Hydrographic Services and Standards Committee

Report of the

Data Quality Working Group

Principal activities and achievements

- Membership
  - 17 Member States
  - 3 Expert Contributors

- Meetings
  - DQWG-14, 05 – 08 February, IHO Secretariat, Monaco
  - 13 delegates from 11 Member States
 - Secretary-General, IHO Director and Staff joined for some items on the agenda

Principal activities and achievements

1. Develop and maintain a data quality checklist for product specification developers.
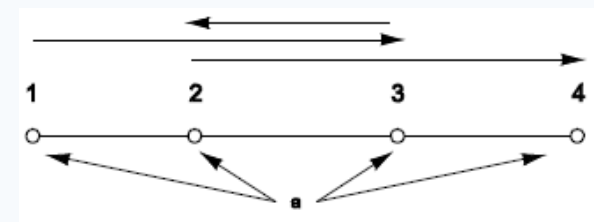
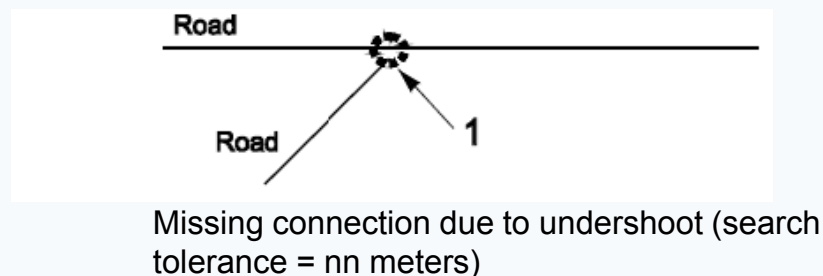- DQ checklist was developed and reviewed by correspondence.
- Result was provided as input into S-97 – part C Data Quality. (DQ Guideline)
- S-127 developers followed the guidance, resulting in a very good example of DQ Measures and associated Validation Checks.
- S-101PT included the guidance in their draft Validation Checks.
- S-97 part C was reviewed at DQWG14.
- Demand for graphical examples, mainly Topology Checks.

Graphical examples of Topology Checks (ISO19157)

Two point curve exists where only one should be present
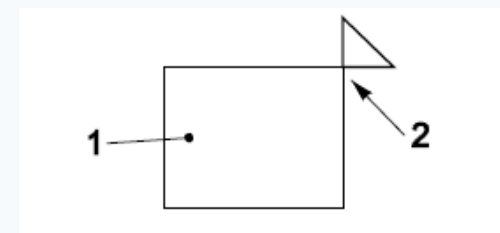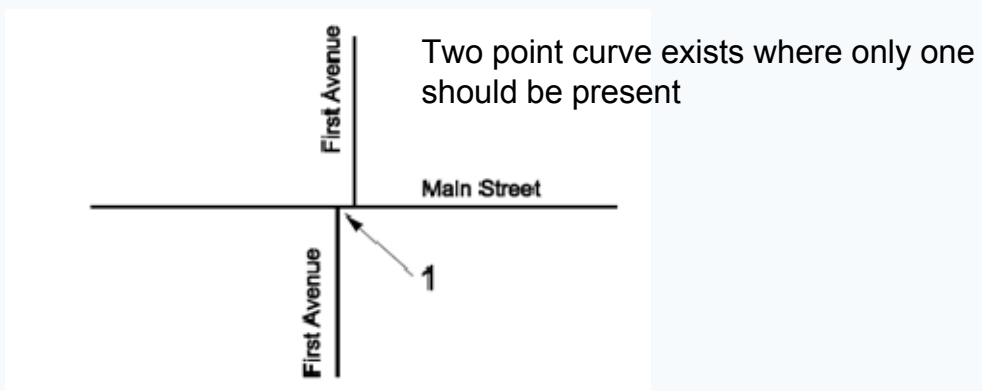
Self intersect error
1 = building
2 = illegal intersection

Missing connection due to undershoot (search tolerance = nn meters)

Self overlap error
Line is drawn using vertex 1 -> 3 ->2 -> 4
The correct sequence is 1 -> 2 -> 3 -> 4

Principal activities and achievements

2. Periodically review S-100 based product specifications for DQ aspects.

- Review of Product Specification S-101, S-102 and S-127 done.

- Result provided to S-100WG4 meeting.

- DQWG will continue to work on a Minimum Standard for Data Validation, in liaison with other HSSC WGs/PTs.

- S-102 PS is unclear about horizontal/vertical uncertainty.

- No request received to review Product Specification S-111 and S-121 before DQWG14. To be done by correspondence.

Principal activities and achievements

3. Monitor periodically development of ISO and other international standards regarding DQ and advise the S-100WG accordingly.

- DQWG14-10J: Data integrity, marine boundaries from a MSDI perspective.

- As a consequence DQWG suggests to amend the ToR: Monitor periodically development of ISO and other international standards regarding DQ and advise ~~the S-100WG~~ accordingly.

- the DQWG recommends that the process of SENC distribution that entered into force for certified (Norske Veritas procedure) value-added resellers for S-57 data should be considered (or re-considered) within the S-100 framework for S-100 based products.

Principal activities and achievements

4. Provide guidance on DQ aspects to HOs, in particular to ensure harmonized implementation.

- Six Member States so far have shared their national policies how the quality of a single survey is translated into the appropriate M_QUAL/CATZOC value. (see DQWG webpage)

- CSB is typically assigned CATZOC = D (sometimes C).

- SDB is typically assigned CATZOC = C.

- LIDAR survey is typically assigned CATZOC = B (sometimes A2).

- Port authority surveys are typically assigned CATZOC = B, on port-by-port basis a higher value.

Principal activities and achievements

4. Provide guidance on DQ aspects to HOs, in particular to ensure harmonized implementation.

- Different depth ranges are used in various standards.

- S-44: 40m and 100m boundary.

- S-52: default safety depth and safety contour = 30m.

- C-55: 200m boundary.

- S-4: 0, 2, 5, 10, 20, 30, 50, 100, 200, 300, 400, 500, 1000, 2000m etc.

- High density ENCs: 3, 8, 15, 25, 40 and 75m and multiples of 10 or 100m may be shown. (S-4 recommendation).

- S-101 Oceanic: 200m boundary

Principal activities and achievements

4. Provide guidance on DQ aspects to HOs, in particular to ensure harmonized implementation.

- Guidance document: How to provide meaningful Quality of Bathymetric Data (QoBD) values.

- Decision tree, textual and graphical.

- Best practice from Survey to QoBD.

- Aggregation of QoBD in relation to the compilation scale of the chart.

- Small scale charts should inherit their values from large scale charts.

- CATZOC value does not change when converting to S-101 Quality of Bathymetric Data value!

Decision Tree (graphical)

→ true
→ false

data assessment	temporal variation	seafloor coverage	vertical uncertainty	horizontal uncertainty	Quality of Bathymetric Data value

Start →

Assessed, not Oceanic, not Unassessed	unlikely to change	full area search undertaken, significant seafloor features detected, depths measured	0.50 + 1%depth	5 + 5%depth	QoBD = 1
	likely to change but significant shoaling unexpected	full area search undertaken, significant seafloor features detected, depths measured	1.0 + 2%depth	20m	QoBD = 2
		full area search not achieved, uncharted features hazardous to surface navigation are not expected but may exist.	1.0 + 2%depth	50m	QoBD = 3
QoBD = Oceanic	likely to change and significant shoaling expected	full area search not achieved, depth anomalies may be expected	2.0 + 5%depth	500m	QoBD = 4
QoBD = Unassessed	extreme event	full area search not achieved, large depth anomalies may be expected	>2.0 + 5%depth	>500m	QoBD = 5

International Hydrographic Organization
Organisation Hydrographique Internationale

HSSC-11, Cape Town, South Africa, 6-9 May 2019

Decision Tree (textual)

STEP	Question/Result	Answer = YES	Answer = NO
1	Is data assessment = unassessed?	Go to 2	Go to 3
2	QUALITY OF BATHYMETRIC DATA = UNASSESSED		
3	Is data assessment = Oceanic?	Go to 4	Go to 5
4	QUALITY OF BATHYMETRIC DATA = OCEANIC		
5	Is category of temporal variation "Unlikely to change"?	Go to 6	Go to 10
6	full area search undertaken, significant seafloor features detected, depths measured?	Go to 7	Go to 15
7	Is vertical uncertainty < 0.5m + 1% of depth?	Go to 8	Go to 12
8	Is horizontal position uncertainty < 5m + 5% of depth?	Go to 9	Go to 13
9	QUALITY OF BATHYMETRIC DATA = 1 (*CATZOC = A1*)		
10	Is category of temporal variation = likely to change but significant shoaling unexpected?	Go to 11	Go to 19
11	full area search undertaken, significant seafloor features detected, depths measured?	Go to 12	Go to 15
12	Is vertical uncertainty < 1.0m + 2% of depth?	Go to 13	Go to 21
13	Is horizontal position uncertainty < 20m?	Go to 14	Go to 17
14	QUALITY OF BATHYMETRIC DATA = 2 (*CATZOC = A2*)		

Decision Tree (textual)

STEP	Question/Result	Answer = YES	Answer = NO
15	Full area search not achieved, uncharted features hazardous to surface navigation are not expected but may exist?	Go to 16	Go to 20
16	Is vertical uncertainty < 1.0m + 2% of depth?	Go to 17	Go to 21
17	Is horizontal position uncertainty < 50m?	Go to 18	Go to 22
18	QUALITY OF BATHYMETRIC DATA = 3 (*CATZOC = B*)		
19	Is category of temporal variation = likely to change and significant shoaling expected?	Go to 20	Go to 24
20	Full area search not achieved, depth anomalies may be expected?	Go to 21	Go to 25
21	Is vertical uncertainty < 2.0m + 5% of depth?	Go to 22	Go to 26
22	Is horizontal position uncertainty < 500m?	Go to 23	Go to 26
23	QUALITY OF BATHYMETRIC DATA = 4 (*CATZOC = C*)		
24	Is category of temporal variation = extreme event?	Go to 26	Go to 2
25	Full area search not achieved, large depth anomalies may be expected?	Go to 26	Go to 2
26	QUALITY OF BATHYMETRIC DATA = 5 (*CATZOC = D*)		

Principal activities and achievements

5. Provide data quality educational material for the use of Mariners.

- S-67: Mariners Guide to the Accuracy of Depth Information in Electronic Navigational Charts.

- Edition 0.8 – review done.

- First complete Guidance to HO, then explain the CATZOC symbol and isolated features hazardous to navigation in S-67.

- Remove guidance on UKC calculations.

- Verify S-67 against S-4.

- S-67 medium priority.

Principal activities and achievements

6. Review appropriate methodology for the display of quality information to Product Specification developers.

- Interactive workshop session at DQWG-14

- Input papers: current CATZOC symbology, NCWG3-08.4A, DQWG14-08C, AHO comments.

- Intertanko paper HSSC9-05.2D (end user perspective).

- 17 observations resulted from this workshop (DQWG-14 Final minutes).

- Proposal in paper HSSC11-05.5B, also supportive for autonomous shipping.

Principal activities and achievements

6. Review appropriate methodology for the display of quality information to Product Specification developers.

- In current ECDIS systems, the Mariner enters a draught value, a safety depth and safe distance from isolated objects hazardous to navigation.

- By doing so, the Mariner creates a SAFETY ZONE around the vessel.
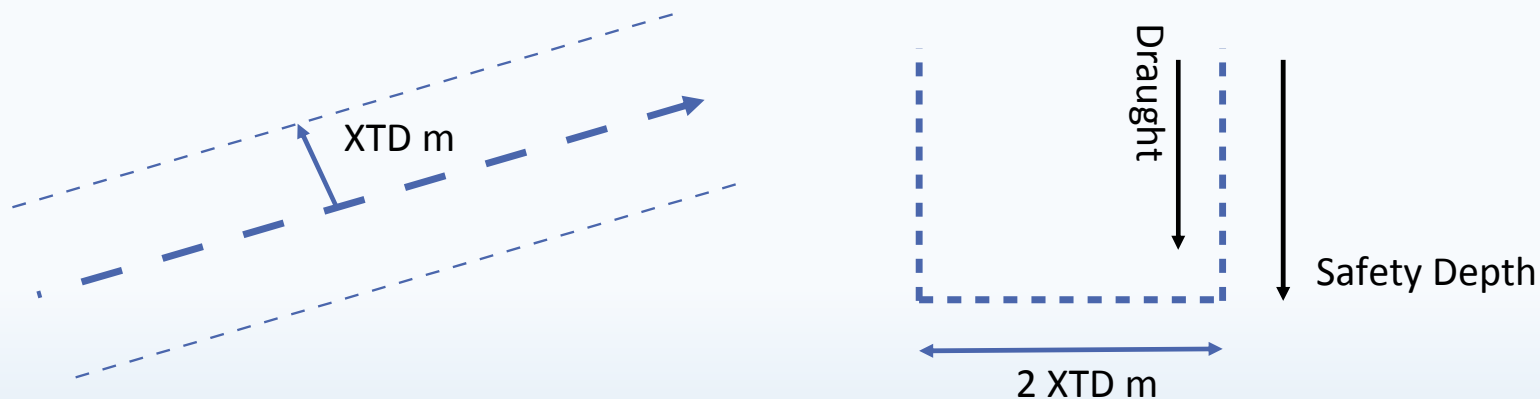
XTD m

Draught

Safety Depth

2 XTD m
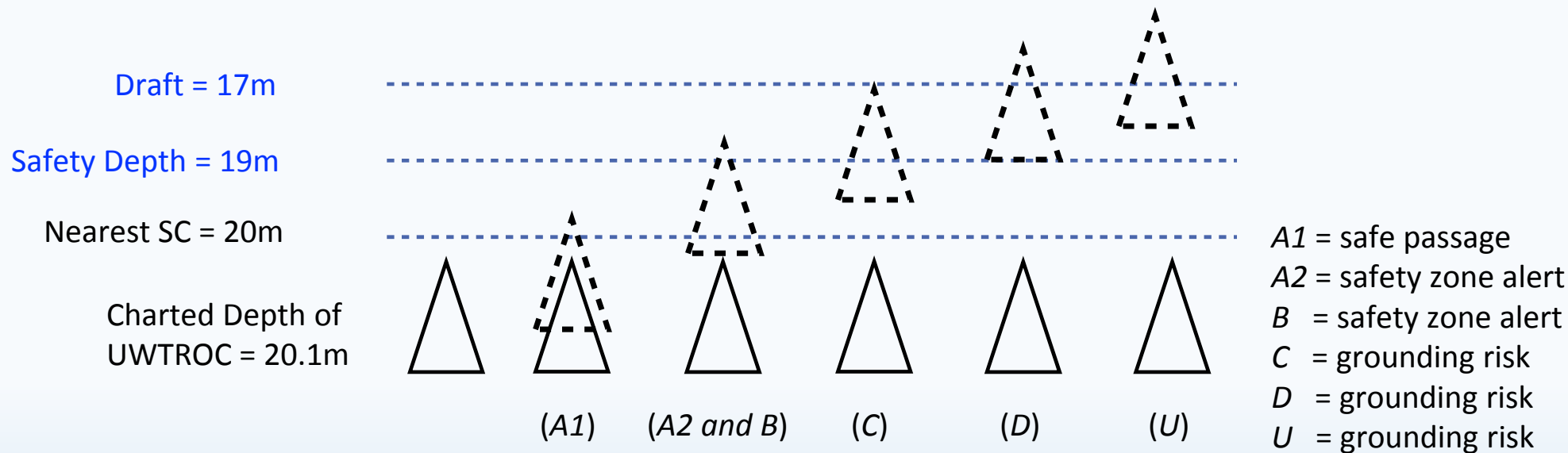
Principal activities and achievements

6. Review appropriate methodology for the display of quality information to Product Specification developers.

- Smart algorithm, vertical QoBD is taken into account for safe passage.

Standard Contour Lines			Example			
0 m						
2 m						
5 m						
10 m						
20 m	Draft = 17m					
30 m	Safety Depth = 19m					
50 m	Nearest SC = 20m					
100 m		0.7m	1.4m	1.4m	3.0m	>3.0m ?
200 m	Vertical Uncertainty	(A1)	(A2)	(B)	(C)	(D) (U)
Oceanic						
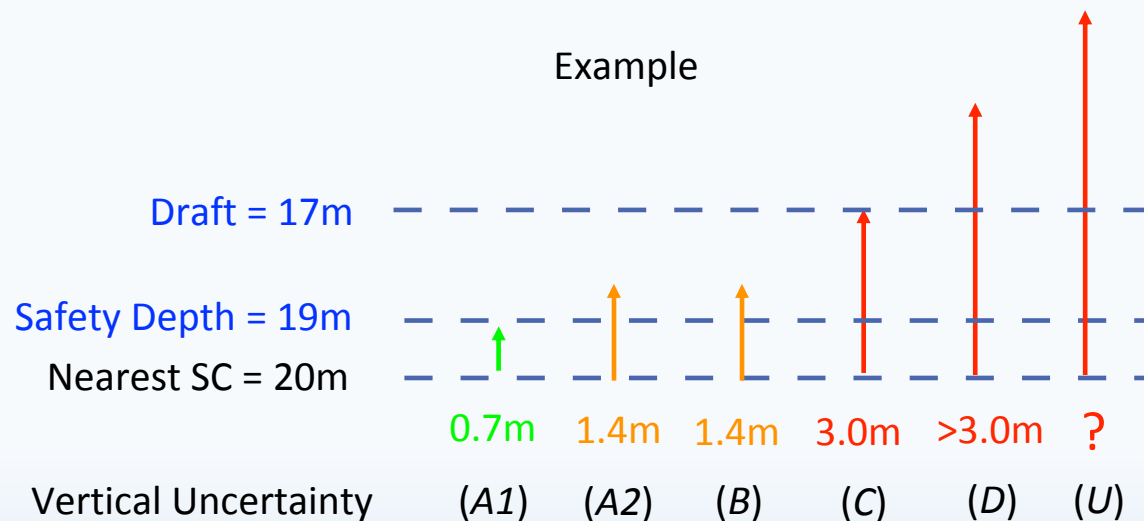
Principal activities and achievements

6. Review appropriate methodology for the display of quality information to Product Specification developers.

- SAFETY ZONE alarm for UWTROC, WRECKS, OBSTRN, SOUNDG.

Draft = 17m

Safety Depth = 19m

Nearest SC = 20m

Charted Depth of UWTROC = 20.1m

(A1)   (A2 and B)   (C)   (D)   (U)

A1 = safe passage
A2 = safety zone alert
B = safety zone alert
C = grounding risk
D = grounding risk
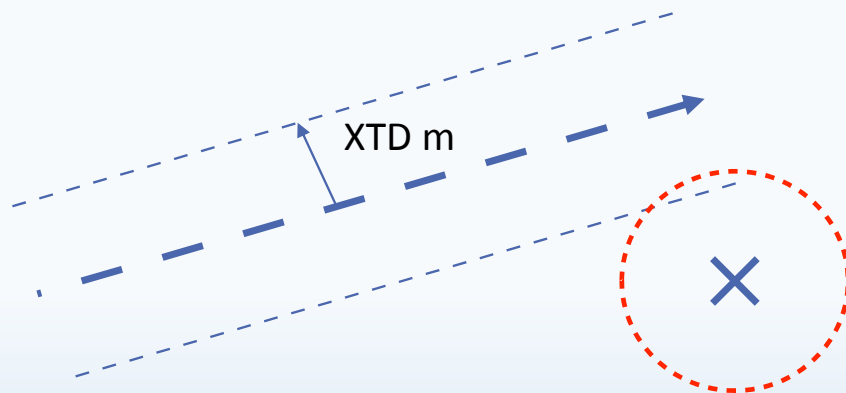U = grounding risk

Principal activities and achievements

6. Review appropriate methodology for the display of quality information to Product Specification developers.

- SAFETY ZONE alarm for Horizontal Safe Distance.

- Combine Vertical and Horizontal QoBD

Safety Contour = 20m

Position uncertainty

($A1$) = 6m   (vary with depth)
($A2$) = 20m   (fixed value)
(B)   = 50m   (fixed value)
(C)   = 500m (fixed value)
(D)   > 500m (more than)
(U)   = ?   (unknown)

XTD m

Grounding Risk alert

Attributes - WRECKS

| Attributes	
Exposition of sounding	within the range of depth of surrounding depth area
Quality of sounding measurement	least depth known
Sounding accuracy	0,5 m
Technique of sounding measurement	found by multi-beam
Value of sounding	20,1 m
Water level effect	always under water/submerged

Isolated danger with individual sounding accuracy – no grounding risk alert.
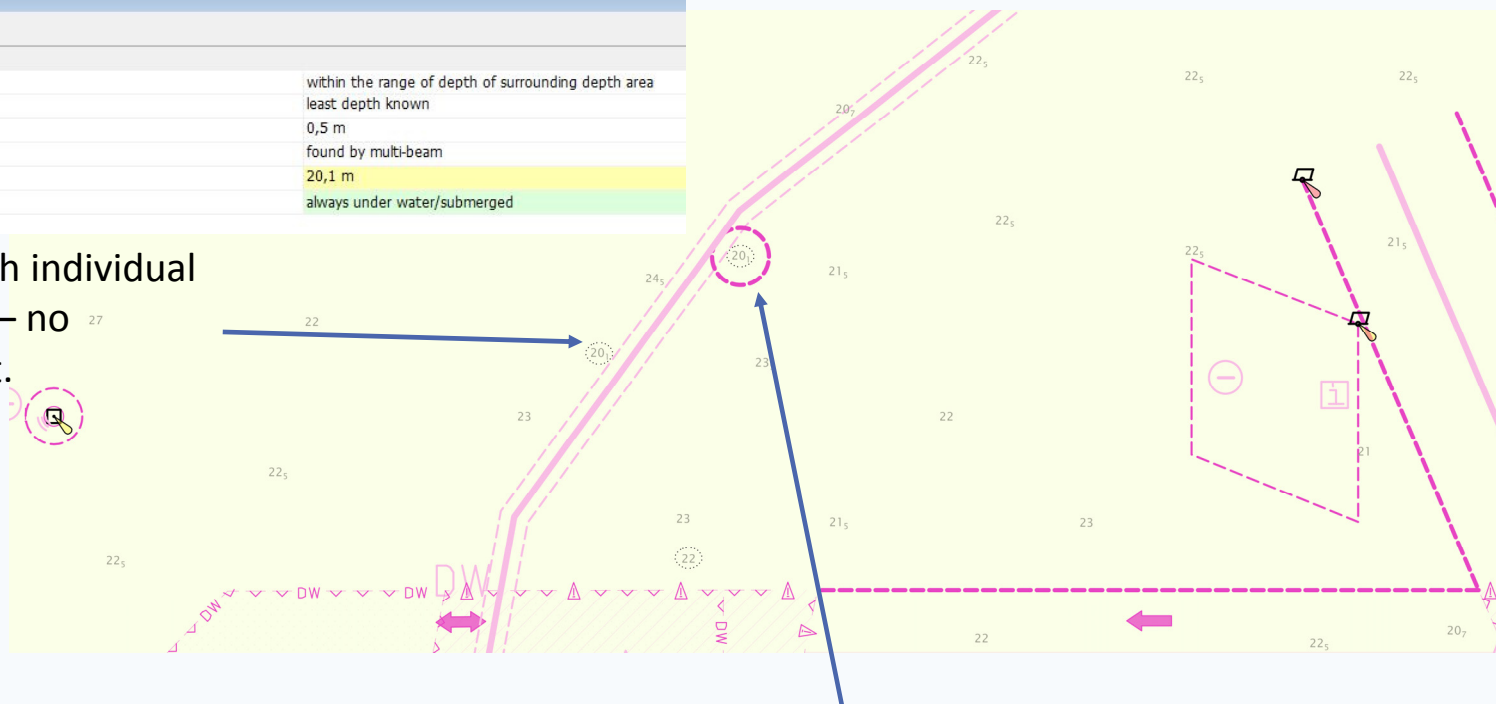
Isolated danger with minimum depicted depth of 20.1m, no individual quality values. In area of CATZOC = C, least possible depth = 17.1m. System will issue a grounding risk alert.

Blocked passage d/t poor quality
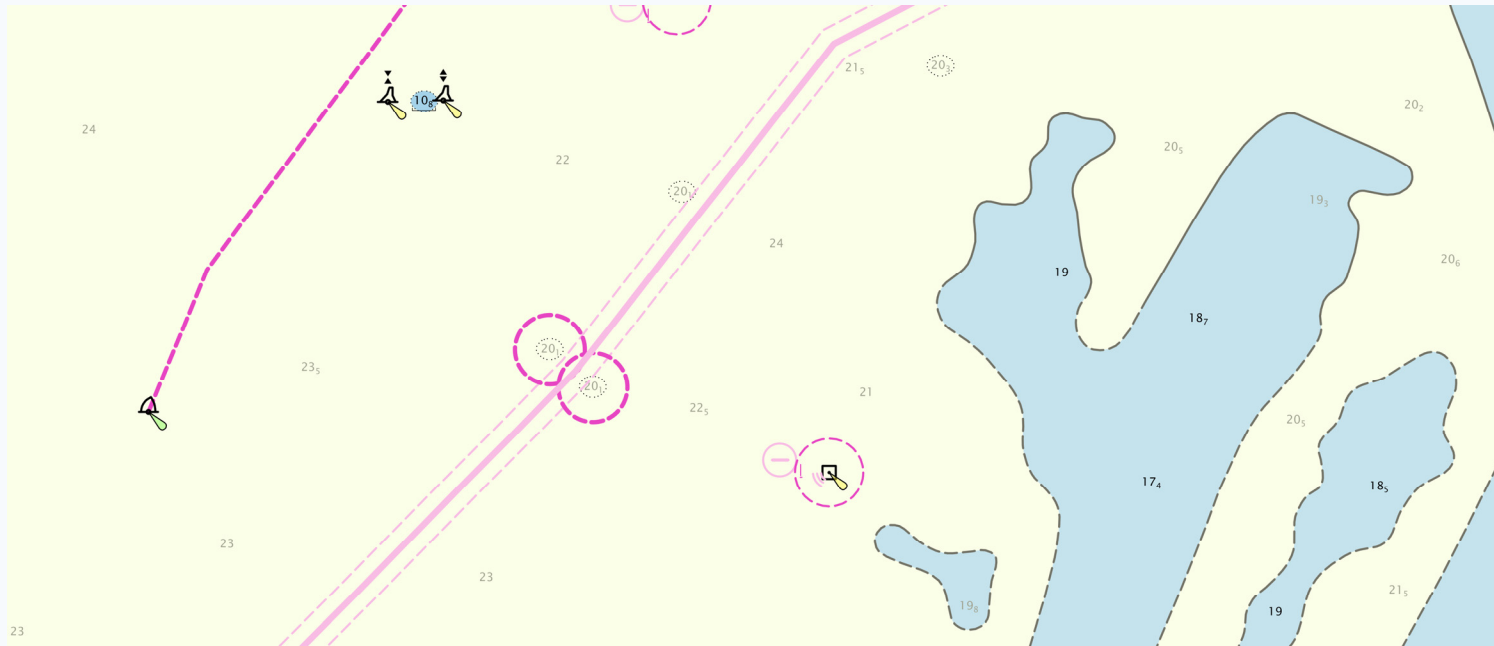
Transit in-between two isolated dangers in CATZOC C area is not advised. DEPCNTs are approximate, drawn as dashed lines.

Principal activities and achievements

6. Review appropriate methodology for the display of quality information to Product Specification developers.

Recommendations for NCWG/S101PT:

- Screen wide symbology (*CATZOC*) is needed for spatial awareness.

- Avoid screen clutter.

- Should be an area centered symbol, not staggered. Maximum size = 5 mm.

- Boundaries of QoBD should be visualized.

- Introduce a check route functionality.

- Use QoBD values to validate the SAFETY ZONE under/around the vessel.

- Create clear warning signals (show details/accept) for SAFETY ZONE alerts in planning and monitoring mode.

Principal activities and achievements

6. Review appropriate methodology for the display of quality information to Product Specification developers.

Recommendations for HOs [1]:

- Provide meaningful values to Quality of Bathymetric Data (S-101).

  (1, 2, 3, 4, 5 or Oceanic. Unassessed should not be used)

- Provide horizontal/vertical uncertainty for isolated features

  (UWTROC, WRECKS, OBSTRN, SOUNDG) hazardous to navigation:

- if the horizontal/vertical uncertainty of the individual features is different from the surrounding Quality of Bathymetric Data,

- mainly in areas < 30m depth,

- in/close to major shipping routes.

Principal activities and achievements

6. Review appropriate methodology for the display of quality information to Product Specification developers.

Recommendations for HOs [2]:

- Assign DEPCNTs with *QUAPOS*=3 (inadequately surveyed) or *QUAPOS*=4 (approximate) in areas with *CATZOC=D (all depths)* or *C (<30m depth*).

- Be aware of vertical uncertainty when generating High-Density ENCs in areas of Quality of Bathymetric Data = 4 or 5 (*CATZOC = C or D*).

- Be aware of the use of S-102 as a decision aid, combined with S-101.

Work plan 2019-2020

Task	Work Item	Priority H=High M=Medium L=Low	Milestones	Start Date	End Date	Status P=planned O=Ongoing C=completed	Contact Person	Affected Pubs/ Standards	Remarks
A.1	Develop checklist on data quality components	H	HSSC11	2018	2019	C	R.Broekman	S-97 Part C	None
A.2	Provide graphical examples of DQ measures	M	HSSC12	2019	2020	P	R.Broekman	S-97 Part C	None
B.2	Development of a minimum standard for Data Validation in S-1xx based products	H	S-101 Ed.2.0.0	2018	2020	O	R.Broekman	S-1xx	Start with S-101
C.1	Review S-100 Section 4C	L	DQWG15	2017	2020	O	R.Broekman	S-97 Part C	None
D.2	Provide guidance documentation how to populate CATZOC values	H	S101PT4	2018	2019	O	S.Legeer	S-101 DCEG	None
D.3	Provide guidance documentation on the transition from S-57 CATZOC to S-101 QoBD	M	S-101 Ed.2.0.0	2019	2020	P	S.Legeer	S-101 DCEG	None
D.4	Collect best practice on how to assign ZOC from survey	M	HSSC11	2019	2020	C	S.Legeer	S-101 DCEG	Ref IHO CL50/2017
E.1	Submit editition 1.0.0 of S-67 for endorsement by HSSC	M	S-101 Ed.2.0.0	2018	2020	O	S.Legeer	S-4, S-101	After task D2 and D3
E.3	Consider a video version of S-67 when approved by MS	L	S-101 Ed.2.0.0	2020	2020	P	R.Broekman	S-4, S-101	After task E.1
F.1	Continue development of Portrayal of bathymetry quality in S-101	H	HSSC11	2017	2019	O	R.Broekman	S-101 DCEG	Autonomous shipping
F.2	Invite industry partners (ECDIS producers) and end users to get their input on methodology for the display of quality information	H	DQWG14	2018	2019	C	R.Broekman	S-101 DCEG	Overtaken by events

Problems or outstanding issues

- Complexity of Data Modelling, concept of Data Quality Measures, Metadata features and associated Validation Checks.

- S-67 is at present a mixture of guidance using the CATZOC symbol, guidance to HO and UKC management.

- S-67 should not contradict with already existing standards/publications (S-4, S-44, INT V on Data Quality).

- Every possible allegation that might be used to question the liability of HOs should be removed in S-67.

Data Quality

Good Data Quality does not mean
that the quality of the data has to be good.

It means that the end user is well informed
how good the Quality of the Data is.

Action requested of HSSC

- Note this report;

- Approve the proposal to amend the Terms of Reference;

- Provide recommendations if needed, and approve to continue the development of the conditional visualization methodology of quality of bathymetric data in liaison with NCWG (lead?), NIPWG, ENCWG, S-101PT, involving if possible academia, training centers, expert contributors and industry partners. (testing and implementation)

- Endorse the tasks in the DQWG Work Plan 2019-2020.