1ST SESSION

OF THE IHO ASSEMBLY

Monaco, 24-28 April 2017

REPORTS ON THE WORK OF THE IHO FOR THE PERIOD 2012 - 2016

WORK PROGRAMME No. 2
HYDROGRAPHIC SERVICES AND STANDARDS

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Introduction

1. The IHO Work Programme 2 "Hydrographic Services and Standards" seeks to develop, maintain and extend technical standards, specifications and guidelines to enable the provision of standardised products and services that meet the requirements of mariners and other users of hydrographic information. This Work Programme is under the principal responsibility of the Hydrographic Services and Standards Committee (HSSC).

Technical Programme Coordination

2. This element monitors technical developments and oversees the development of IHO technical standards, specifications and publications through the coordination and interaction of the relevant IHO working groups reporting to the HSSC.

3. At its 5th meeting in 2013, the Committee agreed the principles for re-structuring its working groups in order to reflect the changing focus from paper to digital data based products and services, ensure better use of limited resources, improve its efficiency and facilitate inputs from industry and other stakeholders. The new structure was further developed intersessionally and agreed at the 6th HSSC meeting. The new structure was comprised of four new working groups (WG) which replaced previously existing working groups: the S-100WG, ENC Standards Maintenance WG (ENCWG), Nautical Information Provision WG (NIPWG) and Tides, Water Level and Currents WG (TWCWG). The terms of reference of the new working groups and the arrangements for the transition from the previous to the new structure were agreed. The Committee agreed to maintain the Chart Standardization and Paper Chart WG (CSPCWG), renamed the Nautical Cartography WG (NCWG), the Data Protection Scheme WG (DPSWG) and the Data Quality WG (DQWG), subject to annual review and further consideration of their interactions with the new working groups. At its 8th meeting in 2016, the Committee decided to disband the DPSWG and to continue the development of the protection scheme of S-100 based-products as well as the monitoring of cyber security requirements through a Project Team under the S-100WG. The ENCWG was given the responsibility of maintaining the expertise required to support the IHO Secretariat as Scheme Administrator of the existing S-63 - *Data Protection Scheme*.

4. Following a proposal from the Inter-Regional Coordination Committee (IRCC) approved by HSSC-6, the governance of the Marine Spatial Data Infrastructure Working Group (MSDIWG) was transferred to the IRCC on 1 January 2015. The activities of the MSDIWG are reported under Programme 3.

5. Annex A details the structure, membership, meetings and agenda items of the Committee and its subordinate bodies during the period 2012-2016.

6. At its 4th meeting in 2012, the Committee agreed to implement five working level performance indicators:

   - Number of S-100 based product specifications approved;
   - Percentage of annual work programme achieved;
   - Total number of participants at meetings (Member States and Expert Contributors);
   - Number of technical revisions and clarifications approved;
   - Number of ENCs distributed annually under license (equivalent annual licences).

7. In order to ensure the continuity of the indicators, the participation in the MSDIWG meeting continued to be included in the subsequent assessment of the participation at meetings, although the governance of the MSDIWG was transferred to the IRCC on 1 January 2015.

8. Annex B provides the annual values for the period 2012-2016.

9. A more realistic estimate of the time and resources required to address the work items explains the progress in the percentage of annual work programme achieved (from less than 20% in 2012 and 2013 to more than 40% from 2014 to 2016). There remains, however, scope for further improvement.

10. It appears difficult to draw significant conclusions from the other indicators.

11. Most entities under the governance of the HSSC provided their biannual reports as requested by the IHB in accordance with Decision No 3 of the 5th Extraordinary International Hydrographic Conference (EIHC-5). The following entities did not provide their report:

    - end of 2014: TSMAD, SNPWG/NIPWG, TWLWG/TWCWG and HDWG;
    - mid-2015: ABLOS;
    - end of 2015: DQWG, TWCWG and ABLOS;
    - mid-2016: DQWG.

12. In 2015, the Member States agreed to amend the terms of reference of the HSCC to allow the chairs of the subordinate bodies to designate a representative to report to HSSC meetings. The Terms of Reference implementing the new structure of the IHO which entered into force on 8 November 2016 are provided in Annex C. Considering that the possible establishment of two coordinating Sub-Committees has not been required so far and noting the new structure of the working groups implemented in 2015, it is proposed to remove the provisions related to the coordinating Sub-Committees in article 2.8 of the Rules of Procedure, as shown in Annex C.

Difficulties and challenges yet to be addressed

13. The implementation of the work programme depends essentially on the voluntary contribution of experts from Member States and from industry.

14. The increasing and very important contribution being made by industry in their role as expert contributors, especially in the development of S-100 - *IHO Universal Hydrographic Data Model* and its related applications, and in the maintenance of many other IHO technical standards was acknowledged by EIHC-5 in 2014.

15. A number of working groups reported that the rate of active participation by Member States in meetings and intersessional work was a concern and was hampering progress, causing delays in drafting new or revised publications and affecting the quality of their content. Although funds were available in the Special Project Funds to outsource some tasks, the limited resources available to the affected working group chairs to specify and manage contracts impeded the use of contractor support.

16. The situation was particularly critical with regard to the development of S-100 and S-100 based product specifications, considering the risk to undermine the central role of S-100 in the establishment of the common maritime data structure in support of e-navigation. A number of tasks and activities related to the development of the S-100 framework progressed slower than expected due to insufficient expertise or a lack of human resources. Delays affected in particular the upgrade of the S-100 Registry and the development of the portrayal component. This in turn impacted the work on the development of product specifications. The establishment of a permanent Secretariat position of Technical Standards Support Officer, which was effective from October 2016, addressed some of the gaps identified in the support for S-100 and its associated Registry.

17. The drafting of the new editions of S-58 - *ENC Validation Checks* and S-66 - *Facts about Electronic Charts and Carriage Requirements* was also delayed due to the lack of human resources. The implementation of the new set of IHO normative references for ECDIS revealed imperfections which had been overlooked due to the limited expertise available. Lack of expertise also hampered the progress of work items of the NCWG, the TWCWG and the HDWG. The secondment of a project officer by Peru, in March 2015, alleviated some of the difficulties encountered by the HDWG.

18. The implementation of the re-organized structure of HSSC highlighted the difficulty to attract volunteers for the positions of office-bearers of the working groups. The position of vice-chair of the HDWG remained vacant during the reporting period; the position of vice-chair of the DQWG was vacant during six months. The positions of secretary of the S-100WG, DQWG and HDWG are vacant.

19. Improving the situation calls for increased participation and longer term commitment of the Member States in the relevant IHO organs. Member States may wish to consider when developing proposals for the capacity building programme if any specific capacity building actions, such as training and tutoring, could assist them in developing their own expertise and in so doing, expand the pool of experts available to develop and maintain the relevant IHO standards.

Achievements/outputs/conclusions

Element 2.2 - Hydrographic Data Transfer Standards

S-100 and related activities

20. These activities were divided between the Transfer Standard Maintenance and Applications Development WG (TSMAD) and the Digital Information Portrayal WG (DIPWG) until the establishment of the S-100WG.

21. Two planning documents were elaborated to guide the development of S-100 and related activities and set a timeline. An S-100 Master Plan was drafted in 2013 to set the long term goals and objectives of the development and implementation of S-100 and related specifications and tools, and to outline the tasks that need to be considered to achieve these objectives and the associated timelines. A more detailed roadmap was produced to provide an estimated timescale of events in the development, test and implementation of S-101 - *ENC Product Specification*. Both documents are now maintained by the S-100WG. Edition 1.1 of the S-100 master plan was endorsed at HSSC-7. The current edition of the S-101 Value Added Roadmap was published in April 2016.

S-100

22. Two new editions of S-100 were prepared during the reporting period. Edition 2.0.0 was published in June 2015. The draft Edition 3.0.0 was endorsed by the HSSC at its 8th meeting in November 2016 and is expected to be published during the first quarter of 2017, subject to its approval by the Member States.

23. The changes included in the new editions are shown in tables 1 and 2.

Table 1
Changes included in S-100 Edition 2.0.0

Part No	Part Name	Description	Change Type
1	Conceptual Schema Language	Added support for: Codelists Truncated date-time types Uniform resource identifiers	Extension
2A	Feature Concept Dictionaries	Added support for: Codelists Truncated date-time types Uniform resource identifiers	Extension
3	General Feature Model	Added support for: Codelists Truncated date-time types Uniform resource identifiers Expanded roles	Extension
4A	Metadata	Inclusion of metadata schemas and clarification of the S-100 catalogue UML model	Correction

Part No	Part Name	Description	Change Type
5	Feature Catalogue	Added support for: Codelists Truncated date-time types Uniform resource identifiers New spatial types (ArcByCenterPoint, CircleByCenterPoint)	Extension
7	Spatial Schema	Added support for: New spatial types (ArcByCenterPoint, CircleByCenterPoint)	Extension
9	Portrayal	Inclusion of the S-100 Portrayal Model	Extension
10A	ISO-IEC 8211 Encoding	Corrections to the ISO 8211 encoding	Correction
10B	GML Encoding	Inclusion of GML as an available encoding format	Extension
11	Product Specifications	Inclusion of the S-10X template for building new product specifications	Extension
12	Maintenance Procedures	Alignment of procedures to S-99	Correction

Table 2
Changes included in S-100 Edition 3.0.0 (draft)

Part No	Part Name	Description	Change Type
0	Cover	Amends the copyright note	Clarification
2B	Portrayal Register	Inclusion of the Portrayal Register Model into S-100	Extension
4A	Metadata	S100_Support File Format (add Tiff)	Clarification
4A	Metadata	Invalid reference to a clause that does not exist	Correction
4A	Metadata	Exchange catalogue metadata harmonization and include the S-101 data coverage methodology	Correction
4A	Metadata	PDF as a support file format	Extension
4A	Metadata	Amend the definition of layerID	Clarification
5	Feature Catalogue	Feature catalogue model and schema extended to include roles in information bindings	Extension
5	Feature Catalogue	Clarification on the use of supertypes	Clarification
7	Spatial	Clarification on internal and external boundaries for areas with holes	Clarification
8	IGD	Alignment to revised ISO models	Correction
9	Portrayal	Correction of editorial issues	Correction
9C	SVG Profile	Draft profile of SVG elements that are used in the creation of S-100 symbols	Extension
10A	8211	Needed to amend 8211 to handle a conditional need for the SEGH field	Correction
10B	GML	Place existing description of associations in a sub-section and add a second sub-section describing an alternate method for encoding feature and information associations	Extension
10C	HDF	Adds HDF as an encoding format for S-100	Extension
11	Product Specification	Clarifies the rules for namespaces for product specifications	Clarification

S-100 Interoperability Specification

24. In order for multiple S-100 based product specifications to overlay and interact with each other on a single navigation system, it was determined that the S-100WG needed to create an S-100 Interoperability Specification. This will enable a harmonized portrayal of different types of navigation data within a system and allow the mariner to make informed decisions. Work commenced on this specification in 2016 and a draft for testing is expected to be available in late 2017, with an aim for finalization in 2018.

S-100 Registry

25. The S-100 Registry underpins the entire S-100 infrastructure and this item has been the highest priority for the TSMAD and then the S-100WG as it has a direct effect on the functionalities of the S-100 Feature Catalogue Builder and the S-100 Portrayal Catalogue Builder. The Registry continued to be managed, developed and maintained by the Chair of the TSMAD on a part-time basis, until his retirement in February 2015, through the generous and continuing support of the United Kingdom (UK). Edition 1.1.0 of S-99 - *Operational Procedures for the Organization and Management of the S-100 Geospatial Information Registry* was published in 2013 to take into account feedback and experience in the practical use of the S-100 Registry. The revision deleted the distinction between two classes of information arranged in main and supplementary registers and extended the time allowed to raise objections to proposals from 30 days to 60 days in order to allow stakeholders a longer period to circulate the documentation and consider responses. In 2013, the Feature Concept Dictionary Register was expanded to include the domains requested by other Submitting Organizations and a revised Help file was implemented. A detailed technical documentation of the current version of the Registry and a report containing recommendations for correcting or improving the code were delivered using contract support assistance. In 2014, the Registry was moved to a new server and a number of security vulnerabilities were fixed using contract support assistance. From February 2015 to October 2016, an interim management arrangement, based on in-kind support from the Republic of Korea (ROK), UK, and United States of America (USA), was implemented in liaison with the HSSC Chair Group and the S-100WG. USA and ROK undertook further development to address shortcomings in the operation of the Feature Concept Dictionary, to implement changes required by Edition 2.0.0 of S-100 and to support the future connexion with the Feature Catalogue Builder. In accordance with the recommendation of the HSSC, the establishment of a permanent position at the IHO Secretariat to support the S-100 Registry, and more generally the development of S-100 based standards and services, was approved by the Member States towards the end of 2015. A Technical Standards Support Officer was recruited in 2016 and has been acting as Registry Manager since 1st October 2016.

26. Now that the S-100 Registry Manager is a permanent position at the Secretariat and noting that Submitting Organizations other than the IHO are more and more active as Registry users, it is expected that continued refinements of the Registry will be required in 2017 and beyond.

S-100 Feature Catalogue Builder and Portrayal Catalogue Builder

27. The first version of the S-100 Portrayal Catalogue Builder (PCB) was developed in 2014 through contract support. Further extensions and adjustments were required in 2015 to accommodate changes to the feature model that were introduced in Edition 2.0.0 of S-100 and in the draft S-101 feature catalogue. SVG formatted symbol graphics of all existing S-52 point symbols were also delivered as part of the contract to support the portrayal of S-101 ENCs.

28. ROK has developed an initial prototype of the S-100 Feature Catalogue Builder (FCB) that will be used to create conformant feature catalogues for various product specifications under development. In late 2016, the FCB was connected to the S-100 Registry, thus enabling the testing process of the S-100 PCB and conformant S-100 portrayal catalogues to be built for testing. As more testing and development are undertaken, it is expected that there will be continued improvements to the process.

S-101 - ENC Product Specification

29. S-101 is a multi-part product specification that when put together will form the basis for the creation and display of a new generation of Electronic Navigational Charts (ENC) interoperable with other S-100 based products. The major components of S-101 and their current status are indicated in table 3.

Table 3

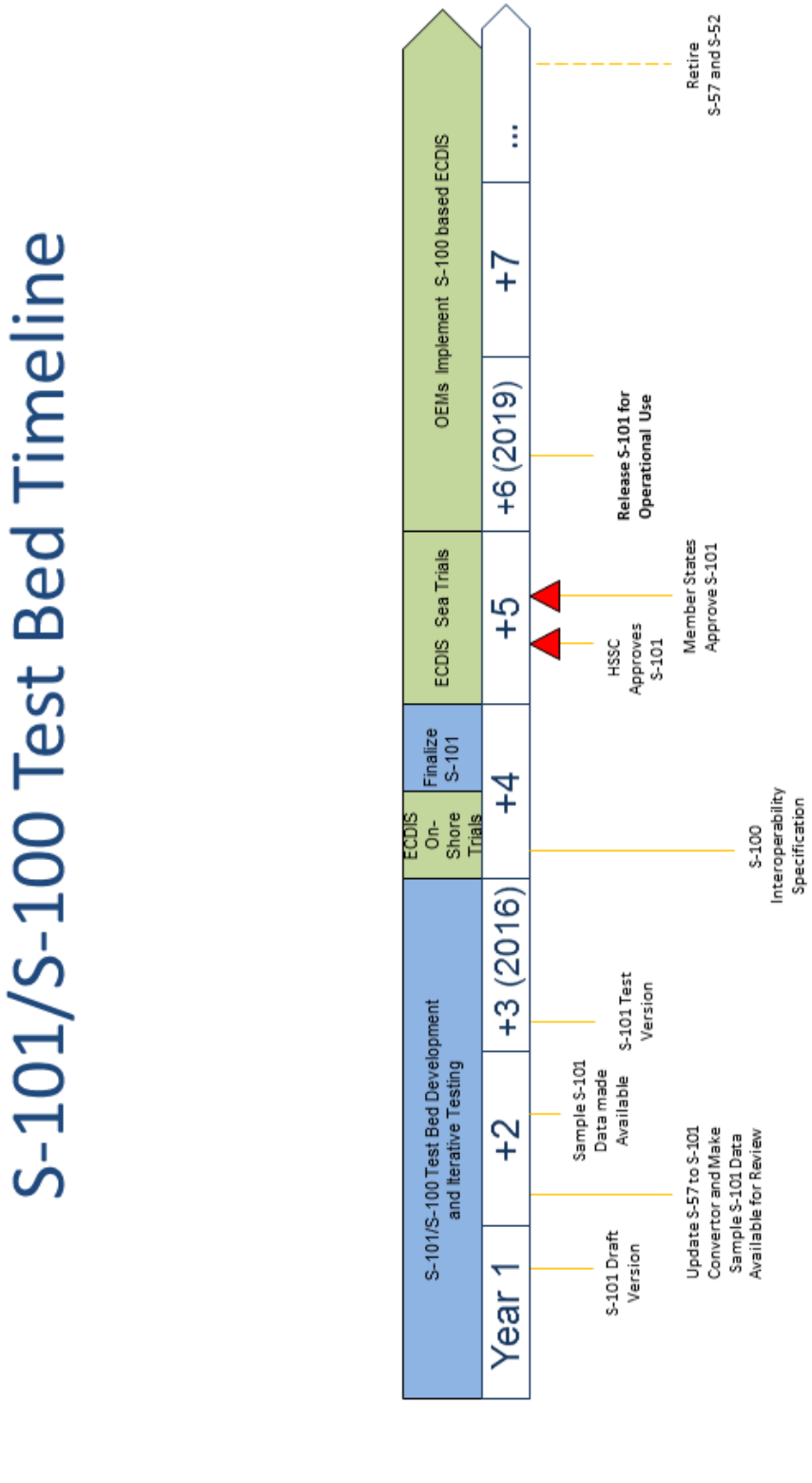
Status of the components of S-101 - ENC Product Specification

S-101 Component	Current Status	Comment
Main Document	Testing Baseline	Sent out for stakeholder review in September 2014 and final comments incorporated into the testing baseline. New Items have been registered in the GI Registry. Changes to the DCEG will undergo a controlled proposal process in order to manage change effectively.
Data Classification and Encoding Guide	Baselined – June 2016	
8211 Annex	Testing Baseline	
Feature Catalogue	Testing Baseline	Awaiting the FCB connection to the GI Registry to create a new version that contains the new DCEG items.
Portrayal Catalogue	Partial Baseline	Caris has created a partial portrayal catalogue using the elements from S-52 in the S-100 format. There is still more work to be done once the S-100 Register is operational. NOAA has funded work on baselining the S-52 CSPs into XSLT 1.0 that will be part of the Portrayal Catalogue.
Implementation Guidance	In Progress	Will continue to be refined during the S-101 test bed process.
Validation Checks	In Progress	

30. S-101 progress has been slow during this reporting period. Much of this is due to waiting for the S-100 infrastructure to be updated for operational use. Once the Registry and the FCB are operational a new Feature Catalogue will be created and the PCB will be tested to create the S-101 Portrayal Catalogue. This will then be made available on Basecamp to the S-100 Stakeholder community for testing and further development in accordance with the timeline shown at figure 1.

Figure 1

S-101/S-100 test bed timeline

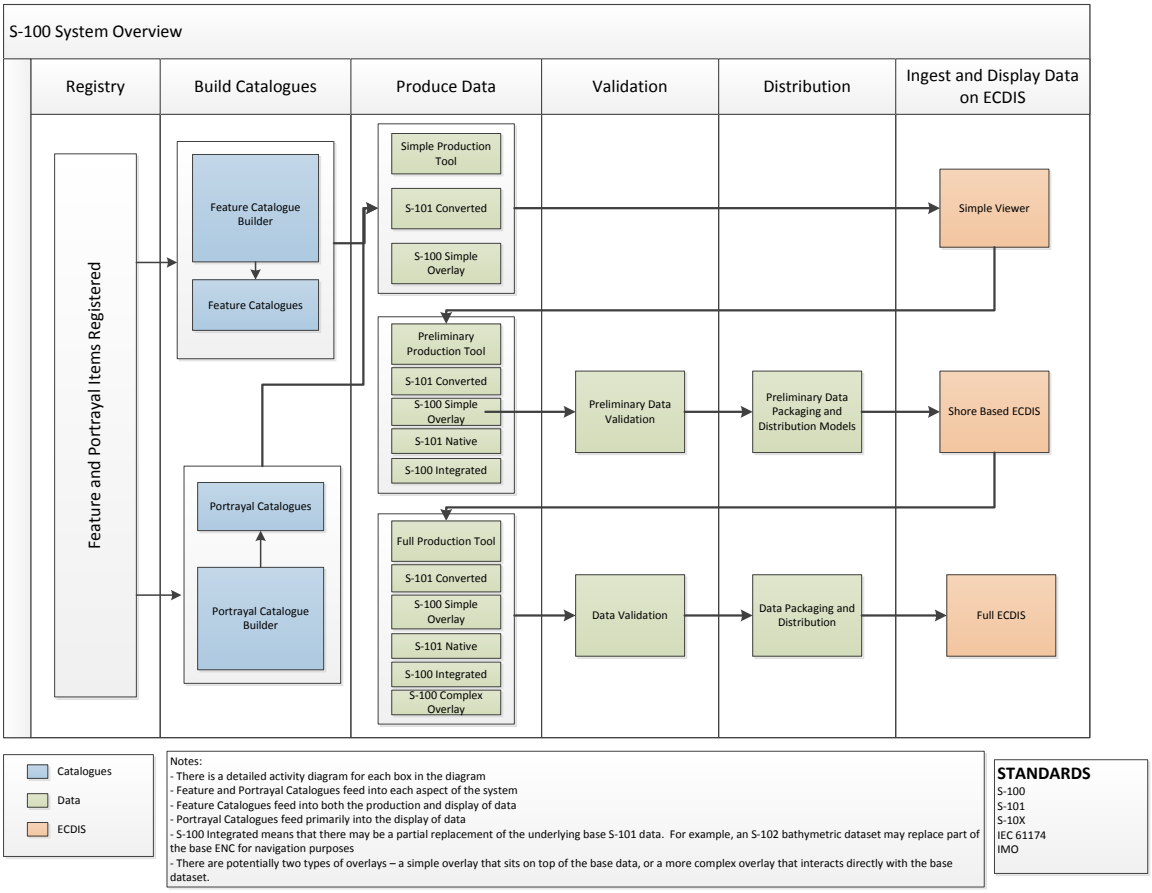


S-101/S-100 Test Strategy and Test Bed

31. Before the IHO Member States can approve S-101 as a functional standard, it must undergo a rigorous testing process that will require the implementation of test bed projects. It is important to understand that these test beds will need to be S-100-based, that is be capable of testing other product specifications which can be either supplementary to S-101 ENC or non-related GIS applications. The overarching test bed strategy completed in 2014 is depicted in figure 2 which shows the logical progression from catalogue creation to use within an ECDIS.

Figure 2

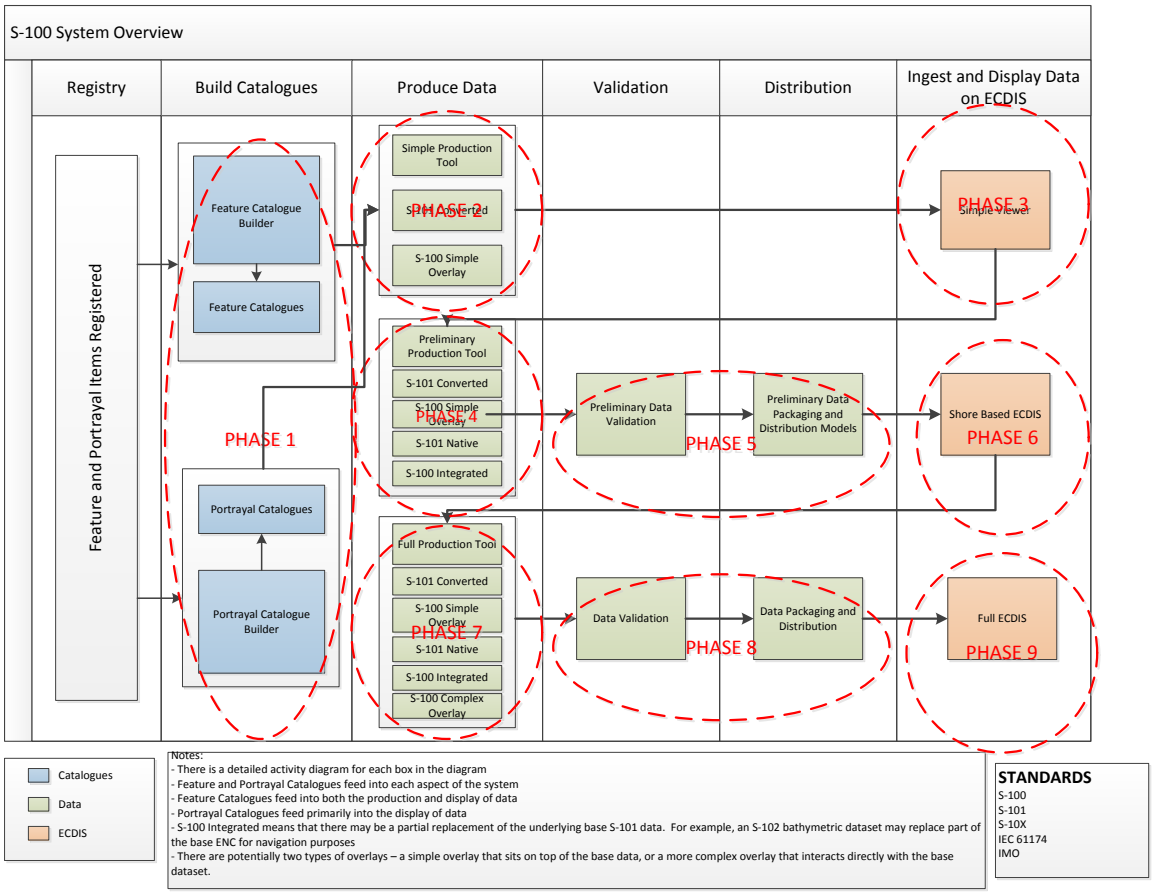
S-101/S-100 Test Strategy



32. In order to manage the complexity of the testing process it has been divided into nine phases as depicted in figure 3.

Figure 3

S-101/S-100 Test Strategy



33. Breaking out the testing through phases allows for the iterative development of future ECDIS as a system by gradually expanding requirements and the different types of test scenarios that are needed to validate S-101 as a functional standard. The status of the different phases is shown in table 4.

Table 4

Status of the S-101/S-100 Test Strategy

Phase No	Phase Name	Status	Comment
1A	Feature Catalogue Builder	Completed	Development done by KHOA S-100 Test Cases Written
1B	Portrayal Catalogue Builder	Completed	Developed under IHB Contract S-100 Test Cases Written
2	Simple Production Tool	In Progress	S-57 to S-101 Convertor Joint NOAA/ESRI initiative
3	Simple Viewer	In Progress	S-100 Test Cases Written ROK Simple Viewer SPAWAR Simple Viewer
4	Preliminary Production Tool	In Progress	ROK has developed a tool to produce S-101 updates for testing
5	Preliminary Data Validation and Packaging	Not Started	Initial Scoping Required
6	Shore Based ECDIS	Not Started	Initial Scoping Completed
7	Full Production Tool	Not Started	Initial Scoping Required
8	Data Validation and Packaging	Not Started	Initial Scoping Required
9	Full ECDIS	Not Started	Initial Scoping Required

34. The outcome of testing will also enable a more detailed impact study, as prescribed by IHO Resolution 2/2007 on principles and procedures for making changes to IHO technical standards and specifications, and will provide a clear picture of the effects on the various stakeholders involved in the eventual introduction of S-101.

35. The progress of the test strategy is reviewed by a subset of the S-100WG at an annual Test Strategy Meeting.

36. The ROK reported at HSSC-8 on the first sea-trial of S-100 based test data sets, including dynamic data such as S-111 - *Surface Currents* and S-112 - *Dynamic Water Level Data Transfer*, together with static data such as S-101 - *ENC* and S-102 - *Bathymetric Surface* data.

S-102 - Bathymetric Surface Product Specification

37. The 1st edition of S-102 - *Bathymetric Surface Product Specification* was published in April 2012. In 2014, the HSSC agreed a new work item on the development of a new edition to address changes in the supporting Format Specification Document -Description of the Bathymetric Attributed Grid Object (BAG)- and to make the specification functional for navigation systems. It was decided to narrow the scope of edition 2.0 to safety-of-navigation applications. The submission to HSSC was initially expected in 2016 at HSSC8. Product portrayal is taken longer than expected, delaying the submission of draft edition 2.0 until HSSC9.

Other S-100 based Product Specifications

38. In 2013, the HSSC adopted a standardised method for identifying S-100 based product specifications as shown in table 5. The HSSC also endorsed the development of a new product specification, S-121 - *Maritime Limits and Boundaries* and supported the development of S-124 - *Navigational Warnings*, a new product specification to be progressed by the World Wide Navigational Warning Service Sub-Committee (WWNWS-SC) in liaison with the TSMAD (now S-100WG).

39. In 2015, HSSC-7 considered a submission by Australia reporting that under keel clearance (UKC) systems were increasingly being used around the world in ports and by vessels themselves when sailing in depth critical waterways. Australia recommended that a project team be established under the S-100WG to coordinate the development of a draft product specification for the display of UKC management information. The Committee endorsed the recommendation and established an Under Keel Clearance Management Information Project Team. In 2016, HSSC-8 assigned the identifier S-129 to the product specification.

40. Table 5 indicates the status of S-100 based product specifications that have been identified so far.

Table 5

Status of identified S-100 based Product Specifications

No / *N°*	**Title / *Titre***	**Status / *Etat***
Product Specifications being developed by the IHO (Numbers S-101 to 199) ***Spécifications de produits élaborées par l'OHI (Numéros S-101 à 199)***		
S-101	Electronic Navigational Chart (ENC) / *Cartes électroniques de navigation*	Under Development *En cours d'élaboration*
S-102	Bathymetric Surface / *Surface bathymétrique*	Published / *Publié*
S-103	Sub-surface Navigation / *Navigation sous la surface*	Planned / *Prévu*
S-104	Water Level Information for Surface Navigation / *Information de hauteur d'eau pour la navigation de surface*	Under Development *En cours d'élaboration*

No / *N°*	Title / *Titre*	Status / *Etat*
S-111	Surface Currents / *Courants de surface*	Under Development *En cours d'élaboration*
S-112	Dynamic Water Level Data Transfer / *Transfert de données dynamiques de hauteur d'eau*	Under Development *En cours d'élaboration*
S-121	Maritime Limits and Boundaries / *Limites et frontières maritimes*	Under Development *En cours d'élaboration*
S-122	Marine Protected Areas / *Aires marines protégées*	Under Development *En cours d'élaboration*
S-123	Radio Services / *Services radio*	Under Development *En cours d'élaboration*
S-124	Navigational Warnings / *Avertissements de navigation*	Under Development *En cours d'élaboration*
S-125	Navigational Services / *Services de navigation*	Under Development *En cours d'élaboration*
S-126	Physical Environment / *Environnement physique*	Under Development *En cours d'élaboration*
S-127	Traffic Management / *Gestion du trafic*	Under Development *En cours d'élaboration*
S-128	Catalogues of Nautical Products / *Catalogues de produits nautiques*	Under Development *En cours d'élaboration*
S-129	Under Keel Clearance Management (UKCM)	Under Development *En cours d'élaboration*
S-1xx	Marine Services / *Services maritimes*	Planned / *Prévu*
S-1xx	Digital Mariner Routeing Guide / *Guide numérique du navigateur sur l'organisation du trafic*	Planned / *Prévu*
S-1xx	Harbour Infrastructure / *Infrastructure portuaire*	Planned / *Prévu*
S-1xx	(Social/Political) / *(Social / Politique)*	Planned / *Prévu*

Product Specifications being developed by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) (Numbers S-201 to 299) ***Spécifications de produits élaborées par l'Association internationale de signalisation maritime (AISM) (Numéros S-201 à 299)***		
S-201	Aid to Navigation Information / *Information sur les aides à la navigation*	Under development *En cours d'élaboration*
S-210	Inter-VTS Exchange Format / *Format d'échange inter-STM*	Under development *En cours d'élaboration*
S-230	Application Specific Messages / *Messages d'applications spécifiques*	Planned / *Prévu*
S-240	DGNSS Station Almanac / *Almanach de station DGNSS*	Under development *En cours d'élaboration*
S-245	eLoran ASF Data / *Données FAS eLoran*	Under development *En cours d'élaboration*
S-246	eLoran Station Almanac / *Almanach de station eLoran*	Planned / *Prévu*
Product Specifications being developed by the Intergovernmental Oceanographic Commission (IOC) (Numbers S-301 to 399) ***Spécifications de produits élaborées par la Commission océanographique intergouvernementale (COI) (Numéros S-301 à 399)***		
Product Specifications being developed by other Organizations (Numbers from S-401) ***Spécifications de produits élaborées par d'autres organisations (Numéros à partir de S-401)***		
S-401	Inland ENC (Inland ENC Harmonization Group [IEHG]) / *ENC intérieures (Groupe d'harmonisation des ENC intérieures [IEHG])*	Under Development *En cours d'élaboration*
S-411	Ice Information (WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology [JCOMM]) / *Information sur la glace (Commission technique mixte OMM-COI pour l'océanographie et la météorologie marine [JCOMM])*	Under Development *En cours d'élaboration*
S-412	Weather Overlay (JCOMM) / *Couche d'information météorologique (JCOMM)*	Under Development *En cours d'élaboration*
Product Specifications for Additional Military Layers (AML) being developed by the NATO Geospatial Maritime Working Group (GMWG) (Numbers S-501 to 525) ***Spécifications de produits de couches militaires additionnelles (AML) élaborées par le groupe de travail géospatial maritime de l'OTAN (GMWG) (Numéros S-501 à 525)***		

ECDIS standards

41. The maintenance of IHO standards related to ECDIS was divided between the TSMAD and DIPWG until the establishment of the ENCWG.

42. A review of the IHO ECDIS-related standards was undertaken in 2012 as a consequence of the investigations into the anomalous operation of some ECDIS. The investigations had revealed that certain parts of the requirements of the standards had been interpreted and implemented in different ways by different manufacturers. The investigations made it clear that there were a number of improvements that should be made to S-52 - *Chart Content and Display Aspects of ECDIS* to reduce the risk of implementation irregularities in the future and improve the clarity of the standard. Feedback from ships at sea also indicated that there were a number of display enhancements to be included in Annex A to S-52 - *IHO Presentation Library for ECDIS* that would significantly increase the usability of ENC in ECDIS. As a consequence, the improvements to the contents of S-52 had to be reflected in the associated IHO standard related to the testing of ECDIS, S-64 - *IHO Test Data Sets for ECDIS*. This, in turn, would affect the test standard for ECDIS of the International Electrotechnical Commission, IEC 61174 - *Electronic chart display and information system (ECDIS) - Operational and performance requirements, methods of testing and required test results*. This interdependence required the synchronization of the revision, approval and implementation of all three standards. Three revised standards were prepared:

    - draft Edition 6.1.0 of S-52,
    - draft Edition 4.0.0 of S-52 - Annex A - *Presentation Library*; and
    - draft Edition 3.0.0 of S-64.

43. Language within Edition 4.0.0 of the Presentation Library was simplified and clarified, and many of the old diagrams and examples were replaced to bring the document up-to-date. Detailed examples were added to provide ECDIS developers with clear guidance for implementing the more complex parts of the ECDIS presentation. Look-up and colour tables were removed from the Presentation Library, Part I and placed into separate files. In instances where multiple options were specified to perform the same task, sometimes leading to ECDIS inconsistencies, the options were limited. Redundancies and repeated copies of several tables within the specification were eliminated, as were elements that had never been implemented, such as raster symbol definitions. A number of changes were made to reflect the requirements in the revised performance standards for ECDIS adopted by the International Maritime Organization (IMO) (Resolution MSC.232(82) refers), such as new sections being added for the detection and notification of navigational hazards, detection of areas for which special conditions exist and detection of the safety contour. These new sections were developed to provide clear guidance on the S-57 objects and attributes that must initiate an alert and/or indication within ECDIS in order to reduce the number of extraneous alarms in ECDIS. The new Presentation Library also made use of the IMO specified viewing groups mandatory. The complex Nassi-Shneiderman diagrams used to describe the Conditional Symbology Procedures (CSPs) were converted to Unified Modeling Language (UML). The inconsistent use of some terms within the CSPs was also eliminated. The display of text was added to selected features so that this information is available to the mariner without having to initiate a "pick-report". Part II of the Presentation Library was also streamlined. Most of "mariner objects" in Part II and the corresponding symbols in the Addendum to Part I were deleted in Edition 4.0.0 to eliminate redundancy with the IMO Performance Standards for the Presentation of Navigation-Related Information on Shipborne Navigational Displays (Resolution MSC.191(79) refers) and the corresponding IEC test standard.

44. The changes reflected in S-52 Edition 6.1.0 related to the colour calibration information contained in its Annexes B and C, much of which referred to obsolescing CRT display technology. The explicit description of colour calibration methods was replaced with references to current industry standards and practices.

45. The changes in S-64 Edition 3.0.0 included more explicit tests with accompanying expected output portrayed in a similar way to that used in the IHO *ECDIS Data Presentation and Performance Check*

in Ships. Accordingly, graphic plots were embedded within the expanded instruction manual rather than as separate PDF files, as in the previous edition. The new edition was meant to expand in detail chart related functionalities from IEC 61174 and mirror the more precise definitions contained within IHO Publication S-52 of ECDIS functionalities required by the ECDIS Performance Standards of the IMO. A comprehensive set of tests, which exhaustively test the various S-57 feature and attribute combinations which portray navigational hazards and which are used in the depiction of the safety contour were provided in new sections to ensure that all required combinations of features and attributes are dealt correctly by the ECDIS under test. The presentation of the tests was standardized in order to describe the setup, data, expected results and any images required in an accessible form for the users of the document when testing ECDIS. The components required to test that the ENC update status report can be located and executed, in accordance with the relevant functionality required by the new edition of IEC 61174, were included in the revised encrypted ENC data set.

46. The draft revised standards were posted on the IHO website in February 2014 to enable comments from all stakeholders in accordance with the IHO procedures for the revision of its standards. The drafts underwent a thorough review by the full membership of the relevant working groups and ECDIS manufacturers and were further refined at a joint meeting of the TSMAD and DIPWG in April 2014. As a result, updated drafts, incorporating comments from the reviews, were posted on the IHO website and HSSC Members were requested to review and endorse the updated drafts. After endorsement by the Committee and adoption by the Member States, the revised set of standards was published in December 2014.

47. In July 2015, the Secretariat issued a media release on "New normative references for the type approval of ECDIS" to assist ECDIS manufacturers, ship operators, and mariners in the implementation of the new editions of S-52 and S-64.

48. As agreed with IEC and the Comité International Radio-Maritime (CIRM) and reported to the IMO Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) in July 2014, the date of entry into force of the new editions was aligned with the date of publication of the new Edition 4.0 of IEC 61174 which occurred on 19 August 2015. From that date, the new editions became the normative references for the type approval of new ECDIS. It was initially agreed that the previous editions would remain valid for twelve months beyond the date of entry into force of the new editions. In November 2015, views were expressed by the shipping industry and ECDIS manufacturers that this twelve-month transition period would be too short to enable ship owners and operators to update existing systems. This was reported to the NCSR in March 2016 and the Sub-Committee agreed to extend by one year, until 31 August 2017, the transition period for upgrading existing ECDIS systems to meet the revised set of IHO standards.

49. Edition 4.0 of IEC 61174 refers to Edition 6.1 (2014) of S-52 and to Edition 4.0 (2014) of the Presentation Library. Despite the care taken in preparing these new editions, their effective implementation revealed imperfections requiring corrections or clarifications, to be considered by the ENCWG. In order to maintain consistency with IEC 61174, it was agreed that successive versions of S-52 and the ECDIS Presentation Library be identified respectively as *Edition 6.1(.x) - October 2014 - With clarifications up to (date)* and *Edition 4.0(.x) - October 2014 - With clarifications up to (date)*. Versions 6.1(.1) of S-52 and 4.0(.1) of the Presentation Library were published in June 2015 together with Edition 3.0.1 of S-64. A second set of clarifications is expected to be published in early 2017.

50. In parallel, a new edition of S-58 - *Recommended ENC Validation Checks* was prepared. The new Edition 5.0.0 published in June 2014 introduced various new critical error checks to avoid errors in the compilation of ENCs by Hydrographic Offices that might cause a failure in the ECDIS, or at least severely compromise ECDIS performance. Accordingly IHO S-57 Supplement No.3, published in June 2014 also, introduced the minimum validation requirements defined in the new edition of S-58. It also included some minor changes to improve consistency. Both standards were expected to become mandatory on 1st January 2016, to allow sufficient time for ENC producers to adapt their production process and implement the relevant validation tools. This date was postponed following the discovery

in early 2015 of a number of inconsistencies, grammatical omissions and some logic errors in Edition 5.0.0 of S-58. The ENCWG was tasked to draft a new edition addressing the anomalies.

51. The preparation of a new edition of S-66 - *Facts about Electronic Charts and Carriage Requirements* was initiated in 2014 to reflect the significant changes that had occurred since the first edition (January 2010). The revision took longer than expected due to other higher priorities.

52. At the request of the Inter-Regional Coordination Committee, HSSC-7 tasked the ENCWG to draft a revised Edition 2.1.0 of S-65 to align with the latest version of the WEND Principles and Guidelines.

53. In November 2016, HSSC-8 endorsed the principles of the draft revised editions of S-58, S-65 and S-66 proposed by the ENCWG and tasked the working group to finalize the drafts and forward them to the Secretariat for subsequent consideration by the Member States.

54. In accordance with Decision No. 7 of the 18th International Hydrographic Conference, the Secretariat ensured that "issues identified in regard to the anomalous operation of ECDIS are collated, analysed, communicated and resolved as speedily as possible to maintain the safety of navigation and to assist the smooth transition from paper to digital navigation" through the monitoring of ships' reports on ECDIS Data Presentation and Performance Check. Table 6 shows the statistics of the reports received since the check data set was distributed to ship operators and posted on the IHO website in August 2011.

Table 6

Outcome of ECDIS Data Presentation and Performance Checks for Ships

Period	**1 Aug 2011 15 Apr 2013**	**15 Apr 2013 15 Apr 2014**	**15 Apr 2014 1 Dec 2014**	**1 Dec 2014 1 Dec 2015**	**1 Dec 2015 1 Dec 2016**
Number of reports	1,042	76	74	1,318	4,019
% of reports indicating no problem	22%	43%	55%	73%	86%
% of reports indicating no anomaly in the display of "new objects"	60%	91%	95%	95%	93%

55. The number of reports increased significantly in 2015 and continued to increase in 2016. This is probably due to the promotion of the checks by various organizations and the wider use of ECDIS. The statistics indicate a continuing improvement in the updating of ECDIS software. No new issue has been identified. It appeared that the ECDIS Data Presentation and Performance Check for Ships was being used by Port State Control and/or vetting inspectors to check the implementation of ECDIS carriage requirements. As indicated in the relevant section of the IHO website, the checks and the accompanying dataset are designed to alert mariners to the possibility that their ECDIS software may require upgrading. The IHO ECDIS Data Presentation and Performance Check is not intended for, and is not suitable to be used as, a carriage compliance test for ECDIS. Noting that the ECDIS Data Presentation and Performance Check would no longer be useful to ECDIS equipment conforming to the revised set of ECDIS standards, HSSC-7 tasked the ENCWG to investigate the need to develop a new or revised check dataset. HSSC-8 endorsed the ENCWG proposal to use ECDIS Chart 1 to assist mariners in checking ECDIS operating with Edition 4.0 of the Presentation Library. The Committee tasked the Secretariat, in liaison with the ENCWG, to describe the procedure in a new edition of the IHO webpage on *ECDIS Data Presentation and Performance Check in Ships*.

56. Edition 4.0.0 of S-57, Appendix B.1, Annex A - *Use of the Object Catalogue for ENC* (UOC) was published in June 2014. It included new guidance on updating ENC datasets in response to disasters, on addressing depth discontinuities between surveys, and on masking certain objects in order to

improve ECDIS screen display. It also included ENC Encoding Bulletin No. 54 on virtual Aids to Navigation based on the Automatic Identification System (AIS).

57. Member States were reminded to update the information on their requirements for ECDIS back-up arrangements using paper charts which have been posted on the IHO website since 2008. Five updates were received in 2015 and 5 in 2016. 23 of the 34 Member States which have expressed specific requirements have not provided any update of their information since 2008.

Element 2.3 - Nautical Cartography

58. The CSPCWG completed in 2014 the revision of IHO Publication S-4 - *Regulations for International (INT) Charts and Chart Specifications of the IHO* undertaken after the adoption in 2005 of a new format. The outcome of this major work was effected with the publication of Edition 4.5.0 in October 2014. Editions 4.3.0 and 4.4.0 were published respectively in August 2012 and September 2013. The main items addressed in the successive revisions were as follow:

59. Edition 4.3.0: source/ZOC diagrams; historic wrecks; berth-side obstructions, lighthouses, depiction of imprecise shoal areas; development dredging; yellow, amber and orange lights; symbol for diving prohibited.

60. Edition 4.4.0: revision of Section B-300 - *Topography*; "after-disaster" surveys; generic magenta light flare on multi-coloured charts

61. Edition 4.5.0: revision of Section B-500 - *Text: Language, Numbers, Abbreviations, Names, Styles and Fonts*; INT chart numbering; showing limits of surveys on charts; discontinuities between surveys; reported dangers; updating order of charts according to scale; selection of soundings; definition of major lights; specification of direction lights; highlighting of navigation lights; status of "Large Automatic Navigational Buoy" (LANBY).

62. A number of clarifications were also incorporated, as listed in the appropriate "Record of Updates" inserted at the beginning of each chapter of S-4.

63. Edition 4.5.0 was the last revision adopted under the special procedures that were in place during the major revision process: the CSPCWG was authorized to recommend amendments to S-4 directly to the IHB, who would then communicate them to all IHO Member States by Circular Letter, asking Member States to make known any major objection within three months. The relevant specification of S-4, B.160 - *Updating system for the specifications*, was amended in Edition 4.5.0 to revert to the normal maintenance procedure described in IHO Resolutions 11/2002 - *Regulations of the IHO for international (INT) charts and chart specifications of the IHO* and 2/2007 - *Principles and Procedures for making changes to IHO Technical Standards and Specifications*, as amended.

64. The subsequent revised editions of S-4 were prepared in accordance with the normal maintenance regime. Edition 4.6.0 was published in April 2016 to address the following items: light vessels; glaciers; dredged areas; maximum authorized draught; source diagrams; dangerous cargo berth; wind farms under construction; chart maintenance: recording outstanding information; NMs for AIS aids to navigation; QR codes; T&P NMs; INT 2 and INT 3; area to be avoided within traffic separation scheme; use of non-IHO Member State seals on INT paper charts; consistency between chart products; building in or over the water; offshore accommodation vessels; refuge area/anchorage. The changes includes new guidance in section B-100 defining what is meant by "consistency" of information content between corresponding paper charts and ENCs and revised wording in section B-600 strengthening the requirement to apply to ENCs the equivalent of paper chart T&P NMs.

65. A new draft Edition 4.7.0 is under preparation for the consideration of the Member States. It incorporates changes approved at HSSC-8 related to the following items: radio-activated aids to navigation; suspended submarine pipelines; seaweed and seagrass; larger scale chart limits in yellow; vacant entries in INT 1.

66. The associated publication INT 1 - *Symbols, Abbreviations and Terms used on Charts* was updated in accordance with the changes introduced in S-4. The following editions were published during the reporting period:

    - INT 1 (English): maintained by the German Hydrographic Office on behalf of the IHO: 8th Edition, 2015;
    - INT 1 (French): maintained by the French Hydrographic Office on behalf of the IHO: 5th Edition, 2012; 6th Edition, 2016;
    - INT 1 (Spanish): maintained by the Spanish Hydrographic Office on behalf of the IHO: 4th Edition, 2012; 5th Edition, 2015.

67. Edition 2.0.5 of Publication S-11 Part A - Guidance for the Preparation and Maintenance of International Chart Scheme was published in May 2012 to include updated information in Annex A - *Potential Printer Nations* and Annex B - *Dimensions of formats used*.

68. The CSPCWG had been tasked in 2009 to develop guidelines for the preparation and maintenance of small / medium scale ENC schemes. After much delay, an approach for assistance and advice was made in 2012 to the North Sea ENC Harmonization Working Group, under the North Sea Hydrographic Commission to draft a new edition of S-11 Part A. A draft prepared in liaison with the WENDWG was submitted to HSSC-7 in 2015. The Committee determined that more work was required and instructed the NCWG to restructure the draft to separate the guidance for INT (paper) charts schemes and ENC schemes in two separate sections. A revised draft was endorsed by HSSC-8 for subsequent consideration by the Member States. HSSC-8 approved in particular the following arrangements:

    - the former Annexes A and B of S-11 Part A should be moved to S-11 Part B - *INTernational Chart Web Catalogue*;
    - the new edition should no longer be bi-lingual but published in separate English and French versions.

69. The regional chapters of S-11 Part B - *Catalogue of International (INT) Charts* were maintained in pdf format by the Secretariat until 1st April 2016. Revised editions of the chapters were published on the basis of the input from the relevant regional INT coordinators. A new chapter covering INT Region N - *Artic Ocean*, with Norway as coordinator, was released in 2013. The catalogue was replaced in 2016 by an on-line web-based interactive version as reported in the report of programme 3.
70. HSSC-7 invited the NCWG to address as a high priority the work item on the future of the paper chart included in its work plan and report at HSSC-8. Unfortunately, this action was not completed due to resource constraints. A report is now expected at HSSC-9.

Element 2.4 - Digital Data Protection and Authentication

71. Edition 1.1 of S-63 - *IHO Data Protection Scheme* had been published in 2008 to include a more precise description of the correct implementation of the standard. In April 2012, small changes were made to remove the hexadecimal limitation of M_ID, the unique identifier assigned by the Scheme Administrator to each manufacturer, in order to extend the number of possible M_ID values that the scheme is able to accommodate. This resulted in the publication of Edition 1.1.1 of S-63.

72. In September 2012, HSSC-4 reviewed the progress in implementing Edition 1.1 of S-63 reported by the DPSWG and agreed that in order to fully implement and standardise the use of S-63 Edition 1.1.1, a deadline should now be set, after which S-63 Edition 1.0 would no longer be a valid IHO standard. Accordingly, HSSC set 1 January 2014 as the termination date for S-63 Edition 1.0. As a consequence, in December 2012, the Secretariat sent a letter to all S-63 Data Servers and ECDIS manufacturers informing them that the further use of S-63 Edition 1.0 after 1 January 2014 would result in the termination of their protection scheme agreement. This decision did not raise any adverse feedback. A limited extension was granted to two data servers who requested more time to complete the migration of a small proportion of legacy ECDIS systems to be able to use S-63 edition 1.1 ENCs. The migration of these legacy ECDIS systems was monitored in liaison with the two data servers concerned. The percentage of legacy systems dropped from 21% on 1 January 2014 to less than 6% on 31 December

2014 and to 4% on 30 September 2015. Considering that there was no major drawback to letting the few remaining legacy users continue using S-63 Edition 1.0 until their legacy systems were removed or replaced, HSSC-7 decided to discontinue the monitoring of the transition.

73. In relation to the revision of IEC 61174 (see paragraph 4.1), the production of a normative reference that supports the requirement for an "ENC Update Status Report" showing the status of ENC data to the end-user (for operational planning) and to the relevant authorities (for such purposes as Port State inspection) appeared necessary. Further consideration led to acknowledging the need to enhance S-63 with a new Annex C describing the functionality required to provide an ENC Update Status Report. A revised Edition 1.2.0 of S-63 incorporating the new Annex C was published in February 2015. The new functionality applies only to those ECDIS systems that are type-approved in accordance with the Edition 4.0 of IEC 61174.

74. The DPSWG was tasked to draft a new edition of S-63 to support S-100 development. The working group identified the need to provide a framework standard that would allow:

    - the provision of data protection, compression and authentication to product specifications,
    - the ability for modular application so that encryption and authentication are not inter-dependent,
    - the ability to tailor protocols and implementations for different product specifications.

75. Following the development of a pre-draft, it appeared that it would be more efficient to incorporate a large proportion of the content of S-63 into a new part of the S-100 standard. The proposal was endorsed by the S-100WG and agreed at HSSC-8.

76. The Secretariat continued to carry out the role of administrator of the S-63 scheme. This function involves processing applications and providing technical support and the individual and unique digital certificates and codes that are required to allow ENC data servers, ECDIS Original Equipment Manufacturers (OEM) and software developers to encrypt and de-encrypt ENCs as part of the services or equipment that they provide. At the end of 2016 there were 49 Data Servers and 294 OEMs licenced to use the S-63 scheme.

Element 2.5 - Data Quality

77. The DQWG focused its activities on the development of a model for the quality of bathymetric data to be included in S-101 - *ENC Product Specification*. Different systems were investigated. Considering the effort that would be required of Hydrographic Offices to implement a new scheme, the working group decided to recommend retaining the current threshold values for data quality associated to Category of Zone of Confidence (CATZOC). As a consequence, the transition from S-57 to S-101, as far as the quality of bathymetric data is concerned, should be more easily implemented and automated. The data quality model in Unified Modelling Language (UML) and the decision tree for designating the quality of bathymetric data in S-101 were completed in 2016.

78. In addition, the DQWG developed guidance on assessing respectively temporal variations of the seafloor and overlapping depth-related features, such as for areas of mobile seafloor above which a safe clearance depth may exist. The working group provided input to the development of guidance on crowd-sourced bathymetry. Feedback was also provided to the NIPWG on data modelling and portrayal related to uncertain ("fuzzy") areas.
79. As instructed by the HSSC, the DQWG considered the concept of data supply chain certification. The group endorsed the overall importance of end-to-end data integrity, from the data source to the end-user, but did not reach a consensus on the role of the IHO.

80. A work item of the DQWG was to investigate ways to improve mariners' understanding about data quality. This has proved to be a very challenging topic. HSSC-4 tasked the working group to review, in liaison with training institutions, the adequacy of Member States' publications on the quality aspects of the practical use of ENCs. Member States were invited to provide copies of their relevant publications with the intention of compiling an inventory and develop an IHO standard text that could be used as a reference from which other Member States could derive input for their own publications.

Initial findings indicate that most Member State documents are excessively complex and lengthy, discouraging use by mariners. The task has not been completed due to lack of resources and is on-going. At HSSC-8, the representatives of the stakeholders highlighted the pressing requirement for all IHO Member States that produce ENCs to populate them with assessed CATZOC values (1 to 5) to assist mariners in their decision-making process for safe navigation.

Element 2.6 - Nautical Publications

81. The SNPWG and then the NIPWG concentrated on developing S-100 based product specifications related to nautical publications. The working group completed an extensive modelling work with the creation of a comprehensive catalogue of features and attributes covering the information elements of sailing directions, lists of radio signals, lists of lights, lists of buoys and beacons, mariners' handbooks, routeing guides and notices to mariners (updates to nautical publications). The items of the catalogue are being progressively inserted in the Feature Concept Dictionary Register of the S-100 Registry. Data harmonisation with the S-101 Data Classification and Encoding Guide (DCEG) is close to completion and it was decided to merge the former NPUBS domain into the HYDRO domain.

82. The status of the development of S-100-based product specifications related to nautical information is summarized hereinafter.

S-122 - Marine Protected Areas

83. This is the most advanced project:

- The application schema was drafted and is being revised according to the outcome of the harmonization between the S-101 and S-122 data models.
- The Feature Catalogue is stable and will be updated when the application schema is finalised;
- The DCEG is under review. The completion of the data part depends on the progress of the S-101 and S-122 data model harmonization. Considering that S-122 is the first product specification related to nautical publications, the general part of the DCEG will be provided in a way that enables encoders to convert the publication information into the data model based information very easily.
- The test data samples are stable and one test data sample is maintained according to the latest developments.

84. The portrayal section remains the missing element.

S-123 - Radio Services

85. A test data sample, a draft data model, and an application scheme have been developed. As a result of the test data sample review, shore based AIS transmission information will be added. An extension of the data model and the application scheme is under consideration.

S-125 - Navigational Services

86. The initial development of a test data sample has revealed the need to specify more precisely the scope of the product specification.

S-126 - Physical Environment

87. The test data sample has been reviewed and is considered stable and ready for use. A draft data model has been produced.

S-127 - Traffic Management

88. The test data sample is stable and the initial mapping of the content to the data model has been conducted. A draft data model has been produced.

S-128 Catalogue of Nautical Products

89. HSSC-7 endorsed the NIPWG proposal to develop a product specification for catalogues of nautical publications and allocated the identifier S-128. This product specification is intended to enable the exchange of lists of products between Member States and users in support of the Maritime Service

Portfolios (MSPs) for e-navigation. The Republic of Korea is developing a draft product specification for further consideration by the working group.

90. The production schedules for test data samples for other product specifications such as Marine Services, Harbour Infrastructure and Social/Political Information are not yet determined.
91. Portrayal issues associated with nautical information require further investigation. A dedicated workshop is scheduled in May 2017 to discuss options for portraying nautical information on board in combination with S-101 ENC or separately.

92. IHO Publications S-12 - *Standardization of List of Lights and Fog Signals* and S-49 - *Standardization of Mariners' Routeing Guide*) did not require any maintenance during the reporting period.

93. HSSC-7 tasked the NIPWG to coordinate the contribution of the IHO to the development of IMO guidelines for the harmonized display of navigation information received via communications equipment and to the preparation of the IMO output related to the development and implementation of MSPs, notably in liaison with the Sub-Committee on the World-Wide Navigational Warning Service. Discussions are ongoing to develop a single MSP named "Hydrographic Services" that would encompass nautical charts, nautical publications, Maritime Safety Information and other related real-time hydrographic and environmental information.

94. The NIPWG monitored the development of projects and prototype services related to the implementation of e-navigation, such as the European projects Mona Lisa and EfficienSea2, and the Avanti project of the International Harbour Masters Association in order to maintain awareness of issues and progress relevant to the development of the MSPs and the improvement of the relevant product specifications.

Element 2.7 Tides and Water Levels

95. HSSC-4 invited the TWLWG, now TWCWG, to consider as a matter of priority tidal matters relevant to the dynamic application of tides in ECDIS. The working group developed a scoping document in order to identify the relevant requirements and considerations. With the assistance of TSMAD and then the S-100WG, the UK led, in cooperation with Singapore, the development of the first draft of an S-100 based Product Specification designated as S-112 - *Dynamic Water Level Data Transfer*. The draft was based on the AIS Meteorological and Hydrographic Data Application-Specific Message. This AIS message provides the means to transfer a variety of different information, including data for wind, weather, surface currents, sea state, salinity and ice, and provides the scope not only to include dynamic water level data, but other data, as well. One of the main advantages of using this methodology is that it can be assimilated by any ECDIS that is integrated with AIS either in the current S-57 environment or in future S-100 implementations. Further considerations are required to ensure the quality and authenticity of the AIS information. Other modes of transfer should be considered.

96. In parallel, a draft tidal height product specification, S-104 - *Water Level Information for Surface Navigation*, was produced and work was started on developing the attributes of a tidal zone feature.

97. Progress was made on developing a standard for digital tide tables with the development of a list of fundamental attributes generated by the USA.

98. In 2014, the Member States adopted the revision of three IHO Resolutions on tides, water levels and tidal publications which had been proposed by the TWLWG and endorsed by HSSC-5:

- Resolution 27/1919, as amended - *Time to be used*;
- Resolution 2/1977, as amended - *National Tidal Constituent Banks*;
- Resolution 1/1977, as amended - *Collection and Publication of Tidal Data*.

99. Considering the comments received from the Member States concerning the proposed revision of Resolution 3/1919, as amended - *Datums and Bench Marks* and noting that the TWCWG had separately identified that additional work was required on the Resolution and related definitions, the HSSC invited

the working group to review the draft revised text. A revised draft endorsed by the HSSC was proposed to the consideration of the Member States in 2016. As agreed by HSSC-8, the final text, taking into account the comments received, will be promulgated shortly.

100. The working group kept the inventory of tide gauges used by Member States up-to-date. The inventory was extended in 2015 to include current meters. This information is available on the TWLWG page of the IHO web site. A list of on-line links to real-time tides and currents was compiled and posted on the IHO web site as an additional resource. A process for updating the list was agreed.

101. The English version of the Manual on Tides (Tides in Coastal Waters), co-produced in 2007 by the Institut Océanographique (Paris) and SHOM - the French Hydrographic Office, was made available by SHOM in 2013. The Manual was included in the IHO catalogue as publication C-33.

102. The TWCWG has undertaken a review of the material for capacity building courses on tides and currents in liaison with the Capacity Building Sub-Committee.

Element 2.8 Digital Data Updating

103. The mandate of the ENC Updating Working Group (EUWG) that had been established in 2008 to address issues relating to ENC updating was discharged in 2012 with the publication of Edition 4.0.0 of S-52 Appendix 1 - *Guidance on Updating the Electronic Navigational Chart*, providing guidance on processing of ENC updates into an ECDIS, and Edition 2.0.0 of S-65 - *ENCs: Production, Maintenance and Distribution Guidance*, including additional guidance on producing and distributing ENC updates.

104. The Committee continued to monitor the status of production and publication in ENC updates of the equivalent of Temporary (T) and Preliminary (P) Notices to Mariners (NM). A second survey was conducted in 2013 to assess the practices of the 53 Member States that were known to issue ENCs under their producer code, for themselves or on behalf of other States. In accordance with the outcome of the review by HSSC-5 in 2013, the fifteen Member States that had not provided a status report, or had not committed to aligning their ENC and paper chart T&P update regimes, were invited to clarify their position and report any need for assistance. Six responses had been received by the end of 2014. All confirmed their intention to align their ENC and paper chart update regimes. At HSSC-8 in 2016, a submission from the International Association of Independent Tanker Owners (INTERTANKO) reported that its members were facing great difficulties in recognising which T&P information was included in ENC updates or not. The Committee tasked the ENCWG and the NCWG to draft a consolidated, authoritative IHO document addressing the issue of "equivalent" T&Ps for ENCs, with the intention of distributing the completed document to Hydrographic Offices, Port State Control authorities and mariners. Further improvement of the relevant guidance (Clause 2.6.2 of S-57, Appendix B.1, Annex A - *Use of the Object Catalogue for ENC*) will also be considered to reflect the comments received from Member States.

Element 2.10 Hydrographic Data Acquisition and Processing

105. During the consideration by HSSC-6 of the re-organization of the structure of the working groups of the HSSC, concern was expressed by some Members that not a single working group in the new structure dealt with hydrographic surveying. Discussion during HSSC-6 indicated that there might be a need to address the use and standardization of new emerging hydrographic surveying technologies that were not already reflected in the relevant IHO standards and guidelines. The most relevant IHO Standard related to hydrographic surveying is IHO Publication S-44 - *IHO Standards for Hydrographic Surveys* - for which the edition in force is the 5th Edition. The 5th Edition was developed by the Working Group on Standards for Hydrographic Surveys (S-44WG) established in 2005 and adopted by IHO Member States in 2008. The S-44WG was then disbanded. No maintenance or extension of S-44 had been required.

106. As requested by HSSC-6, Member States were invited to indicate their views on the adequacy of S-44, on related work items which might be relevant, if any, and on the possible establishment of a dedicated Hydrographic Surveys Working Group (HSWG). The replies showed that only a minority

of Member States would support the establishment of a new HSWG and even less would support a review of S-44. Although the majority of identified topics could be allocated to existing subordinate bodies of HSSC and IRCC, some topics, which most directly related to S-44, did not lie within the scope of any of the currently established subordinate bodies or active work programme tasks. HSSC-7 considered the outcome and in the absence of a consensus on the scope of work to justify establishing a new working group, the Committee decided to create a Hydrographic Surveys Scoping Project Team (H2SPT) that would be tasked, for one year, to clarify the scope and the deliverables expected from any possible HSWG. IHO Member States and stakeholders were invited to participate in the project team. HSSC-8 considered the report provided by the Chair of the H2SPT and decided to establish a Project Team on Standards for Hydrographic Surveys (HS PT), primarily tasked to review S-44, draft a new edition, if appropriate, and identify additional tasks, if any, that might require the establishment of a standing Hydrographic Surveys Working Group.

Element 2.11 - Hydrographic Dictionary

107. The HDWG struggled to progress its work plan during the reporting period, due to limited participation. In 2012, new or amended definitions for 70 terms which had been endorsed by HSSC-3 in 2011 were approved by Member States and inserted in the English and French on-line versions of S-32 - *Hydrographic Dictionary*. In 2014, further five new definitions which had been agreed by the HDWG and then endorsed by HSSC-5 were approved by Member States.

108. Noting the recurring difficulties to attract participation, HSSC-6 welcomed the offer of Australia to liaise with the Chair and members of the working group by correspondence in order to draft new business rules for the HDWG, focused on a database approach, and addressing the potential for synergy with other requirements for definitions and references, such as the S-100 Registry, HSSC WGs and other IHO and inter-organizational bodies. The Committee also invited the HDWG to consider the structure of the ISO/TC211 Multi-Lingual Glossary of Terms as a way to evolve the IHO on-line Hydrographic Dictionary. The Committee considered further the situation at its 7th meeting and requested the HDWG to investigate options and associated resource requirements and timeline to produce and maintain a reference edition of S-32 and tasked the S-100WG to specify its requirements regarding definitions included in the S-100 Registry.

109. Thanks to the secondment of a project officer by Peru, the development of the Spanish language Wiki version of S-32 was undertaken in March 2015. The English, French and Spanish Word files were reformatted into tables with a common identifier that can be used to create a digital cross-reference between the three language versions. Some investigations were undertaken to identify existing options for on-line multilingual glossaries. This work led to the development of a draft policy for the maintenance of the Hydrographic Dictionary and to the proposal to develop an experimental multi-lingual wiki-based demonstrator to support a subsequent upgrade of S-32. HSSC-8 endorsed the development of the demonstrator through contractor support and invited the HDWG Chair to develop further the draft policy and complement it with an implementation roadmap, compatible with the resources available and taking into account the S 100 framework with regard to the location of authoritative definitions.

Element 2.12 - ABLOS

110. The Advisory Board on the Technical Aspects of the Law of the Sea (ABLOS) is a joint board of the IHO and the International Association of Geodesy (IAG). The ABLOS comprises four representatives from IHO Member States and four representatives from the IAG. The United Nations Division for Ocean Affairs and Law of the Sea (UN-DOALOS) and the IHO Secretariat provide one ex-officio member each. The ABLOS is charged with providing advice, guidance and, where applicable, offering expert interpretation of the hydrographic, geodetic and marine geo-scientific aspects of the Law of the Sea to the parent Organizations, their Member States or to other organizations on request. It also reviews State practice and jurisprudence on Law of the Sea (LOS) matters which are relevant to the work of the Board to enable it to provide expert advice when needed. The ABLOS also studies, promotes and encourages the development of appropriate techniques in the application of the technical provisions contained within the UN Convention on the Law of the Sea (UNCLOS). IHO publication

C-51 - *Manual on the Technical Aspects of the United Nations Convention on the Law of the Sea* (TALOS Manual) is maintained by the ABLOS. ABLOS meets every year and holds a self-funded international seminar (ABLOS Conference) every other year.

111. Two ABLOS Conferences were held during the reporting period. The 7th ABLOS Conference, titled "UNCLOS in a Changing World", was held in Monaco from 3 to 5 October 2012. It attracted an audience of nearly 90 delegates from 26 countries with 30 papers being presented during 11 sessions. The event coincided with the week of GEBCO meetings and Science Day which allowed exchange of experience and cross-fertilization between the ABLOS and GEBCO communities. Due to EIHC-5 planned in October 2014, the 8th ABLOS Conference was postponed in 2015. The Conference, titled "UNCLOS: Advances in Managing the Blue World" took place from 20 to 22 October 2015 in Monaco. It was attended by 70 delegates representing 28 Member States. The Conference included 28 presentations covering a wide variety of topics and issues in relation to the Conference theme. The presentations generated numerous comments in plenary and much discussion in the margins during the break.

112. The 5th edition of C-51, which had been undertaken by an Editorial Group formed in 2010, was published in June 2014. The key elements of the work of the Editorial Group were as follows:

113. In reviewing the old text, the Editorial Group determined that Chapter 2 (Geodesy) was most in need of substantial revision in order to better reflect the current theory and practice in surveying and satellite-based positioning. Accordingly, Chapter 2 was rewritten in its entirety.

114. Minor changes were recommended and implemented for Chapter 4 (Baselines) and Chapter 6 (Bilateral Boundaries). Modifications to Chapter 3 (Nautical Charts) and Chapter 5 (Outer Limits) have been identified but, because of work load considerations, their implementation was deferred to a future edition.

115. In a significant departure from previous editions, selected illustrations throughout the Manual have been made into animations in order to better explain certain concepts and procedures. Where appropriate, figure captions contain links to the IHO website where the animations may be accessed (Home > Standards & Publications > Download > C-51 > Talos Animations).

116. The work on the sections of C-51 that were identified as requiring revision during the final stages of review of Edition 5.0.0 was undertaken in 2015.

117. In order to assist Member States in implementing the technical aspects of UNCLOS, regional seminars were held in conjunction with the business meetings of ABLOS on non-conference years. In 2013, the 20th business meeting held in Oman was followed by a seminar titled "Harmonization with UNCLOS: experiences and observations" attended by approximately 90 delegates from Oman and other countries in the region, including Kuwait, Qatar and Saudi Arabia. In 2014, the 21st business meeting held in Denmark was followed by a seminar titled "UNCLOS and the Arctic - Changes now and in the near future" which was attended by approximately 65 delegates from across the region, including United Kingdom, Faroe Islands and Greenland, as well as representatives from a wide selection of Danish government ministries, technical authorities and universities. In 2016, the 23rd business meeting held in the ROK was followed by a seminar titled "Roles of the Law of the Sea and the Hydrography in Asian Region" which was attended by approximately 45 delegates from across the region, including China and Japan as well as representatives from France and Qatar and a wide selection of Korean government ministries, technical authorities and universities.

118. Workshops on LOS issues were carried out respectively in Muscat, Oman (February 2012), for the ROPME Sea Area Hydrographic Commission, in Ho Chi Minh City, Vietnam (November 2012) and Jakarta, Indonesia (November 2014), for the East Asia Hydrographic Commission, in Paramaribo, Suriname (August 2015) for the Meso American - Caribbean Sea Hydrographic Commission, and in Fish Hoek, South Africa (December 2015) for the Southern Africa and Islands Hydrographic Commission.

119. ABLOS members participated in a number of conferences related to law of the sea and provided technical inputs in some delimitation discussions.

120. The Secretariat maintains a list of LOS Experts designated by the Member States that is available on the IHO web site.

Element 2.13 - Surface Currents

121. Based on a proposal submitted by Canada, HSSC-4 agreed in 2012 to establish a working group to develop an S-100-based standard for the delivery and presentation of navigationally relevant information about horizontal water movement (currents, tidal flow and river flow). The Surface Current Working Group (SCWG) developed an on-line User Requirements Survey in order to identify user needs and requirements as well as to identify the capabilities and products provided by individual Member States. The User Requirements Survey was also intended to identify what needed to be specified in the standard in order to allow the mariner to visualise and best use current information to navigate safely and to make informed navigational decisions. The survey was open from October to December 2013 to Member States and all relevant parties such as maritime administrations, equipment manufacturers, data distributors, users and other professional and educational organizations so as to gain the widest possible consultation and input. The survey elicited 1,401 responses. Based on the analysis of the responses and inputs from expert contributor and Member States, the working group considered coverage types for currents and developed a list of potential features and attributes. This in turn led to the development of a draft edition of S-111 - *Surface Current Product Specification*. The working draft is now under the responsibility of the TWCWG. The production of test datasets has been initiated in order to assist the production of the feature catalogue and portrayal catalogue.

Comments on the Proposals submitted to the consideration of the Assembly

122. HSSC-6 considered the proposal PRO 6 submitted by the Republic of Korea to the consideration of the Assembly. The Committee endorsed the principles of the changes proposed to IHO Resolution 2/2007 - *Principles and procedures for making changes to IHO technical standards and specifications*, as amended. Noting the potentially significant additional resources involved in implementing the proposed changes, the Committee recommended that the proposal be considered through a holistic review of the Resolution, taking into account the feedback and experience gained, notably with the implementation of the S-101 test strategy, and assessing the impacts on all parties involved.

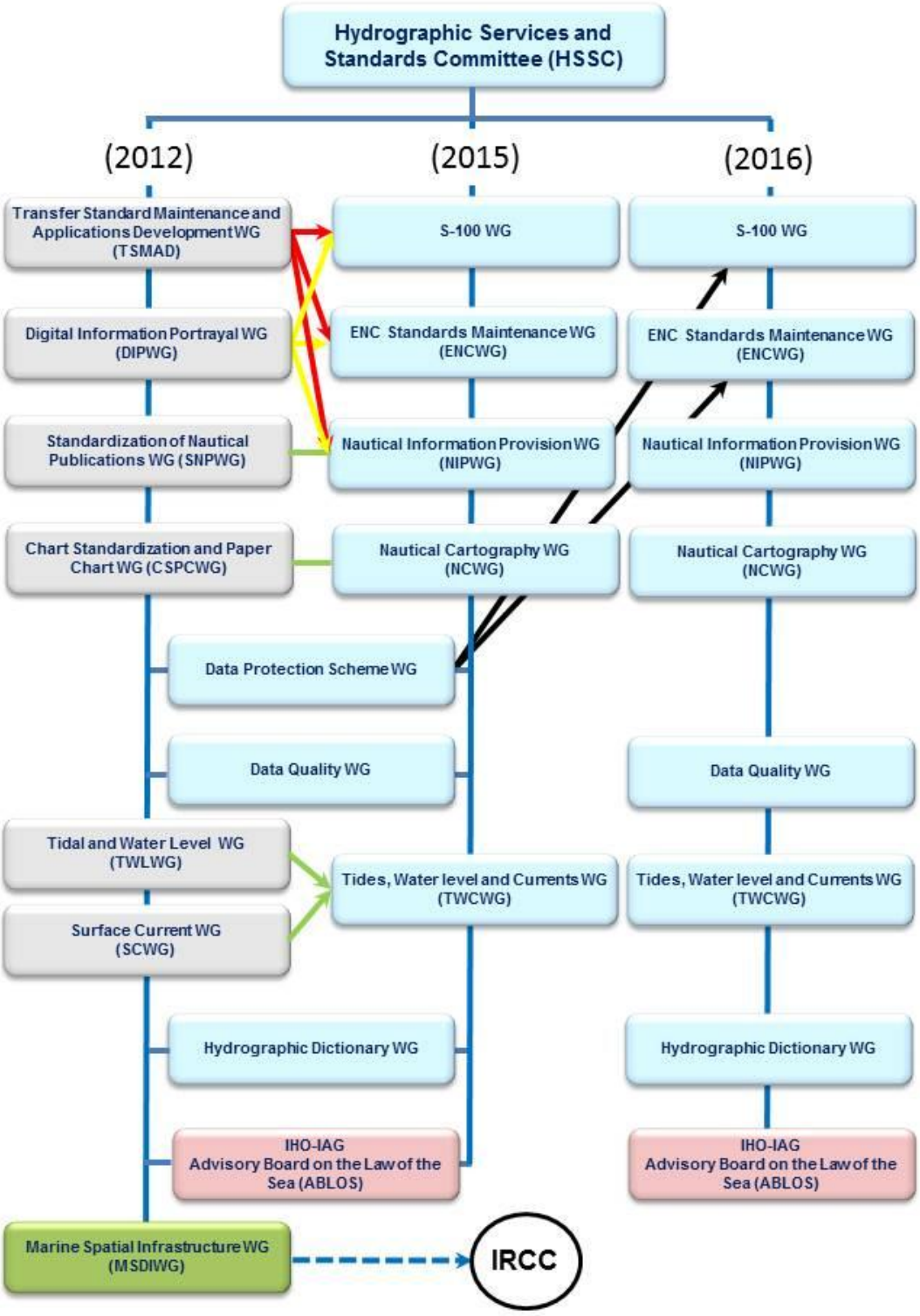
Actions required of the Assembly

123. The Assembly is invited to:
   a) note the report on the execution of programme 2;
   b) approve the continued existence of the HSSC under its amended Terms of Reference and Rules Of Procedure as indicated in Annex C, subject to the consideration and adoption of the IHO Work Programme 2018-2020;
   c) express the gratitude of the Organization to the Chairs of subordinate organs and subsidiary bodies who retired from the hydrographic community during the reporting period:
      - Mr Chris CARLETON, United Kingdom
      - Mr Stephen GILL, USA
      - Mr Barrie GREENSLADE, United Kingdom
      - Mr Chris HOWLETT, United Kingdom
      - Mr Peter JONES, United Kingdom
      - Mr Jerry MILLS, United States;
   d) urge Member States to contribute more actively to the implementation of Programme 2 and to maintain the relevant expertise;
   e) acknowledge the significant contribution of expert contributors from industry and academia and encourage their continuing involvement in the activities of the Organization;
   f) urge Member States to ensure consistency between their paper and digital charts and publications through the provision of the appropriate updates;

g) urge Member States to ensure that the information on national arrangements related to the use of ECDIS are kept current;
h) consider the recommendation in paragraph 5 above when discussing PRO 6.

Annex A - Structure and membership of HSSC

A.1. Structure of the HSSC and its subordinate bodies



A.2. Hydrographic Services and Standards Committee (HSSC)

1. Chairmanship

Chair Dr Mathias JONAS, Germany

Vice-Chair: Mr Mike PRINCE, Australia

2. Membership

(HSSC list of contacts as at *16 November 2016*)

IHO Member States (34): Argentina, Australia, Brazil, Canada, Chile, China, Cuba, Denmark, Ecuador, Estonia, Finland, France, Germany, Greece, India, Indonesia, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Republic of Korea, Russian Federation, Singapore, South Africa, Spain, Sweden, Turkey, United Kingdom, USA

Observers (24): CIRM, CLIA, CNITA, DGIWG, FIG, GEBCO, IAG, IALA, IC-ENC, ICPC, ICS, IEC/TC80, IEHG, IMO, IMPA, IOC/IODE, ISO/TC211, INTERTANKO, OGC, OGP, PRIMAR, RTCA, RTCM, UN/DOALOS

3. Meetings

HSCC has met annually since IHC-18 as follows:

HSSC-4	Taunton, United Kingdom	25-28 September 2012
HSSC-5	Shanghai, China	5-8 November 2013
HSSC-6	Viña del Mar, Chile	11-14 November 2014
HSSC-7	Busan, Republic of Korea	9-13 November 2015
HSSC Chair Group Workshop	Paris / Saint-Mandé, France	1-2 June 2016
HSSC-8	Monaco	14-18 November 2016

4. Agenda Items

Standing items:

- HSSC administration (including preparation of inputs to IH Conference/Assembly sessions as appropriate)
- Reports by HSSC working groups
- Reports by inter-organizational bodies
- Decisions of other bodies affecting HSSC
- Review of new developments and other information papers
- Liaison with external stakeholders
- Review and endorsement of HSSC work plan and list of actions

Specific items:

- HSSC-4: IHO Stakeholders' Forum
- HSSC-7: IHO Stakeholders' Open Session

- HSSC Chair Group Workshop:
    + review of the IHO Strategic Plan
    + preparation of the HSSC Work Programme for 2018-2020
    + review of IHO Resolution 2/2007 as amended - *Principles and procedures for making changes to IHO technical standards and specifications*

A.3. Transfer Standard Maintenance and Applications development WG (TSMAD) (2012-2015)

1. Chairmanship

Chair: Mr Barrie GREENSLADE, United Kingdom

Vice-Chair: Ms Julia POWELL, USA

2. Membership

IHO Member States (16): Australia, Brazil, Canada, Denmark, Finland, France, Germany, Japan, Netherlands, New Zealand, Norway, Republic of Korea, South Africa, Sweden, United Kingdom, USA

Expert Contributors (11): CARIS, ECC, ESRI, Furuno, IC-ENC, IIC Technologies, Jeppesen, NAVTOR, SevenCs, T-Kartor, Transas

3. Meetings

TSMAD-24/DIPWG-4	Monaco	7-11 May 2012
TSMAD-25	Tokyo, Japan	15-18 January 2013
TSMAD-26/DIPWG-5	Silver Spring, Maryland, USA	10-14 June 2013
TSMAD-27	Monaco	2-6 December 2013
TSMAD-28/DIPWG-6	Sydney, Australia	31 March - 4 April 2014
Test Cases Sub-WG Meeting	Arlington, Virginia, USA	16-18 September 2014
TSMAD-29/DIPWG-7	Ottawa, Canada	2-6 February 2015

4. Agenda Items

- Maintain and extend S-100 and related projects: S-99, S-101, S-102
- Maintain and extend S-58
- Maintain S-57 FAQ and encoding bulletin sections of IHO web site
- Maintain and extend S-64 IHO Test Data Sets for ECDIS
- Maintain and extend S-57
- Maintain and extend S-65
- Develop and maintain as-yet undefined S-100-based product specifications
- Maintain and extend S-100 registry
- Provide outreach and technical assistance regarding transfer standards

A.4. Digital Information Portrayal WG (DIPWG) (2012-2015)

1. Chairmanship

Chair: Mr Colby HARMON, USA

Vice-Chair: Mr Thomas MELLOR, United Kingdom

2. Membership

IHO Member States (9): Australia, Brazil, Canada, Finland, France, Germany, Norway, United Kingdom, USA

Expert Contributors (15): CARIS, Det Norske Veritas, Furuno, Geomod, IC-ENC, IEC/TC80, Jeppesen, Kelvin Hughes, OSL, Raytheon, SAM Electronics, SevenCs, Sperry Marine, University of New Hampshire, Transas

3. Meetings

DIPWG-4/TSMAD-24	Monaco	7-11 May 2012
DIPWG-5/TSMAD-26	Silver Spring, Maryland, USA	10-14 June 2013
DIPWG-6/TSMAD-28	Sydney, Australia	31 March - 4 April 2014
DIPWG-7/TSMAD-29	Ottawa, Canada	2-6 February 2015

4. Agenda Items

- Maintain and extend S-52 and its associated Presentation Library
- Contribute to the completion of S-100 and other related projects
- Contribute to the maintenance of S-100 and other related projects
- Monitor relevant international standards
- Assess the impact of other IHO standards on S-52 colours and symbols regulations
- Harmonisation with CSPCWG
- Maintain the DIPWG bulletin and FAQ section on the IHO website
- Investigate enhancing the appearance of existing traditional paper chart symbols used in ECDIS by modifying their size, shape and colour
- Provide, on request, technical assistance on portrayal for S-100 based product specifications

A.5. S-100 WG (since 2015)

1. Chairmanship

Chair: Ms Julia POWELL, USA

Vice-Chair: Mr Yong BAEK, Republic of Korea

2. Membership

IHO Member States (29): Argentina, Australia, Belgium, Brazil, Canada, China, Denmark, Ecuador, Egypt, Estonia, Finland, France, Germany, India, Italy, Indonesia, Japan, Netherlands, Norway, Poland, Portugal, Republic of Korea, Russian Federation, Singapore, South Africa, Sweden, United Kingdom, Ukraine, USA

Expert Contributors (17): CARIS, DGIWG, ESRI, Furuno, IALA, IC-ENC, IIC Technologies, IEHG, KHRA, KRISO, NAVTOR, Noverra, Northrop Grumman, PRIMAR, SevenCs, Transas, Wuhan University

3. Meetings

S-100 TSM-3	Jeju Island, Republic of Korea	22-24 September 2015
S-100WG-01	Tokyo, Japan	14-18 March 2016
S-100 TSM-4	Rostock, Germany	13-16 September 2016
S-121 PT Meeting	New York, USA	5-9 December 2016

4. Agenda Items

- Maintain and Extend S-100
- Develop the S-100 Interoperability Specification
- Update the S-100 GI Registry and improve the web interfaces
- Develop and connect the S-100 Feature Catalogue Builder to the S-100 GI Registry
- Develop S-101 Edition 1.0.0
- Develop an S-100/S-101 Test Strategy and Test Bed
- Develop S-102 Edition 2.0.0
- Establish and monitor the project teams established to develop product specifications:
  - S-121
  - S-129
- Liaise with other HSSC WGs and other IHO and international bodies

A.6. ENC Standards Maintenance WG (ENCWG) (since 2015)

1. Chairmanship

Chair: Mr Thomas MELLOR, United Kingdom

Vice-Chair: Mr Mikko HOVI, Finland

2. Membership

IHO Member States (30): Argentina, Australia, Brazil, Canada, Chile, Ecuador, Egypt, Estonia, Finland, France, Germany, India, Indonesia, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Republic of Korea, Russian Federation, Singapore, Slovenia, South Africa, Sweden, Turkey, United Kingdom, Ukraine, USA

Expert Contributors (19): CARIS, DGIWG, ESRI, Furuno, IALA, IC-ENC, IEHG, IIC Technologies, KHRA, KRISO, NAVTOR, Nipon Sogo, Northrop Grumman, PC Marine, PRIMAR, Sanmarine, SevenCs, Transas, Wuhan University

3. Meetings

ENCWG TG-1	Monaco	8-10 February 2016
ENCWG-1	Tokyo, Japan	14-18 March 2016

4. Agenda Items

- Maintain S-52 - Presentation Library
- Maintain S-58
- Maintain S-64
- Maintain S-65
- Maintain S-66
- Develop an ECDIS Data Presentation and Performance Check in Ships compatible with Edition 4.0 of the Presentation Library
- Liaise with other HSSC WGs and other IHO and international bodies

A.7 Nautical Information Provision WG (NIPWG) (formerly Standardization of Nautical Publications WG (SNPWG))

1. Chairmanship

Chair: Mr Jens SCHROEDER-FUERSTENBERG, Germany

Vice-Chair: Mr Thomas LOEPER, USA

2. Membership

IHO Member States (21): Argentina, Brazil, Denmark, Estonia, Finland, France, Germany, India, Italy, Japan, Netherlands, Norway, Poland, Republic of Korea, Russian Federation, Singapore, South Africa, Spain, Sweden, United Kingdom, USA

Expert Contributors (10): Anthropocene Institute, CARIS, CIRM, IHMA, Interschalt, KRISO, Novaco, Snowflake, Transas, University of New Hampshire

3. Meetings

SNPWG-14	Monaco	13-17 February 2012
SNPWG-15	Helsinki, Finland	12-16 November 2012
SNPWG-16	Silver Spring, Maryland, USA	3- 7 June 2013
SNPWG-17	Rostock, Germany	7-10 April 2014
SNPWG-18	Cadiz, Spain	1-4 December 2014
NIPWG-1	Monaco	29 June - 3 July 2015
NIPWG-2	Monaco	21-24 March 2016
NIPWG-3	Busan, Republic of Korea	5-9 December 2016

4. Agenda Items

- Specify and develop nautical information layers for use in ECDIS:
  - S-122
  - S-123
  - S-125
  - S-126
  - S-127
  - S-128
- Monitor the requirements for and provision of nautical information in e-navigation test-beds
- Develop high level specifications for a combined Maritime Service Portfolio (MSP) covering the provision of hydrographic services to mariners in accordance with the IMO e-navigation strategy implementation plan
- Liaise with other HSSC WGs and other IHO and international bodies

A.8 Nautical Cartography WG (NCWG) (formerly Chart Standardization and Paper Chart WG (CSPCWG)

1. Chairmanship

Chair:	Mr Peter JONES, United Kingdom, until March 2014
	Mr Jeff WOOTOON, Australia, until September 2016
	Mr Mikko HOVI, Finland
Vice-Chair:	Mr Jeff WOOTTON, Australia, until March 2014
	Mr Chris THORNE, United Kingdom, until August 2014
	Mr Nick WEBB, United Kingdom, until March 2016
	Mr Mikko HOVI, Finland, until September 2016
	vacant since 1 October 2016

2. Membership

IHO Member States (29): Australia, Brazil, Canada, Chile, Colombia, Denmark, Egypt, Finland, France, Germany, Greece, India, Indonesia, Iran (Islamic Republic of), Italy, Japan, Latvia, Netherlands, New Zealand, Norway, Pakistan, Republic of Korea, Russian Federation, South Africa, Spain, Sweden, Turkey, United Kingdom, USA

Expert Contributors (2): ESRI, Jeppesen

3. Meetings

CSPCWG-9	Seoul, Republic of Korea	13-16 Nov 2012
CSPCWG-10	Wellington, New Zealand	21-24 January 2014
CSPCWG-11/NCWG-1	Rostock, Germany	27-30 April 2015
Workshop for Regional	Monaco	25 April 2016
INT Chart/ENC Coordinators		
NCWG-2	Monaco	26-29 April 2016

4. Agenda Items

- Maintain and extend S-4
- Maintain and extend S-11 Part A
- Develop new (and revised) symbology
- Maintain S-4 supplementary publications INT 1, 2 & 3
- Liaise with other HSSC WGs and other IHO and international bodies

A.9 Data Protection Scheme WG (DPSWG)

1. Chairmanship

Chair: Mr Jonathan PRITCHARD, United Kingdom

Vice-Chair: Mr Robert SANDVIK, Norway

2. Membership

IHO Member States (6): Australia, France, Germany, Japan, Norway, United Kingdom

Expert Contributors (9): ChartWorld, Furuno, IC-ENC, IIC Technologies, Japan Radio Company, Kelvin Hughes, PRIMAR, SAM Electronics, Transas

3. Meetings

DPSWG-9	Monaco	26-28 February 2013
DPSWG-10	Monaco	13-15 May 2014
DPSWG-11	Tokyo, Japan	14-18 March 2016

4. Agenda Items

- Maintain and extend S-63
- Provide technical support to the Scheme Administrator, OEMs and Data Servers
- Develop a new edition of S-63 to support S-101 development
- Develop views on Data Supply Chain Certification
- Monitor the development of the industry guidance on maritime cybersecurity and advice HSSC on possible future actions

A.10 Data Quality WG (DQWG)

1. Chairmanship

Chair: Mr Chris HOWLETT, United Kingdom, until December 2014
Mr. Antti CASTREN, Finland

Vice-Chair: Mr Leendert DORST, Netherlands, until November 2014
Mr. Antti CASTREN, Finland, until December 2014
Mr Sean LEGEER, USA, from July 2015

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2. Membership

IHO Member States (10): Australia, Brazil, Finland, France, Italy, Netherlands, Norway, Sweden, United Kingdom, USA

Expert Contributor (1): CARIS

3. Meetings

DQWG-6	Silver Spring, Maryland, USA	24-26 July 2012
DQWG-7	Fredericton, New Brunswick, Canada	16-18 July 2013
DQWG-8	Wollongong, Australia	25-27 March 2014
DQWG-9	Poole, United Kingdom	3-7 November 2014
DQWG-10	Brest, France	7-9 July 2015
DQWG-11	Arlington, Virginia, USA	10-12 May 2016

4. Agenda Items

- Monitor and further develop quality indicators for hydrographic data
- Develop data quality related elements of S-101 and other S-100-based product specifications
- Investigate possible methods to educate practicing mariners on data quality issues
- Investigate data quality related topics concerning crowd sourced hydrographic information
- Investigate data quality related topics concerning satellite derived bathymetry
- Liaise with other HSSC WGs and other IHO and international bodies

A.11 Tides, Water level and Currents WG (TWCWG) (formerly Tidal and Water Level WG (TWLWG)

1. Chairmanship

Chair:	Mr Stephen GILL, USA, until May 2013
	Ms Gwenaële JAN, France
Vice-Chair:	Ms Zarina JAYASWAL, Australia, until May 2013
	Mr Chris JONES, United Kingdom, until April 2015
	Mr Louis MALTAIS, Canada

2. Membership

IHO Member States (34): Argentina, Australia, Brazil, Canada, Chile, China, Denmark, Ecuador, Egypt, Estonia, Finland, France, Germany, India, Indonesia, Italy, Japan, Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Republic of Korea, Russian Federation, Singapore, South Africa, Spain, Sweden, Ukraine, United Kingdom, Uruguay, USA, Venezuela.

Expert Contributors (4): IOC-GLOSS; C-Map, SPAWAR Atlantic, University of New Hampshire

3. Meetings

TWLWG-4	Fish Hoek, South Africa	8-10 May 2012
TWLWG-5	Helsinki, Finland	13-17 May 2013
TWLWG-6	Wollongong, Australia	25-28 March 2014
TWLWG-7	Silver Spring, Maryland, USA	21-24 April 2015
TWCWG-1	Niteroi, Brazil	25-29 April 2016

4. Agenda Items

- Maintain the list of standard tidal constituents
- Compare the tidal predictions generated as a result of analysis of a common data set using different analysis software
- Develop, maintain and extend a product specification for digital tide tables
- Develop, maintain and extend a product specification for the transmission of real-time tidal data (S-112)
- Develop, maintain and extend a product specification for the transmission of real-time surface current data
- Develop, maintain and extend a product specification for dynamic surface currents in ECDIS (S-111)
- Develop, maintain and extend a product specification for dynamic tides in ECDIS (S-104)
- Liaise with S-100WG on tidal and current matters relevant to ECDIS applications
- Liaise with industry experts on the development of product specifications for tides and currents
- Prepare and maintain an inventory of tide gauges and current meters used by Member States and publish it on the IHO web site
- Review feedback of on-line real time water level observation document
- Develop and maintain material for course on tides, water levels and currents

A.12 Surface Current WG (SCWG) (2013-2015)

1. Chairmanship

Chair: Mr Kurt HESS, USA

Vice-Chair: Mr Louis MALTAIS, Canada

2. Membership

IHO Member States (7): Canada, France, Japan, Netherlands, Republic of Korea, Spain, USA

Expert Contributors (4): CARIS, Jeppesen, SPAWAR Atlantic, University of New Hampshire

3. Meetings

SCWG-1	Silver Spring, Maryland, USA	29-31 May 2013
SCWG-2	Québec City, Canada	28-30 May 2014
SCWG-3	Tokyo, Japan	13-15 May 2015

4. Agenda Items

- Develop, maintain and extend a product specification for the transmission of real-time surface current data
- Develop, maintain and extend a product specification for dynamic surface currents in ECDIS (S-111)

A.13 Hydrographic Dictionary WG (HDWG)

1. Chairmanship

Chair: Mr Jerry MILLS, USA, until December 2012
Mr Jean LAPORTE, France

Vice-Chair: vacant

2. Membership

IHO Member States (8): Argentina, Australia, Brazil, France, Malaysia, Spain, Uruguay, USA.

Expert Contributor (1): CARIS

3. Meetings

None

4. Agenda Items

- Maintain and extend the definitions in the IHO Dictionary in French, English and Spanish
- Liaise with other IHO bodies preparing publications containing glossaries
- Liaise with other organizations developing dictionaries and/or glossaries
- Develop the Spanish language Wiki version of S-32 with commercial contract support
- Investigate options (scope, format / content management system, languages, cross-references, maintenance regime, etc.) and associated resource requirements and timeline to produce [and maintain] a reference edition of S-32
- Develop a multilingual Wiki crowd-sourced demonstrator for the Hydrographic Dictionary

A.14 Marine Spatial Data Infrastructure WG (MSDIWG) (2012-2014)

(see the report on Programme 3 for the period 2015-2016)

1. Chairmanship

Chair: Mr Jens Peter HARTMANN (Denmark)

Vice-Chair: Ms Ellen VOS (Netherlands)

2. Membership

IHO Member States (26): Argentina, Australia, Brazil, Canada, Cuba, Denmark, Estonia, Finland, France, Germany, Italy, Japan, Latvia, Nigeria, Netherlands, Norway, Portugal, Republic of Korea, Romania, Singapore, Slovenia, Spain, Sweden, Ukraine, United Kingdom, USA

Expert Contributors (8): CARIS, Envitia, ESRI, EUCC, Geosciences Australia, KESTI, OceanWise, Wuhan University

3. Meetings

MSDI Open Forum	Copenhagen, Denmark	30 January 2013
MSDIWG-4	Copenhagen, Denmark	31 January - 1 February 2013
MSDI Open Forum	Silver Spring, Maryland, USA	4 Feb 2014
MSDIWG-5	Silver Spring, Maryland, USA	5-7 February 2014

4. Agenda Items

- Investigate methods for IHO to support Member States' capability development in MSDI
- Monitor national and international marine SDI activities and liaise to increase visibility
- Identify and recommend possible solutions to significant technical issues related to interoperability
- Maintain and extend C-17 - *Spatial Data Infrastructures: The Marine Dimension - Guidance for Hydrographic Offices*

A.15 IHO-IAG Advisory Board on the Law of the Sea (ABLOS)

1. Chairmanship

Chair:	Mr Chris M. CARLETON, IHO, United Kingdom, until October 2012
	Prof. Sunil BISNATH, IAG, Canada, until October 2015
	Mr John BROWN, IHO, United Kingdom
Vice-Chair:	Prof. Sunil BISNATH, IAG, Canada, until October 2012
	Mr John BROWN, IHO, United Kingdom, until October 2015
	Dr Niels ANDERSEN, IAG, Denmark

2. Membership

The Advisory Board comprises 4 representatives from IHO Member States and 4 representatives from the International Association of Geodesy (IAG). The UN DOALOS and the IHO Secretariat are ex-officio members. IHO Member States may send observers to the meetings and other observers may attend at the invitation of the Chairman

3. Meetings

ABLOS-19 Business Meeting Monaco 1 & 6 October 2012

ABLOS-7 Conference Monaco 3-5 October 2012

ABLOS-20 Business Meeting Muscat, Oman 28 - 29 October 2013

ABLOS-21 Business Meeting Copenhagen, Denmark 21-23 October 2014

ABLOS-22 Business Meeting Monaco 19 & 22 October 2015

ABLOS-8 Conference Monaco 20-22 October 2015

ABLOS-23 Business Meeting Seoul, Republic of Korea 26-28 October 2016

4. Agenda Items

- Organize the bi-annual ABLOS Conference
- Maintain C-51
- Deliver a standard training program on the hydrographic aspects of maritime delimitation
- Provide advice and guidance on the technical aspect of the law of the sea to relevant organizations, bodies and Member States

A.15 Attendance of IHO Member States at HSSC and WG meetings

Number of meetings / Member State	HSSC	TSMAD	DIPWG	S-100WG	ENCWG	SNPWG NIPWG	CSPCWG NCWG	DPSWG	DQWG	TWLWG TWCWG	SCWG	HDWG	MSDI WG
	5	6	4*	1	1	8	4	3	6	5	3	/	2**
Argentina													1
Australia	5	6	4	1	1		4	2	5	4			1
Belgium	1												
Brazil	4	6	4	1	1	2	2			4			2
Canada	5	6	4	1	1		3		2	2	3		
Chile	4									2			
China	4			1						1			
Cuba													
Democratic People's Republic of Korea	1												
Denmark	3	3	2	1		5	3						2
Ecuador	2									1			
Egypt				1	1		1						
Estonia													1
Finland	5	6	4	1	1	5	4		5	4			1
France	5	6	4	1	1	8	4	3	5	4	3		2
Germany	5	6	4		1	8	4			1			1
Greece	2												
India	2												
Indonesia	1			1	1		1		1				
Iran (Islamic Republic of)							1						
Italy	2			1	1	2	1		1				
Japan	4	6	4		1	8	2			2	1		2
Latvia							2						1

Number of meetings / Member State	HSSC	TSMAD	DIPWG	S-100WG	ENCWG	SNPWG NIPWG	CSPCWG NCWG	DPSWG	DQWG	TWLWG TWCWG	SCWG	HDWG	MSDI WG
	5	**6**	**4***	**1**	**1**	**8**	**4**	**3**	**6**	**5**	**3**	**/**	**2****
Malaysia	1												
Mexico	1					1	1		1				
Netherlands	5	5	3	1	1	3	3		6	2	3		2
New Zealand				1			1			1			
Norway	5	5	4		1	6	4	3		5			2
Peru	2									4			
Poland	5												
Portugal	1												
Republic of Korea	5	6	4	1		6	3			3	1		
Russian Federation		3	2	1	1	2	1			1			
Saudi Arabia	1												
Singapore	4												
South Africa	1	1	1							1			
Spain	2					7	4			3	2		2
Sweden	4	6	4	1	1	4	4		3	1			
Thailand	1												
Turkey	5	1					2		1				
United Kingdom	5	6	4	1	1	8	4	3	6	5			2
USA	5	6	4	1	1	8	4		6	4	3		2
Venezuela						1							

*Joint TSMAD-DIPWG meetings

** 2012-2014

Annex B - HSSC Working Level Performance Indicators

Metric	Source	Rationale	Status 31 Dec 2012	Status 31 Dec 2013	Status 31 Dec 2014	Status 31 Dec. 2015	Status 31 Dec. 2016
Number of S-100 based product specifications approved	**IHO Secretariat**	Relative indicator of uptake of IHO standards including for purposes other than SOLAS navigation	**1**	**0**	**0**	**0**	**0**
Percentage of annual work programme achieved	**HSSC WGs (all)**	Progress against objectives in the strategic plan	**17%**	**19%**	**52%**	**46%**	**42%**
Total number of participants at meetings (Member States (MS) and Expert Contributors(EC))	**HSSC WGs (all)**	Indicates participation of MS and wider community in execution of the plan	**168** *MS: 131* *EC: 37* (9 meetings)	**258** *MS: 172* *EC: 86* (10 meetings)	**171** *MS: 128* *EC: 43* (11 meetings)	**158** *MS:130* *EC: 28* (7 meetings)	**218** *MS: 150* *EC: 68* (9 meetings)
Number of technical revisions and clarifications approved	**IHO Secretariat**	Indicative of ability to provide comprehensive, safe and effective standards	**5**	**3**	**2**	**7**	1
Number of ENCs distributed annually under license (equivalent annual licences)	**WEND WG**	Relative indicator of ENC usage throughout SOLAS market [1]	**2,052,269**	**2,202,487**	**2,272,923**	**2,678,741**	**3,149,772**

[1] Total of Primar and IC-ENC distribution only - does not include local distribution or other distribution mechanisms

Annex C - Terms of Reference and Rules of Procedure of the HSSC

Ref: a/ Decision 4 of the XVIIIth IHC (editorial corrections made in July 2013).
b/ IHO CL 23/2015 and CL 41/2015 (amendment to the Rules of Procedure).
c/ Entry into force of the Protocol of Amendments to the Convention on the IHO.

Considering the need to promote and coordinate the development of standards, specifications and guidelines for official products and services to meet the requirements of mariners and other users of hydrographic information, the International Hydrographic Organization establishes a Hydrographic Services and Standards Committee (HSSC) with the following Terms of Reference and Rules of Procedure. The HSSC shall be the IHO Technical Steering Group acting on behalf of all Member States and shall report to each ordinary session of the Assembly through the Council.

1. Terms of Reference

1.1 Monitor the requirements of mariners and other users of hydrographic information concerning the use of hydrographic products and information systems that may require data and information provided by national hydrographic authorities, and to identify those technical matters that may affect the activities and products of those authorities.

1.2 Monitor the work of specified IHO Inter-Organizational Bodies engaged in hydrographic services, standards and related technical activities as directed by the Assembly and provide advice and guidance to the IHO representatives as required.

1.3 Study and propose methods and standards for the acquisition, assessment and provision of official hydrographic data, nautical products and other related services.

1.4 Maintain technical liaison with other relevant stakeholders, such as type-approval authorities, navigation equipment manufacturers, and the hydrographic data user-community.

1.5 Prepare and maintain publications related to the objectives of the Committee.

1.6 Prepare a Committee Work Programme and propose it to each ordinary session of the Assembly through the Council. Consider and decide upon proposals for new work items under the Committee Work Programme, taking into account the financial, administrative and wider stakeholder consequences and the IHO Strategic Plan and Work Programme.

1.7 Monitor the execution of the Committee Work Programme and report to each meeting of the Council, including an evaluation of the performance achieved.

1.8 Propose to the Assembly through the Council, the establishment of new Sub-Committees, when needed, supported by a comprehensive cost-benefit analysis.

1.9 As required, establish Working Groups to fulfil the Committee Work Programme, in conformance Article 6 of the General Regulations and approve their Terms of Reference and Rules of Procedure.

1.10 Monitor the work of its Sub-committees, Working Groups and other bodies directly subordinate to the Committee.

1.11 Review annually the continuing need for each Working Group previously established by the Committee.

1.12 Liaise and maintain contact with relevant IHO and other bodies to ensure that IHO work activities are coordinated.

1.13 Liaise with other relevant international organizations and Non-Government International Organizations (NGIOs).

1.14 These Terms of Reference can be amended in accordance with Article 6 of the General Regulations.

2. Rules of Procedure

2.1 The Committee shall be composed of representatives of Member States. The Chairs of the relevant subordinate bodies of the Committee, or their nominated representatives, shall attend and report at all Committee Meetings. International Organizations and accredited Non-Government International Organizations (NGIOs) may attend Committee Meetings.

2.2 A Director of the Secretariat shall act as Secretary to the Committee. The Secretary shall prepare the reports required for submission to each meeting of the Council and to sessions of the Assembly as directed by the Council.

2.3 The Chair and Vice-Chair shall be a representative of a Member State. The election of the Chair and Vice-Chair shall be decided at the first meeting after each ordinary session of the Assembly and shall be determined by vote of the Member States present and voting. If the Chair is unable to carry out the duties of the office, the Vice-Chair shall act as the Chair with the same powers and duties.

2.4 The Committee shall meet once a year, unless decided otherwise by the Committee, whenever possible in conjunction with another relevant conference or meeting. The venue and date of the meeting shall be decided at the previous meeting, in order to facilitate participants' travel arrangements. Meetings should normally be scheduled to precede a session of the Council or Assembly by approximately four months. The Chair or any member of the committee, with the agreement of the simple majority of all members of the Committee, can call extraordinary meetings. Confirmation of the venue and date shall normally be announced at least six months in advance. All intending participants shall inform the Chair and Secretary ideally at least one month in advance of their intention to attend meetings of the Committee.

2.5 Decisions shall generally be made by consensus. If votes are required on issues or to endorse proposals presented to the Committee, decisions shall be taken by a simple majority of Committee Members present and voting. When dealing with inter-sessional matters by correspondence, a simple majority of all Committee Members shall be required.

2.6 The draft record of meetings shall be distributed by the Secretary within six weeks of the end of meetings and participants' comments should be returned within three weeks of the date of despatch. Final minutes of meetings should be distributed to all IHO Member States and posted on the IHO website within three months after a meeting.

2.7 The working language of the Committee shall be English.

2.8 The Committee shall progress its work primarily through Working Groups, each of which shall address specific tasks. ~~If required, a coordinating Sub-committee on Data Acquisition & Transfer Standards and a coordinating Sub-committee on Symbology & Data Presentation Standards shall coordinate the work of those working groups dealing with data and presentation standards respectively~~. ~~Sub-committees and~~ Working Groups shall operate by correspondence to the maximum extent practicable.

2.9 Recommendations of the Committee shall be submitted to IHO Member States for adoption through the Council to the Assembly.

2.10 These Rules of Procedure can be amended in accordance with Article 6 of the General Regulations.