute) of observation point, using chart graticule or, if ungraduated, relative position by bearing/distance from prominent charted features (navigation lights, trig. Points, church spires etc.)
3. Confirm that GPS positions are referenced to WGS 84 Datum.
4. Non-essential, extra information such as GPS receiver model. Also of interest, values of PDOP, HDOP or GDOP displayed (indications of theoretical quality of position fixing depending upon the distribution of satellites overhead) and any other comments.

GPS OBSERVATIONS BY MARINERS, INCLUDING YACHTMEN, FOR RELATING BRITISH ADMIRALTY CHARTS TO WGS 84 DATUM

1. **Background**

The world series of British Admiralty (BA) navigational charts numbers more than 3000. About 60% of these are referenced to defined horizontal datums whose relationships to the World Geodetic System 1984 (WGS 84) Datum can be established. It is therefore possible to make use of satellite-derived positions, such as those obtained using the Global Positioning System (GPS), which are referenced to WGS 84 Datum, by applying latitude/longitude adjustments so that, when plotted, these positions are compatible with chart datum.

Horizontal datums for the remaining 40% of BA charts have not been established. Indeed, some have no geographical graduation (graticule). No reference to a horizontal datum will be found beneath the title of these charts and many now carry a cautionary note stating that positional discrepancies between the chart and WGS 84 positions may be significant to navigation. They may be based on local datums which were defined for surveying purposes at the time, **but whose relationship to the recently developed WGS 84 Datum has not been established or investigated**. There may also be problems of distortion which have resulted from surveying inaccuracies or unresolved local datum differences. A list of charts remaining in this category will be issued and periodically updated in Notices to Mariners (NM).

2. **Growth in the Use of GPS**

The GPS constellation of 24 satellites is complete and the use of ever-cheaper GPS receivers is increasing rapidly. These, even with the current level of positional degradation by Selective Availability (S/A), provide accuracy of 100 metres or better at the 95% confidence level.

Thus, numerous professional and amateur navigators are using a system which, unless the provider denies access, allows an unprecedented standard of continuous, weather-independent worldwide position fixing. This presents the opportunity of improving the positional accuracy of charts in general and, more specifically, establishing a relationship with WGS 84 Datum where this is unknown.

3. **Objective of GPS Data Collection**

The Hydrographic Office would appreciate the reporting of GPS positions, referenced to WGS 84 Datum, at identifiable locations on charts. Such observations could be used to calculate positional shifts between WGS 84 and chart datums. These would be incorporated in future new editions or new charts and promulgated by Preliminary Notices to Mariners in the interim.

It is unrealistic to expect that a series of reported WGS 84 positions relating to a given chart will enable it to be referenced to that datum with the accuracy required for geodetic purposes. However, this must be balanced against the 100 metre degradation currently applied to GPS, which nevertheless provides adequate accuracy for general navigation. It is also necessary to consider the practical limits to the precision of 0.2mm (probably the best possible under ideal conditions – vessel alongside, good light, sharp dividers etc), this represents 10 metres on the ground at a chart scale of 1:50,000. Similarly, the 100 metre effect of S/A is not plottable at scales of 1:500,000 or smaller.

It is clear that users prefer to have **some** indication of the magnitude and direction of the positional shift, together with an assessment of its likely accuracy, rather than be informed that a definitive answer cannot be formulated. Consequently, some charts now carry approximate shifts relating WGS 84 Datum to chart datum. Further observations may enable these values to be refined with greater confidence.

4. **GPS Observations**

Users are requested to record their GPS observations on the data form overleaf. Some brief guidance notes are provided beneath the table.

Please return completed forms to: HDC – Geodesy, Hydrographic Office, Ministry of Defence (Navy), TAUNTON TA1 2DN, Somerset, United Kingdom.

RECORD OF TIDAL OBSERVATIONS

Title of Survey:

HI No:

Place:

Latitude

°

'

"

Zone Time:

Longitude

°

'

"

Inclusive dates:

to

Position of tidegauge or pole:

Connection between sounding datum, benchmarks and zero of pole or gauge:

Chart datum on pole

metres

TIDE READINGS (ABOVE ZERO OF GAUGE)

Month:

Day:															
0000															
30															
0100															
30															
0200															
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0300															
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HIGH WATER

Time															
Height															

Time															
Height															

LOW WATER

Time															
Height															

Time															
Height															

Sounding Datum below zero of gauge = metres

[illegible]

DESCRIPTION OF GEODETIC CONTROL STATION

Name of Station

Letter / No.

General Locality

HM Surveying Ship

Date

This Station is

(For Help with any field press F1 when the cursor is located in the relevant field)

1. CO-ORDINATES

FIELD VALUES

Horizontal Datum
Spheroid
Projection
Grid
Grid Zone

Latitude	°	'	" N	Easting	m	Estimated Position
Longitude	°	'	" E	Northing	m	accuracy m s95%

Vertical Datum (For orthometric height)
Geoid Model used

Station Height	Ellipsoidal	m	Observed
	Orthometric	m	Observed

Field Remarks

RE-ADJUSTED VALUES (For completion by UKHO)

Horizontal Datum
Spheroid
Projection
Grid
Grid Zone

Latitude	°	'	"	Easting	m	Estimated Position
Longitude	°	'	"	Northing	m	accuracy m s95%

Vertical Datum (For orthometric height)
Geoid Model used

Station Height	Ellipsoidal	m	Observed
	Orthometric	m	Observed

UKHO Remarks

2. LOCATION DESCRIPTION

(Import scanned images diagrams drawings etc. into section below)

3. DETAILED DESCRIPTION OF STATION

STATION MARK

WRITTEN DESCRIPTION

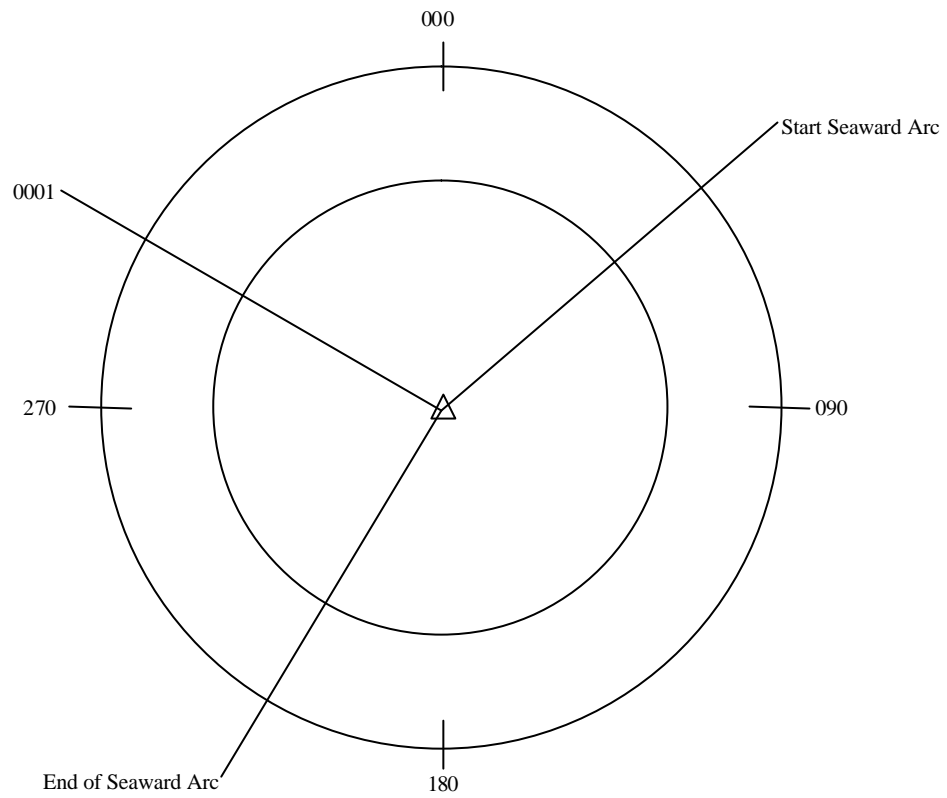
IMMEDIATE LOCALITY OF STATION MARK –

(Import scanned images diagrams drawings etc. into section below)

4. OTHER VISIBLE STATIONS – List of other stations visible from this station. All listed stations to be included in the visibility diagram, see Section 5.

Letter/Number	Name	Approx distance	Bearing
		m	°
		m	°
		m	°
		m	°
		m	°

5. VISIBILITY DIAGRAM – Indicate orientation of stations listed in section 4 along with open arcs to seaward (Drawing below is given as an example, delete and import your own drawing / picture).



6. SUITABILITY FOR POSITION FIXING SYSTEMS

7. APPROVAL

Station established by	Date
Station described by	Date
H159 Checked and approved by	Date

EXTRACT FROM TIDAL STREAM AND CURRENT LOG

H183A (1 Feb 2003)

[illegible]

CO-TIDAL COMPARISON

H185

Survey:

HI No:

JD:

[illegible]

COMPLEX CO-TIDAL FORM (4 or 6 Factors)

Survey:

HI No:

Consec No.:

[illegible]

SAPS CABLE OUT TOTE

Ship:

Survey:

HI:

Sheet:

Date:

JD:

[illegible]

SAPS PROCESSING LOG SHEET

Serial No:

Ship:

Survey:

HI:

Sheet:

Date data gathered:

JD:

Date(s) of processing

JAZ Disc No:

[illegible]

DEFINITION OF GRAVITY STATION

(Click on the yellow boxes to enter data - TAB between boxes)

Name of Ship

Date

STATION DETAILS

Country
Port / Town
Station Name

Latitude
Longitude
Elevation

Station Location Diagram

Station Description

VERTICAL GRAVITY GRADIENT

(Click on the yellow boxes to enter data - TAB between boxes)

The vertical gravity gradient should be measured alongside the ship in each port visited in which the Bell gravimeters carried are tied to the IGSN71 gravity datum. A section on this subject can be found in the latest version of NP684 "Gravity Surveying". The measurements should ideally be obtained using two LaCoste & Romberg land gravimeters .

Difference in height between the two sets of readings metres

METER #1

Serial number for meter #1

Location of Measurement	GMT	Accepted Meter Reading
Top/Bottom	<input type="text"/>	<input type="text"/>
Bottom/Top	<input type="text"/>	<input type="text"/>
Top/Bottom	<input type="text"/>	<input type="text"/>

METER #2

Serial number for meter #2

Location of Measurement	GMT	Accepted Meter Reading
Top/Bottom	<input type="text"/>	<input type="text"/>
Bottom/Top	<input type="text"/>	<input type="text"/>
Top/Bottom	<input type="text"/>	<input type="text"/>

PRESS F9 TO PERFORM CALCULATIONS

The calculations below assume that the above meter readings are pseudo - gravity values and are therefore slightly inaccurate. However the height differences are so small that this assumption only leads to errors in the third decimal place and are therefore within the accuracy range associated with gravity transfers performed using L&R land meters.

Vertical gravity gradient obtained from Meter #1 *[computed]*

Vertical gravity gradient obtained from Meter #2 *[computed]*

mGal/metre
 mGal/metre

AVERAGE VERTICAL GRAVITY GRADIENT *[computed]*

ASSOCIATED STANDARD DIFFERENCE *[computed]*

mGal/metre
 mGal/metre

Completed by

Checked by

CALCULATION OF GRAVITY VALUE

(Click on yellow boxes to enter data - TAB between boxes)

Observer Date Meter Identifier

Station Name or Number	Time		Land Meter Reading	Meter Temp. (°C)	Accepted Time GMT	Accepted Meter Reading	Comments
	Local	GMT					
A1 (alongside ship)							
B1 (known station)							
C (known station)							
B2 (known station)							
A2 (alongside ship)							

Value of gravity at station B mGal
 Value of gravity at station C mGal

B1 as secondary mGal
 B2 as secondary mGal
 C as secondary mGal

PRESS F9 TO PERFORM CALCULATIONS

Difference in gravity between stations A and B *[computed]* mGal
 Difference in gravity between stations A and C *[computed]* mGal
 Difference in gravity between stations B and C *[computed]* mGal

Value of gravity for station A using station B as reference *[computed]* mGal
 Value of gravity for station A using station C as reference *[computed]* mGal

AVERAGE GRAVITY VALUE AT STATION A *[computed]* mGal
 ACCURACY ASSOCIATED WITH THIS VALUE *[computed]* mGal

Completed by Checked by

BELL GRAVIMETER DRIFT CALCULATION

(Click on yellow boxes to enter data ~ TAB between boxes)

Name of Ship

Meter N^o

HI N^o

DEPARTURE PORT

Name of port of departure	<input type="text"/>	
Mid time of the tie in (time of zero Earth tide)	Julian Day <input type="text"/>	GMT <input type="text"/>
Name (or number) of station alongside ship	<input type="text"/>	
Value of gravity at this station	<input type="text"/>	mGal
Height correction from station to mean water level	<input type="text"/>	metres
Measured vertical gravity gradient (default 0.3086)	<input type="text"/>	mGal/metre
Bell gravimeter uncorrected gravity	<input type="text"/>	mGal
Equivalent gravity correction <i>[computed]</i>	0.00	mGal
Gravity at sea level <i>[computed]</i>	0.00	mGal

ARRIVAL PORT

Name of port of arrival	<input type="text"/>	
Mid time of the tie in (time of zero Earth tide)	Julian Day <input type="text"/>	GMT <input type="text"/>
Name (or number) of station alongside ship	<input type="text"/>	
Value of gravity at this station	<input type="text"/>	mGal
Height correction from station to mean water level	<input type="text"/>	metres
Measured vertical gravity gradient (default 0.3086)	<input type="text"/>	mGal/metre
Bell gravimeter uncorrected gravity	<input type="text"/>	mGal
Equivalent gravity correction <i>[computed]</i>	0.00	mGal
Gravity at sea level <i>[computed]</i>	0.00	mGal

PRESS F9 TO PERFORM CALCULATIONS

DRIFT CALCULATION

Actual change in gravity <i>[computed]</i>	0.00	mGal
Observed change in gravity <i>[computed]</i>	0.00	mGal
Period between tie ins <i>[computed]</i>	0.0000	days

RESIDUAL DRIFT RATE *[computed]* #DIV/0! mGal/day

Completed by

Checked by

SIPS LINE DATA LOG SHEET

A new sheet is to be used for each DATA file

[illegible]

SIPS BRIDGE EVENT LOG

[illegible]

Checked By:

Revised 02/2002

SIPS CHART DATA PROCESSING LOG SHEET

A new sheet is to be used for each BATCH file

Ship:		Survey:				HI:		Sheet:		Serial No:			
Date data gathered:		JD:		Date(s) of processing				BATCH File:					
Source QDL File: _ _		Processed Files Archived:		QPF CD/Tape No:		Backup CD/Tape No:							

QPF	SOL (Z)	EOL (Z)	Raw Track	Track Edited	Fair Track Plotted	Filtering				Selection	Infill		Compare with E/S Trace	Apply Tide	Add to DEM	Remark No
						Min Depth	½ Gate Width	FTC	Valid Returns	Window Size	Annotation Size	White Space Factor				

Remarks:

Track: Parts to Edit Identified Fair Track Approved for use	Sounding Selection: Selection Satisfactory Compared with Echo Trace	Tide File Name: Curve Checked for Spurious Data Approved to Apply Tides	Approved to add to DEM DEM_ and Archive to Tape/Disc
--	--	--	---

A new sheet is to be used for each DEM created

DEM File Name: DEM_

SIPS DEM LOG

Ship:

Survey:

HI:

Sheet:

DEM Created by:

Date:

Origin:

N/S

E/W

Area Height:

Band Width:

Area Width:

Minimum Depth:

Azimuth:

Maximum Depth:

Checked By:

BATCH, QPF and DEM files added to DEM

File	Initials/Date	File	Initials/Date	File	Initials/Date

Approved to Weed:

Weeded by:

Date:

Hydrographic Format Multipass Mode

Scale:

Character Size:

Azimuth of Annotation:

Weeding checked by:

Edited by:

Date:

Remarks:

Editing checked by:

Approved to Archive and for Bathymetric Sheet:

Grid File Created by:

Date:

File Name: GRD_

Grid Origin:

N/S

Area Height:

Square Size:

E/W

Area Width:

Search Distance:

Grid File checked by:

DEM and GRD Files archived by:

DEM Tape No:

Backup Tape No:

Optical Disc No:

A new sheet is to be used for each fair graphic created

Graphic:

SIPS DRAWN FAIR GRAPHIC LOG

Ship:

Survey:

HI:

Sheet:

FAIRSHEET File created by:

Date:

Scale:

SW Corner

Latitude Tick Interval:

Azimuth:

NE Corner

Longitude Tick Interval:

X & Y Offsets

Border Style:

Grid Tick Interval:

Plot Rotation

Panels Required

Checked by:

MEMOIR File created by:

Date:

Checked by:

DEM Files used:

Approval on H443 confirmed:

Database Files used

Approval confirmed:

Manual QPFs used:

Manual Data added

Drawn by:

Checked by:

Border Checked against Master by:

Sheet ready for approval:

Approved

Files archived by:

DEM Tape No:

Backup Tape No:

Optical Disc No:

SYSTEM

Fairsheet

Memoir

Databases

Manual QPFs

Local Magnetic Field at Site

This should be completed to develop the connection between the F and D/I site. It only needs to be conducted once and the gradient should not exceed 5nT/metre.

Points to note when taking readings:-

Observers should remove any magnetic items from their clothing (at least 5m away)

The line on the bottle should point to magnetic north

Consistent readings. Consecutive readings should not change by more than 2nT

On Elsec 820 the signal strength value should be between 7 and 9 (1-6 is bad)

All readings should be taken with the bottle on the top of 4 sections of pole.

Observer				Date	
Recorder				Location	
Ref Object				Time Zone	
RO Lat					
RO Long					

[illegible]

Height of Magnetometer above F site:	
Height of Magnetometer above D/I site:	
Distance between F and D/I sites:	

Magnetic Gradient	
-------------------	--

Field at D/I site minus Field at F Site

Observer				Date	
Recorder				Location	
Ref Object				Time Zone	
RO Lat					
RO Long					

True North Determination														
Face Right			Face Left			Mean			RO True Azimuth			True North Circle Reading		
°	'	"	°	'	"	°	'	"	°	'	"	°	'	"

Declination [Telescope should be level, i.e. 090°, 270° on vertical circle]												
Pos	Time (Z)	Hz Circle Reading (Blue)				Mean				Mean Hz Circle		
			°	'		"		°		'	"	
ED												
WD										True N Circle Reading		
EU												
WU										Declination		
Reciprocal Mean Horizontal Circle Reading												

Inclination [Horizontal Circle reading should be set to mean value from above] (Southern Hemisphere Case)								
Pos	Time (Z)	Vertical Circle Reading (Yellow)				Mean Hz Circle		
		°	'	"		°	'	"
SU					Θ			
ND					Θ - 180°			
SD					360° - Θ			
NU					180° -Θ			
Mean								

Total Field	Time (Z)	F (Remote)	Correction	F (corrected)	
F SU					
F ND					
F SD					
F NU					
Mean Corrected Total Field					nT

H Component nT

$$H = F \cos I$$

Z Component nT

$$Z = F \sin I$$

Note: In the southern hemisphere Inclination (I) and the Vertical Component (Z) are defined as negative.

SUMMARY OF CHECKS ON AUTOMATIC TIDE GAUGE

Consec No:

Place:

HI No:

Title

Pole Sounding Datum Correction:**Gauge Sounding Datum Correction:**

Instructions: Observe details required on the form below. Reduce the pole and gauge readings to Sounding Datum by applying the appropriate corrections. Determine the difference between the reduced pole and gauge readings and record in the column provided. If the difference between the reduced pole and gauge readings is greater than $\pm 0.2\text{m}$, report the findings to the Tidal Officer, or in his absence the XO or CO.

[illegible]

REPORT OF WRECK INVESTIGATION

Wreck No:

Ship/Unit

HI No:

Survey:

Date located:

Date Examined/Swept:

Listed Position: $dd^\circ mm' . mm''$ 'N/S $ddd^\circ mm' . mm''$ 'E/WFixed Position: $dd^\circ mm' . mm''$ 'N/S $ddd^\circ mm' . mm''$ 'E/WMethod of Positioning: Accuracy (2,448 σ): metres

Horizontal Datum:

Depth Data:	Swept Clear:	metres
(LAT)	Swept Foul:	metres
	Least E/S Depth:	metres
	General Depth:	metres
	Scour Depth:	metres

Tidal observations at:
 Cotidal adjustments by:

Contact Data:	Sonar Height:	metres
	Sonar Length:	metres
	Sonar Width:	metres
	Orientation:	ddd° / ddd° (Bows: ddd°)

Sonar Signal Strength:	Nil	Poor	Moderate	Strong	Unknown
------------------------	-----	------	----------	--------	---------

Magnetic Anomaly:	Nil	Poor	Moderate	Strong	Unknown
-------------------	-----	------	----------	--------	---------

Scour Length:	metres	Direction (towards):	$^\circ$
---------------	--------	----------------------	----------

Bottom Texture:

Debris Field:	Length:	metres	Direction (towards):	$^\circ$
---------------	---------	--------	----------------------	----------

Buoyage:

Description (include attitude and whether intact):

Approved:

In Charge of Surveys

Date:

Sweep Diagram, E/S trace (reduced for tide), sidescan traces, magnetometer trace, investigation and close sounding plots to be included. (See HQAI GSI D.5.7)

PARTICULARS OF HM SURVEYING SHIP (See HQAIs Annex C0105)				
Remarks :				Date :
Signed				Hydrographic Office, Taunton
I. GENERAL, DIMENSIONS, CAPACITIES & MEASUREMENTS				
Builders :				
Launched by :		Date :		
Completed by :		Date :		
First commissioned at :		Date :		
Length overall		Draught	For'd	Aft
“ B. P.		normal		
" Stem to Standard		Deep		
Beam		Dome down		
Speed (full)		Endurance		
“ (economical)		“		
Engines				
Horsepower				
Fuel consumption (economical speed)				
“ “ (full speed)				
Water capacity				
Distilling machinery		Max output		
Refrigeration machinery				
Details of max. stowage (capacity & days)				
Heights above W. L. at normal draft :				
U. D. at stem		Bridge (deck)		
“ abreast bridge		“ (rail)		
“ stern				
Radar aerial				
Fore truck				
Hi-Fix mast				
Tonnage (gross)				
“ (Register)				
“ (displacement)				

II. BOATS			
Surveying Motor Boats) :			
Length	(a)	(b)	
Number	(a)	(b)	
Engine	(a)	(b)	
Power supply	(a)	(b)	
E/S type	(a)	(b)	
Remarks	(a)	(b)	
Inflatable & Recreational Craft			

III. SOUNDING EQUIPMENT & SONAR
Echo-sounding (supply voltage to be stated in each case)
Ship
Boats
Portable
Sonar equipment
Ship
Boats
Portable

IV. RADAR, W/T & EQUIPMENT, POSITION FIXING SYSTEMS
Radar equipment (including Precision Ranging attachments)
W/T equipment
Ship
Portable
V/S arrangements
Position Fixing Systems

V. OCEANOGRAPHIC & METEOROLOGICAL EQUIPMENT	
Oceanographic equipment	
Winches	Wire (size & length
Bathythermograph equipment	
Thermograph	
Other fitted equipment	
Meteorological equipment	

[illegible]

VII. OTHER EQUIPMENT
Taut Wire equipment
Ship
Boats
Sweeping equipment
Ship
Boats
Compasses & repeaters
Log
Reproduction & Printing equipment
Anchors & cables
Transport
Aircraft (with brief details of range & lifting capacity or vertrep capabilities)

VII. (Contd.)
Other special equipment fitted

VIII. ELECTRICAL POWER SUPPLIES					
Supply	Source	AC/DC	Freq	Max. Capacity (kw)	Remarks

IX. MISCELLANEOUS		
Complement		
	Total berths available	Berths occupied as at date of form
Officers		
System specialists		
WO's		
CPO's		
PO's		
Junior rates		

LEVELLING REDUCTION FORM

H532 (1.0 Aug 02)

H.I.	HM S/NP				Date.					Observer		
Locality:					Time.	Map No.				Recorder		
BM'S:					Weather					Inst. No.		
									Staff No.			
Staff Station	Distance		Back Reading	Delta Height	Inter Reading	Forward Reading	Delta Height	Rise	Fall	Reduced Level	Remarks	
	0.0	T		0.000						100.000		
	0.0	M										
	0.0	B		0.000								
	0.0	T		0.000			0.000			0.000		
	0.0	M						0.000	0.000	0.000		
	0.0	B		0.000			0.000					
	0.0	T		0.000			0.000			0.000		
	0.0	M						0.000	0.000	0.000		
	0.0	B		0.000			0.000					
	0.0	T		0.000			0.000			0.000		
	0.0	M						0.000	0.000	0.000		
	0.0	B		0.000			0.000					
	0.0	T		0.000			0.000			0.000		
	0.0	M						0.000	0.000	0.000		
	0.0	B		0.000			0.000					
	0.0	T		0.000			0.000			0.000		
	0.0	M						0.000	0.000	0.000		
	0.0	B		0.000			0.000					
	0.0	T		0.000			0.000			0.000		
	0.0	M						0.000	0.000	0.000		
	0.0	B		0.000			0.000					
	0.0	T		0.000			0.000			0.000		
	0.0	M						0.000	0.000	0.000		
	0.0	B		0.000			0.000					
Check Totals	0.0		0			0.000		0	0		Traverse length (K) 0 km	
Reduced Checked					Delta Height	0.000				0.000	Allow. M' close 0.00 mm	
											Actual M'close 0 mm	

TRANSFER OF SOUNDING DATUM

(where tide is 'mainly semi-diurnal')

Date and time of 1st LW observation.

At Established Station:					
Heights above Chart Datum			Contributions for		
	H.W.	L.W.	Factor	H.W.s	L.W.s
a	-		1	-	0.000
b		-	1	0.000	-
c	-		3	-	0.000
d		-	2	0.000	-
e	-		3	-	0.000
f		-	1	0.000	-
g	-		1	-	0.000
Sums of contribution				0.000	0.000
Observed MHW and MLW				0.000	0.000

At New Station:					
Heights above zero of pole			Contributions for		
	H.W.	L.W.	Factor	H.W.s	L.W.s
	-		1.000	-	0.000
		-	1.000	0.000	-
	-		3.000	-	0.000
		-	2.000	0.000	-
	-		3.000	-	0.000
		-	1.000	0.000	-
	-		1.000	-	0.000
				0.000	0.000
				0.000	0.000

(Observed MHW = sum of HW contributions / 4)

(Observed MHW = sum of HW contributions / 8)

Observed Mean Range (R)

=

0.000

(r)

=

0.000

Observed Mean Level (M')

=

0.000

(m')

=

0.000

(Obs. Mean range = Obs MHW-Obs MLW)

(Obs Mean Level = 1/2(Obs MHW+Obs MLW))

CALCULATION OF SOUNDING DATUM (d) AT NEW GAUGE

(A) Where 'True Spring ML' at established station is known

From Tide Tables (ATT)

MHWS

m

MLWS

m

Half sum

0.00

m=M
(True Spring M.L.)

(B) Where 'True Spring ML' at established station is not known

$$d = m' - (M' - M) - M(r/R)$$

$$d = \#DIV/0! \quad \text{metres above zero of pole}$$

$$d = m' - (M'r/R)$$

$$d = \#DIV/0! \quad \text{metres above zero of pole}$$

TRANSFER OF SOUNDING DATUM

(where tide is 'mainly semi-diurnal')

For instructions on the use of this form, see N.P. 122(2) Admiralty tidal Handbook No. 2. 'Datum's for Hydrographic Surveys.'

General locality

Positions of established station

Position of new station

Place

Place

Lat

Lat

Long

Long

CONNECTION BETWEEN FIXED MARKS AND CHART DATUM AT NEW STATION

CONNECTION BETWEEN FIXED MARKS AND SOUNDING DATUM AT ESTABLISHED STATION

Remarks

HMS/NP

Date

Commanding Officer

Sheet No:

Revised 02/2002

Julian Day Calendar – Leap Year Edition

JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
1	001	1	032	1	061	1	092	1	122	1	153	1	183	1	214	1	245	1	275	1	306	1	336
2	002	2	033	2	062	2	093	2	123	2	154	2	184	2	215	2	246	2	276	2	307	2	337
3	003	3	034	3	063	3	094	3	124	3	155	3	185	3	216	3	247	3	277	3	308	3	338
4	004	4	035	4	064	4	095	4	125	4	156	4	186	4	217	4	248	4	278	4	309	4	339
5	005	5	036	5	065	5	096	5	126	5	157	5	187	5	218	5	249	5	279	5	310	5	340
6	006	6	037	6	066	6	097	6	127	6	158	6	188	6	219	6	250	6	280	6	311	6	341
7	007	7	038	7	067	7	098	7	128	7	159	7	189	7	220	7	251	7	281	7	312	7	342
8	008	8	039	8	068	8	099	8	129	8	160	8	190	8	221	8	252	8	282	8	313	8	343
9	009	9	040	9	069	9	100	9	130	9	161	9	191	9	222	9	253	9	283	9	314	9	344
10	010	10	041	10	070	10	101	10	131	10	162	10	192	10	223	10	254	10	284	10	315	10	345
11	011	11	042	11	071	11	102	11	132	11	163	11	193	11	224	11	255	11	285	11	316	11	346
12	012	12	043	12	072	12	103	12	133	12	164	12	194	12	225	12	256	12	286	12	317	12	347
13	013	13	044	13	073	13	104	13	134	13	165	13	195	13	226	13	257	13	287	13	318	13	348
14	014	14	045	14	074	14	105	14	135	14	166	14	196	14	227	14	258	14	288	14	319	14	349
15	015	15	046	15	075	15	106	15	136	15	167	15	197	15	228	15	259	15	289	15	320	15	350
16	016	16	047	16	076	16	107	16	137	16	168	16	198	16	229	16	260	16	290	16	321	16	351
17	017	17	048	17	077	17	108	17	138	17	169	17	199	17	230	17	261	17	291	17	322	17	352
18	018	18	049	18	078	18	109	18	139	18	170	18	200	18	231	18	262	18	292	18	323	18	353
19	019	19	050	19	079	19	110	19	140	19	171	19	201	19	232	19	263	19	293	19	324	19	354
20	020	20	051	20	080	20	111	20	141	20	172	20	202	20	233	20	264	20	294	20	325	20	355
21	021	21	052	21	081	21	112	21	142	21	173	21	203	21	234	21	265	21	295	21	326	21	356
22	022	22	053	22	082	22	113	22	143	22	174	22	204	22	235	22	266	22	296	22	327	22	357
23	023	23	054	23	083	23	114	23	144	23	175	23	205	23	236	23	267	23	297	23	328	23	358
24	024	24	055	24	084	24	115	24	145	24	176	24	206	24	237	24	268	24	298	24	329	24	359
25	025	25	056	25	085	25	116	25	146	25	177	25	207	25	238	25	269	25	299	25	330	25	360
26	026	26	057	26	086	26	117	26	147	26	178	26	208	26	239	26	270	26	300	26	331	26	361
27	027	27	058	27	087	27	118	27	148	27	179	27	209	27	240	27	271	27	301	27	332	27	362
28	028	28	059	28	088	28	119	28	149	28	180	28	210	28	241	28	272	28	302	28	333	28	363
29	029	29	060	29	089	29	120	29	150	29	181	29	211	29	242	29	273	29	303	29	334	29	364
30	030			30	090	30	121	30	151	30	182	30	212	30	243	30	274	30	304	30	335	30	365
31	031			31	091			31	152			31	213	31	244			31	305			31	366

Julian Day Calendar

JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
1	001	1	032	1	060	1	091	1	121	1	152	1	182	1	213	1	244	1	274	1	305	1	335
2	002	2	033	2	061	2	092	2	122	2	153	2	183	2	214	2	245	2	275	2	306	2	336
3	003	3	034	3	062	3	093	3	123	3	154	3	184	3	215	3	246	3	276	3	307	3	337
4	004	4	035	4	063	4	094	4	124	4	155	4	185	4	216	4	247	4	277	4	308	4	338
5	005	5	036	5	064	5	095	5	125	5	156	5	186	5	217	5	248	5	278	5	309	5	339
6	006	6	037	6	065	6	096	6	126	6	157	6	187	6	218	6	249	6	279	6	310	6	340
7	007	7	038	7	066	7	097	7	127	7	158	7	188	7	219	7	250	7	280	7	311	7	341
8	008	8	039	8	067	8	098	8	128	8	159	8	189	8	220	8	251	8	281	8	312	8	342
9	009	9	040	9	068	9	099	9	129	9	160	9	190	9	221	9	252	9	282	9	313	9	343
10	010	10	041	10	069	10	100	10	130	10	161	10	191	10	222	10	253	10	283	10	314	10	344
11	011	11	042	11	070	11	101	11	131	11	162	11	192	11	223	11	254	11	284	11	315	11	345
12	012	12	043	12	071	12	102	12	132	12	163	12	193	12	224	12	255	12	285	12	316	12	346
13	013	13	044	13	072	13	103	13	133	13	164	13	194	13	225	13	256	13	286	13	317	13	347
14	014	14	045	14	073	14	104	14	134	14	165	14	195	14	226	14	257	14	287	14	318	14	348
15	015	15	046	15	074	15	105	15	135	15	166	15	196	15	227	15	258	15	288	15	319	15	349
16	016	16	047	16	075	16	106	16	136	16	167	16	197	16	228	16	259	16	289	16	320	16	350
17	017	17	048	17	076	17	107	17	137	17	168	17	198	17	229	17	260	17	290	17	321	17	351
18	018	18	049	18	077	18	108	18	138	18	169	18	199	18	230	18	261	18	291	18	322	18	352
19	019	19	050	19	078	19	109	19	139	19	170	19	200	19	231	19	262	19	292	19	323	19	353
20	020	20	051	20	079	20	110	20	140	20	171	20	201	20	232	20	263	20	293	20	324	20	354
21	021	21	052	21	080	21	111	21	141	21	172	21	202	21	233	21	264	21	294	21	325	21	355
22	022	22	053	22	081	22	112	22	142	22	173	22	203	22	234	22	265	22	295	22	326	22	356
23	023	23	054	23	082	23	113	23	143	23	174	23	204	23	235	23	266	23	296	23	327	23	357
24	024	24	055	24	083	24	114	24	144	24	175	24	205	24	236	24	267	24	297	24	328	24	358
25	025	25	056	25	084	25	115	25	145	25	176	25	206	25	237	25	268	25	298	25	329	25	359
26	026	26	057	26	085	26	116	26	146	26	177	26	207	26	238	26	269	26	299	26	330	26	360
27	027	27	058	27	086	27	117	27	147	27	178	27	208	27	239	27	270	27	300	27	331	27	361
28	028	28	059	28	087	28	118	28	148	28	179	28	209	28	240	28	271	28	301	28	332	28	362
29	029			29	088	29	119	29	149	29	180	29	210	29	241	29	272	29	302	29	333	29	363
30	030			30	089	30	120	30	150	30	181	30	211	30	242	30	273	30	303	30	334	30	364
31	031			31	090			31	151			31	212	31	243			31	304			31	365

In a Leap Year use H579 or add 1 to each number from March 1st onwards.

SECCHI DISC OBSERVATIONS REPORTING FORM

H631 (Issue 1.0 1 Feb 2003)

SHIP		CRUISE/ SHIP' S REF	
------	--	---------------------	--

DATE dd.mm.yy	TIME (Z)	LAT dd mm . t	LONG ddd mm . t	COLOUR	DEPTH 1- DISC NO LONGER VISIBLE	DEPTH 2 – DISC REAPPEARS	AVERAGE DEPTH	CLOUD COVER (oktas)	SUN ALTITUDE (APPROX)	SEA STATE

Colour : Deep blue, blue, greenish blue, bluish green, green, yellowish green, dirty green, brownish green, brown.

Depth : Average Depth must always be completed. Columns Depth 1 and Depth 2 may be used, if required, to record data prior to deriving Average Depth.

Sea State: 0 – 9

For further information see **BR4023(4)** paragraph 1206

Completed forms and enquiries should be addressed to: Maritime Environment Information Centre, United Kingdom Hydrographic Office, Admiralty Way, TAUNTON, TA1 2DN
 Tel: (01823) 337900 extension 4217 Fax: (CCITT group 3) (01823) 284077
 e-mail: Ben.Maughan@ukho.gov.uk

MARINE BIOLUMINESCENCE OBSERVATIONS REPORTING FORM

Unit:

HI No. / Cruise Reference:

[illegible]

Colour of Bioluminescence:

White, blue, green, yellow, cream, orange, red, etc.

Description of Bioluminescence:

Glowing sheet, Sparks (steady light), Sparkle (glittering), Small Globes, Expanding/Upwelling Blobs, Bands, Wheels, 'Milky sea' etc.

Extent:

Approximate area covered by bioluminescence.

Means of Stimulation:

Mechanical - either Ship's passage, or Sea Swell. Light (e.g. Aldis lamp), Active Sonar or E/S, Shaft rpm. If no stimulus apparent, insert ' ? '

Wind Direction and Speed:

Use Compass point e.g. W, SW, WSW with speed in knots.

Sea State:

Enter sea state from 0 – 9.

Certified free of transcription errors:

Name:

Rank/Rate:

Signature:

MARINE LIFE REPORTING FORM

For the recording of sightings of marine mammals, sharks and other large fish, fish schools, turtles, jellyfish, sea snakes and fishing activity.

Unit:

HI No. / Cruise Reference:

DATE dd.mm.yy	TIME (z)	PERIOD OF DAY	POSITION		NUMBER OBSERVED	IDENTIFICATION	HDNG (°)	SPEED (kts)	SIZE (m)	BEHAVIOUR / REMARKS
			LAT dd.mm.m	LONG ddd.mm.m						
									-	

Hdng: Direction of travel for the sighted object(s). Use Compass point e.g. E, NE, ENE etc
Speed: Approximate speed of sighted object(s) in knots
Size: Approximate size of sighted object(s) in metres
Behaviour/Remarks: For cetaceans – general description of activities, including any bow riding, play, porpoising, acoustic activity, tail/fluke slapping, breaching, resting. For fishing boats, describe type of fishing activity observed (if any) e.g. passage, trawling etc.

Certified free of transcription errors:

Name:

Rank/Rate:

Signature:

DEEP SCATTERING LAYER OBSERVATIONS REPORTING FORM

SHIP		HI / CRUISE REF	
------	--	-----------------	--

TYPE OF SONAR:						E/S TRACE REF:							
DATE	START TIME	PERIOD OF DAY	START LAT	START LONG	DEPTH OF TOP OF LAYER	LAYER THICKNESS	EXTENT OF MOTION UP OR DOWN	SEA STATE	END TIME	END LAT	END LONG	SONAR FREQ	GAIN SETTING
dd.mm.yy	(Z)		dd mm . t	ddd mm . t	(m)	(m)	(m)	(0 - 9)	(Z)	dd mm . t	ddd mm . t		
REMARKS:													

TYPE OF SONAR:						E/S TRACE REF:							
DATE	START TIME	PERIOD OF DAY	START LAT	START LONG	DEPTH OF TOP OF LAYER	LAYER THICKNESS	EXTENT OF MOTION UP OR DOWN	SEA STATE	END TIME	END LAT	END LONG	SONAR FREQ	GAIN SETTING
dd.mm.yy	(Z)		dd mm . t	ddd mm . t	(m)	(m)	(m)	(0 - 9)	(Z)	dd mm . t	ddd mm . t		
REMARKS:													

Completed forms and enquires should be addressed to: Maritime Environment Information Centre, United Kingdom Hydrographic Office, Admiralty Way, TAUNTON, TA1 2DN
 Tel: (01823) 337900 extension 4217 Fax: (CCITT group 3) (01823) 284077
 e-mail: Ben.Maughan@ukho.gov.uk

HOURLY WEATHER LOG

HI No.			Leg No.					JD		Date				Sheet No.			
GMT	REL WIND		SEA STATE	REL SWELL		REL WAVE		PITCH +/-	ROLL +/-	HEAVE CM	ROLL MAX	COURSE	SPEED	PRESSURE	REMARKS	TRUE WIND	
	DIR	SPEED		DIR	L/H	DIR	HEIGHT									DIR	SPEED
0001																	
0100																	
0200																	
0300																	
0400																	
0500																	
0600																	
0700																	
0800																	
0900																	
1000																	
1100																	
1200																	
1300																	
1400																	
1500																	
1600																	
1700																	
1800																	
1900																	
2000																	
2100																	
2200																	
2300																	

Title of Survey:

Type	Line No.	JD	Fix Times	JAZ Disc No.

Revised 02/2002

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

ANNEX B

SURVEY INSTRUMENTS AND EQUIPMENT

Contents

B0101	Surveying Instruments – General
B0102	Responsibility for Instruments
B0103	The Inventory Account
B0104	Permanent Instruments
B0105	Consumable Instruments
B0106	Supply of Instruments
B0107	Transfer of Instruments
B0108	Return of Instruments
B0109	Musters of Instruments
B0110	Care of Instruments
B0111	Packing & Transmission
B0112	Losses of and Damage to Instruments
B0113	Repair of Instruments
B0114	Personal Computers and Pocket Calculators
B0115	Computer Software Copyright
B0116	Oceanographic & Meteorological Equipment
B0117	Positioning Equipment
B0118	Geophysical & Oceanographic Systems - Accounting

B0101 Surveying Instruments - General

1. Surveying Instruments are supplied by DNSOM exclusively for use in surveying activities; they are never to be used for any other purpose without the authority of the Charge Surveyor.
2. New instruments are no longer issued with local serial numbers, but if manufacturers serial numbers are displayed, these are recorded in the ledger. Where possible, surveying instruments are marked in some way to indicate their government ownership; most of the older instruments are marked 'H↑O' or 'Property of SESU, Taunton'. If security considerations suggest that it would be preferable to use unmarked instruments, the matter should be raised formally. Ships and units are not to attempt to remove markings or serial numbers.
3. The Equipment Store is located in the ground floor of Shackleton building in Devonport. The point of contact for survey ships is DNSOM/EM2.
4. Instrument Officers are to make regular checks on instrument holdings and only retain those items for which a need might be foreseen. Equipment surplus to requirement should be returned to the Equipment Store.

B0102 Responsibility for Instruments

1. Surveying instruments, while remaining the general responsibility of Commanding Officers, are to be directly in the charge of a surveying officer, chief petty officer or petty officer survey recorder, who is to be nominated for that task by the Commanding Officer; he will be known as the Officer-in-Charge of Instruments. In cases where only one surveying officer is borne in a ship or unit, he is to assume this direct charge.
2. The Officer-in-Charge of Instruments is to maintain a regular review of the condition, serviceability and accuracy of all instruments in his charge, and is not to hesitate to withdraw from service, and return to the Equipment Store, for repair or re-calibration, any item whose precision is in doubt.
3. When the charge passes from one officer to another, the latter is to carry out a full muster in accordance with BR 96 Part III art 0422. He is to sign a certificate at the front of the Inventory Account (Art B0103) as soon as he is satisfied that it is correct. On the Record Sheet (S1099a) this type of muster is 'A'; the column headed 'Signature of Supply Officer' should be left blank and the column headed 'Muster' should be signed by the new custodian.
4. Surveying officers and ratings sent in charge of boats or detached camp parties are responsible for the security, cleanliness and accuracy of all instruments in their charge.
5. Officers-in-Charge of Instruments may correspond directly with DNSOM/EM2, Equipment Store, on minor routine matters affecting the administration of instruments and the account. Such matters as special demands, losses, damage, comparison musters, etc, are to be communicated through Commanding Officers.
6. Officers-in-Charge of Instruments are to ensure the correct completion of Supply, Transfer, Return Note as required by Arts B0106-8 and B0112; in particular, a logical sequence of serial numbers is to be employed.

B0103 The Inventory Account

1. All Permanent instruments are to be accounted for in an Inventory Account.
2. A separate page (Form S1099h) is to be raised for each item; these pages, together with a record of musters and comparisons (Form S1099a) are to be enclosed in a binder (Form S1099f).
3. For all ships and units, the Inventory Account is to be maintained in duplicate. The original is held, and kept up to date, in the Equipment Store, and the duplicate in the ship or unit. All transactions involving

Permanent instruments are to be supported by an appropriate supply or issue voucher, and are to be recorded on the relevant pages of the Inventory Account, new pages being raised as necessary.

4. At intervals not exceeding one year, a comparison is to be made between the original and duplicate copies (Art B0109). It is advisable for these comparisons to be made as soon as possible after the annual muster. The procedure for this comparison is as follows. The ship is to arrange with DNSOM/EM2, Equipment Store, for the comparison to be held on board on a mutually convenient date. After the comparison and the resolution of any discrepancies, both copies of the Inventory are to be signed, on Form S1099a, by the Officer-in-Charge of Instruments and DNSOM/EM2 or his representative. The original, together with the ship's supporting vouchers which are no longer required on board, will be returned to the Equipment Store for retention, the duplicate remaining onboard.
5. When items are obtained by local purchase and there is doubt as to whether they are Permanent or Consumable, they should in the first instance be treated as Permanent and taken on charge in the account, the matter being referred to DNSOM/EM2, Equipment Store, for a decision.

B0104 Permanent Instruments

1. The supply notes which accompany issues of equipment from the Equipment Store will indicate whether the items are "Permanent" or "Consumable", so that the receiving unit's Instrument Officer may take appropriate accounting action in the Instrument Inventory Account (Art B0103). Whenever permanent equipment new to a particular unit is issued, staff at the Equipment Store will also supply the appropriate pages for the unit's account. Where applicable, serial numbers will be shown on the reverse of the relevant pages.
2. It is the Officer-in-Charge of Instruments' responsibility to ensure that appropriate quantities of each item are held for envisaged tasks, and that all are fully serviceable. The practice of returning instruments to the Equipment Store that are not required for the current task or any task that the ship may be called upon to undertake at short notice is encouraged.
3. In addition to the regular allowances shown, a quantity of Special Surveying Instruments, listed below, equipment is held at the Equipment Store, for issue when required for special purposes. Such items must be returned on completion of the particular task for which they were drawn.

LIST OF SPECIAL SURVEYING INSTRUMENTS

"Shelter" Tents
 Acoustic Release and Command Unit.
 Aquashuttle
 Ashtech Geodetic GPS Receivers
 Ashtech OTF RTK GPS Receivers
 Ashtech Z12
 Atlas DESO 14 Portable Echo Sounder
 Atlas Polartrac
 Constant Tension winches with Hatfield swivels
 Del Norte 1009 DGPS/Trisponder systems
 Digibar SV
 Drawing Instruments
 DRCM
 EA400 Echo Sounders
 Generators, 6, 12, 24v DC; 115 and 230v AC
 Geodimeter 422LR Total Station
 Handheld GPS receivers
 Hugin Tenets PC
 Hydrotide Tide gauge
 Lightweight CTD Probe (For use in CSVs and below)
 Magnetometers
 Mobile package (Laptops)

Moored Current Meter Array
MORS SV
MRA7 Tellurometers
Offshore Seabed Tidegauge
PSS (Hypack)
Rucksacks
S4 Current Meter
Samplers, bottom (boat)
Sextants
Solar Panels
T2 Theodolites
Telescopic masts (21m and 30m) (for use with Trisponder)
Thermal Generators (for use with Trisponder)
Topcon levels
Video Cameras
Wreck wire sweeping equipment

B0105 Consumable Instruments

1. Items of small intrinsic value are classified as Consumable. Once these have been issued from the Equipment Store no further accounting action is necessary. Nevertheless, it is essential that all reasonable measures are taken to keep consumption to a minimum; excessive expenditure will be questioned and if consumption of a particular item is apparently becoming excessive, it may be classified as Permanent.
2. Demands to replace items expended or broken are to be forwarded to the Equipment Store, as necessary.

B0106 Supply of Instruments

1. When a surveying vessel or unit is accepted from the builder, those instruments allowed by establishment, both Permanent and Consumable, will be supplied from the Equipment Store without demand. A good liaison with DNSOM/EM2, is encouraged and he must be informed in good time of the date by which instruments are required, or of any particular extra requirement.
2. When instruments additional to those supplied, or in excess of establishment, are deemed necessary, they may be demanded from the Equipment Store by letter or, if the need is urgent, by signal; brief reasons for the demand, and a target date and place for supply, are to be included. When making such demands, due allowance of time must be made for the matter to be dealt with in the Store, and for the transit time between the Store and the ship. Instruments allowed in excess of establishment are to be returned to the Equipment Store as soon as the requirement lapses.
3. When reporting the loss, return or transfer of instruments, relevant notes are to be raised and copies must be forwarded to the Equipment Store for accounting action, an indication thereon that replacements are required will be accepted in lieu of a formal demand; replacements will not be issued unless this is done even if the unit is below establishment. Copies of Form C126, Transfer and Return Notes, with a defect report of applicable, is to be sent by the quickest means so that, if required, replacement action may be initiated. (See also art B0112).
4. All instruments issued from the Equipment Store will be accompanied by a computer generated Supply and Receipt Note. This form will indicate whether items are classified Permanent or Consumable.

B0107 Transfer of Instruments

1. Occasions may arise when it is necessary for a surveying ship or unit to transfer instruments to another vessel or direct to a repairer. A Transfer Note is to be used for transactions between ships and other surveying units and is to show the serial numbers of the instruments (where applicable). The supplying ship is to complete four copies of the form which are to be actioned as follows:
 - a. Copy 1 sent to receiving ship, signed by receiving ship, forwarded to the Equipment Store in order that the master records can be updated.
 - b. Copy 2 sent to receiving ship, signed by receiving ship, forwarded to supplying ship as a receipt. Retained by supplying ship to support instrument account.
 - c. Copy 3 sent to receiving ship, retained by receiving ship to support instrument account.
 - d. Copy 4 retained by supplying ship to support instrument account until signed Copy 2 is received, Copy 4 may then be destroyed.
2. When instructed by the Equipment Store to send an instrument direct to a repairer, or other authority outside the surveying service, guidance will be given on the documentation to be raised.

B0108 Return of Instruments

1. Instruments returned to the Equipment Store for repair, when no longer required, or for any other reason, are to be packed with care in accordance with Art B0111 and despatched by a suitable means.
2. A Transfer Note is to be used for the transaction and is to show the serial numbers of the instruments (where applicable), whether serviceable (i.e. fit for immediate re-issue) or unserviceable. For unserviceable instruments, it is essential that details of defects are given on the Transfer Note and that a label is attached to the instrument stating that it is unserviceable and giving full details of the defects. If a replacement is required, this may be indicated on the Transfer Note. Three copies of the form are to be raised and actioned as follows:
 - a. Copy 1 forwarded to the Equipment Store, by mail.
 - b. Copy 2 packed with the instruments, will be signed by Equipment Store staff and returned, to be retained by the ship to support the instrument account.
 - c. Copy 3 retained by ship to support the instrument account until signed Copy 2 is received, Copy 3 may then be destroyed.
3. When instruments are rendered unserviceable due to damage it will normally also be appropriate to raise a Form C126 (Art B0112).

B0109 Musters of Instruments

1. A complete muster of instruments is to be carried out at least once per year. The muster will normally be conducted with the assistance of Equipment Store staff and is to include a demonstration of serviceability of a random selection of instruments. The serial numbers of instruments and their cases are to be checked and all components, accessories or detachable parts mustered. The ship's holding of SLBs is to be checked at the same time.
2. The normal procedure for the muster is:
 - a. A date for the annual instrument muster is agreed between the Officer-in-Charge of Instruments and DNSOM/EM2 (Art B0103).
 - b. At least one week before the formal muster, the custodian is to muster the instruments and note any unresolved discrepancies against the Permanent Loan Record.

- c. On the day of the muster, as many instruments as possible are to be laid out with their cases and accessories. All other instruments on board are to be moved to accessible positions where they may be checked.
 - d. Provide documentation to support instruments not available e.g. deployed in the field.
 - e. Carry out comparison between Equipment Store and ship's S1099.
 - f. Muster instruments against the master copy of the Form S1099 and resolve discrepancies. Instrument Store staff nominate instruments for serviceability check. Muster SLBs.
 - g. Officer-in-Charge of instruments and Equipment Store staff sign Forms S1099.
 - h. Ship provide staff and facilities to demonstrate serviceability of selected instruments.
3. The Officer-in-Charge of instruments is, in addition, to carry out musters of all instruments in accordance with the regulations for Permanent Loan Records contained in BR 96 part III art 0422.

B0110 Care of Instruments

1. Every instrument is to be carefully checked on receipt to ensure that damage has not occurred in transit. Its precision should be checked and any allowable errors, or calibration factors, established as soon as practicable. Where possible, these should be eliminated, or a note made of them in the appropriate record.
2. Where instruments are in regular use, they are to be cleaned and checked for serviceability on completion of the day's work, so that they may be ready for the next. Instruments used less frequently should be checked before use, and similarly cleaned and checked on completion. Any which have suffered exposure to rain, salt water or spray are to be carefully dried and wiped down to remove all trace of the effects of salt before being stowed.
3. All instruments are to be kept in their proper cases. Precision instruments, theodolites, Tellurometers, levels, sextants, etc, are to be carefully guarded against all risk of damage; they are never to be transported out of their boxes, or handled in any manner which involves risk. Inner catches which secure an instrument inside its box must always be kept closed to guard against the accidental opening of the outer catches, and care is to be taken that such instruments are properly seated in their boxes before the inner catches are pushed home, lest strain and possible damage result.
4. The SIS Reversing Thermometers (RTM 4002) and Reversing Pressure Meters (RPM 6000H) used for carrying out independent checks of CTD data, are delicate instruments and are very prone to damage. When not in use they are to be stowed in the upright position in the aluminium carrying case provided.
5. Overside hydrographic/oceanographic instruments (e.g. towed sonars, CTD probes, cables and water bottles) are particularly susceptible to corrosion, which will affect their performance. It is essential that they are carefully washed in fresh water after use and thoroughly dried. Before transfer to another ship or return to the Equipment Store, they are to be carefully examined to ensure that no avoidable corrosion is present, and that all the accessories are correct.

B0111 Packing and Transmission

1. Whenever instruments are sent from one place to another, every care is to be taken to prevent damage in transit. Instruments that are provided with their own carrying cases, such as theodolites and levels, are to be firmly secured in them, but must not be wedged so tightly as to cause damage by too much pressure on their delicate elements. Instruments which are not provided with individual cases are to be carefully wrapped in cloth and/or paper, or surrounded by expanded polystyrene packaging as a means of protection, and to exclude dirt.

2. Special cases for some equipments are held at the Equipment Store due to their size. These should be demanded before the relevant equipments are returned. It will often be possible to return equipment in the packing in which the replacement is received.
3. When packing instruments into crates, care is to be taken that every instrument case or bundle of loose items is surrounded on all sides by an adequate cushion of packing material. Sawdust is on no account to be used for this purpose as it may find its way into the cases and cause damage to instruments. The lids of all crates are to be adequately secured, using screws, not nails.
4. A copy of the relevant supply note is to be placed in the crate (Art B0108). The copy sent by post is to state the mode of conveyance, route, markings on the crate (if known), and the expected date of arrival. Crates are to be sent to the Equipment Store, and are to be clearly marked 'Instruments - With Care'.
5. Small instruments may be packed as a parcel, provided adequate protective material is incorporated, and despatched by appropriate means.
6. Air freight should be avoided unless the need is urgent, as the charges incurred are extremely high.
7. Digital thermometers must always be moved in their transit cases. They do not need to remain vertical but are very fragile and must be handled with care. For air shipment, the internal batteries are to be removed.

B0112 Losses of and Damage to Instruments

1. All incidents of loss of, or damage to, Permanent instruments are to be dealt with in accordance with BR 96 Part III Chapter 8. Commanding Officers' powers of write-off are also contained in this reference. In cases where the write-off value of the instrument exceeds the Commanding Officer's delegated powers, Form C126 and the associated report are to be forwarded to the Equipment Store for action. Loss of, or damage to, an important instrument is also to be entered in the Ship's Log. If any component part is damaged or lost then a Return Note and C126 is to be raised, one copy being forwarded to the equipment Store with copies of the C126, and any associated incident and investigation reports; a duplicate Return Note and C126 being retained with the Inventory Account. If the important instrument is lost then a Form C126 and the associated report are to be forwarded to Captain (HM) for action. DNSOM's staff can provide valuation prices required for the completion of Forms C126.
2. Whenever damaged or unserviceable instruments are returned to the Equipment Store for repair, all details of known damage, or symptoms of faulty operation, are to be described on the Transfer Note (Art B0108); this will greatly facilitate the repair work.
3. Since accounting action for consumable items is not required, these may be written off locally without reference to other authorities.

B0113 Repair of Instruments

1. Under ordinary conditions, and with strict care in handling, most instruments should not require frequent repair. When instruments are returned to the Equipment Store for repair, the accounting action required by Arts B0108 and B0112 is to be observed.
2. Instruments which are damaged beyond further use are to be returned to the Equipment Store at the first opportunity so that repair work may be put in hand. Other instruments which are usable but require attention to rectify minor defects, are to be despatched whenever they can be made available.

B0114 Personal Computers and Pocket Calculators

1. FOSF issues computers and software for general ship-board administration, including those used for production of Reports of Survey. DNSOM will only provide PCs which are specifically for a dedicated survey requirement - e.g. notebook PCs for operating Geodetic GPS post-processing software. Any additional software, such as Microsoft Office, which may be pre-loaded by the Equipment Store using a

multi-user licence, will not be issued with discs or manuals. No other software is to be installed without the express permission of DNSOM/EM1.

2. A number of other equipments incorporate personal computers which are to be treated as component parts of the parent equipment.
3. Commercial software is to be used strictly in accordance with the licence agreement that accompanies it. The master disks should be kept in a secure stowage and only working copies used. The suite of programs for surveying computations is provided and maintained by Hydrographic Information Processing Project Implementation Branch (HPI) at the UKHO, to whom all queries should be addressed.
4. Supplies of hand held scientific calculators are held for general use and are issued to ships and units at approximately one per surveying officer or senior rating complemented.
5. Defective computers or calculators are normally to be returned to the Equipment Store for exchange. If the fault can be isolated to a particular unit (e.g. display, keyboard, printer) only the defective unit need be returned. If the fault cannot be isolated then the entire system must be returned. In all cases, a full description of the defect is to accompany the equipment (Art B0108).

B0115 Computer Software Copyright

1. Many new portable surveying equipments include a software package supplied by the manufacturer. This software is invariably subject to rules of copyright which would typically stipulate the following:
 - a. The software package is only to be used by serving members of the Hydrographic Branch and is, on no account, to be released to a third party.
 - b. Copies of the software are only to be made by the Equipment Store.
2. Surveying units will always be supplied with three copies of each computer program. Only one copy should be used as a working copy; the remaining two held in a secure stowage for use in the event of corruption or loss. Copies are not to be made locally.
3. All software packages issued to surveying units are accountable items and must remain under the charge of the Survey Operations Officer until returned to the Equipment Store.
4. The loss of a software package is to be reported immediately by signal to CAPT HM for DNSOM/EM2 and copied to HYDROUK.

B0116 Oceanographic and Meteorological Equipment

1. All defects or shortcomings in oceanographic and meteorological equipment which have achieved Fleet Weapon Acceptance are to be reported using OPDEF procedure. Defects in equipment which is sponsored by DNSOM should be reported by letter to DNSOM, or, if the urgency of the situation dictates, by signal to Captain (HM), info HYDROUK.

B0117 Positioning Equipment

1. Contracts exist for the maintenance and repair of DGPS and other nav aids specifically acquired for a task. These contracts provide for:
 - a. The periodic servicing of equipment either at the contractors premises or on board ships.
 - b. The emergency repair of equipment either on board the ships or in the field.

2. In the case of requirements under a. above these should be arranged through ASWEO4 to COMDEVFLOT giving as much notice as possible and clearly indicating any known defects. Any requirements under b. above should be initiated by OPDEF procedure.
3. Any equipments returned to contractors are to be properly packaged to prevent any damage in transit. If defective, a clear description of the symptoms and any other information is to be enclosed with the equipment. ASWEO4 to COMDEVFLOT is to be informed, on a Transfer Note, of any equipment so returned.
4. The direct transfer of equipments between ships is to be discouraged except in cases of operational necessity. If it is necessary then ASWEO4 to COMDEVFLOT is to be informed immediately. ASWEO4 is then to inform the appropriate project, group or contractor of the whereabouts of the equipment such that a correct record can be maintained.
5. Trisponder 540* has been accepted into service and normal service channels are to be employed for obtaining spares and effecting repairs.
6. Trimble Navtrac GPS receivers procured by DNSOM are maintained by Local Purchase Order (LPO). All requests for maintenance and spares are to be signalled to HYDROUK (for DNSOM-EM1), information HYDROUK TAUNTON (for TOSE) and CAPT HM.
7. Ashtech XII Geodetic and OTF RTK GPS receivers are procured by DNSOM and maintained by LPO. Sufficient numbers of units are held at the Equipment Store to meet anticipated operational requirements. All requests for loan are to be directed to Captain (HM), giving as much notice as possible in order that conflicting requirements can be avoided.

B0118 Geophysical and Oceanographic Systems – Accounting

1. Because of their specialised nature, the method of accounting for geophysical and oceanographic systems (seaborne and land gravimeters, towed magnetometers, CTD probes, salinometers, tide gauges, current meters and acoustic releases) differs from that used for other instruments.
2. For each instrument or system, an equipment list is raised by the UKHO in duplicate. The list details all equipment, spares and consumable items supplied by the Ship Equipment Support Unit (SESU) at the UKHO. The original is held by SESU and the duplicate will always accompany the system. Each inventory details, by type and serial number, each significant item in the system, including spare parts. Amendments to these pages, resulting from the use, or loss, of items, are to be made, at the time, in the ship's copy and SESU informed as soon as practicable or, if appropriate, when the system is returned to Taunton.
3. No form is necessary for the issue or return of these instruments. Before being supplied to a ship, the equipment is checked in the Office against its Inventory. Both copies of the Inventory accompany the instrument to the ship. On receipt on board, the Officer responsible is to check the instrument against its Inventory and, when satisfied that it is correct, sign the certificate at the front of both copies, return the original to UKHO for the attention of SESU, and retain the duplicate on board.
4. When equipment is removed from a ship for overhaul, it will be checked against its Inventory on arrival in the UKHO. In the event of any Permanent items being lost a written explanation will be called for and C126 action may be taken if applicable.
5. Consumable spares are supplied in sufficient quantities to cover a deployment. When appropriate additional supplies, to replace those used, may be demanded from the UKHO (SESU) at any time either by letter, telex, telephone or signal (using SIC JPP), depending on urgency.

HYDROGRAPHIC QUALITY ASSURANCE INSTRUCTIONS

ANNEX C

MISCELLANEOUS INFORMATION

Contents

C0101	Hydrographic Returns
C0102	Surveying Contingent Account (H56)
C0103	Return of Survey (H68)
C0104	Return of Survey (H68a)
C0105	Particulars of Survey Ships (H526)
C0106	Points of Contact
Table A	List of Hydrographic Returns

C0101 Hydrographic Returns

1. The full list of the returns to be rendered to either UKHO or DNSOM, as indicated by the nominated action officer, are at Table A to this Annex. For returns required by Captain (HM) see HSSSOs.

C0102 Surveying Contingent Account (Form H56)

1. DNSOM administers a small fund of money (from Vote 1L6 4152) for expenditure on items and services which do not properly fall to any other authorised account. Except in circumstances of immediate necessity, prior approval is to be obtained from DNSOM/RM for expenditure in excess of £200.
2. All items of expenditure on the Survey Contingent Account are to be reported immediately, on Form H56. Four copies are required; one copy is to be retained by the ship, the second copy is to be put in the ship's Main Cash Account to support payment (having been marked clearly "For Recovery from Vote 1L6 4152"), the third copy, which is to carry a full justification for payment, is to be forwarded to DNSOM/RM and the fourth copy is to be sent to DNSMO/EM2 for assessment as permanent or consumable nature and ledger action as appropriate. The justification is to be sufficiently detailed to allow defence of payment in the event that queries are raised. Expenditure is recovered direct from DNSOM's Equipment Vote. Equipment and stores purchased using the Surveying Contingent Account are to be taken on charge and this fact noted in the justification to DNSOM/RM on the third copy of Form H56.
3. Where possible, invoices should be forwarded to DNSOM/RM in preference to local payment. Form H56 is not then required.

C0103 Annual Return of Survey (Form H68)

1. Form H68 is to be rendered annually to date 31 March, and is to cover the work carried out during the financial year. Two original copies of Form H68 are required by SOSP by 20 April and one copy is to be forwarded to DNSOM. The original Form H68 together with all Forms H68A (with HI chartlet) rendered during the year will be incorporated in the bound volume of 'Admiralty Surveys' prepared annually. Duplicate Forms H68A (with HI chartlet) are not required (but see para 3c below).
2. Forms H68 should be unclassified; details of any classified activities should be given in such vague terms that a security classification need not be applied.

C0104 Return of Survey (Form H68A)

1. On completion of the field work of a survey, Form H68A is to be forwarded to SOSP and Captain (HM). It is to be accompanied by a copy of the HI chartlet supplied with the HI showing the area completed, and is to indicate any aspects of the survey which may not allow it to be classified as 'complete in all respects'. These forms are to be rendered without delay as they are essential in planning future HIs.
2. Form H68A (with HI chartlet) is also to be rendered when a survey is broken off for a substantial period (e.g. to commence another operation, but with the intention of returning later to finish the work). This is required to show the current survey state, and may influence future planning decisions.
3. For surveys which have not yet been concluded and upon which further work is planned in the following year Forms H68A are to be forwarded at the end of each financial year, with the Annual Return of Survey (Form H68). These, and their accompanying HI chartlet, are to show the extent of the work completed by 31 March, and are required to complete indexes, showing the surveys undertaken in the year, which are used during planning and for publication.
4. Forms H68A and HI chartlets rendered to UKHO are to be originals. SIPS produced chartlets are not to be rendered in lieu of the UKHO supplied chartlet.

C0105 Particulars of Surveying Ships (Form H526)

1. To assist with the proper employment of surveying units, Captain (HM) maintains a record, on Forms H526, of the details and particulars of all surveying ships and craft. This is used for planning purposes and is often referred to in discussions with other naval departments.
2. This record is started when a vessel is first accepted into service; it is essential that it is kept up-to-date, and Commanding Officers are to forward any necessary amendments annually on 30 November. Such amendments are to be sent on Form H526 with the appropriate sections, only, re-written; if no amendments are necessary, a manuscript 'Nil' report is to be forwarded. At the end of a major refit, a fully completed form should be rendered.
3. A copy of the original form and each amendment should be kept in the Surveying Data Book.

Table A - List of Hydrographic Returns**Annual Returns**

Format	Subject	Date Required	Action Officer	HQAI Reference
H68	Return of Survey	20 Apr	SOSP DNSOM	HQAI C0103
H68A	Return of Survey (HI's not completed but further work planned)	20 Apr	SOSP	HQAI C0104

Occasional Returns

Format	Subject	Occasion	Action Officer	Reference
H68A	Return of Survey	Whenever the fieldwork of a survey is concluded or broken off for a substantial period	SOSP	HQAI C0104
H56	Surveying Contingent Account	Whenever payment is made	See form	HQAI C0102
MS	Report of Aerial Photography	On completion of a photographic deployment	HDC(P)	NP 137
H526	Particulars of Surveying Ships	30 Nov	Capt HM	HQAI C0105

C0106 Points of Contact1. The UK Hydrographic Office

a. The Hydrographic Office Defence Agency is established at Taunton.

b. Correspondence should be addressed to:

The Chief Executive
The UK Hydrographic Office
Admiralty Way
Taunton
Somerset
TA1 2DN

Telephone : Taunton (01823) 337900
Telex : 46274 NAVHYD G
Fax (UKHO) : Taunton (01823) 284077
Fax (SOSP) : Taunton (01823) 352509
Signal Address : HYDROUK TAUNTON

2. The Directorate of Naval Surveying, Oceanography and Meteorology

a. The Directorate of Naval Surveying, Oceanography and Meteorology (DNSOM). The Directorate provides advice to the Naval and Defence staffs, and other Government Departments, on the policy and planning aspects of hydrographic surveying, oceanography and naval meteorology and the Defence requirement for related products and services.

b. Correspondence should be addressed to:

Director of Naval Surveying, Oceanography and Meteorology
Metropole Building
Northumberland Avenue
London
WC2N 5BP

Telephone and e mail:

DNSOM		020 780 70175	dnsom.d@dial.pipex.com
DNSOM/PA	Personal Assistant	020 780 70176	
DNSOM/AD1	Policy & Operational/non-Operational advice to Naval & Defence Staffs for Hydrographic Surveying, Precise Positioning & METOC	020 780 70166	
DNSOM/SP	Survey Policy, Plans & Tasking. Input to Naval & TLB Plans Hydrographic/Service Requirements	020 780 70164	dnsom.sp@dial.pipex.com
DNSOM/SPR	Survey Plans & Requirements. Law of the Sea	020 780 70165	
DNSOM/PM	Manager of Defence, Civil and National Hydrographic Programmes with UKHO; Civil Survey Programme Manager	020 780 70168	
DNSOM/EM1	Equipment manager for DNSOM supported equipment. Charter of STUFT vessels.	020 780 70169	
DNSOM/EM2	Equipment Store Manager	Devonport 52104	
DNSOM/EM3	Storeman	Devonport 52126	

CHOTS : DNSOM/SP
Telex : 22241 MOD DCC G
Fax : 0207 80 70180
Signal Address : MODUK(NAVY)

Notes:

- I. The Signal and Telex facilities are located in the Ministry of Defence Main Building in Whitehall and messages usually take several hours to reach their destination.
- II. The first words of the text of signal and Telex messages are to be "FOR DNSOM".

3. Surveying Units – Captain (HM)/Hydrographer of the Navy

a. Captain (HM) commands the surveying units from offices ashore in HM Naval Base Devonport.

b. Address: Captain (HM)
Room 225a
COMDEVFLOT
Defiance Building
HM Naval Base
Devonport
PL2 2BG

c. Telephone (01752) 555780/84
(Outside working hours Captain (HM) staff can be contacted through Port
Controller's Assistant on 01752 552413

E mail: hydro.devonport@gtnet.gov.uk
Telex: 45132 NBC DEV G
Fax: (01752) 555779
Signal Address CAPT HM

Notes:

- i. When at sea CAPT HM AFLOAT will be promulgated as the address for signals requiring the personal attention of Captain (HM).
- ii. Correspondence for Hydrographer of the Navy should use the address above replacing Captain (HM) in the first line.
- iii. Signals for Hydrographer of the Navy should be addressed to CAPT HM with 'For Hydrographer of the Navy' as the first line in the text.

4. Royal Naval HM School (Drake)

- a. The RN HM School is a direct command school accountable to the Flag Officer Training and Recruiting, with functional responsibility for professional training standards to the Hydrographer of the Navy.

b. Address: The Commander
 Royal Naval HM School (Drake)
 HMS DRAKE
 HM Naval Base
 Devonport
 Devon
 PL2 2BG

c. Telephone: (01752) 555980
 Fax: (01752) 555980
 Signal Address: HYDROSCH DEVONPORT
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INTERNATIONAL HYDROGRAPHIC ORGANIZATION



IHO STANDARDS FOR HYDROGRAPHIC SURVEYS

4th Edition, April 1998

SPECIAL PUBLICATION N° 44



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S-44

INTERNATIONAL HYDROGRAPHIC ORGANIZATION



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TABLE OF CONTENTS

	Pages
Preface	1
Introduction	2-3
Chapter 1 Classification of surveys	4-6
Chapter 2 Positioning.....	7-8
Chapter 3 Depths.....	9-10
Chapter 4 Various measurements	11
Chapter 5 Data attribution.....	12
Chapter 6 Elimination of doubtful data.....	13
Chapter 7 Guidelines for quality control.....	14-16
Glossary.....	17
Annex..A Classification Criteria for Deep Sea Soundings	18-23

PREFACE

This fourth edition of IHO Special Publication No. 44 has been prepared by an IHO Working Group set up in accordance with Decision No. 15 of the XIVth International Hydrographic Conference. Terms of Reference and work procedures were established by Circular Letter 20 of 1993. Initially, the Working Group was divided into several sub-groups to address specific topics by correspondence. Subsequently, two meetings were held at the IHB, Monaco, 26-30 September 1994 and 29 September - 3 October 1997, to discuss proposals for and to draft a new edition of the publication.

Thanks are due to the Hydrographic Offices of Australia, Brazil, Canada, France, Italy, Japan, Norway, Portugal, Spain, Sweden, UK, and USA (NOAA & NIMA) for nominating members for this Working Group.

It should be noted that the issue of a new standard does not invalidate charts and nautical publications based on previous standards, but rather sets the standards for future data collection to better respond to user needs. Member States are encouraged to develop estimates of the positional and depth accuracies of hydrographic surveys conducted prior to the implementation of these new standards.

The principal aim of this publication is to specify minimum standards for hydrographic surveys in order that hydrographic data collected according to these standards is sufficiently accurate and that the spatial uncertainty of data is adequately quantified to be safely used by mariners (commercial, military or recreational) as primary users of this information.

Previous editions of S-44 concentrated primarily on classifying accuracies for hydrographic surveys for the compilation of nautical charts. It has now been recognized that users of hydrographic data make up a much more diverse group than previously recognized. Hydrographic data is also important for coastal zone management, environment monitoring, resource development (hydrocarbon and mineral exploitation), legal and jurisdictional issues, ocean and meteorological modelling, engineering and construction planning and many other uses. To increase its usefulness, users require data that is more up to date, detailed, reliable, and in digital form. Even if the standard does not always specifically address these additional users' needs, it is felt that the standard provides them with a basis to assess the quality of hydrographic data.

INTRODUCTION

Hydrographic surveying is undergoing fundamental changes in measurement technology. Multibeam acoustic and airborne laser systems now provide almost total seafloor coverage and measurement as compared to the earlier sampling by bathymetric profiles. The capability to position the data precisely in the horizontal plane has increased enormously by the availability of satellite positioning systems, particularly when augmented by differential techniques. This advance in technology has been particularly significant with navigators now able to position themselves with greater accuracy than that of the data on which charts are based. It should be noted, however, that the accuracy and completeness of a hydrographic survey can never reach that of land mapping.

The increased use of satellite positioning systems by the mariner, combined with the cost effectiveness and improved accuracy provided by these systems (over more traditional terrestrial-based precise navigation systems), have encouraged hydrographic agencies to utilise systems that afford positioning accuracy equal to or better than those enjoyed by the mariner for all future surveys conducted in Special Order and Order 1 (see Chapter 1, Table 1).

The required positioning accuracies in previous editions of S-44 were to a large extent based on the practical limitations of draughtsmanship at a given scale. Automated data management allows data to be presented at any scale. Therefore the accuracy requirements for positions in this new edition of S-44 must be a function of the errors contributed by positioning and sounding systems and the likely use of the data.

The state of the art of the depth measurement equipment has been evaluated by the working group as follows:

- a) Single beam echo sounders have reached a sub-decimetre accuracy in shallow water. The market offers a variety of equipment with different frequencies, pulse rates etc. and it is possible to satisfy most users' and, in particular, the hydrographers' needs.
- b) Side scan sonar equipment technology has also reached a high level of bottom obstacle detection and definition. Although, at present, its use is limited by the low speed (5-6 knots maximum) at which it can be operated, it is widely employed for harbour and navigable channels surveys to ensure obstacle detection between the measured survey lines. Many hydrographic agencies consider its use compulsory in such areas, often prescribing overlaps of 100% or more.
- c) Multibeam echosounder technology is developing rapidly and offers great potential for accurate and total seafloor search if used with proper procedures and provided that the resolution of the system is adequate for proper detection of navigational hazards.
- d) Airborne laser sounding is a new technology which can offer substantial productivity gains for surveys in shallow, clear water. Airborne laser systems are capable of measuring depths to 50 m or more.

It is likely that many hydrographic surveys will continue to be conducted with single beam echo sounders which only sample discrete profiles of the seafloor, with the 100% bottom search techniques outlined above possibly only employed in critical areas. This assumption led to the decision to retain the concept of line spacing even though it is no longer directly related to survey scale.

When specifying depth accuracies, this revision of S-44 departs from previous editions by specifying different accuracy requirements for different areas according to their importance for the safety of navigation. The most stringent requirements entail higher accuracies than previously specified, but for areas of less critical nature for navigation the requirements have been relaxed. Furthermore, this version of S-44 makes the new requirement, that surveyors strive to attribute all new data with a statistical estimate of its probable error.

Equipment and procedures used to achieve the standards laid down in this publication are left to the discretion of the agency responsible for the survey quality.

The optimum results are achieved when the appropriate procedures and equipment are used in conjunction with the expertise and training of the hydrographic surveyor. The importance of professional judgement cannot be overemphasized.

Chapter 2 of the 3rd edition of S-44 "Classification Criteria for Deep Ocean Soundings" has been retained for historical reasons. It is reproduced **without amendment** at Annex A.

Chapter 1 CLASSIFICATION OF SURVEYS

To accommodate in a systematic manner different accuracy requirements for areas to be surveyed, four orders of survey are defined. These are described below and at Tables 1 and 2 which summarize the overall requirements and are in fact the essence of the complete standard.

Special Order

Special Order hydrographic surveys approach engineering standards and their use is intended to be restricted to specific critical areas with minimum underkeel clearance and where bottom characteristics are potentially hazardous to vessels. These areas have to be explicitly designated by the agency responsible for survey quality. Examples are harbours, berthing areas, and associated critical channels. All error sources must be minimized. Special Order requires the use of closely spaced lines in conjunction with side scan sonar, multi-transducer arrays or high resolution multibeam echosounders to obtain 100% bottom search. It must be ensured that cubic features greater than 1m can be discerned by the sounding equipment. The use of side scan sonar in conjunction with a multibeam echosounder may be necessary in areas where thin and dangerous obstacles may be encountered.

Order 1

Order 1 hydrographic surveys are intended for harbours, harbour approach channels, recommended tracks, inland navigation channels, and coastal areas of high commercial traffic density where underkeel clearance is less critical and the geophysical properties of the seafloor are less hazardous to vessels (e.g. soft silt or sand bottom). Order 1 surveys should be limited to areas with less than 100 m water depth. Although the requirement for seafloor search is less stringent than for Special Order, full bottom search is required in selected areas where the bottom characteristics and the risk of obstructions are potentially hazardous to vessels. For these areas searched, it must be ensured that cubic features greater than 2 m up to 40 m water depth or greater than 10% of the depth in areas deeper than 40 m can be discerned by the sounding equipment.

Order 2

Order 2 hydrographic surveys are intended for areas with depths less than 200 m not covered by Special Order and Order 1 and where a general description of the bathymetry is sufficient to ensure there are no obstructions on the seafloor that will endanger the type of vessel expected to transit or work the area. It is the criteria for a variety of maritime uses for which higher order hydrographic surveys cannot be justified. Full bottom search may be required in selected areas where the bottom characteristics and the risk of obstructions may be potentially hazardous to vessels.

Order 3

Order 3 hydrographic surveys are intended for all areas not covered by Special Order, and Orders 1 and 2 in water depths in excess of 200 m.

Notes:

- For Special Order and Order 1 surveys the agency responsible for the survey quality may define a depth limit beyond which a detailed investigation of the seafloor is not required for safety of navigation purposes.
- Side scan sonar should not be used for depth determination but to define areas requiring more detailed and accurate investigation.

TABLE 1

Summary of Minimum Standards for Hydrographic Surveys

ORDER	Special	1	2	3
Examples of Typical Areas	Harbours, berthing areas, and associated critical channels with minimum underkeel clearances	Harbours, harbour approach channels, recommended tracks and some coastal areas with depths up to 100 m	Areas not described in Special Order and Order 1, or areas up to 200 m water depth	Offshore areas not described in Special Order, and Orders 1 and 2
Horizontal Accuracy (95% Confidence Level)	2 m	5 m + 5% of depth	20 m + 5% of depth	150 m + 5% of depth
Depth Accuracy for Reduced Depths (95% Confidence Level) (1)	a = 0.25 m b = 0.0075	a = 0.5 m b = 0.013	a = 1.0 m b = 0.023	Same as Order 2
100% Bottom Search	Compulsory (2)	Required in selected areas (2)	May be required in selected areas	Not applicable
System Detection Capability	Cubic features > 1 m	Cubic features > 2 m in depths up to 40 m; 10% of depth beyond 40 m (3)	Same as Order 1	Not applicable
Maximum Line Spacing (4)	Not applicable, as 100% search compulsory	3 x average depth or 25 m, whichever is greater	3-4 x average depth or 200 m, whichever is greater	4 x average depth

- (1) To calculate the error limits for depth accuracy the corresponding values of a and b listed in Table 1 have to be introduced into the formula

$$\pm \sqrt{[a^2 + (b \cdot d)^2]}$$

with

- a constant depth error, i.e. the sum of all constant errors
- b*d depth dependent error, i.e. the sum of all depth dependent errors
- b factor of depth dependent error
- d depth

- (2) For safety of navigation purposes, the use of an accurately specified mechanical sweep to guarantee a minimum safe clearance depth throughout an area may be considered sufficient for Special Order and Order 1 surveys.
- (3) The value of 40 m has been chosen considering the maximum expected draught of vessels.
- (4) The line spacing can be expanded if procedures for ensuring an adequate sounding density are used (see 3.4.2)

The rows of Table 1 are explained as follows:

- Row 1 "Examples of Typical Areas" gives examples of areas to which an order of survey might typically be applied.
- Row 2 "Horizontal Accuracy" lists positioning accuracies to be achieved to meet each order of survey.
- Row 3 "Depth Accuracy" specifies parameters to be used to calculate accuracies of reduced depths to be achieved to meet each order of survey.
- Row 4 "100% Bottom Search" specifies occasions when full bottom search should be conducted.
- Row 5 "System Detection Capability" specifies the detection capabilities of systems used for bottom search.
- Row 6 "Maximum Line Spacing" is to be interpreted as
 - spacing of sounding lines for single beam sounders, and
 - distance between the outer limits of swaths for swath sounding systems.

Chapter 2 POSITIONING

2.1 Introduction

The accuracy of a position is the accuracy at the position of a feature (e.g. sounding, navaid) to be located within a geodetic reference frame; but see paragraph 2.3.

If the accuracy of a position is affected by different parameters, the contributions of all parameters to the total position error should be accounted for.

A statistical method, combining different error sources, for determining positioning accuracy should be adopted. The position error, at 95% confidence level, should be recorded together with the survey data (see also 5.2).

Positions should be referenced to a geocentric reference system, recommended as the World Geodetic System 84 (WGS 84). If, exceptionally, positions are referenced to the local horizontal datum, this local datum should be tied to a geocentric reference system, recommended as the World Geodetic System 84 (WGS 84).

It is strongly recommended that whenever positions are determined by terrestrial systems, redundant lines of position should be observed. Standard calibration techniques should be completed prior to and after the acquisition of data. Satellite systems should be capable of tracking at least five satellites simultaneously; integrity monitoring for Special Order and Order 1 surveys is recommended.

2.2 Horizontal Control

Primary shore control points should be located by ground survey methods to a relative accuracy of 1 part in 100,000. When geodetic satellite positioning methods are used to establish such points, the error should not exceed 10 cm at 95% confidence level.

Secondary stations for local positioning which will not be used for extending the control should be located such that the error does not exceed 1 part in 10,000 for ground survey techniques or 50 cm using geodetic satellite positioning.

2.3 Positioning of Soundings

The position of soundings, dangers, and all other significant submerged features should be determined such that the horizontal accuracy is as specified in Table 1.

The accuracy of the position of a sounding is the accuracy at the position of the sounding on the bottom located within a geodetic reference frame. The exception to this are Order 2 and Order 3 surveys using single-beam echo sounders where it is the accuracy of the position of the sounding system sensor. In such cases, the agency responsible for the survey quality should determine the accuracy of the positions of soundings on the seafloor.

2.4 Navigation Aids and Important Features

The horizontal positions of navigation aids and other important features should be determined to the accuracy stated in Table 2, at 95% confidence level.

Table 2

Summary of Minimum Standards for Positioning of Navigation Aids and Important Features

	Special Order surveys	Order 1 surveys	Order 2 and 3 surveys
Fixed aids to navigation and features significant to navigation	2 m	2 m	5 m
Natural Coastline	10 m	20 m	20 m
Mean position of floating aids to navigation	10 m	10 m	20 m
Topographical features	10 m	20 m	20 m

Chapter 3 DEPTHS

3.1 Introduction

The navigation of commercial vessels requires increasingly accurate and reliable knowledge of the water depth in order to exploit safely the maximum cargo capabilities. It is imperative that depth accuracy standards in critical areas, particularly in areas of marginal underkeel clearance and where the possibility of obstructions exists, be more stringent than those established in the past and that the issue of adequate bottom search be addressed.

3.2 Depth Accuracy

Depth accuracy is to be understood as the accuracy of the reduced depths. In determining the depth accuracy, the sources of individual errors need to be quantified. All error sources should be combined to obtain a Total Propagated Error (TPE). TPE results from the combination of all contributing errors which include among other things:

- a) measurement system and sound velocity errors
- b) tidal measurement and modelling errors, and
- c) data processing errors.

A statistical method for determining depth accuracy by combining all known errors should be adopted and checked (see also Chapter 7).

The TPE, determined statistically at the 95% confidence level, is the value used to describe the depth accuracy achieved. The TPE should be recorded together with the sounding value (see also 5.2).

Recognizing that there are both constant and depth dependent errors that affect the accuracy of depths, the formula under Table 1 in Chapter 1 is to be used to compute, at 95% confidence level, the allowable depth errors by using for a and b the values from row 3 of Table 1.

3.3 Depth Measurement

Determination of the general seabed topography, tidal reduction, and detection, classification and measurement of seabed hazards are fundamental hydrographic surveying tasks. Depths above hazards need to be determined with, at least, a depth accuracy as specified for Order 1 in Table 1.

For wrecks and obstructions which may have less than 40 m clearance above them and may be dangerous to normal surface navigation, the least depth over them should be determined either by high definition sonar examination or physical examination (diving). Mechanical sweeping may be used when guaranteeing a minimum safe clearance depth.

All anomalous features previously reported in the survey area and those detected during the survey should be examined in greater detail and, if confirmed, their least depth be determined. The agency responsible for survey quality may define a depth limit beyond which a detailed seafloor investigation, and thus an examination of anomalous features, is not required.

Measured depths should be reduced to chart or survey datum, by the application of tidal or water level height. Tidal reductions should not be applied to depths greater than 200 m, except when tides contribute significantly to the TPE.

3.4 Sounding Density

3.4.1 Introduction

In planning the density of soundings, both the nature of the seabed in the area and the requirements of the users have to be taken into account to ensure adequate bottom search.

It should be noted that no method, not even 100% search, which is desirable, guarantees by itself the reliability of a survey. Furthermore they cannot disprove the existence of hazards to navigation with certainty; in particular, the existence or not of isolated natural hazards or man made objects such as wrecks, between survey lines.

3.4.2 Line Spacing

An appropriate line spacing for the various orders of survey is proposed in Table 1. The results of a survey have to be assessed using procedures developed by the agency responsible for the survey quality. Based on these procedures it has to be decided whether the extent of bottom search is adequate and whether the line spacing should be reduced or extended.

These procedures may include an appropriate statistical error analysis which should take into consideration interpolation errors, as well as depth and positioning errors of the measured depths (see also Chapter 7).

Chapter 4 VARIOUS MEASUREMENTS

4.1 Bottom Sampling

The nature of the seabed should be determined by sampling or may be inferred from other sensors (e.g. single beam echo sounders, side scan sonar, sub-bottom profiler, video, etc.) up to the depth required by local anchoring or trawling conditions; under normal circumstances sampling is not required in depths greater than 200 m. Samples have to be spaced according to the seabed geology. Spacing of samples should normally be 10 times that of the selected line spacing. In areas intended for anchorages, density of sampling should be increased. Any inference technique should be ground-truthed by physical sampling.

4.2 Tidal Observations

Tidal height observations should be made throughout the course of a survey for the purpose of:

- a) providing tidal reductions for soundings, and
- b) providing data for tidal analysis and subsequent prediction, for which purposes the observations should extend over the longest possible period and not less than 29 days.

Tidal heights should be observed so that the total measurement error at the tide gauge, including timing error, does not exceed ± 5 cm at 95% for Special Order surveys. For other surveys ± 10 cm should not be exceeded.

In order for the bathymetric data to be fully exploited in the future using advanced satellite observation techniques, tidal observations should be related both to a low water datum (usually LAT) and also to a geocentric reference system, preferably the World Geodetic System 84 (WGS 84) ellipsoid.

4.3 Tidal Stream Observations

The speed and direction of tidal streams which may exceed 0.5 knots should be observed at the entrances to harbours and channels, at any change in direction of a channel, in anchorages and adjacent to wharf areas. It is also desirable to measure coastal and offshore currents when they are of sufficient strength to affect surface navigation.

The tidal stream at each position should be measured at depths between 3 and 10 m below the surface. Simultaneous observations of tidal height and meteorological conditions should be made.

Tidal stream observations should be made using a recording device. The period of observation should not be less than 15 days, at intervals not greater than 1 hour. Whenever possible, the observation period should be extended to 29 days or more. Alternatively, a logship may be deployed over a period of maximum and minimum water flow. The speed and direction of the tidal stream should be measured to 0.1 knot and the nearest 10° respectively, at 95% confidence level.

Where there is reason to believe that seasonal river discharge influences the tidal streams, measurements should be made to cover the entire period of variability.

Chapter 5 DATA ATTRIBUTION

5.1 General

To allow a comprehensive assessment of the quality of survey data it is necessary to record or document certain information together with the survey data. Such information is important to allow exploitation of survey data by a variety of users with different requirements, especially as requirements may not be known when survey data is collected.

The process of documenting the data quality is called data attribution; the information on the data quality is called metadata.

Metadata should comprise at least information on:

- the survey in general as e.g. date, area, equipment used, name of survey platform
- the geodetic reference system used, i.e. horizontal and vertical datum; including ties to WGS 84 if a local datum is used
- calibration procedures and results
- sound velocity
- tidal datum and reduction
- accuracies achieved and the respective confidence levels.

Metadata should preferably be in digital form and an integral part of the survey record. If this is not feasible similar information should be included in the documentation of a survey.

It is recommended that agencies responsible for the survey quality systematically develop and document a list of metadata used for their survey data.

5.2 Point Data Attribution

All soundings should be attributed with a 95% statistical error estimate for both position and depth. Although this should preferably be done for each individual sounding, the error estimate may also be derived for a number of soundings or even for an area, provided differences between error estimates can be safely expected to be negligible.

In the case of positions, they should be qualified by analyzing redundant lines of position (terrestrial systems) or integrity monitoring (satellite systems); in the case of depth observations, they could be qualified by analyzing redundant depths observed at, for example, checkline crossings.

It is understood that each sensor (i.e. positioning, depth, heave, pitch, roll, heading, seabed characteristic sensors, water column parameter sensors, tidal reduction sensor, data reduction models etc.) possesses unique error characteristics. Each survey system should be uniquely analysed to determine appropriate procedure(s) to obtain the required spatial statistics. These analysis procedure(s) should be documented or referenced in the survey record.

Chapter 6 ELIMINATION OF DOUBTFUL DATA

6.1 Introduction

To improve the safety of navigation it is desirable to eliminate doubtful data, i.e. data which are usually denoted on charts by PA (Position Approximate), PD (Position Doubtful), ED (Existence Doubtful), SD (Sounding Doubtful) or as "reported danger". To confirm or disprove the existence of such data it is necessary to carefully define the area to be searched and subsequently survey that area according to the standards outlined in this publication.

6.2 Extent of Area to be Searched

No empirical formula for defining the search area can suit all situations. For this reason, it is recommended that the search radius should be 3 times the estimated position error of the reported hazard at the 95% confidence level as determined by a thorough investigation of the report on the doubtful data by a qualified hydrographic surveyor.

If such report is incomplete or does not exist at all, the position error must be estimated by other means as, for example, a more general assessment of positioning and depth measurement errors during the era when the data in question was collected.

6.3 Conducting the Search

The methodology for conducting the search should be based on the area in which the doubtful data is reported and the estimated danger of the hazard to navigation. Once this has been established, the search procedure should be that of conducting a hydrographic survey of the extent defined in 6.2, to the standards established in this publication.

6.4 Presentation of Search Results

Doubtful data shall be replaced with actual data collected during the search whether or not the hazard has been detected. If not detected, the agency responsible for the survey quality shall decide whether to retain the hazard as charted or to expunge it.

Chapter 7 GUIDELINES FOR QUALITY CONTROL

7.1 Introduction

To ensure that the required accuracies are achieved it is necessary to check and monitor performance. Establishing quality control procedures should be a high priority for hydrographic authorities. This chapter provides guidelines for the implementation of such procedures.

7.2 Positioning

Quality control for positioning ideally involves observing redundant lines of position and/or monitor stations which are then to be analyzed to obtain a position error estimate.

If the positioning system offers no redundancy or other means of monitoring system performance, rigorous and frequent calibration is the only means of ensuring quality.

7.3 Depths

A standard quality control procedure should be to check the validity of soundings by conducting additional depth measurements. Differences should be statistically tested to ensure compliance of the survey with the standards given in Table 1. Anomalous differences should be further examined with a systematic analysis of contributing error sources. All discrepancies should be resolved, either by analysis or re-survey during progression of the survey task.

Checklines crossing the principal sounding lines should always be run to confirm the accuracy of positioning, sounding, and tidal reductions. Checklines should be spaced so that an efficient and comprehensive control of the principal sounding lines can be effected. As a guide it may be assumed that the interval between checklines should normally be no more than 15 times that of the selected sounding lines.

7.4 Sounding Density

7.4.1 Single-beam Echo Sounders (SBES)

Depending on the characteristics of the seafloor the line spacing from Table 1 may have to be reduced or, if circumstances permit, expanded. Checklines should be run at discrete intervals (see 7.3).

7.4.2 Side scan Sonar (SSS)

Where SSS is being used in conjunction with SBES or MBES, the line spacing from Table 1 may be increased, whilst ensuring adequate coverage of the area directly beneath the towfish.

7.4.3 Multibeam Echosounders (MBES)

MBES have great potential for accurate seafloor coverage if used with proper survey and calibration procedures. An appropriate assessment of the accuracy of measurement with each beam is compulsory for use in areas surveyed to Special Order and Order 1 standards. If any of the outer beams have unacceptable errors, the related data are to be excluded. If not hampered by geographical constraints, all swaths should be crossed, at least once, by a checkline to confirm, by this method, the accuracy of positioning, depth measurement and depth reductions.

7.4.4 Sweep Systems

Sweep (multi-transducer) systems provide one technology for ensuring the accuracy and total seafloor coverage required for Special Order. It is essential that the distance between individual transducers and the acoustic area of ensonification should be matched to the depths being measured to ensure total search across the measurement swath. If not hampered by geographical constraints, all "sweeps" (width of coverage using a multi-transducer system) should be crossed, at least once, by a checkline to confirm, by this method, the accuracy of positioning, depth measurement and depth reductions.

7.4.5 Airborne Laser

Airborne laser systems are capable of measuring depths to 50 m or more provided the water is clear. Hazards to navigation detected by airborne laser should be examined using SBES, MBES or high density airborne laser. All swaths should be crossed, at least once, by a checkline to confirm, by this method, the accuracy of positioning, depth measurement and depth reductions.

7.4.6 Geostatistics

When the seabed has not been totally searched during a survey, the soundings only provide samples of the seabed at discrete points. In such a case, it is necessary to interpolate depths derived from soundings to obtain a bathymetric model which provides an estimate of depth information over the entire seabed surface.

Geostatistical interpolation techniques may be used to estimate the error introduced by interpolation between soundings, taking into consideration the accuracies of reduced depths and positions as well as the spatial distribution of depth measurements.

Using the values for a and b from Table 3 below, the formula under Table 1 is to be used to compute, at 95% confidence level, the allowable errors for the bathymetric model. If these errors are exceeded, the density of soundings should be increased.

Table 3
Bathymetric Model Accuracy

ORDER	Special	1	2	3
Bathymetric Model Accuracy (95% Confidence Level)	Not applicable, as 100% search compulsory	a = 1.0 m b = 0.026	a = 2.0 m b = 0.05	a = 5.0 m b = 0.05

These interpolation techniques, based on an appropriate statistical error analysis that quantifies the roughness of the seabed, should not be used as the only means to assess the quality of a survey, as they may not provide reliable estimates of the accuracy of the bathymetric model in all cases; particularly, if surveys were conducted with excessive line spacing.

7.5 Error Sources and Budget

Although the following text focusses on errors of data acquired with multibeam systems, it should be noted that it is in principle applicable to data acquired with any echosounding system.

With multibeam and multitransducer echosounding systems, the distance between the sounding on the seafloor and the positioning system antenna can be very large, especially in deep water with a wide

swath system. Because of this, sounding position accuracy becomes also a function of the gyrocompass heading accuracy, beam angle (or transducer location for sweep systems) and the water depth (swath systems only).

Roll and pitch errors will also contribute to the relative error of the sounding from the transducer. Overall, it may be very difficult to generalize what is achievable as a typical position accuracy for each sounding as a function of depth in some of these modern systems. The errors are a function not only of the echosounder but also the vessel and the location and accuracy of the auxiliary sensors.

The use of non-vertical beams introduces additional errors caused by incorrect knowledge of the ship's orientation at the time of transmission and reception of sonar echoes. Errors associated with the development of the position of an individual beam must include the following:

- a) positioning system error,
- b) depth measurement error,
- c) the uncertainty associated with the ray path model (including the sound speed profile),
- d) the accuracy of the vessel heading,
- e) the accurate identification of system pointing errors resulting from transducer misalignment,
- f) vessel motion sensor, i.e. roll, heave and pitch accuracy, and
- g) time latency.

Agencies responsible for the survey quality are encouraged to develop error budgets for their own systems.

Glossary

accuracy. The extent to which a measured or enumerated value agrees with the true value.

bathymetric model. A surface model of the seafloor as determined by interpolating a grid of depths in between the observed depth samples. Also called seabed surface model, seafloor surface model, seafloor model.

bottom search. A method of exploring the seabed which attempts to provide complete coverage of an area for the purpose of detecting all features addressed in this publication.

confidence level. The probability that an error will not exceed the specified maximum value.

correction. A quantity which applied to an observation or function thereof will diminish or eliminate the effects of errors and give an improved value of the observation or function. The correction corresponding to a given error is of the same magnitude but of opposite sign. (IHO S32 ed.1994, #1079)

error. The difference between an observed or computed value of a quantity and the ideal or true value of that quantity. (IHO S32 ed.1994, #1671)

geostatistics. The field of statistics which deals with estimating the confidence of interpolated values derived from measurements of geo-referenced data.

line of position (LOP). A line indicating a series of possible positions of a craft, determined by observation or measurement. Also called *position line*. (IHO S32 ed.1994, #2848)

metadata. Information describing characteristics of data, e.g. the accuracy of survey data.
ISO definition: Data (describing) about a data set and usage aspect of it. Metadata is data implicitly attached to a collection of data. Examples of metadata include overall quality, data set title, source, positional accuracy and copyright.

precision. A statistical measure of repeatability of a value, usually expressed as variance or standard deviation of repeated measurements.

quality assurance. All those planned and systematic actions necessary to provide adequate confidence that a product or a service will satisfy given requirements for quality.

quality control. All procedures which ensure that the product meets certain standards and specifications (IHO S32 ed.1994, #4115)

ANNEX A

This Annex corresponds to Chapter 2 of the 3rd edition (1987) of S-44 which has been reproduced without modifications

CLASSIFICATION CRITERIA FOR DEEP SEA SOUNDINGS**Introduction**

The criteria given in this Chapter are an updated version of those drawn up by the IHO working group established in 1972.

The aim of compiling deep sea soundings is to map the shape of the seabed. The interest is scientific as much as it is navigational, as distinct from the aim of a hydrographic chart, which must emphasize hazards to navigation.

The aim of classifying deep sea soundings is to select the better data where overlapping soundings disagree. It will also be needed should the requirement arise to compile charts on which all data meet a specified minimum standard.

These criteria provide guidance also to surveyors and data collectors so that essential technical details will be recorded with the soundings. Classification should be applied by the ship collecting the soundings and amended, if necessary, by the Hydrographic Office concerned, if it processes the data further before passing it on to the authorities responsible for storing the data and compiling the charts.

"Deep sea soundings" implies depths greater than 200 m.

The classification is made under four headings:

A. Position, with categories:

Track/Systematic Survey,
Position accuracy;

B. Soundings, with categories:

Beamwidth,
Timing accuracy;

C. Fidelity of scaling soundings to reproduce seabed, with categories:

Single/multi-beam Echo-sounder,
Scaling accuracy;

D. Data processing, with categories:

Whether original data supplied,
Method of correcting soundings.

The reason for preferring this over a single code are :

- (i) A multiple code where each characteristic is judged separately is easier for the observer to apply than a single, combination code; the number of combinations required to classify all the information required in a single code would make coding a complicated process. A multiple code is also easier to adjust when one characteristic changes during the course of a cruise; this will often happen with positioning accuracy, for example.
- (ii) The compiler needs detailed information on some aspects of the classification. Take, for example, the dilemma that positioning is more important than sounding accuracy on a steeply sloping seabed,

whereas sounding accuracy is more important over an abyssal plain; the only practical solution appears to be to classify position and sounding accuracy independently, and leave the final decision to the compiler.

The steps between each category have deliberately been made large in order to simplify classification and to discourage exaggerated claims by making them ridiculous.

Each code has a "Z" category for "unspecified" data. This may be old data or current data submitted without accuracy classification. Category A, B and C of each code are left unused in case of future developments.

The Data Processing Code

- (i) This code should describe the form of the data when it is finally entered into the data bank.
- (ii) The significance of submitting original soundings as observed is that the corrected depth can be refined should improved sound velocity become available after the original work is done.
- (iii) Perhaps the most serious weakness in the present-day process of reporting deep sea soundings is that only a very small part of the data collected is preserved; for example, spot sounding at 10 km intervals out of a continuous seabed profile. Codes A, B and C are intended for the day when a continuous profile can be stored (on magnetic tape?) and used to reproduce all the information gathered.

The roughness of the seabed is an important factor in judging the fidelity with which spot soundings can reproduce a continuous profile, but it is a difficult quality to classify. The fidelity of Scaling soundings code gives the limited information that either the bottom roughness has been described by the sounding selection (category D), or it is rougher than the soundings indicate.

PART 2.A - POSITION

2.A.1 - General

In mapping the seabed, a systematic survey of a large area with high relative position accuracy is the equivalent of a series of single tracks of equivalent geographical accuracy. To reflect this, the code consists of a number specifying the type of survey, followed by a letter specifying the positioning accuracy.

2.A.2 - Type Category

- a- Sounding is from a single track. In this case the position accuracy code selected must be based on the geographical position accuracy.
- b- Sounding is from a systematic survey of a large area. In this case the position accuracy code must be determined by the relative accuracy between positions in the area followed by the geographical accuracy of the survey as a whole, the two code letters being separated by a slant line.

2.A.3 - Accuracy Category

Accuracy of 95% of positions:

- D Better than 100 metres
- E Better than 500 metres
- F Better than 2km (1.0 NM)
- G Better than 10km (5.0 NM)
- H Worse than 10km (5.0 NM)
- Z Position accuracy not specified.

Examples of positioning methods which may meet the above accuracy categories:

- D.
 - (i) Radio navigational systems using frequencies of 1 500 kHz or higher,
 - (ii) Acoustic range on fixed transponder - the absolute accuracy depending upon the accuracy with which the transponders are located.
 - (iii) G.P.S. (Global positioning system),
 - (iv) Doppler satellite (dual frequency), with automatic course and speed input from inertial system speed input from inertial system or bottom lock sonar doppler or Rho-Rho navigational system using frequency of 100 kHz with ground wave reception in best conditions.
- E.
 - (i) Radio navigational system using frequencies of 100 kHz or higher with groundwave reception in best conditions,
 - (ii) Radio navigational systems using frequencies of 10 kHz or higher which are monitored by a fixed station within 500 km.,
 - (iii) Doppler satellite (dual frequency) with automatic course and speed input from an electronic positioning system.
- F.
 - (i) Doppler satellite (dual frequency) with manual input of course and speed from D.R. or an electronic positioning system,
 - (ii) Doppler satellite (single frequency).
- G.
 - (i) Radio navigational system using frequencies of 10 kHz or higher,
 - (ii) Celestial observations.

2.A.4 - Notes on Positions

- 2.A.4.1** The accuracy refers to the position of the sounding vessel. The position of the soundings, particularly when interpolated between fixes, may be of lower accuracy.
- 2.A.4.2** If positions are read off a plotting sheet, the scale of the sheet sets and upper limit on the accuracy of the positions.
- 2.A.4.3** The differences between geodetic datums, and between a local datum and a geocentric satellite navigation datum, may amount to several hundred metres. For geographic accuracies better than 500m (categories 1D, 1E, 2D and 2E) the datum used must be defined, either by a recognized terms (e.g. "Tokyo datum") or by quoting the reference ellipsoid's "a" and "1/f" values and the datum translation components X_o , Y_o ,

Z_0 that give the coordinates of the centre of the datum relative to the geocentre. (If the Navy Navigation Satellite System is used, its centre can be assumed to be at the geocentre).

2.A.5 - Example

A systematic offshore survey (category 2) using a positioning system employing radio frequency of 100 kHz (category E) but which was not calibrated and so could have geographical position error of up to 3km would be classified as 2 E/G.

PART 2.B - SOUNDINGS

2.B.1 - General

The accuracy with which the sounder can map the seafloor depends on the precision with which it measures the return travel time of the echo, and on the width of the beam, since a wide beam distorts the depicted shape of the seabed. To reflect this, the code consists of a number specifying the beamwidth followed by a letter specifying the time and recording accuracy (which will be matched in a well-designed sounder).

2.B.2 - Type Category

- a Very narrow beam; total beamwidth less than 6° to -3db point, or sounder deep-towed or in a submersible such that dimension of area "illuminated" is less than 1/10 of water depth.
- b Narrow beam; total beamwidth less than 12° to -3db point, or dimension of area illuminated less than 1/5 of water depth.
- c Normal beamwidth 12° or greater to -3db point.

2.B.3. - Accuracy Category

D	<u>Timing</u> High precision better than 0.1% travel time	<u>Recording</u> High precision, stable dry paper, or calibration marks applied by timer to give recording accuracy of + or - 0.1%. Digital recording to be of the same precision.
E	Better than 2% of travel time	Better than 2% of depth
F	Less accurate than 2%	Less accurate than 2%
Z	Sounding accuracy not specified	

2.B.4 - Example

A normal beamwidth sounder, crystal controlled to give better than + or - 0.1% timing accuracy and with time marks on the depth record, would be classified "3D".

PART 2.C - FIDELITY WITH WHICH SCALED SOUNDINGS REPRODUCE SEABED

2.C.1 - General

Ideally, a profile reconstructed from the scaled soundings would reproduce the original echogram exactly; no information would be lost. Unless the seabed is quite smooth, practical problems of man-hours, plotting scales, etc., reduce the "fidelity" of scaling. The classification reflects how closely the ideal has been approached under the existing constraints of seabed roughness and practical considerations. Since the wide swathe sounded by multi-beam array sonar provides a fuller picture of the seabed than a single beam, the "fidelity" classification includes a number to identify data from a multi-beam sounder.

2.C.2 - Type Category

- a. Single beam sounder used
- b. Multi-beam array sounder used

2.C.3 - Accuracy Category

- D Soundings scaled at peaks, deeps and points of change of slope; seabed smooth between soundings. On the depth profile, straight lines between scale soundings agree with the actual seabed within the tolerance established by the sounding accuracy.
- E Soundings scaled at peaks, deeps, and points of change of slope; seabed not smooth between soundings. On the deep profile, straight lines drawn between scaled soundings depart from the actual depth by more than the sounding accuracy.
- F Soundings scaled at equal intervals along the track, with a maximum of one deep and one peak scaled between each regular sounding; or soundings scaled at a specified contour interval plus all highs and lows.
- G Sounding scaled at equal intervals along the track.
- H Only spot soundings available.
- Z Sounding selection criteria not specified.

2.C.4 - Example

Soundings scaled at peaks, deeps and points of changes of slope. But due either to the seabed being very rough, or to constraints of time available, or a small plotting scale, the difference between the original echogram and a profile reconstructed from the scaled soundings will exceed the timing accuracy of + or - 0.1%. Classification is "E".

PART 2.D - DATA PROCESSING

2.D.1 - General

In compiling large-scale plots of seabed areas of special interest, and in reconciling data from different sources, it is useful to have the source data available and to know just how the depth measurements, which are in fact time measurements, were converted to true depth. This code consists of a number denoting whether or not the source data is supplied, and whether the sounding velocity used in recording depths is specified, followed by a letter giving the method used in correcting the soundings. It is assumed that corrections have been made for the depth of the transducer and, where appropriate (eg. over seamounts), reduced for the height of the tide.

2.D.2 - Type Category

- a Original or photocopy of line sounding echogram, or array sonar isobath graphic/digital recording, supplied. Recording velocity specified.
- b Original or photocopy of line sounding echogram, or array sonar isobath graphic/digital recording, supplied. Recording velocity not supplied.
- c Listing of original, uncorrected soundings supplied. Recording velocity specified.
- d Listing of original, uncorrected soundings supplied. Recording velocity not specified.
- e Only corrected soundings supplied.

2.D.3 - Accuracy Category

- D By sound velocity measurement at the time of the survey, giving a correction of an accuracy that matches the timing accuracy.
- E By sound velocity measurement at the time of the survey, giving a correction that is less accurate than the timing measurements itself.
- F By local sound velocity tables which are an improvement over "Echo-sounding Correction Tables" 3rd edition N.P. 139, (U.K.).
- G By "Echo-sounding Correction Tables" N.P. 139 (U.K.) 2nd edition.
- H By reference to Matthews Tables N.P. 139 (U.K.) 2nd edition.
- J Soundings are not corrected.
- Z Correction not specified.

2.D.4 Example

If a photocopy of the echogram were supplied with the recording velocity specified, and a listing of soundings corrected by N.P. 139 (U.K.) 3rd edition was also supplied, the classification would be "1G".

COLLECTIVE EXAMPLE

A systematic survey in which soundings were positioned to better than + or - 500 metres relative and + or - 2 km (1.0 NM) geographic accuracy; a normal beamwidth crystal controlled sounder was used; soundings were scaled at peaks, deeps and points of change of slope but it was not feasible to reproduce the entire echogram within the + or -0.1% timing accuracy; photocopy of the echogram was supplied, sounding recording velocity specified and soundings corrected by N.P. 139 (U.K.), 3rd edition. The classification would be :

(Position)	(Sounding)	(Fidelity)	(Data)
2E/F	3D	1E	1G