CSPCWG9-08.6A

9th CSPWG MEETING
Seoul, Republic of Korea, 13-16 November, 2012

Paper for Consideration by CSPCWG

Depth quality indicators

Submitted by:	Chairman and Secretary
Executive Summary:	Consideration of changes to depth quality indicators, subsequent to the finding of the DQWG Questionnaire.
Related Documents:	DQWG Questionnaire, WG Letter 07 & 12/2012, S-4, INT1
Related Projects:	INT1 subWG WG8 action 29 on 'reorganizing INT1 Sections K & L'

Introduction / Background.

WG8 Action 34 was for Chairman and Secretary to consider DQWG questionnaire in more detail and advise WG members of the best way to take forward the requests from DQWG. This was done through WG Letter 07/2012, which received 22 responses. Some of the original questions in Letter 07/2012 were adequately answered so that no further discussion is required. Others justify further consideration and this paper is intended to summarize and add to ideas expressed in response to Letter 07/2012 and stimulate further discussion in a 'round-the-table' forum.

Analysis / Discussion.

The areas for further discussion can be addressed under three headings:

1. Discontinuity between surveys
2. Use of upright numerals to indicate unreliability of soundings
3. Presentation of depth quality indicators in INT1

A separate annex to this paper is provided to stimulate discussion on each subject.

Conclusions & Recommendations.

None

Justification and Impacts.

1. The DQWG questionnaire has demonstrated user uncertainty about the meaning of some quality indicators used on paper charts.

2. Some possible changes to S-4 and INT1, with consequences to charting practice.

Action required of CSPCWG.

The CSPCWG is invited to advise on the various suggestions detailed in the Annexes, specifically:

1. What is the best way to highlight a 'discontinuity' between surveys?
2. Is there a better way to indicate unreliable soundings?
3. Should the INT1 description of K30 (Unsurveyed Safe Clearance wreck) be improved?
4. Can any existing depth/position quality indicators be made obsolescent?
5. Should INT1 be reorganized to group all depth quality indicators in one place?

Discontinuity between surveys

The responses to the question 'Should a legend be inserted in the 'discontinuity between surveys gap' (S-4 B-416.1), eg 'Surveys do not match'?' can be grouped as follows:

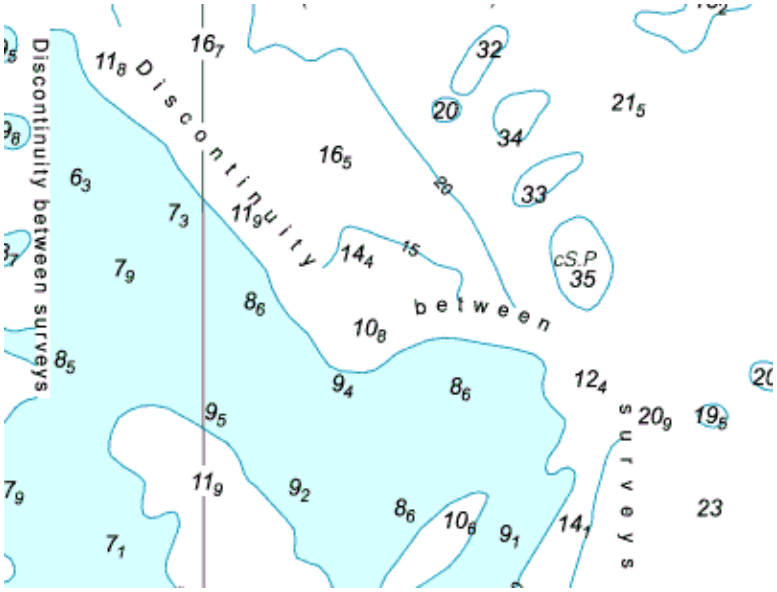
1. A 'white' ribbon is sufficient indication on the face of the chart, no legends are required; the Source Diagram should be sufficient explanation.
2. A legend should be used to direct the user to the Source/Zoc Diagram which can be used to indicate the different ages of the surveys.
3. The discontinuity can be explained in a chart note.
4. Better to manually adjust the contours to join up, using approximate (broken) contours if necessary.
5. Legends are useful, but not the one in the proposal (see French example).
6. Legends should be given in INT1 to avoid chart clutter.

15 respondents voted against a legend, compared with 7 in favour of a legend. Of the 7 in favour, 3 proposed a different legend from 'Surveys do not match'.

<u>Comments to start</u> discussion (on the 6 possibilities above):

1. **A 'white' ribbon is sufficient indication on the face of the chart, no legends are required; the Source Diagram should be sufficient explanation.**

   The DQWG questionnaire has exposed the situation that many users do not understand the 'white ribbon'; some additional or alternative method is required. UK has received several complaints from customers who thought the white gap and displaced contours were printing errors; this is why we added the legend 'Discontinuity between surveys' but it does not seem to have been well understood. Also, the white ribbon (on its own) does not work very well in areas where there are no tints, eg:



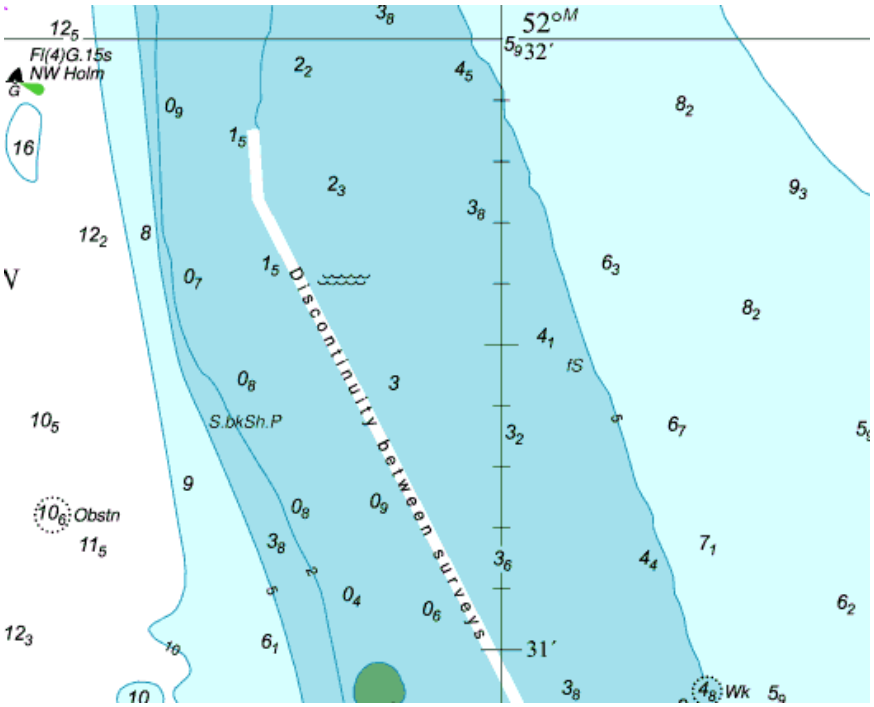
2 & 3. **A legend should be used to direct the user to the Source/ZOC Diagram which can be used to indicate the different ages of the surveys. The discontinuity can be explained in a chart note.**

A legend directing the user to the source diagram or a chart note still 'adds clutter', but does provide a way of increasing the understanding of the user. However, a note adds some more clutter (in a different place). Not all mariners are able to easily interpret the Source Diagram. A ZOC diagram would not clarify where two surveys of similar quality (but different age) abut.

4. Better to manually adjust the contours to join up, using approximate (broken) contours if necessary.

In many cases where the disparity is comparatively small, an adjustment to the contours and/or use of short lengths of approximate contours adequately covers the situation. Nevertheless, in many cases where the disparity is more significant, such blending of contours could result in a very misleading depiction. The French example is such a case. In the UK example, it would be possible to draw a 2m contour instead of the white band, but this could mislead the user who would assume that the full extent eastward of the 2m bank is charted, whereas the white ribbon warns him that it may be moving further east. (He would need to check the Source Diagram to see which side of the line was the more recent survey).

French example



UK example

5. **Legends are useful, but not the one in the proposal (see French example).**

The example from France may be more easily understood than the proposed ‘Surveys do not match’ or UK’s ‘Discontinuity between surveys’. It has the advantages of providing more information (ie which side is more recent) and not needing to fit inside the white gap but the disadvantage of being two legends.

6. **Legends should be given in INT1 to avoid chart clutter.**

At present there is no entry in INT1 to cover this situation (except I31 approximate contours). It is difficult to see how putting a legend in INT1 could help. An alternative may be to design a unique symbol, eg a band of broken grey stipple, 2 or 3mm wide. This could be used without additional legends or notes and be added to INT1 (eg at I26). However, it is not very intuitive. Note that a specific line symbol is being considered for S-100, as there is currently no approved method of depicting such discontinuities on ENC.

Use of upright numerals to indicate unreliability of soundings

17 respondents indicated they use upright soundings to show less reliable depths. Of the 6 who do not, 3 use upright soundings for a different purpose. The evidence from the DQWG questionnaire is clear that this practice is not well understood; this may be partly confusion created due to non-standardization or different usage but it seems to be more commonly the case that the differentiation is simply not noticed.

Suggestions for overcoming this shortcoming in response to letter 07/2012 were:

1. No need to use this device at all; broken contours and the Source/ZOC diagram are adequate.
2. Adding legend such as 'Inadequately surveyed' or simply 'Depths' (possibly with an associated explanatory note or reference to the Source/ZOC diagram).
3. Enhance the source diagram with colour or grey tint for poorly surveyed areas.
4. Using colour (eg red, grey) or changing the strength of the sounding (heavier or lighter weight) on the face of the chart.
5. Adding a circle around the soundings (as ENC).
6. Including in a key/glossary to bathymetric symbols.
7. Refer the user to INT1.
8. Enhance the description in INT1 (this has already been agreed).

Comments:

Most HOs consider that there is some need to differentiate soundings from poor sources (eg very old, significantly enlarged, non-hydrographic survey sources). Sometimes these are large areas of the chart; on other occasions they are amongst better quality data, either because there are gaps in the better surveys or the better survey is considered not to have adequately disproved older data.

Many of the suggestions above work well for large areas, which can easily be identified by the various devices listed in S-4 B-417 (ie: broken contours; uneven, widely spaced or lines of soundings; chart legends and associated notes; the source/ZOC diagram). Such areas can still include upright soundings, but are not so dependant on the mariner understanding or even noticing the difference.

The need to highlight less reliable soundings amongst better data is not really covered by those practices or the first three suggestions above. Of the remaining, these are some of the issues which need to be considered:

4. Use of grey conflicts with ENC, which uses grey to indicate safe water (also relevant to paper charts highlighting safe fairways). Use of red may not be available to most HOs. UK has always used a thinner line weight as well as upright, but apparently this has not helped; it seems unlikely that heavier line weight would work any better.

5. Adding a circle round all such soundings may be over obtrusive and be cartographically difficult in some areas. A circle is usually used to indicate a centred symbol within an area.

6. It may be difficult to find space on some charts to add a key/glossary and there would be pressure to continually add more symbols – where do you draw the line? This is a useful device when adopting charts which use different symbols from those given in the national equivalent of INT1.

7 & 8. Noted to improve the explanation of upright soundings in INT1 and many MS already include a reference to INT1 either in the margin or under the title. While useful, it may not have made this symbol widely understood.

Another option we might consider is the use of '?'. A '?' (LOWACC01) is used on ENC to indicate low accuracy or reliability. Could we utilise this on paper charts? It could be used against an individual sounding, inside a circle centred in an area, or at intervals in an outer limit of a bigger area. This usage could also be extended to replace or augment other existing symbols or abbreviations; see next Annex.

Presentation of depth quality indicators in INT1

The only two suggestions for enhancing the chart user's understanding of a bar over an obstruction or wreck (K3/30) were to either move or improve the description in INT1. There were also suggestions for rearranging (consolidating) all the entries concerned with depth quality into one section of INT1. Other suggestions included the possibility of rendering some symbols or abbreviations obsolete (or at least obsolescent).

We also need to keep in mind DE's earlier proposal to rationalize the combination symbols for obstructions found in Section K and L (late paper at WG7, resubmitted as CSPCWG8-11.1A rev1). The INT1subWG has been asked to consider this paper further before the next editions of INT1. These suggestions would have some impact on each other.

1. Safe clearance wrecks. NZ's suggestion to enhance the description for K30 would read:

> 'Safe clearance depth over wreck. The exact depth is unknown but is estimated to have a safe clearance at the depth shown'.

If this is accepted, it is only necessary to do it if K30 is to be retained (depending on decision re DE's suggestion for removing duplicated combination symbols).

2. Depth/position quality indicators. Suggestions for making obsolescent included:

- B8 (position doubtful)
- I1 (existence doubtful) (See Appendix)
- I2 (sounding of doubtful depth)
- I4 (special symbol for Reported on small-scale charts)
- I14 (unreliable sounding – see Annex B)

'PA' means 'position has not been accurately determined or does not remain fixed'.

'PD' means 'reported in various positions but not confirmed in any'.

PA is not appropriate for an ordinary bottom sounding (as if the position is uncertain, so is the depth at its charted position). However, it is useful for a feature, such as an obstruction, which may have an accurate depth over it but there is some doubt about the accuracy of its position. While it is different from PD, which may be appropriate as a qualifier to a reported depth, the difference is probably more one of degree of doubt over the potential positional discrepancy. However, the mariner is likely to assume that a reported depth (ie unconfirmed by proper survey) is always suspect in both horizontal and vertical dimensions, so adding PD may not really add anything useful. So perhaps neither of these properly belong with depth quality indicators; they are position quality indicators and are rightly placed in Section B. It is certainly difficult to articulate the difference in a way that is easily grasped by the chart user (and even the compiler). However, see French paper CSPCWG9-08.6B.

'ED' means 'existence doubtful' and seems to be associated with underwater features, which may be expressed as a shoal sounding, or eg an obstruction. It seems that ED is used rather than 'Rep' when there is more doubt.

A reported depth may be considered quite likely to be valid, especially if:

- there is a cluster;
- it is fairly recent;
- the report include credible evidence about position and method of recording the depth.

ED is more likely to be added when:

- the age and lack of any supporting reports in the vicinity;
- the resultant shape of the sea floor;
- a likely misinterpretation of an echo trace

make the feature unlikely. It is difficult to articulate this difference concisely in a way the chart user will easily grasp.

'SD' implies doubt about the depth rather than the position. This is useful where there is evidence of a shoal depth in an accurate position, but there is a possibility that the least depth has not been found. Again, INT1 does not articulate all of this, so is it useful to differentiate between 'reported' and 'SD' on charts?

It would not be practicable to put PD, PA, SD, ED and/or Rep against every sounding in a significant area of a chart. For this reason, the upright sounding has been used to indicate some doubt about the quality; whether this refers to the position or depth is really immaterial, as a sounding in the wrong position will inevitably be a sounding which shows an inaccurate depth.

Each indicator means something a little different, but it would be very difficult to articulate these differences concisely in INT1. Some of them are defined in S-32, but the mariner does not have easy access to that. They are not included in the glossary of UK Mariner's Handbook.

CSPCWG needs to determine whether it is necessary or useful to differentiate these indicators. It seems likely that chart users are, at most, interested in knowing whether data is suspect in some way. In ENC this is catered for by using a '?', but allows various attributes to be recorded and 'cursor picked' if the user wishes to know in what way the data is suspect. Paper charts cannot do this. Paper charts could simplify symbology by simply replacing all the 'poor quality' indicators by a '?', which would be sufficient warning for most mariners to be particularly cautious. As mentioned in Annex B, this could be as a point or area symbol.

Problems with this proposal include:

- Long term legacy of obsolescent symbols and abbreviations;
- Lack of more detailed information for anyone who wants to know what element of the data is suspect (eg depth or position);
- For ENC compiled entirely from paper charts, lack of information to populate the S-57 data quality attributes.

If these problems are considered to be 'show-stoppers', maybe the use of '?' should be limited to sounding quality (in lieu of the upright sounding) and other indicators retained for use with obstruction features.

3. Reported symbol on small-scale charts. Australia questioned the I4 symbol, intended for use only on small-scale charts. The I4 symbol was presumably agreed when the small-scale specifications (now S-4 Part C) were drafted (perhaps to avoid

clutter by too many ‘Rep’ legends on the charts) and then found not really to be suitable on larger scales, perhaps for the reasons stated by AU. The term ‘small-scale’ is subjective to compilers and users alike, who do not necessarily understand that it is ‘code’ for the 1:2M and smaller scale charts covered by Part C of S-4. Consequently, this use (or perhaps misuse) of the dotted circle has found its way onto ‘medium’ scale charts. It would be a challenge to change, as the small scale charts are rarely fully revised. It opens the debate over the use of a danger circle; should it only apply to dangers to surface navigation? If so, its use as part of the obstruction/wreck symbol is incorrect too. As a reported depth, this symbol is intended to represent a vigia (S-32: A pinnacle, rock, or shoal the existence or position of which is doubtful, or a warning note to this effect on a chart). Perhaps INT1 should be more specific about the scale, ie ‘1:2 000 000 and smaller’ (assuming the user understands ‘smaller’). (See also Annex to CSPCWG9-04.4A DQWG report)

4. Reorganization of INT1. Australia suggested:

- (as a minimum) transferring K2 and K3 into section I;
- (or more radically) reorganizing the first part of section I as ‘Depth quality indicators’, or;
- a completely new section ‘O’ for ‘Depth quality indicators’.

If reorganizing Section I, the possible new entries in the first sub-section could be:

‘reliable’ sounding (currently I10)

‘unreliable’ sounding (currently I14)

‘unsurveyed safe clearance’ (currently K3)

‘swept depth’ (currently K2)

‘approximate depth contour’ (currently I31)

‘no bottom found’ (currently I13)

‘position approximate’ (currently B7)

‘position doubtful’ (currently B8)

Numbers 1-4 are currently occupied (and cannot be reused, even if we decide to make any obsolescent). Therefore, including all these will require I5-12, which overlaps with existing numbers in the ‘Soundings’ sub-section. This need will depend on whether we include all the above. If we do, some will need to be repeated, eg B7 is certainly still required for features other than depths so belongs in section B too.

Other options could be to:

1. make I1-14 ‘Depth quality indicators’ and reduce the ‘soundings’ sub-section to I15-20 (with only 2 entries at present), leaving existing I10-14 unchanged.
2. create new sub-section I40 for ‘Depth quality indicators’,
3. utilize the empty section O.

Option 1 allows no space for any new data quality indicators (eg a new line symbol for discontinuity between surveys (Annex A); a new symbol for ‘unreliable sounding’ (Annex B); a new symbol ‘to indicate that a thorough target investigation has been undertaken over a wreck or obstruction, and the depth and position has been ascertained to the best standard currently available, in line with IHO standards’ (see CSPCWG9-08.11A).

Option 2 may leave us with some duplication (unless we remove the old entries).

Option 3 has the same issue as 2; it also seems too early to reuse this section for something completely different from its former use.

Extracts from email correspondence with Chairman DQWG Chris Howlett (UK)

From: Howlett Chris **Sent:** 21 November 2011 10:00 **To:** Jones Peter; Coleman Andrew
Subject: Existence Doubtful

Peter, Andrew,
At the DQWG meeting last week we were looking at what attributes we want to be carried forward into the S-101 data quality attributes and have a question regarding ED or Existence Doubtful legend.

We are unsure what value this legend adds to the chart. If the feature is doubtful but not disproved why does the mariner need to know of its doubtful nature? We suspect he will navigate in the same way regardless and avoid the item. Saying it is doubtful does not appear to add to his ability to make a decision.

As a consequence we are contemplating not having this in our recommendation for S-101 but I would welcome your (and your group's?) views on this, particularly why the ED legend may be of use.

Many thanks, Chris

From: Howlett Chris **Sent:** 23 November 2011 10:10 **To:** Jones Peter; Harper Samuel
Cc: Coleman Andrew

Peter, Andrew,
Although not mentioned by the DQWG last week I have just been talking to Paul Barrett about the legend 'Reported' and think this may fall into the same category as ED, ie: if a reported depth is on a chart will the mariner react any differently to it than to a 'true' depth. If not, is there any advantage in using the term Reported?

From: Jones Peter **Sent:** 23 November 2011 18:37 **To:** Howlett Chris; Harper Samuel
Cc: Coleman Andrew; Barrett Paul

Your views noted.
However, Andrew and I believe there are other considerations which you may not have considered (S-4 B420, SP20, small-scale charts, potential for other shoals in vicinity, date of report…)?
We're happy to consider further idc but prefer to digest outcomes of your research to pick and prioritise items worth pursuing rather than on an ad hoc basis.

We will need to keep in close touch over this.

Thanks again, Peter Jones