Paper for Consideration by TSMAD and DIPWG

AIS and Virtual AIS Aids to Navigation

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Executive Summary:	This paper reports on the development of AIS and Virtual Aids to Navigation and their potential impact for TSMAD.
Related Documents:	1. Implementation of Virtual Aids to Navigation (IHB File S3/3103) dated 3rd February 2010 2. IALA Draft Guidelines on Virtual Aids to Navigation
Related Projects:	E-Navigation

Introduction / Background

There are two issues which TSMAD need to consider:

- AIS – the use of AIS (Automatic Identification System) is becoming more widespread and has been addressed by the CSPCWG through the development of symbols for paper charts. TSMAD need to consider if there is a requirement to encode the presence of AIS targets in ENC data and how this can be accomplished in both existing S-57 ENCs and future S-101 implementation.

- Virtual AtoN - more recently IALA has extended the concept of AIS in developing Virtual Aids to Navigation. This will potentially introduce different issues which TSMAD need to consider, further to that which may be required for encoding AIS targets. .

In addition, consideration must be given to whether a vessel is using an ECDIS which is integrated with these systems. If this is the case further consideration must be given to the range at which the transmission is received.

Where existing physical aids to navigation carry AIS they are currently charted on paper charts using INT 1 symbols S 17.1 and 17.2. S-4 B 489.1 allows for Virtual AtoN using symbol S 17.1.

Figure 1. Depiction of AIS as shown in IHO S-4 B 489.1

S-52 contains the symbol AISATN02 for an AIS based Aid to Navigation which is identical to that used in IEC 62288 Ed 1.
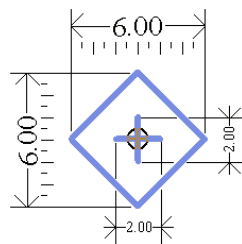

Figure 2 – S-52 symbol AISATN02 – AIS based Aid to Navigation

IALA have produced draft guidelines for the provision of Virtual AtoN whilst development and trialling of Virtual Aids to Navigation (Virtual AtoN) is ongoing. They highlight the fact that although AIS technology is currently used, other means of transmission may evolve. However, not all vessels will have the ability to display AIS messages on ECDIS or Radar displays limiting the benefit to the mariner. As trials are gathering pace IHO and TSMAD in particular need to be aware of developments and prepare to act accordingly if required.

CPSCWG are currently developing paper chart symbology to depict Virtual AtoN, this uses a magenta diamond and the magenta radio circle. The topmark is displayed above the magenta diamond indicating the type of AtoN with V-AIS as a text label , see figure 2. It is envisaged that V-AIS could be replaced by V-Sat, V-WiMax etc as future modes of transmission develop.

ECDIS that support AIS messages will display the targets as a diamond with a cross at the position of the AtoN. This symbology is specified in IEC 62288 however colour is not specified.

Figure 4. – Draft paper chart symbology being developed by CPSCWG

Analysis/Discussion

AIS

AIS aids to navigation differ from Virtual AtoN in that physical features exist, these fall into two categories:

Real – A physical AtoN exists and transmits an AIS message from its location. This is covered by INT 1 S 17.2 and S-4 489.1.

Synthetic – A physical AtoN exists but its AIS message is transmitted from shore based on its predicted or monitored position. The symbology in INT 1 S17.2 as for Real aids to navigation can be used in this case. However, there is a difference between monitored and predicted Synthetic aids, which should be conveyed to the mariner. However IALA state *"the use of predicted synthetic AIS AtoN is not recommended for use on floating AtoN"* (IALA Draft Guidelines on the Establishment of AIS as Aids to Navigation).

Encoding AIS targets in S-57 ENCs

If AIS is integrated with the ECDIS there will not be any symbol representation until the vessel is in range of AIS transmission. Whether the AIS transmission is integrated with the ECDIS or not, it may be necessary to indicate to the user the existence of an AIS target for both planning and passage mode use.

Given that S-57 is frozen there isn't the possibility to introduce new features or attributes. One option would be to use the INFORM attribute to indicate that an aid to navigation is an AIS enabled target. This would, of course, add to the numerous occurrences of the "I" symbol in the ECDIS display.

Encoding AIS targets in S-101 ENCs

Encoding AIS targets in S-101 ENCs could be achieved either by using attribution of the existing AtoN or by use of a new feature which is associated to the AtoN. The latter would follow the model used for Radar Transponder Beacons. An attribute for type of AIS AtoN would be required whilst MMSI number and responsible authority would reduce the risk from spoofing/ or jamming.

Virtual aids to Navigation

IALA define a Virtual Aid to Navigation as:

"A virtual aid to navigation does not physically exist but is a digital information object promulgated by an authorized service provider that can be presented on navigational systems."

Source: IALA Draft Guidelines on Virtual Aids to Navigation

Simply put a Virtual AtoN is a virtual navigational aid, which is normally communicated by VHF in an AIS message. It can be displayed on ECDIS or Radar displays which support the display of AIS message type 21.
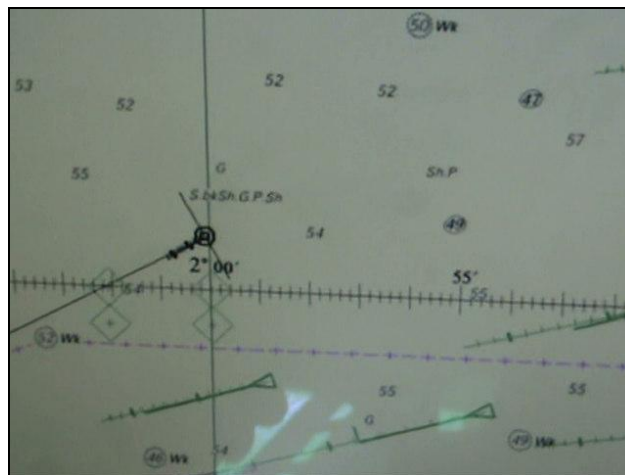

Figure 5. Chart display showing four Virtual AtoN marking the wreck of the Ice Prince in the English channel during November 2008.

Source CIL Report on AIS for Buoys of Primary Navigational Significance

Currently Broome Port Authority in North-Western Australia is trialling a mix of virtual and synthetic AtoN. This trial also incorporates 'aim for' points in the approach channel.

Trials have also taken place in Denmark and through the General Lighthouse Authority in the UK. Reponses from these trials have generally been positive, with the main advantages being the ease of monitoring and deployment

for the relevant authority. However many vessels have identified the inability of many systems to display these messages as a serious limitation.

Types of Virtual AtoN

Virtual AtoN can be used in different situations as described in the following table:

Scenario
'Instant' E.g. Wreck marking
Temporary E.g. Marking works in progress
Dynamic E.g. Channel formerly marked by buoys but now marked by Virtual AtoN which are moved as required.
Seasonal E.g. Ice Buoys, Racing Marks
Permanent

Figure 6. Possible scenarios for Virtual AtoN's

Encoding Virtual AtoN in S-57 ENCs

Currently there is no feature that could be used to encode Virtual AtoN in S-57. The New Object class included in S-57 Supplement 2 could be used to encode these features and use of the Object Class Definition and Object Class Name attributes would convey their meaning.
A caution area could be used to mark an area where permanent Virtual AtoN are in use.

Encoding Virtual AtoN in S-101 ENCs

A new feature type would be required for S-101 as Virtual AtoN do not fit any existing feature. This would most probably apply only to instant and permanent Virtual AtoN.
An information type could be used to mark an area where permanent Virtual AtoN are in use. It must however be remembered that information types do not have spatial entities.

TSMAD Impacts

AIS

TSMAD has issued Encoding Bulletin 17 for AIS, see below:

EB 17 - Automatic Identification System (AIS) in ENC

The IHO Charting Standards Paper Chart Working Group (CSPCWG) has developed new symbols to portray AIS on paper charts (see INT1 – S17.1 and S17.2). As ENCs are intended to be used in conjunction with ECDIS as part of an Integrated Bridge System, it is not necessary to encode AIS in ENC cells.

Encoders are to note, therefore, that AIS information should not be included in ENC cells.

[Feb 2008]

Encoding bulletin 17 has been issued to ensure that producers do not begin encoding AIS in a variety of different ways causing inconsistency. However it is now generally accepted that as Virtual AtoN are used more widely ENC's will need to contain them to aid at the planning stage and in order to avoid confusion for the mariner.

TSMAD and DIPWG need to discuss whether this information should be encoded and if so what means of encoding is appropriate?

Virtual aids to Navigation

Virtual AtoN represent a separate case as no physical feature exists or is currently charted. Whether or not Virtual AtoN should be included on ENC's is still a matter for debate. Clearly for planning purposes where Virtual AtoN are used in lieu of significant physical AtoNs ENC's need to contain this information.

Questions for TSMAD

Should AIS AtoN be encoded in ENCs?

If so how should they be encoded based on the current S-57?

Should Virtual AIS AtoN be encoded in ENCs?

How should these be encoded based on the current S-57?

How should AIS AtoN and Virtual AIS AtoN be incorporated in future versions of S-57/S-52 and S-101?