Minutes of DQWG meeting 13
15 – 19 January 2018, IHO Secretariat, Monaco

Present: Mr. Nigel Robinson (DK), Mr. Jyrki Mononen (FI), Mr. Nicolas David (FR), Mr. Carlo Marchi (IT), Mr. Satoshi Sato (JP), Mr. Rogier Broekman (Chair/NL), Mrs. Daria Mulyarenko (NO), Mr. Aaron Pullen (UK), Mr. Sean Legeer (Vice-Chair/US-NOAA), Mr. Joshua Clayton (US-NGA), Mr. Yves Guillam (IHO-Assistant Director), Mr. Matthias Jonas (IHO-Secretary General), Mr. Abri Kampfer (IHO-Director), Mr. Anthony Pharaoh (IHO-Assistant Director), Mr. Jeff Wootton (IHO-Technical Standards Support Officer), Mr. David Wyatt (IHO-Assistant Director), Mr. Svein Skjaeveland (PRIMAR)

Not present/correspondence members: Mr. Mike Prince (AU), Mr. Paulo Matos (BR), Mrs. Ana Mileze (BR), Mr. Andrew Leyzack (CA-CHS), Mr. Eivind Mong (CA-CCG), Mr. Juan José Villaneuva Hernández (ME), Mr. Kennet Swahn (SE), Mr. Ulf Olsson (SE), Mr. Edward Hosken (UK), Mr. Brian Heap (US-NGA), Mrs. Whitney Anderson (US-NGA), Mrs. Karen Cove (Teledyne CARIS), Mr. Thomas Richardson (IC-ENC).

FINAL MINUTES

Note: These Minutes have been ordered as they were addressed during the meeting.

1a. OPENING AND ADMINSTRATIVE ARRANGEMENTS

The Chair opened the meeting and welcomed everyone to the 13th meeting of the Data Quality Working Group at the IHO Secretariat in Monaco. There are many new group members, the Chair invited all members to briefly introduce themselves and inform the group what they will bring to the table and expect to take back home from this meeting. At the end of this introduction moment, the IHO Secretary General introduced himself to the group and gave a short speech on the importance of Data Quality to the IHO in the near future and the task ahead to develop methods to better facilitate machine to machine interaction based on data quality measures and thus improving interoperability. The IHO Secretary-General left the meeting after this introduction and came back during the week for some specific agenda items.

1b. ORGANIZATIONAL ARRANGEMENTS AND WORKSHOP EXPECTATIONS – NOMINATION OF A SECRETARY

Guillam (IHO Sec) explained the organizational arrangements for the week. The Chair asked the members to think about hosting the next DQWG meeting and reply on Friday morning to this request.
The Chair called for a nomination of a Secretary. *Mononen* (FI) kindly volunteered to take notes during this meeting. There were no volunteers to take the role of Secretary for this WG.

1c. ADOPTION OF THE AGENDA - PROGRAM OUTLINE

Sato (JP) was scheduled to leave the meeting after the Workshop. *Robinson* (DK) was scheduled to leave at the end of Thursday. The agenda item *"How HO's, DQWG members allocate CATZOC values"* was considered to be of great importance and was therefore moved to Tuesday morning.

Development of a Data Quality Checklist was moved to Tuesday afternoon and Wednesday as it related to item 7. There were no other changes to the agenda.

4. HARMONISATION OF DATA QUALITY

4a. REVIEW OF SECTION OF THE DATA CLASSIFICATION AND ENCODING GUIDE *(Quality of Bathymetric Data, Quality of Survey, Quality of Non-Bathymetric Data)*.

Docs	*DQWG13-04A*	*Review of sections of the DCEG (.doc)*

The current Data Quality model has a primary division between Bathymetric Data and Non-Bathymetric Data. During the workshop it was discussed and decided that Quality of Non-Bathymetric Data will be optional in S-101 and that Quality of Bathymetric Data will be mandatory for all Geometry Surfaces that contain any bathymetric data, even if it is very sparse.

The generic data model has a Quality of Temporal Variation feature that holds two enumerated type attributes:
1) categoryOfTemporalVariation;
2) dataAssessment.

Wootton (IHO-Sec) suggested that the enumerated list for categoryOfTemporalVariation should contain all values possible for both bathymetric and non-bathymetric data. By assigning a subset of the full list of values for each class (bathymetric/non-bathymetric) based on context, only one enumerated list is needed, which can be used generically throughout S-1xx Product Specifications.

Currently dataAssessment holds three values: Assessed, Oceanic and Unassessed. After discussion it was decided to change this list to: Assessed, Assessed (Oceanic) and Unassessed.

The most substantive change made to the DCEG was the complete re-write of the guidance for the encoding of Quality of Bathymetric Data covering swept areas (DCEG Baseline version 0.0.2, clause 11.5.1). This was required because of the new functionality in S-101 allowing Quality of Bathymetric Data features to be "stacked" in the water column, and effectively simplifies encoding for the cartographer, although it is likely that there will have to be some manual work required when converting S-57 datasets to S-101 for this particular situation.

The updated result into the DCEG draft version 0.0.3 is listed in Annex D

Outcome: The data quality model has been refined and is now updated in the DCEG draft Baseline Edition 0.0.3. Temporal variation of non-bathymetric data shall be optional. List of enumerated values for quality of bathymetric/non-bathymetric data is updated. All documents and web pages related to the Data Quality Model need updating in line with DCEG Edition 0.0.3. Registry shall be updated.
Action -> DQWG13/01, 13/02, 13/03, 13/04, 13/05.

6. GUIDANCE ON DATA QUALITY ASPECTS

6a. Best practices on the use of CATZOC by HO's

During this session of the workshop the group members presented their paper/presentation on how the HO of each member allocates CATZOC values, explaining the HO policy to this matter. The outcome of these presentations was that there is at present no harmonized encoding of CATZOC as the current S-57 model has some shortcomings that HO's use workarounds for. In the new S-101 model, most of these shortcomings have been resolved into a better model. See item 6c. "How HO's, members of DQWG will allocate QualityOfBathymetricData values."
This session may be a first step to improve and harmonize ENC CATZOC population within IHO Member States.

6b. How HO's, members of DQWG allocate CATZOC values

Docs	*DQWG13-06B*	*NL, IT, FI, US, NO, FR, UK, JP, BR*

Each member presented their policy on how to allocate and modify CATZOC values. During the discussion five major items showed up where HO's have different policies:

1) Degradation of quality of depth over time in an area of unstable seabed or glacial movement.
2) CATZOC value in shallow water area in the coastal zone where the hydrographic surveys cannot be executed due to its draft.
3) Consequences of charting generalization on the values of CATZOC in different Usage Bands.
4) CATZOC value for UNSARE.
5) Loss of quality due to conversion of paper charts to digital charts

Outcome
CATZOC is not downgraded due to the passage of time. CATZOC is downgraded by some HO's in an area of unstable seabed or moving glaciers over time, other HO's use M_SREL. After an extreme event, the CATZOC value is set to D. After re-survey of the area it is raised to the appropriate level.

In the coastal zone and intertidal areas from the nation maritime Baseline to the first available DEPARE where bathymetric surveys have taken place, there are different policies applied. When considered appropriate by the HO, this area inherits the same CATZOC value as its neighbour that is related to the hydrographic survey. Another policy is to assign the area a lower CATZOC value as its neighbor, usually D. Technically it is an UNSARE but as it generally is an area where no mariner would sail into, the above policies are applied to make the portrayal look better.

HO's have different policies when it comes to assigning CATZOC values for the same area in different Usage Bands (UB). The small scale charts (UB 1 to 3) are by some HO encoded with Unassessed if a larger scale chart (UB 4 to 6) lies underneath with an assessed CATZOC value. The INFORM field then states to use larger scale ENCs. Some HO's do not downgrade CATZOC values due to the generalization to smaller scales. It was suggested that all members provide input on the next DQWG meeting for a common approach to degrade CATZOC with generalization to smaller scales, or any other option.
Action -> DQWG13/06

CATZOC should only be encoded on UNSARE if there is depth information (DEPCNT, OBSTRN, SOUNDG, UWTROC or WRECKS). If an UNSARE contains some depth information, it should be assigned CATZOC value = D.
Recommend to ENCWG to consider change in the validation policy that M_QUAL object is no longer mandatory for an UNSARE that contains no depth information at all.
Action -> DQWG 13/07

Currently there are still many HO's making the transition from paper chart to ENC by digitizing old paper charts to ENC format. Digitizing is the process where the primary data source is a paper chart that is run through a map scanning or digitizing machine. The digitally produced positions of the objects will never be in full conformity with the real position on the ground/seabed. Also is it sometimes unclear what the accuracy of the initial survey was, performed a long time ago. *David* (FR) provided a table with a guideline how to assign CATZOC values to "old", modern, and non-HO surveys. This guideline will be translated in English and uploaded. All members are requested to provide their internal guidelines on this process if applicable and publicly available. Create best practice document and repository for being used later in the development of possible guidance.
Action -> DQWG13/08, 13/09, 13/10

It was noted that some HO's receive survey data from third parties but not associated metadata on the quality of survey. If the entrance to a port for example has a maintained depth by the port authorities but does not meet all criteria from CATZOC value = A1, the vessel coming from sea going to port goes from an A1 area to a B area. This is however not a technical data model issue but lack of information between two parties. If both parties agree that maintained depth means a quality level of A1, then it can be assigned as such. The liability aspect has to be agreed upon between the two parties.

It was noted that when zooming in to a display scale of larger than 1:4000, the display goes into overscale mode and some quality areas are no longer visible. The overscale is the compilation scale/1.8. As general guidance, if a chart is to be produced at such a high scale, the density of the underlying data has to be sufficient to allow for proper portrayal. At DQWG13-07D a recommendation is made regarding the accuracy of a contour line related to the density of the ground sampling at the seabed.

It was noted that some HO's have data that was originally recorded in another geodetic reference system than WGS84. The conversion from local to WGS84 may also give loss of positional accuracy due to the less accuracy of the conversion parameters. It was also briefly discussed that the global geodetic reference is the ITRF (International Terrestrial Reference Frame) with its latest realization in the year 2014. In Europe the difference between ETRS89 and WGS84 is at present 0.72 meters, increasing by 0.02 meters per year. US-NAD is showing similar numbers. Tectonic plate movements have to be compensated for in case of using a dataset in sub-meter accuracy. The ISO organization is working on a document relating to the conversion to/from ITRF14.

It was noted that adjacent ENC's from two different HO's sometimes have different CATZOC values assigned. *Skjaeveland* suggested that PRIMAR could look into possible solutions for investigating discrepancies in CATZOC values of adjacent areas. The group agreed to this.
Action -> DQWG13/11

6c. How HO's, members of DQWG will allocate QoBD values

See Annex D for the updated data model entries in DCEG draft version 0.0.3.
Degradation of quality over time in an area of unstable seabed or moving glaciers has been accounted for with the attribute Category of Temporal Variation. By definition this is an assessment of the likelihood of change over time. HO's will have to opportunity to assign 1) extreme event, 2) likely to change and significant shoaling expected, 3) likely to change but significant shoaling not expected, 4) likely to change (non-bathymetric only), 5) unlikely to change, and 6) unassessed. This method will allow HO's to compensate for loss of quality over time in a consistent and harmonized manner.

Where an HO has charts of deep sea oceanic area with little underlying bathymetric data to support its appearance but is confident that the area holds no danger to surface navigation, it is now allowed to assess this area as Oceanic. By definition this means "the quality of oceanic bathymetric data (depths deeper than 200 meters) has been assessed, however details are not required."

The Data Quality Working Group developed a decision tree at DQWG-11, how to allocate Quality of Bathymetric Data. This flow diagram is quite complex and needs explanatory notes in plain English with a guidance. The items 2, 3 and 5 of chapter DQWG13-6b may be added at a later stage when HOs agree on a common approach of these non-technical issues.

Outcome: A guidance document is to be drafted including an explanation of the Data Quality Model, the Decision Tree to allocate Quality of Bathymetric Data values for Product Specification developers and HO's for usage.
Action -> DQWG13/12

5. DATA QUALITY CHECKLIST

5a. Development of a data quality checklist

Chair introduced the need to develop a data quality checklist. Data quality measures and their reported outcome as metadata are a means to enable interoperability. Operability adds the value of coherent representation of spatial data. The Data Quality dilemma in SDI's is displayed below:

<table>
<tr><td></td><td>DQ dilemma in SDI's</td><td></td></tr>
<tr><td>No a priori DQ requirements for inclusion</td><td>  </td><td>Stringent a priori DQ requirements</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Wide selection of data available</td><td rowspan="4">Put DQ requirements in when justified by the scope and typical use-cases of the infrastructure</td><td>No interoperability obstacles</td></tr>
<tr><td>Interoperability problems in many applications</td><td>Only few databases included</td></tr>
<tr><td>Users a generally unsatisfied with data quality</td><td>Low level of data sharing</td></tr>
<tr><td></td><td>Smaller groups of users satisfied, while the rest remain empty handed</td></tr>
</table>

Source: JRC Technical Reports – Data Quality in INSPIRE, Balancing Legal Obligations with Technical Aspects.

The basis for the data quality checklist is ISO publication 19157 – Data Quality. The data quality measures are divided into these main parts:

- Completeness (commission/omission)
- Consistency
  - Logical consistency
  - Format consistency
  - Topological consistency
- Accuracy
  - Positional Accuracy (absolute/horizontal/vertical/gridded)
  - Thematic
- Temporal quality
- Aggregation measures

A draft data quality checklist based on ISO-19157 was made on Wednesday. This checklist was discussed and agreed upon. To refine this data quality checklist, more examples, especially on topological consistency will be added. For positional accuracy the RMSE (absolute) and 2σ value (horizontal/vertical) will be recommended as default. Other positional measures are allowed as deemed necessary. The members agreed to this data quality checklist for all S-1xx WGs/PTs and recommend the data quality measures to be used by all WGs/PT in this order. Non-justified Data Quality measures may be omitted from this sequence for a particular Product Specification.

Several draft Product Specifications that were delivered for review to DQWG, were visually checked against this Data Quality Checklist. Most Product Specifications were missing several data quality measures.

Outcome: the draft Data Quality Checklist was accepted with the remarks that it should include a paragraph “general introduction to data quality” and further examples and recommendations. The group agreed to propose the refined Data Quality Checklist to present to HSSC for endorsement to all other WG’s/PT under the “comply or explain” principle.
Action -> DQWG13/13

This ends the two day workshop. The *Chair* thanked *Mr. Sato* (JP) for his attendance at the workshop and wished him safe travels home.

1a. OPENING AND ADMINSTRATIVE ARRANGEMENTS

On Wednesday the regular part of the meeting started. The opening and administrative arrangements have been addressed on Monday morning.

1c. Adaption of the agenda – Program outline

For item 7 (Data Validation in S-1xx), *Pharaoh* (IHO Sec) will join the meeting. For item 8 (Methodology for the display of quality of information), the IHO Secretary-General will join the meeting. For item 10 (Relations with other working groups) *Wyatt* (IHO-Sec) will join the meeting. *Skjaeveland* (PRIMAR) will present input from S-102 on Thursday morning.

1d. Working by correspondence

The member list on the website was reviewed. IT will become a correspondence member until further notice. Some correspondence members have not replied to any communication during the last two years. UK, US and CA have both active and correspondence members. The active member is the first point of contact within the group.
To promote working by correspondence the following **decisions** were made:

1. Minutes of the meeting will be send out, response within two weeks.
2. DQWG Letter will be posted, first response period is six weeks, next period is four weeks.
3. No response to Minutes of meeting or Letter means no comment and approval of the actions and decisions.

DQWG is an advisory group to most other HSSC WGs/PT. To deliver in time to other WGs/PT, the dates below are important:

12 March: NIPWG meeting
26 March: Deadline submission paper HSSC-10
09 April: S-100WG
16 April: TWCWG, ENCWG
14 May: HSSC-10
02 July: HSPT
06 November: NCWG

2. MATTERS RELATING TO UPPER IHO BODIES

2a. HSSC-9

Docs	*DQWG13-02A*	*DQWG Report and Presentation to HSSC-9* *HSSC9-minutes and list of decisions and actions*

Chair presented the Report and Presentation of the DQWG to HSSC-9. This included the new Terms of Reference, the proposal for a new publication *S-67 Guide to Accuracy and Reliability of an ENC*, the relation between ISO, S-1xx, OGC and INSPIRE. The future work programme includes the S-101 DCEG, provide guidance documents, transition from S-57 to S-101 (CATZOC

to Quality of Bathymetric Data), and continue development of modelling and portrayal of data quality.
The HSSC action list was noted (HSSC9/16, HSSC9/35, HSSC9/36) as item that the group needs to work on and report back to at HSSC-10.

2b. IHO Council

Docs	*DQWG13-02B*	*IHO council report*

Guillam (IHO Sec) introduced the summary report of the 1st meeting of the IHO Council, IHO-C1, Monaco held on 17-19 October 2017. In this report the Director in charge of Programme 2 (Hydrographic Services and Standards) presented six priorities, and associated issues and risks. One is to consider data quality aspects in an appropriate and harmonized way for all S-100 based product specifications. This report was noted and the *Chair* recommended all members to share this information within their own office.

3. PREVIOUS DQWG MEETING AND STATUS OF ACTIONS

3a. Minutes of DQWG-12 meeting

Docs:	*DQWG13-03A*	*DQWG12 Minutes*

The minutes were accepted without changes.

3b. Status of Actions

Docs:	*DQWG13-03B*	Status of Actions from DQWG12

DQWG12/04 -> completed at workshop
DQWG12/05 -> completed at workshop
DQWG12/06 -> postponed (low priority)
DQWG12/08 -> overtaken by events
DQWG12/10 -> completed at workshop
DQWG12/11 -> on agenda (relations with other WGs)
DQWG12/12 -> open, assigned to *David* (FR) with support *Wootton* (IHO-Sec) and Italy (IT). Deliver to NCWG.
DQWG12/14 -> as deemed necessary for next meeting.
DQWG12/17 -> incorporated into DQWG13/06
DQWG12/18 -> Mr. Mong is now correspondence member from Canadian Coast Guard.

7. DATA VALIDATION IN S-1XX

7a. Develop of a minimum standard for data validation

Docs:	*DQWG13-07A*	Canada's input

The paper was written by *Mong* (CA), the *Chair* introduced on his behalf. S-58 specifies the recommended validation checks for S-57 ENC, and was released May 2017 in its 6th edition. The S-101 Project Team is developing a validation annex for S-101 ENC. The S-101PT is reviewing if these checks should be an annex for S-58, an annex to the S-101 Product Specification or another solution. IALA is developing S-201. NIPWG has developed S-122 as well as S-123. S-127 is in the pipeline.
There are three categories of Validation Checks: 1) format specific, 2) data content and 3) data delivery. The author has four recommendations:

1. Keep the guidance on S-100 based specification validation checks at a high level requiring S-100 specifications to include sufficient data checks in the three noted categories.
2. Minimum sets of encoding specific checks be evaluated for each of the S-100 adopted encodings.
3. Minimum sets of data model checks be created for feature based data and coverage data.
4. Develop the Guideline as an addition to S-100, either as new part or as an annex to Part 4, so that it becomes common practice throughout the e-Navigation development.

Outcome: The Data Quality Checklist and the recommendations from this paper will generate a Guideline on S-1xx minimum set of validation checks. This guideline is to be drafted by the *Chair* in support of *Mong* (CA) and then be delivered to S-101PT and other WGs/PT
Action -> DQWG13/14

7b. Existing standard for data validation (S-58)

The S-58 specifies the checks that at a minimum, producers of ENC validation tools should include in their validation software. This software must be used by Hydrographic Offices to help ensure that their ENC data are compliant with the S-57, Appendix B1 ENC Product Specification.

The validation checks are categorized as:

1. Checks relating to S-57 Data Structure
2. Checks relating to ENC Product Specification
3. Exchange set Level checks
4. Checks relating to Use of Object Catalogue for ENC
5. Checks relating to allowable attribute values for particular object classes

Check Classification:
C = Critical Error
E = Error
W = Warning
At a minimum validation software must group validations reports using these categories.

The above lays out the existing structure in S-58. This issue is addressed in the next session/paragraph “From S-58 to new standard”.

7c. From S-58 to new standard

The group noticed that the layout of the newly developed Data Quality Checklist and the existing structure of S-58 do not match. The S-58 Checks relating to S-57 Data Structure and checks relating to ENC Product Specification are a mix of the data quality measures as described in the Data Quality Checklist (session 5a.). For future Product Specification development in S-101 and others to follow, the DQWG recommends data quality and validation checks are listed in a logical order as described in the Data Quality Checklist. The validation software to be developed should group validations reports using the categories Critical Error/Error/Warning but also provide an indication of the type of error and list accordingly: (Completeness/Consistency/Accuracy/Temporal quality/Aggregation measures). The result will then look like:

No.	Description	Message	Solution	Conformity to:	Cat.1	Cat2.
					Critical	Completeness
					Error	
					Warning	
					Critical	Consistency
					Error	
					Warning	
					Critical	Accuracy
					Error	
					Warning	
					Critical	Temporal
					Error	
					Warning	
					Critical	Aggregation
					Error	
					Warning	

Outcome: DQWG recommends that the Data Quality Checklist is used as a basis combined with the level of importance of the validation results. This is to be included into action DQWG13/13.

07d. Data Quality indicators in S-102

Docs:	*DQWG13-07D*	*Data quality indicators in S-102*
		DQWG S-102 data quality indicators

The representative from PRIMAR, *Mr. Skjaeveland* introduced the paper submitted by S-102 PT to seek assistance from the DQWG to include quality indicators in the product and to able to access and display quality information.

S-102 has uncertainty defined as one of its features. The S-102 product specification also lists different code (values) defining how to determine uncertainty. These are: 1) unknown 2) Raw_Std_dev 3) CUBE_std_dev 4) Product_Uncert and 5) Historical_Std_Dev.

The paper addresses loss of quality from ping to chart. It also addresses if S-102 data are used as a basis for terrain models and 3D applications. The correlation between data quality measures, reported values, setting priorities and display settings are also mentioned as issues.

After some discussion on which items do/do not belong in the TOR of the DQWG, the Chair indicated that many questions asked are addressed in other parts of the agenda. The quality from ping to chart is item 10b (mismatch between S-44 and CATZOC), noting that the gridding mechanism used by the software is also a quality measure. The Data Quality Checklist provides a framework for S-102 to develop data quality measures as appropriate. The display of data quality is item 8a and work in progress. The present uncertainty attributes in S-102 are of the type Accuracy/Positional Accuracy. The following recommendation to S-102 was made:

1) Use the Data Quality Checklist as a framework for developing data quality measures.
2) For Positional Accuracy, add the default value RMSE for gridded data.

3) When displaying a value of uncertainty, provide information about the calculation of that value to the user.
4) When displaying depth, provide information on the algorithms (shoalest depth/TPU weighted mean/basic weighted mean)
5) When displaying uncertainty, note if the slope of the terrain is taken into account.
6) To compute the target accuracy from raw data, the following guidelines are provided:

Recommendations for Positional Accuracy / Absolute or External Accuracy[1]
- Maximum RMSE (horizontal) = E / 10000
- Maximum RMSE (vertical) = V_{INT} /6

Recommendation for Positional Accuracy / Gridded Data Position Accuracy
- Maximum RMSE (horizontal) = GSD / 6
- Maximum RMSE (vertical) = GSD / 3

Where:
E = chart composition scale
V_{INT} = normal contour line interval
GSD = Ground Sampling Distance.

Outcome: DQWG is responsible for modelling data quality measures, not the actual computation of a value of a position. S-102 has been given several recommendations during the meeting.

8. METHODOLOGY FOR THE DISPLAY OF QUALITY INFORMATION

8a. Review appropriate methodology for the display of quality information

Docs:	*DQWG13-08A*	*HSSC9 Proposal and Presentation*
	DQWG13-08B	*Suggestions from Teledyne CARIS*

The IHO Secretary-General joined the meeting for this session. The *Chair* introduced the presentation at HSSC9 from Intertanko "End users perspective on ENC and ECDIS." *Kampfer* (IHO Sec) provided the group with comments from this presentation. The associated paper listed two main issues for the DQWG:

i. To minimize the "unassessed" CATZOC values
ii. If the "depth accuracy" figure should be taken into account in doing UKC calculations (since this was not a practice when paper charts were in use), an IHO guideline on this would be very helpful.

Next the *Chair* presented paper NCWG3-08.4A titled "Data Quality indicators for bathymetric data on ECDIS chart display." This paper was submitted by Germany, providing a solution for Visualizing Quality of Bathymetric Data in a route planning scenario and ECDIS mode day via hierarchical texture overlay and visualizing Quality of Bathymetric Data in a monitoring scenario and ECDIS mode dusk via hierarchical texture overlay. The Secretary-General commented on the development of this paper.

[1] INSPIRE Data Specification Elevation on Elevation – Technical Guidelines v3.0 page 94.

Next the *Chair* presented the proposal by the DQWG, portrayal of bathymetry quality in S-101, at HSSC9. This has the idea to combine safety depths with Quality of Bathymetric Data into a surface displaying sense of safety.

A lengthy discussion took place on this subject. The considerations were 1) lack of contour lines to be used as safety contour, 2) current symbology of CATZOC, 3) planning versus executing a voyage 4) new type of symbology, and 5) isolated dangers.

Outcome: no definite conclusion. The mixture of safety depth and Quality of Bathymetric Data is **rejected** as it may lead to too much confusion. Methodology is to be further developed by correspondence. Lack of safety contours is a policy issue, not a data model issue in S-1xx. Stakeholders are to be invited when appropriate.
Action -> DQWG13/15, 13/16, 13/17.

9. DATA QUALITY EDUCATIONAL FOR THE USE OF MARINERS

9a. Review comments and input received from other WGs on S-67 version 0.5

Docs:	*DQWG13-09A*	*NIPWG/NCWG/France comments*

S-67 draft version was delivered at HSSC9. It was then decided that feedback from other WGs should be included. The feedback came as general, technical or editorial. The group went through the general comments first to note if there were items of major concern. After some time, it was decided that there were so many general comments on the paper that it would need serious rework. The title of the document does not the cover the subject completely and is now changed into “Mariners Guide to the Accuracy of Depth Information in Electronic Navigational Charts.” It was also noted that some HOs request a G-document instead of an S-document. This is outside the scope of the DQWG.

Outcome: S-67 draft version 0.5 needs rework and cannot be submitted as Ed.1.0.0 at HSSC10. After rework another review by other WGs is to be done.
Action -> DQWG13/18

10. RELATIONS WITH OTHER WORKING GROUPS

Docs:	*DQWG13-10A*	*S-100WG Guidance for Product Specification Developers (part A, Part B)*
		Report from NCWG: no associated documents
		Report from NIPWG: Draft Product Specifications
		Report from TWCWG: Draft Product Specifications
		Report from ENCWG: no associated documents
		S-101PT: DCEG (see workshop)
		S-102: see section 7d.
		HSPT: see section 10b.
		S-121: Draft Product Specifications
		UKCM: Draft Product Specifications

10a. S-100WG

S-100WG Guidance for Product Specification Developers, part A chapter 2.2.11 was checked. They need updating with the latest data quality model. The introduction paragraph of data quality is very good and should be implemented in the Data Quality Checklist as an introduction paragraph to all S-1xx Product Specifications.

S-100WG Guidance for Product Specification Developers, part B chapter 11.1 was checked. This needs to be brought in line with any changes made in part A.

Outcome: documents need to be brought up-to-date with the latest Data Quality Model and Data Quality Checklist.
Action -> DQWG13/19

NIPWG/TWCWG/S-121/UKCM Draft Product Specifications were checked against the Data Quality Checklist. S-121 has the same layout but is missing several DQ measures. The others do not have the same layout and are missing several items. Each WG will be sent an advice by the Chair.
Action -> DQWG13/20

10b. HSPT

Docs:	*DQWG13-10B*	*Mismatch between S-44 and CATZOC*
		Annex A
		Report of the HSPT to HSSC9

HSPT has made a request to the DQWG to consider to resolve the mismatch between S-44 and CATZOC. S-44 describes accuracy for data at raw data acquisition. CATZOC describes the quality level of the data in an area displayed in an ENC. HSPT suggests to change the CATZOC coefficients a and b to match S-44 and to apply the S-44 formula for CATZOC depth accuracy.

Wyatt (IHO Sec) in the role of Secretary for HSPT joined this session of the meeting. After some discussion it was decided that the mismatch between S-44 and CATZOC (Quality of Bathymetric Data in the future) should not be technically aligned. FR has composed a table how to allocate a CATZOC value from a particular survey. US has a similar paper. It was suggested to all members to provide input at the next meeting what their policy is. DQWG will request HSPT to think about a methodology from survey to CATZOC.

Outcome: the request from HSPT has been **rejected**. Chair to inform HSPT.
Action -> DQWG13/21

11. INTERNATIONAL STANDARDS FOR DATA QUALITY

11a. ISO Standards

Docs:	*DQWG13-11A*	*ISO TC-211 Standards*
		Doc. HSSC9-07.7A
		Comments (Eivind Mong) on Doc. DQWG13-11A

Both the IHO and the Open Geospatial Consortium (OGC) are liaison members of the ISO/TC211. The OGC have established a Marine Domain Working Group (DWG) to address interoperability challenges with marine geospatial data.
The S-1xx Product Specifications are based on these ISO standards. ISO-19157 describes Data Quality. In theory, the Data Quality Measures from OGC and S-1xx should align.

11b. OGC

No associated document at this time.

11c. Others

Docs:	*DQWG13-11C*	*Data Quality in INSPIRE: Balancing Legal Obligation with Technical Aspects.*
		INSPIRE Data Specification on Elevation – Technical Guidelines
		Geospatial Positioning Accuracy Standards – Part 3, National Standard for Spatial Data Accuracy (US-Federal Geographic Data Committee)

The above documents are useful references. The INSPIRE papers are from the European INSPIRE program. The Technical Guidelines are enforced as European Rule of Law and adopted by Member States into National Law. Implementation will be effective in the year 2020.

12. HSSC-10

12a. Review of decisions and actions
The list of decisions and actions was reviewed. The list is provided in Annex B.

12b. DQWG Work Plan update
The DQWG work plan was updated in accordance with the new actions from this meeting. The work plan is provided as Annex C

12c. Key priorities/risks/issues

Priorities:
1. provide a draft data quality checklist for product specification developers.
2. provide a better methodology to display data quality
3. provide guidance to HOs how to allocate Quality of Bathymetric Data values
3. provide guidance to the end-user.

Legeer proposed to show the S-57 to S-101 converter used by US for the next meeting.
Action -> DQWG13/24

Risks:
No major risks are identified at this time.

Issues:
No major issues are identified at this time.

12d. Funding request to HSSC
There is no funding request at this time.

12e. Task assignment among DQWG members
See list of Actions.

12f. Date and venue of the next meeting
The next meeting will take place in at the IHO Secretariat in Monaco 5-8 February 2019. This will give the members enough time to prepare after the Christmas holidays.

ANNEX A – Terms of Reference

Terms of Reference are available at:
https://www.iho.int/mtg_docs/com_wg/TOR/DQWG_TOR_E_13Nov2017.pdf

ANNEX B – List of Decision and Actions

LIST OF DECISIONS & ACTIONS ARISING FROM DQWG13

Agenda item	Subject	Actions (in bold, action by)	Target Date/Event	Status (after DQWG-13)
	DQWG12-03.3A	**NL (Broekman)** to develop proposal to NCWG to explore whether there is a requirement, and to model possible display options, for QoBD stacked layers which are slightly shallower than the vessels nominated safety depth. (**DQWG12/06**)	Until further notice	Postponed
	DQWG12-04.7A	DQWG to create a work item to undertake a global review of Quality of horizontal measurement values and their definitions by the DQWG and consider a workshop to address the issue. **David**. (**DQWG12/12**) **Chair** to make recommendation to HSSC once paper is agreed by all DQWG members.	HSSC-10	In progress
	DQWG13-04A	**DECISION**: Temporal variation of non-bathymetric data shall be options. Update the DCEG accordingly. (**DQWG13/01**)	DQWG-13	Complete
		DECISION: Area assigned as Oceanic shall not be shallower than 200m. Update the DCEG accordingly. (**DQWG13/02)**	DQWG-13	Complete
		Change the list of enumerated values for quality of bathymetric/non-bathymetric data. (**DQWG13/03**)	DQWG-13	Complete
		All documents and web pages related to the Data Quality Model need updating in line with DCEG Edition 0.0.3. (**Legeer/Wootton**). (**DQWG13/04**)	HSSC-10	In progress
		Update the registry with the results from the workshop above. (**Wootton**) (**DQWG13/05**)	DQWG-13	Complete
	DQWG13-05A	The draft Data Quality Checklist was accepted with the remarks that it should include a paragraph “general introduction to data quality” and further examples and recommendations. The group agreed to propose the refined Data Quality Checklist to present to HSSC for endorsement to all other WG’s/PT under the “comply or explain” principle. (**Chair**) (**DQWG13/13**)	HSSC-10	In progress

	DQWG13-06B	It was suggested that all members provide input on the next DQWG meeting for a common approach to degrade CATZOC with generalization to smaller scales or any other option. (**All**) (**DQWG13/06**)	DQWG-14	Planned
		Recommend to ENCWG to consider change in the validation policy that M_QUAL object is no longer mandatory for an UNSARE that contains no depth information at all. Recommend an encoding bulletin and an addition to the UOC. (**Legeer > Chair**) (**DQWG13/07**)	HSSC-10	Planned
		FR/US/AU to deliver. **Guillam** to upload method from survey to CATZOC from FR/US/AU. (**DQWG13/08**)	DQWG-14	Planned
		All members to provide documentation about the method from survey to CATZOC value. (**DQWG13/09**)	DQWG-14	Planned
		Create "best practice" from DQWG13/09 and distribute to other WGs/PTs. (**Chair**) (**DQWG13/10**)	Post DQWG-14	Planned
		PRIMAR to investigate discrepancies in CATZOC values of adjacent areas of neighboring countries. All to provide PRIMAR feasible areas for the study. (**Skjaeveland** / **All**). (**DQWG13/11**)	DQWG-14	Planned
	DQWG13-06C	A guidance document is to be drafted including an explanation of the Data Quality Model, the Decision Tree to allocate Quality of Bathymetric Data values for Product Specification developers and HO's for usage. (**Legeer**) (**DQWG13/12**)	01 Apr 2018	Planned
	DQWG13-07A	The Data Quality Checklist and the recommendations from this paper will generate a Guideline on S-1xx minimum set of validation checks. This guideline is to be drafted by the **Chair** in support of **Mong** and then be delivered to S-101PT and other WGs/PT. (**DQWG13/14**)	01 July 2018	Planned
	DQWG13-08A	The mixture of safety depth and Quality of Bathymetric Data is **rejected** as it may lead to too much confusion. Methodology is to be further developed by correspondence. (**Chair**) (**DQWG13/15**)	01 Oct 2018	Planned
		Invite INTERTANKO and other users for DQWG DQWG13/15. (**Chair**) (**DQWG13/16**)	01 Oct 2018	Planned
		Invite Product Specification developers as required. (**Chair**) (**DQWG13/17**)	01 Oct 2018	Planned

	DQWG13-09A	S-67 draft version 0.5 needs rework and cannot be submitted as Ed.1.0.0 at HSSC10. After rework another review by other WGs is to be done. (**Legeer , Wootton, > Chair**) (**DQWG13/18**)	01 March 2018	Planned
	DQWG13-10A	S-100WG Guidance for Product Specification Developers Part A and B need to be brought up-to-date with the latest data quality model and Data Quality Checklist and decision tree.(**Chair/Wootton**) (**DQWG13/19**)	01 March 2018	Planned
		Draft Product Specifications to be checked against draft Data Quality Checklist and WGs to be informed accordingly (**Chair**). (**DQWG13/20**)	26 March 2018	Planned
		DQWG **rejects** the proposal made by HSPT to align S-44 and CATZOC a and b parameters. **Chair** to inform HSPT. (**DQWG13/21**)	01 March 2018	Planned
	Other	All papers for DQWG-14 to be delivered to Chair and uploaded on website no later than 18th January 2019. (**All>Chair>Guillam**) (**DQWG13/22**)	18 January 2019	To be done
		Invite DQWG members to forward risks associated with assigned task to the Chair. (**Chair**) (**DQWG13/23**)	16 February 2018	Planned
		Provide guidance How S57 to S-101 converter works and guidance how the decision tree works. (**Legeer**) (**DQWG13/24**)	DQWG-14	Planned

ANNEX C – DQWG Work Plan

See the DQWG Work Plan 2018-2019 in the Consolidated HSSC Work Plan:

https://www.iho.int/mtg_docs/com_wg/HSSC/HSSC_Misc/Consolidated_HSSC_Work_Plan_2018-19_23Jan2018.pdf

ANNEX D – Data Quality Model

S-101 – ENC Product Specification - Data Classification and Encoding Guide (DCEG)

Definition of "Oceanic" (or as it is now "Assessed (Oceanic)":

Data assessment: IHO Definition: The categorisation of the assessment level of bathymetric data for an area.

1) **Assessed**

   IHO Definition: The quality of the bathymetric data has been assessed.

2) **Assessed (Oceanic)**

   IHO Definition: The quality of oceanic bathymetric data (depths deeper than 200 metres) has been assessed, however details are not required.

3) **Unassessed**

   IHO Definition: The quality of the bathymetric data has yet to be assessed.

Remarks:

- No remarks.

Category of Temporal Variation:

All allowable values (note definitions that have been added/amended from the current version of the DCEG):

Category of temporal variation: IHO Definition: An assessment of the likelihood of change over time.

1) **Extreme event**

   IHO Definition: Indication of the possible impact of a significant event (for example hurricane, earthquake, volcanic eruption, landslide, etc.), which is considered likely to have changed the seafloor or landscape significantly.

2) **Likely to change and significant shoaling expected**

   IHO Definition: Continuous or frequent change (for example river siltation, sand waves, seasonal storms, ice bergs, etc.) that is likely to result in new significant shoaling.

3) **Likely to change but significant shoaling not expected**

   IHO Definition: Continuous or frequent change (for example sand wave shift, seasonal storms, ice bergs, etc.) that is not likely to result in new significant shoaling.

4) **Likely to change**

   IHO Definition: Continuous or frequent change to non-bathymetric features (for example river siltation, glacier creep/recession, sand dunes, buoys, marine farms, etc.).

5) **Unlikely to change**

   IHO Definition: Significant change to the seafloor is not expected.

6) **Unassessed**

   IHO Definition: Temporal variation not assessed or cannot be determined.

Remarks:

- No remarks.

Restricted enumerate list for Quality of Bathymetric Data:

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Category of temporal variation		1 : extreme event 2 : likely to change and significant shoaling expected 3 : likely to change but significant shoaling not expected 5 : unlikely to change 6 : unassessed	EN	1,1

Restricted enumerate list for Quality of Non-Bathymetric Data:

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Category of temporal variation		1 : extreme event 4 : likely to change	EN	0,1