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# An Overview Automatic Identification System and Its Applications

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## Abstract

The introduction of Automatic Identification System in the sea navigation has provided a greater assistance rather than other navigational systems, in guiding a vessel and forewarning. Primarily designed for the purpose of collision avoidance, now the AIS systems provide a wide range of information ranging from speed to turn rate. This paper mainly aims about bringing a brief overview of AIS systems, its broadcastings, operation and working, various parameters implemented while taking into consideration and with a management technique. Various additional factors such as emission rates and vessel activity have been described here. The factors taken here for considerations are supposed to be a common for both port and underway emissions.

**Keywords**: AIS, vessel activity, emission rate, emissions, rotation rate..

## Introduction

Navigation through sea has increased now-a-days due to ability to transport a large amount of goods through containers and in cargos rather than that of roadways, railways and waterways. However, lack of insufficient navigation systems and equipments, the vessels that travel for longer distances, even crossing over various continental distances may prone to unexpected atmospheric changes, natural calamities ore even the presence of another vessel that crosses over the path of travel. The previous navigational systems, which operated at low frequencies, were not designed sufficiently enough to meet the current requirements. Hence, it was necessary to create systems with very high frequency transmitters and receivers that eventually gave rise to Automatic Identification System. The automatic identification systems were primarily designed for the purpose of collision avoidance between two vessels. Even though the AIS systems are intended to provide only the most basic information, the complex data can be retrieved by combining the systems, with electronic charts, most probably a radar display system. Usually the data are collaborated together for a single screen display mode. In some cases satellite based detection is enables in some AIS systems. Such systems are generally said to be S- AIS systems or satellite based Automatic Identification Systems.

## AIS- A Summary

AIS, being abbreviated as Automatic Identification System are a mode of communication channel between two or more vessels, i.e. ships, as well as the station bases linked with it. AIS systems are used to share the data including, vessel identification, track course and speed of the vessel travelling. The AIS technology uses Global Positioning System (GPS), through which, the information is transmitted to the other. Most basically used for avoiding collisions, they are also implied for safety management. The identification most basically relies on radar technology in identification of the objects by transmission and reception of the signals. The path of the signal propagated determines the visualization of the scenario. The schematic view of an AIS mapping is given in the below figure 1.

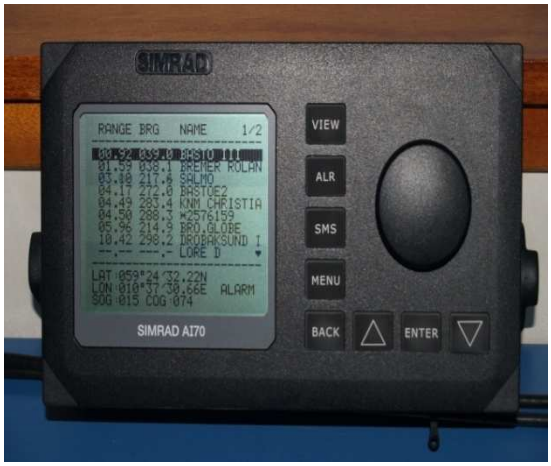



**Fig 1:**

## Types of AIS

The AIS system is classified in to two major types that includes the following,

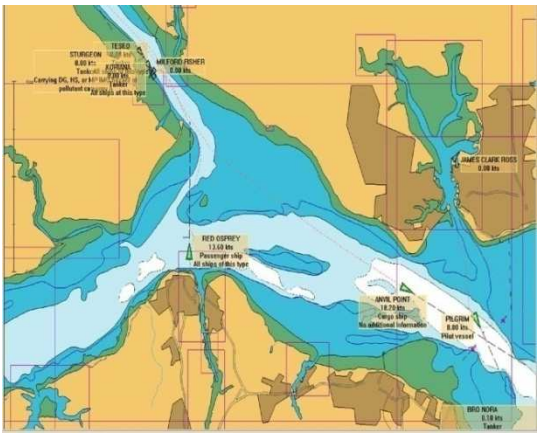
1) Class A type.
2) Class B type.

Class A type AIS systems are implemented and utilized to meet the requirements of the vessels such as unique reference identification (IMO) and also carriage requirements. Class B is most probably similar to that of the class A except that it holds the following disadvantages:

1) Does not transmit status of navigation.
2) Possess only the capacity of reception and not transmission.
3) Reception includes only binary messages and safe texts.
4) Doesn't transmit the destination.
5) Doesn't point out the rate of turn.
6) Does not transmit the vessel's IMO number

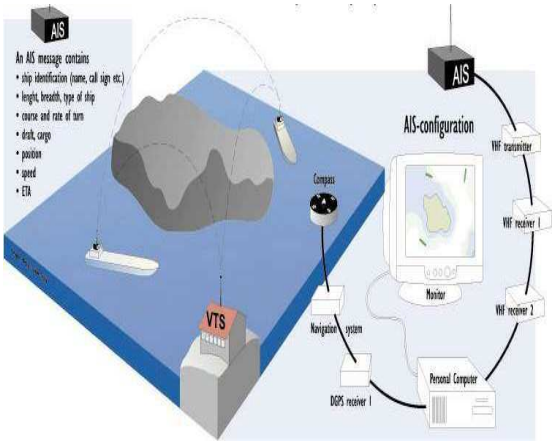
## Broadcasts of AIS

The AIS broadcasts various other data such as MMSI number, Navigation status, rate of turn, speed, position accuracy, Longitude and Latitude Course over Ground. The MMSI number is an n unique identification number which is specifically used to mark a vessel particularly in order to differentiate it from the other sea vessels. Navigation status determines the positioning of the ship determining whether the vessel is on move or anchored. The rate of turns estimates the movement of the vessel either right or left is its path of movement. The degree of turns for a particular vessel ranges from 0 to 720 degrees per minute. In addition to this the time stamp plays a prime role. The time stamp is a universal time standard which provides the time for which the information was created.



## Working of Automatic Identification System

The working of AIS systems is mainly based on transmission and reception of data. Since the data is to be obtained through a satellite, i.e. through space borne radar or satellite, the transmission must be of very high or ultra high frequency. Generally, AIS equipment consists of one Very High Frequency receiver and transmitter, to possibly send and receive a signal or a data. The most preferred operating frequency is of VHF-FM channel 87B and 88B. Depending upon the availability, the usage of various frequency channels is encouraged. Hence a constant communication link maintained with the vessel. Communication in AIS is generally implied by following using a time division multiple access schemes. This unique method allows several users to access the frequency channel range by all users, of dividing the signal into different time slots. The users transmit and receive data individually by using their own time slot. The basic navigational factors which the AIS is intended to display such as the timing and position are obtained through Global Positioning System, which may be external or internal. The transponders of AIS systems work on a normal and in a continuous mode uninterruptedly. The system coverage range depends on the height of the antenna. Its propagation is slightly better than that of radar, due to the longer wavelength.




## Factors Involved in AIS

One among taken for consideration includes vessel characteristics, activities and rate of emission. They are taken as prime consideration because of vessels of larger emission rate are not supposed to be a part of AIS system. Hence the implementation of AIS systems in sea navigation is restricted to a very limited level. The types of vessels that are generally excluded from the AIS systems includes military vessels, fishing boats and vessels that are used for making the expanding canals , rivers, remover of mud from lakes, etc. The rates were designed for controlling the amount of hazardous air pollutants mixing in the air that includes sulphur di oxide, particulate matters, carbon monoxide and ammonia. The equation for the emission rate is given by the following,

AE=AH*CF1*LF*EF*CF2 (1)

Where the terms,

AE= annual emissions,

CF=conversion factor,

AH=annual activity,

LF=load factor (engine),

EF=emission factor.

The following table describes the various types of ships and their amount of emissions.

| TYPE | CO | NOX | SOX |
|---|---|---|---|
| Fishing | 0.9 | 11.1 | 1.3 |
| container | 229 | 4076 | 2082 |
| dredging | 54 | 587 | 78 |
| Military | 25 | 268 | 36 |
| Tanker | 458 | 8152 | 4165 |
| Cruise | 229 | 4076 | 2082 |
| Ferry | 458 | 8,152 | 4,165 |

The above table is listed for the vessels of underway emissions. The obtained values are of emissions of vessels in tons per year calculation.

Another parameter considered for account is the vessel activity. The vessel activity is the determinant of the original working hours or operative hours of a vessel. The data calculated through UTC timings are not absolutely accurate due to the gaps present in the data. Hence as an act of compromise, the vessels were tracked to their respective routes. The vessel speed was categorized, to valid the working hours. In order to obtain the values these data were used to obtain the following,

HRS hp =Hp*En*(St2-St1) (2)

Where the terms,

HRS hp= horse power hours,

En= no of engines in the vessel,

St1= time where the vessels enter a specific segment.

St1= time where the vessels leaves a specific segment.

## Implementation of Higher Efficient Radars- A Scope

Radar is one among the most important part of the instrument. The transmission and reception of data is maintained through higher efficient radars. Even though higher efficiency is maintained, the transmission and reception of the data transfer may be interrupted or even contaminated due to various atmospheric factors. Major factors may include such as atmospheric changes between the ground level and the estimate level (factor considered if the vessel is monitored through space borne radars), creation of beam blockages due to the presence of hailstones in the atmosphere, resulting improper transmission and reception of the data. Such conditions can be rectified through increase in the band that radar uses, such as of higher orders (L,P) and introduction to polarimetric radar may have significant impact in estimation of a specific target, if necessary. Since these types of radars can exhibit waves of both horizontal as well as vertical orientations and rather than conventional ones that produces a two dimension view, creates a three dimensional view of a target since possibilities of providing output in three axis respectively. Other than that, possibilities of multiple polarizations produced by this kind of radars can be implemented effectively for various

purposes. Widely used in agriculture, meteorology and forestry, it may also be used effectively in sea navigation.

## Port Management

Port management is a prime factor considered in the maritime affairs. It solely deals with the incoming and outgoing of vessels, amount of transportation and maintains a constant record regarding the vessels that are stationed. Automatic Identification System is an efficient option in management of ports and sea navigation. Since they can effectively handle the vessels consequently, they are widely preferred in modern sea affairs.

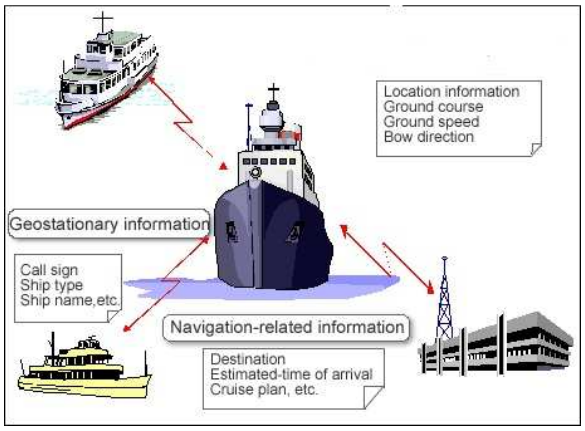



Fig:

## General Factors Considered in Port Management

Since the advent of usage of the AIS systems in the sea navigation systems, the efficient management of the ports has been increased, by evolving the technique of data flows. The flow throughout the port must be made easier such that it is intensely noticed there is no interferences in the work. While considering an example of loading and unloading of a cargo ship, the following factors are made in to the considerations which maintenance of the data flow.

1) Arrival.
2) Positioning of the container.
3) Arrival of the ship
4) Transportation of the container.
5) Loading and unloading.
6) Departure of the ship.

The monitoring of vessels mainly deals with their arrival and departure. They determine the total number of vessels that is to be anchored in an individual port. Other than that, various factors are highly monitored using their transportation and loading of the containers in the vessels. The observances of vessels rely upon transponders. Usage of transponders plays a prime role in surveillance of the vessels. The positioning of vessels through its monitoring can be sequential, till it keeps with the station. These transponders are much efficient in short time response rather than that of radar equipments and satellite navigation. However transponders cost efficiency can be improved by installation of the following equipments for:

1) Wind speed and direction.
2) Water level (sea).
3) Technical issues with the notifications of warning.

## Conclusion

AIS provide a best navigational support for the maritime environment. Their ability to monitor continuously the vessels, despite of various harsh weather conditions they display various information regarding the navigation, such as the speed and turn rate more accurately. This feature of the system specifically distinguishes the system with other navigational aids. Even though the concept of Automatic Identification System is widespread, the implementation of the system is limited. Due to various factors, they are not fully influential. Some other vessels due to various emission factors are not actively supported to participate in AIS program.

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