Paper for Consideration by S-101 Project Team

Miscellaneous S-101 DCEG Proposals

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Executive Summary:	This paper addresses recently discovered issues in the DCEG.
Related Documents:	Comments on S-101 FC 0.8.8/0.8.9
Related Projects:	S-100 Register and S-101 Feature Catalogue

Proposal Type

Type of Change Requested	Mark All that Apply
S-101 DCEG Change	X
New/Amended Feature	
New/Amended Complex Attribute	
New/Amended Simple Attribute	X
New/Amended Information Type	X
New/Amended Association/Aggregation/Composition	X
New/Amended Enumerate Value	X

Notes: 1) The templates are located in the annex to this proposal form
2) Where the proposal suggests a minor amendment to a feature/information type or attribute (e.g. a change in the definition), the proposal may be explained here without a supporting table as included in the annex.

Clarifications for Fixed date range and Periodic date range

The difference between the meanings of attribute fixedDateRange bound to SupplementaryInformation vs. fixedDateRange bound to a geographic feature to which the SupplementaryInformation feature is associated is not clear enough to encoders and end users.

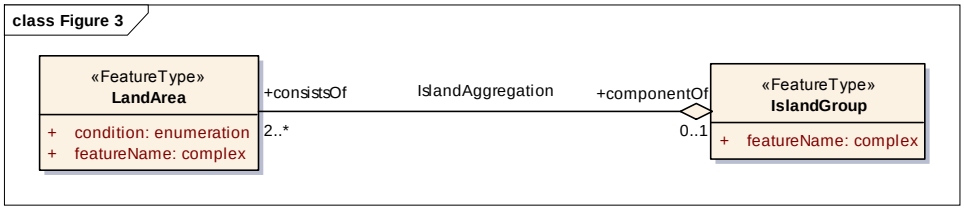
Recommendation: Add an explanation in DCEG § 23.1 explaining the difference in meaning between fixed/periodic date range attributes bound to a geo feature instance vs. a SupplementaryInformation object associated to a geo feature.

(new) 23.1.2 Date ranges and Supplementary Information
Attributes fixedDateRange and/or periodicDateRange bound to a SupplementaryInformation instance apply only to the SupplementaryInformation instance and not to any feature instance to which it may be associated. Similarly, fixedDateRange and periodicDateRange attributes of a feature instance apply only to the feature instance and not to any SupplementaryInformation instance to which it may be associated.

Associations and roles

Table format for describing associations and roles in feature definition tables

The table format given in § 2.6 (Description of table format for S-101 meta and geo features) does not include feature or information associations. The tables for individual feature types in §§ 4 to 23 do indicate feature associations, but the way associations are currently documented in §§ 4-23 and the Associations section (24.X) defines only one end of the association, and often reverses roles. For example, the feature association for LandArea (§ 5.4) can be interpreted as “LandArea consistsOf 0 or 1 IslandGroups”. It should actually define the following relationship:



The problem is compounded by the absence of UML diagrams for most of the S-101 application schema, inadvertent reversals of roles in early drafts of the PS, and by mentioning only one end of the association.

Recommendation 1: *Remove any ambiguity by documenting the entire association in the feature tables (Association Names). Details of the suggested format follow later in this section.*

Recommendation 2: Whether the format is revised or not, all the sub-tables describing feature and information associations in clauses 3.11 and 4.x to 23.x, as well as the association definitions in clause 24.x, must be reviewed to correct any reversals of role names.

Details for recommendation 1 follow.

Add the following material in the table in 2.6, below the attributes:

Feature associations:

Type	Association Name	Association Ends					
		Class	Role	Multiplicity	Class	Role	Multiplicity
Aggregation Association Composition	name of association	FeatureA (S, T)*	role at FeatureA end	multiplicity at FeatureA end	FeatureB (S, T)*	role at FeatureB end	multiplicity at featureB end
Remarks: Optional. Any constraints or remarks about the association. For example if an aggregation has an arrowhead indicator for navigability as well as the diamond "aggregation" or "composition" decoration, the navigability indicated by the arrowhead can be mentioned here.							
Aggregation	IslandAggregation	Land Area (S)	consistsOf	2..*	Island Group (T)	componentOf	0..1
See also	UpdateInformation (3.11); Names of other feature associations and references to their definitions.						

Information associations

Type	Association Name	Association Ends					
		Class	Role	Multiplicity	Class	Role	Multiplicity
Association	name of info. association	Feature or InfoType A (S, T)*	role at this end	multiplicity at this end	InfoType B (S, T)*	role at this end †	multiplicity at this end
Remarks: Optional. Any constraints or remarks about the association.							
See also	Names of other information associations and references to their definitions.						

*) S or T are added if the association is directed or an aggregation or composition. Aggregations and compositions are considered to be directed from the containee to the container class.
†) Indicator "– –" in this cell means the role is the default role

2) Remarks on next page of DCEG: Add a bullet about reducing duplication of content.

- To reduce duplication, the complete association information may be given in only one of the two class tables involved. The table for the other class can contain only a reference to the association.

3) Add a clarification for associations, after the Remarks on the next page of the DCEG:

2.6.2 Example of feature association

The IslandAggregation association in the table corresponds to the following fragment of the application schema:

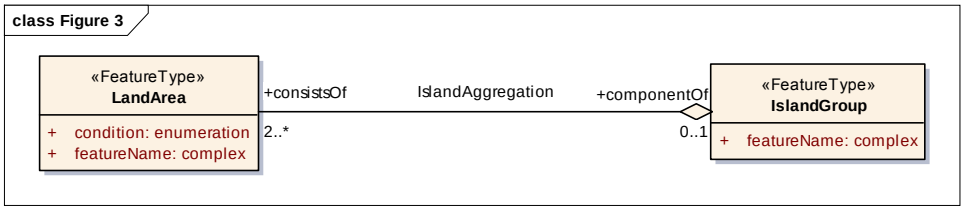


Figure X.Y: Example of feature association in application schema

Multiplicities in ASL Aggregation, Bridge Aggregation, and Island Aggregation

Clause No. / Paragraph	Explanation	Proposed Change
24.3 ASL Aggregation 15.26 Archipelagic Sea lane	The association end at Archipelagic Sea Lane has the multiplicity "1..1" in the DCEG but "2..*" in the FC in both directions. It should be "0..1" since sometimes the aggregation may be omitted. Clause 15.25.1 says "…**may** be associated…". Clause 15.26.1 in the DCEG is ambiguous about whether an ArchipelagicSealane feature must always be present (it suggests an ASL feature is required only if a complete ASL system is being encoded. The language does not say whether an ASLAxis feature can be encoded without an ASL feature.)	Set the multiplicity at the ArchipelagicSeaLane end to "0..1".
24.4 Bridge Aggregation 6.5 Bridge	Bridge components (e.g., SpanFixed) must be linked to a Bridge feature (the multiplicity at the Bridge end must be "1..1" (see the DCEG clause 6.6.1). But when we create a bridge with geometry, it may have no link to a span or a pylon. In this case the multiplicity is 0. The current versions of FC and DCEG have the multiplicity "0..1" for the first direction and "1..*" for the opposite direction.	Set the multiplicity at the Bridge end to "0..1".
24.8 Island Aggregation 5.4 Land Area	Similar situation to ASL aggregation, but with LandArea / IslandAggregation	Change the multiplicity "1..1" to "0..1" at the IslandGroup end

Discrepancies relating to permitted values of attributes

Clause No. / Paragraph	Explanation	Proposed Change
16.26 Restricted Area	There is no 14 (area to be avoided) in the list of permitted values for the "restriction" attribute of Restriction Area. There is no way to encode "area to be avoided" except as restriction = 14. Besides the DCEG clause 16.26.1.6 requires the encoding of such areas by use of the value 14.	Add code 14 to the list of the permitted values for the "restriction" attribute.
26.1 Beacon shape	The enumerated value 4 (lattice beacon) has been omitted in the table in clause 26.1. It is present in the FC. 4) lattice beacon	Reconcile DCEG and FC & update DCEG as needed

	A structure consisting of strips of metal or wood crossed or interlaced to form a structure to serve as an aid to navigation or as a support for an aid to navigation	
26.14 Category of coastline	The enumerated values: 3, 4, 5, 9 and 11 have been omitted in the table. They are present in the FC. 3) sandy shore a shoreline area made up of rock and rock fragments ranging in size from pebbles and gravel to boulders or large rock masses. 4) shingly shore a shoreline area made up of rounded, often flat waterworn rock fragments larger than approximately 16 millimetres. 5) glacier, seaward end projecting seaward extension of glacier, usually afloat. 9) coral reef a reef, often of large extent, composed chiefly of coral and its derivatives. 11) shelly shore a shoreline area made up of shells, i.e., made up of the hard outside covering of marine animals.	Reconcile DCEG and FC & update DCEG as needed
26.39 Category of Obstruction	The enumerated value 7(foul ground) has been omitted in DCEG clause 26.39. It is present in IHO FCD register and FC_0.8.9. It looks strange in the FC because we have the feature type Foul Ground. The CATOBS value 7 duplicates that feature type. The value 13 is "fish aggregating device (FAD)" in the FC_0.8.9 but it is "Subsurface ocean data acquisition system (ODAS)" in the DCEG clause 26.39. The omission causes the following values to change as well	Restore fish aggregating device as #13 in the DCEG. Increment the code for the following items by 1. No DCEG action for value 7, but FC will need to be reconciled.
26.39 Category of Obstruction	Definitions required for some items in this clause. FC contains additional codes 19 (remains of platform) and 20 (scientific instrument)	Determine disposition of the extra and undefined items & update DCEG accordingly.
26.54 Category of road	The enumerated value 7 (crossing) of CATROD attribute have been omitted in the table. They are present in the FC and IHO FCD register.	Reconcile DCEG and FC & update DCEG as needed.
26.115 Nature of construction	The enumerated value 9 (painted) of NATCON attribute have been omitted in the table. It is present in the FC and IHO FCD register	Reconcile DCEG and FC & update DCEG as needed.
26.103 Light characteristic	The codes 9 and 10 of LITCHR have been omitted in the attribute table though they are included the allowed values list for LITCHR in §§ 18.2, 18.3, 184 and in the FC. 9) interrupted quick flashing a quick light in which the sequence of flashes is interrupted by regularly repeated eclipses of constant and long duration. 10) interrupted very quick flashing a light in which the very rapid alterations of light and darkness are interrupted at regular intervals by eclipses of long duration.	Reconcile DCEG and FC & update DCEG as needed.
26.123 Publication Reference	This clause describes the Publication reference (PUBREF) attribute but this attribute is not used in any feature type. The DCEG does not use the feature type "NauticalPublicationInformation". Nautical publications datasets should substitute for this legacy feature.	Delete § 26.123 Publication Reference

Feature associations for Recommended Route Centerline and Range System (New)

It is desired to aggregate the **Recommended Route Centerline** (RCRTCL) feature into the **Range System**. The RCRTCL has the "Category of recommended track" (CATTRK) attribute and it can be based on a system of fixed marks. It means it can be aggregated with NAVLNE and Leading marks. This aggregation should be described by the **Range System** feature.

The S-101 PT is requested to confirm whether aggregation of **Recommended Route Centerline** with range systems was intentionally omitted.

Recommendation: If omission was unintentional: Add the Recommended Route Centerline feature to list of possible aggregated features for the Range System feature type in the table of 15.6 and the table of the clause 24.9 "Range system aggregation".

Clause 15.6 Feature Associations: Add a row to the feature associations for allowing recommended route centerline to be associated to a range system.

Type	Association name	Association Ends					
		Class	Role	Mult.	Class	Role	Mult.
Aggregation	RangeSystemAggregation	Recommended Route Centerline (S)	consistsOf	0..*	Range System (T)	componentOf	0..1

Feature associations for two-way routes

In S-57 the Two-way Route Part (TWRTPT) feature may be included in a Traffic Separation Scheme directly (i.e., linked to a C_AGGR object representing the TSS). Now according to the S-101 DCEG:

1. A **Two-way Route Part** feature cannot be a direct component of a **Traffic Separation Scheme** feature, because it is not one of the **componentOf** features in §§ 15.23 & 24.12.
2. A **Two-way Route Part** feature can be an indirect component of a **Traffic Separation Scheme** feature only if it is a component of a **Two-way Route** feature using the association **Two–Way Route Aggregation**.
3. The association **Two–Way Route Aggregation** requires at least two instances of **Two-way Route Part**.

The combined effect of the conditions above is that if there is a two-way route measure consisting of a single TWRTPT feature, it is not possible to make it part of a **Traffic Separation Scheme** via a **Two-way Route** feature or any other way.

By the way it is possible for **Deep Water Route Part** and **Deep Water Route Centerline** features to participate directly in a **Traffic Separation Scheme** aggregation (see § 15.23). For consistency, this paper takes a similar approach to handling **Two-way Route Part.**

*Recommendation: Add **Two-way Route Part** to the list of possible associated features for the **Traffic Separation Scheme** feature type. The changes required are listed below:*

- Table in clause 15.9: Add **Traffic Separation Schema Aggregation** to the list of feature associations for **Two-way Route Part**.
- Table in clause 15.23: Add Two-way Route Part to the list of features for **Traffic Separation Schema Aggregation.**
- Table in clause 24.12 (**Traffic Separation Scheme aggregation**): Add **Two-way Route Part** to the list of features for the role "**componentOf**."

Discrepancies relating to structure/equipment associations

These include discrepancies in feature descriptions, associations, and features not mentioned in the lists of structure and equipment features in clause 17.

Clause No. / Paragraph	Explanation	Proposed Change
14.2 Offshore wind turbine	The new feature type "OffshoreWindTurbine" can carry equipment features and should be added the list of structures that may also carry equipment features.	Add structure/equipment association in documentation table. Add offshore wind turbine as a structure feature in 17.1.

15.31 Radar Station	According to the S-57 UOC § 12.1.1the RADSTA objects was included in the list of equipment objects. In S-101 the RadarStation feature type has been omitted from the list of Equipment features in the DCEG, § 17.1. But § 15.31.1 says RadarStation is to be used only for Equipment and if a structure is needed it must be encoded using a Building, Landmark, or other appropriate feature. No Structure/Equipment association is mentioned for RadarStation features. The S-101 PT is requested to confirm whether the omissions from the list in 17.1 and the omission of a Structure/Equipment association are intentional.	Either clarify why the structure/equipment association is not used for RadarStation, or add the appropriate text in § 17.1 and make the appropriate changes in 15.31.
20.4 Radio Station	Similar issue to that described above for RadarStation.	As for RadarStation, but in § 20.4 instead of 15.31.
19.17 Radar Reflector	According to the DCEG clause 19.17.1 the Radar Reflector feature type must be encoded on curve features only (e.g. overhead cables). It cannot be encoded on point or surface features. But there is a mention that the feature must be (multiplicity=1,1) associated with a structure feature (association in § 19.17). However the list of structure features in 17.1 does not include such feature types as Overhead Cables, Overhead Pipelines, and Conveyor. They can really support Radar reflector. Possible solutions are to add the overhead features to the lists of structure features in clause 17.1, or define a new composition for aggregating the Radar Reflector feature with the supporting overhead or linear feature type.	Add another bullet to the Remarks in clause 17.1: Overhead and curve structure features: Some overhead features, or features with curve spatial primitives, may carry radar reflectors and participate as the Structure feature in a Structure/Equipment association. These include Overhead Cables, Overhead Pipelines, Conveyor, Span Fixed, Span Opening, Fence Wall, Fortified Structure, Shoreline Construction, Causeway, Gate, Dam, Mooring Warping Facility, Floating Dock, and Pontoon.

Missing associations

Clause No. / Paragraph	**Explanation**	**Proposed Change**
16.27 Pilotage District 21.1 Pilot boarding Place 24 Association Names 25 Roles	§ 24 does not contain the description of the "District boarding locations" feature association though it is in the FC and it is mentioned in the pilot boarding place feature type (table 21.1). § 16.27 (Pilotage District) does not include an association to Pilot boarding Place though this association is suggested in the Remarks in 21.1.1. Roles for the association are missing in § 25.	Add feature binding in § 16.27 and the association in §§ 24 & 25.
24 Association Names 25 Roles	There is no formal description of the "spatial Quality" information association.	Add a new section in §§ 24-25 to describe the "Spatial Quality" information association and its roles.

Information type Spatial Quality

There is no formal description of the "Spatial Quality" information type in § 23 (Information Types) though it is shown in clause 2.4.7. If the quality model is still being developed it may have to wait for that but a starter clause should be added in the DCEG anyway.

Recommendation: Add new starter clause 23.2 Spatial Quality

IHO Definition: **SPATIAL QUALITY:** Definition. (Authority for definition).

S-101 Information Feature: Spatial Quality (no S-57 acronym)

Primitives: None

Real World	*Paper Chart Symbol*	*ECDIS Symbol*

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Positional uncertainty	POSACC		RE	0,1
Vertical uncertainty	VERACC		RE	0,1
Quality of position	QUAPOS	1 : surveyed 2 : unsurveyed 3 : inadequately surveyed 4 : approximate 5 : position doubtful 6 : unreliable 7 : reported (not surveyed) 8 : reported (not confirmed) 9 : estimated 10 : precisely known 11 : calculated	EN	0,1
Category of Temporal variation		TBD	EN	0,1

Information associations

Type	Association Name	Association Ends					
		Class	Role	Mult.	Class	Role	Mult.
Association		GM_Curve, (S)		0..*	Spatial Quality (T)		0..1
Association		GM_Point (S)		0..*	Spatial Quality (T)		0..1
Association		GM_MultiPoint (S)		0..*	Spatial Quality (T)		0..1

INT 1 Reference:

X.X.X Spatial Quality (see S-4 – B-YYY.Y)

Introductory remarks. Includes information regarding the real world entity/situation requiring the encoding of the Feature in the ENC, and where required nautical cartographic principles relevant to the Feature to aid the compiler in determining encoding requirements.

Specific instructions to encode the feature.

At least one of the attributes must be encoded.

Remarks:

- Vertical uncertainty is prohibited for curves
- Additional encoding guidance relevant to the feature.

X.X.X.X Sub-sub-clause heading(s) (see S-4 – B-CCC.C)

Clauses related to specific encoding scenarios for the Feature (if required).

Remarks:

- Additional encoding guidance relevant to the scenario (if required).

Distinction: List of features in the Product Specification distinct from the Feature.

Unnamed association between spatial primitives and Spatial Quality: IHO Definition: Definition. (IHO).

Remarks:

• Additional encoding guidance relevant to the attribute.			
Role Type	**Role**	**Primitives/Information Types**	**Multiplicity**
Association		GM_Curve, GM_Point, GM_MultiPoint	0..*
		Spatial Quality	0..1

Miscellaneous issues

Clause No. / Paragraph	Explanation	Proposed Change
19.13 Daymark	Sub-head Feature Associations is duplicated	remove extra sub-head
2.4.3, 3.7, 3.10, 11.9, 11.10	Clause 27.2 defines "full seafloor coverage achieved" but there are still some uses and references to "full sea floor coverage" (2.4.3 (Quality of Bathymetric data; Quality of survey), 3.7, 3.10, 11.9, 11.10).	Update to use "full seafloor coverage achieved" consistently.
23.1 Supplementary Information 24.1 Additional Information 25.5 Provided By 25.6 Provides	The role names "provides" and "provided by" appear to be correct in the context of this association to some readers even when they are switched. Perhaps the confusion is compounded by the actual reversal of roles in other places, but consider using role names which are less chameleon-like, e.g., "providesInformation" and "informationProvidedBy." Or simply "theSupplementaryInformation" and "theFeature" or something similar. The definition in 25.6 "Acts as the authority and provider of a specified service" should be revised since references to authority and service may be misleading.	Devise less ambiguous names for the roles and update the cited clauses and FC accordingly. Definition in 25.6 – will think about revisions. At present I'm leaning to theSupplementaryInformation & theFeature. Suggest marking this as TBD.
24.5 Bridge association	Sub-head in table says "Caution area association"	Correct to "Bridge association"

Justification and Impacts

The issues mentioned above were discovered during recent review and comparison of the DCEG, XML feature catalogue, and the S-101 product specification. The recommended changes resolve discrepancies and ambiguities within the DCEG and between DCEG and FC, add content that has been overlooked, and in some cases add features or relationships needed for improved modelling of ENC data.

Action Required of S-101 Project Team

The S-101 Project Team is invited to:

a. discuss the above proposals

b. agree to their inclusion in the DCEG and proposal to the IHO FCD (if applicable) and to amend the S-101 Feature Catalogue