Annex A – Draft of S-101 Chapter 6 – Data Quality

1 Data Quality

1.1 Introduction

Data quality comprises the following:
- completeness of data (e.g. seafloor coverage).
- currency of data (e.g. temporal degradation);
- uncertainty of data;
- source of data;

Data quality is considered to be meta information. As such, it can be encoded at three different levels (dataset, meta feature area, feature instance). All positional (2D), vertical (1D), horizontal distance (1D) and orientation (1D) uncertainty attributes concern the 95% confidence level of the variation associated with all sources of measurement, processing and visualization error. Uncertainty due to temporal variation should not be included in these attributes.

Data quality is broken into three main meta features; **QualityOfBathymetricData**, **QualityOfNonbathymetricData** and **QualityOfSurvey**. This is necessary to properly express data quality for bathymetry items as opposed to non-bathymetry items. Quality of the surveys that originated these items can be further expressed in **QualityOfSurvey**. **QualityOfSurvey** can apply to bathymetry (e.g. underwater rock), non-bathymetry (e.g. navigational aids) and a combination of these (e.g. lidar survey).

Figure 1 shows the high level architecture for the revised data quality representation system used in S-101. The individual data quality indicators (meta features and attributes) that are encoded in the ENC provide individual inputs into the data quality algorithm, which resides within the ECDIS system. This algorithm has the capability to accept additional optional inputs from vessel specific parameters (entered into the ECDIS) and external information (e.g. Dynamic tides). This algorithm then drives an on-demand data quality overlay that exists within the ECDIS system.

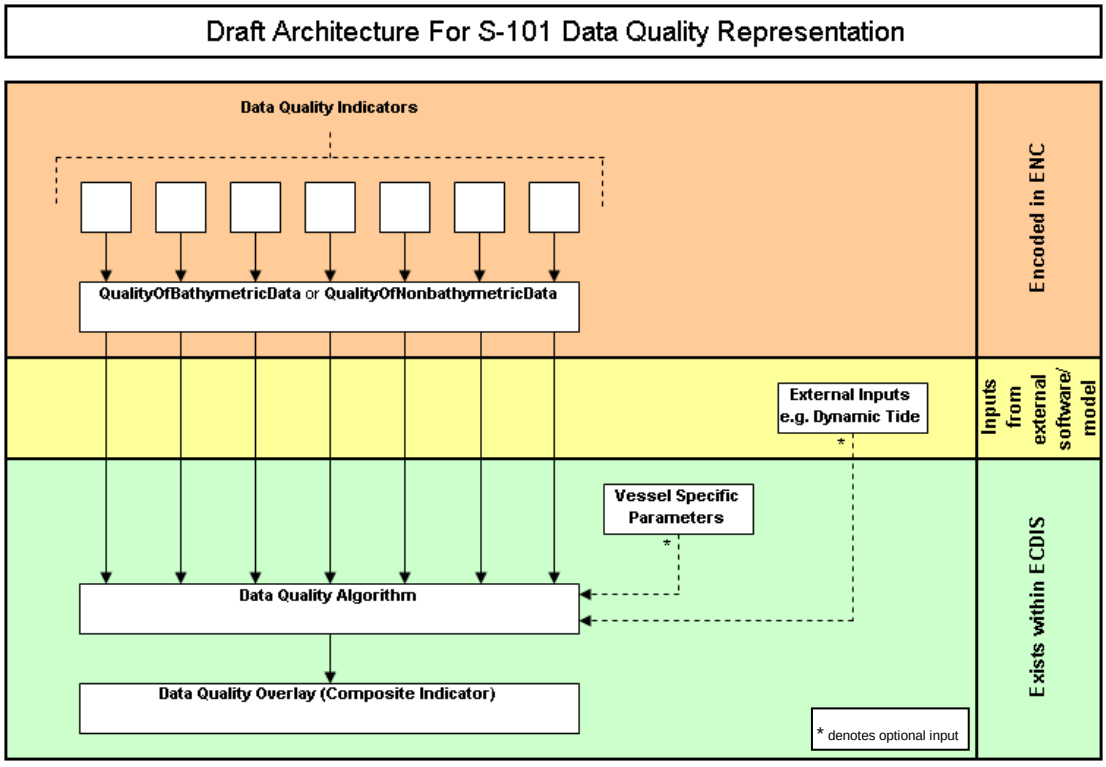

Figure 1

1.2 Quality of Bathymetric Data

The meta feature **QualityOfBathymetricData** defines areas within which uniform assessment exists for the quality of bathymetric data, and must be used to provide an assessment of the overall quality of bathymetric data to the mariner. Areas of a dataset containing bathymetry must be covered by one or more **QualityOfBathymetricData**, which must not overlap.

To express completeness of bathymetric data, the attribute **fullSeafloorCoverageAchieved** must be encoded. **fullSeafloorCoverageAchieved** indicates that a systematic method of exploring the sea floor was undertaken to detect significant features.

1.2.1 Feature detection

In the context of bathymetry, a feature is any object, whether manmade or not, projecting above the sea floor, which may be a danger for surface navigation. Refer to S-44.

The ability to detect bathymetric features must be encoded using **FeaturesDetected**. **FeaturesDetected** is a complex attribute, consisting of the simple attributes **significantFeaturesDetected**, **sizeOfFeaturesDetected** and **leastDepthOfDetectedFeaturesMeasured**. **significantFeaturesDetected** indicates if the survey was capable of detecting features of a size indicated by **sizeOfFeaturesDetected**. **leastDepthOfDetectedFeaturesMeasured** indicates if least depth of detected features was measured. E.g. a wreck was found, but it is not certain that the least depth of that wreck was measured; in such cases **leastDepthOfDetectedFeaturesMeasured** is set to No.

sizeOfFeaturesDetected and **leastDepthOfDetectedFeaturesMeasured** must not be encoded, unless **significantFeaturesDetected** is set to yes.

1.2.2 Temporal variation

The changeability of the bathymetry must be encoded using **categoryOfTemporalVariation**. In order for a time reference to be given for the expression of temporal variation, the relevant dates of the bathymetric data must be given in **surveyDateStart** and **surveyDateEnd**.

1.2.3 Positional and vertical uncertainty

General positional uncertainty of the bathymetry is given in **positionalUncertainty**, similarly general vertical uncertainty is given in **verticalUncertainty**. Positional or vertical uncertainty for a feature instance, that is different from the general uncertainty, can be given by using **positionalUncertainty** or **verticalUncertainty** in **SpatialQuality**.

verticalUncertainty in **SpatialQuality** can only be used for soundings. Some feature types carry bathymetry attributes (e.g. **valueOfsounding**). For these feature types, **verticalUncertainty** is an attribute on the feature instance level.

1.2.4 Source of data

The source of information should be encoded using the attribute **sourceIndication** on the individual features, but only if this information is considered to be useful to the mariner.

1.3 Quality of non-bathymetric data

1.3.1 Positional and vertical uncertainty

General positional uncertainty of the non-bathymetry features is given in **positionalUncertainty**, similarly general vertical uncertainty is given in **verticalUncertainty**. Positional uncertainty for a feature instance, that is different from the general uncertainty, can be given by using **positionalUncertainty** in **SpatialQuality**. **verticalUncertainty** in **SpatialQuality** must not be used.

Some feature types carry elevation attributes (e.g. **verticalClearance**). For these feature types, **verticalUncertainty** is an attribute on the feature instance level.

1.3.2 Horizontal distance and Orientation uncertainty

General horizontal distance and orientation uncertainty are given in **horizontalDistanceUncertainty** and **orientationUncertainty** respectively.

Some feature types carry horizontal distance attributes (e.g. **horizontalClearance**). For these feature types, **horizontalDistanceUncertainty** is an attribute on the feature instance level.

Some feature types carry orientation attributes (e.g. **orientation**). For these feature types, **orientationUncertainty** is an attribute on the feature instance level.

1.3.3 Source of data

The source of information should be encoded using the attribute **sourceIndication** on the individual features, but only if this information is considered to be useful to the mariner.

1.4 Quality of Survey

If it is required to encode information about an individual survey, this can be done using **QualityOfSurvey**, which must have **surveyAuthority**, **surveyDateStart**, **surveyDateEnd** and **surveyType** encoded.

If it is required to encode information about feature detection capabilities for an individual survey, this can be done using **featuresDetected** of **QualityOfSurvey**.

If it is required to encode information about technique of vertical measurement for an individual survey, this can be done using **techniqueOfVerticalMeasurement** of **QualityOfSurvey**.

If it is required to encode information about full sea floor coverage of an individual survey, this can be done using **fullSeafloorCoverageAchieved** of **QualityOfSurvey**.

It is not allowable to provide additional uncertainty values for individual surveys. If this is necessary, new coincident instances of **QualityOfBathymetricData** and/or **QualityOfNonbathymetricData** must be encoded.

1.4.1 Source of data

The source of information should be encoded using the attribute **sourceIndication** on the individual features, but only if this information is considered to be useful to the mariner.

1.5 Qualitative expressions of uncertainty

1.5.1 Quality of position

If it is required to encode positional uncertainty about a feature instance that cannot be done at the 95% confidence level, a qualitative expression of the positional uncertainty can be encoded using **qualityOfPosition** in **SpatialQuality**.

1.5.2 Quality of vertical measurement

If it is required to encode vertical uncertainty about a feature instance that cannot be done at the 95% confidence level, a qualitative expression of the vertical uncertainty can be encoded using **qualityOfVerticalMeasurement** on the feature instance.