S-100WG

Paper for Consideration by S-100WG

Defining feature-oriented discrete coverage attributes for S-102 products

Submitted by:	NOAA (USA), BSH (Germany), GST (Denmark)
Executive Summary:	This paper proposes additional metadata attributes in a separate regular grid within the S-102 product HDF5 file that would support S-102 products to produce the necessary attributes and information mariners and marine navigation software systems need to support safe navigation and prevent the selection of soundings from interpolated areas (e.g. in between set line-spacing survey lines). Many of this additional feature information missing from the current S-102 Product Spec (2.1.0).
Related Documents:	• S102PT6(2020) Germany/BSH S-102 extension as proposal to implement source metadata • S-102PT7 2021 3.5 05-US S102 metadata layers proposal • S-100WG VTC2 2021 EN 06 Proposal for storing feature oriented discrete coverage in HDF5 • S-100WG VTC2 2021 06 EN Presentation for storing feature oriented discrete coverage in HDF5
Related Projects:	Any related projects that may impact upon considerations

Introduction / Background

We envision S-102 products to be a critical element to the future of navigation, poised to transform the marine navigation system. To realize this vision, the S-102 product specification must be built on a foundation of supporting attributes, especially in the context of source and quality. To enable this, S-100 Part 10c was recently updated with the addition of a new DataCodingFormat and an attribute table as CompoundDataSet.

This proposal outlines a number of optional attribute fields in a compound dataset not defined in the current product specification (S-102 2.1.0) we believe will enable and support future navigation software to appropriately auto-generate and attribute cartographic features such as custom depth contours and soundings from S-102 products, all while minimally impacting the overall file size of the product. Furthermore, the proposed raster attribute table compliant with HDF-5 and S-100 will provide valuable information about the bathymetry on a node-by-node basis compared to traditional vector-based metadata files, simplifying the interpretation and implementation by navigation software systems.

Analysis/Discussion

In general, the proposed georeferenced attribute fields for the value table correspond with the S-101 Quality of Bathymetric Data metaclass (with some noted exceptions), and are summarized in Table 1.

Table 1: summary of proposed additional attribute fields

Attribute Name	Data Type	Details
dataAssessment	Unsigned Integer	Valid numbers are 1 to 3, corresponding to S-101 encoding
featureLeastDepth	Boolean	See S-101 least depth of detected feature measured
significantFeatures	Boolean	See S-101 significant features detected
featureSize	Float	See S-101 feature size
featureSizeVar	Float	See further discussion (1)
fullCoverage	Boolean	See S-101 full seafloor coverage achieved
bathyCoverage	Boolean	See further discussion (3)
horizontalUncertaintyFixed	Float	See S-101 horizontal position uncertainty fixed

horizontalUncertaintyVar	Float	See S-101 horizontal position uncertainty variable factor
surveyDateStart	String ISO 8601:2004	See S-101 Survey date start
surveyDateEnd	String ISO 8601:2004	See S-101 Survey date end
sourceSurveyID	String	The survey filename or ID
sourceInstitution	String	The institution responsible for the survey

Further Discussion:

The proposed quality and source fields support a three-fold purpose:

1. Support S-101-defined attribution of auto-generated vector depth areas, depth contours, and soundings created directly from the S-102 dataset. Note that featureSizeVar is meant to augment featureSize which corresponds to S-101 size of features detected. As noted in S-101, size of features detected is intended to be described as the smallest size in cubic metres the survey was capable of detecting. Depending on the type of survey this definition might force different depth ranges to have different values. For example, a survey vessel that works at a fixed height off the seafloor, such as an autonomous underwater survey vessel, could maintain a fixed feature detection size capability over a wide range of depths. A surface vessel working over those same range of depths may have a feature detection capability that varies with depth causing the detection capability to be ambiguous and potentially misrepresented. For this reason, featureSizeVar is the percentage of depth that a feature of such size could be detected. When both featureSize and featureSizeVar are present, the greater of the two should be considered valid. The expectation is that featureSizeVar will be set to zero if the feature size does not scale with depth. As with featureSize, featureSizeVar should be ignored if significantFeatures is False. Additionally, note that depth range maximum and minimum in S-101 are omitted. The assumption is that if this information is required than the corresponding nodes in the elevation layer can be queried for a minimum and maximum depth for each table row.
2. Provide necessary uncertainty information as an input into critical underkeel clearance precision navigation systems.
3. Prevent the automated selection of soundings from interpolated nodes, while still providing continuous data required or depth contour creation. This is done by implementing the proposed "bathyCoverage" Boolean attribute field, which flags nodes populated by interpolation across gaps of bathymetric observations greater than the S-102 raster resolution. This is especially useful in side-scan surveys which are characterized by gaps in bathymetric observations with full coverage side-scan imagery (interpolated gaps between bathymetry coverage in this situation would show fullCoverage = True and bathyCoverage = False). If full coverage = False, bathyCoverage must also equal False, such as gaps between single beam echosounder data without correlating side scan sonar coverage. Thus, this will provide navigation software systems with the required information necessary to preferably select soundings from direct bathymetric observations.

Conclusions

Implementing these proposed metadata fields within the S-102 product specification will increase the mariner's situational awareness when using S-102-derived and auto-generated cartographic features, such as depth areas, soundings, and depth contours. It also reduces, if not eliminates, the number of soundings selected from interpolated nodes, ensuring that soundings are only derived from bathymetric observations.

While we believe such metadata attribute fields greatly increase the value of S-102 products, we also understand that implementing a solution to populate these fields may place undue burden on the current resource capacity of many HOs. Therefore, it is proposed that these fields be deemed optional, and not mandatory to official S-102 products.

Recommendations

We recommend that the specification should be adjusted to incorporate the additional metadata attribute fields

Justification and Impacts

Benefits from implementing the proposed optional metadata attribute fields include enabling navigation software systems to improve the auto-generated cartographic representation of the underlying bathymetric source data encapsulated in the S-102 dataset. This will help support navigation safety, sound decision making by the watchstander, and prevent a misunderstanding of the data by preventing soundings selection on interpolated nodes.

Action Required of S-102 Project Team

The S-102 Project Team is invited to:

a. endorse …….

b. agree …….

c. note ……...

et cetera.