

ASSESSMENT OF CORRECTNESS OF INFORMATION OBTAINED FROM AUTOMATIC IDENTIFICATION OF SHIP'S SYSTEM (AIS)

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Abstract

In order to provide safety of navigation, the ship's officer employs a lot of different devices which are installed on navigational bridge. One of them, very useful equipment is system for Automatic Identification of Ships (AIS). However, the information thus obtained can be inaccurate or even false. In this article the author presented ways to verify the data obtained from Automatic Identification of Ships (AIS) with the help of radar (ARPA). The advantages of earlier verification of information obtained from AIS are presented when a vessel is manoeuvring and the data presented by ARPA are not reliable. An algorithm of a program which makes it possible to verify the reliability of data obtained from AIS has been presented here. A possibility has been demonstrated of constructing a device employing that algorithm in order to support the navigating officer in making decisions avoiding collisions.

This system will alert the Watch Officer about incorrectness and about inaccuracy of ARPA and AIS. This solution could be a very helpful tool to be used in adverse weather conditions particularly for the vessels in collision situation.

Keywords: AIS, ARPA, collision avoiding, data verification

1. Introduction

The development of navigation has always been connected with the care for its safety. One of the most important elements is safe, without collision, sailing from port to port. This mainly depends on professional skills of navigating officers but now when there is a lot of traffic and the technology employed on vessels is constantly developing aids to navigation become more and more important.

An introduction of radar on ship's bridge may be regarded to be revolution because vessels were able not only to define their relative position (course and speed) but also to carry out safe navigation in fog.

A new era in collision avoiding, similar to air navigation, started together with AIS, Automatic Identification System.

In practice it turned out that this system cannot always be relied on. Their indications, depending on different circumstances can often be wrong.

2. Radars as aids in collision avoiding actions on board a vessel

During World War II radars were introduced as aids to navigation first on warships and later on merchant vessels. They helped a lot to carry out navigation in restricted visibility as they traced other vessels and defined parameters of their movement. The details of the ship's movement were calculated by the navigator by means of so called radar plotting.

After some time, when computers developed, radars were improved by adding a computer segment with appropriate software, AIS, Automatic Identification System came into use.

This system allows defining in an automatic way such parameters as:

- course,
- speed,
- CPA, Closest Point of Approach,
- TCPA, Time of Closest Point of Approach,
- new parameters of movement after using the simulated trial manoeuvre.

All these data are very useful, especially in solving collision situations. However these data are reliable only when vessels are proceeding steady course and at steady speed. In case any manoeuvres taken, the obtained information may have errors because of changes in ship's movement parameters and because of delay. The observed errors may be indicated by ARPA also because of other reasons, e.g.

- improper orientation of the gyrocompass,
- improper calibration,
- improper adjustment,
- operator's lack of proper skills to handle this device.



Fig. 1. ARPA screen

While at sea the navigator finds it difficult to say whether the ARPA indications are correct or not as it requires a lot of experience, proper skills and appropriate conditions, e.g. the observed vessel is on parallel course.

3. Automatic Identification System (AIS) as an aid to make anti-collision decisions

The introduction of AIS was meant to create a system enabling automatic transfer of data among vessels and among vessels and shore.

This system allows sending data such as name and the call sign of the vessel, its type, position, type of cargo, status, course and speed.



Fig. 2. AIS configuration [2]

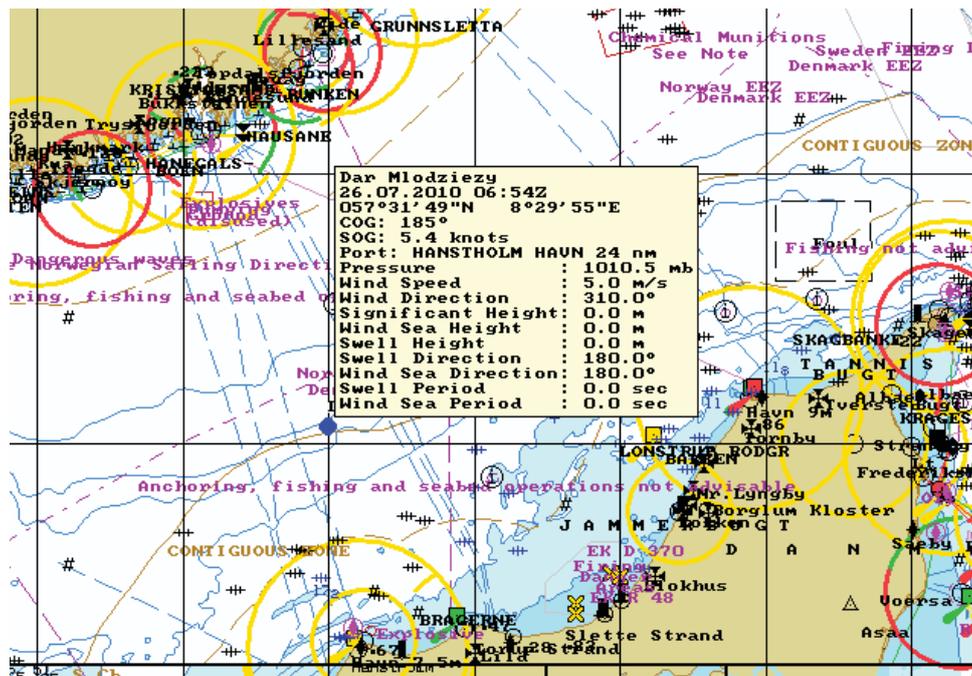


Fig. 3. Example information obtained with AIS [1]

Because of safety of navigation these data are very important as they make it possible to define situation of the vessels in relation to one another. However a few conditions must be fulfilled. Proper installation is the most important factor (it is essential where the antenna is located). Proper handling of AIS using its manual mode is also very crucial and here the right knowledge of this device is indispensable in order to by means of keyboard and monitor, as R. Wawruch specifies in his book 'Universal Ship's Identification System', perform the following activities:

- configuration AIS and to handle it,
- manual introduction of all necessary data, e.g. voyage data,
- display of at least names of the traced ships' AIS and their bearings and distances,
- display of alarms and their acknowledges,

- display of the information regarding safety,
- manual insert information regarding safety manually,
- turn on long and short range mode: automatically and manually,
- display the received and acknowledged questions in long range mode,
- send a reply manually to a question received in a long range mode,
- change in work frequency of AIS and the power of the transmitter,
- display indications of GNSS receiver in case it is used as the source of information regarding the ship's position.

The above mentioned proves how important proper installation, proper configuration and professional handling of AIS is. Real life approach seems to be different as the students running their navigational practice on board merchant vessels state that the masters' approach to using AIS was the following:

- they prohibited making use of it claiming that the obtained information is unreliable,
- they recommended using it unquestioningly,
- they recommended using it only if the information obtained was verified.



Fig. 4. AIS manufactured by Raymarine [2]

The fact that AIS is not used surprises because of its practicability fitting vessels with this device is made compulsory by the Convention. What is more, if the reason why the AIS indications are not reliable was explained, then it would be easy to get rid of it.

4. Possibilities of assessing the correctness of information from AIS and ARPA regarding collision avoidance

As it has already been mentioned the data obtained with ARPA and AIS could be unreliable. In good conditions the navigator is able to assess their reliability easily, e.g. in clear weather and in short distance from the other vessel, with some degree of accuracy, and they can define parameters of the observed vessel and compare them with those displayed by AIS. The situation is different when the vessels are far away from each other or when the visibility is restricted.

As the navigating bridge is fitted with both radar and AIS at the same time therefore it is possible to verify accuracy of their readings in relation to each other. When comparing the information regarding parameters of vessels in vicinity obtained from AIS with these indicated by ARPA we can either confirm or exclude the indication errors of the latter device. In practice, navigators seldom act in this way and when taking manoeuvres, especially during restricted visibility they may be unaware of incorrect, inaccurate data from ARPA. There is similar possibility of verification of the information obtained by AIS. When ARPA is properly calibrated and its indications are reliable and certain then by comparing them with AIS data, it is possible to detect

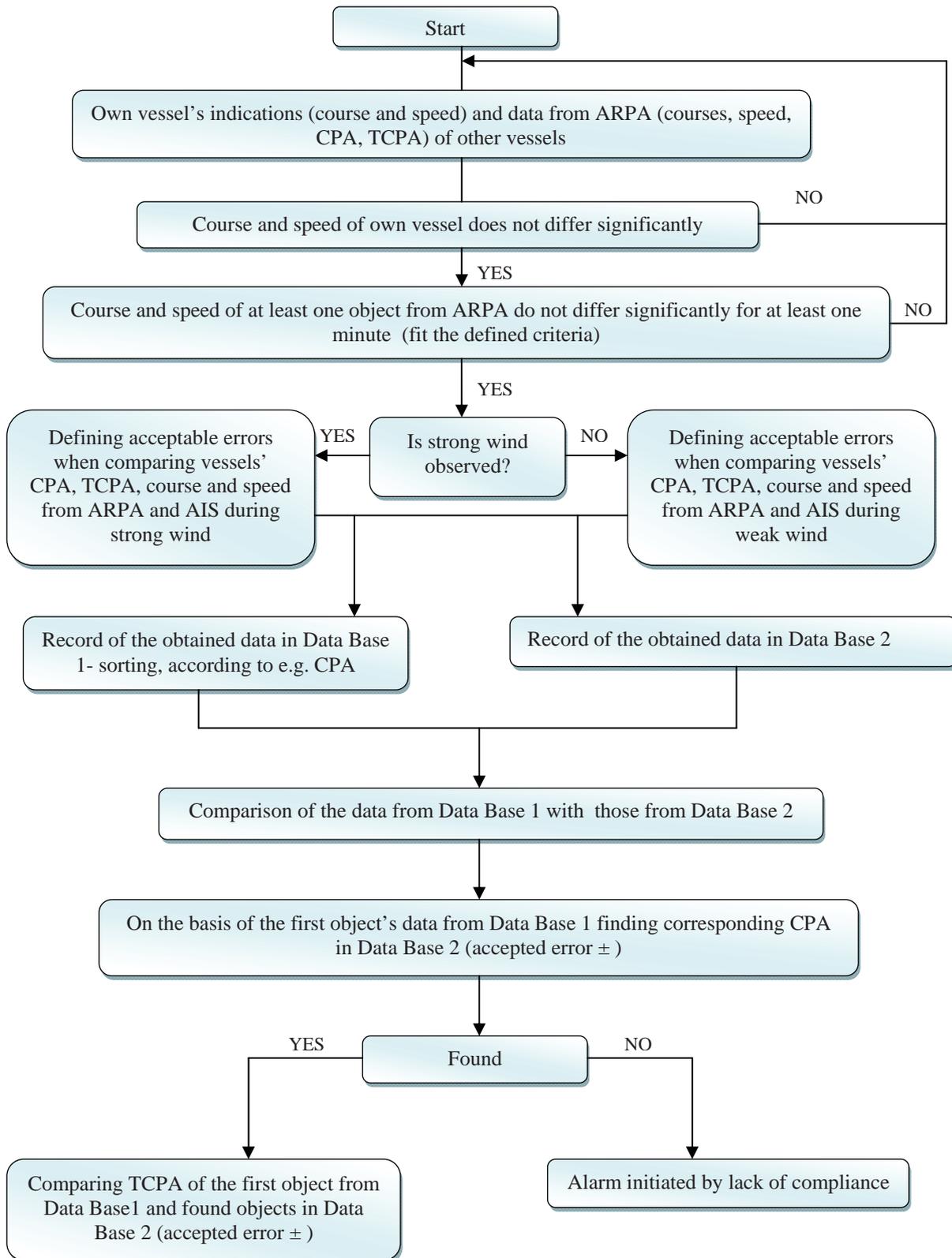


Fig. 5. Example algorithm for finding errors of ARPA and AIS indications

errors made by AIS. However all these operations require active engagement of the navigating officer and here the problem begins as there are no procedures enforced and great accuracy is required especially in restricted conditions. The crew handling these devices has no knowledge regarding the accuracy of indicated parameters. Modern bridges are equipped with devices which

are controlled by the ship's computer. If an algorithm was created to detect the errors of ARPA and AIS automatically and then appropriate computer program could be employed to inform the navigator about any improper indications detected. Fig. 5 presents a proposed algorithm which can be used to compare and to detect differences between the data obtained from ARPA and AIS.

5. Conclusions

During decision making regarding collision avoidance the navigator will make use of information supplied by the ship's equipment. For many reasons but mainly because of too much information provided there should be possibility to group and verify it in order to use it in a safe and most efficient way. A navigating officer does not verify these data during stable and safe conditions and when emergency occurs and there is need for prompt action, there is no time to do it. That is why when navigating bridges are built a very important factor should be taken into consideration, i.e. a clear access to information and installation of such equipment which will alert the officer in case of errors in indications. There are a lot of different ways of raising alarms in emergency situations but still there is no possibility of automatic mutual verification of the data between AIS and ARPA.

References

- [1] www.fleetviewonline.com.
- [2] www.raymarine.com.
- [3] www.marinetraffic.com.
- [4] Norris, A., *Integrated bridge systems: Radar and AIS*, Nautical Institute, 2010.
- [5] Wawruch, R., *Uniwersalny statkowy system automatycznej identyfikacji (AIS)*, Gdynia 2002.
- [6] Bole, A., Dineley, B., Wall, A., *Radar and ARPA manual*, Elsevier 2007.