

(d) a positive indication of the time-scale of the vector in use shall be given.

(8) The ARPA information shall not obscure radar information in such a manner as to degrade the process of detecting targets. The display of ARPA data shall be under the control of the radar observer. It shall be possible to cancel the display of unwanted ARPA data.

(9) Means shall be provided to adjust independently the brilliance of the ARPA data and radar data, including complete elimination of the ARPA data.

(10) The method of presentation shall ensure that the ARPA data are clearly visible in general to more than one observer in the conditions of light normally experienced on the bridge of a ship by day and by night. Screening may be provided to shade the display from sunlight but not to the extent that it will impair the observers' ability to maintain a proper lookout. Facilities to adjust the brightness shall be provided.

(11) Provisions shall be made to obtain quickly the range and bearing of any object which appears on the ARPA display.

(12) When a target appears on the radar display and, in the case of automatic acquisition, enters within the acquisition area chosen by the observer or, in the case of manual acquisition, has been acquired by the observer, the ARPA shall present in a period of not more than one minute an indication of the target's motion trend and display within three minutes the target's predicted motion in accordance with clauses 75(7), 77, 79(2) and 79(3) of this performance standard.

(13) After changing range scales on which the ARPA facilities are available or resetting the display, full plotting information shall be displayed within a period of time not exceeding four scans.

76. Operational warnings—(1) The ARPA shall have the capability to warn the observer with a visual and/or audible signal of any distinguishable target which closes to a range or transits a zone chosen by the observer. The target causing the warning shall be clearly indicated on the display.

(2) The ARPA shall have the capability to warn the observer with a visual and/or audible signal of any tracked target which is predicted to close to within a minimum range and time chosen by the observer. The target causing the warning shall be clearly indicated on the display.

(3) The ARPA shall clearly indicate if a tracked target is lost, other than out of range, and the target's last tracked position shall be clearly indicated on the display.

(4) It shall be possible to activate or de-activate the operational warnings.

77. Data requirements—(1) At the request of the observer the following information shall be immediately available from the ARPA in alphanumeric form in regard to any tracked target:

- (a) present range to the target;
- (b) present bearing of the target;
- (c) predicted target range at the closest point of approach (CPA);
- (d) predicted time to CPA (TCPA);
- (e) calculated true course of target; and
- (f) calculated true speed of target.

78. Trial manoeuvre—The ARPA shall be capable of simulating the effect on all tracked targets of an own ship manoeuvre without interrupting the updating of target information. The simulation shall be initiated by the depression either of a spring-loaded switch, or of a function key, with a positive identification on the display.

79. Accuracy—(1) The ARPA shall provide accuracies not less than those given in sub-clause (2) and (3) for the four scenarios defined in sub-clause (5) of this clause. With the sensor errors specified in sub-clause (6) of this clause, the

values given relate to the best possible manual plotting performance under environmental conditions of plus and minus ten degrees of roll.

(2) An ARPA shall present within one minute of steady state tracking the relative motion trend of a target with the following accuracy values (95 per cent probability values).

Scenario	Data		
	Relative course (degrees)	Relative speed (knots)	CPA (nautical miles)
1	11	2.8	1.6
2	7	0.6	
3	14	2.2	1.8
4	15	1.5	2.0

(3) An ARPA shall present within three minutes of steady state tracking the motion of a target with the following accuracy values (95 per cent probability values).

Scenario	Data					
	Relative course (degrees)	Relative speed (knots)	CPA (nautical miles)	TCPA (mins)	True Course (degrees)	True Speed (knots)
1	3.0	0.8	0.5	1.0	7.4	1.2
2	2.3	0.3			2.8	0.8
3	4.4	0.9	0.7	1.0	3.3	1.0
4	4.6	0.8	0.7	1.0	2.6	1.2

(4) When a tracked target, or own ship, has completed a manoeuvre, the system shall present in a period of not more than one minute an indication of the target's motion trend, and display within three minutes the target's predicted motion, in accordance with clauses 75(7), 77, 79(2) and 79(3) of this performance standard.

(5) The ARPA shall be designed in such a manner that under the most favourable conditions of own ship motion the error contribution from the ARPA shall remain insignificant compared to the errors associated with the input sensors, for the scenarios following.

For each of the following scenarios predictions are made at the target position defined after previously tracking for the appropriate time of one or three minutes:

(a)	Scenario 1	
	Own ship course	000°
	Own ship speed	10 knots
	Target range	8 nautical miles
	Bearing of target	000°
	Relative course of target	180°
	Relative speed of target	20 knots
(b)	Scenario 2	
	Own ship course	000°
	Own ship speed	10 knots
	Target range	1 nautical mile
	Bearing of target	000°
	Relative course of target	090°
	Relative speed of target	10 knots
(c)	Scenario 3	
	Own ship course	000°
	Own ship speed	5 knots
	Target range	8 nautical miles
	Bearing of target	045°
	Relative course of target	225°
	Relative speed of target	20 knots
(d)	Scenario 4	
	Own ship course	000°
	Own ship speed	25 knots
	Target range	8 nautical miles
	Bearing of target	045°
	Relative course of target	225°
	Relative speed of target	20 knots

(6) **Sensor Errors**—The accuracy figures quoted in this clause are based upon the following sensor errors and are appropriate to equipment complying with IMO's performance standards for shipborne navigational equipment.

Note: σ means "standard deviation".

(a) Radar

(i) Target glint (scintillation) (for 200m length target).
Along length of target $\sigma = 30$ metres (normal distribution).
Across beam of target $\sigma = 1$ metre (normal distribution).

(ii) Roll pitch bearing

The bearing error will peak in each of the four quadrants