

8th Meeting of the Hydrographic Services and Standards Committee
14-18 November 2016, IHB, Monaco

Submitted by:	Chairman, NCWG
Executive Summary:	NCWG High Priority Work Plan item B1 is to 'Develop guidelines for preparation & maintenance of small / medium scale ENC schemes'. An initial version was submitted to HSSC7, but NCWG was requested to separate the guidance on INT chart schemes from that for ENC.
Related Documents:	S-11 Part A; HSSC7/Action 22; NCWG Letters 06 and 11/2016
Related Projects:	None

Introduction / Background

Draft revision of S-11 Part A showing changes, from existing version 2.0.5 (May 2012), in red (Annex A) and clean copy (Annex B).

This version has been revised following the decision of HSSC7 to separate the guidance for INT chart and ENC schemes and also to conform to the probable new layout of S-11 agreed at NCWG2.

Action Required of HSSC

The HSSC is invited to approve this revision of S-11 Part A for submission to IHO Member States for publication.

INTERNATIONAL HYDROGRAPHIC ORGANIZATION

Guidance for the Preparation and Maintenance of International (INT) Chart and ENC Schemes

and

Catalogues of INT Charts and ENCs

Part A – Guidance

Red Line Version

PREFACE

1. The International Hydrographic Organization (IHO) was formed in 1921 as the result of a desire for greater standardization of nautical charts and associated publications and consequently for greater safety of mariners. It was felt that this standardization could be achieved in such a way that language and symbol differences would be minimized and that a chart produced by one country would be perfectly comprehensible to a navigator from another country.
2. Although measures have been taken since the formation of the ~~IHO—International Hydrographic Bureau (IHB) in 1921~~ to develop standards to be followed nationally when producing charts and publications, it was not until 1967 that the concept of an international (INT) chart was proposed. It was felt that, instead of several different hydrographic offices each producing different charts of the same ocean area, often with differing data, scales and limits, it would be both more economic and safer if one hydrographic office would compile and produce an original chart to internationally agreed specifications. ~~and that Other hydrographic offices would then~~ be able to print the chart, using the basic reproductive material provided by the original producer nation but substituting their own language, if they wished.
3. The first step was to agree on the standardization of the format and symbols to be used on international charts. The 1967 International Hydrographic Conference (IHC) established a Commission which, working by correspondence, ~~—developed the "Chart Specifications of the IHO"~~ which were adopted at the 1982 ~~IHC—International Hydrographic Conference~~. These Specifications are now contained in ~~published as~~ IHO Publication S-4. They are applicable to all INT Charts and recommended also for all national chart series.
4. It was also necessary to develop an agreed scheme, at agreed scales, to provide world-wide coverage. A system of two series of small scale paper charts at scales of 1:10 million (19 charts) and 1:3,5 million (60 charts) was agreed. The two series were published during a 15 year period starting in 1972. This provided international shipping with uniform modern chart coverage for all ocean passages. **Specifications for these small scale INT charts are contained in S-4 Part C.**
5. In 1982, the success of the small-scale INT Chart Series led to consideration of extending the concept to include charts at medium and large scales. Following the ~~IHC International Hydrographic Conference~~ of that year, the North Sea Hydrographic Commission began to assess the problem by ~~conducting making~~ a pilot study of the North Sea. Once again, the IHO Member States involved had to agree to a chart scheme that would satisfy the needs of international shipping for that area. It was agreed that this would include medium scale charts of coastal and sea areas at scales between 1:150 000 and 1:1,5 million, and approach and harbour charts at scales greater than 1:150 000. Agreement

was also ~~had been~~ reached that the maximum paper size should be defined as being A0 (1189 x 841 mm). Specifications for these medium and large scale INT charts are contained in S-4 Part B.

6. Following the study of INT Charts at medium and large scales for the North Sea, Regional Chart Committees or Groups were established, within the relevant Regional Hydrographic Commissions (RHC), for a number of other regions around the world. Their task was ~~being~~ to develop and maintain chart schemes of paper nautical charts for their regions, leading eventually to ~~a full total~~ world coverage of INT Charts at medium and large scales for ~~all of~~ the world's main shipping routes, ports and port approaches. This coverage may be complemented by large scale national charts for navigation by mariners requiring a more detailed knowledge of a country's waters. INT Charting regions were thus set up, covering the world's oceans.

7. ~~With the~~ Increased production of Electronic Navigational Charts (ENC) ~~(Electronic Navigational Charts)~~, has driven the need for similar principles to those already applying to ~~for~~ paper nautical charts, in respect of coordinated scheme development, production and maintenance, ~~was identified~~. This created the concept of International Charting Coordination Working Groups (ICCWG) which ~~will~~, on a regional basis, collaborate and coordinate activities for ~~in respect of~~ both paper and electronic charts.

8. Hydrographic offices have created small scale ocean coverage ENCs from INT paper charts in the 1:10 million and 1:3,5 million scale series, essentially replicating the scheme for these small scale paper charts without the assistance of ICCWGs. However, constraints on the design and content of ENCs make simply replicating the schemes and content of larger scale paper charts impractical. Therefore, coordination and harmonization of ENC schemes through ICCWGs is considered to be beneficial.

~~8.9.~~ Guidance for the Preparation and Maintenance of International (INT) Chart Schemes ~~and generic Terms of Reference for ICCWG are~~ is contained in Section 100 ~~Part A~~ of S-11 Part A. Guidance for the Preparation and Maintenance of Small and Medium Scale ENC schemes is contained in Section 200 of S-11 Part A. Generic Terms of Reference for ICCWG are included as Annex I. ~~The guidance refers to paper nautical charts only, pending development of equivalent guidelines for the preparation and maintenance of small and medium scale ENC schemes.~~

~~9.10.~~ The current status of ~~INT charting~~ development and production, at all scales and in all regions, is presented in ~~Part B~~ Section 100 of S-11 Part B for INT charts, and in Section 200 of S-11 Part B for ENC.

Guidance for the Preparation and Maintenance of International (INT) Chart Schemes

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1. INTRODUCTION

1.1 **Regional Hydrographic Commissions (RHC)**, the creation of which was encouraged ~~by the IHB~~ under IHO ~~Administrative Resolution T1.3~~ Programme 3, Resolution 2/1997 (as amended), bring together those Member States having common regional interests in ~~problems of nautical charting~~¹, research or data collection, so that cooperative solutions to these problems may be reached. Regional Charting Groups (~~RCC~~) or Committees, later re-titled **International Charting Coordination Working Groups (ICCWG)**, may also exist ~~at the regional level~~. These were set up following Decision 26 of the XII IHC in 1982 with “a primary objective of developing integrated schemes of **International (INT)** charts for the areas concerned”.² They consist of any Member States with an interest in the charting of a particular region. The ~~Chairman~~ coordinator of such a group is referred to as the **Regional Coordinator** (see Annex II), who advises and reports to the relevant RHC (see paragraph 3.10 of Annex I).

1.2 ~~The **Chart Standardization and Paper Chart Nautical Cartography Working Group (CSPNCWG)** (formerly the Chart Standardization ~~Committee~~ and Paper Chart Working Group (CSPCWG)) has a range of duties in the charting field, as set out in IHO ~~Technical Resolutions (TR) B5.4, B5.6~~ 2/1982 (as amended) and ~~K2.11~~ 11/2002 (as amended). In particular, it has an on-going role (~~TR B5.4~~) to ~~advise the IHB on the setting up of RHCs and ICCWGs to develop integrated schemes of International (INT) charts at medium and large scales. Under TR B5.4, it also has the responsibility to offer advice on the construction of INT chart schemes, in order to ensure homogeneity. This role of the CSPCWG is purely consultative.~~~~

¹ Nautical chart: A chart specifically designed to meet the requirements of marine navigation, showing depths of water, nature of bottom, elevations, configuration and characteristics of coast, dangers and aids to navigation. May be a paper chart, electronic navigational chart (ENC) or a raster navigational chart (RNC). Also called marine chart, hydrographic chart, or simply chart. [IHO Hydrographic Dictionary].

- Keep under continuous review S-11 Part A 'Guidance for the Preparation and Maintenance of International (INT) Chart and ENC Schemes' in order to advise the IHO Hydrographic Services and Standards Committee (HSSC) on its updating;
- Advise the International Hydrographic Bureau (IHB – to be replaced by "IHO Secretariat" when the IHO Secretariat is established) and RHCs, as appropriate, on the work of ICCWG in order to promote the production of INT charts; and
- Offer advice based on NCWG experience to ICCWG and individual Member States on chart schemes and cartographic work, in order to strongly encourage adherence to IHO charting specifications.

1.3 ~~This The basic~~ guidance for application to INT charts, ~~which was has been~~ prepared by the Chairman and Secretary of the CSPCWG. ~~It draws-drew~~ upon, and superseded, that contained in former IHO Publication SP-48. It is intended to be used as an aide-memoire and should be used in conjunction with the Regulations of the IHO for ~~International (INT)~~ Charts in IHO Publication S-4, Part A, and the Specifications of the IHO for ~~International-INT~~ Charts in S-4 Parts B ~~& and~~ C.

~~1.4 This guidance refers to paper nautical charts only, pending development of equivalent guidelines for the development and maintenance of small and medium scale ENC schemes.~~

2. OBJECTIVE AND CONCEPT

2.1 The overall objective for International (INT) charts differs from that for **national charts**, which must permit the safe navigation of **all** classes of vessels throughout their coastal waters. ~~This includes including~~ major ports visited by the largest vessels and minor arms of the sea which are of purely local interest. National charts must also satisfy the requirement for an information source on behalf of a variety of national users other than navigators. The combined effect of these two requirements has caused national chart series to cover national waters in great detail. Very large scale charts may be used for port plans, and there are usually at least two continuous coastal **paper chart** series, one on a relatively large-scale, the other slightly smaller.

2.2 For **INT International** charts, the overall objective is the creation of a compact set of medium- and large scale charts that are specifically designed for planning, landfall and coastal navigation and access to ports used by ships engaged in international trade. Their content will, therefore, differ from that of national charts. A careful selection of detail on ~~International (INT)~~ charts will allow updates to be restricted to items which are essential for international shipping, thus keeping the maintenance of the series ~~to manageable proportions. Conceived for the needs of the international mariner, International INT chart design will be uninhibited by national boundaries or political considerations. They will not attempt to fulfil the needs of local shipping nor act as national information sources.~~

2.3 ~~Conceived for the needs of the international mariner, INT chart design will be uninhibited by national boundaries or political considerations. They will not attempt to fulfil the needs of local shipping nor act as national information sources. However, it is recommended that, for the sake of economy, national chart series are designed so that selected charts can be used for the INT chart series (see 3.3.2).~~

~~2.3 In all cases, the content of INT charts must be complete and comprehensive for use by international mariners. They should not require reference to other national charts for any information required by the international mariner.~~

2.4 The content of INT charts must be sufficiently complete and comprehensive to enable international mariners to navigate to their destination; there should be no need for them to use larger scale national charts.

~~2.4 It is recommended that, for the sake of economy, national charts series are designed so that selected charts can be used for the International chart series (see 3.3).~~

2.5 The language must be English although other languages may be supplementary options within the chart.

3. PROCEDURE

3.1 Port Selection.

3.1.1 The ports to be covered by large scale and, where necessary, approach ~~scale charts plans~~ should be selected through consultation within the ~~ICCWG—International Charting Coordination Working Group~~. It is important to establish the frequency of use of the ports by international shipping and their charting needs for navigation (plan, execute, monitor, modify) and compliance under SOLAS Chapter V. Statistical data for the volume of traffic at each port should be sought from the relevant authorities. This may include the net registered tonnage of ships arriving each year and the proportion of this tonnage under foreign flags. Where statistical data are not available, other approaches can be used, such as a study of the traffic of companies using a particular area, the number of charts sold or advice from the national authority.

3.1.2 In less developed areas, consideration can be given to including harbours because of their importance as regional centres or as the main port of an island or group of islands.

3.1.3 Other ports, ~~and~~ anchorages, offshore terminals and production areas may need charts designed to meet the individual navigational requirements of certain sectors of users, such as ~~to be included to satisfy~~ the needs of cruise liners. Particularly for such selections, the type of chart to be produced (paper, ENC or both formats) must be specified so as to satisfy users' needs.

3.1.4 This selection of ports forms the framework around which the chart scheme is built. The choice of ports must be kept under review in ~~the~~ light of new developments and the chart scheme adjusted accordingly.

3.2 Shipping Routes.

3.2.1 The major routes along the coasts and in the approaches to ports that are used by international shipping should be identified. AIS data can be utilised in locating shipping movements. The inclusion and impact of routeing measures (both IMO-approved and national), vessel traffic services, pilotage and port operations management must also be considered. Where there is a good chance of obtaining a response, existing chart users and international commercial shipping companies should be consulted. In general, a better response will be obtained if users are asked to comment on options rather than to come up with solutions on their own.

3.3 Comparison of Catalogues.

3.3.1 All relevant IHO Member States' chart catalogues should be examined. The catalogues of other countries, in particular those providing extensive regional or world cover, are likely to give a good ~~better~~ indication of the scales and numbers of charts likely to be appropriate for the international mariner ~~than that of the nation whose waters are being considered~~.

3.3.2 Ideally, ~~the~~ INT chart limits and scales should conform to the corresponding charts, present or projected, in the local national series. Such charts, which may not always be the largest scale national charts, can then be modified, or prepared from the start, to full INT specifications, as required for all ~~International~~ INT charts. They can then often be published with a minimum of delay. It will not always be possible to simply select INT charts from existing national series. Where new limits and scales are proposed for INT charts, the member country should be encouraged to amend their national chart series to accommodate the INT coverage, so that, for example, the smaller of the two national coastal series may be utilised for ~~International~~ INT charts.

3.4 Scale.

3.4.1 The choice of scales should depend upon the navigational requirements of international shipping and the need to provide a coherent and logical scheme of charts for a route or for port entry.

Although the precise structure of the scheme may vary from area to area, reflecting different hydrographic and navigational requirements, it will usually be possible to identify the navigational purposes for INT charts:

- **Berthing.** Detailed data to aid berthing, at very large scales. It will often be appropriate to include these as inset plans on Harbour charts.
- **Harbour.** To ~~Generally at scales larger than 1:30 000 these will~~ provide for port entry, and navigating within ports, harbours, anchorages, bays, rivers and canals. **Generally at scales larger than 1:30 000.** Sometimes the largest scale equivalent national charts will be followed; sometimes the smaller of such scales will be adequate for the International series, since it is in harbour plans that the national information document role of nautical charts is most clearly seen.
- **Approach.** To provide ~~Generally at scales between 1:30 000 and 75 000~~ for navigating in the approaches to ports, in major channels or through intricate or congested waters. **Generally at scales between 1:30 000 and 1:75 000.** Such areas may well contain complicated traffic routing measures. Uncomplicated port approaches should not warrant the provision of separate approach charts; in such cases, the harbour charts should be scribed with sufficient sea-room offshore to permit the safe transfer by the user from the appropriate chart of the coastal series.
- **Coastal.** To provide for coastal navigation and coastal shipping routes. It is desirable, but not essential, that a continuous coastal series should have a uniform scale since this offers a number of advantages to:
 - the navigator in being presented with a common display along a route and in transferring fixes;
 - the cartographer in compiling the overlaps; and
 - the database manager in facilitating the creation of a seamless database for the Navigational Purpose.

Generally at scales between 1:75 000 and 350 000, ~~for coastal navigation.~~ Where a national chart series has ~~Many national series have~~ two continuous coverage coastal scales ~~series;~~, usually the smaller scale will be adequate for the needs of international shipping. ~~It is desirable, but not essential, that a continuous coastal series should have a uniform scale since this offers advantages to the navigator in transferring fixes; the cartographer in compiling the overlaps; and it may also facilitate the creation of a seamless database for Electronic Navigational Charts (ENCs).~~ In some areas, however, it may be desirable to have intermediate scales to meet the needs of a large volume of offshore traffic or to give overall cover to extensive offshore shoal areas or outlying island groups.

- **General.** To provide for landfall identification and non-oceanic route planning. Generally at scales between 1:350 000 and 1:2 000 000. ~~These medium scale charts are intended for landfall identification and non-oceanic route planning.~~
- **Overview.** To provide for route planning and ocean passage before progressing to 'General' for landfall purposes. Generally scales at 1: 2 000 000 and smaller, ~~intended for route planning and ocean crossing. These will~~ normally be provided for by the two established series of small scale INT charts, details of which can be found in **Section 100 of S-11 (Part B).**

3.4.2 ~~Note:~~ It will not always be necessary to use all the above scale bands. ~~(For example, in uncomplicated areas an Approach chart will not usually be necessary where it is considered that a Coastal chart satisfies mariner requirements).~~ For INT charts the best appropriate scale based on this guidance should be determined by the ICCWG. ~~Also, the scale bands above are those that are usually suitable for International charts;~~ For national chart series, the scale bands may also ~~well~~ be different. ~~(For example, the national Coastal band may well include charts as large scale as 1:50 000 or as small scale as 1:500 000).~~ Other values may be used if agreed by the ICCWG.

3.4.3 If there is no conflict with other important criteria, the charting scale should not ~~normally~~ be larger than the available source material.

3.5 **Geodetic Datum and Projections**~~and mid-latitudes.~~

3.5.1 INT charts should be referenced to WGS 84 Datum or equivalent and, where not, priority should be given to their re-positioning to WGS 84 Datum as a significant part of their modernisation (S-4, B-201 refers). The choice of projection for INT charts and in the case of Mercator projections, the mid-latitude, should be made in accordance with the INT Specifications, contained in S-4, B-203 and B-211.

3.6 **Dimensions.**

3.6.1 Within the standards laid down in the INT Specifications (S-4, B-222) the regional preferences for the chart dimensions should be determined. The printing capabilities of all potential Producer and Printer Nations should be investigated, in order to determine both the preferred and maximum sizes to be used for charts in the regional scheme. ~~Annex A Section 100 of S-11 Part B~~ lists potential Printer Nations ~~while Annex B and provides gives~~ details of the use of A0 size paper.

3.7 **Limits and Overlaps.**

3.7.1 It is the detailed limits and the degree and arrangement of overlaps, which largely determine the quality of a scheme. In general, overlaps between INT charts should be sufficient to enable the mariner to safely transfer ~~their his~~ position from one chart to the next. They should be designed so that changing charts in an area of complicated navigation is avoided. Larger overlaps may sometimes be necessary where, for example, an important strait is covered on two charts to allow an adequate depiction of both approaches. Particular care is needed to ensure the provision of adequate overlaps with schemes in adjoining Regions. **More specifically, the following should be considered:**

~~3.7.2~~ • For schemes of **coastal charts**, ideally each major port should lie towards the centre of a sheet, allowing approach from all directions. This principle can, therefore, provide the starting point for the remainder of the sheet limits.

~~3.7.3~~ • The **area covered** by any chart should be a coherent unit where possible, **for example:** ~~eg~~ an ocean, a bay, a port approach, a strait. If the chart has an obvious title this condition is usually satisfied.

~~3.7.4~~ • Each chart should have **adequate sea room** and allow satisfactory transfer to adjoining charts and to the next larger or smaller scales. This is particularly important in any chart used for entering and leaving port.

~~3.7.5~~ • The **land area** shown should include the visual and radar horizons.

~~3.7.6~~ • **Overlaps** should include at least one good fixing point. They should be of such extent as to allow adequate time to transfer the course and ship's position, but not be so large as to create a need to duplicate ~~correction~~ updating unnecessarily. They need to avoid cutting off visual marks or ~~radiobeacons~~ radio-transmitted aids to navigation near the edges of charts that might be used in position fixing. On coasts where there are many off-lying islands and shoals, overlaps need to be large enough to include visual transits of objects in line.

~~3.7.7~~ • The **objects that determine the heading of a vessel** should appear on the chart even **if it means having at the expense of** a large overlap.

~~3.7.8~~ • There should be room for the **chart title**, notes, scales etc, without obliterating important hydrographic detail, or reducing the effective overlap between charts.

~~3.7.9~~ • **Features** which should be within the chart's limits ~~if at all possible~~ and not just outside them are:

- Lights, radio aids, navigational buoys and beacons (especially landfall buoys on port approach sheets and beacons controlling transits in fairways).
- Pilot boarding stations, anchorages, radio reporting points.
- Prominent dangers, protruding coasts and offshore islands.

- ~~Traffic separation schemes~~ **Routeing systems**, dredged channels, recommended tracks etc. Features under this heading should not be split by chart limits, unless, like some **traffic** separation schemes, they are extensive enough to cover several charts.
- Conspicuous or prominent features (natural or artificial) on the land, ~~e.g. for example:~~ radio masts, chimneys, hill summits.

~~3.7.10~~ **3.7.2** It is possible occasionally to meet the above requirements by **moving the chart limits** in one direction or another, changing the scale or the mid latitude in a Mercator scheme, or increasing the number of charts. The remaining possibilities are:

- **To** break the inner border and continue the work to the outer border (but preferably not beyond).
- **To** continue the work which cannot be included in situ, in an inset plan, if there is room for this (not normally appropriate for fixing marks).
- **To** design the chart in separate sections, for example to cover a North/South oriented channel.

~~3.7.14~~ **3.7.3** Charts with the longer side running east-west are in **'landscape' format**. They are convenient for use on chart plotting tables and are therefore the preferred format in scheming decisions.

3.8 Chart Numbering.

3.8.1 Blocks of approved INT chart numbers, sub-divided on a regional basis, have been allocated to major areas. These numbers are listed in S-4, part A-204, together with the principles by which the numbers are allocated within a region. There should preferably be a logical order to the allocated INT numbers (~~e.g. for example,~~ a series of charts numbered sequentially around a coast).

3.8.2 In some instances, these allocations will need to be agreed with the Coordinators of adjoining regions who may share the same block. It is possible, if necessary, to transfer blocks of numbers from one region to another, with the agreement of the relevant Regional Coordinators and the **NCWG** ~~CSPCWG~~ Chairman.

3.8.3 When a Producer replaces an existing **INT International** chart by a **new INT International** chart (~~i.e. that is,~~ one where the area covered has changed significantly, **see S-4 B-601.3**) then a new INT number should be allocated by the Regional Coordinator. The old INT number should ~~preferably~~ not be re-used for at least five years.

3.9 Draft Schemes.

3.9.1 A first draft of **any new or amended** ~~the~~ INT chart scheme should be prepared. Indexes should be drawn on a large enough scale to show clearly where the proposed chart limits intersect coastline detail. These indexes should be accompanied by a list of chart numbers, together with the chart scales, geographical limits and inner neat-line dimensions. Where proposed INT charts correspond to existing national charts, this should be indicated. In some complex cases, explanatory notes of how particular ~~charts sheets~~ were schemed should be included.

3.10 Consultation.

3.10.1 **Cooperation and collaboration is important and essential to ensure the optimum outcome in the charts produced and the consistency of their content.** Draft INT chart schemes should be circulated for comment to the following, **as appropriate:**

- All members of the **ICCWG** ~~International Charting Coordination Working Group~~ and, where appropriate, members of the **RHC** ~~Regional Hydrographic Commission~~.
- The Coordinators of adjoining ~~ICCWGs International Charting Coordination Working Groups~~, if the scheme impacts on their region.
- Hydrographic offices producing or printing charts in the region.

- The Chairman of the ~~NCWG-CSPCWG~~.
- The ~~International Hydrographic Bureau-IHB~~ (IHO Secretariat).

~~3.10.2 3.10.1~~ Comments received should be considered and discussed as necessary and the initial scheme should be refined ~~accordingly into a second draft version~~. It may be necessary to produce further draft versions before final agreement is obtained. In general, the smaller the scale the more necessary it is to obtain a wide consensus. This consultation can generally be effected by correspondence. However, meetings of the ~~ICCWG International Charting Coordination Working Group~~ at significant points ~~may will~~ speed up the process. The final draft of the scheme should be submitted to the RHC for formal approval.

~~3.10.3~~ For minor changes to INT chart schemes, see 3.12.

3.11 Allocation of Producers.

3.11.1 In most cases, the allocation of Producer Nations for INT charts will be a fairly straightforward process. For most medium- and large-scale INT charts, the Producer Nation will be the IHO Member State with responsibility for charting the waters covered by these charts. There will, however, be some exceptions. (For further information, see S-4, A-203).

3.11.2 Where an INT chart covers the waters of more than one nation, a single Producer Nation should be agreed. Nations may collaborate in the production, the resulting chart carrying both nations' seals (crests). Examples of collaboration include:

- Two nations compiling sections of the chart to an agreed dividing line, such as the median line, with the producer nation joining the sections and producing the finished reformat.
- One nation compiling the chart, the other nation completing quality control, reformat production and printing for both nations.

3.11.3 In such cases, the Producer Nation will usually be that nation which is responsible for the content and creation of the final chart.

3.11.4 ~~3.11.3~~ An agreed production schedule should be determined when the allocation of Producer Nations has been completed for all the proposed INT charts. This will facilitate the forward planning for the adoption of these charts by potential Printer Nations and will enable the ~~ICCWG International Charting Coordination Working Group~~ to monitor future progress. It would also be advisable, at this stage, to give consideration to the preparation of a Regional INT Chart Catalogue. This would ultimately provide the source data for the IHO catalogue (Section 100 of S-11 (Part B)). In reality, some nations may start production before the allocation is completed.

3.11.5 ~~3.11.4~~ Where a chart has been included in the INT scheme, but the national ~~IHO hydrographic office~~ is unable to effect its production within an acceptable timescale, its production may be undertaken, with the agreement of the national ~~IHO hydrographic office~~ concerned, by a potential Printer Nation.

3.12. Review.

3.12.1 It will be necessary to keep ~~all these~~ INT chart schemes under continuous review. Adjustments will be required in order to cater, for example, for:

- ~~†~~The expansion of existing ports.
- ~~†~~The development of new ports.
- ~~€~~Changes to routing measures. ~~and~~
- ~~†~~The re-positioning of major aids to navigation ~~at aids~~.

3.12.2 The consultation process (~~Section clause~~ 3.10) needs not ~~aim to~~ finalise every detail of every INT chart in ~~a the~~ scheme. Once the general requirements, scales and limits have been agreed, it may be left to the designated Producer Nation to make the final detailed decisions. It will not normally be necessary to obtain the approval of the Regional Coordinator ~~of the ICCWG~~ for a minor amendment to an individual chart. It can often take many years to finalise a regional INT chart scheme and, in that time, national charts which are candidates for inclusion may themselves have

been re-schemed, although the adequacy of the overall coverage will not have changed. However, for major changes to a chart (for example, to scale or limits which could reduce overlaps or even create a gap in a scheme), for partial re-scheming and for the addition or deletion of an INT chart, the ICCWG should be consulted, via the Regional Co-ordinator.

3.13 Maintenance of S-11.

3.13.1 Any changes to scale, limits or numbering of INT ~~International~~ charts, which affect Section 100 of S-11 Part B '~~Catalogue of International~~ International Charts Web Catalogue', ~~shall~~ must be notified by the Regional Coordinator or other designated regional representative to the IHB, who will update the Catalogue.

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1. INTRODUCTION

1.1 The **Hydrographic Services and Standards Committee** (HSSC) tasked the **Chart Standardization and Paper Chart Working Group** (CSPCWG – now Nautical Cartography Working Group (NCWG)) to extend the guidance developed for INT charts to include guidelines for the development and maintenance of small and medium scale Electronic Navigational Chart (ENC¹) schemes. This extended guidance was prepared by the **North Sea ENC Harmonisation Working Group** (NSEHWG), under the direction of its Chairman and Secretary (2013), building on earlier work by the **Worldwide Electronic Navigational Chart Database Working Group** (WENDWG); and to fulfil parts of the requirements of Resolution 1/1997 (as amended). It should be used in conjunction with Resolution 1/1997, IHO Publication S-57 and its Appendices, as well as S-4.

1.2 **Regional Hydrographic Commissions** (RHC) bring together those Member States having common regional interests in nautical charting, research or data collection, so that cooperative solutions to these problems may be reached. **International Charting Coordination Working Groups** (ICCWG) may also exist at the regional level, with 'a primary objective of developing integrated schemes of International (INT) charts for the areas concerned', which has since been extended to include ENC schemes. They consist of any Member State with an interest in the charting of a particular region. The coordinator of such a group is referred to as the **Regional Coordinator**, who advises and reports to the relevant RHC (see Annex II).

1.3 **The Nautical Cartography Working Group** (NCWG) has a range of duties in the charting field, as set out in IHO Resolutions 2/1982 (as amended) and 11/2002 (as amended). In particular, it has an on-going role to:

¹ ENC: The data base, standardized as to content, structure and format, issued for use with ECDIS on the authority of government authorized hydrographic offices. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation. [IHO Hydrographic Dictionary].

- Keep under continuous review S-11 Part A ‘Guidance for the Preparation and Maintenance of International (INT) Chart and ENC Schemes’ in order to advise the IHO Hydrographic Services and Standards Committee (HSSC) on its updating;
- Advise the International Hydrographic Bureau (IHB – to be replaced by ‘IHO Secretariat’ when the IHO Secretariat is established) and RHCs, as appropriate, on the work of ICCWG in order to promote the production of ENCs; and
- Offer advice based on NCWG experience to ICCWG and individual Member States on ENC schemes and cartographic work, in order to strongly encourage adherence to IHO charting specifications.

2. OBJECTIVE AND CONCEPT

2.1 An Electronic Navigational Chart (ENC) is a digital vector chart, issued by or on behalf of a government authorized hydrographic office or other relevant government institution, which complies with the IHO ENC Product Specification and, when used in a type-approved Electronic Chart Display and Information System (ECDIS²), meets the requirements of the IMO SOLAS regulations for carriage of nautical charts. Within the ECDIS, the features and their attributes (for example: position, colour, shape) can be selectively displayed and queried, enabling the chart image to be manipulated on the screen. This not only provides ECDIS users with control over the level and type of detail they wish to see, but can also be linked to other onboard systems to provide additional features such as automatic alarms and indications.

2.2 The principles for the provision of ENC services in terms of coverage, consistency, quality, updating and distribution are encapsulated in the Worldwide Electronic Navigational Chart Database (WEND) Principles (IHO Resolution 1/1997 as amended). These principles have been developed to ensure ‘a world-wide consistent level of high quality, updated official ENCs through integrated services that support the chart carriage requirements of SOLAS Chapter V, and the requirements of the IMO Performance Standards for ECDIS’.

2.3 ENC scheme design will be uninhibited by national boundaries or political considerations (see paragraph 3.10.4).

2.4 The content of ENCs must, as a minimum, be sufficiently complete and comprehensive to enable international mariners to navigate to their destination. However, additional content intended to satisfy national requirements may also be included in ENCs, particularly in the larger scale (Navigational Purpose 3 to 6) ranges, noting that in using ENCs in an ECDIS, the burden on the user for updating and maintenance is much lighter compared to a paper chart folio. The objective of providing a folio of ENCs designed for planning, landfall and coastal navigation, nominally within (but not restricted to) the Navigation Purpose 1 to 3 ENC cell usage bands, should be considered in determining content and level of detail to be charted.

2.5 The language must be English although other languages may be supplementary options within the ENC.

3. PROCEDURE

3.1 Port Selection.

3.1.1 All ports that are selected for inclusion in the INT chart scheme, in accordance with the guidance at paragraph 3.1.1 of Section 100, must be included in large scale (that is, Berthing or Harbour Navigational Purpose) ENC schemes. Other ports, anchorages, offshore terminals and production areas may need ENCs designed to meet national requirements including the individual navigational requirements of certain sectors of users, such as the needs of cruise liners.

² ECDIS: A navigation information system which with adequate back-up arrangements can be accepted as complying with the up-to-date chart required by regulations V/19 and V/27 of the 1974 SOLAS convention, as amended, by displaying selected information from a System Electronic Chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and if required display additional navigation-related information.

3.2 Shipping Routes.

3.2.1 The major routes along the coasts and in the approaches to ports that are used by international shipping should be identified. AIS data can be used in identifying shipping movements. The inclusion and impact of routeing measures (both IMO-approved and national), vessel traffic services, pilotage and port operations management must also be considered. Where there is a good chance of obtaining a response, existing chart users and international commercial shipping companies should be consulted. In general, a better response will be obtained if users are asked to comment on options rather than to come up with solutions on their own.

3.3 Comparison of Schemes.

3.3.1 All relevant regional (if they exist) and IHO Member States' national ENC schemes should be examined. The schemes of other countries, in particular those providing extensive regional coverage, are likely to give a good indication of the scales and numbers of ENCs likely to be appropriate for the international mariner.

3.4 Scale.

3.4.1 The choice of scales should depend upon the navigational requirements of international shipping and the need to provide a coherent and logical scheme of charts for a route or for port entry. Although the precise structure of the scheme may vary from area to area, reflecting different hydrographic and navigational requirements, the Navigational Purpose of each ENC must be clear. Navigational Purposes are derived from and defined in S-57 Appendix B.1 – ENC Product Specification; and a further theoretical link between scale and Navigational Purpose is defined within the ENC consistency recommendations in IHO Publication S-66 – Facts about Electronic Charts and Carriage Requirements. S-66 also provides a more detailed correlation between scale, Navigational Purpose and selectable radar range display scales. For ENCs it is important that, where possible, there be a regional commonality of scale across at least the Overview and General Navigational Purposes, noting that the suggested alignment of Navigational Purposes to scale ranges in S-66 is not mandatory.

3.4.2 The term 'compilation scale' is used differently for paper (raster) charts and ENCs. In paper chart construction, compilation scale is that of the final analogue (printed) chart which displays content statically as it is designed by the hydrographic office to be shown. In ENCs, compilation scale refers to the optimum scale at which the compiling hydrographic office intends the ENC data to be displayed for the Navigational Purpose, while recognising the user's ability to modify the actual scale at which the ENC is viewed in the ECDIS. While there is no requirement to do so, consideration should be given to making the relationship between the compilation scales of at least the smaller scale Navigational Purposes for ENCs and corresponding INT charts consistent, in order to simplify chart maintenance requirements and provide greater consistency of product portfolios to the end user.

3.4.3 The following are general parameters in order to identify the Navigational Purposes for ENCs:

- **Berthing (Navigational Purpose 6).** Detailed data to aid berthing, at very large scales. The Berthing Navigational Purpose is recommended to have compilation scales larger than 1:4 000. Where the source data used to produce the ENC is of a scale larger than 1:4 000, then that source scale may be used as the compilation scale for the ENC.
- **Harbour (Navigational Purpose 5).** To provide for port entry, and navigating within ports, harbours, anchorages, bays, rivers and canals. The Harbour Navigational Purpose is recommended to have compilation scales between 1:4 000 and 1:21 999. The available corresponding compilation scales for the Harbour scale band as related to standard selectable radar range display scales are 1:4 000, 1:8 000 and 1:12 000.
- **Approach (Navigational Purpose 4).** To provide for navigating in the approaches to ports, in major channels or through intricate or congested waters. Such areas may well contain complicated traffic routeing measures. Uncomplicated port approaches should not warrant the provision of

separate approach ENC; in such cases, the harbour ENCs should be schemed with sufficient sea-room offshore to permit the safe transfer by the user from the appropriate ENCs of the coastal series. The Approach Navigational Purpose is recommended to have compilation scales between 1:22 000 and 1:89 999. The available corresponding compilation scales for the Approach scale band as related to standard selectable radar range display scales are 1:22 000 and 1:45 000.

- **Coastal (Navigational Purpose 3).** To provide for coastal navigation and coastal shipping routes. It is desirable, but not essential, that a continuous coastal ENC series should have a uniform scale since this offers a number of advantages to:
 - the navigator in being presented with a common display along a route;
 - the cartographer in achieving 'horizontal consistency' along ENC cell boundaries; and
 - the database manager in facilitating the creation of a seamless database for the Navigational Purpose.

The Coastal Navigational Purpose is recommended to have compilation scales between 1:90 000 and 1:349 999. The available corresponding compilation scales for the Coastal scale band as related to standard selectable radar range display scales are 1:90 000 and 1:180 000.

- **General (ENC Navigational Purpose 2).** To provide for landfall identification and non-oceanic route planning. For ENCs, the General Navigational Purpose is recommended to have compilation scales between 1:350 000 and 1:1 499 999. The available corresponding compilation scales for the General scale band as related to standard selectable radar range display scales are 1:350 000 and 1:700 000.

- **Overview (ENC Navigational Purpose 1).** To provide for route planning and ocean passage before progressing to 'General' for landfall purposes. For ENCs, the Overview Navigational Purpose is recommended to have compilation scales smaller than 1:1 499 999, and should be based on the 1:3 500 000 small scale INT paper chart series to provide a seamless and consistent scale coverage. The available corresponding compilation scales for the Overview scale band as related to standard selectable radar range display scales are 1:1 500 000 and 1:3 000 000. Where the source data used to produce the ENC is of a scale smaller than 1:3 000 000, then that source scale may be used as the compilation scale for the ENC.

3.4.4 It will not always be necessary to use all the above Navigational Purposes. For example, in uncomplicated areas an Approach ENC will not usually be necessary where it is considered that a Coastal ENC satisfies mariner requirements. S-57 and S-66 provide guidance only for the assignment of ENC Navigational Purpose to compilation and standard selectable radar range scales – the best appropriate scale based on this guidance should be determined by the ICCWG. For example, the Coastal band may include ENCs as large scale as 1:45 000 or as small scale as 1:350 000.

3.5 Geodetic Datum and Projections.

3.5.1 All ENCs must be referenced to WGS 84 Datum. There is no projection defined for ENC.

3.6 Dimensions.

3.6.1 ENC cells must be rectangular, defined by 2 parallels of latitude and 2 meridians of longitude. However the area covered by data within a cell does not need to be rectangular. It is important to note that the geographic extent of an ENC cell is not restricted by paper size. The geographic extent of the cell must be chosen by the ICCWG/ENC Producer to ensure that the resulting dataset file contains no more than 5 Megabytes of data. Subject to this consideration, the cell size must not be too small in order to avoid the creation of an excessive number of cells.

3.7 Coverage.

3.7.1 A mandatory carriage requirement for ECDIS means a consequential expectation that coastal States will ensure the provision of ENCs.

3.7.2 When scheming ENC cell limits, coverage may be based on 'equivalent' paper chart limits, a grid or a combination of both. If possible a Producer should not mix a combination of grid and paper chart limits in the same Navigational Purpose.

- The **area covered** in a given Navigational Purpose must be split into cells in order to facilitate the efficient processing of ENC data in ECDIS.
- Each cell must be contained in a physically separate, **uniquely identified file** on the transfer medium, known as a data set file (S-57 Appendix B.1, clause 5.6.3 refers).
- The **ENC scheme** must take account of ENCs that are already produced.
- Where a cell's data content is **captured from paper charts**:
 - Selection of data should be based on the most appropriate paper chart (for example: scale, currency).
 - In some cases, data may be incomplete due to the paper chart's design (for example: placement of chart title, scale etc) leading to the creation of 'no coverage areas'. Consideration should be given to compiling such areas from source, where data exists.
- When **edge matching** it is important for ENC Producers to use the same Coordinate Multiplication Factor (COMF). Producers should follow the IHO recommendations as defined in the ENC Product Specification to hold the ENC production systems at a resolution of 0.0000001 (10^{-7}) and the COMF value in the ENC cell header to 10 000 000 (10^7). It is also recommended to use the same Compilation Scale of Data (CSCL) in the ENC cell header for cells in the same Navigational Purpose; this helps to bring consistency at the boundary between two Producers.
- **Overlaps.** Cells with the same Navigational Purpose may overlap, however data within cells in the same Navigational Purpose must not overlap. Therefore, in an area of overlap only one cell may contain data, and all other cells of the same Navigational Purpose must have a meta object M_COVR with attribute CATCOV = 2 (no coverage available) covering the overlap area. This rule should apply even if several producers are involved; however, if it is difficult for technical reasons to achieve a perfect join at agreed adjoining national data limits, a 5 metre (on the ground) overlapping buffer zone may be used.

It has also been found that in addition to the unpredictable performance of ECDIS when cells of the same Navigational Purpose overlap, similar performance issues occur when data having the same compilation scale and within different Navigational Purposes overlap. Such performance issues reduce mariner confidence in using ECDIS and may impact on safety of navigation. Data Producers should therefore ensure that data within cells having the same compilation scale and different Navigational Purposes does not overlap, in addition to ensuring that data within cells of the same Navigational Purpose does not overlap.

- **International boundaries.** Refer to paragraph 3.10.4.
- A **data gap** between ENC cells designed to adjoin each other in the same Navigational Purpose must be avoided.

3.7.3 It is generally accepted that 87 degrees north is approximately the northern limit at which ENCs will perform adequately in an ECDIS; some ECDIS systems are limited in their ability to display ENCs for latitudes further north.

3.8 ENC Cell Naming.

3.8.1 ENC cells must be named (numbered) according to the convention in S-57 Appendix B.1 - ENC Product Specification, clause 5.6.3. If an ENC cell is cancelled, the ENC cell name (number) must not be reused.

3.9 Consultation.

3.9.1 In order to enhance consistency such that ENCs appear seamless in an ECDIS (termed 'ENC harmonization'), it is important to establish common ENC content standards (where open to

interpretation) both within a national ENC scheme and between different Producers' data where they adjoin. This should be achieved in consultation with neighbouring producer hydrographic offices; and with all nations within a Regional Electronic Chart Coordinating Centre (RENC), ICCWG or RHC, as appropriate. Examples of some obvious features that affect the mariner's use of data in an ECDIS include the application of SCAMIN, routing measures, critical information and depth contour intervals.

3.9.2 Cooperation and collaboration is important and essential to ensure the optimum outcome in the ENCs produced and the consistency of their content. Draft ENC schemes should be circulated for comment to the following, as appropriate:

- All members of the ICCWG and, where appropriate, members of the RHC.
- The Coordinators of adjoining ICCWGs, if the scheme impacts on their region.
- Hydrographic offices producing ENCs in the region.
- RENCs.
- Technical Experts Working Groups (for example: a regional ENC Harmonisation Working Group).
- The IHB (IHO Secretariat).

3.9.3 Comments received should be considered and discussed as necessary and the initial scheme should be refined accordingly. It may be necessary to produce further draft versions before final agreement is obtained. In general, the smaller the scale the more necessary it is to obtain a wide consensus. This consultation can generally be effected by correspondence. However, meetings of the ICCWG at significant points may speed up the process. The final draft of the scheme should be submitted by the Regional Coordinator to the RHC for formal approval.

3.9.4 For minor changes to ENC schemes, see 3.12.

3.10 Allocation of Producers.

3.10.1 The production of individual ENC cells can be assigned to only one ENC Producer Nation.

3.10.2 In most cases, the allocation of Producer Nations for ENCs will be a fairly straightforward process. For most medium- and large-scale ENCs, the Producer Nation will be the IHO Member State with responsibility for charting the waters covered by these ENCs.

3.10.3 Responsibility for the production of an ENC can be delegated by a national hydrographic office to another hydrographic office, which then becomes the Producer Nation in that area until such time as the national hydrographic office develops the capacity to maintain the ENC.

3.10.4 When the maritime limits of national jurisdiction between two neighbouring countries are not established, or it is convenient to agree boundaries other than at established international boundaries, producing countries should define the cartographic boundaries for ENC production within a technical arrangement. These limits are for cartographic convenience in ENC production only and do not have any significance, legal effect or status regarding political or other jurisdictional boundaries. Where agreed, such cartographic boundaries should be as simple as possible (for example a succession of straight segments and turning points, corresponding to meridians and parallels or paper chart limits). For technical reasons, diagonal lines should be avoided. When determining the boundaries of ENC coverage between adjoining States, it is important that a rigorous consultation process be initiated (refer to clause 3.9).

3.10.5 In areas of national jurisdiction for which there is no recognised ENC Producer Nation, the ICCWG or RHC must determine the ENC Producer Nation in consultation with the relevant coastal State. ENCs produced under such arrangements should be offered for transfer to the national hydrographic office of the coastal State in the event that the national hydrographic office subsequently develops the capacity to maintain the ENCs.

3.11 Review.

3.11.1 It will be necessary to keep all ENC schemes under continuous review. Adjustments will be required in order to accommodate changes, such as:

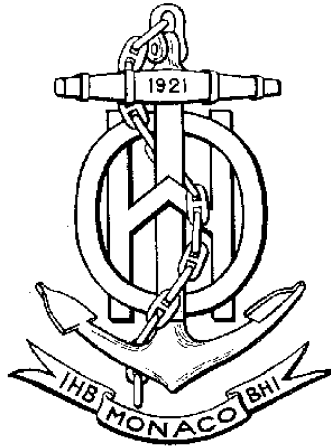
- The expansion of existing ports.
- The development of new ports.
- Changes to routing measures.
- The re-positioning of major aids to navigation.

3.11.2 The consultation process (clause 3.10) needs not finalise every detail of every ENC cell in a scheme. Once the general requirements, Navigational Purpose, compilation scales and cell limits have been agreed, it may be left to the designated Producer Nation to make the final detailed decisions. It will not normally be necessary to obtain the approval of the Coordinator of the ICCWG for a minor amendment to an individual ENC cell. However, for major changes to a cell (for example: scale and limits, to avoid overlaps or gaps), for partial re-scheming and for the addition or deletion of an ENC cell, the ICCWG should be consulted, via the Regional Coordinator.

3.12 **Maintenance of S-11.**

3.12.1 Any changes to scale, limits or naming of ENCs, which affect Section 200 of S-11 Part B 'IHO ENC Catalogue', must be notified by the Regional Coordinator or other designated regional representative to the IHB, who will update the Catalogue.

INTERNATIONAL HYDROGRAPHIC ORGANIZATION



**S-11 – GUIDANCE FOR THE PREPARATION AND MAINTENANCE
OF INTERNATIONAL (INT) CHART AND ENC SCHEMES**

And

CATALOGUE OF INTERNATIONAL (INT) CHARTS AND ENCS

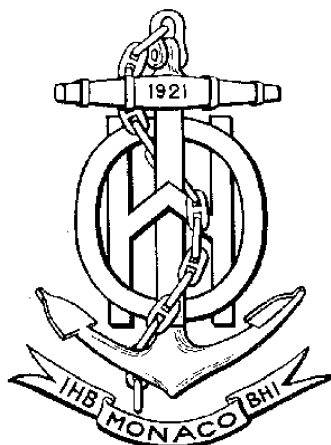
Edition 3.0.0 – April 2017

Publication S-11

Published by the
International Hydrographic Organization
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INTERNATIONAL HYDROGRAPHIC ORGANIZATION



PART A

**GUIDANCE FOR THE PREPARATION AND MAINTENANCE OF
INTERNATIONAL (INT) CHART AND ENC SCHEMES**

PART B

CATALOGUE OF INTERNATIONAL (INT) CHARTS AND ENCs

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INTERNATIONAL HYDROGRAPHIC ORGANIZATION

Guidance for the Preparation and Maintenance of International (INT) Chart and ENC Schemes

and

Catalogues of INT Charts and ENCs

Part A – Guidance

Clean Version

IHB to confirm new title pages, French language columns(?) and copyright statement as appropriate.

This version has been revised following the decision of HSSC7 to separate the guidance for INT chart and ENC schemes and to conform to the probable new layout of S-11 agreed at NCWG2.

PREFACE

1. The International Hydrographic Organization (IHO) was formed in 1921 as the result of a desire for greater standardization of nautical charts and associated publications and consequently for greater safety of mariners. It was felt that this standardization could be achieved in such a way that language and symbol differences would be minimized and that a chart produced by one country would be perfectly comprehensible to a navigator from another country.
2. Although measures have been taken since the formation of the IHO to develop standards to be followed nationally when producing charts and publications, it was not until 1967 that the concept of an international (INT) chart was proposed. It was felt that, instead of several different hydrographic offices each producing different charts of the same ocean area, often with differing data, scales and limits, it would be both more economic and safer if one hydrographic office would compile and produce an original chart to internationally agreed specifications. Other hydrographic offices would then be able to print the chart, using the basic reproductive material provided by the original producer nation but substituting their own language, if they wished.
3. The first step was to agree on the standardization of the format and symbols to be used on international charts. The 1967 International Hydrographic Conference (IHC) established a Commission which, working by correspondence, developed the 'Chart Specifications of the IHO' which were adopted at the 1982 IHC. These Specifications are now contained in IHO Publication S-4. They are applicable to all INT Charts and recommended also for all national chart series.
4. It was also necessary to develop an agreed scheme, at agreed scales, to provide world-wide coverage. A system of two series of small scale paper charts at scales of 1:10 million (19 charts) and 1:3,5 million (60 charts) was agreed. The two series were published during a 15 year period starting in 1972. This provided international shipping with uniform modern chart coverage for all ocean passages. Specifications for these small scale INT charts are contained in S-4 Part C.
5. In 1982, the success of the small-scale INT Chart Series led to consideration of extending the concept to include charts at medium and large scales. Following the IHC of that year, the North Sea Hydrographic Commission began to assess the problem by conducting a pilot study of the North Sea. Once again, the IHO Member States involved had to agree to a chart scheme that would satisfy the needs of international shipping for that area. It was agreed that this would include medium scale charts of coastal and sea areas at scales between 1:150 000 and 1:1,5 million, and approach and harbour charts at scales greater than 1:150 000. Agreement was also reached that the maximum

paper size should be defined as being A0 (1189 x 841 mm). Specifications for these medium and large scale INT charts are contained in S-4 Part B.

6. Following the study of INT Charts at medium and large scales for the North Sea, Regional Chart Committees or Groups were established, within the relevant Regional Hydrographic Commissions (RHC), for a number of other regions around the world. Their task was to develop and maintain chart schemes of paper nautical charts for their regions, leading eventually to full world coverage of INT Charts at medium and large scales for the world's main shipping routes, ports and port approaches. This coverage may be complemented by large scale national charts for navigation by mariners requiring a more detailed knowledge of a country's waters. INT Charting regions were thus set up, covering the world's oceans.

7. Increased production of Electronic Navigational Charts (ENC) has driven the need for similar principles to those already applying to paper nautical charts, in respect of coordinated scheme development, production and maintenance. This created the concept of International Charting Coordination Working Groups (ICCWG) which, on a regional basis, collaborate and coordinate activities for both paper and electronic charts.

8. Hydrographic offices have created small scale ocean coverage ENCs from INT paper charts in the 1:10 million and 1:3,5 million scale series, essentially replicating the scheme for these small scale paper charts without the assistance of ICCWGs. However, constraints on the design and content of ENCs make simply replicating the schemes and content of larger scale paper charts impractical. Therefore, coordination and harmonization of ENC schemes through ICCWGs is considered to be beneficial.

9. Guidance for the Preparation and Maintenance of International (INT) Chart Schemes is contained in Section 100 of S-11 Part A. Guidance for the Preparation and Maintenance of Small and Medium Scale ENC schemes is contained in Section 200 of S-11 Part A. Generic Terms of Reference for ICCWG are included as Annex I.

10. The current status of development and production, at all scales and in all regions, is presented in Section 100 of S-11 Part B for INT charts, and in Section 200 of S-11 Part B for ENC.

Part A: Section 100

Guidance for the Preparation and Maintenance of International (INT) Chart Schemes

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1. INTRODUCTION

1.1 **Regional Hydrographic Commissions (RHC)**, the creation of which was encouraged under IHO Programme 3, Resolution 2/1997 (as amended), bring together those Member States having common regional interests in nautical charting¹, research or data collection, so that cooperative solutions to these problems may be reached. Regional Charting Groups or Committees, later re-titled **International Charting Coordination Working Groups (ICCWG)**, may also exist at the regional level. These were set up following Decision 26 of the XII IHC in 1982 with “a primary objective of developing integrated schemes of International (INT) charts for the areas concerned”. They consist of any Member State with an interest in the charting of a particular region. The coordinator of such a group is referred to as the **Regional Coordinator** (see Annex II), who advises and reports to the relevant RHC (see paragraph 3.10 of Annex I).

1.2 **The Nautical Cartography Working Group (NCWG)** (formerly the Chart Standardization and Paper Chart Working Group (CSPCWG)) has a range of duties in the charting field, as set out in IHO Resolutions 2/1982 (as amended) and 11/2002 (as amended). In particular, it has an on-going role to:

- Keep under continuous review S-11 Part A ‘Guidance for the Preparation and Maintenance of International (INT) Chart and ENC Schemes’ in order to advise the IHO Hydrographic Services and Standards Committee (HSSC) on its updating;
- Advise the International Hydrographic Bureau (IHB – to be replaced by “IHO Secretariat” when the IHO Secretariat is established) and RHCs, as appropriate, on the work of ICCWG in order to promote the production of INT charts; and

¹ Nautical chart: A chart specifically designed to meet the requirements of marine navigation, showing depths of water, nature of bottom, elevations, configuration and characteristics of coast, dangers and aids to navigation. May be a paper chart, electronic navigational chart (ENC) or a raster navigational chart (RNC). Also called marine chart, hydrographic chart, or simply chart. [IHO Hydrographic Dictionary].

- Offer advice based on NCWG experience to ICCWG and individual Member States on chart schemes and cartographic work, in order to strongly encourage adherence to IHO charting specifications.

1.3 The guidance for application to INT charts was prepared by the Chairman and Secretary of the CSPCWG. It drew upon, and superseded, that contained in former IHO Publication SP-48. It is intended to be used as an aide-memoire and should be used in conjunction with the Regulations of the IHO for INT Charts in IHO Publication S-4 Part A, and the Specifications of the IHO for INT Charts in S-4 Parts B and C.

2. OBJECTIVE AND CONCEPT

2.1 The overall objective for International (INT) charts differs from that for **national charts**, which must permit the safe navigation of **all** classes of vessels throughout their coastal waters. This includes major ports visited by the largest vessels and minor arms of the sea which are of purely local interest. National charts must also satisfy the requirement for an information source on behalf of a variety of national users other than navigators. The combined effect of these two requirements has caused national chart series to cover national waters in great detail. Very large scale charts may be used for port plans, and there are usually at least two continuous coastal paper chart series, one on a relatively large-scale, the other slightly smaller.

2.2 For **INT charts**, the overall objective is the creation of a compact set of medium and large scale charts that are specifically designed for planning, landfall and coastal navigation and access to ports used by ships engaged in international trade. Their content will, therefore, differ from that of national charts. A careful selection of detail on INT charts will allow updates to be restricted to items which are essential for international shipping, thus keeping the maintenance of the series manageable.

2.3 Conceived for the needs of the international mariner, INT chart design will be uninhibited by national boundaries or political considerations. They will not attempt to fulfil the needs of local shipping nor act as national information sources. However, it is recommended that, for the sake of economy, national chart series are designed so that selected charts can be used for the INT chart series (see 3.3.2).

2.4 The content of INT charts must be sufficiently complete and comprehensive to enable international mariners to navigate to their destination; there should be no need for them to use larger scale national charts.

2.5 The language must be English although other languages may be supplementary options within the chart.

3. PROCEDURE

3.1 Port Selection.

3.1.1 The ports to be covered by large scale and, where necessary, approach scale charts should be selected through consultation within the ICCWG. It is important to establish the frequency of use of the ports by international shipping and their charting needs for navigation (plan, execute, monitor, modify) and compliance under SOLAS Chapter V. Statistical data for the volume of traffic at each port should be sought from the relevant authorities. This may include the net registered tonnage of ships arriving each year and the proportion of this tonnage under foreign flags. Where statistical data are not available, other approaches can be used, such as a study of the traffic of companies using a particular area, the number of charts sold or advice from the national authority.

3.1.2 In less developed areas, consideration can be given to including harbours because of their importance as regional centres or as the main port of an island or group of islands.

3.1.3 Other ports, anchorages, offshore terminals and production areas may need charts designed to meet the individual navigational requirements of certain sectors of users, such as the needs of

cruise liners. Particularly for such selections, the type of chart to be produced (paper, ENC or both formats) must be specified so as to satisfy users' needs.

3.1.4 This selection of ports forms the framework around which the chart scheme is built. The choice of ports must be kept under review in light of new developments and the chart scheme adjusted accordingly.

3.2 Shipping Routes.

3.2.1 The major routes along the coasts and in the approaches to ports that are used by international shipping should be identified. AIS data can be utilised in locating shipping movements. The inclusion and impact of routeing measures (both IMO-approved and national), vessel traffic services, pilotage and port operations management must also be considered. Where there is a good chance of obtaining a response, existing chart users and international commercial shipping companies should be consulted. In general, a better response will be obtained if users are asked to comment on options rather than to come up with solutions on their own.

3.3 Comparison of Catalogues.

3.3.1 All relevant IHO Member States' chart catalogues should be examined. The catalogues of other countries, in particular those providing extensive regional or world cover, are likely to give a good indication of the scales and numbers of charts likely to be appropriate for the international mariner.

3.3.2 Ideally, INT chart limits and scales should conform to the corresponding charts, present or projected, in the local national series. Such charts, which may not always be the largest scale national charts, can then be modified, or prepared from the start, to full INT specifications, as required for all INT charts. They can then often be published with a minimum of delay. It will not always be possible to simply select INT charts from existing national series. Where new limits and scales are proposed for INT charts, the member country should be encouraged to amend their national chart series to accommodate the INT coverage, so that, for example, the smaller of the two national coastal series may be utilised for INT charts.

3.4 Scale.

3.4.1 The choice of scales should depend upon the navigational requirements of international shipping and the need to provide a coherent and logical scheme of charts for a route or for port entry. Although the precise structure of the scheme may vary from area to area, reflecting different hydrographic and navigational requirements, it will usually be possible to identify the navigational purposes for INT charts:

- **Berthing.** Detailed data to aid berthing, at very large scales. It will often be appropriate to include these as inset plans on Harbour charts.
- **Harbour.** To provide for port entry, and navigating within ports, harbours, anchorages, bays, rivers and canals. Generally at scales larger than 1:30 000. Sometimes the largest scale equivalent national charts will be followed; sometimes the smaller of such scales will be adequate for the International series, since it is in harbour plans that the national information document role of nautical charts is most clearly seen.
- **Approach.** To provide for navigating in the approaches to ports, in major channels or through intricate or congested waters. Generally at scales between 1:30 000 and 1:75 000. Such areas may well contain complicated traffic routeing measures. Uncomplicated port approaches should not warrant the provision of separate approach charts; in such cases, the harbour charts should be scribed with sufficient sea-room offshore to permit the safe transfer by the user from the appropriate chart of the coastal series.

- **Coastal.** To provide for coastal navigation and coastal shipping routes. It is desirable, but not essential, that a continuous coastal series should have a uniform scale since this offers a number of advantages to:
 - the navigator in being presented with a common display along a route and in transferring fixes;
 - the cartographer in compiling the overlaps; and
 - the database manager in facilitating the creation of a seamless database for the Navigational Purpose.

Generally at scales between 1:75 000 and 350 000. Where a national chart series has two continuous coverage coastal scales, usually the smaller scale will be adequate for the needs of international shipping. In some areas, however, it may be desirable to have intermediate scales to meet the needs of a large volume of offshore traffic or to give overall cover to extensive offshore shoal areas or outlying island groups.

- **General.** To provide for landfall identification and non-oceanic route planning. Generally at scales between 1:350 000 and 1:2 000 000.
- **Overview.** To provide for route planning and ocean passage before progressing to 'General' for landfall purposes. Generally scales at 1: 2 000 000 and smaller, normally provided for by the two established series of small scale INT charts, details of which can be found in Section 100 of S-11 Part B.

3.4.2 It will not always be necessary to use all the above scale bands. For example, in uncomplicated areas an Approach chart will not usually be necessary where it is considered that a Coastal chart satisfies mariner requirements. For INT charts the best appropriate scale based on this guidance should be determined by the ICCWG. For national chart series, the scale bands may also be different. For example, the national Coastal band may include charts as large scale as 1:50 000 or as small scale as 1:500 000. Other values may be used if agreed by the ICCWG.

3.4.3 If there is no conflict with other important criteria, the charting scale should not be larger than the available source material.

3.5 Geodetic Datum and Projections.

3.5.1 INT charts should be referenced to WGS 84 Datum or equivalent and, where not, priority should be given to their re-positioning to WGS 84 Datum as a significant part of their modernisation (S-4, B-201 refers). The choice of projection for INT charts and in the case of Mercator projections, the mid-latitude, should be made in accordance with the INT Specifications, contained in S-4, B-203 and B-211.

3.6 Dimensions.

3.6.1 Within the standards laid down in the INT Specifications (S-4, B-222) the regional preferences for the chart dimensions should be determined. The printing capabilities of **all** potential Producer and Printer Nations should be investigated, in order to determine both the preferred and maximum sizes to be used for charts in the regional scheme. Section 100 of S-11 Part B lists potential Printer Nations and provides details of the use of A0 size paper.

3.7 Limits and Overlaps.

3.7.1 It is the detailed limits and the degree and arrangement of overlaps, which largely determine the quality of a scheme. In general, overlaps between INT charts should be sufficient to enable the mariner to safely transfer their position from one chart to the next. They should be designed so that changing charts in an area of complicated navigation is avoided. Larger overlaps may sometimes be necessary where, for example, an important strait is covered on two charts to allow an adequate depiction of both approaches. Particular care is needed to ensure the provision of adequate overlaps with schemes in adjoining Regions. More specifically, the following should be considered:

- For schemes of **coastal charts**, ideally each major port should lie towards the centre of a sheet, allowing approach from all directions. This principle can, therefore, provide the starting point for the remainder of the sheet limits.
- The **area covered** by any chart should be a coherent unit where possible, for example: an ocean, a bay, a port approach, a strait. If the chart has an obvious title this condition is usually satisfied.
- Each chart should have **adequate sea room** and allow satisfactory transfer to adjoining charts and to the next larger or smaller scales. This is particularly important in any chart used for entering and leaving port.
- The **land area** shown should include the visual and radar horizons.
- **Overlaps** should include at least one good fixing point. They should be of such extent as to allow adequate time to transfer the course and ship's position, but not be so large as to create a need to duplicate updating unnecessarily. They need to avoid cutting off visual marks or radio-transmitted aids to navigation near the edges of charts that might be used in position fixing. On coasts where there are many off-lying islands and shoals, overlaps need to be large enough to include visual transits of objects in line.
- The **objects that determine the heading of a vessel** should appear on the chart even if it means having a large overlap.
- There should be room for the **chart title**, notes, scales etc, without obliterating important hydrographic detail, or reducing the effective overlap between charts.
- **Features** which should be within the chart's limits and not just outside them are:
 - Lights, radio aids, navigational buoys and beacons (especially landfall buoys on port approach sheets and beacons controlling transits in fairways).
 - Pilot boarding stations, anchorages, radio reporting points.
 - Prominent dangers, protruding coasts and offshore islands.
 - Routeing systems, dredged channels, recommended tracks etc. Features under this heading should not be split by chart limits, unless, like some traffic separation schemes, they are extensive enough to cover several charts.
 - Conspicuous or prominent features (natural or artificial) on the land, for example: radio masts, chimneys, hill summits.

3.7.2 It is possible occasionally to meet the above requirements by **moving the chart limits** in one direction or another, changing the scale or the mid latitude in a Mercator scheme, or increasing the number of charts. The remaining possibilities are:

- To break the inner border and continue the work to the outer border (but preferably not beyond).
- To continue the work which cannot be included in situ, in an inset plan, if there is room for this (not normally appropriate for fixing marks).
- To design the chart in separate sections, for example to cover a North/South oriented channel.

3.7.3 Charts with the longer side running east-west are in '**landscape**' format. They are convenient for use on chart plotting tables and are therefore the preferred format in scheming decisions.

3.8 Chart Numbering.

3.8.1 Blocks of approved INT chart numbers, sub-divided on a regional basis, have been allocated to major areas. These numbers are listed in S-4, part A-204, together with the principles by which the numbers are allocated within a region. There should preferably be a logical order to the allocated INT numbers (for example, a series of charts numbered sequentially around a coast).

3.8.2 In some instances, these allocations will need to be agreed with the Coordinators of adjoining regions who may share the same block. It is possible, if necessary, to transfer blocks of numbers from one region to another, with the agreement of the relevant Regional Coordinators and the NCWG Chairman.

3.8.3 When a Producer replaces an existing INT chart by a new INT chart (that is, one where the area covered has changed significantly, see S-4 B-601.3) then a new INT number should be allocated by the Regional Coordinator. The old INT number should not be re-used for at least five years.

3.9 Draft Schemes.

3.9.1 A first draft of any new or amended INT chart scheme should be prepared. Indexes should be drawn on a large enough scale to show clearly where the proposed chart limits intersect coastline detail. These indexes should be accompanied by a list of chart numbers, together with the chart scales, geographical limits and inner neat-line dimensions. Where proposed INT charts correspond to existing national charts, this should be indicated. In some complex cases, explanatory notes of how particular charts were schemed should be included.

3.10 Consultation.

3.10.1 Cooperation and collaboration is important and essential to ensure the optimum outcome in the charts produced and the consistency of their content. Draft INT chart schemes should be circulated for comment to the following, as appropriate:

- All members of the ICCWG and, where appropriate, members of the RHC.
- The Coordinators of adjoining ICCWGs, if the scheme impacts on their region.
- Hydrographic offices producing or printing charts in the region.
- The Chairman of the NCWG.
- The IHB (IHO Secretariat).

3.10.2 Comments received should be considered and discussed as necessary and the initial scheme should be refined accordingly. It may be necessary to produce further draft versions before final agreement is obtained. In general, the smaller the scale the more necessary it is to obtain a wide consensus. This consultation can generally be effected by correspondence. However, meetings of the ICCWG at significant points may speed up the process. The final draft of the scheme should be submitted to the RHC for formal approval.

3.10.3 For minor changes to INT chart schemes, see 3.12.

3.11 Allocation of Producers.

3.11.1 In most cases, the allocation of Producer Nations for INT charts will be a fairly straightforward process. For most medium- and large-scale INT charts, the Producer Nation will be the IHO Member State with responsibility for charting the waters covered by these charts. There will, however, be some exceptions. (For further information, see S-4, A-203).

3.11.2 Where an INT chart covers the waters of more than one nation, a single Producer Nation should be agreed. Nations may collaborate in the production, the resulting chart carrying both nations' seals (crests). Examples of collaboration include:

- Two nations compiling sections of the chart to an agreed dividing line, such as the median line, with the producer nation joining the sections and producing the finished reprostat.
- One nation compiling the chart, the other nation completing quality control, reprostat production and printing for both nations.

3.11.3 In such cases, the Producer Nation will usually be that nation which is responsible for the content and creation of the final chart.

3.11.4 An agreed production schedule should be determined when the allocation of Producer Nations has been completed for all the proposed INT charts. This will facilitate the forward planning for the adoption of these charts by potential Printer Nations and will enable the ICCWG to monitor future progress. It would also be advisable, at this stage, to give consideration to the preparation of a Regional INT Chart Catalogue. This would ultimately provide the source data for the IHO catalogue (Section 100 of S-11 Part B). In reality, some nations may start production before the allocation is completed.

3.11.5 Where a chart has been included in the INT scheme, but the national hydrographic office is unable to effect its production within an acceptable timescale, its production may be undertaken, with the agreement of the national hydrographic office concerned, by a potential Printer Nation.

3.12 Review.

3.12.1 It will be necessary to keep all INT chart schemes under continuous review. Adjustments will be required in order to cater, for example, for:

- The expansion of existing ports.
- The development of new ports.
- Changes to routeing measures.
- The re-positioning of major aids to navigation.

3.12.2 The consultation process (clause 3.10) needs not finalise every detail of every INT chart in a scheme. Once the general requirements, scales and limits have been agreed, it may be left to the designated Producer Nation to make the final detailed decisions. It will not normally be necessary to obtain the approval of the Regional Coordinator for a minor amendment to an individual chart. It can often take many years to finalise a regional INT chart scheme and, in that time, national charts which are candidates for inclusion may themselves have been re-schemed, although the adequacy of the overall coverage will not have changed. However, for major changes to a chart (for example, to scale or limits which could reduce overlaps or even create a gap in a scheme), for partial re-scheming and for the addition or deletion of an INT chart, the ICCWG should be consulted, via the Regional Coordinator.

3.13 Maintenance of S-11.

3.13.1 Any changes to scale, limits or numbering of INT charts, which affect Section 100 of S-11 Part B 'INTERNATIONAL CHART WEB CATALOGUE', must be notified to the Regional Coordinator or other designated regional representative to the IHB, who will update the Catalogue.

Part A: Section 200

Guidance for the Preparation and Maintenance of ENC Schemes

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1. INTRODUCTION

1.1 The **Hydrographic Services and Standards Committee** (HSSC) tasked the **Chart Standardization and Paper Chart Working Group** (CSPCWG – now Nautical Cartography Working Group (NCWG)) to extend the guidance developed for INT charts to include guidelines for the development and maintenance of small and medium scale Electronic Navigational Chart (ENC¹) schemes. This extended guidance was prepared by the **North Sea ENC Harmonisation Working Group** (NSEHWG), under the direction of its Chairman and Secretary (2013), building on earlier work by the **Worldwide Electronic Navigational Chart Database Working Group** (WENDWG); and to fulfil parts of the requirements of Resolution 1/1997 (as amended). It should be used in conjunction with Resolution 1/1997, IHO Publication S-57 and its Appendices, as well as S-4.

1.2 **Regional Hydrographic Commissions** (RHC) bring together those Member States having common regional interests in nautical charting, research or data collection, so that cooperative solutions to these problems may be reached. **International Charting Coordination Working Groups** (ICCWG) may also exist at the regional level, with 'a primary objective of developing integrated schemes of International (INT) charts for the areas concerned', which has since been extended to include ENC schemes. They consist of any Member State with an interest in the charting of a particular region. The coordinator of such a group is referred to as the **Regional Coordinator**, who advises and reports to the relevant RHC (see Annex II).

1.3 **The Nautical Cartography Working Group** (NCWG) has a range of duties in the charting field, as set out in IHO Resolutions 2/1982 (as amended) and 11/2002 (as amended). In particular, it has an on-going role to:

¹ ENC: The data base, standardized as to content, structure and format, issued for use with ECDIS on the authority of government authorized hydrographic offices. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation. [IHO Hydrographic Dictionary].

- Keep under continuous review S-11 Part A 'Guidance for the Preparation and Maintenance of International (INT) Chart and ENC Schemes' in order to advise the IHO Hydrographic Services and Standards Committee (HSSC) on its updating;
- Advise the International Hydrographic Bureau (IHB – to be replaced by 'IHO Secretariat' when the IHO Secretariat is established) and RHCs, as appropriate, on the work of ICCWG in order to promote the production of ENCs; and
- Offer advice based on NCWG experience to ICCWG and individual Member States on ENC schemes and cartographic work, in order to strongly encourage adherence to IHO charting specifications.

2. OBJECTIVE AND CONCEPT

2.1 An Electronic Navigational Chart (ENC) is a digital vector chart, issued by or on behalf of a government authorized hydrographic office or other relevant government institution, which complies with the IHO ENC Product Specification and, when used in a type-approved Electronic Chart Display and Information System (ECDIS²), meets the requirements of the IMO SOLAS regulations for carriage of nautical charts. Within the ECDIS, the features and their attributes (for example: position, colour, shape) can be selectively displayed and queried, enabling the chart image to be manipulated on the screen. This not only provides ECDIS users with control over the level and type of detail they wish to see, but can also be linked to other onboard systems to provide additional features such as automatic alarms and indications.

2.2 The principles for the provision of ENC services in terms of coverage, consistency, quality, updating and distribution are encapsulated in the Worldwide Electronic Navigational Chart Database (WEND) Principles (IHO Resolution 1/1997 as amended). These principles have been developed to ensure 'a world-wide consistent level of high quality, updated official ENCs through integrated services that support the chart carriage requirements of SOLAS Chapter V, and the requirements of the IMO Performance Standards for ECDIS'.

2.3 ENC scheme design will be uninhibited by national boundaries or political considerations (see paragraph 3.10.4).

2.4 The content of ENCs must, as a minimum, be sufficiently complete and comprehensive to enable international mariners to navigate to their destination. However, additional content intended to satisfy national requirements may also be included in ENCs, particularly in the larger scale (Navigational Purpose 3 to 6) ranges, noting that in using ENCs in an ECDIS, the burden on the user for updating and maintenance is much lighter compared to a paper chart folio. The objective of providing a folio of ENCs designed for planning, landfall and coastal navigation, nominally within (but not restricted to) the Navigation Purpose 1 to 3 ENC cell usage bands, should be considered in determining content and level of detail to be charted.

2.5 The language must be English although other languages may be supplementary options within the ENC.

3. PROCEDURE

3.1 Port Selection.

3.1.1 All ports that are selected for inclusion in the INT chart scheme, in accordance with the guidance at paragraph 3.1.1 of Section 100, must be included in large scale (that is, Berthing or Harbour Navigational Purpose) ENC schemes. Other ports, anchorages, offshore terminals and production areas may need ENCs designed to meet national requirements including the individual navigational requirements of certain sectors of users, such as the needs of cruise liners.

² ECDIS: A navigation information system which with adequate back-up arrangements can be accepted as complying with the up-to-date chart required by regulations V/19 and V/27 of the 1974 SOLAS convention, as amended, by displaying selected information from a System Electronic Chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and if required display additional navigation-related information.

3.2 Shipping Routes.

3.2.1 The major routes along the coasts and in the approaches to ports that are used by international shipping should be identified. AIS data can be used in identifying shipping movements. The inclusion and impact of routing measures (both IMO-approved and national), vessel traffic services, pilotage and port operations management must also be considered. Where there is a good chance of obtaining a response, existing chart users and international commercial shipping companies should be consulted. In general, a better response will be obtained if users are asked to comment on options rather than to come up with solutions on their own.

3.3 Comparison of Schemes.

3.3.1 All relevant regional (if they exist) and IHO Member States' national ENC schemes should be examined. The schemes of other countries, in particular those providing extensive regional coverage, are likely to give a good indication of the scales and numbers of ENCs likely to be appropriate for the international mariner.

3.4 Scale.

3.4.1 The choice of scales should depend upon the navigational requirements of international shipping and the need to provide a coherent and logical scheme of charts for a route or for port entry. Although the precise structure of the scheme may vary from area to area, reflecting different hydrographic and navigational requirements, the Navigational Purpose of each ENC must be clear. Navigational Purposes are derived from and defined in S-57 Appendix B.1 – ENC Product Specification; and a further theoretical link between scale and Navigational Purpose is defined within the ENC consistency recommendations in IHO Publication S-66 – Facts about Electronic Charts and Carriage Requirements. S-66 also provides a more detailed correlation between scale, Navigational Purpose and selectable radar range display scales. For ENCs it is important that, where possible, there be a regional commonality of scale across at least the Overview and General Navigational Purposes, noting that the suggested alignment of Navigational Purposes to scale ranges in S-66 is not mandatory.

3.4.2 The term 'compilation scale' is used differently for paper (raster) charts and ENCs. In paper chart construction, compilation scale is that of the final analogue (printed) chart which displays content statically as it is designed by the hydrographic office to be shown. In ENCs, compilation scale refers to the optimum scale at which the compiling hydrographic office intends the ENC data to be displayed for the Navigational Purpose, while recognising the user's ability to modify the actual scale at which the ENC is viewed in the ECDIS. While there is no requirement to do so, consideration should be given to making the relationship between the compilation scales of at least the smaller scale Navigational Purposes for ENCs and corresponding INT charts consistent, in order to simplify chart maintenance requirements and provide greater consistency of product portfolios to the end user.

3.4.3 The following are general parameters in order to identify the Navigational Purposes for ENCs:

- **Berthing (Navigational Purpose 6).** Detailed data to aid berthing, at very large scales. The Berthing Navigational Purpose is recommended to have compilation scales larger than 1:4 000. Where the source data used to produce the ENC is of a scale larger than 1:4 000, then that source scale may be used as the compilation scale for the ENC.
- **Harbour (Navigational Purpose 5).** To provide for port entry, and navigating within ports, harbours, anchorages, bays, rivers and canals. The Harbour Navigational Purpose is recommended to have compilation scales between 1:4 000 and 1:21 999. The available corresponding compilation scales for the Harbour scale band as related to standard selectable radar range display scales are 1:4 000, 1:8 000 and 1:12 000.

- **Approach (Navigational Purpose 4).** To provide for navigating in the approaches to ports, in major channels or through intricate or congested waters. Such areas may well contain complicated traffic routing measures. Uncomplicated port approaches should not warrant the provision of separate approach ENC's; in such cases, the harbour ENC's should be schemed with sufficient sea-room offshore to permit the safe transfer by the user from the appropriate ENC's of the coastal series. The Approach Navigational Purpose is recommended to have compilation scales between 1:22 000 and 1:89 999. The available corresponding compilation scales for the Approach scale band as related to standard selectable radar range display scales are 1:22 000 and 1:45 000.
- **Coastal (Navigational Purpose 3).** To provide for coastal navigation and coastal shipping routes. It is desirable, but not essential, that a continuous coastal ENC series should have a uniform scale since this offers a number of advantages to:
 - the navigator in being presented with a common display along a route;
 - the cartographer in achieving 'horizontal consistency' along ENC cell boundaries; and
 - the database manager in facilitating the creation of a seamless database for the Navigational Purpose.

The Coastal Navigational Purpose is recommended to have compilation scales between 1:90 000 and 1:349 999. The available corresponding compilation scales for the Coastal scale band as related to standard selectable radar range display scales are 1:90 000 and 1:180 000.

- **General (ENC Navigational Purpose 2).** To provide for landfall identification and non-oceanic route planning. For ENC's, the General Navigational Purpose is recommended to have compilation scales between 1:350 000 and 1:1 499 999. The available corresponding compilation scales for the General scale band as related to standard selectable radar range display scales are 1:350 000 and 1:700 000.
- **Overview (ENC Navigational Purpose 1).** To provide for route planning and ocean passage before progressing to 'General' for landfall purposes. For ENC's, the Overview Navigational Purpose is recommended to have compilation scales smaller than 1:1 499 999, and should be based on the 1:3 500 000 small scale INT paper chart series to provide a seamless and consistent scale coverage. The available corresponding compilation scales for the Overview scale band as related to standard selectable radar range display scales are 1:1 500 000 and 1:3 000 000. Where the source data used to produce the ENC is of a scale smaller than 1:3 000 000, then that source scale may be used as the compilation scale for the ENC.

3.4.4 It will not always be necessary to use all the above Navigational Purposes. For example, in uncomplicated areas an Approach ENC will not usually be necessary where it is considered that a Coastal ENC satisfies mariner requirements. S-57 and S-66 provide guidance only for the assignment of ENC Navigational Purpose to compilation and standard selectable radar range scales – the best appropriate scale based on this guidance should be determined by the ICCWG. For example, the Coastal band may include ENC's as large scale as 1:45 000 or as small scale as 1:350 000.

3.5 Geodetic Datum and Projections.

3.5.1 All ENC's must be referenced to WGS 84 Datum. There is no projection defined for ENC.

3.6 Dimensions.

3.6.1 ENC cells must be rectangular, defined by 2 parallels of latitude and 2 meridians of longitude. However the area covered by data within a cell does not need to be rectangular. It is important to note that the geographic extent of an ENC cell is not restricted by paper size. The geographic extent of the cell must be chosen by the ICCWG/ENC Producer to ensure that the resulting dataset file contains no more than 5 Megabytes of data. Subject to this consideration, the cell size must not be too small in order to avoid the creation of an excessive number of cells.

3.7 Coverage.

3.7.1 A mandatory carriage requirement for ECDIS means a consequential expectation that coastal States will ensure the provision of ENC's.

3.7.2 When scheming ENC cell limits, coverage may be based on 'equivalent' paper chart limits, a grid or a combination of both. If possible a Producer should not mix a combination of grid and paper chart limits in the same Navigational Purpose.

- The **area covered** in a given Navigational Purpose must be split into cells in order to facilitate the efficient processing of ENC data in ECDIS.
- Each cell must be contained in a physically separate, **uniquely identified file** on the transfer medium, known as a data set file (S-57 Appendix B.1, clause 5.6.3 refers).
- The **ENC scheme** must take account of ENC's that are already produced.
- Where a cell's data content is **captured from paper charts**:
 - Selection of data should be based on the most appropriate paper chart (for example: scale, currency).
 - In some cases, data may be incomplete due to the paper chart's design (for example: placement of chart title, scale etc) leading to the creation of 'no coverage areas'. Consideration should be given to compiling such areas from source, where data exists.
- When **edge matching** it is important for ENC Producers to use the same Coordinate Multiplication Factor (COMF). Producers should follow the IHO recommendations as defined in the ENC Product Specification to hold the ENC production systems at a resolution of 0.0000001 (10^{-7}) and the COMF value in the ENC cell header to 10 000 000 (10^7). It is also recommended to use the same Compilation Scale of Data (CSCL) in the ENC cell header for cells in the same Navigational Purpose; this helps to bring consistency at the boundary between two Producers.
- **Overlaps.** Cells with the same Navigational Purpose may overlap, however data within cells in the same Navigational Purpose must not overlap. Therefore, in an area of overlap only one cell may contain data, and all other cells of the same Navigational Purpose must have a meta object M_COVR with attribute CATCOV = 2 (no coverage available) covering the overlap area. This rule should apply even if several producers are involved; however, if it is difficult for technical reasons to achieve a perfect join at agreed adjoining national data limits, a 5 metre (on the ground) overlapping buffer zone may be used.

It has also been found that in addition to the unpredictable performance of ECDIS when cells of the same Navigational Purpose overlap, similar performance issues occur when data having the same compilation scale and within different Navigational Purposes overlap. Such performance issues reduce mariner confidence in using ECDIS and may impact on safety of navigation. Data Producers should therefore ensure that data within cells having the same compilation scale and different Navigational Purposes does not overlap, in addition to ensuring that data within cells of the same Navigational Purpose does not overlap.

- **International boundaries.** Refer to paragraph 3.10.4.
- A **data gap** between ENC cells designed to adjoin each other in the same Navigational Purpose must be avoided.

3.7.3 It is generally accepted that 87 degrees north is approximately the northern limit at which ENC's will perform adequately in an ECDIS; some ECDIS systems are limited in their ability to display ENC's for latitudes further north.

3.8 ENC Cell Naming.

3.8.1 ENC cells must be named (numbered) according to the convention in S-57 Appendix B.1 - ENC Product Specification, clause 5.6.3. If an ENC cell is cancelled, the ENC cell name (number) must not be reused.

3.9 Consultation.

3.9.1 In order to enhance consistency such that ENC's appear seamless in an ECDIS (termed 'ENC harmonization'), it is important to establish common ENC content standards (where open to interpretation) both within a national ENC scheme and between different Producers' data where they adjoin. This should be achieved in consultation with neighbouring producer hydrographic offices; and with all nations within a Regional Electronic Chart Coordinating Centre (RENC), ICCWG or RHC, as appropriate. Examples of some obvious features that affect the mariner's use of data in an ECDIS include the application of SCAMIN, routing measures, critical information and depth contour intervals.

3.9.2 Cooperation and collaboration is important and essential to ensure the optimum outcome in the ENC's produced and the consistency of their content. Draft ENC schemes should be circulated for comment to the following, as appropriate:

- All members of the ICCWG and, where appropriate, members of the RHC.
- The Coordinators of adjoining ICCWGs, if the scheme impacts on their region.
- Hydrographic offices producing ENC's in the region.
- RENCs.
- Technical Experts Working Groups (for example: a regional ENC Harmonisation Working Group).
- The IHB (IHO Secretariat).

3.9.3 Comments received should be considered and discussed as necessary and the initial scheme should be refined accordingly. It may be necessary to produce further draft versions before final agreement is obtained. In general, the smaller the scale the more necessary it is to obtain a wide consensus. This consultation can generally be effected by correspondence. However, meetings of the ICCWG at significant points may speed up the process. The final draft of the scheme should be submitted by the Regional Coordinator to the RHC for formal approval.

3.9.4 For minor changes to ENC schemes, see 3.12.

3.10 Allocation of Producers.

3.10.1 The production of individual ENC cells can be assigned to only one ENC Producer Nation.

3.10.2 In most cases, the allocation of Producer Nations for ENC's will be a fairly straightforward process. For most medium- and large-scale ENC's, the Producer Nation will be the IHO Member State with responsibility for charting the waters covered by these ENC's.

3.10.3 Responsibility for the production of an ENC can be delegated by a national hydrographic office to another hydrographic office, which then becomes the Producer Nation in that area until such time as the national hydrographic office develops the capacity to maintain the ENC.

3.10.4 When the maritime limits of national jurisdiction between two neighbouring countries are not established, or it is convenient to agree boundaries other than at established international boundaries, producing countries are to define the cartographic boundaries for ENC production within a technical arrangement. These limits are for cartographic convenience in ENC production only and do not have any significance, legal effect or status regarding political or other jurisdictional boundaries. Where agreed, such cartographic boundaries should be as simple as possible (for example a succession of straight segments and turning points, corresponding to meridians and parallels or paper chart limits). For technical reasons, diagonal lines should be avoided. When determining the boundaries of ENC coverage between adjoining States, it is important that a rigorous consultation process be initiated (refer to clause 3.9).

3.10.5 In areas of national jurisdiction for which there is no recognised ENC Producer Nation, the ICCWG or RHC must determine the ENC Producer Nation in consultation with the relevant coastal State. ENC's produced under such arrangements should be offered for transfer to the national hydrographic office of the coastal State in the event that the national hydrographic office

subsequently develops the capacity to maintain the ENC.

3.11 **Review.**

3.11.1 It will be necessary to keep all ENC schemes under continuous review. Adjustments will be required in order to accommodate changes, such as:

- The expansion of existing ports.
- The development of new ports.
- Changes to routing measures.
- The re-positioning of major aids to navigation.

3.11.2 The consultation process (clause 3.10) needs not finalise every detail of every ENC cell in a scheme. Once the general requirements, Navigational Purpose, compilation scales and cell limits have been agreed, it may be left to the designated Producer Nation to make the final detailed decisions. It will not normally be necessary to obtain the approval of the Coordinator of the ICCWG for a minor amendment to an individual ENC cell. However, for major changes to a cell (for example: scale and limits, to avoid overlaps or gaps), for partial re-scheming and for the addition or deletion of an ENC cell, the ICCWG should be consulted, via the Regional Coordinator.

3.12 **Maintenance of S-11.**

3.12.1 Any changes to scale, limits or naming of ENCs, which affect Section 200 of S-11 Part B 'IHO ENC Catalogue', must be notified by the Regional Coordinator or other designated regional representative to the IHB, who will update the Catalogue.