

# Research for Navigation Safety and Function of Electronic Devices on Ship

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**Abstract:** The Marine Radar and use of electronic chart gives precise calculation of range and bearing of targets which is required for accurate navigation. Integration of radar wave detection and ranging system on the navigational station is a mandatory requirement for safe navigation. Human eye alone can guess the distance but cannot quantitatively state the range of object therefore, intervention of RADAR technology makes a ship master accurate object detector. In navigation we can fix vessel's position by many methods like by cross bearings taken from two different objects, beam bearing to four-point bearing method, Horizontal sextant method, Vertical sextant method, cross bearing from three objects, by celestial fix, by bearing of object and sounding contour change, GPS fixing and by marine Radar. A ship's master can monitor vessel's real time position continuously on the ECDIS monitor. All together both equipment have improved master's ability to better monitoring of navigation.

**Keywords:** Navigation technique, marine radar, electronic chart, ranging and direction, ship's captain, position fixing.

## 1. Introduction

Marine Radar and ECDIS are now mandatory equipments for safe navigation. Innovation and technology has developed in right direction for improving the safety in navigation. Nautical officers has to precisely detect the objects with great accuracies and it is possible by use of marine radar. Marine radar sends pulses of Radar waves on the horizon and receives back the reflected waves back on the receiver.

Ship's master finds the object on planned position indicator and with help of electronic bearing line and variable range marker. Ship's master even can use the cursor to observe the bearing and range of object. Here this important part is data detection. Automatic radar plotting aid is additional features in marine radar. Ship's master can find out all required data like position of target, speed of target, closest point of approach of target, time for closest point of approach of target, bow cross distance, time etc. in very prompt manner. These data are extremely important for interpretation of exact situation of vessel with respect to closing target. Ship's master, Nautical officer therefore can take appropriate action whatsoever is needed as per international convention for prevention of collision at sea. Targets with zero closest point of approach are the targets with collision course and requires avoiding action as per international regulations for avoiding collision. Targets with small CPA are those which are creating close quarter situations and action is required.

Fixing of radar scanner can be planned in such a way that radar has bare minimum blind area, blind sector etc. Marine Radar are extremely good devices for position fixing as navigator easily can fix position using range and direction from fixed objects etc. Always a good selection of object and correct plotting easily can give highly accurate results. Infact error-less radar fixes are more accurate than fixes by global positioning system.

Proper use of tuning, gain, sea clutter, rain clutter is important as suppressing gain can cause non detection of weak echoes on the other hand, during rough sea interference can cause problem in detection therefore appropriate use of sea clutter and rain clutter is essential.

## 2. Guideline and Text

Nautical officer should understand the problem of multiple echo from target or poor detection of extremely small object etc. It is very important to use proper range of detection including long range scanning. Guard zone, sector zone, map plotting, alarm setting functions are also useful functions in marine radar and it should be used in proper manner. Now a days feather touch marine radar is also used in navigation.

Parallel indexing tool is also important tool and should be used to maintain fix distance off from any land mass passing from a close distance.

With use of radar easily nautical officer can assess difference in course steered and course made good. Radar display can be set for true motion or relative motion both are good and should be used in appropriate manner. As per stabilization is concerned radar can be set for sea stabilized mode or ground stabilized mode. It is always recommended to use sea stabilization for collision avoidance need.

Radar can be made to North up mode, head up mode or course up mode as suitable to the user. In North up mode your gyro north in display remains upward and ship's heading line will be pointing to the direction as in display card for example if heading is ninety degree then it will point to horizontal right side extending from centre and vice versa. Correct use of vector length also helps a lot in safe navigation.

Radar also can pick up Racon beacon signal hence it is many time used by nautical officers to fix the vessel's position.

Racon can give signal like "c" 'f' etc. Function of marine radar in search and rescue operation cannot be denied. It is always used throughout the navigation and in search and rescue

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operation. Expanding square search, sector search, parallel search etc. Radar can give good detection in searching to survival craft.

'Search and rescue radar transponder' interrogates its signal to 'X band' radar as frequency of 'X band' radar and SART beacon matches accurately. In X band radar SART signal at distance gives a dotted bearing line of survival craft and as the ship closes to survival craft it changes into arc and finally into circle [1]. Assumption should never be made on the scanty radar information always cross checking of information is essential.

'Automatic identification system' overlay can be made into modern radar. The advantage of overlay is that radar now can read AIS target data into planned position indicator. Such radar using AIS overlay gave give target vessel's name and particular information's about targets. Radar is also very useful in port approach and in dropping anchor accurately in precise position.

The ship's master can mark the anchorage position on PPI and then can safely proceed to that position. Editing of Map and use of same is also a good function on radar and with help of this even buoyage system, port boundary etc., can be marked very well on the marine radar. Aeroplane also uses radar for the detection and it always helps to flying pilots. Radar is also used in the warfare technologies in defence system. Radar and target homing technologies can pinpoint the targets for accurate results.

Electronics chart system and radar are real friends of nautical officers and at present research is going on to improve more on electronic charts. ENC data exploration is in progress even for the world sea areas to provide great coverage of vector charts.

International Hydrographic office has done wonderful work in setting up of ECDIS international maritime organization's standard of performance s 52, s57 etc. [2]. ECDIS equipment is a grounding-enemy device. Proper use and input of Echo sounder device can ensure that ECDIS provides timely warning signal prior the vessel entering into shallow waters. Safety depth, safety contour, deep contour should be set carefully to enjoy the safe nautical passages. ECDIS system mainly comprises computer processor, RAM, software, graphic card, hard disk, data interfaces facilities, CD, DVD drives, USB ports and a display unit etc. ENC data presentation library is always there in ECDIS.

Ship master can monitor vessel's position continuously on ECDIS system that means every second he knows where is my vessel with respect to geodetic position at sea.

This is a brilliant function of ECDIS, unlike the paper chart where master has to plot position to find out position, ECDIS system is a real time navigation system. ECDIS helps ship's master throughout in the navigation by giving alerts and visuals.

Ship master remains in touch of real land topography at all time. Think if there is no ECDIS and low land is there 4 nautical mile abreast it is really difficult to observe the non-linear curve of topography from a distance but once master is navigating the ship with ECDIS he can keep a very close look in the topography.

Passage planning, appraisal, planning, execution and monitoring all becomes easier by the use of ECDIS [3]. Radar and ECDIS both are very helpful during restricted visibility. It is not possible to navigate any ship in dense traffic in restricted visibility without the use of marine radar.

ECDIS can be interfaced with marine radar, Global positioning satellite system, Echo sounder, Gyro, speed log, automatic identification system, voyage data recorder etc. A well interfaced ECDIS can provide huge information's availability in the ECDIS panel itself.

### 3. Conclusion

Marine Radar and Electronic display and Information system has improved the safety of navigation. Use of these modern technologies has improved quantitative analytical ability of nautical officer to find out accurate data. Accurate data availability ensures safety of navigation. High standard equipments definitely help ship's master, nautical officers in the safe navigation. Ship's officer feels comfortable in the faster chart correction and also chart correction can be received even while vessel is on the passage. Voyage planning, editing of route, voyage execution everything becomes very easy with the help of ECDIS and Marine Radar.

### References

- [1] "IMO: International Aeronautical and Maritime Search and Rescue".
- [2] "International Maritime Organization Performance standard for ECDIS".
- [3] "ICS, Bridge Procedure Guide".