**RADAR and ARPA**

**TARGET TRACKING**

**Exercise Description: Radar and ARPA target tracking**

**Introduction:**

***Objective:***

The objective of this exercise is to familiarize participants with the principles and operation of Automatic Radar Plotting Aid (ARPA) systems. Participants will gain practical skills in utilizing ARPA to enhance situational awareness, track targets, and make informed decisions for collision avoidance.

***Materials Needed:***

* Radar (real or simulated)
* ARPA system (real or simulated)
* Training data sets (if using simulated ARPA)

***Duration:***

* The duration may vary based on the participants' prior knowledge and experience.

***Exercise Steps:***

* Familiarize participants with the various elements displayed on an ARPA system, including own ship's position, target vectors and collision warning indication.
* Explain how to interpret target information provided by ARPA, such as target ranges, bearings, courses, speeds, closest points of approach (CPA), time to closest points of approach (TCPA).

***ARPA Operation and Settings:***

* Demonstrate the operation of an ARPA system, including system initialization, acquisition of radar targets, adjustment of display settings and trial manoeuvre.
* Discuss the importance of properly configuring ARPA settings, such as radar offset, target vectors, CPA and TCPA alarms in order to suit the operational requirements.

***Practical ARPA Exercises:***

* Utilize real or simulated radar data and ARPA systems or simulators to conduct practical exercises.
* Guide participants in using ARPA to track targets, determine target courses and speeds, CPA and TCPA, predict potential collisions and make informed navigational decisions.

***Collision Avoidance Strategies assisted by ARPA:***

* Discuss collision avoidance strategies using ARPA, including the utilization of International Regulations for Preventing Collisions at Sea (COLREGs).
* Present different collision scenarios and guide participants in using ARPA to assess the situation, calculate CPA and TCPA, evaluate risk of collision and take appropriate evasive actions.

**Discussion**:

* Facilitate participants to share insights, challenges and lessons learned from the practical ARPA exercises.
* Summarize the key points of ARPA operation, target tracking and collision avoidance strategies.
* Emphasize the importance of regular training and maintaining situational awareness by utilizing ARPA effectively.
* Address any remaining questions or concerns raised by participants.

**Note:** If access to a real ARPA system is not available, the exercise can be adapted to use ARPA simulators or pre-recorded ARPA data sets for practical exercises.

**Scenario: Radar and ARPA target tracking VIDEO TUTORIAL**

**Entry condition:**

The student has already basic knowledge of radar and ARPA operation.

Video exercise, described below, has the following prerequisite: Relative motion. True vectors. Radar screen orientation: Head Up. ARPA on. Own ship course 030 degr, own ship speed 8.0 kn. Three target tracking by use of ARPA. Targets keep steady their course and speed. In addition, there will be showed execution of own ship manoeuvring, observing safety distance of 2.0 NM (Open Sea). Exercise trial manoeuvre and manoeuvre with own course change.

**Exercise description:**

Radar and ARPA target tracking typically includes the following steps:

1. Set up the radar display and adjust the settings for optimal performance.
2. Identify the targets on the radar display and activate ARPA tracking for each target.
3. Monitor the target's speed, course, and closest point of approach (CPA) to the ship.
4. Use the information provided by ARPA to make course and speed adjustments to avoid collisions and maintain safe navigation.
5. Continuously monitor the targets and make adjustments as necessary.

**Video description:**

The video starts with Radar screen on and target acquiring. After work out of target data, the targets are evaluated as “head on” target, “stand on” target, crossing with a “right of the way” and “satellite target”. Setting safety distance 2.0 NM. Vectors changed to “relative vectors”. “Head on” target, “stand on” target showing CPA less than 2.0 NM. Exploring the capability of the trial manoeuvre as seen on the right part of the screen. Using parallel index line for evaluating relative track of the targets. Display change to “North Up”. Checking target relative motion. Evaluating the situation. After using trial manoeuvre, decision taken to change own vessel course to 070 degr. Monitoring the relative motion of the targets. The satellite target appeared with relative vector too and consequently is not more a satellite. Using trial manoeuvre to estimate the time to return to the original course. Range reduced to 6 NM for better view of the interested area. Progress and target advance monitoring. Setting EBL as relative beam. Target trails (true) clearly visible. Returning to the original course of 030 degr. Monitoring the progress of the targets. Changing speed vector size as appropriate to evaluate the situation. Vessel returned to the original course. The satellite target became again satellite and its relative vector disappeared. Monitoring the rest two target movement. Exploring ARPA data such as CPA, TCPA. After target passing own relative beam, the manoeuvre is completely finished.

**Conclusion:**

ARPA exercises provide mariners with practical experience in utilizing ARPA systems, tracking targets, interpreting ARPA data and making informed navigational decisions. By developing proficiency in ARPA operations, mariners can and will enhance situational awareness, improve collision avoidance capabilities, and ensure safe navigation in challenging maritime environments.

**Radar and ARPA target tracking**

Questionnaire with answers (in bold):

1. What is the fundamental purpose of the marine radar?
2. Provide early warning of ships
3. **Detection of other objects outside own ship**
4. Determine the course of other ships
5. Provide an early warning of ships on collision course
6. On a radar screen, the target is assessed as dangerous when:

A - continuation of its true vector passes through the circle with the centre point of your own ship and a radius equal to the set safety distance

B - continuation of its true vector passes through the place of your own ship

C - when the distance decreases

**D - continuation of its relative vector passes through the circle with the centre point of your own ship and a radius equal to the set safety distance**

1. Targets are classified as:
2. Hazardous and non- hazardous
3. Hazardous and potentially hazardous
4. Moving and stationary
5. **Hazardous, potentially hazardous and non-hazardous**
6. CPA (Closest Point of Approach) is called:
7. Point in the course of the vessel in which the target crosses its course on the bow

B. Shortest distance to be in 6 minutes

1. **The nearest point where the object will get to the own ship**
2. Distance along the bow or stem of the ship, at which a target will pass
3. ARPA vector modes are:
4. Only true mode
5. Only relative mode
6. **True or relative**
7. Only absolute mode
8. The ARPA display is
9. A radar picture of the situation
10. **Processed video signals reproduced in convenient mode**
11. A satellite picture of situation
12. None of the answers is correct
13. What is the correct speed input to an ARPA used for traffic surveillance?
14. **Speed through the water**
15. Speed from doppler log
16. Speed from GPS
17. Speed over ground
18. What is the purpose of digitising the radar echoes?
19. **The ARPA tracking system only work with digital signals**
20. Increase accuracy of system
21. No special purpose
22. Reduce number of radar echoes
23. Which ARPA presentation provides the information “closest to what you see through the bridge windows?
24. Relative Motion, North Up, Relative vector
25. True Motion, Course Up, Relative Vector
26. **True Motion, Course Up, True Vector**
27. True Motion, North Up, True Vector
28. How can the true course and speed of a target be found when the ARPA display is showing relative vectors?
29. By comparing target vector with own ships vector
30. **By looking at the digital readout of target information**
31. Can only be found by changing to true vectors
32. By examining the vectors displayed