

Paper for Consideration by DQWG

S-101 and Quality of horizontal measurement

Submitted by:	S-100WG (S-101PT)
Executive Summary:	S-101 and Quality of horizontal measurement
Related Documents:	100WG1/S-101PT/S-101PT01-03.2A_S-101_DCEG_Proposals_Australia.pdf
Related Projects:	S-101 DCEG, S-32, IHO registry

Introduction / Background

- At S-100WG1 (14-18 March 2016, Tokyo), Australia made a proposal (see related document a.) to replace in the S-101 Data Classification and Encoding Guide (DCEG) the use of *Quality of horizontal measurement = 4 (approximate)* by value 5 (*inadequately surveyed*) on “approximate contours”.

A short discussion followed and an action was decided (S-101PT1 3.2A) to prepare a paper to “clarify the use of attribute Quality of horizontal measurement on DEPCNT at the next DQWG meeting”.

When starting to prepare the paper it appeared that the definitions of this attribute values are not clear, sometimes subjective, or even inconsistent.

Analysis/Discussion

- QUAPOS and Quality of horizontal measurement:*
 - For S-57 ENC's, UOC (§5.2) recommends to encode attribute *QUAPOS = 4 (approximate)* on the spatial objects associated to the DEPCNT. In S-57, *QUAPOS* has 11 possible values.
 - In S-101, the equivalent of S-57 attribute *QUAPOS* is *Quality of horizontal measurement*, which admits (in the last version of S-101 DCEG) the same values for *QUAPOS*.

The following are the definitions of the possible values for this attribute:

Quality of horizontal measurement: IHO Definition: Definition required.

1) **Surveyed**

IHO Definition: The position(s) was(were) determined by the operation of making measurements for determining the relative position of points on, above or beneath the earth's surface. Survey implies a regular, controlled survey of any date. (Adapted from IHO Dictionary – S-32, & IHO Chart Specifications, M-4, 175.2).

2) **Unsurveyed**

IHO Definition: Survey data is does not exist or is very poor. (Adapted from IHO Dictionary – S-32).

3) **Inadequately surveyed**

IHO Definition: Position data is of a very poor quality. (Adapted from IHO Dictionary – S-32).

4) **Approximate**

IHO Definition: A position that is considered to be less than third-order accuracy, but is generally considered to be within 30-5 metres of its correct geographic location. Also may apply to a feature whose position does not remain fixed. (Adapted from IHO Dictionary – S-32, & IHO Specifications, M-4, 424.1).

5) **Position doubtful**

IHO Definition: A feature whose position has been reported but which is considered to be doubtful. (S-57 Edition 3.1, Appendix A – Chapter 2, Page 2.256, November 2000).

6) **Unreliable**

IHO Definition: A feature's position obtained from questionable or unreliable data. (S-57 Edition 3.1, Appendix A – Chapter 2, Page 2.256, November 2000).

7) **Reported (not surveyed)**

IHO Definition: A feature whose position has been reported and its position confirmed by some means other than a formal survey such as an independent report of the same feature.. (S-57 Edition 3.1, Appendix A – Chapter 2, Page 2.256, November 2000).

8) **Reported (not confirmed)**

IHO Definition: A feature whose position has been reported and its position has not been confirmed. (S-57 Edition 3.1, Appendix A – Chapter 2, Page 2.256, November 2000).

9) **Estimated**

IHO Definition: The most probable position of a feature determined from incomplete data or data of questionable accuracy. (Adapted from IHO Dictionary – S-32).

10) **Precisely known**

IHO Definition: A position that is of a known value, such as the position of an anchor berth or other defined feature..(S-57 Edition 3.1, Appendix A – Chapter 2, Page 2.257, November 2000).

11) **Calculated**

IHO Definition: A position that is computed from data. (S-57 Edition 3.1, Appendix A – Chapter 2, Page 2.257, November 2000).

Remarks:

- No remarks.

It appears that the use of some of these values is subjective, due to a lack of precision of these definitions. Moreover, inconsistencies also exist between different IHO standards as regards to these terms.

3. If we consider the term: “approximate”. It has various definitions:

- In S-4:
 - (B-411.2): “**Approximate contours**. Where it is necessary to draw the navigator’s attention to inadequacy in survey data, depth contours should be indicated as approximate by breaking them ...”
 - (B-424.1): “**PA**, meaning **Position approximate**, must be used to indicate that the position of a shoal, wreck, etc, either has not been accurately determined or does not remain fixed.”
 - (B-311): “**An unsurveyed (or approximate) coastline** must be represented on large-scale charts by a dashed line delimiting the land.”
- In INT1:
 - PA = Position approximate (not accurately determined or does not remain fixed)
- In S-32:
 - Position approximate: Of inexact position. The expression is used principally on charts to indicate that the position of a wreck, shoal, etc., has not been accurately determined or does not remain fixed. Usually shown by the abbreviation 'PA'.
 - Approximate position: A position that is considered to be less than third-order accuracy, but is generally considered to be within 100 feet (30.5 metres) of its correct geographic location. The method of location may be an indication of the recorded accuracy.
NOTE: This definition refers to the third-order which was deleted from S-44 at edition 5 (1988).

These statements show inconsistencies between the definitions of “approximate”.

It seems useful to underline that all depth contours depicted on paper charts are approximate by nature in that they are an interpolation of the source survey(s) by the cartographer (or increasingly by automated contouring tools). These interpolations are based on factors such as the requirement to show bathymetry based on "shoal bias" or creating an appropriate representation based on the scale (or "optimum scale") of the chart. In the end, however, these interpretations are only as good as the underlying survey information, which may be "well surveyed" or "inadequately surveyed". In the latter case, the cartographer will use a dashed line (“approximate” contours according to S-4) to draw the mariner’s attention to the inadequacy of the source bathymetric data in the area.

It then seems logical to apply *Quality of horizontal measurement = 4 (approximate)* only to define the approximate nature of a measured position (e.g. the position of a wreck), but not for an interpretation based on measured positions (e.g. a depth contour).

4. If we consider the terms: “unsurveyed” and “inadequately surveyed”, there is an overlapping in the definitions: “very poor”.

Quality of horizontal measurement is an enumerated attribute, which means that, when used, it must be populated by only one value. The current definitions are such that one object could be:

“Surveyed” and “Unreliable” or

“Surveyed” and “precisely known” or

“Unsurveyed” and “reported (not surveyed)” or

“Unsurveyed” and “reported (not confirmed)” or

“precisely known” and “calculated”, etc.

Which value must be chosen?

5. Possible solutions. One option to solve these inconsistencies would be to add information to precise when each value is to be used (or not to be used). This option would not be entirely satisfactory for this is the type of recommendation that can be found in an encoding guide such as the S-101 DCEG, but not in the very definition of the attribute value.

Another option would be to split these different concepts into separate attributes. For instance, “Calculated” and “Estimated” give information on the method used to determine the position, but not on the quality of this position.

Conclusion

6. Currently, the cartographer chooses the QUAPOS value to use on one object geometry not according to its definition but according to what the UOC recommends. If there were no such recommendations, different values would certainly be used by HOs for the same real world situation, increasing inconsistencies between ENC's.

In view of S-101 and the possible use of attribute *Quality of horizontal measurement* by other S-10x product specification, there is a need to review this attribute.

Recommendations

7. The S-101PT recommends the DQWG to undertake a global review of *Quality of horizontal measurement* values and their definitions by the DQWG.

Justification and Impacts

8. A review of *Quality of horizontal measurement* values and definitions will improve ENC's and S-10x products consistencies.

This will also be appreciated in view of the use of the IHO Geospatial Information HYegistry by Hydrographic Offices and other communities.

The new definitions will have to be taken into account in the S-32 Standard and may have minor impacts on S-4.

Action Required of DQWG

9. The DQWG is invited to:
 - a. Note and discuss on this paper

- b. Consider the recommendations at paragraph 7
- c. Prepare proposals for next S-100WG meeting