Input paper: [[1]](#footnote-2) ARM18-8.4.6

Input paper for the following Committee(s): check as appropriate Purpose of paper:

**X** ARM **□** ENG **□**  PAP **X** Input

**□** ENAV **□** VTS **□** Information

Agenda item [[2]](#footnote-3) 8.4

Author(s) / Submitter(s) Eivind Mong, Natasha McMahon (Canadian Coast Guard)

Outcome of S-201 data model review

# Summary

CCG has funded a study of S-201 data model as part of its implementation efforts. The findings seems to warrant review and appropriate actions by ARM to resolve.

## Purpose of the document

CCG wish to present the finding of the review of S-201 1.1.0 and discuss ways to resolve the matters raised.

## Related documents

S-201 1.1.0

# Background

Canadian Coast Guard (CCG) is in the process of reviewing and renewing its Aid to Navigation Management systems, especially the IT infrastructure that supports the operational programs. To that end, CCG have started experimenting with implementing the design state of AtoNs into a new database solution that is S-100 compatible and configured forS-201.

However, in working on configuring the database for S-201, the software vendor encountered some challenges with the specification and its alignment with other S-100 based product specifications, as well as with the content in the IHO GI Registry.

CCG then funded a comprehensive review of the data model and options for resolving any identified issued. The findings are listed in Annex A.

The importance a stable and mature standard version has a direct impact on AtoN authorities planning and progressing with transformation of data, training the workforce and overall change management.

# Discussion

The CCG AtoN database system envisioned to be a shared environment between AtoN information, Radio Aids, and traffic management information like VTS zones, reporting requirements etc. This means that the same system must manage data that is compatible with S-201, S-125, S-123 and S-127. S-124 is a likely source of change information, and the AtoN database will be a source for generating parts of Navigational Warnings. It is therefore important to CCG that the data models of these product specifications align with each other and allow for reuse of classes and attributes where the data models have overlaps.

The implementation plan of CCG also includes a gradual improvement of the AtoN content data quality and better alignment with the Canadian Hydrographic Service data products. An initial step in the data preparation and gap analysis has been the alignment with IHO, S-4 Regulations for International (INT) Charts and Chart Specifications of the IHO (English: Edition 4.9.0, March 2021 - Publication date: April 2021). This will aid in bringing the concept of the standard into malleable data format to be transformed for S-201. The impact of transformation from CCG database to CHS database is also considered, but the details of how this will be done is still a matter of debate. Nevertheless, the review of the S-201 data model made some preliminary study of potential problems that may be encountered when this link is established.

The findings highlighted in the report are of such a nature that ARM should consider resolutions that will likely require a new version of the product specification to resolve. CCG is of the view that such actions are in line with that is expected within the test and trial period of an S-100 product specification.

## S-124 connection

As the future AtoN database will be one of several sources of information used to generate navigational warnings, it is necessary to consider that the S-124 navigational warnings include a feature named NAVWARNAreaAffected, which can be used to give an indication of area impact of a point feature issue, such as an AtoN being discrepant from its design state. For lit AtoNs this can be generated from the nominal range with sector information of an AtoN. However, for unlit aids, there is still a visual range component that can be used to generate an affected area. The S-201 data model should include attribution to record such information that can then be utilized by S-124 production software.

# Action requested of the Committee

The Committee is requested to:

1. Note this paper
2. Consider the review of the S-201 1.1.0 product specification
3. Consider the need for a new version S-201 product specification to resolve the findings
4. Take any further appropriate actions

Annex A

1. **Overview**

Having much the same content in multiple documents poses a challenge for maintenance and consistency. The following documents were included in the review from the 1.1.0 version of S-201

2. S-201 Product Specification - 1.1.0 Oct. 2022 - main document.doc (referred to as PS)

3. S-201 DCEG - Annex A.doc (referred to as DCEG)

7. S-201 Feature Catalogue - Annex D1.docx (referred to as D1)

8. S-201 Feature Catalogue - Annex D2.xml (referred to as D2 or FC)

These were compared to the IHO Data Dictionary Register.

The review of the S-201 was challenging because it was not obvious that one document could be considered the reference to align the others with. Issues were found in each document.

Some concepts have not yet been added to the Register and this has likely been a factor in the result of being dropped from the latest FC.

It has been noticed that decisions have been made to make S-201 like S-57 instead of S-101 such as to keep using simple attributes instead of using complex attributes or information types. There are several things to consider about this, including;

* There has been a lot of work on conversion guidance from S-57 to S-101 which cannot be fully utilized due to the differences in the S-201 model. This will require efforts to provide guidance for conversion to S-201 as well as to custom implementations and test data.
* Implementors will need incentives to prepare conversions from S-57 to S-201.
* Using the same name of an attribute with a different data type is problematic for implementations. Care should be taken to ensure that the simple forms have different names/codes than the complex types used in other specs. Consider if all the specs are combined in one production or viewing system that the content will be more interoperable if the data types are consistent.
* Going forward the differences between S-201 and S-101 will cause ongoing interoperability issues between the agencies managing S-201 and the producing S-101.
* A simpler data model might be easier for data maintenance and presentation of the content

In many cases it was not clear what the correct resolution of a discovered inconsistency should be. In those cases options have been presented or items flagged for review or consideration by the S-201 project team.

1. **Simple Attributes**

| **Name** | **Notes** | **Recommended Action** |
| --- | --- | --- |
| Administrative division | Used by **contactAddress** | None |
| Aid availability category | Moved from being bound to **StructureObject** in 1.0 to individual objects in 1.1 FC.  Not used by Buoy emergency  wreck marking in Annex D1 or D2   Used by Feature Types in Annex D1 and D2 & DCEG but not used by Feature Types in the Register:  *StructureObject* ***Beacon Cardinal*** *Landmark Light Float****s*** *Light Vessel****s*** *Offshore Platform Pile****s******Silo Tank*** *Equipment* | Possible updates to Register |
| AtoN maintenance record | Type:Annex D1 = D2 = Register = Text Annex DCEG = URI **-**  Binding moved from **AidsToNavigation** to individual Features   Used by Feature Types from DCEG & Annex D1 and D2 but not from the Register:  *Topmark****sBeacon Cardinal******Beacon Isolated Danger******Beacon Lateral******Beacon Safe Water******Beacon Special Purpose General******Buoy Cardinal******Buoy Installation******Buoy Isolated Danger******Buoy Lateral******Buoy Safet Water*** *(mind the t on Safe****t****)* ***Buoy Special Purpose General*** *Daymark Fog Signal****s*** *Landmark****s*** *Light****s*** *Light Float****s*** *Light Vessel****s*** *Navigation Line Offshore Platform Pile****s*** *Radar Reflector****s*** *Radar Transponder Beacon Recommended Track Retroreflector****s******Silo Tank*** Note: names marked in **bold** are in DCEG different than in Annex D1 or D2 or Register**-**  Not used by Buoy emergency  wreck marking in Annex D1 or D2but used by Feature Types in the Register and DCEG.***-***  *Not used by* ***Lighthouse*** *in Annex D1 nor D2 or**DCEG (feature type not in DCEG even) but used by Feature Types in the Register****.******-***   Feature Types that use it in Annex D1 and D2 and Register:*AidsToNavigation*Note: *AidsToNavigation*which is Abstract in Annex D1 & D2 is Feature Type in Register and does not exist in DCEG | Propose to IHO to adopt URI, but for now use Text - Suggest to amend DCEG  Check bindings |
| Beacon shape | In PS Figure 10, enums 1,3,4,5  In DCEG enums 1,2,3,5,6,7  In FC  1,2,3,4,5,6,7  = D1 = Register  Moved from ***GenericBeacon*** in 1.0 FC to individual beacon objects in 1.1  Feature Types that use it but with a different name in Register and DCEG: *BeaconCardinal -****CardinalBeacon*** *BeaconIsolatedDanger -****IsolatedDangerBeacon*** *BeaconLateral -****LateralBeacon*** *BeaconSafeWater -****SafeWaterBeacon*** *BeaconSpecialPurposeGeneral -****SpecialPurposeGeneralBeacon*** | Confirm if all Registered enums are desired and update PS UML, DCEG or other places as needed. |
| Bridle link type  **bridleLinkType** | Was in 1.0 FC but dropped from 1.1 FC  Still in DCEG  Still in PS Figure 7 for Bridle Feature  Not in Register | Add back to FC and D1 Add to Register |
| Building shape | Only enums 5,6,7,8,9 used. | none |
| Buoy shape | Listed Values used in Annex D1 & D2 that have a different name in DCEG and Register: 7. super-buoy (Register & DCEG: 7. **superbuoy**) **-** Moved from ***GenericBuoy*** in 1.0 FC to individual buoy objects in 1.1 | Check names |
| Cable length  **cableLength** | Was in 1.0 FC but dropped from 1.1  Not in DCEG  Used by cableDimensions complex for CableSubmarine  Still in PS Figure 8  Not in Register | Add back to FC and DCEG  Add to Register |
| Candela  **candela** | Was in 1.0 FC but not in 1.1  Was on Light  Not in DCEG  Not in Register  Is on Light in PS Figure 5 | Add back to FC, DCEG  Add to Register |
| Category of aggregation | Value of 4 dropped in 1.1 = Register  PS Figure 1 still shows value 4 in diagram   Used by Feature Types in DCEG & Annex D1 and D2 but not used by Feature Types in the Register: *Aggregation****s*** | Amend PS Figure 1 to remove value 4 from **categoryOfAggregation** |
| Category of association | = Register | None |
| Category of cable | Was in 1.0 but not in 1.1 FC  Only Enum 7 included  In DCEG  In PS Figure 7  In Register enum val 6 is Mooring Cable and 7 is Ferry | Add back in to FC.  Enum value 6 Mooring cable |
| Category of cardinal mark | Added to **BeaconSafeWater**in 1.1 FC  **BeaconSafeWater** has 1..\* in D1, FC but is 1..1 in DCEG  **categoryOfCardinalMark** not included on **SafeWaterBeacon** in Register  Use of **categoryOfCardinalMark** on **BeaconSafeWater** not shown in PS diagrams  Feature Types that use it but with a different name in Annex D1, D2, Register and DCEG: BeaconSafeWater*-****SafeWaterBeacon*** | If meant to be on **BeaconSafeWater/SafeWaterBeacon**  Binding probably should be 1,1 in FC |
| Category of fog signal  **categoryOfFogSignal** | PS only has 3,7,8,10  FC in 1.1 added 1,2,4,5,6,9, also in DCEG | Add rest of values to PS Figure 9 or remove extra values from FC and DCEG |
| Category of installation buoy |  | none |
| Category of landmark | 3 ,7, 9 ,15, 16, 17,19 in 1.0 FC and PS  Additional values were added from Register to FC in 1.1  Listed Values used in Annex D1, DCEG and Register that are commented out on D2:  22, 23, 24 **-**  Listed Values used in DCEG and Register but not in Annex D1 or D2:  25 | Consider if new values are needed and add from Register to PS |
| Category of lateral mark |  | None |
| Category of light | Adjustments to enum list aligned with Register  Listed Values **not in Annex D1:** 1. *directional function***-**  Listed Values in Annex D1 & Registerbut not in DCEG: 16. *moire effect* Note: it's **not**listed as allowable encoding value in DCEG but it says there that if a moiré effect light is to be encoded then it should be for Light and Category of light = 16 (moir**é** effect). | Double check if enums match |
| Category of mooring warping facility | Was in FC 1.0 not in 1.1  Only value was 7 Mooring Buoy  In S-101 replaced with new Feature type of Mooring Buoy | Add Mooring Buoy to S-201 |
| Category of navigation line |  |  |
| Category of offshore platform | In 1.0 had values 2 and 3  More values added to FC and DCEG from Register in 1.1  PS Figure 9 only has values 2 and 3 | Consider new values and add to PS UML Figure 9 |
| Category of physical AIS aid to navigation | Was in FC 1.0 not in 1.1  Not in D1 or DCEG  Figure 4 shows this enumeration but it is not present on the **PhysicalAISAidToNavigation** object in the diagram.  **PhysicalAISAidToNavigation** also not in FC 1.1 | Determine if this attribute is still intended to be included. If so, **PhysicalAISAidToNavigation**will need to be added as well. |
| Category of pile | PS Figure 9 has values 1,3,4  DCEG has 1,3,4,5,6,7  Register has value 8 Mooring Post | Decide which enum values to include and update documents accordingly. |
| Category of power source | Was in FC 1.0 not in 1.1  Power Source (and category of) is still in DCEG  In PS Figure 5 and 9  **PowerSource** is not in Register (probably why it is not in FC) | Add this and Power Source back into FC  Add Power Source to Register |
| Category of radar transponder beacon | Value 3 added in 1.1  Is in FC and DCEG  **categoryOfRadarTransponderBeacon** is in PS Figure 9 but **RadarTransponderBeacon** does not seem to be in Figure 3 as mentioned in 4.2 | **RadarTransponderBeacon** seems to be missing from the Figures in PS. |
| Category of radio station | Was in 1.0 along with **RadioStation** but not included in 1.1 FC  Not in DCEG  Is in PS Figure 4 | If still needed, add to DCEG and FC |
| Category of recommended track | Optional in PS Figure 1 but mandatory in 1.1 FC on **RecommendedTrack**  In Register it is no longer used on **RecommendedTrack**  Replaced in Register and S-101 by boolean **basedOnFixedMarks** | Consider replacing with **basedOnFixedMarks** |
| Category of silo/tank | Values 3,4 added to Version 1.1 FC and DCEG  PS Figure 9 still only shows values 1,2 | Consider adding values 3,4 to PS |
| Category of special purpose mark | Listed values not in D1: 15. LANBY > name in DCEG: 15. LANBY (Large Automatic Navigational Buoy) 57. Ice Mark 58. Nature Reserve Mark(57 & 58 are in DCEG)**-**  Listed values not in D1 or D2: *BeaconSpecialPurposeGeneral, BuoySpecialPurposeGeneral* and *Daymark*:  57. Ice Mark (it's in DCEG for all the three attributes) 58. Nature Reserve Mark (it's in DCEG for all the three attributes) 59. Fish Aggregating Device (it's in DCEG for Special purpose/general buoys only) > name in DCEG: 59. floating fish aggregating device (FAD)**-**  Note in DCEG about *Landmarks* possibly also using it:  "The attribute category of special purpose mark should only be used if the Landmark is used as the front or rear lead for a transit, clearing line or measured distance, or for a leading line.  Values for category of special purpose mark such as 16 (leading mark), 17 (measured distance mark) or 41 (clearing mark) in particular should be used for these purposes." **-**  Listed values in the Register and Annex D1 and D2 but not in DCEG: 9. ODAS name in DCEG: 9. ODAS (Ocean-Data Acquisition-System) buoy**-**  Other listed Values' inconsistent names: DCEG: 19. *TSS mark (Traffic Separation Scheme)* D1: 28. '"sound ships siren" mark' D1: 35. *"channel edge gradient" mark;* D2 & Register: 35. *channel edge gradient mark;* DCEG: 35. *channel edge gradient’ mark*  1.0 FC had values 65,66,67 that were taken out in 1.1 | Review enums and which are permitted. |
| Category Of Synthetic AIS Aid to Navigation | Was in FC 1.0 not in 1.1  Not in DCEG  **SynteticAISAidToNavigation** not in 1.1 FC either, note should be Synthetic  Is in PS Figure 4  Not in Register | Consider adding to FC and DCEG  Add to Register |
| Category of temporal variation | Values do not match Register  Values do not match S-101 | Review enum values |
| Category of text | Was in FC 1.0 not in 1.1  Doesn't appear in other docs | None |
| City name | Used by **ContactAddress** | None |
| Colour | Enums aligned with Register in version 1.1 FC and DCEG  PS Figure 10 still includes fluorescent colours | Align PS Figure 10 with current colour values |
| Colour Pattern | Register has values 1-9  Allowable values in DCEG only: 1 - 6  PS Figure 10 Has 10='other pattern' | Drop 10 from PS Figure 10 |
| Condition | DCEG - beacons & piles & silo/tanks: only Values 1, 2, 5 **but** Piles do **not** use Condition in Annex D1or on D2 **-**  PS Figure 10 includes 1,2,3,5  Listed Values used in Annex D1 & D2: Landmark 1, 2, 4, 5 **-**  Listed Value 3 not in DCEG is commented out on D2 for *Landmark*and for *Lighthouse* only **-**  Not used by ***Lighthouse*** in Annex D1 nor D2 orDCEG**.** | Review enum values |
| Counter weight type | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2  In PS Figure 7 bu enum not defined | Add to Register  Add to FC, DCEG |
| Country | Attribute not in DCEG, it's only in Annex D1 & D2 In any case, the name is different in the Register: Country Name. There are also Producing Country, Address Country and State Country (S-121) | Change to Country Name, **countryName** |
| Date end  Date start | Not used by Buoy emergency  wreck marking in Annex D1 or D2.  Also, they are not used by ***Lighthouse*** in Annex D1 nor D2 or DCEG**.**  In S-201 used directly on features, similar to S-57. In S-101 and other specs these are used within complex attributes such as **fixedDateRange, periodicDateRange,surveyDateRange** | Could use within complex attributes to be more consistent with other specs |
| Delivery point | There is a double space on the definition - in Annex D2  Not in DCEG or PS | None otherwise |
| Depth range value 2 | Name is different: Register & DCEG - ***Depth range maximum value*** Annex **D1 & D2** - *Depth range value 2***-**  Code is: ***depthRangeMaximumValue*** in Annex D1, D2, Register and DCEG **-**  Precision is different: Register - 0.01 Annex D2 - 1 **-**  In Register *RecommendedTrack*uses *depthRangeMinimumValue*but does not use  **depthRangeMaximumValue.** Register has **maximumPermitted Draught** instead | Review Recommended Track in comparison to Register and other specs |
| Depth range value 1 | Name is different: Register & DCEG - *Depth range maximum value* Annex D1 & D2 - *Depth range value 1***-**  Precision is different: Register - 0.01 Annex D2 - 1 | Check usage and spelling in each document |
| Diameter | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2  Used by **cableDimensions** complex  which is not Registered  In PS Figure 7 for Moorings | Add **cableDimensions** to Register along with sub attributes.  Add to FC and DCEG. |
| Direction uncertainty | Not in DCEG  Precision is different: Register - 0.1 Annex D1 & D2: 1**-**  Closure: Register does **not**have it  Is this different from **orientationUncertainty**?  In 201 FC used by QualityOfNonBathymetricData but not on QualityOfNonBathymetricData in Register. | Review |
| Display name | Was in FC 1.0 not in 1.1 It's on the Register (boolean) Not in DCEG Not in Annex D1 or D2  Part of featureName, see featureName complex | consider **featureName** complex |
| Elevation | Precision is different: Register - 0.1 Annex D2: 1 Annex D1 does **not** have it | Consider precision |
| estimated range of transmission | Was in FC 1.0 not in 1.1 Is on the Register (real) Not in DCEG Not in Annex D1 or D2/FC | Add to FC |
| Exhibition condition of light | In FC Mentioned in DCEG - section 7.2.4 Elevations of lightsIn Annex D1 and Annex D2 - for *Light* Is in Register(enumeration) | None |
| File locator | Was in FC 1.0 not in 1.1 Is in Register(text) Not in DCEG Not in Annex D1 or D2 | See notes on **information** complex vs text |
| File reference | Was in FC 1.0 not in 1.1 Is in Register(text) Not in DCEG Not in Annex D1 or D2 | See notes on **information** complex vs text |
| Function | Some enum values added in 1.1 FC but more new ones added to Register since | consider new enum values |
| headline | Was in FC 1.0 not in 1.1 Is in Register(text) Not in DCEG Not in Annex D1 or D2 | See notes on **information** complex vs text |
| Height | Move from ***GenericBeacon*** to specific beacons and Lighthouse in 1.1  Attribute not on D1 **-**  Still on ***GenericBeacon***  in PS Figure 2  Precision is different: Register - 0.1 Annex D2: 1 **-**  Not used by **Lighthouse** in Annex D1 nor D2 orDCEG | Review |
| Height length units | Was in FC 1.0 not in 1.1 Is in Register(enumeration) but as Height/LengthUnitsNot in DCEG Not in Annex D1 or D2  Used in **cableDimensions** and **sinkerDimensions** | Add back to FC |
| Horizontal accuracy | It's **not**on the Registerand it is in DCEG- real, used by two Feature Types: *LightVessel****s*** *and LightFloat****s*** (there is there Spatial Accuracy (Domain IHO Hydro) but it does not get used by those two LightVessel or LightFloat  In Annex D1& D2 it also exists as Real but is not used by any Feature Type  Removed from LightFloat in FC  In Register not found on LightVessel or LightFloat | Add back to **LightFloat** in FC  or  Consider switch to using **SpatialQuality** Information object associated with geometry |
| Horizontal datum | Was in FC 1.0 not in 1.1 Is in Register(enumeration)Not in DCEG Not in Annex D1 or D2  Used by **AtoNFixingMethod** | See notes on **AtoNFixingMethod** information type |
| Horizontal distance uncertainty | Attribute not in DCEG-  Precision is different: Register - 0.1 Annex D1 & D2: 1 | Consider precision |
| Horizontal length  Horizontal width | Attributes not on D1 -  Precision is different: Register - 0.1 Annex D2: 1 | Add to Annex D1  Consider precision |
| Horizontal position uncertainty | In Register it's complex, not real **-**  Has no Precision | Consider using complex to align with Register |
| ID Code | In FC moved binding from ***AidsToNavigation*** to specific features  Type:  in FC 1.0.0 was URN Annex D1 & D2 & Register: Text; DCEG = (S) Text **-**  Not used by Buoy emergency wreck marking in Annex D1 or D2but used by Feature Types in theRegister and DCEG. **-**  *Not used by* ***Lighthouse*** *in Annex D1 nor D2 or*DCEG  Seems to have been replaced by **interoperabilityIdentifier** | Consider replacing with **interoperabilityIdentifier** for compatibility |
| Information in national language | Not used by Buoy emergency wreck marking in Annex D1 or D2 | See comments on **featureName** complex type |
| Inspection frequency | Not in Register  In PS under ***AidsToNavigation*** abstract type | Add to Register |
| Inspection requirements | attribute in Register  In DCEG is missing 's'  - 'Inspection requirement' | Spelling in DCEG |
| Installation date | Type: Register = Date D1 = D2 = S100\_TruncatedDate in DCEG: "The optional attribute IALA\_installationDate (S100\_TruncatedDate)... also in DCEG**:** Installation date (S) DA Note: DCEG has two contradictory definitions/names**-**  In PS under ***AidsToNavigation*** abstract type  Not used by Buoy emergency  wreck marking in Annex D1 or D2 **-**  Not used by **Lighthouse** in Annex D1 nor D2 orDCEG (feature type not in DCEG even) but used by Feature Types in the Register**.** | None |
| Installation Type | Attribute not on the Register or D1 or DCEG. It's in Annex D2 section: <!-- Updated by KRISO - -> **-**  Not used by **Topmark** in Annex D1 or Register  Feature Types using it in Annex D2: **Topmark** | Add to Register  Amend D1 and DCEG |
| Is slatted | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2  Is on Daymark in PS Figure 2 | Remove from PS or add to Register and other docs. |
| language | Was in FC 1.0 not in 1.1 Is in Register(text)Not in DCEG Not in Annex D1 or D2  Used by **featureName** and **information** type | See comments on **featureName** complex and **information** type |
| Legs details | Was in FC 1.0 not in 1.1 Is in DCEGfor Bridle and mentioned in Recommended Track Not in Register Not in Annex D1 or D2  On PS Figure 7 | Add to Register  Add back to FC and D1 |
| Light characteristic | Listed Values' inconsistent names:  Register: 6. Continuous Ultra Quick-Flashing; 11. Interrupted Ultra Quick-Flashing DCEG: 6 : ultra quick-flashing; 11 : interrupted ultra quick flashing Register & DCEG: 13. Fixed and Flash; 14. Flash and Long-Flash; 15. Occulting and Flash; 16. Fixed and Long-Flash**-**  In Annex D2 some list values have the Remark: Not defined in the GI Registry as of Dec. 2016: 14, 15, 16, 17, 18, 19, 25, 26, 27, 29 | Review values |
| Light visibility | In FC, DCEG | None |
| Manned structure | In FC, DCEG.  In PS Figure 2 | None |
| Manufactorer | Should be spelled **manufacturer**  Was in FC 1.0 not in 1.1 In DCEG as **manufacturer** Not in Register Not in Annex D1 or D2  Should be spelled **manufacturer** | Fix spelling in PS  Add to FC and Register |
| Marks navigational - System of | Moved from generic buoy and beacon to specific types in FC 1.1 | None |
| Maximum display scale |  | None |
| Minimum display scale |  | None |
| MMSI code | Was in FC 1.0 not in 1.1 Is in Register(text) with code **mMSICode** Not in DCEG Not in Annex D1 or D2  In PS Figure 4 | Add back to FC, D1 and DCEG |
| Multiplicity of lights | Is in Register  **multiplicityOfFeatures**complex used in S-101 | Consider **multiplicityOfFeatures**complex |
| name | Was in FC 1.0 not in 1.1 Is in Register (text)Not in DCEG Not in Annex D1 or D2  Used in **featureName** | See notes on **featureName** complex |
| Nature of construction | Moved from generic to specific types  Feature Types inconsistently using the Listed Values: Allowed Listed Values Annex D1 & D2 for *Landmark*& *Lighthouse*:  1 -12 Allowed Listed Values Annex D1 & D2 for all the other Feature Types: 1-9  Allowed in DCEG for the Feature Types showing it below - but not in Annex D1 or D2:  10. latticed DCEG: Daymark: 1, 2, 4, 6-10 LightFloat: 6, 7, 9, 10 LightVessel: 6, 7, 9 OffshorePlatform: 1-9 Silo/Tank: 1, 2, 6-9 All Beacons: 1, 2, 6-10 All Buoys: 6-10 Mooring Shackle, Sinker Anchor, Swivel: 1, 2, 6-10**-**  Not used by Buoy emergency  wreck marking in Annex D1 or D2 **-**  Not used by ***Lighthouse*** in Annex D1 nor D2 or DCEG | Review values |
| NMEA String | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2  Used by **positioningMethod** | See notes on **positioningMethod** complex |
| Object name  Object name in national language | Other attributes not used by Buoy emergency  wreck marking in Annex D1 or D2. Also, they are not used by **Lighthouse** in Annex D1 nor D2 | See notes on **featureName** complex |
| Orientation | Type:  Annex D1 = D2 = DCEG = Real; Register = Complex  Is complex in Register and other specs | Consider using new complex type for compatability with other S-100 products. If not, change to **orientationValue** |
| Period end | Was in FC 1.0 not in 1.1 Is in DCEG with this attribute name Not in Annex D1 or D2 Not in Register | Consider **periodicDateRange** complex or clean up docs to use Periodic date end |
| Periodic date end | It's called *Period end* in DCEG**-**  Not used byBuoy emergency wreck marking in Annex D1 or D2but used by Feature Types in the Register and DCEG. **-**  Not used by ***Lighthouse*** in Annex D1 nor D2 orDCEG (feature type not in DCEG even) but used by Feature Types in the Register**.** | Consider **periodicDateRange** complex |
| Periodic date start | It's called Period start in DCEG**-**  Not used by Buoy emergency  wreck marking in Annex D1 or D2but used by Feature Types in the Register and DCEG. **-**  Not used by ***Lighthouse*** in Annex D1 nor D2 orDCEG (feature type not in DCEG even) but used by Feature Types in the Register. | Consider **periodicDateRange** complex |
| Period start | Was in FC 1.0 not in 1.1 Is in DCEG with this attribute name Not in Annex D1 or D2 Not in Register | Consider **periodicDateRange** complex or clean up docs to use Periodic date start |
| Pictorial representation | Not used by Buoy emergency wreck marking in Annex D1 or D2 but used in DCEG.  Moved from abstract types to specific ones. | Add to FC for emergency buoy |
| Positional accuracy | used by **SpatialUncertainty** | See notes on **SpatialUncertainty** information type |
| positioning device | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2 | See notes **PositioningInformation** complex |
| Positioning equipment | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2 | See notes on **positioningMethod** complex |
| Postal code |  | See notes on **contactAddress** complex |
| Product | New enum values added in 1.1 FC but not values 23 Electricity, 24 Ice, 25 Clay  DCEG states value 23 is Ice in conflict with Register  Attribute not on the Register; It's in Annex D1 & D2; DCEG mentions it but only one one section for: "Oil or gas installation buoy (Product = 1 or 2)" | Review enum values for consistency with Register  Change Ice to value 24 |
| Quality of horizontal measurement | Was in FC 1.0 not in 1.1 Is in Register(enumeration)Not in DCEG Not in Annex D1 or D2 | None |
| Quality of position | It's not on the Register or DCEG It's in Annex D1 & D2 | See notes on **SpatialUncertainty** information type |
| Quality of sounding measurement | It's not on the Register It's in Annex D1 & D2 & DCEG  Used by Recommended Track  Recommended Track in Register uses quality of vertical measurement | vs quality of vertical measurement |
| Quality of vertical measurement | Was in FC 1.0 not in 1.1 Is in Register(enumeration)Not in DCEG Not in Annex D1 or D2 | vs Quality of sounding measurement |
| Radar conspicuous | Type:  D1 = D2 = Enumeration (same list values);  Register & DCEG = Boolean | Switch to new Boolean type for compatibility |
| Radar wave length | Type:  Annex D1 = D2 = Text; Register = **Complex**; DCEG = (S) TE | Switch to complex to match Register or use a different name **waveLengthValue** |
| Reference date | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2 | See notes on **AtoNFixingMethod** |
| Reference Point | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2 | See notes on **AtoNFixingMethod** |
| Remotely monitored |  | None |
| Remote monitoring system | Moved from ***Equipment*** to specific types in 1.1 FC  Still on Equipment in PS Figure 4 | Move to specifics in PS |
| Scale minimum | Not on Buoy emergency  wreck marking in FC | Add to **Buoy emergency  wreck marking** |
| Seasonal action required | Was in FC 1.0 not in 1.1 Is in DCEG for *Bridle, Cable Submarine, Mooring Shackle, Sinker Anchor* and *Swivel* Not in Register Not in Annex D1 or D2  In PS Figure 7 on ***AidsToNavigation*** | Add back to FC on ***AidsToNavigation*** or individual features |
| Sector limit one Sector limit two | Type:  D1 = D2 = Real; Register = **Complex**; DCEG = **Integer**  For compatibility, don't use same class name with different types | Change to complex to match S-101 or use a distinct name to avoid FC compatibility issues. |
| Shackle type | Was in FC 1.0 not in 1.1 Is in DCEG for Mooring ShackleNot in Register Not in Annex D1 or D2  In PS Figure 9 | Add back to FC |
| Shake type | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2  Mispelled record removed | None |
| Signal frequency | Aligned | None |
| Signal generation | ok | None |
| Signal group | ok | None |
| Signal output | Units: not in Register nor Annex D1 or D2; **DCEG = Hertz** | Add to Register |
| Signal period | Precision is different: Register - 0.1 D2: 2 D1 does not have it | Check precision  Add to Annex D1 |
| Signal sequence | Type:  D1 = D2 = DCEG = Text; Register = **Complex** | Change to complex to match S-101 or use a distinct name to avoid FC compatibility issues. |
| Sinker type | Was in FC 1.0 not in 1.1 Not in DCEG Not in Register Not in Annex D1 or D2  In PS Figure 7 | Add to Register  Add to FC, DCEG |
| Sounding accuracy | Was in FC 1.0 not in 1.1 Is in DCEG for Recommended Track Is in Register(real)Not in Annex D1 or D2  Is in PS Figure 1 | Add to FC |
| Sounding uncertainty | Attribute not on the Register nor DCEG;it's on D1 & D2  Not in PS Figure 1  Used by Recommended Track | Drop in favour of Sounding accuracy? |
| Source date | It's on D1 & D2& DCEG  Registered  moved from ***AidsToNavigation*** to specific types **-**  Not used by Buoy emergency  wreck marking in Annex D1 or D2 | Add toBuoy emergency  wreck marking? |
| Source indication | Attribute not used by **BeaconLateral** in Annex D1 or D2 **-**  Not used by Buoy emergency  wreck marking in Annex D1 or D2  Not used by **Lighthouse** in Annex D1 nor D2 orDCEG | Review if included on desired features |
| Status | Listed Values' inconsistent names: 17. Register: unwatched; DCEG & D1 & D2: 17. un**-**watched (with hyfen) **-**  Used values in Annex D1 & D2: 1-9, ~~10~~, 11-18, 29-34 (value 10 is not used)  Feature Types using it in DCEG but with different allowed values: All Beacons: 1, 2, 4, 5, 7, 8, 12, 18 All Buoys: 1, 2, 4, 5, 7, 8, ~~12~~, 18 (value 12 is not used)  *OffshorePlatform*: 1, 2, 4, 7, 8, 12, 16, 17, 19 *LightVessel****s***, *LightFloat****s***, *Topmark****s***, *Light****s***: 1, 2, 4, 5, 7, 8, 14, 16, 17 *Silo Tank*: 1, 4, 12, 13 *Landmark****s***: 1, 2, 4, 5, 7, 8, 12-14, 16, 17 *FogSignal*: 1, 2, 4, 5, 7, 8, 15 *RetroReflector*, *Radar Reflector*, *EnvironmentObservationEquipment*: 1, 4, 8 *Daymark*: 1, 4, 5, 7, 8, 12 *RadarTransponderBeacon*: 1, 2, 4, 5, 7, 8 *RecommendedTrack*: 1, 2, 5, 7, 9, 12, 16, 17 *NavigationLine*: 1, 2, 5, 7, 8, 14**-**  Not used by Buoy emergency  wreck marking in Annex D1 or D2**-**  Not used by ***Lighthouse*** in Annex D1 nor D2 orDCEG | Review values and bindings |
| Swivel type | Was in FC 1.0 not in 1.1 Is in DCEG for Swivel Not in Register, Not in Annex D1 or D2 | Add back to FC with Swivel  Add to Register |
| Technique of sounding measurement | Attribute not on the RegisterIt's on D1 & D2& DCEG  **techniqueOfVerticalMeasurement** is in Register | consider **techniqueOfVerticalMeasurement** |
| Technique of vertical measurement | Was in FC 1.0 not in 1.1Is in Register (enumeration) Not in DCEG Not in Annex D1 or D2 | Add to FC, DCEG etc |
| text | Was in FC 1.0 not in 1.1 Is in Register(text) Not in DCEG Not in Annex D1 or D2  Used by **information** complex | See notes on **information** complex |
| Textual description | Type: D1 = D2 = DCEG = Text; Register = Complex | Align with Register or use different name  See notes on **information** complex |
| Textual description in national language | Only supports one national language | See notes on **information** complex |
| Topmark/daymark shape | D1 = D2 **=** DCEG: the enumerated values **do** match except for DCEG: 33 : *other shape (see information)* DCEG: 34: tubular does not exist **-**  Listed Values' inconsistent names in the Register:  1. *Cone (Point Up)* 5.*Cylinder* 7. *X-shaped* 10. *2 Cones (Point to Point)* 11. *2 Cones (Base to Base)* 22.*Trapezium (Up)* 23.*Trapezium (Down)* 24.*Triangle (Point Up)* 33. *Other Shape (See Shape Information)* This list value has the Remark:*‘*Not defined in the GI Registry as of Dec. 2016’:  33. *Other Shape (See Shape Information)*2. *Cone (Point Down)* 8. *Upright Cross* 9. *Cube (Point Up)* 15. *Besom (Point Up)* 16. *Besom (Point Down)* 18. *Sphere Over a Rhombus* 28. *T-shape* - Proposed in the Register | Review values |
| Traffic flow | ok | None |
| Type of battery | Registered | None |
| Type of buoy | Not used by Buoy emergency  wreck marking inAnnex D1 or D2 not listed as attribute in Register  Moved from generic to specific buoys in 1.1 FC | None |
| Type of environment observation equipment |  | None |
| Type of light |  | None |
| Value of geographi**cal** range | Listed Values' inconsistent names  Register: Value of **Geographic**Range; Name - DCEG**:** Value of geographic**al** range CamelCase - **Register**: valueOf**Geographic**Range **-**  Type: D1 - Text; D2 & DCEG & Register **-** Real **-**  Units not in Register | Align with Register |
| Value of luminous range | Type: D1 - Text; D2 & DCEG & Register - Real  Units not in Register | Change D1 to Real |
| Value of maximum range |  | None |
| Value of nominal range |  | None |
| Vertical datum |  | None |
| Vertical length | Precision is different:Register - 0.1 D2: 1  D1does not have it  Not used by Buoy emergency  wreck marking in Annex D1 or D2  Not used by **Lighthouse** in Annex D1 nor D2 orDCEG | Review precision and bindings |
| Vertical uncertainty | Type: D1 & D2 - Real; Register - Complex  Attribute not in DCEG. Type also not. It mentions it on a diagram though: "Vertical uncertainty is prohibited for curves" | Align with Register or change name |
| virtual AIS aid to navigation type | Was in FC 1.0 not in 1.1 Is in Register(enumeration) Not in DCEG but mentioned in 12.8.10 Remote monitoring Not in Annex D1 or D2  In PS Figure 4 | Add to FC and DCEG |
| Visual prominence | Was in FC 1.0 not in 1.1 Is in Register(enumeration) Not in DCEG Not in Annex D1 or D2  New attribute for CONVIS | Add Visual prominence back to FC and remove **visuallyConspicuous** |
| Weight | Was in FC 1.0 not in 1.1 Is in DCEG for Mooring Shackle, Sinker Anchor and Swivel Not in Register Not in Annex D1 or D2  In PS Figure 7 | Add back to FC |
| Aton Commissioning Aton Removal Aton Replacement Beacon Change Buoy Change Leading Lights Change Light Change | Added to FC 1.1  Attribute not in: Annex D1 & Register & DCEG; It's only in Annex D2 -  (Change Details does not exist either, also not on D2) | Add to other documents |
| Change Types | Attribute not in: Annex D1 & Register & DCEG;It's only in Annex D2  In PS Figure 1 under **AtoNStatusInformation** | Add to other docs |
| Fog Signals | Added to FC 1.1  sub attribute of **changeDetails** | None |
| Information | Is Text is D1 and D2 and DCEG  Register has type complex | Change to complex to align with Register and other specs or use a different name to avoid FC conflicts |
| Radio Aids Change | Attribute not in: Annex D1 & Register & DCEG; It's only in Annex D2 **-**  Typo:1. AIS transmitter out of servi**v**e  Sub attribute of Change Details | Add to docs as needed |
| Visually conspicuous | Type: D1 & D2 - enumeration; Register - Enumerated**;** DCEG - Boolean **-**  D1 & D2 & DCEG: Visually conspicuous but Visual Prominence is still in the Register - as Attribute Type   - with Related List Values: 1. *Visually Conspicuous*; 2. *Not Visually Conspicuous* & 3. *Prominent*  Visual Prominence is not in DCEGnor D1 or D2 | Add Visual prominence back to FC and remove **visuallyConspicuou**s to align with other specs |
| Vertical accuracy | Was in FC 1.0 not in 1.1 Is in DCEG for ALL Feature Types Not in Register Not in Annex D1 or D2 | Add back if needed.  **SpatialQuality** might be used instead |
| Vertical datum | *Attribute not used by**BeaconLateral* in DCEG*Attribute not used by**Lighthouse*in DCEG*Attribute not used by**VerticalDatumOfData*in DCEG | Review use |

* 1. **Notes on Simple Attributes:**

**Part of DCEG** - features/attributes have been possibly accidentally removed from D1, perhaps because they are not in the IHO Register:  
Bridle  
Power Source  
Cable Submarine  
Mooring Shackle  
Sinker Anchor  
Swivel  
& all attributes that relate to each of them: Bridle link type; Category of power source; **Cable dimensions**; **Sinker dimensions**; Sinker type; Swivel type (Note that *Sinker dimensions* is marked in **Red** in DCEG)  
  
**Part of DCEG** - Missing on D1 & D2:  
Buoy emergency  wreck marking (BuoyEmergencyWreckMarking) (to avoid issues trying to use the feature type the double space would have to be removed from the name in DCEG).  
  
**\* DCEG Missing:**  
*Lighthouse* feature & Lighthouse as feature used by the corresponding attributes - marked in Used by.   
Affects: Category of Landmark, and the rest of the attributes  
  
The precision in the Registeris quite often different from D1 (most of the times does not include it) or D2.

1. **Complex Attributes**

| Class | Details | Notes | Recommended Action |
| --- | --- | --- | --- |
| Cable dimensions  cableDimensions | cableLength [1]  diameter [1]  heightLengthUnits [1]  PS Figure 7 | In 1.0 but not in 1.1 FC not in D1  In DCEG is Listed as an attribute under CableSubmarine but sub attributes are not defined.  CableSubmarine not in 1.1 FC  Not in Register | Add to FC  Define in DCEG  Add to Register |
| Contact address  contactAddress | administrativeDivision [0..1]  cityName [0..1]  country [0..1]  deliveryPoint [0..\*]  postalCode [0..1] | In FC and D1  Mentioned in 12.8.13 of DCEG but not listed on feature classes  Moved from StructureObject in 1.0 FC to BeaconLateral, BeaconCardinal,etc  Is on StructureObject in PS Figure 2  If not meant to be on all structures could be placed on *GenericBuoy* and *GenericBeacon*  but is not on BeaconSpecialPurposeGeneral so maybe there is reason to have on specific objects  In Register has country Name instead of country | If move from StructureObject  is intentional then update UML diagram in PS Figure 2  Change to use country name |
| Feature name  featureName | name [1]  displayName [0..1]  language [0..1] | was in 1.0 but replaced with objectName and objectNameInNationalLanguage in 1.1 FC  PS Figure 1 and 8 UML still shows featureName  featureName has been remodeled in S-101 to better support multiple language not just English and one National  Suspect this was to make compatibility with S-57 easier but there will be migration capabilities from S-57 to S-101 so it would be better going forward to be in sync with S-101 for interoperability. | Reconsider using latest featureName |
| Information  information | fileLocator [0..1]  fileReference [0..1]  headline [0..1]  language [0..1]  text [0..1] | was in 1.0 but replaced with simple text information and informationInNationalLanguage in 1.1  Is still in PS Figure 8  These types are not in the Register  At least the simple text have multiplicity  Would be better to use a different name because the code should be unique to one entity and type.  It is a conflict to have information simple text and information complex. | If complex is not wanted, change name to informationText or something else to distinguish it from the complex attribute. Add informationText to Register  Otherwise, restore information complex to be interoperable with S-101 and other S-100 products. |
| Positioning method  positioningMethod | NMEAString [1]  positioningEquipment[1] | Not in 1.1 FC and DCEG  Product Spec Figure 13. Spatial Attributes shows positioningMethod on PositioningInformation type.  Not in Register | Add to FC and DCEG  Add to Register |
| Sinker dimensions  sinkerDimensions | heightLengthUnits [1]  horizontalLength [0..1]  horizontalWidth [0..1]  verticalLength [0..1] | In 1.0 but not in 1.1 FC  Used by SinkerAnchor which is also not in 1.1 FC  Referenced in DCEG under SinkerAnchor but not defined.  Is in PS Figure 7 and Figure 8  Not Registered | Add back to FC  Add to Register |
| Survey date range  surveyDateRange | dateEnd [1]  dateStart [0..1] | dateEnd mandatory in D1 and XML FC  surveyDateRange mentioned in DCEG 2.4.5 but not seen in Feature definitions  Used by QualityOfNonBathymetricData  Not in PS | Either remove from FC or add it to PS, DCEG and add bindings to Objects |
| Change Details  changeDetails | atonCommissioning [1]  atonRemoval [1]  atonReplacement [1]  beaconChange [1]  fogSignals [1]  leadingLightsChange [1]  lightChange [1]  radioAidsChange [1]  buoyChange [0..1] | Not in D1  Strange that most sub attributes are mandatory in FC but optional in PS Figure 8  Used by AtoNStatusInformation  Shown in PS Figure 1 and Figure 8 | Amend FC to make sub attributes optional |

1. **Information Associations**

| Class | Details | Notes | Recommended Action |
| --- | --- | --- | --- |
| Fixing Method Information  fixingMethodInformation | Fixing Method Information  Role:fixingMethod | Is in XML FC.  Was in 1.0.0 FC  Not in Annex D1  Not in DCEG  Not in Register  Product Spec Figure 13. Spatial Attributes shows an association PositioningMethod with role:method binding between GM\_Point and PositioningInformation but these are not in the DCEG or D1, D2. | Assuming that PS UML diagrams are latest model:  Amend Annex D1, D2 XML FC and DCEG to replace fixingMethodInformation with PositioningInformation, PositioningMethod and method.  Add to Register |
| Spatial Quality  SpatialQuality | Spatial Quality  Role:SpatialQuality | Is in Annex D1  In DCEG 2.4.4  In S-101 called SpatialAssociation  Spatial Quality Information type in Register but not this association. | Watch S-101 Roles.  Consider aligning with S-101 SpatialAssociation |
| Aton Status  atonStatusInformation | Aton Status  Role: atonStatus | New in 1.1 FC  Not in Annex D1  Not in DCEG  Not in Register.  There is an Information type AtoNStatusInformation  No bindings are defined in FC from Features to AtoNStatusInformation so this association is not being used.  Figure 1 in Product Spec shows atonStatus binding from Abstract class AidsToNavigation to  AtoNStatusInformation. | Assuming that PS UML diagrams are latest model:  Amend Annex D1 and DCEG  Add appropriate binding(s) to FC.  Add to Register |
|  |  |  |  |

1. **Feature Associations**

|  |  |  |  |
| --- | --- | --- | --- |
| Class | Details | Notes | Recommended Action |
| Aggregations | Role: peer  Used between Aggregation and *AidsToNavigation* base class.  FC Matches what is shown in PS Figure 1. | DCEG shows peer role from Aggregation  to *AidsToNavigation* is mandatory but PS and FC have 0..\* in both directions. | Change DCEG or  Update UML and FC binding from Aggregation to *AidsToNavigation* |
| Associations | Role: peer  Used between Association and *AidsToNavigation* base class.  FC Matches what is shown in PS Figure 1. | DCEG shows peer role from Association to *AidsToNavigation* is mandatory but PS and FC have 0..\* in both directions. | Change DCEG or  Update UML and FC binding from Association to *AidsToNavigation* |
| Bridle Connection | hangs  holds  PS Figure 7 Used between Bridle and *GenericBuoy* | In 1.0 FC not in 1.1 FC or D1  Not defined in DCEG  Neither Bridle or BridleConnection are in FC and association binding not on *GenericBuoy* | Add Bridle and BridleConnection to DCEG and FC and association bindings between Bridle  and *GenericBuoy* |
| Buoy Counter Weight | attached  holds  PS Figure 7 Used between CounterWeight and *GenericBuoy* | In 1.0 FC not in 1.1 FC or D1  CounterWeight and BuoyCounterWeight not in DCEG | Add CounterWeight and BuoyCounterWeight to DCEG and FC and association bindings between CounterWeight and *GenericBuoy* |
| Cable Connection | attached  holds  PS Figure 7 Used between  Bridle and CableSubmarine  Swivel and CableSubmarine | In 1.0 FC not in 1.1 FC, D1, DCEG  Bridle, Swivel, CableSubmarine not in FC or D1.  They are in DCEG but not the association/bindings for CableConnection | Add CableConnection association and bindings to DCEG and FC |
| Range System | navigableTrack  navigationLine  PS Figure 1  Between NavigationLine and RecommendedTrack | In 1.1 FC, DCEG and D1 | None |
| Shackle Connection | connectedTo  connected  PS Figure 7 Used between  MooringShackle and *GenericBuoy*  MooringShackle and SinkerAnchor  MooringShackle and CableSubmarine | In 1.0 FC not in 1.1 FC, D1, DCEG | Add ShackleConnection feature association and related features to DCEG and FC |
| Structure Equipment | child parent | The association is in the FC however the binding from structure to equipment seems to have been moved from the Structure object to the Equipment object. So the Equipment object can have a child or a parent but the structure object cannot.  StructureEquipment association concept is in DCEG but the Association class is not defined. | In S-101 roles for structure Equipment are changing to something like 'structure', 'equipment'.  In FC move StructureEquipment binding to child from *Equipment* to *Structure.*  Add StructureEquipment definition to DCEG |
| Swivel Connection | hangs  holds  PS Figure 7 Used between  Swivel and Bridle | In 1.0 FC not in 1.1 FC, D1, DCEG  Bridle, Swivel not in FC or D1.  They are in DCEG but not the association/bindings for SwivelConnection | Add SwivelConnection feature association and related features to DCEG and FC |
| Virtual AIS | broadcasts  broadcastBy  In PS Figure 4  Between RadioStation and PhysicalAISAidToNavigation, SynteticAISAidToNavigation, VirtualAISAidToNavigation | In 1.0 FC not in 1.1FC, D1 or DCEG  The connecting objects RadioStation and PhysicalAISAidToNavigation, SynteticAISAidToNavigation, VirtualAISAidToNavigation are all missing from the 1.1 FC and DCEG | Assuming PS Figure 4 is current then add VirtualAIS association and all associated features back in to DCEG and FC |

1. **Information Types**

| Class | Details | Notes | Recommended Action |
| --- | --- | --- | --- |
| AtoN fixing method  AtoNFixingMethod | positioningMethod [1]  referenceDate [1]  horizontalDatum [0..1]  referencePoint [0..1] | In 1.0 FC not in 1.1  Not in DCEG  Mentioned in PS 1.1, 4.2  PS Figure 13 shows PositioningInformation instead  Not Registered | Leave out of FC  Change mentions in PS to Positioning Information |
| Positioning information  PositioningInformation | positioningDevice [1]  positioningMethod [0..1] | in 1.0 FC but not in 1.1  Not in D1  Not in DCEG  In PS Figure 13  Not Registered | Add to D1, FC and DCEG  Add to Register |
| Spatial uncertainty  SpatialUncertainty | positionalAccuracy [0..1]  qualityOfPosition [0..1] | In FC  Not in DCEG  In PS Figure 13  In Register as SpatialQuality  In S-101 as SpatialQuality | Change name to SpatialQualityUpdate PS, DCEG and FC |
| AtoN Status Information  AtoNStatusInformation | changeDetails [1]  changeTypes [0..1] | it's on D2 (XML FC) only but not referenced by anything - Register: not mentioned  PS Figure 1 shows is bound to AidsToNavigation | Add to D1  Add binding from AidsToNavigation to AtoNStatusInformation with atonStatusInformation association  Add to Register |

1. **Feature Types**

| Name: | Notes | Recommended Action |
| --- | --- | --- |
| Aggregation | Feature associations (not feature links) in DCEG: Any Aids to Navigation Geographic feature and Mulitplicity: 1,\* (not AidsToNavigation with multiplicty [0..\*]) & Definition in DCEG is quite different: "AGGREGATION.  Used to identify an aggregation of two or more objects." | Change DCEG binding to 0..\*  Check definition |
| Aids To Navigation | not in DCEG; In DCEG it has AtoN Fixed structures, AtoN floating structures, AtoN relevant structures and AtoN Equipment which are not Feature Types or anything but comprise many of the Feature Types  Is in PS Figure 1 etc | Add to DCEG |
| Association | Feature associations (not feature links) in DCEG: Any Aids to Navigation Geographic feature and Mulitplicity: 1,\* (not AidsToNavigation with multiplicty [0..\*]) & This part is on on Definition/Remarks for DCEG: "The association may be named. remarks: For example, an association relationship may be used to indicate that a buoy marks a wreck." | Check definition and multiplicity of binding |
| Beacon,  cardinal Beacon, isolated danger Beacon,  lateral Buoy,  cardinal Buoy,  installation Buoy,  isolated danger  Buoy,  lateral Buoy,  safe water Buoy,  special purpose/general Buoy, Daymark,  Fog signal, Environment Observation Equipment,  Landmark, Light, Light float, Light vessel, Offshore platform, Pile, Radar reflector, Radar transponder beacon, Recommended track, Retro-reflector, Silo/tank | It's in DCEG: Marks navigational – system of  It's in DCEG: Vertical accuracy (0,1) It's in DCEG: Period end, not Periodic date end It's in DCEG: Period start, not Periodic date start It's Inspection requirement, not requirements &*Contact Address* is not in DCEG for *Beacon, lateral Contact Address* is not in DCEG for *Buoy, cardinal  Contact Address* is not in DCEG for *Buoy, installation   Contact Address* is not in DCEG for *Buoy, isolated danger    Contact Address* is not in DCEG for *Buoy, lateral  Contact Address* is not in DCEG for *Landmark Contact Address* is not in DCEG for *Offshore platform Contact Address* is not in DCEG for *Pile Contact Address is not in DCEG for Silo/tank& verticalUncertainty is not in DCEG as an attribute or Feature Type; It's in Register as Complex*Affects: All buoys, all beacons &*Daymark, Landmark, Light, Light float, Lighthouse, Light vessel, Offshore platform, Pile, Radar reflector, Radar transponder beacon, Recommended track, Retro-reflector, Silo/tank* and *Topmark*  Re: *Contact Address* is not in DCEG:This is in DCEG:"12.8.13 Address of AtoNIf it is required to encode an address of an AtoN the optional attribute contactAddress (complexAttributeType from NIPWG wiki) on any structure feature type is be used. This is in addition to the spatial attributes." | Consider periodicDateRange complex  Review use of ContactAddress |
| Beacon, cardinal Beacon, isolated danger Buoy, safe water  Buoy, special purpose/general | *Contact Address* is not in DCEG for *Beacon, cardinal Contact Address is not in DCEG for Beacon, isolated danger Contact Address is not in DCEG for Buoy, safe water Contact Address is not in DCEG for Buoy, special purpose/general* & Remarks and definition are switched around - and this part is not in DCEG: Edition, 420). Topmark, light, fog signal, radar reflector and retro-reflector are separate objects. Definition in DCEG has also (UKHO NP735, 5th Edition) & Note (applies to Buoy, special purpose/general): (S-57 Edition 3.1, Appendix A – Chapter 1, Page 1.24, November 2000). is there too.  Re: *Contact Address* is not in DCEG:This is in DCEG:"12.8.13 Address of AtoNIf it is required to encode an address of an AtoN the optional attribute contactAddress (complexAttributeType from NIPWG wiki) on any structure feature type is be used. This is in addition to the spatial attributes." | Review inconsistencies |
| Beacon, lateral | Remarks and definition are switched around - and this part is not in DCEG: Edition, 420). Topmark, light, fog signal, radar reflector and retro-reflector are separate objects. | Consider adjustments |
| Beacon, safe water | It's in DCEG: Marks navigational – system of  It's in DCEG: Vertical accuracy (0,1) It's in DCEG: Period end 0,1 It's in DCEG: Period start 0,1 It's in DCEG: Inspection requirement (not requirements) & *categoryOfCardinalMark* in DCEG & D2: 1,1 D1: 1..\* & *idCode* in DCEG & D2: 1,1 D1: 0..1 & In DCEG:  & *Contact Address is not in DCEG for Beacon, safe water* & Definition in DCEG has also (IHO Dictionary – S-32, Edition 5). Remarks - "A safe water beacon is used..." (not "A safe water beacon may be used")and this part is not there: "Topmark, light, fog signal, radar reflector and retro-reflector are separate objects." | Consider periodicDateRange complex  Review use of ContactAddress |
| Beacon, special purpose/general | *idCode*in DCEG & D2: 1..\* D1: 1,1 & Definition in DCEG has also (S-57 Edition 3.1, Appendix A – Chapter 1, Page 1.12, November 2000) and this part is not there: "Topmark, light, fog signal, radar reflector and retro-reflector are separate objects." | idcode vs interoperabilityIdentifier  check when/if id should be mandatory |
| Bridle | Was dropped from FC 1.1  Is in DCEG with this feature type name Not in Register Not in Annex D1 or D2/FC      Attributes: bridleLinkType [0..1] legsDetails [0..1] | Add to Register and to FC |
| Buoy, cardinal Buoy, isolated danger | Definition in DCEG has also (UKHO NP 735, 5th Edition).and this part is not there:  5th Edition, 565). Topmark, light, fog signal, radar reflector and retro-reflector are separate objects. &Note (applies to Buoy, isolated danger only: in DCEG it's: "An isolated..." | check definition |
| Buoy, installation | Definition in DCEG has also *(S-57 Edition 3.1, Appendix A – Chapter 1, Page 1.20, November 2000).*And this part is not there: *, 5th Edition, 565).* | check definition |
| Buoy emergency wreck marking | Name is in Register but not quite exactly: *Emergency Wreck Marking Buoy (EmergencyWreckMarkingBuoy)* It's *Buoy emergency  wreck marking* (*BuoyEmergencyWreckMarking*) (with the double space) in DCEG  It's in DCEG and Definition is correct The feature type (and attributes and values) is entirely missing on D1 & D2. | Add BuoyEmergencyWreckMarking or EmergencyWreckMarkingBuoy to FC |
| Buoy, lateral | In DCEG this part is there too: (UKHO NP 735, 5th Edition) and there is also the usual text in the Remarks section: " BUOY LATERAL MARKS.  A buoy is a floating object moored to the bottom in a particular place, as an aid to navigation or for other specific purposes.  (IHO Dictionary – S-32)." Note (applies to Buoy, safe water only: Name in DCEG has a typo: Safet water buoys (BuoySafeWater) | check definition |
| Cable submarine | Was dropped from 1.1 FC  It's in DCEG & Register but not on D1 nor D2  Definition is not in DCEG and not on D1 & D2 The feature type (and attributes and values) is entirely missing on D1 & D2. | Add to Register and FC |
| Counter weight | Was dropped from 1.1 FC  not in DCEG Not in Register Not in Annex D1 or D2 | Add to Register and FC |
| Couter weight | not in DCEG Not in Register Not in Annex D1 or D2  Wrong spelling use Counter weight | None |
| Data coverage Generic Beacon Generic Buoy Local Direction of Buoyage Quality of NonBathymetric Data | not in DCEG (certainly not as Feature Types) | Add to documents as needed |
| Daymark | It's *Topmark/daymark shape* in DCEG It's in DCEG: Vertical accuracy (0,1) & Definition in DCEG has also (IHO Dictionary – S-32, Edition 5). | Adjust as noted |
| Environment Observation Equipment | In DCEG it has the definition of a Radar Reflector... | Check definition |
| Equipment | In DCEG there's only AtoN Equipment  Equipment abstract class not defined in DCEG | Add to DCEG |
| Fog signal | Definition in DCEG has also (IHO Dictionary – S-32). | Check definition |
| Landmark | It's in DCEG: *Vertical accuracy* (0,1) Height is incorrect. It's 0,1 in DCEG Note (duplicates note on Simple attributes doc): Visual prominence - no longer in DCEG nor D1 nor D2 it is still in Register & It's "Any prominent..." Definition in DCEG has also (IHO Dictionary – S-32). | Check definition |
| Light | Note (duplicates note on Simple attributes doc): Visual prominence - no longer in DCEG nor D1 nor D2 it is still in Register & It's in DCEG but not quite exactly: AID TO NAVIGATION. (mind the capitals) Additionally, this part is there: For internationally agreed abbreviations of light characteristics see the International Chart Specifications. (IHO Dictionary – S-32). This part is not there though:  "A light may be fixed on a buoy, beacon, tower, etc. These are separate objects." | Check definition |
| Light float | It's in DCEG: *Vertical Accuracy* (0,1) It's in DCEG: *Horizontal Accuracy* (0,1) *Contact Address* is not in DCEG for *Light Float* & Definition in DCEG has also (IHO Dictionary – S-32).     The light of a light float is a separate object, handled as with buoys, beacons, etc. This part is not there though:  "A light may be fixed on a buoy, beacon, tower, etc. These are separate objects." | Check definition  Check Contact Address |
| Lighthouse | In FC  In Register  Not defined in DCEG or PS Figures | Add to DCEG and PS |
| Light vessel | *Contact Address* is not in DCEG for *Light vessel* & Definition in DCEG has also (IHO Dictionary – S-32). This part is not there though: "The light(s), fog signal etc. of a light vessel is a separate object, handled as with buoys, beacons, etc." | Check definition |
| Mooring shackle | It's in DCEG but not in Register nor on D1 nor on D2 Definition in DCEG has also (IALA Dictionary, 8-5-150) The feature type (and attributes and values) is entirely missing on D1 & D2. | Add back to FC and DCEG  Add to Register |
| Mooring warping facility |  | Add Mooring Buoy to S-201 |
| Navigational system of marks | not in DCEG as Feature Type. It's an attribute for Lights in DCEG: *Navigational system of marks*  Register also has LocalDirectionOfBuoyage | Review |
| Navigation line | It's in DCEG: Period end, not Periodic date end It's in DCEG: Period start, not Periodic date start It's Inspection requirement, not requirements & Definition in DCEG is quite different: "NAVIGATION LINE.  A straight line extending towards an area of navigational interest and generally generated by two navigational aids or one navigational aid and a bearing.  (Service Hydrographique et Oceanograhique de la Marine, France)." | Consider periodicDateRange complex  or use  Periodic date end, Periodic date start  Check definition |
| Offshore platform | Definition in DCEG has also (Adapted from IHO Dictionary – S-32). This part is not there though: "used in the production of oil or natural gas." | Check definition |
| Physical AIS aid to navigation | not in DCEG Not in Register Not in Annex D1 or D2 | Add to Register  Add back to FC and docs |
| Pile | Definition in DCEG has also  1) (IHO Dictionary – S-32). 2) into the earth or seabed | Check definition |
| Power Source | It's in DCEG but not in Register nor on D1 nor on D2 | Add to Register  Add to DCEG and FC |
| Quality of NonBathymetric Data | In FC  Not found in DCEG  Mentioned in PS  direction Uncertainty in 201 but not in Register | Add to DCEG |
| Radar reflector | Definition in DCEG has also: "corner reflector (…) to facilitate" This part is not there though: The object 'radar reflector' is only used to encode a device specifically intended to reflect radar signals. If any other object, e.g. topmark, buoy, beacon, etc. is radar conspicuous, because of its construction, the attribute 'CONRAD' must be used. | Check definition |
| Radar transponder beacon | Definition in DCEG has also: "Also called racon.  (IHO Dictionary – S-32)." This part/remark is not there though: "The object class 'radar transponder beacon' is only used to encode the technical equipment independent of the structure on which it is located (e.g. a beacon, light-vessel or tower)." | Check definition |
| Radio station | Was in FC 1.0 not in 1.1, with Attributes: categoryOfRadioStation [1] estimatedRangeOfTransmission [0..1] status [0..1]-  Is on the Register with this Feature Type name-  Radio is in DCEG and Annex D1 and D2an attribute for Landmark:  31. radio | Add to FC  and DCEG |
| Recommended track | Note (duplicates note on Simple attributes doc):  soundingUncertainty is not in DCEG nor Register; It's on D1 & D2 & Definition in DCEG has also: (IHO Dictionary – S-32). This part/remark is not there though: "Recommended tracks include all channels recommended for hydrographic reasons to lead safely between shoal depths. The use of such tracks is generally left to the discretion of the mariner and will depend on the vessel's draught, the state of the tide, adequacy of navigational aids and so on (IHO Chart Specifications, M-4). The recommended track is that portion of a 'navigation line' that a ship should use for navigation. In the case of a two-way recommended track only one value of orientation is encoded (in the attribute ORIENT); the other value can be deduced (i.e. the value in ORIENT + 180 degrees)." | Check use of soundingUncertainty  Check definition |
| Retro-reflector | It's *Topmark/daymark shape* in DCEG & Definition in DCEG has: Retro-reflective (with hyfen) Definition in DCEG does not have this part/remark: "The body carrying the retro-reflector is a separate object." | Check definition |
| Silo/tank | Note (duplicates note on Simple attributes doc): Visual prominence - no longer in DCEG nor D1 nor D2 it is still in Register  Definition in DCEG is quite different: "SILO/TANK.  A silo is a large storage structure used for storing loose materials.  (Defence Geospatial Information Working Group; Feature Data Dictionary Register, 2012).A tank is a container used for the storage of liquids and/or gases.  (Adapted from Defence Geospatial Information Working Group; Feature Data Dictionary Register, 2012)." | Check definition |
| Sinker anchor | Name is not in Register nor on D1 nor on D2 It's in DCEG | Add to Register  Add to FC and DCEG |
| Sounding datum | Name is not in DCEG;  It's in Register & D1 & D2 as Feature Type | Review |
| Structure Object | Not in DCEG other than on an image and on the Description of lights section - certainly not as Feature Type | Add to DCEG |
| Swivel | Name is not in Register nor on D1 nor on D2 It's in DCEG | Add to FC and DCEG |
| Syntetic AIS aid to navigation | Was in FC 1.0 not in 1.1  Not in DCEG  SynteticAISAidToNavigation not in 1.1 FC either, note should be Synthetic  Is in PS Figure 4  Not in Register | Correct spelling  Add back to FC and DCEG |
| Topmark | installationTypenot in DCEG for Topmark *&*Definition in DCEG has: *"..*.a BUOY or BEACON to aid in its identification. (IHO Dictionary – S-32)*."* (mind the capitals) This part/remark is not there though: "The body carrying the topmark is a separate object."  Topmark is complex attribute in S-101 | Check definition |
| Vertical datum | *Vertical Datum* is in Register & D1 & D2 & DCEG as Attribute - enumeration  Used in D1 & D2 in 13 feature types, *but*3 of them are not in DCEG: *\* Lighthouse*not in DCEG *\* SoundingDatum* not in DCEG*\* VerticalDatumOfData*not in DCEG | Review |
| Vertical datum of data | *Vertical Datum of Data* is not in DCEG It's in Register & D1 & D2 as Feature Type | review |
| Virtual AIS aid to navigation | Was in FC 1.0 not in 1.1 with attributes:   MMSICode [1]virtualAISAidToNavigationType [1] estimatedRangeOfTransmission [0..1] status [0..\*] Is on the Register Not in DCEG nor Annex D1 or D2  Attributes moved to specific classes | OK |
|  |  |  |

* 1. **Notes on Feature Types**

D1 & D2 \* Missing:   
Buoy emergency  wreck marking (BuoyEmergencyWreckMarking)

\*\*\* DCEG Obsolete features/attributes:

(already removed from D1):  
Only one of them in red in DCEG: - Bridle; Power Source; Cable Submarine; Mooring Shackle; Sinker Anchor; Swivel (and all attributes that relate to it: Bridle link type; Category of power source; **Sinker dimensions**; Sinker type; Swivel type)

\* DCEG Missing:   
Lighthouse feature & Lighthouse as feature for the corresponding attributes - Used by.  
Affects: Category of Landmark, and many more

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-2)
2. Leave open if uncertain [↑](#footnote-ref-3)