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**THE ROLE OF IALA IN THE DEVELOPMENT OF THE
AUTOMATIC IDENTIFICATION SYSTEM (AIS)**

by

Berthold Tepper, Canadian Coast Guard

ABSTRACT

Automatic Identification System (AIS) is a new technology that has the potential to greatly improve the safety of navigation while offering economic benefits to all those who use it. The basic concept for a shipborne transponder that could be used for ship-to-ship and ship-to-shore communication was introduced by IALA as far back as the early 1990's. The introduction of the Self-organizing Time Division Multiple Access (SOTDMA) technology in around 1996 provided a highly capable technology platform for this concept. Since that time IALA has been leading the effort to produce the necessary technical specifications, recommendations and guidelines for AIS. This paper describes IALA's role in and contribution to the international development of AIS.

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Introduction

On the first day of this month, July 01, 2002, the new IMO SOLAS Chapter V carriage requirements for Automatic Identification Systems (AIS) came into force. This event could not have taken place without the many contributions made by many international organizations. IALA can take pride in the fact that it, through its AIS Committee, has materially and substantially contributed to the development and the international implementation of a new technology that has the potential to greatly improve the safety of navigation and provide collateral economic benefits to all who use it.

The basic principles of AIS are relatively straightforward. Its practical implementation, however, is quite complex and very challenging. IALA together with the International Maritime Organization (IMO), the International Telecommunications Union (ITU) and the International Electrotechnical Commission (IEC) have developed the necessary standards and guidelines that turned the original ideas for a ship transponder into the practical reality of today.

This paper describes IALA's role in and contributions to the development of AIS since October 1997 when a Special Working Group on AIS first met and commenced the work that now five years later has led to an international approved AIS.

Historical Notes

Pioneering work done by IALA on developing the concept of an AIS goes back to the early nineteen nineties [1].

In 1988-89 the VTS Committee of the International Association of Lighthouse Authorities (IALA) including experts from the International Association of Ports and Harbours (IAPH), the International Association of Institutes of Navigation (IAIN), the International Federation of Shipmasters' Associations (IFSMA) and the International Maritime Pilots' Association (IMPA), undertook a study covering "*The possible use of a transponder system which would permit ships to be identified and tracked when approaching, entering or sailing within a VTS area.*" A paper outlining the initial results of that study was submitted by IALA to the thirty-sixth session of the Sub-Committee on Safety of Navigation (NAV 36) of the International Maritime Organization (IMO) in September 1990. Entitled "*Requirements for a ship identification, polling, tracking*

and automatic report system to operate in conjunction with VTS “ [3]. This operational requirements document was the embryo of a performance specification for AIS. [2].

After consultation with other IMO member states, including Germany, the Netherlands, Norway, and the United States, known to be developing VHF transponder systems at the time, IALA presented a more robust technical requirements document to NAV 37 in 1991 [4]. The draft technical requirement now carried the title “*Radio Transponder for VTS Purposes and Possible Ship-to-Shore Identification*” and also recognized a new requirement beyond the VTS application, the capability of “*transferring databetween certain categories of suitably equipped ships and other shipping.*” [2].

Thus, while initially concerned with ship-to-shore data exchange in support of ship traffic management applications, such as Vessel Traffic Services (VTS), the transponder concept had been expanded at an early stage to encompass the additional requirement for ship-to-ship data transfer to assist in collision avoidance. [2].

The Technology Debate

Early implementation concepts for AIS were based on the well-established technology of Digital Selective Calling (DSC). DSC had been developed in the mid 1970’s under the umbrella of the Global Maritime Distress and Safety Systems (GMDSS) to improve the alerting of rescue and stand-by forces in case of maritime distress [1].

However, an AIS implementation based on DSC has a number of performance limitations that put an upper limit on its potential for long-term application. Consequently, when Sweden introduced the new Self-Organizing Time Division Multiple Access (SOTDMA) concept in around 1995, its high potential for maritime applications was quickly acknowledged.

However, not everyone (administrations and manufacturers) was ready, at first, to jump ship and drop DSC and accept SOTDMA. Hence at that time a very lively debate took place during several meetings of the IMO Sub-Committee on Safety of Navigation until eventually a consensus in favour of SOTDMA was achieved. This consensus led to the adoption by IMO of the first key document that is the basis for the AIS of today. In May 1998, IMO/MSC 69 adopted “Performance Standards for a Universal Shipborne Automatic Identification System (AIS)” [MSC. 74(69)].

How IALA became involved in AIS

Once a dominant trend had been established in favour of the SOTDMA technology, IMO, in 1997, requested the ITU to prepare the Technical Standards based on the IMO AIS Performance Standard and to allocate 2 dedicated VHF channels. It was obvious to IMO and the ITU that IALA had taken the lead in AIS matters and that within IALA were the skills to coordinate the drafting of the necessary technical recommendations on AIS. The subsequent, actual transmission of these draft recommendations to ITU would be done by individual administrations.

Consequently, a meeting of an IALA Special Working Group to discuss the preparation of the technical characteristics for a Universal AIS took place at IALA Headquarters in St. Germain en Laye during the period 8-10 October 1997. The meeting was chaired by the Secretary General of IALA, Torsten Kruise.

However, before this work could be finalized, a number of potential and competing AIS manufacturers, some of which had already invested heavily in their own particular technology approaches, had to agree on a common technical approach. Hence at the conclusion of this meeting the manufacturers agreed to a number of confidential meetings among themselves. The purpose of these meetings was to agree on a common technical approach and design philosophy for AIS. A representative from the International Radio-Maritime Committee (CIRM) chaired these meetings.

During the exceedingly short period of time following this very first meeting, i.e. mid October to December 1, 1997, the group of manufacturers was able to present two technology proposals, proposal A and proposal B, to the Special Working Group on December 1, 1997. Following a short, but intense, period of debate by correspondence, the Special Working Group selected one of these proposals as best meeting the established operational requirements. Sweden, on behalf of Canada, Finland, Germany, South Africa, and the United States of America, submitted this proposal (ITU-R M.[8C/XA]) to ITU in time for the March 1998 meeting of SG 8/WP 8B. This proposal was formally adopted by ITU later that same year and became "Recommendation ITU-R M.1371: Technical characteristics for a universal shipborne automatic identification system using time division multiple access in the VHF maritime mobile band".

This was the beginning of an intense four-year period of work for IALA that produced a tremendous output of high quality and important work in an exceptionally short time frame. The detailed work was entrusted to a dedicated IALA AIS Committee. Over the period of the past four years this Committee produced a significant number of output documents as described in the next section.

Work Output

During the past work term 1998-2002, the IALA AIS Committee prepared and delivered a large number of output papers and liaison statements and reports to various organizations such as IMO, the IEC, the ITU (via the individual IALA members), and other IALA Committees (VTS and RNAV). It is not practical to list all of these reports in the context of this report. However, the following list identifies those key papers that have a continuing impact on the manner in which AIS is being implemented internationally. A detailed study of these outputs will give an impression of the amount of work and depth of analysis that went into their preparation.

1. In February 1998, Sweden on behalf of Canada, Finland, Germany, South Africa and the United States submitted to ITU a comprehensive "Draft Recommendation on the Technical Characteristics for a Universal Shipborne Automatic Identification System using Time Division Multiple Access in the Maritime Mobile Band". This document was

- adopted by ITU as ITU-R M. 1371 towards the end of 1998. Working as a team within the AIS Committee structure, the national and industrial members of the IALA AIS Committee had prepared the document.
2. Noting the need for improvements, refinements and additions to ITU-R M.1371, the AIS Committee subsequently prepared during the next two to three years a Draft Revisions to Recommendation ITU-R M.1371. These draft revisions were tabled in 2001 and approved as ITU-R M.1371-1.
 3. Noting the condensed and often times cryptic language of the ITU-R 1371-1 document and hence the consequential need for clarifying explanations, the AIS Committee prepared and issued a document entitled “Technical Clarifications of Recommendation ITU-R M.1371-1, Edition 1.2.” It is expected that, in due course, this document may be the foundation for a further update of ITU-R M.1371-1 leading eventually to another issue, ITU-R.M.1371-2.
 4. AIS is a complex and new system. Recognizing that there is an urgent need to inform mariners, users, manufacturers and administrations of the total range of AIS capabilities, system complexities and implementation approaches, the AIS Committee has begun the process of producing a comprehensive set of guidelines on AIS. This work has produced at this point in time a document entitled “IALA Guidelines on Universal Shipborne Automatic Identification System (AIS), Version 1.0, December 2001 ”. The document can be accessed on the public IALA website. Further improvements will lead to other updated versions during the next work term.
 5. While drafting the new SOLAS Chapter V AIS carriage requirements, IMO had stipulated that AIS could not come into force in July 2002 unless a set of operational onboard guidelines was available. The IALA AIS Committee prepared an input paper to IMO that became the basis for the current IMO “Guidelines for the On Board Operational Use of Shipborne Automatic Identification System (AIS)” [5].
 6. The members of the AIS Committee worked closely with and made significant contributions to the development of standard IEC 61993-2: “Universal Shipborne Automatic Identification System (AIS) Operational and Performance Requirements, Methods of Testing and Required Test Results”.
 7. As the IALA AIS Committee members worked on the many operational and technical details of implementing AIS, they realized that the manner in which AIS outputs are displayed to the ship operators is a crucial element. Consequently, the operational members of the AIS Committee Working Group 5 supported by fundamental research work done by the German Forschungsinstitut für Kommunikation, Informationsverarbeitung and Ergonomie (FGAN) [Research Institute for Communication and Informatics Processing and Ergonomics] prepared inputs to IMO on display issues. As a result IMO has issued S/Circular 217: “Interim Guidelines for the Presentation and Display of AIS Target Information”. [6]

8. Noting the significant contributions IALA has made to the advancement of AIS internationally ITU-R M. 1371-1 *recommends* as follows:

3.3 that the AIS applications should take into account the International Application Identifier Branch, as specified in Annex 5, maintained and published by the IALA;

.4 that the AIS design should take into account technical guidelines maintained and published by IALA.

Work in Progress

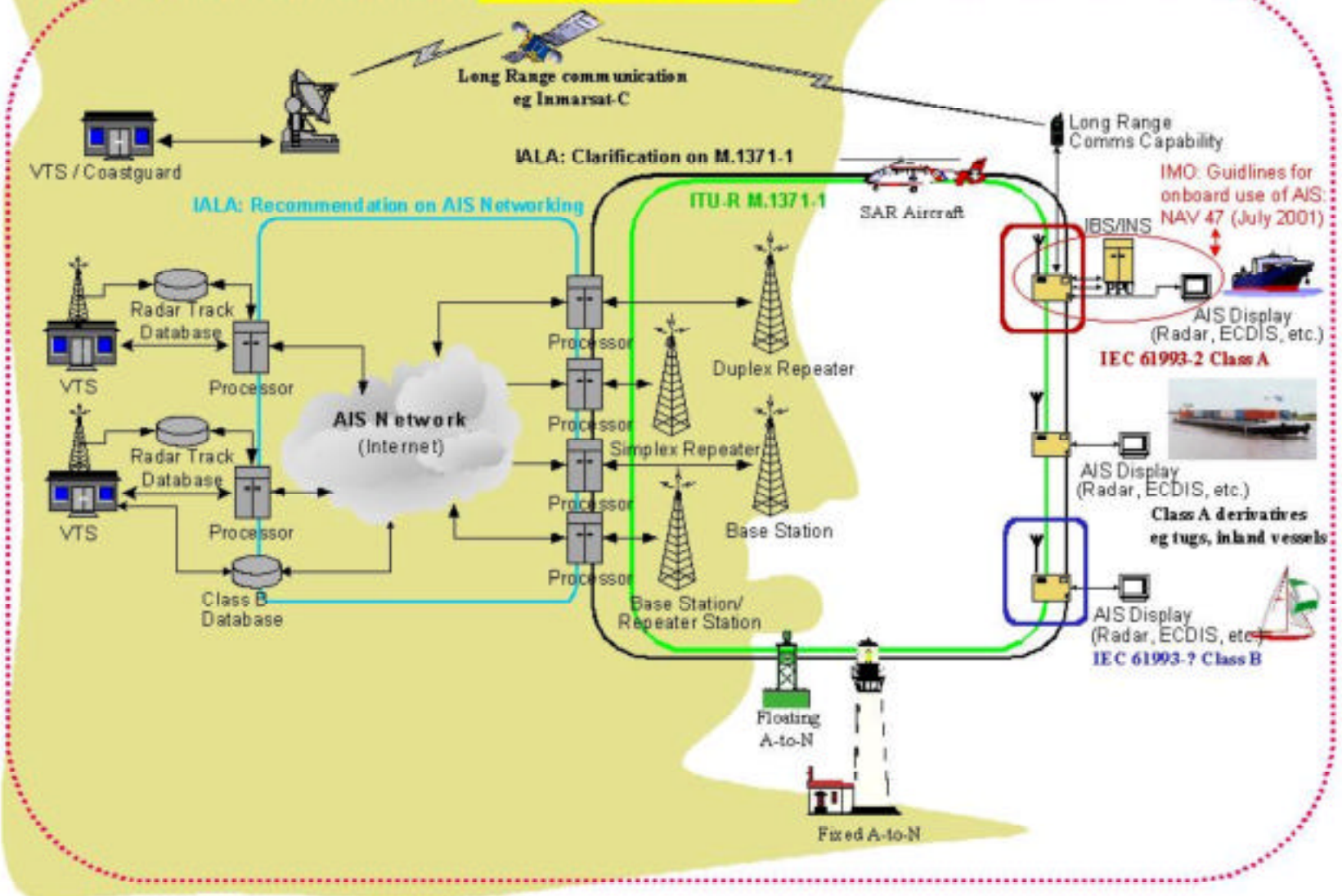
As part of an approved intersessional work program for the period September 2001 to September 2002, the AIS Committee through its Technical Working Group is working on a series of draft documents that concentrate on key elements of the AIS shore based infrastructure. A short description of the documents follows.

1. The current AIS standards define explicitly how the mobile AIS environment is supposed to function. However, there are no guidelines that explain how to design an AIS shore base infrastructure. IALA is addressing this need by drafting a recommendation entitled at this point in time: “ Draft (“C”) IALA Recommendation on AIS Shore Stations and networking aspects related the AIS Service”.
2. Great progress has been made with the key AIS document the *IALA AIS Guidelines*. However, more work is required and new ideas and lessons learned occur regularly. Hence this document, now on the public IALA web site as Version 1.0, will be improved and completed during the next work term. IALA is working on Version 1.1 now.
3. The range of possible, practical application is quite large. One such application is the use of AIS to monitor AtoNs or even more imaginatively generate pseudo AtoNs. Preliminary work has started on a *Recommendation on Aids-to-Navigation AIS Stations*.

Summary

This report has provided a condensed overview of the work done by IALA in placing AIS on a solid footing. Figure 1 summarizes this work as well as that of other international organizations. The diagram provides a pictorial overview of where all of these standards and recommendations fit in the overall AIS environment.

IALA AIS GUIDELINES



Conclusions

As demonstrated in this report, AIS is well on its way towards international implementation. IALA, through its AIS Committee, has been instrumental in laying the foundation for this new technology and operational system. IALA can be proud of having contributed to a safer marine navigation environment.

Some work remains to be done and it will be done. Beyond that, IALA also has a longer-term role as custodian of certain elements of the AIS as recorded in ITU-R M.1371-1.

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