S-101 Metadata Features

Issues and recommended changes

S-101 Feature Types

- S-100 2a-4.2.5 S100_CD_FeatureUseType
  - geographic
    - carries the descriptive characteristics of a real world entity.
  - meta
    - Delineates geographic location where meta information is applicable. Distinct from an Information Type which carries information related to features which are related.
  - cartographic
    - carries information about the cartographic representation (including text) of a real world entity.
  - theme
    - Grouping features thematically.
- S-100 does not describe how feature use type impacts attribution
  - S-101 attribute value inheritance

S-101 Meta Features

- Information about other features
- Overrides default metadata values defined in the ISO-8211 encoding [Sometimes]
  - No formal mapping between encoded defaults and meta feature(s) is defined
  - Not machine readable
  - Affects sounding datum and vertical datum
- Attribution on feature or spatial object(s) overrides attribution "inherited" from a meta feature [Sometimes]
  - S-101 PS 4.3.2.2 Metadata features
  - No formal mapping between meta features and overrides is defined
  - Not machine readable

S-57 Mapping

- ENC PS 3.5.6 Hierarchy of meta data
- Provides formal mapping
- Not machine readable

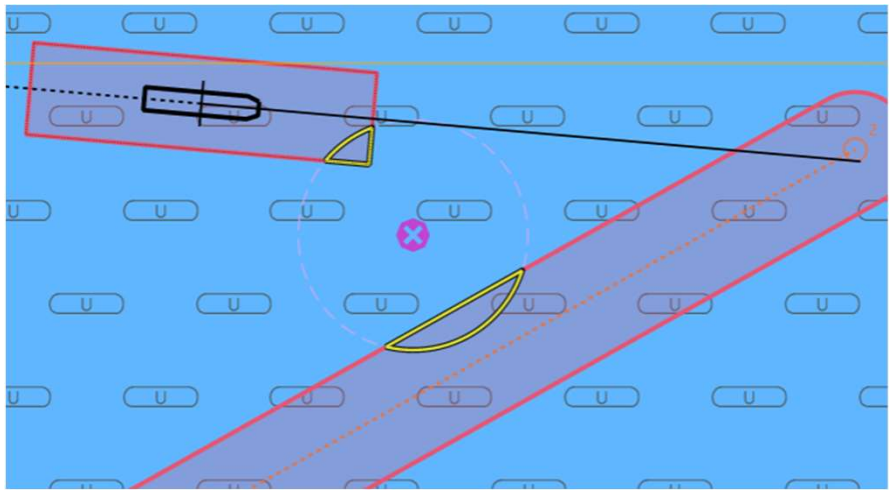
Field	Subfield	Meta object class	Meta object attribute	Geo or spatial object attribute
DSID	AGEN	The use of M_PROD is prohibited		
DSID	UADT	The use of M_PROD is prohibited		
DSID	ISDT	The use of M_PROD is prohibited		
DSPM	HDAT	The use of M_HDAT is prohibited		The use of HORDAT is prohibited
DSPM	VDAT	M_VDAT	VERDAT	VERDAT
DSPM	SDAT	M_SDAT	VERDAT	VERDAT
DSPM	CSCL	M_CSCL	CSCALE	
DSPM	DUNI	The use of M_UNIT is prohibited		The use of DUNITS is prohibited
DSPM	HUNI	The use of M_UNIT is prohibited		The use of HUNITS is prohibited
DSPM	PUNI	The use of M_UNIT is prohibited		The use of PUNITS is prohibited
		M_ACCY	HORACC	HORACC
		M_ACCY	POSACC	POSACC
		M_ACCY	SOUACC	SOUACC
		M_ACCY	VERACC	VERACC
		M_NSYS	MARSYS	MARSYS
		M_NSYS	ORIENT	Attribute ORIENT of an individual object does not supersede the meta object attribute.
		M_QUAL	CATZOC	POSACC,SOUACC and TECSOU
		M_QUAL	SOUACC	SOUACC
		M_QUAL	POSACC	POSACC
		M_SREL	SURATH	SORIND
		M_SREL	SUREND	SORDAT
		M_SREL	SURSTA	SORDAT
		M_SREL	TECSOU	TECSOU

Why does S-101 have meta features?

- *Because S-57 has them…*
- To save space in the encoding?
  - S-57 app. B.1 clause 3.4
    - *The maximum use must be made of meta objects to reduce the attribution on individual objects*
  - Saves an average of 10 to 16 bytes per feature instance
- To provide an area geometry for the legend and/or pick report
  - Attributes of some meta features are never overridden…
    - Data coverage (M_COVR)
    - Local direction of buoyage (ORIENT)
    - Sounding datum (overridden by Vertical CRS on spatial, not by attribution)
  - Some meta features are overridden by feature attributes associated with points
    - Sounding / Vertical Datum (M_SDAT / M_VDAT)
    - Without meta area, would only show in legend if cursor is directly over the point

Capabilities affected by Meta Feature Issues

- Implementation of S-98 Water Level Adjustment
  - TBD, but meta features complicate evaluation of vertical datums
- Implementation of uncertainty circles (Portrayal / Alarms)
  - Requires spatial evaluation
- Interoperability



Meta Feature Issues

- Meta feature “inheritance”/”override” concepts aren’t supported by S-100
  - Requires applications to add functionality specific to S-101
  - Interoperability is restricted to working with S-100 concepts
  - Update S-100?
- Relationships are not machine readable
  - FC doesn’t relate meta features to geo / spatial features
    - Relationships must be determined by spatial evaluation
  - Applications must hard-code knowledge of the types in DCEG clause 3 when implementing the pick report and legend
  - Inflexible maintenance
- Hierarchy of meta data in S-101 is unclear
  - DCEG should identify relationships if machine readability is not supported

Meta Feature Issues

- Metadata relationships evaluated during portrayal are “expensive” in terms of CPU time (due to spatial evaluation)
  - Currently, overrides are not processed by the S-101 portrayal catalogue
- Unclear how to handle in pick report
  - Show “inherited” attribute values in geo feature(s)/spatial(s)?
- Possible training issue
  - Does the mariner evaluate the meta features?
    - “inheritance” / “overrides”

Meta Feature Issues

- Storing unreferenced / default values in the encoding or exchange set metadata makes them “invisible” to the pick report and portrayal
  - Default VerticalDatum: CRSH/VDAT, AXTY=11
    - unreferenced by any VerticalDatumOfData feature
  - Default SoundingDatum: CRSH/VDAT, AXTY=12
    - unreferenced by any SoundingDatum feature
  - S-100 Part 3 GFM & Part 5 FC model can’t reference encoding specifics

Meta Feature Inconsistencies

- Which meta feature to override?
  - verticalDatum (on geo feature) – override VerticalDatumOfData or SoundingDatum?
  - uncertaintyFixed – QoNBD or QoBD? (meta features can overlap…)
- Which meta feature supplies default value?
  - Gate/verticalDatum, Tunnel/verticalDatum, etc. – VDatumofData or SDatum?
  - X/verticalUncertainty – QoBD or QoNBD or SpatialQuality? (meta features can overlap…)
- Which meta attributes should not be overridden?
  - LocalDirectionOfBuoyage/orientationValue, SoundingDatum/verticalDatum
- How to match attributes when attribute codes don't match?
  - QualityOfSurvey/surveyDateRange – geo feature/reportedDate

Issue Summary

- Support for meta features must be hard-coded for each S-101 feature type
  - S-101 does not provide clear implementation guidance
  - Attribute inheritance and overrides are not applied consistently
  - Default values “hidden” in the encoding or exchange set are unavailable to portrayal
    - Requires special case handling in the pick-report
- Interoperability does not support meta inheritance / overrides

Possible Improvements

- Option A
  - remove inheritance / override concept
  - store attribute values on each feature
- Option B
  - remove inheritance / override concept
  - store attribute values in separate feature or information types
    - associated with each feature
- Option C
  - Provide a mapping table (via an information type)

Option A

A. Don't use default values
   - Require attribute on each feature instance
     - approximately 10 – 16 bytes per simple attribute * number of affected feature instances
   - Keep features supporting the ECDIS legend
     - Buoyage system (NavigationalSystemOfMarks)
     - Sounding / Vertical Datum (SoundingDatum / VerticalDatumOfData)
     - Bathy / Non-Bathy Quality (Quality of Bathymetric Data / QoNBD)
   - No spatial processing
   - No data hierarchy
   - Supported by S-100
   - Bigger dataset
   - Multipoint feature can only include points with shared attribution

Option B

B. Don't use default values

- Remove shared attribute(s) from geo and meta features
- Require association(s) from geo and meta features to feature or information type(s)
  - 11 bytes per association
  - Associated object provides attribute value(s)
- Keep features supporting the ECDIS legend
  - Same as option A, but associated type provides attribute value(s)
- No spatial processing
- No data hierarchy
- Supported by S-100
- Bigger dataset
- Multipoint feature can only include points with shared attribution

Option C

C. Remove DDR defaults and provide a mapping table (via information type)

- Machine readable identifier of the attribute override hierarchy
- Each meta feature has association to a new Information type: AttributeOverrides
- AttributeOverrides (InformationType)
  - attributeOverrideMap [1..*] – the mapping table (ComplexAttribute)
    - attributeCode [1] – identifies the meta feature attribute to override (SimpleAttribute)
    - overrides [1..*] – identifies the mapping to the override (ComplexAttribute)
      - featureCode [1] – identifies the feature providing the override (SimpleAttribute)
      - attributeCode [1..*] – identifies the path to the attribute providing the override (SimpleAttribute)
- Supports machine readability
- Establishes data hierarchy
- Processing requires expensive spatial evaluation
- Concept not described in S-100

Recommended Changes

- Implement option A, option B, or combination of A and B
  - Remove unreferenced metadata (defaults) from the encoding
    - CRSH/VDAT, AXTY=11 (Vertical datum)
    - CRSH/VDAT, AXTY=12 (Sounding datum)
- Ensure legend is supported (retain surface geometries)
  - Sounding datum (SoundingDatum/verticalDatum)
  - Vertical datum (VerticalDatumOfData/verticalDatum)
  - Bathy quality (QOBD/…/categoryOfZoneOfConfidenceInData)
  - Non-Bathy quality (QONBD/horizontalPositionUncertainty/uncertaintyFixed)
  - Buoyage system (NavigationalSystemOfMarks/marksNavigationalSystemOf)

Result of Recommended Changes

- 101GB00GB302045.000
  - 2,354,415 bytes (~2,300KB, 2.24MB)
  - ~5,650 features
  - Estimated size increase = ~32 - 96KB (< 5% prior to compression)
  - Expected size difference post compression < 1%

Backup

Attribute override mappings

- attribute (MetaFeature)
  - Inheriting Features

Attribute override mappings

- verticalDatum (SoundingDatum, VerticalDatumOfData)
  - Building, CableOverhead, Conveyor, Crane, Gate, LightAirObstruction, LightAllAround, LightFogDetector, LightSectored, PipelineOverhead, SpanFixed, SpanOpening, Tunnel, WindTurbine
- horizontalDistanceUncertainty (QualityOfNonBathyData)
  - Canal, DockArea, Gate, LockBasin, ShorelineConstruction, SpanFixed, SpanOpening, Tunnel
- horizontalPositionUncertainty (QualityOfBathyData, QualityOfNonBathyData)
  - SpatialQuality (InformationType)

Attribute override mappings

- verticalUncertainty (QualityOfBathyData, QualityOfNonBathyData)
  - Berth, Building, CableOverhead, Conveyor, Crane, DeepWaterRouteCentreline, DeepWaterRoutePart, DredgedArea, DryDock, Fairway, FoulGround, Gate, MarineFarmCulture, PipelineOverhead, RecommendedRouteCentreline, RecommendedTrack, SpanFixed, SpanOpening, Tunnel, TwoWayRoutePart, WindTurbine
  - SpatialQuality (InformationType)
- marksNavigationalSystemOf (NavigationalSystemOfMarks, LocalDirectionOfBuoyage)
  - BeaconCardinal, BeaconIsolatedDanger, BeaconLateral, BeaconSafeWater, BeaconSpecialPurposeGeneral, BuoyCardinal, BuoyIsolatedDanger, BuoyLateral, BuoyNewDangerMarking, BuoySafeWater, BuoySpecialPurposeGeneral, LightAllAround, LightSectored

Attribute override mappings

- categoryOfZoneOfConfidenceInData (QualityOfBathyData)
  - ? (CATZOC)
- M_QUAL/SOUACC (?)
  - ?
- spatialAccuracy? (QualityOfBathyData)
  - M_QUAL/POSACC
  - ?
- surveyAuthority (QualityOfSurvey)
  - ?

Attribute override mappings

- surveyDateRange (QualityOfSurvey)
  - Overridden by *reportedDate* attribute
  - AirportAirfield, BeaconCardinal, BeaconIsolatedDanger, BeaconLateral, BeaconSafeWater, BeaconSpecialPurposeGeneral, Bridge, Building, BuiltUpArea, CableOverhead, Canal, Causeway, CautionArea, Conveyor, DiscolouredWater, Dyke, FenceWall, FishingFacility, FortifiedStructure, FoulGround, HarbourFacility, Hulk, IceArea, InformationArea, Landmark, LocalMagneticAnomaly, MooringWarpingFacility, Obstruction, OffshorePlatform, OffshoreProductionArea, OilBarrier, Pile, PipelineOverhead, PipelineSubmarineOnLand, ProductionStorageArea, PylonBridgeSupport, Railway, Road, Runway, ShorelineConstruction, SiloTank, Sounding, Tunnel, UnderwaterAwashRock, WindTurbine, Wreck
- techniqueOfVerticalMeasurement (QualityOfSurvey)
  - DeepWaterRouteCentreline, DeepWaterRoutePart, DepthNoBottomFound, DredgedArea, FoulGround, Obstruction, RecommendedRouteCentreline, RecommendedTrack, Sounding, TwoWayRoutePart, UnderwaterAwashRock, Wreck