

# The role of navigational aids such as Radar/ARPA, ECDIS, AIS, Autopilot, on safe navigation at sea

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**ABSTRACT:** Chabahar Maritime University has started radar/ARPA simulator training course since 2004 and the training has been carried out fully comply with STCW95 Convention and the IMO model course. According to the improvement in navigational technology, the reduction of Navigational Aids as two credits of the latest BSc syllabus for future officers on board ships will be discussed through this article in depth. In addition to the above, the author attempts to describe the AIS (Automatic Identification System) which is defined by IMO and has been adopted by the latest revision of SOLAS chapter V. In fact, the AIS is part of ship's radio station and is surveyed together with radio installation. The AIS training is going to be taken place from next semester at Chabahar Maritime University in order to improve the skill of the trainees in order to rely the information provided by AIS.

## 1 RADAR/ARPA SIMULATOR TRAINING COURSE

Based on Section A-1/2 of STCW95 Convention, training of marine simulator regarding Radar and ARPA Courses are compulsory for future officers and masters on board ships. According to the above section of STCW95 Convention, the following factors should be considered:

- be suitable or the selected objectives and training tasks and be capable of satisfying the specific assessment objectives;
- be capable of simulating the operating capabilities of shipboard equipment concerned, to the level of physical realism appropriate to training of assessment objectives, and include the capabilities, initiations and possible error of such equipment;
- have sufficient behavioural realism to allow a trainee to acquire and a candidate to exhibit the skills appropriate to the training and assessment objectives;
- provide a controlled operating environment, capable of producing a variety of conditions, which may include emergency, hazardous or unusual situations relevant to the training and assessment objectives;
- provide an interface through which a trainee can interact with the equipment, the simulated environment and, as appropriate, the instructor; and
- present an instructor, and assessor the ability to control, monitor and record exercises for the effective debriefing of trainees and effective assessment of the performance of candidates.

In addition to the above essential simulator training items, instructors and assessors should consider some more factors in order to assess the ability of candidates based on his/her competency level.

## 2 AUTOMATIC IDENTIFICATION SYSTEM

AIS is abbreviated as Automatic Identification System which is being used to concur with the IMO standards (MSc74,(69), annex3). Indeed, IMO recommended that it is compulsory for all vessels to be equipped with AIS until July 2008. As Cap.Holder said that we might discover that AIS could have a positive or negative influence on collisions. Its impact will be positive if it aids mutual recognition, enhances the application of the correct rules and provides unambiguous agreement of further action. It will also be positive if AIS can identify ships in clutter or hidden behind bends.

In fact, AIS offers the following information which can be categorized as three main groups: a). Constant information such as name of ship, IMO no, length and breadth of ship, type of ship. b). Voyage information such as draft, type of loaded cargo, destination and ETA, etc. c). Changed information such as time, compass course, position, ship speed, sailing condition, etc.

David Patrisko pointed out that within a decade, ships could have to fit VDRs, AIS and increasingly ECDIS, with a proliferation of different designs for similar equipment.

In the meantime, Cap. EM.Scott stated that ...there are significant risks associated with the introduction of AIS and regulators must resolve uncertainty through practical research to evaluate optimum displays.... therefore, seafarers can use AIS guideline book which has been issued by IALA in order to get following information:

1. Receiving information related to the AIS radar targets that have been sent by local VTS.
2. Maximum 12 courses and way points with the recommended turning circle which are presented by VTS.
3. Information regarding meteorology, oceanography, direction & velocity of wind, sea temperature, air temperature, direction and speed of current, depth of water, etc.
4. Navigational information such as crossing, overtaking, head on situation, etc.
5. Regional or local information for safe navigation at coastal waters.

### 3 THE ROLE OF ECDIS ON SAFE NAVIGATION AT SEA

According to the new amendment of SOLAS (no.19), ECDIS became a compulsory navigational aids on board ships. The advantages of the system is to save time for applying correction and a large space as chartroom in the bridge. Peter Jones from UK Hydrographic Office stated that... the emergency of electronic publications with their additional functionality and potential for more efficient updating may assist in enhancing access to the full range of relevant navigational information.

ECDIS can be used as an optimum equipment in order to save all the ship's courses, turning and manoeuvring, etc. By installing ECDIS system, modern technology, to all vessels; it may cause to enhance safety at sea and improve seafarers operational capability while sailing. Of course, adoption of IMO regulations by all countries will cause to provide clean, secure and safe sea. As Andrew Hal as seafarer concluded in his presented paper that... I have no doubt that the increased use of electronic charting can only improve safety and efficiency of navigation.

### 4 GPS AND DGPS FOR SAFE NAVIGATION

It is essential to know that what is meant by GPS? The system consists of three operational segments such as a). Ground station tracking / processing network b). Space based constellation of transmitting satellites c). User segment consisting of GPS navigation receivers. Ground station is controlled by department of Defence of the United States and

the earth stations track the GPS satellites and the information transmitted to each satellite every six hours.

The space satellites consists of 27 operational satellites which are distributed in six polar orbits and located at an altitude of 20000 km above the earth's surface.

The receiver on the earth's surface allows to see at least four and max 12 satellites simultaneously with 10 degree elevation, it will be either a military Precise Positioning Service (PPS) or civilian Standard Positioning Service (SPS) unit. The GPS receiver measures the time for a signal transmitted by the satellite and multiplied by the velocity of light in order to calculate latitude, longitude and height.

It should be noted that since the clock of the GPS receiver is not synchronised with the satellite clock, therefore to avoid of receiving large position errors it is arranged to observe four or more satellites at the same time. In 1980, the international surveying companies offer Differential GPS (DGPS) with all the capability of GPS plus better positioning accuracy of  $\pm 3$  to 5 metres. The principle configuration of DGPS is that by arranging one or more GPS receiver as fixed reference stations in order to measure ranges to all satellites in view; and also calculate all the errors in the signals by DGPS correction processor then the DGPS corrections are transmitted via the Inmarsat A,B or M compatible marine satellite communications network.

DGPS service improves vessel safety for navigating in confined waters or even as hydrographic surveying or offshore construction vessels and so on.

### 5 THE ADVANTAGES OF USING VDR FOR SAFE NAVIGATION AT SEA

VDR or Vessel Data Recorded is used for recording ship voyage information; it is called black box too which is introduced based on the advanced technology in shipping. The advantages of this equipment is as follows:

1. Main Recording Unit (MRU) can record the required information of IMO and shipowner up to 24 hours.
2. Voyage information capsule or main black box of ship which is located at the highest point of ship; it can save the required IMO information up to 12 hours.
3. Electrical power of the equipment is supplied by linking the system to the emergency power of ships with a 2 hours battery.
4. The required information of the IMO for passenger ships are as follows: date, time, latitude and longitude, ship speed, ship course, communication of personnel at the bridge and VHF, radar

information, depth of water, ship engines, velocity and direction of wind, alarm system, etc.

## 6 THE ROLE OF NEW TYPE OF RADAR ON SAFE NAVIGATION AT SEA

Although, the technology of marine radars is under progress, nevertheless the latest technology of the radars is going to be considered through this paper. There is no any modification in the magnetron system and the scanner of marine radars. Referring to the new design of marine radars, radar display unit of CRT has been changed LCD system. Based on advanced technology, marine radars integrated with AIS which is quite important equipment in order to prevent collision cases at sea.

The combination of the above two systems require some corrections to be applied to the new type of radars; for instance whether a marine radar should be able to detect mountain and rock in 20 miles distance toward the land. Indeed, a marine radar must easily find the emergency signals from SART, Racon, Beacon, etc and be able to detect small radar targets in critical situations.

Concerning to the significance of marine radars, Mike Pope (2002) concluded that ... I believe radar will continue to play an important, if not critical, role in safety at sea. Even with the advent of high accuracy DGPS and AIS, radar will continue to be a primary aid to navigation and collision avoidance.

## 7 CONCLUSION

Improvement in technology making new navigational equipment to be become more complicated for user or seafarers. Therefore, reduction of Navigational Aids as two credits in the latest BSc syllabus is not suitable for future officers on board ships. It means that more emphasis should be taken to improve safety of navigation. Use of advanced equipment on board ships is not the solution for safe navigation at sea; the quality of training of new navigational tools is vital for navigators which should be considered by the nautical colleges.

## REFERENCES

- Buckens K, 2001, "How to work with AIS", The International Journal of the Nautical Institute, Seaways.
- Nigel S, 2002, "ECDIS-the future of navigation, The International Journal of the Nautical Institute, Seaways.
- Hall A, 2002, "Electronic Chart at Sea", The International Journal of the Nautical Institute, Seaways.
- Robert G, 2003, "The devil is in the detail, a seafarer looks at AIS", The International Journal of the Nautical Institute, Seaways.
- Goddard J, 2002, "Getting added Value out of your VDR", The International Journal of the Nautical Institute, Seaways.
- Scott E, 2002, "Integrated Bridge Systems", The International Journal of the Nautical Institute, Seaways.
- Evans P., 1999, "The GPS/DGPS revolution", The International Journal of the Nautical Institute, Seaways.
- Pope M., 2002, "Marine radar technology", The International Journal of the Nautical Institute, Seaways.
- Jones P., 2003, "The Admiralty Nautical Chart", The International Journal of the Nautical Institute, Seaways.