



Progress on the S-104 Product Specification

S-104 Project Team

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5th Tides, Water Level and Currents Working Group (TWCWG5)

Remote VTC

16-18 March 2021

In memory of Kurt Hess





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PROGRESS IN S-104 PS: RECENT TIMELINE



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- Apr 2019: **Ed 0.0.7** discussed at TWCWG4
 - Tasks: gather use cases, build HDF5 format
- Sep 2019: attended 7th S-100 Test Strategy Meeting (TSM7) (Monaco)
 - Proposed changes to S-100 for S-104
- **Ed 0.0.8** worked on, based on TWCWG4, TSM7, use cases
 - Thank you to TWCWG Chair Gwenaële Jan for big help in pushing forward
- Mar 2021: attended 8th S-100 Test Strategy Meeting (TSM8) (VTC)
 - Discussed tide and water level adjustment, real-time data, additional vertical datums, interoperability
- **Ed 0.0.8** ready for TWCWG5



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PROGRESS IN S-104 PS: OVERVIEW



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- Updates to S-104 PS
- Issues to discuss
- Next Steps
 - Get to Ed 1.0.0



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UPDATES TO S-104 PS

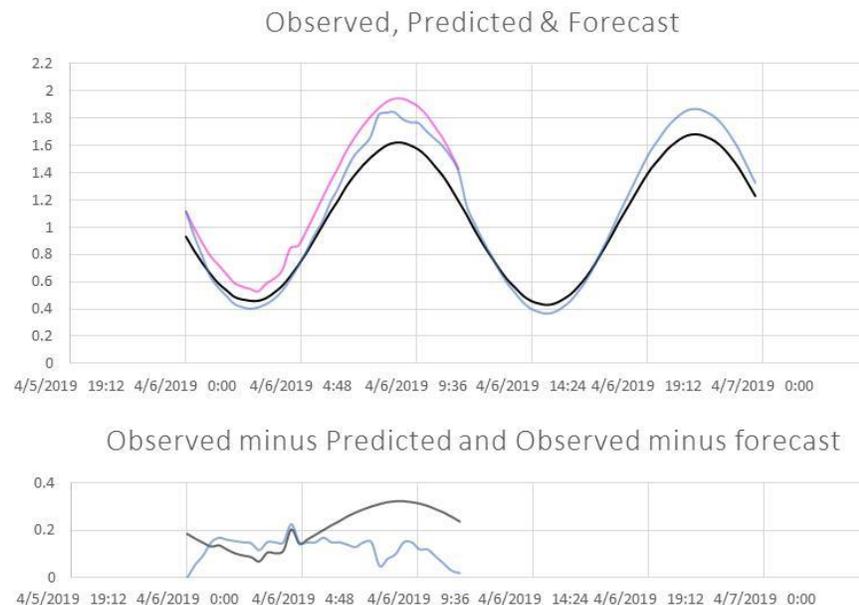


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- S-104 HDF5 format built out by S-104 PT based on use cases

Booby Island
03Aug2016 1512
1.93 m
Increasing
Tide Prediction

Pick Report



Graphic time series plot

- HDF5 can contain water level data of 4 types:
 - time series at stations
 - data such as forecasts on a regular grid
 - data on an ungeorectified ('irregular') grid
 - data in TINs
- Major focus on time series data since gridded data can be structured similarly to S-111



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UPDATES TO S-104 PS (CONT'D)



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- Built out Section 10 Data Product Format (Encoding)- based on S-111

10.3 HDF5 Product Structure for Time Series and Gridded Data

The key idea at the core of the structure is this: the organization of the information is substantially the same for each of the various types of data, but the information itself will be interpreted differently.

10.3.1 Data Type Definition

HDF5 will be used for all water level data types for dissemination methods other than AIS, as well as for datum separation fields.

Format Name: HDF5
 Character Set: MD_CharacterSetCode (ISO 19115)

- Added full carrier (file) metadata (Tables 12.1-12.4)

12.3 Carrier Metadata

The metadata for the S-104 product is divided in three sections, corresponding to the General Metadata (Table 12.1), the Feature Metadata (Table 12.2), and the Instance Metadata (Table 12.3). Since these values do not reside in the Metadata blocks, but are in the HDF5 files, they are referred to as Carrier Metadata. The eCarrier Mmetadata consists of the data and parameters needed to read and interpret the information in the Water Level product even if the other S-104 Metadata files are unavailable.

12.4 Values Group Attributes

An expanded new metadata block is required for the Values Groups (Table 12.4). The variables stationName and stationIdentification have been added for both identification and possibly for inclusion



- Added *dataCodingFormat* = 8: ‘Stationwise time series’
 - Same as for S-111
 - Only applies to S-100 Ed 5.0.0
 - Includes non-uniform time interval data and metadata support (Germany’s request)

Table 12.4 – Values Group attributes (see S-100 Table 10c-18). All times are in UTC format.

waterLevelHeight	waterLevelTrend	waterLevelTime
1.324	0	20190703T000100Z
1.384	0	20190703T001500Z
1.438	0	20190703T003000Z

S-104 non-uniform time intervals example

No	Name	Camel Case	Mult.	Data Type	Remarks and/or Units
<i>dataCodingFormat</i> = 1, 2, 3, or 7					
1	Time stamp	<u>timePoint</u>	1	String	<u>Date</u> Time. All times are in UTC.
<i>dataCodingFormat</i> = 8					
1	Index for time interval	<u>timeIntervalIndex</u>	1	(Integer)	1 (TRUE) denotes uniform time interval; interval provided by <u>timeRecordInterval</u> . 0 (FALSE) denotes non-uniform time interval. This is a <u>boolean</u> data type implemented as described in S-100 Table 10c-1.
2	Time interval	<u>timeRecordInterval</u>	0..1	Integer	Only if <u>timeIntervalIndex</u> = 1. The uniform interval between time records. Units: Seconds. Value here overrides corresponding value at Instance level.
<i>Additional restrictions on core values group metadata for S-104 for dataCodingFormat = 8</i>					
3	Name of the station	<u>stationName</u>	1	String	Mandatory for S-104. E.g., a geographic description or ‘Not Available’
4	Station identification	<u>stationIdentification</u>	1	String	Mandatory for S-104. E.g., a letter-number combination for the



- Added suggestion for native integer type for enumerations, as for S-111
 - e.g. *dataCodingFormat* = 2: Regularly-gridded arrays → '2' is an H5T_NATIVE_UINT8
- Revised Annex A DCEG
 - Included *waterLevelTrendThreshold* root metadata: critical value to determine steady trend (provided by HO)

ANNEX A – DATA CLASSIFICATION AND ENCODING GUIDE

IHO Definition: FEATURE: WATER LEVEL: The vertical position of a water surface			
S-104 Geo Feature: Water Level			
Primitives: S100_GridCoverage , S100_PointCoveragepointSet , coverage			
S-104 Attribute	Allowable Encoding Value	Type	Multiplicity
Water Level Height	must be in decimal metres, maximum resolution of 0.01 metres	RE	1
Water Level Trend	1: Decreasing Steady 2: Increasing Decreasing 3: Steady Increasing 4: Not-available	EN	1
Water Level Time	YYYYMMDDTHHMMSSZ	DT	0..1

Water Level Trend: [The tendency of water level to change in a particular direction.](#)

1: [Decreasing](#) (*decreasing*)
 2: [Increasing](#) (*increasing*)
 3: [Steady](#) (*steady*)

Unit: none (enumeration)
 Minimum Resolution: N/A (enumeration)
 Format: x
 Example: 3: [Steady](#)
 Remarks:

- To determine category, use metadata variable [waterLevelTrendThreshold](#) (See Table 12.1):
 - [Decreasing](#): $trend \leq -waterLevelTrendThreshold$
 - [Increasing](#): $trend \geq +waterLevelTrendThreshold$
 - [Steady](#): $-waterLevelTrendThreshold < trend < +waterLevelTrendThreshold$



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UPDATES TO S-104 PS (CONT'D)



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- Registered Features & Attributes in IHO Registry
 - Coordination with NIPWG for trend definition: *“The tendency of water level to change in a particular direction.”*
- Added Annex D Feature Catalogue (FC)
 - With help from Korea’s FC Builder

D.10. Feature Catalogue XML

```
<?xml version="1.0" encoding="utf-8" ?>
- <S100FC:S100_FC_FeatureCatalogue xmlns:S100FC="http://www.iho.int/S100FC"
  xmlns:S100Base="http://www.iho.int/S100Base"
  xmlns:S100CI="http://www.iho.int/S100CI"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:S100FD="http://www.iho.int/S100FD"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.iho.int/S100FC S100FC.xsd">
  <S100FC:name>S-104</S100FC:name>
  <S100FC:scope>Water level data are intended to be used as stand-alone data or as
    a layer in an ENC.</S100FC:scope>
  <S100FC:fieldOfApplication>Marine navigation</S100FC:fieldOfApplication>
  <S100FC:versionNumber>0.0.7</S100FC:versionNumber>
  <S100FC:versionDate>2020-07-30</S100FC:versionDate>
- <S100FC:producer>
  <S100CI:role>owner</S100CI:role>
- <S100CI:party>
- <S100CI:CI_Organisation>
  <S100CI:name>International Hydrographic Organization</S100CI:name>
  <S100CI:contactInfo>
```



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UPDATES TO S-104 PS (CONT'D)



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- Added complete Annex E Sample HDF5 encoding

Annex E – Sample HDF5 Encoding

The following are examples of HDF5 water level data files for each of the five data coding formats. The general structure of the data product is shown in Table 10.2, and the specific variables contained in the attributes are explained in Tables 12.1, 12.2, 12.3 and 12.4. The sample HDF5 files were produced by MATLAB® and were displayed in HDFView version 2.14.

E.1 Common Groups and Attributes

Information shown in Figures E.1 through E.4 is common to all the data coding formats.

104US_dc1_series1.h5

- Group_F
- WaterLevel

Group Members

Number of members: 2

Name	Type
Group_F	Group
WaterLevel	Group

Figure E.1 - Typical HDF5 file (left) and its two groups, 'Group_F' and 'WaterLevel' (right)

104US_dc2_rgrid.h5

- Group_F
 - WaterLevel
 - featureCode
- WaterLevel
 - WaterLevel.01
 - Group_001
 - values
 - Group_002
 - Group_003
 - Group_004
 - Group_005
 - uncertainty
 - axisNames

values at /WaterLevel/WaterLevel.01/Group_001/ [104US_dc2_rgrid.h5]

Table

7, 3 waterL... 0

	0	0	0
	waterLevelHeight	waterLevelTrend	waterL
0	-9999.0	0	-9999.0
1	-9999.0	0	1.232
2	-9999.0	0	1.234
3	-9999.0	0	1.236
4	-9999.0	0	1.238
5	-9999.0	0	1.24
6	-9999.0	0	1.242
7	-9999.0	0	-9999.0



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ISSUES TO DISCUSS



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- Datum separation (difference) product ('hydroid')
 - Not included in development of HDF5 formats, metadata, FC, DCEG, Registry, Annex E Sample Encoding
 - **What is the use case?**
 - **For S-104 Ed 1.0.0, should this be removed for simplicity and to expedite?**
 - Would be large effort to support now, could always add it back in Ed 2.0.0

A.2 Vertical Datum Difference

Feature: Vertical Datum Difference (*VerticalDatumDifference*)

<u>IHO Definition: FEATURE: VERTICAL DATUM DIFFERENCE: the separation distance between an ellipsoid and a chart datum</u>			
<u>S-104 Geo Feature: Datum Difference</u>			
<u>Primitives: S100 GridCoverage, S100 PointCoverage</u>			
<u>S-104 Attribute</u>	<u>Allowable Encoding Value</u>	<u>Type</u>	<u>Multiplicity</u>
<u>Vertical Datum Difference Value</u>	<u>must be in decimal metres, maximum resolution of 0.01 metres</u>	<u>RE</u>	<u>1</u>



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ISSUES TO DISCUSS (CONT'D)



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Uncertainty

uncertainty at /WaterLevel/WaterLevel.01/ [104...]

Table

0-based

0, value = -1.0

	name	value
0	waterLevelHeight	-1.0

Uncertainty dataset

- Right now just Uncertainty dataset at Instance level in HDF5 (e.g. 1 number for entire forecast field over all forecast times)
- **Should uncertainty be a new optional Feature Attribute? e.g. *waterLevelUncertainty*?**
- **Pro:** Would allow for spatially and temporally varying uncertainty, critical for e.g under keel clearance management (UKCM)
- **Con:** large workload to include in little time to Ed 1.0.0
 - e.g. add to DCEG, register attribute, re-build FC, update UML, Group_F, Sample HDF5 Encoding, add uncertainty method to HDF5 attributes? DQWG review?
- **Expedite for Ed 1.0.0, or wait until Ed 2.0.0 to do correctly?**

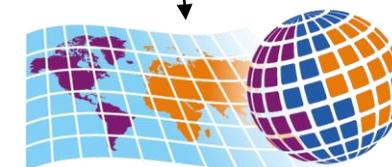


- Additional vertical datums (S-100 change proposal at TSM8)
 - Table 12.1 General Metadata (metadata in actual HDF5 file) applies to S-100 Ed 5.0.0. If datum isn't in S100_VerticalAndSoundingDatum, can use EPSG:

13	Vertical coordinate system	<u>verticalCS</u>	0..1	Integer	EPSG code. Allowed values: 6489 – depth (m) oriented down 6499 – height (m) oriented up
14	Vertical coordinate base	<u>verticalCoordinateBase</u>	0..1	Enum.	1: Sea surface 2: Vertical datum 3: Sea bottom
15	Vertical datum reference	<u>verticalDatumReference</u>	0..1	Enum.	Only if <u>verticalCoordinateBase</u> =2 1: S-100 vertical datum 2: EPSG code
16	Vertical datum	<u>verticalDatum</u>	0..1	Integer	Only if <u>verticalCoordinateBase</u> =2. If <u>verticalDatumReference</u> =1, use value from S100_VerticalAndSoundingData. If <u>verticalDatumReference</u> =2, use the EPSG code for the vertical datum.

12.2.10 S100_VerticalAndSoundingDatum

Role Name	Name	Description	Code	Remarks
Enumeration	S100_VerticalAndSoundingDatum	Allowable vertical and sounding datums	-	-
Value	<u>meanLowWaterSprings</u>		1	(MLWS)
Value	<u>meanLowerLowWaterSprings</u>		2	-
Value	<u>meanSeaLevel</u>		3	(MSL)
Value	<u>lowestLowWater</u>		4	-
Value	<u>meanLowWater</u>		5	(MLW)



EPSG

GEODETIC PARAMETER DATASET

Managed by IOGP's Geomatics Committee



- Additional vertical datums (S-100 change proposal at TSM8)
 - Problem arises in S-100 discovery metadata (metadata outside of HDF5 file, in exchange dataset)
 - In discovery metadata, must use S100_VerticalAndSoundingDatum (EPSG code is not allowed)

12.2.6 S100_DatasetDiscoveryMetadata

Data in the Discovery Metadata are used to identify the relevance of the dataset to the particular application.

Role Name	Name	Description	Mult	Type
Class	S100_DatasetDiscoveryMet	Metadata about the individual datasets in the	-	-
Attribute	<u>verticalDatum</u>	Vertical Datum of the entire dataset	0..1	S100_VerticalAndSoundingDatum
Attribute	<u>dateType</u>	The encoding format of the dataset	1	S100_DataFormat

12.2.10 S100_VerticalAndSoundingDatum

Role Name	Name	Description	Code	Remarks
Enumeration	S100_VerticalAndSoundingDatum	Allowable vertical and sounding <u>datums</u>	-	-
Value	<u>meanLowWaterSprings</u>		1	(MLWS)
Value	<u>meanLowerLowWaterSprings</u>		2	-
Value	<u>meanSeaLevel</u>		3	(MSL)
Value	<u>lowestLowWater</u>		4	-
Value	<u>meanLowWater</u>		5	(MLW)



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ISSUES TO DISCUSS (CONT'D)



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- Additional vertical datums (S-100 change proposal at TSM8)
 - S-104 (and/or S-111) will use datums not in *S100_VerticalAndSoundingDatum*
 - Datums to be added must be **chart datum**, so that tide and water level adjustments can occur in coordination with S-101 and S-102 (to be described in S-98 Interoperability Annex C)



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S-98 COMMENTS FOR DISCUSSION

International Hydrographic Organization

- Comment from Furuno C-5.1 g)

Tidal and water level adjustments

This is a serious issue. From maritime industry point of view, it is very difficult to justify investments in the development of S-100 compliant ECDIS and investments to any onboard retrofit of S-100 based ECDIS, if the end result is the same as with S-57 ENC charts.

The drafted specification in Clause C-5.1 g) will lock the functionality of S-100 based ECDIS to the same level as today is possible with S-57 based ECDIS.

It is well known that IMO SOLAS rule for voyage planning (IMO Assembly resolution A.893(21) year 2000) require use of current and tidal atlases and tide tables. At the date of publishing of the still valid IMO rule only printed books or their electronic facsimile copies were available. Today, 20 years later, it is well known that S-100 based products: S-102, S-104 and S-111 are planned to provide electronic alternatives for the IMO requirement of "current and tidal atlases and tide tables". Therefore, now is the time to describe how ECDIS shall be able to manage the combination of S-101, S-102, S-104 and S-111 to facilitate machine-managed tidal and water level adjustment.

S-100 itself is the technology baseline for all S-100 based Products. S-100 itself should not prevent forever all possibilities to adjust tidal and water levels for applicable situation – being it planning or monitoring.

S-100 as baseline should provide overarching principles to be used by S-98 and S-100 Product Specifications for adjusting the depth related functionality.

As reference below are IMO MSC.252(83) specifications related to human machine interface:

- **simple operator action:** procedure achieved by no more than two hard-key or soft-key actions, excluding any necessary cursor movements, or voice actuation using programmed codes or equivalent alternative means

single operator action: procedure achieved by no more than one hard-key or soft-key action, excluding any necessary cursor movements, or voice actuation using programmed codes

From TSM8



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ISSUES TO DISCUSS (CONT'D)

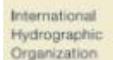


- Additional vertical datums (S-100 change proposal at TSM8)
 - S-104 (and/or S-111) will use datums not in *S100_VerticalAndSoundingDatum*
 - Datums to be added must be **chart datum**, so that tide and water level adjustments can occur in coordination with S-101 and S-102 (to be described in S-98 Interoperability Annex C)



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S-98 COMMENTS FOR DISCUSSION



International Hydrographic Organization

• Proposed solution

Change C-5.1 g) as in the redline version below:

As default depth information should only be displayed as it has been provided in the ENC and not adjusted by tidal or water level height. If the ECDIS has integrated the use of a S-100 based tidal or water level product specifications and ENC charts, it may provide all depth related functionality based on the adjusted tide or water level ~~display the adjusted tide as an italicized offset to the sounding in the ENC.~~ The data for the adjustment may be static (for example a forecast of future) or may be real-time (for example from water level measurements through radiocommunication). The details of such integrated depth related functionality are specified both in S-98 and in related S-100 based Product specifications (for example S-101, S-102, S-104 and S-111). The related standard, S-98 and related S-100 based Product Specification, may include conditional model to limit applicability of individual products for adjustment of water level. For example, individual S-101 chart cells or individual S-102 bathymetric cells may include metadata or feature objects which limit the geographical area for which the depth adjustment is permitted. For example, individual S-104 cells may include limitations related to date/time period when the depth adjustment is permitted.

When providing depth related functionality that has adjusted the depth information in the ENC:

1. The ECDIS shall display a permanent and non-obscured indication of the adjustment in use and if the adjustment is based on static or real-time information. Further details of the adjustment, at least source and applied date/time period of the data used for adjustment shall be available at least on demand by single operator action. If displayed area consist of sub-areas based on different sources and applied date/time periods or include areas without applied depth adjustment the border of such areas shall be presented and it shall be possible to toggle between presentation of no area fill and transparent area fill of different areas by single operator action.
2. It shall be possible to toggle between the adjusted and non-adjusted depth functionality by single operator action. This toggle function shall apply to all functionality of the ECDIS which is subject to the tidal and water level adjustment.
3. It shall be possible to select date/time period of the data used for the adjustment by simple operator action.
4. It shall be possible by single operator action to see both the adjusted safety contour and the safety contour based on non-adjusted ENC chart. This functionality shall be available both when the functionality of ECDIS is based on adjusted depth and when the functionality of ECDIS is based on non-adjusted depth. The line styles of the separate safety contours shall be distinguishable.
5. The ECDIS shall be capable to provide functionality depth adjustment based on static data and the ECDIS may be capable to provide functionality depth adjustment based on received real-time measurements of water level,
6. The ECDIS shall record at one-minute intervals the use of depth adjustment: depth adjustment related user selections in use and details of used S-100 products such as cell name, edition, update, issue date as applicable.

For definition of 'single operator action' and 'simple operator action', see IMO MSC.252(83)

From TSM8

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ISSUES TO DISCUSS (CONT'D)

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Code number	Enumerated value Name	Code number	Enumerated value Name
1	Mean Low Water Springs	2	Mean Lower Low Water Springs
3	Mean Sea Level	4	Lowest Low Water
5	Mean Low Water	6	Lowest Low Water Springs
7	Approximate Mean Low Water Springs	8	Indian Spring Low Water
9	Low Water Springs	10	Approximate Lowest Astronomical Tide
11	Nearly Lowest Low Water	12	Mean Lower Low Water
13	Low Water	14	Approximate Mean Low Water
15	Approximate Mean Lower Low Water	16	Mean High Water
17	Mean High Water Springs	18	High Water
19	Approximate Mean Sea Level	20	High Water Springs
21	Mean Higher High Water	22	Equinoctial Spring Low Water
23	Lowest Astronomical Tide	24	Local Datum
25	International Great Lakes Datum 1985	26	Mean Water Level
27	Lower Low Water Large Tide	28	Higher High Water Large Tide
29	Nearly Highest High Water	30	Highest Astronomical Tide
31	Local Low Water Reference Level	32	Local High Water Reference Level
33	Local Mean Water Reference Level	34	Equivalent Height of Water (German GLW)
35	Highest Shipping Height of Water (German HSW)	36	Reference Low Water Level According to Danube Commission
37	Highest Shipping Height of Water According to Danube Commission	38	Dutch River Low Water Reference Level (OLR)
39	Russian Project Water Level	40	Russian Normal Backwater Level
41	Ohio River Datum	43	Dutch High Water Reference Level
44	Baltic Sea Chart Datum 2000	45	Dutch Estuary Low Water Reference Level (OLW)

**S100_VerticalAndSounding
Datum
in IHO Registry**



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ISSUES TO DISCUSS (CONT'D)



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- Additional vertical datums (S-100 change proposal at TSM8)
 - **What chart datums do we need added in addition to the below?**
 - **Which of these datums will not be used?**
 - **Can we remove the 2 generic datums if at all possible?**

Name	Description	Code	Remarks
ITRF2014	International Terrestrial Reference Frame 2014	?	
ITRF2020	International Terrestrial Reference Frame 2020	?	<i>[determination underway]</i>
ellipsoidalHeightGeneric	Ellipsoidal height (generic)	?	Ellipsoidal height for an ellipsoid not specifically named in the list of datums.
balticSeaChartDatum2000	Baltic Sea Chart Datum 2000	44	
geoidGeneric	Geoid (generic)	?	Geoid not specifically named in the list of datums
internationalGreatLakesDatum2020	International Great Lakes Datum 2020	?	<i>[determination underway]</i>
seaSurface	Sea surface	?	A two-dimensional (in the horizontal plane) field representing the air-sea interface, with high-frequency fluctuations such as wind waves and swell, but not astronomical tides, filtered out
seaBottom	Sea bottom	?	Local sea bottom reference



- Additional vertical datums (S-100 change proposal at TSM8)
 - Also, likely want to state EPSG codes for vertical datums in discovery metadata, as allowed in S-100 Edition 5.0.0 carrier metadata → reference more than just a name but also full coordinate transforms, etc.

Datatype of verticalDatum in S-100 discovery metadata (Fig. 4a-D-4)

«enumeration» S100_VerticalAndSoundingDatum
meanLowWaterSprings = 1 meanLowerLowWaterSprings = 2 meanSeaLevel = 3 lowestLowWater = 4 meanLowWater = 5 balticSeaChartDatum2000 = 44 ITRF2014 = ?

Current S-100 4.0.0
+ additional datums

«S100_Codelist» S100_VerticalAndSoundingDatum
+ meanLowWaterSprings = 1 + meanLowerLowWaterSprings = 2 + meanSeaLevel = 3 + lowestLowWater = 4 + meanLowWater = 5 + balticSeaChartDatum2000 = 44 + ITRF2014 = ?
<i>tags</i> codelistType = open enumeration encoding = other: [something]

Proposed alternative 1
Modify datatype to
Open enumeration codelist

«S100_Codelist» S100_VerticalAndSoundingDatum
<i>tags</i> codelistType = closed dictionary URI = urn:mrm:iho:spec:s100:5:0:vdatum

Proposed alternative 2
Modify datatype to
Dictionary codelist

Alternative 3: S100_DatasetDiscoveryMetadata.otherVerticalDatum: CharacterString [0..1].
Not being machine-processable, this is not the recommended solution.



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ISSUES TO DISCUSS (CONT'D)



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- Additional vertical datums (S-100 change proposal at TSM8)

Encoding of verticalDatum in discovery metadata XML

Current (S-100 4.0.0):

If enumerated:

`<S100XC:verticalDatum>meanLowWaterSprings </S100XC:verticalDatum>`

If unenumerated, omit *verticalDatum* or encode as empty element with *nilReason* attribute:

`<S100XC:verticalDatum xsi:nil="true" gco:nilReason="other: not enumerated"/>`

or

`<S100XC:verticalDatum xsi:nil="true" gco:nilReason="other: ITRF2014"/>`

Not machine-processable!

With open enumeration codelist:

If enumerated:

`<S100XC:verticalDatum>meanLowWaterSprings</S100XC:verticalDatum>`

If unenumerated:

`<S100XC:verticalDatum>other: EPSG 1234</S100XC:verticalDatum>`

With dictionary codelist:

`<S100XC:verticalDatum codeList="urn:mrn:iho:spec:s100:5:0:vdatum" codeListValue="EPSG1234" />`

Searchable key in the datums dictionary file



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ISSUES TO DISCUSS (CONT'D)



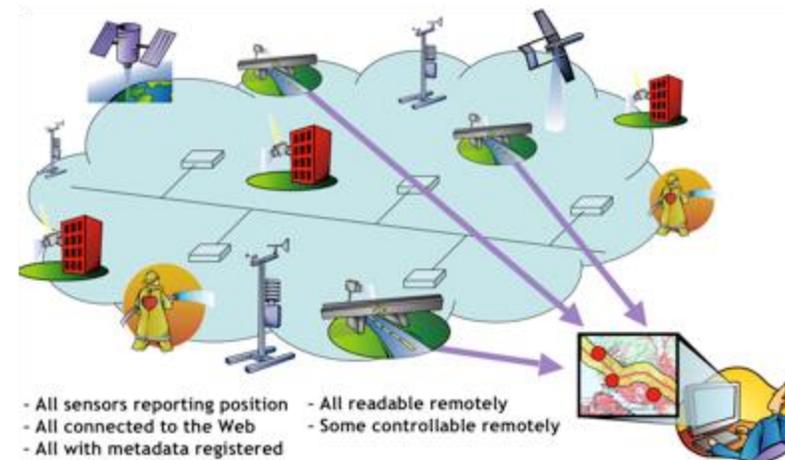
- At S-100 TSM8, **real-time data** handling way forward was proposed:

Paper for Consideration by S100WG TSM
Realtime data handling way forward proposal

Submitted by:	IIC Technologies
Executive Summary:	Proposals for handling of realtime data in S-100.
Related Documents:	S-100WG5 papers, OGC Sensor API
Related Projects:	GML Revision to Part 10b

Introduction / Background

A previous submission to S-100WG5 looked at the task of including realtime data handling within S-100. As the proposed version 5.0.0 of S-100 is drafted some specific revisions to certain parts are required in order to provide



The Challenge:

- Implementing changes to S-100 to specifically address the requirements of realtime data exchange

Steps include:

- Key use cases in existing product specifications and maritime services
- Proposal to edit:
 - Part 10b (GML Profile)
 - Part 14 Data streaming
 - Guidance for Product Specification developers
- Demonstrate with use cases
- Include bandwidth limited use cases
- **Can we provide S-104 AIS use case? Is one already written?**



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ISSUES TO DISCUSS (CONT'D)



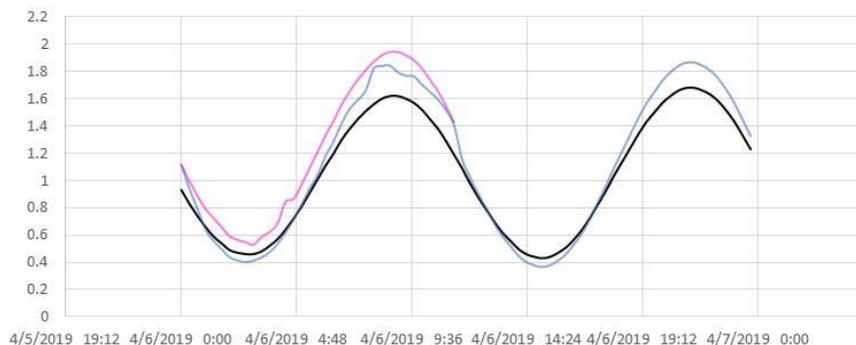
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- **Portrayal** (including portrayal catalogue—will there be one?) not needed until Ed 2.0.0
- S-100 interoperability being worked on now
- **Should we remove portrayal information from Ed 1.0.0, or leave in as useful guidance, e.g. for use cases?**

Booby Island
03Aug2016 1512
1.93 m
Increasing
Tide Prediction

Pick Report

Observed, Predicted & Forecast



Graphic time series plot

Observed minus Predicted and Observed minus forecast





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ISSUES TO DISCUSS (CONT'D)



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- **Should we release S-104 Ed 1.0.0 compliant with S-100 Ed 4.0.0, or S-100 Ed 5.0.0 (2022)?**
 - Suggest S-100 Ed 5.0.0 as it will have new HDF5 features like verticalCS, dataCodingFormat = 8, non-uniform time interval data support
 - But not sure about timing coordination?
 - HSSC want compatibility with Ed 5.0.0, but by 2023



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ISSUES TO DISCUSS (CONT'D)



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- File naming convention (same as for S-111)
 - S-104 uses 104CC (2-character producer code)
 - Then no limit on unrestricted characters
 - S-97 Guidance for PS Developers suggests 4-character producer code, and S-100WG wants 4 characters for all data products
 - S-100 needs to discuss formally moving to 4-characters (S-100 Chair)
 - **Should S-104 use 4-character producer code? Suggest yes.**

5.2.19 Dataset naming rules

Dataset naming should follow a standard pattern to give implementers greater predictability of incoming datasets. All dataset naming conventions are recommended to follow these rules as much as possible.

XXXXXXXXXXXXXXXXXXXX

XXX is the product code, for example 123 is for Maritime Radio Service; 101 for ENC.

YYYY is the producer code according to the Producer Code Register.

XXXX is an arbitrary length unique code in alphanumeric characters.

If useful, the Product Specification can include a differentiating character or code (for example the underscore (_) character) in the 'XXXX' space of the file name.

Support files should follow a similar naming.

S-97 Ed 1.1.0



- Added requirement in Group_F for:
 - *fillValue* to be '-9999.' for water level height and '0:unknown' for water level trend (*denotes missing data*)
 - *code* to be 'waterLevelHeight', 'waterLevelTrend', and 'waterLevelTime'
 - *uom.name* to be 'meters' and 'DateTime' (no *uom.name* for trend) (*units of measurement*)

	code	name	uom.name	fillValue	datatype	lower	upper	closure
0	waterLevelHeight	Water level height	meters	-9999.	H5T_FLOAT	-99.99	99.99	closedInterval
1	waterLevelTrend	Water level trend		0	H5T_ENUM			
2	waterLevelTime	Water level time	DateTime		H5T_C_S1	19000101T000000Z	21500101T000000Z	closedInterval

Values provided here for code (waterLevelHeight, waterLevelTrend, and waterLevelTime), uom.name (meters and DateTime), and fillValue (-9999. and 0:unknown) are required.

- Test bed feedback (U.S. NIWC) suggests requiring same code, uom.name, and fillValue for all S-104 datasets. **Thoughts?**



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NEXT STEPS

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S-100 Readiness Levels

- Get to Ed 1.0.0
- Remove all remaining real-time/AIS items
- Finish updating UML (S-100WG, Raphael)

Required Product Specification component	Level 1 v1.0.0	Level 2 v1-2.0.0	Level 3 >v2.0.0	Level 4 >v2.0.0	Level 5 >v2.0.0
Main Document (Defines the relevant parts of S-100 that are required for the Product Specification)	X	X	X	X	X
A Default Encoding	X	X	X	X	X
S-100 Compliant Feature Catalogue	X (draft)	X (updated)	X (final, from IHO GI Registry)	X	X
Data Classification and Encoding Guide	X (draft)	X	X (final)	X	X
S-100 Compliant Portrayal Catalogue NOTE: Not every Specification will need a Portrayal Catalogue – this should be determined as part of the development process and stakeholder feedback.		X	X	X	X
Data Quality Checks		X	X	X	X
Test Data Sets		X	X	X	X
Data Validation (and test datasets)		X	X	X	X
Exchange Catalogue		X	X	X	X
Encryption / Digital Signatures			X	X	X
Interoperability			x* (draft)	X* (tested)	X*
Alerts and Indications				X*	X*
Operational data					X

(X* = ECDIS only)



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NEXT STEPS (CONT'D)



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- **Add Annex B: Additional Terms and Definitions?**

ANNEX B. ADDITIONAL TERMS AND DEFINITIONS

S-111 Annex B

Terms that are defined in this Annex or in Clause 1.4.2 are highlighted in **bold**.

accuracy

closeness of agreement between an observed value and the true value or a reference value accepted as true

NOTE 1: A test result can be observations or

classification

abstract representation of real-world phenomena using

classifiers

[ISO 19144-1]

- Ensure S100WG Review comments from 2017 are addressed (S-104 PT lead included them)
- Update S-100 discovery metadata based on upcoming S-100 updates (S-100WG, Raphael could help)



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NEXT STEPS (CONT'D)



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- Incorporate results from discussions on issues:
 - Datum separation
 - Uncertainty
 - Additional vertical datums
 - S-104 AIS use case
 - Portrayal
 - S-104 compliant with S-100 Ed 4.0.0 or Ed 5.0.0?
 - Group_F fillValue, uom.name, code requirement
 - Dataset file naming