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Workplan Task Number / Technical Domain 2 Communications

Working Group WG3

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Revision of the ‘Type of Electronic Position Fixing Device’ Information  
in Rec. ITU-R M.1371-5

# Summary

## Purpose of the document

This document discusses a possible approach to updating the ‘Type of Electronic Position Fixing Device’ information in AIS. The Committee is requested to consider the contents of the document when preparing input to ITU-R WP5B on the revision of Rec. ITU-R M.1371-5.

## Related documents

Proposal for a revision of Rec. ITU-R M.1371-5, People’s Republic of China [1].

# Background

AIS message types 4, 5, 11, 19, 21 and 24 contain an indication of the type of Electronic Position Fixing Device (EPFD) providing position input to the AIS (see Tables 51, 52, 71, 73 and 79 in Rec. ITU-R M.1371-5). Due to recent technological developments, the list of the available EPFD options does not accurately reflect the range of options currently or potentially available to mariners. This paper points out some deficiencies of the ‘Type of EPFD’ field as currently defined and proposes two alternative approaches to updating the information included in this field. The paper was prompted by an input from the People’s Republic of China to ITU-R WP5B requesting the addition of the BeiDou system to Rec. ITU-R M.1371 [1].

# Discussion

## Purpose of the EPFD Field

The authors believe that the original purpose of the EPFD field was to indicate the integrity and accuracy of the position input to the AIS unit.

## What’s Wrong with It?

The ‘Type of EPFD’ field lists specific positioning systems such as GPS, GLONASS, Galileo, Loran-C and Chayka, yet only four bits (i.e. sixteen entries) are available to encode this information in the AIS messages, and only six entries in the field currently remain unused. This does not seem sufficient to accommodate the variety of positioning systems that may be available to mariners in the near future. Examples of systems that may need to be added include BeiDou, which was recently recognised as part of the World-Wide Radionavigation System (WWRNS), the IRNSS (Indian Regional Navigation Satellite System), eLoran / eChayka, R-mode and other techniques such as absolute radar positioning.

Furthermore, modern EPFDs can combine data from multiple sensors including different GNSS constellations, terrestrial positioning systems and inertial sensors. The current EPFD type encoding does not allow specifying arbitrary combinations of individual systems / sensors. Ideally, one bit would be available for each sensor (or type of sensor), indicating whether or not that sensor has been used to produce the current position fix.

Lastly, the ‘Integrated navigation system’ entry (currently included as an option in the EPFD type field) is not considered a useful category as it is not clear what sensors are being integrated and which of the sensors have been used to produce the current position fix. Therefore this entry gives no indication of accuracy or integrity.

## How Can We Fix It?

One possibility to address the limitations of the EPFD type field would be, instead of adding specific systems to the list, to consider only certain broad categories of EPFDs, such as GNSS, terrestrial systems, absolute radar positioning, dead reckoning and their most likely combinations. However, the existing entries would have to be preserved to maintain backward compatibility with Rec. ITU-R M.1371-5, limiting the number of categories and their combinations that could be considered. In order to be future-proof, the new categories should encompass, as a minimum, the following positioning techniques:

1. Single GNSS;
2. Multi-constellation, multi-frequency GNSS;
3. Standalone terrestrial systems such as eLoran / eChayka;
4. Hybrid terrestrial radionavigation (e.g. a combination of eLoran, R-mode and television signal ranging);
5. Absolute radar positioning (using enhanced racons or based on feature matching);
6. Dead reckoning;
7. Alternative positioning technologies (e.g. ePelorus / BinoNav, communications satellites, gravity gradient matching);
8. Various combined technology options (in particular dead reckoning combined with terrestrial ranging and dead reckoning combined with absolute radar positioning).

However, given that the purpose of the ‘Type of EPFD’ field is to indicate integrity and accuracy of the position, perhaps a better approach would be to require that the EPFD provides, along with each position fix, an estimated integrity bound on the horizontal position error, and transmit this information instead of the EPFD type. After all, it is the EPFD (and not the recipient of the AIS messages) that has the information required to estimate the accuracy and integrity of the position fix. The estimated integrity bound could be quantised into bands and encoded using the six spare entries in the ‘Type of EPFD’ field. This approach would require a standard algorithm for calculating the integrity bound for various combinations of sensors to be implemented in the EPFD and a standardised protocol for inputting that information into the AIS unit. The GLA are conducting research in this area; however, no definitive results are available at this point.

# References

[1] ITU, ‘China (people’s Republic of), Working Document to the Proposal of the Preliminary Draft Revision on the Recommendation ITU-R 1371-5, Technical Characteristics for an Automatic Identification System Using Time Division Multiple Access in the VHF Maritime Mobile Frequency Band’, ITU-R WP5B-AR Contribution 35, May 2016.

# Action requested of the Committee

The Committee is requested to:

1. Consider the contents of this document, along with proposal for revision [1] provided by the People’s Republic of China, when preparing input to ITU-R WP5B on the revision of Rec. ITU-R M.1371-5.

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Input papers should be assigned to a work task as listed in the Committee work plan which is available in input papers. Leave open if uncertain but consider how the paper is to be processed if not relevant to a work task [↑](#footnote-ref-2)