

Title: Additional Vertical Datums for S-104**S-100 Maintenance - Change Proposal Form**

Organisation	TWCWG	Date	18-Feb-2021/26-Aug-2021 (rev2)/20-Oct-2021 (r3)
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Change Proposal Type (*Select only one option*)

1. Clarification	2. Correction	3. Extension
		X

Location (*Identify all change proposal locations*)

No.	S-100 Version No.	Part No.	Section No.	Proposal Summary
1	5.0.0 draft	4a	App. 4a-D	Amend Figure 4A-D-4 and table S100_VerticalAndSoundingDatum to include additional vertical datums needed for S-104.
2			App. 4a-D	Amend Figure 4A-D-4 and table S100_VerticalAndSoundingDatum to change the datatype to an S-100 codelist to provide for vertical datums not listed in the enumeration.
3			App 4a-D	Define a new S100_VerticalDatumAndEpoch class for vertical datums and their epochs as attributes.
4			App. 4a-D	Amend Figure 4A-D-4 and table S100_DatasetDiscoveryMetadata to change the type of attributes verticalDatum and soundingDatum to S100_VerticalDatumAndEpoch.

Change Proposal

The change proposal adds vertical datums to the list in the S100_VerticalAndSoundingDatum enumeration for use by S-104 (Water Level Information). It also proposes replacing this enumeration with a codelist of the same name to allow product specifications to describe vertical datums that are not included among the enumerated values.

The application of proposal TSM8-6.5 (Vertical CRS vice Datum in Metadata) should be taken into account, e.g., the enumeration name should be changed as appropriate.

In the proposal details below, bracketed italic text indicates discussion of the proposal.

Revised August 2021:

- (1) Add "Hydrographic zero" to the list of new datums.*
- (2) Delete ellipsoidalHeightGeneric and geoidGeneric from the original proposal*
- (3) Indicate preference for "open enumeration" over "dictionary" codelist for the datatype.*
- (4) Add language describing the recommendations for and limitations of encoding "other: ..." values for vertical datum.*
- (5) Add an attribute to indicate the reference time period for vertical datum.*

Revised October 2021:

(1) Following a discussion on GitHub about using epoch with sounding datum too, the new class *S100_VerticalDatumAndEpoch* is proposed as the type for the vertical/sounding datum attributes, to hold the datum identifier and its epoch.

(2) Removed old material about dictionary codelist alternative, following discussion in the S-100 metadata group and subsequently on GitHub.

Text below in italics is informative in this proposal and not intended for addition to S-100.

Item (1) Amendments to include additional vertical datums:

S100_VerticalAndSoundingDatum & Figure 4a-D-4

[Add the following to the table S100_VerticalAndSoundingDatum. Amend the UML diagram in Figure 4a-D-4 to include the additional datums.

TWCWG will propose the new datums to the IHO GI Registry, the codes will be available after they are accepted.]

Role name	Name	Description	Code	Remarks
Value	ITRF2014	International Terrestrial Reference Frame 2014	?	
Value	ITRF2020	International Terrestrial Reference Frame 2020	?	
Value	balticSeaChartDatum2000	Baltic Sea Chart Datum 2000	44	
Value	internationalGreatLakesDatum2020	International Great Lakes Datum 2020	?	
Value	seaSurface	Sea surface	?	Local sea surface
Value	seaBottom	Sea bottom	?	Local sea bottom reference
Value	hydrographicZero	Hydrographic Zero	TBD	A vertical reference near the lowest astronomical tide (LAT, following IHO recommendation), below which the sea level falls only very exceptionally. The origin of the deviation between LAT and hydrographic zero may be due to a strong anticyclonic atmospheric condition, adding weight to the

				<p>water column that may exceptionally cause the lowest sea level to fall below the astronomical low water level.</p> <p>The deviation between hydrographic zero and LAT must be less than 0.50 m.</p>
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[ITRF2020 (determination underway) per Altamimi et al., IAU 2018, Vienna, August 27, 2018, “The International Terrestrial Reference Frame (ITRF) ITRF2014 and future plans”]

Item (2) Change of data type to codelist:

S100_VerticalAndSoundingDatum & Figure 4a-D-4

[Change the type of S100_VerticalAndSoundingDatum to S100_Codelist, “open enumeration”. The tags (see S-100 4.0.0 clauses 1-4.8, 3-5.3.11, 3-6.7) must be:

codelistType=open enumeration

encoding=other: [something]

Change type in table S100_VerticalAndSoundingDatum:

Role name	Name	Description	Code	Remarks
S100_Codelist	S100_VerticalAndSoundingDatum	<i>(no change)</i>	--	Open enumeration.

Proposed additional language to be added below table S100_VerticalAndSoundingDatum:

Datums not included in the S-100 enumeration must be encoded using the “other: ...” form. If the datum in question is listed in the IHO GI registry (as one of the standard listed values for attribute “Vertical Datum” in the “IHO Hydro” domain), the “camel case code” in the registry must be used in the “other: ...” element. For datums from the EPSG registry but not listed in the IHO GI registry, the form should be “other: EPSG_NNNN”.

EXAMPLE 1: “Local Low Water Reference Level” is in the GI registry but not listed in the S-100 standard. It must be encoded with the camel case in the GI registry as: “other: localLowWaterReferenceLevel”.

EXAMPLE 2: “European Vertical Reference Frame 2019 mean tide” is in the EPSG registry list of vertical datums (EPSG 1287) but not in the IHO GI registry list. It must be encoded as: “other: EPSG_1287”.

If the datum is not listed in any the table above, the IHO GI registry, or the EPSG registry, producers should determine a suitable special code in consultation with the IHO working group(s) and the IHO GI registry authority.

The use of datums that are neither in the enumeration above, nor in the IHO GI registry, nor the EPSG registry is discouraged. Producers who need to use a datum not listed in the S-100 enumeration should propose its addition to the IHO GI registry and/or this enumeration by means of an S-100 maintenance proposal.

Note that application software is not required to process information encoded in “other: ...” form, meaning that ECDIS software, for example, is not required to recognise any datum

encoded as “other: ...” and will therefore be unable to adjust ENC depth information with water level data from the corresponding S-104 dataset, and may warn or reject the S-104 dataset as being incompatible with S-101 ENCs.

Item (3) New type class for vertical and sounding datums:

S100_VerticalDatumAndEpoch

Role Name	Name	Description	Mult.	Type	Remarks
Class	S100_VerticalDatumAndEpoch	Identification of a vertical datum and its epoch of realisation.	--	--	
Attribute	name	Identifier for the datum	1	S100_VerticalAndSoundingDatum	
Attribute	realizationEpoch	The time after which this datum definition is valid.	0..1	Date	

Notes:

S100_VerticalDatumAndEpoch is derived from, but not a specialisation of, the ISO 19111:2007 type CD_VerticalDatum. The differences are:

- The *name* attribute (datatype RS_Identifier in the ISO model), is assigned the datatype S100_VerticalAndSoundingDatum.
- The ISO *anchorDefinition*, *domainOfValidity*, and *scope* attributes are not used.
- The *realizationEpoch* attribute carries the same significance and datatype as in ISO 19111:2007, except that it must always be coded as the date after which it is valid. This time may be precise (e.g. 1997.0 for IRTF97) or merely a year (e.g. 1986 for NAD83(86)). In the latter case, the epoch usually refers to the year in which a major recalculation of the geodetic control network underlying the datum, was executed or initiated. An old datum may remain valid after a new datum is defined. Alternatively, a datum may be replaced by a later datum, in which case the realization epoch for the new datum defines the upper limit for the validity of the replaced datum. [ISO 19111:2007]

Item (4) Modify table S100_DatasetDiscoveryMetadata to change the types of verticalDatum and soundingDatum.

Modify the following rows in table S100_DatasetDiscoveryMetadata:

Role Name	Name	Description	Mult	Type	Remarks
Attribute	verticalDatum	(no change)	0..1	S100_VerticalDatumAndEpoch	
Attribute	soundingDatum	(no change)	0..1	S100_VerticalDatumAndEpoch	

Change Proposal Justification

(1) S-104 has a requirement for discovery and carrier (i.e. root/general) metadata to encode datums that are not in the current list of datums in the S100_VerticalAndSoundingDatums. The additional datums are proposed to satisfy this requirement.

(2) There are several ellipsoids and geoids, each of which would require its own entry in the datums list. Further, the list may need extension in the future. If S100_VerticalAndSoundingDatum is an enumeration, a product specification cannot encode in its discovery or carrier metadata a datum different from the existing members. Adding to the enumeration requires a revision to S-100. This means a product specification must either use a non-standard means of specifying other datums, or await a revision to S-100. Changing the type to an S-100 codelist provides flexibility to avoid delay.

Ongoing discussion within NOAA emphasizes a need to reference EPSG (or ISO Geodetic Registry) codes which convey more information on datums/CRS/transformations than simply a name of a datum on a list, e.g. S100_VerticalAndSoundingDatum. This probably emphasizes the need for changing S100_VerticalAndSoundingDatum to a codelist, to allow for EPSG references, e.g. "other: EPSG NNNN", along with a mechanism to add a new entry into the EPSG registry (which could take at least 6 months?) if an EPSG code doesn't exist for a datum.

(3) The inclusion of ITRF 2014 and ITRF 2020 recognizes the fact that tidal data is used for more than just navigation and enables the producers to use one format to service more than one type of customer. It also recognizes that most Hydrographic Offices are moving to being data product providers rather than end product.

(4) Hydrographic zero has been historically used in water level data records and is requested for S-104 water level datasets. In Australia, the term "Adopted LAT" is used.

(5) Encoding the reference time period for vertical datum is needed for similar reasons to the use of "epoch" for indicating realizations of horizontal reference systems. Levelling adjustments result in periodic revisions to datums used for water levels and it is necessary to indicate the reference time period for water level data especially historical data.

What parts of the S-100 Infrastructure will this proposal affect?

- ☐ S-100 Feature Concept Dictionary Interface or Database
- ☐ S-100 Portrayal Register
- ☐ S-100 Feature Catalogue Builder
- ☐ S-100 Portrayal Catalogue Builder
- ☒ S-100 UML Models
- ☒ S-100 GitHub Schemas

Please send completed forms and supporting documentation to the secretary S-100WG.