6th CSPCWG MEETING
Monaco, 01-03 December 2009

Paper for Consideration by CSPCWG

Fouls and Foul Ground

Submitted by:	Australia (Jeff Wootton)
Executive Summary:	Depiction of fouls and foul ground and distinction with foul area
Related Documents:	S-4 – B-422.8-9; INT1 – K31; S-32 (1915, 1917, 1918, 3503); S-57 Appendix A, Chapter 1 (Code 86) and Chapter 2 (Code 42); S-57 Appendix B.1, Annex A (clause 6.2); Minutes of IHO Technical Working Groups (Various)
Related Projects:	S-4/INT1 development; S-100/S-101; S-32; S-52

Introduction / Background

As experience has been gained in the compilation of ENC cells in conformance with the S-57 ENC Product Specification (S-57 Appendix B.1) and its Annex A (Use of the Object Catalogue for ENC), instances of Object to Attribute binding and related encoding guidance have been raised with TSMAD. These issues have caused confusion amongst compilers, created problems with ECDIS portrayal and in some cases resulted in an incorrect picture of the real-world situation for the mariner. One of the issues raised is the encoding of foul ground, and its distinction from foul areas and other obstructions to surface navigation. This paper discusses the possible reasons for this problem, and recommends some options for possible solutions for discussion by CSPCWG.

Analysis / Discussion

When S-57 was being developed, in particular the Object and Attribute Catalogues (Appendix A Chapters 1 and 2) and the Use of the Object Catalogue for ENC (Appendix B.1, Annex A), developers relied on existing navigation product specifications to build the bindings between Objects, Attributes and Attribute Values and formulate rules for encoding guidance. The main specification used was the IHO M-4 (now S-4), and its associated publication INT1. Definitions were obtained (and often derived) from the most authoritative source available, which in most cases was the IHO Hydrographic Dictionary S-32, and in some cases M-4.

When determining the Object to Attribute binding in order to encode obstructions and foul ground in S-57 ENCs, it was decided to have these features exist in the ENC as a single object class OBSTRN (Obstruction). The defining characteristics (category) of the obstruction is defined by the attribute CATOBS (Category of obstruction), which is an enumerated attribute type having values including value 6 (foul area) and value 7 (foul ground). This binding was in line with the location of the chart specification for foul ground in M-4 as part of section B-420 – Dangers, and in INT1 section K – Rocks, Wrecks, Obstructions. The problem that has been identified with this binding of foul ground to OBSTRN is that there is no clear distinction for the ECDIS user between a foul area in which it is not safe to navigate, and an area of foul ground over which it is safe to navigate for surface vessels. This problem has been identified and will be addressed in the S-101 Feature Catalogue and Product Specification, but to be consistent in the guidance across all navigational charting specifications, CSPCWG will also need to address this issue in S-4 and INT1.

The existing S-32 and S-57 definitions, and S-4 and ENC specifications, as well as the relevant minuted discussions at various IHO Technical Working Group meetings, are listed below for reference for further discussions.

Definitions: The following are the definitions for terms related to fouls and obstructions as taken from S-32 and S-57 Appendix A Chapters 1 and 2:

S-32:

1915 **foul area.** An area of numerous uncharted dangers to navigation. The area charted serves as a warning to the mariner that all dangers are not charted individually and that navigation through the area may be hazardous. The term "foul" should not be applied to a soft continuum with indefinite boundaries such as mud or sand; to areas congested with marine vegetation such as kelp or grass in water; or to materials not likely to cause damage to a vessel.

1917 **foul bottom.** A hard, uneven, rocky or obstructed BOTTOM having poor holding qualities for anchors, or one having ROCKS or WRECKAGE that would endanger an anchored vessel.

1918 **foul ground.** An area where the holding qualities for an anchor are poor, or where danger of striking or fouling the GROUND or other OBSTRUCTIONS exists.

3503 **obstruction.** In MARINE NAVIGATION, anything that hinders or prevents movement, particularly anything that endangers or prevents passage of a vessel. The term is usually used to refer to an isolated danger to NAVIGATION, such as a SUNKEN ROCK or PINNACLE.

S-57:

OBSTRN (Obstruction)

Definition: In marine navigation, anything that hinders or prevents movement, particularly anything that endangers or prevents passage of a vessel. The term is usually used to refer to an isolated danger to navigation... (IHO Dictionary, S-32, 5th Edition, 3503).

foul area: an area of numerous unidentified dangers to navigation. The area serves as a warning to the mariner that all dangers are not identified individually and that navigation through the area may be hazardous. Commonly used to encode areas behind danger lines on navigation charts. (adapted from IHO Dictionary, S-32, 5th Edition, 1915).

foul ground: areas over which it is safe to navigate but which should be avoided for anchoring, taking the ground or ground fishing. (IHO Chart Specifications, M-4, 442.8)

Charting Specifications: The following are the charting specifications/encoding guidance as taken from S-4 (Edition 3.006) and S-57 (Appendix B.1, Annex A – Use of the Object Catalogue for ENC - 2002):

S-4:

B-422.8 **Foul ground and sites of cleared platforms.** Large areas of foul ground (ie areas over which it is safe to navigate but which should be avoided for anchoring, taking the ground or ground fishing) must be shown by legend, within dashed limits where the extent is known.

K31

Areas too small to be shown to scale should be shown by the symbol.

K31, L22

This symbol may also be used for the remains of a wreck or the site of a cleared production platform, provided the platform has been removed to the seabed. Platforms which have been cut-off above the seabed must be charted as obstructions.

B-422.9 **Submerged obstructions** too small to be shown to scale must be charted similarly to wrecks (see B-422.3, 422.4, 422.7) but with the international abbreviation '*Obstn*' in place of '*Wk*'. Larger obstructions must be charted with a danger line and legend. Blue tint must be added over obstruction symbols in accordance with the charted depth, and in all cases where a depth numeral is not charted and the general depth of water is less than 100m.

K40 (depth unknown)

K41 (depth known)

K2, K42 (depth known, swept by wire drag or diver)

K3 (safe clearance depth)

For safe clearance depths over obstructions, see B-422.5.

For breakwaters and training walls, see B-322.2

For stumps of posts or piles, see B-327.5.

For works under construction, see B-329.

For submarine pipelines and outfalls, see B-444.

For submerged wellheads, see B-445.1.

For underwater turbines, see B-445.10-11.

For spoil grounds, see B-446.

For fish traps and havens, see B-447.

S-57:

6.2.2 Obstructions and foul areas

If it is required to encode snags, stumps, wellheads, diffusers, cribs, fish havens, foul areas, foul grounds, booms, ice booms or ground tackle, it must be done using the object class **OBSTRN**.

Geo object: Obstruction (**OBSTRN**)
Attributes:
CATOBS CONDTN
EXPSOU - indicates objects with a "value of sounding" within or not within the range of depth of the surrounding area
HEIGHT - only if WATLEV = *1 or 2*
NATCON NATQUA NATSUR NOBJNM OBJNAM
PRODCT - only used for wellheads
QUASOU - see Table 6.3 below
SOUACC - see use of the meta object **M_QUAL** (clause 2.2.3.1)
STATUS - *18* - existence doubtful
TECSOU - see Table 6.3 below
VALSOU VERACC VERDAT
VERLEN - distance above the sea bed
WATLEV - see Table 6.3 below
INFORM NINFOM

In the following table, the symbol '/' indicates that this attribute must not be encoded. A blank indicates that the encoder may choose a relevant value for the attribute.

Obstruction...	**INT1**	**WATLEV**	**QUASOU**	**TECSOU**
Depth unknown	K40	*3* or *4*	*2*	*/*
Least depth known	K41	*3* or *4*	*6*	
Swept by wire to the depth shown	K42	*3*	*6*	*6*

table 6.3

All obstructions should be encoded using one of the above combinations of attributes.

Remarks:
- If the nature of a dangerous underwater object, dangerous underwater area, or floating object is not explicitly known, it must be encoded using **OBSTRN**.
- An **OBSTRN** object of type area must be covered by an area object from Group 1 as appropriate.

- In certain circumstances where an obstruction is always dry (e.g. cribs), it may be covered by a **LNDARE** object.

6.3 Danger lines

6.3.1 Danger line around a point danger or an isolated sounding

In general terms, a danger line that surrounds a single symbol or sounding (e.g. INT1 – K28, K40a or K 41 to K43.1) should not be encoded as a separate area. However, when the danger line indicates the true shape of the feature, it should be encoded using **WRECKS** or **OBSTRN** objects of type area. A single sounding enclosed by a danger line should be encoded using an **OBSTRN** object of type point. The sounding value, in this case, must be encoded using the attribute VALSOU.

6.3.2 Danger line limiting an area of wrecks or obstructions

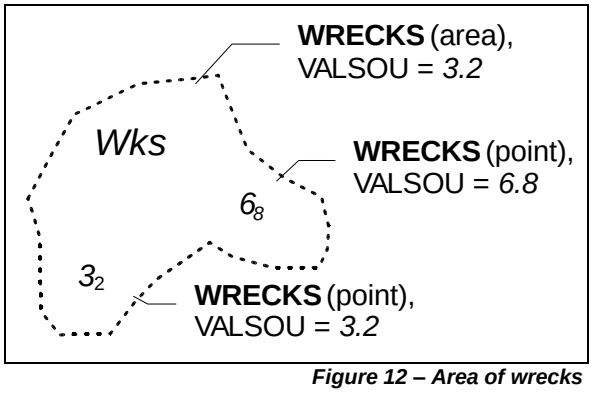

Figure 12 – Area of wrecks

The area enclosed by the danger line must be encoded using **WRECKS** or **OBSTRN** objects of type area, with the attribute values, when encoded, reflecting the characteristics of the shallowest point object encoded in the area. The area must also be covered by **DEPARE** or **UNSARE** objects as appropriate.

If it is required to encode one or more least depths in such an area, it must be done using a point object for each of the depths, in addition to the area object.

6.3.3 Danger line bordering an area through which navigation is not safe (see M-4 - §420.1)

A danger line, bordering an area through which navigation is not safe, should be encoded using an **OBSTRN** object of type area, with attribute CATOBS = *6* (foul area).

The record of discussion by IHO Technical Working Groups on the issue of the definition and interpretation of fouls and foul ground as distinct from foul area is as follows:

CSMWG16 (May 2006):

6.11 Use of FOULGND1 symbol for WRECKS with CATWRK 3

Doc: CSMWG16-6.11A, introduced by MJ

MJ: the variety of symbols on paper charts is far wider than for ENCs. Paper and ENC should have similar portrayal whenever possible.

PB: supports the proposal

CR: supports revised portrayal

OW: in principal supports reducing isolated danger symbols

PB: Solution is already implemented in PresLib, possibly ENC production system does not visualize according to PresLib

MJ: CATWRK means “distributed remains of wrecks”. For such attribution the hash symbol should be shown always – even if VALSOU is known!

Decision:

- Proposal agreed in principle

Action:

- **31.** MJ to get more details from the originator of CSMWG16-6.11A
- **32.** PB to check again if symbol is shown for known VALSOU and prepare a new look up table entry as deferred amendment if needed

CSPCWG4 (November 2007):

12.2.3 K31 (Fouls)

The meeting agreed that K31 should remain in its present location in INT1 and that its description should be amended to: 'Foul ground, not dangerous to surface navigation, but to be avoided by vessels anchoring, trawling, etc (eg remains of wreck, cleared platform)'. [After –meeting note: this is not exactly as agreed at the meeting, but is adapted to conform to the actual specification recently approved for M-4 B-422.8.]. The heading of the sub-section in INT1 should be re-titled 'Wrecks and Fouls'.

The meeting also considered that the definition of foul ground as not dangerous to surface navigation is widely and long established. An alternative definition of foul *areas* as being dangerous to surface navigation is potentially confusing to the user and the Chairman was asked to take this up with the S-57 and S-32 working groups.

ACTION 28: INT1 producers to amend term for K31 to 'Foul ground, not dangerous to surface navigation, but to be avoided by vessels anchoring, trawling, etc (eg remains of wreck, cleared platform)'. Also, amend heading of subsection beginning K20 to 'Wrecks and Fouls' (all at next opportunity).

ACTION 29: Chairman to raise the issue of the definitions of a foul in S-57 and S-32 with appropriate WGs.

TSMAD15 (January 2008):

6.2 **Report on CSPCWG4 by Australia.** *(TSMAD15-6.2CSPCWG4.pdf)*

- INT1 K31 (Fouls) – CSPCWG chairman to raise the issue of the definitions of a "foul" in S-57 and S-32 with appropriate WGs. There was some discussion related to "foul" ground not being dangerous to surface navigation, with the meeting generally agreeing with CSPCWG sentiments. This poses a problem in relation to the definition of **OBSTRN** as outlined in the paper. The meeting agreed that there was an inconsistency in the Standards between the definition for **OBSTRN** and including the value CATOBS = *7* (foul ground) as an enumerate. This causes a conflict between S-57 and M-4.

TSMAD16 (June 2008):

4. Matters Arising (4.1 Action Items from TSMAD 14)

General issues – Problem with OBSTRNs and alarms in ECDIS. Action: TSMAD members to discuss with their home offices and report back – also members to propose specific new object/attributes to reduce the overuse of caution area. (Discussed at the stakeholders meeting – and continued work under S-101 It was proposed that consideration should be given to creating a new feature for "foul ground" – perhaps new display rules for this. Caution areas are also the cause of numerous alarms).

CSPCWG5 (November 2008):

CSPCWG 4 Action 28 (INT1 producers to amend term for K31 to 'Foul ground, not dangerous to surface navigation, but to be avoided by vessels anchoring, trawling, etc (eg remains of wreck, cleared platform)'. Also, amend heading of subsection beginning K20 to 'Wrecks and Fouls' (all at next opportunity)): The heading of the sub-section has been amended to 'Wrecks and Fouls' in the recently published ES and DE INT1 versions. The definition is not exactly as agreed in the CSPCWG4 record, particularly in missing the example of a cleared platform, which was suggested to make more explicit that the foul may apply to something other than a dispersed wreck. INT1 producers were invited to note to amend at next editions of INT1. CSPCWG action closed.

NEW ACTION 2: INT1 producers to amend term for K31 to 'Foul ground, not dangerous to surface navigation, but to be avoided by vessels anchoring, trawling, etc (eg remains of wreck, cleared platform)' at next new edition of INT1.

CSPCWG 4 Action 29 (Chairman to raise the issue of the definitions of a foul in S-57 and S-32 with appropriate WGs). This matter is currently under consideration by TSMAD, with a view to resolving it for S-101. The matter has not yet been brought to the attention of the HDWG (for S-32).

NEW ACTION 3: Secretary to communicate with HDWG to make them aware of the issues regarding the use of the term 'Foul'.

NEW ACTION 4: AU to review TSMAD progress with the issue of 'Fouls' and keep CSPCWG informed.

CSPCWG 4 Action 33 (INT1 subWG to discuss way to implement DK suggestion on moving part of K to L in INT1): This has not been progressed to date, as nothing can be done until the next new editions of INT1. This is now included on the CSPCWG Work Plan, as item E8, therefore the CSPCWG 4 action is closed.

TSMAD18/DIPWG1 (May 2009):

8.1 Presentation Library Look-up Table Modifications for Obstructions

Doc: DIPWG1-18.1A PL Look-up Table Modifications for Obstructions

MJ presented a paper on behalf of BSH which described two instances in which entries in the look up tables for obstructions and wrecks need to be deleted, modified or added to the Presentation Library to bring S-52 into alignment with accepted conventions for portrayal in INT1.

MJ reported that there were inconsistencies in INT1 symbols K2, K27 & K42 in respect of swept depths carried out by divers. It was proposed to modify CSP SNDFRM03 to accept TECSOU = 4 (found by diver). MJ commented that if this can be tested and found to work it could become a deferred amendment.

MJ further proposed to modify the CSP OBSTRN06 to call up obstruction symbology instead of foul ground (INT1 - K31). Subject to detailed investigation this could also become a deferred amendment.

JP stated that the CSPCWG are looking into the issues and definitions relating to obstructions, foul ground, foul bottom, etc.
EM observed that there was a clear difference between foul ground (safe to navigate) and obstructions (unsafe to navigate).
CH explained that “swept by wire drag” is inaccurate but “swept by diver” is very accurate.
MJ stated that the symbolisation for wire (swept) was the same as for diver (found by). MJ asked JP if we should wait for the CSPCWG to come up with something?
JP said it was more an issue for M4 than S-57.
CH said the reference in INT1 was poorly crafted and could do with improved definitions.
MJ suggested that we should perhaps separate the two issues of wrecks and obstructions. MJ asked if we could agree on the wrecks proposal but wait and see what the CSPCWG come up with for obstructions?
JLD said he was surprised to see the same symbol for swept by wire as for found by diver as these have very different meanings.
CH informed the meeting that the CSPCWG were meeting in December 2009 and recommended that we wait for the outcome.
JP suggested that it might be good idea to submit a paper on the subject to the CSPCWG.
MJ said it was never their intention to give a measure of the depth accuracy. This was more to do with the display and give the same appearance as the paper chart. BSH just wants the paper chart and ECDIS display to have an identical appearance.
JW reported some actions taken at the last CSPCWG in Sydney 2008 as follows:

- Amend term for K31 to 'Foul ground, not dangerous to surface navigation, but to be avoided by vessels anchoring, trawling, etc (e.g. remains of wreck, cleared platform)'.
- Raise the issue of the definitions of a foul in S-57 and S-32 with appropriate WGs.

JW continued by saying that CSPCWG were waiting to see what TSMAD are doing. His report on “fouls/foul ground” began the process to define the term “foul”. JW informed the group that it is their intention to move some features from section K to L and this work was ongoing.
BG said that from a TSMAD perspective foul is an attribute of Obstruction and that, perhaps, it should be an object in its own right. BG asked JW if M4 had been ratified.
JW responded by saying it was currently under review.
CH agreed an action to craft a deferred amendment for Wrecks but hold off on creating one for Obstructions. Furthermore we should check with CSPCWG. CH went on to say that JW should write a report outlining our discussions for the CSPCWG.

Action: MJ to create a deferred amendment for Wrecks
Action: JW to draft a report on discussions and present it to CSPCWG for their next meeting in Monaco in December 2009.

The issues to be considered include:

- No wording in the S-32 definition for foul ground to indicate that the area is considered to be safe for surface navigation (inconsistent with S-4 specifications);

- Inclusion of an enumerate for OBSTRN/CATOBS for foul ground over which, by its S-57 definition, is safe for surface navigation. Therefore not an obstruction? TSMAD has suggested removing CATOBS = 7 from OBSTRN in favour of a new feature class in the IHO Hydro Register for Foul Ground;
- Inclusion of foul ground at INT1, K31 (section Rocks, Wrecks, Obstructions) which has contributed to the confusion over the distinction between foul area and foul ground (feedback from TSMAD and DIPWG).

Conclusions

A cooperative approach is required between CSPCWG, HDWG, TSMAD and DIPWG in order to ensure consistency in definitions, charting/encoding specifications and portrayal for fouls and foul ground in order to avoid confusion for compilers and users of paper and electronic navigational charts. This may be best achieved by CSPCWG making appropriate amendments to S-4 and INT1 with input from HDWG, TSMAD and DIPWG, and passing recommendations based on these changes back to HDWG, TSMAD and DIPWG.

Recommendations

CSPCWG discussion on this issue is required. In order to facilitate this discussion, the following recommendations are suggested.

- S-4: Amend B-422 clause heading to "WRECKS, OBSTRUCTIONS". Move clause B-422.8 to B-449 (perhaps to B-449.7, or to B-449.5 and re-number existing B-449.5 and B-449.6). Re-number B-422.9 to B-422.8 and insert reference to the moved clause on foul ground (e.g. "For foul ground and sites of cleared platforms, see B-449.X"). Alternatively, this statement may be inserted at B-422.
- INT1: Amend sub-section heading for K20-30 to "Wrecks". Move K31 to new N65 (this would put foul ground in the same section as ice shelves and spoil grounds).
- S-32: Submit a proposal to HDWG to amend the definition for foul ground to include a statement that the area is not an obstruction to surface navigation.
- S-57: Submit a proposal to TSMAD outlining the above changes to S-4 and INT1 for development of new feature for the IHO Hydro Register (e.g. FOUGRD), and appropriate attributes and, if required, enumerates.
- S-52: Submit a proposal to DIPWG outlining any changes to S-4 and INT1 for refinement of ECDIS portrayal to ensure consistent portrayal of fouls and foul ground on navigational products.

Justification and Impacts

The issue of having a clear distinction between foul areas through which it is not considered safe to navigate and foul ground through which it is considered safe to navigate needs to be rectified and requires cooperation amongst various IHO Technical Working Groups in order to ensure consistency in compiling and portrayal on navigational products. This paper is designed to initiate discussion on the issue of fouls and foul ground at CSPCWG and promote collaboration with HDWG, TSMAD and DIPWG. Any actions taken from discussions will impact S-4 and INT1 from a CSPCWG perspective, and S-32, S-100/101 and possibly S-52 from the perspective of other IHO Technical Working groups.

Action required of CSPCWG

The CSPCWG is invited to:

a. Discuss this report and the recommendations made.
b. Liaise with other IHO Technical Working Groups as appropriate.