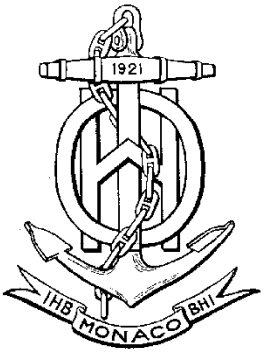
INTERNATIONAL HYDROGRAPHIC ORGANIZATION



IHO UNIVERSAL HYDROGRAPHIC DATA MODEL

Working Version – January 2013

Special Publication No. 101
Electronic Navigational Chart Product Specification

Appendix A
Data Classification and Encoding Guide

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14.2.1 Submarine cables (see S-4 – B-443; B-443.1-2 and B-443.7-8) ..... ***Error! Bookmark not defined.***
14.3 SUBMARINE CABLE AREA ..... **ERROR! BOOKMARK NOT DEFINED.**
14.3.1 Submarine cable areas (see S-4 – B-439.3 and B-443.3) ..... ***Error! Bookmark not defined.***
14.4 SUBMARINE/LAND PIPELINES ..... **ERROR! BOOKMARK NOT DEFINED.**
14.4.1 Pipelines, submarine or on land (see S-4 – B-377; B-444; B-444.1-2; B-444.4-5 and B-444.7) ***Error! Bookmark not defined.***
14.4.2 Diffusers, cribs ..... ***Error! Bookmark not defined.***
14.5 SUBMARINE PIPELINE AREA ..... **ERROR! BOOKMARK NOT DEFINED.**
14.5.1 Submarine pipeline areas (see S-4 – B-439.3 and B-444.3) ..... ***Error! Bookmark not defined.***
14.6 OFFSHORE PRODUCTION AREA ..... **ERROR! BOOKMARK NOT DEFINED.**
14.6.1 Offshore production areas (see S-4 – B-445.3; B-445.9; B-445.11 and B-445.12) .***Error! Bookmark not defined.***
14.6.2 Offshore tanker loading systems (see S-4 – B-445.4) ..... ***Error! Bookmark not defined.***

15 TRACKS AND ROUTES ..... ERROR! BOOKMARK NOT DEFINED.

15.1 LEADING, CLEARING AND TRANSIT LINES AND RECOMMENDED TRACKS (SEE S-4 – B-433 AND B-434) ..... **ERROR! BOOKMARK NOT DEFINED.**
15.1.1 Range systems - relationship ..... ***Error! Bookmark not defined.***
15.2 TRAFFIC LANES ..... **ERROR! BOOKMARK NOT DEFINED.**
15.3 TRAFFIC SEPARATION SCHEMES AND TRAFFIC SEPARATION SCHEME SYSTEMS .. **ERROR! BOOKMARK NOT DEFINED.**
15.4 NAVIGATION LINE ..... **ERROR! BOOKMARK NOT DEFINED.**
15.4.1 Navigation lines (see S-4 – B-433) ..... ***Error! Bookmark not defined.***
15.4.2 Measured distances (see S-4 – B-458) ..... ***Error! Bookmark not defined.***
15.5 RECOMMENDED TRACK ..... **ERROR! BOOKMARK NOT DEFINED.**
15.5.1 Recommended tracks (see S-4 – B-432.1; B-434 and B-434.1-4) ..... ***Error! Bookmark not defined.***
15.6 FAIRWAYS ..... **ERROR! BOOKMARK NOT DEFINED.**
15.6.1 Fairways (see S-4 – B-432.1(c) and B-434.5) ..... ***Error! Bookmark not defined.***
15.7 RECOMMENDED ROUTES ..... **ERROR! BOOKMARK NOT DEFINED.**
15.7.1 Recommended routes (see S-4 – B-435.4) ..... ***Error! Bookmark not defined.***
15.8 TWO-WAY ROUTE PART ..... **ERROR! BOOKMARK NOT DEFINED.**
15.8.1 Two-way Routes (see S-4 – B-435.6) ..... ***Error! Bookmark not defined.***
15.9 RECOMMENDED DIRECTION OF TRAFFIC FLOW ..... **ERROR! BOOKMARK NOT DEFINED.**
15.9.1 Recommended traffic lane part (see S-4 – B-435.5) ..... ***Error! Bookmark not defined.***
15.10 TRAFFIC SEPARATION SCHEME LANE PART ..... **ERROR! BOOKMARK NOT DEFINED.**
15.10.1 Traffic separation scheme lanes (see S-4 – B-435.1) ..... ***Error! Bookmark not defined.***
15.11 TRAFFIC SEPARATION ZONE ..... **ERROR! BOOKMARK NOT DEFINED.**
15.11.1 Traffic separation zones (see S-4 – B-435.1 and B-436.3) ..... ***Error! Bookmark not defined.***
15.12 TRAFFIC SEPARATION SCHEME BOUNDARY ..... **ERROR! BOOKMARK NOT DEFINED.**
15.12.1 Traffic separation scheme boundaries (see S-4 – B-435.1) ..... ***Error! Bookmark not defined.***
15.13 PRECAUTIONARY AREA ..... **ERROR! BOOKMARK NOT DEFINED.**
15.13.1 Precautionary areas (see S-4 – B-435.2) ..... ***Error! Bookmark not defined.***
15.14 DEEP WATER ROUTE CENTRELINE ..... **ERROR! BOOKMARK NOT DEFINED.**
15.14.1 Deep Water routes centrelines (see S-4 – B-435.3) ..... ***Error! Bookmark not defined.***
15.15 DEEP WATER ROUTE PART ..... **ERROR! BOOKMARK NOT DEFINED.**
15.15.1 Deep Water route parts (see S-4 – B-435; B-435.3 and B-436.3) ..... ***Error! Bookmark not defined.***
15.16 TRAFFIC SEPARATION LINE ..... **ERROR! BOOKMARK NOT DEFINED.**
15.16.1 Traffic separation line (see S-4 – B-435.1 and B-436.3) ..... ***Error! Bookmark not defined.***
15.17 INSHORE TRAFFIC ZONE ..... **ERROR! BOOKMARK NOT DEFINED.**
15.17.1 Inshore traffic zones (see S-4 – B-435.1) ..... ***Error! Bookmark not defined.***
15.18 TRAFFIC SEPARATION SCHEME CROSSING ..... **ERROR! BOOKMARK NOT DEFINED.**
15.18.1 Traffic separation scheme crossing (see S-4 – B-435.1) ..... ***Error! Bookmark not defined.***
15.19 TRAFFIC SEPARATION SCHEME ROUNDABOUT ..... **ERROR! BOOKMARK NOT DEFINED.**
15.19.1 Traffic separation scheme roundabout (see S-4 – B-435.1) ..... ***Error! Bookmark not defined.***
15.20 ARCHIPELAGIC SEA LANE ..... **ERROR! BOOKMARK NOT DEFINED.**
15.20.1 Archipelagic Sea Lane (see S-4 – B-435.10) ..... ***Error! Bookmark not defined.***
15.21 ARCHIPELAGIC SEA LANE AXIS ..... **ERROR! BOOKMARK NOT DEFINED.**
15.21.1 Archipelagic Sea Lane Axis (see S-4 – B-435.10) ..... ***Error! Bookmark not defined.***
15.22 RADIO CALLING-IN POINT ..... **ERROR! BOOKMARK NOT DEFINED.**
15.22.1 Radio calling-in (reporting) points (see S-4 – B-488.1 and B-488.2) ..... ***Error! Bookmark not defined.***
15.23 FERRY ROUTE ..... **ERROR! BOOKMARK NOT DEFINED.**
15.23.1 Ferries (see S-4 – B-438) ..... ***Error! Bookmark not defined.***
15.24 RADAR LINE ..... **ERROR! BOOKMARK NOT DEFINED.**

15.24.1 Radar reference lines (see S-4 – B-487.2) ***Error! Bookmark not defined.***
15.25 RADAR RANGE ***ERROR! BOOKMARK NOT DEFINED.***
15.25.1 Radar ranges (see S-4 – B-487.1) ***Error! Bookmark not defined.***
15.26 RADAR STATION ***ERROR! BOOKMARK NOT DEFINED.***
15.26.1 Radar station (see S-4 – B-485.1 and B-487.3) ***Error! Bookmark not defined.***

16 AREAS, LIMITS ERROR! BOOKMARK NOT DEFINED.

16.1 INTERNATIONAL BOUNDARIES AND NATIONAL LIMITS (SEE S-4 – B-440) ***ERROR! BOOKMARK NOT DEFINED.***
16.2 MARITIME JURISDICTION AREAS ***ERROR! BOOKMARK NOT DEFINED.***
16.2.1 Maritime jurisdiction areas in dispute ***Error! Bookmark not defined.***
16.3 ANCHORAGE AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.3.1 Anchorages (see S-4 – B-431.1; B-431.3 and B-431.7) ***Error! Bookmark not defined.***
16.4 ANCHOR BERTH ***ERROR! BOOKMARK NOT DEFINED.***
16.4.1 Anchor berths (see S-4 – B-431.2) ***Error! Bookmark not defined.***
16.5 SEAPLANE LANDING AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.5.1 Seaplane landing areas (see S-4 – B-449.6) ***Error! Bookmark not defined.***
16.6 DUMPING GROUND ***ERROR! BOOKMARK NOT DEFINED.***
16.6.1 Dumping grounds (see S-4 – B-442; B-446 and B-446.1) ***Error! Bookmark not defined.***
16.6.2 Spoil grounds, dredging areas (see S-4 – B-446) ***Error! Bookmark not defined.***
16.7 MILITARY PRACTICE AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.7.1 Military practice areas (see S-4 – B-441.1-6) ***Error! Bookmark not defined.***
16.8 ADMINISTRATION AREA (NAMED) ***ERROR! BOOKMARK NOT DEFINED.***
16.8.1 International and national territories (see S-4 – B-440.1 and B-440.3). ***Error! Bookmark not defined.***
16.9 CARGO TRANSHIPMENT AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.9.1 Cargo transhipment areas (see S-4 – B-449.4) ***Error! Bookmark not defined.***
16.10 CAUTION AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.10.1 Caution areas (see S-4 – B-242) ***Error! Bookmark not defined.***
16.10.1.1 Collision regulations ***Error! Bookmark not defined.***
16.11 CONTIGUOUS ZONE ***ERROR! BOOKMARK NOT DEFINED.***
16.11.1 Contiguous Zones (see S-4 – B-440.6) ***Error! Bookmark not defined.***
16.12 CONTINENTAL SHELF AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.12.1 Continental Shelf (see S-4 – B-440.8) ***Error! Bookmark not defined.***
16.13 CUSTOM ZONE ***ERROR! BOOKMARK NOT DEFINED.***
16.13.1 Custom Zones (see S-4 – B-440.2) ***Error! Bookmark not defined.***
16.14 EXCLUSIVE ECONOMIC ZONE ***ERROR! BOOKMARK NOT DEFINED.***
16.14.1 Exclusive Economic Zones (see S-4 – B-440.9) ***Error! Bookmark not defined.***
16.15 FISHERY ZONE ***ERROR! BOOKMARK NOT DEFINED.***
16.15.1 Fishery zones (see S-4 – B-440.7) ***Error! Bookmark not defined.***
16.16 FISHING GROUND ***ERROR! BOOKMARK NOT DEFINED.***
16.16.1 Fishing grounds ***Error! Bookmark not defined.***
16.17 FREE PORT AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.17.1 Free port areas ***Error! Bookmark not defined.***
16.18 HARBOUR AREA (ADMINISTRATIVE) ***ERROR! BOOKMARK NOT DEFINED.***
16.18.1 Administrative harbour areas (see S-4 – B-430.1) ***Error! Bookmark not defined.***
16.19 INCINERATION AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.19.1 Incineration areas (see S-4 – B-449.3) ***Error! Bookmark not defined.***
16.20 LOG POND ***ERROR! BOOKMARK NOT DEFINED.***
16.20.1 Log ponds (see S-4 – B-449.2) ***Error! Bookmark not defined.***
16.21 OIL BARRIER ***ERROR! BOOKMARK NOT DEFINED.***
16.21.1 Oil barriers (see S-4 – B-449.2) ***Error! Bookmark not defined.***
16.22 STRAIGHT TERRITORIAL SEA BASELINE ***ERROR! BOOKMARK NOT DEFINED.***
16.22.1 Straight Territorial Sea Baselines (see S-4 – B-440.4) ***Error! Bookmark not defined.***
16.23 TERRITORIAL SEA AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.23.1 Territorial Seas (see S-4 – B-440.5) ***Error! Bookmark not defined.***
16.24 SUBMARINE TRANSIT LANE ***ERROR! BOOKMARK NOT DEFINED.***
16.24.1 Submarine transit lanes (see S-4 – B-441.5) ***Error! Bookmark not defined.***
16.25 RESTRICTED AREA ***ERROR! BOOKMARK NOT DEFINED.***
16.25.1 Restricted areas in general (see S-4 – B-431.4; B-435.7; B-435.11; B-437.1-7; B-439.2-4; B-445.9; B-448; B-448.1 and B-449.5) ***Error! Bookmark not defined.***
16.25.1.1 Minefields (see S-4 – B-441.8) ***Error! Bookmark not defined.***
16.25.1.2 Degaussing ranges (see S-4 – B-448) ***Error! Bookmark not defined.***
16.25.1.3 Nature reserves (see S-4 – B-437.3) ***Error! Bookmark not defined.***
16.25.1.4 Speed limits (see S-4 – B-430.2) ***Error! Bookmark not defined.***

16.25.1.5 Anchoring restricted (see S-4 – B-431.4) ..... **Error! Bookmark not defined.**
16.25.1.6 Areas to be avoided (see S-4 – B-435.7) ..... **Error! Bookmark not defined.**
16.25.1.7 Environmentally Sensitive Sea Areas (see S-4 – B-437) ..... **Error! Bookmark not defined.**
16.26 PILOTAGE DISTRICT ..... **ERROR! BOOKMARK NOT DEFINED.**
16.26.1 Pilotage districts (see S-4 – B-XXX) ..... ***Error! Bookmark not defined.***

17 AIDS TO NAVIGATION - OVERVIEW ..... ERROR! BOOKMARK NOT DEFINED.

17.1 GEO FEATURES FORMING PARTS OF NAVIGATIONAL AIDS ..... **ERROR! BOOKMARK NOT DEFINED.**
17.2 RELATIONSHIPS ..... **ERROR! BOOKMARK NOT DEFINED.**
17.3 BUOYAGE SYSTEMS AND DIRECTION OF BUOYAGE (SEE S-4 – B-461) ..... **ERROR! BOOKMARK NOT DEFINED.**
17.3.1 Buoyage systems and direction of buoyage (see S-4 – B-461) ..... ***Error! Bookmark not defined.***
17.3.1.1 Encoding IALA marks within IALA A or B ..... **Error! Bookmark not defined.**

18 LIGHTS ..... ERROR! BOOKMARK NOT DEFINED.

18.1 LIGHTS: GENERAL ..... **ERROR! BOOKMARK NOT DEFINED.**
18.1.1 Rhythms of lights (see S-4 – B-471.2) ..... ***Error! Bookmark not defined.***
18.1.2 Elevations of lights (see S-4 – B-471.6) ..... ***Error! Bookmark not defined.***
18.1.3 Colours of lights (see S-4 – B-471.6) ..... ***Error! Bookmark not defined.***
18.1.4 Times of exhibition and exhibition conditions (see S-4 – B-473) ..... ***Error! Bookmark not defined.***
18.1.4.1 Night lights ..... **Error! Bookmark not defined.**
18.1.4.2 Occasional lights (see S-4 – B-473.2) ..... **Error! Bookmark not defined.**
18.1.4.3 Daytime lights (see S-4 – B-473.4) ..... **Error! Bookmark not defined.**
18.1.4.4 Fog lights (see S-4 – B-473.5) ..... **Error! Bookmark not defined.**
18.1.5 Leading lights (see S-4 – B-475.6) ..... ***Error! Bookmark not defined.***
18.1.6 Lighthouses (see S-4 – B-457.3) ..... ***Error! Bookmark not defined.***
18.1.7 Various special types of lights ..... ***Error! Bookmark not defined.***
18.1.8 Light structures ..... ***Error! Bookmark not defined.***
18.2 LIGHT ALL AROUND/SINGLE SECTORED ..... **ERROR! BOOKMARK NOT DEFINED.**
18.2.1 All-around and single sectored lights (see S-4 – B-470) ..... ***Error! Bookmark not defined.***
18.2.1.1 Types and functions of lights (see S-4 – B-471.1) ..... **Error! Bookmark not defined.**
18.3 LIGHT MULTI-SECTORED ..... **ERROR! BOOKMARK NOT DEFINED.**
18.3.1 Multi-sectored lights (see S-4 – B-475) ..... ***Error! Bookmark not defined.***
18.3.1.1 Lights obscured by obstructions (see S-4 – B-475.3) ..... **Error! Bookmark not defined.**
18.3.1.2 Oscillating light sectors ..... **Error! Bookmark not defined.**
18.4 LIGHT DIRECTIONAL ..... **ERROR! BOOKMARK NOT DEFINED.**
18.4.1 Directional lights (see S-4 – B-470) ..... ***Error! Bookmark not defined.***
18.5 LIGHT FOG DETECTOR ..... **ERROR! BOOKMARK NOT DEFINED.**
18.5.1 Fog detector lights (see S-4 – B-470) ..... ***Error! Bookmark not defined.***
18.6 LIGHT AIR OBSTRUCTION ..... **ERROR! BOOKMARK NOT DEFINED.**
18.6.1 Air obstruction lights (see S-4 – B-470) ..... ***Error! Bookmark not defined.***

19 BUOYS, BEACONS ..... ERROR! BOOKMARK NOT DEFINED.

19.1 DAYMARK ..... **ERROR! BOOKMARK NOT DEFINED.**
19.1.1 Daymarks (see S-4 – B-455.9) ..... ***Error! Bookmark not defined.***
19.2 LATERAL BUOYS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.2.1 Lateral buoys (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.3 ISOLATED DANGER BUOYS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.3.1 Isolated danger buoys (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.4 LATERAL BEACONS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.4.1 Lateral Beacons (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.5 SPECIAL PURPOSE/GENERAL BEACONS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.5.1 Special purpose/general beacons (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.5.2 Signs and notice boards ..... ***Error! Bookmark not defined.***
19.6 SPECIAL PURPOSE/GENERAL BUOYS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.6.1 Special purpose/general buoys (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.7 SAFE WATER BUOYS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.7.1 Safe water buoys (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.8 CARDINAL BUOYS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.8.1 Cardinal buoys (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
~~19.9 TOPMARKS~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
~~*19.9.1 Topmarks (see S-4 – B-463 and B-467)*~~ ..... ***Error! Bookmark not defined.***
19.10 RETROREFLECTORS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.10.1 Retroreflectors (see S-4 – B-460.7) ..... ***Error! Bookmark not defined.***

19.11 CARDINAL BEACONS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.11.1 Cardinal beacons (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.12 SAFE WATER BEACONS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.12.1 Safe water beacons (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.13 ISOLATED DANGER BEACONS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.13.1 Isolated danger beacons (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.14 INSTALLATION BUOYS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.14.1 Installation buoys (see S-4 – B-445.4) ..... ***Error! Bookmark not defined.***
19.15 LIGHT FLOATS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.15.1 Lights floats (see S-4 – B-462.8) ..... ***Error! Bookmark not defined.***
19.16 EMERGENCY WRECK MARKING BUOYS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.16.1 Emergency wreck marking buoys (see S-4 – B-461.3 and B-467) ..... ***Error! Bookmark not defined.***
19.17 LIGHT VESSELS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.17.1 Lights vessels (see S-4 – B-474.1-3) ..... ***Error! Bookmark not defined.***
19.18 RADAR REFLECTORS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.18.1 Radar reflectors (see S-4 – B-455.8 and B-465) ..... ***Error! Bookmark not defined.***
19.19 FOG SIGNALS ..... **ERROR! BOOKMARK NOT DEFINED.**
19.19.1 Fog signals (see S-4 – B-451-454) ..... ***Error! Bookmark not defined.***

20 RADAR, RADIO ..... ERROR! BOOKMARK NOT DEFINED.

20.1 AUTOMATIC IDENTIFICATION SYSTEMS (AIS) (SEE S-4 – B-489) ..... **ERROR! BOOKMARK NOT DEFINED.**
20.1.1 AIS equipped aids to navigation (see S-4 – B-489.1) ..... ***Error! Bookmark not defined.***
20.2 RADIO STATION ..... **ERROR! BOOKMARK NOT DEFINED.**
20.2.1 Radio stations (see S-4 – B-480-484) ..... ***Error! Bookmark not defined.***
~~*20.2.2 Marine and aero-marine radiobeacons (see S-4 – B-481)*~~ ..... ***Error! Bookmark not defined.***
~~*20.2.3 Aeronautical radiobeacons (see S-4 – B-482)*~~ ..... ***Error! Bookmark not defined.***
20.2.4 Radio direction-finding stations (see S-4 – B-483) ..... ***Error! Bookmark not defined.***
~~*20.2.5 Coast radio stations providing QTG service (see S-4 – B-484)*~~ ..... ***Error! Bookmark not defined.***
20.3 RADAR TRANSPONDER BEACON ..... **ERROR! BOOKMARK NOT DEFINED.**
20.3.1 Radar beacons (see S-4 – B-486) ..... ***Error! Bookmark not defined.***

21 SERVICES ..... ERROR! BOOKMARK NOT DEFINED.

21.1 PILOT BOARDING PLACE ..... **ERROR! BOOKMARK NOT DEFINED.**
21.1.1 Pilot boarding places (see S-4 – B-491.1-2) ..... ***Error! Bookmark not defined.***
21.1.2 Pilot stations ashore (see S-4 – B-491.4) ..... ***Error! Bookmark not defined.***
21.2 VESSEL TRAFFIC SERVICE AREA ..... **ERROR! BOOKMARK NOT DEFINED.**
21.2.1 Vessel traffic service area ..... ***Error! Bookmark not defined.***
21.3 COASTGUARD STATION ..... **ERROR! BOOKMARK NOT DEFINED.**
21.3.1 Coastguard stations (see S-4 – B-492) ..... ***Error! Bookmark not defined.***
21.4 WARNING SIGNAL STATIONS ..... **ERROR! BOOKMARK NOT DEFINED.**
21.4.1 Warning signal stations (see S-4 – B-494; B-496-7) ..... ***Error! Bookmark not defined.***
21.5 TRAFFIC SIGNAL STATIONS ..... **ERROR! BOOKMARK NOT DEFINED.**
21.5.1 Traffic signal stations (see S-4 – B-494-5) ..... ***Error! Bookmark not defined.***
21.6 RESCUE STATION ..... **ERROR! BOOKMARK NOT DEFINED.**
21.6.1 Rescue station (see S-4 – B-490 and B-493) ..... ***Error! Bookmark not defined.***
21.7 HARBOUR FACILITY ..... **ERROR! BOOKMARK NOT DEFINED.**
21.7.1 Harbour facilities (see S-4 – B-320 and B-321.5) ..... ***Error! Bookmark not defined.***
21.8 SMALL CRAFT FACILITY ..... **ERROR! BOOKMARK NOT DEFINED.**
21.8.1 Small craft facilities (see S-4 – B-320.1-2) ..... ***Error! Bookmark not defined.***

22 FEATURE ATTRIBUTE AND ENUMERATE DESCRIPTIONS ..... ERROR! BOOKMARK NOT DEFINED.

22.1 BEACON SHAPE (BCNSHP) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.2 BUILDING SHAPE (BUISHP) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.3 BUOY SHAPE (BOYSHP) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.4 BURIED DEPTH (BURDEP) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.5 CALL SIGN (CALSGN) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.6 CATEGORY OF AIRPORT/AIRFIELD (CATAIR) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.7 CATEGORY OF ANCHORAGE (CATACH) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.8 CATEGORY OF BRIDGE (CATBRG) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.9 CATEGORY OF BUILT-UP AREA (CATBUA) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.10 CATEGORY OF CABLE (CATCBL) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.11 CATEGORY OF CANAL (CATCAN) ..... **ERROR! BOOKMARK NOT DEFINED.**

22.12 CATEGORY OF CARDINAL MARK (CATCAM) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.13 CATEGORY OF CHECKPOINT (CATCHP) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.14 CATEGORY OF COASTLINE (CATCOA) ..... **ERROR! BOOKMARK NOT DEFINED.**
~~22.15 CATEGORY OF CONTROL POINT (CATCTR)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
22.16 CATEGORY OF CONVEYOR (CATCON) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.17 CATEGORY OF CRANE (CATCRN) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.18 CATEGORY OF DAM (CATDAM) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.19 CATEGORY OF DISTANCE MARK (CATDIS) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.20 CATEGORY OF DOCK (CATDOC) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.21 CATEGORY OF DUMPING GROUND (CATDPG) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.22 CATEGORY OF FENCE/WALL (CATFNC) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.23 CATEGORY OF FERRY (CATFRY) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.24 CATEGORY OF FISHING FACILITY (CATFIF) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.25 CATEGORY OF FOG SIGNAL (CATSIG) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.26 CATEGORY OF FORTIFIED STRUCTURE (CATFOR) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.27 CATEGORY OF GATE (CATGAT) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.28 CATEGORY OF HARBOUR FACILITY (CATHAF) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.29 CATEGORY OF HULK (CATHLK) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.30 CATEGORY OF ICE (CATICE) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.31 CATEGORY OF INSTALLATION BUOY (CATINB) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.32 CATEGORY OF LAND REGION (CATLND) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.33 CATEGORY OF LANDMARK (CATLMK) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.34 CATEGORY OF LATERAL MARK (CATLAM) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.35 CATEGORY OF LIGHT (CATLIT) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.36 CATEGORY OF MARINE FARM/CULTURE (CATMFA) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.37 CATEGORY OF MILITARY PRACTICE AREA (CATMPA) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.38 CATEGORY OF MOORING/WARPING FACILITY (CATMOR) ..... **ERROR! BOOKMARK NOT DEFINED.**
~~22.39 CATEGORY OF NAME~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
22.40 CATEGORY OF NAVIGATION LINE (CATNAV) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.41 CATEGORY OF OBSTRUCTION (CATOBS) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.42 CATEGORY OF OFFSHORE PLATFORM (CATOFP) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.43 CATEGORY OF OIL BARRIER (CATOLB) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.44 CATEGORY OF PILE (CATPLE) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.45 CATEGORY OF PILOT BOARDING PLACE (CATPIL) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.46 CATEGORY OF PIPELINE/PIPE (CATPIP) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.47 CATEGORY OF PRODUCTION AREA (CATPRA) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.48 CATEGORY OF PYLON (CATPYL) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.50 CATEGORY OF RADAR TRANSPONDER BEACON (CATRTB) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.51 CATEGORY OF RADIO STATION (CATROS) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.53 CATEGORY OF RESCUE STATION (CATRSC) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.54 CATEGORY OF RESTRICTED AREA (CATREA) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.55 CATEGORY OF ROAD (CATROD) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.56 CATEGORY OF RUNWAY (CATRUN) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.57 CATEGORY OF SEA AREA (CATSEA) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.61 CATEGORY OF SILO/TANK (CATSIL) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.63 CATEGORY OF SMALL CRAFT FACILITY (CATSCF) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.64 CATEGORY OF SPAN ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.69 CATEGORY OF WATER TURBULENCE (CATWAT) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.70 CATEGORY OF WEED/KELP (CATWED) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.73 CLEARANCE VALUE VERTICAL (VERCLR) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.74 COLOUR (COLOUR) ..... **ERROR! BOOKMARK NOT DEFINED.**

22.75 COLOUR PATTERN (COLPAT) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.76 COMMUNICATION CHANNEL (COMCHA) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.77 CONDITION (CONDTN) ..... **ERROR! BOOKMARK NOT DEFINED.**
~~22.78 CURRENT VELOCITY (CURVEL)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.80 DATE START (DATSTA) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.83 DIRECTIONAL ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.89 EXHIBITION CONDITION OF LIGHT (EXCLIT) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.93 FILE REFERENCE (TXTDSC) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.95 FUNCTION (FUNCTN) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.99 HORIZONTAL CLEARANCE WIDTH ..... **ERROR! BOOKMARK NOT DEFINED.**
22.100 HORIZONTAL LENGTH (HORLEN) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.102 ICE FACTOR (ICEFAC) ..... **ERROR! BOOKMARK NOT DEFINED.**
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~~22.104 INFORMATION IN NATIONAL LANGUAGE (NINFOM)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.106 LANGUAGE ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.108 LIGHT CHARACTERISTIC (LITCHR) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.111 MAGNETIC ANOMALY VALUE MINIMUM ..... **ERROR! BOOKMARK NOT DEFINED.**
22.112 MAJOR LIGHT ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.116 MULTIPLICITY OF LIGHTS (MLTYLT) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.119 NATURE OF CONSTRUCTION (NATCON) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.120 NATURE OF SURFACE (NATSUR) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.121 NATURE OF SURFACE – QUALIFYING TERMS (NATQUA) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.122 ORIENTATION VALUE (ORIENT) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.134 RADIUS (RADIUS) ..... **ERROR! BOOKMARK NOT DEFINED.**
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~~22.136 RECORDING INDICATION (RECIND)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**

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22.138 REFERENCE TIDE ..... **ERROR! BOOKMARK NOT DEFINED.**
22.139 REFERENCE TIDE TYPE ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.149 SIGNAL GENERATION (SIGGEN) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.151 SIGNAL PERIOD (SIGPER) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.173 TIME RELATIVE TO TIDE ..... **ERROR! BOOKMARK NOT DEFINED.**
22.174 TIME START (TIMSTA) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.175 TOPMARK/DAYMARK SHAPE (TOPSHP) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.176 TRAFFIC FLOW (TRAFIC) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.177 VALUE OF ANNUAL CHANGE IN MAGNETIC VARIATION (VALACM) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.182 VALUE OF NOMINAL RANGE (VALNMR) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.183 VALUE OF SOUNDING (VALSOU) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.184 VELOCITY MAXIMUM (CURVEL) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.185 VELOCITY MINIMUM ..... **ERROR! BOOKMARK NOT DEFINED.**
~~22.186 VERTICAL CLEARANCE (VERCLR)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
~~22.187 VERTICAL CLEARANCE, CLOSED (VERCCL)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
~~22.188 VERTICAL CLEARANCE, OPEN (VERCOP)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
~~22.189 VERTICAL CLEARANCE, SAFE (VERCSA)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
22.190 VERTICAL DATUM (VERDAT) ..... **ERROR! BOOKMARK NOT DEFINED.**
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22.192 VISUALLY CONSPICUOUS (CONVIS) ..... **ERROR! BOOKMARK NOT DEFINED.**
22.193 WATER LEVEL EFFECT (WATLEV) ..... **ERROR! BOOKMARK NOT DEFINED.**
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23 META AND SPATIAL ATTRIBUTE AND ENUMERATE DESCRIPTIONS ..... ERROR! BOOKMARK NOT DEFINED.

~~23.1~~ ~~CATEGORY OF COVERAGE (CATCOV)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
23.2 CATEGORY OF TEMPORAL VARIATION ..... **ERROR! BOOKMARK NOT DEFINED.**
23.3 CATEGORY OF ZONE OF CONFIDENCE (CATZOC) ..... **ERROR! BOOKMARK NOT DEFINED.**
~~23.4~~ ~~COMPILATION SCALE OF DATA (CSCALE)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
23.5 FULL SEAFLOOR COVERAGE ACHIEVED ..... **ERROR! BOOKMARK NOT DEFINED.**
~~23.6~~ ~~HORIZONTAL DATUM (HORDAT)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
23.7 HORIZONTAL DISTANCE UNCERTAINTY (HORACC) ..... **ERROR! BOOKMARK NOT DEFINED.**
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23.9 LINE SPACING MAXIMUM (SDISMX) ..... **ERROR! BOOKMARK NOT DEFINED.**
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23.11 MAXIMUM DISPLAY SCALE (CSCALE) ..... **ERROR! BOOKMARK NOT DEFINED.**
23.12 MEASUREMENT DISTANCE MAXIMUM ..... **ERROR! BOOKMARK NOT DEFINED.**
23.13 MEASUREMENT DISTANCE MINIMUM ..... **ERROR! BOOKMARK NOT DEFINED.**
23.14 MINIMUM DISPLAY SCALE ..... **ERROR! BOOKMARK NOT DEFINED.**
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23.16 POSITIONAL UNCERTAINTY (POSACC) ..... **ERROR! BOOKMARK NOT DEFINED.**
23.17 QUALITY OF POSITION (QUAPOS) ..... **ERROR! BOOKMARK NOT DEFINED.**
23.18 SCALE VALUE MAXIMUM (SCVAL1) ..... **ERROR! BOOKMARK NOT DEFINED.**
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~~23.20~~ ~~SHIFT PARAMETERS (SHIPAM)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
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23.25 SOUNDING UNCERTAINTY (SOUACC) ..... **ERROR! BOOKMARK NOT DEFINED.**
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23.28 SURVEY AUTHORITY (SURATH) ..... **ERROR! BOOKMARK NOT DEFINED.**
~~23.29~~ ~~SURVEY DATE - END (SUREND)~~ ..... **ERROR! BOOKMARK NOT DEFINED.**
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23.31 SURVEY TYPE (SURTYP) ..... **ERROR! BOOKMARK NOT DEFINED.**
23.32 UPDATE DESCRIPTION ..... **ERROR! BOOKMARK NOT DEFINED.**
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23.34 VERTICAL UNCERTAINTY (VERACC) ..... **ERROR! BOOKMARK NOT DEFINED.**

24 COMPLEX ATTRIBUTES ..... ERROR! BOOKMARK NOT DEFINED.

24.1 CURRENT VELOCITY ..... **ERROR! BOOKMARK NOT DEFINED.**
24.2 FEATURE NAME ..... **ERROR! BOOKMARK NOT DEFINED.**
24.3 FEATURES DETECTED ..... **ERROR! BOOKMARK NOT DEFINED.**
24.4 FIXED DATE RANGE ..... **ERROR! BOOKMARK NOT DEFINED.**
24.5 HORIZONTAL CLEARANCE CLOSED ..... **ERROR! BOOKMARK NOT DEFINED.**
24.6 HORIZONTAL CLEARANCE FIXED ..... **ERROR! BOOKMARK NOT DEFINED.**
24.7 HORIZONTAL CLEARANCE OPEN ..... **ERROR! BOOKMARK NOT DEFINED.**
24.8 INFORMATION ..... **ERROR! BOOKMARK NOT DEFINED.**
24.9 LIGHT SECTOR ..... **ERROR! BOOKMARK NOT DEFINED.**
24.10 MEASURED DISTANCE VALUE ..... **ERROR! BOOKMARK NOT DEFINED.**
24.11 ORIENTATION ..... **ERROR! BOOKMARK NOT DEFINED.**
24.12 PERIODIC DATE RANGE ..... **ERROR! BOOKMARK NOT DEFINED.**
24.13 RADAR WAVE LENGTH ..... **ERROR! BOOKMARK NOT DEFINED.**
24.14 RHYTHM OF LIGHT ..... **ERROR! BOOKMARK NOT DEFINED.**
24.15 SIGNAL SEQUENCE ..... **ERROR! BOOKMARK NOT DEFINED.**
24.16 SURFACE QUALITY ..... **ERROR! BOOKMARK NOT DEFINED.**
24.17 SURVEY DATE RANGE ..... **ERROR! BOOKMARK NOT DEFINED.**
24.18 TEXTUAL DESCRIPTION ..... **ERROR! BOOKMARK NOT DEFINED.**
24.19 TIDAL STREAM PANEL VALUES ..... **ERROR! BOOKMARK NOT DEFINED.**
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24.24 VERTICAL CLEARANCE CLOSED ..... **ERROR! BOOKMARK NOT DEFINED.**
24.25 VERTICAL CLEARANCE FIXED ..... **ERROR! BOOKMARK NOT DEFINED.**
24.26 VERTICAL CLEARANCE OPEN ..... **ERROR! BOOKMARK NOT DEFINED.**

24.27 VERTICAL CLEARANCE SAFE ..... **ERROR! BOOKMARK NOT DEFINED.**

25 UPDATING (SEE S-4 – B-600) ..... ERROR! BOOKMARK NOT DEFINED.

25.1 ISSUING UPDATES IN ADVANCE ..... **ERROR! BOOKMARK NOT DEFINED.**
25.1.1 Advance notification of changes to traffic separation schemes ..... ***Error! Bookmark not defined.***
25.2 GUIDELINES FOR ENCODING TEMPORARY AND PRELIMINARY ENC UPDATES ... **ERROR! BOOKMARK NOT DEFINED.**
25.2.1 Introduction ..... ***Error! Bookmark not defined.***
25.2.2 Temporary (T) Notices to Mariners (see S-4 – B-633) ..... ***Error! Bookmark not defined.***
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Document Control

Version	Version Type	Date	Approved By	Signed Off By	Role
0.0.0	Editing Committee Draft	Xxx 2012	TSMAD		TSMAD Chair
0.0.1	Draft Document		TSMAD		TSMAD Chair
0.0.2					

1 Overview

1.1 Preface

The "Data Classification and Encoding Guide" has been developed to provide consistent, standardized instructions for encoding S-100 compliant ENC data. This document has been laid out, as far as possible, along the lines of the IHO publication S-4, Part B "Chart Specifications of the IHO – Medium and Large-Scale National and International (INT) Charts".

The purpose of the Data Classification and Encoding Guide is to facilitate S-101 encoding to meet IHO standards for the proper display of ENC in an ECDIS. The document describes how to encode information that the cartographer considers relevant to an ENC. The content of an ENC is at the discretion of the producing authority provided that the conventions described within this document are followed. A "producing authority" is a Hydrographic Office (HO) or an organization authorized by a government, HO or other relevant government institution to produce ENCs.

Comment [j1]: S-57 Appendix B.1 Annex A contains a statement about conformance with a particular version of the Product Specification. Is such a statement required, or is a new version of the PS going to be published as Appendix A is amended?

The entire S-100 Standard, including the S-101 Product Specification, is available at the following web site, http://www.iho.int.

1.2 S-101 Appendix A; Data Classification and Encoding Guide - Metadata

Note: This information uniquely identifies this Appendix to the Product Specification and provides information about its creation and maintenance.

Title: The International Hydrographic Organization Electronic Navigation Chart Product Specification, Appendix A – Data Classification and Encoding Guide

Version: 0.0.1

Date: January 2013

Language: English

Classification: Unclassified

Contact: International Hydrographic Bureau
4 Quai Antione 1er
B.P. 445
MC 98011 MONACO CEDEX
Telephone: +377 93 10 81 00
Fax: +377 93 10 81 40

URL: www.iho.int

Identifier: S-101 Appendix A

Maintenance: Changes to S-101 Annex B; Data Classification and Encoding Guide are coordinated by the IHO Transfer Standard Maintenance and Application Development Working Group (TSMAD) and must be made available via the IHO web site.

Comment [j2]: S-101 contains a reference to an unknown Annex here. Is this required for this document?

1.3 Terms, definitions and abbreviations

1.3.1 Terms and definitions

aggregation
special form of association that specifies a whole-part relationship between the aggregate (whole) and a component (see composition)

attribute
named property of an entity

NOTE: Describes the geometrical, topological, thematic, or other characteristic of an entity

curve
1-dimensional **geometric primitive**, representing the continuous image of a line

NOTE: A **boundary** of a **curve** is the **set** of **points** at either end of the **curve**. If the **curve** is a cycle, the two ends are identical, and the **curve** (if topologically closed) is considered to not have a boundary. The first **point** is

called the **start point**, and the last is the **end point**. Connectivity of the curve is guaranteed by the "continuous image of a line"

feature
Abstraction of real world phenomena

NOTE: A feature may occur as a type or an instance. The terms "feature type" or "feature instance" should be used when only one is meant

EXAMPLE: The feature instance named "Eiffel Tower" may be classified with other phenomena into a feature type "tower"

enumeration
A fixed list of valid identifiers of named literal values. Attributes of an enumerated type may only take values from this list (source: ISO 19136:XX, *Geographic information — Geography Markup Language (GML)*)

geometric primitive
geometric object representing a single, connected, homogeneous element of geometry

NOTE: Geometric primitives are non-decomposed objects that present information about geometric configuration. They include **points**, **curves**, surfaces and solids

maximum display scale
the larger value of the ratio of the linear dimensions of features of a dataset presented in the display and the actual dimensions of the features represented (largest scale) of the scale range of the dataset

minimum display scale
the smaller value of the ratio of the linear dimensions of features of a dataset presented in the display and the actual dimensions of the features represented (smallest scale) of the scale range of the dataset

point
0-dimensional geometric primitive, representing a position

NOTE: The **boundary** of a point is the empty set

1.3.2 Abbreviations

ENC	Electronic Navigational Chart
GNSS	Global Navigation Satellite System
IHO	International Hydrographic Organization
SENC	System Electronic Navigational Chart
TSMAD	Transfer Standard Maintenance and Application Development Working Group

Comment [j3]: Examples only. Complete list of abbreviations to be determined later on.

1.4 Use of language

Within this document:

"Must" indicates a mandatory requirement;

"Should" indicates and optional requirement, that is the recommended process to be followed, but is not mandatory;

"May" means "allowed to" or "could possibly", and is not mandatory.

1.5 Maintenance

Changes to the Data Classification and Encoding Guide must occur in accordance with the S-101 ENC Product Specification clause 1.5.1.

~~**1.5.1 Maintenance procedures**~~

~~Changes to the Data Classification and Encoding Guide are coordinated by Transfer Standard Maintenance and Application Development Working Group (TSMAD). Individuals that wish to make changes to the Data Classification and Encoding Guide must address their comments to the TSMAD.~~

~~There are three change proposal types to the Data Classification and Encoding Guide. They are:~~

(1) Clarification;

(2) Revision; and

(3) New Edition.

Any change proposal must be one of these types.

ALL proposed changes must be technically assessed before approval. All proposals must be submitted using S-101 Appendix A Maintenance – Change Proposal Form. See Annex A.

Approved changes must be issued and entered on the Document Control page of this document.

1.5.1.1 Clarification

Clarifications are defined as non-substantive changes to the Data Classification and Encoding Guide. Typically, clarifications: remove ambiguity; correct grammatical and spelling errors; amend or update cross references; and insert improved graphics. A clarification must not cause any substantive semantic change to the document.

1.5.1.2 Revision

Revisions are defined as substantive semantic changes to the Data Classification and Encoding Guide. Typically, revisions will change the document to correct factual errors; or introduce necessary changes to ENC encoding guidance that has become evident as a result of practical experience or changing circumstances. A revision must not also be classified as a clarification. Revisions could have an impact on either existing users or future users of the document. All cumulative clarifications must be included with the release of approved revisions.

In most cases a new Feature or Portrayal Catalogue will result in a revision of the Data Classification and Encoding Guide.

1.5.1.3 New Edition

New Editions are significant changes to the Data Classification and Encoding Guide. They can include additional information from the TSMAD or related committees that were not originally included in the Data Classification and Encoding Guide that may be needed for additional applications. A New Edition results in a new major version of the Data Classification and Encoding Guide. One New Edition may result in multiple related actions. All cumulative clarifications and revisions must be included with the release of an approved New Edition.

1.5.2 Version control

The TSMAD must release new versions of the Data Classification and Encoding Guide as necessary. New versions must include clarifications, revisions and New Editions. Each version must contain a change list that identifies the changes between versions of the Data Classification and Encoding Guide.

1.5.2.1 Clarification version control

Clarifications must be denoted as 0.0.x. Each clarification or set of clarifications approved at a single point in time must increment x by 1.

1.5.2.2 Revision version control

Corrections must be denoted as 0.x.0. Each correction or set of revisions approved at a single point in time must increment x by 1. Revision version control will set clarification version control to 0.

1.5.2.3 New Edition version control

New Editions must be denoted as x.0.0. Each New Edition approved at a single point in time must increment x by 1. New Edition version control will set the clarification and revision version control to 0.

2 General

~~The S-101 Data Classification and Encoding Guide is designed to permit the encoding and transfer of data describing the real world. The real word is far too complex for a complete description to be practical; therefore a simplified, highly specific, view of the real world must be used. This is achieved by modelling the reality.~~

The S-101 Data Classification and Encoding Guide describes how data describing the real world should be captured using the types defined in the S-101 Feature Catalogue (see S-101 XXXX). It provides the encoding rules and guidance required to create S-101 ENCs. This standard is specifically concerned with those entities in the real world that are of relevance to hydrography. This hydrographic regime is considered to be geo-spatial. As a result, the model defines real world entities as a combination of descriptive and spatial characteristics. Within the model these sets of characteristics are defined in terms of feature, spatial and information types. A type is defined as a stereotype of class that is used to specify a domain of instances (objects) together with the operations applicable to the objects. A type may have attributes and may be related to other types.

The types used within S-101 are described below. Within this document feature types, information types, associations and attributes appear in **bold** text.

2.1 Feature types

Feature types contain descriptive attributes and do not contain any geometry (i.e. information about the shape and position of a real world entity).

Features have two aspects – feature type and feature instance. A feature type is a class and is defined in a Feature Catalogue. A feature instance is a single occurrence of the feature type and represented as an object in a data set. A feature instance is located by a relationship to one or more spatial instances. A feature instance may exist without referencing a spatial instance.

S-101 makes use of the following feature types:

Geographic (Geo) feature type – carries the descriptive ~~and geometric~~ characteristics of a real world entity.

Aggregated feature type – are features that are made up of component features.

Cartographic Feature type – contains information about the cartographic representation (including text) of real world entities. No cartographic features are currently included in S-101.

Meta feature type – contains information about other features.

2.1.1 Multiple features and features shown out of position on paper charts

On some sources, multiple features in close proximity are generalised to a single feature with a text string indicating the presence of the other features. In such cases, where it is considered that this information may be useful for visual navigation, one feature of the appropriate class should be encoded and the true number of features should be encoded using the complex attribute **information**, sub-attribute **text** (e.g. *3 chimneys*) on this feature. If the true number of features is not known, the text "*more than one*" should be encoded using **information** (**text**).

Multiple submerged features in close proximity, which have been generalised to a single feature, should not have **information** populated unless the multiplicity has some significance to safe navigation. This is so as to minimise the presence of ECDIS "information" symbols, which may contribute to screen clutter (see clause X.X).

For the encoding of multiple, identical lights using the attribute **multiplicity of lights**, see table in clause X.X.

For the encoding of leading lights that are merged on the source document, see clause X.X.

On paper charts, features such as buoys may be displaced from their real world position in order to allow for the depiction of underlying hazards. Where ENCs are captured from paper charts this displacement may then be carried onto the ENC. As a result of the ability of ECDIS users to zoom in to inappropriate scales this can result in an ECDIS display which is not an accurate representation of reality. There is no method within ENC to indicate to the mariner that a feature has not been encoded in its true position, therefore it is considered important for features to be encoded in their true position to provide the mariner with an accurate representation of the real world.

Encoders are advised, therefore, that if it is required to encode a feature which has been displaced on the paper chart for cartographic reasons, it should be captured in its real-world position on the ENC.

Comment [A4]: (EM) - To be revisited once SI/SD get added. In case of an SI overlay, the need to generalize can be done by adding SCAMIN/SCAMAX. JW: The issue is not a generalization issue. The issue is that there is no indication on the source of the position of all the real-world features.

Comment [A5]: (EM) - Should features out of place be included here? If not, this must be covered elsewhere in the document.

2.2 Spatial primitives

The allowable spatial primitive for each feature type is defined in the Feature Catalogue. Within this document, allowable primitives are included in the tables containing a description of each feature type. Allowable spatial primitives are point, curve and surface.

Each spatial value must be referenced by a feature instance.

Within this document, allowable primitives are included in the description of each feature type. For easy reference, Table 2.1 below summarises the allowable geometric primitives for each feature type. In the Table, abbreviations are as follows: point (P), curve (C) and surface (S). A feature having no allowable spatial primitive is annotated as none (N).

Comment [A6]: This is not a section in the Product Specification – should it be? This section needs to be expanded. Sub-WG2 decision was to retain this table (agreed at TSMAD24).

Administration Area			S	
Anchorage Area	P		S	
Beacon Cardinal	P			
Beacon Safe Water	P			
Bridge	P	C	S	
Buoy Cardinal	P			
Buoy Lateral	P			
Cable Area			S	
Canal		C	S	
Caution Area	P		S	
Coastline		C		
Control Point	P			
Current – Non-gravitational	P		S	
Daymark	P			
Depth Area		~~C~~	S	
Dock Area			S	
Dumping Ground	P		S	
Fairway			S	
Fishery Zone			S	
Floating Dock	~~P~~	C	S	
Foul Ground	P	~~C~~	S	
Gridiron	P		S	
Hulk	P		S	
Inshore Traffic Zone			S	
Land Elevation	P	C		
Light Air Obstruction	P			
Light Float	P			
Light Vessel	P			
Log Pond	P		S	
Military Practice Area	P		S	
Obstruction	P	C	S	
Oil Barrier		C		
Pingo	P		S	
Pipeline Overhead		C		
Precautionary Area	P		S	
Radar Line		C		
Radar Station	P			
Radio Station	P			
Recommended Route Centreline		C		
Rescue Station	P			
River		C	S	
Sandwave	P	C	S	
Seaplane Landing Area	P		S	
Signal Station Warning	P			
Sloping Ground	P		S	
Span		C	S	
Submarine Transit Lane			S	
Tide Stream – Flood/Ebb	P		S	

Airport/Airfield	P		S	
Archipelagic Sea Lane			S	
Beacon Isolated Danger	P			
Beacon Special Purpose	P			
Building	P		S	
Buoy Installation	P			
Buoy Safe Water	P			
Cable Overhead	P	C	S	
Cargo Transhipment Area	P		S	
Checkpoint	P		S	
Contiguous Zone			S	
Conveyor		C	S	
Custom Zone			S	
Deep Water Route Centreline		C		
Depth Contour		C		
Dredged Area			S	
Dyke		C	S	
Fence/Wall		C		
Fishing Facility	P	C	S	
Fog Signal	P			
Free Port Area			S	
Harbour Area (Administrative)			S	
Ice Area			S	
Lake			S	
Land Region	P		S	
Light All Around/Single Sectored	P			
Light Fog Detector	P			
Local Magnetic Anomaly	P	C	S	
Magnetic Variation	P	C	S	
Mooring/Warping Facility	P	C	S	
Offshore Platform	P		S	
Pile	P	C		
Pilotage District			S	
Pipeline Submarine/On Land		C		
Production/Storage Area	P		S	
Radar Range			S	
Radar Transponder Beacon	P			
Railway		C		
Recommended Track		C		
Restricted Area			S	
Road	~~P~~	C	S	
Sea Area/Named Water	P		S	
Shoreline Construction	P	C	S	
Silo/Tank	P		S	
Small Craft Facility	P		S	
Spring	P			
Swept Area			S	
Tide Stream – Harmonic Prediction	P		S	

Anchor Berth	P		S	
Archipelagic Sea Lane Axis		C		
Beacon Lateral	P			
Berth	P	C	S	
Built-up Area	P		S	
Buoy Isolated Danger	P			
Buoy Special Purpose	P			
Cable Submarine		C		
Causeway		C	S	
Coastguard Station	P			
Continental Shelf Area			S	
Crane	P		S	
Dam	P	C	S	
Deep Water Route Part			S	
Distance Mark	P			
Dry Dock			S	
Exclusive Economic Zone			S	
Ferry Route		C	S	
Fishing Ground			S	
Fortified Structure	P	C	S	
Gate	P	C	S	
Harbour Facility	P		S	
~~Incineration Area~~	P		S	
Land Area	P	C	S	
Landmark	P	C	S	
Light Directional	P			
Light Multi-sectored	P			
Lock Basin			S	
Marine Farm/Culture	P	C	S	
Navigation Line		C		
Offshore Production Area			S	
Pilot Boarding Place	P		S	
Pipeline Area	P		S	
Pontoon	~~P~~	C	S	
Pylon/Bridge Support	P		S	
Radar Reflector	P			
Radio Calling-in Point	P	C		
Rapids	P	C	S	
Recommended Traffic Lane Part	P		S	
Retroreflector	P			
Runway	P	C	S	
Seabed Area	P	C	S	
Signal Station Traffic	P			
Slope Topline		C		
Sounding	P			
Straight Territorial Sea Baseline		C		
Territorial Sea Area			S	
Tide Stream – Non-harmonic Prediction	P		S	

Comment [A7]: Extension 6/01

Comment [A8]: Extension 6/01

Tide Stream Panel Data	P		S	
Tide – Non-Harmonic Prediction	P		S	
~~Topmark~~	P			
Traffic Separation Scheme Crossing			S	
Traffic Separation Zone			S	
Underwater/Awash Rock	P			
Water Turbulence	P	C	S	
Weed/Kelp	P		S	
~~Compilation Scale of Data~~			S	
Nautical Publication Information	P		S	
Quality of Survey		C	S	
Update Information	P	C	S	

Tide Stream – Time Series	P		S	
Tide – Time Series	P		S	
Traffic Separation Line		C		
Traffic Separation Scheme Lane Part			S	
Tunnel	P	C	S	
Unsurveyed Area			S	
Waterfall	P	C		
Wreck	P		S	
Data Coverage			S	
Navigational System of Marks			S	
Sounding Datum			S	
Aggregation				N

Tide – Harmonic Prediction	P		S	
Tideway		C	S	
Traffic Separation Scheme Boundary		C		
Traffic Separation Scheme Roundabout			S	
Two-way Route Part			S	
Vegetation	P		S	
Vessel Traffic Service Area			S	
Quality of Non-Bathymetric Data			S	
Horizontal Datum Shift Parameters			S	
Quality of Bathymetric Data			S	
Vertical Datum of Data			S	
Association				N

Table 2.1 Features permitted for ENC and their geometric primitives

2.2.1 Capture density guideline

It is recommended that curves and surface boundaries should not be encoded at a point density greater than 0.3mm at the maximum display scale for the ENC data.

[Note: Compilation scale is the scale the data is captured to, and is not stored in the dataset. Only minimum and maximum scales are stored in the dataset.]

A curve consists of one or more curve segments. Each curve is defined as a loxodromic line on WGS84. Long lines may need to have additional coordinates inserted to cater for the effects of projection change.

Comment [A9]: (EM) - Subject to confirmation for data producers. May need to be covered in portrayal.

The presentation of line styles may be affected by line length. Therefore, the encoder must be aware that splitting a curve into numerous small curves may result in poor symbolization.

[consider diagram]

Comment [EM10]: Angel to do.

2.3 Information types

An information type is an identifiable object that can be associated with features in order to carry information particular to the associated features. An example of an information type might be a note about overhead cables. Information types can also be associated with other information types. This can be done where there is further supplementary information that is relevant to the information type.

Comment [A11]: (EM) - Not supported in S-100 v1.0.0, but support is planned for S-100 v2.0.0.

Information types carry attributes but not geometry.

[verify if information types associated with other information types is possible in S-101]

2.4 Attributes

Attributes may be simple type or complex type. Complex (C) attributes are aggregates of other attributes that can be simple type or complex type. Simple attribute types consist of Text (TE), Date (DA), Time (TI), DateTime (DT), Enumeration (EN), Boolean (BO), Integer (IN) and Real (RE) (see clause X.X).

The binding of attributes to feature types, the binding of attributes to attributes to construct complex attributes, and attribute multiplicity is defined in the Feature Catalogue. Within this document, the allowable attributes is included in the description of each feature type, as well as the allowable values for enumeration type attributes.

Real or integer attribute values must not be padded by non-significant zeroes. For example, for a signal period of 2.5 seconds, the value populated for the attribute **signal period** must be 2.5 and not 02.50.

2.4.1 Multiplicity

In order to control the number of allowed attribute values or sub attribute instances within a complex attribute, S-100 uses the concept of multiplicity. This defines lower and upper limits for the number of values, whether the order of the instances has meaning and if an attribute is mandatory or not. Common examples are shown in the table below:

Format : MinOccurs, MaxOccurs (if * Infinite) ordered – sequential

Multiplicity	Explanation
0,1	An instance is not required; there can be only one instance.

1,1	An instance is required and there must only be one instance.
0,*	An instance is not required and there can be an infinite number of instances.
1,*	An instance is required and there can be an infinite number of instances.
1,* ordered	An instance is required and there can be an infinite number of instances, the order of which has a specific meaning.
2,2	Two instances are required and no more than two.

Note: The function of the S-57 attribute type List has been replaced by Enumeration (EN) with an upper limit of multiplicity greater than 1. This means that when more than one value is needed for an enumerated attribute, the attribute code is populated multiple times with the required values.

Example: A red and white tower is encoded with attribute **colour** = *3* (red) and **colour** = *1* (white).

2.4.2 Simple attribute types

Each simple attribute is assigned to one of 8 types:

EN Enumeration: A fixed list of valid identifiers of named literal values. Attributes of an enumerated type may only take values from this list.

BO Boolean: A value representing binary logic. The value can be either *True* or *False*. The default state for Boolean type attributes (i.e. where the attribute is not populated for the feature) is *False*.

RE Real: A signed Real (floating point) number consisting of a mantissa and an exponent. The representation of a real is encapsulation and usage dependent.

Examples: 23.501, -0.0001234, -23.0, 3.141296

IN Integer: A signed integer number. The representation of an integer is encapsulation and usage dependent.

Examples: 29, -65547

TE Free text: A CharacterString, that is an arbitrary-length sequence of characters including accents and special characters from a repertoire of one of the adopted character sets.

DA Date: A date provides values for year, month and day according to the Gregorian Calendar. Character encoding of a date is a string which must follow the calendar date format (complete representation, basic format) for date specified by ISO 8601:1988. See clause X.X.

Example: 19980918 (YYYYMMDD)

TI Time: A time is given by an hour, minute and second. Character encoding of a time is a string that follows the local time (complete representation, basic format) format defined in ISO 8601:1988.

Time zone according to UTC is optional.

Example: 183059 or 183059+0100 or 183059Z

The complete representation of the time of 27 minutes and 46 seconds past 15 hours locally in Geneva (in winter one hour ahead of UTC), and in New York (in winter five hours behind UTC), together with the indication of the difference between the time scale of local time and UTC, are used as examples.

Geneva: 1527460100

New York: 1527460500

DT Date and Time: A DateTime is a combination of a date and a time type. Character encoding of a DateTime shall follow ISO 8601:1988 (see DA and TI above and clause X.X).

Example: 19850412T101530

2.4.3 Mandatory and conditional attributes

Some attributes are mandatory and must be populated for a given feature type. There are some reasons why attribute values may be considered mandatory:

- They are required to support correct portrayal;
- Certain features make no logical sense without specific attributes;
- Some attributes are required for safety of navigation.

Where a value of a mandatory attribute is not known, the attribute should be populated with an empty (null) value.

Where the value of a non-mandatory attribute is not known, the attribute should not be populated (i.e. not included in the dataset).

Within this document, mandatory attributes (multiplicity 1,1; 1,n (n>1); or 1,*) are identified in the description of each feature type. For easy reference, Table 2.2 below summarises the mandatory attributes for each feature type:

Comment [j12]: Agreed at Sub-WG2 to retain the table for easy reference for cartographers. Ratified at TSMAD24.

Feature	Attributes
Administration Area (Named)	**jurisdiction**
Archipelagic Sea Lane	**nationality**
Archipelagic Sea Lane Axis	**nationality**
Beacon Cardinal	**beacon shape** **category of cardinal mark** **colour**
Beacon Isolated Danger	**beacon shape** **colour**
Beacon Lateral	**beacon shape** **category of lateral mark** **colour**
Beacon Safe Water	**beacon shape** **colour**
Beacon Special Purpose/General	**beacon shape** **category of special purpose mark** **colour**
Berth	**feature name**
Bridge	over navigable water: **category of bridge** other cases: none
Buoy Cardinal	**buoy shape** **category of cardinal mark** **colour**
Buoy Installation	**buoy shape** **colour**
Buoy Isolated Danger	**buoy shape** **colour**
Buoy Lateral	**buoy shape** **category of lateral mark** **colour**
Buoy Safe Water	**buoy shape** **colour**
Buoy Special Purpose/General	**buoy shape** **category of special purpose mark** **colour**
Cable Overhead	over navigable water, one of: **vertical clearance fixed** or **vertical clearance safe** other cases: none
Caution Area	at least one of: **information** **textual description**
Contiguous Zone	**nationality**
Continental Shelf Area	**nationality**
Conveyor	over navigable water: **vertical clearance fixed** other cases: none
Current – Non-gravitational	**current velocity** **orientation**
Customs Zone	**nationality**
Daymark	**colour** **topmark shape**
Deep Water Route Centreline	**category of recommended track** **orientation** **traffic**
Deep Water Route Part	**depth range minimum value** **orientation** **traffic**
Depth Area	**depth range maximum value** **depth range minimum value**
Depth Contour	**value of depth contour**
Dredged Area	**depth range minimum value**
Exclusive Economic Zone	**nationality**
Ferry Route	**category of ferry**
Fishery Zone	**nationality**
Fog Signal	**category of fog signal**
Gate	if navigable at maximum display scale for the data: **clearance horizontal**
Harbour Facility	**category of harbour facility**
Ice Area	**category of ice**

Feature	Attributes
Land Elevation	**elevation**
Land Region	at least one of: **category of land region** **feature name**
Landmark	**category of landmark** **visually conspicuous**
Light All Around/Single Sectored	**category of light** **colour** **rhythm of light**
Light Directional	**colour** **orientation** **rhythm of light**
Light Multi-sectored	**light sector** **rhythm of light**
Light Float	**colour**
Light Vessel	**colour**
Local Magnetic Anomaly	**value of local magnetic anomaly**
Magnetic Variation	**reference year for magnetic variation** **value of annual change in magnetic variation** **value of magnetic variation**
Marine Farm/Culture	**water level effect** at least one of: **value of sounding** **height**
Mooring Facility	**category of mooring facility**
Navigation Line	**category of navigation line** **orientation**
Obstruction	**water level effect** at least one of: **value of sounding** **height**
Pilotage District	at least one of: **information** **textual description**
Pipeline Overhead	over navigable water: **vertical clearance fixed** other cases: none
Precautionary Area	at least one of: **information** **textual description**
Production Area	**category of production area**
Pylon/Bridge Support	**category of pylon**
Radio Calling-in Point	**orientation** (point features only) **traffic**
Radar Line	**orientation**
Radar Transponder Beacon	**category of radar transponder beacon**
Recommended Route Centreline	**category of recommended track**
Recommended Track	**category of recommended track** **orientation** **traffic**
Recommended Traffic Lane Part	**orientation**
Restricted Area	at least one of: **category of restricted area** **restriction**
Sea Area/Named Water Area	at least one of: **category of sea area** **feature name**
Seabed Area	**surface quality**
Signal Station Traffic	**category of signal station traffic**
Signal Station Warning	**category of signal station warning**
Small Craft Facility	**category of small craft facility**
Span	at least one of: **vertical clearance closed** **vertical clearance fixed** **vertical clearance open**
Straight Territorial Sea Baseline	**nationality**
Swept Area	**depth range minimum value**
Territorial Sea Area	**nationality**
Tidal Stream – Harmonic Prediction	**tide – method of tidal prediction** **tide – value of harmonic constituents**
Tidal Stream – Non-harmonic Prediction	**tide – method of tidal prediction** **tide – time and height differences**
Tidal Stream – Time Series	**time range** **tidal stream, current – tide series values** **tide, current – time interval of values**
Tide – Harmonic Prediction	**tide – method of tidal prediction** **tide – value of harmonic constituents**

Comment [A13]: MD8 – 2.Co.8

Feature	Attributes
Tide – Non-harmonic Prediction	**tide – method of tidal prediction** **tide – time and height differences**
Tide – Time Series	**time range** **tide – high and low water values**
Tide Stream – Flood/Ebb	**category of tidal stream** **current velocity** **orientation**
Tide Stream Panel Data	**tidal stream –** **reference station data** **tidal stream values**
~~**Topmark**~~	~~**topmark shape**~~
Traffic Separation Scheme Lane Part	**orientation** (except when the lane part is a junction)
Two-way Route Part	**orientation** **traffic**
Underwater Rock	**value of sounding** **water level effect**
Vegetation	**category of vegetation**
Water Turbulence	**category of water turbulence**
Wreck	**water level effect** at least one of: **category of wreck** **value of sounding**
~~**Compilation scale of data**~~	~~**compilation scale**~~
Data Coverage	**category of coverage**
Horizontal Datum Shift Parameters	**horizontal datum** **shift parameters**
Navigational System of Marks	one of: **marks navigational – system of** or **orientation**
Quality of Bathymetric Data	**category of temporal variation** **features detected** **full seafloor coverage** **survey date range**
Quality of Non-bathymetric Data	**positional uncertainty**
Quality of Survey	**features detected** **full seafloor coverage** **survey authority** **survey data range** **survey type**
Sounding Datum	**vertical datum**
Update Information	**update description**
Vertical Datum	**vertical datum**

Table 2.2 Mandatory attributes

Comment [A14]: MD8 – 1.Co.23 and 1.Cl.30

NOTE 1: In the Tables below describing each feature and its attributes, mandatory attributes are described with a multiplicity of "1,1'" "1,n" (n>1); or "1,*". Note that sub-attributes of complex attributes, as well as the complex attribute itself, may also be designated as mandatory. "Conditional" mandatory attributes are not identified in the Tables below other than by comments in the Remarks for the relevant feature, but are indicated in Table 2.2 above by the following additional text:

over navigable water	for **Bridge**, **Cable Overhead**, **Conveyor**, **Pipeline Overhead**
at least one of	for **Caution Area**, **Land Region**, **Marine Farm/Culture**, **Obstruction**, **Pilotage District** **Restricted Area**, **Seabed Area**, **Sea Area/Named Water Area**, **Span** **Wreck**
if navigable at….	for **Gate**
if it is…..	for **Light**
except when…..	for **Traffic Separation Scheme Lane Part**
one of ... or ...	for **Navigational System of Marks**
(point features only)	for **Radio Calling-in Point**

Compilers must consider these conditional circumstances when encoding features for ENC, as well as any additional information given in the feature class descriptions in this document. For example, when encoding a **Restricted Area**, the mandatory attributes are *at least one of* **category of restricted area** or **restriction** – if **restriction** is known but **category of restricted area** is not known, then **category of restricted area** must not be populated with an empty (null) value, as it is not mandatory in this case.

NOTE 2: The attribute **colour pattern** is mandatory for any feature (except **Light**) that has more than one value populated for the attribute **colour**.

Comment [j15]: AU S-57 Encoding Guide

2.4.4 Missing attribute values

Where a value of a mandatory attribute is not known, the attribute should be populated with an empty (null) value.

Where the value of a non-mandatory attribute is not known, the attribute should not be included in the dataset.

In a base dataset (EN application profile), when an attribute code is present but the attribute value is missing, it means that the producer wishes to indicate that this attribute value is unknown.

In an Update dataset (ER application profile), when an attribute code is present but the attribute value is missing it means:

- that the value of this attribute is to be replaced by an empty (null) value if it was present in the original dataset, or
- that an empty (null) value is to be inserted if the attribute was not present in the original dataset.

2.4.5 Textual information

The complex attributes **information** and **textual description** must not be used when it is possible to encode the information by means of any other attribute. Under certain ECDIS display settings the "information" symbol will display when these attributes are populated. Therefore producers should carefully consider use of these attributes as the symbol may contribute significantly to ECDIS screen clutter.

Information contains information as text using the sub-attribute **text**, whereas **textual description** encodes the name of an external file using the sub-attribute **file reference**.

Character strings contained in **information** sub-attribute **text** must be UTF-8 character encoding. **Information** should generally be used for short notes or to transfer information which cannot be encoded by other attributes, or to give more detailed information about a feature. Text populated in **text** must not exceed 300 characters.

The files referenced by **textual description** sub-attribute **file reference** must be.TXT, .HTM or .XML files, and may contain formatted text. These files should generally be used for longer texts (e.g. longer chart notes, tables or paragraphs from nautical publications), but should not be used to replicate large blocks of text (e.g. entire chapters of Sailing Directions) that can be found in other Nautical Publications, which may not be suitable for viewing in ECDIS. It is up to the Producing Authority to determine the most suitable means of encoding a particular piece of text. Files must only use UTF-8 character encoding.

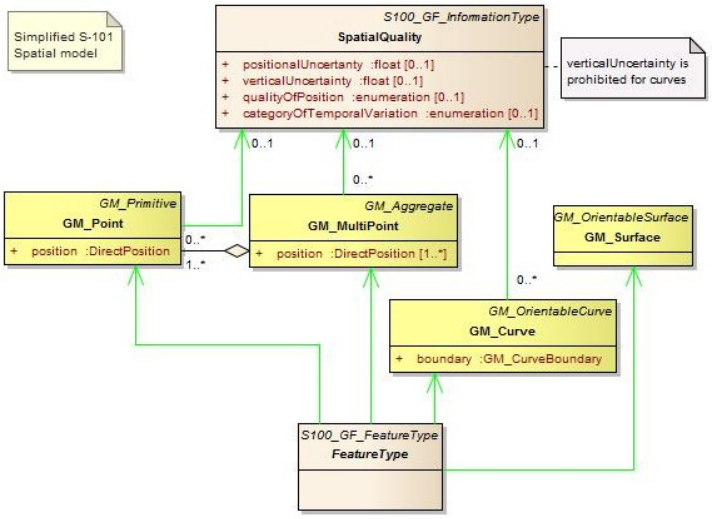
The exchange language for textual information should be English. The sub attribute **language** must be populated with an appropriate value to indicate the language used. Languages other than English may be used as a supplementary option. Generally this means, when a national language is used in the textual attributes, the English translation must also exist.

Remarks:

- Clause X.X of the S-101 Product Specification specifies the content of an ENC exchange set, including the option to include text files.
- In some cases, for external files referenced by the attribute **textual description** with sub-attribute **language** populated as a language other than English, encoders have created text files using local character encoding that may not be interpreted correctly by an ECDIS and therefore not readable by the user. Encoders must encode national text files (files referenced by the sub-attribute **file reference**) using UTF-8 character encoding. This means that the encoding of the characters in text files must match the encoding of other textual national attributes (i.e. **feature name**, **information** with value other than English populated for sub-attribute **language**) within the data set.
- For details on names, see clause X.X.

2.4.6 Spatial attribute types

Spatial attribute types must contain a referenced geometry and may be associated with spatial quality attributes. Each spatial attribute instance must be referenced by a feature instance or another spatial attribute instance.



Spatial quality attributes are carried in an information class called **Spatial quality**. Only points, multipoints and curves can be associated with Spatial quality. Currently no use case for associating surfaces with spatial quality attributes is known, therefore this is prohibited. Vertical uncertainty is prohibited for curves as this dimension is not supported by curves.

2.4.7 Dates

Comment [j16]: May be completely revised as a result of new date proposals.

When encoding dates using the attributes ~~compilation date,~~ **dredged date**, **fixed date range**, **periodic date range**, **reported date**, ~~source date~~ **survey date range** and **swept date**, and no specific year, month or day is required, the following values must apply in conformance to ISO 8601:1988.

- No specific year required, same day each year: --MMDD
- No specific year required, same month each year: --MM
- No specific day required: CCYYMM
- No specific month required: CCYY

Notes: CCYY = calendar year; MM = month; DD = day.
In the first two values, the dashes (--) must be included.

2.4.7.1 Seasonal features

If it is required to show seasonality of features, it must be done using the attribute **Status** = *5* (periodic/intermittent). If it is required to encode the start and/or end dates of the season, this must be done using the complex attribute **periodic date range**.

2.4.8 Times

If it is required to show the beginning and end of the active period of a feature, it must be encoded using the complex attribute **time range**, sub-attributes **time end** and **time start**. When using these sub-attributes, all times must be encoded as Coordinated Universal Time (UTC). The attribute definition for **time end** and **time start** (see clause X.X) states that the mandatory format is CCYYMMDDThhmmss, where T is the separator, and this format must be used.

2.4.9 Colours and colour patterns

If it is required to encode multiple colours on a feature, they must be encoded using the attributes **colour pattern** and **colour** as follows:

- For horizontal stripes (**colour pattern** = *1*), the first colour in the list must be the top-most, and subsequent colours follow sequentially from top to bottom. For example, **colour** = *3,1* to encode a red stripe above a white stripe.

- For vertical stripes (**colour pattern** = *2*), the first colour in the list must be the left-most, and subsequent colours follow sequentially from left to right. For example, **colour** = *3,1,3* to encode red, white, red vertical stripes
- For diagonal stripes (**colour pattern** = *3*), the first colour in the list must be the top-left-most, and subsequent colours follow sequentially from top left to bottom right. For example, **colour** = *1,3,1,3,1* to encode white, red, white, red, white diagonal stripes.
- For squares (**colour pattern** = *4*), the first colour in the list must be the top-left-most square. Subsequent colours follow sequentially from left to right along the top row then repeated for subsequent rows until the bottom right-most square is reached. For example, **colour** = *1,3,3,1* to encode white, red squares on the top row and red, white squares on the bottom row.
- For border stripes (**colour pattern** = *6*), the first colour in the list must be the border stripe, the second colour must be that of the background. For example, **colour** = *3,1* to encode a red border stripe on a white background. Where a border stripe is combined with other patterns, the border stripe colour must be the first colour in the list, and subsequent colours must be interpreted in accordance with the rules defined for the additional patterns. Therefore, if a pattern contains a border stripe as well as other patterns, the border stripe must be the first value in the list of **colour pattern**.

Note that the attribute **colour pattern** is mandatory for any feature (except **Light**) that has more than one colour.

2.4.10 Radar conspicuous features (see S-4 – B-485.2)

The attribute **radar conspicuous** is used to encode whether or not a feature is radar conspicuous.

Remarks:
- If it is required to encode a feature which has no radar reflector, but is radar conspicuous, it must be indicated using attribute **radar conspicuous**.
- If it is required to encode a surface or point feature which is radar conspicuous because it is fitted with a radar reflector, it must be indicated using **radar conspicuous** on the feature.
- If it is required to encode radar reflectors on curve features (e.g. overhead cables), this must be done using the feature **Radar Reflector** (see clause X.X).

~~2.4.11 Spatial attributes~~

~~Some attributes qualify the location of a feature, as opposed to defining the characteristics of the individual feature itself.~~

~~Attributes specifying the accuracy and quality of a position (x,y - coordinates) are considered to be attributes of spatial types.~~

~~Within an S-101 compliant dataset, the attributes of spatial types are held in the **Spatial Quality** information type.~~

2.5 Datasets

A Dataset is a grouping of features, attributes, geometry and metadata which comprises a specific coverage.

Three types of ENC dataset may be produced and contained within an exchange set:

- Update: Changing some information in an existing dataset.
- Re-issue of a dataset: Including all the updates applied to the original dataset up to the date of the reissue. A Re-issue does not contain any new information additional to that previously issued by Uupdates.
- New dataset and New Edition of a dataset: Including new information which has not been previously distributed by Updates. Each New Edition of a dataset must have the same name as the dataset that it replaces. A New Edition can also be ENC data has previously been produced for this area and at the same maximum display scale.

Comment [AHO17]: What is this sentence trying to say?

2.5.1 ENC data coverage

An ENC dataset can contain more than one **Data Coverage** (see clause X.X). The data boundary is defined by the extent of the **Data Coverage** meta features. Data must only be present within **Data Coverage** meta features.

Producing Authorities should not leave “holes” (i.e. areas not covered with data) in smaller scale range coverage, under the assumption that the ECDIS user will have the larger scale data available.

When a feature extends across datasets of overlapping scale ranges, its geometry must be split at the boundaries of the **Data Coverage** features and its complete attribute description must be repeated in each dataset.

An ENC Update data set must not change the limit of data coverage for the base ENC cell. Where the limit of data coverage for a base ENC cell is to be changed, this should be done by issuing a New Edition of the cell.

2.5.2 Discovery metadata

Comment [AHO18]: Needs words.

2.5.3 Minimal depiction areas

Where minimal depiction areas exist in a specified ENC maximum display scale, they should be encoded using one of the following options:

2.5.3.1 Wide blank areas

Areas of a dataset which contain no data must be excluded from the area(s) covered by the meta feature **Data Coverage**. The areas that contain data must be completely covered by **Data Coverage** features.

Producing Authorities should not leave "holes" in **Data Coverage** features in smaller maximum display scale coverage, under the assumption that the ECDIS user will have the larger maximum display scale data available.

2.5.3.2 Simplified or minimum depiction areas

- Bathymetry in such areas should be encoded as described in clause X.X.
- Information that does not relate to bathymetry but is relevant to land area features may be encoded.
- One **Caution Area** feature covering the whole area should be created. The complex attributes **information** (sub-attribute **text**) or **textual description** (sub-attribute **file reference**) should be encoded using one of the following options (the textual content of the attributes (for **file reference** this will be the contents of the referenced file) is within quotation marks and italicised):

Where larger scale coverage is available:

"Most features, including bathymetry, are omitted in this area. The minimal depiction of detail in this area does not support safe navigation; mariners should use a more appropriate scale ENC."

Any other relevant information ~~contained in chart notes~~ pertaining to the area should be incorporated within, or replace completely, the above statement.

Where no larger scale coverage is available:

"Most features, including bathymetry, are omitted in this area. The minimal depiction of detail in this area does not support safe navigation."

This statement should be supplemented by additional cautionary information ~~from chart notes~~ relating to any authority to be consulted before navigating in the area.

Comment [AHO19]: (JW) Have left this in pending approval of new feature and related encoding guidance.

Comment [AHO21]: (EM) Angel and Eivind to rework original proposal and submit new one where Guys comments are incorporated.

Comment [AHO22]: (TR) This needs to reflect the new minimum depiction area feature

Comment [EM20]: Angel to sort out with S-101 8211 encoding.

2.5.4 Dataset attributes

Dataset attributes contain metadata that apply to the whole dataset. Some attributes have designated ISO 8211 encoding subfields; other attributes use the ATTR subfield. See table below for details.

[Insert table with all dataset attributes]

2.5.5 Units

The depth, height and positional accuracy units in a dataset must be metres.

2.5.6 Coordinate multiplication factor

The coordinate multiplication factor stored in the CMFX and CMFY subfield values in the Data Set Structure Information field must be set to *10000000* (10^7) for all datasets.

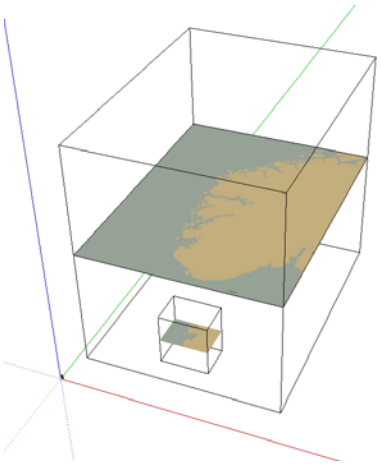
Comment [AHO23]: (EM) Likely to be replaced by table in 3.7.1.

2.5.7 Seamless ENC coverage

ENCs should form a seamless coverage in the navigable waters of the producer's area of responsibility. However, it is often impractical to do so in all radar range scales, and therefore S-101 ENCs declare a scale range, which dictate between what scales the data can be used.

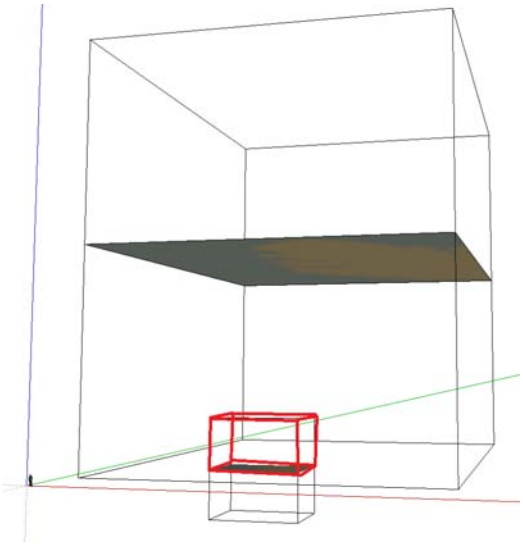
All data within a dataset must have the same minimum scale, but portions of a dataset can have a different maximum scale than other parts, depending on the best scale required for navigation in an area for the purpose of the ENC data.

Comment [EM24]: Insert how the scale ranges are captured in the data when this concept is finalized.



Example of scale ranges

There must be no gaps in data between adjoining datasets if they share the same scale range in part or in full. Similarly, there must be no overlapping data between datasets if they share same scale range in part or in full, except at the agreed adjoining producer data limits, where, if it is difficult to achieve a perfect join, a 5 metre overlapping buffer zone may be used.



Example of scale range overlap. The red box indicates an overlap between the scale range of two datasets, which is not permitted.

To ensure a seamless ECDIS display of ENC data within the same scale range, it is important that the data on the border of the dataset is aligned and matched with the corresponding data in any adjoining datasets within the scale range, where possible. Where there is a mismatch in depth data between adjoining datasets, editing of the

depth data should be done such that depth contours and depth areas are adjusted on the side of safety. Edge matching of data across different scale ranges, particularly depth data, is often not possible due to generalisation issues resulting from differing scales, although features such as maritime boundaries, navigation lines, recommended tracks, roads etc. should be edge matched where possible. Note that point or curve features which are at the border **Data Coverage** (see clause X.X) of adjoining cells with the same scale range must be part of only one dataset.

In areas which include neighbouring producer nations, Hydrographic Offices should co-operate to agree on dataset boundaries and ensure no data overlap within scale ranges. Where possible, adjoining nations should agree on common data boundaries within a technical arrangement based on cartographic convenience and benefit to the mariner. Suitable communications between neighbouring nations should be put in place to ensure data consistency across dataset boundaries. These should include exchange mechanisms to allow access to each other's ENCs.

2.5.8 Feature Object Identifiers

Each feature and information instance within an ENC must have a unique universal Feature Object Identifier [FOID]. Where a real-world feature has multiple geometric elements within a single ENC dataset due to the ENC dataset scheme, the same FOID may be used to identify multiple instances of the same feature. Features within a dataset may carry multiple geometries.

Data converted from S-57 may contain the same feature in multiple feature instances. Where this occurs, all these feature instances must be identical, i.e. same feature class and attribute values.

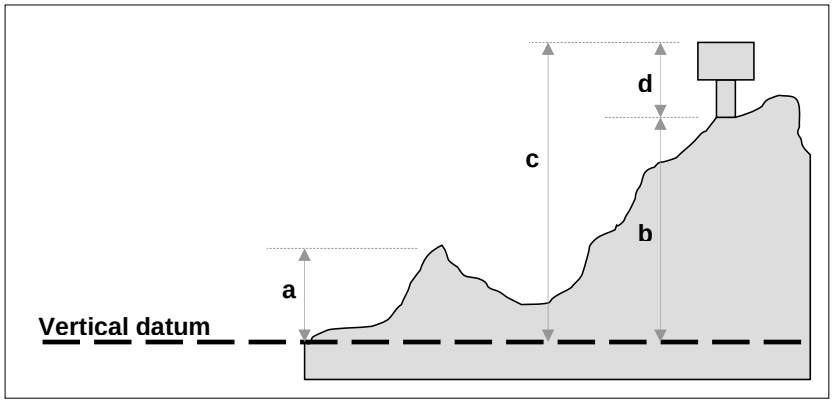
Features split across multiple datasets may be identified by the same Feature Object Identifier [FOID]. Features repeated in different scale ranges may be identified by the same Feature Object Identifier [FOID].

Feature Object Identifier's must not be reused, even when a feature has been deleted.

2.5.9 180° Meridian of Longitude

Datasets may cross the 180° meridian of longitude.

2.5.10 Heights and elevations



If it is required to encode the altitude of natural features above a vertical datum (e.g. hills, coastlines, slopes), with the exception of trees, it must be done using the attribute **elevation** (figure (a)).

For artificial features (e.g. landmarks, buildings) or trees:

- If it is required to encode the altitude of the ground level at the base of the feature, or the elevation of a light, above a vertical datum, it must be done using **elevation** (figure (b)).
- If it is required to encode the altitude of the highest point of the feature above a vertical datum, it must be done using the attribute **height** (figure (c)).
- If it is required to encode the height of the feature above ground level or the sea floor (i.e. not associated with a vertical datum), it must be done using the attribute **vertical length** (figure (d)).

Comment [j25]: (EM) Verify with Jeff on the use of height versus elevation, based on the work of the HDWG on these two terms. (JW) Revised HD definitions aligned to S-57 definitions. Wording in this clause is aligned to these definitions.

2.5.11 Geographic names

Comment [j26]: (TR) Need to consider groups of islands and a table might be useful here also? (JW) See new (5) in this clause.

If it is required to encode an international or national geographic name, it must be done using complex attribute **feature name** (see clause X.X). When possible, existing features (e.g. **Built-Up Area**, **River**, navigational marks) should be used to carry this information.

If it is required to encode a geographic name for which there is no existing feature, a specific **Administration Area (Named)**, **Sea Area/Named Water Area** or **Land Region** feature must be created (see clauses X.X, X.X and X.X). In order to minimise the data volume, these features should, where possible, use the geometry of existing features, e.g. a **Sea Area/Named Water Area** feature may use the geometry of a **Depth Area** feature.

National geographic names can be left in their original national language in a non-English iteration of the sub-attribute **feature name** (but only if the national language can be expressed using lexical level 0 or 1), or transliterated or transcribed and used in an English iteration of the sub-attribute **feature name**, in which case the national name should be populated in an additional iteration of the **feature name** with sub-attribute **language** populated with the relevant national language value in accordance with ISO 639-3.

Geographic names should be encoded using **feature name** based on the following criteria and at the Producing Authority's discretion:

1. Named points or capes that do not contain navigational aids should be encoded as **Land Region** features (of type surface or point), with the geographic name encoded using **feature name**.
2. Named points or capes that contain one navigational aid should be encoded using **feature name** on the structure feature associated with the navigational aid. If more than one navigational aid exists on the point or cape or if the point or cape and the structure feature have different names, a **Land Region** feature (of type surface or point) should be encoded, with the geographic name of the point or cape encoded using **feature name** .
3. A group of hydrographic features (e.g. **Seabed Area**, **Underwater/Awash Rock**, **Obstruction**), associated with a particular geographic name, should have the name encoded using **feature name** on a **Sea Area/Named Water Area** feature (of type surface or point). The name should not be encoded on the individual hydrographic features.
4. A major island name close to primary shipping corridors should be encoded using **feature name** on the **Land Area** feature delimiting the island. A group of islands associated with a geographic name should have the name encoded using **feature name** on a **Land Region** feature (of type surface or point).
5. A named island group or archipelago should be encoded using **feature name** on a **Land Region** feature (of type surface covering the area of the island group, or of type point in the centre of the island group). Where individual islands within the group are named, these should be encoded using **feature name** on the **Land Area** feature delimiting the island.
6. Named features listed in Hydrographic Office's Sailing Directions that may assist in navigation should be encoded using **feature name** on the relevant feature (e.g. **Land Region**, **Underwater/Awash Rock**, **Seabed Area**, **Sea Area/Named Water Area**, **Obstruction**).
7. If it is required to encode an administrative area of international, national, provincial or municipal jurisdiction that may have legal inference, it must be done using an **Administration Area (Named)** feature, with the name encoded using **feature name**.
8. If it is required to encode a major city along the coast, it must be done using **Built-Up Area** or **Administration Area (Named)** features (see clause X.X), with the name encoded using **feature name**.
9. If it is required to encode the name of a navigable river, lake or canal, it must be done using a **Sea Area/Named Water Area** feature, with the name encoded using **feature name**.

In all instances, if the exact extent of the feature to be named is known, a surface feature must be created. If the exact extent is not known, an existing or specifically encoded point feature should be used to encode the geographic name.

Comment [j27]: (EM) Tom to make a table and a drawing of what the various items look like. Consider also adding case for groups of islands.

2.6 Description of table format for S-101 meta and geo features

X.X Clause heading

IHO Definition: **FEATURE:** Definition. (Authority for definition).

S-101 Geo Feature: Feature (S-57 Acronym) S-101 feature and corresponding S-57 acronym

Primitives: Point, Curve, Surface Allowable geometric primitive(s)

Real World	*Paper Chart Symbol*	*ECDIS Symbol*
Example if real world instance(s) of the Feature.	Example(s) of paper chart equivalent symbology for the Feature.	Example(s) of ECDIS symbology for the Feature.

S-101 Attribute	S-57 Acronym	Allowable Encoding Value *	Type	Multiplicity
Category of beer		1 : ale 2 : lager 3 : porter 4 : stout 5 : pilsener	EN	1,1
This section lists the full list of allowable attributes for the S-101 feature. Attributes are listed in alphabetical order. Sub-attributes (Type prefix (S)) of complex (Type C) attributes are listed in alphabetical order and indented directly under the entry for the complex attribute (see below for example).	This section lists the corresponding S-57 attribute acronym. A blank cell indicates no corresponding S-57 acronym.	This section lists the allowable encoding values for S-101 (for enumerate (E) Type attributes only). Further information about the attribute is available in Section XX.	Attribute type (see clause X.X).	Multiplicity describes the "cardinality" of the attribute in regard to the feature. See clause X.X.
Fixed date range			C	0,1
Date end	(DATEND)		(S) DA	0,1
Date start	(DATSTA)		(S) DA	0,1

INT 1 Reference: The INT 1 location(s) of the Feature – by INT1 Section and Section Number.

X.X.X Sub-clause heading(s) (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.

Remarks:
- 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. (Not required for all Features).

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

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

* For (EN) type attributes, the enumerates listed are only those allowable for the particular occurrence of the attribute relevant to the feature. Allowable values may vary for the attribute depending on the feature to which the attribute is bound. Such bindings are defined in the S-101 Feature Catalogue. The full list of enumerates that may be assigned to an attribute can be found in Chapter XX – Attribute and Enumerate Descriptions – of this document.